Memorandum

To: ISO Board of Governors

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

Date: September 11, 2019

Re: **Briefing on MSC activities from July 16, 2019 to Sept. 9, 2019**

This memorandum does not require Board action.

During the period covered by this memorandum, the MSC held a general session meeting in Folsom on August 19, 2019.[1] The presentations and discussions are briefly summarized below, During this time, the MSC also began preparing a formal opinion on mitigation of system-wide market power, which is planned for submission to the Board of Governors in November, 2019.

The next general session meeting of the MSC is scheduled for October 11, 2019,

General Session Meeting of August 19, 2019

The general session meeting had three major items. The first addressed the possible need for mitigating market power at a system level, and alternatives under consideration by the ISO for accomplishing that mitigation. The second addressed the day-ahead market enhancements initiative, with a focus on combined versus sequential designs for the energy and residual unit commitment markets. The third item concerned a proposal for mitigation of market power from storage devices; this proposal is part of the energy storage and distributed energy resources phase 4 initiative. Each of those agenda items included presentations by ISO staff and/or MSC members followed by discussion among stakeholders, ISO staff, and MSC members.

Structural system-level competitiveness analysis discussion. Three presentations were made during this agenda item. The first was by Perry Servedio, Lead Market Design Policy Developer at the ISO. His presentation was followed by presentations by two of the MSC members, Dr. Scott Harvey and Dr. James Bushnell. Mr. Servedio's presentation summarized some possible design elements of a proposal that the ISO is presently developing to address system-wide market power. The three elements emphasized in the presentation included:

1. screening for uncompetitive conditions;
2. determining which resources to mitigate; and

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

3. ISO estimation of resource costs for use in default energy bids.

The first element has several features that need to be considered: whether to apply in just the real-time market or in both the day-ahead and real-time markets; screening criteria to be used to determine whether to apply mitigation (based on residual supply index and/or constrained import conditions); and determination of which resources to mitigate (internal only, or to include either all imports or just those obligated to bid into the ISO market). Details were provided about how the ISO might assess whether imports to the ISO are constrained. When imports are constrained, this is anticipated to increase opportunities for market power exercise within the ISO markets, and the calculation of residual supply that can serve load.

An active audience discussion followed Mr. Servedio's presentation. One stakeholder questioned the ISO's process of first considering whether or not to have system-wide market power and to develop general design principles; then, subject to Board of Governors approval, a formal stakeholder process would be begun. The expressed concern was that the first part of the process will prematurely conclude that no system-wide mitigation is necessary. Another stakeholder asked whether the few hours of system-wide market power apparently occurring in the last year could justify the effort required to mitigate it; however, MSC member Dr. Jim Bushnell pointed out that some stakeholders and the Department of Market Monitoring have previously indicated that exercise of such market power could become more frequent in the future. Many stakeholders and some MSC members expressed concern that mitigation in just the real-time market would not be sufficient to eliminate market power day-ahead. On the other hand, Dr. Bushnell pointed out that mitigating in the day-ahead market could encourage import bids to wait until real-time. Another question that was discussed extensively was how import bids could be mitigated. Dr. Scott Harvey of the MSC suggested that, in the case of imports subject to a resource adequacy contract, a generously high default energy bid (several hundreds of dollars per MWh) could be set, but still be below the bid cap of $1000/MWh, which might result in more day-ahead import bids clearing but not at prices below their cost.

Dr. Harvey then made a detailed presentation that addressed five topics:

- The three-pivotal supplier test. Dr. Harvey cited the conclusion of the MSC's 2013 study[2] that concludes that the test is very conservative (resulting in mitigation at times that it isn't needed);
- The changing supply-demand balance in the ISO markets. Dr. Harvey noted that the replacement of existing California gas-fired generation with less flexible resources or out-of-state gas-fired generation should reduce market concentration. However, out-of-state resources cannot offer three-part bids (start-up, minimum load, and variable costs), which could lessen their flexibility and make it more difficult to mitigate them. He also expressed concern that in-state variable renewable or demand response resources might not contribute as much as needed during peak hours exacerbating market power or even shortages at those times. Dr. Benjamin Hobbs of the MSC noted that this could happen because of errors or approximations in effective load carrying capabilities of such resources;

[2] J. Bushnell, S. Harvey, B. Hobbs and S. Oren, "Report on the Appropriateness of the Three Pivotal Supplier Test and Alternative Competitive Screens, " https://pdfs.semanticscholar.org/1849/e298ed3cac55bb32d2b984e77db114d615c7.pdf, June 27, 2013.

