



California ISO

WEIM Resource Sufficiency Evaluation Enhancements Phase 2

Second Revised 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 Revised Final 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 and in response is putting forth revisions to its final 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 revised final proposal:

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Table 1 – Stakeholder Comments and Changes from Final Proposal

Topic	Notes/Changes from Previous Proposals
Incorporation of load conformance in RSE	No change
Curtailement of LPT exports	No change
Exclusion of LPT exports from the CAISO's obligations in the WEIM RSE	No change
Change to the designation of LPT exports on e-tags and clarification to scheduling priorities after HASP	No change
LPT curtailment priority	Clarification that LPT exports can be curtailed subject to operator judgement and consistent with good utility practice
RSE capacity test uncertainty adders	No change
Curing supply insufficiencies through WEIM assistance energy transfers	No Change
Allocation of WEIM assistance energy revenue	No change
Monitoring for misuse of WEIM assistance energy	No change
WEIM decisional classification	No change

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.

The WEIM RSE's capacity and flexible ramping tests address the first objective of preventing inappropriate use of the capacity of other market participants; the balancing test also provides a level of protection against inappropriate use, however that is not its primary objective.

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 proposal 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

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

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- 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 proposal 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 end, the proposal is for rule 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 stakeholder process 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 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

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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-for-1 increase in WEIM transfers.² Given the complex interactions that drive market outcomes, the proposal 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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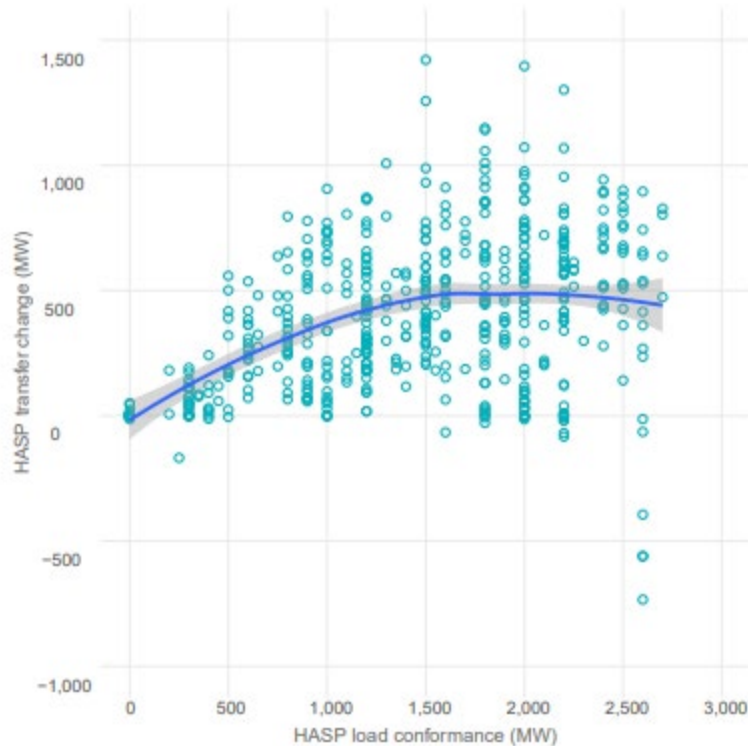


