

# Memorandum

**To:** ISO Board of Governors  
**From:** Eric Hildebrandt, Director, Market Monitoring  
**Date:** January 27, 2016  
**Re:** Market Monitoring report

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*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:

- **Accounting of minimum load costs.** DMM supports the general policy incorporated in Management's proposed modifications for accounting of minimum load costs. These modifications are designed to improve the efficiency of unit commitments and ensure full cost recovery for generating units in situations where the minimum operating level of units must be increased due to physical limitations. DMM worked closely with the ISO to develop a proposal that can accomplish these objectives without creating opportunities for excessive bid cost recovery. To ensure the proposal accomplishes these objectives, DMM has emphasized that the ISO should clarify that participants can only modify unit operating constraints in the ISO market software to reflect actual physical limitations, such as changes due to ambient weather conditions or environmental restrictions. DMM notes that if this rule is not enforced, the proposal could lead to decreased operational flexibility, over-generation and excessive bid cost recovery payments. The ISO's Draft Final Proposal clarifies market rules pertaining to modifications made to minimum operating levels in the outage management system.
- **Flexible ramping product.** DMM supports Management's proposal for establishing a flexible ramping product. DMM worked closely with the ISO, stakeholders and Market Surveillance Committee on developing this proposal. The final proposal incorporates a variety of key enhancements made through this process which make the flexible ramping product a significant improvement over the current flexible ramping constraint. DMM has provided recommendations for further potential refinements to the way in which costs of this new product are allocated.

This memo also provides an initial summary of 2015 market performance highlighting the growth in solar energy and the impact this has on market prices. DMM will provide a more detailed analysis of 2015 market performance in its annual report, which DMM plans to publish in April.

## **ACCOUNTING FOR MINIMUM LOAD COSTS**

DMM supports the general policy incorporated in Management's proposal to modify rules for how minimum load costs are calculated in the event a generator has to increase its minimum operating level.

As explained in Management's memo, the ISO's market software currently uses a single minimum load bid cost for each operating day. Minimum load costs are based on each resource's minimum operating level as listed in the ISO market's master file. Minimum load bids are capped at 125 percent of calculated costs under the "proxy cost" option and 150 percent of calculated costs under the "registered cost" option.

The ISO's market software allows generators to increase minimum operating levels above levels entered in the ISO's master file by submitting re-rates in the outage management system. Currently, however, minimum load cost bids are not increased when a unit's minimum operating level is temporarily increased in this manner. In this situation the minimum load bid cost used by the software may not accurately reflect and cover the resource's actual operating costs at minimum load.

Under the proposed modifications, when a generator temporarily increases its minimum operating level through the outage management system, minimum load bid costs used by the market software will be automatically increased based on the unit's *default energy bid* for this additional minimum load energy. Default energy bids are developed for energy bid mitigation and reflect the incremental operating costs of each unit plus a 10 percent adder. This modification should generally improve the efficiency of unit commitments and ensure full cost recovery for generating units in situations where the minimum operating level of units must be increased due to operational limitations.

DMM worked with the ISO to develop a proposal that can accomplish these objectives without creating opportunities for market inefficiencies, excessive bid cost recovery or gaming. To accomplish these objectives, DMM has emphasized that the ISO should clarify that participants can only modify unit operating constraints in the ISO's market software to reflect actual operational limitations, such as changes resulting from ambient weather conditions, equipment outages or environmental constraints.

If these rules are not clarified and enforced, the new settlement rule could make it profitable for generators to increase their minimum operating levels when units must be kept on at minimum operating levels due to various system conditions, software limitations or unit constraints (such as minimum operating times). This could be profitable since the default energy bids include at 10 percent adder above estimated costs. If generators can increase minimum operating levels and be guaranteed this additional profit, this may lead to decreased efficiency and operational flexibility, additional bid cost recovery payments and potential over generation.

In response to this recommendation, the Draft Final Proposal includes a discussion clarifying how ISO market rules pertain to the type of modifications to minimum operating levels that will result in higher minimum load bid costs under this proposal.<sup>1</sup>

## FLEXIBLE RAMPING PRODUCT

DMM is highly supportive of Management's proposal for establishing a flexible ramping product. This proposal was developed through an extensive market design and stakeholder process dating back to late 2011. Over this period, DMM worked closely with the ISO, stakeholders and Market Surveillance Committee on developing and refining this proposal.

Management's final proposal incorporates a variety of key enhancements through this process which make the flexible ramping product a significant improvement over the current flexible ramping constraint. Key elements of Management's final proposal that were developed and refined over the course of this initiative include the following.

