



California ISO

EIM Resource Sufficiency Evaluation Enhancements Phase 2

Draft Final Proposal

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1 Introduction

The purpose of this initiative is to continue to enhance the accuracy of the WEIM resource sufficiency evaluation (RSE) while also exploring the potential for the WEIM to be used for energy assistance.

This second phase of this initiative has been examining:

- Whether adjustments made to a balancing authority area's (BAA's) load forecast used by the real-time market should be included in a BAA's RSE obligations;
- The potential for WEIM advisory transfers in the hour-ahead scheduling process (HASP) to result in additional block hourly exports from the CAISO;
- Measures to assess uncertainty; and
- Consideration of appropriate failure consequences during over and under supply conditions and the potential to leverage the WEIM to facilitate energy assistance.

This initiative is addressing remaining items from the RSEE Phase 1 initiative as well as elements deferred from the Phase 1 policy development process. This scope is informed by analysis the CAISO performed on different aspects of the WEIM RSE that were not addressed under the RSEE Phase 1 policy development.

2 Stakeholder Comments and Changes from Straw Proposal

The CAISO appreciates the wide array of comments received from a large segment of market participants and stakeholders. It is a testament to the close engagement of the stakeholder community on this initiative, which is vital to its success. The CAISO has carefully considered all stakeholder input in developing this revised proposal. The CAISO has made every effort to balance the diverse viewpoints of its stakeholders while adhering to principles of sound market design and utility practice.

Table 1 summarizes the changes reflected in this draft final proposal. The CAISO has made a number of changes from the straw proposal in this draft final proposal:

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Table 1 – Stakeholder Comments and Changes from Straw Proposal

Topic	Stakeholder Comments	Changes from Straw Proposal
Incorporating load conformance in RSE	Stakeholders generally support not considering load conformance in the RSE, recognizing that the use of load conformance does not regularly benefit any BAA in passing the WEIM RSE. In addition, to the extent that it drives additional WEIM transfers, there is limited ability to accurately predict the result of load conformance.	None
Adjusting RSE obligations to account for low-priority exports	Stakeholders acknowledge HASP scheduling can cause the CAISO BAA to inappropriately fail RSE. Stakeholders outside CAISO BAA maintain low-priority (LPT) exports from CAISO BAA should count towards the importing BAA's RSE obligations because not counting them would result in last minute changes and inefficiencies. They also point out that low-priority exports are delivered the vast majority of the time and other non-firm imports can count as base schedules in the RSE.	In section 4.2.2, the CAISO describes the revised proposal not to include low-priority exports in the CAISO BAA's RSE obligations. Also described are revisions to allow other BAAs to continue counting low-priority exports from the CAISO BAA as supply that counts towards their RSE obligations.
Clarifying firmness of low-priority exports within the hour and establishing tagging rules for low-priority exports	CAISO BAA stakeholders support clarifying the lower scheduling priority of low-priority exports within the hour, non-CAISO BAA stakeholders note a lower priority will diminish the value of HASP exports.	In section 4.2.3, the CAISO describes its proposed clarifications to the scheduling priority of low-priority exports within the hour.
RSE capacity test uncertainty adders	While some stakeholders support re-introducing the net load uncertainty adder to RSE's capacity test, many stakeholders want to first assess quantile regression method's	In section 4.3.2, the CAISO proposes to defer this topic until after it has implemented the quantile regression methodology as part of the <i>FRP Refinements</i> implementation and has had the

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Topic	Stakeholder Comments	Changes from Straw Proposal
	<p>performance. Stakeholders support not re-introducing the inertia uncertainty adder.</p>	<p>opportunity to assess its performance. The CAISO maintains its proposal to permanently remove the inertia uncertainty adder.</p>
WEIM energy assistance	<p>Stakeholders support allowing WEIM transfers at an additional cost price into a BAA that fails the RSE although they request additional description of how the CAISO would implement this. Stakeholders are divided on whether the penalty proceeds should be allocated in proportion to BAAs' net transfer exports or in proportion to their offered supply that exceeds their RSE obligation.</p> <p>Some stakeholders advocate that they should be able to elect to receive energy transfers at a penalty price hourly.</p> <p>Some stakeholders advocate for increased penalties for repeated or more severe RSE failures.</p>	<p>In section 5, the CAISO clarifies that the penalty price implemented will result in only the quantity of transfers needed to resolve the insufficiency and that the penalty price will apply to all of a BAA's real-time imbalance energy. It also describes additional details of the approach.</p> <p>In section 5, the CAISO proposes to allocate penalty proceeds in proportion to BAAs' net transfer exports and describes that this is the option that would be feasible to implement by Summer 2023.</p> <p>In section 5, the CAISO describes its rationale that hourly elections do not seem appropriate, and, in any case, would not be feasible to implement by next summer.</p> <p>The CAISO also proposes to defer developing any metrics for repeated or severe failures because of their complexity.</p>
WEIM export assistance energy	<p>Stakeholder requested additional detail and examples about how this export assistance would work and how this it interacts with existing penalty prices that incentivize downward flexibility.</p> <p>A stakeholder also requested additional explanation on how this design would work in a situation where multiple BAA's</p>	<p>The CAISO proposes to defer the development of WEIM export energy assistance because of resource and timing constraints to get import energy assistance in-place by summer 2023.</p>

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Topic	Stakeholder Comments	Changes from Straw Proposal
	were experiencing negative prices.	
WEIM governance classification	A stakeholder questioned why the proposed change to require that low-priority exports be tagged as “firm-provisional” is outside the scope of the WEIM Governing Body’s joint approval role.	As described in section 4.2.3, the rules about how to tag exports from the CAISO BAA are not applicable to WEIM participants in their capacity as WEIM participants. Rather, these rules apply without regard to WEIM, to all exporters from the CAISO BAA. For this reason, and because they are severable from the remainder of the proposed changes, they fall outside the scope of joint authority.

The CAISO recognizes that additional refinement to its proposal relating to the treatment of LPT exports or for assistance energy may be desired by some stakeholders. The CAISO is open to further refining these aspects of the proposal at a future date, however, to implement the proposal by summer of 2023, there is very limited time for additional policy development. The CAISO requests that stakeholders keep in mind implementation limitations due to time and resources when submitting their comments on this draft final proposal.

3 RSE Background

This section provides a high-level review of the purpose of each WEIM RSE test component as well as the principles that informed the existing WEIM RSE design.

3.1 Resource Sufficiency Evaluation Purpose and Principles

The purpose of the WEIM RSE is to ensure each WEIM BAA is able meet its demand and uncertainty with its own net supply prior to engaging in transfers with other BAAs in the real-time market. This is accomplished by meeting the following objectives: 1) ensuring that BAAs do not inappropriately lean on the real-time capacity, flexibility, and transmission of other BAAs in the WEIM footprint, and 2) providing an incentive for WEIM BAAs to submit base schedules that balance supply and demand while identifying and resolving potential transmission congestion.

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The WEIM RSE's capacity and flexible ramping tests address the first objective of preventing inappropriate leaning; the balancing test also provides a level of protection against inappropriate leaning that is not its primary objective. Leaning has been previously understood as a BAA participating in the WEIM without bringing sufficient capacity and ramping flexibility to cover its expected demand, including net load uncertainty; the concept of BAA self-sufficiency is part of the scope for phase 2.

The WEIM RSE's capacity and flexible ramping tests do not determine if a BAA is able to meet its individual reliability requirements since, for example, ancillary services are not included in these tests. Rather, these are real-time tests that serve as prerequisites for WEIM participation. Ensuring each WEIM BAA meets its reliability requirements is addressed by individual WEIM entities' resource adequacy requirements determined by their regulatory authority, and by meeting NERC reliability standards.¹ The capacity and flexible ramping tests do not necessarily ensure a BAA is resource-adequate. Rather, they aim to ensure no inappropriate leaning occurs by limiting receiving and/or sending WEIM energy transfers from other BAAs when a BAA fails the tests.