Figure 1: HASP Load Conformance vs WEIM Transfers

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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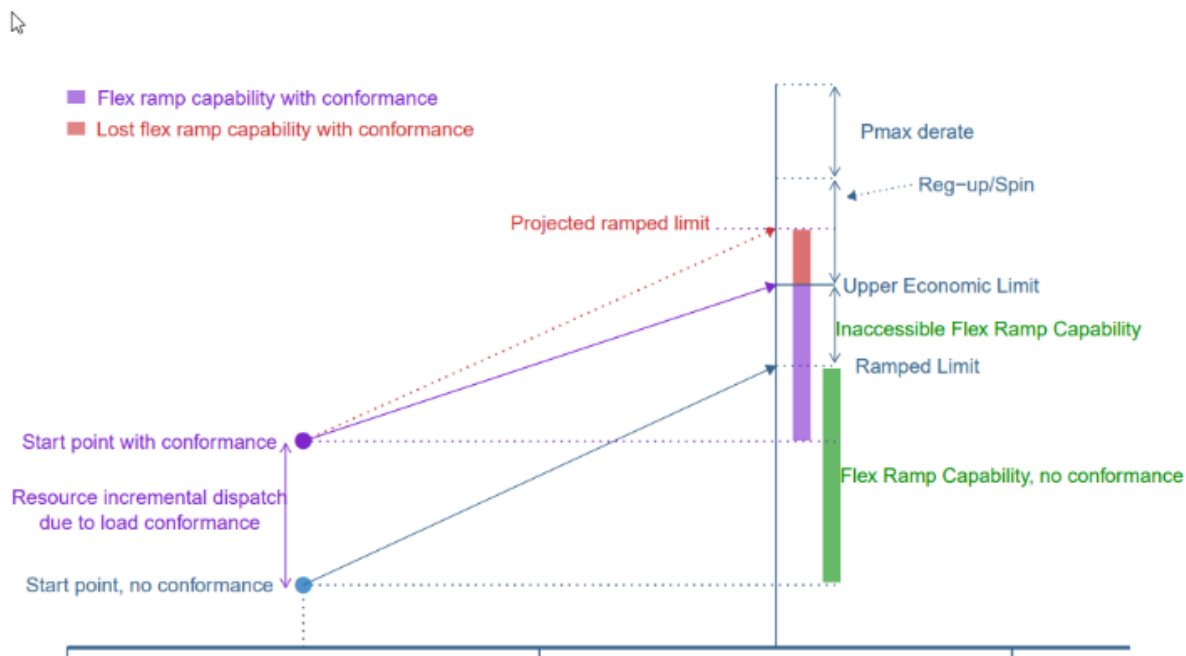


Figure 2: Illustration in reduction in resource flexibility due to load conformance

Given these findings, the proposal is to not make 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 proposal 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.

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4.2.1 Background

The real-time market's 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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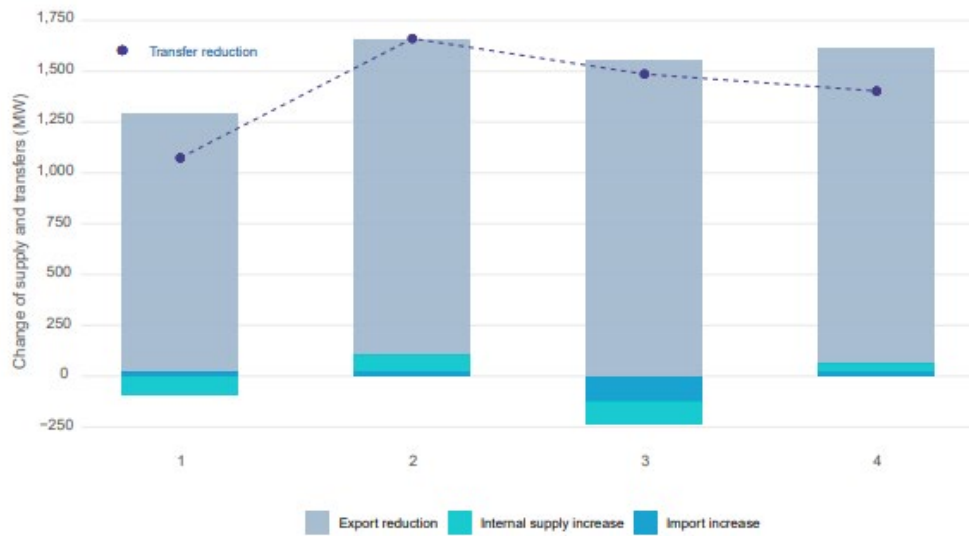


Figure 3: Changes of exports and supply relative to changes in WEIM transfer -July 9, 2021, HE19

