



June 21, 2016

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Re: California Independent System Operator Corporation
Docket No. ER16- ____-000**

**Tariff Amendments to Enhance Local Market Power Mitigation
Procedures**

Dear Secretary Bose:

The California Independent System Operator Corporation (“CAISO”) submits these tariff amendments to enhance the local market power mitigation procedures used in the five-minute real-time dispatch (RTD) process.¹ These amendments would improve the accuracy of that mitigation, addressing situations where the CAISO currently under- and over-mitigates in the RTD.

The CAISO respectfully requests an effective date of January 30, 2017, for these amendments. To ensure orderly implementation, the CAISO requests that the Commission issue an order on the proposed amendments by December 1, 2016.

¹ The CAISO submits this filing pursuant to section 205 of the Federal Power Act, 16 U.S.C. § 824d. Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff, and references to specific sections, articles, and appendices are references to sections, articles, and appendices in the current CAISO tariff and revised or proposed in this filing, unless otherwise indicated.

I. Background

A. General Market Timeline for Real-Time Dispatch

Understanding the RTD market power mitigation procedures, and any potential alterations to them, first requires explaining the RTD timeline. The RTD is the most granular of the CAISO market processes, producing distinct unit dispatches and locational market prices for discrete five-minute increments.² The CAISO conducts a multi-interval optimization. Therefore, when the CAISO runs its five-minute RTD market optimization, the system provides solutions for multiple intervals. This includes results for the next five-minute interval, which constitutes the binding market run, as well as results for between seven and twelve of the following five-minute intervals.³ The results for those subsequent five-minute intervals beyond the binding run are advisory only and do not serve as the basis for market settlements or unit dispatch.⁴

For example, consider the five-minute market interval running from 9:00 AM to 9:05 AM. The CAISO would start the binding run for that five-minute interval at 8:52:30 AM and complete it by 8:57:30 AM. The same optimization that produces the binding results for that interval also will produce advisory results for the following nine five-minute intervals.⁵ Looked at from another perspective, by the time the CAISO produces binding results for the 9:00 AM to 9:05 AM interval, it already will have calculated advisory results for that five-minute period nine separate times.

B. Market Power Mitigation Measures for the Real-Time Dispatch

To protect against the exercise of seller-side market power resulting from insufficient or concentrated control of supply offers within a local area, the CAISO

² The CAISO markets include both the day-ahead and real-time markets. The real-time market consists of the hour-ahead scheduling process, the fifteen-minute market, and the five-minute RTD. This filing only proposes to modify the mitigation applicable to the five-minute RTD, which is one portion of the overall real-time market.

³ The specific number of subsequent five-minute intervals for which the CAISO calculates advisory results in each market run varies from optimization to optimization based on where that optimization lies in the given hour.

⁴ The multi-interval optimization also implies that a dispatch in the binding interval may be necessary to position the resource to address requirements in subsequent intervals.

⁵ Specifically, this includes the intervals running from 9:05-9:10, 9:10-9:15, 9:15-9:20, 9:20-9:25, 9:25-9:30, 9:30-9:35, 9:35-9:40, 9:40-9:45, and 9:45-9:50.

markets employ automated market power mitigation measures. Evaluating congestion patterns for uncompetitive transmission paths in an advisory run for a particular market interval determines whether or not a particular binding market run will utilize mitigated supply offers.

The specific advisory run that evaluates congestion to determine whether or not mitigation measures will be applied in the binding market run is known as the mitigation run. The first mitigation run conducted for a given trading hour starts by using the as-submitted market bids. If any CAISO or EIM transmission constraints are binding in that advisory run,⁶ then the CAISO assesses the amount of counterflow available from generators on the other side of the constraint. If load only can be served by dispatching resources owned by a small sub-set of “pivotal suppliers,” then the CAISO assumes there is local market power and automatically imposes market power mitigation measures on resources that would benefit from the non-competitive congestion. The mitigation measures consist of applying the higher of the default energy bid or the competitive locational marginal price, unless the original bid is lower than that number. The competitive locational marginal price is a price the CAISO calculates to reflect what the market price at a location would be netting out any contribution to the price from the congestion that caused the mitigation to be applied in the first place.

The CAISO currently does not conduct a distinct mitigation run for each RTD interval. Instead, for the real-time market the CAISO conducts a mitigation run for each 15-minute real-time unit commitment (RTUC) interval, which includes fifteen-minute market awards. That mitigation run is the advisory run conducted immediately before the binding run. This means that the mitigation run starts fifty-two-and-a-half minutes (T-52.5) before the time covered by that RTUC interval, with the binding run for that same interval starting at thirty-seven-and-a-half minutes (T-37.5) before the interval. Mitigation triggered for a 15-minute RTUC interval will also apply for each of the constituent RTD intervals within that fifteen-minute market interval. Mitigation also carries over for the remaining RTUC intervals for that hour, as well as the RTD intervals within any such remaining RTUC intervals.

Continuing the prior example, the mitigation run that would determine whether or not bids for the 9:00-9:05 five-minute interval will be mitigated begins at 8:07:30 AM, which is the same time the mitigation run for the 9:00-9:15 RTUC interval occurs. If the mitigation run that starts at 8:07:30 reflects congestion on uncompetitive transmission paths, then mitigation measures will apply when the binding run for the 9:00-9:05 RTD interval is conducted starting at 8:52:30 AM.

⁶ The CAISO does not mitigate bids at interties because they are deemed competitive.

Additionally, that bid will be mitigated for the balance of the 9:00 AM-10:00 AM operating hour.

C. Different Congestion Patterns Between Mitigation Run and Market Run can Create Suboptimal Outcomes

In practice, the CAISO's market power mitigation procedures have worked relatively well. The approach, however, is captive to the key assumption that the conditions predicted in the advisory run likely will prevail in the binding market run. The larger the divergence between the two, the greater potential there is to erode the overall efficacy of the mitigation procedures.⁷ The divergence can occur in both directions, creating what is essentially either a false positive or a false negative.

Under-predicted congestion (*i.e.*, a false negative) occurs when constraints that do not experience congestion in the mitigation run subsequently experience congestion in the market run for the same market interval. The impact of under-predicting congestion depends on the level of competition on the constraint in question. If there is a competitive supply of counterflow to the constraint, then under-predicting congestion is a smaller concern. If there is not a competitive supply of counterflow, however, strategic behavior could lead to artificially high prices. Under-predicting congestion on a constraint in an area with a limited number of counterflow suppliers could provide opportunities for suppliers to exercise local market power under the CAISO's current market power mitigation procedures.

When a mitigation run predicts the presence of congestion that can create market power, but that congestion does not materialize in the financially binding market run, mitigation can occur that may seem unnecessary (*i.e.*, there is a false positive). The CAISO refers to this as *potential* over-mitigation because, as discussed in more detail below, in some cases the congestion does not materialize because of the mitigation measures that properly were applied. In instances where the mitigation run over-predicts congestion, the design of the mitigation procedure helps limit the impact of changing bids. The same process that evaluates competitiveness of constraints also estimates competitive prices that would predominate absent market power. Resource bids that are equal to, or below, this competitive price are not changed. Bids that are above the competitive price are lowered to the higher of the resource's estimated marginal costs, or the competitive price. In this respect, mitigation triggered from over-predicted congestion may not necessarily harm market efficiency. Nevertheless,

⁷ For more information on the impact of this issue see sections 7.3 and 7.4 of the 2015 Annual Report of Market Issues and Performance at: <http://www.caiso.com/Documents/2015AnnualReportonMarketIssuesandPerformance.pdf>.

it is a form of market intervention that preferably should be limited, even if theoretically it would not significantly impede market efficiency.

The mitigation run and the binding market run can reflect different congestion patterns, and thus create either over- or under-predicted congestion, for several reasons.

Some discrepancy between predicted and actual congestion can result from applying market power mitigation. If congestion in the mitigation run triggers mitigation in the market run and the mitigation measures result in increased production on the downstream side of the constraint so that the constraint is no longer binding, then, upon a cursory review, it may appear that there was over-mitigation; congestion appeared in the mitigation run that did not appear in the pricing run. In this case, though, the *congestion did not appear in the pricing run because of the mitigation measures applied in the LMPM run*. This is a necessary and desirable result of market power mitigation. Here, what appears to be over-predicted congestion is actually a “false” false positive.

True congestion discrepancies frequently are caused by changes to inputs to the market optimization, as well as new information becoming available, in the time between conducting the mitigation and binding market runs. For example, load forecasts, the limits on transmission lines, the actions or deviations of curtailable load and other resources, base schedules for EIM resources, and forecasts for wind and solar generation all can change. As these inputs to the model change, they can move the solution that minimizes cost, in turn influencing whether or not congestion occurs on particular constraints.