The RSE's balancing test protects against strategic base schedule submissions that are intentionally designed to arbitrage imbalance energy prices between supply and load. The RSE's feasibility test enables WEIM participants to check whether their initial base schedules are feasible considering transmission congestion.

The CAISO reiterates the voluntary nature of participation in the WEIM. The RSE is not intended to set reliability requirements. With that understanding, the RSE has been generally accepted as being consistent with the following principles:

- Inappropriate leaning is participation in the WEIM without sufficient capacity and ramping capability to meet expected load;
- WEIM RSE failures should not cause operational or reliability issues; and
- The WEIM RSE does not dictate resource adequacy or integrated resource plans in individual BAAs.

During this phase of the initiative, the CAISO is exploring leveraging the WEIM to provide energy assistance during under and over-supply conditions. The CAISO recognizes that the WEIM platform could be leveraged to increase a BAA's reliability in the real-time market, but it should not be relied on in this way. It is the responsibility of each BAA to develop their own plans to reliably operate their control areas absent the WEIM. To this

¹ [Order Conditionally Accepting Proposed Tariff Revisions to Implement Energy Imbalance Market \(ER14-1386\)](#)

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end, the CAISO is proposing rules and compensation for when leaning within the WEIM is acceptable.

4 Phase 2 – Accuracy Enhancements

This section of the paper discusses additional accuracy enhancements to the WEIM RSE that the CAISO was unable to address in the first phase of the initiative. These include the consideration of load conformance, developing appropriate measures of uncertainty, and the interaction between advisory WEIM transfers and block hourly exports cleared in the CAISO's HASP process.

4.1 Load Forecast Adjustments

BAA operators currently use load forecast adjustments or “load conformance” to meet a number of real-time operational needs that the market is either unable to account for, or does not model. These operational needs range from 1) increasing their resource fleet's flexibility to 2) accounting for forecast error, or 3) ensuring the availability of replacement reserves. The use of load conformance may cause the commitment of additional resources internal to the BAA, an increase in block hourly interchange supply, a decrease in block hourly exports, or an increase in WEIM transfers.

During the RSEE Phase 1 policy development, stakeholders raised concerns that the use of load conformance was inappropriately advantaging the CAISO BAA in passing the WEIM RSE. However, the existing design of the WEIM RSE does not count WEIM transfers as available supply in the bid-range capacity test. Intrinsic to its design, the use of load conformance cannot help any BAA pass the WEIM RSE capacity test. The flexible ramping sufficiency test uses the financially binding market results for the 15-minute interval immediately prior to the hour under evaluation as a reference point to determine the upward and downward ramping requirements in each 15-minute interval in the following hour. To the extent that load conformance drives WEIM transfers that unload resources internal to a BAA, the resulting lower operating level of those resources would be reflected as additional upward ramping capability in the flexible ramping sufficiency test. Limited analysis in Phase 1 showed that load conformance did result in an increase to WEIM transfers, however, this analysis did not show load conformance resulted in a 1-

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for-1 increase in WEIM transfers.² Given the complex interactions that drive market outcomes, the CAISO deferred additional consideration of load conformance until Phase 2 to allow time for more robust analysis.

To better understand this relationship, the CAISO preformed additional analysis on the 16 highest load days in 2021, as well as 3 non-summer days in January of 2022. The results of that analysis were presented by the CAISO in preliminary form on March 30, 2022, and final form on June 21, 2022.³ The analysis confirms that the use of load conformance does not result in a one-to-one increase in WEIM import transfers. Rather it shows that there is no precise means to routinely estimate the impact of load conformance on incremental WEIM transfers. A regression performed on the change in HASP import transfers indicates that, even during high levels of conformance, it does not necessarily result in significant volumes of incremental WEIM transfers. This relationship can be seen in Figure 1.

² [CAISO Resource Sufficiency Evaluation Performance on July 9: Presented to the Market Surveillance Committee November 19, 2021](#)

³ [CAISO Report on WEIM Transfers, Hourly Interties and Load; June 21, 2022](#)

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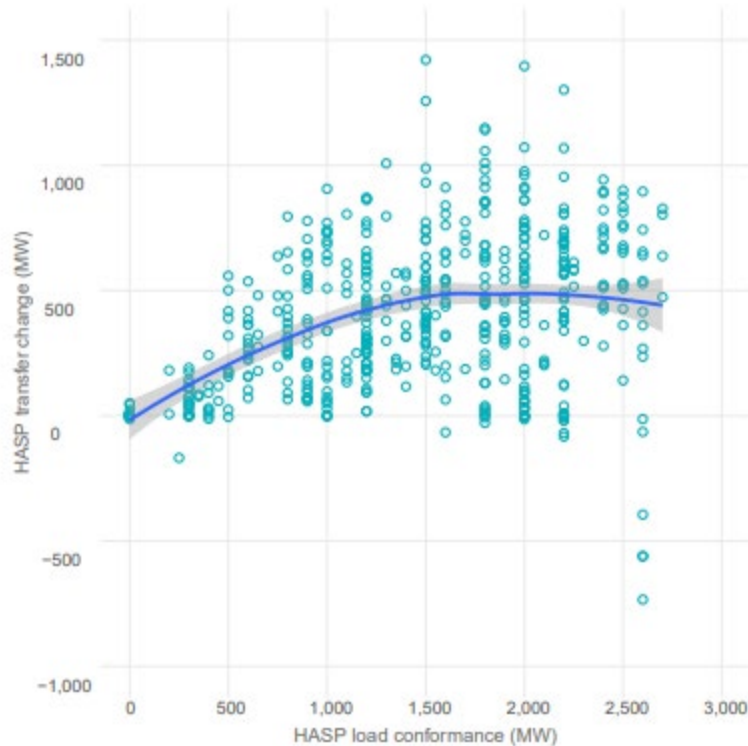


Figure 1: HASP Load Conformance vs WEIM Transfers

The other pertinent finding is that the use of load conformance routinely results in schedules to increase the output of resources internal to the CAISO BAA, resulting in less upward flexibility to be used in the flexible ramping sufficiency test. This phenomenon is illustrated in Figure 2. While the analysis clearly shows that load conformance does lead to an increase in WEIM transfers, it also shows that this transfer increase is often less than the increase in output levels of resources internal to the CAISO BAA, resulting in a net reduction of flexibility for the CAISO BAA. More detailed information about the result of load conformance and its impact on the market results in the CAISO BAA can be seen in the CAISO's published analysis.⁴

