



California ISO

EIM Resource Sufficiency Evaluation Enhancements Phase 1

Revised Draft Final Proposal

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Table of Contents

1	Introduction	4
2	RSE Background	5
	2.1 Resource Sufficiency Evaluation Purpose and Principles	5
3	Changes to the Revised Draft Final Proposal	7
4	Stakeholder comments	8
5	Proposal – Phase 1	16
	5.1 Resource Sufficiency Evaluation Design Changes	16
	5.1.1 Capacity Test Modifications – Intertemporal Constraints.....	16
	5.1.2 Flexible Ramping Test Modifications	21
	5.1.3 Balancing Test Modifications	23
	5.1.4 Generally applicable modifications	26
	5.1.5 Net-Load Uncertainty Calculation	31
	5.1.6 Intertie Uncertainty Calculation.....	32
	5.2 Resource Sufficiency Test Transparency.....	32
	5.2.1 Additional Transparency	32
	5.2.2 Increasing EIM entities situational awareness regarding test performance	34
6	Proposal Phase 2	35
	6.1 Resource Sufficiency Evaluation Failure Consequences	35
	6.2 Load Conformance.....	36
	6.3 Demand Response Monitoring.....	37
7	EIM Decisional Classification	37
8	Stakeholder Engagement	38
9	Appendix 1 – Background RSE information.....	39
	A. Existing Design	39
	a. Feasibility Test	39
	b. Balancing Test	40
	c. Capacity Test	41
	d. Flexible Ramping Sufficiency Test	42

Revised Draft Final Proposal

- B. August 2020 Events 44
 - a. Impact of August events on the entire EIM 46
 - b. DMM's 2020 analysis on bid range capacity tests..... 47

1 Introduction

The purpose of this initiative is to explore, with stakeholders, further improvements to the EIM resource sufficiency evaluation (RSE). The CAISO and stakeholders reviewed several potential changes in the recent *Market Enhancements for Summer 2021 Readiness* initiative. That initiative added net load uncertainty to the RSE's capacity test. This initiative's goal is to continue reviewing potential enhancements to ensure the RSE is administered accurately and applied equitably.

To date, the CAISO has published multiple proposals and has held multiple meetings and workshops to obtain stakeholder input on refining the proposed scope of this initiative. Based on that stakeholder input, the CAISO proposes to bifurcate this initiative into two phases. This will allow the CAISO to implement enhancements that improve the accuracy and transparency of the RSE more quickly. The enhancements the CAISO proposes to implement as a first phase include:

- Consideration of intertemporal constraints in the capacity test
- Consideration of interchange schedule reliability
- Adjustments to the initial reference point used in the RSE's flexible ramping sufficiency test
- Consideration of net load and inertia uncertainty that is currently applied to the capacity test component of the RSE
- The ability for the RSE's capacity test to account for a demand response that is not explicitly modeled in the real-time market
- Treatment of energy from capacity made available through energy emergency actions
- Allocation of funds resulting from failures of the RSE's balancing and subsequent under and over scheduling test
- Increased RSE data on RSE results and additional data transparency and reporting
- Rules for counting storage resources

The improvements to the RSE made in the first phase will then serve as a baseline for the second phase of the initiative in which the CAISO and stakeholders will consider:

- RSE failure consequences

Revised Draft Final Proposal

- Consideration of the treatment of storage resources within the RSE
- Consideration of adjustments made to a balancing authority area's load forecast, including load conformance used by the real-time market
- Consideration of treatment for distributed energy resources
- Methods to account for CAISO hourly export awards that are cleared in HASP based on access to advisory EIM transfers
- Consideration of relaxation of the flexible ramping sufficiency down requirement during periods of high marginal energy prices
- Consideration of potential further measures to prevent misusing the ability to adjust the load forecast used by the RSE to account for demand response

This paper provides background information on the RSE. It details the policy changes needed to increase RSE accuracy and transparency that the CAISO proposes to make in the first phase. It proposes a scope of the policy changes the CAISO plans to address in a second phase, detailing how the outcome of the first phase will inform the policy develop in the second phase. It concludes with a proposed decisional classification and schedule.

2 RSE Background

This section reviews at a high level the purpose of each RSE component test as well as the principles under which the RSE design is intended to fulfill.

2.1 Resource Sufficiency Evaluation Purpose and Principles

The purpose of the resource sufficiency evaluation is to ensure each EIM entity is able meet their demand with their own net-supply prior to engaging in transfers with other balancing authority areas through the EIM in the real-time market. The purpose is also to ensure an EIM entity submits balanced supply and demand schedules, while providing EIM entities information about potential congestion within their balancing authority areas. This is accomplished by meeting the following objectives: 1) ensuring that balancing authority areas do not lean on the real-time capacity, flexibility and transmission of other balancing authority areas in the EIM footprint, and 2) providing an incentive for EIM entities to submit base schedules that balance supply and demand as well as a means to check for potential internal congestion.

Revised Draft Final Proposal

The RSE's capacity and flexible ramping tests address the first objective of preventing leaning. Leaning has been defined as an EIM entity participating in the EIM without sufficient capacity and ramping flexibility to cover its balancing authority area demand, including net load uncertainty. The RSE's balancing test protects against an EIM entity submitting strategic base schedules solely to arbitrage and profit from differences in imbalance energy prices between supply and demand. The RSE's feasibility test serves as means for EIM participants to check whether their initial base schedules are feasible considering congestion.

The RSE's capacity and flexible ramping tests do not determine if a balancing authority area is able to meet its individual reliability requirements, rather it is a real-time test that serves as a prerequisite for EIM participation. Ensuring each EIM entity meets their reliability requirements is addressed by individual EIM entities' resource adequacy requirements determined by their regulatory authority, and by NERC reliability standards¹. The capacity and flexible ramping sufficiency tests do not necessarily ensure a balancing authority area is resource adequate. Rather, it addresses concerns with leaning through limiting receiving from and/or sending EIM energy transfers to other balancing authority areas when a balancing authority area fails the tests.

The CAISO reiterates the voluntary nature of participation that the existing EIM design allows. The RSE is not intended to set reliability requirements or a minimum amount of capacity that must be offered into the EIM. Rather with that understanding, the RSE has been generally accepted as intended to be consistent with the following principles:

- Leaning is participation in the EIM without sufficient capacity and ramping capability to meet expected load
- The resource sufficiency evaluation should accurately and transparently measure the capacity and ramping capability of a balancing authority area prior to allowing additional incremental transfers into or out of the balancing authority
- The consequences of resource sufficiency evaluation failures should not cause operational or reliability issues
- The resource sufficiency evaluation does not dictate resource adequacy or integrated resource plans in individual balancing authority areas

Stakeholders have generally agreed with the CAISO's proposed design principles, although some have noted that the prevention of leaning has not been discretely identified as a principle. The CAISO agrees that the intent of the RSE is to prevent

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

Revised Draft Final Proposal

leaning, and believes that this is accomplished through an accurate and transparent measure of the capacity and ramping capability made available by each balancing authority area, which is listed as a principle. Stakeholders have also put forward the idea that the RSE is designed to ensure reliable operation and to better incent more robust forward procurement. Reliability remains the obligation of each balancing authority area. Meanwhile, forward procurement remains the responsibility of each local regulatory authority's resource adequacy or integrated resource plans. Neither of these suggestions are consistent with the voluntary premise under which the EIM is operated.

The CAISO understands the perspectives stakeholders have put forth and believes its proposed principles strike an appropriate balance of addressing these concerns while striving to prevent leaning, given the different methods available to participate in the real-time market

3 Changes to the Revised Draft Final Proposal

Changes	Details
Intertemporal constraints	Additional detail provided on: <ul style="list-style-type: none"> • Making configurable capacity made available through the STUC horizon that is not online at the time of the RSE • Clarifying rules regarding resource use limitations and capacity crediting • Treatment of storage resources
Load Conformance	<ul style="list-style-type: none"> • Proposing to defer consideration until phase 2 • Proposing to continue data analysis, with planned workshops to discuss analysis between phase 1 and 2 of the proposal
Net Load Uncertainty	<ul style="list-style-type: none"> • Propose to remove the net load uncertainty adder in the capacity test pursuant to existing tariff authority.
Intertie Uncertainty	<ul style="list-style-type: none"> • Propose to remove intertie uncertainty from the RSE capacity test.

Revised Draft Final Proposal

Interchange Reliability	<ul style="list-style-type: none"> Clarifying T-40 transmission profile requirement applies to all interchange awards
Demand Response	<ul style="list-style-type: none"> Remove any proposed penalties targeted towards the new demand response functionality
Emergency actions	<ul style="list-style-type: none"> Add adjustments to system operating voltage, outside of normal operating parameters, for the purposes of reducing power consumption, as a demonstration of resource insufficiency

4 Stakeholder comments

Stakeholders submitted comments on the October 6 draft final proposal and participated in a stakeholder call held on October 12, a Market Surveillance Committee (MSC) meeting discussing the RSE on November 19, and a workshop on December 8. The comments received by the CAISO indicate stakeholder support for a number of elements of the proposal including changes to the balancing test, flexible ramping sufficiency test, treatment of CAISO intertie schedules, treatment of balancing authority area emergency actions as well as the changes to data transparency and reporting. Stakeholders in their comments did express concern on elements of the proposal relating to uncertainty, demand response, capacity test counting rules as well as the consideration of load conformance.

Importantly, written stakeholder comments and discussions during the recent stakeholder and MSC meetings have pointed out that the RSE design should consider that the CAISO balancing authority area is differently situated and has different practices than EIM entity balancing authority areas operating under an OATT framework. This is highlighted in how the RSE proposes treatment for the balancing test, interchange awards, the use of demand response as well as its use of load conformance. The CAISO believes that this revised draft final proposal appropriately balances increasing the RSE's accuracy while accounting for these differences.

The main difference is that the CAISO, going into the CAISO's fifteen-and five-minute markets, uses the outcome of the real-time market's optimization to commit and schedule resources. The market optimizations include the hour-ahead scheduling process's optimization schedules that commits supply resources for the hour. Depending on the economics, it may use CAISO internal generation, imports at the

Revised Draft Final Proposal

CAISO interties, or EIM transfers to meet the CAISO's capacity and flexibility needs. It may also schedule exports at CAISO interties, which may go to both EIM and non-EIM balancing authority areas that count against the CAISO in the RSE; these exports can be backed by CAISO internal generation or access to EIM transfers.² There is no constraint in the hour-ahead scheduling process's optimization that ensures that EIM energy transfers do not help the CAISO pass the RSE or that exports at CAISO interties do not cause it to fail.³

On the other hand, EIM entities go into the CAISO's fifteen- and five-minute markets with EIM resource base schedules they develop outside of the CAISO market using manual processes. Consequently, EIM entities can more readily ensure they have committed sufficient internal generation or scheduled imports to the RSE. They also can more readily ensure they do not schedule bilateral exports that would prevent them from passing the RSE.

The remainder of this section summarizes the changes the CAISO has made in this revised draft final proposal relative to the October 6 draft final proposal and describes changes that stakeholders suggested but the CAISO did not make.

Balancing Test

Regarding potentially extending the RSE's balancing test to apply to the CAISO balancing authority area, the CAISO understands stakeholder concerns regarding both resources in the CAISO balancing authority being re-dispatched as a result of out-of-balance EIM entity base schedules, as well as the CAISO's potential to be under scheduled as a result of its market clearing process.

The CAISO maintains its proposal to continue to exclude the CAISO, or any other entity that does not use the base scheduling process as its means of participation in the EIM from the balancing test. The test is designed to provide financial incentives for base schedules to more closely align with forecasted demand; the CAISO market process has a number of features that are explicitly intended to ensure that same alignment.

However, the CAISO maintains its proposal that any entity that is not subject to the balancing test should be excluded from any revenues derived from the balancing test, even if that entity ultimately helps to cure the over- or under-scheduled base schedules.

² This exports are CAISO interties are distinct from EIM dispatched energy transfers out the CAISO. The fifteen-minute market may also schedule exports at CAISO

³ Such a constraint would be complex and likely require additional market runs, likely making it infeasible to implement.

Revised Draft Final Proposal

This proposal provides a balanced solution that accounts for the different ways entities participate in the EIM.

Flexible Ramping Sufficiency Test

PG&E asked for additional clarification regarding how the CAISO would implement its proposed enhancement to the flexible ramping sufficiency test that would account for instances in which the real-time market must relax the power balance constraint modeled for a balancing authority area.

The flexible ramping sufficiency upward and downward requirements are calculated using as a reference, the real-time pre-dispatch interval results immediately prior to RSE's hour of evaluation. To the extent that the market solution contains a power balance constraint relaxation, that quantity may artificially bias the upward and downward requirements as the resulting calculation will not reflect the expected operating conditions the test is ensuring the ability to ramp from.