In addition to changes in inputs to the model, the RTUC and RTD solve slightly different optimization problems. Even if the inputs to the models were identical, the differences in the optimizations can lead to different congestion patterns showing in the mitigation run (which is determined from the RTUC optimization) as compared to the binding run (which is determined from the RTD optimization). For example, the RTUC optimization considers a longer time horizon than the RTD and may position units differently than RTD based on expected load patterns that change beyond the time horizon that the RTD considers. In sum, because the RTUC and RTD answer different (albeit highly related) questions, they can sometimes generate different answers.

A final factor leading to inconsistent congestion results between the mitigation run and the market run stems from an inherent limitation in the optimizing algorithm. In the optimization, there can be considerable “room” where the value of the objective function is similar across a range of solutions. While looking for the best solution, the optimization could move around this area without there being significant differences in the value of the objective function. Essentially, there can be multiple possible solutions that qualify as “good

enough” according to the solution criteria of the market optimization. If the differences between the set of potential “good enough” solutions are big enough the result can be different congestion outcomes.

II. Discussion of Filing

Through this filing the CAISO proposes tariff amendments to reduce the frequency of inconsistent congestion results between the mitigation run and the market run in the RTD. The proposed enhancement would create a new mitigation run for each RTD interval, rather than relying *solely* on the RTUC process to determine whether bids used in RTD runs should or should not be mitigated. Implementing these amendments will allow the CAISO to reduce the instances of under-predicted congestion significantly, which in turn will reduce the potential for intervals to have market-power-creating congestion that goes unmitigated. These benefits will accrue both within the CAISO balancing authority area and the balancing authority areas participating in the Energy Imbalance Market.

Under the CAISO’s proposed new tariff section 34.1.5.4, the bids considered in the mitigation run for the first of three five-minute RTD intervals within a fifteen-minute RTUC interval would be the final bid set used for the financially binding fifteen-minute market run corresponding to that RTUC interval. Thus, if a bid were mitigated for a fifteen-minute market run, that mitigation automatically would carry over to the RTD mitigation process. On the other hand, bids not mitigated for the RTUC interval will enter the RTD mitigation process as unmitigated. The CAISO then would conduct the mitigation run for the first RTD interval to determine whether any of the previously unmitigated bids needed to be mitigated, or whether any bids needed to be mitigated further. That mitigation run would occur at the same time as the binding run for the immediately preceding RTD interval. The inputs to the mitigation run for the second of the three five-minute RTD intervals within a fifteen-minute RTUC interval will be the final bid set used for the first RTD interval. Likewise, the inputs to the mitigation run for the third five-minute interval within a given RTUC interval would be the final bid set used for the second RTD interval. Any bids that were mitigated during the RTD mitigation process will revert to their unmitigated status at the start of the next RTUC.

In sum, each incremental mitigation run from the fifteen-minute market to each RTD interval comprising that fifteen-minute interval potentially could result in incremental mitigation but, once a bid is mitigated, that mitigation will carry through for the balance of that fifteen-minute period in the market. However, by the fourth RTD interval there will be a new financially binding fifteen-minute market run, and thus a new round of potential bid mitigation would begin. At that point all bids that previously were mitigated in the RTD mitigation process would be released and be evaluated anew. As is the case now, bids that were

mitigated in the RTUC mitigation process would still be mitigated for the balance of the hour.

Continuing the example from above, under the CAISO proposal the mitigation run for the binding RTD interval running from 9:00 AM to 9:05 AM would start at 8:47:30 AM, which is the same time as the binding market run for the 8:55 AM to 9:00 AM RTD interval. The mitigation run for the 9:00 AM to 9:05 AM interval would use as its initial input the final bids used for the financially binding fifteen-minute market run for the 9:00 AM to 9:15 AM period. If a bid that had not been mitigated for the 9:00 AM-9:15 AM RTUC were mitigated for the 9:00 AM-9:05 AM RTD interval, then it automatically would be mitigated for the 9:05-9:10 and 9:10-9:15 intervals. It would then revert to unmitigated status at the start of the 9:15-9:30 RTUC interval (and its three constituent RTD intervals) but could be mitigated again if new mitigation analysis indicated that it were warranted.

This proposal is just and reasonable because it will allow the CAISO to mitigate local market power more effectively by reducing the frequency of instances where the mitigation process under-predicts congestion.⁸ By creating a distinct mitigation run for each RTD interval that will be conducted based on the advisory run immediately preceding the binding market run (as opposed to conducting RTD mitigation for all three RTD intervals within a RTUC interval based on a RTUC advisory run that is conducted as much as fifty-and-a-half minutes before the operating interval), the CAISO will *increase the granularity* of RTD mitigation and *reduce the latency* between the mitigation and market runs. Both factors will reduce the number of RTD intervals in which market-power-creating congestion goes unmitigated.

The CAISO's proposal to carry over mitigation from the RTUC to the RTD and to carry over RTD mitigation within a given fifteen-minute RTUC interval is just and reasonable based on operational concerns.

⁸ The rule change that would be implemented through proposed section 34.1.5.4 would only reduce the frequency of under-predicted congestion but would not reduce the frequency of over-predicted congestion. The changes to the RTUC mitigation processes, which are not specifically covered by this tariff filing, would address both under- and over-predicted congestion.

Carrying over mitigated bids from RTUC to the RTD, rather than starting the first RTD interval of that fifteen-minute period with unmitigated bids, is appropriate because the RTUC commits units, but the RTD does not. If a unit were mitigated in the RTUC run for the FMM but not mitigated in the five-minute RTD intervals, it would be too late for the CAISO to commit other units to account for the fact that the unit that initially was mitigated for the RTUC is no longer mitigated. Also, a unit that was mitigated for the RTUC but unmitigated for the RTD could be put in the untenable position of having to buy back its FMM schedule at a loss.⁹ Essentially, the lower mitigated bid considered in RTUC will make the unit more affordable and thus more likely to receive a higher MW award. When the unit's higher unmitigated bid is considered in the RTD, it will likely receive a lower MW award, creating a potential loss. The possibility of that loss in turn suggests the possibility of creating bid cost recovery. It is just and reasonable to avoid creating a new category of uplift payments for mitigated units simply based on when the mitigation is conducted.

The CAISO determined that carrying over mitigated bids from one RTD interval to another within a given fifteen-minute RTUC interval was appropriate to maintain smooth unit dispatch. If a unit could be mitigated in the first RTD interval, unmitigated in the second, then mitigated again in the third, the unit's dispatch level could be highly variable within a short timeframe, potentially causing operational stress for the unit. Maintaining mitigation across the RTD intervals within a given RTUC interval helps prevent that from occurring. The CAISO, however, determined that where a bid is only mitigated through the RTD processes, then that mitigation should not carry over throughout the whole hour (as is done with RTUC mitigation) because it was unnecessary and potentially would over-mitigate. For example, congestion could appear in the first RTD interval of an hour but resolve by the second or third RTD interval. If a bid were mitigated in the first five-minute period of that hour as a result of that congestion, then the CAISO determined that it was not necessary to maintain an efficient market to mitigate that bid automatically for the balance of the entire hour. Again, a key factor in this determination is that RTUC commits units but the RTD does not.

⁹ The CAISO Draft Final Proposal includes a detailed numerical example explaining the scenario in question. Draft Final Proposal, 13-14.

III. Stakeholder Process

The CAISO has wanted to pursue these RTD mitigation enhancements for some time and has considered them internally at various times in the past, but the CAISO discovered they were technologically infeasible at those times. In 2015, the CAISO considered them again and determined that implementing them was feasible. As a result, the CAISO commenced a stakeholder process to consider the changes.

The CAISO commenced the stakeholder process in December 2015 by publishing a presentation and conducting a stakeholder call.¹⁰ Following the initial call, the CAISO posted its draft final proposal in January 2016, followed by another stakeholder call. The CAISO Board of Governors approved the proposal on March 25, 2016, and the CAISO now presents it to the Commission.

Aside from the RTD mitigation proposal described above, the stakeholder initiative also included, and the Board approved, enhancing the mitigation procedures applied in the fifteen-minute market. Under this enhancement, which the CAISO has targeted for implementation in July 2016, mitigation analysis for the fifteen-minute market will now occur as an integral part of the RTUC run for the binding interval. There will no longer be a separate mitigation run for the fifteen-minute market. This enhancement eliminates the possibility of differences in inputs between the mitigation run and the binding run for RTUC intervals because they now would be one and the same. These planned changes should also improve the RTD mitigation process because under the proposed changes outlined above, the RTD mitigation process would use as its initial input the final bid set from the RTUC run that produces the binding fifteen-minute market results. By improving the quality of mitigation in the fifteen-minute market, the CAISO also indirectly will improve the quality of mitigation in the RTD.

