Memorandum

To: ISO Board of Governors

From: Eric Hildebrandt, Director, Market Monitoring

Date: March 21**,** 2016

Re: Market Monitoring Report

This memorandum does not require Board action.

EXECUTIVE SUMMARY

This memo provides comments by the Department of Market Monitoring (DMM) on two proposals being presented to the Board:

- **Commitment costs.** DMM supports the ISO's effort to develop an approach for incorporating opportunity costs into start-up and minimum load bids for units with actual environmental, regulatory or physical limitations on start-up or operating hours. This issue has been deferred over the last three years due to the complexity of some implementation details and the controversial nature of some aspects of the proposal. DMM believes that the impact and effectiveness of Management's proposal will depend on a number of important implementation details, as described in this memo. DMM will continue to provide input in the process to help ensure this initiative is implemented in a manner that helps ensure more efficient unit commitment and full recovery of commitment costs. DMM is also supportive of providing a mechanism for participants to seek after-the-fact reimbursement for any prudently incurred gas costs due to unit commitments in excess of start-up and minimum load bid caps that are not recovered through market revenues. DMM performed extensive analysis of historical gas price data which indicates that the actual need to rely on this mechanism should be very infrequent – but could be important in the case of extreme events.
- **Market power mitigation enhancements**. DMM worked closely with the ISO to develop several software enhancements to market power mitigation procedures for the real time market. Both 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.

This memo also provides a summary of overall costs per MWh of load served by the ISO in 2015. After normalizing for higher gas prices and greenhouse gas compliance costs, DMM

estimates that total wholesale energy costs remained relatively stable, decreasing about 6 percent from $45/MWh in 2014 to about $42/MWh in 2015. The decrease in adjusted costs may be driven by record solar generation and the continued addition of new solar generating capacity within the footprint. DMM will provide a more detailed analysis of 2015 market performance in its annual report, which DMM plans to publish in April.

COMMITMENT COST BIDDING IMPROVEMENTS

Overview

DMM supports Management's overall proposal for commitment cost bidding improvements as a step forward in addressing a variety of important, but difficult and controversial issues. DMM notes that this initiative incorporates several market design changes which are being made to accommodate various stakeholders, but which could have the effect of reducing overall market efficiency and the flexibility of the ISO's gas-fired fleet at a time when the ISO will likely need to rely on a smaller but more flexible gas fleet to integrate the growing volume of renewable resources on the ISO system.

The impact and effectiveness of this initiative will also depend on a number of important implementation details, including how some of the proposed rules are ultimately interpreted and implemented in practice. DMM will continue to provide input in the process to help ensure this initiative is implemented in a manner that helps ensure more efficient unit commitment and recovery of reasonably incurred commitment costs. DMM has provided detailed comments on this initiative internally as well though written comments submitted as part of the stakeholder process.[1] The following sections address several of the key components of Management's final proposal.

Opportunity cost bid adders

DMM has worked closely with the ISO to provide detailed input into the design and implementation details of opportunity cost adders for energy, start-up, minimum load and transition cost bids. The ISO's goal of developing a way to incorporate opportunity costs in commitment cost bids dates back to 2010. This issue has now been addressed through a series of three different initiatives over the last three years, but has repeatedly been deferred due to the complexity of some implementation details and the controversial nature of some aspects of the proposal.

The effectiveness of the opportunity cost bid adders will depend on the details of the opportunity cost model process – including input assumptions, methods for determining unit start and run

[1] *Comments on Commitment Cost Enhancements Phase 3 Draft Final Proposal*, Department of Market Monitoring, March 4, 2016 http://www.caiso.com/Documents/DMMComments-CommitmentCostEnhancementsPhase3-DraftFinalProposal.pdf

hour limitations, and the frequency with which the opportunity cost calculation may be updated as actual market conditions unfold. DMM recommends that the ISO complete development of a fully functional opportunity cost model and then utilize this model to work with stakeholders using actual unit and market data to identify any needed refinements prior to implementation. DMM is also working with the ISO in an effort to draft tariff language that will allow flexibility adjust the modeling details and process based on experience after implementation.

Exemption for contractual limitations

As noted in Management's memo, the ISO has a "longstanding position that economic limits like limitations originating from contracts such as power purchasing or tolling agreements are not acceptable limitations for establishing an opportunity cost adder to a resource's commitment cost bid cap…. . These limitations exist not as a result of restrictions imposed by external statutes or regulations, but rather reflect economic trade-offs made by the contracting parties." Management's current proposal allows units to seek and three year exemption for contractual limitations incorporated in long term contracts that have undergone "extensive regulatory scrutiny" and were entered into prior to January 1, 2015.

