



# California ISO

## **Resource Adequacy Enhancements**

## **Fifth Revised Straw Proposal**

**July 7, 2020**

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## **1. Executive Summary**

The California Independent System Operator Corporation (CAISO) is performing a comprehensive review of the CAISO's Resource Adequacy (RA) tariff provisions and proposing enhancements that ensure effective procurement of capacity to reliably operate the grid all hours of the year. This comprehensive review has identified potential modifications to the CAISO tariff provisions for System, Local, and Flexible RA.

The CAISO's fifth revised straw proposal considers enhancements to RA counting rules and assessments. This includes considering methodologies for determining forced outage rates for system, local, and flexible RA requirements. It is common practice among other independent system operators (ISOs) and regional transmission organizations (RTOs) to include an assessment of unforced capacity values that relies on the probability a resource will experience a forced outage or derate at some point when it has been procured for RA capacity. The CAISO proposes to develop a methodology for calculating unforced capacity values and a portfolio assessment to ensure the shown RA capacity is collectively adequate to meet the CAISO's operational needs in all hours. The CAISO believes this proposed portfolio assessment is necessary to address the growing reliance on use- and availability-limited resources as part of the RA fleet. The CAISO is proposing to develop a stochastic production simulation model that assesses the RA fleet's ability to reliably operate the grid under a variety of conditions.

Regarding provisions for RA must offer obligations and bid insertion, the CAISO is proposing modifications to ensure coordination with the Day Ahead Market Enhancements and Extended Day-Ahead Market initiatives. This coordination is key to ensure all three proposals work without conflicting outcomes. To align with the CAISO's Day-Ahead Market Enhancements initiative, RA resources will have a 24 by 7 must offer obligation into the day-ahead market unless explicitly provided an exemption to this requirement through the proposed policy modifications. The CAISO also proposes that RA resources are subject to bid insertion, unless exempted.

The CAISO is proposing several changes to the existing planned outage provisions and the planned outage process. In response to stakeholder feedback, several changes are intended to provide higher assurance that planned outages scheduled by 45 days prior to the month actually can be taken when scheduled. The CAISO proposes to redesign the planned outage process to reflect system UCAP targets rather than traditional NQC targets. This proposal includes a process that accounts for the need for planned outages in the upfront procurement and eliminates the need for all planned outage substitution. Under this proposal, the CAISO will (1) eliminate RAIM, and (2) retain complete discretion to grant or deny all opportunity outages. The CAISO previously considered a second option, under which the CAISO would procure all substitute capacity on behalf of resources seeking planned outages. The CAISO is no longer considering this option due to numerous complexities involved with such a proposal.

The CAISO proposes modifications to the RA import provisions. The SC for the RA resource will be required to submit supporting documentation demonstrating that any RA import resource shown on annual and monthly Supply plans represent physical capacity that has not been sold

or committed to any other entity for the applicable RA period. The CAISO will include these requirements in the tariff to ensure similar treatment among all LSEs and RA import suppliers.

The CAISO will require that all RA imports, at minimum, identify the source BA and resource or aggregation or portfolio of resources within a single BAA that will provide the capacity. This will ensure that RA imports are not double counted for EIM entities' resource sufficiency tests or otherwise relied upon by the host BAA to serve native load. The CAISO is also considering whether to require firm transmission for RA imports from source-to-sink or only requiring firm transmission delivery on the last line of interest (last leg) to the CAISO BAA, as shown a day-ahead e-Tag, or the requirement of having one of these two options.<sup>1</sup>

The CAISO is proposing a new flexible RA framework that more deliberately captures the CAISO's operational needs for unpredictable ramping needs between day-ahead and real-time markets. Proposed changes to the flexible capacity product and flexible capacity needs determination are intended to closely align with CAISO's actual operational needs for various market runs (*i.e.*, day-ahead market and fifteen-minute market). The proposal also incorporates Effective Flexible Capacity (EFC) counting rules and allowing imports to qualify to meet flexible RA requirements. CAISO also proposes rules for allocation of identified flexible RA needs, updated showings and assessments rules, and updated Must Offer Obligations for flexible RA capacity.

Regarding local RA modifications, the CAISO is examining incorporating forced outage rates into the local RA process.

The CAISO is proposing modifications to its backstop capacity procurement provisions to align backstop authority with the resource adequacy counting rules and adequacy assessments. These proposed modifications include new procurement authority to use the capacity procurement mechanism as an option to fulfill load serving entities' unforced capacity deficiencies and system deficiencies as determined through a resource adequacy portfolio showing analysis. The CAISO is seeking feedback on potential changes for that could be made for incentivizing performance for RMR resources. The CAISO is also seeking authority for a tool to incentivize load serving entities to show UCAP capacity up to requirements.

## **2. Introduction and Background**

The rapid transformation to a cleaner, yet more variable and energy limited resource fleet, and the migration of load to smaller and more diverse load serving entities requires re-examining all aspects of the CAISO's Resource Adequacy program. In 2006, at the onset of the RA program in California, the predominant energy production technology types were gas fired, nuclear, and hydroelectric resources. While some of these resources were subject to use-limitations because of environmental regulations, start limits, or air permits, they were generally available to produce energy when and where needed given they all had fairly dependable fuel sources.

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<sup>1</sup> The obligations for resource specificity and firm transmission fall to the SC for the RA import based on their contractual arrangement.

However, as the fleet transitions to achieve the objectives of SB 100,<sup>2</sup> the CAISO must rely on a very different resource portfolio to reliably operate the grid. In this stakeholder initiative, the CAISO, in collaboration with the California Public Utilities Commission (CPUC) and stakeholders, will explore reforms needed to the CAISO’s resource adequacy rules, requirements, and processes to ensure continued reliability and operability under the transforming grid.

The CAISO has identified certain aspects within the CAISO’s current RA tariff authority that, among other things, require refinement to ensure effective procurement, help simplify overly complex rules, and ensure resources are available when and where needed all hours of the year. The following issues are of growing concern to the CAISO:

- Current RA counting rules do not adequately reflect resource availability, and instead rely on complicated substitution and availability incentive mechanism rules;
- Flexible capacity counting rules do not sufficiently align with operational needs;
- Provisions for import resources need clarification to ensure physical capacity and firm delivery from RA imports;
- Current system and flexible RA showings assessments do not consider the overall effectiveness of the RA portfolio to meet the CAISO’s operational needs; and
- Growing reliance on availability-limited resources when these resources may not have sufficient run hours or dispatches to maintain and serve the system reliably and meet energy needs in local capacity areas and sub-areas.

The CAISO is conducting a holistic review of its existing RA tariff provisions to make necessary changes to ensure CAISO’s RA tariff authority adequately supports reliable grid operations into the future.

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<sup>2</sup> The objective of SB 100 is “that eligible renewable energy resources and zero-carbon resources supply 100% of retail sales of electricity to California end-use customers and 100% of electricity procured to serve all state agencies by December 31, 2045.”  
[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201720180SB100](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100)

### 3. Stakeholder Engagement Plan

Table 1 outlines the schedule for this stakeholder initiative below. The CAISO plans to seek CAISO board approval of the elements in this RA Enhancements initiative in the first quarter of 2021.

**Table 1: Stakeholder Engagement Plan**

Date	Milestone
July 7	<b>Fifth revised straw proposal</b>
July 14-16	Stakeholder meeting on fifth revised straw proposal
July 30	Stakeholder comments on fifth revised straw proposal due
Oct 12	<b>Draft final proposal</b>
Oct 19-20	Stakeholder meeting on draft final proposal
Nov 3	Stakeholder comments on draft final proposal
Aug – Q1 2021	Draft BRS and Tariff
Q1 2021	<b>Final proposal</b>
Q1 2021	<b>Present proposal to CAISO Board</b>

## 4. RA Enhancements Fifth Revised Straw Proposal

The following sections detail the CAISO's proposed modifications and provide the CAISO's rationale and supporting justification. The CAISO has organized the Fifth Revised Straw Proposal into sections covering System, Flexible, and Local RA and related sub topics, and a section covering proposed modifications to the CAISO's backstop procurement provisions. In its Second Revised Straw Proposal, the CAISO separated two local RA topics from previous versions into a separate draft final proposal.<sup>3</sup>

The RA Enhancements Fifth Revised Straw Proposal covers the following topics. This list also includes a summary of major changes from previous proposals:

- System Resource Adequacy
  - Determining System RA Requirements
  - Unforced Capacity Evaluations
    - Modifications - Updated outages definitions, forced outage exemption process. Modified seasonal availability calculation to include top 20% tightest supply cushion hours. Added UCAP calculations for storage and hydro. Added transition plan options for stakeholder consideration.
  - System RA Showings and Sufficiency Testing
  - Must Offer Obligation and Bid Insertion Modifications
    - Modifications - Added additional detail to day-ahead must offer obligation alignment with Day-Ahead Market Enhancements initiative. Minor updates to the variations to the standard must offer obligation for specific resource types.
  - Planned Outage Process Enhancements
    - Modifications – Added additional detail and justification for establishing a planned outage reserve margin in non-summer months.
  - RA Import Provisions
    - Modifications – Modified definition of source specification to include specific units or aggregation of units only. Added details to the resource specification proposal.
    - Considering maintaining firm transmission from source to sink but introducing an alternative option of only requiring firm transmission service on the last line of interest to CAISO BAA with a minimum day-ahead e-tagging requirement.
  - Operationalizing Storage Resources
    - Modifications – Additional detail and clarifications added.
- Flexible Resource Adequacy – remains on-hold; no new additions to this section
- Local Resource Adequacy

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<sup>3</sup> Draft Final Proposal for Local Assessments with Availability Limited Resources and Final Proposal for Meeting Local Needs with Slow Demand Response can be found on the RA Enhancements and Proxy Demand Resource - Resource Adequacy Clarifications Webpage:  
<http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx>,  
<http://www.caiso.com/StakeholderProcesses/Proxy-demand-resource-resource-adequacy-clarification>

- UCAP in Local RA Studies
- Backstop Capacity Procurement Provisions
  - Capacity Procurement Mechanism Modifications
  - Making UCAP Designations
  - Reliability Must-Run Modifications
  - UCAP Deficiency Tool

## **4.1. System Resource Adequacy**

Resource deliverability under stressed system conditions remains an essential and important part of a resource's ability to support reliable grid operations, and the CAISO intends to preserve the current NQC calculations for resources, *i.e.*, the CAISO will continue to perform NQC calculations exactly as it does today, and will continue to derate Qualifying Capacity values (QC) based on deliverability.<sup>4</sup>

For all resources with NQC values, the CAISO proposes to establish UCAP values to identify the unforced capacity value (NQC discounted for units' forced outage rates) for use in system, local, and flexible RA showings and assessments.<sup>5</sup> The UCAP value speaks to the quality and dependability of the resources procured to meet RA requirements. The CAISO also proposes to establish system RA requirements and associated sufficiency tests that account for unit forced outage rates. In other words, a resource's RA value should be measured in terms of its UCAP value, and individual LSE sufficiency tests should be measured based on meeting UCAP requirements each month. The following section provides the CAISO's proposed modifications to incorporate these changes into CAISO RA processes and tariff.

### **4.1.1. Determining System RA Requirements**

The CAISO proposes that RA accounting should reflect both NQC and UCAP values. The CAISO will coordinate with the CPUC and LRAs to ensure alignment with individual LRA requirements.

The following discussion represents the initial proposal of the CAISO. This section remains unchanged from the Fourth Revised Straw Proposal. However, the CAISO is conducting an assessment of actual June RA showings using stochastic production simulation. This production simulation was originally designed to demonstrate the capabilities needed to conduct an RA portfolio assessment. However, the CAISO believes that such a study will also provide additional context about how UCAP requirements should be established. As a result, the CAISO will issue a supplement to this straw proposal in mid-August. This supplement will include details regarding the inputs used in the assessment, the outcome of the assessment in terms of probabilities of stage emergencies and unserved energy. Based on this assessment, the CAISO make additional updates and recommendations regarding how best to set UCAP requirements.

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<sup>4</sup> Section 4.1.2 describes two options for transitioning to the UCAP construct to minimize implementation complexity for the CAISO and participants. Option 1 would modify the terminology of NQC but the process would remain unchanged.

<sup>5</sup> Resources without an NQC are not eligible to provide system or local RA capacity.

### **System UCAP Requirement**

From a planning perspective, it is reasonable to require that the amount of UCAP made available should be sufficient to serve forecasted peak load and ancillary services requirements given the forced outage rate of resources is embedded in the UCAP value. After removing forced outages from the planning reserve margin, what remains is forecast error and ancillary services. When the RA program was originally developed, the estimated forced outage rate for RA resources was approximately 4% to 6% of the 15% planning reserve margin. Unfortunately, as noted in greater detail below, the CAISO observes forced outage rates far exceeding these values at critical times. The inference drawn from this is that the current PRM, after accounting for such high forced outages rates, is insufficient to cover load, forecast error, and operating reserves during key times, jeopardizing reliability and not meeting a “good utility practice” standard.

To address these concerns, the CAISO is proposing a system UCAP requirement to more directly account for forced outages. To ensure resource adequacy, the CAISO must carry operating reserves for three percent of load and three percent of generation, or cover the Most Severe Single Contingency according to BAL-002-WECC-2a,<sup>6</sup> and must have sufficient RA capacity to provide regulation and the flexible ramping product. Therefore, CAISO proposes to develop a minimum system UCAP requirement that all LSEs must meet and show as RA under the CAISO tariff.

The current system RA structure is designed to cover peak forecasted load, operating reserves, forced outages, and demand forecast error. It is reasonable to assess how well the current program achieves those objectives. The CAISO analyzed data from its Customer Interface for Resource Adequacy (CIRA) system. The goal of this analysis was to assess how well the RA requirements would meet peak forecasted load, operating reserves, and forced outages. Forecast error was excluded from the assessment. The CAISO used the RA requirements for May 2018 through July 2019 based on the CEC 1-in-2 peak load forecast. The CAISO added six percent to that number to account for required operating reserves. Then, the CAISO compared that value to the available RA capacity. Available RA capacity is defined as shown RA capacity plus credits<sup>7</sup> minus forced outages. This analysis was conducted at a daily granularity.<sup>8</sup> As shown in Figure 1, there are several days that the CAISO would have been unable to cover CEC forecasted peak demand plus operating reserves. This is shown by observations below zero on the vertical axis. More specifically, on just over 17.5 percent of the days, CAISO would not have adequate RA capacity to meet its planning targets. Further, this assumes that 100 percent of all RA credits are available at the fully credited level, including over 1000 MW of credited demand response in all but one month (which was 950 MW). For

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<sup>6</sup> BAL-002-WECC-2a found here:

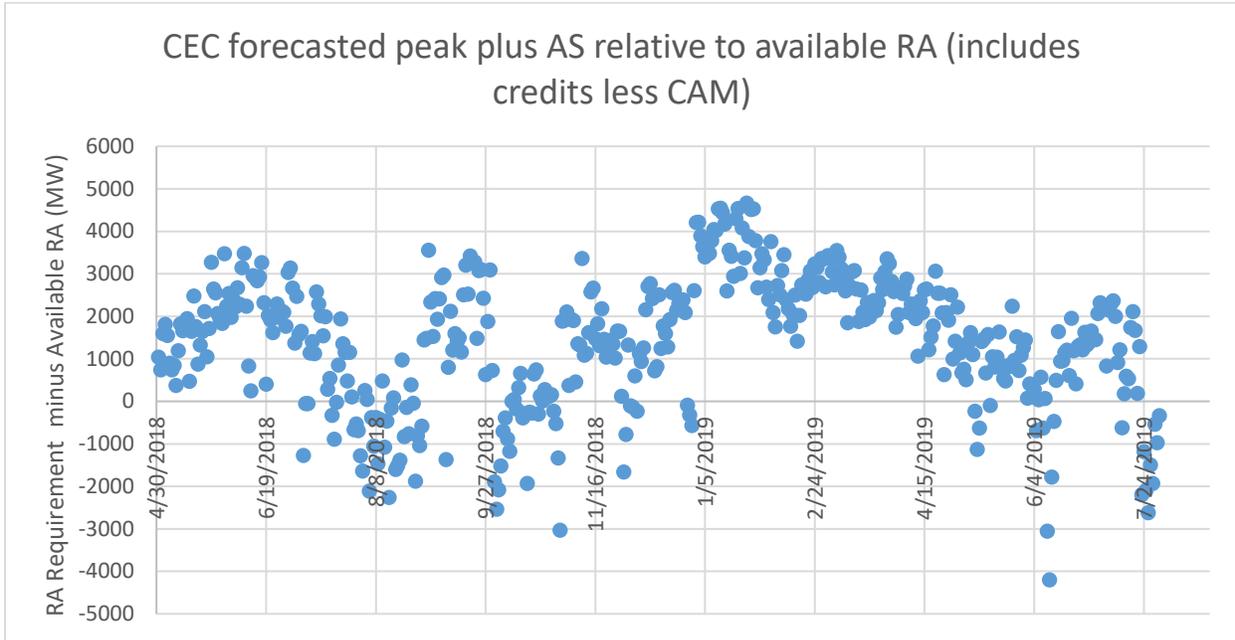
<https://www.nerc.com/ layouts/15/PrintStandard.aspx?standardnumber=BAL-002-WECC-2a&title=Contingency%20Reserve&jurisdiction=United%20States>

<sup>7</sup> CAM credits were excluded from this analysis to avoid double counting.

<sup>8</sup> CIRA only captures when a forced outage flag has been inserted for a day. Hourly granularity is not available in CIRA.

example, if 500 MW of credited capacity is not available or was not responsive for any reason, the percent of days the CAISO would be deficient increases to 25 percent.

Figure 1: Available capacity relative to forecasted need



Additionally, the CAISO looked at the coincidence of forced outages rates with high load days. The CAISO wanted to see if forced outage rates differed based on actual load. Figure 2 shows the forced rates from May 1, 2018 through December 31, 2018. Additionally, the highest load days in each month have been isolated as well. This figure shows there is only a very slight reduction in the forced outage rates on high load days meaning there is very little difference between forced outage rates based on load levels. Put another way, a planning reserve margin should assume forced outage rates are the same regardless of load. Figure 2 shows forced outage rates regularly in excess of ten percent, and even exceeding 15 percent on multiple occasions, including higher load days. This means that any LRA setting a planning reserve margin that accurately and thoroughly accounts for forced outages should include at least a 10-15 percent range on top of the forecasted peak demand. This is further demonstrated by the distributions shown in Figure 3, which shows the maximum, minimum, and average forced outage rates for each month.<sup>9</sup>

<sup>9</sup> Additional assessments regarding the RAIM and its effectiveness at incentivizing forced outage replacement capacity is provided in section 8.3. If RAIM is working effectively, it would likely reduce the overall need for UCAP values. However, as shown below, it has not been very effective at incentivizing replacement capacity.

Figure 2: Forced outages relative to monthly high load days (2018 only)

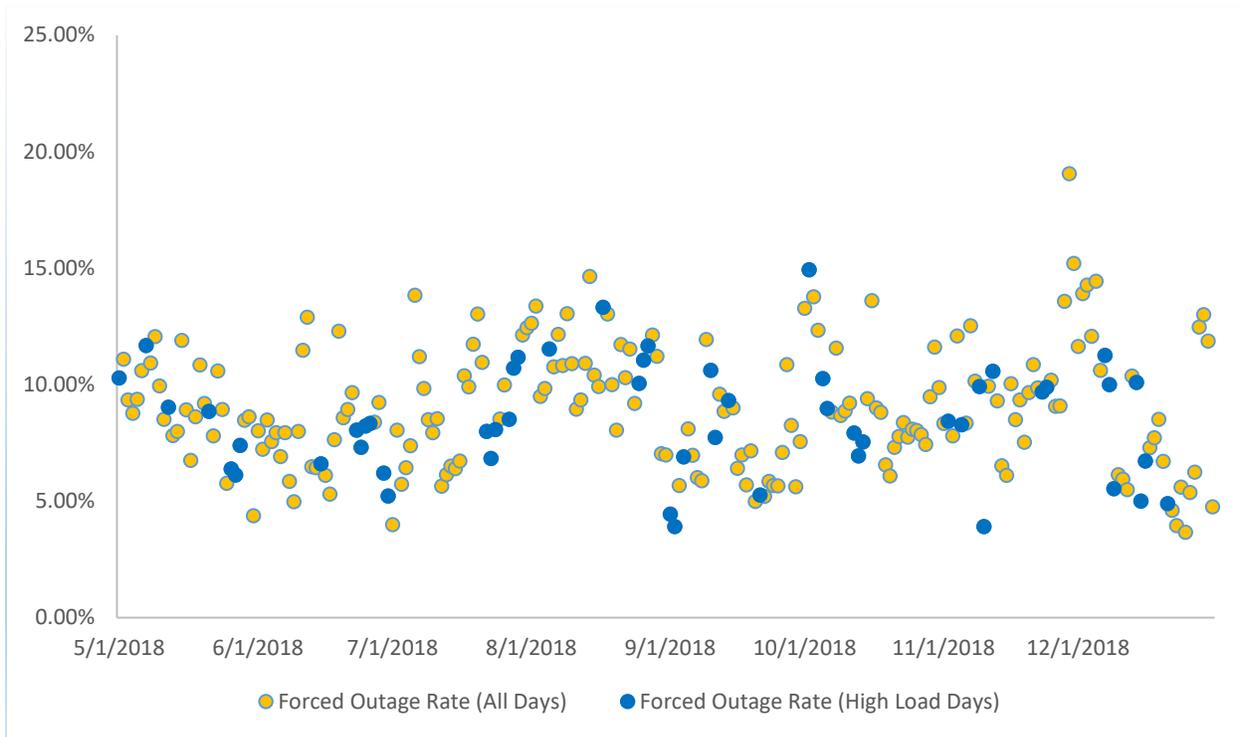
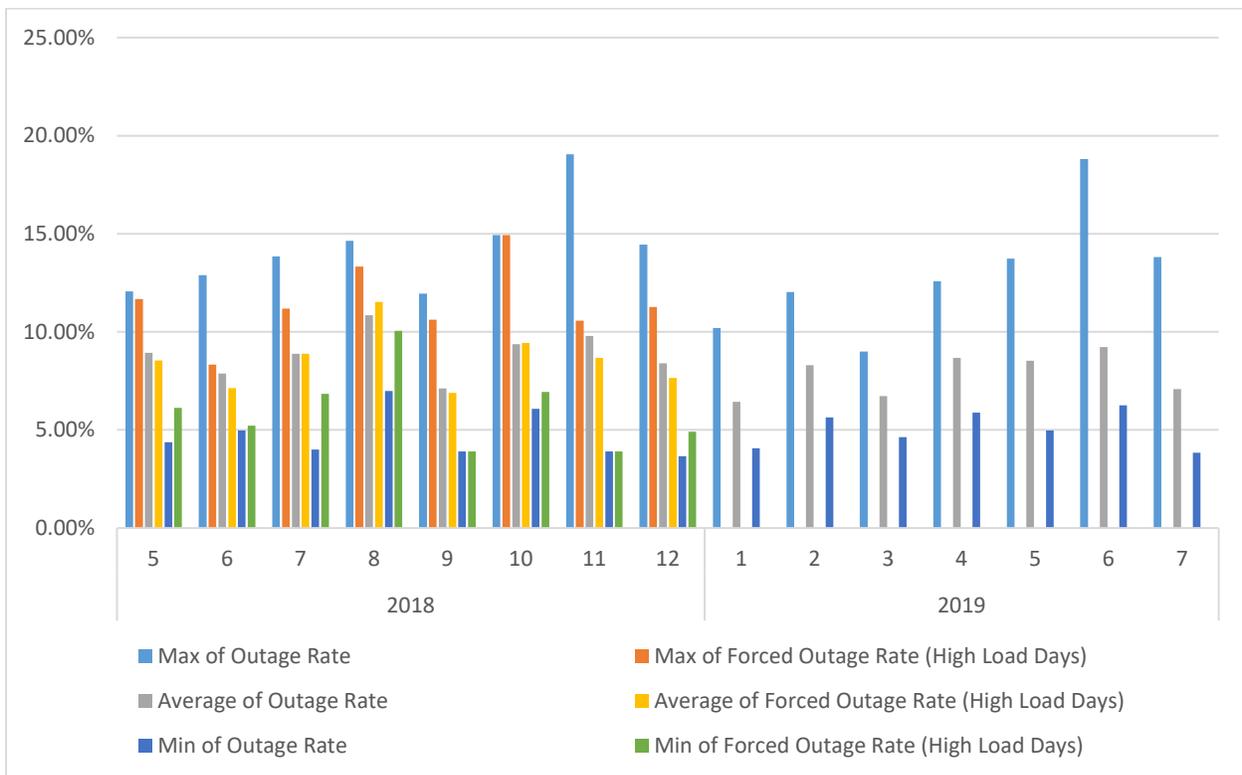


Figure 3: Distributions of Forced Outage Rates



CAISO examined two options to establish the minimum amount of UCAP required to maintain reliable grid operations: Top-down and bottom-up. The top down assumes all units in a given tech type will have the same average forced outage rate while the bottom up examines each unit individually.