- Dr. Harvey's analysis of two groupings of high-priced hours in 2018. He asked:
    - o whether local market power mitigation was appropriately triggered (which he concluded did generally occur),
    - o whether congestion on interties limited competition from imports (concluding that there was no pattern of the ISO as a whole being insulated from competition from import supply on the major ties during those hours, although SCE and SDGE were at times insulated), and
    - o whether market prices clearly exceeded competitive levels in some of those hours (gas prices were very high during those hours, and bidder risk aversion or errors in gas price estimates rather than market power could be responsible for differences between prices and estimated marginal costs that were estimated by the Department of Market Monitoring).

  One stakeholder observed however that during a high priced hour studied by DMM, net buyers and net sellers systematically bid differently, which might be evidence of market power. Dr. Harvey said that it was not clear that such a pattern existed without examining those bids in more detail, particularly with respect to location and which resources had offers in excess of their DEBs;
- The issue of high priced resource adequacy import supply. Dr. Harvey elaborated on his proposal mentioned above that the offer prices of resource adequacy imports be capped at a relatively high default energy bid of several hundred dollars, so that they would be cleared in the day-ahead market if they were needed to meet load on high cost days and would be exposed to losses if the supplier did not perform in real-time and real-time prices rose to or near the $1000 price cap; and
- Application of system market power mitigation. He concluded that if the ISO and other stakeholders believe there is a potential for changes in market conditions that will materially increase dependence on imports and result in more hours in which the supply of imports is constrained by transmission congestion, the ISO could develop an expanded local market power mitigation design in which a three pivotal supplier test would be triggered not only by material congestion within the ISO but could also be triggered by material congestion on the major interties into California.

This agenda item concluded with a presentation by Dr. Jim Bushnell of the MSC. In that presentation, he argued that contracts for energy, and not just capacity, in the resource adequacy process are needed to mitigate market power, and that this was a major lesson from the 2000-01 crisis. He argued that such contracts also have benefits for risk hedging and supporting construction of new resources. There was then stakeholder discussion addressed mismatches between standard contract time profiles and actual load profits, and whether energy contracts would lessen flexibility. Dr. Bushnell then asked whether fewer hedging contracts for energy are being acquired because of the growth of community choice aggregators. The use of power charge indifference adjustments in aggregator contracts may serve to at least partially insulate them from price risks. He concluded that system-wide mitigation would not address all issues arising from reduced hedging by load serving entities.

Day-ahead market enhancements (DAME) discussion. The second agenda item was day-ahead market enhancements. Dr. Scott Harvey of the MSC provided a presentation in two broad parts: benefits and implementation challenges of combined energy-residual unit

commitment design for the day ahead market; and a discussion of alternative sequential designs. Dr. Harvey also posted a set of numerical examples of the application of the sequential and combined designs designed to show their differences.

Dr. Harvey's discussion of the combined design first summarized that design and then reviewed its potential benefits. Five categories of benefits were outlined relative to the present day-ahead market which has separate energy market and residual unit commitment models:

