



California ISO

EIM Resource Sufficiency Evaluation Enhancements

Draft Final Proposal

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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. 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 a straw proposal and has held multiple meetings 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 import schedule reliability
- 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
- Adjustments to the initial reference point used in the RSE's flexible ramping sufficiency 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
- Consideration of the treatment of storage resources within the flexible ramping sufficiency test

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- Consideration of adjustments made to a balancing authority area's load forecast used by the real-time market
- 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.

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

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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 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

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

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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 Straw Proposal

Changes	Details
Intertemporal constraints	Additional detail provided on: <ul style="list-style-type: none"> • Resource start-up times • Generator forbidden zones • Consideration of storage resources
Flexible Ramping Sufficiency Test	<ul style="list-style-type: none"> • Phase 2 consideration of relaxing flexible ramping down constraint during select system conditions • Provided an example of proposed implementation of PBC constraint relaxation quantity
Balancing Test	<ul style="list-style-type: none"> • Provided additional detail and examples on the types of base scheduling practices the balancing test is designed to prevent
Demand Response	Additional detail provided on: <ul style="list-style-type: none"> • Clarification on measures to prevent misuse of functionality and consideration of additional policy development in phase 2 • Timing of demand response participation

	<ul style="list-style-type: none"> • Clarification of a balancing authority area's ability to decide types of demand response participation
Emergency actions	<ul style="list-style-type: none"> • Clarification on implementation and interaction with the RC West or other reliability coordinator functions
Additional Transparency	<ul style="list-style-type: none"> • Citation of DMM's reporting to date, and request for feedback on DMM's recently published RSE report
Intertie Uncertainty	<ul style="list-style-type: none"> • Companion technical document provides analysis on current methodology • Proposing to revise methodology with stakeholders in phase 2 of the initiative

4 Stakeholder comments

Stakeholders submitted comments on the August 16 straw proposal and had opportunities to participate in a stakeholder call on August 23rd and a discussion of the RSE with the CAISO's Market Surveillance Committee on August 27th. The comments the CAISO received in those forums have been supportive of a number of elements of the proposal including changes to the balancing test, flexible ramping sufficiency test, treatment of CAISO imports, treatment of balancing authority area emergency actions, demand response participation methods, and changes to data transparency and reporting. Stakeholders did express varying opinions on the accuracy of intertemporal constraint enhancements, as well as the possibility of accounting for load conformance within RSE.

The majority of stakeholders supported the proposal to exclude from the balancing test and its potential revenue disbursements, any balancing authority area that does not submit base schedules and instead participates in the CAISO's day-ahead market.² The Public Generating Pool, Public Power Counsel, SMUD, and Vistra all raised equity concerns regarding the CAISO's potential to have unbalanced schedules while not having the balancing test applied. The CAISO agrees this potential exists, however,

² This currently only includes the CAISO but could potentially exclude other entities in the future.

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maintains that its market clearing process does not make available the same incentives for strategically over or under base scheduling that the balancing test is designed to prevent.

The CAISO's overall available supply capacity is more appropriately addressed by the RSE capacity test. The capacity test limits a balancing authority area's incremental transfers if an entity does not have sufficient supply to meet its forecast demand and net load uncertainty requirement. PG&E raised an additional equity concern of the CAISO balancing authority area not being eligible for revenue disbursement while its supply and demand helps cure potential over or under scheduling by other balancing authority areas. The CAISO believes this concern is addressed by the capacity test, as it assures all balancing authority areas have supply to meet their demand, and that it is more appropriate that the CAISO not share in the pool of revenues for a penalty it is not exposed to.

Stakeholders supported the proposal to adjust the flexible ramping sufficiency targets to reflect a power balance constraint relaxation. This type of constraint relaxation typically occurs as a means to achieve a market solution. The constraint is relaxed during a supply deficiency in the market run that is used as the baseline for calculating the ramping sufficiency test requirements. The proposal would increase the upward flexibility requirement by a value equal to the relaxation, while decreasing the downward requirement by that same amount. To aid stakeholders in understanding how the CAISO proposes to implement this enhancement a graphic example is provided in [Section 5.1.2](#).

The majority of stakeholders supported the proposal to limit the CAISO imports considered by the RSE, to those that have a valid e-Tag transmission profile submitted forty minutes prior to the hour. This limits the imports the CAISO is able to consider in the RSE to those it has a reasonable assurance of delivery on. In [Section 5.1.4.2](#), the CAISO provides additional detail on the quantity of imports that this change would have excluded since the intertie deviation settlement deadline was implemented during the Spring of 2021. Vistra identified that the RA Enhancements proceeding may be a better place to address CAISO's import reliability. The CAISO believes better reflecting imports that will actually be available in the RSE will improve the accuracy of the RSE. The CAISO also notes that not all of the imports into its balancing authority area are RA resources.

Stakeholders supported the proposal to not allow a balancing authority area to receive incremental EIM energy transfers when it is in an energy emergency. Clarification was requested on how these limitations would be implemented, as well as what would be the triggers of such limitation. [Section 5.1.4.3](#) provides additional detail on this aspect of the proposal.

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Stakeholders were supportive of the proposed changes to allow demand response programs operated by EIM entities to be accounted for in the RSE. Stakeholders expressed varying amounts of concern regarding the ability for this functionality to be misused. Stakeholders such as Pacificorp believe that any verification of demand response program function should be performed after-the-fact. NVE and SMUD support the proposed functionality with no requirement of attestation or changes to the balancing, over and under scheduling tests. The Joint EIM entities believe that an attestation is sufficient to prevent misuse.

While the CAISO believes the potential for this functionality to be misused exists, after considering stakeholder feedback we believe the appropriate balance is to require an attestation of intent regarding how these demand response programs will be used. Further the CAISO would plan to review the use of this functionality, and re-address the need for potential changes to the over- and under-scheduling penalties to provide an additional deterrence against potential misuse during the second phase of this initiative. Additional clarification and discussion regarding how the CAISO plans to implement this functionality can be found in [Section 5.1.4.1](#)

Several stakeholder's provided comments supporting the CAISO's proposal for DMM to have primary responsibility for monitoring and reporting on the RSE. The DMM has already assumed this responsibility and issued its first report on September 24, 2021. Please see [Section 5.2.1](#) in the proposal for additional details on the DMM's reporting function and how the CAISO can help to facilitate the disbursement of this information.