The CAISO's proposed enhancement is to account for the difference between the market solution and expected operating conditions when the flexible ramp sufficiency requirements are determined.

CAISO Intertie Schedules

The majority of stakeholders support RSE provisions that discount import schedules that are not reasonably assured of being delivered. The CAISO proposes to enhance the existing provisions and not count CAISO intertie schedules (imports and exports) for which an e-tag with at least a transmission profile is not submitted by 40 minutes prior to the operating hour. This change is consistent with an existing market rule that does not dispatch these intertie schedules in the fifteen-minute market if an e-tag with at least a transmission profile is not submitted by 40 minutes prior to the operating hour.

The CAISO recognizes that the proposed timing of discounting of the import awards does not provide the CAISO with a curing period to re-procure the supply that was discounted for the purposes of passing the RSE. However, the CAISO's existing practice of not dispatching these resources makes them inappropriate to count for purposes of passing the RSE.

Balancing Authority Area Emergency Actions

In the draft final proposal, the CAISO proposed to classify some emergency actions that can be taken by a balancing authority area as a demonstration of resource insufficiency. This proposed change will help ensure that to the extent the RSE does not capture all instances of resource insufficiency, entities are not able to lean on the capacity or flexibility of other entities during obvious emergency conditions.

Revised Draft Final Proposal

While this proposal has near unanimous stakeholders support, some stakeholders have raised a concern that the proposed triggering actions are targeted to the actions taken by the CAISO during the August 2020 events, such as the deployment of operating reserves to serve demand. In response to those comments, in this revised draft final proposal, the CAISO is proposes to add additional criteria for the RSE to deem a balancing authority area resource insufficient. These are operator directed voltage reductions, outside of nominal voltage ranges, made for the purpose of reducing load during emergency conditions. Further, the CAISO requests that stakeholders identify other actions they believe demonstrate resource insufficiency so they can be considered in phase two of the *Resource Sufficiency Evaluation Enhancements* initiative.

Counting of offline resources

In this revised draft final proposal, the CAISO maintains its proposal for the RSE's capacity test to count only capacity made available to the real-time market that the real-time market can start or could have started. This change corrects over-counting of capacity that occurred during the August 2020 events in which the CAISO received credit for a generator during several hours in which the generator was starting-up after an outage. This change improves the existing capacity test that counts all capacity made available to the real-time market not considering start-up time.

The CAISO maintains its proposal that this includes capacity available to the real-time market's short-term unit commitment process (STUC), as well as capacity that is able to be dispatched by the real-time unit commitment (RTUC) process. This includes capacity offered throughout the STUC horizon, even if a resource was not committed by STUC and whose start-up time does not allow RTUC to start it. All capacity that is made available for the real-time market to optimally use should count towards an entity showing resource sufficiency in meeting their forecasted obligations.

Although some stakeholders maintain that the RSE should only count capacity from resources that RTUC can start for the upcoming hour, and not count offline resources that only STUC can start, the CAISO believes that this approach would undercount capacity and could create adverse market incentives. It would undercount capacity because STUC is an integral part of the real-time market, and resources that can only be started by STUC are nonetheless available to the real-time market. Furthermore, STUC may not start a particular resource because there are more optimal resources. For example, STUC could not start a resource because EIM transfers into a BAA are more efficient. An approach that would not count capacity from these resources in this circumstance would create adverse incentives to self-schedule or change bid prices to ensure the resources are running so they count towards the capacity test. It could also

Revised Draft Final Proposal

create incentives to not follow dispatch instructions, such as to shut down or move to a lower multi-stage generator configuration.

Upon implementation of the revisions contained in the proposal, the CAISO proposes to count the maximum bid-in output of these resources; with no consideration to ramping constrains in the capacity test. The CAISO believes the addition of ramping constraints would both add significant complication to the capacity test while being somewhat duplicative of the ramping constraints that are embedded in the flexible ramping sufficiency test. In recognition of stakeholder concerns on the lack of accounting for ramping constraints leading to an over counting of capacity that was made available for use in the real-time market, the CAISO proposes to make this quantity configurable through a business practice manual process. While the CAISO will initially credit up to the maximum bid in capacity of the resource, the CAISO recognizes this can potentially over-represent the capacity for resources with less flexible characteristics. This approach is appropriate for the offline resources that are considered; the ability to ramp is largely implicitly accounted for in resources online or able to be started in the RTUC horizon through the flexible ramping sufficiency test. This will provide the CAISO with the ability to adjust the counting should reporting show that counting to a resources bid max is significantly over-representing the capacity available to the real time market for use.

Demand Response

The CAISO has previously proposed enhancements to classify expected demand response participation through forecast adjustments, as an EIM entity generated forecast; which results in the automatic application of the under-scheduling test. Stakeholders have raised concerns that automatic application of the under-scheduling test creates significant financial risk should the forecast vary significantly from actual demand, with no consideration given of the entities base schedule accuracy as compared to the demand forecast. The CAISO understands this concern and proposes to remove any unique penalties associated with the use of demand response in phase 1 of this proposal. To the extent misuse is observed through normal monitoring and reporting, the CAISO will look to develop more targeted penalties in the phase 2 policy development.

Intertie Uncertainty

In concert with its draft final proposal, the CAISO published analysis on the intertie uncertainty adder. This analysis highlighted the potential for the accuracy of this calculation to be improved, which the CAISO proposed to do in an open, transparent manner via the second phase of the resource sufficiency enhancements initiative. Stakeholders were supportive of the proposal to enhance the accuracy of this component of the RSE, however, requested the immediate suspension of the current

Revised Draft Final Proposal

calculation. The CAISO agrees with this sentiment and proposes to remove the intertie uncertainty calculation from the RSE capacity test.

Net-Load Uncertainty

Stakeholders in their comments also raised concerns over the continued inclusion of the net load uncertainty adder in the capacity test. They cited DMM analysis, which shows that the inclusion of the adder resulted in a significant increase in failures of the capacity test. While the increase in capacity test failures was not an unintended outcome of this change, the frequency or magnitude of capacity test failures supports a conclusion that the results were unintended. The CAISO believes this unintended result is may be due to the continued use of the histogram methodology, which does not ensure that this increase in failures is due to a well correlated increase in accuracy of the test.⁴ Given the delayed implementation of flexible ramping product refinements, and its quantile regression methodology which may be a viable replacement for the calculation of uncertainty, the CAISO believes this requirement should be removed. The CAISO would propose to re-add uncertainty to the capacity test once the proposed quantile regression methodology and its ability to calculate uncertainty relative to real time net load and variable energy output, or another suitable calculation for uncertainty, has been implemented and shown to be functioning as designed. The CAISO intends to provide notice that this requirement will be removed and will submit a report to FERC within 30 days of such notice supporting this conclusion.

Load Conformance

In their comments, some of stakeholders continue to maintain that the RSE's flexible ramping sufficiency test requirement for a balancing authority area should include the amount of load conformance made by the operators (i.e. the amount that they increase the load forecast used by the market.) The concern is that the CAISO typically makes significant load conformance adjustments in RTPD during peak hours. The CAISO acknowledges that there are instances where the use of load conformance, to the extent it results in EIM transfers that unload resources internal to the CAISO, can aid the CAISO in passing the flexible ramping sufficiency test. However, for the reasons described below, the CAISO believes the interaction of load conformance and transfers, as well as interactions of other market elements related to interchanges between balancing authority areas requires further analysis. Consequently, the CAISO plans to further consider this topic in the second phase of this initiative.

⁴ See CAISO Tariff section 29.34(l)(5) (providing for elimination of net load uncertainty from the capacity test if the frequency or magnitude of capacity test failures supports a conclusion that the results were unintended and caused by including the uncertainty requirement).

Revised Draft Final Proposal

Load conformance in RTPD is typically used by the CAISO as a mechanism for it to secure additional flexibility (i.e. ramping capability) through the real-time market. Its use in the real time market, starting in the HASP run, drives three potential market outcomes 1) the awarding of additional block hour import supply at the CAISO interties; 2) the commitment of additional generation internal to the CAISO balancing authority area (or merely increasing on-line generators' scheduled output); or 3) scheduling EIM import transfers in advisory market intervals. These outcomes are all dictated by market economics. The HASP process has no mechanism to ensure that the CAISO does not forego the commitment of additional internal generation, or the awarding of block hourly import supply based upon the potential availability of EIM transfers in the advisory runs.

Including the full quantity of load conformance in the RSE to account for potential increases in EIM transfers could result in the CAISO experiencing spurious failures of the RSE due to the optimization. This is because there is not a one to one correlation between load conformance and transfers. Load conformance may result in changing internal resource schedules or hourly imports rather than transfers. Also the EIM transfers occur because they are the most economic supply and not because they are the only supply available. The CAISO has shown through analysis that the HASP process has the potential to award block hourly exports from the CAISO based the assumed availability of EIM transfers⁵; to the extent this occurs this adds to the CAISO's capacity test obligations while not adding to its available supply.

Some stakeholders maintain that the CAISO's use of load conformance illustrates that the RSE is not accurately testing for the supply and flexibility the CAISO needs to operate the grid. The CAISO disagrees with this position. The RSE is not intended to serve as a reliability test, rather it is to ensure each entity brings sufficient supply and flexibility to the EIM such that each balancing authority area can balance their own demand, export obligations and ramping prior to engaging in economic transfers. This has long been understood and is evidenced by the fact the EIM specifically excludes dictating balancing authority areas ancillary service and reserve requirements. The CAISO's use of load conformance is intended to allow the CAISO to secure additional internal generation or block hourly supply; similar to the functionality that EIM entities currently poses through their base scheduling and bilateral transacting process, not increase EIM transfers.

The use of load conformance can result in EIM transfers that unload internal balancing authority area resources which aid the CAISO in passing the flexible ramping sufficiency test. However, the CAISO believes that additional analysis is needed to determine the

⁵ [Bautista Alderete, Guillermo, Resource Sufficiency Evaluation Performance on July 9, 2021](#) – Power Point Presentation

Revised Draft Final Proposal

impact and frequency of inappropriate passage of the RSE due to this practice. To the extent this can be quantified, the CAISO believes that quantity should be accounted for and added to the CAISOs requirement because these transfers can be construed as leaning. Given the complex market interactions that lead to this result and the infrequency of it occurring, the CAISO does not believe that it can do so accurately as part of phase 1 of this proposal. The CAISO has concerns that any correlation developed at this time would be based on a small sample size and may not serve to increase the accuracy of the test. Attempting to develop a correlation for load conformance without robust analysis has the potential to reduce EIM efficiency by causing the CAISO to spuriously, and inappropriately fail the RSE; while creating potential reliability risk to the extent spurious failures occur during tight system conditions.

To more fully address this issue, the CAISO believes that additional analysis is needed to develop a stronger correlation between the load conformance that drives EIM transfers that aid the CAISO in passing the RSE, as well as the dynamics between the EIM RSE and the HASP clearing process. The Joint EIM entity proposal to add an averaged quantity of load conformance has the potential to significantly over represent the amount of load conformance that leads to EIM transfers that constitute leaning, as demonstrated through analysis⁶. Further, the CAISO analysis has shown that the interaction between HASP and the RSE during stressed system condition already significantly disadvantages the CAISO in passing the RSE. The addition of load conformance at this time without resolving this underlying issue has the potential to further disadvantage the CAISO and drive the RSE further away from its goal of testing a balancing authority area for its ability to meet its obligations.

Forecast Accuracy

The CAISO also understands stakeholders remain concerned regarding the accuracy of variable energy supply forecasts used in the RSE, as compared to the supply realized in the real time market. The CAISO believes the examples referenced do not illustrate inaccuracy of the CAISO's forecast. Rather they highlight potential differences between forecast values used in the RSE and availability of supply in the real time dispatch. These two snapshots both vary between 40 and 100 minutes, with the RTD dispatch also accounting for congestion. At this time the EIM does not test base schedules used in the RSE for feasibility and deliverability; to the extent that entities are interested in pursuing this, the CAISO suggest they raise it as a scope item in phase 2. The CAISO would note however that testing for deliverability is likely to be a substantial market enhancement. Further, any forecast error to the extent it is driven by uncertainty

⁶ *ibid*

inherent to variable energy resources, ideally will be captured by the net-load uncertainty adder, which the CAISO plans to revise as part of phase 2.

5 Proposal – Phase 1

This section of the paper discusses enhancements to the RSE that the CAISO plans to address in the first phase of this initiative. These proposed enhancements draw from suggestions made by stakeholders throughout this initiative. The objective of the phase 1 enhancements is to improve the accuracy and transparency of the RSE.

