

WESTERN ENERGY IMBALANCE MARKET

Memorandum

To: Western Energy Imbalance Market Governing Body
From: Susan Pope, Western EIM Governing Body Market Expert
Date: May 10, 2023 (May 15, 2023, addendum on page 14)
Re: **Opinion on California ISO Day-Ahead Market Enhancements, Revised Final Proposal**

EXECUTIVE SUMMARY

This memorandum presents my opinions and comments on the California ISO's Revised Final Proposal for Day-Ahead Market Enhancements (Revised Final Proposal).¹ With the Day-Ahead Market Enhancements (DAME) market offering, the California ISO proposes two new day-ahead imbalance reserve (IR) products. The enhancements are intended as a market approach for scheduling resources capable of responding quickly to provide services the California ISO, as a system operator, needs to maintain power system reliability for the Balancing Authority Areas (BAAs) participating in the Extended Day-Ahead Market (EDAM). The DAME proposal also presents market rules to enable storage resources to provide IR and for scheduling EDAM reliability capacity, which is the term for energy scheduled in the day-ahead Reliability Unit Commitment (RUC).

The need for the DAME IR products stems from ongoing increases in the uncertainty and variability of electricity supply and demand in the West. The proposed IR products are intended to address gaps in the present electricity market design arising from: 1) net load forecast uncertainty between the time of the Integrated Forward Market (IFM) and the time of the Fifteen Minute Market (FMM), and 2) ramping needs arising from real-time within-hour variations in net load that are not covered by day-ahead IFM hourly schedules. When the California ISO uses manual actions to manage this uncertainty and variability today, the unit commitment is not being co-optimized and day-ahead and real-time energy prices can be misaligned.²

¹ California ISO, *Day-Ahead Market Enhancements – Revised Final Proposal*, May 1, 2023, available at: <https://www.CaliforniaISO.com/InitiativeDocuments/RevisedFinalProposal-DayAheadMarketEnhancements.pdf>

² Importantly, the effectiveness of Western Energy Imbalance Market (WEIM) penalties for failing the Resource Sufficiency Evaluation depend on reducing the misalignment of day-ahead and real-time prices attributable in part to load biasing. Susan L. Pope, *WEIM Resource Sufficiency Evaluation Enhancements, Phase 2*, revised December 12, 2022, p. 8, available at:

A further motivation for the DAME initiative is that it is an integral element of the EDAM initiative to improve the efficiency and reliability of power system operations and reduce power costs for loads within the EDAM footprint. The largest immediate benefit of the EDAM has been estimated to derive from cost reductions from the real-time sharing of IR among EDAM BAAs.³

With the DAME, EDAM participants would make day-ahead offers to supply the two IR products in addition to making offers for energy and ancillary services. The California ISO would then run the IFM for the EDAM, using co-optimization software to determine IR schedules and IR locational prices along with those for energy and ancillary services. IR resources scheduled day-ahead would be required to offer into the real-time FMM, making their energy available to manage real-time EDAM imbalances and ramping needs.

In my view, the DAME proposal is a necessary step forward both to enhance the California ISO electricity markets in the face of growing net load uncertainty in the West and to enable the EDAM. Like EDAM, it introduces new and untested market design features that will require extensive testing and gradual implementation. At a high level, the DAME would add IR to the contingency-constrained, co-optimized, multi-settlement markets for energy and ancillary services operated by many ISOs. However, the IR design includes new market features, such as inclusion of deployment scenarios in the co-optimization to test the deliverability of IR schedules. Because of the imperative to sustain its markets and manage net load uncertainty and variability, the California ISO is proposing new market design concepts. To address uncertainties about certain market design elements, the California ISO proposes to work with stakeholders as it refines certain flexible market design parameter settings both before and after the IR product launch.

In this memo, I explain my support for three major elements of the Revised Final Proposal for scheduling IR, i.e., the nodal market design, the inclusion of flexible parameters in the market design, and the initial design of the IR demand curve. With rapid changes in the uncertainty and variability of net load in the West and the time required for major software procurement and testing, it is essential for the California ISO to move forward with an IR market design that will be robust for many years. In my view, this requires the nodal IR market design proposed by the California ISO. I also support the California ISO having latitude to explain the logic for the initial settings of certain flexible model parameters in its Business Practice Manual (BPM), as well as the logic and rules for adjusting some parameters post-launch. Notwithstanding this support, I am concerned about the absence of clearly articulated principles to guide the logic for setting the different flexible parameters and the possibility that the logic might not be consistent across parameters or applied consistently to different BAAs. Finally, I find the California ISO's approach to initially

<https://www.westerneim.com/Documents/BriefingbyWEIMGoverningBodyexpertonresourcesufficiencyevaluationenhancementsphase2-Presentation-Dec2022-updatedclean.pdf>

³ Revised Final Proposal, p. 19.

configuring the IR demand curve to be reasonable and agree that setting lower initial IR penalty prices will facilitate gradual roll-out and testing of the new IR market design.