A majority of stakeholders supported the CAISO's proposal to count capacity made available through the short term unit commitment (STUC) market time horizon towards the capacity test. These stakeholders asked for additional information regarding how this proposal would have worked during the August 2020 events, as well as for clarification on the treatment of startup types, forbidden zones and ramping. The proposal includes additional details in [Section 5.1.1](#) on these topics. A number of stakeholders including BPA, PGP and PPC disagree with the CAISO's proposal to count capacity made available in the timeframe of the STUC horizon. Their concern is that this approach is inconsistent with the RSE capacity test's intent of reviewing the supply each EIM entity brings to the upcoming hour.

The CAISO believes that the RSE should evaluate the capacity made available for use by each EIM entity during the hour under evaluation. Resources may have varying startup times and may have been made available to the EIM for use more than an hour in advance. Limiting the counting of capacity to resources already online or short-start resources that are available within the RSE horizon may disadvantage entities whose resource mix possess a higher proportion of these longer start resources that were

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made available to the real-time market coinciding with the hour under the RSE's evaluation, but were not started due to the market's unit commitment decisions.

The CAISO retains its concern that not counting capacity made available into the real-time market through the STUC horizon disadvantages EIM participants to the extent they do not submit supply resource base schedules or self-schedules to the real-time market and instead rely on the CAISO market to commit resources. This concern, and its proposed solution of testing for capacity made available to the real-time market through the STUC horizon is supported by the majority of stakeholders including the CAISO DMM, the Joint EIM Entities, NVE, PG&E, Six Cities, SRP and Vistra. The STUC process optimizes the unit commitment in the entire market footprint through its horizon. In lieu of committing short start resources whose startup time or cycling times exceeds the RSE horizon, specific to any balancing authority area, the market optimization may rely on access to forecasted variable energy output or more cost effective import supply. To the extent that net load uncertainty materializes within the market footprint between the start of the STUC horizon and the RSE, the CAISO does not believe an entity should be penalized for relying on these previous market procurement decisions that do not procure additional supply for this uncertainty. Not counting resources offered into the market, whose start-up instructions would have needed to be issued by STUC prior to the real-time unit commitment process, can create incentives for EIM participants to take inefficient manual actions rather than relying on the market to optimize resource dispatch. These include base scheduling resources at minimum load or manually dispatching resources to ensure they are online and counted for the purpose of passing the RSE.

The CAISO does not plan to add a requirement to either the STUC or real-time unit commitment (RTUC) process to ensure its market optimization clears capacity within its balancing authority area sufficient to pass the RSE, as suggested by the Public Generating Pool. As described above, the CAISO believes that this type of requirement has the potential to lead to inefficient market outcomes. NVE requested the CAISO further expand its consideration resources that may not be available during the RSE's evaluation window to include capacity for resources that are use limited on a much longer time horizon. The CAISO is not planning to address these types of use limited resources on the basis that this capacity was never made available to the real time market for use.

The CAISO does not propose to modify the RSE's capacity test to consider a balancing authority areas load conformance as part of phase 1 of this initiative. The CAISO remains unconvinced that it is appropriate to add load conformance to the CAISO requirement from a policy perspective. As discussed at the August 27 MSC meeting, increasing a balancing authority area's load considered by the capacity test to account for load conformance could lead to an overstatement the capacity required by a

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balancing authority area. This would particularly affect the CAISO, as it utilizes load conformance to a greater extent than other EIM balancing authority areas due to the CAISO depending on its real-time market to schedule imports and start-up resources. Load conformance used by system operators is used to commit additional internal resources, or to drive additional imports. This is analogous to an EIM entity base scheduling more resources online, or scheduling more bilateral interchange prior to the RSE; ensuring they have more headroom or flexibility going into the operating hour. While stakeholders such as “Joint EIM entities” are correct that this additional capacity is made available from some EIM entities, which adds to their requirements, this capacity was transacted willingly between two parties, and is analogous to a bilateral transactions made between two EIM entities in the hour ahead timeframe. The CAISO is still open to considering load conformance in the second phase of this initiative, however it would look to do so in a manner that would treat all balancing authority areas equally regarding the actions they take to secure additional capacity in excess of the RSE forecasted requirements prior to participation in the EIM.

The CAISO also received comment from the Joint EIM entities regarding the straw proposals failure to address the potential for systematic errors in the load forecasts used by the RSE. The CAISO did not address, and at this time does not plan to address this issue as it believes that the examples provided may not necessarily reflect a deficiency in the forecast used by the RSE. The example references the HASP forecast and the real-time dispatch (RTD) variable energy dispatch. The RTD is a market result that considers transmission congestion in its dispatch, which is not accounted for in the raw forecast. The RSE does not currently contain, nor have any plans at this time to enforce a deliverability feasibility constraint of the capacity made available for the RSE. Further, the inclusion of net load uncertainty within the capacity test already accounts for load forecast error.

Comments showed strong stakeholder support for starting phase 2 of the resource sufficiency evaluation enhancements immediately after the completion of the first phase. The CAISO plans to make RSE phase 2 policy development a high priority next year with the goal of implementing any changes in 2023. However, the CAISO plans to determine the exact timing of the stakeholder initiative when it considers the timing of all planned stakeholder initiatives schedules as part of developing its annual policy development plan for 2022. Additional discussion on this topic can be found in [Section 6.1](#).

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 startup 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 that the real-time market could not have 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 horizon, but in excess of the time horizon considered by RTPD.³ 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.

³ [CAISO BPM for Market Operations Section 7.7](#)

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It is reasonable that the capacity test should count resources that have a start-up and minimum run time 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 both (1) the resource's start-up time, and (2) the hours for which bids for the resource were submitted. 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 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 CAISO, please see [Appendix 1-B](#) for additional detail. As detailed previously by the CAISO's analysis,⁴ 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 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

⁴ [Bautista Alderete, Guillermo and Kalaskar, Rahul. Resource Sufficiency Evaluation Bid Range Capacity Test. Mar 2021](#)- PowerPoint Presentation

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receive credit for the bid in capacity that would have been available but for the market instruction.

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 startup 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 startup times longer than the STUC horizon will be started through the day-ahead processes.

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.