The top-down approach relies on developing a probabilistic model to determine how much installed capacity must be procured to reach a predetermined loss of load expectation. This installed capacity value is then translated to an estimated UCAP requirement. This study can be conducted using either individual or system average forced outage rates. Top-down approaches that use system wide average forced outage rate rely heavily on the assumption that forced outage rates are homogenous within a technology type. As shown, this assumption may not hold in California under greater scrutiny. Large variances in the forced outage rates within a technology type can lead to inefficient capacity procurement. Further, this type of study has not been applied to a system as reliant on variable and energy-limited resources as is the CAISO's. Studies that rely on individual forced outage rates still have to account for the various permutations of outages that occur to derive the estimated UCAP requirement.

The bottom-up approach is built on the foundation of forecasted peak demand. From there, ancillary services are added. However, unlike the top down approach, the bottom-up approach does not rely on any assumptions about average forced outage rates for various technology types. Only individual resource outage rates are needed and then only for procurement and showing purposes. Therefore, average forced outage rates are not used since this information is embedded in the UCAP values.

On balance, the CAISO believes the bottom-up approach is best to establish a minimum system RA requirement based on UCAP because it helps ensure minimum resource adequacy requirements are achieved to maintain reliability given the growing number of LRAs and the potential variance in the LRAs' PRM targets. A RA requirement based on UCAP should also help mitigate the potential for capacity leaning among LSEs.

In comments to the revised straw proposal, the CPUC staff suggested using either a higher planning reserve margin or a more conservative load forecast (*i.e.*, 1-in-5 instead of 1-in-2) as an alternative solution to UCAP. As noted in CAISO's testimony in the CPUC's RA proceeding, the CAISO supports using the more conservative 1-in-5 load forecast, particularly for the shoulder months where the CAISO observes greater variability in the monthly peaks.<sup>10</sup> Utilizing higher load forecast would ensure more diverse load profiles can be addressed by RA procurement. However, such a change does not address the fundamental and underlying issue of incorporating forced outages upfront in the procurement process.<sup>11</sup>

Based on the data reviewed by the CAISO, to avoid deficiencies caused by forced outages, all LRAs must provide ancillary services to ensure six percent operating reserves based on forecasted peak demand, plus an additional 10-15 percent to reasonably address forced

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<sup>10</sup> [http://www.caiso.com/Documents/Jul10\\_2018\\_RAProceedingTrack2Testimony-Chapter4-SystemRADemandForecasts\\_ProposalNo3\\_R17-09-020.pdf](http://www.caiso.com/Documents/Jul10_2018_RAProceedingTrack2Testimony-Chapter4-SystemRADemandForecasts_ProposalNo3_R17-09-020.pdf)

<sup>11</sup> These tools may provide more capacity to the CAISO but they do not ensure the quality and reliability of that capacity.

outages. The results of CAISO's analysis show that a planning reserve margin of at least 20 percent is needed to address all needs, including peak demand, forced outages, and operating reserves. This excludes forecast error, which, at least in part, can be addressed by using a 1-in-5 peak load forecast. However, this may not provide adequate RA capacity in many years. For example, using a 1-in-10 year forecast for planning purposes should cover all reasonably foreseeable procurement needs, avoiding the need to include forecast error in a planning reserve margin. Alternatively, using a 1-in-2 forecast would require that virtually all under-forecasting error be included in the planning reserve margin.

Therefore, the CAISO recognizes that efforts to establish a minimum UCAP requirement needs additional collaboration with LRAs to address under-forecasting risks. At this time, CAISO believes that the UCAP requirement should be set at a minimum of 110 percent of forecasted peak. This number accounts for forecast load, reserves, and forecast error. The value used for the forecast error is derived from comparing the low, mid, and high load forecasts from the CEC's 2018 final Integrated Energy Policy Report (IEPR).<sup>12</sup> The IEPR mid load forecast was approximately between one to three percent higher than the low load forecast. The high load forecast was between four and seven percent higher. To account for forecast error, the planning reserve margin likely would need an additional two to six percentage points. The CAISO has selected four percent as a reasonable starting point.

The CAISO received stakeholder feedback indicating a need for the CAISO to consider how to coordinate these important system RA modifications with the CPUC's RA program and with other LRAs. The CAISO agrees this is an important consideration. For a detailed discussion on matters related to coordination of the proposed UCAP concepts with the CPUC's programs, please see section 4.1.2.

#### 4.1.2. Unforced Capacity Evaluations

The CAISO is proposing to adopt provisions for evaluating the reliability and availability of resources that account for the probability of forced outages and derates. This proposed evaluation will eliminate the need for complicated assessments of availability and replacement capacity rules. Many of the U.S. Independent System Operators (ISOs) and Regional Transmission Operators (RTOs) utilize an Installed Capacity (ICAP) and Unforced Capacity (UCAP) concept. ICAP values generally account for resource capacity impacts caused by ambient weather conditions and represents physical generating capacity. UCAP is a percent of the ICAP available once outages are taken into consideration. NYISO, PJM, and MISO incorporate forced outages when calculating each resource's qualifying capacity value and measure capacity value using UCAP in their respective markets. In contrast, ISO-NE relies on an ICAP value that incorporates historical forced outage data when establishing its Installed Capacity Requirement.

The methodological assumptions for calculating UCAP values vary somewhat among system operators and the criteria inputs are unique for each resource type. Generally, UCAP incorporates the availability of a resource using a derating or availability factor. There are

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<sup>12</sup> 2018 Integrated Energy Policy Report found here: [https://ww2.energy.ca.gov/2018\\_energy\\_policy/](https://ww2.energy.ca.gov/2018_energy_policy/)

several key advantages to integrating forced outages and derates into a generator's calculated RA qualifying capacity value. Recognizing a unit's contribution to reliability enables one to compare its reliability to other resources by accounting for differences in forced outage rates. Greater resource accountability should produce market signals that promote procurement of better performing resources with improved operational reliability and availability. The accessibility of information on the forced outages and derates of resources that impact their availability can help buyers avoid risks and make better informed decisions when making bilateral trades or procuring replacement RA capacity.

To date, neither the CAISO nor the CPUC account for the impact forced outages and unit derates have on system reliability beyond what is minimally assured in the established planning reserve margin requirement. Instead, the CAISO relies on substitution rules and the Resource Adequacy Availability Incentive Mechanism (RAAIM) to discipline capacity availability on the very back-end, *i.e.*, the operational end of the process. RAAIM calculates incentive payments and resource non-availability charges based on a resource's bidding behavior. RAAIM is intended to incentivize compliance with bidding and must-offer obligations and ensure adequate availability of RA resources. However, the CAISO believes that confirmation that RA capacity will be available, or be replaced if unavailable, occurs inappropriately late. The dependability and reliability attributed to all resources should be better known and understood upfront during the RA procurement process.

The CAISO proposes to calculate and publish monthly NQC and UCAP values for all resources annually (*i.e.*, once per year a unit will get a distinct NQC and UCAP value for each month of the upcoming year).<sup>13</sup> The NQC process will remain similar to the current approach with no major proposed changes. The CAISO proposes that the calculation of each resource's UCAP will be limited at a resource's NQC value and will consider the resource's forced and urgent outages and derates in determining a resource's UCAP value. The CAISO proposes to calculate seasonal availability factors for UCAP determination purposes. The CAISO proposes to utilize two seasons for this availability factor determination, on-peak (summer) and off-peak (winter). UCAP values will not be affected by CAISO approved planned or opportunity outages. The CAISO will calculate UCAP values for all resource types that do not rely on an LRA established Effective Load Carrying Capability (ELCC) methodology for determining QC values. For resources with QC values calculated using an ELCC methodology, the CAISO will use the ELCC value as the UCAP value. The CAISO provides more discussion regarding the basis for this treatment below.

### ***Outage Definitions***

The first and primary input needed to calculate a resource's UCAP value is accurate and appropriate forced outage and derate data. The seasonal availability factor counting methodology proposed below will be based upon a resource's forced and urgent outages and derates during the tightest system supply condition hours. This outage and derate data is the

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<sup>13</sup> Given the relationship between NQC and UCAP, while a resources' Weighted Average Availability Factors will only be calculated on an annual basis, if a resource's NQC value increases mid-year, as allowed under the existing tariff, the CAISO will update the resource's NQC and UCAP value accordingly.

key information necessary to calculate the expected value (in terms of MWs) of a capacity resource's unforced capacity.

Today, the CAISO has numerous outage cards in the CAISO Outage Management System (OMS) that are designed to describe the nature of work for resource outages. The CAISO also uses these outage cards to determine whether a resource must provide substitute capacity to avoid RAAIM charges, or if the outage is beyond the resource's control and therefore RAAIM exempt. However, the CAISO has encountered challenges utilizing the OMS as currently configured. More specifically, the OMS system is not currently designed to generate and store historical forced outage rates.

Given these challenges, the CAISO considered how best to collect and store data to calculate forced outage rates. The CAISO efforts can be broken down into two objectives: (1) transitioning to UCAP, and (2) longer term outage collection and reporting. The CAISO proposes here a solution that aligns the outage reporting in CAISO systems for the CAISO as the balancing authority with the outage reporting for the Reliability Coordinator (RC) outage coordination process. The CAISO believes this approach will facilitate a smooth transition to UCAP because CAISO systems already classify outages this way for RC purposes and simplify outage classification for the purposes of calculating forced outage rates. Additionally, this approach offers benefits beyond those related to UCAP, as aligning the definitions with the RC definitions will provide clarity and minimize confusion stemming from multiple outage definitions. The remainder of this subsection provides additional details regarding the CAISO's efforts to align CAISO balancing authority area outage definitions with those adopted by the CAISO's reliability coordinator, transition to UCAP, and then ensure accurate long term outage reporting.

In Reliability Coordinator Procedure RC0630, the CAISO defines outage types, their priorities, and the study windows with timelines for outage submission.<sup>14</sup> The following are outages taken by generating resources:

Forced Outage – Facility/equipment that is removed from service real-time with limited or no notice

Urgent Outage – Facility/equipment that is known to be operable, yet carries an increased risk of a Forced outage occurring. Facility/equipment remains in service until personnel, equipment and/or system conditions allow the outage to occur. Urgent outages allow Facilities to be removed from service at an optimal time for overall system reliability. For Urgent outages, the work may or may not be able to wait for the Short-Range outage window.

Planned Outage – Facility/equipment outage with enough advance notice to meet short range submittal requirements.<sup>15</sup>

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<sup>14</sup> RC Procedure RC0630, p13-15: <http://www.caiso.com/Documents/RC0630.pdf>.

<sup>15</sup> Outage management BPM Section 7.2 describes the short range outage submittal requirements for planned outages for the CAISO BAA.

Opportunity Outage – A Facility/equipment outage that can be taken due to a change in system conditions, weather or availability of field personnel. Opportunity outages did not meet the short range window requirements.

The following outage types are for transmission equipment or outages that do not affect the output of the generator. These outages would not be included in the resource’s UCAP value because they do not indicate reduced availability of a generator. The CAISO proposes to incorporate these definitions into the CAISO BA outage process to ensure full alignment in outage definitions between CAISO BA and the RC, beyond just those used for generation availability, and their associated UCAP determinations.

Operational Outage – Transmission Facility/equipment that is removed from service in the normal course of maintaining optimal or reliable system conditions but remains available if needed upon short notice. (This outage type may be either planned or real-time. Work is not being performed on the equipment/facility, but may be part of an operating plan.)

Informational Outage – Facility/equipment outage that is entered for informational reasons including increased situational awareness, for BA/TOP internal purposes or to satisfy the RC Data Specification where WebOMS is the mechanism for communicating the information.

The CAISO is not proposing any changes to the RC outage definitions or outage coordination process in this initiative. Instead, the CAISO proposes to align its CAISO BA outage definitions with the RC outage definitions. For the purposes of UCAP, CAISO proposes forced and urgent outages will be considered in a resource’s forced outage rate calculation. Approved planned and opportunity outages will not be considered in a resource’s forced outage rate calculation. Additional details on how forced outage rates will be used to calculate UCAP values are described in detail below. Finally, the CAISO proposes to reconfigure its OMS system or to develop an alternative system to accurately track and store resources’ forced outages and derates to generate resource specific UCAP values.

### ***UCAP Exemption Process for Rare Events***

The CAISO’s review of some other ISOs/RTOs show there are several approaches for determining which outages to include in the outage rate of the resource for the UCAP calculation. MISO includes forced outages and derates, but excludes outages caused by events deemed “outside of management control” including transmission outages, natural disasters, and fuel quality problems.<sup>16</sup> The NYISO exempts outages caused by equipment failure that involves equipment located beyond the generator and including the step up transformer. The exemption

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<sup>16</sup> BPM 011 – Resource Adequacy, MISO: <https://www.misoenergy.org/legal/business-practice-manuals/#:~:text=BPM%20011%20addresses%20MISO's%20and,have%20an%20appropriate%20reserve%20margin.>

does not apply to other outages that might be classified as outside management control.<sup>17</sup> PJM also includes forced outages and derates, and appears to exclude only outages due to natural disasters that PJM determines have a low probability of recurrence.<sup>18</sup> For the 2018/2019 Delivery Year and all subsequent Delivery Years, PJM considers outages deemed to be outside of plant management control within NERC guidelines in determining the forced outage rate.<sup>19</sup> AESO, which uses a similar availability factor method as proposed by the CAISO, and includes all historical derates, forced outages, planned outages, and force majeure outages in availability factors with the ability for the asset owner to dispute the UCAP value calculated by AESO in certain circumstances.<sup>20</sup> In an effort to ensure the UCAP value reflects the true availability and reliability of a resource, the CAISO proposes here an approach most similar to PJM.

There are some rare outlier events that could cause longer duration outages with a large impact on a resource's UCAP value that would not represent the true forced outage rate of the resource. For these rare instances, the CAISO proposes an after the fact review process that would exempt large outlier events. To capture the actual forced outage rate of the resource, and ensure the UCAP values reflect the availability and reliability of RA fleet, and to limit the administrative burden of SC submittal and CAISO review, the CAISO proposes to consider only outages that are outside normal utility operations, significantly affect the resource's UCAP value, and are unlikely to recur within the same UCAP calculation period of 3 years for possible exemption.

The CAISO proposes to use the following definition of a UCAP exempt outage to determine whether the outage would be excluded from the resource's UCAP calculation.

### **UCAP Exempt Outage**

An outage caused by a natural disaster, act of the public enemy, war, or insurrection. The cause must occur at the plant location and directly affect operability of a generating unit for 5 consecutive days or longer, has not occurred in the previous three years, and could not be avoided through the exercise of Good Utility Practice.

Due to known conditions within California, the CAISO finds it necessary to provide additional detail regarding outages caused by fires. California has a known fire season in which it is reasonable to assume recurrence of generator outages due to nearby wildfires or PSPS events. These outages should not be subject to a UCAP exemption. They are recurring and can significantly impact the availability of the resources located in fire prone areas, thus impacting the CAISO's ability to reliably serve system load year after year. Comparatively, a generator on outage because of equipment damage due to arson would be eligible for a UCAP exemption

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<sup>17</sup> Installed Capacity Manual, NYISO:

[https://www.nyiso.com/documents/20142/2923301/icap\\_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338](https://www.nyiso.com/documents/20142/2923301/icap_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338)

<sup>18</sup> Manual 22, PJM: <https://www.pjm.com/-/media/documents/manuals/m22.ashx>

<sup>19</sup> PJM Reliability Assurance Agreement, Schedule 5, Section B.

<sup>20</sup> 3 Calculation of Unforced Capacity (UCAP), AESO: <https://www.aeso.ca/assets/Uploads/CMD-2.0-Section-3-Calculation-of-UCAP.pdf>

because equipment damage from arson is unlikely to cause repeated unavailability year after year.

The CAISO selected 5 days for the outage duration threshold to limit outage exemption requests to those that could have a significant impact on the resource's UCAP value. From years 2017 to 2019, the median number of UCAP Assessment Hours per day was 4 hours for Peak Months and 5 hours for Off Peak Months, and the average number of hours across all seasons was 4.8 hours per day (see Table 4 below). Assuming 5 hours per day were assessed for UCAP, then the 5 day minimum threshold could reduce a resources availability factor by 2.45-3.4%, which when weighted could impact a resource's UCAP value by about 2%.

To ensure exemptions are only requested for outages that have a low probability of recurring, the CAISO will only review outages that have occurred once within the same three year UCAP calculation period. As described below, the CAISO will calculate forced outage rates annually, using three years of historic outage rates. Therefore, the CAISO proposes not to exempt an outage if it has occurred within the last the three years of historical forced outage data for the same reason. Doing so would undermine the intention to exclude on rare events and demonstrates that this does have a probability of reoccurrence.

UCAP exempt outages submitted by the generator's SC with sufficient justification within 30 days of the conclusion of the outage will be reviewed by the CAISO, and if approved, exempted from the UCAP calculation for the season in which the outage occurred.

In comments to the June 10<sup>th</sup> working group, stakeholders expressed concern that this proposal would penalize resources for outages outside the control of the generator. The CAISO's intent with this proposal is capturing resources' true outage rate during tightest supply conditions such that enough resources are procured to meet resource adequacy needs, considering all forced outages that occur as part of normal utility operations. All resources will be treated equally based on their availability. With rare exception, outages that affect resource availability should be incorporated into resource outage rates to ensure the CAISO has sufficient reliable, dependable resource adequacy capacity to meet the reliability needs of the system. Excluding outages that predictably occur as a part of normal operations poses reliability risks by overestimating the availability of resource adequacy resources.

### ***Seasonal availability factor counting methodology***

The CAISO has proposed, and stakeholder comments have supported, a seasonal approach to UCAP. To establish the proposed Peak and Off-Peak Months Seasonal Average Availability Factors (SAAFs) used to calculate the seasonal UCAP values for each resource, the CAISO will establish a process that includes the following steps and underlying calculations. The CAISO believes that this updated UCAP determination proposal, based on seasonal availability factors, is best applied to the following resource types: Thermal, Hydro, and Storage resources. In the next section we provide more details on modifications to the underlying methodology detailed below for Hydro and Storage resources that better captures their true availability and ensure a resource isn't double penalized.

In the 3<sup>rd</sup> revised straw proposal, the CAISO had proposed to calculate hourly availability factors for each resource during the tightest supply cushion hours in each season. Supply cushion is a measure of real-time system resource adequacy risk. A large supply cushion indicates less real-time system resource adequacy risk because more energy remains available to respond to unplanned events. A low supply cushion indicates the system has fewer assets available to react to unexpected outages or load increases, indicating a high real-time system resource adequacy risk. Evaluating the historical performance of a capacity asset during a subset of tight supply cushion hours captures the correlation of the asset's availability and capability with all other system factors that drive the tight supply cushion hours. This technique should provide a better indication of how the asset will perform in the future under similar conditions when capacity is needed.

Initially, the CAISO had proposed to evaluate a resource's availability during the top 100 tightest supply cushion hours in each season. Stakeholder comments largely did not support this approach. Stakeholders were concerned that with such a small sample size, a resource's UCAP value could be affected more heavily by randomness/ "luck factor" than a true representation of their availability. Stakeholders wanted to see additional data to further justify the selection of the number of assessment hours to include, and question why we don't look at all 8760 hours. DMM suggested we look at all 8760 and weight each hour by the supply cushion. The CAISO believes that such an approach is more complex than it needs to be. Additionally, since we are not allowing for nearly any exemptions of forced and urgent outages, an 8760 approach may over penalize a resource's UCAP value in hours when there was a low real-time system resource adequacy risk.

Today, the CAISO evaluates five RAAIM Assessment Hours, which roughly translate to 20% of all hours (including weekends).<sup>21</sup> Using RAAIM as a template, the CAISO now proposes to evaluate a resource's UCAP value based on the top 20% of tightest supply cushion hours. This translates to 735 hours during the Peak Months (May through September) and 1018 hours in the Off-Peak Months (October through April). The advantages to this approach are that 1) it appropriately penalizes resources for being unavailable during tight system conditions; 2) unlike RAAIM, UCAP Assessment hours can fall at any point during the operating day and thus provides better incentives to be available 24x7; 3) simpler than the EFORd methodology or weighting all hours, while still providing an accurate snapshot of a resource's true available capacity to the grid; 4) utilizing a percentage of hours rather than specific number of hours provides consistency across seasons and years.

In the 3<sup>rd</sup> revised straw proposal, the CAISO had not provided a formal definition of supply cushion. The CAISO defines supply cushion as:

***Supply Cushion***

$$\begin{aligned} &= \text{Daily Shown RA}(\text{excluding wind and solar}) - \text{Planned Outage Impacts} \\ &- \text{Forced Outage Impacts} - \text{Net Load} - \text{Contingency Reserves} \end{aligned}$$

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<sup>21</sup> RAAIM calculations do not currently consider weekend. However, it is important to note that tight supply cushions may also occur on weekends. Therefore, the CAISO has included them for this assessment.

The supply cushion thus represents how much Shown RA remains after serving net load, meeting Contingency reserves, and accounting for planned and forced outages. We exclude wind and solar resources from the shown RA because their capacity value is much lower than their actual production in real-time. Also by looking at Net Load rather than Gross Load we can further account for the actual production of these variable resources. Net load values are taken from the 5-minute market, to convert the supply cushion into an hourly measure we take the average of the supply cushion of all 12 RTD intervals to represent the hourly supply cushion value.

In response to stakeholder request for further data analysis, the CAISO calculated the hourly supply cushion values for May 2018 through April 2020. CIRA provided daily shown RA and forced and planned outage impacts. Net Load data was pulled from the Production and Curtailment publically available data sets. Contingency Reserves were estimated as 6% of Gross load or 2500 MW,<sup>22</sup> whichever was larger. Table 2 provides the percentile distribution of the supply cushion for peak and off-peak months. A negative value indicates that in that hour there was not enough shown RA to serve net load, and cover contingency reserves, planned and forced outages. Although there was likely economic energy to cover these capacity short falls in these hours, the goal of the RA program is to ensure that the CAISO has enough capacity to meet demand. Thus by accounting for a resources forced outage rates from the beginning LSEs will be able to procure sufficient, reliable capacity to cover real time operation needs.

**Table 2: Percentile distribution of average hourly supply cushion**

<b>Percentile</b>	<b>2018 Peak Months</b>	<b>2018-2019 Off-Peak Months</b>	<b>2019 Peak Months</b>	<b>2019-2020 Off-Peak Months</b>
1.0	-3,062	-2,266	-1,584	-2,619
5.0	380	-217	3,494	-449
10.0	2,619	1,191	5,859	977
20.0	5,890	3,152	8,842	3,243
25.0	7,012	3,989	9,936	3,960
50.0	10,627	7,069	14,572	7,526
75.0	14,139	10,592	18,237	11,840
90.0	17,030	13,881	21,500	15,688
95.0	18,790	15,220	23,468	18,076
99.0	21,213	17,737	26,867	21,467
<b>Hours</b>	3,672	5,088	3,672	5,111

Looking at the 20<sup>th</sup> percentile we see that there is variability in the size of the supply cushion across seasons which further points to the need to calculate UCAP on a seasonal basis. In Peak Months the supply cushion during UCAP Assessment Hours ranged from 5,890 MWs and below in 2018 to 8,842 MWs and below in 2019. Whereas in Off-Peak Months the supply

<sup>22</sup> 2,500 MW is an estimate for the Most Severe Single Contingency.

cushion during UCAP Assessment Hours ranged from 3,152 MWs and below in 2018/2019 and 3,242 in 2019/2020.

**Table 3: Distribution of UCAP Assessment Hours by Operating Hour**

HE	2018 Peak Months		2018-2019 Off-Peak Months		2019 Peak Months		2019-2020 Off-Peak Months	
	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.
1	4	0.54	6	0.59	18	2.45	13	1.27
2	0	0.00	2	0.20	8	1.09	2	0.20
3	0	0.00	1	0.10	4	0.54	2	0.20
4	0	0.00	1	0.10	4	0.54	1	0.10
5	0	0.00	3	0.29	7	0.95	4	0.39
6	2	0.27	12	1.18	16	2.18	20	1.96
7	4	0.54	66	6.48	19	2.59	65	6.36
8	1	0.14	51	5.01	8	1.09	46	4.50
9	0	0.00	10	0.98	5	0.68	14	1.37
10	0	0.00	5	0.49	4	0.54	7	0.68
11	0	0.00	1	0.10	3	0.41	4	0.39
12	1	0.14	0	0.00	4	0.54	1	0.10
13	6	0.82	0	0.00	7	0.95	1	0.10
14	14	1.90	3	0.29	9	1.09	2	0.20
15	23	3.13	5	0.49	13	1.77	6	0.59
16	30	4.08	11	1.08	22	2.99	15	1.47
17	38	5.17	42	4.13	27	3.67	60	5.87
18	60	8.16	102	10.02	44	5.99	116	11.35
19	93	12.65	150	14.73	82	11.16	141	13.80
20	124	16.87	169	16.60	115	15.65	146	14.29
21	126	17.14	161	15.82	117	15.92	140	13.70
22	109	14.83	126	12.38	103	14.01	121	11.84
23	72	9.80	74	7.27	66	8.98	69	6.65
24	28	3.81	17	1.67	31	4.22	27	2.64
Total	735	100.0	1018	100.0	735	100.0	1022	100.0

The CAISO was also interested when in the course of the Operating Day UCAP Assessment Hours fell. We extracted the hours that fell within the 20<sup>th</sup> percentile and tabulated the number of Assessment Hours across all 24 hours, and the results are presented in Table 3 above. As we would expect, the majority of UCAP Assessment hours fall within the evening ramp periods HE 18-22 (rough 65% of observations). In Off-Peak Months we also see a clustering of UCAP Assessment hours during the morning ramp period HE 6-9. However, there are Assessment Hours that fall outside of these two ramping periods, which further documents the need to incentivize resources to be available at all points in the operating day. Another advantage of this approach vs. RAAIM today, is that by extracting the top 20% of tightest supply cushion hours to evaluate, this will allow the UCAP values to evolve as the grid evolves and capture when conditions are actually the tightest, such as overnight or during the morning ramp period in Off-

Peak Months. This chart also demonstrates that this approach will provide a similar estimation of a resource’s availability as a weighted 8760 analysis would, while also not penalizing a resource for going on outage if grid conditions were not tight. We also examined how many days had at least one UCAP Assessment Hour, and over the two year period, on average 79.3% of days were included, which is similar to RAIM today which covers roughly 71% of days. Table 4 shows the tabulation of days in which a certain number of UCAP Assessment Hours were included. The median number of hours per day was 4 for Peak Months and 5 for Off-peak months. This is similar to the number of hours currently assessed in RAIM. Together what these table show is that this new approach to look at the top 20% of tightest supply cushion hours rather than the top 100 will address many concerns of stakeholders that “luck” will be driving UCAP values rather than a resource’s true forced outage rate. As we will see in subsequent examples, what drives a resource’s UCAP value is the persistence of outages, rather than any one random outage.