While I support the proposal for scheduling IR, I am concerned that the California ISO's proposal for allocating the costs of IR does not appear to be workable and may not be consistent with the EDAM design. When participating in the EDAM, BAAs will share their IR resources in real time at no charge. However, in the Revised Final Proposal, I understand the California ISO to be proposing to allocate IR costs to EDAM BAAs based on the IR scheduled to meet each BAA's IR requirement. The proposed IR cost allocation to the BAAs seems to face substantial implementation challenges and might not be fair because it may be inconsistent with the intention to co-optimize EDAM IFM schedules, including IR schedules, and to use all EDAM IR in the real-time dispatch to reduce costs and maintain reliability for all EDAM BAAs.

INTRODUCTION

With the DAME, the California ISO proposes original day-ahead market scheduling and settlement rules for IR energy in order to increase the quantity of flexible resource supply offered into the real-time market. The proposed design seeks to arrange in advance for more flexible supply to be available to manage the balance between real-time energy supply and demand. The DAME proposal also presents market rules to enable storage resources to provide IR and for scheduling day-ahead reliability capacity, which is the term for energy scheduled in the day-ahead RUC.⁴ As directed by the Governing Body, my comments primarily address the proposed market rules for IR.

There is some urgency to the development and implementation of the IR products because changes in supply and demand in the West pose challenges for the reliable operation of power systems. Real-time supply and demand forecasts can differ substantially from the day-ahead forecasts used to commit and schedule resources in the IFM. The uncertainty between day-ahead and real-time forecasts is driven by changes in net forecast load, which is the forecast difference between load and the output of variable energy resources (VERs), namely wind and solar. As the quantity of variable energy supply has increased, day-ahead to real-time forecast uncertainty has similarly increased, as has the variability of real-time net load.

The objective of the IR proposal is to arrange in advance for dispatchable capacity to address two operational needs that are not currently covered by IFM schedules for energy and ancillary services: 1) net load forecast uncertainty between the time of the IFM and the

⁴ The DAME proposal includes additional changes and adjustments to the EDAM and WEIM market rules to accommodate the primary DAME objectives, i.e., the introduction of IR and increased market participation by storage resources. The proposal addresses how market rules for long-term contracts, metered subsystems, existing transmission contracts, transmission ownership rights, and variable energy resource participation would be affected by the DAME.

time of the FMM, and 2) ramping needs arising from real-time within-hour variations in net load that are not covered by hourly day-ahead schedules.

To ensure power system reliability today, the California ISO system operator takes manual actions, called load biasing or load conformance, to increase the quantity of flexible resources available in real time above the quantities scheduled in the IFM. When load biasing occurs, it means that the IFM is not efficiently co-optimizing the day-ahead unit commitment and schedules and frequently indicates misalignment of day-ahead and real-time prices. With the IR component of the Revised Final Proposal, the California ISO is introducing a market solution to reduce manual actions that appear to happen regularly to procure IR.

The proposed EDAM is also driving the DAME initiative. A major reason for BAAs to join the EDAM is to decrease their costs and increase the reliability of their service to load. With the new IR products, EDAM BAAs will benefit from sharing responsibility for scheduling IR and by sharing it in real time to balance the net load of the EDAM footprint. The design of the IR products impacts the costs and benefits BAAs can expect from joining the EDAM.

In the next section of this memorandum, I provide comments and opinions on the proposed IR market design, organized into two sections as follows:

1. The proposed model for scheduling IR, including: the choice of a nodal model; the inclusion of flexible (“tunable”) model parameters in the market design; and the IR demand curve.
2. The proposed market rules for settlement of the costs of IR.

In the concluding section, I summarize my opinions about whether the DAME IR proposal is prudent, fair, and will support “the success of the EDAM for the benefit of its participants as a whole.”⁵ My comments focus on elements of the proposal that raise policy-level concerns or have been the subject of recent stakeholder concerns.

As a reference for the discussion herein, Appendix A to this memorandum presents a high-level summary of my understanding of the IR market rules in the Revised Final Proposal.⁶ Appendix B contains questions about the allocation methodology that the California ISO appears to be proposing to recover the costs of IR.

⁵ Charter for Energy Imbalance Market Governance, available at: <https://www.westerneim.com/Documents/CharterforEnergyImbalanceMarketGovernance.pdf>.

⁶ See the Revised Final Proposal, pp. 7-9, for a summary of the proposed market rules for IR.

DISCUSSION

Proposal for Scheduling Imbalance Reserves

In my view, the DAME proposal for IR is a necessary step forward to unlock the benefits of EDAM.

A major reason for BAAs to join the EDAM is to decrease their costs and increase the reliability of their service to load. All EDAM BAAs will benefit by sharing flexible resources in the real-time dispatch. The EDAM market design requires a way for the system operator to arrange for flexible resource capacity in the footprint of the EDAM BAAs in advance, which it will later have available, along with energy offers and schedules, to reliably manage EDAM real-time net load uncertainty and within-hour variations. The EDAM design will not work without equitable rules, as proposed for IR, for scheduling and paying for flexible resources scheduled day-ahead across the BAAs in the EDAM footprint.