⁴ *Id.*, at 3

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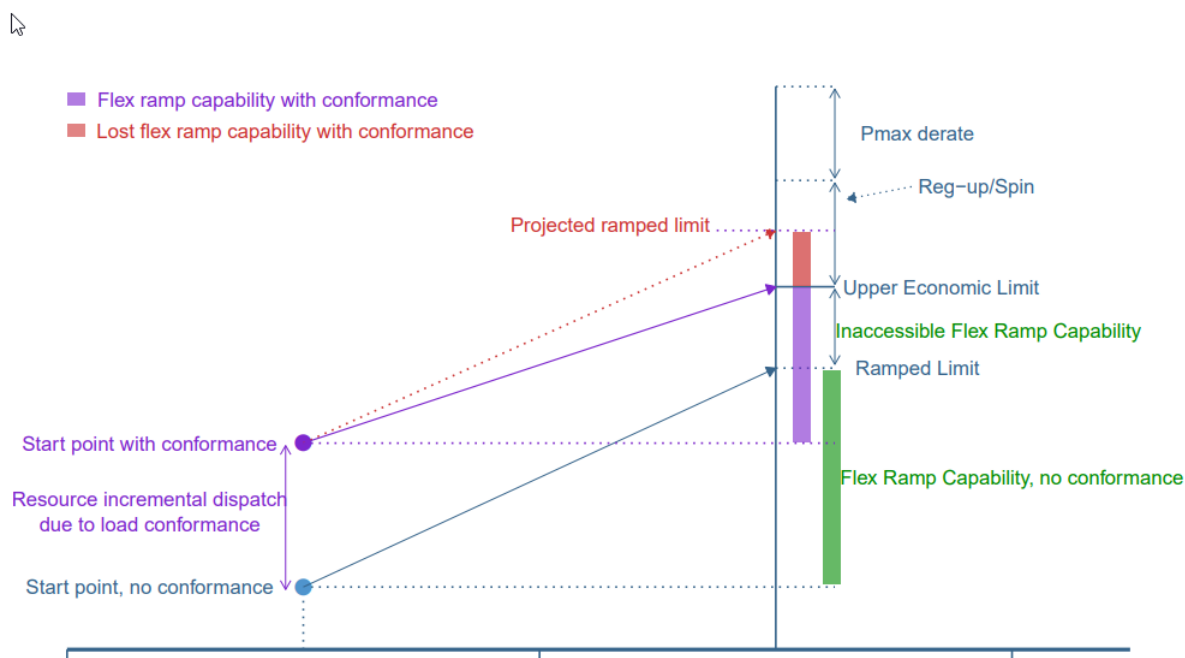


Figure 2: Illustration in reduction in resource flexibility due to load conformance

Given these findings, the CAISO is not proposing any changes in the WEIM RSE formulation to account for load conformance. The analysis concludes that the use of load conformance does not regularly benefit any BAA in passing the WEIM RSE. In addition, to the extent that it drives additional WEIM transfers, there is limited ability to accurately predict the result of load conformance. Rather, the CAISO reiterates that the WEIM RSE should be applied in a narrow manner to test for a BAA’s ability to meet its forecasted demand and ramping requirements, rather than forecasted requirements plus out of market actions or otherwise undefined operating practices.

4.2 Interaction between Advisory WEIM Transfers and HASP

During Phase 1 of the RSEE initiative, preliminary analysis showed an interaction wherein advisory WEIM transfers enabled the HASP process to clear additional hourly exports from the CAISO BAA. Since not all HASP exports are cleared using supply internal to the CAISO BAA, this interaction creates the potential for the CAISO BAA to erroneously fail the WEIM RSE.

4.2.1 Background

The CAISO's real-time unit commitment process performs a rolling multi-interval optimization to minimize costs in the upcoming four to seven 15-minute intervals;⁵ the cost minimization occurs across the entire market footprint. The first sequence in this process is the HASP run which optimizes the next seven 15-minute intervals, with the last four of the seven intervals being the upcoming hour. The HASP considers all offers including 1) bids from resources internal to the CAISO BAA, 2) bids on interties, and 3) bids from resources in the WEIM footprint outside the CAISO BAA. One result of this optimization is the award of hourly interchange schedules into (imports) and out of (exports) the CAISO BAA.⁶ Another result is the dispatch of resources across the WEIM that results in WEIM energy transfers between BAAs.

Under the existing WEIM RSE design, awarded HASP exports are added to the CAISO BAA's WEIM RSE obligation, yet WEIM transfers are not counted as available supply. As a result, the CAISO BAA can have sufficient supply to meet its own obligations over the upcoming hour, but fail the WEIM RSE due to insufficient capacity to support the block hourly export transfers cleared through access to WEIM transfers.

Analysis published by the CAISO on June 21, 2022 confirms that this dynamic occurs.⁷

In performing this analysis, production market cases were rerun with adjustments made to account for unrealized WEIM transfers in the real-time dispatch (RTD).⁸ The analysis shows that this interaction has the potential to result in hundreds, if not thousands of additional MW of obligation for the CAISO BAA. However, given the complex interaction that leads to this outcome, the analysis did not show a strong correlation between the volumes of WEIM import transfers and HASP exports. Results from July 9th can be seen below in Figure 3, and a simplified, graphic example of this interaction can be seen below in Figure 4.

⁵ [CAISO Business Practice Manual for Market Operations Section 7.5](#)

⁶ The hourly imports and exports over CAISO interties are based on import and export bids and schedules. These hourly imports and exports are separate from WEIM energy transfers.

⁷ *Supra*, note 2

⁸ RTD is a 5-minute security constrained economic dispatch application that re-optimizes the results of the unit commitment performed through the 15-minute granularity RTUC process.

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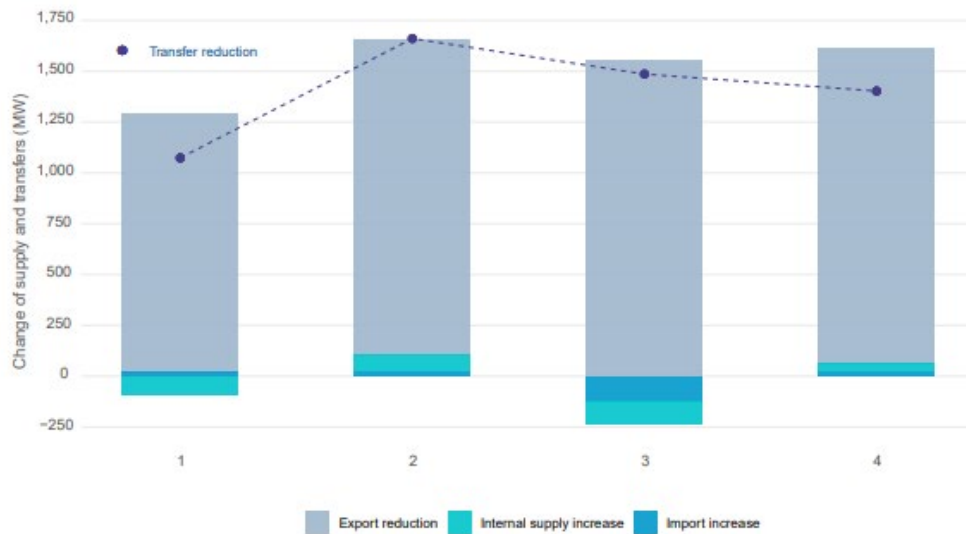


Figure 3: Changes of exports and supply relative to changes in WEIM transfer -July 9, 2021, HE19

