

Memorandum

To: ISO Board of Governors

From: Benjamin F. Hobbs, Chair, ISO Market Surveillance Committee

Date: September 23, 2020

Re: **Briefing on MSC activities from July 14 to September 22, 2020**

This memorandum does not require Board action.

During the period covered by this memorandum, the MSC held one general session meeting by webinar on July 30, 2020 and adopted three Opinions.¹ The topics discussed in the general session meeting are briefly summarized in the first section below. Subsequent sections of this memo summarize the recommendations made in Opinions, which are addressed in turn:

- the ISO's plans to comply with FERC Order 831 concerning the raising of energy offer caps in its markets;
- enhancements to the flexible ramping product in order to improve deliverability and other dimensions of its performance; and
- phase 4 of the ISO's energy storage and distributed energy resources initiative.

Details concerning the MSC's analysis of the proposals and justifications for the recommendations are provided in the Opinions themselves.

The MSC plans to hold its next general session meeting on October 9, 2020.

1. General Session Meeting of July 30, 2020

This general session meeting had four agenda items, each addressing a different ISO initiative: the day-ahead market enhancements initiative; phase 4 of the ISO's energy storage and distributed energy resources initiative; system market power; and FERC Order 831 concerning import bidding and market parameters.

1.1 Day-Ahead Market Enhancements Discussion

This agenda item included presentations by James Friedrich and Don Tretheway from Market Design Policy at the ISO, Chair Ben Hobbs of the MSC, and Ryan Kurlinski of the Department of

¹All presentations and recordings of the meeting can be found at www.caiso.com/informed/Pages/BoardCommittees/MarketSurveillanceCommittee/Default.aspx

Market Monitoring.

First, Dr. Hobbs addressed the question: “Do the new day-ahead capacity products create a double payment?” Two new capacity prices are to be introduced in the day-ahead market: reliability capacity and imbalance reserves provided. The issue of possible double payment arises because the proposed day-ahead market enhancements design would use market prices to compensate these new capacity products no matter whether the resources are under resource adequacy contracts or not. This is in contrast to the present market design in which resources under such contracts do not receive a market clearing price if they are scheduled in ISO’s reliability unit commitment procedures. Dr. Hobbs expressed his opinion that it is preferable for resources providing reserves to be allowed to make offers that reflect the fuel reservation and other costs of providing that capacity, and to be incented by spot prices to be available when that capacity is most valuable. This position is consistent with previous formal MSC opinions that state a preference that compensation to short-term markets should be the primary source of economic incentives for providing flexibility to the ISO system. This is also consistent with several recent ISO market changes, such as the flexible ramping product, that have had this goal.

Dr. Hobbs pointed out that the challenge will be in the transition to the new system, as present resource adequacy contracts do not reflect expectations concerning capacity revenues in the new market design. However, in the longer term, under competitive conditions, the price of those contracts will likely be decreased to reflect increased short-run gross margins, and double payments will likely be avoided. This shift is also desirable from a cost allocation point of view. This is because by implicitly including short run reliability unit commitment costs in long run resource adequacy payments, the present system shifts those reliability unit commitment costs away from underbid loads and virtual supply bids (who are responsible for the need for reliability unit commitment, and are therefore should be allocated the expense of reliability unit commitment payments) to load serving entities who as a result of this cost shifting bear the cost of contracting for higher cost resource adequacy on the margin.

Mr. Friedrich and Mr. Tretheway staff presentation then resumed, in which they summarized how the proposal would address three additional issues:

- A cap upon real-time energy offers for resources that are awarded reliability capacity and imbalance reserves;
- Market power mitigation for the new capacity products; and
- Deviation settlements in real-time for capacity, in situations in which they had been awarded reliability capacity and imbalance reserves in the day-ahead market, but do not make that capacity available in real-time.

Stakeholder discussion addressed several of these issues. For instance, one stakeholder argued that risk aversion could mean that greater reliance on spot market revenues for capacity compensation could increase costs to risk averse resources, which might be reflected in resource adequacy contracts in a way that increases total costs to consumers to provide the new capacity products.

This agenda item concluded with Mr. Kurlinski’s presentation of a proposal by the ISO’s Department of Market Monitoring to extend the real-time flexible ramping product horizon.