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2	<p>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</p>	<p>Capacity is Credited</p> <p>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</p>
3	<p>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</p>	<p>Capacity is credited</p> <p>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.</p>
4	<p>Pmax: 400 MW Status at T-270: Online 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>Capacity is not credited</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</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>

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	Availability: Bid continuously start at 270 Minutes prior to operating hour	
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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 within the STUC horizon, without consideration of its incentives to discharge has the potential for the capacity test to overstate these resources' capabilities. Thus, the CAISO proposes in phase 1 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. The CAISO requests comment on this approach. 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.

The CAISO proposes to utilize the cold startup time for short start cycling resources that are offline at the start of the STUC horizon, and warm start startup time for resources that are online at the start of the STUC horizon. Consideration of a cold start startup 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). T

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

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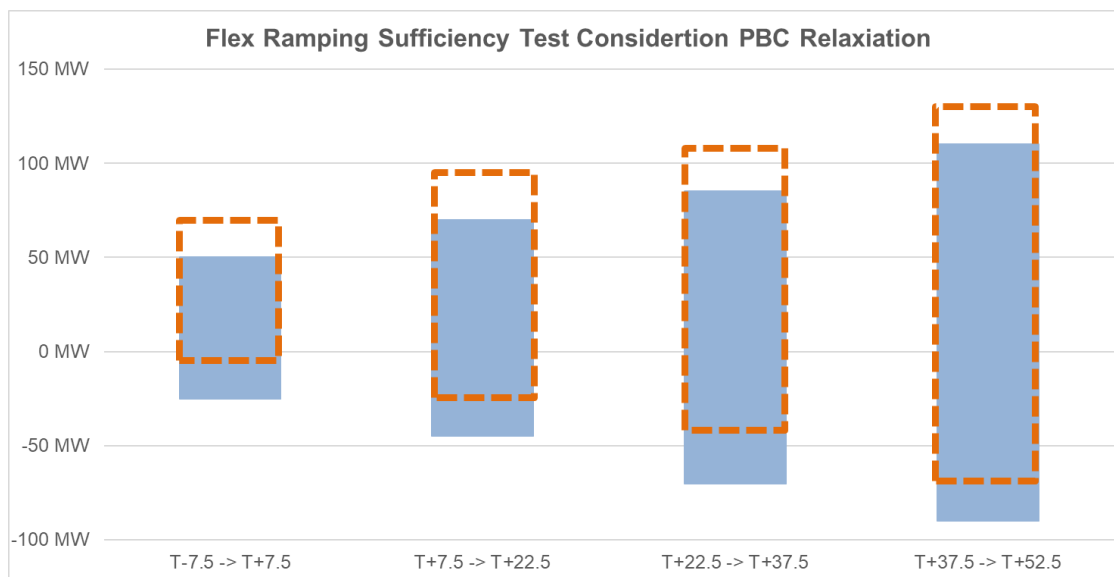


Figure 1: Graphic Display of PBC Consideration in the flexible ramping sufficiency test

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 the extent that stakeholders believe additional policy 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

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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,⁵ 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.

- 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

⁵ [Comments on issue paper and workshop presentations/discussion – Six Cities](#)

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- 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

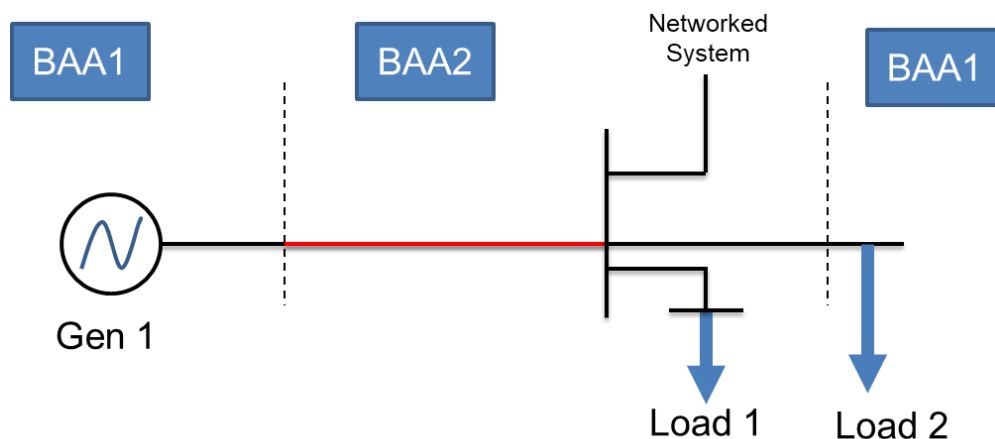


Figure 2: Graphic to aid in over-scheduling example

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 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

Table 2: Table to aid in under-scheduling example

	Base Scheduled Capacity	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

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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.