5.1 Resource Sufficiency Evaluation Design Changes

This section reviews proposed changes unique to the capacity, flexible ramping sufficiency and balancing tests. It then details generally applicable changes that apply to multiple aspects of the RSE.

5.1.1 *Capacity Test Modifications – Intertemporal Constraints*

The RSE's existing capacity test assumes the availability of all supply base schedules and bids within a balancing authority area. Intertemporal constraints, such as a resource's start-up time and cycling time are not considered. This design creates the potential for the capacity test to overestimate the supply in the real-time market available in each balancing authority area because the supply may actually be unavailable or limited because of intertemporal constraints.

The CAISO agrees with the comments submitted by stakeholders in response to both the issue paper and straw proposal, that capacity in the real-time market could not have been used due to start-up or cycling time should not be counted as available supply in the capacity test. However, the CAISO believes that capacity should not be considered unavailable if it was scheduled or bid into the real-time market, but is limited because of previous results of the real-time market's economic optimization. As described below, this would undermine market's efficiency and could create adverse market incentives.

The CAISO's real-time market consists of two different market processes that issue start-up instructions to offline resources: (1) the short-term unit commitment (STUC) process, (2) the real-time pre-dispatch (RTPD) process. STUC starts-up resources whose start-up, plus minimum run time is within STUC's 4.5 hour look ahead time

Revised Draft Final Proposal

horizon, but in excess of the time horizon considered by RTPD.⁷ RTPD starts-up resources whose start-up, plus minimum run time is within the time horizon of the particular RTPD run, which range from a 1 to 1.75 hour look ahead.

It is reasonable that the capacity test should count resources that have a start-up and minimum run times no longer than what can be started by the STUC process. The CAISO proposes that the capacity test consider the start-up time when evaluating an offline bid-in resource that the real-time market is capable of starting by considering (1) the resource's start-up time, (2) the hours for which bids for the resource were submitted, and (3) the number of daily start or upward state transitions available to the resource. A resource would be counted in the upcoming hour's capacity test even if it had a start-up time longer than the RTPD horizon, but only if there was a bid for the resource for the upcoming hour available to the real-time market and the ability to be started when it ran at the time calculated as the beginning of the upcoming hour minus the resource's start-up time. Review of these proposed rules during the August 2020 events would have resulted in up to 1400 MW of temporally stranded capacity not being counted for the CAISO⁸. As detailed previously by the CAISO's analysis,⁹ this capacity consisted of long- start resources returning from outages, which the CAISO acknowledges through this proposal should not have been counted.

For example, a resource with a four hour start-up time would be counted in the capacity test conducted for hour ending 18 only if bids for the resource were in the market for hour ending 18 when the market was running during hour ending 14 through hour ending 18. This approach ensures capacity that would have been capable of being available for dispatch prior, but for economic decisions made by the real time market, is counted to passing the RSE's capacity test.

The CAISO also proposes that during this period, any offline capacity that participated in the real-time market in RTPD or previously through the STUC horizon that received a binding unit commitment instruction that was subsequently not followed, will not be counted as available capacity towards the test. In addition, capacity that was made available through the STUC horizon, but is on outage during the upcoming hour, or has returned from outage but is unable to ramp to minimum load will also not be counted.

Additionally, it is reasonable to count the capacity of a resource if it is shut down, or receives a state transition down by STUC or RTPD market runs. The CAISO proposes

⁷ [CAISO BPM for Market Operations Section 7.7](#)

⁸ Please see [Appendix 1-B](#) for additional detail

⁹ [Bautista Alderete, Guillermo and Kalaskar, Rahul. Resource Sufficiency Evaluation Bid Range Capacity Test. Mar 2021-](#) PowerPoint Presentation

Revised Draft Final Proposal

to also count capacity with bids through the hour under evaluation that are available at the time a resource is decommitted or transitioned into a lower configuration. Under this example, if a resource has a two hour state-transition time and is online at hour ending 16, but receives a state-transition instruction that runs through hour ending 18; it would receive credit for the bid in capacity that would have been available but for the market instruction.

The CAISO is not proposing to consider any ramping constraints in the capacity test. Upon implementation, the CAISO proposes to discount offline or stranded capacity that does not meet the aforementioned criteria, capacity that meets the criteria will be counted at its maximum bid-in output. The CAISO proposes to make this a configurable parameter in its software to ensure it retains the ability to adjust these counting practices. Should regular analysis conducted by the DMM, or event root cause analysis conducted by the CAISO, indicate the use of the maximum bid-in combination with the exclusion of ramping constraints systemically over represent the capacity available of any resource, the CAISO would move the quantity counted for the purposes of passing the RSE to a quantity more reflective of the capacity that resource could have provided.

Stakeholders have contemplated utilizing a shorter availability horizon, between one to two hours, to screen for capacity that should be counted as available in the RSE's capacity test. The CAISO has concerns that limiting available capacity to this truncated horizon has the potential to create competing incentives for EIM participation for resources with a longer start-up time. These incentives include the potential for EIM entities to make uneconomic commitment decisions for the purpose of passing the RSE and ensuring future access to EIM transfers, such as:

- base scheduling or manual dispatching resources online at minimum load, or
- not following optimal resource de-commitments or
- not following optimal state transitions

An EIM entity should not be dis-incentivized for using a more cost effective resource elsewhere within the EIM footprint. This type of economic displacement is inherent to the commitment and dispatch decisions made under a centrally cleared market and is a primary benefit offered by the EIM. Table 1 offers examples with differing initial conditions and bidding / base scheduling practices that illustrate how the proposal would work. The CAISO assumes that resources with start-up times longer than the STUC horizon will be started through the day-ahead processes.

Revised Draft Final Proposal

Table 1: Examples of Capacity Test with proposed intertemporal constraints

No.	Resource capability, status and bidding	Expected results
1	Pmax: 400 MW Status at T-270: Online Status at Final RSE: Online Output: 200 MW Startup Time: 180-minutes Availability: Bid continuously starts at 400 MW 270-minutes prior to operating hour	Capacity is credited The resource was online at the time of the final RSE. Therefore, their entire 400 MW will be credited as available capacity. This is because the capacity was made available to the EIM.
2	Pmax: 400 MW Status at T-270: Offline Status at Final RSE: Offline Output: 0MW Startup Time: 180-minutes Availability: Bid continuously starts at 400MW 270-minutes prior to operating hour	Capacity is Credited The resource was made available to the EIM for dispatch within the operating horizon and could have ramped to minimum load. The test, for optimal decisions made by the EIM, did not bring the resources online. Therefore, the EIM entity will be credited for 400 MW in their capacity test
3	Pmax: 400 MW Status at T-270: Online Output: 100 MW Status at Final RSE: Offline Startup Time: 180-minutes Availability: Bid continuously bid from 270-minutes and prior to the operating hour	Capacity is credited While the resource was offline, it was online at the start of the RSE test and made available through the STUC horizon. Therefore, the resources was made available for optimal use the EIM entity and will be credited for 400 MW in their capacity test.
4	Pmax: 400 MW Status at T-270: Online	Capacity is not credited

Revised Draft Final Proposal

	<p>Schedule: 100 MW Status at Final RSE: Offline Startup Time: 180-minutes Availability: Bid from 270-120 minutes prior to the operating hour</p>	<p>While the resource was online to start, during STUC it was de-committed either by the EIM or the EIM entity. At the time of its de-commitment, bids were not available through the hour under evaluation. As such, the capacity for this resource is not credited to the EIM entity.</p>
5	<p>Pmax: 400 MW Status at T-270: Offline Schedule: 0 MW Status at Final RSE: Offline Startup Time: 600 Minutes Availability: Bid continuously start at 270 Minutes prior to operating hour</p>	<p>Capacity is not credited</p> <p>Since the resources start time is outside of the real time operating horizon (STUC), the capacity is not credited as available capacity to the EIM BAA.</p>

The RSE’s accounting for storage resources’ capacity, including battery and pumped hydro, involves unique issues. Storage resources are different from conventional resources as they have limited continuous energy production, which is dependent on whether they were charging or discharging during previous market intervals.

This evaluation may not be sufficient for storage resources because their energy availability, and thus their available capacity, is dependent on their market dispatch prior to the time the capacity test is run. Counting a storage resource considering its potential to charge or pump within the STUC horizon, without consideration of its incentives to discharge or generate has the potential for the capacity test to overstate these resources’ capabilities. Thus, the CAISO proposes to limit the counting of these resources to the capacity corresponding to their amount of charge at the time of the RSE, plus any additional amount made available through energy bids to charge. The CAISO believes that this treatment of storage resources balances the capacity they make available to the EIM while also preserving the accuracy of the capacity test by considering their incentives to produce energy in prior market runs. To ensure equitable treatment between the CAISO and EIM entities the CAISO will require that EIM entities include in their base schedule the state of charge or stored energy of storage resources. To the extent that stakeholders believe additional policy development is needed regarding the treatment of storage resources within the capacity test, the CAISO proposes to address this issue in phase 2 of this initiative.

Revised Draft Final Proposal

The CAISO proposes to utilize the cold start-up time for short-start cycling resources that are offline at the start of the STUC horizon, and warm-start start-up times for resources that are online at the start of the STUC horizon. Consideration of a cold-start start-up time for resources that are offline at the start of the STUC horizon is appropriate as a conservative approach that avoids unduly counting capacity from resources that, if offered into the market, would have no possibility of being available to be started by the hour under evaluation. Resources that are online and receive shut down instruction by the market, would typically be viewed as a warm-start.

The RSE's capacity test does not consider resource ramping constraints because they are accounted for in the RSE's flexible ramping test (which accounts for online conventional resources' ability to ramp to the BAA's forecasted demand, plus an additional amount for uncertainty within the hour under evaluation).

Finally, the CAISO proposes to count capacity made available by a resource while it is transitioning through a forbidden operating zone. This will ensure that a resource following a dispatch does not have its output discounted leading to an inadvertent failure of the capacity test.

5.1.2 Flexible Ramping Test Modifications

5.1.2.1 Flexible Ramping Test Power Balance Constraint Modifications

The flexible ramping test currently measures a balancing authority areas ability to ramp between forecasted demand, including uncertainty, for each fifteen minute interval within the hour under evaluation. This measurement is conducted using the RTPD schedule for the interval immediately prior to the hour being evaluated, as the reference point. To increase the accuracy of this test, the CAISO proposes to calculate the quantity of any power balance constraint relaxation, if needed, that is present in the market solution. This quantity will then be accounted for in the flexible ramping sufficiency test, for both the upward and downward requirements. This power balance constraint relaxation adder will exclude any operator load conformance inherent to the market schedule. This change will ensure that the market schedule that is used as the reference point in the flexible ramping sufficiency test does not have an artificially biased ramping requirement due to capacity shortfalls preventing market schedules from fully balancing to demand. Figure 1 provides a graphic example of how the CAISO envisions this change being implemented. In this example, the calculated flexible ramping sufficiency requirements are adjusted by 25 MW to account for the 25 MW

Revised Draft Final Proposal

power balance constraint relaxation that occurred in the interval immediately prior to the hour under evaluation.

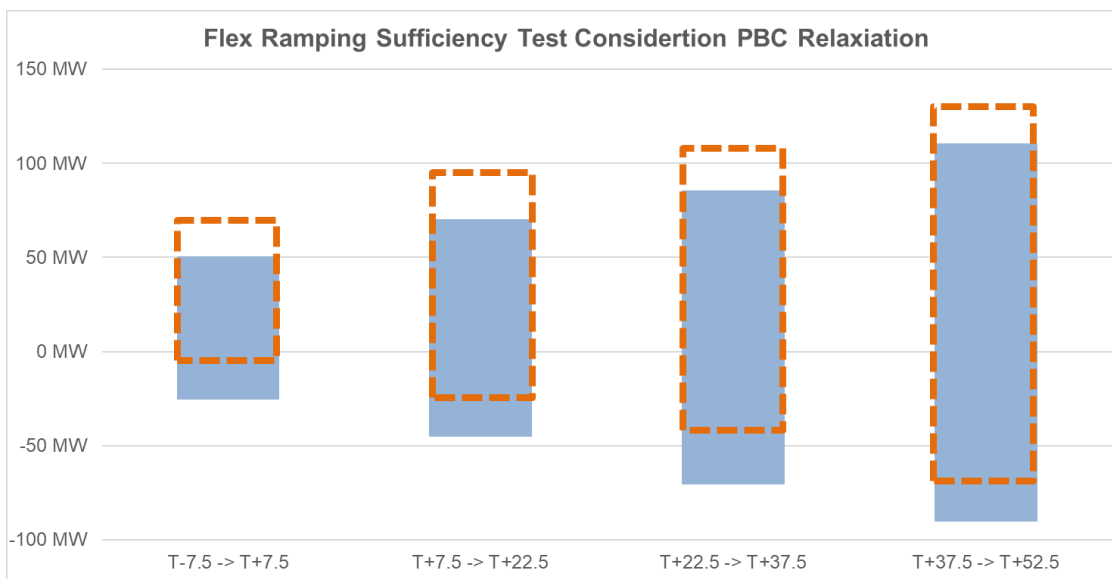


Figure 1: Graphic Display of PBC Consideration in the flexible ramping sufficiency test

The CAISO proposes to also consider a resource's transition through a forbidden operating region in the flexible ramping sufficiency test. Currently, the market software transitions resources through these operating zones in the least number of intervals possible. The CAISO will consider this ramping capability, consistent with its policy for transitioning these resources, as additional upward or downward ramp in evaluating an EIM entity's ramping capability.