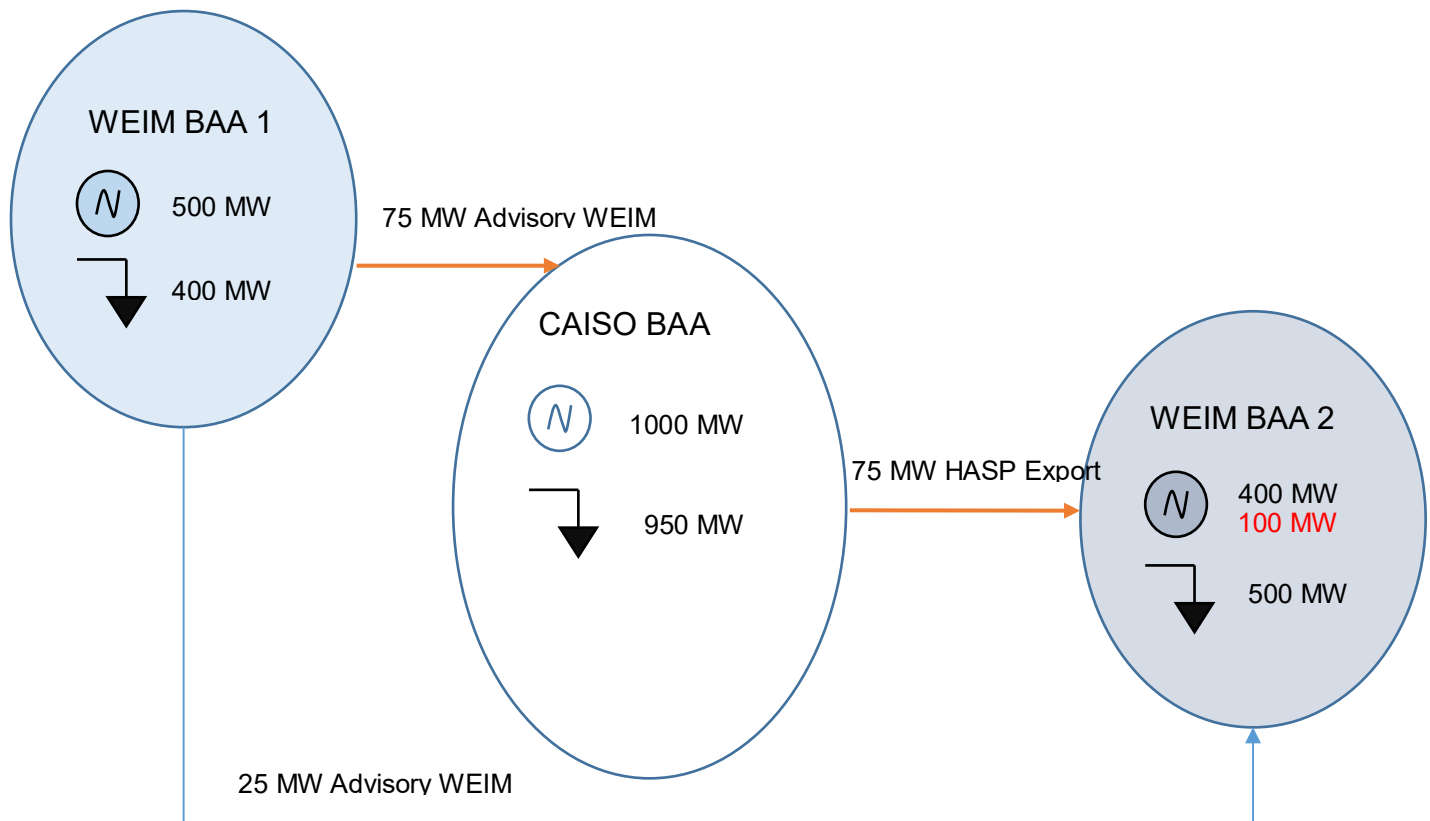


Figure 4: Graphic Example of HASP Export Advisory WEIM import interaction

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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 WEIM RSE, they do not count in the final WEIM 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. LPT exports offers that are not able to be cleared by the HASP process should not be represented on the base schedule of any WEIM BAA.

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

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internal CAISO BAA resources, or with imports or WEIM transfers. As the HASP is 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 prior to participating in the real-time market, the CAISO BAA should not experience a failure of the WEIM RSE based on LPT schedules. While the CAISO BAA retains the ability to curtail all LPT exports, the existing sequencing of the market makes it unlikely DA LPT exports could result in a failure of the WEIM RSE, as the exports would have been cleared absent potential influence of WEIM advisory transfers, and would be required to re-bid into the real-time market to potentially address any changes to the supply that cleared the exports in the day-ahead process. Therefore the proposal is to count high priority block hourly export transfers, day-ahead cleared lower priority exports 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

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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 proposal puts forth the following rules for the RSE test for the RSE calculations for the CAISO BAA.

4.2.2.1 Capacity Test

The proposal is to only to count demand, net-load uncertainty,⁹ exports that meet the high priority criteria, or lower priority exports that have cleared the ISO's day-ahead market process, in the WEIM RSE capacity test obligation for the CAISO BAA. As described above, no longer including real-time LPT exports is appropriate because HASP may schedule LPT exports at the CAISO BAA interties based on WEIM energy transfers. Including LPT exports that have cleared the day-ahead process is reasonable as the ISO has previously determined that they can be supported through the reliability unit commitment process; any changes to the resultant supply mix that resulted in these LPT exports clearing would already be accounted for as the exports would be required to re-bid into the real-time market, would not clear the subsequent HASP process, and thus would not be added to the CAISO BAA's RSE obligation.