**Table 4: Tabulation of days by number of UCAP Assessment Hours**

	2018 Peak Months		2018-2019 Off-Peak Months		2019 Peak Months		2019-2020 Off-Peak Months	
	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days
0	22	14.38	36	16.98	31	20.26	65	30.52
1	5	3.27	7	3.30	6	3.92	2	0.94
2	11	7.19	5	2.36	11	7.19	5	2.35
3	24	15.69	31	14.62	16	10.46	9	4.23
4	15	9.80	25	11.79	22	14.38	7	3.29
5	24	15.69	23	10.85	19	12.42	20	9.39
6	10	6.54	25	11.79	12	7.87	22	10.33
7	9	5.88	18	8.49	2	1.31	18	8.45
8	9	5.88	8	3.77	8	5.23	34	15.96
9	6	3.92	18	8.49	11	7.19	7	3.29
10	5	3.27	9	4.25	4	2.61	6	2.82
11	5	3.27	1	0.47	1	0.65	4	1.88
12	5	3.27	0	0.00	1	0.65	6	2.82
13	2	1.31	4	1.89	0	0.00	4	1.88
14	0	0.00	2	0.94	1	0.65	1	0.47
15	0	0.00	0	0.00	1	0.65	0	0.00
16	1	0.65	0	0.00	0	0.00	0	0.00
17	0	0.00	0	0.00	1	0.65	0	0.00
18	0	0.00	0	0.00	2	1.31	1	0.47
19	0	0.00	0	0.00	2	1.31	2	0.94
20	0	0.00	0	0.00	1	0.65	0	0.00
21	0	0.00	0	0.00	0	0.00	0	0.00
22	0	0.00	0	0.00	0	0.00	0	0.00
23	0	0.00	0	0.00	0	0.00	0	0.00
24	0	0.00	0	0.00	1	0.65	0	0.00
<b>Total</b>	<b>153</b>	<b>100.0</b>	<b>212</b>	<b>100.0</b>	<b>153</b>	<b>100.0</b>	<b>213</b>	<b>100.0</b>

**California ISO Resource Adequacy Enhancements – Fifth Revised Straw Proposal**

Median # of hours per day		4.00		5.00		4.00		5.00
Average # of hours per day		4.80		4.75		4.80		4.97

**Stakeholder Comments:**

In response to the working group held on June 10<sup>th</sup>, comments submitted by stakeholders were generally more supportive of the proposal to use 20% of tightest supply cushion hours as a more reasonable approach than the top 100 hours. CalCCA requested that we calculate the UCAP value for all resources currently on the system and release information about what percentage of resources fell into certain ranges of UCAP value in order to assess the impact of this methodology. Since UCAP is still under development, the CAISO does not have the systems or resources in place to accommodate such a request. CalCCA also requested that we notify each SC of the specific UCAP value for each of their resources, which we also cannot accommodate at the moment. However, with the working group meeting, the CAISO released three example resource’s UCAP calculation which identified the actual UCAP Assessment Hours for May 2018-April 2020, and so we invite SC’s to utilize their own outage data to match with these published UCAP Assessment Hours, and following the steps listed below, can calculate for themselves what their resource’s UCAP value would be.

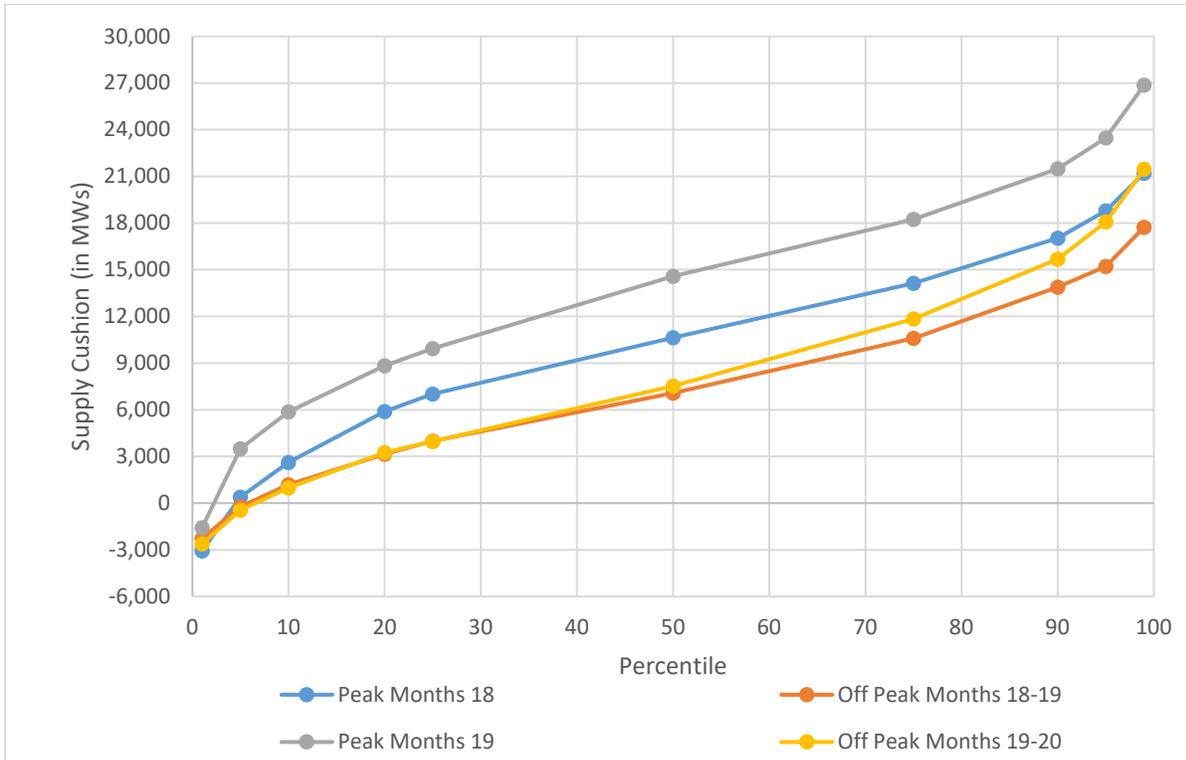
Stakeholders also provided several suggestions on how to modify our proposed definition of supply cushion to identify which hours should be UCAP Assessment Hours. Calpine commented that the current formula may fail to capture periods when RA capacity is available but may not have been committed day ahead so is operationally unavailable, or may not be able to respond to changes in system conditions sufficiently rapidly. Given that majority of tight supply cushion hours fall within the evening ramping period, the CAISO does not believe that including an evaluation of committed capacity or ramping capability would significantly change which hours are deemed UCAP Assessment Hours. Additionally, with the development of Imbalance Reserves and other changes to ensure sufficient capacity is committed in the day ahead to meet uncertainty currently under development in the Day Ahead Market Enhancement Initiative, the CAISO believes that the proposed supply cushion definition will be sufficient to identify the tightest system conditions.

SDG&E suggest that we define the “tight” supply cushion hours as: Daily Shown RA PRM \* Load > Daily Shown RA (excluding wind and solar) – Daily Planned Outages – Daily Forced Outage Impacts – Net Load, and evaluate UCAP based on these hours rather than a percentage of hour. The CAISO has already considered this option, and ruled it out for a number of reasons. Upon analysis, the CAISO identified that during Peak Months (May-September) there were only 248 hours in 2017, 160 hours in 2018, and 52 hours in 2019 that fell below this threshold. The wide variety of hours will mean that the impact of a forced outage can vary wildly between years, and we could run into instances when no hours or a small subset of hours falls below this threshold, such that a resource’s UCAP value could fall to

zero. This would further exacerbate stakeholders concern that “luck” would drive UCAP values rather than a true representation of the resource’s availability.

SCE found the 20% proposal more favorable than the top 100 hours but wanted more information about the distribution of historical outages. Figure 4 shows the distribution curves of the supply cushion for peak and off peak months. The 20<sup>th</sup> percentile was chosen more for its logical connection to the number of hours we assess for RAAIM, and sufficiently large sample size to reduce the likelihood that randomness or luck is driving UCAP values.

**Figure 4: Supply Cushion Distribution Curves**



Several stakeholders requested that we set the assessment hours in advance so that operators know the risks of going on forced outage. This contradicts one of the goals of moving to the UCAP paradigm, to incentivize resources to be available 24x7, rather than trying to game when they take outages to avoid penalties as is done today with RAAIM. Additionally several stakeholders asked that we publish when UCAP Assessment Hours fell in the previous year. The CAISO will accommodate this request and will publish after-the-fact when UCAP Assessment Hours occurred during the previous Peak and Off Peak Months as part of its annual UCAP process.

**Proposed UCAP Determination Process**

Once the CAISO has identified which hours are UCAP Assessment Hours it will use the following process to determine a resource’s UCAP value using the seasonal availability approach. The CAISO will calculate an hourly unavailability factor using forced and urgent outages and derates for each hour studied, divided by the resource’s maximum capability for

each of the 20% of tightest supply cushion hours per summer season, May-September (on-peak), and the 20% of tightest supply cushion hours per winter season, October-April (off-peak), for the past three years. To determine each resource’s Hourly Unavailability Factor (HUF) for each of the tightest supply cushion hours per season the CAISO proposes the following approach:

$$\text{Hourly Unavailability Factor} = \frac{\text{Derates} + \text{Forced \& Urgent Outage Impacts}}{\text{NQC}}$$

The CAISO will utilize the average of the Hourly Unavailability Factor (HUF) for each season for each of the past three years to create a Seasonal Average Availability Factor (SAAF) for each resource:

$$\text{Seasonal Average Availability Factor} = 1 - \frac{\sum \text{Hourly Unavailability Factors}}{\text{Number of Observed Hours}}$$

The CAISO also proposes incorporating a weighting method that places more weight on the most recent year’s performance and less weight on more historic periods in determining a resource’s UCAP values. The CAISO proposes to place the following percentage weights on the availability factor calculation by year from most recent to most historic: 45-35-20%. In other words, the following percentage weights will be applied to the seasonal availability factors; 45% weight for the most recent year’s seasonal availability factor, 35% weight on the second year, and 20% on the third year most historical seasonal availability factor. The CAISO will then apply this proposed weighting approach to each of the three previous annual periods (for each on-peak and off-peak season) to create Weighted Seasonal Average Availability Factors (WSAAF) as follows:

$$\begin{aligned} \text{Weighted Seasonal Average Availability Factor} \\ = \text{Annual Weighting} * \text{Seasonal Average Availability Factor} \end{aligned}$$

Once the Weighted Seasonal Average Availability Factors are established for each season of each of prior three years the CAISO will sum the factors and apply them to each resource’s NQC to determine the resource’s seasonal UCAP ratings as follows:

$$\text{On Peak UCAP} = \sum \text{Weighted Seasonal Average Availability Factors}^{\text{Summer}} * \text{NQC}$$

$$\text{Off Peak UCAP} = \sum \text{Weighted Seasonal Average Availability Factors}^{\text{Winter}} * \text{NQC}$$

The following tables provide examples based on the forced outage rates of three thermal resources currently on the CAISO system to illustrate the proposed UCAP determination process. For brevity and simplicity, the initial steps of determining the Hourly Availability Factors and Seasonal Availability Factors have been omitted, but those steps will be calculated as described above and incorporated prior to the following steps in the process. To preserve anonymity of the resource, the NQC values have been modified and the resource’s outage MW values have also been changed in proportion.

Table 5: Determining UCAP value of Thermal Resource A

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)	
3	0.911	20%	0.182	
2	0.835	35%	0.292	
1	0.931	45%	0.419	
		Total = 100%	0.893	
Year	Off Peak SAAF	Annual Weight	Weighted SAAF (Winter / Off-Peak)	
3	0.986	20%	0.197	
2	0.986	35%	0.345	
1	0.987	45%	0.444	
		Total = 100%	0.986	
Sum of Weighted SAAFs (Summer)	Sum of Weighted SAAFs (Winter)	NQC	On-Peak UCAP	Off-Peak UCAP
0.893	0.986	250 MW	223.25 MW	246.5 MW

Thermal Resource A in the Peak Months of Year 2, this resource submit frequent “plant trouble” forced outages for a portion of its NQC value, which resulted in a Seasonal Availability Factor of 0.835. The plant seems to have fixed this underlying issue and its Seasonal Availability Factor increased to 0.931 in Year 1. The Resource’s Off-Peak Seasonal Availability factor remained consistently around 0.987.

Table 6: Determining UCAP value of Thermal Resource B

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)	
3	0.941	20%	0.188	
2	0.990	35%	0.347	
1	0.891	45%	0.401	
Total = 100%			0.936	
Year	Off Peak SAAF	Annual Weight	Weighted SAAF (Winter / Off-Peak)	
3	0.972	20%	0.194	
2	0.982	35%	0.344	
1	0.962	45%	0.433	
Total = 100%			0.971	
Sum of Weighted SAAFs (Summer)	Sum of Weighted SAAFs (Winter)	NQC	On-Peak UCAP	Off-Peak UCAP
0.936	0.971	100 MW	93.6 MW	97.1 MW

Thermal Resource B began submitting frequent “Ambient not due to Temperature” outages for a small portion of their NQC value on a regular basis, starting in Peak Months of Year 1, along with a few other outages caused by plant trouble that reduced the resource’s Peak Month SAAF from 0.990 to 0.891. A similar pattern emerged in Off-Peak Months, but the frequency in which they submitted “Ambient not due to Temperature” outages was less in Year 1, so the resource’s Off Peak SAAF only decreased from 0.982 to 0.962.

Table 7: Determining UCAP value of Thermal Resource C

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)	
3	0.947	20%	0.189	
2	0.929	35%	0.325	
1	0.964	45%	0.434	
		Total = 100%	0.948	
Year	Off Peak SAAF	Annual Weight	Weighted SAAF (Winter / Off-Peak)	
3	0.818	20%	0.164	
2	0.958	35%	0.335	
1	0.678	45%	0.305	
		Total = 100%	0.804	
Sum of Weighted SAAFs (Summer)	Sum of Weighted SAAFs (Winter)	NQC	On-Peak UCAP	Off-Peak UCAP
0.948	0.804	50 MW	47.42 MW	40.20 MW

Thermal Resource C also submitted semi-regular “Ambient not due to Temperature” outages which affected both their Peak and Off Peak SAAFs. However, in the Off Peak Months in Year 1, this resource experience frequent and sustained “Plant Trouble” forced outages for its full NQC value. This had a large impact on the resource’s Off Peak SAAF, reducing it to 0.678. One advantage of the proposed weighting methodology and only looking at three years is that if the resource invested in the necessary repairs to address the underlying issue, the impact of this bad Off Peak SAAF would lessen over time and eventually roll off, allowing the resource to increase its capacity value over time.

As a whole, what these three examples point to is that this UCAP counting methodology is driven more by the frequency and persistence of outages rather than a “luck” factor. In fact, the impact of a single day outage, which included the average five UCAP Assessment Hours, would only reduce a resource’s UCAP value by 0.3% in Year 1, 0.24% in Year 2, and 0.14% in Year 3, if we assume 100% availability in all other hours.

Several stakeholders requested that we establish a dead band around which we would not begin to derate a resources NQC value. LS Power, SEIA, and EDF-Renewables suggested that we not derate a resource’s NQC value unless the resource’s WSAAF was .98 or below. The additional of a dead band would add significant complexity in terms of establishing the correct UCAP requirements. If we were to establish this dead band, we would likely have to increase the system RA requirements to account for this 2% decrease in capacity, which could be as high as 1000 MWs in peak months. This increased capacity procurement requirement would then have to be allocated to LSEs. CAISO is continuing to vet this suggestion internally. The CAISO would like additional stakeholder feedback on whether to establish a dead band around a resource’s UCAP value given the associated benefits and burdens of this option.

In the next section, we explain modification to the base UCAP calculation methodology for new resources, energy storage technologies, and hydro resources to better capture their true availability and prevent double counting.

### ***UCAP methodology for new and non-conventional resource types***

#### **New resources**

The CAISO is considering two approaches for calculating UCAP for new resources without three full years of operating history. Option 1 is a class average approach. Class averages would be based on outage rates for similarly designed resources of the same technology type. The class-average will be based on availability factors observed during the tightest 20% supply cushion hours each season (summer and winter) per year for the previous three years. As new resources begin to build an operational history, the CAISO will blend their actual performance data with class average data, beginning with the class average and maintaining constant weights over time, as follows:

- Year 0 (i.e. before actual operational data is available): 45% class average, 35% class average, 20% class average
- Year 1: 45% year 0 performance, 35% class average 20% class average
- Year 2: 45% year 1 performance, 35% year 0 performance, 20% class average
- Year 3: 45% year 2 performance, 35% year 1 performance, 20% year 0 performance

In this approach, resources begin with the class average, which may be lower or higher than the resources' actual performance. Weights are constant under option 1 and puts lower weight on earlier years than option 2, allowing resources to “work out any bugs” that occur in early years of operation.

Under option 2, resources will begin with their NQC the first year, and places heavy emphasis on actual performance in the initial years. Under this approach, resources will start with a higher capacity value, but actual performance will have a significant impact early on. The CAISO included this option based on stakeholder feedback from LS Power expressing concern with using the class average for new battery storage resources, given the relatively small number of battery storage currently participating in the market, which may not reflect the operational characteristics of future projects. Weights for option 2 are:

- Year 0 (i.e. before actual operational data is available): NQC
- Year 1: 70% year 0 performance, 30% NQC
- Year 2: 55% year 1 performance, 35% year 0 performance, 10% NQC
- Year 3: 45% year 2 performance, 35% year 1 performance, 20% year 0 performance

In comments to the working group meeting on June 10<sup>th</sup>, Stakeholders provided an even split between the two options. Option 1 was supported by CalCCA, NRG, and the Public Advocates Office, whereas Option 2 was supported by CESA, EDF- Renewables, and LS Power. CAISO requests additional stakeholder feedback on these two options for the UCAP calculation and weighting for new resources.

#### **Storage**

In addition to outages, optional parameters available to storage resources will reduce RA amount. For example, in the Energy Storage and Distributed Energy Resources Phase 4 initiative, the CAISO proposed an end-of-hour state of charge (EOH SOC) parameter, an optional real-time market biddable parameter that allows storage resources to achieve a desired state of charge by the end of an hour. It also outlined a market enhancement to preserve minimum SOC levels in order to respect self-schedules in future hours<sup>23</sup>. Resources can also elect SOC levels in the master file which may limit resource availability below RA value. The UCAP calculation should consider these SOC constraints, in addition to forced outage rates, if the SOC is set such that the resource's full RA amount is not available.

The CAISO developed the proposal for storage UCAP counting with the following objectives:

- UCAP calculation should not double count if there is overlap between unavailability caused by both forced outage and SOC constraint;
- UCAP calculation should consider how SOC constraint affects ability to be available for full RA value for the minimum duration required for RA resources, currently 4 hours, and;
- UCAP calculation should consider outages on both the charge and discharge portion of the resource.

The CAISO proposes a formulation for resource availability for any specific hour as the minimum of: 1) the absolute value of the effective minimum that the storage resource could be dispatched to (i.e. not on outage on the charge portion), 2) the effective maximum the resource could be dispatched to (i.e. not on outage on the discharge portion), and 3) the total amount of energy that the resource can store (i.e. energy not subject to min/max constraints during that hour) divided by the resource adequacy continuous deliverability duration (currently four hours). After this value is calculated it can be used to determine the resource's hourly unavailability factor defined above.

$$\text{Availability} = \min(\text{ABS}(\text{Effective Min}), \text{Effective Max}, \frac{\text{Effective Energy}}{4})$$

The following examples demonstrate the impact of both forced outages and state of charge on resource availability. Assume a +/- 25 MW storage resource with 100 MWh of energy storage capability.

#### **Outages and State of Charge Examples:**

**Hour 1:** The resource is not on outage (+/- 25 MW) in the real-time market, and there is no constraint on the state of charge for this hour

- Total 4-hour deliverable energy in hour 1 (effective availability): 25 MW

**Hour 2:** The resource is on outage for 5 MW (+/- 20 MW) in the real-time market, and there is no constraint on the state of charge for this hour

- Total 4-hour deliverable energy in hour 2 (effective availability): 20 MW

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<sup>23</sup> Energy Storage and Distributed Energy Resources Stakeholder Initiative Webpage: <http://www.caiso.com/StakeholderProcesses/Energy-storage-and-distributed-energy-resources>

**Hour 3:** The resource is not on outage (+/- 25 MW) in the real-time market, but imposes a minimum end of hour SOC of 25 MWh

- Total 4-hour deliverable energy in hour 3 (effective availability):  $18.75 \text{ MW} = (100 \text{ MWh} - 25 \text{ MWh}) / 4 \text{ hours}$

**Hour 4:** The resource is on outage for 10 MW (+/- 15 MW) in the real-time market, and imposes a minimum end of hour SOC of 25 MWh and a maximum state of charge of 75 MWh

- Total 4-hour deliverable energy in hour 1 (effective availability):  $12.5 \text{ MW} = (75 \text{ MWh} - 25 \text{ MWh}) / 4 \text{ hours}$ ; note that this value is selected because it is less than the 15 MW that is bid into the market

When considering forced outages for storage, the UCAP calculation should consider outages on both the charge and discharge portion of the resource to ensure the resource can be charged and available to the grid when needed. The next examples demonstrate how the same resource's availability would be impacted by outages on either the charge, discharge portion, or both. Assume no constraints on the state of charge in these examples.

#### **Outages on Charge and Discharge Examples**

**Hour 5:** Bid range from -20 MW to 25 MW (5 MW outage on the charge portion)

- Resource's effective availability is 20 MW for this hour

**Hour 6:** Bid range from -25 MW to 18 MW (7 MW outage on the discharge portion)

- Resource's effective availability is 18 MW for this hour

**Hour 7:** Bid Range from -50 MW to 25 MW

- Resource's effective availability is 25 MW for this hour

**Hour 8:** Bids Range from -50 MW to 50 MW

- Resource's effective availability is still only 25 MW for this hour because that is the most that could be delivered persistently for 4 hours, given 100 MWh of energy storage capacity, and equal to the resource's NQC

Table 8 summarizes each of the above examples and its impact on the hourly unavailability factor for the UCAP calculation:

Table 8: Calculating Hourly Unavailability Factor for storage resources

Example (Hour)	Effective Min (-MW)	Effective Max (MW)	Effective energy available (MWh)	Effective availability (MW)	Unavailability (MW) (NQC – Effective Availability)	Hourly Unavailability Factor (MW) (Unavailability /NQC)
1	25	25	$100 / 4 = 25$	25	0	0
2	20	20	$100 / 4 = 25$	20	5	0.2
3	25	25	$75 / 4 = 18.75$	18.75	6.25	0.25
4	15	15	$50 / 4 = 12.5$	12.5	12.5	0.5
5	20	25	$100 / 4 = 25$	20	5	0.2
6	25	18	$100 / 4 = 25$	18	7	0.28
7	50	25	$100 / 4 = 25$	25	0	0
8	50	50	$100 / 4 = 25$	25	0	0

**Hydro**

Hydro resource output depends heavily on water availability, which can vary from year to year. To capture this variability, CAISO proposes an alternative to the standard UCAP calculation, which would use a historical-year weighted average assessment of resource availability during the 20% tightest supply condition hours to capture the variability of hydro output. Historical bid in capacity would be used to calculate a 50 percent exceedance and a 10 percent exceedance value. The CAISO proposes to weight the 50 percent value by 80 percent and the 10 percent value by 20 percent to determine the UCAP value.

The CAISO believes this alternative methodology is generally consistent with the hydro counting methodology outlined in the CPUC’s proposed decision in track 2 of the Resource Adequacy

Proceeding.<sup>24</sup> Under that proposal, historical bid in capability during the availability assessment hours is used to establish the historical weighted average. In this counting methodology, mechanical outages are removed from the QC calculation, such that only outages due to water unavailability are included. Those mechanical outages are then subject to RAAIM.

