Commitment Cost and Default Energy Bid Enhancements (CCDEBE)

Second Revised Draft Final Proposal

March 2, 2018

Table of Contents

1. Executive Summary

The purpose of this initiative is to evaluate the California Independent System Operator Corporation's (California ISO) market rules relating to suppliers' bidding flexibility. Over the past decade, the California ISO 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 submit prices that reflect their cost expectations and other business needs. This second revised draft final proposal provides a comprehensive proposal to address these issues.

The California ISO proposes to support market-based commitment cost bids subject to caps and mitigation under uncompetitive supply conditions. Market-based commitment cost bids will be mitigated dynamically in the day-ahead and real-time market if any constraint that could trigger a commitment to resolve it is uncompetitive. Commitment and energy costs that are subject to mitigation are mitigated to a reference level, which estimates the commitment cost or energy cost of the resource. The California ISO proposes that suppliers will have the opportunity to negotiate commitment cost reference levels, similar to current provisions to negotiate reference levels for energy bids, if the California ISO reference level calculations do not accurately reflect their unique circumstances.

To ensure the California ISO calculated reference levels can accurately reflect gas-fired units cost expectations, the California ISO proposes to make permanent the use of the next day gas commodity price from Intercontinental Exchanged published the morning of the day-ahead process in the day-ahead markets. Finally, the ISO proposes to allow suppliers to request adjustments from their reference levels in day-ahead or real-time if a fundamental driver has changes such that it drives their cost expectations away from the reference level used on a routine basis. These adjustments will be subject to verification requirements that ensure the adjustments are reasonable reflections of suppliers cost expectations.

The business rules the California ISO will use to implement the changes described in this second revised draft final proposal are available on the California ISO website.

2. Summary of changes

The purpose of this section is to summarize the major changes to the proposal.

The following describes the changes that are in this second revised draft final proposal:

- Market-based commitment cost circuit breaker cap

The following describes the significant changes that appeared in the January 31, 2018 revised draft final proposal from the August 2017 draft final proposal. It also includes the planned changes to the draft final proposal discussed in December 2017 including related stakeholder comments. The major changes were:

- Change to include phased approach for setting levels of market-based caps and headroom scalars
- Change to apply mitigation separately to energy and commitment cost bids
- Change to mitigate commitment costs if effective to any non-competitive non-binding constraint if resource could bid commitment costs to inflate uplift
- Change to settle resources in full ramp at bid for interval where ramp begins
- Change to mitigate exceptional dispatches to all four reasons in tariff today
- Change to include a manual verification prior to market
- Change to approach for calculating fuel volatility scalar in reasonableness threshold

- Change to ex post verification and cost recovery based on actual costs unrecovered through market
- Change to add audit authority to ensure reference level adjustments are cost-based bids

Change to include phased approach for setting levels of market-based caps and headroom scalars

Several stakeholders requested the California ISO perform testing of the new commitment cost mitigation design prior to go-live. Additionally, they requested the results be shared with stakeholders and if needed, that the California ISO hold a quick stakeholder initiative to correct any issues. The California will test the new mitigation functionality during the implementation phase as it does with all market changes. In addition, the California ISO proposes a phased in approach to setting the levels for the market-based bid circuit break caps and head room scalars.

Based in part on these stakeholder comments, the California ISO revises its proposal regarding market-based commitment cost circuit breaker caps and the headroom scalar used in the reference level calculations. The California ISO now proposes that initially the circuit breaker caps will be set at 150% and headroom scalar to 125%. After 18 months, the California ISO will automatically increase the circuit breaker cap to 300% and decrease the headroom scalar to 110%. The California ISO will review the performance of its enhanced dynamic market power mitigation of commitment cost using the first 12 months of available data. If design issues are identified, the California ISO would file with FERC to delay the automatic increase and decrease of the cap and headroom scalar respectively to allow for California ISO to address any issues with stakeholders. Any delay or change would apply to both increasing the circuit breaker cap from 150% to 300% and decreasing the headroom scalar from 125% to 110%.

The phased approach will allow a period to assure commitment cost market power mitigation is functioning correctly – balancing false positives and false negatives.

Change to apply mitigation separately to energy and commitment cost bids

The California ISO has revised its proposal to apply mitigation to energy and commitment cost components separately. Mitigation will be based on whether the resource test for energy (non-competitive congestion component) fails and whether the resource tests (non-competitive commitment mitigation criteria) fails.

Change to mitigate commitment costs if effective to any non-competitive non-binding constraint if resource could bid commitment costs to inflate uplift

The California ISO has revised a number of elements of its dynamic commitment cost market power mitigation proposal. The most significant of these is to now mitigate resources effective to any non-competitive critical constraints during periods where commitment cost bids could be bid to inflate uplift.

Change to include a manual verification prior to market

The California ISO proposes to perform ex ante verification through evaluating the reference level adjustment requests through an automated screen. This automatic screen would compare the requested adjusted values against a reasonableness threshold. After further considering FERC Order No. 831, the California ISO revised its proposal to allow for suppliers to seek an ex ante manual consultation for energy costs exceeding $1,000/MWh. The manual consultation is not being proposed for energy below $1,000/MWh, minimum load, or start-up costs due to the administrative burden this would incur. Suppliers may request ex post review for any reference level adjustment that were limited because their cost-based bid exceeded the reasonableness threshold.

Change to approach for calculating fuel volatility scalar in reasonableness threshold

DMM expressed concerns with the statistical approach proposed for the volatility scalar included in the reasonableness threshold calculation. In response, the California ISO proposes to modify its previous proposal to calculate the reasonableness threshold using a seasonal statistical measure to define in the tariff the exact level of the fuel volatility scalar included in its reasonableness threshold. The reasonableness threshold establishes a level up to which the California ISO would automatically verify an adjustment since this level is a being a reasonable reflection of a suppliers' cost expectations. The revised proposal calculates a reasonableness threshold by including a fuel price volatility scalar in the reference level formulations. The California proposes the volatility scalar will vary depending on the day of the week. For gas-fired resource, the volatility scalar will be 125% on Monday and days without a published index and 110% on all other days.

Change to ex post verification and cost recovery based on actual costs unrecovered through market

Based on the guidance FERC has issued in FERC Order No. 831, the California ISO proposes to modify its proposal for ex post verification and cost-recovery rules to state that eligibility will be based on actual incurred energy or commitment costs that exceed either a cap or mitigated price level, rather than expected costs, unrecovered through market revenues.

Change to add audit authority to ensure reference level adjustments are cost-based bids

To protect against the risk that suppliers submit market-based bids that include prices above cost expectations in the reference level adjustments, a violation of the guidelines, California ISO revised its proposal to have the authority to audit a supplier's adjustment requests and validate whether the requests are based on cost expectations or not (i.e. cost-based bids). If the California ISO finds that supplier did not bid based upon cost expectations, the California ISO will deem the supplier ineligible to submit reference level adjustments for a period of time and potentially refer the behavior to Federal Energy Regulatory Commission (FERC).

3. Stakeholder comments

The purpose of this section is to summarize comments received on the draft final proposal relevant to the proposals included in the revised draft final proposal. Stakeholders submitted comments on the draft final proposal and on planned changes to the draft final proposal discussed at a December 21, 2017 stakeholder call. The comments address:

- Market-based bid caps and headroom scalars
- Dynamic market power mitigation
- Mitigating minimum online constraints
- Hourly market-based bids
- Ex ante adjustments to reference levels subject to verification

Market-based offer caps and headroom scalars

Most stakeholders support the revised approach to phase the levels of the market-based cap and headroom scalars approach as a reasonable framework that will allow the opportunity to assess the effectiveness of dynamic market power mitigation of commitment cost while not overly limiting bidding flexibility in the interim. Some market participants contend that 300% is needed and appropriate to allow them to reflect their own cost expectations and business needs but they also recognize the need for a phased in approach to assure dynamic commitment cost mitigation accurately detects market power. Others comment that 200% is a more appropriate level and that 300% is excessively high. For this reason, the California ISO proposes the phased in approach.

Among those that believe that 300% is too high, DMM also opposes the automatic increase in the bid cap and believes stakeholders must prove a need for a bid cap increase before it is increased. DMM also

maintains the 125% headroom scalar double counts (i.e. the reasonableness threshold already includes 110% or 125% on top of fuel costs) and any scalar should be significantly lower than 125%. The ISO will file to delay the automatic changes if it identifies concerns with the effectiveness of the local market power mitigation of commitment cost.

Market participants believe the reduction to the headroom scaler should not occur until the circuit-breaker bid cap is increased because until there is confidence that the mitigation does not result in excessive false positives, if the California ISO were to mitigate at similar levels to what it currently performs (100% mitigation) then suppliers whose costs do exceed what the reference levels with 110% headroom scaler allows them to recover will not be made worse off than they are today. The headroom scalar should not be decreased until the cap is increased to 300% allowing for the inclusion of risk margins to account for this risk during market runs where there is sufficient competition. The potential for receiving profits under competitive conditions mitigates the concern that potentially undercompensating during uncompetitive conditions leads to overall undercompensating suppliers costs since there is opportunity for profits the remainder of the time. This is similar to the dynamics suppliers face on the cost recovery for their energy bids in the existing market design. DMM believes the increase in the bid cap should not be linked to the increase in the headroom scaler. The California ISO believes specifying the automatic changes in the tariff is a reasonable compromise to effectively phase-in the bidding and mitigation changes.

Dynamic market power mitigation

NRG asked that the California ISO's principle that resources at the system level are competitive be codified in the tariff. The California ISO believes this is an opinion based on NRG's assessment of current conditions. The California ISO does not currently mitigate for system market power and therefore its tariff lacks any language enabling it to do so. Whether resources remain competitive at the system level can change over time with changes in system conditions and characteristics. However, at this time, the California ISO does not propose under this initiative to add the dynamic market power mitigation test for system competitiveness. The CAISO does test BAA level constraints for the Energy Imbalance Market, and does not plan on changing this in this initiative.

A number of stakeholders oppose both net buyers and net sellers of energy being included in the residual supply index calculation for commitment cost market power mitigation. Stakeholders are concerned that including net buyers will subject too many resources to mitigation and, alternatively, the California ISO should change its bid cost recovery allocation rules to address the potential to bid high commitment costs to inflate bid cost recovery. The CAISO believes net buyers should be included in the residual supply index because they would have the incentive to inflate commitment costs. The California ISO does not believe this can be addressed through bid cost recovery allocation rule changes. The California ISO determined through its *Bid Cost Recovery Enhancements* initiative that bid cost recovery cost allocation changes were not feasible.

Mitigating minimum online constraints

A number of stakeholders were confused why a proposal to mitigate minimum online constraints (MOCs) was included in *CCDEBE* when the *Contingency Modeling Enhancements (CME)* initiative was eliminated all MOCs. The California ISO clarified that the *Contingency Modeling Enhancements (CME)* design would eliminate most minimum online constraints (MOC). However, the California ISO might need to continue to enforce minimum online constraints for issues such as managing reactive power or voltage requirements. As such, the California ISO needed to include mitigation measures for minimum online constraints in its proposal. By definition, minimum online constraints are deemed "uncompetitive" because they are enforced for local issues and would likely include very few resources under the constraint.

Ex ante adjustments to reference levels subject to verification

Some stakeholders commented that by the California ISO publishing resource specific reasonableness thresholds to each market participant, that it would aid them in understanding how much headroom is available for adjustments. Other stakeholders commented that in order to protect against artificial price formation California ISO cannot make such information public.

California ISO clarifies that the reasonableness thresholds are not a safe harbor. The California ISO policy does not support using the reasonableness threshold to submit cost-based bids that are intended to exercise market power by including artificial price formation. The California ISO proposes suppliers will be required to submit bids based on cost expectations using contemporaneous information available to the supplier such as actual gas price quotes. Submitting requests to adjust any component by strategically bidding near the reasonableness threshold to inflate market revenues or uplift would be inconsistent with the market rules. The California ISO will not provide these values to suppliers.

4. Identified Issues

The following subsections describe the issues this proposal addresses.

4.1. Market-based commitment cost and hourly minimum load bids

The California ISO understands that stakeholders are concerned that the current bidding rules preclude suppliers from bidding market-based bids for their commitment costs and from bidding minimum load costs that vary by hour. They have expressed that this inflexibility limits their suppliers' to reflect accurately their cost estimates and other business needs.

Some stakeholders also maintain the current market implementation limits their ability to select hours in which to participate. However, the California ISO believes the current market largely allows this and stakeholders may have this perception because of the way the market inserts bids to accommodate resource intertemporal constraints and terminal conditions or for other circumstances for which an energy bid is needed for the market. Stakeholders expressed concern that the current rules are overly limiting because:

- Suppliers are required to submit cost-based bids for their commitment cost components subject to validation even under competitive conditions
- While suppliers can update the daily minimum load bids in real-time the single value is considered for each hour across the entire market optimization, if they are not awarded in day-ahead, this does not address need to have different values for minimum load in each hour so that the market optimization can evaluate the costs for operating it at least at its minimum operating level based on the costs for the given hour.

The California ISO is currently the only organized electricity market that does not support market-based commitment costs bids subject to mitigation. Only mitigating commitment cost bids when a resource has market power increases the ability for suppliers to reflect their cost expectations and business needs.

The findings of the California ISO's survey of organized markets bidding rules showed that all other organized markets support market-based bids for all components of the supply bid and apply mitigation to each component under various, complex rules. Most other markets support hourly variation across the minimum load energy costs (ISO-NE, MISO, PJM, and SPP). Requiring cost-based bids for commitment cost components for every run, not allowing hourly variation for minimum load costs, and forcing bids for every hour across the day results in an overly restrictive bid structure design.

Regardless of whether the bids could adversely affect the market, the current design precludes suppliers from submitting commitment cost bids based on prices that reflect their cost expectations and other business needs if these exceed the cost-based cap at 125% of fuel cost proxy. Currently, the California ISO treats commitment costs as uncompetitive in every run. California ISO currently applies a cost cap for every run at 125% of its reference levels. California ISO existing design limits cost-based bids to 125% because it has shown empirically that this level is a reasonable range of costs. Under most scenarios, the 25 percent appears to provide a sufficient margin of error for most resources to allow the suppliers' cost expectations to be reflected in their commitment cost bids.

However, this headroom may be insufficient to bid prices that reflect a market participant's own cost expectations or other business needs including risk margins, subsidies, contracts, or factors such as preferred use. This disregards that under competitive conditions, suppliers should be able to bid prices that reflect their own cost expectations or other business needs. 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.

Stakeholders raised concerns during the *Commitment Cost and Default Energy Bid Enhancements* stakeholder process 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. The California ISO clarifies that its current bidding policies do not, in themselves, require non-resource adequacy resources to bid power for every operating day or to submit bids for all hours of the day. California ISO will continue to support this policy.

Minimum load bids need to have ability to vary by hour

Stakeholder raised three examples for business needs to bid minimum load costs that vary across hour. First, multi-stage generators (MSGs) need flexibility to reflect minimum load costs that 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. This was addressed in *Bidding Rules Enhancements* but needs to be enhanced to allow the market-based bids which reflect preferred use of resource to bid at levels below the default energy bid used in the revised minimum load cost formula. Second, resources with physical minimum load rerates request flexibility to reflect their business needs in the default energy bid integration[1]. Third, that fuel costs can be expected to differ in various hours based on whether fuel was for the first gas day, second gas day, or hours after 5PM when pipeline flow orders may be issued.

4.2. Market power mitigation enhancements

In this proposal, the California ISO is addressing the need for enhancements to its existing local market power mitigation test. California ISO's current commitment cost market power mitigation methodology, which in effect applies bid price mitigation based on estimated costs in every run, without regard to the

[1] 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.

potential for the exercise of locational market power, may result in over-mitigation of units since it assumes uncompetitive market conditions in every run (cost-based cap). To address the concern that supplier bids should not be based on estimated costs when the market is competitive, the California ISO needs to design a market power mitigation test that includes ability of suppliers to withhold their capacity, including minimum load.

In its original nodal market design, the California ISO adopted the approach to treat biddable commitment costs as cost-based bids and subject to a validation of a percentage of its commitment cost reference levels. In the related board memo, the California ISO committed to evaluating whether a dynamic mitigation test would be feasible to implement stating:

> *"These proposed provisions have been specifically designed to be implemented without any changes in the MRTU market software. Over the longer term, the CAISO will assess other options for mitigation of start-up and minimum load bids which may be integrated into the MRTU software and allow for more targeted mitigation only when units are constrained on due to uncompetitive transmission constraints… more dynamic approach employed by PJM could not be implemented under the CAISO's current MRTU design since software modifications could not be made to incorporate mitigation of bid-based start-up and minimum load cost bids directly into the MRTU LMPM procedures."* [2]

Once implementation feasibility was no longer a primary barrier to implementing mitigation on the entire supply bid, the California ISO evaluated the merits of extending its mitigation paradigm and identified several issues that need to be addressed in implementing such a change. Its mitigation paradigm applies a local market power mitigation test that includes a dynamic competitive path assessment (DCPA)[3] to identify uncompetitive conditions on binding transmission paths and a resource test to identify whether a resource has a locational advantage to exercise market power to uncompetitive constraints.

The major issues that create challenges when applying local market power mitigation to committed units are:

- **DCPA does not test critical constraints that are non-binding in the market run, so applying the current DCPA design without modification could potentially allow resources to exercise market power.** This is because a resource may be committed to resolve congestion on the system when local constraints are enforced in the unit commitment run, called critical constraints. The commitment of a unit can add more capacity than needed to relieve the constraint due to the lumpiness of minimum load requirements. It is therefore possible for the commitment of a

[2] Decision on Bid Caps for Start-up and Minimum Load Bids under MRTU, September 7, 2007, Page 1 and 4, http://www.caiso.com/Documents/070906DecisiononBidCaps_Start-upandMinimumLoadBidsunderMRTU-Memo.pdf.

[3] Dynamic competitive path assessment performs a three pivotal supplier test (PST) and determines if there is sufficient residual supply of counterflow to meet the demand for counterflow on a given constraint, measured by a residual supply index (RSI).

resource to be triggered by a constraint, but the constraint no longer binds once the unit is committed. Testing non-binding as well as binding constraints will require developing an approach to treating the unloaded capacity on the constraint under a pivotal supplier test.