4.2.2.2 Flexible Ramping Sufficiency Test

The proposal is to only count demand, net-load uncertainty,¹⁰ exports that meet the high priority criteria, or lower priority exports that have cleared the ISO's day-ahead market process 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 real-time LPT exports is reasonable as the HASP may schedule LPT exports at the CAISO BAA interties based on WEIM energy transfers. Day-ahead LPT exports are reasonable to include in the CAISO BAA's RSE obligation for the reasoning provided in 4.2.2.1.

The proposal is to account for demand, net-load uncertainty and all LPT exports in the derivation of its flexible ramping sufficiency downward requirement. LPT exports signify a willing off-taker of supply made available to the 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.

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

¹⁰ The net-load uncertainty requirement in the capacity test is currently suspended.

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4.2.2.3 WEIM Entity Treatment of HASP Awards

In response to stakeholder feedback, the proposal is to no longer proposing any rules discounting LPT exports that are shown within the base schedule for WEIM BAAs. The proposal recognizes that allowing for these exports to count creates an asymmetry. However, 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.
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. WEIM BAAs would only be able to count LPT exports that clear the HASP in the final RSE run, which occurs after HASP is complete.

The proposal recognizes that this may inadvertently allow WEIM BAAs to count in their base schedules WEIM transfer supply that is “firmed up” by the 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 proposal is to require LPT exports be e-tagged as “Firm Provisional Energy (G-FP).”¹¹ 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 day-ahead and real-time market¹² 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 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 proposal is 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 proposal is limited to 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 market on a day-ahead basis.

The proposal is to continue to retain operator discretion regarding the curtailment of LPT export transfers out of the CAISO BAA. The advisory results produced by the 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.

¹¹ 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

¹² CAISO tariff section 34.12

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The CAISO BAA system operators would curtail these exports within the hour when it does not have enough resources to meet its load and reserve obligations. Subject to operator judgement and consistent with good utility practice, this would happen even before the CAISO BAA is in an Energy Emergency Alert (EEA) 3. When the CAISO is in an EEA 3, subject to operator judgement and consistent with good utility practice, it will require 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.

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 Flexible Ramping Product (FRP) has been 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 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.¹³ This same uncertainty requirement is used as part of the calculation

¹³ [Flexible Ramping Product Requirements - Appendix C "Quantile Regression Approach"](#)

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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 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 that will be monitored.

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 intertie uncertainty adder¹⁴ was suspended 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 deviation¹⁵ and a highest absolute deviation¹⁶. 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 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 intertie 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.¹⁷

¹⁴ FERC Order Accepting Tariff Revisions (ER22-1278)

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

¹⁶ $Absolute\ deviation = \sum Base\ Schedules_{T-40} - \sum Tagged\ Schedules_{T-20}$

¹⁷ [CAISO Report on Intertie Deviation adder for the WEIM Resource Sufficiency Evaluation Enhancements](#)

4.3.2 Revisions to Uncertainty in the WEIM RSE

The proposal is 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.¹⁸ In the straw proposal, the proposal 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 proposal was 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. Its performance would then be assessed 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.¹⁹

With regard to the inertia uncertainty adder, the proposal is to permanently remove it from the capacity test. Analysis performed by the CAISO shows that the existing methodology 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 use of 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.

¹⁸ *ibid* 13

¹⁹ [Flexible Ramping and Inertia Deviation Uncertainty in the Western Energy Imbalance Market; June 22, 2022](#)

5 Phase 2 – Energy Assistance through the WEIM

The proposal is 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. The proposal is that each BAA retain discretion on whether it wants to be eligible to receive assistance energy as part of its participation in the WEIM. Transfers will be sourced from supply offers voluntarily made into the WEIM.

During the previous iteration of the proposal, stakeholders raised concerns with an “in-market” assistance energy transfer design. Specifically, that the design necessitated changes to scarcity pricing and would result in changes to penalty prices. Several stakeholders also pointed out that the CAISO BAA is differently situated than other WEIM BAAs in that its real-time imbalance energy is settled off of its day-ahead schedule rather than a base schedule that is submitted up to forty minutes prior to the hour. They contended that this asymmetry significantly increased the volume of real-time imbalance energy that is exposed to the assistance energy transfer cost. In response to these concerns the CAISO feels it is more appropriate to consider the WEIM RSE failure consequences for an assistance energy product that explicitly impacts price formation as part of a more holistic scarcity pricing design within the *Price Formation Enhancements* initiative.