Under the Revised Final Proposal, the California ISO would schedule IR using what is referred to as a “nodal” model. EDAM participants would make day-ahead offers to supply the two IR products in addition to making offers for energy and ancillary services. The California ISO would then run the IFM for the EDAM, using co-optimization software. The model would schedule IR at nodal locations and include “deployment scenarios” to ensure the IR scheduled up and down would be feasible if fully utilized to manage imbalances in the up or down direction. IR resources scheduled day ahead would be required to offer into the real-time FMM, making their energy available for optimized scheduling and dispatch to manage real-time imbalances and ramping needs across the EDAM.

During meetings in March, stakeholders offered alternative proposals for zonal, rather than nodal, IR procurement and, more generally, sought a better understanding of the benefits of the proposed nodal model in comparison with zonal models for IR.⁷ They questioned whether the benefits relating to the deliverability of IR schedules in the nodal model, in comparison with a zonal model, were likely to be sufficiently high to offset concerns about solution time and model complexity inherent in the nodal model. They were also concerned about the impact of nodal model design choices on energy market prices and on additional charges that might be allocated to loads to compensate for decreases in the congestion costs collected to fund Congestion Revenue Rights (CRRs).

The Revised Final Proposal for IR includes changes to prior drafts to address many comments and concerns from stakeholders, the Market Surveillance Committee (MSC), and

⁷ See presentations by the Western Power Trading Forum and Vistra available at: <http://www.caiso.com/InitiativeDocuments/WPTFPresentation-Day-AheadMarketEnhancements-Mar8-2023.pdf> and <http://www.caiso.com/InitiativeDocuments/VistraPresentation-Day-AheadMarketEnhancements-Mar7-2023.pdf>. The proposal at the time of the March hybrid meetings was *Day-Ahead Market Enhancements –Final Proposal*, January 11, 2023, available at: <http://www.CaliforniaISO.com/InitiativeDocuments/FinalProposal-Day-AheadMarketEnhancements.pdf>.

the Department of Market Monitoring (DMM).⁸ The Revised Final Proposal retains the intention to implement the full nodal IR design. At the same time, proposed changes introduce flexible parameters to address uncertainties about the settings for some elements of the market design and, further, would reduce the penalty prices comprising the IR demand curve.⁹ I address each of these design choices in this section.

Nodal Imbalance Reserve Scheduling with Deliverability Test

I support the retention of the nodal IR model in the Revised Final Proposal.

The MSC explains why it is reasonable for the California ISO to propose market rules that would enable a full nodal test of the deliverability of IR schedules.¹⁰ The problems the California ISO had with the deliverability of the Flexible Ramping Product (FRP) using a zonal deliverability test and the movement toward more granular deliverability tests in several other ISOs clearly indicate that a nodal model is the correct path forward.¹¹ The more granular nodal model is also consistent with ISOs' ongoing design improvements to more efficiently use existing transmission capability, for example, with dynamic line ratings and relaxation of transmission constraint penalty factors for small violations.

I do not agree, as I understand some to have suggested, that day-ahead zonal designs for ancillary services can provide guidance for the IR market design. Operating reserves, for example, are intended to be used in the event of contingencies, whereas IR is expected to be used hourly to address net load uncertainty and within-hour ramping needs.¹² Because IR is expected to be relied on frequently, as evidenced by the California ISO's use of load biasing, it would not be prudent to procure software lacking the option to run nodal tests of

⁸ Revised Final Proposal, pp. 5-6. In addition to comments in the previously cited Western Power Trading Forum and Vistra presentations, please see Department of Market Monitoring, *Comments on Day-Ahead Market Enhancements March 2023 Workshops*, March 31, 2023 and J. Bushnell, S. M. Harvey, and B. F. Hobbs, *Opinion on Day-Ahead Market Enhancements (DAME)*, Draft of May 3, 2023, available at: <http://www.CaliforniaISO.com/Documents/DMMComments-DAMEMarch2023Workshops3-31-2023.pdf> and <http://www.caiso.com/Documents/MarketSurveillanceCommitteeFinalOpiniononDay-AheadMarketEnhancements.pdf>.

⁹ For a full list of the changes introduced in response to comments, see pp. 6-7 of the Revised Final Proposal. Two material changes not discussed in this memorandum are the proposal to include the congestion costs for IR flows in the IR cost allocation and to increase the maximum IR that may be scheduled from 15-minute rampable resources from 15 minutes to 30 minutes.

¹⁰ Bushnell, Harvey and Hobbs, pp. 9-11.

¹¹ The modification of other ISO market designs to address deliverability concerns has also occurred for spinning reserves, with the gradual refinement of reserve zones to avoid scheduling of bottled reserves (e.g., NYISO and PJM).