The CAISO determined that implementing this improvement to the fifteen-minute market mitigation, which was discussed extensively in the underlying stakeholder process, does not require a tariff amendment because it complies with the requirements currently specified in section 34.1.5 as they pertain to the RTUC. Specifically:

- 1) Whether or not a bid will be mitigated for RTUC will continue to be based on the non-competitive congestion component of each locational market price for each fifteen-minute interval of the

¹⁰ Complete details of the stakeholder process leading to this filing are available on the stakeholder initiative site at <https://www.aiso.com/informed/Pages/StakeholderProcesses/LocalMarketPowerMitigationEnhancements2015.aspx>.

applicable trading hour, using the methodology set forth in sections 31.2.2 and 31.2.3 of the CAISO tariff;

- 2) A bid mitigated for the first fifteen-minute interval of a trading hour will continue to be mitigated for all market applications covering that fifteen-minute interval;
- 3) A bid not mitigated in the first fifteen-minute interval of a trading hour may still be mitigated for subsequent fifteen-minute intervals of the trading hour if the mitigation runs for the subsequent intervals determine that mitigation is needed; and
- 4) For each trading hour, any bid mitigated in a prior fifteen-minute interval of that trading hour will continue to be mitigated in subsequent intervals of that trading hour and may be further mitigated as determined in the mitigation runs for any subsequent fifteen-minute interval.

Stakeholder feedback focused primarily not on the substance of the CAISO proposal but instead on implementation issues. Western Power Trading Forum (WPTF), San Diego Gas & Electric Co. (SDG&E), Pacific Gas and Electric Co. (PG&E), and Southern California Edison Co. (SCE) expressed concern about the CAISO's ability to solve the RTUC within the needed window of time given that the mitigation run would be merged with the market run. The CAISO explained during the stakeholder process that it will test the new procedures rigorously before deployment and will not implement them until it is confident that it can solve the market reliably within the needed timeline. The new mitigation approach also will be monitored upon implementation to ensure it is operating at a high level.

WPTF, SDG&E, and SCE indicated they were comfortable with this commitment to pre-deployment testing and post-deployment performance monitoring. PG&E suggested that the CAISO continue conducting the current RTUC mitigation process in parallel with the new process in the event that the new process failed. The CAISO rejected this approach because engaging in parallel processes would further stress computing resources, to the extent they were stressed in the first place. Also, with the mitigation and market runs conducted at the same time, any failure in the mitigation run also would impact the market run. In that case conducting the old mitigation processes in parallel would not be useful without a market run to which they could be applied.

WPTF also expressed concern that implementing the RTD enhancements would delay the on-time implementation of other CAISO initiatives. WPTF suggested that instead of implementation in Fall 2016 (which was the planned implementation timeframe during the stakeholder process), the CAISO consider

Fall 2017 implementation. Given that the CAISO now has proposed implementation in January 2017 these concerns should be addressed.

IV. Effective Date

The CAISO respectfully requests that the Commission issue an order by December 1, 2016, accepting the tariff revisions contained in this filing effective as of January 30, 2017. The CAISO requests an order approximately two months in advance of the implementation date to provide market participants with regulatory certainty regarding this important initiative.

Pursuant to Section 35.11 of the Commission's regulations, 18 C.F.R. § 35.11, the CAISO also requests a waiver of Section 35.3 of the Commission's regulations, 18 C.F.R. §35.3, to allow the proposed tariff provisions to go into effect more than 120 days after this tariff amendment filing. Good cause exists for both the waiver and issuance of a Commission order by December 1, 2016. The market power mitigation enhancements that would be implemented by the proposed tariff amendments may be relevant to market-based rate filings proposed by potential new EIM entities. Knowing whether or not these enhancements are approved well in advance of their proposed implementation date would promote regulatory certainty. Therefore, granting the requested waiver is appropriate.

V. Communications

Correspondence and other communications regarding this filing should be directed to:

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VI. Service

The CAISO has served copies of this filing on the California Public Utilities Commission, the California Energy Commission, and all parties with scheduling

coordinator agreements under the CAISO tariff. In addition, the CAISO has posted a copy of the filing on the CAISO website.

VII. Contents of Filing

In addition to this transmittal letter, this filing includes the following attachments:

Attachment A	Clean CAISO tariff sheets incorporating this tariff amendment
Attachment B	Red-lined document showing the revisions contained in this tariff amendment
Attachment C	Comments of the CAISO Department of Market Monitoring

VIII. Conclusion

For the reasons set forth in this filing, the CAISO respectfully requests that the Commission accept the tariff revisions proposed in the filing effective as of January 30, 2017.

Respectfully submitted,

/s/ David S. Zlotlow
Roger E. Collanton
General Counsel
Anna A. McKenna
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Counsel for the California Independent System
Operator Corporation

CERTIFICATE OF SERVICE

I certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 21st day of June, 2016.

/s/ Martha Sedgley
Martha Sedgley

Attachment A – Clean Tariff Records

**Tariff Amendments to Enhance
Local Market Power Mitigation Procedures**

California Independent System Operator Corporation

Local Market Power Mitigation Enhancements 2015

34.1.5 Mitigating Bids in the RTM

34.1.5.1 Generally

After the Market Close of the RTM, after the CAISO has validated the Bids pursuant to Section 30.7 and Section 34.1.4, and prior to conducting any other RTM processes, the CAISO conducts a MPM process. The results are used in the RTM optimization processes. Bids on behalf of Demand Response Resources, Participating Load, and Non-Generator Resources are considered in the MPM process but are not subject to Bid mitigation.

34.1.5.2 Fifteen Minute Market MPM

The MPM process for the first fifteen-minute (15) interval for a Trading Hour starts with the unmitigated Bid set as validated pursuant to Section 30.7 and Section 34.1.4. The MPM process produces results for each fifteen (15) minute interval of the Trading Hour and thus may produce up to four mitigated Bids for any given resource for the Trading Hour. The determination as to whether a Bid is mitigated is made based on the non-competitive Congestion component of each LMP for each fifteen (15) minute interval of the applicable Trading Hour, using the methodology set forth in Sections 31.2.2 and 31.2.3 above. If a Bid is mitigated in the MPM process for the first fifteen (15) minute interval for a Trading Hour, the mitigated Bid will be utilized for all market applications for that first fifteen (15) minute interval. If a Bid is not mitigated in the first fifteen (15) minute interval, the CAISO will still mitigate that Bid in subsequent fifteen (15) minute intervals of the Trading Hour if the MPM runs for the subsequent intervals determine that mitigation is needed. For each Trading Hour, any Bid mitigated in a prior fifteen (15) minute interval of that Trading Hour will continue to be mitigated in subsequent intervals of that Trading Hour and may be further mitigated as determined in the MPM runs for any subsequent fifteen (15) minute interval.

34.1.5.3 Hour-Ahead Scheduling Process MPM

For HASP mitigation, a single mitigated Bid for the entire Trading Hour is calculated using the minimum Bid price of the four mitigated Bid curves at each Bid quantity level. For RMR Units, RMR Proxy Bids resulting from the MPM process will be utilized in all RTM optimization processes for each Trading Hour.

34.1.5.4 Real-Time Dispatch MPM

The RTD MPM process produces results for each five (5) minute interval of a Trading Hour. The determination as to whether a Bid is mitigated is made based on the non-competitive Congestion component of each LMP for each five (5) minute interval, using the methodology set forth in Sections 31.2.2 and 31.2.3 above. The input Bids to the MPM for the first of the three (3) RTD runs corresponding to a particular RTUC interval are the final Bids as mitigated pursuant to Section 34.1.5.2 for the RTD intervals corresponding to the applicable financially binding Fifteen Minute Market run. If a Bid is mitigated in the MPM process for the first five (5) minute interval for an applicable fifteen-minute (15) RTUC interval, the mitigated Bid will be utilized for all the corresponding RTD intervals in that fifteen-minute (15) RTUC interval. If a Bid is not mitigated in the first five (5) minute interval, the CAISO will still mitigate that Bid in subsequent five (5) minute intervals of the applicable RTUC interval if the MPM runs for the subsequent intervals determine that mitigation is needed. For each fifteen-minute (15) RTUC interval, a bid that is mitigated is maintained through the rest of the RTD intervals corresponding to the same RTUC interval as the original mitigated RTD interval. The input Bids to the RTD MPM process for the second of the three (3) RTD intervals corresponding to the RTUC interval will be the final mitigated bids used in the first RTD intervals. The input bids to the RTD MPM mitigation process for the third of the three RTD interval corresponding to the particular RTUC interval will be the final mitigated Bids used in the second RTD interval.

34.1.5.5 Reliability Must Run Resources

For a Condition 1 RMR Unit, the use of RMR Proxy Bids is determined based on the non-competitive Congestion component of each LMP for each fifteen (15) minute interval of the applicable Trading Hour, using the methodology set forth in Section 31.2.2 above. If a Condition 2 RMR Unit is issued a Manual RMR Dispatch by the CAISO, then RMR Proxy Bids for all of the unit's Maximum Net Dependable Capacity will be considered in the MPM process. For both Condition 1 and Condition 2 RMR Units, when mitigation is triggered, a RMR Proxy Bid is calculated using the same methodology described above for non-RMR Units. For a Condition 1 RMR Unit that has submitted Bids and has not been issued a Manual RMR Dispatch, to the extent that the non-competitive Congestion component of an LMP calculated in the MPM process is greater than zero, and that MPM process dispatches a Condition 1 RMR Unit at a level

such that some portion of its market Bid exceeds the Competitive LMP at the RMR Unit's Location, the resource will be flagged as an RMR dispatch if it is dispatched at a level higher than the dispatch level determined by the Competitive LMP. Both Condition 1 and Condition 2 RMR Units may be issued manual RMR dispatches at any time to address local reliability needs or to resolve non-competitive constraints.