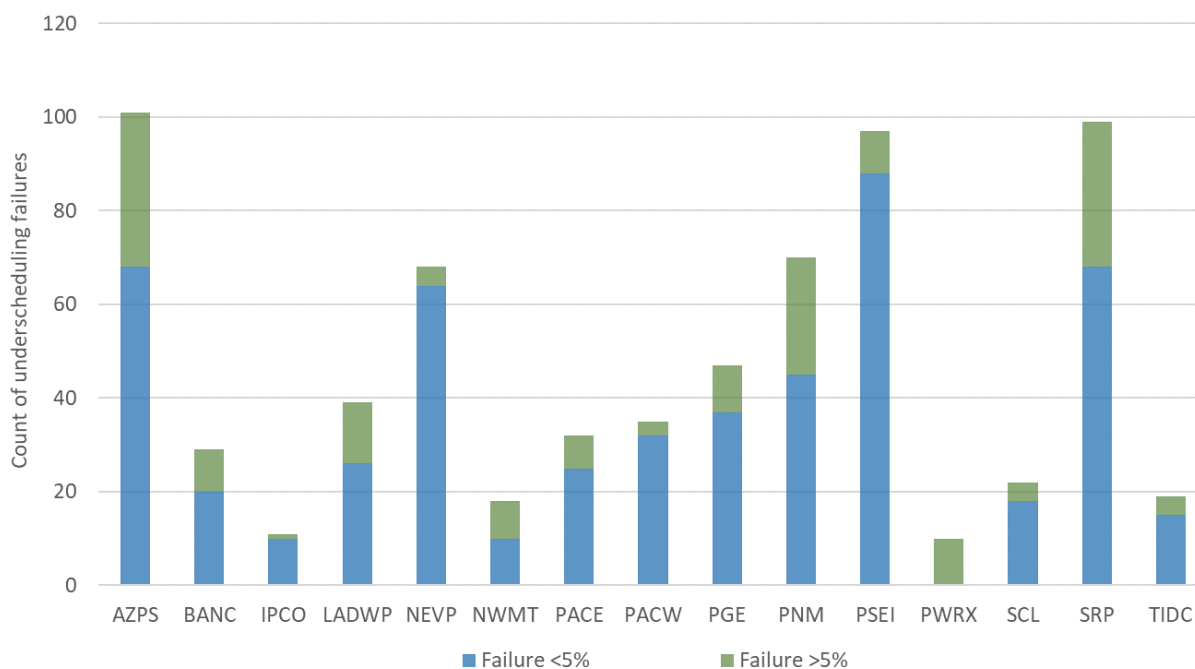


Figure 3: Count of under-scheduling failures for October 2020 through September 2021

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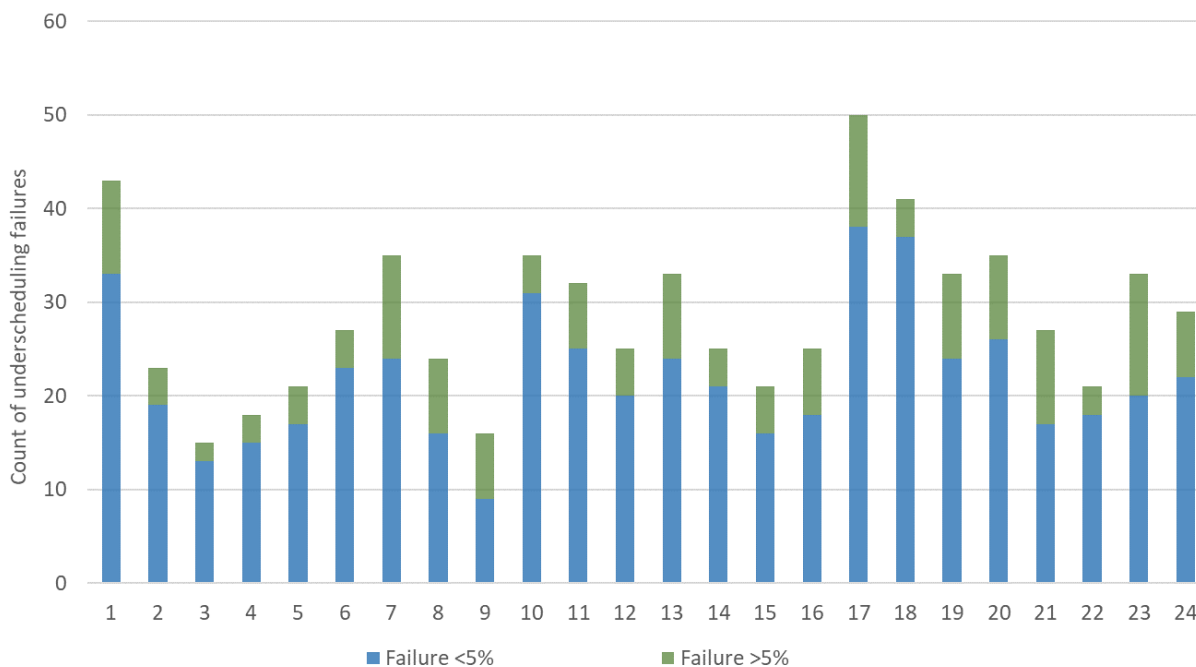


Figure 4: Hourly count of under-scheduling failures for October 2020 through September 2021

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

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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. The election to change the CAISO generated load forecast will result in the forecast being treated as an EIM entity generated forecast; with automatic application of the over and under scheduling tests. Imbalance charges will continue to be settled against metered demand; imbalance charges 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 capacity or flexible ramp sufficiency test. 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 does not plan to change the current penalties associated with the balancing test. Should an EIM entity elect to utilize this functionality, they will automatically have the over and under scheduling test applied with its current penalty structure. The CAISO will review how this functionality is used by EIM entities and will revisit the need for additional penalties in phase 2 of the RSE enhancements 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-

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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, 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 Delivery of CAISO Import Schedules

Stakeholders in their comments supported the CAISO’s proposal to discount any import 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.⁶ The CAISO believes import schedules supported by an e-Tag with a valid transmission profile should be counted as it provides a reasonable representation of intent for an import awardee to deliver on the award; this corresponds to a positive affirmation of intent to deliver. In addition, the CAISO imposes an under/over delivery charge, which further incentivizes the delivery of awards. The charges are 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 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 accessing energy

⁶ [CAISO Tariff § 11.31.1.2](#)

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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.