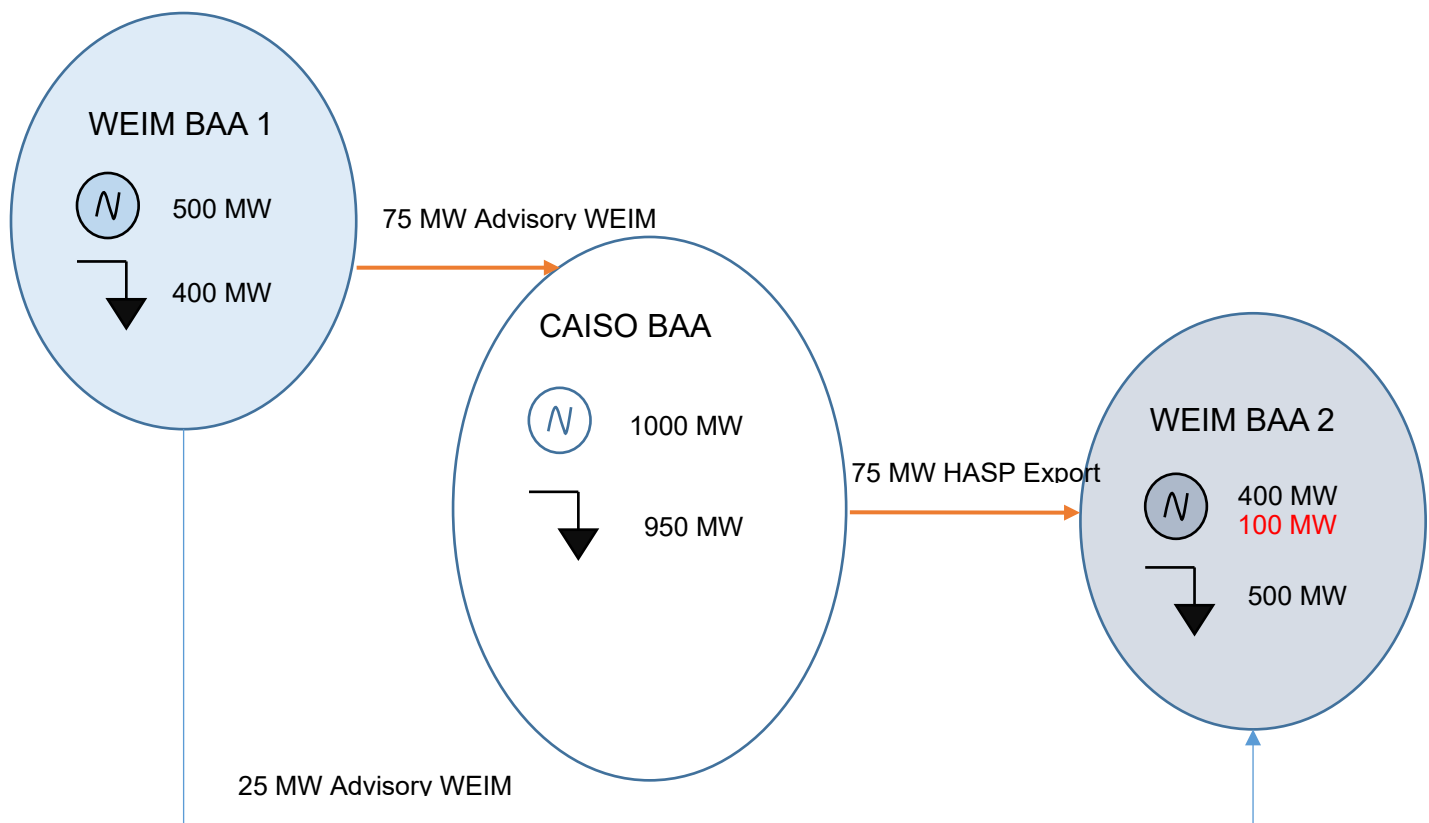


Figure 4: Graphic Example of HASP Export Advisory WEIM import interaction

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In the example shown in Figure 4 above, each balancing authority area would be resource sufficient based on the conditions that exist prior to HASP, however HASP scheduling a low-priority export at a CAISO BAA intertie based on WEIM transfers into the CAISO BAA subsequently results in the CAISO BAA failing the WEIM RSE:

- There is 2000 MW of supply for 1850 MW load across the three BAAs
- The optimal HASP solution clears a 75 MW advisory WEIM transfer into the CAISO BAA and reflects 25 MW of advisory transfers from BAA 1 to BAA2. This allows HASP to schedule a 75 MW hourly export at a CAISO BAA intertie to BAA2 because the export is supported by the 75 MW transfer.
- The CAISO BAA would then fail the final WEIM RSE conducted after the HASP as the CAISO BAA's demand obligation in the final RSE run is 1025 MW while it only has 1000 MW of supply. Its demand obligation in the RSE is based on its 950 MW internal load plus the 75 MW hourly export scheduled by HASP. However, the supply considered by the RSE is only the CAISO BAA's 1000 MW of internal supply as the RSE does not consider WEIM transfers as supply. Thus, the WEIM transfer into the CAISO BAA allowed HASP to schedule the export, resulting in the export causing the CAISO BAA to fail the RSE. HASP may do this because HASP does not consider the RSE as part of its optimization.

A similar interaction can occur if HASP schedules imports into the CAISO BAA to support exports. Although imports count as supply in the WIM RSE, they do not count in the final WIM RSE if the import supplier has not submitted an e-tag with the transmission path for the import before the final WEIM RSE after the HASP. Thus HASP can schedule exports from the CAISO BAA based on import supply but then fail the WEIM RSE if an import e-tag is not submitted.

While the example above highlights a snapshot showing the potential for WEIM import transfers to add to the CAISO BAA's obligation, the table below shows how this phenomenon can occur, and worsen the CAISO BAA's net position across an hour. Specifically how the CAISO BAA can fail the WEIM RSE mid-hour, and the resulting limitation of incremental WEIM import transfers can exacerbate the capacity shortfall. An example of this dynamic in practice would be the HASP awarding export transfers from the CAISO BAA during the net-load peak when its solar supply is reduced throughout the hour.

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Table 2: Numeric Example of WEIM Transfers Facilitating HASP Exports

Numeric Example of WEIM Transfers Facilitating HASP Exports				
HASP Results that are the input to the T-55 RSE	0:15	0:30	0:45	1:00
CAISO BAA Supply	40250	39500	38750	38250
CAISO BAA Demand	39000	38750	38250	38000
WEIM Import Transfers	500	500	750	1000
Optimal HASP Export	1250	1250	1250	1250
T-55 RSE results				
CAISO BAA supply	40250	39500	38750	38250
CAISO BAA RSE Obligation	40250	40000	39500	39250
CAISO BAA Deficiency	0	-500	-750	-1000
Pass / Fail	X	X	X	X
Net Supply Position				
Last 15min interval	500	0	-250	-500

Following a failure of the WEIM RSE, the current design is to limit incremental transfers in the direction of failure to the greater of either the base transfer or the transfer in the most recently passed 15-minute interval. Should the CAISO BAA fail the WEIM RSE due to this interaction, its incremental WEIM transfers are likely to be limited to the most recently passed 15-minute interval. Alternatively, the CAISO BAA would pay a penalty for incremental transfers under the change proposed later in this paper. Either of these results appear to be flawed as the CAISO BAA's failure results merely because of the interaction of exports with WEIM transfers and imports in the HASP optimization.

4.2.2 Resource Sufficiency Evaluation Treatment

As described above, the HASP optimization can result in the CAISO BAA failing the WEIM RSE even if the CAISO BAA is resource sufficient because the optimization may schedule low-priority (LPT) hourly exports at the CAISO BAA interties based on supply from WEIM energy transfers into the CAISO BAA. The CAISO BAA may fail the WEIM RSE because the LPT exports add on to the CAISO BAA's load obligation in the WEIM RSE while the transfers do not count as RSE supply.

This issue is unique to the CAISO BAA because the HASP schedules hourly exports at the CAISO BAA intertie based on economic bids and self-schedules clearing in the market optimization process. The optimization can choose to meet this demand with either internal CAISO BAA resources, or with imports or WEIM transfers. As the HASP is

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scheduling for the subsequent hour about an hour ahead of time, it may be supplying exports with transfers scheduled in the advisory market intervals covering the next hour.

Because of this, the CAISO BAA cannot ensure it has sufficient internal supply and imports to support LPT exports as the supply for the exports is coming from WEIM transfers. As shown in the example in the previous section, this may result in the CAISO BAA failing the WEIM RSE merely because it is economic to dispatch WEIM supply up to provide transfers to the WEIM to use as the source of supply for LPT exports from the CAISO BAA. The CAISO BAA would fail the WEIM RSE because the RSE does not count WEIM transfer supply towards meeting a BAA's RSE obligation, while at the same time it, under the current rules, it counts the LPT exports as additional obligations in the RSE.