Other stakeholders raised concerns regarding the optional nature of assistance energy. The proposal considered eliminating the voluntary nature of this functionality, however it does not propose mandatory participation as the inaccuracies inherent to the ex post surcharge design discussed below create a financial liability that each WEIM BAA should retain control over their exposure to. Instead, the proposal aims to address this asymmetry and put forward a design that encourages more WEIM BAA's to participate.

The CAISO will continue to look to refine the consequences for failing the WEIM RSE, such as limiting WEIM transfers in a way that does not exacerbate reliability issues for WEIM BAA's. The proposal is to sunset this assistance energy design no later than December 31, 2025. This will serve to provide an opportunity for an “in market” assistance energy design to be completed and implemented in future initiatives such as *Price Formation Enhancements* and *RSEE Phase 3*.

5.1 Curing Resource Undersupply Conditions

The CAISO proposes that BAAs be able to elect whether they want to utilize assistance energy as part of their participation in the WEIM. If a BAA does not elect to utilize energy assistance, the 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 prior to the failed interval from the last passed run, or to the base scheduled transfer amount if greater. Continuing to provide the current rule set as an option ensures that a BAA's reliability is not further degraded through the WEIM following a failure of the WEIM RSE.

If a BAA has elected to utilize assistance energy and the BAA is short on supply or upward ramping capability resulting in a failure of the WEIM RSE in the upwards direction, the proposal is to allow the BAA to still receive WEIM energy transfers. The BAA would then pay an after-the-fact or "ex post" surcharge. This surcharge will serve as an hourly capacity payment to the WEIM in exchange for the ability to access energy from the remainder of the WEIM footprint.

The CAISO's settlement systems will apply an ex-post cost of either \$1,000/MWh or \$2,000/MWh depending on whether the market is accepting bids above the \$1,000/MWh soft bid cap.²⁰ This surcharge will be applied to all dynamic WEIM import transfers into a BAA that has failed the WEIM RSE. Varying the level of the ex post surcharge will serve as a proxy to scale the surcharge during stressed or abnormal system conditions. Lower ex post surcharge levels to provide gradation within normal system conditions were considered, however additional analysis and stakeholder feedback would be necessary to develop price thresholds and surcharge levels supported by a broad subset of stakeholders.

To limit inaccuracies inherent to an ex post settlement the proposal limits the surcharge to the lower of (a) the quantity of upward WEIM RSE failure of the capacity or flexible ramping sufficiency test, or (b) the dynamic WEIM transfers that are tagged. Using the minimum of these values attempts to limit non optimal settlements that can arise due to the ex post design not accounting for these costs explicitly in the market optimization. The surcharge will only be applied to net-import WEIM transfers, if conditions change such that the WEIM BAA who has failed the WEIM RSE is exporting no surcharge or payment will result.

²⁰ 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.

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The following series of examples are intended to show how the ex post surcharge will be applied; for simplicity sake no physical or schedule transfer limits are present. The examples show how applying the minimum quantity of the alternatives as explained above would be implemented. The examples also show more complex interactions where the market schedules dynamic WEIM transfers because it perceives those transfers as efficient compared to dispatching more expensive generation internal to the failed BAA.

The simple example in Figure 5 shows the market only clearing WEIM transfers needed to cure the deficiency. In this example BAA1 fails the WEIM RSE by 100 MW and receives 100 MW of transfers from BAA 2. The transfers are settled at market prices; BAA 1 is then assessed a surcharge of \$1000/MWh for the transfers it receives.