Under the CAISO’s UCAP proposal, the CAISO would evaluate resource availability during the tightest 20% supply cushion hours for the on and off peak seasons, considering outages due to both water availability and mechanical outages for the previous 10 years.<sup>25</sup> Mechanical forced outages must also be considered in addition to water availability under the UCAP construct to remain consistent with incorporating all forced outages upfront in the UCAP calculation once RAAIM and substitution are no longer be in place.

In this simplified example, assume a Hydro Resource with a Pmax of 100 MW with the following unavailability in MWs during the top 20% tightest supply cushion hours (for this example, assume these hours align with the current availability assessment hours).

**Table 9: Example resource unavailability**

	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	...
Fuel Unavailability	0	0	25	10	5	15	22	5	0	0	
Mechanical Outage**	0	25	25	0	0	0	10	0	0	0	
Total Hourly Unavailability	0	25	50	10	5	15	32	5	0	0	

\*\* Under the existing methodology in place at the CPUC, mechanical outages are not factored into the QC, but are subject to RAAIM. For simplicity, assume no overlap of fuel and mechanical outage capacity.

Under the existing methodology in place at the CPUC, the resource’s QC would be calculated as follows:

**Table 10: Existing hydro counting methodology**

	Fuel Unav.	Avail (w/water)	<b>**Uses 10 years of availability</b>
HE1	0	100	
HE2	0	100	
HE9	0	100	

<sup>24</sup> <https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M338/K277/338277501.PDF>

<sup>25</sup> If historical bidding data is not available for 10 years, the ISO will consider as much outage data that is available.

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HE10	0	100	
HE5	5	95	Median
HE8	5	95	Median
HE4	10	90	
HE6	15	85	
HE7	22	78	
HE3	25	75	10th Percentile
...			

The resulting NQC = (.8\*Median+.2\*10th percentile) = 91 MW and the resource is subject to RAAIM for mechanical outages.

Under the CAISO’s proposed UCAP methodology, the resource’s UCAP would be calculated as follows:

**Table 11: Proposed Hydro UCAP methodology**

	Fuel Unavailability	Mechanical Outage	Tot. Unavailability	Availability	<b>**Uses 10 years of availability</b>
HE1	0	0	0	100	
HE9	0	0	0	100	
HE10	0	0	0	100	
HE5	5	0	5	95	
HE8	5	0	5	95	Median
HE4	10	0	10	90	Median
HE6	15	0	15	85	
HE2	0	25	25	75	
HE7	22	10	32	68	
HE3	25	25	50	50	10th Percentile
...					

The resulting UCAP = (.8\*Median+.2\*10th percentile) = 84 MW.

Because the hydro counting proposal requires more years of data than the UCAP calculation for thermals and storage, the CAISO is considering how to transition from the existing CPUC counting methodology that uses historical availability during the RAAIM hours, to the using the historical availability during the tightest 20% supply cushion hours. The CAISO plans to calculate the tightest supply cushion hours beginning three years before the implementation of this policy, currently 2019. The CAISO proposes to use the historical availability during the RAAIM hours for years prior to 2019 and the historical availability during the 20% tightest supply cushion hours in years 2019 and beyond. The CAISO is seeking stakeholder feedback on this approach for hydro resources and whether this is necessary or preferred to the standard UCAP calculation to reflect hydro availability.

### ***ELCC counting***

The CAISO recognizes that the proposed availability factor approach to determine UCAP values may not be the best approach for every resource type, specifically, Solar, Wind, and Demand Response, which require alternative approaches.

The CAISO proposes to use an ELCC value for wind and solar to set UCAP values. Other resource types that may not work well under Availability Factors are those that have inherent use limitations such as some DR and QF resources. The CAISO considered these different resource technologies and explains the current proposal for setting UCAP values for these resource types below.

### **Wind and Solar**

The CAISO will rely on an ELCC methodology when applicable. Currently, the CPUC only applies this methodology to wind and solar resources, but could expand it to cover other variable energy resources such as weather sensitive or variable output DR. The reason for the CAISO's reliance on the ELCC calculation for wind and solar is two-fold. First, other ISOs equate wind and solar UCAP values with a statistical assessment of resources' output. Second, the ELCC already takes into account the probability of forced outages for wind and solar resources.<sup>26</sup> Therefore, the CAISO understands these technologies already have their QCs reduced for expected forced outages and derates.

The CPUC's ELCC calculation has two challenges as applied for this purpose. First, the CPUC calculates the average ELCC for the wind and solar fleet. This means that some resources will perform better than average, while others will perform worse. If all wind and solar resources are shown for RA, then there is no problem. However, if only a subset of solar and/or wind resources are shown as RA, then the average ELCC value of the RA wind and solar fleet may differ from the average ELCC value of the entire fleet.

A second but related issue is the CPUC calculates a diversity benefit that relies on the portfolios of wind and solar resources. If the showings have a different ratio of wind and solar resources, then the diversity benefit may not be reflected in the RA fleet. Either of these issues can result in over or under-procurement depending on what resources are shown as RA.

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<sup>26</sup> Forced outages are accounted for by using actual production data to inform the wind and solar production profiles in the ELCC modeling.

## **Demand Response**

The CAISO notes that some DR resources also need an alternative approach for determining their UCAP values. This is because majority of DR resources exhibit variability and are availability-limited. This approach may not work well with the availability factor approach that assesses availability based upon tightest supply condition hours that can occur during any hour of the day, and may include hours when DR programs are not available. This approach would likely impact DR resources' UCAP values since these resources are generally only available during a subset of hours. Because of their limited and variable availability on a daily and annual basis, the CAISO believes that DR resources are best evaluated under an ELCC approach similar to wind and solar resources that have limited or variable output.

Through the Energy Storage and Distributed Energy Resources initiative, the CAISO is studying application of an ELCC methodology to DR resources.<sup>27</sup> The CAISO will use this methodology to inform local regulatory authorities of a QC counting methodology that incorporates the variable and availability-limited nature of certain DR resources into its QC value. Similar to the ELCC methodology for wind and solar, an ELCC methodology for DR would consider resource availability and DR's ability to serve system reliability when determining the capacity value of DR. If LRAs adopt an ELCC methodology for DR resources, the CAISO could rely on the ELCC methodology to establish UCAP values for DR resources as it proposes to do for wind and solar resources. If LRAs do not adopt an ELCC methodology for DR resources, the CAISO proposes to use a historic performance based approach described below.

For DR and QF resources, their availability is often variable or limited to certain periods dictated by program hours or end-use customer needs. The CAISO believes these resources should be assessed in a different manner than other resource types to establish their UCAP values. If the LRAs do not adopt an ELCC based QC methodology for these variable and availability-limited resources, the CAISO will apply the following UCAP determination approach. For DR and QF resources, the CAISO will evaluate these resources' performance relative to their dispatch instructions for periods when they received market awards or test events.

For DR providers, the CAISO proposes applying this approach at an SC-level, rather than an individual resource level to mitigate the potential for gaming or manipulation by simply creating new DR resource IDs. This SC-level approach is intended to block the ability for poorly performing DR providers to receive class-average UCAP values simply by changing or creating a new resource IDs that have no historical data.

The CAISO will track these resources historical performance over the prior 3 years and compare their market dispatches to their actual performance during those periods to establish the availability that will be applied to their UCAP value.

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<sup>27</sup> ESDER 4 Stakeholder Initiative Webpage:  
[http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage\\_DistributedEnergyResources.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx)

### ***Transition from NQC to UCAP***

The CAISO proposes a clean transition from the current NQC to the new UCAP-based approach rather than a phased in approach. The CAISO proposes that the 2022 RA year binding RA requirements would still be in terms of today's NQC values, but we would "shadow" test both UCAP RA requirements and showings. The 2023 RA year would transition to binding RA requirements and showings in terms of UCAP. CalCCA expressed support for this transition timeline. SDG&E did not support starting UCAP in the 2023 RA year because this is the same year that the Central Procurement Entity was instructed to begin by the CPUC, and this could add additional complexity to the transition. SMUD also did not support transitioning in 2023 RA year because many LSEs have already contracted through 2023, and suggest we transition to UCAP in 2024 to remain more consistent with CPUC rules. The CAISO seeks additional feedback on timing of the transition from NQC to UCAP.

Given CAISO's reluctance to grandfather existing contracts, several stakeholders asked the CAISO to take steps to ease this transition for existing contracts. For instance, SCE has advocated that we keep RA requirements in terms of NQC, and derate NQC values for forced outage rates rather than creating a new term. In the Working Group Meeting on June 10, the CAISO presented two options for integrating unforced capacity outages into the RA program, and received mixed stakeholder feedback.

Option 1 would create a two-step de-rate process to a resources QC. The first step in this process would be to conduct a resource deliverability assessment to adjust QC for deliverability and create a new term Deliverable QC (DQC). The Deliverable QC would take the place of the NQC term used today. The second step is to apply the Weighted Seasonal Average Availability Factors to the resource's DQC, which would result in the NQC for the resource. The new definition of NQC would represent the UCAP value of the resource. Under this option, a resource's must offer obligation would be set at its DQC. The advantages of this option is that it would continue to express capacity values in terms of NQC and address stakeholder concerns around existing contracts. The disadvantage of this option are that it could create confusion by changing the meaning of an existing term. CalCCA, CESA, EDF-Renewables, and SCE submitted comments in support of option 1.

Option 2 would retain the existing definition of NQC and create a new term (UCAP) to represent a resource's capacity value. This approach would apply the Weighted Seasonal Average Availability Factors to the resource's NQC value, and result in the new UCAP value. This approach would not introduce the potential confusion resulting from a dual meaning of the term NQC over time. Clarifications of existing RA contracts would be jointly required, and would not favor one side over the other. This option would not address the contracting concerns brought up by stakeholders. Calpine, CDWR, NRG, Powerex, Six Cities, SDG&E, and Wellhead submitted comments in support of option 2. The CAISO also favors option 2. However, given the split among stakeholders, the CAISO seeks additional feedback on which option to pursue, as well as any other potential pros and cons associated with each option.

### **Coordination of Proposed UCAP Concept with CPUC RA Program**

The CAISO received stakeholder feedback that it must closely consider how its proposed UCAP concept will be coordinated with the current CPUC RA program. Certain parties expressed concern that the CAISO proposal could create conflicting RA requirements, or otherwise undermine the System RA Planning Reserve Margin (PRM) established by LRAs. CAISO appreciates these concerns and will work with LRAs to align RA programs with the current proposal, including the CAISO submitting its proposed counting rules in the upcoming CPUC RA proceeding.

The CAISO's proposal provides improved transparency over resource forced outage rates, which will help improve procurement of the most dependable and reliable resources and better inform retirement decisions. Existing installed capacity measures reflect an expected fleet average outage rate factored into the PRM, which can result in inefficient resource procurement on the low end of the forced outage distribution and more overall procurement than might be seen using UCAP values. The CAISO seeks stakeholder input to identify any additional CPUC/LRA RA program issues or UCAP related concepts that should be included for consideration and coordination.

### ***Removing Forced Outage Replacement and RAIM application to forced outage periods***

CAISO's analysis in Appendix 8.3 shows that RAIM does not effectively ensure adequate capacity will be provided to the CAISO and, therefore, it is reasonable to eliminate RAIM once an alternative solution is in place.

The CAISO believes a superior approach is to establish incentives to conduct resource maintenance to avoid outages and to procure capacity that is more reliable in the first instance. UCAP provides the proper incentives, while still allowing LSEs to procure the most cost effective capacity needed to meet their procurement obligations. The relationship between MOOs, RA substitution rules, and RAIM creates a complex system of processes that differ vastly from other ISOs/RTOs. In light of the data in Appendix 8.3 and CAISO's UCAP proposal, it is possible and desirable to eliminate these complex relationships for a process that appropriately relies on the upfront and transparent accounting of resource availability and reliability.

## **4.1.3. System RA Showings and Sufficiency Testing**

### **Stakeholder feedback**

As a general matter, most stakeholders support the CAISO developing a portfolio assessment for only RA resources using the stochastic model similar to the production simulation model used in the CAISO's summer assessment. The CAISO provides additional detail on this model, below.

Stakeholders also continue to request additional information about establishing up-front rules and/or guidance to minimize the risk of backstop and backstop cost allocations. To address these concerns, the CAISO is doing two things. First, the CAISO is coordinating with the CPUC and will work with other LRAs such that LRAs are able to set up-front requirements for their jurisdictional LSEs. Second, as noted above in section 4.1.1, is working to provide preliminary

results from a test run using June 2020 RA showings to help further inform market participants. The CAISO will issue a supplement to this proposal upon completion of this assessment. This section remains unchanged pending the results of this assessment.

### **Overview**

The CAISO will conduct two sufficiency tests for system capacity: an individual deficiency test and a portfolio deficiency test. These tests are designed to ensure there is both adequate UCAP to maintain reliability for peak load and that the portfolio of resources, when combined, work together to provide reliable operations during all hours at the system level. The CAISO will also conduct tests for flexible and local capacity needs, described in Section 4.4.

### ***Individual Deficiency Assessments***

The CAISO will assess LSE RA showings and resource supply plans to ensure there is sufficient UCAP shown to meet the identified UCAP need described above. Because the CAISO will be assessing system capacity showings based on UCAP values, the CAISO proposes that LSEs and resource SCs need only submit and show resources' UCAP values. Once shown, the CAISO will consider each resource's UCAP value to conduct its UCAP assessment.

Additionally, LSEs will not be permitted to procure only the “good part” of a resource (*i.e.*, LSEs cannot simply procure only the unforced capacity portion of a resource, and any amount shown for RA will be assessed considering the resource's forced outage rate). For example, an LSE could not claim to buy 90 MW of both NQC and UCAP from a 100 MW resource with a 10 percent forced outage rate. In comments to the straw proposal – part 2, several parties requested CAISO allow resources to sell and show only the UCAP value of the resource. There are two reasons CAISO cannot allow this. First, the UCAP accounting method relies on the probability that some resources will be out at various times. Allowing some resources to do so would likely require CAISO to maintain the same complicated substitution rules it is seeking to eliminate to maintain the desired level of reliability. Second, the CAISO's review of best practices in other ISO's shows such practices are not permitted.

Partial RA resources (shown for RA for only a portion of its capacity) will receive a proportional UCAP value reflecting the proportion shown for RA purposes (*i.e.*, a 100 MW resource with a 10 percent forced outage rate shown for 50 MW of NQC will be assessed as being shown for 45 MW of UCAP RA).

LSEs that fail to meet the UCAP requirement will be notified of the deficiency and provided an opportunity to cure. LSEs that fail to cure may be subject to backstop procurement cost allocation. Specific backstop procurement authority for this deficiency and cost allocation are discussed in greater detail in Section 4.4.

### ***Individual RA Showing Incentive***

The CAISO also proposes to develop an individual LSE RA showing incentive. The CAISO proposes to develop a new tool called the UCAP deficiency tool, which is intended to discourage LSEs from failing to show RA at least equal to their UCAP requirement and

incentivize LSEs to show above their UCAP obligations. The concept of the UCAP deficiency tool is to apply a penalty to LSEs that show less than (below) their UCAP requirement, and distribute those collected penalties to LSEs showing over (above) their UCAP requirements. This proposed tool and incentive is described in Section 4.4. Examples and further discussion of this proposed concept are also provided below.

### ***Portfolio Assessment***

The CAISO will conduct a portfolio deficiency test of the resources shown for RA to determine if the portfolio is adequate to serve load under various load and net load conditions during all hours of the day. The portfolio deficiency test will use only the shown RA fleet in a production simulation to determine if the CAISO is able to serve forecasted gross and net-load peaks, and maintain adequate reserves and load following capability. The need for this assessment is similar in concept to the collective deficiency test CAISO conducts for local RA. However, the CAISO will only conduct this assessment for monthly RA showings because they are the only showings where LSEs must meet 100 percent of the system, local, and flexible RA capacity requirements. The increased number of energy and availability-limited resources on the system and the reliance on these resources to meet RA needs means that some resource mixes provided to meet RA requirements may not ensure reliable operation of the grid during all hours of the day across the entire month. Similar to the local assessments, the CAISO is looking to maintain a consistent definition for capacity to facilitate transacting a homogeneous product. However, the CAISO must assess how the shown RA fleet works collectively to meet system needs.

The objective of a portfolio analysis is to assess if the CAISO can serve load with the shown RA fleet. Because year ahead system RA showing requirements are currently only 90 percent for the five summer months for CPUC jurisdictional entities, the CAISO can only reasonably conduct this assessment using monthly RA showings.

The CAISO has considered a variety of deterministic, stochastic, and hybrid modelling approaches for this portfolio analysis. Based on stakeholder feedback and additional CAISO assessments, the CAISO has determined that a stochastic approach offers the greatest opportunity to assess the widest array of load, wind, and solar profiles as well as various outage profiles for other resource types. Additionally, the CAISO sought to leverage its existing production simulation expertise and modeling by relying on tools that are already available. This provides at least two benefits. First, using an existing production simulation model will help the CAISO expedite testing and implementation. Second, the CAISO can utilize an accepted and vetted model that has been relied on for other CAISO published studies.

The CAISO proposes to use the production simulation tool that it currently uses for the Summer Loads and Resources Assessment (Summer Assessment) study.<sup>28</sup> The CAISO has used its production simulation tool to conduct this study since 2016, updating the model annually to

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<sup>28</sup> The annual study process is typically completed in May of each year. The most current study is the 2019 assessment, available at <http://www.caiso.com/Documents/Briefing-2019-SummerLoads-Resources-Assessment-Report-May2019.pdf>

create a robust tool for CAISO to convey potential risks for the upcoming summer needs. More specifically,

The 2019 Summer Loads and Resources Assessment (“Assessment”) provides an assessment of the upcoming summer supply and demand outlook for the California Independent System Operator (CAISO) balancing authority area. The CAISO works with state agencies, generation and transmission owners, load serving entities, and other balancing authorities to formulate the summer forecast and identify any issues regarding upcoming operating conditions. The Assessment considers the supply and demand conditions across the entire CAISO balancing authority area (representing about 80 percent of California).<sup>29</sup>

Although the Summer Assessment has been developed for a slightly different purpose, much of the core modelling functions are identical to what the CAISO needs for the proposed portfolio analysis. For example, the model is a detailed representation of loads and resources characteristics across the CAISO. It can also model resources across the WECC, allowing the CAISO imports into the CAISO. The model commits resources based on load, unit specific forced outage rates, ramp rates, start times, and minimum down times to meet CAISO needs, including operating reserves, regulation, and load following. Load following requirements are necessary because the analysis is run on hourly blocks. The model can run both stochastically and deterministically, allowing the CAISO to develop robust statistical results while still testing various sensitivities.

The CAISO notes that the model setup will be different from that of the Summer Assessment to align its functions with the objective of an RA portfolio assessment. The primary difference will be to allow only RA resources to be scheduled by the model. The Summer Assessment assumes that all resources are available to the CAISO to meet peak summer loads. However, the portfolio assessment model will only model the shown RA resources to assess how well the RA fleet meets a given reliability standard. Energy provided in the CAISO’s day-ahead or real-time markets from non-RA resources represents economic energy substitutes, which will not be considered in the portfolio assessment to determine if the RA fleet is adequate. Additionally, the CAISO will coordinate with the CPUC and CEC to develop a common set of hourly load profiles so that the CAISO and the CPUC are using consistent distribution of load profiles for their respective modeling purposes.

If the portfolio is adequate, the CAISO will take no additional actions. If the RA portfolio fails the portfolio assessment, the CAISO will declare a collective deficiency, provide a cure period, and if the deficiency remains, conduct backstop procurement using the CPM competitive solicitation process to find the least cost solutions to resolve any uncured deficiency. The CAISO provides the specific details regarding CPM designations and cost allocation in Section 4.4.

A stochastic monthly assessment of the RA fleet to support additional backstop procurement authority creates unique challenges that do not exist under the simple accounting tools currently used for RA showings. The two primary challenges are (1) establishing the defined reliability

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<sup>29</sup> <http://www.caiso.com/Documents/Briefing-2019-SummerLoads-Resources-Assessment-Report-May2019.pdf> at p. 1.

criteria that triggers the need for backstop procurement, and (2) establishing the quantity of capacity needed to cure the portfolio deficiency. As part of this stakeholder initiative, the CAISO will propose solutions to both of these challenges. However, at this time, the CAISO only provides additional details regarding each challenge and will propose specific solutions in subsequent proposals within this stakeholder process.

Stochastic capacity analyses have been conducted in California for several years, starting with the CPUC's Long-Term Procurement Planning process. These analyses have evolved, and variations of these types of studies are used in the CPUC's Integrated Resource Planning proceeding and the RA proceeding for determining ELCC values for wind and solar. Despite all of the work that has been in these proceedings, there is still a great deal of debate about the ultimate reliability standard that must be met. Some of the debate centers on the difference between studying a full year, which has been done historically in most LOLE studies, versus a single month, which is done for California's RA program. Another area of debate includes what constitutes a loss-of-load event. For example, the original loss-of-load studies did not account for ancillary service requirements. Current studies include ancillary services, but there is a debate about whether a loss-of-load event is defined by utilizing any of those ancillary services or only by merely dropping below three percent reserves – when the CAISO must initiate firm load shedding. Alternatively, the answer to what constitutes a loss-of-load event may also include how often the CAISO would be expected to rely on its reserves. For example, how often is it acceptable for the CAISO to rely on reserves and dip below 6 percent reserves? Is it acceptable during one percent of hours, 10 percent, 15 percent or more? As noted above, the CAISO will offer a solution in a subsequent iteration.

In addition to developing criteria for when additional capacity is needed, the CAISO must also develop a methodology to determine how much capacity is needed. Therefore, if the CAISO identifies a portfolio deficiency, the CAISO must establish a means for determining the amount of additional capacity needed either through a capacity cure period or through CAISO backstop procurement

The CAISO considered additional assessments of individual RA showings, however, it is not feasible to adequately develop individual LSE load profiles and determine how a specific LSE's RA portfolio contributed to the collective deficiency and, therefore, is subject to LSE specific cost allocation. However, the CAISO supports, and is committed to, working with the LRAs to establish up-front procurement requirements, similar to the CPUC's maximum cumulative capacity (MCC) buckets to help ensure collective procurement of a resource portfolio with the best possibility of passing the portfolio assessment.

#### **4.1.4. Must Offer Obligation and Bid Insertion Modifications**

The RA program is designed to ensure the CAISO has sufficient capacity available to serve load reliably all hours of the year. Any resource providing RA capacity to the CAISO is obligated to offer that capacity into the CAISO market. This ensures the market has sufficient bids available to dispatch resources to serve system load reliably. RA resources will continue to have a must offer obligation under RA Enhancements. Currently, the CAISO tariff contains provisions

regarding must offer obligations, bidding, and bid insertion rules. The CAISO proposes the following must offer obligation and bid insertion modifications in this initiative:

- Must offer obligations must be set at the amount of NQC shown for RA, not the amount of UCAP shown;
- Resources have a 24 by 7 must offer obligation into the day-ahead market unless exempt, and;
- Resources will receive bid insertion, unless exempt.

### **Must offer obligations must align with NQC values**

The CAISO proposes a resource's must offer obligation be consistent with the resource's shown capacity scaled up for the forced outage rate adjustment. This means that the must offer obligation will be for the equivalent installed capacity, up to the resource's NQC value. For simplicity, the CAISO will refer to this quantity as shown NQC. This is consistent with the practice in other ISO/RTOs.<sup>30</sup> More specifically, if a 100 MW resource with a 20 percent forced outage rate is shown for 80 MW of UCAP, then it has shown its full 100 MW of NQC. It must then bid 100 MW of capacity into CAISO's markets when the resource is not on outage.<sup>31</sup> This bidding rule is required to ensure sufficient capacity is available to the system at all times by accounting for the fact that some resources will be on forced outage. Absent this requirement, units must be available 100 percent of the time to their UCAP values or provide substitute capacity, otherwise the CAISO would be short of available RA capacity. Assuming resources are available 100% of the time is an unreasonable expectation and requiring replacement capacity defeats the goal of simplifying RA rules.

Alternatively, and as proposed here, setting the must offer obligation at the shown NQC value allows CAISO to eliminate forced outage substitution and its complexities. By establishing a UCAP-based RA construct with an associated must offer obligation at the NQC value, the RA fleet effectively provides its substitute capacity upfront, eliminating the need for complex resource substitution rules. For this reason, CAISO proposes to eliminate the existing RA forced outage substitution rules in favor of UCAP-based resource RA counting and NQC-based resource bidding. This concept is addressed in greater detail in Section 4.1.2, above.

### **Resource Adequacy resources will have a day-ahead must offer obligation**

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<sup>30</sup> See "A case study in capacity market design and considerations for Alberta" at p. 22: <http://www.assembly.ab.ca/lao/library/egovdocs/2017/ca7/aeso/226509.pdf>. "In all the reviewed markets except California and ISO-NE, the capacity of these facilities is procured and settled as UCAP. In California and ISO-NE, the capacity obligation is denominated as installed capacity (ICAP). Notwithstanding that, in most markets, capacity is procured and settled as UCAP, the resulting performance obligation on conventional controllable generation is to offer all of the ICAP except on recognized outages."

<sup>31</sup> If a resource only shows a portion of its NQC as RA, the must offer obligation is set at the portion of the NQC that is shown for RA, not the full amount.