39.7.2.2 Criteria

Subject to Section 39.7.3, for the DAM and RTM, a Transmission Constraint will be non-competitive only if the Transmission Constraint fails the dynamic competitive path assessment pursuant to this Section 39.7.2.2.

- (a) Transmission Constraints for the DAM – As part of the MPM process associated with the DAM, the CAISO will designate a Transmission Constraint for the DAM as non-competitive when the fringe supply of counter-flow to the Transmission Constraint from all portfolios of suppliers that are not identified as potentially pivotal is less than the demand for counter-flow to the Transmission Constraint. For purposes of determining whether to designate a Transmission Constraint as non-competitive pursuant to this Section 39.7.2.2(a):
- (i) Counter-flow to the Transmission Constraint means the delivery of Power from a resource to the system load distributed reference bus. If counter-flow to the Transmission Constraint is in the direction opposite to the market flow of Power to the Transmission Constraint, the counter-flow to the Transmission Constraint is calculated as the shift factor multiplied by the resource's scheduled Power. Otherwise, counter-flow to the Transmission Constraint is zero.
 - (ii) Fringe supply of counter-flow to the Transmission Constraint means all available capacity from internal resources not controlled by the identified potentially pivotal suppliers and all internal Virtual Supply Awards not controlled by the identified potentially pivotal suppliers that provide counter-flow to the Transmission Constraint. Available capacity reflects the highest capacity of a resource's

Energy Bid adjusted for Self-Provided Ancillary Services and derates.

- (iii) Demand for counter-flow to the Transmission Constraint means all internal dispatched Supply and Virtual Supply Awards that provide counter-flow to the Transmission Constraint.
- (iv) Potentially pivotal suppliers mean the three (3) portfolios of net sellers that control the largest quantity of counter-flow supply to the Transmission Constraint.
- (v) Portfolio means the effective available internal generation capacity under the control of the Scheduling Coordinator and/or Affiliate determined pursuant to Section 4.5.1.1.12 and all effective internal Virtual Supply Awards of the Scheduling Coordinator and/or Affiliate. Effectiveness in supplying counter-flow is determined by scaling generation capacity and/or Virtual Supply Awards by the shift factor from that location to the Transmission Constraint being tested.
- (vi) A portfolio of a net seller means any portfolio that is not a portfolio of a net buyer. A portfolio of a net buyer means a portfolio for which the average daily net value of Measured Demand minus Supply over a twelve (12) month period is positive. The average daily net value is determined for each portfolio by subtracting, for each Trading Day, Supply from Measured Demand and then averaging the daily value for all Trading Days over the twelve (12) month period. The CAISO will calculate whether portfolios are portfolios of net buyers in the third month of each calendar quarter and the calculations will go into effect at the start of the next calendar quarter. The twelve (12) month period used in this calculation will be the most recent twelve (12) month period for which data is available. The specific mathematical formula used to perform this calculation will be set forth in a Business Practice Manual. Market Participants without physical resources will be deemed to be net sellers for purposes of this Section 39.7.2.2(a)(vi).
- (vii) In determining which Scheduling Coordinators and/or Affiliates control the resources in the three (3) identified portfolios, the CAISO will include resources and Virtual Supply Awards directly associated with all Scheduling Coordinator ID

Codes associated with the Scheduling Coordinators and/or Affiliates, as well as all resources that the Scheduling Coordinators and/or Affiliates control pursuant to Resource Control Agreements registered with the CAISO as set forth Section 4.5.1.1.13. Resources identified pursuant to Resource Control Agreements will only be assigned to the portfolio of the Scheduling Coordinator that has control of the resource or whose Affiliate has control of the resource pursuant to the Resource Control Agreements.

- (b) Transmission Constraints for the RTM – As part of the MPM processes associated with the RTM, the CAISO will designate a Transmission Constraint for the RTM as non-competitive when the sum of the supply of counter-flow from all portfolios of potentially pivotal suppliers to the Transmission Constraint and the fringe supply of counter-flow to the Transmission Constraint from all portfolios of suppliers that are not identified as potentially pivotal is less than the demand for counter-flow to the Transmission Constraint. For purposes of determining whether to designate a Transmission Constraint as non-competitive pursuant to this Section 39.7.2.2(b):
- (i) Counter-flow to the Transmission Constraint has the meaning set forth in Section 39.7.2.2(a)(i).
 - (ii) Supply of counter-flow from all portfolios of potentially pivotal suppliers to the Transmission Constraint means the minimum available capacity from internal resources controlled by the identified potentially pivotal suppliers that provide counter-flow to the Transmission Constraint. The minimum available capacity for the current market interval will reflect the greatest amount of capacity that can be physically withheld. The minimum available capacity is the lowest output level the resource could achieve in the current market interval given its dispatch in the last market interval and limiting factors including Minimum Load, Ramp Rate, Self-Provided Ancillary Services, Ancillary Service Awards (in the Real-Time Market only), and derates.
 - (iii) Potentially pivotal suppliers mean the three (3) portfolios of net sellers that

control the largest quantity of counter-flow supply to the Transmission Constraint that can be withheld. Counter-flow supply to the Transmission Constraint that can be withheld reflects the difference between the highest capacity and the lowest capacity of a resource's Energy Bid (not taking into account the Ramp Rate of the resource), measured from the Dispatch Operating Point for the resource in the immediately preceding fifteen (15) minute FMM interval or the preceding five (5) minute RTD interval, as applicable (taking into account the Ramp Rate of the resource), adjusted for Self-Provided Ancillary Services and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM, or adjusted for Ancillary Service Awards and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM. In determining whether to designate a Transmission Constraint as non-competitive for the RTM, counter-flow supply to the Transmission Constraint that can be withheld also reflects the PMin of each Short Start Unit with a Start-Up Time of sixty (60) minutes or less that was off-line in the immediately preceding fifteen (15) minute interval of the FMM. In determining whether to designate a Transmission Constraint as non-competitive for the FMM, counter-flow supply to the Transmission Constraint that can be withheld also reflects the PMin of each Short Start Unit with a Start-Up Time of fifteen (15) minutes or less that was off-line in the immediately preceding fifteen (15) minute interval.

- (iv) Portfolio means the effective available internal generation capacity under the control of the Scheduling Coordinator and/or Affiliate determined pursuant to Sections 4.5.1.1.12 and 39.7.2.2(a)(vii). Effectiveness in supplying counter-flow is determined by scaling generation capacity by the shift factor from that location to the Transmission Constraint being tested.
- (v) A portfolio of a net seller has the meaning set forth in Section 39.7.2.2(a)(vi).
- (vi) Fringe supply of counter-flow to the Transmission Constraint means all available capacity from internal resources not controlled by the identified potentially pivotal

suppliers that provide counter-flow to the Transmission Constraint. Available capacity reflects the highest capacity of a resource's Energy Bid (not taking into account the Ramp Rate of the resource), measured from the Dispatch Operating Point for the resource in the immediately preceding fifteen (15) minute interval of the FMM or five (5) minute interval of the RTD, as applicable (taking into account the Ramp Rate of the resource), adjusted for Self-Provided Ancillary Services and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM, or adjusted for Ancillary Service Awards and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM.

- (vii) Demand for counter-flow to the Transmission Constraint means all internal dispatched Supply that provides counter-flow to the Transmission Constraint.

Attachment B – Marked Tariff Records

**Tariff Amendments to Enhance
Local Market Power Mitigation Procedures**

California Independent System Operator Corporation

Local Market Power Mitigation Enhancements 2015

34.1.5 Mitigating Bids in the RTM

34.1.5.1 Generally

After the Market Close of the RTM, after the CAISO has validated the Bids pursuant to Section 30.7 and Section 34.1.4, and prior to conducting any other RTM processes, the CAISO conducts a MPM process. The results are used in the RTM optimization processes. Bids on behalf of Demand Response Resources, Participating Load, and Non-Generator Resources are considered in the MPM process but are not subject to Bid mitigation.