5.1.2.2 Flexible Ramping Test Storage Resource Treatment

The CAISO proposes to consider the SOC in the reference market interval at T-7.5, as well as any bids, throughout the operating hour to either charge or discharge as the bounds on flexibility offered by a storage resource. This will ensure the CAISO accurately assess the flexibility provided by the resource at the time of the test in addition to its ability to provide flexibility in the upcoming hour. To ensure equitable treatment between the CAISO and EIM entities, the CAISO will require that EIM entities include in their base schedule the state of charge or stored energy for storage resources they offer bids on. To the extent that stakeholders believe additional policy

Revised Draft Final Proposal

development is needed regarding the treatment of storage resources within the flexible ramping sufficiency test, the CAISO proposes to address this issue in phase 2 of this initiative.

5.1.3 *Balancing Test Modifications*

The RSE balancing test was designed to offer a financial incentive for EIM balancing authority areas to provide base schedules near forecasted demand to ensure equitable and robust participation in the EIM. The balancing test determines if a submitted base schedule is within 1% of forecasted demand; a base schedule outside this tolerance band is then subject to the over and under scheduling test. This process has not been applied to the CAISO balancing authority area, as the CAISO does not actively make available to the market its supply through the base scheduling process. As previously stated by the CAISO and supported by comments from the Six Cities,¹⁰ the intent of the balancing test is to prevent gaming opportunities.

For the CAISO, real-time market imbalance energy is settled relative to day-ahead schedules produced by the CAISO's integrated forward market. Although CAISO day-ahead schedules depend on the schedules and bids submitted by market participants, various mechanisms exist to incent scheduling to the demand forecast in the integrated forward market, i.e. market prices and convergence bids. Although the CAISO balancing authority area's load forecast may change between the day-ahead market and real-time, it would be inequitable to apply the balancing test to the real-time demand forecast as that may be significantly different than the forecast that was used in the day-ahead timeframe. Similar application would be inequitable as the real-time market imbalance energy in the CAISO is settled against integrated forward market schedules, not the real-time demand forecast. Conversely, EIM base schedules are the reference for settling real-time imbalance energy in EIM balancing authority areas outside of the CAISO. These base schedules are submitted in the same timeframe that the demand forecast used by the balancing test is produced, leading to a much more accurate reference for imbalance settlement. However, this process by its very nature is open to potential over or under scheduling to attempt to exploit systemic differences in congestion.

Over-scheduling:

There are many ways overscheduling can be used to derive systemic profits. Figure 2 and the following example highlight a potential means of overscheduling the balancing test intends to limit. In this example BAA 1 has Gen1 near the seam of BAA2.

¹⁰ [Comments on issue paper and workshop presentations/discussion – Six Cities](#)

Revised Draft Final Proposal

- BAA1’s Gen1 output causes congestion on BAA 2’s active flowgate
- BAA 1 is paid imbalance, to reduce the generation schedule from the base scheduled on Gen 1
- BAA 1 may profit to the extent that they are able procure energy for Load 2 through the EIM at a cost less than the imbalance charges they will receive to reduce output on Gen 1, plus the savings from not producing the energy from Gen 1

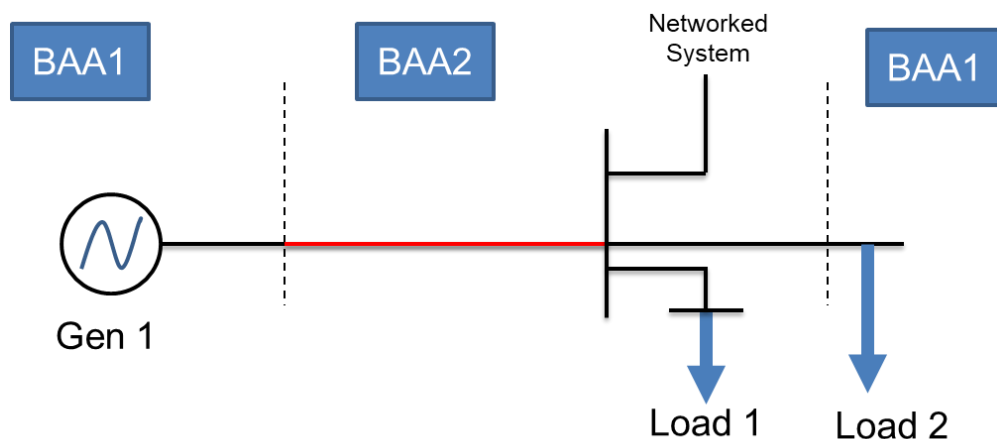


Figure 2: Graphic to aid in over-scheduling example

While this type of scheduling exists under all conditions, the 5 percent threshold of the over-scheduling component of the balancing test serves to put an upper limit on how much capacity an entity can schedule on Gen 1, and limits the ability to profit from this type of congestion pattern.

Under-scheduling:

In this example, an EIM entity has a non-supply side demand response program of 5 MW. In hour 1 they are able to show enough capacity to pass the test, while in hour 2 the balancing authority area fails the test due to a lack of capacity. In hour 3 they are

	Base Scheduled	Capacity Test Requirement	Demand Response	Pass / Fail
Hour 1	110	110	0	Pass
Hour 2	100	110	0	Fail
Hour 3	106	110	5	Pass
Hour 4	98	110	12	Pass

Table 2: Table to aid in under-scheduling example

Revised Draft Final Proposal

able to utilize their demand response under the proposed participation mechanism to pass the test. In hour 4 the BAA could inflate their proposed demand response to ensure they pass the test, while just paying imbalance charges for the difference in energy. The under-scheduling test, and its 5 percent threshold, limits the amount of overstatement from either a conventional resource or demand response that can be used to aid in passing the capacity test in this manner.

Therefore, the CAISO believes it is still appropriate to run the balancing test, but for the aforementioned reasons, exclude the CAISO balancing authority area from the balancing test. The CAISO proposes to exclude any EIM participant not subject to the balancing, and subsequent over and under scheduling tests from the potential revenues resulting from failures of these tests, as they are not subject to the test that derives these revenues.

Figure 3 and Figure 4 show the count of under-scheduling failures in the balancing test for all EIM entities in the period of October 2020 through September 2021. For cases when the balancing test failed (exceeding the 1 percent threshold) the entity is assessed penalties when the under-scheduling is above five percent threshold. Overall, the under-scheduling over 5 percent was assessed on about 23 percent of the under-scheduling failures.

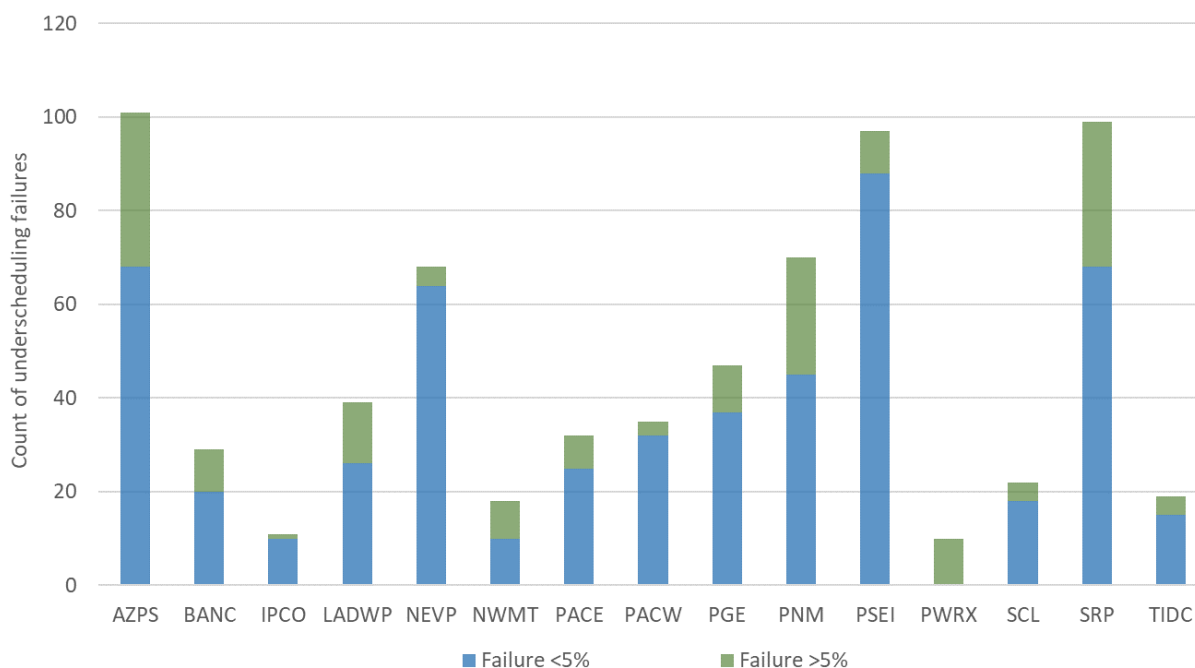


Figure 3: Count of under-scheduling failures for October 2020 through September 2021

Revised Draft Final Proposal

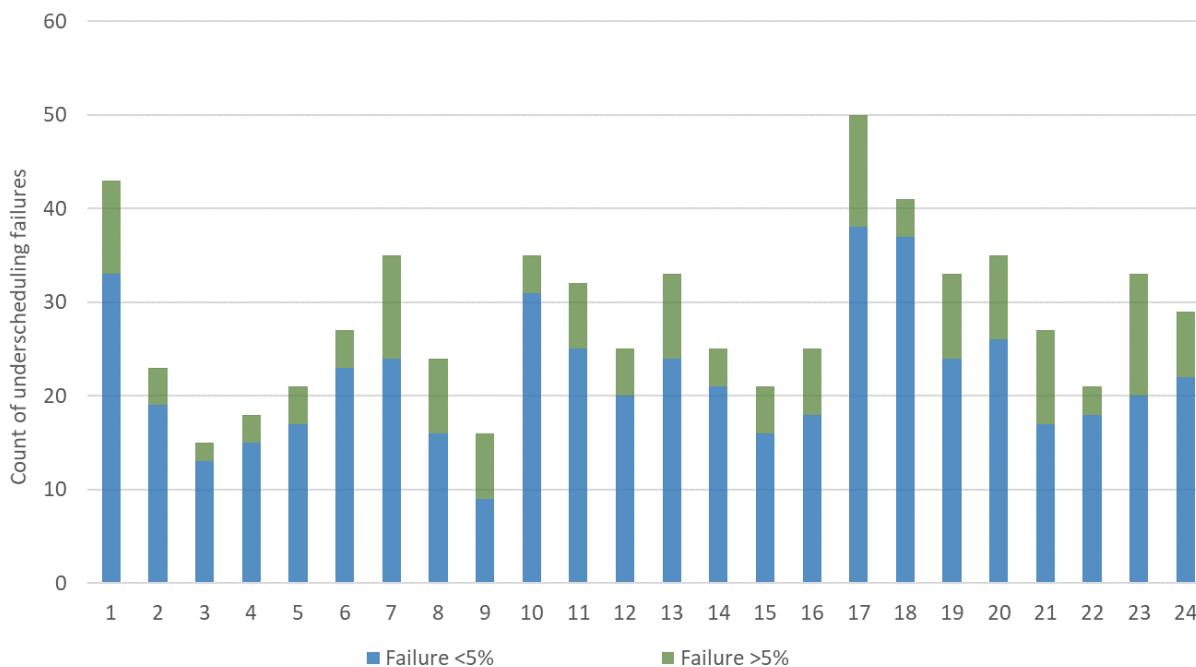


Figure 4: Hourly count of under-scheduling failures for October 2020 through September 2021

5.1.4 Generally applicable modifications

This section of the paper describes changes that can apply to multiple components of the RSE.