1. More efficient commitment of long start resources when needed for residual unit commitment, because the energy market benefits of dispatching those resources would be recognized in the combined market.
2. Binding financial schedules would be provided in day-ahead market for all resources needed to reliably meet ISO load forecast, whereas in the present day-ahead market, resources committed in the separate residual unit commitment step do not receive an energy schedule. This is important for scheduling the needed fuel for operating generators.
3. Consistent and efficient energy and capacity prices across resources scheduled in the integrated forward market to meet bid load, and to meet the ISO's load forecast. In contrast, under stressed system conditions, the inconsistent prices yielded by a sequential design could provide incentives to distort energy and capacity offers.
4. Assurance that resources committed to meet the ISO's load forecast can be dispatched to meet that load, because their use is considered in the network constrained dispatch.
5. More efficient pricing for virtual supply bids that require the scheduling of incremental reliability capacity, because the price of capacity will be based on the marginal cost of providing that capacity (net of margins earned in the energy market). Physical resources can earn both energy and capacity revenues, but virtual supply only earns energy revenues. In contrast, within the present day-ahead market, costs of residual unit commitment to the system operator are in part rolled into uplifts assigned to virtual bids on an average cost basis, and no consideration is given to offsetting energy market benefits of having that capacity.

Dr. Harvey noted that some of the sequential designs have some of the above advantages also. This part of the presentation was followed by active discussion by stakeholders, several of whom strongly supported the more efficient pricing of virtual bids. There was also clarifying discussion of the mathematical formulation and how virtual bids affect prices.

Dr. Harvey then outlined four challenges in implementing a combined design:

1. Can the optimal design be implemented in a manner that achieves sufficiently optimal solutions within an acceptable time for problem set-up, computation, and reporting?
2. Can a workable market power mitigation design be developed and implemented that effectively covers both capacity and energy bids, and provides for efficient incentives for imports in the day-ahead market?
3. Can the basic combined pricing design be refined to eliminate the potential for anomalous outcomes involving intermittent resource output, when different from the ISO's forecast?

4. Can a market design and framework for ISO implementation be developed that will produce efficient outcomes and be consistent with the potential impact of the ISO's net load forecast on energy, flexible capacity, and reliability capacity prices? Dr. Harvey outlined several issues involved in this challenge, focusing on incenting import bids for both energy and capacity and the rules for their participation (such as real-time bidding rules).

In the second part of his presentation, Dr. Harvey summarized five distinct proposal for sequential energy-residual unit commitment markets, about which he made eight sets of observations. The observations addressed issues such as whether capacity should be required to be dispatchable within 15 minutes (relaxing this requirement would lower costs to consumers and, according to MSC members, not endanger reliability), and the inability of some proposals to guarantee deliverability of capacity reserves.

Energy storage and distributed energy resources initiative Phase 4 discussion. Mr. Gabe Murtaugh, Sr. Infrastructure & Regulatory Policy Developer at the ISO, presented an overview of the ISO's present proposal for defining battery cycling costs for use in determining default energy bids for distributed storage in the ISO's local market power mitigation mechanism. Because storage will often be installed to manage local congestion problems, if a significant amount of storage is owned by one entity, it could be in a position to exercise local market power.

Mr. Murtaugh presented two different methods for approximating cycling costs in default energy bid calculations for storage. One applies a higher per MWh cost to the extent that the storage facility has already been discharged. The other uses a constant per MWh charge based on an estimate of average cycling cost. Each makes significant approximations compared to a quadratic model,

Dr. Hobbs of the MSC then made a brief presentation addressing how a research paper written by University of Washington engineers had examined the question of the accuracy of approximations of battery cycling cost upon simulated ISO-New England operations.[3] In particular, among other questions, that research addressed the effect of the number of piecewise line segments approximating the quadratic cost vs discharge depth. The analysis concluded that, first, considering cycling costs would dramatically change how batteries are optimally dispatched by the ISO-NE system. Its second conclusion is that using a single line segment, which is broadly consistent with one of the possible approaches proposed by California ISO staff, results in very different operations of batteries on an ISO system than more accurate approximations. This implies that the ISO's consideration of cycling costs could improve system dispatch, but that that the accuracy of the approximation matters. A stakeholder pointed out that a two-segment approximation might serve adequately, since the University of Washington paper indicates that the two-segment solution was actually closer to the most accurate model's solution than it was to the single segment solution.

[3] Xu, B., Zhao, J., Zheng, T., Litvinov, E. and Kirschen, D.S., 2017. Factoring the cycle aging cost of batteries participating in electricity markets. *IEEE Transactions on Power Systems*, *33*(2), pp. 2248-2259.