Presently, the product is designed to manage ramps and their uncertainties over the 15 minutes between the binding and first advisory scheduling interval of the fifteen-minute market. Mr. Kurlinski pointed out that there is significant uncertainty concerning ramps over a 1 to 4 hour time horizon as well. He argued that operators are presently adjusting schedules to accommodate that uncertainty, and that it would be more efficient and transparent to manage that uncertainty with a flexible ramping product with a longer time horizon. In the MSC's Opinion on flexible ramping product enhancements (adopted on September 8 and summarized in Section 3, below), the MSC concurred that these uncertainties exist, but recommended that the enhancements proposed by the ISO be implemented first and their performance be evaluated before extension of the time horizon be considered.

1.2 Energy Storage and Distributed Energy Resources Initiative, Phase 4

This session began with a presentation by three ISO Infrastructure and Regulatory Policy staff members on three issues. First was a presentation by Lauren Carr on the E-three methodology for calculating the effective load carrying capability of demand response resources; the MSC was asked to review this methodology as part of its Opinion on this initiative (summarized in Section 4, below). Stakeholders offered several comments about that study, and some questioned the perception that demand response had been performing below expectations. Then Bridget Sparks of the ISO summarized the ISO's proposal to allow storage owners to provide an end-of-hour state-of-charge parameter (which could be a range of charge levels) to the market software. The parameter would compel the software to schedule the battery's state-of-charge to meet that parameter, with certain exceptions. She also discussed how use of that parameter would result in adjustments to the amount of bid cost recovery payments that could potentially be made to the resource. Finally, Gabe Murtaugh of the ISO briefly summarized the framework for quantifying default energy bids for storage under the proposed application of market power mitigation to storage resources.

These three issues are extensively reviewed in the MSC's Opinion on this initiative, summarized in Section 4, below.

1.3 System Market Power

This agenda item began with a presentation by Perry Servedio, Lead Market Design Policy Developer at the ISO, and Dr. Guillermo Bautista-Alderete, Director of Market Analysis and Forecasting. Danielle Tavel and Daniel Johnson of ISO Market Design Policy also contributed to the presentation. This presentation first gave an overview of the ISO's proposal for identifying when system market power has a high likelihood of being present in the ISO's energy markets and mitigating that market power. This proposal has also been extensively discussed in previous MSC general session meetings. This presentation emphasized the provision of details on the set of conditions that have to be satisfied to trigger mitigation, and the results of simulations showing how often they would have been encountered in 2017-2019 (approximately 0.5% of the time). The presentation summarized a number of concerns raised by stakeholders about the definition of those conditions as well as to whom mitigation would be applied if satisfied, and possible modifications to the proposal that could address them. In response to this presentation, extensive discussion took place among stakeholders, ISO staff, and MSC members on these issues.

Dr. Scott Harvey of the MSC then made a presentation about the application of the proposed system market power mitigation process in the hour-ahead schedule process, and the effectiveness of mitigation triggered at that time upon potential market power in the subsequent real-time fifteen-minute market and five-minute dispatch market. He argued that because the resources used to meet load in the latter markets cannot raise their offer prices after the hour-ahead evaluation, resources scheduled in the hour-ahead process cannot exercise market power in the subsequent dispatch markets by taking advantage of the fact that some supply that was offered in the hour-ahead process would be unavailable in the subsequent markets. He also stated that testing for system market power in the hour-ahead process avoids the high levels of false positives that would result from applying a pivotal supplier test for system market power in the subsequent fifteen- and five-minute markets.

Dr. Harvey then provided an extensive discussion of conceptual and implementation issues involved in testing for system market power in the provision of ramp capability or in meeting higher than forecast loads. He identified the potential for a high level of false positives, and described ways that these could be avoided by applying a more complete and accurate set of pivotal supplier tests for higher load levels or the impact of ramp constraints in the fifteen- and five-minute markets. The mechanics of these methods were described by Dr. Harvey, along with an example. Dr. Harvey then posed the question: is there a near-term potential for the exercise of material system market power in the supply of ramp capability that warrants potentially delaying implementation of the core design of the ISO's proposal in order to develop and implement these additional tests in the fifteen- and five-minute markets? Such a potential is not presently indicated by Department of Market Monitoring reports, but is nevertheless a possibility. Dr. Harvey then outlined studies that could, in theory, be undertaken to determine whether it is plausible that withholding of ramp capability could be profitable in the fifteen- and five-minute markets. On the basis of the information presently available, he did not advise delaying the initiative.