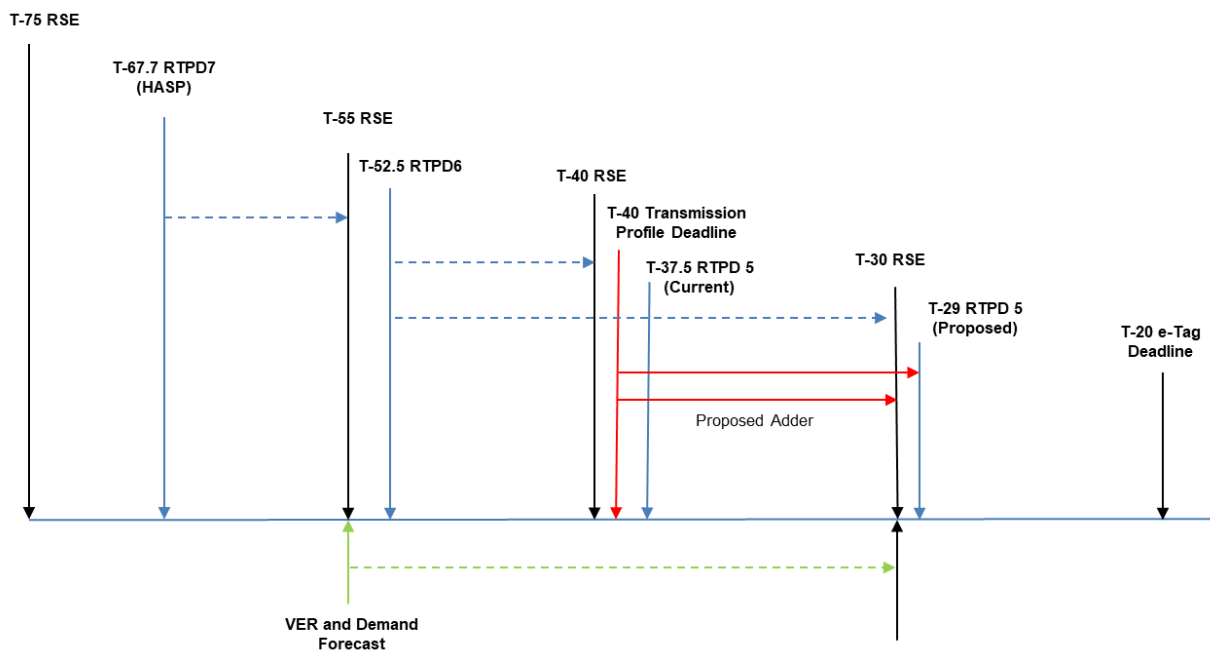


Figure 5: Sequencing of RSE, RTPD and Intertie Deviation Settlement timelines

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 deviation 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.

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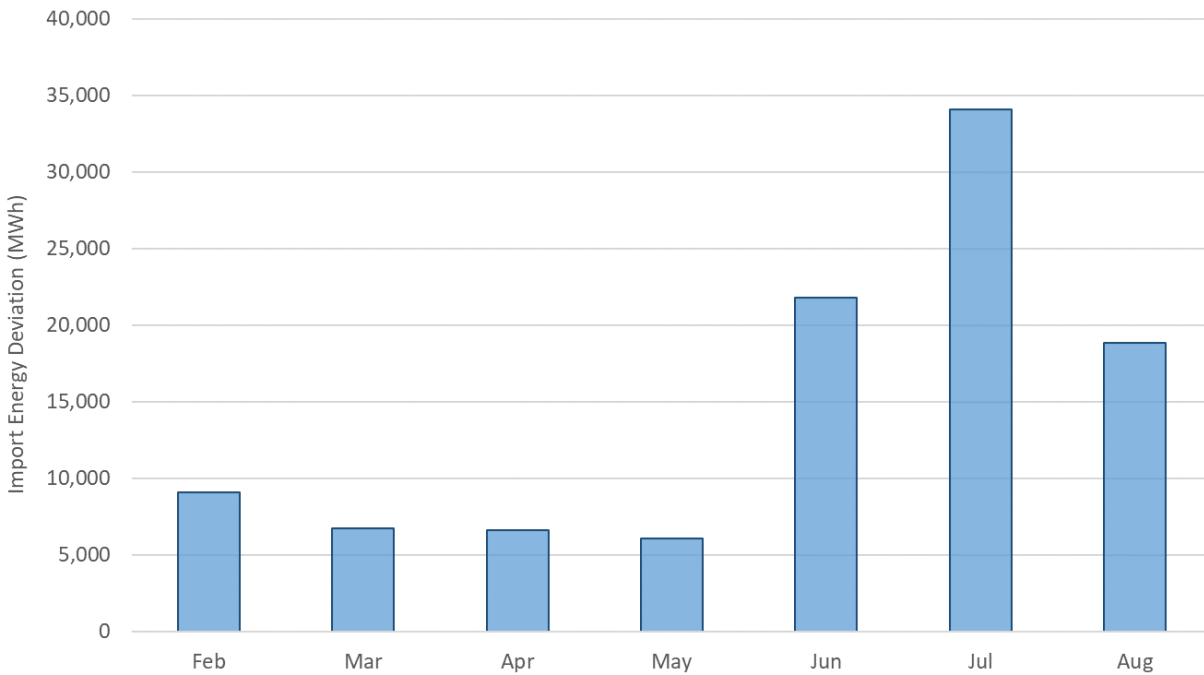


Figure 6: Monthly energy volume (in MWh) for import deviations

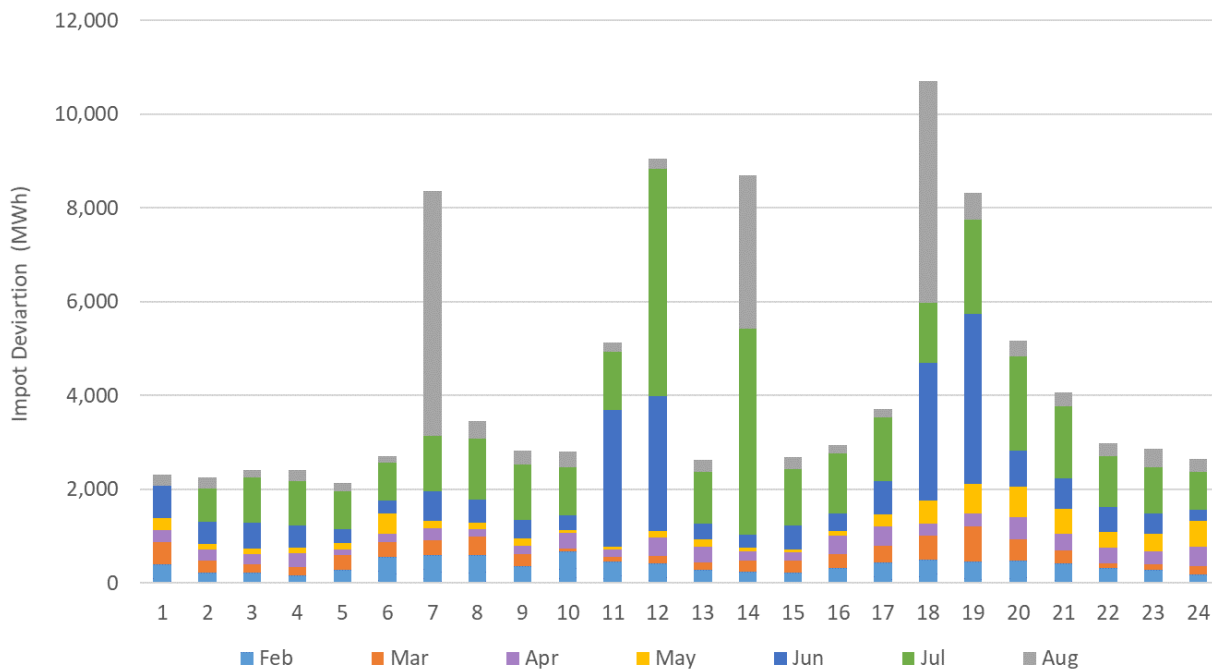


Figure 7: Hourly energy volume (in MWh) for import deviations

5.1.4.3 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.