The CAISO is proposing several new capacity products in separate initiatives called reliability capacity, imbalance reserves, and corrective capacity.<sup>32</sup> Based on these proposals, the CAISO has determined a day-ahead must offer obligation for resource adequacy resources is sufficient to commit resources and reserve capacity for use in real-time. This is because, as proposed in the Day-Ahead Market Enhancements, the CAISO will begin procuring additional resources in the day-ahead timeframe to be available in real-time to cover uncertainty between day-ahead and real-time. Resources awarded in the day-ahead, including resources awarded reliability capacity, imbalance reserves, and corrective capacity, will have a real-time must offer obligation up to their day-ahead award. As such, the CAISO proposes must offer obligations for RA resources into the day-ahead market only. All real-time MOOs will be determined in the day-ahead market. All capacity that receives a day-ahead energy or A/S award or a reliability capacity or imbalance reserve award, regardless of RA status, will have a must offer obligation into the real-time market for all hours in which they received a day-ahead award to the amount of their day-ahead award. RA capacity that does not receive a day-ahead market award has no further obligation to be available in the real-time market.

This solution is more efficient than the current 24 by 7 resource adequacy must offer obligation into both day-ahead and real-time markets. Under this proposal, the resource adequacy program will ensure suppliers offer sufficient capacity into the day-ahead market. The day-ahead market will then commit resources to meet the energy, reliability capacity, imbalance reserve, corrective capacity, and ancillary service needs for the following trade day. Resources awarded in the day-ahead, including resources with imbalance reserve or reliability capacity awards, will have a must-offer obligation into the real-time market. The CAISO will require any resource with day-ahead awards for the new capacity products to reserve capacity in the day-ahead timeframe and make that capacity available in real-time. This will ensure the CAISO can efficiently meet uncertainty needs between the day-ahead and real-time markets. The real-time must offer obligation based on awards made in the day-ahead will provide the CAISO with adequate capacity for use in real-time, while relieving capacity not committed in day-ahead of their real-time must offer obligation.

Under the Day-Ahead Market Enhancements and RA Enhancements proposals, resource adequacy resources will have a 24 by 7 must offer obligation in the day-ahead market only. Their must offer obligation will be extended into real-time if the resource is scheduled in day-ahead for energy, ancillary services, or imbalance reserves. Although RA resources would not have a real-time must-offer obligation if they are not awarded in the day-ahead, **RA resources must still be available for exceptional dispatch after the day-ahead market whether or not they receive a day-ahead award.** If a resource is not available for exceptional dispatch after the day-ahead market, the resource should submit an outage. If resources receive an exceptional dispatch, they will be required to provide that energy real-time and would not qualify for an ED CPM designation when they respond to that exceptional dispatch.

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<sup>32</sup> For detailed descriptions of each product see the Day-Ahead Market Enhancements and Contingency Modeling Enhancements stakeholder initiative webpages:  
<http://www.caiso.com/StakeholderProcesses/Day-ahead-market-enhancements> and  
<http://www.caiso.com/StakeholderProcesses/Contingency-modeling-enhancements>

Resources providing system and local resource adequacy will be required to bid or self-schedule for energy and bid or self-provide ancillary services. Additionally, resources providing system and local resource adequacy will be required to economically bid for reliability capacity and corrective capacity. Resources providing system and local resource adequacy only will not be required to bid for imbalance reserves.

If a resource self-schedules its entire resource adequacy obligation into the day-ahead market for energy or ancillary services, economic bids will not be required for any of the other products. If a resource economically bids its entire resource adequacy obligation for energy and ancillary services, the resource must economically bid for reliability capacity and corrective capacity.

If a portion of the resource is self-scheduled for energy or ancillary services, the resource will be required to economically bid the rest of the resource's obligation for energy, ancillary services, reliability capacity and corrective capacity. Resource adequacy resources will have the same real-time must offer obligation as any other resource based upon day-ahead awards.

Resource adequacy resources will have the same real-time must offer obligation as any other resource based upon day-ahead awards. Resources must economically bid the full range of their reliability capacity and imbalance reserve awards into the real-time market. Real-time must offer obligations apply in the hourly intervals that a resource has a day-ahead schedule. Additional detail on must offer obligations for resources providing flexible resource adequacy is outlined in section 4.2, below.

### **Standard must offer obligation**

The CAISO performed a comprehensive review of must offer obligations for all resource types in the tariff and Reliability Requirements BPM and believes the current must offer obligations can be simplified to provide market participants more clarity when determining the must offer obligations for different resource types. To simplify the must offer obligations, the CAISO proposes a standard must offer obligation into the day-ahead market that would apply to all resources unless specified by CAISO under a tariff exemption by resource type.<sup>33</sup>

**Standard day-ahead must offer obligation:** Economic bids or self-schedules for all RA capacity for all hours of the month a resource is not on outage.<sup>34</sup>

Some stakeholders suggested the 24 by 7 must offer obligation does not align with the future makeup of the RA fleet, in which many resources will have use- or availability-limitations. The CAISO recognizes certain resources require variations to the standard must offer obligation and identifies these below. However, the standard must offer obligation into the day-ahead market remains 24 by 7 for most resource types. While the makeup of the resource fleet is becoming increasingly use- and availability-limited, the CAISO believes most resources should still bid into the day-ahead market for all hours the resource is not on outage. A resource should have bids

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<sup>33</sup> The CAISO is not proposing changes to how load-following metered subsystems are treated under the existing tariff section 40.2.4.

<sup>34</sup> Outage refers to both planned and forced. If a resource is on outage, whether it is planned or forced, it should not be bidding that capacity into the market because it would not be able to deliver it.

in all hours it is available, such that the day-ahead market can determine when the resource is needed over the course of the day and schedule it appropriately.

Rather than modifying the day-ahead 24 by 7 must offer obligation, the CAISO believes modifying the MCC buckets would more appropriately address the increased amounts of availability-limited resources on the system. In its Order Instituting Rulemaking in the RA proceeding, the CPUC lists potential modifications to the MCC buckets as an option to consider when structurally changing the RA program in response to the rapidly changing resource fleet.<sup>35</sup> Redefining the MCC buckets, coupled with a 24 by 7 must offer obligation into the day-ahead market could be beneficial because resources with limited availability could contribute to RA needs consistent with their energy limitations, while still providing the CAISO market the ability to determine the hours the resource is needed over the course of the day. Additionally, this approach would benefit LSEs by providing more guidance into resource attributes needed to increase the possibility of passing the portfolio assessment, as discussed in Section 4.1.3.

### ***Bid Insertion Proposal***

The CAISO is proposing revisions to the bid insertion rules. Although the CAISO currently requires RA resources to economically bid or self-schedule into the market, it also supplements those bidding obligations with bid insertion provisions for non-use limited resources. The CAISO proposes to continue applying bid insertion to all RA resources in the day-ahead market, with minimal exemptions described below. Applying bid-insertion will ensure that resources have bids in the market and that outages would be reported to avoid market dispatch, enhancing the CAISO's ability to identify forced outages.

The CAISO allows resources with certain use limitations to include approved opportunity costs in their market bids. The policy is designed to ensure the more effective and efficient use of resources in the market and to facilitate regular and consistent market participation from resources with certain use limitations. Conditionally available resources, which have regulatory or operational limitations that do not qualify as use-limited, would not be exempt from bid insertion.<sup>36</sup> Conditionally available resources are able to use outage cards to manage their conditionally available outages and derates. The CAISO requires that conditionally available resources submit outage cards when unavailable, similar to all other resources on the system. The CAISO proposes not to exempt use-limited resources or conditionally available resources from the standard must offer obligation or bid insertion.

### ***Variations to Standard Must Offer Obligation and Bid Insertion Proposal***

The CAISO recognizes that not all resource types are physically capable of meeting the proposed standard must offer obligation, or require variations to the standard must offer obligation to provide the needed attributes of system and local RA. Therefore, the CAISO proposes a limited list of variations to the standard must offer obligation outlined in Table 12.

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<sup>35</sup> CPUC Order Instituting Rulemaking, November 13, 2019.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M319/K527/319527428.PDF>

<sup>36</sup> Tariff Definition of Use-Limited Resource and Conditionally Available Resource:

<http://www.caiso.com/Documents/AppendixA-MasterDefinitionSupplement-asof-Sep28-2019.pdf>

These resource types will still be subject to must offer obligations, but they will be defined by the CAISO based on the characteristics of the resource type.

The CAISO also recognizes the need to specifically define the bid insertion rules for resources that fall outside the categories of non-use-limited or registered use-limited. For example, it may not be appropriate to apply bid insertion to resources with variable output. Therefore, the CAISO also includes bid insertion exemptions listed in Table 12. If a resource is exempt from bid insertion, the CAISO would not insert bids into the day-ahead market for these resources in the event that required amounts of RA capacity are not offered into the day-ahead market. This table summarizes day-ahead market must offer obligations and bid insertion rules only.

The CAISO initially proposes to generally define the following variations to the must offer obligations and bid insertion into the day-ahead market based on resources type and seeks stakeholder feedback on this list, including modifications or additions. Resources exempted from the standard must offer obligation will still be required to offer into the CAISO market, but must do so as described in Table 12 and the paragraphs below.

**Table 12: Variations to Standard Day-Ahead Must Offer Obligation and Bid Insertion Proposal**

<b>Resource Type</b>	<b>DA MOO</b>	<b>DA Bid Insertion</b>
<b>Eligible Intermittent Resource</b>	May, but not required to, submit Bids in the Day-Ahead Market	No
<b>NGR</b>	Standard DA MOO plus MOO should reflect charge and discharge capabilities and resource must be non-REM <sup>37</sup>	Yes <sup>38</sup>
<b>PDR<sup>39</sup></b>	CAISO will defer to program parameters established by the LRA. If none established, resources must follow the standard must offer obligation <sup>40</sup>	No
<b>Participating Load</b>	Participating load that is pumping load shall submit Economic Bids for Energy and/or a Submission to Self-Provide Ancillary Services in the Day-Ahead Market for its	No

<sup>37</sup> Additional detail on potential solutions for market participation of storage resources is included in section 4.1.7.

<sup>38</sup> NGR resources currently do not have default energy bids (DEBs). Energy storage DEBs are proposed in ESDER 4 and once implemented will allow energy storage resources to receive bid insertion as part of this proposal.

<sup>39</sup> Refer to Energy Storage Distributed Energy Resources Phase 4 initiative for developments on bidding obligations for PDR under an ELCC counting methodology. In that initiative, CAISO is proposing potential modifications to must offer obligations for variable-output DR in the ESDER 4 stakeholder process, including bidding requirements and submission of forecasted capability. ESDER Stakeholder Initiative Webpage: [http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage\\_DistributedEnergyResources.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx)

<sup>40</sup> PDR bidding requirements are specified in CAISO tariff Section 30.6.1 – Bidding and Scheduling of PDRs.

	Resource Adequacy Capacity that is certified to provide Non-Spinning Reserve Ancillary Service.	
<b>RDRR</b>	May, but not required to submit Bids in the Day-Ahead Market	No
<b>Regulatory Must Take (RMT)</b>	Standard MOO	No
<b>Run-of-River Hydro</b>	May, but not required to, submit Bids in the Day-Ahead Market	No

The following paragraphs include additional detail and rationale on the variations outlined in Table 12 above.

The CAISO proposes that for resources participating under the NGR model, the must offer obligation reflect both the charge and discharge capabilities of the resource so the CAISO can fully optimize the resource. To do so, the CAISO must have bids available for the unit’s full capability. Bidding full charge and discharge capability will allow the CAISO to ensure fuel sufficiency for the resource. At this time, the proposal would also apply for battery storage resources participating under the NGR model regardless of the point of interconnection (*i.e.* transmission or distribution), and the CAISO is considering how it would apply to other technology types that may participate under NGR in the future.

Additionally, the CAISO has limited NGR eligibility for system RA to resources under the non-regulation energy management (non-REM) option. The CAISO cannot maintain system reliability over-relying on resources limited to providing regulation only. REM management resources are neither required, nor capable, of providing energy needed to meet the energy needs of system. Therefore, the CAISO has limited the system RA eligibility of NGRs to NGRs with the non-REM option.

A few resources will continue to have a real-time must offer obligation for RA capacity, including RDRRs and resources with intra-hour variability. The CAISO must maintain the real-time must offer obligation for RDRR resources. Unlike other RA resources, RDRR is not required to participate in day-ahead and is only available in real-time if the CAISO declares a warning or emergency. Therefore, the CAISO must ensure RDRR resources continue to have a real-time must offer obligation to ensure they are available in real-time if needed.

The CAISO must also maintain the real-time must offer obligation for resources with intra-hour variability, such as eligible intermittent resources and run-of-river hydro. Run-of-river hydro resources have similar operating characteristics to wind and solar because they have limited ability to control output from one interval to the next. It is optional for eligible intermittent resources to bid into the day-ahead market. In real-time, they are scheduled based on a forecast provided by the CAISO. This ensures feasible real-time dispatches that reflect intra-hour variability. The CAISO does not currently receive forecast data for run of river hydro or have the ability to provide forecasts for them. Therefore, run-of-river hydro cannot be treated as a VER due to lack of data availability. However, they can be treated similarly for the purposes of the must offer obligation. The CAISO proposes run-of-river hydro submit their own forecast

of resource output to set the upper economic limit on bids. Eligible intermittent resources and run-of-river hydro would, therefore, not have a day-ahead must offer obligation, and would have a real-time must offer obligation up to their forecasted amount.

#### 4.1.5.Planned Outage Process Enhancements

The CAISO considered modifying its planned outage provisions to correspond with the proposed modifications to its RA counting rules and assessments. The CAISO describes proposed changes to its planned outage provisions in the following section and provides relevant background on the current provisions.

##### **Stakeholder feedback**

In the fourth revised straw proposal, the CAISO put forward two new planned outage processes based on stakeholder proposals<sup>41</sup> to facilitate outage coordination and provide the greatest certainty regarding the timing of planned outages to both the CAISO and resource SCs. Option 1 established a planned outage reserve margin for off-peak months. Option 2 established a replacement marketplace conducted by the CAISO. Stakeholder feedback on these options is generally divided. Many stakeholders, including SCE, Calpine, MRP, CalCCA, and Wellhead offer some level of support for Option 1. The basis for support includes the simplicity offered by Option 1, the fact that this option improves capacity price transparency by removing any embedded costs to cover planned outage replacement, and that Option 1 eliminates any incentive to withhold excess capacity from the bilateral capacity market. Alternatively, SDG&E CPUC staff, DMM, and Public Advocates Office offered some level of support for Option 2. The basis their support included that Option 2 appears to apply more direct causation to the resources taking the planned outages and offered more of a market based solution.

In addition to considering stakeholder feedback, the CAISO has looked to other ISOs/RTOs for guidance on how they have approached this issue. Based on the CAISO's review of other ISO/RTOs, CAISO is uniquely situated. More specifically, the CAISO's planned outage options are constrained by the monthly nature of the RA program. All other ISOs/RTOs conduct RA procurement annually, potentially including seasonally different RA requirements. Additionally, other ISO/RTOs can require up to two years of notice for planned outages. This allows the ISO/RTOs to include those planned outages in LOLE studies when conducting annual capacity procurement. Because other LSEs have much longer visibility into the RA obligations of resources, the planned outage procedures are much cleaner. However, the CAISO does not know which resources will be RA resources until 45 days prior to the month. This timeline creates a complicated overlap between the CAISO's planned outage and RA processes. To the greatest extent possible, the CAISO will attempt to mitigate this overlap.

Based on the CAISO research and stakeholder feedback, the CAISO, will pursue Option 1, developing an additional planned outage reserve margin for the non-summer months. Although the cost causation arguments in support of Option 2 appear persuasive *prima facie*, the CAISO

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<sup>41</sup> In addition to these two proposals, the CAISO also explored numerous other options in prior straw proposals. However, given stakeholder feedback, the CAISO is currently only evaluating the two most recent options.

believes the potential benefits of Option 2 are far outweighed by its complexity – requiring the development of a substitute capacity market that could be subject to market power – and creates additional incentives to withhold capacity from the bilateral resource adequacy capacity market. The argument in support of Option 1 and the specific concerns with Option 2 are explained in greater detail below.

Although the CAISO is proposing Option 1 in this current straw proposal, it remains open to one other option: Keep the existing planned outage process unchanged. Over the course of the stakeholder process, the CAISO has offered numerous alternatives based on both CAISO and stakeholder proposals. To date, stakeholders have rejected the proposals or have been highly divided in their approval or disapproval of the options offered. The CAISO has acknowledged that the existing planned outage substitution process is complex and creates risk that previously approved planned outages may be cancelled. Although the existing process has its challenges, the CAISO is prepared to recognize that may be the best that can be done under the current monthly RA program. Therefore, should stakeholders reject Option 1, the CAISO will leave the existing process unchanged and eliminate this element of the overall proposal.

Stakeholders continue to comment on the CAISO’s view that, depending on the circumstances, it can violate the tariff for a generator or transmission operator to submit a forced outage after the CAISO has rejected the same outage when submitted as a maintenance outage. This topic of “planned-to-forced” outage reporting has been the subject of even more attention given the recent appeal to the CAISO executive appeals committee of a CAISO revision to the business practice manual for outage management.<sup>42</sup> The committee’s decision directed staff to consider the following as expeditiously as practicable:

What amendments are necessary in the outage reporting sections of the ISO tariff to further clarify when planned-to-forced outage reporting is prohibited and when it is permitted. Such amendments to consider include, but are not limited to, amendments to the definitions of planned and forced outages, as appropriate. This process also should consider resolving any other potential ambiguities in section 9 of the tariff, as well as consideration of further illumination of the factors used in determining whether to approve or reject a planned outage, whether in the tariff or BPM, as appropriate.<sup>43</sup>

As a result of stakeholder feedback and the appeals committee’s decision, the CAISO will address the planned-to-forced outage reporting issue within this RA Enhancements stakeholder process. Specifically, the outage definitions proposed in section 4.1.2 will clarify the planned and forced outage definitions and a properly designed UCAP construct will likely eliminate the incentive for market participants to engage in problematic planned-to-forced outage reporting, which in turn may influence the relevant outage reporting tariff provisions. Due to the relationship between outage reporting and the rest of the RA Enhancements proposal, it is most appropriate to address this issue within this initiative and its timeline.

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<sup>42</sup> Details of that appeal, which related to proposed revision request 1122, are available at: <http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=D8E40756-EA62-4851-B528-3F2D6DD04728>

<sup>43</sup> <http://www.caiso.com/Documents/ExecutiveAppealsCommitteeDecision-PRR1122-Mar112020.pdf>

## ***Background***

The CAISO's Planned Outage Substitution Obligation (POSO) process is codified in CAISO tariff sections 9.3.1.3 and 40.9.3.6 and the Outage Management BPM.<sup>44</sup> RA resources currently enter planned outages into the CAISO Outage Management System (OMS). The CAISO's Customer Interface for Resource Adequacy (CIRA) system runs a daily POSO report and determines the planned outage substitution need. The POSO process is currently conducted on a first-in, last-out basis.<sup>45</sup> Therefore, resources submitting planned outages earliest will have the greatest likelihood of taking their planned outages without substitution requirements. The POSO process compares the total amount of operational RA capacity to the total system RA requirement.

As noted previously, LRAs establish system RA requirements based upon CEC monthly peak forecasts, which are updated 60 days prior to the start of each delivery month. If, after removing all planned outages, available capacity is less than the RA requirement, the CAISO assigns substitution obligations for resources seeking to take planned outages.

## ***Objectives and Principles***

The CAISO lists the following objectives and principles that inform changes to its planned outage provisions. Modifications to the CAISO planned outage provisions should:

- Encourage resource owners to enter outages as early as possible
- Avoid cancellation of any approved planned outages to the extent possible
- Minimize or eliminate the need to require substitute capacity to greatest extent possible
- Identify specific replacement requirements for resources requiring replacement
- Allow owners to self-select, or self-provide, replacement capacity
- Include development of a CAISO system for procuring replacement capacity

## ***Current Planned Outage Substitution Obligation Timeline***

The current POSO timeline is provided in Figure 5 below. The current timeline provides the first POSO assessment at T-22, or 22 days prior to the start of the RA delivery month, for all outages submitted prior to T-25. This is the first instance when resource owners are provided with indication of any POSO replacement obligations. Resource owners are allowed to provide replacement capacity through the T-8 timeframe, and the CAISO finalizes replacements and outages at T-7.

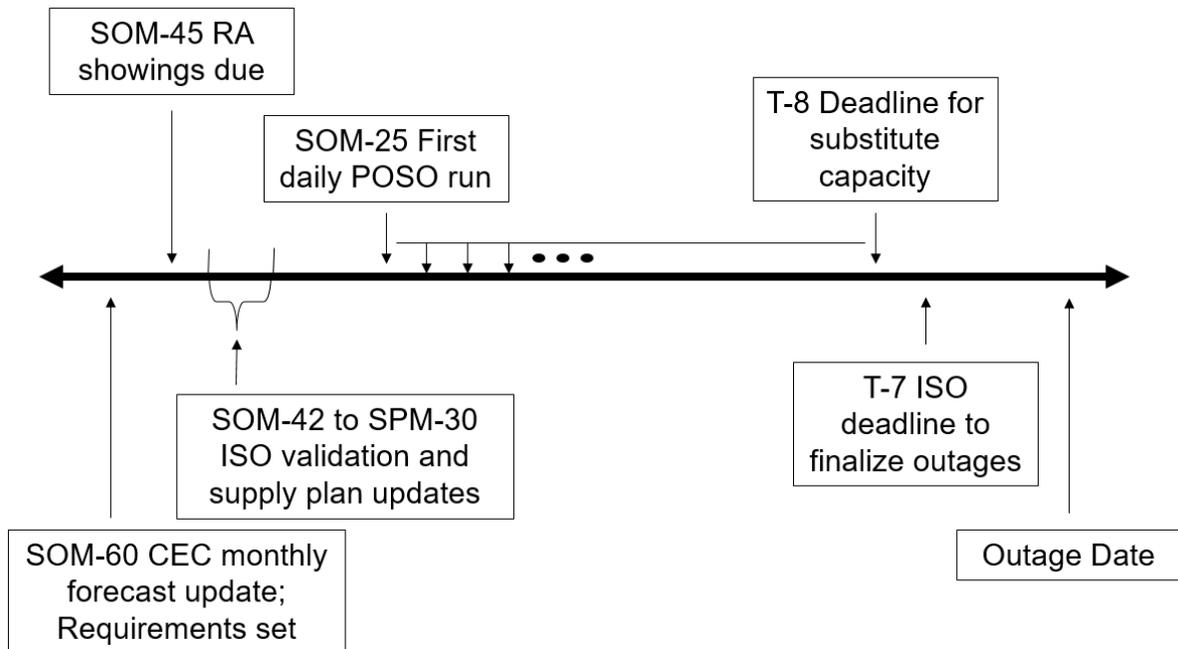
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<sup>44</sup> Outage management BPM found here:

<https://bpmcm.aiso.com/Pages/BPMDetails.aspx?BPM=Outage%20Management>

<sup>45</sup> CAISO will first request the resource providing RA Capacity with the most-recently-requested outage for that day to provide RA Substitute Capacity and then will continue to assign substitution opportunities until the ISO has sufficient operational RA Capacity to meet the system RA requirement for that particular day.

Figure 5: Current POSO timeline



**Proposed Modifications to the Planned Outage Process**

Based on stakeholder comments, the CAISO is proposing several changes to ensure planned outages can be taken with minimal cancellation risk after their initial approval. The CAISO also is attempting to remove obligations for outage replacement to the greatest extent possible. The CAISO proposes to redesign the planned outage process to reflect system UCAP targets rather than traditional NQC targets. This proposed change will better align with the counting rules and RA assessments proposal to incorporate forced outage rates in capacity valuation and assess resource adequacy on a UCAP basis.

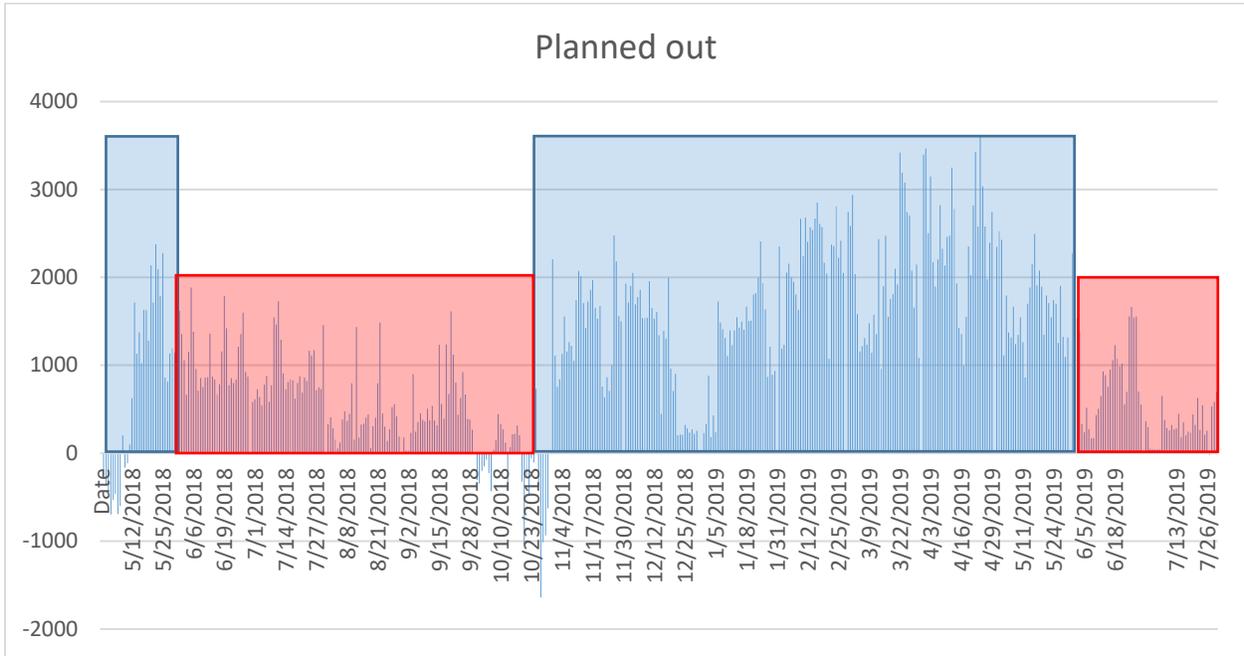
**Revised RA Planned Outage Process**

To facilitate outage coordination and provide the greatest certainty regarding the timing of planned outages to both the CAISO and resource SCs, the CAISO is considering establishing a planned outage reserve margin for off-peak months.

