

Memorandum

To: ISO Board of Governors

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

Date: September 15, 2021

Re: Briefing on MSC activities from July 8, 2021 to September 15, 2021

This memorandum does not require Board action.

During this time period, the MSC held a general session meeting on August 27, 2021. Three topics were addressed during this meeting:

- Energy storage enhancements, in particular the proposed real-time state-of-charge product;
- Energy imbalance market resource sufficiency evaluation; and
- Day-ahead market enhancements, with a focus on the imbalance reserves proposal.

The presentations and discussions for each of these topics are summarized below.¹

1. Energy Storage Enhancements Initiative

This agenda item began with a presentation by Gabe Murtaugh, Storage Sector Manager at the ISO, who summarized the potential proposal for this initiative.² Mr. Murtaugh summarized several features of the proposal, with his presentation emphasizing a proposed real-time state of charge market product that would replace the present minimum state of charge requirement for individual resources. The intention of the product is to improve the efficiency with which the ISO manages the state of charge of the battery energy storage fleet during days when stored energy is needed to meet the evening peak loads. The presentation reviewed the timing of the product, development of procurement requirements, and an example illustrating the possible effect upon charging and discharging patterns.

The presentation resulted in extensive discussion by MSC members, ISO staff, and attending stakeholders of the purpose of the proposal and its details. Issues discussed included:

1. Technical issues regarding modeling of battery resources, outage management, and implementation of exceptional dispatch instructions;
2. Whether the proposal should be implemented in several phases in order to keep the complexity of implementation manageable, as some stakeholders suggested, or in one phase, as the ISO proposes because tools to manage rapidly growing storage are needed.

¹All staff and MSC member presentations at the general session meeting are available at www.caiso.com/informed/Pages/BoardCommittees/MarketSurveillanceCommittee/Default.aspx

²<https://stakeholdercenter.caiso.com/StakeholderInitiatives/Energy-storage-enhancements>

3. MSC members addressed the issue of possible discrimination among types of resources, and suggested that energy-limited resources other than batteries could be subjected to the same approach to managing their availability during the evening peak. They also asked about why storage would be eligible to receive more revenues (through state-of-charge payments and energy revenues) than a dispatchable thermal resource (which would only receive energy revenues) when providing the same amount and timing of energy. The members raised concerns that a focus on batteries might result in increased costs to load if less expensive thermal or import resources were disadvantaged as a result of the state-of-charge payments. Stakeholders replied that a separate process for storage state-of-charge was justified by the specialized procedures used by the ISO to manage storage and other non-generator resources.
4. The timing of the state-of-charge procurement was discussed, with a stakeholder suggesting that day-ahead procurement might be preferable. MSC Chair Dr. Ben Hobbs proposed that it may be sufficient to acquire state-of-charge only for the time when the evening storage discharge begins, and that it is not necessary to specify the amount of energy stored prior to that time.
5. One stakeholder asked about congestion, being concerned about whether the state-of-charge acquired would actually be deliverable.

As noted in our previous Board memo, the design of incentives or rules intended to correct the problems arising from the limited time horizons of real-time scheduling of storage involves important conceptual and practical market design problems. MSC members and ISO staff will be organizing a workshop tentatively scheduled in October that will convene national experts on storage management to consider these issues and the ISO proposal.

2. Resource Sufficiency Evaluation Enhancements

The ISO is proposing to enhance the resource sufficiency evaluation process in order to better ensure that each balancing area authority in the energy imbalance market has sufficient capacity available to meet its net 15-minute demand. ³As summarized in the previous Board memo, before the ISO runs the real-time market, the ISO applies tests for each balancing area authority in the market to assess the feasibility of base schedules, determine whether the base schedule of supply and demand balance, and assess the sufficiency of resource capacity and flexible ramping capacity to meet demand. In its summer 2021 enhancements, the ISO expanded the resource capacity component of the resource sufficiency evaluation to add an additional required amount to account for net demand uncertainty. If a balancing authority has sufficient resources, the entity is deemed to be able to meet its area's demand with its own net-supply, and is then allowed to transfer power with other entities through the EIM real-time market. Improved accuracy of the evaluation process will better characterize the ability of balancing area authorities to meet their obligations, without undue risk of restricting power exchanges unnecessarily.