¹² I have additional concerns with the zonal models suggested by stakeholders. Many variations were discussed, but common limitations include the question of how to define IR zones in the absence of historical data about wind, solar and load variations that could be used for this purpose and lack of clarity about how to implement IR for zones that might not be contiguous with the BAA regions used for settlements.

deliverability, especially as both net load uncertainty and ramping needs are expected to increase over the coming years.¹³

The proposal to move forward with the nodal model rather than a zonal model is also supported by the California ISO's introduction of flexible parameters. In effect, these will enable the California ISO to address a number of the concerns raised by stakeholders if they are identified as such during model testing or even post-launch. While the DAME IR proposal is for a nodal model, it can be tuned in myriad ways to be more "zone-like," if justified.¹⁴

With the rapid changes occurring in the uncertainty and variability of supply and demand in the WEIM and the length of time required for software procurement and testing, it is essential for the California ISO to move forward with an IR market design that will remain robust over many years. If some of the nodal model features are not useful in the near term, they can be disabled, but would be available in the future, if needed.

Flexible Parameters in the Imbalance Reserve Market Design

I support the California ISO's proposal to include in its BPM the logic for the initial settings of certain flexible model parameters as well as for adjusting certain parameters post-launch. Notwithstanding this support, I have concerns about the transparency and consistency of the proposed process for setting the flexible parameters.

The Revised Final Proposal includes flexible parameters to enable the California ISO to make adjustments determined to be necessary to achieve the reliability, pricing, and software model solution time objectives sought through the DAME. The "Flexible Parameter Matrix" lists the proposed tunable parameters, the latitude the California ISO requests for adjusting each, the proposed stakeholder process for setting each parameter, and the analyses that would be used to assess the different flexible parameter settings.¹⁵ The proposed flexible parameters are:

1. The set of transmission constraints that will be enforced in the IR deployment scenario feasibility tests;
2. The percentage of IR tested for feasibility in the deployment scenarios;

¹³ Some have also questioned the net benefits of the nodal model because EDAM BAAs can use export constraints to retain reserves needed for real-time balancing. In my view, the EDAM diversity benefit from sharing IR could be materially reduced if, without an IR product, BAAs were to rely on the EDAM export constraint to retain flexible reserves for their footprint.

¹⁴ This is a significant advantage because many, if not all, of the questions about cost and benefits posed during the March 2023 stakeholder meetings cannot be evaluated in advance, prior to running the full IR software model.

¹⁵ California ISO, *Flexible Parameter Matrix*, May 1, 2023, available at <http://www.caiso.com/InitiativeDocuments/FlexibleParameterMatrix-Day-AheadMarketEnhancements.pdf>.

3. The percentage of each hour's IR schedule included in envelope constraints that will be used to track the possible state of charge of storage resources and thereby improve the feasibility of storage resource IFM schedules;
4. The maximum price for the IR demand curve; and
5. The default availability bid price used for IR offer mitigation.

Because the IR design is wholly new to electricity markets and the software is untested, it is reasonable for the California ISO to propose to adjust elements of the model based on pre-launch testing and to be able to adjust some parameters post-launch without filing tariff changes. Except for Parameter #2 in the above list, I support the adjustment processes described in the "Flexible Parameter Matrix."¹⁶ During the May 1, 2023 stakeholder meeting, the California ISO confirmed its intention to fully inform and consult with stakeholders (and to work with the MSC and DMM, as appropriate) both before and after launch to develop the BPM criteria and logic for setting the parameters.

Notwithstanding my support, I have concerns about the transparency and consistency of the process for setting the flexible parameters due to an absence of guiding principles. It would enhance transparency to develop, *in advance*, a set of principles to guide how tradeoffs between and among DAME objectives will be addressed in determining the flexible parameter settings (especially Parameters #1, #2 and #4). The possibly competing DAME objectives affected by the parameter settings include reduced software solution time, the level of IR and energy prices, and increases in EDAM reliability (e.g., as evidenced by decreased reliance on load conformance).¹⁷ These tradeoffs could surface quickly in the pre-launch software testing and there is no information yet about how the California ISO would weigh them. For example, tight settings of Parameters #1, #2, and #4 will tend to increase prices and the optimization solution time, while looser settings may not meet targets for increased reliability. The decision criteria column of the "Flexible Parameter Matrix" provides reasonable suggestions about data and analyses that could be used in the parameter setting processes. A set of clearly stated principles would support consistency with respect to the logic and criteria developed for setting each parameter based on this information and would increase stakeholders' understanding about how tradeoffs will be made among competing objectives.¹⁸

¹⁶ I agree with the MSC's concern about the California ISO's proposal to adjust the percentage of IR tested for feasibility in the deployment scenarios and the suggestion that the California ISO instead consider modifying the penalty factors of transmission constraints in the deployment scenarios. (Bushnell, Harvey and Hobbs, p 13). In a separate document, the California ISO indicates the intention to tune the penalty factors in the deployment scenarios "such that they would be relaxed if the cost of imbalance reserve procurement within a constrained area were too expensive." California ISO, *Day-Ahead Market Enhancements: Comparison Matrix*, March 20, 2023, available at: <http://www.caiso.com/InitiativeDocuments/ComparisonMatrix-Day-AheadMarketEnhancements.pdf>. These adjustments pertain to situations in which specific constraints appear to be causing under-procurement of IR, in relation to the value of incremental IR, because the IR price is at the cap

¹⁷ Note that there is no current benchmark for what IR market prices should be in a well-functioning market.