The HASP could potentially be modified to ensure that WEIM transfers into the CAISO BAA cannot be used as the source of export supply. However, such a measure would likely be very complex and/or greatly reduce WEIM benefits. For example, the WEIM transfer constraints for the CAISO BAA in the HASP run for the advisory market intervals in the next hour could conceivably be set to zero. However, this would entail transfers into the CAISO BAA not being available to the market optimization in future intervals, undermining the benefits of the multi-interval optimization. It would prevent transfers into the CAISO BAA from serving as the source for low-priority exports, but it would also prevent HASP from optimally using economic supply offers to avoid the more expensive commitment of a resource within the CAISO BAA. Again, this would be inefficient and reduce the WEIM benefits.

In addition, the scheduling priorities of LPT exports are appropriate to consider in the RSE's treatment of LPT exports as additional obligations. These scheduling priorities ensure LPT exports from the CAISO BAA are awarded with a lesser priority than serving CAISO BAA demand with the understanding they could be curtailed to serve CAISO BAA demand. Given that the WEIM RSE is designed to test that a BAA can meet its own obligations, the CAISO BAA should not experience a failure of the WEIM RSE based on LPT schedules. The CAISO therefore proposes to only count high priority block hourly export transfers as well as its own demand in determining the CAISO BAA obligation in the WEIM RSE. This provides equivalent treatment to how interchange schedules are made and represented by WEIM entities through the base scheduling process. Bilaterally, only schedules the WEIM entity is confident it can support are sold as firm energy, reflected in the base schedules, and tested against in the RSE.

Based on these considerations, the CAISO proposes the following rules for the RSE test for the RSE calculations for the CAISO BAA.

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4.2.2.1 Capacity Test

The CAISO proposes only to count demand, net-load uncertainty,⁹ and exports that meet the high priority criteria in the WEIM RSE capacity test obligation for the CAISO BAA. As described above, no longer including LPT exports is appropriate because HASP may schedule LPT exports at the CAISO BAA interties based on WEIM energy transfers.

4.2.2.2 Flexible Ramping Sufficiency Test

The CAISO proposes only to account for demand, net-load uncertainty and exports that meet the high priority criteria in the derivation of its flexible ramping sufficiency upward requirements. This tests to ensure that the CAISO BAA is able to ramp from the binding market schedule in the previous hour, to expected obligations in the upcoming hour. As described above, no longer including LPT exports is appropriate because HASP may schedule LPT exports at the CAISO BAA interties based on WEIM energy transfers.

The CAISO proposes to account for demand, net-load uncertainty and all HASP exports in the derivation of its flexible ramping sufficiency downward requirement. LPT exports signify a willing off-taker of supply from the CAISO market. Counting LPT exports in the CAISO BAA's obligation for the derivation of the flexible ramping down requirement in the WEIM RSE is reasonable. This is because the CAISO BAA, in practice, would deliver on these LPT exports prior to curtailing supply that results in the lack of downward flexibility.

4.2.2.3 WEIM Entity Treatment of HASP Awards

In response to stakeholder feedback, the CAISO is no longer proposing any rules discounting LPT exports that are shown within the base schedule for WEIM BAAs. The CAISO recognizes that allowing for these exports to count creates an asymmetry. However, the CAISO also believes that allowing WEIM entities to count these may be rationale for the following reasons:

1. The CAISO BAA would be unable to offer advisory pro-rata curtailments to LPT exports until the second advisory WEIM RSE that is executed at T-55. Potential curtailments made at this time do not leave the sink WEIM BAA sufficient time to update their base schedules. This in turn results in the sink BAA either base scheduling in excess of its actual expected needs resulting in market inefficiency, or failing the WEIM RSE resulting in either potential reliability issues or the need to cure the deficiency through the assistance energy product discussed in section 5.1.

⁹ The net-load uncertainty requirement in the capacity test is currently suspended.

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2. The HASP market optimally clears LPT exports. To the extent that these LPT exports do not cause the CAISO BAA to fail the WEIM RSE, it is reasonably expected that these transfers will flow.

The CAISO recognizes that this may inadvertently allow WEIM BAAs to count in their base schedules WEIM transfer supply that is “firmed up” by the CAISO’s HASP process. However, per stakeholder feedback, this outcome is preferable to the significant inefficiencies that may result from real-time pro-rata derates, or the inability to count LPT exports as a portion of their base schedules.

To the extent this treatment results in the WEIM having insufficient capacity or flexibility, the WEIM BAAs whose LPT exports were curtailed would see the power balance constraint violation appear in their control areas. This result is appropriate as the shortfalls are limited to BAAs who claimed LPT exports, which are provisional-firm in nature, within their WEIM base schedules.

4.2.3 HASP Export Firmness

As part of this initiative, the CAISO proposes to require LPT exports be e-tagged as “Firm Provisional Energy (G-FP).”¹⁰ The purpose of this rule is to apply the existing market scheduling priorities affording LPT exports a lower priority than serving CAISO BAA load in the CAISO’s markets¹¹ post HASP so if the CAISO BAA is unable to maintain its own load serving obligations as a balancing authority it can manually curtail LPT exports that have cleared HASP within the hour. Requiring LPT exports to be tagged as Firm Provisional Energy also will provide better visibility to other BAAs regarding the firmness of these exports.

This rule will not apply to high-priority (PT) exports, which require a non-RA resource internal to the CAISO BAA be designated to back the export. HASP exports that meet that qualify as high priority exports will have equal priority to CAISO BAA load and can be tagged as firm-energy (G-F).

As a practice, the CAISO BAA would carry reserves for all exports from its BAA, and it would only look to curtail these exports if it is unable to replace its reserves within the NERC allotted timeframes or it cannot deploy its reserves to address a supply shortfall that

¹⁰ WECC Glossary of Terms G-FP: Firm Provisional Energy. This product may be interrupted only if the interruption is within the recall time and for conditions allowed by applicable provisions governing interruption of service, as mutually agreed to by the parties. A G-FP product cannot be interrupted for economic reasons

¹¹ CAISO tariff section 34.12

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risked its load. All LPT exports clearing the HASP would be made with this understanding regarding the potential for future curtailment, which will be reflected in the tariff.

In the manual curtailment process, the CAISO also proposes to provide a higher priority to LPT exports that cleared the day-ahead process over LPT exports that appear only in real-time only. This essentially extends the market curtailment priorities in tariff section 34.12.1 to manual curtailments. Because the CAISO only proposes manual, operator driven curtailment of these LPT exports, this differentiation will be reflected as different tiers of LPT exports that are available for pro-rata curtailment by CASIO BAA system operators. This differentiation will provide additional certainty for market participants who scheduled their LPT exports from the CAISO market on a day-ahead basis.

The CAISO also proposes to retain operator discretion regarding the curtailment of LPT export transfers out of the CAISO BAA. The advisory results produced by the CAISO's real-time unit commitment (RTUC) process will return a list of potential lower priority export curtailments necessary to preserve CAISO BAA load. The CAISO systems, following affirmation of the system operator, will pro-rata curtail these exports for all BAAs.

The CAISO would curtail these exports within the hour when it does not have enough resources to meet its load and reserve obligations. This would occur when the CAISO BAA is in an Energy Emergency Alert (EEA) 3 and requires LPT exports to be curtailed to prevent the need to arm load, or to reduce the amount of load that is armed, to meet its reserve obligations. This would also occur when the CAISO BAA is shedding firm load.

4.3 RSE Measures of Uncertainty

4.3.1 Background on Existing Measures of Uncertainty

During the RSEE Phase 1 policy development stakeholders raised concerns that the WEIM RSE's existing measures of net load uncertainty may not be sufficiently accurate. Specifically with respect to future demand uncertainty, these measures may not adequately increase the accuracy of the WEIM RSE.