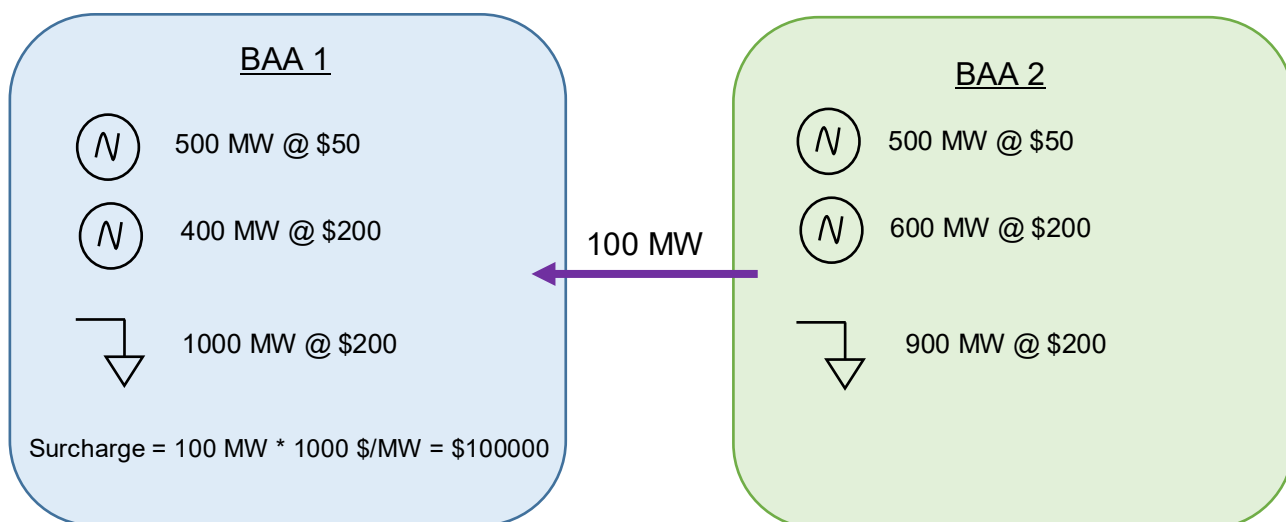


Figure 5: Simple Example of Ex Post surcharge

The next example described in Figure 6 shows how the surcharge amounts would be limited by the RSE failure quantity. In this example BAA 1 fails the WEIM RSE by 100 MW due to only having 900 MW of supply for its 1000 MW of obligation. However, due to the supply offers made available to the real-time market, 25 MW of supply offered within BAA 1 is displaced by 25 MW of economic transfer from BAA 2. These economic transfers occur in addition to the 100 MW of assistance energy transfers that are needed to resolve the deficiency in BAA 1. Basing the surcharge on the minimum of the failure amount or the tagged transfers ensures that BAA 1 does not have the 25 MW of transfers that result from economic displacement incorrectly exposed to the surcharge. This limitation does have the potential to cap the surcharge exposure for BAA 1 for any changes between when the final RSE is run at T-40 and the real-time conditions that necessitate additional transfers to cure the deficiency. This trade-off is made on the assumption that conditions deteriorating further from what was observed in the T-40 RSE are lesser in magnitude than economic displacement transfers resulting from the WEIM's optimal solution.

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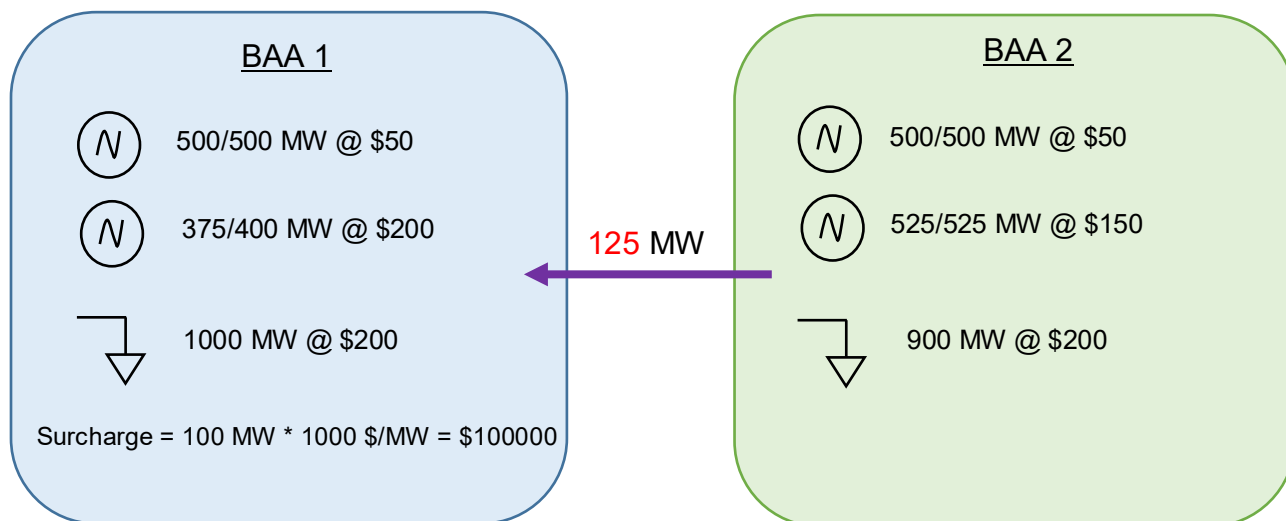


Figure 6: Surcharge based on minimization of RSE failure amount

The next example described in Figure 7 shows how the surcharge would be based on the tagged flows rather than the RSE failure amount. This allows for potential changes in generation availability or the actual materialization of forecast demand to be captured in the surcharge to some extent. To the extent that fewer transfers are scheduled compared to the RSE failure amount, the WEIM BAA who has failed the RSE would only have those transfers exposed to the surcharge. In this example BAA 1 fails the RSE by 100 MW, but the full 1000 MW of load does not materialize; rather 950 MW does. In this case only 50 MW of WEIM transfers are needed to cure BAA 1’s deficiency. Under the proposed design the surcharge for BAA 1 would be based on the minimum of their failure amount or materialized transfers. Thus the surcharge is based on the 50 MW of transfers.