- **Bidding.** The initial revised flexible ramping proposal suggested that bids would be submitted by each generator for flexible ramping capacity. DMM recommended that this feature be eliminated unless it was demonstrated that generators incurred any significant marginal costs associated with providing flexible ramping capacity beyond the opportunity costs upon which the price for the flexible ramping product is based.<sup>2</sup> The proposal was subsequently modified to eliminate bidding for the flexible ramping product.
- **Day-ahead procurement.** The initial flexible ramping proposal also called for procurement of flexible ramping capacity in the day-ahead market. This feature was

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<sup>1</sup> *Bidding Rules Enhancements Correct Inefficient Accounting of Minimum Load Costs after Pmin Re-rate*, Draft Final Proposal, January 8, 2016, pp. 5-6.

[http://www.caiso.com/Documents/DraftFinalProposal\\_BiddingRulesEnhancements.pdf](http://www.caiso.com/Documents/DraftFinalProposal_BiddingRulesEnhancements.pdf)

<sup>2</sup> *DMM Comments on Flexible Ramping Products Straw Proposal Incorporating FMM and EIM*, July 7, 2014.

<http://www.caiso.com/Documents/DMM-CommentsFlexibleRampingProductsStrawProposal.pdf>

*The Role of Separate Capacity Offers in Capacity Reserve Markets*, July 31, 2014.

<http://www.caiso.com/Documents/RoleSeparateCapacityOffers-SpotCapacityReserveMarkets.pdf>

dropped from the market design after concerns were raised that systematic procurement of the wrong amount of capacity and that this capacity would likely not increase real-time flexibility.<sup>3</sup>

- **Settlement of costs based directly on market prices vs. out-of-market uplift charges.** More recently, the proposal was modified so that most costs for the flexible ramping product charged based on the flexible ramping product price and the expected ramp of each resource, rather than by allocating costs through an out-of-market uplift. DMM strongly advocated for this change as a major improvement that provides better price signals to the market participants reflecting the value of upward and downward flexibility. This design provides a strong framework for other enhancements as the ISO continues to adapt its markets to the changing energy grid by facilitating integrating additional renewable generation, energy storage and demand response resources.
- **Procurement based on demand curve.** Under Management's final proposal, the flexible ramping product will be procured based on a price-sensitive demand curve. This represents another improvement over the current flexible ramping constraint, which incorporates a fixed requirement. Use of a demand curve allows flexible capacity costs to be balanced with the value of flexibility. More flexible capacity will be procured when the expected benefits outweigh the incremental cost of this capacity. Less capacity will be procured as the costs rise above the benefits. DMM has provided extensive input into how this demand curve should be derived based on operational data and looks forward to working with the ISO to implement this approach.<sup>4</sup>

As noted in the ISO's initial 2011 straw proposal for a flexible ramping product, "[b]y allocating costs to resources that cause the procurement of the flexible ramping product, a resource seeking to maximize profit in the energy market would make efforts to minimize

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<sup>3</sup> The *DMM Comments on Flexible Ramping Products Incorporating FMM and EIM Draft Final Proposal*, December 31, 2014 [http://www.caiso.com/Documents/DMMComments\\_FlexibleRampingProduct-DraftFinalProposal.pdf](http://www.caiso.com/Documents/DMMComments_FlexibleRampingProduct-DraftFinalProposal.pdf)

<sup>4</sup> The demand curve in the ISO's straw proposal was based on the historical incidence of power balance violations which would not have correctly valued flexibility. DMM proposed the alternative demand curve formulation based on the distribution of net load forecast errors which the ISO adopted for the final proposal.

*DMM Comments on Flexible Ramping Products Straw Proposal Incorporating FMM and EIM*, July 7, 2014. <http://www.caiso.com/Documents/DMM-CommentsFlexibleRampingProductsStrawProposal.pdf>

*DMM Comments on Demand Curves in the Flexible Ramping Product Draft Technical Appendix*, July 15, 2015. [http://www.caiso.com/Documents/DMMComments\\_FlexibleRampingProductTechnicalAppendix\\_DemandCurves.pdf](http://www.caiso.com/Documents/DMMComments_FlexibleRampingProductTechnicalAppendix_DemandCurves.pdf)

their exposure to flexible ramping cost allocations.”<sup>5</sup> DMM agrees and believes that further refinements can be made to the initial cost allocation approach incorporated in Management’s proposal to better align the allocation of flexible ramping costs with resources and performance that create demand for this product.<sup>6</sup>

## 2015 MARKET PERFORMANCE

Solar generation grew by about 40 percent in 2015 and began to have a much more dramatic impact on prices during hours of high solar production. Figure 1 shows the increase in total solar and wind generation between 2009 and 2015. Key trends related to the growth of solar generation in the last few years include the following:

- Solar energy is now the largest source of renewable energy connected to the ISO grid and now provides over 35 percent of renewable energy in 2015.
- During the warm days of the year when load was highest, solar energy routinely provides more than 10 percent of all system energy during high load hours.
- High solar generation volumes during the middle of the day have changed the traditional pattern of hourly prices, resulting in lower prices during many peak hours when loads are highest.