- **DCPA does not directly account for an offline resource's potential ability to withhold counterflow**: The current design does not directly account for all potential withheld capacity due to a simplified approach. The revised draft final proposal for the *Dynamic Competitive Path Assessment* initiative stated, "We note that this measure of potential withheld capacity does not directly account for a resource fully withholding by shutting down. We recognize that this potential exists but note that some of the withheld capacity will be accounted for in the proposed measure and the market will detect after a few intervals that the resource is now off-line and that absence of capacity will be reflected in the measure. In addition, the Department of Market Monitoring monitors for physical withholding."[4] A competitive path assessment would need to be enhanced to directly account for ability to withhold capacity to the extent possible.

- **The resource test used to assess the impact of a resource's bid on market prices does not account for the potential for inflated commitment cost bids to inflate uplift, only the ability to inflate energy prices. Hence, using the resource test to apply commitment cost mitigation could potentially allow resources to exercise market power by inflating uplift payments.** Hence, the determination of locational advantage based on the combined impact of non-competitive constraint's shadow prices and the resource's shift factors will not indicate an ability to inflate uplift. A resource test for locational advantage to submit inflated commitment costs bids in order to inflate uplift payments will need to not rely on shadow prices to identify the potential for the exercise of locational market power.

- **The resource test, which accounts for a net effect of a resource's output on binding transmission constraints across the system, while appropriate for energy mitigation, is not appropriate for commitment cost mitigation:** The market may commit a resource to resolve any enforced constraint while a corresponding contribution of prevailing flow elsewhere may not alter that commitment decisions or provide a disincentive to inflate bids. A resource test for locational advantage to withhold to inflate uplift will need to assess effectiveness to any non-competitive constraint.

The DMM stated during the Bidding Rules Enhancements initiative that the California ISO market faces several challenges when developing commitment costs mitigation methodology even beyond the specifics of the local market power mitigation test. DMM recommends that any future methodology would:

- Need to consider transmission and contingency constraints, exceptional dispatches, operator action to override market software, and outage re-rates among others to be effective

[4] Dynamic Competitive Path Assessment Revised Draft Final Proposal, Page 11, Footnote 4, July 5, 2011, http://www.caiso.com/Documents/RevisedDraftFinalProposal-DynamicCompetitivePathAssessment.pdf.

- Need to effectively identify opportunities for market power and appropriately applying mitigation.

In the revised draft final proposal, the California ISO addresses these concerns.

4.3. Supplier submitted reference level adjustments

The California ISO current method of calculating reference levels may not always reasonably reflect impact of externalities or suppliers' cost expectations. This inaccuracy is important relative to commitment cost reference levels as it may force an uneconomic resource to be committed. It also impacts any EIM participant that is required to submit bids to the California ISO at reference levels, at default energy bids (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 California ISO 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 has been 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 California ISO 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 California ISO 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.

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

While the California ISO identified needs to address its bidding flexibility design for resource commitment costs and energy bids, the California ISO did not initially intend to address the unlikely risk that a suppliers' cost-based energy bid 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 (FERC Order No. 831) requiring the California ISO to enhance its functionality to address bidding flexibility for cost-based energy bids above $1,000. To comply with FERC Order No. 831, the California ISO must allow suppliers' verified[5] cost-based energy bids greater than $1,000/MWh and up to $2,000/MWh to be eligible to contribute to setting bid merit order used in dispatch and pricing and be eligible to set locational marginal prices. FERC Order No. 831 also requires the California ISO to support an ex post verification process where any submitted

[5] 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.

bids either above $2,000/MWh or any bid greater than $1,000/MWh and up to $2,000/MWh that is unverified ex ante, are eligible for an after-the-fact review and eligible for uplift payments if verifiable based on the after-the-fact review. The California ISO expanded the scope of this initiative to address FERC Order No. 831 compliance for cost-based energy bids above $1,000/MWh and proposes to leverage the ex-ante and ex post verification processes needed for FERC Order No. 831 compliance to address existing limitations in its calculation of commitment cost and energy bid reference levels.

4.4. Reference level calculations

California ISO believes its bidding rules can be enhanced to better allow suppliers to bid prices that reflect their own cost expectations or other business needs. By increasing the accuracy of its reference level calculations, the California ISO can better:

- Support integration of renewable resources through improving its valuation of resources under uncompetitive conditions in a manner that will incentivize 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.

The California ISO has evaluated under this initiative whether using only one value for prevailing gas market prices results in reference levels that effectively value the suppliers' cost expectations. Using one gas market price to value power production that encompasses hours across two gas flow days increases the likelihood that estimates will not perfectly align with a suppliers' estimates of its costs given the fuel costs across one electric day will be influenced by both days. One day, the later day (i.e. second gas day, gas day 2, GD2), will have more of an impact on actual costs as it represents gas commodity prices for ~75 percent of the hours. If on the other hand, the California ISO uses the earlier day (i.e. first gas day, gas day 1, GD1) then this price information would only apply to the valuation of gas flows during hours ending 1-7 comprising only about 25% of the operating day.

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

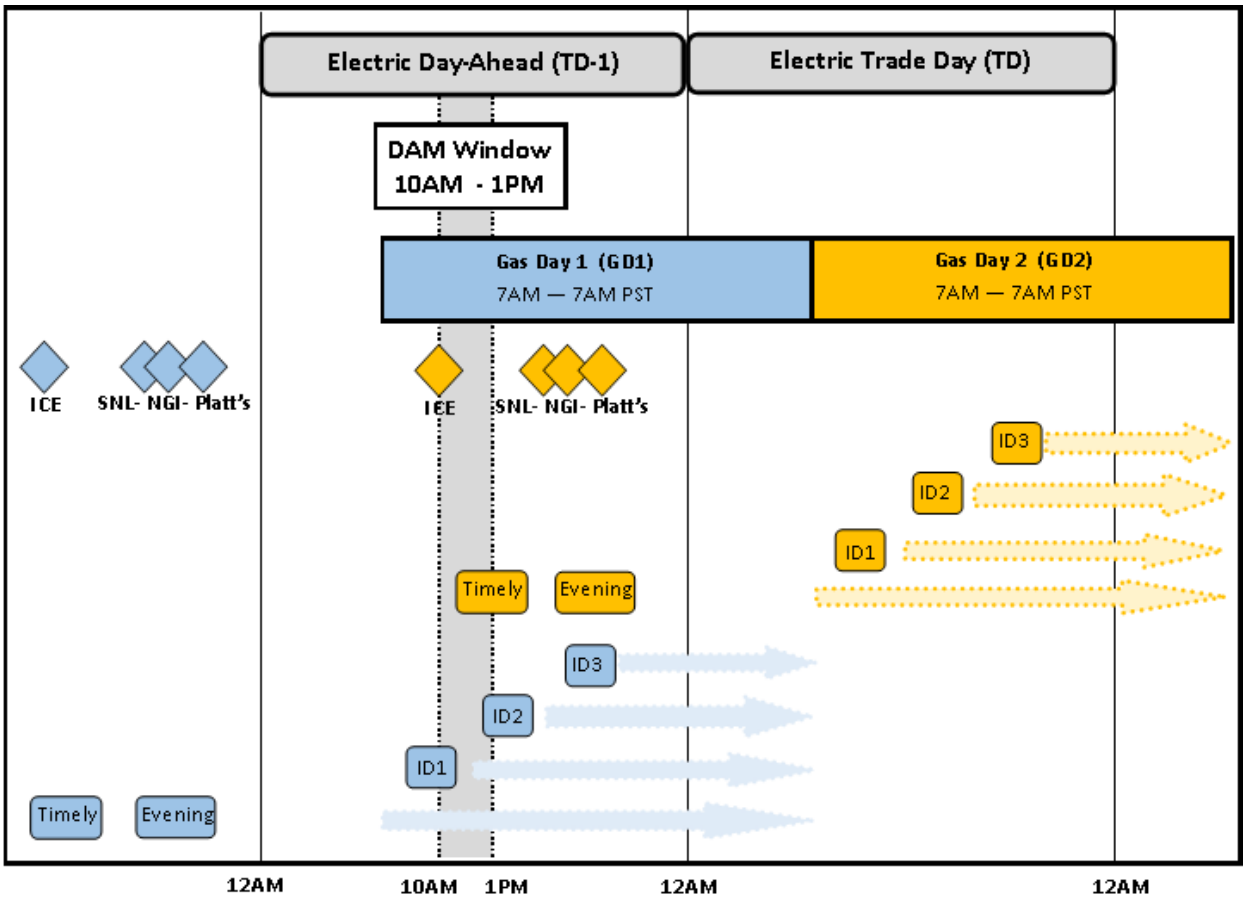

Figure 1: Gas and Electric Day Timelines effective April 1, 2016 (Order 809)

The colored items in this diagram show the gas trade day and publication timing for the first gas day that began flows TD-1 at 7AM Pacific (Gas Day 1 ,GD1) in blue and second gas day that begins flowing on TD at 7AM Pacific (Gas Day 2, GD2) in orange. The colored blocks represent each nomination cycle during the gas day from its deadline to final notification with arrows associated with each cycle showing the effective flow hours. The publication times associated with GD1's GPI are shown in Figure 1as blue diamonds and the flows hours under that contract is shown by the blue box entitled "Gas Day 1". The publication times associated with GD2's GPI are shown in Figure 1as orange diamonds and the flows hours for that product type is shown by the orange arrows under the orange box entitled "Gas Day 2". Table 1 shows the nomination cycles deadlines and when the gas flows based on a schedule in each cycle.

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

Intra-day 1	8:00 a.m.	11:00 a.m.	12:00 p.m. effective	Yes
Intra-day 2	12:30 p.m.	3:30 p.m.	4:00 p.m. effective	Yes
Intra-day 3	5:00 p.m.	8:00 p.m.	8:00 p.m. effective	No

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

As seen in Figure 1, the day-ahead market publication is released after all but one nomination cycle deadline for GD1 and after the timely cycle deadline for GD2, which increases the risk of a mismatch of nominated gas flow and actual gas demand triggering deviations from daily balancing requirement. If resources wait for ISO day-ahead schedules to procure gas and request nominations for gas flows in the early hours of its operating day, hours ending 1 through 7 associated with last hours of GD1 nominations, then the suppliers would procure gas during the last and most illiquid procurement and nomination cycle, intraday 3. The day-ahead market also does not inform timely gas procurement or pipeline nominations for its operating day hours ending 8 through 24 since the first cycle of gas nomination for GD2 concludes at 11AM PST TD-1.

The two different gas days will often have similar fundamental drivers so on a routine basis prices day-over-day in a month will be generally correlated. However, if fundamentals such as outages on the gas system differ between days the fundamental drivers might be significantly different so as to drive a weaker correlation between prices.

The reference level approach with a fuel cost estimate driven by next day gas commodity prices has generally worked well because California has historically experienced limited volatility and generators basis risk is moderate since California generators are geographically approximate to major trading hubs with published indices. However, with the expansion of the real-time footprint because of the EIM, more generators are farther away from liquid trading hubs and experience greater levels of basis risk than generators internal to the California balancing authority area.

Stakeholders have expressed to the California ISO that “working well” means they might still incur large losses on a particular day as result of market features. While the ability to submit ex ante reference levels subject to ex ante and ex post verification processes largely mitigates the insufficient cost recovery risks when the GD2 index is significantly different than the GD1 index, the automated screen using the reasonableness threshold that controls for outliers will ensure that requests that would result in significantly higher adjustments would be subject to a more rigorous ex post review. This means that even if the adjustment is within a reasonable threshold of the prevailing price trading on the morning of the California ISO day-ahead market, if the adjustment exceeds the reasonableness threshold it could be limited in the market and sent to cost recovery. While mitigating cost recovery risks, California ISO believes not allowing bids to reflect prevailing prices as observed on ICE in its day-ahead market would be a step backward away from market efficiency and accurate price formation.

5. Proposal

The California ISO proposes to allow market-based bids for each component of the supply bid subject to mitigation and allow greater flexibility to negotiate or adjust each component to support greater market efficiency. The proposal discussed in this section will address the limited flexibility of the California ISO

bidding rules and reference level paradigm. California ISO notes the proposal will apply to all supply resources in the California ISO balancing authority area or Energy Imbalance Markets balancing authority areas. Supply resources include resources eligible to submit market-based or cost-based bids under the California ISO Tariff, which will include Generating Units, Participating Load, Reliability Demand Response Resources, Proxy Demand Resources, or Non-Generating Resources. If there are any differences in how the rules apply to the respective areas, the California ISO will call these out specifically in each section.

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

- Market-based commitment costs and hourly minimum load
- Market power mitigation enhancements
- Reference levels
- Supplier submitted reference level adjustments

5.1. Market-based commitment costs and hourly minimum load

The purpose of this section is to describe the California ISO proposal to allow greater bidding flexibility by allowing Scheduling Coordinators of supply resources[6] (suppliers) to bid market-based commitment cost offers and to bid minimum load costs that vary by hour. Based on existing policy, bidding flexibility allows resources without a must-offer obligation to select hours in which they will submit their supply offers in day-ahead and real-time.

Under this proposal, the California ISO will allow suppliers to submit hourly bids for minimum load and daily values for start-up costs or transitions costs. The hourly minimum load bids are for the trade hour and may be resubmitted in real-time market pursuant to Section 30.5.1(b). The daily start-up and transition bids are for the entire trade day or as resubmitted in real-time market as pursuant to Section 30.5.1(b). Section 30.5.1(b) includes the provisions that allow real-time re-bidding where suppliers can resubmit their daily commitment costs in real-time for hours for which they do not have an integrated forward market award or residual unit commitment award associated with a binding residual unit commitment start up instruction (Section 30.5.1(b)).

Pursuant to current policy resulting from the Bidding Rules Enhancements initiative, suppliers can update their commitment costs in real-time for hours for which they do not have an integrated forward market award or residual unit commitment award associated with a binding residual unit commitment start up instruction. For any hours where a resource without a must-offer obligation does not submit a supply bid for any component, the California ISO will respect this bid strategy and will not insert bids into the market for that hour except to respect bid validation rules for must run resources, as is the current policy.

Today the California ISO does not permit Scheduling Coordinators to submit hourly amounts for any of the commitment cost bids. Although the software allows different hourly values for minimum load, start-up or transition costs in real-time today, the amounts bid are required to be a daily value. Going forward, the second revised draft final proposal policy will leverage the flexibility the software provides and allow

[6] Supply resources refers to resources eligible to submit market-based or cost-based bids under the California ISO Tariff, which will include Generating Units, Participating Load, Reliability Demand Response Resources, Proxy Demand Resources, or Non-Generating Resources.

Scheduling Coordinators to bid hourly amounts for minimum load. The second revised draft final proposal policy does not change the requirement to bid daily values for start-up or transition costs.

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

- Support market-based commitment cost bids subject to caps
- Support market-based treatment under minimum load rerates
- Support hourly minimum load bids
- Settle commitment cost bid when no bid is present

5.1.1. Support market-based commitment cost bids subject to caps

Based on the California ISO understanding of virtually full consensus that it should support market-based commitment cost bids subject to caps as long as a sufficiently robust market power mitigation is applied, the California ISO proposes to pursue this enhancement. From a policy and market design perspective, the California ISO originally committed to this design change in 2007 contingent on it being feasible to implement commitment cost market power mitigation[7].

With an introduction of market-based commitment cost bids, the California ISO proposes it will apply "circuit breaker" hard caps on the commitment cost components of the market-based supply bids as well. Recall the fifth of the California ISO adopted principles under competitive conditions stated,

> *Market-based bids 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, the California ISO enforces a hard cap on its market-based energy bids at $1,000/MWh consistent with this principle. Similarly, the California ISO proposes hard caps on market-based commitment cost bids. These hard caps serve as backstop mitigation accounting for imperfect information in mitigation methods. California ISO proposes to establish a conservative cap initially and then as needed increase over time similar to the manner it phased in higher energy bid caps over several years.

Some stakeholders stated in their comments that the cap at the 300% of commitment cost reference levels the California ISO initially proposed was too high and others stated that it was too low. In response, California ISO proposes to establish the new market initially based commitment cost component caps at 150% of the commitment cost reference levels for start-up, transition, and minimum load bid components for the first 18 months. California ISO proposes to increase the percentage from 150% to 300% automatically after the first 18 months the bidding changes go into effect. After the data for the first 12 months is available, the California ISO proposes to analyze the mitigation performance. If the California ISO identifies that the market yields false negatives mitigation, would file to delay the automatic increase to allow for California ISO to address issues. This change would be in coordination with changing the headroom scalar from 125% to 110%.

[7] Decision on Bid Caps for Start-up and Minimum Load Bids under MRTU, September 7, 2007, http://www.caiso.com/Documents/070906DecisiononBidCaps_Start-upandMinimumLoadBidsunderMRTU-Memo.pdf.

The market-based cap will be a percentage multiplier of the resource-specific reference level[8]. If a resource submits an ex ante reference level adjustment and is successfully verified through the automated process, the market-based offer cap will be percentage multiplier of the adjusted reference level. The cap will initially multiply the reference level by 150% where the reference level is calculated as shown in Equation 3, Equation 4, and Equation 5. For example, if the minimum load reference level is calculated using the formula in Equation 3: Proxy Minimum Load Costs at $1,000/hour then the market-based bid cap for minimum load will be at $2,000/hour.

5.1.2. Support market-based treatment under minimum load rerates

This second revised draft final proposal includes a revised proposal for treatment of bids during hours for which a resource has a minimum load re-rate. The California ISO will not be able to support market-based bids to be submitted for the portion of the minimum load energy that is the rerated portion – i.e. the additional energy moved under the registered minimum load operating levels. However, the CAISO proposes to meet the spirit of its prior proposal by calculating a market-based bid ratio that will be applied to the default energy bid curve that is integrated into the minimum load.

Equation 1 shows the formulation for this enhancement to the DEB integration design implemented in the market as a result of the minimum load rerate rules developed under the *Bidding Rules Enhancements* initiative.

$$MLC' = MLC + \int_{P_{min}}^{P_{min}'} (\delta DEB(p)dp)$$

$Where$

$I\ commitment\ costs\ are\ mitigated \rightarrow \delta = \min(1, \frac{MLC}{ML\ Ref})$

$If\ commitment\ costs\ are\ not-mitigated \rightarrow \delta = \frac{MLC}{ML\ Ref}$

MLC'	Minimum load bid with the re-rated minimum load level's default energy bid integration
MLC	Minimum load bid (used in market after bid validation) subject to caps
ML Ref	Minimum load cost reference level
$DEB(p)$	Default energy bid cost associated with the cost of re-rating a resource or MSG configuration's minimum load

[8] Note - California ISO proposal includes revisions to its calculations for its commitment cost reference levels in Section 5.3 and Appendix C: Proposed reference level calculations.

dp	Change in energy

Equation 1: Minimum Load under Minimum Load Rerate

With this enhancement, the California ISO can ensure that, as long as not mitigated, the integrated portion of the default energy bid curve can better reflect the supplier's energy bid. Under uncompetitive conditions, the California ISO can allow the integrated curve to reflect lower values than the energy reference level if the market-based minimum load bids are submitted at levels lower than the minimum load reference level. California ISO proposes this so that if minimum load bids are submitted at say $0/hour to maintain units operation then when the default energy bid is integrated it will be integrated at $0 as well. This allows the market to reflect the preferred use of the resource up to the energy reference level.