**Including planned outage planning in procurement requirements**

The CAISO proposes to establish two new elements of the RA program with respect to planned outages. First, the CAISO would no longer allow for anything other than short-term and off-peak opportunity outages between June 1 and October 31. As can be seen from Figure 6 below, the vast majority of planned outages occur during off-peak months. Additionally, the off-peak months also provide the greatest opportunity to procure low cost capacity to ensure adequate capacity is available to the CAISO.

Figure 6: Approved Planned Outages (Both with and Without Substitution)<sup>46</sup>



Therefore, the CAISO proposes that UCAP capacity requirement would increase during the non-summer months, creating a well-defined planned outage reserve margin. To be clear, the higher UCAP requirement in the non-summer months does not mean that the CAISO’s overall capacity needs are higher in these months. Instead, the higher UCAP requirement is to reflect that all maintenance outages on RA capacity will have to occur during this time, meaning that the planned outage rate on the RA fleet during this time will be substantially higher than during the peak summer months. No substitute capacity is allowed or required for an outage. The CAISO’s proposed capacity outage calendar would track all planned outages for each day until RA showings are made for a given month. Once RA showings are made, the CAISO will track how much additional capacity can take a planned outage under the planned outage reserve margin. The CAISO is not, at this time proposing a specific reserve margin. The reason for this is that it is not possible to declare a fixed number based on historic data. Instead the size of the planned outage reserve margin should be based on a balance of LSE costs and providing reasonable opportunities for resources to undertake needed maintenance. For example, if the final decision is that the planned outage reserve margin is zero, then the CAISO could deny or cancel all planned outages for RA resources. However, this bookend has the down side of potentially leading some resources to be unable to sell RA for a whole month due to a couple day planned outage. Alternatively, should the planned outage reserve margin be set at 10,000 MW, then the CAISO would likely be able to approve most planned outage requests, but this opportunity would come at significant rate-payer expense. Further, the planned outage reserve margin need not be fixed for all months. For example, it could be set at 5,000 MW in January, taper down to 3,000 MW in March, down to zero in May, and then increase again over the

<sup>46</sup> Observations with negative values represent days when the quantity of substitute capacity exceed the quantity on approved planned outage.

remaining months of the year. Therefore, the CAISO proposes to work with LRAs and other stakeholders to determine the best balance between these extremes.

The CAISO will review outage requests as they are submitted. Outage requests submitted prior to RA showings will either be approved or denied based on the CAISO’s reliability assessment. The CAISO will not wait for RA showings to make this determination. The difference between this and current practices is that the CAISO will no longer issue POSO notifications at T-22 days prior to the month for outages requested by T-25. When RA showings are made, the CAISO will subtract all planned outages on RA showings from the planned outage reserve margin for each day in the RA month. If on a given day the approved planned outages for RA resources exceeds the planned outage reserve margin, then the CAISO will not allow any additional planned outages for that day. If the approved planned outages are less than the planned outage reserve margin, the CAISO will allow for additional planned outages on a given day for up to the remaining difference. Once subsequent planned outage requests reach the remaining planned outage reserve margin, the CAISO will automatically reject all additional planned outage requests. However, even if additional planned outage reserve margin remains, all planned outages will be subject to the CAISO’s reliability assessment and may be denied for potential adverse reliability impacts. Finally, the CAISO will retain discretion to grant or deny all opportunity outages based on CAISO engineering assessment, regardless of threshold.

Table 13 below provides several examples of how the CAISO would assess a 300 MW resource requesting a planned outage. This example assumes a 3,000 MW planned outage reserve margin based on the data shown in Figure 6 above.

**Table 13: Examples of how CAISO will assess planned outages with a planned outage reserve margin**

Timing of submission	Outage Calendar requests	Remaining planned outage reserve margin	Approved or rejected
Request made January 1 for outage on June 1	0 MW	NA	Rejected
60 days prior to month	2,500 MW	NA	Based on reliability assessment
60 days prior to month	3,500 MW	NA	Based on reliability assessment
20 days prior to outage date	2,000 MW	1,000	Based on reliability assessment
20 days prior to outage date	2,800 MW	200	Rejected

1 day prior to requested outage	3,000 MW	0	At the discretion of the CAISO
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For purposes of UCAP calculations, any planned or opportunity outage approved by the CAISO will not impact the resource’s UCAP calculation. However, all rejected planned outages, if taken, may count against the resource in its UCAP calculation.<sup>47</sup> This applies regardless of the timing of the outage request or the ultimate RA status of a resource.

Although, this option would require higher overall procurement, there are several other potential benefits to load. First, the CAISO’s proposal eliminates all planned outage substitution. This removes both the incentive for LSEs to withhold capacity from the market to provide substitute capacity and the need for resources to include a risk premium in capacity contracts to cover any potential costs of replacement capacity. As a result, the supply of capacity in the bilateral market should increase and hidden costs included in the contracts should decrease. Instead, all excess capacity should be more readily available for sale in the bilateral capacity market, maximizing LSEs’ opportunities to find capacity when needed at a lower price. These benefits can be captured in both peak and off-peak months. Under the existing rules, substitution may be required in all months. Eliminating substitution rules in their entirety should also free up additional capacity during summer months, increasing overall supply and lowering costs. Finally, because the CAISO proposal would only include a planned outage focuses on off-peak months to minimize the potential for increased capacity prices to LSEs.

The alternative the CAISO considered from the Fourth Revised Straw Proposal was to develop a new procurement tool designed to procure planned outage substitution capacity.<sup>48</sup> The procurement would take place for daily substitute capacity obligations. This new procurement option, and the tool the CAISO would employ, would be separate from its existing CPM authority. Instead, the CAISO would have served as a facilitator to enable planned outages. Resource participation to provide daily substitute capacity via a competitive solicitation process would have been completely voluntary.

Although this option may seem conceptually easy to understand, there are numerous complex policy issues that needed to be resolved, and the CAISO would have to build a complex and costly capacity clearing mechanism when the benefits are unclear and the potential downsides appear significant, such as potential replacement costs and market power concerns. However, stakeholders offered little in the way of how these issues would be resolved. For example, stakeholders were split over making participation in the substitute capacity market optional or mandatory. Additionally, there was no discussion about how to resolve potentially withholding capacity from the market (except for making participation mandatory) to supplement another outage for the same SC. This can lead to some days where the price of substitute capacity is

<sup>47</sup> The final determination of if the outage would count in the resource’s UCAP calculation depends on the final UCAP calculation methodology.

<sup>48</sup> The SDG&E proposal suggested the CAISO develop this tool for both planned and forced outages. However, the CAISO’s proposal will not extend to forced outages. The basis for this decision is discussed later in this proposal.

zero and other days where it could be priced at the peak. There was no stakeholder discussion regarding ways to set daily price caps or monthly earnings caps.

Ultimately, the CAISO remains concerned that planned outage replacement under this type of tool can lead to planned outage costs becoming disincentives to resources doing maintenance. Additionally, since resources will not know the cost of replacement capacity, they will be forced to include higher risk premiums in their RA contracts to compensate for the risk that they may be required to procure substitute capacity at a premium price. This is where the cost causation arguments in support of a secondary substitute capacity start to break down. First, at the end of the day, all costs are ultimately passed onto to load. So, while a specific generator may pay a price for substitute capacity, that resource will build that cost into its overall RA cost, which is then passed on to rate-payers. Second, this secondary market creates incentives for LSE to withhold some capacity to mitigate replacement cost risk. In these instances, the resource taking the planned outage is faced with one of two options 1) withhold capacity from the RA market to mitigate price risk or 2) risk looking for substitute capacity in a scarce market. The CAISO is concerned that running a daily replacement capacity market will require a daily price cap, a monthly earning cap, or both, which will prove costly and potentially result in resources forgoing maintenance. This risk is mitigated by the potential impacts to a resources UCAP if it is forced out due skipping maintenance. However, these risks can be avoided entirely by simply establishing a planned outage reserve margin and eliminating planned outage substitution requirements.

Finally, this option has an additional downside in that it does not resolve the issue of LSEs withholding capacity to self-insure against replacement costs. In fact, given that the resource SC will be charged directly for the substitute capacity, it provides an incentive for that SC to have additional capacity on hand to minimize the price and maximize the probability that capacity is available when requesting planned outages.

### **Opportunity Outages**

The CAISO currently allows both short-term opportunity and off-peak outages. The CAISO proposes to maintain both of these options as opportunity outages described in section 4.1.2, regardless of which planned outage option is ultimately selected. Further, as noted in section 4.1.4, the CAISO is proposing to modify the RA must offer obligation with the introduction of the day-ahead market enhancements. With limited exceptions, if resources do not receive any day-ahead awards, the resource will be eligible to take a single day opportunity outage. These opportunity outages may be requested after the day-ahead market closes and are subject to CAISO review and approval. If approved, no replacement capacity is required for these outages. However, because no replacement is required, these outages are only permitted for a single day and resources must participate in the subsequent day-ahead market.

### ***Planned Outage Outlook Transparency***

The CAISO proposes to offer greater visibility into how much resource adequacy capacity is shown relative to the resource adequacy requirements. The goal is to provide resources greater transparency regarding available capacity well in advance of planning outages. Specifically, CAISO proposes to develop a calendar that shows in advance and on a daily basis,

the potential availability of additional system RA headroom. This RA headroom should allow resources to identify potential calendar dates with RA headroom in advance of requesting planned outages, thus mitigating replacement obligations and helping the CAISO maintain adequate available capacity. If the calendar shows no available headroom, then any RA resource requesting a planned outage will be required to show substitute capacity.

Outages will be approved and denied through the planned outage tool discussed above. The CAISO will continue to evaluate and accept outages and substitute capacity and adjust the outage calendar on a first-in, last-out basis. Thus, resources submitting outage requests will be assessed first, making it less likely the CAISO will deny their outage or require substitute capacity compared to later requesting resources. The CAISO will continue to allow resources taking outages requiring replacement to self-provide substitute capacity for any outages requiring replacement.

Figure 7 demonstrates the conceptual planned outage outlook calendar. The CAISO proposes to publish this type of calendar including daily MW values for UCAP headroom in excess of system RA requirements. The specific content of this calendar will ultimately be driven by the planned outage option selected, however, the goal of providing this type of information is to assist resource SCs in planning outages and ensuring proper resource maintenance.

**Figure 7: Example substitution availability calendar**

2 Headroom: 25 MW	3 Headroom: 205 MW	4 Headroom: - MW	5 Headroom: - MW	6 Headroom: - MW	7 Headroom: 350 MW	8 Headroom: 7 MW
9 Headroom: 30 MW	10 Headroom: 712 MW	11 Headroom: 145 MW	12 Headroom: 320 MW	13 Headroom: 200MW	14 Headroom: - MW	15 Headroom: - MW

## 4.1.6. RA Import Requirements

### **Introduction**

In this fifth revised straw proposal, the CAISO provides additional refinements to the proposed RA imports provision after further consulting with stakeholders and considering guidance from the CPUC's track 1 resource adequacy decision on RA imports.<sup>49</sup> This revised proposal attempts to balance the CAISO's need for reliable and dependable RA imports, with the need for efficient and liquid markets recognizing that California competes for imported energy and transmission across a broad and diverse west-wide market. Given California's long-standing reliance on RA imports to support reliability, the CAISO must ensure there is sufficient, verifiable, and dependable RA import capacity secured in advance to meet California's capacity and energy needs, particularly as competition for supply tightens across the west.

The proposed modifications support and build on the CAISO's RA import market participation rules and align directionally with the RA program rule changes the CAISO has been advocating in the CPUC's Track 1 and Track 3 RA proceedings. CAISO and CPUC alignment on RA imports coming out of the CPUC's Track 3 RA proceeding is critical to ensure comparable treatment across all LSEs and avoid disconnects between the CAISO's and CPUC's RA import rules and regulations.

### **Background**

LSEs can meet system RA requirements with a mix of RA resources, including imports from outside the CAISO balancing authority area. Import RA resources were used to meet an average of around 3,600 MW (or around 7 percent) of system RA requirements during the peak summer hours of 2017. In the summer of 2018, this increased to an average of around 4,000 MW (or around 8 percent) of system resource adequacy requirements.<sup>50</sup> In 2019, this increased to about 4,700 (or about 10 percent).<sup>51</sup> Thus, import quantities are an integral component of the RA program, and their availability and dependability affect the RA program's ability to ensure reliability.

Today, the CAISO tariff does not require that RA import resources be resource-specific or specify they represent supply from a specific balancing authority area (BAA). RA import resources are only required to be shown on RA supply plans with associated maximum import capability allocations, and make offers as shown at a specific intertie point into the CAISO's system. Import RA is not obligated to bid into the real-time market if it is not scheduled in the day-ahead integrated forward market or residual unit commitment process.

The current RA import provisions can undermine the integrity of the RA program and threaten system reliability. The CAISO's Department of Market Monitoring (DMM) expressed similar

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<sup>49</sup> CPUC Track 1 Decision, D.20-06-028

<sup>50</sup> 2017 CAISO DMM Annual Report, p. 259:

<http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf>

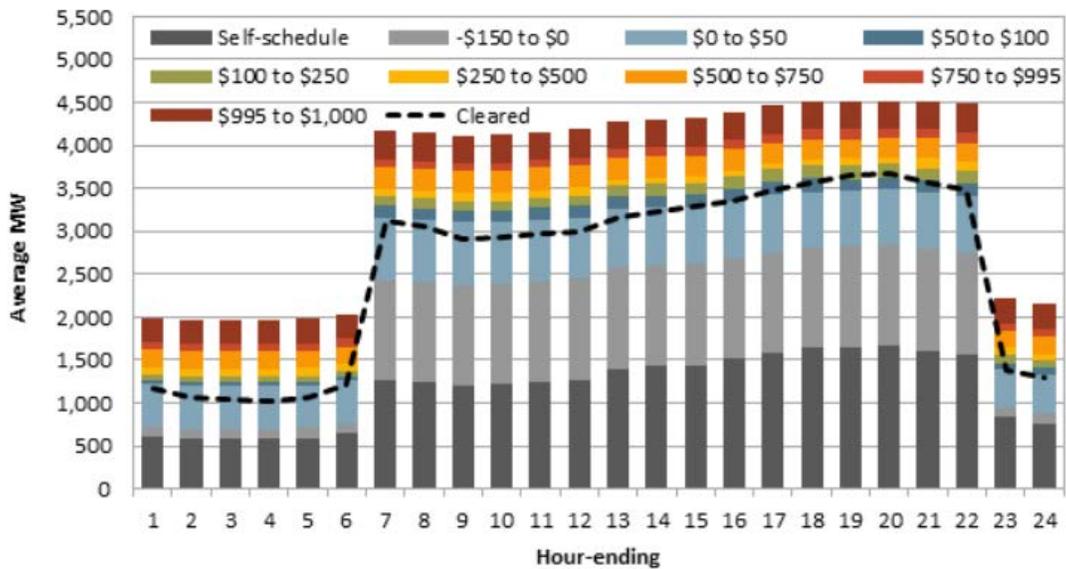
<sup>51</sup> 2019 CAISO DMM Annual Report, p. 266:

<http://www.caiso.com/Documents/2019AnnualReportonMarketIssuesandPerformance.pdf>

concerns in its September 2018 DMM special report on import RA.<sup>52</sup> In that report, DMM explained the existing rules could allow for some portion of resource adequacy requirements to be met by import RA that have limited availability and value during critical system and market conditions. For example, DMM indicated non-resource specific RA imports could satisfy their RA must offer obligation by routinely bidding significantly above projected prices in the day-ahead market so they do not clear the market, relieving them of any further offer obligations in real-time. DMM said this is possible because non-resource specific RA imports can be speculative and do not have bid cost recovery or bid cost verification, meaning they can bid up to the bid cap to avoid delivery.

The DMM provided specific examples of these bidding behaviors in its comments on the recent CPUC Proposed Decision clarifying RA Import rules (R17-09-020). Figure 4.7.1 shows the average hourly RA imports offered into CAISO’s market at various price levels.<sup>53</sup> This information provides additional evidence that around 1000-1200 MW RA imports were submitting bids at bid levels in excess of \$500/MW in August of 2018.

Figure 8: Average hourly RA imports offered by price bin (weekday hours) August 2018



On February 28, 2020, the CAISO submitted a proposal in the CPUC’s RA proceeding, R.19-11-009.<sup>54</sup> The CAISO’s proposal specifically addressed the need to eliminate speculative import RA supply by strengthening import RA qualification and verification requirements. The CAISO’s proposal included recommendations for priority actions the CPUC should adopt both to

<sup>52</sup> DMM Special Report: Import Resource Adequacy, September 10, 2018:

<http://www.caiso.com/Documents/ImportResourceAdequacySpecialReport-Sept102018.pdf>

<sup>53</sup> DMM comments on CPUC Proposed Decision clarifying RA Import rules (R17-09-020). September 26, 2019:

<http://www.caiso.com/Documents/CommentsofDepartmentofMarketMonitoringonProposedDecisionClarifyingRAImportRules-R17-09-020-Sept262019.pdf>

<sup>54</sup> CAISO Resource Adequacy Track 1 Proposal (R.19-11-009) Feb 28, 2020:

<http://www.caiso.com/Documents/Feb28-2020-Track1-Proposal-R19-11-009.pdf>

establish stricter RA program rules and to collect data necessary to enforce those rules. The CAISO proposed that the CPUC require that RA imports:

1. Provide source specific information at the time of the resource adequacy showings. Source specification can be a specific generating unit, specified aggregation or system of resources, or a specified balancing authority area, but should be clearly identified in advance.
2. Provide an attestation or other documentation specifying the resource adequacy import is a specific resource, aggregation of physically linked resources, or capacity in excess of the host balancing authority area or supplier's existing commitments that is dedicated to CAISO balancing authority area needs; and
3. Can be delivered to the CAISO balancing authority area boundary via firm transmission.

The CPUC in Decision D.20-06-028, updated its requirements for import resources to count towards meeting jurisdictional LSEs' RA requirements. Specifically, for the 2021 RA year, only LSE contracts with resource specific import resources – defined by the CPUC as only dynamic and pseudo-tied resources – would allow economic bids (or self-schedules). LSE contracts with non-resource specific resources would only permit such resources to self-schedule or submit economic bids between \$-150 and \$0. The CPUC noted it sees merit in the CAISO's proposal. However, it believes more robust verification and visibility is necessary before implementation.<sup>55</sup> In addition to coordinating with the CPUC in the RA proceeding to ensure the RA requirements are aligned, the CAISO anticipates it will require tariff changes to support the RA import requirements it discussed in the CPUC proceedings. Therefore, the CAISO has further developed its proposal, providing additional details to support full implementation of new import eligibility rules including an interim real-time must offer obligation that would be in effect until the CAISO implements the Day-Ahead Market Enhancements (DAME) policy in which it proposes to adopt the imbalance reserve product that will be the basis for the real-time must offer when those changes are implemented. Additionally, the CAISO has continued researching the availability and need for firm transmission service and transmission tagging requirements. These proposed requirements are included below.

### ***RA Import related concerns and issues under review***

The CAISO's review of the current RA import provisions is focused on determining where they cause reliability concerns and how to mitigate those concerns. The CAISO has identified two areas of concern with the current RA import provisions:

#### **1. Lack of specification and double counting of RA import resources:**

The CAISO's current RA tariff provisions and existing CPUC RA program guidelines allow non-resource specific resources to qualify as System RA capacity. As indicated above, RA imports are not required to be resource specific or to represent supply from a specific balancing area. Instead, they are only required to be shown as sourced on a specific intertie into the CAISO system. Thus, the CAISO may not know what specific resources are supporting an RA import.

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<sup>55</sup> CPUC Track 1 Decision, D.20-06-028

Because of tightening supply in the West, the CAISO is increasingly concerned about the potential that non-resource specific RA imports are not supported by real, physical capacity dedicated only to the CAISO LSEs, *i.e.*, these RA import commitments may be speculative and the capacity shown may remain unsecured at the time of the RA showing, or may be concurrently committed to serve other load.

Although the CPUC's recent decision, D.20-06-028 directed that LSE contracts with non-resource specific resources require such resources to self-schedule or bid at or below \$0/MWh, there is no assurance that these non-specified resources are backed by physical resources that will actually be available when the CAISO needs them. Similarly, the CAISO is concerned that continuing to allow non-resource specific imports to qualify for RA without any source-specification may create the potential that the underlying resources may be double counted and unable to serve CAISO reliability needs, especially under stressed system conditions in the west. Double counting occurs when RA capacity is also sold or committed to a third-party in other regions or to other Balancing Authority Areas (BAA), while simultaneously being shown as CAISO RA capacity. The CAISO is concerned reliability risks will continue to exist as long as there is the potential for import RA supply to qualify without a forward resource specification requirement and a requirement the resource not be sold to another entity during the applicable RA period.

## **2. Speculative RA import supply being used on RA showings:**

The CAISO believes that RA import provisions should foreclose (or at a minimum, discourage) speculative RA import supply. Speculative RA import supply can occur when RA imports shown on RA supply plans have no physical resources backing them up, and no firm contractual delivery obligations secured, which means such schedules are subject to being recalled or curtailed by a source or intervening BAA to meet its own needs, and/or are not afforded a curtailment priority comparable to that afforded a BAAs native load. Without resource specificity that is dedicated solely to the CAISO BAA and assurance that the contracted capacity is supported by reliable transmission service, RA imports are subject to double counting and may be speculative if transmission service is unavailable to deliver the needed energy on more constrained paths.

The CAISO previously described speculative RA import supply and noted that it shares DMM's concerns about speculative supply. Significant amounts of speculative supply supporting import RA could present reliability concerns. The CAISO's review of available evidence reflects frequent cases of relatively high priced DA bidding by non-resource specific RA imports. This conduct raises concern these non-resource specific RA imports represent speculative supply, as this bidding practice is a logical strategy any scheduling coordinator might use to meet the letter of the must-offer obligation rule but avoid an award from the CAISO market.

### **Objectives**

The CAISO identifies the following general objectives to guide RA import rule modifications.

- Modify RA import provisions to ensure RA imports are backed by physical and verifiable capacity, are not speculative, are not “double-sold” or committed elsewhere, and are dependable and reliable.
- Treat RA imports more comparably to internal-CAISO RA resources, recognizing the CAISO competes for supply across a broad and diverse west-wide market.
- Coordinate import provisions with any related modifications being proposed through CAISO’s extended EIM and DAME initiatives. Coordination between the RA Enhancements, DAME, and Extended Day-Ahead Market (EDAM) initiatives is vital to ensure all of the interrelated aspects work together without unintended consequences.
- Create requirements that track and reasonably assimilate the resource-specific showings and verification provisions of other ISOs and RTOs.

### ***RA Import Proposal***

The CAISO summarizes the key principles and elements of the CAISO’s RA imports proposal in this fifth revised straw proposal as follows:

- RA imports must be verifiable and resource specific
  - Eligible resource-specific RA types include:
    - Resource-specific system resources (non-dynamic)
    - Resource-specific system resources (dynamically scheduled)
    - Pseudo-ties

Note: Non-resource specific system resources will no longer qualify as RA import capacity
  - Non-dynamic resource specific system resources definition encapsulates (1) a single resource, (2) a specified portfolio of resources within a single BAA, or (3) a BAA’s pool of resources
- The capacity underlying the RA import must be dedicated solely to the CAISO
  - An attestation requirement specifying the RA capacity is not sold or otherwise committed to any other entity and is not being used in connection with any other capacity or resource adequacy construct in the applicable RA compliance month.
- The RA import capacity must be dependable and deliverable
  - CAISO is considering requiring firm transmission service source to sink (*i.e.*, service that ensures the RA imports have the same curtailment priority afforded to the BAA’s native load) on complete path (*i.e.*, all lines of interest, to ensure delivery to CAISO border) or,
  - Alternatively allowing requirement to be met with firm transmission service on last line of interest (last leg) to CAISO BAA. In the alternative case:
    - For example, require firm transmission service on BPA’s southern interties (to COB and NOB) but allow non-firm service on upstream lines of interest

- If only requiring firm transmission on last line of interest, consider appropriateness of other mechanisms to incent/promote delivery of RA import if service on an upstream line(s) of interest is curtailed because it is less than firm service
- CAISO would monitor and consider if it must impose firm transmission service requirement on all lines of interest, source to sink, if curtailments occur under the proposed “last line of interest” alternative proposal
- Require minimum day-ahead e-Tagging requirement of the firm transmission service on last line of interest; prudent to secure firm transmission service on all paths and in advance to avoid non-delivery and the potential for non-compliance penalties, if imposed.
- Provisions to ensure RA import cannot be recalled or curtailed to meet a source or intervening BAA’s own needs
- RA Import must offer obligation
  - Day-ahead must offer obligation
  - Interim real-time MOO requirement until CAISO implements the DAME which will redefine all must-offer obligations.