The impact of increased solar energy on market prices is illustrated in Figure 2, which compares average system marginal energy prices to average and net system loads for each hour on the day. As shown in Figure 2, average prices in 2015 now reflect the same hourly pattern of net system load depicted in the “duck curve”. Prices rise during the morning ramping hours, and then drop during the later morning and afternoon hours with increased solar production despite an increase in system loads. This is followed by a sharp increase in prices in the evening as solar generation drops and load increases.

Figure 2 also shows that overall average prices in the day-ahead and both real-time markets tracked closely in 2015. As shown in Figure 2, day-ahead prices tended to be slightly higher than real-time prices. Prices in the 5-minute market tend to be more volatile and vary more from hour-to-hour than either the day-ahead market or the 15-minute market. As discussed in prior DMM reports, this trend is partially due to energy from intermittent sources that is not scheduled in the day-ahead market or deviates from day-ahead schedules in real time.

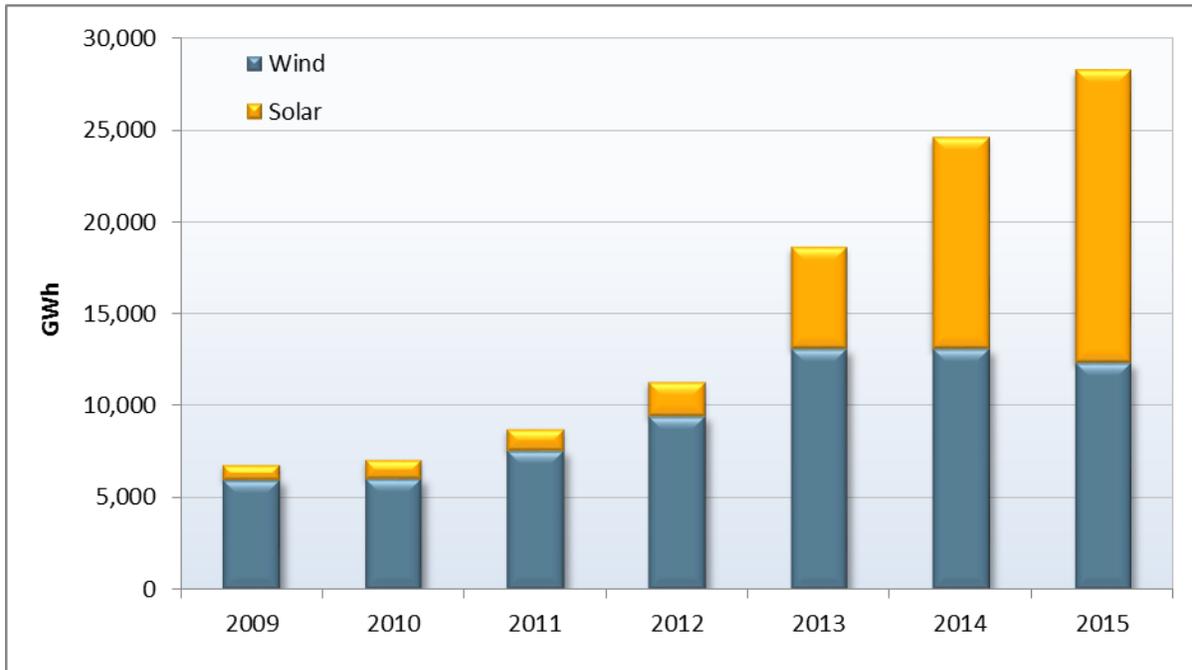
DMM will include extensive additional analysis of these trends along with other key aspects of market performance in our 2015 annual report scheduled for completion in April.

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<sup>5</sup> *Flexible Ramping Products Straw Proposal*, November 1, 2011, p. 19,  
<http://www.caiso.com/Documents/FlexibleRampingProductStrawProposal.pdf>

<sup>6</sup> *DMM Comments on Flexible Ramping Product Revised Draft Final Proposal*, January 15, 2016.  
<http://www.caiso.com/Documents/DMMComments-FlexibleRampingProductRevisedDraftFinalProposal.pdf>

**Figure 1. Total solar and wind generation (2009-2015)**



**Figure 2. Average hourly energy prices and load (2015)**