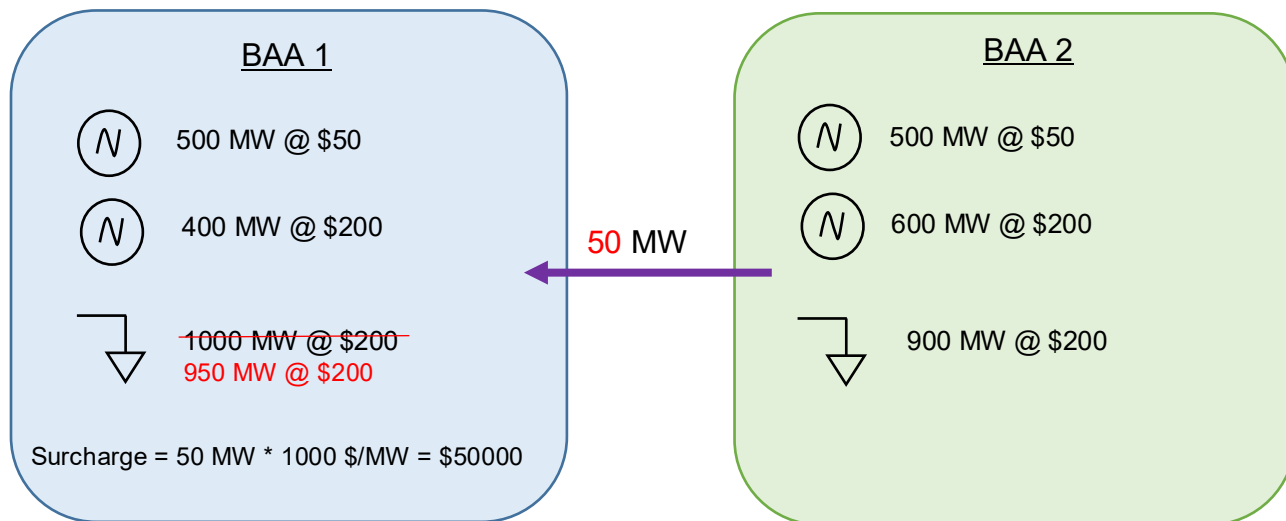


Figure 7: Surcharge based on minimization of failure quantity or materialized transfers

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There remains the potential that improved operational conditions would not result in lower WEIM import transfers due to the economic displacement that results from the real-time markets optimization. An example of this interaction can be seen in Figure 8. In this example, BAA 1 fails the RSE by 100 MW, but the full 1000 MW of load does not materialize; rather 950 MW does. Only 50 MW of WEIM transfers are needed to cure the insufficiency. However, due the supply offers made available to the real-time market, 25 MW of supply offered within BAA 1 is displaced by 25 MW of economic transfer from BAA 2. These economic transfers occur in addition to the 50 MW of assistance energy transfers that are need to resolve the deficiency in BAA 1. Since the optimization is not able to consider the ex post cost which would price the transfers at \$1150/MWh, the optimal result will include 25 MW of economic displacement which is then exposed to the \$1000/MWh surcharge. While the failure quantity of the WEIM RSE places an upper bound on the exposure to this result, each WEIM BAA will have to decide if this financial risk is an acceptable trade-off for the increased reliability that can be derived from accessing assistance energy transfers.