5.1.3. Support hourly minimum load bids

Given the clarification that the current policy is to allow the flexibility for resources without a must-offer obligation to select hours to participate[9], the California ISO proposes to address the limitations issues identified for the need to vary minimum load costs hourly by supporting hourly minimum load bids.

While there was discussion of two minimum load bidding options during the stakeholder working groups, based on stakeholder input the California 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 challenges involved with hourly treatment, the ISO proposes to adopt that option.

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

California ISO clarifies that its existing rules allow for real-time market re-bidding of all commitment cost bids based on the re-bidding rules existing policy approved in November 2016 by FERC. . Under these rules, a supplier will be able to rebid minimum load, start-up, or transition costs in the real-time market for any hours without an integrated forward market or a residual unit commitment (RUC) schedule associated with a binding start-up instruction, the supplier may resubmit and update these daily bids in the real-time. Once a resource receives a binding real-time market start-up instruction, the resource will not be able to re-bid their commitment cost bids until it has fulfilled its minimum run time. California ISO clarifies that in combination with these existing rules a supplier may resubmit its commitment cost bids to higher values to reflect upward volatility or resubmit lower values to reflect

[9] Some suppliers maintain the current market implementation limits their ability to select hours in which to participate. However, the California ISO has examined this issue and does not require offers for hours not bid by the supplier unless the resource is a must run resource (e.g. ancillary service awards or self-schedules) or for units dispatched to respect a minimum up time or bid in the final interval. The only scenario the California ISO has identified that may be the basis of stakeholders concerns relates to seams issues where if there is a bid in the final interval then the market assumes there will be bids available in following runs, otherwise the market will shut the resource down. This applies to the last hour of day-ahead and the last interval of any short-term unit commitment run.

downward price volatility. The intent is to allow suppliers to bid prices that reflect their cost expectations and business needs.

In its comments on the California ISO straw proposal, WPTF recommended the California ISO provide an explicit statement on how stakeholders and the California ISO should understand this proposal related to resource adequacy resources. Resource adequacy resources in the content applies to any resource with an obligation to make capacity available to the California ISO under California ISO tariff. As stated at the July 6, 2017 stakeholder meeting discussing the straw proposal, the proposal for non-resource adequacy and energy imbalance market resources to select hours for submitting bids will not change resource adequacy resources' tariff must-offer obligations.

Hourly bids will be locked to levels evaluated under existing re-bidding rules

Although several stakeholders indicated concern and the importance of ensuring bidding rules are effective to mitigate behavioral concerns with this enhanced flexibility, after further consideration the California ISO has determined its current real-time market re-bidding rules do not need to be modified. Current re-bidding rules allow suppliers to resubmit their commitment cost bids in real-time only if they did not receive an integrated forward market award or binding residual unit commitment start-up instruction for that hour. In addition, once committed by the real-time market, the ISO has automated bidding rules to ensure the commitment cost bids are locked at the last bid 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).

Figures 2, 3, and 4 illustrate the current re-bidding rules on the minimum load component under the proposed hourly treatment. In Figure 2, the green triangles represent the hourly minimum load bids initially submitted and evaluated in the short-term unit commitment process for the 4 ½ hour optimization window from 2:30 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 through hour ending 10 that would be evaluated in later STUC runs. This resource must be able to both meet its start-up time and fulfill its minimum run time by the end of the unit commitment horizon unless a bid is present in the final interval of the optimization window. If there is a bid in the final interval, the optimization will assume the next run will include bids in future intervals.

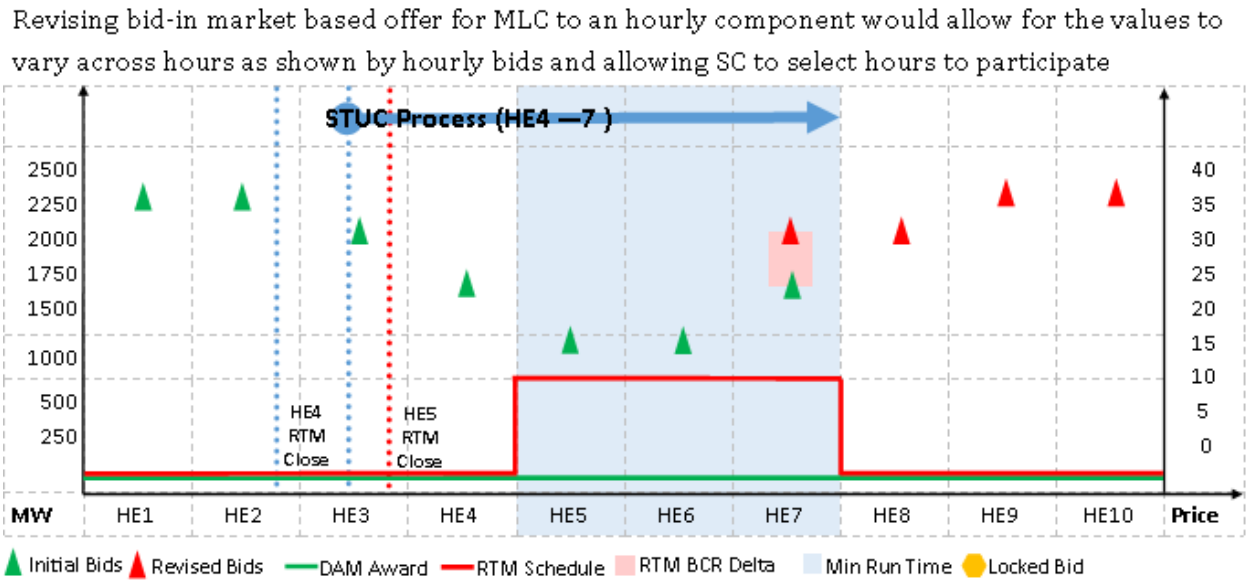

Figure 2: Illustration of proposed change for hourly minimum load

In Figure 3, once the hour ending 5 binding real-time market start-up instruction is issued then the ISO would automatically apply the re-bidding rules and lock the re-bidding window. In the current STUC run, if the supplier re-submitted a bid for hour ending 7 at $2,000/hour, the market would reject the bid since the bidding window is locked. This means California ISO will not accept any new bid submissions for commitment cost components and will ignore any values submitted to the California ISO until the resource completes the minimum run time.

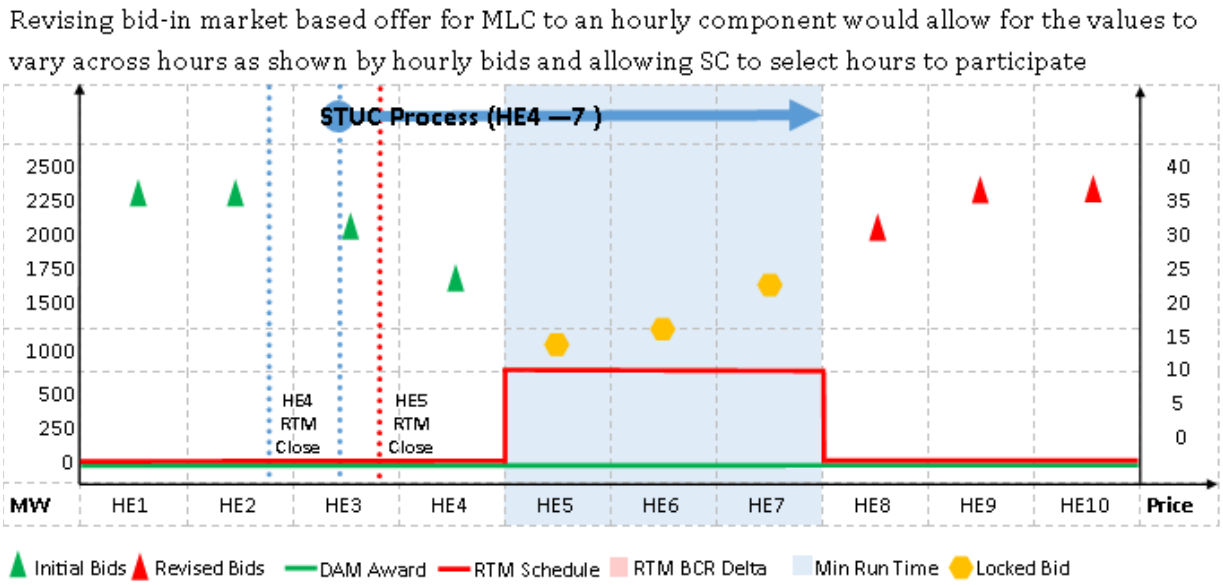

Figure 3: Illustration of rebidding rules on proposed change, no changes inside intertemporal constraints

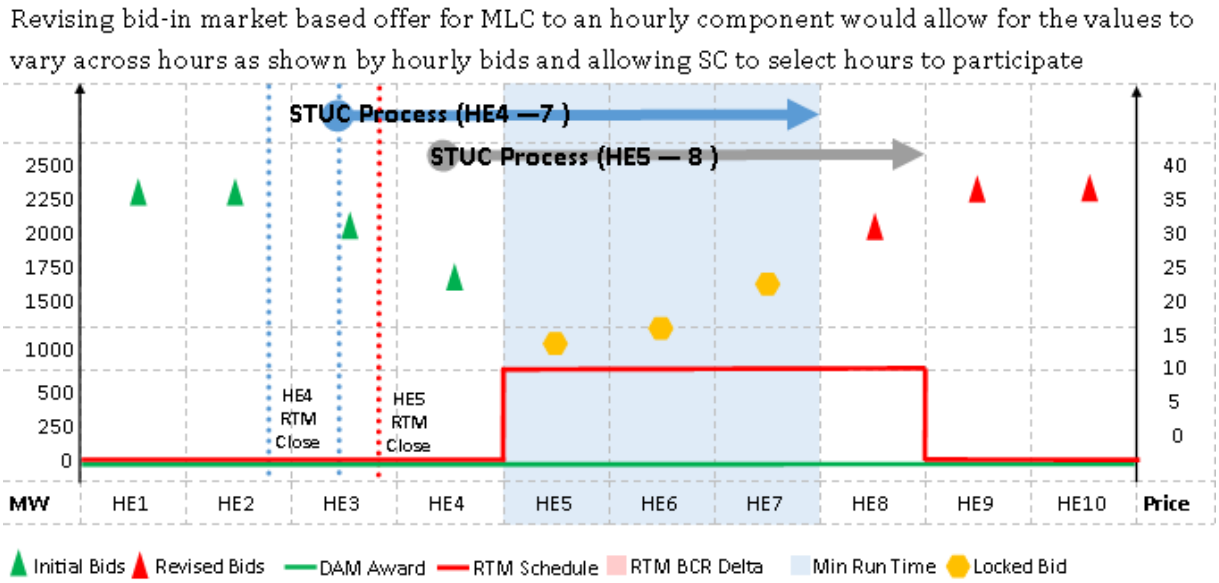

Figure 4shows the next STUC run for hours ending 5 through 8. In this run the market accepts the revised minimum load bid at the higher level of $2,000/hour for hour ending 8. If unmitigated, the market will use this value in the assessment of the unit's economics. This is appropriate because the unit commitment and economic dispatch runs can consider this value in its consideration of the optimal solution.

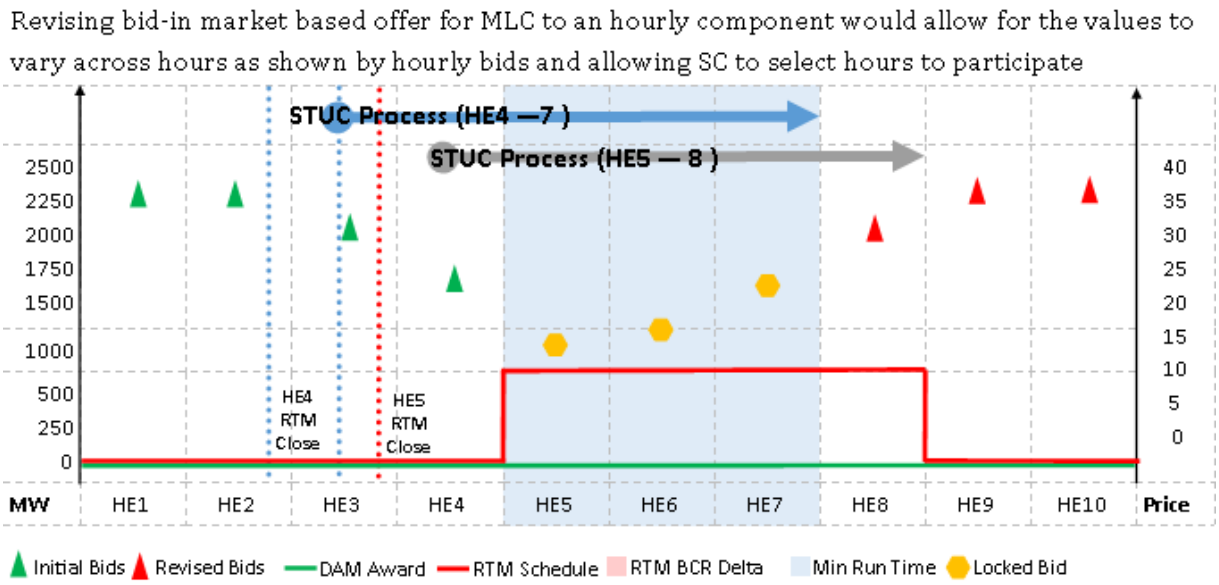

Figure 4: Illustration of rebidding rules on proposed change, changes outside of intertemporal constraints

The re-bidding rules protected against potential gaming concerns while allowing resources not under inter-temporal constraints to reflect their value to increase market efficiency. The higher bid for hour ending 7 was ignored by the market but the higher bid for hour ending 8 was considered because the market can now alter the resource's commitment status if no longer economic at that bid level.

5.1.4. Settle commitment cost bid when no bid is present

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

California ISO market design respects physical constraints. California ISO needs to adopt a "no bid" process for instances without a bid to both respect physical constraints and settle resources appropriately. Figure 5shows the scenario of concern. This resource submitted hourly bids for hours ending 1 through hour ending 7. The commitment process evaluating commitments from 2:30AM to 7AM validates to ensure that sufficient bids are available to meet the inter-temporal constraint within the optimization window. However, as stated in the prior section, if there is a bid in the final interval the market will assume following runs will have bids in future intervals. In this example, the market sends a dispatch instruction to minimum load for hour ending 7 and then will not be able to issue a shutdown instruction until hour ending 10. If the resource was dispatched in hour ending 7 into its dispatchable curve, the market would send the resource to its minimum load beginning in hour ending 8 and maintain its dispatch until the end of hour ending 9 because there are no bids present but the market must respect the resource's minimum run time. The commitment cost no bid rule will be to settle an interval without commitment cost bids where the resource receives a dispatch instruction at its commitment cost reference levels.

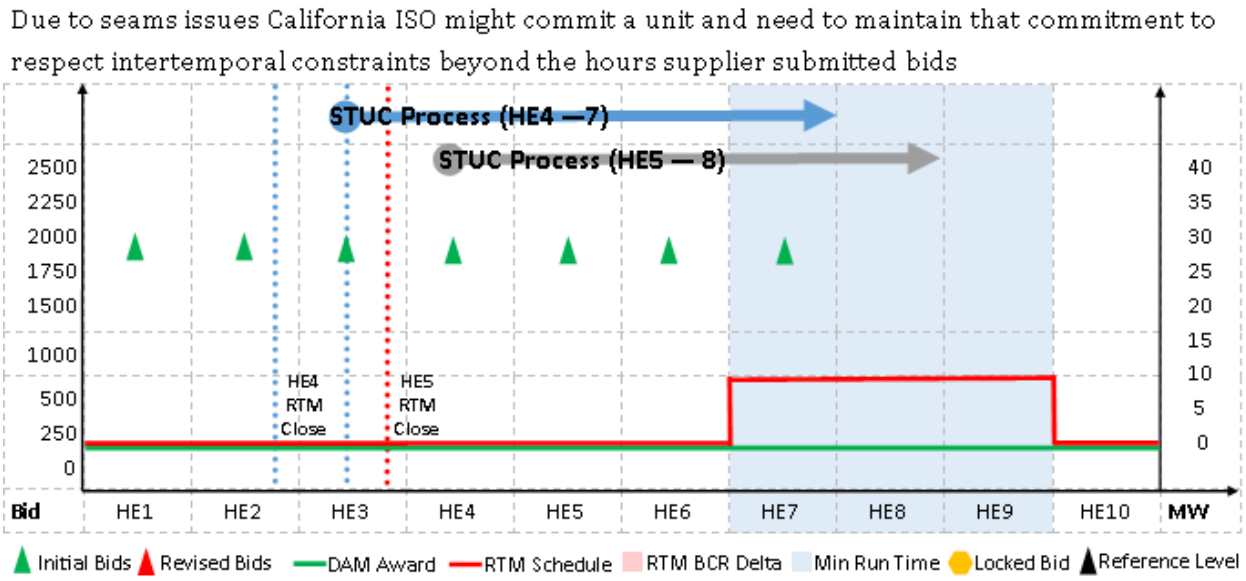

Figure 5: Illustration of need to dispatch even if no bid

In light of NV Energy's request to clarify how the default energy bid integration when a minimum load re-rate occurs impacts the California ISO proposal, the California ISO clarifies that for the purpose of this "no bid" process the methodology described in Section 4.1.2, "Support market-based treatment under minimum load rerates", will be followed and adopt the delta treatment for mitigated bids. This is for purposes of bid-cost recovery settlement.

5.2. Market power mitigation enhancements

The purpose of this section is to describe the California ISO proposal for dynamic local market power mitigation enhancements. California ISO proposes to allow market-based bids for each component of the supply resources'[10] bid subject to mitigation so that suppliers have greater flexibility to submit bids that support their cost expectations and business needs. The proposal will apply consistently to internal constraints in the California ISO and Energy Imbalance Market Balancing Authority Areas and to the BAA level net transfer constraints.