To support these proposed requirements, the CAISO anticipates the CPUC would adopt similar requirements. However, ultimately, the CAISO will require CAISO tariff changes to implement these requirements. The CAISO believes that that the collective impact of these tariff modifications will greatly reduce if not eliminate the potential for speculative import supply and double counting. The CAISO discusses each of the proposed modifications below.

### **Source specification requirements for all RA import supply dedicated solely to the CAISO**

In light of the recent CPUC decisions and stakeholder feedback, the CAISO is committed to requiring broadly defined source specification for all RA imports so that real, physical supply is secured at the time of RA showings and is not speculative. Further, such capacity must be committed solely to CAISO LSEs and serve CAISO reliability. As indicated above, the CAISO does not know whether RA imports are being double counted under current RA import provisions, *i.e.*, whether import capacity shown for RA has been sold to a third party, or is being used to meet capacity or resource adequacy needs in another BAA or under another RA construct for the applicable RA period.

Under the CAISO’s proposal, the following CAISO-defined imports types will qualify as resource-specific resource adequacy import resources: (1) Dynamic Resource-Specific System Resources or Pseudo-Tie resources, and (2) Non-Dynamic Resource-Specific System Resources. The CAISO fully supports Non-Resource Specific System Resources participating for economic energy, but to ensure RA imports are backed by specific units or an aggregation of units, the CAISO proposes here that RA imports must be resource specific, as either a pseudo-tie or dynamic, or non-dynamic resource specific system resources. Non-Dynamic Resource Specific Resources can be (1) a specific external resource, (2) a specified aggregation or

portfolio of resources in a single external BAA,<sup>56</sup> or (3) if the BAA is the RA import supplier the BAA's pool of resources is supporting the RA import.

To achieve these objectives, the CAISO proposes two documentation requirements for RA import capacity. First, the CAISO proposes that all RA import suppliers specify via an attestation that the physical resource or resources that will be relied upon to meet the RA requirement state that the capacity has been secured at the time of the RA showings for the applicable RA showing period and has not been sold, and is not committed, to any other entity. The CAISO is considering the types of information that would be required for each category of RA import supply.<sup>57</sup>

To count as RA capacity, all import RA supply must provide the source specification and CAISO commitment certifications by the deadlines for the applicable year-ahead and month-ahead RA showings.

The CAISO will develop the specific wording of the attestation requirements in the tariff development process, but the CAISO intends to model them similar to provisions in other ISO/RTO tariffs and business practice manuals.

The CAISO recognizes there may be additional and appropriate costs associated with this more rigorous resource-specific standard, but by requiring source specification, import RA will be more on par with the quality and delivery obligations of CAISO internal resource adequacy resources. Adopting a source specification requirement will require host balancing authorities and suppliers to secure the necessary fuel and plan and position their resources to meet their own needs and their commitments to the CAISO BAA. Adopting requirements for forward source specification from real, physical resources committed to serving the CAISO will address both the speculative import supply and bidding behavior concerns because it helps ensure actual physical resource capacity is secured to serve California's reliability needs.

### **Non-specified energy contracts alone should not qualify for Import RA**

Non-resource specific firm energy contracts cannot address speculative supply or double counting concerns. As such, non-resource specific system resources are not a substitute for

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<sup>56</sup> Import suppliers currently specify resource aggregations as a Non-Resource Specific System Resource. To facilitate the option of treating a resource aggregation as a resource-specific supply source, the CAISO proposes to expand the definition of non-dynamic resource-specific system resources to include resource aggregations or portfolios of resources in a single BAA. The resources supporting the aggregation or portfolio must be specified. The new the definition will allow aggregations of resource to be classified as resource specific.

<sup>57</sup> With the potential extension of the day-ahead market to EIM entities, the CAISO believes that, at minimum, RA import resources must specify the source BAA. The proposed source specification will help the CAISO verify that RA imports are not double counted for EIM entities' resource sufficiency tests. Without this rule, it would be possible for an EIM entity to count on capacity from a resource within its own BAA to pass the EIM resource sufficiency evaluation, while also showing the resource as import RA to the CAISO. This is not an appropriate outcome because the resource is incapable of physically meeting both the source BAA's needs *and* the CAISO's needs. The CAISO anticipates that requiring a designation of the source BAA is a good first step.

advance procurement of real physical, resource-specific capacity. Accordingly, contracts that do not identify or specify resources in support of the RA contract should not count as RA resources. Firm energy contracts and related hedging mechanisms can help mitigate day-ahead and real-time market price risk, but they cannot ensure that real physical supply is secured in advance, which is the purpose of the resource adequacy program. In the CPUC's Decision (D.) 05-10-042, it disallowed liquidated damages (LD) energy contracts from internal supply because of the potential for double counting. D.05-10-042 established that LD contracts (which are "non-resource-specific" contracts) would be phased out for resource adequacy purposes because they allowed the possibility of double-counting resources and were not subject to deliverability screens.<sup>58</sup>

Decision D.05-10-042 explains why the Commission accepted firm LD import energy contracts for resource adequacy purposes:

*"Firm import LD contracts do not raise issues of double counting and deliverability that led us to conclude that other LD contracts should be phased out for purposes of RAR. We note that firm import contracts are backed by spinning reserves. Accordingly, we approve the exemption of firm import LD contracts from the sunset/phase-out provisions applicable to other LD contracts as adopted in Section 7.4.6."<sup>59</sup>*

It appeared the CPUC decision assumed because firm LD import contracts are backed by spinning reserves, the resource capacity underlying them could not be double counted as capacity resources, once for CAISO LSEs and again for non-CAISO LSEs or other BAAs to satisfy their capacity or resource adequacy constructs.

However, the presence of spinning reserves does not change the fact that firm energy contracts without a specified source and a commitment to be available only to the CAISO generates the same double counting concern the CPUC expressed in disallowing internal LD contracts. In other words, non-specified resource adequacy imports are by nature not resource specific. Thus, without requirements to document the sources backing these imports to support RA showings and certify their dedication to the CAISO, such non-specified resources may not be backed by actual resources committed only to the CAISO, and may be relied upon by another balancing authority area or load-serving entity, especially during tight system conditions.

Moreover, SCE and Middle River Power have noted that WECC contingency reserve requirements have changed since Decision D.05-10-042 was adopted. A BAA's contingency (and, by extension, its spinning) reserve obligation is no longer determined by its type and amount of interchange, but it instead is determined by the greater of its most severe single contingency and the sum of three percent of (a) its load and (b) its internal generation. As a result, any reference to RA imports being backed by spinning reserves is no longer applicable as a WECC requirement. Therefore, any reliance that Decision D.05-10-042 may have placed on RA imports being backed by spinning reserves to support allowing firm liquidated damages RA import contracts to be RA eligible is now inconsequential given these changed

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<sup>58</sup> CPUC D.05-10-042, p. 101

<sup>59</sup> CPUC D.05-10-042, p. 68.

circumstances. The CPUC appears to have corrected this misunderstanding in its final RA track 1 decision.<sup>60</sup>

## **The Dependability of RA Import Capacity**

### **Transmission delivery requirements for RA imports**

The most robust and secure transmission delivery requirement for RA imports would be to require firm transmission service along the entire delivery path from the source to the CAISO balancing authority area sink. Other organized market regions generally have more stringent requirements than this. The following reflects the requirements on external capacity resources imposed in other ISOs and RTOs resource adequacy constructs:

- ISO-NE requires that in support of new import capacity resources, the customer must submit “documentation for system-backed import capacity that the import capacity will be supported by the Control Area and that the energy associated with that system-backed import capacity will be afforded the same curtailment priority as that Control Area’s native load;”<sup>61</sup> Import capacity must document that neighboring and intervening control areas will afford the capacity the same curtailment priority as native load.<sup>62</sup> ISO-New England can get any and all information sufficient to show the ability of the generator to deliver capacity to ISO-New England.<sup>63</sup> External capacity must describe in detail how its capacity/energy will be delivered to the New England border and explain how such capacity/energy will be recognized by the control area with the same priority as native load.<sup>64</sup>
- MISO requires “demonstrating that there is firm transmission service from the External Resource to the border interface CPNode of the Transmission Provider Region and either that firm Transmission Service has been obtained to deliver capacity on the Transmission System from the border to a Load within an LRZ or demonstrating deliverability...;”<sup>65</sup> MISO also has external BAA qualification options to ensure energy schedules from external resources are interrupted in a manner that is transparent and supports reliability.<sup>66</sup> MISO has three categories: specific generator in external BAA;<sup>67</sup> slice of system;<sup>68</sup> and slice of system in a BAA that coordinates with MISO regarding planning reserve qualifications and emergency procedures.
- NYISO requires a demonstration, to the satisfaction of the NYISO, that the UCAP is deliverable to the New York Control Area.<sup>69</sup> NYISO also requires that in order to

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<sup>60</sup> CPUC Track 1 Decision, D.20-06-028

<sup>61</sup> ISO New England, Transmission, Markets and Services Tariff, Section 13.1.3.5.1

<sup>62</sup> *Id.* at Section 13.2.3.5.3.1

<sup>63</sup> *Id.* at Section 13.1.1.2.7.

<sup>64</sup> ISO New England Attachment M-Manual 20, Sections 12-13.

<sup>65</sup> MISO Tariff, Module E, Sheet 69A.3.1.c

<sup>66</sup> MISO Business Practice Manual 11, Section 4.2.5.

<sup>67</sup> If MISO is in an emergency service will be interrupted only if the specific generator is on an outage.

<sup>68</sup> Curtailment is pro-rata with load in external BAA if the external BAA is in emergency conditions.

<sup>69</sup> NYISO MST - Market Administration and Control Area Services Tariff (MST), Section 5.12.2.1 and NYISO ICAP Manual, Section 4.9.3.2.

participate as external installed capacity suppliers, external resources must demonstrate that “if they demonstrate that the External Control Area will afford the NYCA Load the same curtailment priority that they afford their own Control Area Native Load Customers;”<sup>70</sup> for External Generators and External System Resources this means the external control area will not recall or curtail the capacity for purposes of satisfying its own RA needs.<sup>71</sup> In the case of control Area Resources, the Control Area will afford NYCA load the same pro rata curtailment priority afforded its own control Area load.<sup>72</sup>

- PJM imposes different requirements depending on how the external resource participates in the capacity market that can be either as rigorous as a pseudo-tie arrangement or as is required in most other areas, that the resource have firm transmission service to the PJM border.<sup>73</sup>
- SPP requires Firm Capacity to be supported firm service from external resource to load.<sup>74</sup> Firm Power must be supported by firm service and must be available in a manner comparable to power delivered to native load customers.

The CAISO desires reliable and dependable RA imports on par with native BAA resources, but the CAISO recognizes that load-serving entities are competing in a west-wide energy market where supply is shrinking. Requiring firm transmission service for RA imports from source to sink would provide the most secure and dependable RA import supply. Additionally, the CAISO recognizes there may be different degrees of firmness for firm point-to-point service based on the length the service is procured. For example, under the Pro Forma OATT, although short-term firm transmission rights owners have the right of first refusal, long-term firm transmission service rights would have a higher reservation priority if available transfer capability is insufficient to satisfy all requests and reservations. However, all long-term term point-to-point transmission service has an equal reservation priority with native load customers.<sup>75</sup>

The CAISO’s preference is a source-to-sink firm transmission service requirement; however, the CAISO also is considering only requiring firm transmission service on the last line of interest to the CAISO BAA as an alternative. Some stakeholders have suggested this sufficiently provides reasonable assurance the RA import will be backed by sufficiently secure and reliable transmission service with minimal expected impact to market participant’s ability to provide the import RA to the CAISO, while mitigating other concerns and providing other benefits. In the paragraphs immediately below, the CAISO discusses the differences between requiring firm transmission service from source to sink versus only requiring firm transmission service on the last line of interest to the CAISO BAA and the competing considerations associated with each.

Because firm transmission service can be scheduled up to twenty minutes before the start of the next scheduling interval (i.e., the operating hour), even if a non-firm transmission rights owner schedules in the day-ahead, the transmission provider can “bump” the non-firm rights holder if

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<sup>70</sup> NYISO MST - Market Administration and Control Area Services Tariff (MST), Section 5.12.2.1

<sup>71</sup> NYISO ICAP Manual, Section 4.9.1.

<sup>72</sup> *Id.*

<sup>73</sup> PJM Manual 18: PJM Capacity Market, Section 4.2.2

<sup>74</sup> SPP Open Access Transmission Tariff, Attachment AA, Sections 7.3 and 7.5.

<sup>75</sup> Pro Forma OATT at Section 13.2. BPA’s Tariff has affords the same protection to firm transmission rights holders. BPA OATT at Section 13.6.

the firm rights holder submits their schedule prior to the operating hour or if needed to serve their native load. Stakeholders supporting a source to sink firm transmission requirement state that although there may be a reasonable degree of probability that a resource with non-firm service can support resource adequacy imports in many instances, these may not materialize when system conditions are strained and external entities are competing for the same transmission. They argue these deficiencies with non-firm rights potentially could render the transmission insufficient to support resource adequacy imports. However, these concerns are not present with firm transmission rights. Thus, the CAISO's preferred option would be to require full source to sink, point-to-point firm transmission service similar to other ISOs/RTOs.

Certain stakeholders have opposed requiring a firm source-to-sink transmission service, with some arguing that such a requirement affords less flexibility, is unnecessary, and more costly. They suggest firm service is generally more important in the constrained areas of the transmission grid, but is unnecessary elsewhere. For instance, BPA's system, which is a key concern and of interest to the CAISO, is like a funnel. The northern "network" is a broader, more robust, and non-radial network of transmission while the southern intertie portion funnels radially down to NOB and COB. It is this southern intertie portion of the BPA system that is more constrained and requires greater certainty and firmness to ensure deliverability to the CAISO BAA. Based on additional stakeholder feedback, the CAISO may be persuaded that firm transmission service only on the last line of interest is a prudent compromise, but subject to monitoring, potential additional protections discussed below, and the CAISO's ability to impose source to sink firm transmission service tariff requirements later if critical schedule cuts are occurring.

Based on the comments of some stakeholders and considering the competing concerns identified here, the CAISO is considering an additional or alternative framework whereby firm transmission service would only be required on the "last line of interest" to the CAISO boundary, *i.e.* the last leg. For example, on BPA's system, this represents BPA's southern interties terminating at COB and NOB. This compromise of requiring firm transmission service only on the last line of interest would allow the northern part of BPA's "network" to remain flexible and open. The CAISO anticipates that short-term, non-firm transmission service arrangements will still be possible on intervening lines of interest, while the CAISO gains a measure of RA import delivery security by requiring firm transmission service on the southern part of BPA's system, *i.e.* the last line of interest to the CAISO BAA. The CAISO will provide a list of these "last lines of interest" to the CAISO BAA from neighboring BAAs in the draft final proposal.

The CAISO seeks stakeholder comment on the issue of whether firm transmission service on the last line of interest to the CAISO BAA will ensure reliability and is feasible, or should the CAISO require point-to-point, source to sink firm transmission service as originally proposed. The CAISO requests stakeholders provide support to demonstrate that adopting a "last line of interest" only firm transmission service requirement would not unreasonably and adversely affect the dependability and reliability of RA imports. The CAISO also seeks stakeholder comment on other BAA's systems bordering the CAISO and whether such a "last line of interest" proposal is feasible and would effectively support RA import capacity dependability and deliverability.

The CAISO also is considering no longer requiring that firm transmission service be procured on a month-ahead basis so as not to constrain the market and restrict intra-month buying and selling opportunities. Instead, the CAISO proposes to allow firm transmission service to be procured up until the day-ahead market, where the firm transmission right is demonstrated via an e-Tagging requirement in the Day-ahead by no later than 3:00 PM pacific.<sup>76</sup> This less stringent transmission service requirement allows suppliers ample opportunity and flexibility to procure firm transmission service up until the day-ahead. It would be prudent though for suppliers to procure firm transmission service in advance to ensure delivery certainty and negotiate longer-term firm transmission service arrangements that may result in more favorable and cost-effective outcomes.

The CAISO is also considering a day-ahead e-tagging requirement for suppliers to provide a day-ahead transmission profile that demonstrates firm transmission on the last line of interest to the CAISO border. A day-ahead transmission profile e-tagging requirement would allow verification that firm transmission service has been secured by the supplier along the delivery path. The CAISO notes that more flexible approaches allowing required firm transmission service to be secured after the monthly showing timeframe may not guarantee that firm transmission service can always be secured for delivery. The CAISO will consider this impact and seeks stakeholder comments about whether a non-compliance penalty or other enforcement actions are necessary if delivery is not made under firm transmission service.

The CAISO also seeks stakeholder comment on how to convey the last line of interest. The CAISO suggests it is as the CAISO models the scheduling points in its full network model listed as the set of Intertie Constraints and Branch Groups listed in the table found by following the link in the footnote.<sup>77</sup>

Because the CAISO is considering an alternative approach where a firm transmission service requirement is only required on the last line of interest to the CAISO BAA, and since transmission on the other legs can be non-firm, which can jeopardize the entire schedule path, the CAISO seeks stakeholder input on additional requirements that may be appropriate or necessary to further ensure that suppliers' RA import capacity is dependable and delivered to the CAISO. In that regard, if the RA import supplier does not have firm service on the other intervening lines of interest between the source and sink, and the RA import is curtailed, the supplier may be unable to meet its RA obligations by delivering the required energy to the CAISO BAA.

One option to help prevent this is to impose a RA performance penalty on RA imports that fail to deliver their RA import quantity because they do not have firm service on the intervening lines of interest serving their RA import, which could result in a curtailment. Another alternative for

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<sup>76</sup> The BPA OATT

<sup>77</sup> FNM Description doc, section 4- MAPPINGS OF ITC/BG, TNAME AND RELATED OPERATION PROCEDURES, at p. 13-16, found here:

[http://www.aiso.com/Documents/IntertieConstraintandBranchGroupInformation\\_Based\\_FNMReleaseDB\\_2019Q1.pdf](http://www.aiso.com/Documents/IntertieConstraintandBranchGroupInformation_Based_FNMReleaseDB_2019Q1.pdf)

consideration would be to require an RA import to submit a forced outage for the curtailment of an RA import due to non-firm transmission service, which would subject the resource to a potential UCAP reduction. Either of these options would incentivize (but not require) the RA importer to secure firm service from source to sink or risk the consequences of failing to deliver the RA import and be subject to a penalty or possible UCAP reduction. Any penalty would have to be robust enough to incent the delivery of the RA import to the CAISO border. The CAISO seeks comment regarding the scope, nature, and advisability of any such arrangement.

The CAISO also notes several ISOs/RTOs require that RA import capacity provided by a BAA from its pool of resources be afforded the same curtailment priority that is afforded the BAA's native load. Several ISOs and RTOs have this type of requirement. Some ISOs/RTOs require (1) RA imports supported by an external resource or portfolio of resources provide assurance that the external control area in which the resource is located will not recall or curtail the resource(s) for purpose of meeting its own resource adequacy needs or (2) RA imports document that the source BAA and intervening BAAs will afford the capacity supporting the RA import the same curtailment priority as its native load. The CAISO seeks to adopt similar types of requirements for RA imports to the CAISO to the extent practicable.

The CAISO seeks stakeholder comment regarding these aforementioned options and any other potential mechanisms that would best ensure RA imports are dependable and deliverable if the CAISO were to adopt, as an alternative, a "last line of interest" firm transmission service requirement.

### **Interim real-time bidding requirements for RA imports**

Under current rules, RA imports are obligated to bid their full RA capacity into the real-time market for any hour in which they received any award from the day-ahead market. If they do not receive a day-ahead award for a given hour, then they are released from any further bidding obligation in the real-time market. In light of the CPUC Track 1 decision, and trying to balance market efficiency and liquidity, the CAISO proposes to extend the must offer obligation into the real-time market irrespective of the day-ahead market award for most RA imports. Currently, under the tariff, imports do not have any special rules in this regard. Only fast-start and medium-start generating units are obligated to bid their full RA capacity into the real-time market irrespective of their day-ahead award. System resources, by definition are not generating units under the tariff so they only are subject to the general rule. Pseudo-ties, however, are generating units. Therefore, short-start and medium-start pseudo-ties must bid their entire RA capacity into the real-time market today.

As an interim step, and until the CAISO implements the Day Ahead Market Enhancements initiative, RA imports will have a real-time must offer obligation as applicable to that RA import type. With implementation of the extended suite of day-ahead market products contemplated in that initiative, the CAISO expects all RA imports will then have only a day-ahead market must offer obligation. Real-time market bidding obligations will then depend solely on the day-ahead market award and will apply regardless of RA status.

As discussed above, with the addition of the forward requirement for source specification and the related attestation and supporting documentation that the supply will be dedicated only to the CAISO, the following CAISO-defined import types will qualify as resource-specific resource adequacy import resources: (1) Pseudo-Tie resources, (2) Dynamic Resource-Specific System Resources, and (3) Non-Dynamic Resource-Specific System Resources. The CAISO proposes that the first and second types of import would have the same real-time market must offer obligation during the pre-DAME period, with non-dynamic resource-specific imports holding a different obligation. The proposed obligations are described below:

### **1) Pseudo-Tie and Dynamic Resource-Specific System Resources**

Pre-DAME Interim Period:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into day-ahead market.
- Real-Time Market Must Offer Obligation.
  - Short-start and medium-start pseudo-tie and dynamic imports must bid their full RA capacity into the market regardless of the day-ahead award. All other pseudo-tie and dynamic imports must bid their full RA capacity into the real-time market for any hour in which they receive a day-ahead market award. This essentially matches the status quo.

Post-DAME:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into day-ahead market.
- Real-Time Market Must Offer Obligation.
  - Must submit bid into the day-ahead market to the extent the resource has a day-ahead schedule for energy, ancillary services award, or imbalance reserves award.

### **2) Non-dynamic Resource Specific System Resources**

Pre-DAME Interim Period:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into the day-ahead market.
- Real-Time Market Must Offer Obligation.
  - Must offer full RA capacity into the real-time market regardless of day-ahead award.

Post-DAME:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into day-ahead market.
- Real-Time Market Must Offer Obligation.

Must submit bid into the day-ahead market to the extent the resource has a day-ahead schedule for energy, ancillary services award, or imbalance reserves award.

### 4.1.7. Operationalizing Storage Resources

The CAISO has a small number of storage resources operating on the grid today, but that number will grow rapidly during the next few years, representing a growing share of the system’s resource adequacy capacity. Storage resources are different from other resources in that they must first charge using energy from the grid to later discharge and provide energy back to the grid. The CAISO’s current real-time market only looks ahead 65 minutes, but a charge and discharge cycle can take several hours. This timing discontinuity means that the real-time market does not allow sufficient lead-time to optimize the use of storage resources over full charge and discharge cycles.<sup>78</sup> Thus, being unable to charge a storage resource for anticipated future discharge needs can create reliability issues for the CAISO.

Since storage resources can qualify as resource adequacy resources, it is important that the CAISO can access and confidently rely on sustainable energy output from shown resource adequacy storage devices in the real-time market to ensure reliable operations. In this initiative, the CAISO proposes a framework that will give the CAISO this confidence. This framework includes using resource adequacy must offer obligations outlined in this paper, market power mitigation, combined with restrictions on state of charge managed through a new tool called the minimum charge requirement.<sup>79</sup>

Figure 9: Market rules for storage resources

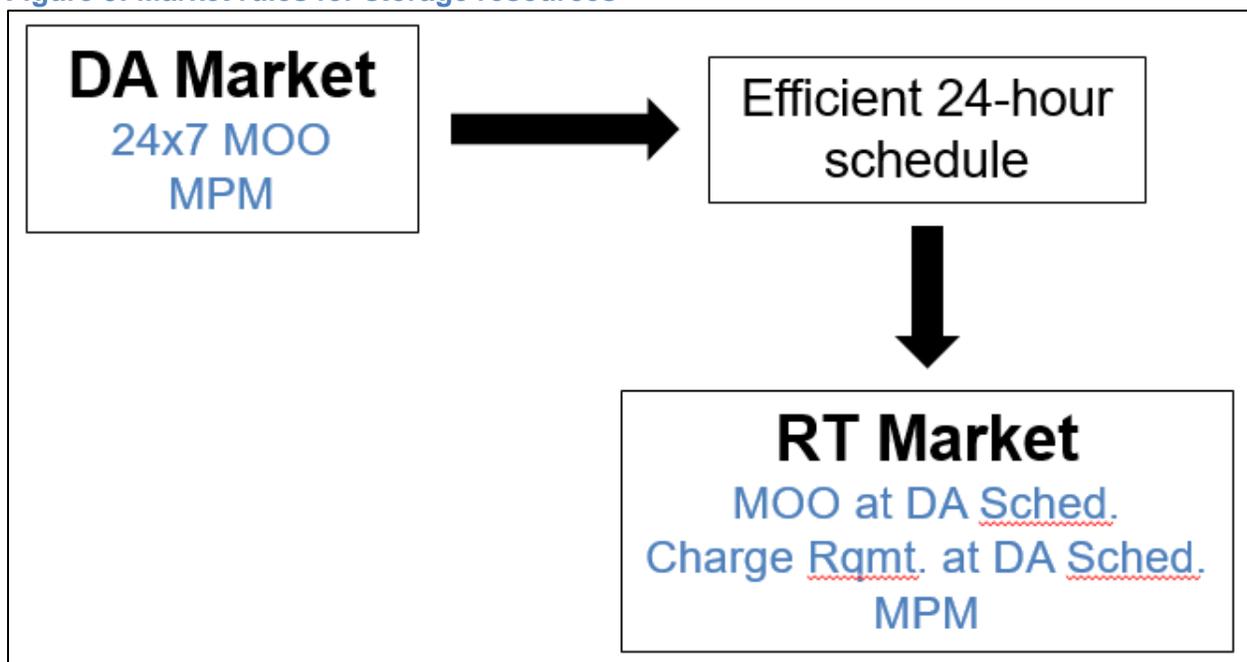


Figure 9 is a sketch of the rules that will apply to shown resource adequacy storage resources and how the CAISO will ensure that the storage resources are charged and available in the real-

<sup>78</sup> Nearly all of the storage resources in the fleet today are 4-hour duration batteries. This means that fully charged resources can discharge in 4-hours, and take just over 4 hours to charge due to round-trip efficiencies.