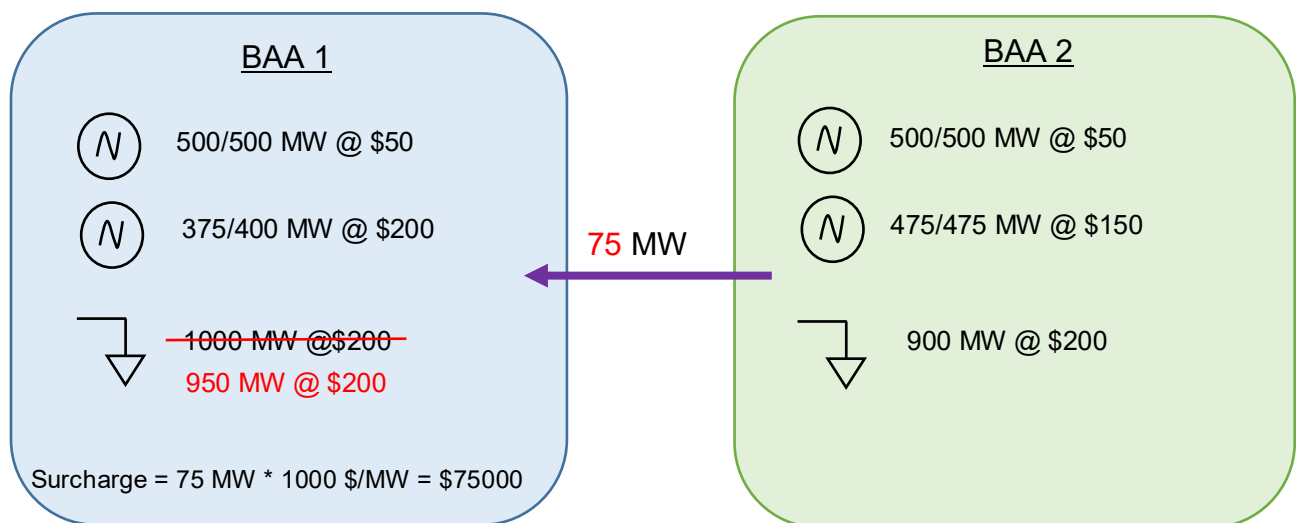


Figure 8: Example of potential for ex post settlement to be applied to WEIM transfers resulting from economic displacement

The proposal will also provide optionality if a WEIM BAA would like their available balancing capacity (ABC) to be considered as a credit to reduce the volume of WEIM transfers exposed to the surcharge. Optionality on this functionality is appropriate as the capacity that constitutes ABC may be designated as part of each WEIM BAA’s ancillary service requirements. By allowing ABC capacity to be netted on a 1 for 1 MW basis off the WEIM import transfer amount that is exposed to the ex post cost, each BAA retains some ability to mitigate their exposure to the ex post cost for spurious failures for the WEIM RSE during non-stressed system conditions.

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The proposal is for the election to utilize assistance energy to be made in the Master File and any changes to that election will occur through the existing Master File process²¹. This allows BAAs optionality in curing resource insufficiency, either including the ability to utilize WEIM, or to access emergency supply. 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 offering more granular functionality may not be necessary.

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. A more granular ability to access this functionality could result in strategic decisions to fail the WEIM RSE and cure through a combination of bilateral emergency energy assistance WEIM transfers limited to the values in the last passed interval that include no surcharge, as an economic alternative to curing through assistance energy transfers. In addition, because of resource and timing constraints, the only option that can realistically implement by summer 2023 is to provide for elections through the Master File.

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 proposal is to allocate the assistance energy revenue pro-rata by net WEIM export transfer amount, excluding base transfers, 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

The previous proposals have 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. This option has been ruled out this option as it would not be feasible to implement by summer 2023 because of resource and timing constraints. The settlement system already calculates the net export transfer quantity information.

²¹ [CAISO Business Process Manual for Managing Full Network Model](#)

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Information on bid amounts and RSE obligations would require additional system integration effort that would put summer 2023 implementation at risk.

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

The proposal is that WEIM BAAs charge for any assistance energy revenue received as defined in their OATT. For the CAISO BAA, the proposal is to sub-allocate the assistance energy charge to measured demand.

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. The proposal is 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.

Administrative consequences for BAAs that misuse this functionality is a potential avenue for design; however, the comments did not indicate broad support for any specific means to prevent misuse. Based on this feedback the proposal is 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 proposal put forward the concept of providing for oversupply 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 straw proposal proposed to allow exports from a BAA failing the RSE in the downward direction once pre-defined conditions have been met.

²² NERC TOP-001-5

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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) No longer include LPT exports when calculating the CAISO balancing authority area's WEIM resource sufficiency obligation (Section 4.2.3).
- (2) 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 (3) 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 (3) 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

Note that the revised draft final proposal additionally included a change to permanently remove the intertie uncertainty adder from the resource sufficiency evaluation's capacity test. As that uncertainty adder is not currently specified in the CAISO tariff, this element of the proposal does not in fact require a change.

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 (3), 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 (3), 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:

Table 3

Date	Milestone
<i>December 14, 2022</i>	Decision at Joint Governance Meeting
<i>June 1, 2023</i>	Implementation