34.1.5.2 Fifteen Minute Market MPM

The MPM process for the first fifteen-minute (15) interval for a Trading Hour starts with the unmitigated Bid set as validated pursuant to Section 30.7 and Section 34.1.4. The MPM process produces results for each fifteen (15) minute interval of the Trading Hour and thus may produce up to four mitigated Bids for any given resource for the Trading Hour. The determination as to whether a Bid is mitigated is made based on the non-competitive Congestion component of each LMP for each fifteen (15) minute interval of the applicable Trading Hour, using the methodology set forth in Sections 31.2.2 and 31.2.3 above. If a Bid is mitigated in the MPM process for the first fifteen (15) minute interval for a Trading Hour, the mitigated Bid will be utilized for all market applications for that first fifteen (15) minute interval. If a Bid is not mitigated in the first fifteen (15) minute interval, the CAISO will still mitigate that Bid in subsequent fifteen (15) minute intervals of the Trading Hour if the MPM runs for the subsequent intervals determine that mitigation is needed. For each Trading Hour, any Bid mitigated in a prior fifteen (15) minute interval of that Trading Hour will continue to be mitigated in subsequent intervals of that Trading Hour and may be further mitigated as determined in the MPM runs for any subsequent fifteen (15) minute interval.

34.1.5.3 Hour-Ahead Scheduling Process MPM

For HASP mitigation, a single mitigated Bid for the entire Trading Hour is calculated using the minimum Bid price of the four mitigated Bid curves at each Bid quantity level. For RMR Units, RMR Proxy Bids resulting from the MPM process will be utilized in all RTM optimization processes for each Trading Hour.

34.1.5.4 Real-Time Dispatch MPM

The RTD MPM process produces results for each five (5) minute interval of a Trading Hour. The determination as to whether a Bid is mitigated is made based on the non-competitive Congestion component of each LMP for each five (5) minute interval, using the methodology set forth in Sections 31.2.2 and 31.2.3 above. The input Bids to the MPM for the first of the three (3) RTD runs corresponding to a particular RTUC interval are the final Bids as mitigated pursuant to Section 34.1.5.2 for the RTD intervals corresponding to the applicable financially binding Fifteen Minute Market run. If a Bid is mitigated in the MPM process for the first five (5) minute interval for an applicable fifteen-minute (15) RTUC interval, the mitigated Bid will be utilized for all the corresponding RTD intervals in that fifteen-minute (15) RTUC interval. If a Bid is not mitigated in the first five (5) minute interval, the CAISO will still mitigate that Bid in subsequent five (5) minute intervals of the applicable RTUC interval if the MPM runs for the subsequent intervals determine that mitigation is needed. For each fifteen-minute (15) RTUC interval, a bid that is mitigated is maintained through the rest of the RTD intervals corresponding to the same RTUC interval as the original mitigated RTD interval. The input Bids to the RTD MPM process for the second of the three (3) RTD intervals corresponding to the RTUC interval will be the final mitigated bids used in the first RTD intervals. The input bids to the RTD MPM mitigation process for the third of the three RTD interval corresponding to the particular RTUC interval will be the final mitigated Bids used in the second RTD interval.

34.1.5.5 Reliability Must Run Resources

For a Condition 1 RMR Unit, the use of RMR Proxy Bids is determined based on the non-competitive Congestion component of each LMP for each fifteen (15) minute interval of the applicable Trading Hour, using the methodology set forth in Section 31.2.2 above. If a Condition 2 RMR Unit is issued a Manual RMR Dispatch by the CAISO, then RMR Proxy Bids for all of the unit's Maximum Net Dependable Capacity will be considered in the MPM process. For both Condition 1 and Condition 2 RMR Units, when mitigation is triggered, a RMR Proxy Bid is calculated using the same methodology described above for non-RMR Units. For a Condition 1 RMR Unit that has submitted Bids and has not been issued a Manual RMR Dispatch, to the extent that the non-competitive Congestion component of an LMP calculated in the MPM process is greater than zero, and that MPM process dispatches a Condition 1 RMR Unit at a level

such that some portion of its market Bid exceeds the Competitive LMP at the RMR Unit's Location, the resource will be flagged as an RMR dispatch if it is dispatched at a level higher than the dispatch level determined by the Competitive LMP. Both Condition 1 and Condition 2 RMR Units may be issued manual RMR dispatches at any time to address local reliability needs or to resolve non-competitive constraints.

39.7.2.2 Criteria

Subject to Section 39.7.3, for the DAM and RTM, a Transmission Constraint will be non-competitive only if the Transmission Constraint fails the dynamic competitive path assessment pursuant to this Section 39.7.2.2.

- (a) Transmission Constraints for the DAM – As part of the MPM process associated with the DAM, the CAISO will designate a Transmission Constraint for the DAM as non-competitive when the fringe supply of counter-flow to the Transmission Constraint from all portfolios of suppliers that are not identified as potentially pivotal is less than the demand for counter-flow to the Transmission Constraint. For purposes of determining whether to designate a Transmission Constraint as non-competitive pursuant to this Section 39.7.2.2(a):
- (i) Counter-flow to the Transmission Constraint means the delivery of Power from a resource to the system load distributed reference bus. If counter-flow to the Transmission Constraint is in the direction opposite to the market flow of Power to the Transmission Constraint, the counter-flow to the Transmission Constraint is calculated as the shift factor multiplied by the resource's scheduled Power. Otherwise, counter-flow to the Transmission Constraint is zero.
 - (ii) Fringe supply of counter-flow to the Transmission Constraint means all available capacity from internal resources not controlled by the identified potentially pivotal suppliers and all internal Virtual Supply Awards not controlled by the identified potentially pivotal suppliers that provide counter-flow to the Transmission Constraint. Available capacity reflects the highest capacity of a resource's

Energy Bid adjusted for Self-Provided Ancillary Services and derates.

- (iii) Demand for counter-flow to the Transmission Constraint means all internal dispatched Supply and Virtual Supply Awards that provide counter-flow to the Transmission Constraint.
- (iv) Potentially pivotal suppliers mean the three (3) portfolios of net sellers that control the largest quantity of counter-flow supply to the Transmission Constraint.
- (v) Portfolio means the effective available internal generation capacity under the control of the Scheduling Coordinator and/or Affiliate determined pursuant to Section 4.5.1.1.12 and all effective internal Virtual Supply Awards of the Scheduling Coordinator and/or Affiliate. Effectiveness in supplying counter-flow is determined by scaling generation capacity and/or Virtual Supply Awards by the shift factor from that location to the Transmission Constraint being tested.
- (vi) A portfolio of a net seller means any portfolio that is not a portfolio of a net buyer. A portfolio of a net buyer means a portfolio for which the average daily net value of Measured Demand minus Supply over a twelve (12) month period is positive. The average daily net value is determined for each portfolio by subtracting, for each Trading Day, Supply from Measured Demand and then averaging the daily value for all Trading Days over the twelve (12) month period. The CAISO will calculate whether portfolios are portfolios of net buyers in the third month of each calendar quarter and the calculations will go into effect at the start of the next calendar quarter. The twelve (12) month period used in this calculation will be the most recent twelve (12) month period for which data is available. The specific mathematical formula used to perform this calculation will be set forth in a Business Practice Manual. Market Participants without physical resources will be deemed to be net sellers for purposes of this Section 39.7.2.2(a)(vi).
- (vii) In determining which Scheduling Coordinators and/or Affiliates control the resources in the three (3) identified portfolios, the CAISO will include resources and Virtual Supply Awards directly associated with all Scheduling Coordinator ID

Codes associated with the Scheduling Coordinators and/or Affiliates, as well as all resources that the Scheduling Coordinators and/or Affiliates control pursuant to Resource Control Agreements registered with the CAISO as set forth Section 4.5.1.1.13. Resources identified pursuant to Resource Control Agreements will only be assigned to the portfolio of the Scheduling Coordinator that has control of the resource or whose Affiliate has control of the resource pursuant to the Resource Control Agreements.

- (b) Transmission Constraints for the RTM – As part of the MPM processes associated with the RTM, the CAISO will designate a Transmission Constraint for the RTM as non-competitive when the sum of the supply of counter-flow from all portfolios of potentially pivotal suppliers to the Transmission Constraint and the fringe supply of counter-flow to the Transmission Constraint from all portfolios of suppliers that are not identified as potentially pivotal is less than the demand for counter-flow to the Transmission Constraint. For purposes of determining whether to designate a Transmission Constraint as non-competitive pursuant to this Section 39.7.2.2(b):
- (i) Counter-flow to the Transmission Constraint has the meaning set forth in Section 39.7.2.2(a)(i).
 - (ii) Supply of counter-flow from all portfolios of potentially pivotal suppliers to the Transmission Constraint means the minimum available capacity from internal resources controlled by the identified potentially pivotal suppliers that provide counter-flow to the Transmission Constraint. The minimum available capacity for the current market interval will reflect the greatest amount of capacity that can be physically withheld. The minimum available capacity is the lowest output level the resource could achieve in the current market interval given its dispatch in the last market interval and limiting factors including Minimum Load, Ramp Rate, Self-Provided Ancillary Services, Ancillary Service Awards (in the Real-Time Market only), and derates.
 - (iii) Potentially pivotal suppliers mean the three (3) portfolios of net sellers that

control the largest quantity of counter-flow supply to the Transmission Constraint that can be withheld. Counter-flow supply to the Transmission Constraint that can be withheld reflects the difference between the highest capacity and the lowest capacity of a resource's Energy Bid (not taking into account the Ramp Rate of the resource), measured from the Dispatch Operating Point for the resource in the immediately preceding fifteen (15) minute FMM interval or the preceding five (5) minute RTD interval, as applicable (taking into account the Ramp Rate of the resource), adjusted for Self-Provided Ancillary Services and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM, or adjusted for Ancillary Service Awards and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM. In determining whether to designate a Transmission Constraint as non-competitive for the RTM, counter-flow supply to the Transmission Constraint that can be withheld also reflects the PMin of each Short Start Unit with a Start-Up Time of sixty (60) minutes or less that was off-line in the immediately preceding fifteen (15) minute interval of the FMM. In determining whether to designate a Transmission Constraint as non-competitive for the RTMFMM, counter-flow supply to the Transmission Constraint that can be withheld also reflects the PMin of each Short Start Unit with a Start-Up Time of fifteen (15) minutes or less that was off-line in the immediately preceding fifteen (15) minute interval.