DMM continues to believe it is inefficient to treat contractual limitations as physical limitations in the ISO market optimization, whether these contractual provisions are treated directly as physical unit operating constraints or indirectly through an opportunity cost adder. To the extent that these contractual limitations may reflect actual physical or environmental limits, it is more efficient and appropriate to incorporate any actual physical or environmental limits directly into unit operating constraints or opportunity cost bid adders. The ISO's prior proposals involving use limited status and opportunity costs have always been designed based on this principle.

If these contract limitations reflect maintenance costs, as suggested by the Market Surveillance Committee, DMM notes that the ISO market is explicitly designed so that any incremental maintenance costs associated with starting up and operating unit can be incorporated directly in commitment cost bids through *major maintenance adders*. These major maintenance adders represent the most economically efficient way of incorporating any incremental maintenance costs associated with starting up and operating resources into unit commitments. By incorporating these costs into commitment cost bids, the market software optimizes unit dispatch decisions. These major maintenance bid adders also ensure that generators can recover the full incremental costs of starting up and operating a unit – through a combination of market revenues plus any supplemental bid cost recovery payments.

The actual amount and location of capacity eligible for the proposed exemption – and the actual contractual limitations of these resources – will only be known with certainty after approval and implementation of the ISO's proposal. However, DMM understands that an additional 5,000 to 10,000 MW of recently built gas fired capacity may be eligible under this three-year exemption and that much of this capacity is located in transmission constrained areas. While providing exemptions for a limited number of contracts may not have significant detrimental impacts, DMM is concerned about these cumulative impacts if exemptions are provided to a significant amount of capacity, particularly if this includes a relatively large amount of capacity used to meet resource adequacy requirements in transmission constrained areas. DMM also questions the equity of this approach for entities that do not have eligible contractual limitations.

The opinion of the Market Surveillance Committee and comments by the CPUC and some other stakeholders suggest that this exemption should be extended beyond three years to the life of these contracts. DMM believes this would be imprudent given the lack of information on these contract limitations, especially at a time when the ISO will likely need to rely on a smaller but more flexible gas fleet to integrate the growing volume of renewable resources on the ISO system.

Negotiated opportunity cost bid adders

The ISO's proposal offers a negotiated opportunity cost option to a potentially large set of resources. However, the proposed opportunity cost model will not include modeling of the most common type of multi-stage generating resource – a combined cycle unit -- which may have a limit on the number of transitions between configurations. Under the ISO's proposal, these types of resource constraints would need to be addressed through a special negotiated opportunity cost bid adder. If modeling this type of resource is too complex to be incorporated in the opportunity cost models being developed by the ISO, it may be challenging for ISO staff and generators to assess the opportunity costs of this type of resource through a process of negotiation.

Again, it is difficult to assess how widespread or problematic this situation might be given the lack of data on units and constraints that would be eligible under the proposed criteria and exemptions. However, DMM notes that this could conceivably represent a significant category of units requiring the ISO to establish special negotiated opportunity cost bid adders – without having the type of optimization tool that will be developed for some units. Consequently, DMM has recommended the optimization tool being developed be expanded if possible to allow modeling of additional resource types if a significant number of units apply for opportunity cost adders.

Resource characteristics

The ISO tariff currently requires resource characteristics submitted to the ISO's master file used by the market to reflect only actual physical characteristics. Management is proposing to provide generators flexibility to submit lower values for three key unit characteristics used in the market software: maximum daily starts, maximum multi-stage generator daily transitions, and ramp rates. Resources will be restricted from submitting less than two starts per day as a preferred resource characteristic unless the resource is only physically capable of one start per day.

DMM notes that this change may reduce the overall flexibility of the ISO's fleet at time when the ISO will likely need to rely on a smaller but more flexible gas fleet to integrate the growing volume of renewable resources on the ISO system. Although some generators appear to view this change as a "tightening" of market rules, this actually represent a lowering of current tariff requirements concerning unit start-ups and ramp rates.