5.1.4.1 Demand Response Inclusion within the RSE

Should an EIM balancing authority area operate a demand response program that can reduce load and in turn, free resources to participate in the EIM, the reduction in capacity should be able to be represented for the purpose passing the EIM’s RSE. Currently, only EIM entity demand response programs in excess of 4% of an EIM entity’s load are able to be incorporated into the demand forecast that serves as an input to the RSE.

The CAISO envisions two methods through which demand response can be utilized by an EIM entity:

1. The CAISO will provide an EIM entity the ability to adjust the demand forecast used by the RSE to account for demand response programs that are not currently able to be represented within the CAISO market. These adjustments can be made anywhere within the real time operating horizon including STUC. The demand response programs can be reflected as an increase in load that

Revised Draft Final Proposal

captures expected “pre-cooling” as well as a decrease in forecasted load that reflects the demand response event itself. These changes will be reflected in the forecast used to determine the requirements in both the capacity and flexible ramping sufficiency tests; through either an increase or decrease in those requirements. Imbalance charges will continue to be settled against metered demand; and will be applied to the extent demand response programs do not operate as expected. The load modification provided by a demand response program can be performed at the customized load aggregation point using load distribution factors provided by the EIM entity. The CAISO would also provide the ability for the demand response reductions to be included, or excluded from the ALFS generated forecast on a balancing authority area by balancing authority area basis, based on agreement between the CAISO and each balancing authority area. The default will be to include the demand reduction in the load forecast. This will preserve the ability for each EIM entity to work with the CAISO to represent their demand response programs while also ensuring they are able to achieve accurate settlement of imbalance energy.

2. An EIM entity can include demand response through registration and bidding as a proxy demand response resource using CAISOs existing proxy demand response model. All requirements for registering demand response as a participating resource will apply to ensure all resource types within the EIM receive equitable treatment.

The CAISO retains concerns that there is a potential for fictitious demand adjustments to be made for the purpose of passing the RSE. The CAISO proposes that each EIM entity who plans to utilize a demand response program sign an attestation that adjustments made to the demand forecast used by the RSE correspond to expected increases or reductions in demand provided by their programs. After receiving input from stakeholders, the CAISO proposes to not include penalties for misuse of this functionality at this time. Rather the CAISO will review the use of this functionality, and if warranted develop targeted penalties to address misuse in phase 2 of this initiative.

Some stakeholders requested the ability for demand response programs that are not able to be represented by the proxy demand response or reliability demand response models to be included for the CAISO; this would entail the inclusion of optional non-supply side “no pay/no performance” programs. The CAISO is not planning to allow these programs to be counted explicitly for the RSE, as it has already developed a robust mechanism in partnership with the CPUC and internal California stakeholders for demand response participation in the CAISO markets. To the extent that these programs are utilized by California entities, they will be accounted for in the autoregressive demand forecast created by the CAISO. The base scheduling process,

Revised Draft Final Proposal

EIM entity imbalance settlement charges, over and under scheduling charges, and program requirements create different incentives that dictate how these programs can be utilized by an EIM entity. This proposed treatment simply allows entities to decide which demand response programs they operate, are appropriate for consideration by the RSE.

5.1.4.2 Reliability of CAISO Interchange Schedules

The CAISO's proposes to discount any interchange awards that have not submitted a transmission profile e-Tag equal to their hour ahead scheduling process award by the forty minutes prior to the operating hour (T-40) deadline.¹¹ Stakeholders in their comments have supported the CAISO's proposal to reduce import awards; however, the CAISO believes that it is also appropriate for the same requirements to apply to export awards. For purposes of the RSE, applying this requirement to export awards assures that the CAISO's obligations for passing the RSE are not increased without a reasonable expectation of the awardee being able to accept the delivery. This also ensures alignment with the implementation of the intertie deviation settlement policy.

The CAISO believes interchange schedules supported by an e-Tag with a valid transmission profile should be accounted for as they provide a reasonable representation of intent for an interchange awardee to deliver on or receive their award; this corresponds to a positive affirmation of intent. In addition, the CAISO imposes an under/over delivery charge, which further incentivizes the delivery of awards. The charges for undelivered awards with submitted transmission profiles equate to 75% of the higher of the real-time dispatch or fifteen minute market locational marginal price.

The CAISO uses the schedules produced by the RTPD run at 52.5 minutes (RTPD-6) prior to the hour as its input to the final RSE. With the current sequencing of the RSE and RTPD market runs, the automatic reduction of import awards that have not submitted a transmission profile by the T-40 deadline are not incorporated until the RTPD-5 run that initiates following the final RSE, this run begins 37.5 minutes prior to the operating hour. Accounting for this potential underlived capacity can be done by reducing the RTPD-6 import awards that are used as an input for the RSE.

The CAISO does not believe that requiring a full e-Tag at T-40, prior to the NERC/NAESB T-20 deadline for completing-tags (i.e. completing the energy profile section), is an appropriate pre-condition for participation in the CAISO's real-time market. Requiring full e-Tags prior to this deadline would preclude the CAISO from

¹¹ [CAISO Tariff § 11.31.1.2](#)

Revised Draft Final Proposal

accessing energy supply that is made available following T-40; such as renewable or slice supply in the Pacific Northwest whose allocations are determined after this deadline. Figure 5 details the interaction of the RTPD and RSE runs with the T-40 transmission profile deadline.

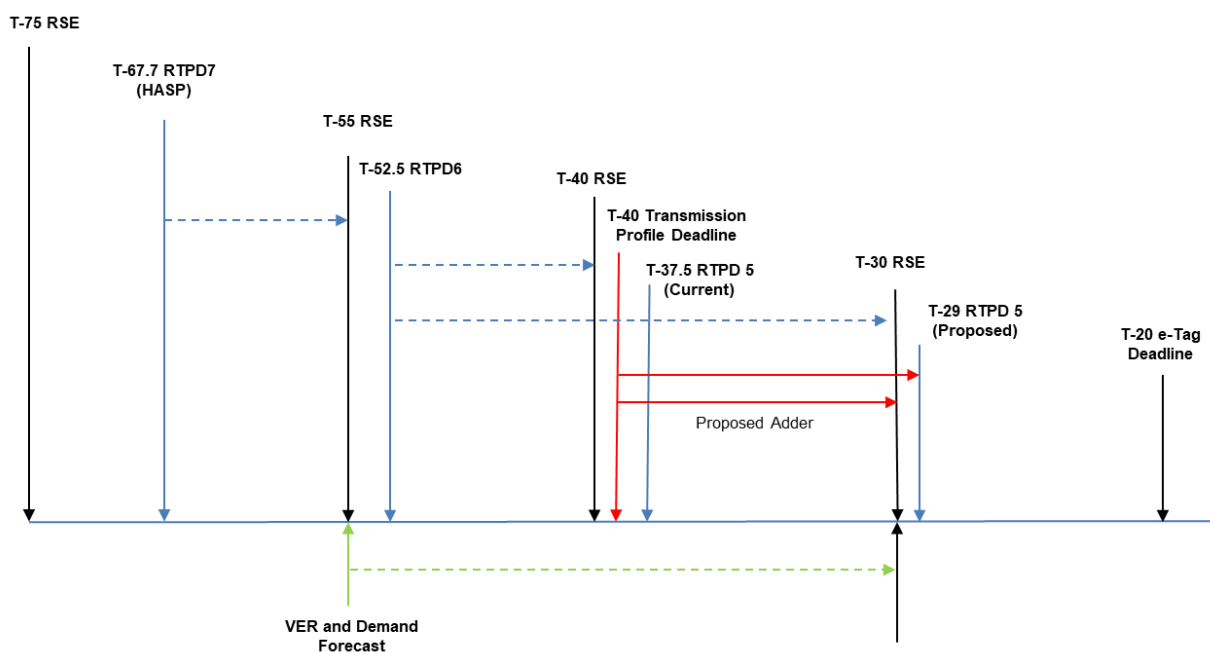


Figure 5: Sequencing of RSE, RTPD and Intertie Deviation Settlement timelines

Stakeholders internal to the CAISO’s balancing authority area asked the CAISO to report on the potential magnitude of this change, to inform how it might impact the CAISOs ability to pass the RSE. Figure 6 and Figure 7 show the volume of import deviations that were assessed through the Import Deviation settlements. These figures captured the component of the deviations set by the level of imports that accepted the HASP award and that did not deliver. The highest volume of these deviations accrued during the summer months and largely on peak hours.

Revised Draft Final Proposal

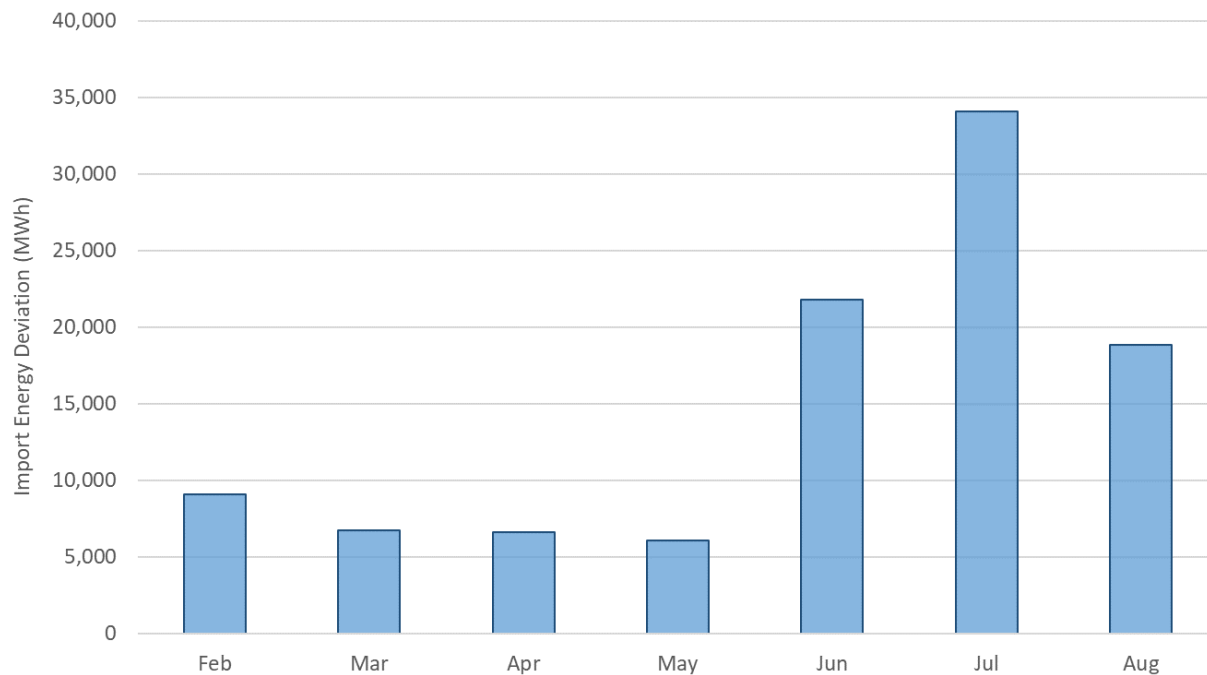


Figure 6: Monthly energy volume (in MWh) for import deviations

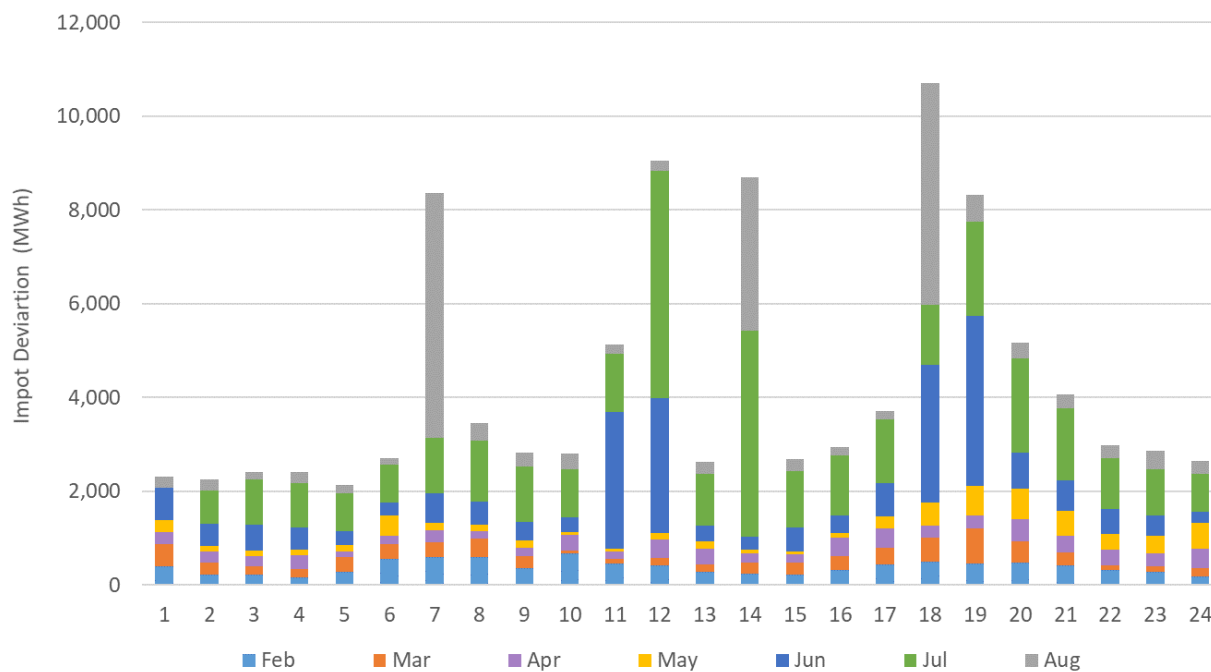


Figure 7: Hourly energy volume (in MWh) for import deviations

5.1.4.3 Emergency Actions that constitute resource insufficiency

Certain actions taken by balancing authority areas in emergency conditions demonstrate resource insufficiency. The CAISO proposes that all EIM participants sign an attestation obligating them to notify the CAISO should they perform these emergency actions. The CAISO proposes that upon notification, the EIM will limit incremental EIM transfers until such time that the CAISO receives a notification that the emergency conditions are no longer present.