1.4 Federal Energy Regulatory Commission Order 831

A presentation was made by Danielle Tavel of Market Design Policy of topics related to the ISO's compliance with FERC Order 831. After summarizing the ISO's proposal, Ms. Tavel discussed data that concerns the frequency of violations of load balance constraints and their magnitude. It has been proposed that a lower penalty (equal to the maximum of \$1000/MWh and the highest accepted cost-verified bid) be applied for small violations, with a higher level (\$2000/MWh) applying to larger violations. For instance, about half of the violations of the constraint in the ISO's balancing area are smaller than the proposed threshold of 150 MW. Her presentation also summarized the shaping factor to be used to define a price screen for imports of power under resource adequacy contract. This shaping factor translates the price of multi-hour contracts at external trading hubs into an estimated hourly price that is used as a screen. The shaping factor is based on the previous day's ratio of the ISO's hourly system marginal energy cost to the average energy cost over the hours of the relevant hub contracts.

Dr. Jim Bushnell of the MSC then made a presentation. First, he reviewed alternatives for defining a proxy price for imports that could be used as a screen for offers of imports of power under resource adequacy contracts. Alternatives considered include operating costs of peaking plants based on prevailing gas prices, and the price of hub contracts. Second, Dr.

Bushnell showed how the relationship between hourly ISO prices and average prices over the duration of hub contracts depend strongly on whether the day in question is a low or a high price day, with much higher peak to off-peak price ratios in the latter day type. A more accurate estimate results from using ratios based on the previous day's prices rather than longer term average prices. However, the results of either method are subject to potentially large mismatches of hourly shaping factors. Dr. Bushnell suggested that the consequences of errors are not a major concern for Order 831, since the need for those thresholds is anticipated to be infrequent. Such factors would be more important if used for system market power mitigation, which potentially would require more frequent use of proxy price metrics for imports.

2. *Opinion concerning Compliance with Federal Energy Regulatory Commission Order 831*

On September 9, 2020, the MSC adopted an Opinion addressing the ISO's plans to comply with Order 831.² The MSC made the following recommendations in the Opinion.

The initiative leading to this proposal has been discussed during MSC meetings on Dec. 6, 2019, May 8, 2020, and July 30, 2020. There are two key aspects to this proposal: the determination of allowable offer prices and the setting of penalty values and market prices. The MSC supports the approach of screening offers above \$1000/MWh from specific resources using methods also utilized for other market power screening purposes. The MSC also supports the proposal for calculating a maximum import price based upon regional bilateral price indices. Although Order 831 was primarily concerned with periods of very high gas prices, experiences with the mid-August 2020 heat-wave demonstrate the need for allowing for higher priced import offers (and export prices) during periods of regional scarcity. However, as discussed during the July 30, 2020 general session meeting of the MSC and in the Opinion itself, there are challenges with adapting these multi-hour bilateral index prices for use as an hourly import price screen, and the ISO should carefully monitor and be ready to modify, if necessary, its formula for calculating these prices.

The MSC also supports the proposal's approach to setting penalty values, which determine market prices during periods of scarcity. The Committee's support, however, is based upon the fact that this initiative was intended to focus primarily on allowable offers and not on the wider set of issues associated with the topic of scarcity pricing. Given this fact, the MSC believes that the compromises made in the development of this proposal are reasonable and an improvement over current practice. However, the Committee strongly urges the ISO to undertake an initiative that will be focused specifically on scarcity pricing, so that a more wholistic and consistent approach to scarcity pricing with both the ISO and EIM regions can be developed. The experiences of mid-August again signal the urgency of such an initiative. These conditions will likely grow more

² J. Bushnell, S.M. Harvey, and B.F. Hobbs, "Opinion on Revisions to Import Bidding and Market Parameters for Compliance with FERC Order 831", Market Surveillance Committee of the California ISO, Sept. 9, 2020, www.caiso.com/Documents/MSC-OpiniononFERC831ImportBiddingandMarketParameters-Sep9_2020.pdf

frequent and the region is in need of a more coordinated approach to managing scarcity conditions.

3. *Opinion concerning Flexible Ramping Product Enhancements*

This Opinion was adopted on September 8, 2020.³ The focus of the opinion was the implementation of a nodal delivery test for the product. The initiative leading to this proposal has been discussed during MSC general session meetings on October 11, 2019 and May 29, 2020, while the issues motivating this initiative have been discussed at a variety of MSC meetings over the 2017 to 2019 period. Below are the recommendations made by the MSC in the Opinion.