¹⁸ In the best case, there would be an economic basis for the tradeoffs, but I do not believe the data would be available to develop this approach.

A related issue is a lack of clarity about whether the same logic and criteria would be used to determine the internal constraints enforced in each BAA during the deployment scenarios (Parameter #1). In its Revised Final Proposal and in stakeholder discussions, the California ISO has stated that it will work with each EDAM BAA to reach a consensus about which internal constraints will be enforced. The transparency of this proposed process is not clear. For instance, during the May 1, 2023 stakeholder meeting, the California ISO stated that it did not intend to list the BAA internal constraints by name.¹⁹ It would be fair and reasonable to apply the same decision criteria to determine which internal constraints are enforced in all the EDAM BAAs because this would provide consistency about deliverability expectations. The decision criteria or logic for evaluating internal transmission constraints could be standardized and shared even if the criteria did not have equal relevance across the BAAs. Since the EDAM BAAs will be sharing their IR, it follows that all the IR schedules should adhere to approximately the same deliverability criteria.

Development of a hierarchy for the flexible parameter adjustments would provide additional transparency. The hierarchy might state, for example, a preference for adjusting transmission constraint enforcement prior to adjusting IR demand curve penalty prices when certain concerns are identified in the model testing or during post-launch operation. This set of priorities might be developed over time with the objective, again, of clarifying the consistency of the various BPM decision criteria developed to set the flexible parameters.

Finally, because of the important commercial implications, I strongly agree with suggestions for the California ISO to develop a schedule of the times at which the different flexible parameter settings might be open to discussion. The California ISO states that it envisions the parameter settings to be relatively static, which I strongly support. Changes to the parameter settings should occur infrequently and with ample notice to stakeholders of upcoming discussions. The parameter settings, such as which constraints will be enforced in the deployment scenarios, will affect the potential impact of the IR product on energy prices and the circumstances under which these impacts might occur. The California ISO should work with stakeholders to set an initial timetable, considering the usual time steps of affected third-party contracts and CRRs.

Imbalance Reserve Demand Curve

I support the California ISO's proposed methodology for determining the IR demand curve.

In the Revised Final Proposal, the California ISO responded to the MSC and DMM's strong suggestions to decrease the IR demand curve prices previously proposed.²⁰ The reduced prices greatly reduce the risk of scheduling IR at prices exceeding the value of the IR, as well as unanticipated results or model interactions following the launch of the IR product. Because the IR product design is new and untested, it is prudent to begin operation with

¹⁹ A video of the meeting can be accessed at: <https://youtu.be/b8an-sFa0CM>.

²⁰ See, for example, Bushnell, Harvey and Hobbs, p. 4 and Department of Market Monitoring, pp. 1-2.

lower demand curve prices and to increase them over time as warranted by subsequent analyses of market operation.

The California ISO's proposal to base the penalty value for IR on the maximum price of real-time flexible reserves is reasonable because it is the highest price that would be paid in real time for flexible reserves if IR has not been scheduled day ahead or is not available in real time. Additionally, the decision to set the initial IR price cap at \$55 per MWh, which the California ISO states is the higher end of offers for spinning reserves, is reasonable because resources offering spinning reserves today would also qualify to offer IR.²¹

While I support the proposed demand curve, there is a possibility (generally thought to be low) that material quantities of IR might at times not be scheduled day ahead because the price is too high.²² If this occurs frequently, the California ISO should assess the relationship between the quantity of IR being scheduled and metrics of reliability, such as the pattern of load biasing. If IR schedules do not provide desired levels of reliability, further analyses will be required. For instance, the California ISO could evaluate whether an increase in the demand curve prices would be likely to decrease load biasing and, if so, the price increase likely to be justified. In the future, with data to assess the effect of IR scheduling on the California ISO operator's reliance on load conformance, it would also be reasonable to evaluate the IR procurement targets (97.5% of the estimated upward and downward net load uncertainty) in relation to the IR costs.

Proposal for Imbalance Reserve Cost Allocation

Based on my current understanding, the California ISO's proposal for allocating the costs of the IR scheduled day ahead does not appear to be workable and could be inconsistent with the EDAM design, under which BAAs would share their IR resources in real time at no charge.

The proposed settlement rules for IR are an allocation of the costs paid to resources scheduled to provide IR in the IFM.²³ The settlement rules intend to align the cost allocation with cost causation. Tier 1 of the allocation assigns hourly IR charges to entities whose FMM schedules do not match their IFM schedules (i.e., exports or imports) or cannot match their IFM schedules because of changes in operating limits. As previously discussed, deviations between IFM and FMM schedules are one of the reasons California ISO transmission operators currently use load biasing to commit and schedule resources in advance to maintain reliability. The Tier 1 cost allocation is applied to generation, load,

²¹ Consideration should be given to the consequences of under-procurement of IR. In addition to the possibility of ongoing load conformance adjustments, consistent under-procurement could undermine estimation of the diversity credit. If less than the intended quantity of IR is scheduled because prices rise, the reliability impact could be magnified by the unachieved diversity benefit.