Since November 1, 2016, the CAISO has had Flexible Ramping Product (FRP) in place for the 15-minute and 5-minute markets. These products provide additional upward and downward flexible ramping capability to account for uncertainty due to gross load, wind and solar forecasting errors. The FRP procurement requirement is based on forecast uncertainty as measured by net load (NL), where net load = load (L) – wind (W) – solar (S).

In each market, FRP needs to estimate both Flexible Ramping Up (FRU) and Flexible Ramping Down (FRD) procurement requirements. The current implemented approach to do this, commonly referred to as the histogram methodology, uses the upper 97.5 and

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lower 2.5 percentiles of observed net load uncertainty from the previous rolling 40 matching week days and 20 matching weekend days to set the FRP requirement. Within this methodology, two main limitations have been observed; 1) no incorporation of the future impact of weather conditions on the net load uncertainty, and 2) the historical sample set utilized.

Developed concurrent with the *FRP Refinements* policy initiative that was approved through the CAISO's governance in October 2020, the CAISO also developed enhancements to the net load uncertainty requirement used to determine the quantity of FRP the real-time market procures. This methodology will be defined in a CAISO Business Practice Manual and is colloquially referred to as the quantile regression methodology.¹² This same uncertainty requirement is used as part of the calculation BAA's RSE obligations. It is used as part of the both the RSE's capacity and flexible ramping test, although its used in the capacity test is currently suspended, as described further below.

Uncertainty requirements, such as the one for FRP, are important to reevaluate and enhance over time to ensure the market properly captures the uncertainty of net load. Within the analysis conducted prior to the RSE Phase 2 stakeholder process, the CAISO presented further information on the CAISO's proposal to use quantile regression to incorporate weather information in estimating FRP. This included the construction of the net load formulation and mosaic quantile regression, the comparison of the current histogram approach to the newly formed mosaic quantile regression, the analysis of the overall benefit in the mosaic quantile regression, and lastly a sensitivity analysis of some additional considerations the CAISO is monitoring.

The RSE's capacity test also included a separate uncertainty requirement to account for undelivered imports, termed the intertie uncertainty adder. As an outcome of the phase 1 policy development, the CAISO suspended the intertie uncertainty adder¹³ from the RSE's capacity test. This adder set an hourly uncertainty requirement based on observed deviations from what was shown in the final WEIM RSE forty minute prior to the hour (T-40) and what was eventually tagged at twenty minute prior to the hour (T-20). The methodology calculates a highest relative deviation¹⁴ and a highest absolute deviation¹⁵. The uncertainty requirement is then determined by taking the minimum of the absolute deviation or the relative deviation multiplied by the scheduled net interchange. The

¹² [Flexible Ramping Product Requirements - Appendix C "Quantile Regression Approach"](#)

¹³ FERC Order Accepting Tariff Revisions (ER22-1278)

¹⁴ $Relative\ deviation = \frac{\sum Base\ Schedules_{T-40} - \sum Tagged\ Schedules_{T-20}}{\sum Base\ Schedules_{T-40}}$

¹⁵ $Absolute\ deviation = \sum Base\ Schedules_{T-40} - \sum Tagged\ Schedules_{T-20}$

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requirement was set to a 95% confidence interval; resulting in only the upper and lower 2.5% of observations not being included in the derivation of the requirement. The small retroactive sample size used – that is, the previous 3 months – is largely due to the changing nature of system operations through the year. Using a longer more robust sample reduces accuracy of the inertia uncertainty adder as the system conditions to which the adder is being applied is more likely to lead to variation from the observed conditions. This results in a small sample which is then prone to increased error and accuracy of the calculated adder due to outlier events driving future requirements. Analysis published by the CAISO on April 26, 2022 further confirms the existing methodology is prone to inaccurate estimations of future uncertainty.¹⁶

4.3.2 Revisions to Uncertainty in the WEIM RSE

The CAISO is planning to utilize the quantile regression methodology to calculate net-load uncertainty as part of implementing the changes resulting from the *FRP Refinements* initiative. The quantile regression methodology uses historic data as well as forecasted load and variable energy resource output to improve accuracy.

Based on concerns with the existing calculation of net load uncertainty that were causing spurious RSE failures, the CAISO proposed and FERC approved suspending net load uncertainty as a component of each BAA's RSE obligation.¹⁷ In the straw proposal, the CAISO asked stakeholders if net load uncertainty should be reintroduced in WEIM RSE obligations. While many stakeholders are supportive of adding net load uncertainty to RSE obligations, they also are of the opinion that the quantile regression methodology's performance should be further assessed before doing so.

Consequently, the CAISO proposes to defer this topic until after it has implemented the quantile regression methodology in conjunction with the *FRP Refinements* implementation and has had the opportunity to assess its performance. The CAISO would assess its performance with respect to the following metrics: 1) coverage, 2) requirement, 3) closeness, and 4) exceedance as explained in CAISO's previous analysis of the quantile regression methodology.¹⁸

With regard to the inertia uncertainty adder, the CAISO proposes to permanently it from the capacity test. Analysis performed by the CAISO shows that the existing methodology

¹⁶ [CAISO Report on Inertia Deviation adder for the WEIM Resource Sufficiency Evaluation Enhancements](#)

¹⁷ *ibid* 13

¹⁸ [Flexible Ramping and Inertia Deviation Uncertainty in the Western Energy Imbalance Market; June 22, 2022](#)

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produces a requirement that does not serve as good predictor of future inertia uncertainty. The inertia uncertainty requirement is either greatly in excess of the observed uncertainty or fails to cover the larger materializations of uncertainty during the rare occasions it arises. The analysis also did not indicate external drivers that could be used to reasonably inform an increased risk of inertia uncertainty. Further, given the recent changes to require the an e-tag showing the transmission path for an import to the CAISO BAA to count in the WEIM RSE, all inertia transactions used to pass the WEIM RSE have similar expectations of delivery. Consequently, all parties will be equally situated regarding the potential for inertia uncertainty to arise.

5 Phase 2 – Energy Assistance through the WEIM

The CAISO proposes to leverage the WEIM for energy assistance during under-supply conditions by optionally allowing incremental transfers following the failure of the WEIM RSE at preset financial consequence. The WEIM is not intended to cure deficiencies in forward planning; however, to the extent it can facilitate energy assistance in real-time without undermining the existing incentives for sufficient forward procurement, it will look to do so.

5.1 Curing Resource Undersupply Conditions

The CAISO proposes that BAAs be able to elect whether they want to utilize energy assistance as part of their participation in the WEIM. If a BAA does not elect to utilize energy assistance, the CAISO market would limit its WEIM energy transfers when it fails the RSE as under the current rules. These rules limit transfers to the amount in the market interval immediately before the failed interval, or to the base scheduled transfer amount if greater.

If a BAA has elected to utilize energy assistance and the BAA fails the RSE because it is short on supply, the CAISO proposes to allow the BAA to still receive WEIM energy transfers, but the BAA would pay an incremental transfer cost on the energy transfer.

The real-time market will model this incremental transfer cost as an additional cost for WEIM import transfers. This cost will be the same as the additional cost used to set prices when a BAA's power balance constraint is relaxed, either \$1,000/MWh or \$2,000/MWh

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depending whether the CAISO is accepting bids above the \$1,000/MWh soft bid cap.¹⁹ This will ensure that a BAA has utilized their own supply prior to accessing assistance through the WEIM, and that any net WEIM import transfer above day-ahead or base transfer is assistance energy, under the vast majority of circumstances.²⁰ This hurdle rate will add an additional cost to the transfer energy above the marginal cost of the supply.