The CAISO proposes that all EIM participants sign an attestation specifying that they will notify the CAISO should they get RC approval to perform these emergency actions. The CAISO proposes that upon notification the system will limit incremental EIM transfers until such time that the CAISO receives a notification that the emergency conditions are no longer present

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 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.

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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 2021⁷. 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 Outlook⁸.
- 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 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

⁷ [CAISO Department of Market Monitoring Summer Market Performance Report for July 2021](#),

⁸ [Link to CAISO Today's Outlook](#)

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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

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.

5.2.3 Net Load Uncertainty Calculation

Stakeholders raised concerns regarding the calculation of the uncertainty requirements that are used as inputs to the capacity test. These include the uncertainty requirements for variable energy resources, load, and historical net import/export delivery. The CAISO plans to update the uncertainty calculations for variable energy resources and load with the quantile regression methodology approved in the *Flexible Ramping Product Refinements* policy. The quantile regression uncertainty calculation is planned for implementation prior to the implementation of the enhancements in this initiative.

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Given the timing, the CAISO believes that developing data reporting metrics for the existing histogram calculation for variable energy resources and load is outside of the scope of this initiative. The CAISO has been assessing the impact of the addition of the current uncertainty requirements to the capacity test and has been reporting the findings and analysis in the monthly summer reports. Overall, the addition of uncertainty requirement has increased significantly across BAAs in the EIM footprint. July and August saw a threefold and twofold increase in the number of capacity test failures in the EIM, respectively.⁹

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

⁹ The detailed analysis and metrics on the capacity test performance with the summer enhancements are provided in the CAISO's monthly performance reports available for [July 2021](#) and [August 2021](#)

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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. As proposed by the select EIM entities in their comments, this type of change should only be done "with a clear rationale",¹⁰ 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 conditions¹¹

6.2 Load Forecast Adjustments

In their comments responding to the straw proposal, some stakeholders maintain the RSE should incorporate upward operator adjustments to the load forecast used by the real-time market. Other stakeholders agree with the approach described in the straw proposal, in which this element would be deferred for further consideration in phase 2 of this initiative. The CAISO proposes to defer this topic to phase 2 of this initiative.

The data cited in comments shows that the CAISO operators load forecast adjustments are typically to increase the load forecast used by the real-time market's RTPD process. These adjustments are typically done to commit additional internal CAISO supply and to

¹⁰ [Comments of Select EIM Entities Page - 15](#)

¹¹ 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

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schedule additional imports. This is to account for market issues that are being addressed, or have been addressed, by other market enhancements.

The CAISO believes that the RSE should test for a balancing authority area's ability to meet its forecasted demand and ramping requirements, rather than forecasted requirements plus out of market actions that are taken to account for market design deficiencies. Instead of including load forecast adjustments as an adder to the load forecast that the RSE would otherwise use, it is more appropriate to address the need for systemic load conformance through market design improvements.

The existing upward load forecast adjustments are primarily designed to obtain additional supply to compensate for a portion of flexible ramping product schedules that may not be deliverable due to transmission constraints, and to maintain in the real-time market extra capacity obtained in the day-ahead market through upward adjustments to the load forecast used in the residual unit commitment process. The need for these load forecasts adjustments should be largely addressed once the CAISO implements nodal flexible ramping product in the real-time market and imbalance reserves in the day-ahead market in fall 2022.

Despite these planned enhancements, the CAISO operators will likely continue to adjust upward, the load forecast the RTPD uses in the event they deem committing additional internal generation or obtaining additional import energy is appropriate to ensure reliability. These load forecast adjustments achieve a similar result to what EIM entities can achieve through their base scheduling practice and through bilaterally transacting for imports. Neither of these EIM entity actions are incorporated into the demand forecast used by the RSE. Further, EIM entities retain the ability to selectively make available to the EIM their capacity, thus allowing them to retain some capacity or flexibility in reserve. To the extent that the interchange the CAISO's load adjustments drive is sourced from an EIM entity's balancing authority area, an additional requirement to cover the export will be added to that entity's requirement. However that transaction was willingly agreed to by both parties, and the CAISO's EIM participation should not be limited by an external entity's willingness to sell it energy outside of the EIM. Should the load conformance drive additional EIM transfers from EIM entities into the CAISO, those EIM exports are credited as additional upward flexibility in the flexible ramping sufficiency test. Should EIM entities believe this process offers an advantage as compared to their current practices, the same ability to conform the load forecast, as performed by the CAISO, is available to them.

By considering load forecast adjustments as part of phase 2 of the initiative, the ISO and stakeholders will have the opportunity to evaluate the frequency of load forecast adjustments after the planned market enhancements to determine if developing a methodology to account for, and add to the requirements of the RSE, how all EIM

entities procure capacity that may be in excess of their forecasted demand prior to EIM participation is appropriate.

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. These changes include the potential for a more stringent threshold than the existing 5% under scheduling threshold, or the 150% of the LMP charge that the existing test proposes.¹² Any changes would be done to ensure that adjustments to base schedules to represent expected demand response is not misused as a mechanism to pass the RSE.

6.4 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 is publishing 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 always an accurate indicator of future expected intertie uncertainty. With this analysis in mind, the CAISO proposes to review and if necessary revise the methodology for calculating this uncertainty in the second phase of this initiative.

Additionally, the EIM Business Practice Manual (BPM) includes a provision to exclude outlier data from this calculation.¹⁴ Based on the July 2021 events, the CAISO is currently assessing to expand on the outlier data that it will exclude to include deviations due to transmission, generation outages as well as derates due to events that lead to abnormal operating conditions. The CAISO proposes to develop the framework for processing data exclusion requests during the second phase of this initiative.