The ISO's proposal to implement a nodal delivery test is a reasonable approach to improving the deliverability of the flexible ramping product, which will thereby enable the ISO to balance variations in variable energy resource output at lower cost. However, the Committee has a few cautions regarding the development of this design. First, it will be important to evaluate the impact of the ultimate nodal delivery test design on the solution times of the fifteen- and (especially) five-minute markets before proceeding to implementation. Second, it will also be important to assess how well the nodal delivery test design will perform before proceeding to implementation. This testing will be particularly important to the extent that the current design is modified in order to reduce solution time impacts. Third, the ISO's software implementation should provide the flexibility to adjust key parameters on an ongoing basis as it is very unlikely that the ISO will be able to specify the best values in advance, and the ideal values are also likely to change over time with changes in the ISO and Western Energy Imbalance Market resource mix and with the further expansion of the imbalance market.

Fourth, stakeholders and the ISO should both recognize that the successful implementation of a nodal delivery ability test will be one step in realizing the full potential of the flexible ramping product design concept and that it is likely that improvements will be needed to other elements of the current design. Fifth, the kind of changes in the scheduling of flexible ramping product in forward periods in the short-term unit commitment that the Department of Market Monitoring has suggested (see discussion in Section 1.4, above) may ultimately be desirable. But it does not appear possible to assess the value of such changes, or even to develop a design for changes of this type until (1) an improved test for deliverability is implemented and works at least roughly as intended and (2) the ISO implements the improved methods for determining future ramp needs that are also being developed as part of this initiative.

³ J. Bushnell, S.M. Harvey, and B.F. Hobbs, "Opinion on Flexible Ramping Product Enhancements", Market Surveillance Committee of the California ISO, Sept. 8, 2020, www.caiso.com/Documents/MSC-OpiniononFlexibleRampingProductEnhancements-Sep8_2020.pdf

4. Opinion concerning the Energy Storage and Distributed Energy Resources Phase 4 Initiative

The MSC voted to adopt this Opinion on September 8, 2020.⁴ The proposal has several elements. The following three elements are the focus of the Opinion:

- (1) allowing storage facilities bidding into the ISO markets to specify an end-of-hour state-of-charge parameter that constrains operation of the battery in the ISO's real-time markets;
- (2) market power mitigation for storage facilities, with a focus on calculation of default energy bids; and
- (3) effective load carrying capability-based estimation of the contribution of demand response to system resource adequacy.

Portions of this initiative have been discussed at MSC meetings, including meetings on June 7, 2019, August 19, 2019, May 8, 2020, and, most recently, July 30, 2020. The recommendations made in the Opinion are summarized below.

First, the end-of-hour state-of-charge parameter will be an important tool for resource owners to manage storage to help prevent the "end effects" distortions that arise from having too short a time horizon in the market optimization. For example, owners could consider opportunity costs of selling in time periods beyond the optimization horizon and set this parameter in order to conserve energy for use later on, rather than sell it at a lower price prior to the time horizon. This is one standard approach to managing end effects; another would be to allow resource owners to specify a \$/MWh value of energy to be applied to the last period's ending state-of-charge, which could even depend on the level of that charge. This alternative approach, which is not part of the ISO's proposal, would give more flexibility to the operator to tradeoff value of power prior to the time horizon against the value of power later. Resource owners might want to use both approaches to save stored energy for later, with a floor on the state-of-charge and a monetary value for stored energy above that level.

The end-of-hour state-of-charge parameter (and the MSC's proposal for a monetary value for the ending state-of-charge) could both be used to exercise market power. The MSC did not propose a hard and fast criterion for detecting and mitigating market power in this parameter. The Committee instead suggested that if a storage resource repeatedly (over several days) specifies a parameter value that is much higher than what the day-ahead solution indicates, and if later real-time prices repeatedly do not economically justify that withholding, that the resource could be prohibited for a set period of time from setting a parameter value appreciably different than what the day-ahead market indicates is optimal.

The second element of the initiative addressed in the opinion concerns two aspects of the proposal to mitigate storage offers: the possibility of a safe harbor, and the calculation of default

⁴ J. Bushnell, S.M. Harvey, and B.F. Hobbs, "Opinion on Energy Storage and Distributed Energy Resources Phase 4", Market Surveillance Committee of the California ISO, Sept. 9, 2020, www.caiso.com/Documents/MSC-OpiniononEnergyStorageandDistributedResourcesPhase4-Sep8_2020.pdf

energy bids. Regarding the first aspect, the MSC proposes adoption of a safe harbor in which storage resources would not have their bids/offers mitigated if they are smaller than some reasonable threshold and/or that are not owned by entities that control other resources that could benefit from higher prices. While such a safe-harbor would arguably be appropriate for all resource types, it would be particularly beneficial in the case of storage resources. This is because of the low potential benefits of mitigating small storage facilities, and the higher potential negative consequences of mitigating storage.