The California ISO will describe its proposal as follows:

- Dynamic market power mitigation enhancements
- Mitigate resources within a minimum online constraint
- Mitigate exceptional dispatches commitment costs
- Settle exceptional dispatches at commitment cost bids considered in initial instruction for the instruction period
- Settle resources in full ramp at the bid used in the interval

[10] Supply resources refers to resources eligible to submit market-based or cost-based bids under the California ISO Tariff, which will include Generating Units, Participating Load, Reliability Demand Response Resources, Proxy Demand Resources, or Non-Generating Resources.

5.2.1. Dynamic market power mitigation enhancements

California ISO recognizes and strongly agrees with stakeholders that an effective market power mitigation test is necessary to allow the introduction of market-based commitment costs. California ISO proposes to perform market power mitigation in all unit commitment processes with enhancements to the dynamic competitive path assessment and its resource test for locational advantage.

The California ISO will enhance its market power mitigation design to test critical constraints in its dynamic competitive path assessment. The California ISO also proposes that the new residual supply index calculation would be applied to critical constraints. Today, the dynamic competitive path assessment deems binding transmission constraints either competitive or uncompetitive based on a residual supply index. The residual supply index based on the current DCPA design will flag energy mitigation based on the value of the RSI_l.

The California ISO proposes to expand its competitiveness testing to all critical transmission and corrective capacity constraints. Specifically:

- Enhance existing calculation to account for potential for pivotal suppliers to shutdown
- Incorporate ability to reduce demand for counterflow by the unloaded capacity on a constraint
- Mitigate commitments costs for resources effective to any non-competitive critical constraints

Recall the California ISO current dynamic mitigation test performs a dynamic competitive path assessment (DCPA) using a three pivotal supplier test on binding constraints and then performs the resource test using the non-competitive congestion component at the resource's location. The resource test is used to flag the resources' locational advantage to exercise market power based on the combination of the portion of its marginal congestion component that comes from the combination of all non-competitive constraint (non-competitive congestion component mitigation criterion).

Table 2 presents the proposed characteristics for the enhanced dynamic market power mitigation test. Detailed explanations for the proposal for the enhancements to the dynamic market power mitigation methodology is provided in Appendix E: Details on local market power mitigation.

Mitigation Design Feature	**Day-ahead**		**Real-time**	
	Energy	**Commitments**	**Energy**	**Commitments**
Market power mitigation processes	Perform dynamic market power mitigation in all unit commitment processes (energy and commitment cost mitigation applied) and add a market power mitigation process in its short-term unit commitment run. Additional modification to allow consideration of minimum load energy in the assessment of competitive path designation if a resource can start up within the optimization time horizon of the unit commitment process time horizon[11].			

[11] Explicitly the inclusion of minimum load energy from off-line resources for each unit commitment process would consider a resource "startable" in each run as: day-ahead would consider all resources that are not extremely long start resources, RTUC#1 with a 105 minute time horizon would consider any resources with start-up times less than 105 minutes, RTUC#2 which includes

Mitigation Design Feature	Day-ahead		Real-time	
	Energy	**Commitments**	**Energy**	**Commitments**
Type of constraint tested	Binding transmission and corrective capacity constraints	Critical transmission and corrective capacity constraints	Binding transmission and corrective capacity constraints	Critical transmission and corrective capacity constraints
Identifying potentially pivotal suppliers	Exempt net buyers	Net buyers or sellers could be considered as potentially pivotal supplier	Exempt net buyers	Net buyers or sellers could be considered as potentially pivotal supplier
RSI calculation – considers commitment or de-commitments	Y[12]	Y	Y	Y
RSI calculation – basis for maximum capacity that could be withheld from pivotal suppliers	Maximum effective available capacity	Maximum effective available capacity	Maximum effective available capacity[13] (ramp constrained)	Maximum effective available capacity[14] (ramp constrained)
Mitigation Criteria	Non-competitive congestion component	Non-competitive commitment mitigation criterion for binding and non-binding constraints	Non-competitive congestion component	Non-competitive commitment mitigation criterion for binding and non-binding constraints
Exempt from mitigation	No changes to current policy that exempts demand response, participating load, non-generator resources and virtual supply from mitigation.			

STUC would consider any resources with start-up time less than 270 minutes, RTUC#3 with a 75 minute time horizon would consider any resources with start-up time less than 75 minutes, and finally RTUC#4 with a 60 minute time horizon would consider any resources with start-up time less than 60 minutes. If the optimization horizons change the resources eligible for start up would change to reflect the revised horizon.

[12] RSI calculation for energy mitigation does not allow de-commitments in the real-time market power mitigation processes today driving the need to apply an enhancement to the energy test as well.

[13] RSI calculation for energy mitigation assesses maximum ramp range within unloaded capacity in the real-time market power mitigation processes relative to prior interval in the mitigation run.

[14] RSI calculation for energy mitigation assesses maximum ramp range within unloaded capacity in the real-time market power mitigation processes relative to prior interval in the mitigation run.

Mitigation Design Feature	Day-ahead		Real-time	
	Energy	**Commitments**	**Energy**	**Commitments**
Apply mitigation	Existing	Minimum load – hour failed and other hours where resource is subject to intertemporal constraints Start-up or Transition – horizon if any hour fails	Existing	Minimum load – interval failed and other interval where resource is subject to intertemporal constraints. Start-up or Transition – horizon if any interval fails

Table 2: Proposed characteristics of market power mitigation enhancements

Propose to address issues that a resource test allowing for a net effect across the system and that does not capture ability to inflate uplift but only inflate energy prices while appropriate for energy mitigation is not appropriate for commitment cost mitigation.

California ISO must enhance its dynamic market power mitigation to add additional mitigation criterion used to flag resources that need to be mitigated based on their potential ability to exercise market power through their commitment cost bids rather than their energy bids. California ISO will apply mitigation to its energy and commitment cost components separately based on whether the resource test for energy (non-competitive congestion component) fails and whether the resource tests (non-competitive commitment mitigation criteria) fails.

If the non-competitive commitment mitigation criterion for binding constraints or the non-competitive mitigation criterion for non-binding constraints fail then only the market-based commitment cost bids are mitigated. The market-based commitment cost bids are mitigated to the commitment cost reference levels.

The mitigation will apply consistently to internal constraints in the California ISO and Energy Imbalance Market Balancing Authority Areas and to the BAA level net transfer constraints where these constraints will either be binding or non-binding based on the flow.

Propose to calculate two residual supply indices: test binding for energy mitigation (existing) and test all critical constraints for commitment cost mitigation.

Local market power mitigation enhancements will test all critical constraints. Binding constraints are constraints where power flows are at a 100% versus critical transmission constraints, which are all constraints enforced in the unit commitment run. Currently the critical constraint limit is set at 85% or greater of the line limit in the prevailing flow direction.

California ISO does not propose to change the constraints that it tests for identifying uncompetitive constraints that trigger energy mitigation if resource has a locational advantage to exercise market power. Today, the California ISO tests binding constraints. Binding constraints are constraints where power

flows are at a 100% versus critical transmission constraints that are constraints where power flows are at a level close to the line limit of the constraint in the prevailing flow direction[15].

The California ISO believes that to feasibly implement a second residual supply index that could capture the effect of "lumpy" minimum load energy levels on relieving constraints that a wider selection of constraints need to be evaluated than binding constraints. California ISO proposes to perform a second residual supply index calculation on all critical constraints.

Currently the configurable parameter defining critical constraints is set at 85% or greater of the line limit in the network application power flow analysis. Any constraint with a power flow in any pass of the network application is greater than 85% will be enforced in the final unit commitment run. The final set of critical constraints that will be tested for insufficient supply will be the union of all constraints critical in any pass of the power flow analysis for a given unit commitment run. This is the set of constraints that could result in a commitment in the unit commitment run.

To address the concern that for non-binding constraints there is unloaded capacity from the lumpy effect of the commitments resolving the constraint with excess capacity, the California ISO proposes to remove this excess demand of counterflow from the denominator of the residual supply index. For example, if a line has a thermal limit of 1,000 MW and there is 2,000 MW of prevailing flow on this constraint, the market will dispatch resources to provide counterflow to bring the line within its limit. If there is no discontinuity in the market, no minimum online constraints or forbidden operating zones that drive "lumpy" decisions then the market would dispatch 1,000 MW of counterflow. However, there is discontinuity in the market from these physical constraints, if the market dispatches 1,020 MW of counterflow due to a minimum online constraint then and the "excess" counterflow of 20 MW would fully resolve the constraint. California ISO believes to include this excess in the demand for counterflow calculation would be over accounting for this demand and will remove the excess so that the demand for counterflow for this constraint would be assessed at its 1000 MW – demand without discontinuity.

The California ISO will apply constraints tests consistently to internal constraints in the California ISO and Energy Imbalance Market Balancing Authority Areas and to the BAA level net transfer constraints where these constraints will either be binding or non-binding based on the flow. For net transfer constraints, the California ISO proposes to only apply the commitment cost mitigation test if there is import congestion into the EIM BAA (net power balance constraints with positive shadow prices) consistent with its testing for energy mitigation today.

Propose to continue exempting net buyers from potentially pivotal suppliers in energy mitigation but to allow both net buyers and net sellers to be potentially pivotal suppliers in commitment cost mitigation.

Currently, the DCPA identifies potentially pivotal suppliers versus fringe competitive suppliers based on total withheld capacity (WC) by supplier on a portfolio basis. DCPA assigns resources to suppliers based on the Scheduling Coordinator ID adjusted for registered tolling agreements, suppliers portfolios are identified in equations with subscript B. All resources made available to the day-ahead or real-time market that can be started to respond to a dispatch in a period tested will be evaluated whether committed

[15] Note the flow level defining critical constraints is a configurable parameter that is tuned to ensure the number of constraints included in that set does not adversely impact market performance since it requires treating these constraints differently than other non-binding constraints such as calculated and saves shift factors for these constraints.

in all constraints run or not. For energy mitigation, the California ISO excludes net buyers of energy from being potentially pivotal suppliers.

California ISO maintains its policy that for energy mitigation, net buyers of energy do not have an incentive to withhold capacity to inflate locational marginal prices. There is no incentive for a net buyer to inflate energy costs because it would be exposed to higher costs for its load than it receives for its generation if it inflated energy costs through high supply bids.

On the other hand, the California ISO allocation of bid cost recovery is done in a manner that would allow either net buyers or net sellers to have the incentive to withhold their capacity to inflate uplift. Net buyers of energy incur allocations of bid cost recovery based on their ratio share of system load. If they were exempt from commitment cost mitigation, there could be an incentive for net buyers to inflate their commitment costs bids because they would recover all of their commitment costs but only be allocated a share of the resulting bid cost recovery. California ISO proposes to not make a distinction between net buyers and net sellers.

Propose to account for potentially withheld capacity directly by including minimum load energy when appropriate.

The California ISO proposes to include in the dynamic competitive path assessment an evaluation of whether a resource is capable of shutting down in the interval tested. If the resource is capable of bidding in a manner to withhold their entire capacity (energy and commitment cost mitigation), then this is supply of counterflow that a potentially pivotal supplier could bid strategically to withhold and result in inflated energy prices or uplift payments. This proposed change will impact the assessment of withheld capacity and supply of counter flow. This will allow the market to accurately account for a resource's potential ability to withhold counterflow addressing an existing limitation in the market power mitigation design.

The minimum load energy (as re-rated or as revised through outage management system) would be accounted for in the withheld capacity and would be excluded from the supply of counterflow from potentially pivotal supplier that would be withheld if the resource has fulfilled its minimum run time (also called minimum up time) and is not a must run resource with either self-schedules or ancillary service awards.

The details will be included in business rules and business practice manuals. These implementation details may be refined in the future if it is determined that refinements are needed to better effectuate the policy described above.

5.2.2. Mitigate resources within a minimum online constraint

California ISO proposes to mitigate all resources within minimum online constraints. Once the *Contingency Modeling Enhancements* (CME) policy is implemented, the corrective capacity constraints will largely replace minimum online constraints for managing thermal constraints. However, the California ISO may still need to enforce minimum online constraints for issues such as managing reactive power or voltage requirements. Therefore, if the ISO enforces such constraints, it will mitigate those constraints in the LMPM process. As it does today. California ISO clarifies it considers minimum online constraints for reactive power or voltage requirements by definition "uncompetitive" because they are enforced for local issues and would likely include very few resources under the constraint.

5.2.3. Mitigate exceptional dispatches commitment costs

The California ISO proposes to enhance the default competitive path assessment for purposes of mitigating commitment cost bids associated with exceptional dispatches by using the new unit commitment residual supply index results for all critical constraints.

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."16*

California ISO maintains the existing policy to ensure the default competitive path assessment effectively mitigates market power concerns related to exceptional dispatches. Today, the California ISO mitigates the energy bid on exceptional dispatches under Section 39.10 of the Tariff:

> *"The CAISO shall apply Mitigation Measures to Exceptional Dispatches of resources when such resources are committed or dispatched under Exceptional Dispatch for purposes of: (1) addressing reliability requirements related to non-competitive Transmission Constraints; (2) ramping resources with Ancillary Services Awards or RUC Capacity to a dispatch level that ensures their availability in Real-Time; (3) ramping resources to their Minimum Dispatchable Level in Real-Time; and (4) addressing unit-specific environmental constraints not incorporated into the Full Network Model or the CAISO's market software that affect the dispatch of Generating Units in the Sacramento Delta and are commonly known as "Delta Dispatch"."*

The California ISO proposes to apply the same four conditions on the mitigation of the commitment cost bids. The California ISO proposes that the default competitive path assessment 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).

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

The first static list is the one maintained today, which determines path designations for purposes of applying mitigation to energy bid of the exceptional dispatch based on whether the dispatch is effective to a constraint deemed non-competitive on the binding list. The historical assessment determines which constraints should be deemed competitive for mitigating energy costs based on whether two thresholds are met otherwise it is deemed non-competitive. The two thresholds are:

- 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.

The California ISO proposes to add a second static list for commitment cost mitigation that leverages the existing exceptional dispatch mitigation process. The historical assessment will determine which constraints should be deemed competitive for mitigating commitment costs based on whether two thresholds are met otherwise it is deemed non-competitive. The two thresholds are:

- 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 current static list used to mitigate the energy bids of exceptional dispatches is based on 60 days of historical data and has proven to be an effective sample size. The California ISO has not identified concerns with using 60 days of historical data and proposes given its experience and satisfaction with this approach to use the same date range and update frequency for mitigating the commitment cost bids of exceptional dispatches. The California ISO is not proposing any changes to the size of the historical dataset and frequency of maintaining these static lists. The current tariff codifies these requirements so that the 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 and that this set of designations will be updated not less frequently than every seven days to reflect changes in system and market conditions.

The California ISO believes with these proposed enhancements to the default competitive path assessment and the application of mitigation in the other three instances described in Section 39.10 that there should be sufficient market power mitigation protections proposed to support increasing flexibility to support market-based commitment cost bids.

5.2.4. Settle exceptional dispatches at commitment cost bids considered in initial instruction for the instruction period

Several stakeholders requested the California ISO clarify how the real-time market re-bidding rules interact with exceptional dispatches[17]. As described above, the re-bidding rules established that suppliers without integrated forward market awards or binding residual unit commitment start-up instructions may re-bid their commitment costs until receiving a binding real-time market instruction. For the purpose of

[17] Note this proposal applies to energy imbalance market manual dispatches. At the time the EIM entity determines a manual dispatch is needed the commitment cost bids in the market at that time will be the values used for California ISO settlement.

treating resources who receive an exceptional dispatch similarly, California ISO proposes that the settlement of exceptional dispatches would be set at the commitment cost bid considered by the California ISO when it issued the exceptional dispatch. The California ISO will settle these exceptional dispatches using commitment cost bids considered when the initial decision was made and not settle the resource based on revised bids submitted through the instruction period. If exceptionally dispatched when there are no commitment costs or energy bids, the California ISO proposes that the bid cost used in the exceptional dispatch payment will follow the "no bid" process.

5.2.5. Settle resources in full ramp at the bid used in the interval

California ISO analyzed its bidding and settlement rules that exist to mitigate inter-temporal market power concerns and identified a need to settle resources dispatched down or up at full ramp to settle at bid at the start of the ramp period. California ISO proposes to settle these resources at the bid used in the interval at the start of the ramp down period.

While it introduced real-time re-bidding rules in 2016 that largely mitigated inter-temporal market power concerns it has identified that its treatment of resources bids when in full ramp need to be addressed. When resources are in full ramp, the market has already issued the shut down or full ramp instruction and changes to the commitment cost bids after the interval where the ramp down or up begins cannot influence the market solution. Therefore, any changes after the full ramp period begins are not appropriate to include in the settlements. Currently, the California ISO has similar rules for residual imbalance energy and proposes to extend the protection to commitment cost bids.

5.3. Reference levels

The purpose of this section is to describe the California ISO proposal to improve its administratively calculated reference levels and to maintain select measures from the *Aliso Canyon Gas-Electric Coordination Phase 1* initiative. California ISO proposes to enhance its calculated reference levels to represent better an estimate of suppliers' cost expectations through improving the commodity price used in the gas price index and ensuring the generic formulas produce robust cost estimates. The California ISO also proposes to make permanent the California ISO practice of sending scheduling coordinators the D+2 residual unit commitment advisory schedules report to assist in planning gas procurement. Finally, the California ISO proposes to continue to use the next day gas commodity price index published the morning of the day-ahead market in its day-ahead market.

The California ISO will describe its proposal as follows:

- Improve commodity price in gas price index
- Formulate energy cost reference levels
- Formulate commitment cost reference levels

5.3.1. Improve commodity price in gas price index

California ISO proposes to make permanent the *Aliso Canyon Gas-Electric Coordination* temporary measure that allows the California ISO to update manually the commodity price used in day-ahead market to calculate the day-ahead gas price index based on an approximation of the next day gas price index available off webICE between 8:30 and 9:00 Pacific Time. This next day gas index would be used for calculating the day-ahead gas price index – a key input into the day-ahead reference level calculations.

Accordingly, the California ISO proposes to make permanent the practice of calculating the day-ahead gas price index (GPI) input to the day-ahead reference level formulations using the approximation of the next day gas commodity price available the morning of its day-ahead market, called the GD2 index (shown in ***Equation 2: Gas Price Index for Delivered Gas Price Estimate***). This proposal is broadly supported by the stakeholder community given the benefits it has brought to the market through making the reference levels more relevant and accurate. The GD2 next day index is the Intercontinental Exchange commodity price index published for gas traded the morning of the day-ahead market for delivery the following day beginning at 7AM Pacific (exceptions around weekends and holidays). This printed index price is a volume weighted average price of trades done during ICE's next day window.