- (iv) Portfolio means the effective available internal generation capacity under the control of the Scheduling Coordinator and/or Affiliate determined pursuant to Sections 4.5.1.1.12 and 39.7.2.2(a)(vii). Effectiveness in supplying counter-flow is determined by scaling generation capacity by the shift factor from that location to the Transmission Constraint being tested.
- (v) A portfolio of a net seller has the meaning set forth in Section 39.7.2.2(a)(vi).
- (vi) Fringe supply of counter-flow to the Transmission Constraint means all available

capacity from internal resources not controlled by the identified potentially pivotal suppliers that provide counter-flow to the Transmission Constraint. Available capacity reflects the highest capacity of a resource's Energy Bid (not taking into account the Ramp Rate of the resource), measured from the Dispatch Operating Point for the resource in the immediately preceding fifteen (15) minute interval of the FMM or five (5) minute interval of the RTD, as applicable (taking into account the Ramp Rate of the resource), adjusted for Self-Provided Ancillary Services and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM, or adjusted for Ancillary Service Awards and derates in determining whether to designate a Transmission Constraint as non-competitive for the RTM.

- (vii) Demand for counter-flow to the Transmission Constraint means all internal dispatched Supply that provides counter-flow to the Transmission Constraint.

**Attachment C -
Department of Market Monitoring Comments on Proposed
Local Market Power Mitigation Enhancements**

**Tariff Amendments to Enhance
Local Market Power Mitigation Procedures**

California Independent System Operator Corporation

Comments on Proposed Local Market Power Mitigation Enhancements

Department of Market Monitoring

June 21, 2016

Summary

The Department of Market Monitoring (DMM) supports the ISO's proposed Local Market Power Mitigation Enhancements. These proposed enhancements were developed directly in response to a recommendation by DMM to enhance market power mitigation provisions to reduce instances in which mitigation was not triggered in the real-time market when congestion occurred on structurally uncompetitive constraints.

DMM has worked closely with the ISO to address this issue by developing enhancements to market power mitigation procedures in both the 15-minute and 5-minute real time markets. These modifications will make the current process more effective by integrating market power mitigation procedures more closely with the final software run used to determine final schedules and prices. These enhancements will increase the accuracy of mitigation in terms of applying mitigation during intervals when potential market power exists in the real time market.

DMM's recommended modifications in the 15-minute process can be implemented without a tariff change. These modifications were initially scheduled for implementation in spring 2016. The ISO has indicated these software modifications are ready for testing and may be implemented in the summer of 2016. DMM continues to recommend that the ISO implement these enhancements to the 15-minute market. Modifications in the 15-minute process will have the largest impact in terms of mitigating market power, since the hourly price used to settle load imbalances is weighted much more heavily by the 15-minute price than the 5-minutes prices within each hour.¹

DMM's recommended enhancements in the 5-minute process require a tariff change. In this tariff filing, the ISO proposes an additional procedure that will be able to trigger mitigation in the 5-minute market runs. Currently, mitigation for the 5-minute market runs is based on results from the 15-minute real-time unit commitment (RTUC) runs. The new procedure being proposed will use an advisory 5-minute run to predict congestion in the next binding 5-minute run. This will reduce the gap between the advisory run used to determine mitigation for each financially binding interval from 45 minutes to 5 minutes. Integrating mitigation into the 5-minute market runs also allows more accurate modeling in cases where constraints in the 5-minute market software have a different impact than the analogous constraints in the 15-minute market software.

¹ DMM estimates that 15-minute prices account for about 80 percent of hourly weighted average prices used to settle load deviations, with 5-minute prices accounting for about 20 percent of these hourly settlement prices.

Background

The ISO's automated bid mitigation procedures address the potential for the exercise of market power through *economic withholding*.² The ISO's local market power bid mitigation procedures are triggered when congestion is projected to occur on a constraint.

If a constraint is projected to be congested, the ISO software applies an automated test to determine if a constraint is structurally uncompetitive or competitive based on actual system supply and demand conditions. This test is a three pivotal supplier test: a constraint is deemed uncompetitive if supply from the three largest suppliers is required to mitigate the projected congestion on the constraint.

If a constraint is deemed structurally uncompetitive, bids from resources that can alleviate congestion on that constraint are subject to bid mitigation. Bids subject to mitigation are capped at the higher of (1) a *default energy bid* (DEB) based on the unit's marginal cost, or (2) a competitive market clearing price. This competitive market clearing price reflects the system marginal energy price plus the congestion component for any constraint that was deemed structurally competitive. This competitive market clearing price is used as a floor in bid mitigation to avoid mitigation of lower cost units below competitive levels.

In the real-time market, the occurrence of congestion on a constraint is projected based on results of the 15-minute market software for the *first advisory interval* — or the first 15-minute interval after the 15-minute interval for which *financially binding* dispatches and prices are being determined by the market software. With this current approach, when congestion is not projected to occur in the 15-minute advisory run, but congestion then occurs in the 15-minute or 5-minute binding runs, bid mitigation is not triggered. When this occurs on structurally uncompetitive constraints, DMM refers to this as *under mitigation*. As discussed in DMM's prior annual and quarterly reports to the Commission, DMM has monitored potential under mitigation and determined that this issue has not had a significant market impact due to the overall market competitiveness.³

Within the ISO, in most cases when real-time congestion occurs but mitigation was not triggered based on the advisory run, the supply of generation that relieves this congestion is structurally competitive. In addition, bidding within the ISO and EIM has been highly competitive, so that there has been an adequate supply of competitively priced bids to manage congestion even when mitigation was not triggered. DMM has also briefed FERC staff periodically on this issue as part of its ongoing communications on ISO and EIM market

² As described in the ISO tariff, economic withholding includes submitting bids "that are unjustifiably high (relative to known operational characteristics and/or the known operating cost of the resource)" so that the resource's bids will either set the market clearing price at a higher level, or will not be dispatched so that a resource with a higher bid will set the market clearing price. 39.3.1(2)

³ For recent examples, see *2015 Annual Report on Market Issues and Performance*, Department of Market Monitoring, May 2016, pp. 146-150: <http://www.caiso.com/Documents/2015AnnualReportonMarketIssuesandPerformance.pdf>, and *2014 Annual Report on Market Issues and Performance*, Department of Market Monitoring, June 2015, pp. 126-131: http://www.caiso.com/Documents/2014AnnualReport_MarketIssues_Performance.pdf.

performance.

The ISO's market power mitigation procedures are currently designed to rely on the advisory 15-minute intervals due to software limitations that existed when these procedures were developed. However, over the course of 2015, DMM continued to work with the ISO to develop software enhancements to effectively address the issue of potential under mitigation in the real-time market. As a result of this effort, enhancements to address the issue of under mitigation are scheduled for implementation in the 15-minute market in 2016 and enhancements to the 5-minute software being proposed in this tariff filing are scheduled for early 2017.

Enhancements to mitigation in 15-minute market

Figure 1 illustrates the current process for mitigation in the 15-minute market. As shown in Figure 1, the occurrence of congestion on a constraint is projected based results of the 15-minute market software for the *first advisory interval* — or the first 15-minute interval after the 15-minute interval for which *financially binding* dispatches and prices are being determined by the market software.⁴

If congestion is projected to occur in this advisory interval, bid mitigation procedures are triggered and any mitigated bids resulting from this process are applied in the financially binding interval of the next iteration of the 15-minute market. However, if no congestion occurs in the advisory run, no mitigation of bids occurs in the financially binding interval of the next iteration of the 15-minute market.

With this current approach, changes in system and market conditions between these two iterations of the 15-minute market may cause congestion to occur in this financially binding interval when congestion was not projected to occur in this interval during the prior iteration of the 15-minute market software. This may cause bids to be unmitigated when real-time congestion occurs on a structurally uncompetitive constraint in real-time.