²² By reducing the demand curve prices in the Revised Final Proposal, the California ISO seeks to avoid the opposite error, of scheduling IR at prices exceeding the reliability value of the IR.

²³ Revised Final Proposal, p 39. The costs of congestion occurring in the imbalance reserve deployment scenarios will also be collected through the IR cost allocation.

imports, and exports scheduled in the IFM. Following the Tier 1 allocation, any remaining IR costs are allocated to metered demand, which is reasonable because IR costs are incurred to maintain real-time reliability for all EDAM load.

The proposed settlement rules can be applied within the California ISO BAA, where the system operator will have information about the IFM and FMM schedules of specific generators and loads. The Revised Final DAME Proposal does not explain, however, how the settlement rules would be applied with multiple EDAM BAAs. It is reasonable to conclude that there is not an intention for the California ISO to apply the Tier 1 and Tier 2 methodology to non-California ISO entities. Under the EDAM market rules, EDAM revenues and costs are settled with the non-California ISO BAAs, as a general matter, and the non-California ISO BAAs have responsibility for the rules for settling these costs and revenues with the entities within their respective footprints. Further, the California ISO will not necessarily have information about the day-ahead and fifteen-minute schedules of generators and loads managed by scheduling coordinators located outside of its footprint, so could not itself apply the tiered cost allocation to non-California ISO IFM schedules. For these reasons, there is clearly a need for explanation of how IFM costs incurred to schedule EDAM IR will be allocated among the EDAM BAAs.²⁴

During the April 7, 2023 hybrid stakeholder meeting, the California ISO responded to a question about how IR costs would be allocated if IR were scheduled to meet the California ISO IR requirement, but no IR was scheduled for other EDAM BAAs because the cost of IR exceeded the \$55 cap on IR prices in these other BAAs per the proposed IR demand curve.²⁵ I am concerned with the California ISO's response that in this hypothetical case, all IR costs would be allocated to the California ISO BAA, because the IR was procured for the California BAA.²⁶ This is a corner case, given the expectation that IR clearing prices will be significantly less than the IR \$55 price cap, but it is still helpful to consider. The reason for my concern is that the proposed allocation of the IR costs to only the California ISO BAA in this instance appears to be inconsistent with EDAM market rules under which IR resources would be shared in real time among EDAM BAAs. With EDAM, the IR scheduled for load in the California ISO BAA in this example could be used in real time to respond to imbalances throughout the EDAM; there would be no priority or reservation for California ISO load to support the proposed cost allocation.

²⁴ The EDAM final proposal does not address this issue, stating: "ISO settlements will separately allocate each EDAM BAA's IRU and IRD costs through a two-tier allocation methodology under development in the DAME initiative. The ISO will update stakeholders regarding the allocation methodology when the DAME initiative concludes." California ISO, *Extended Day-Ahead Market – Final Proposal, December 7, 2022*, available at: <http://www.CaliforniaISO.com/InitiativeDocuments/FinalProposal-ExtendedDay-AheadMarket.pdf>.

²⁵ A video of the meeting can be accessed at: <https://youtu.be/b8an-sFa0CM>.

²⁶ The California ISO stated that all IR costs would be allocated to the California ISO BAA even if the IR were scheduled on resources in other BAAs, but the latter could not occur under the assumption that the IR price exceeded \$55 in the other BAAs. My understanding is that the California ISO is not proposing to allocate IR costs to BAAs based on the BAAs in which the IR resources are located. This would not be reasonable. For example, if all EDAM IR were scheduled on resources in a single BAA, it would not make sense for the load in this BAA to pay all the EDAM IR costs.

My current understanding is that the California ISO proposes to allocate total EDAM IR costs (inclusive of IR congestion costs in the deployment scenarios) to EDAM BAAs based on the IR scheduled to meet each BAA's IR requirement.²⁷ This proposal appears to be inconsistent with the intention to co-optimize EDAM IFM schedules, including IR schedules, and to use IR in the real-time dispatch to reduce costs and maintain reliability for EDAM BAAs as a whole. The inconsistency possibly occurs only when different percentages of the IR requirement are procured in different BAAs because the demand curve reduces the quantities in some BAAs as prices rise. The inconsistency also might only occur if, at the same time, the real-time load in under scheduled BAAs can nonetheless be balanced with flexible reserves imported from other BAAs.

The MSC opinion supports the DAME cost allocation proposal, but it is clear from their comments that they understood the California ISO proposal to be something different than what was explained during the April 7, 2023 meeting. The MSC explains why it is "appropriate and inevitable" to socialize the allocation of IR costs, but the California ISO proposal does not include socialization of these costs across the BAAs, as I understand it.²⁸

In addition to my principled concern about the proposed IR cost allocation approach, Appendix B lists a variety of questions relating to how the proposed inter-BAA allocation of IR costs would be implemented. These highlight possible difficulties with developing an IR allocation methodology along the lines the California ISO proposes. These questions should be resolved in the near term because they potentially impact the balance between which costs and resources are shared versus which costs and resources are not shared among the EDAM BAAs. While I strongly support the objectives of the EDAM and the progress and efforts of the California ISO to date, I believe it is appropriate to raise these questions at this time.