Under *Aliso Canyon Phase 1*, the California ISO has implemented the use of an approximation of the next day gas commodity price index for gas procured the morning on the day prior to its electric operating day for gas day beginning at 7AM Pacific during the operating day. The California ISO pulls an approximation of the ICE next day gas commodity price index made available to it via webICE platform. Additionally, the California ISO stopped performing its previous "manual gas price spike procedure" since an approximation of the next day gas commodity price index would now be routinely used in the day-ahead market.

In the event the California ISO process for pulling the approximation of the commodity price from webICE fails the morning of the day-ahead market, California ISO proposes that it will be appropriate for its systems to fall back to the average of the published indices for the prior day's next day gas commodity price index published the morning of the day prior to its day-ahead market for gas flows beginning the morning of its day-ahead market. This is a current practice under temporary authority.

5.3.2. Formulate energy cost reference levels

The California ISO proposes that the formulation for the energy reference levels will be calculated consistently for all market purposes including generating or inserting bids. For its energy cost reference levels, suppliers will continue to be able to elect either the estimated proxy cost option (variable), LMP, or negotiated option (with variations of these options available for resource adequacy import resources). Currently, generated energy bids are all based on a similar approach as the estimated proxy cost option and a resource's reference level selection is only used to select the energy cost reference level used in market power mitigation (with an exception for resource adequacy import resources). The California ISO proposes to modify this approach by generating energy bids based for all resources on the reference level option selected by the supplier.

5.3.3. Formulate commitment cost reference levels

The California ISO proposes to support two options for the commitment cost reference levels - negotiated and estimated proxy cost options.

5.3.3.1. Support estimated proxy cost option

California ISO proposes to support an estimated proxy cost option that largely leverages the existing proxy cost estimate used for validating the cost-based commitment cost bids under current bidding rules. The California ISO proposes enhancements to the existing formulations to ensure the estimates represent a reasonable reflection of cost expectations based on information available to the California ISO.

California ISO proposes to support commitment cost reference levels that:

- Include headroom scalar to account for incidental costs above fuel cost proxy:

  Under the proposed policy, the commitment cost reference levels (i.e. proxy costs) will include a headroom scalar, similar to the existing approach for energy cost reference levels (i.e. default energy bids). The headroom scalar is intended to account for incidental costs not captured in the California ISO estimate. Note that these incidental costs are not intended to account for fuel price volatility (fuel price volatility under the approach described in this proposal will be accounted for by suppliers requesting reference level adjustments).

  Currently, the California ISO includes a 110% headroom scalar in its energy cost reference level and believes including it in its commitment cost reference levels allows for the same inclusion of incidental costs. These headroom scalars also act as a conservative margin of error in the estimates. Ideally, the headroom scalars used to calculate the reference level should be at the same level in each bid component since it serves the same intent in each calculation.

  Currently the California ISO has a cost-based cap on commitment cost bids of 125% of commitment cost reference levels that is intended to account for both incidental costs not included in the estimate and fuel price volatility. Since fuel price volatility under the approach described in this proposal will be accounted for by suppliers requesting reference level adjustments, a 110% commitment cost headroom scaler, the same as for energy cost reference levels, will be more appropriate.

  The California ISO proposes to initially set the headroom scalar in the commitment cost reference levels at 125%, the same as the current bid cap, as a temporary phase-in measure to allow time to evaluate the effectiveness of the new dynamic commitment cost mitigation. Relevant to the headroom scaler, this will allow time to ensure the dynamic commitment cost market power mitigation is not mitigating when market power in fact does not exist which if immediately mitigating to reference levels that only include a 110% headroom scalar would make resources worse off than the current approach. The California ISO proposes to automatically decrease the scalar from 125% to 110% in 18 months after the effective date. The California ISO will launch a stakeholder process to analyze the mitigation performance after 12 months of data are available. If design issues are identified leading to high commitment cost mitigation test false positives or false negatives, California ISO would file to delay the automatic decrease, and the automatic increase in the commitment cost circuit breaker bid cap, to allow for California ISO and its stakeholders to evaluate and address identified issues.

- Include minimum load costs for run hours unassociated with energy provision:

  California ISO proposes that minimum load cost bids of all supply resources[18] should have the ability to include costs unassociated with energy output at minimum load. In the stakeholder process, stakeholders expressed concerns regarding the existing approach which restricts run hour costs and finds that there may be scenarios where resources may have costs unassociated with

[18] Supply resources refers to resources eligible to submit market-based or cost-based bids under the California ISO Tariff, which will include Generating Units, Participating Load, Reliability Demand Response Resources, Proxy Demand Resources, or Non-Generating Resources.

energy provision that they incur on an hourly basis for each hour that the resource is available. For example, even though demand resources may have a zero MW minimum load output level, they may incur hourly costs to commit the resource and have it ready to respond to a real-time market energy dispatch.

California ISO proposes that resources that elect the estimated proxy cost option may register run hour costs unassociated with energy output that are incurred on an hourly basis. California ISO proposes to have audit authority for these values to ensure these are based on cost expectations based on defined criteria.

- Include opportunity costs for eligible limitations as adder above headroom scalar:

  The California ISO proposes to include opportunity costs as developed in the *Commitment Cost Enhancements Phase 3 (CCE3)* policy initiative as an adder above the headroom scaler for both commitment cost and energy cost reference levels.

  The California ISO proposes to calculate the estimated proxy cost option for energy cost reference levels (DEBs) consistent with its policy for calculating reference levels that include opportunity costs as developed in *Commitment Cost Enhancements Phase 3 (CCE3)*. With CCE3 implementation, energy reference levels (DEB) will include an opportunity cost adder either calculated or negotiated on top of the values scaled using the headroom scalar. Equations Equation 3, Equation 4, and Equation 5 show the methodology for the inclusion of the opportunity cost adder on top of the headroom scalar.

  The California ISO proposes to calculate its commitment cost reference levels so that they include the opportunity cost for eligible energy output, run hour, or start limitations on top of the reference levels including the headroom scalar. Consistent with CCE3 policy, the California ISO proposes that the minimum load reference level will include calculated or negotiated opportunity costs for eligible energy output limitations if the resource has a positive minimum load or eligible run hour limitations; start-up reference level will include calculated or negotiated opportunity costs for eligible start limitations; and transition cost reference levels will include calculated or negotiated eligible opportunity costs on the 'To' configuration.

With the combination of the enhancement of improving its day-ahead gas price index and these enhancements to improve its estimated proxy cost option for commitment costs, the California ISO believes it can provide robust estimates of expected costs to use on a routine basis for majority of resources.

The details will be included in business rules and business practice manuals. These implementation details may be refined in the future if it is determined that refinements are needed to better effectuate the policy described above.

5.3.3.2. Extend negotiated option

For resources with unique costs that may require more complex formulations, the California ISO proposes to extend its existing negotiated reference level option to commitment cost reference levels. The current provisions for negotiated default energy bids are found in the California ISO Tariff Section 39.7.1.3.1. The California ISO plans to extend the existing process to commitment costs.

This extension of the negotiated option will allow the California ISO to develop tailored reference levels across the entire supply bid that the California ISO can calculate on a routine basis to capture a resource's unique costs. The California ISO already provides this flexibility to suppliers for energy bid reference levels through the negotiated option for energy cost reference levels. The California ISO supports the negotiated rate option for purpose of reflecting systematic differences in cost formulations where suppliers have unique circumstances not captured by generic reference levels. The California ISO will not support negotiations on transition cost reference levels as the existing approach for the estimated proxy cost option for transition costs will already include the negotiated start-up cost values and the definition of transitions will continue to be the difference between start-ups of two different configurations of a multi-stage generator.

This design change will provide consistent levels of flexibility for relevant cost inclusion calculated on a routine basis for the entire supply bid. California ISO believes expanding its reference level design to also support negotiated commitment cost reference levels, as it currently supports for energy reference levels, is an appropriate approach to better reflect individual resources unique cost formulations for the entire bid.

Suppliers 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 the following general principles to administer the negotiations across the supply bid subject to sufficient justification:

- Support complex formulations of delivered fuel price especially for fuel-switching resources and resources that have opportunity to procure fuel from multiple locations or to transport fuel supplies across multiple pipelines
- Support complex formulations of delivered fuel price that do not assume the next day gas index is the appropriate price benchmark for the resource (i.e. fuel replacement costs).
- Include additional cost components not included in the generic reference level formula
- Exclude risk margin(s) for risks of undermining gas pipeline instructions or for cash-out risk
- Exclude price information outside of non-published indices since on a routine basis only benchmarks based on published indices that are appropriately monitored is appropriate

As part of this initiative's stakeholder process, the Department of Market Monitoring sought clarification on the process and to identify what cost components would be eligible for negotiation. The California ISO clarifies that at a minimum, the negotiation would include the cost components included in the California ISO's existing proxy commitment cost estimates. If a supplier believes additional components to its calculations are appropriate, the supplier would have to justify including these additional components as part of the negotiation. The California ISO proposes that all components of supply bid reference levels (i.e. start-up, minimum load, and energy costs) must be calculated under the negotiated option if a supplier seeks to negotiate any component. This is because generally these negotiations focus on the fuel or fuel equivalent cost input and the negotiated approach should be consistent across the bid (the start-up, minimum load, or energy reference levels).

Adding the negotiated option alone does not fully accommodate the appropriate level of bidding flexibility since significant changes in price volatility in real-time is largely observed in broker markets or between counterparties trading off the Intercontinental Exchange's electronic trading platform. Further,

on an exceptional basis when conditions warrant, the ISO finds it appropriate for suppliers' valuation of fuel price to change to reflect fuel availability. Under these conditions the California ISO would prefer the supplier be able to request an adjustment to its reference levels or reflect the risk in their bids so the ISO dispatch can consider the scarcity in finding the optimal solution. The appropriate tool for reflecting the fuel insufficiency condition is through leveraging the California ISOs proposed ex ante reference level adjustments.

5.4. Supplier submitted reference level adjustments

California ISO proposes to allow market-based bids for each component of the supply resources'[19] bid subject to mitigation and allow suppliers greater flexibility to negotiate or adjust reference levels for each supply bid component. The purpose of this section is to describe the California ISO proposal to allow greater flexibility to negotiate or adjust each component of supply bid reference levels.

The ISO will describe its proposal for supplier submitted reference level adjustment as follows:

- Support verified, ex ante reference level adjustments
- Support ex ante verification
- Support ex post cost recovery
- Re-calibrate penalty price parameters

5.4.1. Support verified, ex ante reference level adjustments

California ISO proposes to allow suppliers to submit ex ante adjustments to its reference levels for start-up cost, minimum load cost, or energy costs[20]. Reference level adjustments are necessary to address the need to update reference levels based on changes in fundamental drivers that arise on an exceptional basis and that do not routinely impact a resource's cost expectations. The supplier can request an adjustment to deviate from the estimates, which are only designed to serve under largely stable conditions[21]. The feature would be used when conditions arise that drive the suppliers' cost expectations away from the administratively calculated cost estimates – negotiated or estimated.

The California ISO proposes to require these submissions to be based on cost expectations given contemporaneous information available to the supplier. It will not be consistent with these guidelines to submit requests to adjust any component by strategically bidding near the reasonableness threshold to inflate market revenues or uplift. California ISO will reserve the right to verify these guidelines were followed in submitting ex ante adjustments to mitigate risk that a supplier may misuse the tool to adjust reference level to values that include costs outside of a cost-based bid through the ex-ante (using automated screen), ex post, and potentially perform an audit on frequently submitted and approved

[19] Supply resources refers to resources eligible to submit market-based or cost-based bids under the California ISO Tariff, which will include Generating Units, Participating Load, Reliability Demand Response Resources, Proxy Demand Resources, or Non-Generating Resources.

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

[21] 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

adjustments. In the event the California ISO identifies a supplier may be strategically bidding in this manner it will consider a referral to FERC.

Suppliers must be able to support sufficient justification for need to request a reference level adjustment as reference level adjustments must be based on reasonable cost expectations based on actual current information. Supporting documentation will be required to support there is justification for adjusting suppliers' reference levels. Suppliers will not be required to submit this documentation for every adjustment request but it must be available upon the California ISO request. The supporting documentation should indicate a fundamental driver is driving cost expectations to depart from California ISO estimates. The supporting documentation should be contemporaneous information used to:

- Support need for departure from California ISO cost estimates,
- Support which component of costs are impacted by the changes in fundamental drivers or operational needs, and
- Support monetary amount included in adjustment.

California ISO proposes the following list as a non-comprehensive list of appropriate supporting documentation:

- Market price information Supply bids reflecting fuel price volatility will be supported in day-ahead or real-time for cost-based bids that exceed the reference level calculated by the California ISO. Supporting documentation may include index publisher information (consummated low-mid-high), electronic platform information (bid-ask spreads), or off-ICE quotes. Suppliers must have documentation consisting of at least three quotes. The California ISO will assume reasonable pricing excludes the highest quote unless the supplier documents conditions that reasonably required it to procure the highest quote. Suppliers may document less than three price quotes if they document conditions that made it unable to obtain three quotes. California ISO adopts a principle that suppliers should pursue a good faith effort to obtain these quotes.
- Pipeline documentation: Real-time supply bids 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 or gas system capacity levels are insufficient to deliver fuel supply to avoid violating a gas pipeline instructions. If based on notice of fuel transport flow orders, California ISO proposes a reasonable monetary adjustment would be to adjust the delivered gas price estimate from the next day index used in the cost estimate up by adding the non-compliance charge associated with the specific level of flow order associated with hours between TD HE17 and TD HE24. Under fuel market or transport availability conditions[22] documentation may include current line pack levels or other pipeline capacity reports, notice of fuel transport flow orders (e.g. OFO, EFO), or fuel scarcity conditions (e.g. "can't find counterparty").

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

- If supplier is basing delivered gas price off of procurement locations other than standard procurement location or based on additional costs likely to be incurred due to deliverability or capacity limitation on the fuel system, California ISO will support inclusion of other procurement locations or additional fees for items such as backhauling fees. This support is contingent on supporting the constraint by submitting current line pack levels or other pipeline capacity reports.
- Fuel-switching resources to revise reference level to reflect the higher cost fuel if the resource needs to switch to that prime mover to continue to provide power and effectively allow for improved ability for California ISO to support reliability
- Fundamental drivers affecting non-gas units "fuel" or "prime mover" equivalent that will require documentation supporting exogenous factor is impacting ability to produce energy changing non-gas fuel equivalent costs from those registered in Master File. Supporting documentation will be required.

The California ISO proposes to require subjecting adjustments on either commitment cost or energy cost reference levels to verification requirements[23] prior to the market run (ex-ante verification) and if unable to verify in time will verify afterward whether costs were incurred above the adjusted reference level (ex post verification)[24]. California ISO also 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 locational marginal prices.

California ISO notes that FERC Order No. 831 limits the ability of verified cost-based bids – verified reference level adjustments – to set locational marginal prices but requires the ability for uplift settlements if supplier can verify actual costs even at levels above $2,000/MWh. California ISO proposes that the adjustments to energy cost reference levels will be accepted at any price level, subject to screening against a reasonableness threshold, similar to for the rules for commitment costs, but with nuances to their treatment as to whether they can set locational marginal prices or only be eligible for ex post cost recovery.

While the California ISO proposes to allow reference level adjustments on the entire value, these will be required to be based on variations of the fuel cost or fuel cost equivalent components. The California ISO arrived at this decision after reflecting on comments from WPTF that the CAISO should not pursue market enhancements only applicable to gas-fired units given increasingly diverse resources in the market. The California ISO believes allowing adjustments on the reference level instead of changes to the fuel input will provide flexibility in a technology agnostic manner.

The California ISO proposes that the guidelines should not provide specific conditions that would warrant suppliers' requesting adjustments but allow for some flexibility to expand these guidelines as the California ISO gains experience or as the fleet changes in the future. The ISO proposes that the overarching principle for these guidelines be that suppliers should be able to utilize this tool to reflect

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

[24] Suppliers will be eligible for after-the-fact uplift resettlement for energy costs incurred above the $2,000/MWh if the actual costs can be verified.

changes in their expected fuel or fuel equivalent costs to reflect changes in fundamental drivers that impact the fuel equivalent costs of non-gas fired resources.

California ISO has developed an initial process flow diagram to support stakeholders and the California ISO in evaluating the feasibility of the proposed verification requirements[25]. This process includes collaboration between California ISO and the DMM. Additional details are available in Appendix D: Proposed guidelines for ex ante adjustment requests and verification processes. The details will be included in business rules and business practice manuals. These implementation details may be refined in the future if it is determined that refinements are needed to better effectuate the policy described above.

5.4.2. Support ex ante verification

The CAISO proposes to perform ex ante verification through evaluating the reference level adjustment requests through an automated screen comparing the adjusted value against a reasonableness threshold. The reasonableness threshold establishes a level up to which the CAISO will automatically verify a reference level adjustment as a reasonable reflection of a suppliers' cost expectations. California ISO will establish reasonableness thresholds as follows:

- For gas resources: Calculate reference levels with scaled gas price indices and resource-specific feedback loop inputs[26]. The scaled gas price indices are calculated by applying a volatility scalar to the next day commodity price. The volatility scalars will vary depending on the day. For Monday and days without a published index when the market would fall back on the prior day's published index (e.g. weekdays after holidays), the volatility scalar will be 125%. For all other days the volatility scalar will be 110%.
- For non-gas resources: Calculate reference levels with scaled fuel equivalent costs and resource-specific feedback loop inputs. The scaled fuel equivalent costs are calculated by applying a volatility scalar to Master File registered fuel equivalent cost values. The volatility scalar will be 110%.

The resource specific feedback loop inputs will be based on systematic positive differences between a resource's actual fuel or fuel-equivalent costs exceeding the gas price indices or fuel equivalent costs used by the CAISO.

For commitment costs, if the adjustments fall below the reasonableness threshold then the California ISO will accept the reference level adjustment automatically. If the adjustment request is higher than the reasonableness threshold then the California ISO will limit the adjusted reference level to the reasonableness threshold and send the original adjustment request to the ex post verification process. For energy costs, if the energy adjustment falls below the reasonableness threshold, the California ISO will accept the reference level adjustment automatically. If the adjustment is higher than the lower of the reasonableness threshold or cost-based cap at $2,000/MWh then the California ISO will adjust the

[25] The process flow diagram is available at: http://www.caiso.com/Documents/ProcessFlow-CommitmentCosts_DefaultEnergyBidEnhancements.pdf.