As described further below, the CAISO would allocate the incremental transfer costs applied to import transfers to the other EIM BAAs that passed the RSE in proportion to their net exports.

The incremental transfer costs for imports into a BAA that fails the RSE for under-supply will function like a congestion cost. It will raise the price of real-time imbalance energy in the receiving BAA by the amount of the incremental transfer cost. Figure 5 below provides a simple example of how this would work.

¹⁹ CAISO tariff section 27.4.3.3(a) defines when the CAISO is using either the \$1,000/MWh or \$2,000/MWh power balance constraint penalty price.

²⁰ All of a BAA's internal supply may not be dispatched if the source of assistance energy is from a BAA with negative prices. In this case a BAA's supply priced greater than \$850/MWh may not be dispatched.

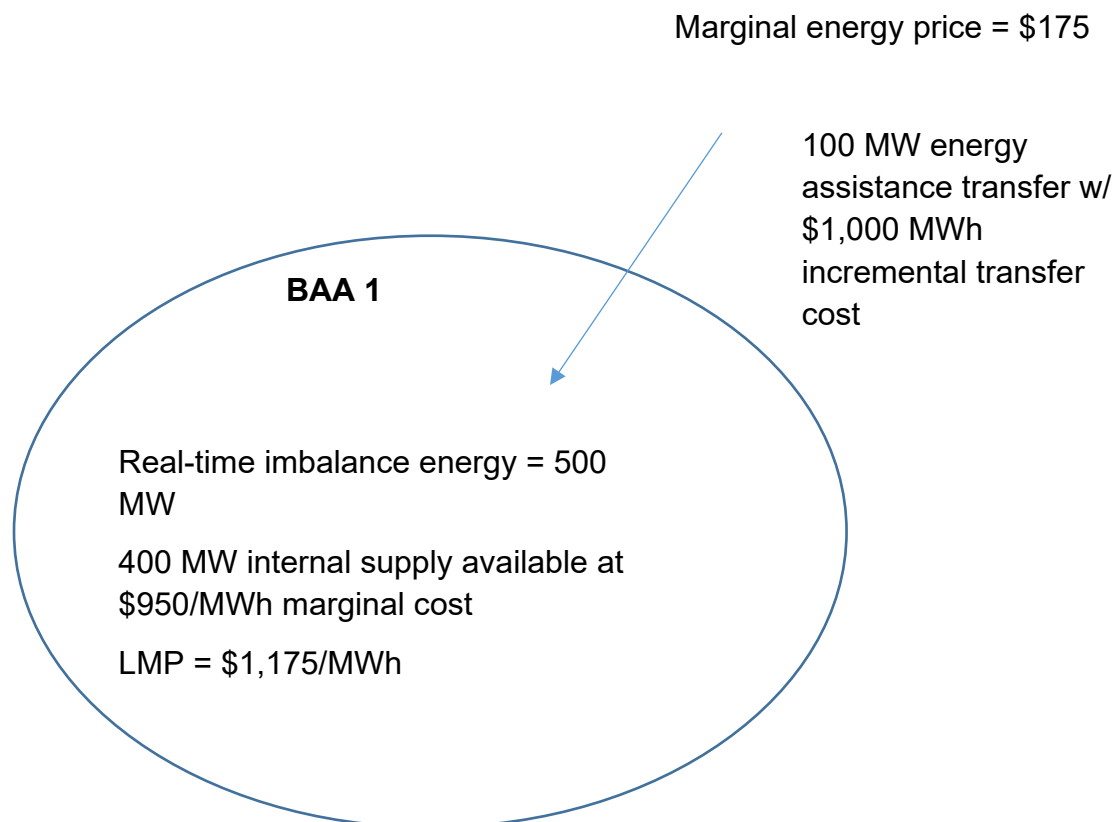


Figure 5: Application of penalty price for WEIM transfers into a BAA having failed the RSE for under-supply and opted for emergency assistance energy

Assume BAA 1 in Figure 5 has failed the RSE because it is short of supply but has elected to receive energy assistance. It needs 500 MW of real-time imbalance energy to meet its load but only has 400 MW of internal supply available. In this situation it would be eligible to receive 100 MW with an incremental cost imposed to the transfers.

Effectively, the incremental cost applied to the transfers will function as a hurdle rate.²¹ This ensures the real-time market dispatches all internal supply when scheduling energy assistance transfers. In this example, 400 MW of supply is available inside BAA 1 at a

²¹ This CAISO would implement this by leveraging existing functionality that currently applies a very small transmission cost used for dynamic transfers in the current WEIM implementation to obtain a robust solution.

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\$950/MWh marginal price. The \$1,000/MWh cost applied to the energy assistance transfers ensures the real-time market fully uses BAA 1's available internal supply and schedules only the amount of energy assistance transfers need to meet the shortfall. BAA 1's internal supply is available at a \$950/MWh marginal cost so the real-time market will fully dispatch it and only use 100 MWh of energy assistance because its \$1,000/MWh incremental transfer cost is higher.

In the example shown in Figure 5, BAA 1's LMPs would be \$1,175/MWh, assuming the marginal energy cost outside BAA 1 is \$175/MWh and considering the \$1,000 incremental cost for the energy assistance transfer (and ignoring other congestion and losses). The \$1,175/MWh LMPs are based on the \$175/MWh marginal cost of the external supply that is the source cost of the energy assistance transfer plus the \$1,000/MWh incremental cost for the energy assistance transfer.

In this example, BAA 1's load would pay \$1,175/MWh for its 500 MW of real-time imbalance energy. Its 400 MW of internal supply would receive \$1,175/MWh.

Because the real-time market models the assistance energy transfer as an incremental cost on import transfers, the incremental cost, \$1,000/MWh in this example, will be incorporated within the congestion component of the receiving BAA's LMPs. During the settlement of the real-time energy imbalance, the CAISO calculates the real-time congestion offset for WEIM BAAs. The CAISO will be able to identify the portion of the congestion price attributable to the incremental transfer cost applied to energy assistance transfers. In this calculation, the CAISO will determine the real-time assistance energy congestion revenue from insufficient BAAs.

The assistance energy congestion revenue is the sum of the product of the amount of the energy assistance transfer and the marginal cost of congestion attributable to the incremental cost applied to the transfer. The CAISO will reduce the real-time congestion offset of the insufficient BAAs by the BAA energy assistance congestion revenue, and will allocate it to other WEIM BAAs, as described below.

In the example shown in Figure 5, \$100,000, based on 100 MW to which a \$1,000/MWh incremental transfer cost has been applied, and will be allocated to other EIM BAAs as described further below. Supply outside BAA 1 will separately be paid based on a \$175/MWh marginal price through the WEIM's existing real-time energy imbalance offset mechanism that pays resources for energy produced, including that used for WEIM energy transfers.

The CAISO proposes the election to utilize assistance energy will be made in the CAISO Master File and any changes to that election will occur through the existing master file process. This allows BAAs optionality in curing resource insufficiency, either including the ability to utilize WEIM, or to access emergency supply or load modification programs

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native to their BAA that are not available for dispatch through the WEIM. However should a BAA elect to cure insufficiency, the intention of the assistance energy transfers are to offer a means to increase real-time reliability and as such the CAISO does not believe it is necessary to offer more granular election of this functionality. Dynamically toggling a BAA's willingness to increase their reliability through accessing assistance energy transfers is not consistent with the intent of this reliability based functionality. In addition, because of resource and timing constraints, the only option the CAISO can realistically implement by summer 2023 is to provide for elections through the Master File.