5.1.4.3.1 Use of firm load as non-spin and spin

Some stakeholders commented that a balancing authority area should be deemed resource insufficient in the event it is in an energy emergency and has resorted to arming firm load to meet reserve requirements. For example, the CAISO was in such a situation in August 2020. The CAISO believes this is a reasonable point and consequently proposes that the real-time market's dispatch of additional energy transfers into a balancing authority area should be limited when a balancing authority area is under an energy emergency and meeting reserve requirements by arming load.

5.1.4.3.2 Operating voltage levels

Each BAA has voltage ranges for different elements of their system, which are treated similar to a thermal limitation. During emergency conditions system operators may direct a system wide reduction in operating voltage, outside of nominal parameters, for the purposes of lowering the power consumption of their balancing authority area. While not possessing the same risk of damaging equipment as operating outside of thermal guidelines, this practice increases the risk of voltage collapse during stressed system conditions. The CAISO believes that such a direction represents resource insufficiency and incremental EIM transfers should be limited.

5.1.5 Net-Load Uncertainty Calculation

Stakeholders raised concerns regarding the calculation of the uncertainty requirements that are used as inputs to the capacity test. This includes the uncertainty requirements for variable energy resources and load, i.e. net-load uncertainty. The current calculation, using the histogram methodology, has not created an increase in test accuracy that corresponds to its increase in test failures. At this time the CAISO proposes under its

Revised Draft Final Proposal

existing FERC authority¹² to remove the net-load uncertainty calculation from the capacity test.

The CAISO plans to update the net-load uncertainty calculation. One possible option is using the quantile regression methodology approved in the *Flexible Ramping Product Refinements* policy. However, to the extent that stakeholders are not confident in its ability to predict uncertainty for the capacity test, the CAISO will look to develop a RSE capacity test specific calculation of uncertainty.

5.1.6 Intertie Uncertainty Calculation

The historical net import/export deviation calculates, with a 95% confidence interval, a future projection of intertie deviation between T-40 and T-20 using a retroactive review of deviations from the previous 90 days. This ensures that largest 2.5% of deviations are excluded from the calculation. Consequently, it ensures that the largest magnitude of intertie uncertainty relating to a failure to deliver is not added to the capacity requirement. The CAISO published a companion analysis that details the impact of the current intertie uncertainty calculation methodology¹³. That analysis shows that the intertie uncertainty calculation has a significant impact on the results of the capacity test. In addition, it shows that the current confidence interval of 95% using a 90 day look back is not an accurate indicator of future expected intertie uncertainty. Given this inaccuracy stakeholders in their comments requested the CAISO suspend this calculation until a more accurate calculation can be developed. With this analysis and sentiment in mind, the CAISO proposes to remove this requirement and revisit the methodology for calculating this type of uncertainty in the second phase of this initiative. The CAISO believes this will also offer the opportunity to consider both intertie and net load uncertainty holistically as the maximum amounts of uncertainty are unlikely to occur coincidentally.

5.2 Resource Sufficiency Test Transparency

5.2.1 Additional Transparency

Stakeholders have urged the CAISO to provide additional transparency through regular reporting on the performance and accuracy of the RSE as this has been greatly beneficial in understanding the calculation, accuracy, and performance of the RSE. The

¹² CAISO Tariff section 29.34(l)(5)

¹³ [Analysis of the Intertie Deviation Adder Used in the Capacity Test](#)

Revised Draft Final Proposal

CAISO agrees this transparency is beneficial in helping balancing authority areas better understand the RSE. However, the CAISO recognizes it serves a dual role, both as the market operator and as a balancing authority area that participates in the EIM, and that reporting from an independent third party can be beneficial. Therefore, the CAISO proposes to no longer provide capacity and flexible ramping failure information for all balancing authority areas as part of its regular reporting activities. Instead, this reporting role will be assumed by the CAISO's Department of Market Monitoring (DMM). The CAISO believes the DMM is the appropriate body to assume this reporting role because it regularly inspects the day-ahead and all real-time markets for efficiency and effectiveness. They also identify and report any market design flaws for all markets through their quarterly reports and through special reports and presentations. The CAISO believes this proposal merely clarifies the reporting they will perform for the EIM. The DMM will provide the EIM performance briefings to the EIM Governing Body on a quarterly basis. Conversely, the CAISO is and will continue to provide all data necessary to the DMM to assist them in their reporting role. In addition the CAISO will provide the EIM Governing Body Market Expert, once established, whatever data they deem necessary to fulfill their role as directed by the EIM Governing Body.

The CAISO and DMM seek to define with stakeholders, what standard performance and reporting metrics that are useful to evaluate the accuracy of the RSE. The DMM issued its first periodic report reviewing the RSE performance for the months of July 2021¹⁴. The CAISO requests

- Comment on the metric's detailed in the report, as well as which additional metrics may be useful to stakeholders
- Comment on which metrics detailed in the report would be advantageous to have on a quicker timeline through near real-time posting
- Comment on the appropriate venue to see near real-time metrics. Options include OASIS or the CAISO website under a dedicated reporting section similar to the existing CAISO Today's Outlook¹⁵.
- Comment on the data granularity made available publically. Do market participants foresee any issue with interval level BAA aggregate data being publically distributed?

At this time, the CAISO does not propose to provide any additional special reporting beyond what has been described above. The CAISO has and will continue to provide overall market performance reports for anomalous events, such as stressed system

¹⁴ [CAISO Department of Market Monitoring Summer Market Performance Report for July 2021](#),

¹⁵ [Link to CAISO Today's Outlook](#)

Revised Draft Final Proposal

conditions (e.g. August 2020). As a result of its DMM reporting proposal, the CAISO will no longer provide its EIM RSE briefings to the EIM Governing Body. CAISO will continue to support market participants, the Department of Market Monitoring, Market Surveillance Committee, and once established, the EIM Governing Body Market Expert.

5.2.2 Increasing EIM entities situational awareness regarding test performance

The CAISO agrees that additional data transparency is needed and proposes to provide each balancing authority area's detailed RSE advisory and binding results for their capacity and flexible ramping tests. The CAISO proposes to provide this data through the CAISO Market Results Interface (CMRI) and the balancing authority area operations portal (BAAOP). While stakeholders have requested this information be available through OASIS, given the proprietary and detailed nature of this information the CAISO believes that CMRI or BAAOP remain the appropriate place for publication. This additional data will enable EIM balancing authority areas to spot check their own performance of the RSE. This will allow for validation that inputs to the capacity and flexible ramp sufficiency tests are correct, and in turn will ensure that the results of the capacity and flexible ramping sufficiency tests are being accurately calculated and producing results consistent with expected data inputs. The CAISO also believes this additional data will enable participants to more accurately formulate their base schedules into the EIM.

The CAISO will provide the following data inputs for each balancing authority area following the capacity and flexible ramping tests results:

- Trade Date
- Resource's Master File ID
- Mega-watt quantity of capacity available for each hour
- Mega-watt ramping capacity for each hour
- Ramping type
- Test time
- Balancing authority area specific load forecast by hour
- Balancing authority area specific export quantity by hour
- Balancing authority area specific uncertainty requirement by hour
- Balancing authority area specific diversity benefit amount by hour

Revised Draft Final Proposal

The CAISO seeks stakeholder comments on the proposed data availability and if any additional data should be considered.

The CAISO seeks stakeholder comments on this element of its proposal and requests any further feedback the CAISO should consider for transparency and reporting.

6 Proposal Phase 2

This section of the paper discusses the scope of future enhancements to the RSE that the CAISO plans to address in a second phase of this initiative. The CAISO was pleased to see stakeholders support of addressing accuracy and transparency enhancements to the RSE in a first phase, with a second phase addressing additional matters, primarily the consideration of RSE failure consequences. Deferring the following topics to a second phase of the initiative ensures that the enhancements proposed as part of phase 1 of this initiative are not delayed.

A number of stakeholders in their comments requested the CAISO begin the second phase of this proposal immediately after the completion of the accuracy and transparency enhancements under consideration in the first phase. The CAISO plans to make RSE phase 2 policy development a high priority in 2022 with the goal of implementing any changes in 2023. The CAISO requests comment on the drivers of the desire to begin policy development on phase two, prior to the implementation of the phase 1 enhancements. The CAISO plans to determine the exact timing of the stakeholder initiative during the prioritization process inherent to the development of its annual policy development plan for 2022.

6.1 Resource Sufficiency Evaluation Failure Consequences

In response to stakeholder feedback, the CAISO does not believe that it is appropriate at this time to put forward a proposal for revised RSE failure consequences. As expressed by multiple stakeholders, it would be premature to propose financial consequences for RSE failure, in light of the enhancements that are being made within this initiative, as well as the pricing improvements the CAISO made in the *Market Enhancements for Summer 2021* initiative. Furthermore the CAISO does not want to delay the implementation of the accuracy and transparency enhancements detailed in phase 1 while working through the necessary policy development of financial consequences. The addition of financial consequences for a failure of the EIM's RSE represents a fundamental change to the existing voluntary nature of EIM participation.

Revised Draft Final Proposal

As proposed by the select EIM entities in their comments, this type of change should only be done “with a clear rationale”,¹⁶ which the CAISO believes the completion, implementation, and performance review of the effectiveness of the proposed RSE enhancements is necessary to achieve.

While the CAISO does not believe it is appropriate to add financial consequences for failure of the RSE at this time, it does propose to add review in a holistic manner of the RSE failure consequences, to the stakeholder catalog as a non-discretionary item. The CAISO proposes this will include:

- A review of the current consequence of limiting incremental transfers
- Consideration of financial consequences in response to EIM transfer limitation relaxation
- Consideration of relaxation of RSE requirements during agreed upon market conditions¹⁷

6.2 Load Conformance

In their comments, stakeholders maintain the RSE should incorporate upward operator adjustments, i.e. load conformance, to the load forecast used by the real-time market. The CAISO proposes to defer this topic to phase 2 of this initiative.

The CAISO believes that the RSE should test for a balancing authority area’s ability to meet its forecasted demand and ramping requirements. However, as detailed in the stakeholder comments section, the CAISO does not currently have the ability to accurately determine the amount EIM transfers driven by load conformance that can be construed as leaning. Further adding a portion of load conformance at this time, given the existing issues created by the interaction between the HASP and RSE would be inappropriate. To ensure that the RSE accurately accounts for any actions that allow the CAISO to inappropriately pass the RSE, additional analysis to understand how load conformance drives EIM transfers, beyond the limited analysis the CAISO has conducted for July 9, 2021 is needed. The CAISO proposes to begin further analysis immediately, ensuring any inappropriate impact derived from the use of load conformance is able to be addressed in the second phase of this initiative.

¹⁶ [Comments of Select EIM Entities Page - 15](#)

¹⁷ In September of 2021 the CAISO observed multiple EIM participants who failed the flexible ramping sufficiency down requirement while exporting during high marginal energy prices

6.3 Demand Response Monitoring

As referenced in Section 5.1.4.1 the CAISO will revisit changes to penalties associated with the demand response program if necessary, based on observed practices of EIM entities.