[26] Resource-specific feedback loop term is a percent multiplier on the reference level that would allow tuning based on observed actual costs verified through the ex post review process.

reference level adjustment to the lower of the reasonableness threshold or the cost-based bid cap and send the original adjustment request to the ex post verification process.

California ISO proposes to introduce a manual verification process for requests above $1,000/MWh. CAISO will allow suppliers to pursue a manual consultation for reference level adjustments for energy costs above $1000/MWh. The consultation should follow the requirements for developing a reference level adjustment and sufficient supporting justification. If verifiable prior to the market close then the verified value will be the adjusted reference level value.

If a market-based bid is submitted at levels lower than the cost-based bid, the California ISO will use the market-based bid. This is an existing practice to use the lower of the bid or the reference level. For bids above $1,000/MWh, the California ISO will support bids above $1,000/MWh but they must be backed with either an administratively calculated reference level above $1,000/MWh or the submission of a reference level adjustment request. The California ISO will limit energy bids to the lower of the $2,000/MWh cap or the higher of the $1,000/MWh cap or the reference level as calculated or adjusted. Any adjustment requests capped at levels lower than the request will be eligible for ex post review.

Verify demand response resources under FERC Order No. 831

California ISO proposes that demand response resource should have the same flexibility to submit reference level adjustments as a generating resource. The ex-ante and ex post verifications for demand response resources will ensure customer opportunity costs[27] form the basis of both ex ante and ex post verification. In the Order on Rehearing and Clarification regarding FERC Order No. 831, FERC clarified that opportunity costs are actual costs.

For validating the reference level adjustment requests, demand response resources will be subject to the same validation rules as generating resources. For energy adjustment request, the requests will be verified up to the lower of the reasonableness threshold or the $2,000/MWh cost-based bid cap.

Reliability Demand Response Resources (RDRR) under FERC Order No. 831

Some stakeholders sought a specific statement from the California ISO on the interaction of this proposal to allow cost-based bids above the market-based offer cap set at $1,000/MWh to a California Public Utility Commission settlement on reliability demand response resources (RDRR) that set bid price of RDRR at 95%-100% of the bid cap. The bid cap referenced is the current $1,000/MWh bid cap that is the circuit breaker bid cap on market-based bids. Like all resources, if the cost expectations were to exceed the $1,000/MWh cap for either day-ahead or real-time, RDRR would be able to utilize the ex-ante reference level adjustment tool.

In day-ahead, RDRR are eligible to submit economic bids consistent with market rules. Therefore if a RDRR submits a request to adjust its reference level in the day-ahead market, the market will accept this as long as it meets the validation rules that limit energy bids to the lower of the $2,000/MWh cap or the higher of the $1,000/MWh cap or the reference level as calculated or adjusted.

In real-time, RDRR are not eligible to bid economically. RDRR resources will not be selected for normal dispatch unless one or more of the following conditions occur:

[27] Customer opportunity costs is associated with foregoing whatever end use the energy would have been used for.

- For system emergencies, including
- Transmission emergencies; and
- Mitigating imminent or threatened operating reserve deficiencies
- For resolving local transmission and distribution system emergencies.

CAISO operator may choose to activate a software flag which will allow these resources to be dispatched. Likewise, after the condition has ended and conditions have stabilized, the operator will reset the flag which will prevent the resources from being dispatched, other than to their day-ahead awarded value. The California ISO will activate these bids in the software based on either the marginal real-time dispatch option (Section 30.6.2.1.2.1) or the discrete real-time dispatch option (Section 30.6.2.1.2.2). For both options, the California ISO proposes to revise the bid price requirements for RDRR to require either a single-segment bid or a multi-segment bid in real-time that must be at least 95% of the market-based cap at $1,000/MWh and can be no greater than the lower of the $2,000/MWh cap or the higher of the $1,000/MWh cap or the reference level as calculated or adjusted.

Verify non-resource specific intertie transactions and virtual resources under FERC Order No. 831

California ISO proposes to exempt non-resource specific intertie transactions and virtual resources from the verification requirements. FERC Order No. 831 does not require verification to be performed on reference level adjustment requests. Non-resource specific intertie transactions and virtual resources will be able to utilize the reference level adjustment tool where energy adjustment requests will be limited to the $2,000/MWh cost-based cap.

Suppliers without market-based rate authority

For resources without market-based rate authority, the California ISO will allow these resources to request reference level adjustments since these are cost-based bids. California ISO will subject these requests to the ex-ante verification against the reasonableness threshold. In addition to limiting an adjustment request if it exceeds the reasonableness threshold, the California ISO will automate a market-based cap for suppliers without market-based rate authority to the adjusted reference levels. In this way, the supplier can submit a cost-based bid and market-based bids at the same level and fulfill its requirement to only submit cost-based bids under the California ISO's cost-based bid design.

5.4.3. Support ex post cost recovery

California ISO proposes to make eligible for ex post review and after-the-fact cost recovery any reference level adjustment request that was limited because the amount exceeded the reasonableness threshold. The proposal will leverage the existing process for the after-the-fact cost recovery filings. After-the-fact recovery will be for actually incurred costs that exceed either a cap or mitigated price level, which may not include any adders above cost such as risk related adder, unrecovered through market revenues.

The supplier must notify the California ISO within thirty (30) business days after the operating day on which the resource incurred the unrecovered costs (actual costs), whether it seeks a California ISO ex post review of its actual costs or if it will proceed directly to a FERC filing. If the supplier does not seek a California ISO ex post review it must submit the filing to FERC within ninety (90) business days after that trading day otherwise the supplier will be subject to ex post review at California ISO prior to having a filing deadline.

Within sixty (60) Business Days after the trading day for which the supplier provides notice to the California ISO per this Section, the California ISO will provide the Scheduling Coordinator with a written explanation of any effect that events or circumstances in the California ISO markets and fuel market conditions may have had on the resource's inability to recover the costs on the Trading Day. If the supplier also elected a California ISO ex post review, the California ISO will also notify the supplier if it is eligible for an ex post review based on whether it had a reference level adjustment that was limited by the reasonableness threshold. If the California ISO is unable to verify a limited reference level adjustment it will extend the requirement for filing at FERC until 30 days after the ex post review is complete.

California ISO proposes that each ex post review the supplier submits to the California ISO must include all the information required to be submitted at FERC plus additional information to assist the California ISO review. The documents will include:

(1) Data supporting the supplier's claim to the unrecovered costs it seeks, including invoices for the unrecovered costs;

(2) A description of the resource's participation in any gas pooling arrangements;

(3) An explanation of why recovery of the costs is justified; and

(4) Notification of gas pipeline instructions, if applicable.

The California ISO will first review the submission to determine if the request required immediate fuel procurement due to constrained conditions. The California ISO will verify that the submitted invoice(s) are dated after the market that produced relevant award where gas balancing rules did not allow delay in procurement. Further, the California ISO will require an attestation that no pooling arrangement or balancing rules would allow other than immediate procurement. California ISO will verify whether gas rules would have allowed additional time for procurement, if immediate procurement is required then the California ISO would verify the costs otherwise it would not verify.

California ISO will not support cost recovery for non-compliance charges incurred in response to a market dispatch because it has no method of identifying authorized or unauthorized gas. California ISO maintains its policy that suppliers need to seek recovery from the gas company for these charges where the gas company may choose to waive the charges.

California ISO will not be supporting ex post review of non-gas resources at this time. Until specific circumstances and experience can be gained on how to verify actual costs for such resources, the California ISO will limit the verification to the ex-ante review. Non-gas resources that have opportunity costs are limited to calculated or negotiated opportunity cost adders developed under *Commitment Cost Enhancements Phase 3.*

Given the proposal that the California ISO support an ex post verification of actual costs, the California ISO believes it prudent to retain the option for stakeholders to seek after-the-fact cost recovery at Federal Energy Regulatory Commission in the event that the California ISO cannot verify the request for uplift re-settlement based on actually incurred costs.

California ISO proposes to make permanent the 205 filing right at FERC for 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 California ISO tariff, the provision is temporary. California ISO proposes to make permanent this opportunity to complement the already permanent tariff language for a cost recovery filing opportunity for incurred commitment costs above commitment cost caps unrecovered through market revenues. California ISO notes that the filing right at FERC will not be limited to instances where the reference level adjustment request was limited but consistent with the current temporary tariff language.

5.4.4. Re-calibrate penalty price parameters

California ISO will support reference level adjustments up to $2,000/MWh in every market run therefore it proposes to re-calibrate its penalty price parameters to be appropriate for the increased $2,000/MWh cap. Table 3below shows each market run, the parameter or sequence that is currently codified in the Tariff, current value, and finally the proposed revised values. The California ISO has reviewed the priority sequence and is not proposing any changes to the sequence. After reviewing the values for the internal and intertie transmission constraint scheduling parameter, the California ISO will propose to amend its tariff to reflect the proposed revised values.

Market Run	Parameter or Sequence	Current Value	Revised Value
IFM	Internal and Intertie Transmission Constraint scheduling parameter	$5,000/MWh	**$10,000/MWh**
RUC	Internal and Intertie Transmission Constraint scheduling parameter	$1,250/MWh	**$2,500/MWh**
RTM	Internal and Intertie Transmission Constraint scheduling parameter	$1,500/MWh	**$3,000/MWh**
IFM	Priority sequence for reduction of self-scheduled LAP demand	No policy change required to priority sequence.	
IFM	Adjustment sequence to non-priced quantities	No policy change required to priority sequence.	
RTM	Adjustment sequence to non-priced quantities	No policy change required to priority sequence.	

Table 3: Proposed penalty parameter changes

California ISO proposes to retain the relative priority of the internal and intertie transmission constraint penalty prices at 500% of cap in integrated forward market (IFM), 125% of cap in residual unit commitment (RUC) process, and 150% of cap in the real-time market (RTM). This proposal adopts the assumption that the relative difference between the current values for the internal and intertie transmission

constraint scheduling parameter relative to the current $1,000/MWh offer cap is the appropriate relationship between these parameters and the cap.

6. Energy Imbalance Market classification

The California ISO proposes that this initiative should involve the EIM Governing Body's advisory role to the Board of Governors.

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 California ISO disagrees. The California ISO 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.

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 California ISO market, including the EIM, so that the least cost solution produced is assessing costs based on similar principles. Accordingly, the California ISO does not anticipate carving EIM specific scope items out from the overarching design making any proposed changes "generally applicable".

Arizona Public Service Co. asked for clarity on which aspects of this proposal impact the Energy Imbalance Market Entities in their comments on the revised straw proposal. California ISO would like to clarify that this initiative will affect EIM entities as the proposed changes all apply to the real-time market.

Appendix A: Stakeholder Engagement Plan

Commitment Costs and Default Energy Bid Enhancements (CCDEBE) will be going to the March 2018 EIM Governing Body and California ISO Board of Governors meeting. Current schedule for this initiative is shown in Table 4.

Milestone	Date
Issue paper posted	November 18, 2016
Stakeholder call	November 22, 2016
Stakeholder written comments due	December 9, 2016
Straw Proposal Posted	June 30, 2017
Stakeholder meeting	July 6, 2017
Stakeholder written comments due	July 20, 2017
Revised straw proposal	August 1, 2017
Stakeholder technical workshop	August 3, 2017
Stakeholder written comments due	August 15, 2017
Draft final proposal posted	August 23, 2017
Stakeholder call	August 30, 2017
Stakeholder written comments due	September 11, 2017
Revised draft final proposal posted	January 30, 2018
Stakeholder call	February 1, 2018
Stakeholder comments due	February 20, 2018
Second revised draft final proposal posted	March 2, 2018
Stakeholder comments opportunity at Market Surveillance Committee meeting	March 5, 2018
EIM governing body meeting	March 8, 2018
Board of Governors meeting	March 21-22, 2018

Table 4: Initiative Schedule

Appendix B: Proposed revisions to cost and bid definitions

California ISO proposes to ensure its market rules and reference level calculations accurately capture cost expectations of gas and non-gas resources. California ISO systems will need to be able to support minimum load costs even for resources without minimum load energy that incur run hour costs. Consequently, the California ISO proposes to revise its supply bid component definitions to be more technology agnostic. Further, the California ISO will define the market-based and cost-based bid components providing clarity for bidding.

Proposals to revise its definitions for to be more technology agnostic

The text in the following revisions is intended to convey the intent of the revised definitions. The actual text may be modified in the tariff development process.

Proposed revisions to revise "Energy":

"The electrical energy *provided*, flowing or supplied by *resources*, transmission or distribution facilities, being the integral with respect to time of the instantaneous power, measured in units of watt-hours or standard multiples thereof, e.g., 1,000 Wh=1kWh, 1,000 kWh=1MWh, etc."

Proposed revisions to revise "Minimum Load":

"For a *resource*, the minimum sustained operating level at which it can operate at a continuous sustained level, as defined in the Master File, or if applicable, as modified pursuant to Section 9.3.3. For a Participating Load, the operating level at reduced consumption pursuant to a Dispatch Instruction. For a *Reliability Demand Response Resource, Proxy Demand Resource or Non-Generating Resource*, the smallest discrete load reduction possible for *Reliability Demand Response Resource, Proxy Demand Resource or Non-Generating Resource*."

Proposed revisions to "Start-up":

"A Commitment Status transition from Off to On *from being shut down or in a state not capable of providing energy into a mode it can provide energy."*

Proposals to revise its definitions of commitment costs (supports cost-based bids)

Proposed revisions to "minimum load costs":

"The costs a Generating Unit, Participating Load, Reliability Demand Response Resource, Proxy Demand Resource, *or Non-Generating Resource* incurs operating at minimum load or for *run hour costs unrelated to energy provision possible even for resources with 0 MWh minimum load*, which in the case of Participating Load, Reliability Demand Response Resource, or Proxy Demand Resource may not be negative. Minimum Load Costs may be adjusted pursuant to Section 30.7.10.2, if applicable."

Proposed revisions to "start-up costs":

"The cost incurred by a particular Generating Unit, *Participating Load, Reliability Demand Response Resource, Proxy Demand Resource, or Non-Generating Resource* during Start-Up from *the time of beginning to bring a resource into a state capable of providing energy*, the time of receipt of a CAISO Dispatch Instruction, or the time the unit was last synchronized to the grid, whichever is later, until the time the *resource* reaches its Minimum Load."

Proposals to revise its definitions of cost-based bids and add cost-based energy bids

Proposed revisions to add a "cost-based energy bid curve":

"The bid component that indicates the *expected costs associated with providing energy* and related quantity at which a resource bids energy in a monotonically increasing (decreasing for participating load) staircase function, consisting of no more than 10 segments defined by 11 pairs of MW operating points and $/MWh, which may be different for each Trading Hour of the applicable Bid time period. If the resource has forbidden operating regions, each forbidden operating region must be reflected as a single, separate energy bid curve segment."

Proposed revisions to the "cost-based minimum load bid":

"The bid component that indicates the *expected* Minimum Load Cost for the Generating Unit, Participating Load, Reliability Demand Response Resource, Proxy Demand Resource, *or Non-Generating Resource* specified by a non-negative number in dollars per hour, which applies *for the hour for* which it is submitted."

Proposed revisions to the "cost-based start-up bid":

"The bid component that indicates the Start-Up Time and *expected* Start-Up Cost curves for the Generating Unit, which applies for a given market horizon. Start-Up Cost curves are strictly monotonically increasing non-negative staircase curves, up to three segments, which represent a function of Start-Up Cost versus down time. *Start-Up Cost curves may be updated pursuant to Section 30.5.1*."

Proposals to revise its definitions of market-based bids and adding market-based commitment bids

Proposed revisions to the "market-based energy bid curve":

"The bid component that indicates the *prices associated with providing energy* and related quantity at which a resource bids energy in a monotonically increasing (decreasing for participating load) staircase function, consisting of no more than 10 segments defined by 11 pairs of MW operating points and $/MWh, which may be different for each Trading Hour of the applicable Bid time period. If the resource has forbidden operating regions, each forbidden operating region must be reflected as a single, separate energy bid curve segment."

Proposed revisions to the "market-based minimum load bid":

"The bid component that indicates the *prices of* Minimum Load Cost for the Generating Unit, Participating Load, Reliability Demand Response Resource, Proxy Demand Resource, *or Non-Generating Resource* specified by a non-negative number in dollars per hour, which applies *for the hour for* which it is submitted."

Proposed revisions to the "market-based start-up bid":

"The bid component that indicates the Start-Up Time and *prices of* Start-Up Cost curves for the Generating Unit, which applies for the entire Trading Day or as resubmitted in real-time market as pursuant to Section 30.5.1(b). Start-Up Cost curves are strictly monotonically increasing non-negative staircase curves, up to three segments, which represent a function of Start-Up Cost versus down time. *Start-Up Cost curves may be updated pursuant to Section 30.5.1*."

Proposed revisions to the "market-based transition bid":

"The bid component that indicates the transition matrix, transition time, and *prices of* Transition Cost for a Multi-Stage Generating Resource for the entire Trading Day or as resubmitted in real-time market as

pursuant to Section 30.5.1(b), where prices are for the dollar cost per feasible transition from a given MSG Configuration to a higher MSG Configuration when the resource is already On. Transition Cost bids must be non-negative."

Appendix C: Proposed reference level calculations

This section provides proposed formulations for the improved gas price indices and each reference level.

The gas price index is the delivered gas price estimate based on next day gas commodity price indices, transportation rates, cap-and-trade credits, etc. California ISO calculates day-ahead and real-time GPIs.

Gas Price Index

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

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

Where:

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

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

$Commodity\ Price_{RT} = average(SNL_{GD2}, Platts_{GD2}, ICE_{GD2}, NGI_{GD2})$[28]

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

Transportation Rate is the approved gas pipeline shipping company rates on the company's electric supplier rate for that region.

Cap & Trade Credit (neg. value) is the approved CARB-jurisdictional gas pipeline shipping company rates on the company's electric supplier rate for that region that are only eligible to resources on the CARB covered entities list or to those who opt-in to the CARB list.

Miscellaneous costs will be defined specific to the fuel region.

***Equation 2: Gas Price Index for Delivered Gas Price Estimate*[29]**

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

[28] SCE1, SCE2, SDG1, SDG2 fuel regions have calculated commodity price in RT that include a scalar on the average of the published indices (175% for purpose of calculating maximum allowable commitment costs 125% for purpose of calculating default energy bids) under temporary *Aliso Canyon* provisions.