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

¹⁴ [CAISO EIM Business Practice Manual § 11.3.2.2](#)

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 December 2021. 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 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 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 October 12, the CAISO will hold a stakeholder call to present its 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
Nov 9, 2021	Final Proposal Posted
Nov 16, 2021	Final Proposal Stakeholder Call
Nov 22, 2021	Final Proposal Stakeholder Comments Due
Nov – Dec 2021	Draft BRS and Draft Tariff Language Development
Mid-Dec 2021	Governance Decision

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-40¹⁵. 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 interval¹⁶. 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 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

¹⁵ [The CAISO has proposed to change the final test to T-30 in the fall of 2021 approved under ER21-955.](#)

¹⁶ 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](#)

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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

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recent *Market Enhancements for 2021 Summer Readiness*,¹⁷ 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),¹⁸
- 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.¹⁹

The capacity test is calculated as follows:

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

Where,

G^{max} Upper capacity limit

¹⁷ [Market Enhancements For Summer 2021 Readiness initiative:](#)

¹⁸ The CAISO's test, only FMM imports and exports are considered in the calculation.

¹⁹ *Ibid*

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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).

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

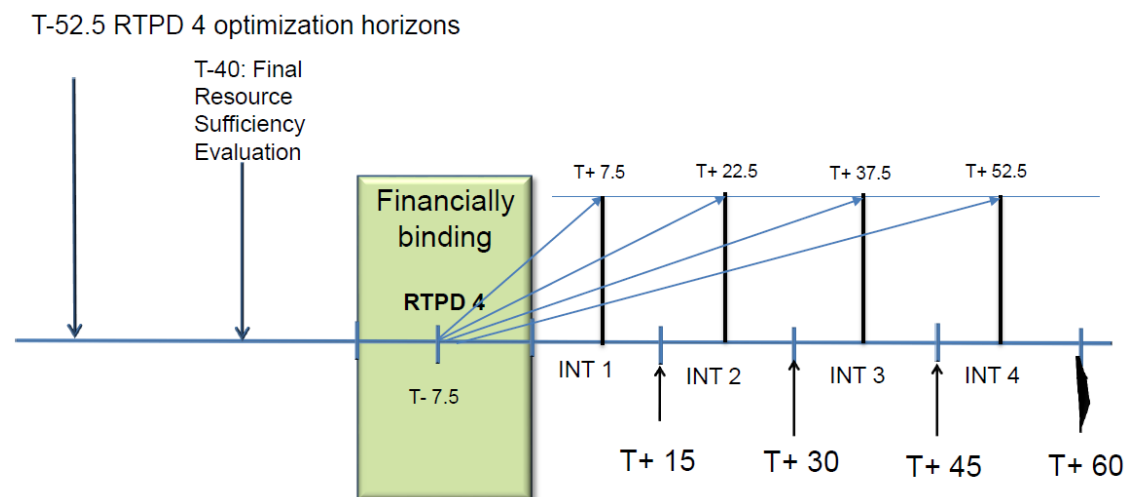
$$100 \text{ MW} > 97 \text{ MW}$$

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



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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:

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

Where,

F_{RD} Flexible Ramp Up 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.²⁰ 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 MW²¹ of capacity. [Figure 9](#) illustrates the difference between overestimated and corrected bid range capacity when derates were correctly applied. This software defect was globally applied to outages submitted by all EIM entity balancing authority areas.

²⁰ [NERC EOP-011-1 Attachment 1: Energy Emergency Alerts](#)

²¹ *Ibid.*

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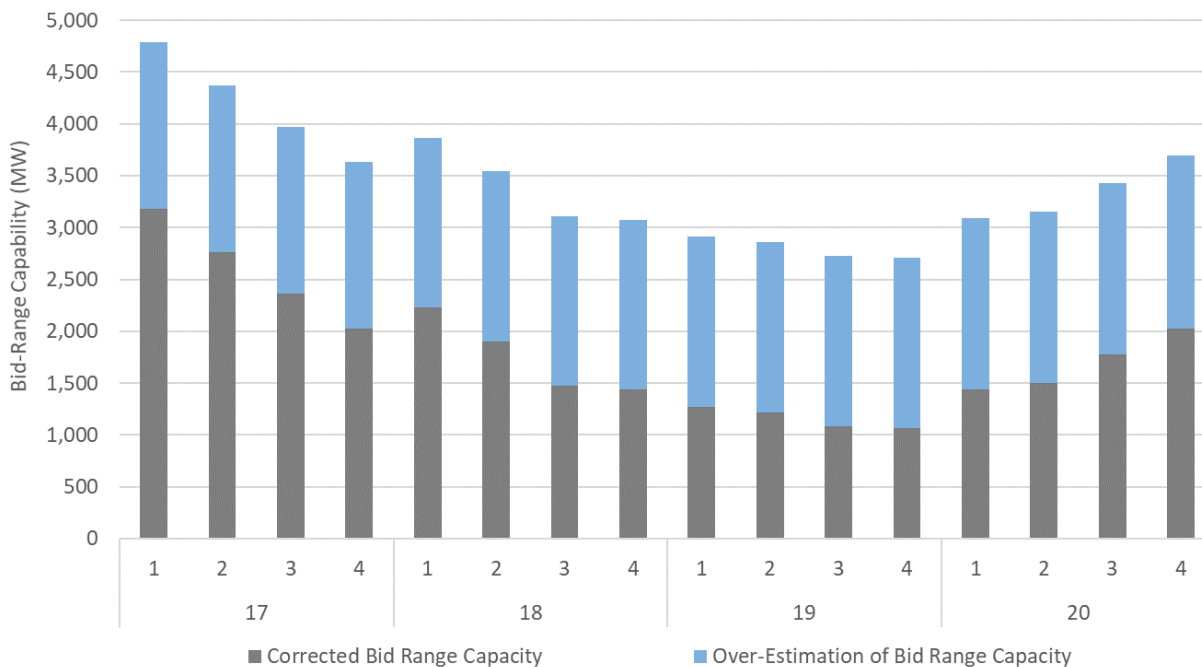


Figure 9: August 14, 2021 Overestimation of Bid Range Capacity in the CAISO balancing authority area

The double counting of mirror resources²² 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 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 picture²³. However, the same

²²Mirror 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.

²³The fixing of Variable Energy Forecast prior to the T-55 RSE was an enhancement to the RSE that was implemented on 12/12/2017.

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variable energy resource forecast is applied to all participating EIM balancing authority areas.