7 EIM Decisional Classification

Phase I of this initiative proposes changes to the resource sufficiency evaluation that would go to the Board of Governors for decision in February 2022. CAISO staff believes that the EIM Governing Body has joint authority with the Board of Governors over the tariff rule changes proposed in Phase I. The CAISO did not receive comment contesting this initiative being under joint authority.

The role of the EIM 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 Committee's Part Two Proposal. Under the new rules, the Board and the EIM 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. All of the tariff rule changes currently contemplated in Phase I of this initiative would 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." None of the proposed tariff rules would be applicable "only to the CAISO balancing authority area or to the CAISO-controlled grid." Accordingly, the matters scheduled for decision in December 2021 fall entirely within the scope of joint authority.

This proposed classification reflects the current state of Phase I of this initiative and could change as the stakeholder process moves ahead. And a proposed classification for Phase II of the initiative will be developed later, when Phase II moves ahead. Stakeholders are encouraged to submit a response to the EIM classification of this

Revised Draft Final Proposal

initiative as described above in their written comments, particularly if they have concerns or questions.

8 Stakeholder Engagement

Table 3 outlines the proposed schedule to complete the policy for the [EIM resource efficiency evaluation enhancements](#):

On December 21, the CAISO will hold a stakeholder call to present its revised draft final proposal. Materials for this upcoming meeting will be posted on the initiative webpage at the link provided above.

Table 3: RSEE Initiative Schedule

Date	Milestone
June 3, 2021	Issue Paper posted
June 18, 2021	Deadline to submit presentations for June 25 and 28 workshops
June 25 and 28, 2021	Stakeholder workshop to discuss issue paper
July 9, 2021	Comments due – issue paper and workshop discussions
Aug 16, 2021	Straw Proposal posted
Aug 23, 2021	Straw Proposal Stakeholder Call
Sept 8, 2021	Straw Proposal Comments Due
Oct 6, 2021	Draft Final Proposal Posted
Oct 12, 2021	Draft Final Proposal Stakeholder Call
Oct 22, 2021	Draft Final Proposal Comments due
Dec 16, 2021	Revised Draft Final Proposal Posted
Dec 21, 2021	Revised Draft Final Proposal Stakeholder Call

Revised Draft Final Proposal

Jan 10, 2022	Revised Draft Final Proposal Stakeholder Comments Due
February 9, 2022	Joint Governance Meeting

9 Appendix 1 – Background RSE information

A. Existing Design

The RSE is run at seventy-five (T-75), fifty-five (T-55) and forty (T-40) minutes prior to the upcoming hour. The first two tests (T-75 and T-55), produce advisory results that allow a balancing authority area to update their base schedules so they may pass the final, financially binding test at T-40¹⁸. The resource sufficiency evaluation is comprised of four tests: 1) feasibility, 2) balancing, 3) capacity, and 4) flexibility. The capacity and flexibility test are designed to ensure EIM entities are resource sufficient. A failure of either the capacity or flexibility test will result in an EIM balancing authority area's incremental transfers being limited to the transfer amount in the most recently passed interval¹⁹. The balancing test is designed to provide an incentive for EIM entities to submit accurate base schedules, and results in financial charges applied to EIM entities for inaccurate schedules. The RSE applies to the CAISO balancing authority area with some differences in its application and operation because the inputs are from the day-ahead market results and not EIM base schedules. The following section provides a detailed description of the existing resource sufficiency evaluation design.

a. Feasibility Test

The feasibility test is intended to serve as an opportunity for EIM participants, who are not members of the CAISO day ahead market, to minimize re-dispatch and resulting imbalance charges that are necessary to resolve infeasible base schedules. The feasibility test performs a power flow evaluation on an EIM balancing authority area's submitted base schedules at T-75, T-55 and T-40 to determine if base schedules would

¹⁸ [The CAISO has proposed to change the final test to T-30 in the fall of 2022 approved under ER21-955.](#)

¹⁹ CAISO revised to RSE to limit transfers to the most recently passed interval, rather than hour. This change was stakeholder in 2018 through the [EIM Offer Rules Workshops](#)

Revised Draft Final Proposal

result in violations of transmission limits. Following the posting of results, the EIM entity has an opportunity to adjust its base schedules to resolve advisory violations. The feasibility test is not explicitly applied to the CAISO balancing authority area, as the CAISO's existing market processes use a security constraint economic dispatch to automatically resolve transmission violations. Consequently, the CAISO does not need to make manual adjustments to market results in order to relieve transmission violations as this is accomplished through the market optimization. The market results from the day-ahead market, hour-ahead scheduling process (HASP) and real time pre-dispatch (RTPD) are used for the CAISO balancing authority area in lieu of base schedules.

b. Balancing Test

The balancing test compares EIM balancing authority area's base schedules from generation and imports to a demand forecast to determine hourly imbalances. This test is not currently applied to the CAISO balancing authority area as the day-ahead market, HASP, and RTPD processes are designed to commit supply equal to forecasted demand. Rather, the purpose of the test is provide a financial incentive for EIM balancing authority areas to provide/update base schedules near forecasted demand.

The EIM provides an opportunity for EIM entities and EIM participating resources within those balancing authority areas to operate more efficiently. However, there is an opportunity for EIM entities to under/over schedule within their submitted base schedules as a means to control energy prices or shift costs. For example, an EIM entity could try to avoid de-committing generation to avoid start-up costs by providing base schedules in excess of their forecasted demand. Overscheduling can also present gaming opportunities via imbalance charges when systemic differences in LMP are present.

For this test, EIM balancing authority areas may choose to use the CAISO's demand forecast or use their own forecasts. If the EIM balancing authority area elects to use the CAISO demand forecast, imbalances within 1% result in the balancing authority area passing the test. If the imbalance is greater than 1%, the balancing authority area fails the test. The EIM balancing authority area is subject to over- or under- scheduling load penalties if their actual load is 5% more or less than its base schedule for an hour. If the EIM balancing authority area chooses to use their own demand forecast for the test, they are always subject to the over-or under-scheduling penalties when load is 5% more or less than their base schedule for an hour.

c. Capacity Test

The capacity test determines whether a balancing authority area is participating in the EIM with sufficient supply to meet its demand forecast. In addition, as a result of the recent *Market Enhancements for 2021 Summer Readiness*,²⁰ the capacity test will require an additional amount of resource capacity to account for net-load uncertainty.

If a balancing authority area fails the capacity up or down test for any interval in an hour, they automatically fail the respective up or down flexibility test for the corresponding hour's fifteen-minute interval.

The capacity test includes the following inputs:

- CAISO's fifteen-minute market (FMM) demand forecast,
- Imports and exports (Hourly net scheduled interchange schedules, NSI),²¹
- Resource bids (internal supply and FMM schedules for upward Ancillary Services),
- Resources' de-rates and re-rates, and
- Historical inertia deviations. This ensures the capacity test better reflects the actual inertia availability by discounting systemically undelivered awards. This requirement provides an incremental adjustment to the capacity requirement.

The CAISO calculates the capacity test by determining if total bid range is greater than the total requirement. If the bid range is greater than the requirement, the balancing authority area passes the test. EIM transfers (imports or exports) and temporal constraints are not included in either of the CAISO or EIM balancing authority area's tests.²²

The capacity test is calculated as follows:

$$G^{max} > LF + NSI$$

²⁰ [Market Enhancements For Summer 2021 Readiness initiative:](#)

²¹ The CAISO's test, only FMM imports and exports are considered in the calculation.

²² *Ibid*

Revised Draft Final Proposal

Where,

G^{max} Upper capacity limit

LF Load Forecast

NSI Net Schedule Interchange (Export–Import)

For example, a balancing authority area's upper capacity limit is 100 MW. The load forecast is 147 MW and the net schedule interchange is –50 MW (import).

$$100 \text{ MW} > 147 \text{ MW} - 50 \text{ MW}$$

$$100 \text{ MW} > 97 \text{ MW}$$

Total bid range is greater than the total requirement, so the balancing authority area passes the test.

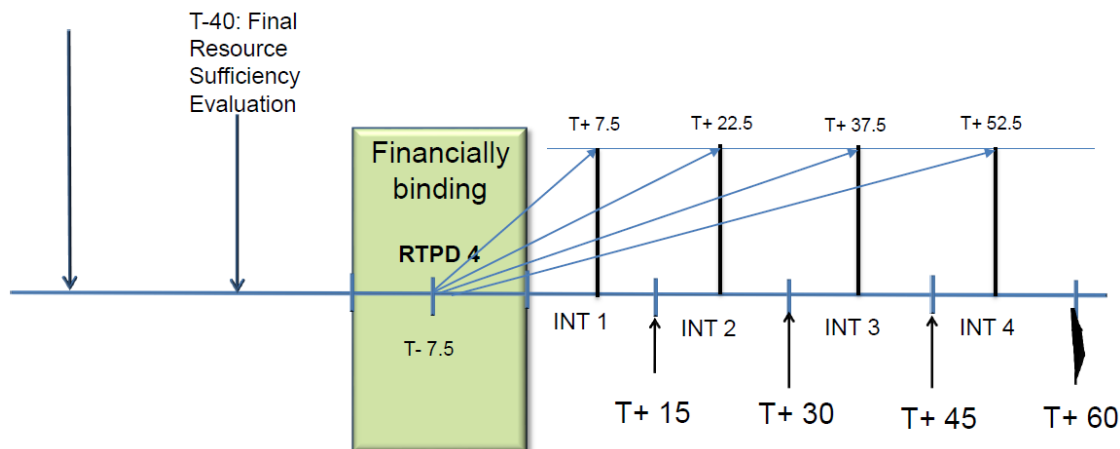
d. Flexible Ramping Sufficiency Test

The flexibility test (flexible ramp sufficiency test) ensures balancing authority areas have sufficient ramping capabilities to meet load forecast change and uncertainty inherent to both load and renewable resource performance. The test assesses that a balancing authority area has upward and downward flexible capacity available to be dispatched in the real-time market. The test evaluates four ramp intervals from the last 15-minute schedule from the proceeding hour to each 15-minute interval of the current hour.

Figure 8 - Temporal Graphic of the Ramping Sufficiency Test

Revised Draft Final Proposal

T-52.5 RTPD 4 optimization horizons



The flexible ramp test has six inputs: net demand uncertainty, forecasted change in demand, diversity benefit factor, net import capability, net export capability, and flexible ramp credit. The net demand uncertainty is a fixed number for all tests and can increase the requirement. The forecasted change in demand can either increase or decrease the requirement. The diversity benefit, net import capability, net export capability, and flexible ramp credit can reduce the requirement.

The flex ramp up requirement is calculated as follows:

$$F_{RU} = \Delta Demand(T) + MAX [(Flex Up Uncertainty - Net Import Capability), ((Diversity Benefit Factor * Flex Up Uncertainty) - Flex Ramp Up Credit)]$$

Where,

F_{RU} Flexible Ramp Up Requirement

The flex ramp down requirement is calculated as follows:

Revised Draft Final Proposal

$$F_{RD} = \Delta Demand(T) + MAX [(Flex Dn Uncertainty - Net Import Capability), ((Diversity Benefit Factor * Flex Dn Uncertainty) - Flex Ramp Dn Credit)]$$

Where,

F_{RD} Flexible Ramp Down Requirement

B. August 2020 Events

During August 2020, the CAISO balancing authority area experienced a severe heat wave. On August 14 and 15, this heat wave caused the CAISO balancing authority area to enter into energy emergency alert 2 (EEA2) and energy emergency alert 3 (EEA3) conditions.²³ The CAISO was forced to implement rotating electricity outages to preserve supply and demand balance and not propagate their energy shortfall, and its corresponding reliability risks, to neighboring balancing authority areas. During this time, the CAISO passed the RSE's capacity test for all intervals. However, the CAISO failed the flexible ramping sufficiency test for several intervals on August 14-15. During the *Market Enhancements for 2021 Summer Readiness* initiative, stakeholders raised concerns that the CAISO inappropriately passed the capacity test during these intervals. Additionally, during the March 2021 EIM Governing Body meeting, the CAISO Market Surveillance Committee, as well as Bonneville Power Authority (BPA), requested the CAISO provide transparency around how the CAISO passed the RSE test during these conditions.