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

Minimum Load Cost

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

Where:

If gas resource, then:

Minimum Load Fuel Cost =

$MIN\_LOAD\_COST + (Unit\ Conversion *\ HEAT_{HEAT_{RATE}\ Point1} * MIN_{GEN} * GPI_{DA,DAFallBack,RT})$

else if non-gas, then:

Minimum Load Fuel Cost

$= (Unit\ Conversion * HEAT\_AVG\_COST_{POINT1} * MIN\_GEN + MIN\_LOAD\_COST)$

$VOM = VOM_{Default,Negotiated} * MIN\_GEN$

GMC Adder = $MIN\_GEN * GMC$

GHG Cost = $Unit\ Conversion * HEAT\_AVG\_COST_{POINT1} * MIN\_GEN *$ GHG_EMISSION_RATE $*$ *GHG Allowance Rate*

Unit conversion = 0.001

MMA = ISO determined major maintenance adder saved in Master File as ADDER_AMT

Scalar=1.25

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

Inputs:

Master File Registered Values: $HEAT\_HEAT\_RATE_{Point1}$, $HEAT\_AVG\_COST_{POINT1}$[30], MIN_LOAD_COST[31], MIN_GEN, GHG_EMISSION_RATE, GHG_COMPLIANCE_OBLIG (i.e. GHG_{Flag}).

California ISO Calculated Inputs: $GPI_{DA,RT}$, EPI, GHG Allowance Rate, calculated opportunity cost for eligible start limitations.

[30] First segment in the average heat rate field in Master File where segment 1 must be the Pmin (i.e. minimum load).

[31] California ISO will revise the definition of this field to make clear that for proxy cost units the registered values should only be the run hour costs expected outside of energy production costs up to Pmin.

California ISO Defined or Negotiated Values: GMC (BPM), VOM (BPM values or negotiated value), ADDER_AMT, negotiated opportunity cost for eligible start limitations.

Equation 3: Proxy Minimum Load Costs

Start-up (or shutdown) cost is a cost incurred per start-up event that is the cost of bringing the resource into a mode by which it can operate hourly and to a given dispatch level. The cost does not vary with the number of hours the resource is kept online.

Start-up Cost Reference Level Calculation

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

Where:

If gas resource, then:

Start-up Fuel Cost $= STRT\_STARTUP\_FUEL * GPI_{DA,RT}$

else if non-gas, then:

Start-up Fuel Cost $= STRT\_STARTUP\_COST$

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

$$GMC\ Adder = \frac{1}{2}(MIN\_GEN * GMC * \frac{STRT\_STARTUP\_TIME_{Point2}}{60})$$

GHG Cost = $STRT\_STARTUP\_FUEL *$ GHG_EMISSION_RATE $*$ GHG Allowance Rate

MMA = ISO determined major maintenance adder saved in Master File as STRT_STARTUP_MMA

Scalar=1.25

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

Inputs:

Master File Registered Values: STRT_STARTUP_FUEL, STRT_STARTUP_COST, STRT_STARTUP_AUX, $STRT\_STARTUP\_TIME_{Point2}$, MIN_GEN, GHG_EMISSION_RATE, GHG_COMPLIANCE_OBLIG (i.e. GHG_{Flag}).

California ISO Calculated Inputs: $GPI_{DA,RT}$, EPI, GHG Allowance Rate, calculated opportunity cost for eligible start limitations.

California ISO Defined or Negotiated Values: GMC (BPM), STRT_STARTUP_MMA, negotiated opportunity cost for eligible start limitations.

Equation 4: Proxy Start-Up Costs

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

Transition Cost

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

Where:

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

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

Scalar=1.25

OC Adder = ISO determined opportunity cost adder for resources with eligible start limitations calculated or negotiated on the "To Configuration"

Inputs:

California ISO Calculated Inputs: start up proxy costs and opportunity cost for eligible start limitations.

California ISO Defined or Negotiated Values: Negotiated opportunity cost for eligible start limitations.

Equation 5: Proxy Transition Costs

Appendix D: Proposed guidelines for ex ante adjustment requests and verification processes

This appendix provides the details for the proposed guidelines for the California ISO proposal to support supplier submitted ex ante reference level adjustments subject to verification.

D.1 Proposed reference level adjustment calculations

The following formulations should be used for adjustments to the start-up, minimum load, and energy components. A supplier must use the existing reference level calculation and will be allowed to submit a request for reference level adjustment based on their reasonable expectations of fuel (or fuel-equivalent) related costs. Suppliers will be expected to calculate the reference level adjustment requests using the formulas under the estimated proxy cost option. The Supplier will be able to revise the values of fuel (or fuel-equivalent) related costs using these formulas.

California ISO will expect the supplier to submit the total reference level value including the variable operations and maintenance cost, grid management charge adder, greenhouse gas compliance costs (if appropriate), frequently mitigated adders (if appropriate), negotiated major maintenance adders (if appropriate), and opportunity cost adders (if appropriate) but that those values will be static and consistent with California ISO existing calculations. Further, the resource characteristics that feed into these equations will be required to be consistent with Master File registered values or as revised through outage management system. For example, the supplier may request a reference level adjustment, based on fuel cost or fuel cost equivalent component variations from the costs the California ISO uses in its calculations by including their expectation of fuel or fuel equivalent cost in a recalculated cost-based bid that the supplier will submit and if verified then used as an adjusted reference level.

Equation 6 The individual components that a supplier is allowed to adjust the values within the formula are limited to:

- Gas Price Index for gas resources
- Average cost curve for non-gas resources[32]
- GHG allowance rate for resources where GHG flag in Master File is "On"

Default Energy Bid Cost

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

Where:

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

If gas resource, then:

Segment's Fuel Cost $= Unit\ Conversion * Incremental\ Heat\ Rate * GPI_{DA,DAFallBack,RT}$, *where*

$Incremental\ Heat\ Rate = (HEAT\_RATE_{i+1} * MW_{i+1} - HEAT\_RATE_i * MW_i)/(MW_{i+1} - MW)_i$[33]

else if non-gas, then:

Segment's Fuel Cost $= Incremental\ Cost\ Curve$, *where*

$Incremental\ Cost\ Curve = (AvgCost_{i+1} * MW_{i+1} - AvgCost_i * MW_i)/(MW_{i+1} - MW)_i$ [34]

VOM=variable operating and maintenance adder (VOM)

$$GHG\ Cost = Unit\ Conversion * Incremental\ Heat\ Rate^{35} * Emissions\ Rate * GHG\ Allowance\ Rate$$

Unit conversion = 0.001

$DEBA = ISO\ determined\ default\ energy\ bid\ adder$

Scalar $= 1.1$

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

Equation 6: Default Energy Bid Variable Cost Calculation

below shows the proposed formulation for the estimated proxy cost option for minimum load reference levels. The individual components that an SC is allowed to adjust the values within the formula are limited to:

- Gas Price Index for gas resources
- Average cost segment 1 for non-gas resources
- Minimum load cost registered for proxy cost units expected run hour costs not associated with any energy production up to minimum load
- GHG allowance rate for resources where GHG flag in Master File is "On"

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

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

[35] Incremental heat rate reflects formula above and additional tariff language descriptions for incremental heat rate as described in footnote 33.

Minimum Load Cost

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

Where:

If gas resource, then:

Minimum Load Fuel Cost =

$MIN\_LOAD\_COST + (Unit\ Conversion *\ HEAT_{HEAT_{RATE}\ Point1} * MIN_{GEN} * GPI_{DA,DAFallBack,RT})$

else if non-gas, then:

Minimum Load Fuel Cost

$= (Unit\ Conversion * HEAT\_AVG\_COST_{POINT1} * MIN\_GEN + MIN\_LOAD\_COST)$

$VOM = VOM_{Default,Negotiated} * MIN\_GEN$

GMC Adder = $MIN\_GEN * GMC$

GHG Cost = $Unit\ Conversion * HEAT\_AVG\_COST_{POINT1} * MIN\_GEN *$ GHG_EMISSION_RATE $*$ *GHG Allowance Rate*

Unit conversion = 0.001

MMA = ISO determined major maintenance adder saved in Master File as ADDER_AMT

Scalar=1.25

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

Inputs:

Master File Registered Values: $HEAT\_HEAT\_RATE_{Point1}$, $HEAT\_AVG\_COST_{POINT1}$[36], MIN_LOAD_COST[37], MIN_GEN, GHG_EMISSION_RATE, GHG_COMPLIANCE_OBLIG (i.e. GHG_{Flag}).

California ISO Calculated Inputs: $GPI_{DA,RT}$, EPI, GHG Allowance Rate, calculated opportunity cost for eligible start limitations.

[36] First segment in the average heat rate field in Master File where segment 1 must be the Pmin (i.e. minimum load).

[37] California ISO will revise the definition of this field to make clear that for proxy cost units the registered values should only be the run hour costs expected outside of energy production costs up to Pmin.

California ISO Defined or Negotiated Values: GMC (BPM), VOM (BPM values or negotiated value), ADDER_AMT, negotiated opportunity cost for eligible start limitations.

Equation 7: Proxy Minimum Load Costs

Equation 8 below shows the proposed formulation for the estimated proxy cost option for start-up reference levels. The individual components that a supplier is allowed to adjust the values within the formula are limited to:

- Gas Price Index for gas resources
- Start-up fuel cost for non-gas resources
- Electricity price index
- GHG allowance rate for resources where GHG flag in Master File is "On"

Start-up Cost Reference Level Calculation

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

Where:

If gas resource, then:

Start-up Fuel Cost $= STRT\_STARTUP\_FUEL * GPI_{DA,RT}$

else if non-gas, then:

Start-up Fuel Cost $= STRT\_STARTUP\_COST$

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

$$GMC\ Adder = \frac{1}{2}(MIN\_GEN * GMC * \frac{STRT\_STARTUP\_TIME_{Point2}}{60})$$

GHG Cost = $STRT\_STARTUP\_FUEL$ * GHG_EMISSION_RATE * GHG Allowance Rate

MMA = ISO determined major maintenance adder saved in Master File as STRT_STARTUP_MMA

Scalar=1.25

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

Inputs:

Master File Registered Values: STRT_STARTUP_FUEL, STRT_STARTUP_COST, STRT_STARTUP_AUX, $STRT\_STARTUP\_TIME_{Point2}$, MIN_GEN, GHG_EMISSION_RATE, GHG_COMPLIANCE_OBLIG (i.e. GHG_{Flag}).

California ISO Calculated Inputs: $GPI_{DA,RT}$, EPI, GHG Allowance Rate, calculated opportunity cost for eligible start limitations.

California ISO Defined or Negotiated Values: GMC (BPM), STRT_STARTUP_MMA, negotiated opportunity cost for eligible start limitations.

Equation 8: Proxy Start-Up Costs

D.2 Proposed ex ante verification

California ISO will evaluate the reference level adjustment request through an automated screen comparing the adjusted value against a reasonableness threshold. California ISO proposes the reasonableness threshold should be a threshold calculated to represent a reasonable cost-based bid that can be calibrated to a specific resources' costs.

For gas-fired resources, the reasonableness threshold will be a calculation using the reference level calculations with a scaled next day gas commodity price in the gas price index. The California ISO proposes to scale the gas price indices as shown in Equation 9. Then the California ISO will calculate the energy, minimum load and start-up reasonableness thresholds using the reference level formulas with the scaled gas price index in place of the standard gas price index (formulas used shown in Equation 6, Equation 7, and Equation 8).

Scaled Gas Price Index

$$GPI_{DA} = Commodity\ Price_{DA,DAFallBack} * Fuel\ Volatility\ Scalar + Transportation\ Rate + \text{Shrinkage Allowance}_{DA} + Cap\ \&\ Trade\ Credit + Miscellaneous$$

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

Where:

$$Fuel\ Volatility\ Scalar = \begin{cases} 125\%, operating\ day\ is\ Monday\ or\ after\ Holiday^{38} \\ 110\%, operating\ day\ is\ non-Monday\ or\ index\ is\ available \end{cases}$$

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

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

$Commodity\ Price_{RT} = average(SNL_{GD2}, Platts_{GD2}, ICE_{GD2}, NGI_{GD2})$

[38] Proposal will utilize 125% for any day that the fallback is needed to account for increased need to reflect volatility.

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

Transportation Rate is the approved gas pipeline shipping company rates on the company's electric supplier rate for that region.

Cap & Trade Credit (neg. value) is the approved CARB-jurisdictional gas pipeline shipping company rates on the company's electric supplier rate for that region that are only eligible to resources on the CARB covered entities list or to those who opt-in to the CARB list.

Miscellaneous costs will be defined specific to the fuel region.

Equation 9: Scaled Gas Price Index in Reasonableness Threshold

For non-gas fired resources the reasonableness thresholds will be calculated for energy, minimum load, and start-up reference levels by applying a 110% fuel equivalent volatility scalar to the fuel equivalent cost component. Then the California ISO will calculate the energy, minimum load and start-up reasonableness thresholds using the reference level formulas with the scaled fuel equivalent costs in place of the registered fuel equivalent costs (formulas used shown in Equation 6, Equation 7, and Equation 8).

Minimum Load Fuel Cost

$$= 110\% * (Unit\ Conversion * HEAT\_AVG\_COST_{POINT1} * MIN\_GEN + MIN\_LOAD\_COST)$$

Equation 10: Scaled Minimum Load Fuel Equivalent Cost in Reasonableness Threshold

Start-up Fuel Cost $= 110\% * STRT\_STARTUP\_COST$

Equation 11: Scaled Start-up Fuel Equivalent Cost in Reasonableness Threshold

If the adjustment request falls below the reasonableness threshold, the California ISO will accept the reference level adjustment automatically. If the adjustment is higher than lower of the reasonableness threshold or cost-based cap if applicable[39], the California ISO 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.

D.3 Proposed ex post verification and auditing

For both commitment cost and energy reference level adjustments, California ISO proposes to perform ex post verification of actual incurred costs.

- Unverifiable reference level adjustments based on reasonableness thresholds, and
- Verified or unverifiable energy reference level adjustments greater than $2,000/MWh.

[39]California ISO proposing to only apply cost-based cap to the adjustments to energy cost reference levels. For the purpose of evaluating adjustments to commitment cost reference levels, these requests will only be evaluated against the reasonableness threshold.

If successfully verified, California ISO proposes to re-calculate the supplier's uplift settlement with the 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.

If the California ISO identifies in its ex post verification process that supplier submitted reference level adjustments did not follow the established principles then the California ISO proposes to render the supplier ineligible to submit reference level adjustments until a defined amount of time has elapsed. This authority is essential as an additional measure to protect against artificial price impacts. California ISO proposes a stepped penalty approach[40].

The California ISO also proposes to add audit authority to allow it to audit automatically approved adjustments if it identifies that a supplier has frequently submitted and been frequently approved for these requests. This is necessary to ensure the adjustment requests were submitted with cost-based bids consistent with the rules.

The California ISO may render suppliers ineligible either through the ex post verification or through a failed audit. The first instance the California ISO determines the supplier failed to follow the guidelines, the California ISO will render the supplier ineligible for reference level adjustments for 60 days. The 60 day period shall start two business days after the date that the ISO provides written notice of its determination that the supplier did not follow the guidelines. The second time California ISO determines the same supplier failed to follow the guidelines, the California ISO will render the supplier ineligible for 180 days.

If failure to follow the rules appears to become a pattern of strategic bidding behavior or false or misleading information, the California ISO or its Department of Market Monitoring may refer behavior to the Federal Energy Regulatory Commission for a more detailed review of compliance with market behavior rules 35.41(b).

[40] Proposed penalty for failure to follow rules modeled after NYISO approach described in New York Independent System Operator Tariff Market Administration and Control Area Services Sections 23.3.1.4.6.8 - 23.3.1.4.6.8.2.

Appendix E: Details on local market power mitigation

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

CAISO proposes to allow market-based bids for each component of the supply bid subject to mitigation where minimum load cost component is treated hourly and start-up and transition costs remain event-based costs at daily values. Proposed enhancements to dynamic market power mitigation will test binding constraints for energy mitigation and test all critical constraints for commitment cost mitigation.

The proposal will apply consistently to internal constraints in the California ISO and Energy Imbalance Market Balancing Authority Areas and to the BAA level net transfer constraints where these constraints will either be binding or non-binding based on the flow. For commitment cost mitigation, the will apply the calculations for binding constraints to the BAA level net transfer constraints that have a positive shadow price (import congestion). The BAA level net transfer constraints are performed using a power balance constraint which requires generation to equal demand, due to the equality constraint this constraint will always be binding. For mitigating commitment costs, the CAISO will apply the non-competitive commitment mitigation criterion for binding constraints to any non-competitive net power balance constraints.

CAISO proposes to apply real-time market commitment cost re-bidding rules as approved by Federal Energy Regulatory Commission on November 21, 2016 (ER16-2445).

E.1 Data inputs and subscript notations in the LMPM and DCPA

The following table, Table 5 and Table 6, contains the subscripts used in the equations for the mitigation process. These subscripts are based on those used in the Business Practice Manual sections on mitigation.

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

Subscript	Subscript Name	Subscript Description
l	critical constraint	All binding constraints and non-binding constraints identified as likely needing commitments to resolve the constraint, potentially critical constraint plus pre-determined constraints based on engineering or economic assessments
L	Set of critical constraints	All critical constraints
t	Interval	Interval within the optimization time horizon
T	Optimization time horizon	Set of all intervals that fall within the optimization time horizon

Table 5: Subscript notation

Variable	Market Run	Formulation	Description
$\boldsymbol{ENGYMIN_i}$	INPUT	$\max[(MINCAP_i + RD_i), self - scheduled\ energy]$	Minimum operating level for resource i that it can be dispatched to on energy bids respecting regulation down awards during test interval (i.e. lower operating limit plus regulation down award).
$\boldsymbol{MINCAP_i}$	INPUT	$\max(Pmin_i + Pmin\ Rerate_i, \min ED)$	Minimum operating level of resource r where $Pmin_i$ is regulation Pmin if on regulation otherwise operational Pmin.
$\boldsymbol{ENGYMAX_i}$	INPUT	$min((MAXCAP_i - OR_i - RU_i), (MAXECON_i - OR_i))$	Maximum operating level for resource i that it can be dispatched to on energy bids given outages and derates and respecting operating reserves and regulation up during test interval (i.e. upper operating limit minus operating reserves or regulation up awards).