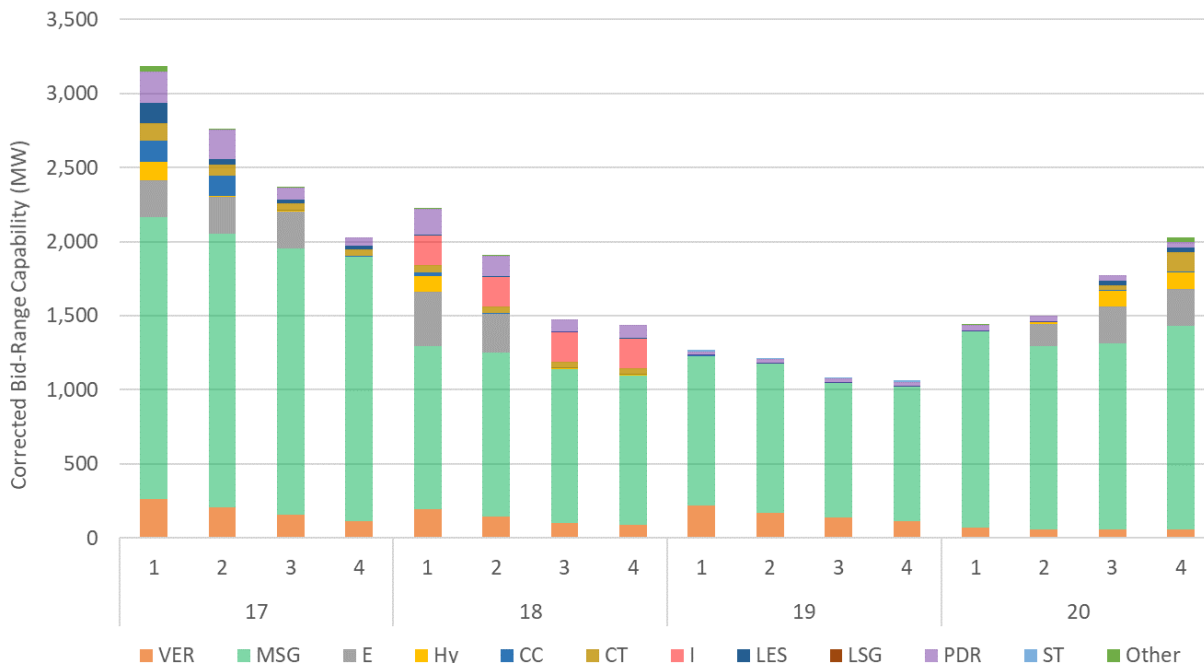


Figure 10 - August 14, 2020 Overestimation

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 111**.

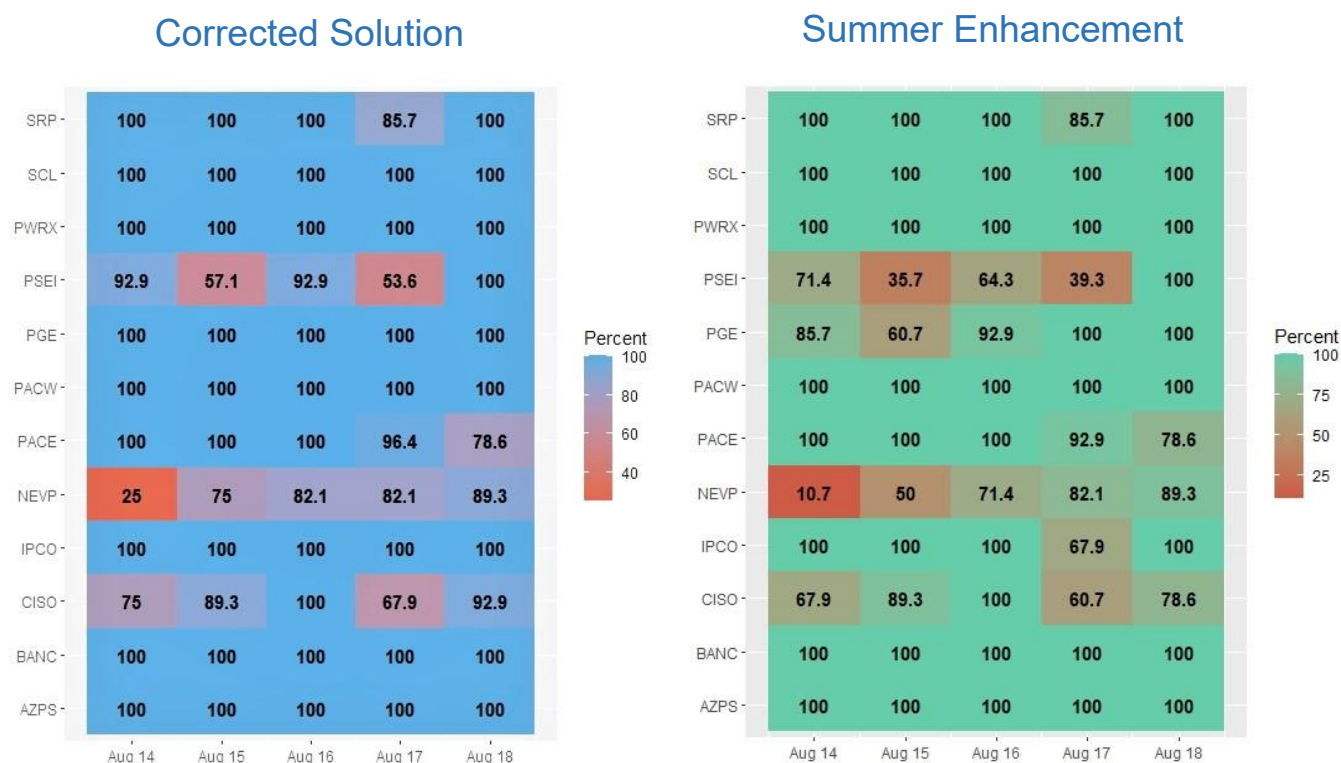


Figure 11 - August 2020 Heat Wave RSE results

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 EIM²⁴. Their assessment illustrates that once the CAISO corrected identified software defects, other balancing authority areas also should have failed the bid-range capacity test.

²⁴ CAISO Department of Market Monitoring: [Report on Resource Sufficiency Test in the Energy Imbalance Market](#). May 20, 2021.

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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