During the CAISO's examination of the August events, it was determined the CAISO passed the test due to software defects, and intertemporal conditions such as startup and ramping constraints. These various factors were not considered in the original test design. The identified software defects related to a double counting of mirror resources and a failure to account for resource derates; these defects were fixed on February 4, 2021. The incorrect application of resource derates resulted in the CAISO inappropriately accounting for approximately 2,000 MW²⁴ of capacity. [Figure 9](#) illustrates the difference between overestimated and corrected bid range capacity when

²³ [NERC EOP-011-1 Attachment 1: Energy Emergency Alerts](#)

²⁴ *Ibid.*

Revised Draft Final Proposal

derates were correctly applied. This software defect was globally applied to outages submitted by all EIM entity balancing authority areas.

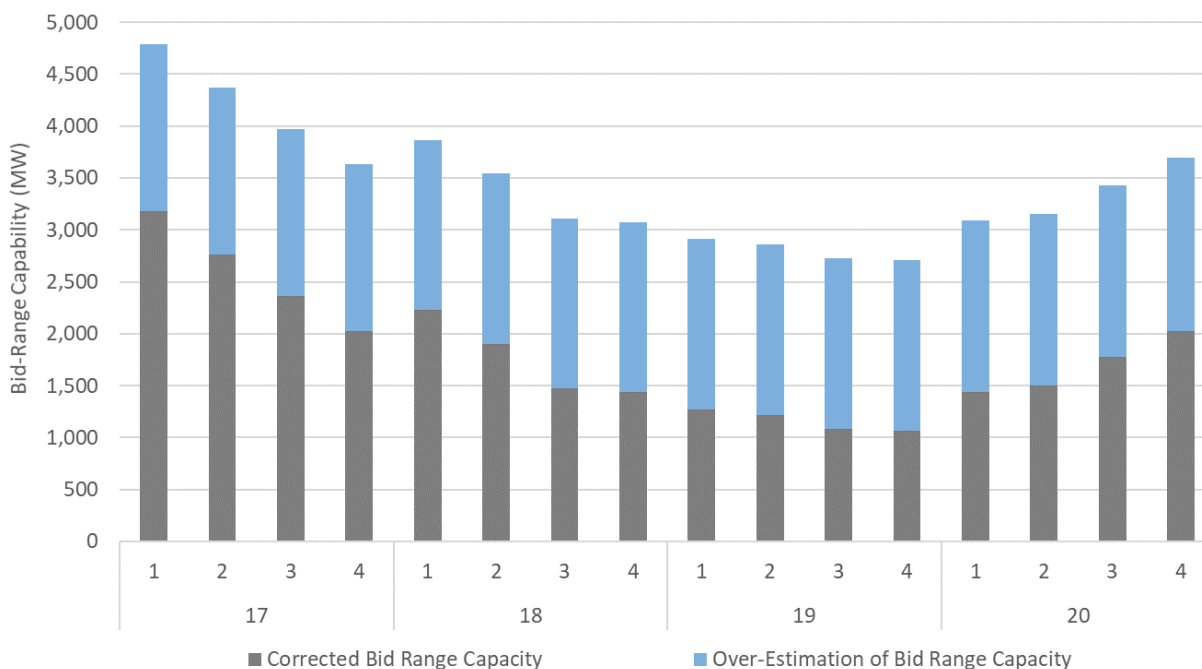


Figure 9: August 14, 2021 Overestimation of Bid Range Capacity in the CAISO balancing authority area

The double counting of mirror resources²⁵ resulted in accounting for fictitious import supply of over 1,000 MW. The remaining over-estimated capacity was the result of a combination of start-up and ramp limited supply, undelivered interchange transactions, and an over-forecasted supply of variable energy resources.

When correcting for these defects this analysis still shows an overestimation of available capacity during these tight supply conditions. As illustrated in **Figure 10**, the majority of the undeliverable capacity was from multi-stage generator resources. Further

²⁵Mirror System Resource: A System Resource at a Scheduling Point registered to an EIM Entity for mirroring CAISO intertie schedules at that Scheduling Point, when the associated Energy is generated at, wheeled through, or consumed at the corresponding EIM Entity Balancing Authority Area.

Revised Draft Final Proposal

inspection revealed these multi-stage generator resources were temporally constrained. Variable energy forecasts at T-55 to the operating hour are used in the final evaluation, which also creates the potential for an inaccurate supply picture²⁶. However, the same variable energy resource forecast is applied to all participating EIM balancing authority areas.

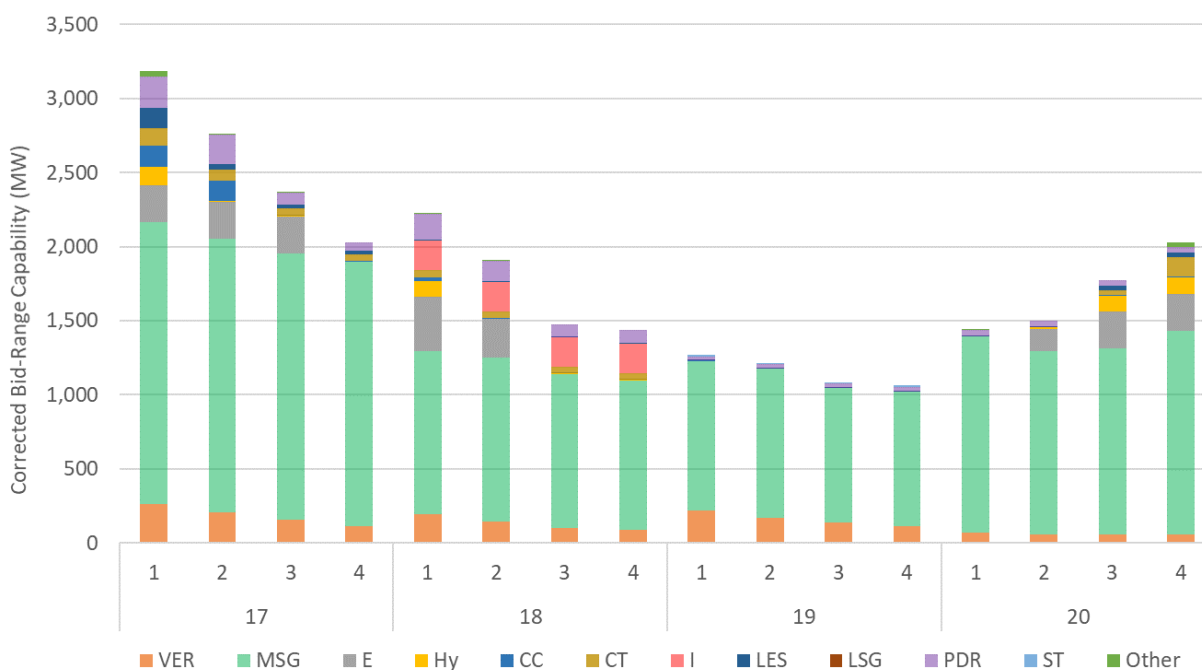


Figure 10 - August 14, 2020 Overestimation

a. Impact of August events on the entire EIM

The events of August 2020 presented challenging operating conditions for many EIM entities. When derates were correctly accounted for, four additional EIM entities would have failed the capacity test during the heat wave. Accounting for the addition of the uncertainty requirement that was approved as part of the *Market Enhancements for Summer 2021*, two additional EIM entities would have experienced capacity test failures during this period. The RSE failures are not unique to any specific region. These results can be seen below in **Figure 11**.

²⁶The fixing of Variable Energy Forecast prior to the T-55 RSE was an enhancement to the RSE that was implemented on 12/12/2017.

Revised Draft Final Proposal

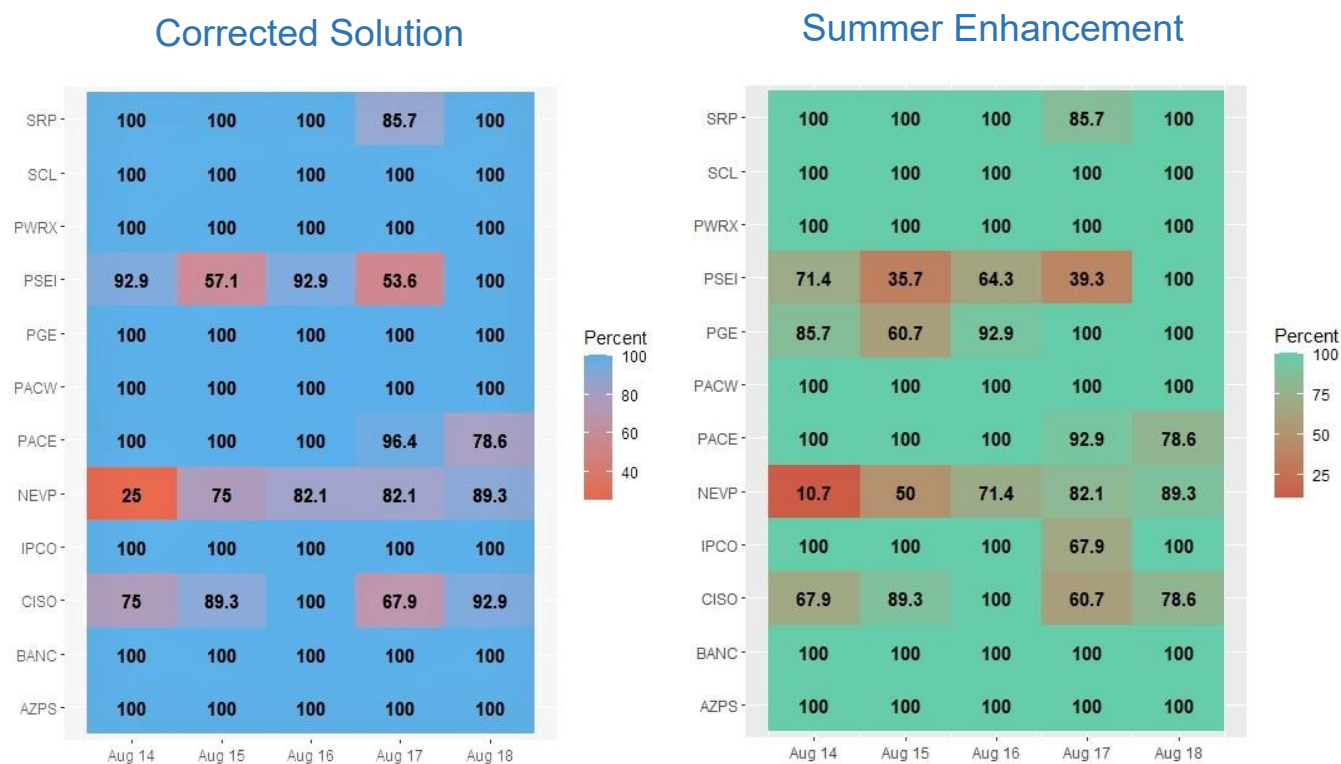


Figure 11 - August 2020 Heat Wave RSE results

b. DMM’s 2020 analysis on bid range capacity tests

The *Market Enhancements for Summer 2021* initiative’s RSE discussion primarily focused on the CAISO’s capacity and ramp sufficiency test performances. However, the Department of Market Monitoring (DMM)’s report on “Resource sufficiency tests in the energy imbalance market” provided information on the performance of the broader

Revised Draft Final Proposal

EIM²⁷. Their assessment illustrates that once the CAISO corrected identified software defects, other balancing authority areas also should have failed the bid-range capacity test.

Originally, the overall total of 2020 upward capacity test failures in EIM areas was very low because capacity was overestimating available supply due to the previously reference software defects. DMM’s Figure 12 illustrates that the number of failures were low and widespread across all EIM areas, with the most amount of capacity test failures seen in Powerex’s balancing authority area during Q1 and Q2.

California ISO	0	0	0	4	6	0	0	0	0	0	0	0
Arizona PS	0	0	4	0	0	1	0	0	0	0	0	9
BANC	0	0	0	0	0	0	1	1	0	2	1	0
Idaho Power	0	0	0	0	0	0	0	0	0	0	0	0
NV Energy	0	0	0	1	1	0	0	0	0	3	6	0
PacifiCorp East	0	0	0	0	0	0	0	0	0	0	4	0
PacifiCorp West	0	3	0	0	0	0	0	0	0	0	4	0
Portland GE	0	0	0	0	0	0	0	0	0	0	0	0
Powerex	12	6	8	6	10	0	0	0	2	2	3	0
Puget Sound En	0	2	0	0	0	0	0	0	0	0	0	0
Salt River Project				7	0	0	0	0	0	3	2	0
Seattle City Light				0	4	0	6	2	0	0	0	0
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2020											

Figure 12 - Observed 2020 RSE failures without software defect correction

²⁷ CAISO Department of Market Monitoring: [Report on Resource Sufficiency Test in the Energy Imbalance Market](#). May 20, 2021.