Concerning the second aspect of the mitigation of storage market power, the MSC believes that the proposal correctly identifies the components of variable storage costs, including charging costs, losses, cycling (life-reduction) costs, and opportunity costs (foregone future revenues). Estimating those costs is difficult, because charging costs, loss costs, and opportunity costs depend on market prices over the charge-discharge cycle, which may extend beyond the time horizon of the market optimization, while cycling costs depend in a complicated manner on the depth and history of discharges. The MSC recommended consideration of a simplified approach that avoids the need to estimate opportunity and charging costs. In particular, if storage is modeled in market software with explicit representation of energy losses; state-of-charge and capacity constraints; a \$/MWh cycling cost parameter; and either a target state-of-charge for the last interval in the optimization and/or an economic value of energy in storage representing opportunity costs after the time horizon, then the most efficient schedule will result from storage submitting the following information to the market operator:

- physical constraint parameters;
- the target state-of-charge in the last interval or the value of energy at that time; and
- the \$/MWh cost of cycling.

The resulting schedule will be both optimal from a system cost point of view, and profit maximizing if the resource owner does not possess market power.⁵ Therefore, to simplify the market power mitigation processes and to better capture opportunity costs, the MSC suggests that the ISO consider mitigation based on the following principles:

- First, that storage owners be allowed to specify state-of-charge parameters for the last interval in the time horizon in both day-ahead and real-time markets, as well as (or instead, if the owner prefers) a value of energy parameter for the state-of-charge in the last interval, and
- Second, that charging and opportunity costs be omitted from default energy bids.

If mitigation is based on these principles, then default energy bids will need to be developed for energy values to be applied to the last interval in the optimization, in case potential market power is identified and to prevent withholding of energy. These default values would reflect opportunity costs after the market optimization's time horizon.

⁵ However, this procedure might miss the option value arising from profits that can be made by taking advantage of real-time price volatility that tends to be understated in the ISO market software.

It is possible that including recharge and opportunity costs in bids to charge and offers to discharge would not distort scheduling decisions, but the MSC does not see significant advantages to allowing those cost components in bids and offers. This is because those costs are automatically and implicitly considered in the market optimization; are difficult to estimate ahead of time (depending as they do on market and shadow prices that are calculated by the market software); must be specified for every market interval; and are possibly subject to manipulation in order to exercise market power. The proposed procedures to mitigate market power in energy discharge offers will involve complex procedures, and furthermore may not be completely effective because end-of-hour state-of-charge parameters can also be used to exercise market power but will not be mitigated.

It is anticipated that the issues of default energy bid estimation will be revisited as storage penetration in the ISO markets increases, and technology evolves. Therefore, the MSC's recommendation is that ISO proceed with its present proposal but consider more elaborate but potentially more accurate alternatives for estimating all the cost components (including cycling costs) in the future.

Extending the time horizon of real-time market software, as proposed by some stakeholders, would likely result in improved reflection of opportunity costs in storage scheduling, especially if the time horizon is after the evening net load peak. However, there are computational costs to doing so, and the extended model will still not capture the option value of responding to highly variable prices in the real-time markets.

The third feature of the initiative addressed by the Opinion concerns effective load-carrying capability of demand response. In general, the events of August 2020 highlight the importance of realistic characterization of resource contributions to system adequacy. Effective load carrying capability is a useful and theoretically valid framework for this purpose, but it is challenging to apply to variable renewable resources, storage, and demand response. More accurate load carrying capability estimates are also critical to ensure that resource adequacy mechanisms do not over-reward resources whose capabilities are overestimated while under-rewarding other resources whose capabilities are underestimated, therefore risking distortions in investment. Methods are needed to include correlations of availability within a class of resources, among different resource classes, and between resource availability and loads; to recognize effects of location and congestion; and to recognize the impact of operational constraints such as unit commitment limitations. This is particularly true for demand response, a resource that will be increasingly important in the future, which is characterized by a diversity of technologies and programs, whose performance is correlated with load and other resources, and whose capability has been overestimated in the past, according to the Department of Market Monitoring.

Finally, the MSC recommended appropriate performance incentives in order to encourage resources, including demand response, to report accurate estimates of capacity availability, and to make that capacity available when most needed by the system.