Variable	Market Run	Formulation	Description
$\boldsymbol{MAXCAP_i}$	INPUT	$\min(Pmax_i - Derate_i, \max ED)$	Maximum operating level of resource r where $Pmax_i$ is regulation Pmax if on regulation otherwise operational Pmax. Note – for MSG plants these are plant level maximums and derates.
$\boldsymbol{MAXECON_i}$	INPUT	$\min\begin{pmatrix} Pmax_i - Derate_i, \\ \max ED, \\ \max econ\ bid\ MW \end{pmatrix}$	Maximum operating level of resource r where $Pmax_i$ is regulation Pmax if on regulation otherwise operational Pmax
$\boldsymbol{DERATE_i}$	INPUT	INPUT	Reduction in potential output from maximum operating level ($MAXCAP_i$) from unit outages or derates during test interval
$\boldsymbol{OR_i}$	INPUT	INPUT	Operating reserve awards for resource i in test interval. For HASP, ORi is (HASP qualified self-scheduled spinning including transferred DA spin capacity)+ (HASP qualified self-scheduled non-spinning including transferred DA non-spinning capacity). For RTUC, ORi is awarded spinning capacity + awarded non-spinning capacity.
$\boldsymbol{RD_i}$	INPUT	INPUT	Regulation down award for resource i in the test interval. For real-time, HASP qualified self-scheduled regulation down including transferred DA regulation down capacity.
$\boldsymbol{RU_i}$	INPUT	INPUT	Regulation up award for resource i in the test interval. For real-time, HASP qualified self-scheduled regulation up including transferred DA regulation up capacity.

Variable	Market Run	Formulation	Description
RR_i	INPUT	INPUT	Effective ramp rate at DOP_t in case of dynamic ramp rate.
CC_i	INPUT	INPUT	Corrective capacity awards.
DOP_i	INPUT	INPUT	Dispatch operating point for physical or virtual supply resource i for the Market Power Mitigation all constraints run results for the test interval[41].
$DOP_{i,t-1}$	INPUT	INPUT	Dispatch operating point for physical or virtual supply resources I from the Market Power Mitigation all constraint run results for the interval prior to the test interval.
$SF_{l,i}$	INPUT	INPUT	Shift factor from resource location r to constraint l where constraint set L includes all critical constraints. Note that for MSG Plants the SF is given per plant aggregate connectivity node.
$SF_{k,i}$	INPUT	INPUT	Shift factor from resource location r to constraint k where constraint set K includes all binding constraints (subset of critical constraints set). Note that for MSG Plants the SF is given per plant aggregate connectivity node.
$SF_{ckc,i}$	INPUT	INPUT	Shift factor from resource location r to constraint ckc where constraint set CKC includes all binding corrective capacity constraints. Note that for MSG Plants the SF is given per plant aggregate connectivity node.

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

Variable	Market Run	Formulation	Description
$SF_{clc,i}$	INPUT	INPUT	Shift factor from resource location r to constraint clc where constraint set CLC includes all critical corrective capacity constraints. Note that for MSG Plants the SF is given per plant aggregate connectivity node.

Table 6: Revised data inputs for commitment cost mitigation

E.2 Potentially pivotal or fringe competitive supplier

Identification of the top three potentially pivotal suppliers in the day-ahead market will be based on the available effective supply that can be withheld by each supplier. In the day-ahead this is the total effective counterflow supply. In real-time, it will be the ramp-constrained capacity including the minimum load energy a supplier could withhold.

The revised real-time withheld capacity calculations applied in both the energy test and the commitment cost test will have conditional logic so that the market removes the floor used to limit ramp capable movement to the minimum operating level. In real-time, the lowest output level for a resource i will account for the ability to de-commit or shutdown the resource by including conditional logic whereby if ramp capable, through its minimum run time, and not must run resource then the minimum load energy will be reflected.

E.2.1 Binding constraint calculations – WC

For each binding transmission constraint l and critical corrective capacity constraint ckc, suppliers are ranked on withheld capacity (WC) from highest to lowest and the top three suppliers are identified as within the set of potentially pivotal suppliers for that constraint and the remainder are identified as fringe competitive suppliers. For determining the array of potentially pivotal suppliers and fringe competitive suppliers for binding transmission or corrective capacity constraints, CAISO will continue to default net buyers to fringe competitive suppliers.

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

IFM Formulation:

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

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

RTUC formulation:

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

$$WC_{ckc,j}^{CCM} = \sum_{i=1}^{n} \Big[SF_{ckc,i} * \big(\min\big(DOP_{i,t-1} + RR_i * 15, ENGYMAX_i\big) - \delta min\big[\max\big(DOP_{i,t-1} - RR_i * 15, ENGYMIN_i\big) + RR_i * 20, ENGYMAX_i\big)\big]\big)\Big]$$

$Where\ \delta = \{0,1\}$

$DOP_{i,IC} - RR_i * 15 * N \leq ENGYMIN_i \rightarrow \delta = 0$

$DOP_{i,IC} - RR_i * 15 * N > ENGYMIN_i \rightarrow \delta = 1$

Where $DOP_{i,IC}$ is the binding dispatch point from the market that establishes the initial condition for the RTUC optimization and N is the number of interval in the time horizon (e.g. the 3rd interval is 3).

Note - Delta is locked to 1 for:

- Must-run resources (i.e. resources with self-schedules or AS awards),
- Resources that have not fulfilled their minimum run time (also called minimum up time)

Today in HASP, for a unit that is offline in the previous interval and has a startup time of 60 minutes or less, then WC = Pmin. For RTUC, the startup time to be used is reduced to 15 minutes or less. Under policy this will be generalized to allow resources with feasible start-ups in that unit commitment to be included in WC or supply of counterflow of fringe competitive suppliers.

Withheld Capacity (WC) shall not consider pump storage resources; demand side of PDR, RDRR, Dispatched Pump resources, and NGR; and any external resources are excluded (consistent logic to existing MPM).

E.2.2 Critical constraint calculations – WC

For each critical transmission constraint l and critical corrective capacity constraint clc (includes binding and non-binding), suppliers are ranked on withheld capacity (WC) from highest to lowest and the top three suppliers are identified as within the set of potentially pivotal suppliers for that constraint and the remainder are identified as fringe competitive suppliers. For determining the array of potentially pivotal suppliers and fringe competitive suppliers on all critical transmission or corrective capacity constraints, CAISO will not default net buyers to fringe competitive suppliers.

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

IFM Formulation:

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

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

RTUC formulation:

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

$$WC_{clc,j}^{CCM} = \sum_{i=1}^{n} \Big[SF_{clc,i} * \big(\min\big(DOP_{i,IC} + RR_i * 15 * N, ENGYMAX_i\big) - \delta min\big[\max\big(DOP_{i,IC} - RR_i * 15 * N, ENGYMIN_i\big) + RR_i * 20, ENGYMAX_i\big)\big]\Big]$$

$Where \; \delta = \{0,1\}$

$DOP_{i,IC} - RR_i * 15 * N \leq ENGYMIN_i \rightarrow \delta = 0$

$DOP_{i,IC} - RR_i * 15 * N > ENGYMIN_i \rightarrow \delta = 1$

Where $DOP_{i,IC}$ is the binding dispatch point from the market that establishes the initial condition for the RTUC optimization and N is the number of interval in the time horizon (e.g. the 3rd interval is 3).

Note - Delta is locked to 1 for:

- Must-run resources (i.e. resources with self-schedules or AS awards),
- Resources that have not fulfilled their minimum run time (also called minimum up time)

Today in HASP, for a unit that is offline in the previous interval and has a startup time of 60 minutes or less, then WC = Pmin. For RTUC, the startup time to be used is reduced to 15 minutes or less. Under policy this will be generalized to allow resources with feasible start ups in that unit commitment to be included in WC or supply of counterflow of fringe competitive suppliers.

Withheld Capacity (WC) shall not consider pump storage resources; demand side of PDR, RDRR, Dispatched Pump resources, and NGR; and any external resources are excluded (consistent logic to existing MPM).

E.3 Counterflow supply from potentially pivotal suppliers

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

The revised real-time supply of counterflow from potentially pivotal suppliers calculations applied in both the energy test and the commitment cost test will have conditional logic so that the market removes the floor used to limit ramp capable movement to the minimum operating level. In real-time, the lowest output level for a resource i will account for the ability to de-commit or shutdown the resource by including conditional logic whereby if ramp capable, through its minimum run time, and not must run resource then the minimum load energy will be reflected.

E.3.1 Binding constraint calculations – SCFPPS

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

$$SCF_k^{PPSCCM} = \sum_{j=1}^{n}\sum_{i=1}^{n} SPCF_{k,j,i}^{PPSCCM}$$

$$SCF_{ckc}^{PPSCCM} = \sum_{j=1}^{n}\sum_{i=1}^{n} SPCF_{ckc,j,i}^{PPSCCM}$$

IFM formulation:

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

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

RTUC formulation:

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

$$SPCF_{ckc,j,i}^{PPSCCM} = SF_{ckc,i} * \delta min\left[\max\left(DOP_{i,t-1} - RR_i * 15, ENGYMIN_i\right) + RR_i * 20, ENGYMAX_i)\right]$$

$Where \; \delta = \{0,1\}$

$DOP_{i,IC} - RR_i * 15 * N \leq ENGYMIN_i \rightarrow \delta = 0$

$DOP_{i,IC} - RR_i * 15 * N > ENGYMIN_i \rightarrow \delta = 1$

Note - Delta is locked to 1 for:

- Must-run resources (i.e. resources with self-schedules or AS awards),
- Resources that have not fulfilled their minimum run time (also called minimum up time)

E.3.2 Critical constraint calculations – SCFPPS

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

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

$$SCF_{clc}^{PPSCCM} = \sum_{j=1}^{n} \sum_{i=1}^{n} SPCF_{clc,j,i}^{PPSCCM}$$

IFM formulation:

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

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

RTUC formulation:

$$SPCF_{l,j,i}^{PPSCCM} = SF_{l,i} * \delta \max(DOP_{i,IC} - RR_i * 15 * N, ENGYMIN_i)$$

$$SPCF_{clc,j,i}^{PPSCCM} = SF_{ckc,i} * \delta min\left[\max\left(DOP_{i,IC} - RR_i * 15 * N, ENGYMIN_i\right) + RR_i * 20, ENGYMAX_i)\right]$$

$Where \; \delta = \{0,1\}$

$DOP_{i,IC} - RR_i * 15 * N \leq ENGYMIN_i \rightarrow \delta = 0$

$DOP_{i,IC} - RR_i * 15 * N > ENGYMIN_i \rightarrow \delta = 1$

Note - Delta is locked to 1 for:

- Must-run resources (i.e. resources with self-schedules or AS awards),
- Resources that have not fulfilled their minimum run time (also called minimum up time)

E.4 Counterflow supply from fringe competitive suppliers

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

E.4.1 Binding constraint calculations – SCFFCS

No changes are being proposed to the test on binding constraints for supply of counterflow from fringe competitive supplier.

E.4.2 Critical constraint calculations – SCFFCS

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

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

$$SCF_{clc}^{FCSCCM} = \sum_{j=1}^{n}\sum_{i=1}^{n} SPCF_{ckc,j,i}^{FCSCCM} + \sum_{j=1}^{n}\sum_{i=1}^{n} SVCF_{clc,j,i}$$

IFM formulation:

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

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

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

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

RTUC formulation:

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

$SPCF_{clc,j,i}^{FCSCCM} = SF_{clc,i} * \min(DOP_{i,t-1} + RR_i * 35, ENGYMAX_i)$[42]

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

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

E.5 Demand for counterflow

The demand for counterflow to binding or critical constraint in the critical constraint set is the sum of all dispatched energy that will flow in the counterflow direction. Dispatched energy from both physical and virtual supply resources included as eligible resources. The set of resources summed will not include virtual supply in real-time since virtuals are liquated prior to the real-time market runs.

D.5.1 Binding constraint calculations – DCF

No changes are being proposed to the demand for counterflow.

[42] Note this corrective capacity constraint formulation for the SCF^{FCS} is not a policy proposal under CCE3 but is included to aid comprehension.

D.5.2 Critical constraint calculations – DCF

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

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

$$DCF_{clc}^{CCM} = \sum_{i=1}^{n} SF_{clc,i} * (DOP_i + CC_i)$$

The supply from pump storage and NGR resources shall be included in the counter flow calculation. The demand side of pump storage and NGR resources shall be excluded from the flow calculation. The NGR, demand side of PDR, RDRR, Dispatched Pump resources, and NGR shall be excluded from the flow calculation. The external resources will be excluded from the flow calculation.

E.6 Residual supply index

Residual supply index is the test metric for whether a constraint l contained within the critical transmission constraint list L or critical corrective capacity constraint list CKC is considered competitive or uncompetitive.

The test metric for this residual supply index for critical constraints is expressed as:

$$RSI_k^{CCM} = \frac{SCF_k^{PPSCCM} + SCF_k^{FCSCCM}}{DCF_k^{CCM} - (Limit_k - Flow_k)}$$

$$RSI_{ckc}^{CCM} = \frac{SCF_{ckc}^{PPSCCM} + SCF_{ckc}^{FCSCCM}}{DCF_{ckc}^{CCM} - (Limit_{ckc} - Flow_{ckc})}$$

$$RSI_l^{CCM} = \frac{SCF_l^{PPSCCM} + SCF_l^{FCSCCM}}{DCF_l^{CCM} - (Limit_l - Flow_l)}$$

$$RSI_{clc}^{CCM} = \frac{SCF_{clc}^{PPSCCM} + SCF_{clc}^{FCSCCM}}{DCF_{clc}^{CCM} - (Limit_{clc} - Flow_{clc})}$$

If $RSI_{k,ckc,l,clc}^{CCM} \geq 1$ then the constraint is deemed competitive else $RSI_{k,ckc,l,clc}^{CCM} < 1$ and deemed uncompetitive.

E.7 LMPM mitigation criteria

E.7.1 Binding constraint calculations – mitigation criterion

First, the CAISO will test for a resources' locational advantage to withhold to impact energy and mitigate the energy bid if the resource fails. For each interval within the optimization horizon, system will assess if the mitigation criterion is met. The mitigation criterion for mitigating energy bid is a positive non-competitive congestion component at the resource's LMP (LMP decomposition).

Given the mitigation reference bus, the analysis finds the binding constraints in AC run, and decomposes

the locational marginal price (LMP) for every pricing node location I to identify what portion of the marginal congestion component (MCC, LMP_i^{NC}) comes from congestion costs associated with non-competitive constraints. Every unit with $LMP_i^{NC} > 0$ will be flagged for mitigation - a zero tolerance criterion.

LMP decomposition breaks out the contribution to marginal congestion component from the non-competitive constraints[43]:

$$LMP_i = LMP_i^{EC} + LMP_i^{LC} + LMP_i^{CC} + LMP_i^{NC}$$

Where:

LMP_i^{EC}= the energy component of LMP_i

LMP_i^{LC}= the loss component of LMP_i

LMP_i^{CC}= the congestion component of LMP_i due to the competitive constraints where $RSI_k \geq 1$ or $RSI_{ckc} \geq 1$

LMP_i^{NC}= the congestion component of LMP_i the non-competitive constraints where $RSI_k < 1$ or $RSI_{ckc} < 1$

E.7.2 Critical constraint calculations – mitigation criterion

The CAISO will calculate additional criteria for mitigating only the commitment cost components if the resource has locational advantage to inflate uplift due to non-competitive critical transmission or critical corrective capacity constraints. The non-competitive commitment mitigation criterion (DOP_i^{NC}) would be determined as follows for resources with negative shift factors to the constraint:

- For binding constraints mitigate if $SF_{l,i} < 0$ *or* $SF_{clc,i} < 0$ *and l or ckc has an* $RSI_k < 1$ or $RSI_{ckc} < 1$.
- For non-binding constraints mitigate if $DOP_i \geq (Limit_l - Flow_l)$ or $DOP_i \geq (Limit_{clc} - Flow_{clc})$ for where l or clc *has an* $RSI_k < 1$ or $RSI_{ckc} < 1$.

The non-competitive commitment mitigation criterion for binding constraints is the shift factor of any non-exempt resource. If a non-exempt resource has a negative shift factor to any non-competitive constraint it would fail the resource test. This is also a zero tolerance criterion.

The non-competitive commitment mitigation criterion for non-binding constraints is whether the resource has a dispatch that is greater than or equal to the unloaded capacity. If a non-exempt resource with a negative shift factor to each non-competitive constraint has a dispatch that provides counterflow that is greater than the unloaded capacity. This does not account for the exact sensitivity of the resource's injection to the non-competitive constraint. This is performed for each non-competitive, critical constraint.

[43] The ISO has a shift factor effectiveness threshold of 0.02, which means that any shift factor with absolute values less than 0.02 will not be considered in the decomposition.

ED.8 Mitigated values

As result of dynamic mitigation, minimum load bids will be mitigated at higher of the market revenues for minimum load energy (product of the LMP and the lower operating limit) and the lower of the minimum load cost bid or the minimum load reference level). Where start-up or transition cost bids will be mitigated at lower of the commitment cost bid of the commitment cost reference level. Mitigated reference levels regardless of which commitment cost component can be one either an estimated or negotiated reference level option or adjusted through the reference level adjustment request tool.

Demand response, participating load, non-generator resources and virtual supply are included in power balance constraint but are exempt from mitigation. Mitigation will not be applied to these types of resources (tariff requirement).

ED.9 Applying mitigation to commitment costs

LMPM applies mitigation to the commitment cost components as follows if the resource failed any of the mitigation criteria: non-competitive congestion component, non-competitive commitment on binding constraints, or non-competitive commitment on non-binding constraints.

Bid mitigation will be applied based on current bid mitigation rules if the non-competitive congestion component fails. Bid mitigation will be applied differently to the minimum load and the start-up/transition cost components if either the non-competitive commitment criterions fail. For minimum load bids, the California ISO will evaluate each interval within an impact window defined as the range of intervals tested (i+MUT). For start-up or transition bids, the California ISO will evaluate each interval within the optimization horizon (T).

LMPM applies mitigation to minimum load bids by:

- Day-ahead market: bids mitigated for the hour the resource failed
- Real-time market: bids mitigated for the range of intervals tested (impact window) if the criteria are met in any interval within the impact window

LMPM applies mitigation to start-up and transition cost bids by:

- Day-ahead market: bids mitigated for the set of intervals of the optimization window T if the criteria are met in any interval within the horizon T
- Real-time market: bids mitigated for the set of intervals of the optimization window T if the criteria are met in any interval within the horizon T