CONCLUSION

This section summarizes my opinions regarding the DAME Revised Final Proposal.

The DAME proposal for IR is a necessary step forward to unlock the benefits of the EDAM.

1. A major reason for BAAs to join the EDAM is to decrease the costs and increase the reliability of their service to load. All EDAM BAAs will benefit by sharing flexible reserves in the real-time dispatch.

²⁷ This remains my understanding following discussion with the California ISO but is subject to review and confirmation by the California ISO. I have no information at this time about the metric, such as MWh of IR, proposed for the inter-BAA allocation of IR costs.

²⁸ Bushnell, Harvey and Hobbs, p 32. "We believe this socialization is appropriate and inevitable... imbalance reserves will be used to balance net load uncertainty across the EDAM footprint. Indeed, this fact is the basis for the diversity benefit." The MSC views here relate to my observation that there should be consistency between the allocation of the costs of IR and the allocation of the benefits of IR resources, which would be shared among the BAAs during real-time operation.

2. The EDAM market design requires a way for the system operator to arrange for EDAM flexible resource capacity to manage EDAM real-time net load uncertainty and within-hour variations efficiently and reliably.
3. The EDAM design will not work without equitable rules for scheduling and paying for flexible resources scheduled day-ahead across the BAAs in the EDAM footprint.

At a high level, I support the DAME proposal for how IR will be scheduled in the EDAM Integrated Forward Market.

1. The California ISO's choice of a nodal model for the IR market design is prudent.
 - a. It will enable deliverability tests that will be important for managing the reliability of the EDAM.
 - b. The development and deployment of new ISO software takes years. It is important to develop software anticipated to be sufficient to address electricity market changes unfolding over many future years.
 - c. Flexible parameters included in the nodal model can be tuned to address IR design objectives, such as IFM optimization solution time, price levels, and reliability improvements.
2. I find the California ISO's approach to initially setting the IR demand curve prices to be reasonable.²⁹
3. While the IR proposal introduces new and untested market design features, the California ISO anticipates the need for extensive testing and gradual implementation.
4. Because the IR market design rules and software are original and new, it is reasonable to provide the California ISO with the latitude to explain the logic for the initial settings of certain flexible model parameters in its Business Practice Manual (BPM), as well as the logic and rules for adjusting some parameters post-launch.
5. Notwithstanding my overall support for affording the California ISO latitude in setting the criteria for the flexible parameters, I have concerns about the absence of guiding principles.
 - a. The addition of principles to guide the logic for setting the flexible parameters would add substantial transparency to the California ISO process, because the parameter settings will need to balance tradeoffs among DAME objectives.

²⁹ Additionally, I support the California ISO's Revised Final Proposal for including the congestion costs for IR flows in the IR cost allocation, increasing the maximum IR that may be scheduled from 15-minute rampable resources from 15 minutes to 30 minutes, including IR market power mitigation in the software model, retaining IR down in the market design and software, and the reliability capacity product design. I do not have anything substantial to add to the discussion of these design elements except to note my agreement with the MSC's point that the penalty for non-available of reliability capacity is insufficient.

- b. Additional clarity could also be provided about whether principles will be consistently applied to develop criteria for setting different parameters and for determining initial parameter settings for each BAA.

The proposal does not include sufficient description of the rules for the allocation of costs of IR for me to conclude that they will be workable and fair.

1. It is unclear whether the California ISO's proposal for allocating the costs of the IR scheduled day-ahead among EDAM BAAs will be workable, because of how IR will be scheduled in the IFM co-optimization.
2. The proposal, as I currently understand it, may not be consistent with the EDAM design under which BAAs would share their IR resources in real time at no charge to reduce costs and maintain reliability for all EDAM BAAs.

MAY 15, 2023 – ADDENDUM

The CAISO proposal for IR cost allocation, as explained to me following the May 10, 2023 posting of this memorandum, appears to be workable and fair in most cases.

To the extent the cost allocation rules might need elaboration or modification to be workable and fair under some operating conditions, this could be addressed in the DAME Implementation Working Group(s), provided this is specified to be within the scope of the working group(s).

APPENDIX A

SUMMARY OF DAME PROPOSAL FOR IMBALANCE RESERVE PRODUCTS

. The day-ahead process for scheduling IR is summarized below.