This agenda item started with a presentation by Mr. Rahul Kalaskar, Manager, Market Validation Analysis and Mr. Danny Johnson, Lead Policy Developer, Market Policy and Performance. They reviewed the performance of capacity up and ramp up tests for each balancing area authority to

³<https://stakeholdercenter.caiso.com/StakeholderInitiatives/EIM-resource-sufficiency-evaluation-enhancements>

assess the impact of the summer 2021 enhancement which added net demand uncertainty to the resource sufficiency evaluation's capacity test. Monthly results starting January 2021 were reported, as were daily results for June 14 through August 15 and average results for each of the 24 hours of the day during that period. They also presented information related to how the resource sufficiency evaluation accounts for import delivery rates under its "net intertie uncertainty" calculation. The new calculations of net intertie uncertainty were illustrated with an example. The presentation closed with discussion of a proposal to allow adjustment of energy forecasts to account for programs that cannot be modeled as proxy demand resources or as ISO reliability demand response to be included in the calculations.

Dr. Scott Harvey of the MSC then made a presentation on a particular issue: accounting for the effect of load conformance adjustments made by the ISO upon the resource sufficiency test.⁴ Dr. Harvey pointed out that including typical adjustments made during the ISO's hour-ahead scheduling process and real-time pre-dispatch, which were intended to increase interchange schedules in the resource sufficiency test load, would likely materially overstate actual ISO load and cause the ISO to fail the test when it should not. Use of adjustments closer to the (generally smaller) real-time dispatch adjustments would be more realistic.

Dr. Harvey continued his presentation with several comments about the flexible ramp product enhancements and possible interactions with load conformance adjustments. He suggested that careful testing of the new nodal deliverability constraints and quantile regression methodology for the ramp product would be needed to ensure that they perform as intended.

Dr. Harvey concluded the presentation with some general principles to be considered in modifying the sufficiency test. He proposed that the test should not incent overcommitment of thermal generation when not needed; it should encourage exchange of variable renewable power when ample; and the test should avoid overcomplexity in order to promote transparency and reduce the chance of erroneous outcomes.

3. Day-Ahead Market Enhancements: Imbalance Reserve Deviations and Priority Exports

Mr. James Friedrich, Senior Policy Developer at the ISO started this agenda item with a presentation that focused on various features of the proposed imbalance reserve product design.⁵ These features included the proposed use of a single penalty price rather than a demand curve to signal scarcity; the requirement that only 15-minute responsive capacity could qualify to provide the product; a requirement that this capacity's as-bid energy price would have to be below a certain level; and market power mitigation. Mr. Friedrich also discussed the reliability capacity and reliability unit commitment pricing design, with a focus on the issue of allowing resource adequacy capacity to submit positive price-offers for its energy in the reliability unit commitment.

The discussion with stakeholders and MSC members began with an exploration of the purpose of the imbalance reserve, which some stakeholders stated was unclear. Dr. Harvey of the MSC

⁴S.M. Harvey, "Load Conformance Adjustments and the Resource Sufficiency Test", MSC Meeting, Aug. 27, 2021, www.caiso.com/Documents/LoadConformanceandResourceSufficiencyTests-Presentation-Aug27_2021.pdf

⁵<https://stakeholdercenter.caiso.com/StakeholderInitiatives/Day-ahead-market-enhancements>

explained why flexible ramp capacity doesn't meet the need addressed by imbalance reserves, because ramp capacity is not presently committed day-ahead. Dr. Harvey also pointed out that the eastern ISOs are increasing their use of 30-minute reserves to address the uncertainty in net load, which are analogous to the role of the proposed imbalance reserve product.

Presently, resources under resource adequacy contracts are required to bid zero for their energy in the residual unit commitment process. The day-ahead market enhancements proposal would allow non-zero offers for imbalance reserves and reliability capacity, which could reflect, for instance, procurement of the fuel needed to cover the possibility of being dispatched in real-time. A stakeholder expressed skepticism that new resource adequacy contracts would see downward price adjustments in response to implementing non-zero bidding. The stakeholder suggested that multiyear contracts and local market power result in price stickiness in resource adequacy contracts.