Figure 2 illustrates the enhanced process scheduled for implementation in 2016. With changes scheduled for implementation in early summer 2016, market power mitigation procedures in the 15-minute market will be incorporated directly in the process for determining financially binding 15-minute dispatches and prices. With these modifications, an additional run will be performed as part of the 15-minute process to determine if bid mitigation should be triggered in the financially binding interval of the 15-minute market run.

With this enhanced process, an initial scheduling run will be performed for each binding 15-minute market interval. If congestion occurs in this initial iteration, market power mitigation procedures will be run to determine if bids should be mitigated. If any bid mitigation occurs, a second scheduling run is performed with these mitigated bids. A final pricing run is then performed to determine financially binding prices for the 15-minute interval.

⁴ As also shown in Figure 1, due to the lead time needed for the 15-minute market inputs and processes, each iteration of the 15-minute market actually starts 37.5 minutes prior to the start of the financially binding 15-minute interval and 52.5 minutes prior to the start of the first advisory interval.

Figure 1. Market power mitigation process before enhancements (15-minute market)

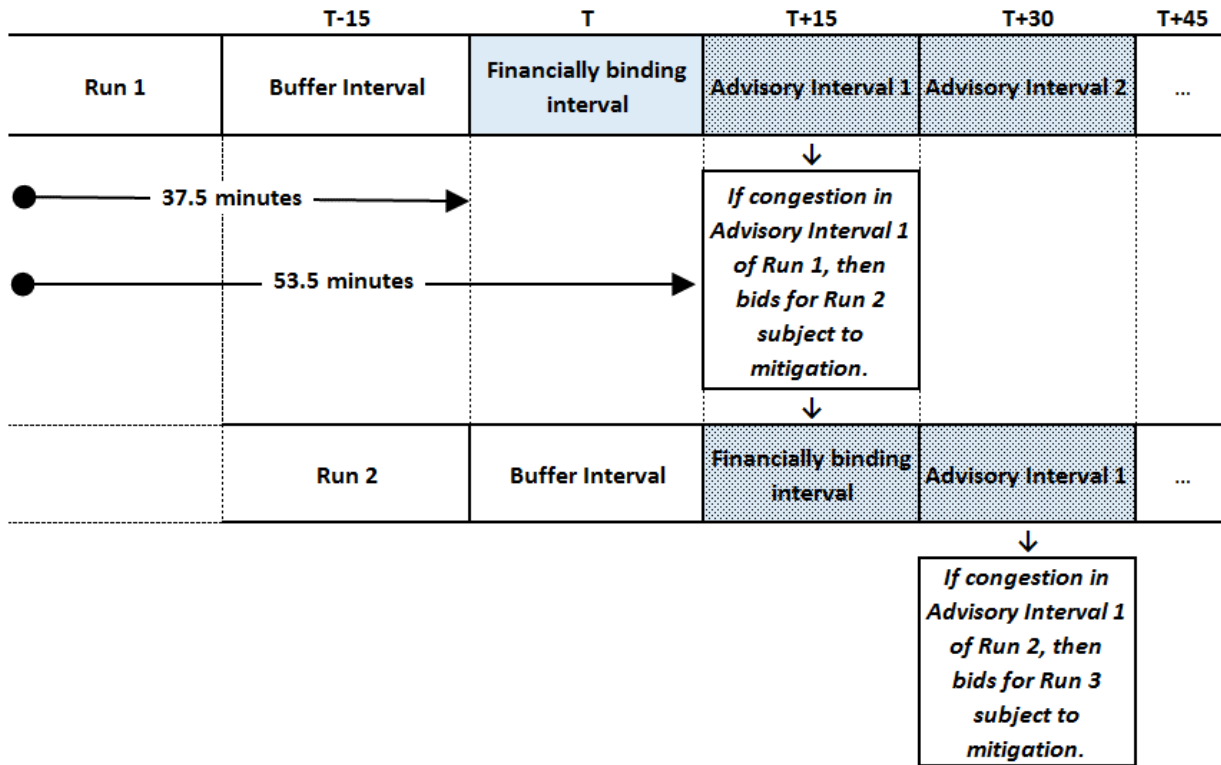
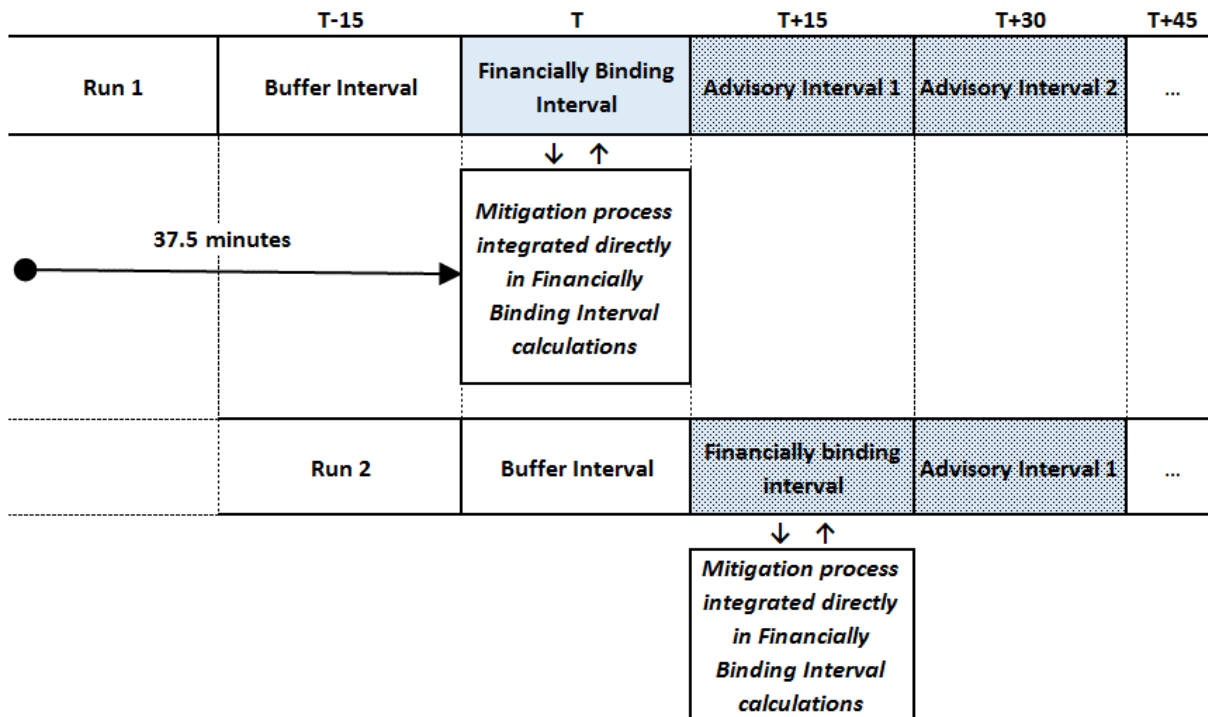


Figure 2. Market power mitigation process after enhancements (15-minute market)



This approach is similar to the mitigation process used in the ISO's day-ahead market. This approach essentially eliminates the potential for under mitigation in the 15-minute market since results used for mitigation are based on the same market inputs and model as those used to determine financially binding dispatches and prices. In addition, this approach also avoids potential *over mitigation* – or when bids are mitigated based on results of an advisory run but no congestion occurs during the next iteration of the 15-minute market in the financially binding interval.

Modifications in the 15-minute process can be implemented without a tariff change. These modifications were initially scheduled for implementation in spring 2016. The ISO has indicated these software modifications are ready for testing and may be implemented in the summer of 2016. DMM continues to recommend that the ISO implement these enhancements to the 15-minute market. Modifications in the 15-minute process will have the largest impact in terms of mitigating market power, since the hourly price used to settle load imbalances is weighted much more heavily by the 15-minute price than the 5-minute prices within each hour.⁵

Proposed enhancements in 5-minute market

The ISO's proposed tariff changes will enhance mitigation in the 5-minute market. As illustrated in Figure 3, mitigation in the 5-minute market is currently based entirely on results of the process used to mitigate bids in the 15-minute market. If bids are mitigated based on the 15-minute advisory run, these mitigated bids are carried over to all of the subsequent 5-minute market runs during that operating hour.

The current approach can result in under mitigation in the 5-minute market. The potential under mitigation in the 5-minute market is mostly due to modeling and data differences between the 15-minute advisory run and the 5-minute market runs. Implementing mitigation in the 5-minute market will eliminate most of the modeling differences and will also reduce the time delay that can lead to differences in the data inputs between mitigation and market runs.

As illustrated in Figure 4, with software modifications that are the subject of this filing, market power mitigation in the 5-minute market will be applied based on an advisory interval using the same method that is currently applied to the 15-minute market. In the 5-minute market there is a much shorter time lag between the advisory and binding market intervals. Therefore, the advisory run in the 5-minute market provides a much more accurate prediction of congestion in the subsequent binding 5-minute market run.