Under the proposal, generator owners may seek an exemption to the two-start per day requirement. The ISO's final proposal appears to limit exemptions to this requirement based on the "design capability" of a unit or if "resources nearing the end of its life cycle may warrant the

resource only starting once per day despite its design capabilities allowing it to start more than once per day." [2] When implementing this provision, DMM notes that exemptions should not be granted on the grounds that starting a unit up to twice a day may increase maintenance. Again, ISO market rules are designed so that any incremental maintenance costs associated with starting up and operating a unit can be incorporated directly in commitment cost bids through major maintenance adders. To help manage this issue, the ISO will need to develop a process, guidelines and expertise to carefully evaluate any exemptions to the two start per day requirement.

Recovery of commitment costs that exceed the commitment cost bid cap

Management proposes to add tariff provisions that will allow market participants to seek after-the-fact FERC approval of incurred actual commitment costs that exceed the commitment cost bid caps. The ISO would then reimburse the FERC approved costs through its bid cost recovery mechanism. As a result the market participant would only be reimbursed for these costs to the extent the resource had a net revenue shortfall over the day considering all market revenue.

DMM is supportive of providing a mechanism for participants to seek after-the-fact reimbursement for any prudently incurred gas costs due to unit commitments in excess of commitment cost bid caps that are not recovered through market revenues. As part of this initiative, DMM performed extensive analysis of historical gas price data which indicates that the actual need to rely on this mechanism should be very infrequent – but could be important in the case of extreme events.

Even though the proposal calls for FERC to assess any gas reimbursement filings by generators, DMM has encouraged the ISO to continue to work with stakeholders – and personnel with additional expertise in gas markets and procurement – to develop more specific guidelines, requirements and methodological details. DMM believes this additional detail would help reduce potential uncertainty about how this provision will be implemented for participants and avoid potential disputes.

MARKET POWER MITIGATION ENHANCEMENTS

Background

DMM has worked closely with the ISO to develop several software enhancements to market power mitigation procedures for the 15-minute and 5-mintue real time markets. Both 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.

[2] *Commitment Cost Enhancements Phase 3 Draft Final Proposal*, February 17, 2016, p. 46 http://www.caiso.com/Documents/DraftFinalProposal-CommitmentCostEnhancementsPhase3.pdf

The ISO's market power mitigation procedures are triggered when congestion is projected to occur on a constraint. In the real-time market, existence of congestion on a constraint in the *advisory interval* software run is currently used to project the occurrence of congestion in the 15-minute market and 5-minute market binding interval software runs. The advisory interval software run currently used to trigger market power mitigation begins 15 minutes before the start of the 15-minute market binding interval software run. If a resource's bid is mitigated during the 15-minute market advisory run, the mitigated bid is used for both the binding 15-minute market run and the 5-minute market dispatch. Mitigated bids are used in the 5-minute market for a unit if that resource's bids were mitigated during any of the 15-minute advisory intervals for that hour. Currently, there is no additional analysis of congestion in the 5-minute market.
With this current approach, when congestion is not projected to occur in the 15-minute advisory run, but congestion does then occur in the 15-minute or 5-minute binding runs, bid mitigation is not triggered. In DMM's prior reports, this is referred to as potential *under-mitigation*.

As discussed in DMM's prior annual and quarterly reports, DMM has continually monitored this potential *under-mitigation* and determined that it has not had a significant impact due to the overall market competiveness.[3] Within the ISO, in most cases when real-time congestion occurs but mitigation was not triggered based on an advisory run, the supply of generation that relieves this congestion is structurally competitive.

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 are being implemented in the 2016 spring and fall software releases to address the issue of potential under-mitigation.

15-minute market enhancements

With changes scheduled for implementation in spring 2016, market power mitigation procedures in the 15-minute market will be performed during the same interval as the binding market run. With these modifications, an additional run will be performed as part of the 15-minute process to determine if bid mitigation should be triggered. These modifications can be implemented without a tariff change and are scheduled for implementation in spring 2016.

5-minute market enhancements

Additional changes being proposed by Management for implementation in fall 2016 will enhance mitigation in the 5-minute market. These modifications require a minor tariff change.

Currently, mitigation in the 5-minute market is based entirely on results of the process used to mitigate bids in the 15-minute market based on an advisory run. If bids are mitigated based on a 15-minute advisory run, these mitigated bids are carried over to all of the subsequent 5 minute market runs during that operating hour.