Later during this agenda item, the general issue of price and efficiency impacts of present zero bid requirements was addressed by a presentation made by Dr. Harvey on residual unit commitment pricing design.⁶ Dr. Harvey noted that the following issue has been neglected in the discussion: the impact of requiring zero offers for residual unit commitment supply on cost shifting among load-serving entities, and on shifting the actual costs of that supply cost to flexible resources. Dr. Harvey pointed out that these shifts could be adversely impacting the ISO supply mix between flexible and inflexible resources, and could potentially cause several other market inefficiencies, which his presentation reviewed. As an example, by reducing the overall cost of supply in the residual unit commitment, the cost to load-serving entities of underbidding expected load is reduced. This shifts part of the cost of underbidding to resource adequacy contracts with other load-serving entities that do not underbid. Another example is that flexible gas units may disproportionately incur unrecovered gas scheduling costs, and an unintended result may be to subsidize inflexible capacity with higher commitment costs that would less often be scheduled in the residual unit commitment process. A stakeholder pointed out, however, that entities that might be harmed now in this way by the present system (the investor-owned utilities who own more flexible capacity) do not favor relaxation of the zero bidding requirement, as might be expected if they were actually significantly harmed.

Extensive discussion addressed whether all imbalance reserve capacity needed to be a 15-minute product. ISO staff stated that operators want confidence in the ability of capacity to respond. Stakeholders and MSC members pointed out that much of the day-ahead uncertainty is resolved well before real-time, and therefore not all the imbalance reserve capacity needs to be 15-minute responsive. It was suggested that the ISO could announce that the initial requirement would be limited to 15-minute capacity, and then later relax that requirement as operators gain confidence. Later in this agenda item, Dr. Hobbs of the MSC provided a presentation that summarized data on net load and variable renewable forecasting errors in systems around the world as a function of forecast lead time.⁷ The data show large reductions in uncertainty as lead times reduced from

⁶S.M. Harvey, "RUC Pricing Design: Cost Shifting and Market Efficiency Considerations", MSC Meeting, Aug. 27, 2021, www.caiso.com/Documents/RUCpricingDesignCostShiftingandMarketEfficiency-Presentation-Aug27_2021.pdf

⁷ B.F. Hobbs, "Day-ahead market enhancements discussion: Role of forecast uncertainty," MSC Meeting, Aug. 27, 2021, www.caiso.com/Documents/RoleOfForecastUncertainty-Presentation-Aug27_2021.pdf

day-ahead to several hours ahead and finally to one hour ahead. The amounts of uncertainty reductions vary greatly, depending on the reduction in lead time, the particular power system, and whether net load or particular types of variable renewable resources were being forecast. However, the cited uncertainty reductions were all non-negligible, varying between 25% and over 75%.

Whether a restriction to only 15-minute capacity increases the cost of imbalance reserves depends on the cost of such capacity relative to the expense of capacity and imports with longer start-up and ramp times. It was pointed out by MSC member Harvey that the cost of this restriction could readily be estimated by executing simulated market runs with higher 10-minute spin requirements. Another issue is that allowing some but not all capacity to have longer lead times would complicate the market, resulting in more than one price for the product, depending on its quality. MSC member Hobbs pointed out that there is at least one other ISO reserve product that allows a portion of the requirement to be met by capacity that cannot meet the most stringent requirement. (In particular, the regulation energy management program allows a predetermined portion of regulation needs to be met by capacity such as flywheels that can sustain energy output for only 15 minutes.⁸)

MSC members also commented on the desirability of a penalty (single price) approach to pricing scarcity in imbalance reserves versus a demand curve with several price levels. On one hand, a range of prices reflects the reality of diminishing marginal value as more reserves are procured. On the other hand, there are concerns that the result would be reductions in acquired reserves, with resources instead being exported, with staff reiterating the need to give operators confidence that adequate reserves will be available in real-time. Dr. Jim Bushnell of the MSC pointed out that this is an example of piecemeal consideration of the general issue of scarcity pricing. He reiterated the importance of the proposed initiative that would give comprehensive consideration of the need and role of scarcity pricing across products and timelines in the ISO's markets. Dr. Harvey emphasized the need to think through the implications of penalty-based pricing, including use of simulations.

Additional discussion addressed the possible impact of the proposed limit on price offers by imbalance reserves upon their availability to the market, and whether use of a price adder or the default energy bid for real-time offers is worth considering as alternatives. Dr. Bushnell described a possible approach based on option pricing, in which procurement of imbalance reserves could be viewed as purchasing an option whose value depends on real-time price volatility.

Mr. Friedrich announced that a workshop was planned in the near future to further discuss these issues and to address the issue of market power mitigation for imbalance reserves and reliability capacity bids.

⁸California ISO, "Non-Generator Resource Regulation Energy Management Project Implementation Plan – Version 2.1," March 13, 2012, www.caiso.com/documents/non-generatorresourceregulationenergymanagementimplementationplan.pdf