In addition, as illustrated in Figure 5, bids that are mitigated in the 15-minute market will continue to be carried over to all of the subsequent 5-minute intervals during that operating hour.

⁵ DMM estimates that 15-minute prices account for about 80 percent of hourly weighted average prices used to settle load deviations, with 5-minute prices accounting for about 20 percent of these hourly settlement prices.

Figure 3. Market power mitigation process before enhancements (5-minute market):
Carry over of mitigated bids from 15-minute market

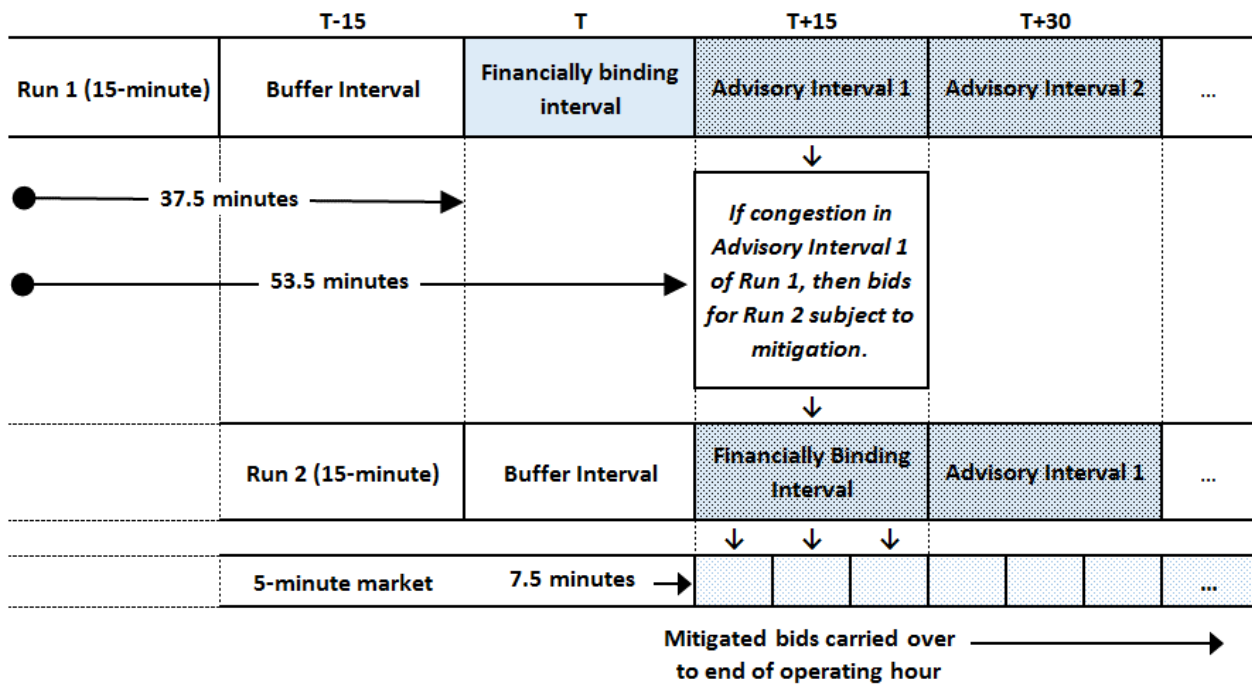


Figure 4. Market power mitigation process after enhancements (5-minute market):
Additional mitigation based on 5-minute advisory run

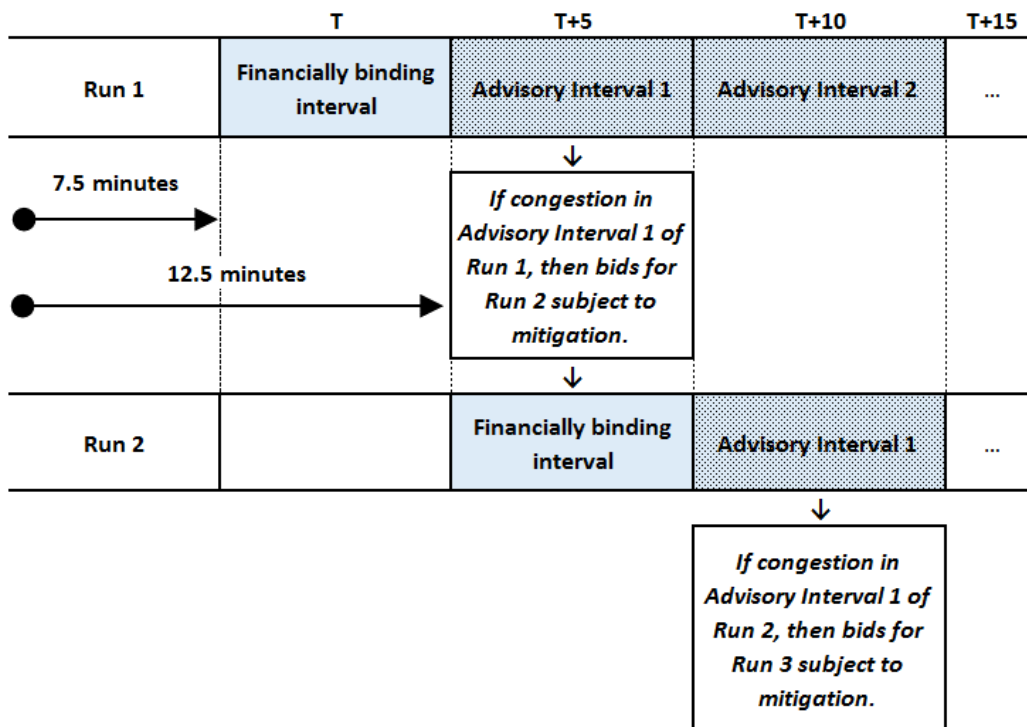
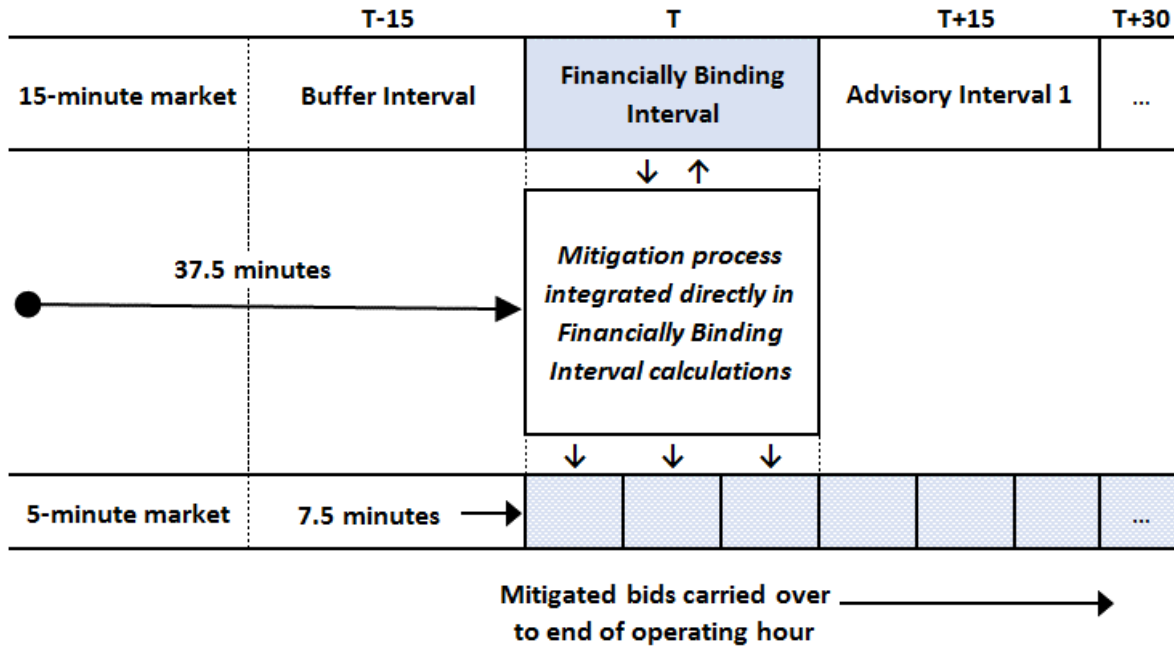


Figure 5. Market power mitigation process after 15-minute market enhancements:

Carry over of mitigated bids from 15-minute market



Conclusions

To address limitations in the ISO’s current real time local market power mitigation procedures identified in DMM’s prior reports to the Commission, DMM has worked collaboratively with the ISO to design appropriate changes to these procedures. The ISO’s filing is the result of this collaboration. DMM was closely involved in the design and stakeholder process for this initiative. The final proposal attached to the ISO’s filing was developed by DMM, and includes additional analysis from the DMM. DMM strongly supports the proposed tariff changes needed for enhancements to mitigation in the 5-minute market, and continues to recommend that the ISO implement changes to the 15-minute market software described in these comments.