In order to ensure the assistance energy interacts appropriately with other components of the real-time market, for BAAs electing to utilize assistance energy in the Master File, their BAA's power balance constraint penalty prices used to set prices must be increased to \$2,000/MWh, or \$4,000/MWh when the CAISO is accepting energy bids greater than \$1,000/MWh. Otherwise, the market's pricing run would fail to dispatch the assistance energy because the market would view relaxing the power balance constraint as less expensive.

The market will utilize a BAA's available balancing capacity before receiving energy assistance transfers. The CAISO would set the penalty price in the real-time market's scheduling run to be just above the price used for releasing available balancing capacity to ensure this.

In order to ensure reliability of BAAs that are the source of WEIM transfer energy, the existing WEIM implementation enforces a constraint that does not allow a WEIM BAA to have simultaneously have a net export transfer above its base net transfer, and also have a power balance constraint relaxation or available balancing capacity dispatched. This constraint will ensure BAAs will not provide assistance energy at the risk to their own reliability.

5.1.1 Allocating Assistance Energy Revenue

The CAISO proposes to allocate the assistance energy revenue pro-rata by net WEIM export transfer amount to BAAs that have passed the WEIM RSE. This allocation methodology assumes that net exports from BAAs passing the RSE are the source of the assistance energy transfers. Allocating to net exporters has the advantage as it further incentivizes competitive energy bids to increase the likely that a BAA's resources are the ones dispatched to provide energy assistance. The potential for the allocation of assistance energy revenue in this manner may create additional incentive to BAAs to make additional capacity, bid in at marginal cost, available to the WEIM due to the premium that BAA may receive for being a net WEIM exporter

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The straw proposal offered a potential alternative allocation methodology, which was to allocate pro-rata to BAAs in proportion to the amount their offered supply exceeded their RSE obligation. The CAISO has ruled out this option as it would not be feasible to implement by summer 2023 because of resource and timing constraints. The CAISO settlement system already calculates the net export transfer quantity information. Information on bid amounts and RSE obligations would require additional system integration effort that would put summer 2023 implementation at risk.

The CAISO proposes that WEIM BAAs sub-allocate any assistance energy revenue received as defined in their OATT. For the CAISO BAA, the CAISO proposes to sub-allocate the assistance energy revenue to real-time imbalance energy from supply.

5.1.2 Misuse of WEIM to cure real-time resource insufficiencies

The concern that the WEIM could be used as an alternative to avoid sufficient forward contracting has existed since the inception of the WEIM. This was one of the primary reasons that net incremental WEIM transfer is limited in the current implementation following a failure of the WEIM RSE. As the CAISO is proposing to relax this limitation, additional consequences may be needed to ensure this practice does not take place. Any attempt to develop additional deterrents to prevent misuse of assistance energy transfers must recognize that currently under NERC guidelines²² and good utility practice emergency energy assistance between BAAs is supported if possible.

The CAISO remains open to administrative consequences for BAAs that misuse this functionality; however, the comments did not indicate broad support for any specific means to prevent misuse. Based on this feedback the CAISO proposes to monitor for misuse, and if necessary develop more stringent rules at a later date.

5.2 Curing resource oversupply conditions

In the straw proposal, the CAISO proposed, in addition to providing for undersupply energy assistance, to also allow a BAA that fails the RSE in the downward direction to have export transfers at a penalty price. Currently, when a BAA fails the flexible ramping sufficiency test or capacity test in the downward direction, its WEIM transfer exports are limited and potential manual curtailments or self-schedule cuts may be required to resolve the condition. Rather than continuing to limit transfer exports, the CAISO in the straw

²² NERC TOP-001-5

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proposal proposed to allow exports from a BAA failing the RSE in the downward direction once pre-defined conditions have been met.

However, after further consideration of resource and timing constraints to implement the remainder of this proposal by summer 2023, particularly energy assistance for supply shortages, the CAISO proposes to defer this topic for future consideration.

6 WEIM Decisional Classification

This initiative proposes changes to the resource sufficiency test that is a part of WEIM. These changes include

- (1) Permanently removing the intertie uncertainty adder from the resource sufficiency evaluation's capacity test (Section 4.3.2), and
- (2) No longer include LPT exports when calculating the CAISO balancing authority area's WEIM resource sufficiency obligation (Section 4.2.3).
- (3) Changing the consequences for a balancing authority area that fails to meet the resource sufficiency test through a range of rules that fall within the new framework of "energy assistance through EIM" (Section 5).

In addition, the initiative proposes (4) a change to the rules for tagging exports from the CAISO balancing authority area. Exports that do not meet criteria to qualify for high priority will be tagged as firm-provisional rather than firm energy (Section 4.2.3). Element (4) is severable from the remaining three elements in the sense that management would proceed to implement it even if the other sets of changes were not approved.²³

As explained below, CAISO staff believes that the WEIM Governing Body has joint authority with the Board of Governors over all of the proposed changes except for element (4), the proposed tagging change in Section 4.2.3, for which it would have an advisory role.

The role of the WEIM Governing Body with respect to policy initiatives changed on September 23, 2021, when the Board of Governors adopted revisions to the corporate bylaws and the Charter for EIM Governance to implement the Governance Review

²³ In addition, several of the proposed rule changes within each of these general categories may be severable from the other proposals. We do not detail every instance of severability, though, because the other instances are not relevant to the decisional classification.

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Committee’s Part Two Proposal. Under the new rules, the Board and the WEIM Governing Body have joint authority over any

proposal to change or establish any CAISO tariff rule(s) applicable to the EIM Entity balancing authority areas, EIM Entities, or other market participants within the EIM Entity balancing authority areas, in their capacity as participants in EIM. This scope excludes from joint authority, without limitation, any proposals to change or establish tariff rule(s) applicable only to the CAISO balancing authority area or to the CAISO-controlled grid.

Charter for EIM Governance § 2.2.1. The proposed tariff changes to implement elements (1) through (3) above would all be “applicable to EIM Entity balancing authority areas, EIM Entities, or other market participants within EIM Entity balancing authority areas, in their capacity as participants in EIM.” They would not be applicable “only to the CAISO balancing authority area or to the CAISO-controlled grid.” Accordingly, these proposed changes to implement elements (1) through (3) would fall within the scope of joint authority.

Element (4), which would change the rules about how to tag exports from the CAISO balancing authority area, are not applicable to WEIM participants in their capacity as WEIM participants. Rather, these rules apply without regard to WEIM, to all exporters from the CAISO balancing authority area. Accordingly, they fall outside the scope of joint authority. The WEIM Governing Body may provide advisory input, however, because this tagging rules apply to the real-time market. The WEIM Governing Body’s advisory role extends to any proposal to change or establish tariff rules that would apply to the real-time market but are not within the scope of joint authority.

Stakeholders are encouraged to submit a response in their written comments to the proposed classification of as described above, particularly if they have concerns or questions.

7 Stakeholder Engagement

Table 3 outlines the proposed schedule to complete the policy for the EIM resource efficiency evaluation enhancements:

On September 2, 2022 the CAISO will hold a stakeholder call to present its straw proposal, comments on the straw proposal will be due September 12, 2022. The CAISO recognizes this an accelerated timeline for this initiative, however the proposed milestones are being offered in an effort facilitate a summer of 2023 implementation.

Table 3

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Date	Milestone
<i>August 25, 2022</i>	Publish Draft Final Proposal
<i>September 2, 2022</i>	Stakeholder Call for Draft Final Proposal
<i>September 12, 2022</i>	Stakeholder comments due on Draft Final Proposal
<i>August / September 2022</i>	Development of Draft Tariff Language and BRS
<i>September 19, 2022</i>	Discussion at Market Surveillance Committee
<i>September 26, 2022</i>	Publish Final Proposal
<i>October 26, 2022</i>	Decision at Joint Governance Meeting
<i>June 1, 2023</i>	Implementation