- The California ISO will schedule day-ahead IR for each EDAM BAA within the EDAM IFM.
- The target quantity of IR for each BAA will be determined hourly, from California ISO estimates of the net load uncertainty for the BAA.
 - The net load uncertainty estimates will be based on the net load uncertainty distributions for load, wind, and solar, which will be separately estimated using a statistical method called quantile regression.
 - The target quantity of IR up and down for each BAA will be set to cover, with 97.5% probability, the deviations (up and down) between the California ISO day-ahead forecast of the BAA's net load and its FMM forecast of the BAA's net load.
 - The BAA target IR quantities will be net of the EDAM diversity credit.
- To represent the demand for IR in the IFM, the BAA's target quantity of IR will be distributed across the nodes in the BAA in proportion to forecasted load, wind, and solar output.
- The IR demand curve will limit the price paid for different quantities of operating reserve for each BAA, with a maximum of \$55.
 - The ten steps of the BAA imbalance reserve demand curves will be determined hourly, based on the distribution of net load uncertainty for each BAA and the IR penalty factor, which will be initially set at the maximum real-time price for FRP (\$247).
 - For imbalance reserves up, the demand curve prices will be calculated as \$247 multiplied by the probability of the net load deviation exceeding the quantity of IR corresponding to each demand curve step.
 - The maximum demand curve price will initially be \$55, which is the high-end of the California ISO's observed range of offers for spinning reserves.
- Flexible supply resources, including storage, may offer to sell IR in the IFM at offers up to \$55 per MWh.
 - The resources must be able to ramp in 15 minutes or less and may offer 30 MW of their rampable capacity in each hour.
 - In the initial implementation, there will be no mitigation of imbalance reserve offers, although this capability will be included in the IR software.
- The California ISO will co-optimize EDAM schedules for energy, ancillary services (regulation up, regulation down, spinning reserves and non-spinning reserves), IR up and IR down, based on bids and offers.
 - The co-optimization will produce schedules that can feasibly flow on the day-ahead transmission network model.
 - The model will also ensure that the schedules, including IR, would be feasible if all upward reserves were deployed or, alternatively, all downward reserves were deployed. These are called the deployment scenarios.

- The software will include a flexible parameter to set the percentage of IR tested for feasibility in the deployment scenarios; this will be set initially at 100% and will be changed infrequently subject to a proposed process.
- The software will also allow adjustment of which transmission constraints are enforced in the IR deployment scenarios, or possibly the setting of transmission constraint penalty factors; adjustments are intended to occur infrequently and with advance notice.
- Resources scheduled to supply IR in the IFM will be paid the clearing price for operating reserves at their location and must offer their scheduled IR into the WEIM FMM
 - The FMM will co-optimize fifteen-minute schedules for energy, ancillary services and FRP to serve forecast load in the EDAM BAAs as a whole.
 - If a resource has insufficient capacity to cover its day-ahead energy schedule and the FMM component of its IR schedule with FMM offers and schedules, it will be charged a “no pay.” For IR up, the no pay price will be equal the maximum of the IR up price and the price of FRP in RTPD.³⁰
- The cost of IR will be recovered through cost allocation within each BAA.³¹
 - Costs will be allocated, first, to generation (e.g., wind and solar), load, imports and exports based on the deviations between their FMM and IFM schedules. The deviation price will be the locational IR price capped at the average cost of IR for the hour.
 - Any remaining costs will be allocated to metered demand.
 - The costs of congestion occurring in the imbalance reserve deployment scenarios will be included in the cost allocation to support the revenue adequacy of CRRs.

³⁰ The five-minute rampable portion of the IR schedule will be subject to a deviation settlement with the FRP scheduled in the FMM.

³¹ At this time, it is unclear how IR costs will be allocated among the BAAs.

APPENDIX B

QUESTIONS ABOUT THE California ISO PROPOSAL FOR ALLOCATING THE COST OF IMBALANCE RESERVES AMONG EDAM BAAs

With the decrease in the penalty prices for IR in the DAME proposal, it has become apparent that there could be situations in which the percentage of the EDAM IR requirement scheduled in the IFM could differ among BAAs. In response to stakeholder questions, the California ISO stated that the allocation of the total cost of the EDAM IR among EDAM BAAs would depend on how much IR is scheduled for each EDAM BAA. Such an allocation of EDAM IR costs would need to address the following questions.

1. How would the total costs of the IFM IR be allocated when different percentages of the IR requirement have been scheduled for different BAAs? It would be helpful to have clarification about whether EDAM BAAs lacking low-cost IR, with the result that the EDAM schedules a lower percentage of their IR requirement, would be allocated a lesser share of IR costs as proposed.
2. Would the allocation of IR costs among EDAM BAAs consider differences in the cost of scheduling IR to fulfill the IR requirements of different BAAs?
3. Even if the full BAA IR requirement were scheduled for all BAAs for an hour, what would be the methodology for allocating to each BAA the costs of the IR scheduled on each BAA's behalf? With co-optimization, there would be no transmission schedules linking the IR schedules of individual resources to specific BAAs.³²
4. The proposed inter-BAA allocation of IR costs also could have implications for FRP settlements. For instance, if one BAA has met its IFM IR requirement and paid in advance for flexible reserves, would it pay the same charge for FRP as a second BAA that has met less of its IFM IR requirement? In other words, would there be a second settlement of IRP relative to FRP for loads as well as for suppliers?³³

³² The MSC identifies this issue: “[W]hile imbalance reserves procurement costs could be assigned to balancing areas based on deployment scenario prices and quantities, this methodology could not be used to allocate imbalance settlements to particular balancing areas because there will be no unique mapping of resources to imbalance reserve deployments.” Bushnell, Harvey and Hobbs, p. 32.

³³ Revised Final Proposal, p. 52.