[3] *2014 Annual Report on Market Issues and Performance*, Department of Market Monitoring, pp. 126-131. http://www.caiso.com/Documents/2014AnnualReport_MarketIssues_Performance.pdf

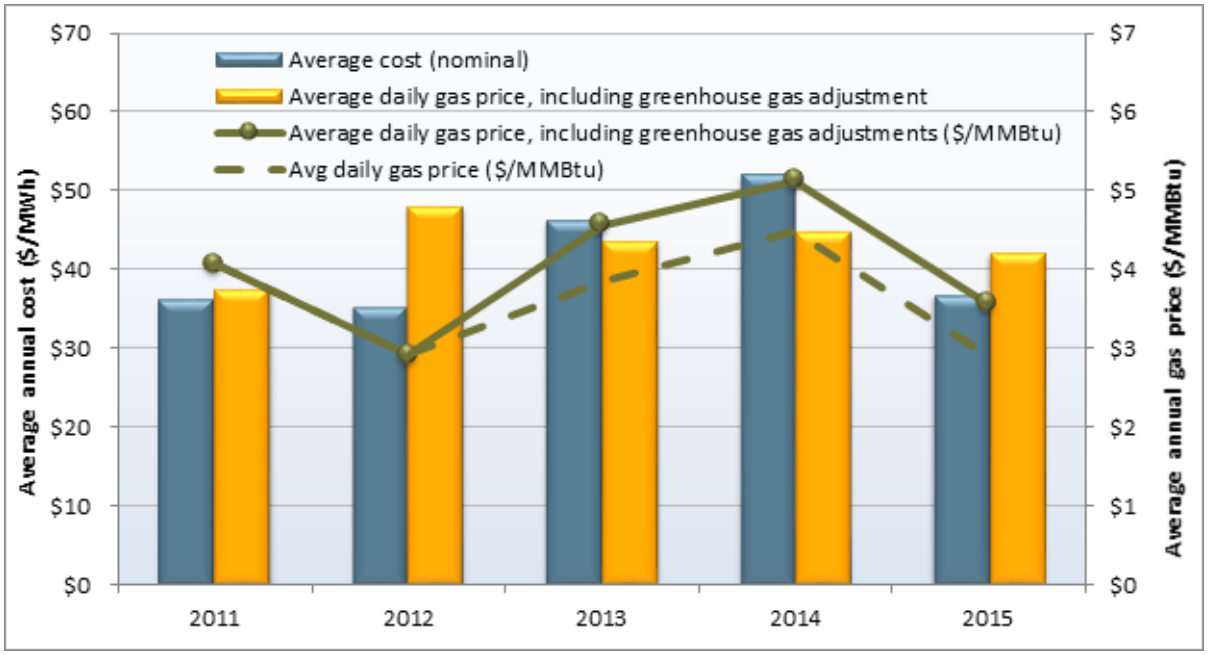
This approach can result in under mitigation due to the time lag between the advisory 15-minute interval and the binding 5-minute intervals, which can range from 45 to 55 minutes. In addition, modeling differences between the 15-minute advisory run and the 5-minute market runs can lead to under mitigation in the 5-minute market.

With software modifications being proposed for implementation in fall 2016, 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-mintue 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.

2015 MARKET PERFORMANCE

One of the key measures of market performance calculated by all ISOs and reported to the FERC each year is the total estimated wholesale costs per MWh of system load. Figure 1 shows these total estimated wholesale costs from 2011 to 2015. Wholesale costs are provided in nominal terms (blue bar), as well as after normalization for changes in average spot market prices for natural gas and greenhouse gas compliance costs (gold bar). The greenhouse gas compliance cost is added to natural gas prices beginning in 2013 to account for the estimated cost of compliance with California's greenhouse gas cap-and-trade program. The green line, representing the annual average of daily natural gas prices including greenhouse gas compliance, is included to illustrate the correlation between the cost of natural gas and the total wholesale cost estimate. The dashed green line excludes greenhouse gas compliance costs and is included for reference for 2011 and 2012.

Figure 1. Total wholesale costs (2011-2015)



The total estimated wholesale cost of serving load in 2015 was about $8.3 billion or just under $37/MWh. This represents a sharp decrease of about 30 percent from wholesale costs of about $52/MWh in 2014. This decrease was mostly due to a corresponding decrease in wholesale natural gas prices of more than 30 percent.

After normalizing for gas prices and greenhouse gas compliance costs, DMM estimates that total wholesale energy costs remained relatively stable for the third consecutive year, decreasing slightly from $45/MWh in 2014 to about $42/MWh in 2015, or a decrease of about 6 percent. The decrease in adjusted costs may be driven by record solar generation and the continued addition of new solar generating capacity within the footprint.

DMM will provide a more detailed analysis of 2015 market performance in its annual report, which DMM plans to publish in April.