<sup>79</sup> Market power mitigation for storage resources is a proposal in the ESDER 4 initiative: <http://www.aiso.com/StakeholderProcesses/Energy-storage-and-distributed-energy-resources>.

time market for grid reliability. Like most resource adequacy resources, storage resources have a 24x7 must offer obligation in the day-ahead market. The resource adequacy program is designed to ensure that loads can always be met with the resource adequacy fleet in the day-ahead market. On peak summer days, this will likely include charging most of the resource adequacy storage fleet during the peak solar hours and discharging these resources during the evening hours during the evening ramp and net load peak. The day-ahead market optimizes over a 24 hour period, and will optimally schedule all resources on the grid to ensure a least cost solution to address market needs given market constraints. As described in this paper, the must offer obligation is a necessary feature so that the market software can derive a least cost solution given the bid-in resources available and load. For storage resources this includes bidding both the charging or discharging components of their resource, and not restricting CAISO from charging and discharging their battery (i.e. allowing the market software to freely adjust the state of charge based on submitted bids). The CAISO also ensures that the market solution is least-cost and includes measures that preclude resources, including storage resources, from exercising market power during intervals when they are marginal and could exercise market power.

The real-time market optimization is fundamentally different than the day-ahead market, primarily in that the real-time market only looks out 65 minutes in advance of the current interval versus the day-ahead market optimizing over 24 hour period. This could lead to a number of inconsistencies between the day-market and real-time market results when optimizing resources like batteries that have fuel availability constraints. For example, real-time prices during the lowest priced hours of the day may materialize at higher prices than in the day-ahead market and may result in storage resources not being charged. Another situation that could result in inconsistencies could be high prices prior to the peak net-load hours causing the real-time market to discharge the limited energy available from storage earlier than anticipated. These situations can occur on the CAISO system today given ramping needs spike as solar generation wanes toward sunset. These high prices could cause storage resources to be discharged prior to the peak net-load, when these resources are critical for the CAISO to meet system needs.

The solution to the day-ahead market results in charge and discharge schedules for storage resources and supply that meets load requirements over a 24-hour period. However, those day-ahead commitments are not immutable and can be adjusted and undone by the real-time market optimization, because the real-time market is sending dispatch instructions to resources based on prevailing market prices and resource bids and does not consider day-ahead schedules. To address this issue, the CAISO proposes that a minimum state of charge be observed in the real-time market, called a minimum charge requirement. This minimum charge requirement will set the minimum state of charge needed to preserve the amount of energy that the shown resource adequacy battery was scheduled to discharge in the day-ahead market solution. This will result in a storage resource shown for resource adequacy to always have state of charge to achieve the day-ahead discharge schedule. This will aid grid reliability because day-ahead schedules may have storage online and charged to meet load that must be served by storage resources. This is an essential resource adequacy market enhancement that

will allow the CAISO to operate the system reliably with a fast growing fleet of use and energy-limited resource adequacy qualifying storage devices.

In the future, the CAISO may look at other market enhancements to address this concern and allow for additional real-time market participation flexibility, noting that shown resource adequacy battery storage devices will still have flexibility under this proposal to re-bid in real-time any capacity not already committed in the day-ahead market.

### ***Stakeholder Feedback***

Some stakeholders raised concerns about the minimum charge requirement (MCR) tool and presented other potential options to address this reliability need in the real-time market. One alternate proposal would be to extend the look ahead in the real-time market to include the net-load period and other periods when storage resources are critical for grid reliability. Another would be to develop a tool similar to short-term unit commitment (STUC) to look ahead and assign minimum state of charge values to storage resources based on expected needs. Today, the real-time market solutions are time and computationally intensive, and forecast accuracy degrades over longer time horizons, jeopardizing the operational integrity and dispatch efficiency of the real-time market. Thus, this solution is technically and operationally infeasible at this time, but the CAISO will continue to consider how greater flexibility can be provided in the real-time market in the future as technology and forecasting techniques progress. CAISO also acknowledges that a tool in the real-time market, similar to the short term unit commitment tool, could also be used to set minimum charge requirements. These minimum requirements may be a better basis for decision making and could be done regularly throughout the day with more accurate load and renewable forecast data available. Although this technology may seem similar to existing tools the CAISO has, it would still need to look out several hours to view the entire evening peak, and would need to interface with nearly all of the real-time market systems. Implementing such a feature is non-trivial, but the CAISO may consider such tools and methods in the future.

Finally, stakeholders also requested that the CAISO develop a tool more similar to an exceptional dispatch tool, which would only dispatch storage resources to charge during critical periods when it was absolutely essential. Certain stakeholders advocated for this approach as it would have less impact than the proposed minimum charge requirement for each individual resource throughout the day. Such an approach may be possible to manage storage resources and ensure the grid is situated to meet evening peak net-load periods, however there are several challenges to implementing an exceptional dispatch solution. First, like the solution discussed previously, this would also require that either the real-time market or a tool running in parallel with the real-time market be developed with the capability to look out and forecast with accuracy several hours in advance. This tool would likely have to have at least an eight hour look ahead function to include the full evening peak, particularly any hours when net load exceeds traditional generation, plus additional hours to allow time to charge a battery prior to the peak and the critical ramping period when additional generation is available. Finally, such a tool would need to be run each 5-minute interval, so that the real-time market does not ‘undo’ the instructions sent to the storage resources from this new tool. Development of a tool like this would be difficult and computationally burdensome, and possibly as computationally

burdensome as expanding the real-time market look out horizon. This tool could also significantly increase bid cost recovery, as storage resources would generally be procured in the most expensive periods at times when they could be far out of the money. Possibly the most serious concern is around reliability. In the event that this tool does not perform perfectly, it may allow a situation where CAISO is unable to serve load because a battery cannot be charged sufficiently prior to periods of need. Furthermore, running a market with frequent exceptional dispatch is not preferable and inefficient, which may occur during tight ramp or system conditions.

A further discussion of other methodologies considered as well as examples of operational concern for storage resources was provided in the previous version of this proposal.

### ***Minimum Charge Requirement***

The minimum charge requirement tool would operate in the real-time market and would set a required state of charge such that each resource adequacy storage resource would have a minimum state of charge set at its cleared day-ahead schedule.

This requirement will consider charging and discharging schedules set in the day-ahead market. For example, a resource with a 180 MWh discharge schedule in the evening and a 50 MWh charge schedule in the afternoon, would have a minimum charge requirement set at 130 MWh in the morning prior to the charging schedule, and a 180 MWh minimum charge requirement between the charging and discharging schedules.

Generally, there will be no minimum state of charge during times of the day after the hour when the resource receives its final awards in the day-ahead market. Resources may bid in a way to ensure additional flexibility and availability in the real-time markets. Resources with greater aggregate discharge schedules may have greater minimum charge requirements, which may bind more frequently than those with lower requirements. Two detailed examples of how these requirements would work are outlined below. Both examples include resource similar to the hypothetical resource discussed in the example above.

#### **Example 1:**

Suppose a 50 MW storage resource with 200 MWh of storage capability is dispatched to charge zero MWh during the lowest priced hours in the morning in the day-ahead market, and is scheduled to discharge a total of 180 MWh in the evening. The ISO minimum charge requirement will require that the resource be charged sufficiently to meet the evening schedule so that it can discharge the full 180 MWh. Because the day-ahead schedule to discharge does not start until hour ending 19, the resource is required to maintain a 180 MWh state of charge until this time. After that time, the minimum charge requirement begins to decrease.

In this example, suppose there is a real-time sustained price spike at \$1,000/MWh for energy in hour ending 17, perhaps during the peak ramping period. Ideally, the resource would like to dispatch up to the full 50 MW of capability to capture these high prices, but it is prevented from

doing so and limited to only 20 MW because of the minimum charge requirement.<sup>80</sup> This is illustrated by the numbers in the red boxes in Table 14, below.

In the later hours of the day, the minimum charge requirement decreases with the day-ahead schedule. If the resource is not scheduled to discharge as much energy in real-time as was scheduled in the day-ahead market, the resource will have an actual state of charge that exceeds the requirement. This is illustrated by the numbers in the green boxes in Table 14 below.

**Table 14: Minimum charge requirement example 1**

Hour	9	10	11	12	...	17	18	19	20	21	22	23	24
<b>Load</b>	190 MW	190	190	200	...	300	330	335	345	350	340	280	210
<b>DA Bid ↓</b>	\$30/MWh	\$30	\$30	\$30		\$30	\$30	\$30	\$30	\$30	\$30	\$30	\$30
<b>DA Bid ↑</b>	\$60/MWh	\$60	\$60	\$60		\$60	\$60	\$60	\$60	\$60	\$60	\$60	\$60
<b>DA Price</b>	\$50/MWh	\$50	\$50	\$50		\$60	\$60	\$80	\$80	\$100	\$100	\$80	\$70
<b>DA Sched</b>	0	0	0	0		0	0	20	30	50	50	30	0
<b>DA SOC</b>	200 MWh	200	200	200		200	200	180	150	100	50	20	0
<b>RT Bid ↓</b>	\$50/MWh	\$50	\$50	\$50		\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50
<b>RT Bid ↑</b>	\$100/MWh	\$100	\$100	\$100		\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100
<b>RT Price</b>	\$60/MWh	\$60	\$60	\$60		\$1,000	\$60	\$100	\$100	\$100	\$100	\$100	\$70
<b>RT Sched</b>	0 MW	0	0	0		20	0	20	30	40	50	30	0
<b>RT SOC</b>	200 MW	200	200	200		180	180	160	130	90	40	10	0
<b>Min Chrg</b>	180 MW	180	180	180		180	180	160	130	80	30	0	0

- Note that in this example, the minimum charge requirement does not necessarily match the scheduled state of charge in the day-ahead market.

<sup>80</sup> In reality, the 5-minute market would dispatch the resource at the full 50 MW Pmax until the state of charge was equal to the 180 MWh minimum charge requirement. After this point the dispatch resulting from bids would be overridden with a dispatch instruction (zero MW) respecting the minimum charge requirement. All of these examples use hourly time blocks for simplicity.

**Example 2:**

Suppose the same 50 MW storage resource with 200 MWh of storage capability, is dispatched to charge 50 MWh during the lowest priced hours in the morning in the day-ahead market, and is scheduled to discharge 80 MWh in the evening. In this case, the ISO minimum charge requirement will require that the resource be charged sufficiently to meet the evening schedule inclusive of the day-ahead morning schedule. Because the day-ahead schedule to discharge does not start until hour ending 19, the resource is required to maintain an 80 MWh state of charge between hour ending 11 and hour ending 19. However, prior to hour ending 11, the resource has a lower minimum charge requirement because of day-ahead schedule to charge 50 MW at that time. The start of the day requires a minimum charge value equal to the state of charge at the beginning of day in the day-ahead market. In the evening, after the scheduled discharge in the day-ahead market, the minimum charge requirement decreases to zero MWh.

This example illustrates that it is possible for a resource to charge in the morning prior to the interval that scheduled for charge in the day-ahead market. This may occur when prices are lower than expected and lower than real-time market bids. This occurs in the example in hour ending 10 where prices are \$25/MWh and the resource has a bid to charge at prices at or below \$25/MWh. In this hour, the resource is scheduled to charge at 30 MW, which increases the state of charge to 60 MWh, above the 30 MWh requirement. The numbers in the green boxes in Table 15: illustrate this below.

This example also illustrates that in hour ending 11, the resource does not have the required 80 MWh of energy stored and is therefore compelled to charge, with an energy schedule of 20 MW, to bring the total state of charge up to the requirement. The numbers in the red boxes in Table 15: illustrate this below.

Prior to the period when the resource was scheduled to discharge in the day-ahead market, periods with particularly high prices may develop. However, if the resource is not charged above the minimum charge requirement the resource may not respond to these high prices. In this example, prices spike to \$200/MWh in hour ending 18, however the hypothetical storage resource is unable to respond these signals because of the minimum charge requirements, ensuring that later day-ahead schedules can be delivered. In hour ending 18, the resource has a requirement for 80 MWh state of charge and has a state of charge of exactly 80 MWh. The numbers in the orange boxes in Table 15 illustrate this below.

Table 15: Minimum charge requirement example 2

Hour	9	10	11	12	...	17	18	19	20	21	22	23	24
Load	190 MW	190	190	200	...	300	330	335	345	350	340	280	210
DA Bid ↓	\$30/MWh	\$30	\$30	\$30		\$30	\$30	\$30	\$30	\$30	\$30	\$30	\$30
DA Bid ↑	\$60/MWh	\$60	\$60	\$60		\$60	\$60	\$60	\$60	\$60	\$60	\$60	\$60
DA Price	\$50/MWh	\$50	\$25	\$50		\$60	\$60	\$60	\$70	\$70	\$60	\$60	\$60
DA Sched	0	0	-50	0		0	0	0	30	50	0	0	0
DA SOC	30 MWh	30	80	80		80	80	80	50	0	0	0	0
RT Bid ↓	\$25/MWh	\$25	\$25	\$25		\$25	\$25	\$25	\$25	\$25	\$25	\$25	\$25
RT Bid ↑	\$70/MWh	\$70	\$70	\$70		\$70	\$70	\$70	\$70	\$70	\$70	\$70	\$70
RT Price	\$60/MWh	\$25	\$60	\$60		\$60	\$200	\$60	\$60	\$60	\$60	\$60	\$60
RT Sched	0 MW	-30	-20	0		0	0	0	0	0	0	0	0
RT SOC	30 MW	60	80	80		80	80	80	80	80	80	80	80
Min Chrg	30 MW	30	80	80		80	80	80	50	0	0	0	0

- Note that in this example, real-time prices remain low in the evening and the resource does not receive a market instruction to discharge.

It is important for resource owners to understand how the minimum charge requirement will work for bidding into the real-time market and state of charge management. This tool will only stipulate a minimum state of charge that a resource needs to maintain based on day-ahead market schedules. These minimums will be determined at the conclusion of the day-ahead market run and will be known to scheduling coordinators in advance of the real-time market. Knowing these minimums and how actual state of charge values develop in the real-time market may encourage resource operators to adapt bids in the real-time market to increase state of charge for resources so that they have more availability to respond to unexpected high real-time market prices.

**5-minute charge requirements**

The examples outlined above all include hourly charge requirements and hourly dispatch instructions. The actual real-time market is broken into 5-minute intervals. The charge requirements will be smoothed over the hour, so they are achievable within 5-minute dispatch instructions. For example, if the minimum charge requirement is zero MWh in the prior hour and 12 MWh for the current hour, then the minimum charge requirement for the first five minute interval would be one MWh, then two MWh for the second interval, increasing by one MWh with each successive interval and ending with a requirement of 12 MWh for the final 5-minute interval.

**RA Implications**

As discussed above, storage resources providing RA capacity will be subject to a must offer obligation that includes charge, discharge and energy bids. When storage resources do not make these available to the CAISO, because of outages or limits set by bid parameters, the RA capacity value for the resource is reduced in the UCAP process. However, if CAISO is

maintaining a state of charge for these resources through the minimum charge requirement, there will be no reduction in the RA capacity values.

## 4.2. Flexible Resource Adequacy

The CAISO seeks to close certain gaps in the existing flexible RA construct through a new flexible RA framework that more deliberately captures the CAISO’s operational needs and the predictability (or unpredictability) of ramping needs. Changes to the flexible capacity product and flexible capacity needs determination must closely align with CAISO’s actual operational needs for various market runs (*i.e.*, day-ahead market and fifteen-minute market). The CAISO must ensure the flexible RA proposal mirrors the needs identified in the Day-Ahead Market Enhancements Proposal. However, at this time, the Day-Ahead Market Enhancements Proposal requires additional development before the CAISO is able to further advance its flexible RA capacity proposal. Therefore, the CAISO is deferring significant modifications to its flexible RA capacity proposal for this straw proposal.<sup>81</sup>

## 4.3. Local Resource Adequacy

In previous proposals, the CAISO developed proposals for Local Assessments with Availability Limited Resources and Meeting Local Needs with Slow Demand Response. These proposals have been separated out from this document and finalized in a separate Draft Final Proposal.<sup>82</sup> A discussion of how to potentially apply UCAP counting to local RA is also now included in this section.

### 4.3.1. UCAP in Local RA Studies

The CAISO will continue running the local capacity studies exactly as is done today using NQC values and will publish the local capacity requirements in terms of NQC. At the beginning of the CAISO’s local capacity study report, the CAISO will include a translation table from NQC to UCAP at the level of LSE compliance requirement. The translations will be done by TAC, as required by the CAISO Tariff. For each TAC, the total local UCAP requirement will be defined as follows:

$$\text{Total TAC UCAP responsibility} = \left( \sum \text{of TAC wide NQC requirements} \right) \times \left[ \frac{\sum \text{of TAC wide UCAP values}}{\sum \text{of TAC wide NQC values}} \right]$$

<sup>81</sup> For the CAISO’s most recent proposal, please refer the Third Revised Straw Proposal, pp. 68-77. Available at <http://www.aiso.com/InitiativeDocuments/ThirdRevisedStrawProposal-ResourceAdequacyEnhancements.pdf>.

<sup>82</sup> The Draft Final Proposal on these items is available at: <http://www.aiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx>.

The CAISO's local capacity study report is done by May 1 and local requirements are sent out in July before the NQC/UCAP list for the next compliance year is available (September). Therefore, the NQC and UCAP *values* used in the second term (*i.e.* the conversion factor) are given by all available values in the previous year's NQC/UCAP list for resources already in-service. This is necessary to avoid complications derived from including estimated NQC and estimated UCAP values for new resources that may or may not become in-service between the time when the report is written and the compliance year.

The CAISO believes using the NQC and UCAP values from the current year is both an infeasible and undesirable result. The LCR base cases are built in December-January and studies are run in February. The stakeholder process runs through May 1.<sup>83</sup> The annual NQC deliverability study is done in June-July timeframe and, per CAISO Tariff and BPM, LCR allocations are released mid-July. The NQC list is currently completed in August (sometimes early September). Therefore, it is not possible to utilize actual NQC and UCAP values for the LCR studies.

Because the annual LCR studies begin in December before the year of need, they are run with the previous year's NQC. Given the timing of the studies, this is necessary even though those values will not be the actual NQC values used in RA showing made in the subsequent October or later. Similarly, given that NQC values already come from previous years and given the limited year-by-year changes in new resources and potential for TAC-wide available total UCAP, waiting for the new UCAP is not needed.

The CAISO will calculate LSEs' local load-share ratio responsibility in terms of UCAP at the TAC level. As is done today, LRAs will be given their share UCAP to allocate to their LSEs. The LRA may allocate these responsibilities using its preferred methodology, however, as specified in 40.3.2 (c) of the CAISO Tariff, if the LRA does not allocate their entire responsibility to their jurisdictional LSEs the CAISO will allocate the difference.

LSEs' individual compliance in meeting their given local allocation is calculated in UCAP<sup>84</sup> (for compliance with ISO Tariff sections 43A.8.1 and 43A.8.2). In other words, an LSE will be determined to be individually adequate if its shown UCAP is greater than its allocated share. As all RA showings will be made in terms of UCAP, the CAISO will convert UCAP values back into NQC values and run its compliance studies of all RA showings with local technical criteria and requirements using NQC values, as done today. In addition to deficiencies caused by effectiveness factors that exist today, the CAISO must also ensure there are adequate MWs in a given area. For example, the CAISO may receive adequate UCAP to meet individual obligations, but not enough MW to serve peak load in a local capacity area. Therefore, collective deficiencies will be defined as both insufficient MW of NQC to meet the LCR as well as the existing insufficiently effective capacity.

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<sup>83</sup> Per Tariff section 40.3.1 (and RR BPM) LCT study (including the new UCAP translation) needs to be final by May 30 – 120 days before the showings get here. CPUC requires us to file draft LCR study by around April 1 and final by May 1.

<sup>84</sup> This is consistent with existing ISO Tariff sections 43A.8.1 and 43A.8.2.

The CAISO will notify LSEs of any deficiencies and provide them an opportunity to cure. If still short, the CAISO may purchase capacity from remaining non-RA resources through its CPM authority cure the deficiency. The cost will first go pro rata to each SC for an LSE based on the ratio of its Local Capacity Area Resource Deficiency to the sum of the deficiency of Local Capacity Area Resources in the deficient Local Capacity Area(s) within a TAC Area (all calculated in UCAP – per 43A.8.1) and second if anything else is required the cost allocation will be based on the SCs proportionate share of Load in such TAC Area(s) as determined in accordance with Section 40.3.2 – per 43A.8.3.

In assessing which resources to offer CPM designations to cure deficiencies, the CAISO may continue to assess a number of variables from the available resources, including but not limited to cost, effectiveness, and reliability as dictated by ISO Tariff section 43A.4.2. The CPM cost will be divided to the LSEs per the different varieties of CPM as required by the CAISO Tariff. The LSEs that receive cost allocation for the CPM will get a capacity credit commensurate with their CPM cost ratio allocation. The amount of the credit is based on the quantity of UCAP purchased, not the NQC value.<sup>85</sup>

#### **4.4. Backstop Capacity Procurement Provisions**

In this initiative the CAISO is: (1) proposing new authority to make CPM designations, (2) flagging potential changes to the RMR performance mechanism if changes to RAIM are considered, and (3) proposing a new tool to encourage load to procure resources up to full UCAP requirements and discourage load serving entities from leaning on capacity procured by other entities.

The CAISO proposes new CPM authority to procure resources in the following three scenarios: (1) system UCAP deficiencies through the RA process; (2) inability to serve load in the portfolio deficiency test; and (3) an identified need to procure local RA after an area or sub-area fails to meet the energy sufficiency test. These three needs are proposed extensions of the existing CPM authority.

This proposal includes a new tool called the UCAP deficiency tool, which incentivizes entities to show at or above their UCAP requirements and will discourage leaning between entities during the RA showings. This tool will assess charges against entities that show UCAP below their requirements and allocate these payments to entities that show above their requirements.

##### **4.4.1. Stakeholder Comments**

Overall, stakeholder comments on the 4<sup>th</sup> revised straw proposal were generally supportive of extending CPM authority for 1) system UCAP deficiencies; 2) inability to serve load in portfolio deficiency test; 3) local RA after area or sub-area fails to meet the energy sufficiency test. Capacity Procurement Mechanism Modifications. While some stakeholders like Middle River Power, were unsupportive of the move towards a UCAP counting methodology for RA credit,

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<sup>85</sup> In other words depending of the situation they may get one-for-one cost/credit allocation, sometimes it may not be one-for-one cost/credit allocation, at worst it could be as low as no credit if the resource has no qualifying UCAP value.

they understood the need to extend CPM authority to cure system UCAP deficiencies. Others, like PG&E and SDG&E, wanted additional clarification on how the portfolio sufficiency test would result in a CPM designation, and how the CAISO would know that the resources it procured would address these deficiencies given that there wouldn't be time to re-run the portfolio analysis. SDG&E also questioned the need to retain CPM authority for both NQC and UCAP system deficiencies. Given the general support from stakeholders, the CAISO's backstop proposal remains largely unchanged.

#### **4.4.2. Capacity Procurement Mechanism Modifications**

The CAISO uses CPM to backstop the RA program. Specifically, when there is insufficient capacity shown in the RA process to reliably operate the grid, the CAISO may make CPM designations to procure resources that have not been shown in the RA process so that sufficient capacity is available to reliably operate the system. RA is shown on a year-ahead and a month-ahead basis, and CPM can be used to backstop in either timeframe or in a more granular timeframe. Resource owners with additional non-RA capacity can participate in the competitive solicitation process (CSP) for their bids to be considered if and when the CAISO makes a CPM designation. Generally, in any timeframe the CAISO makes a designation, the CAISO considers all options for procurement and selects the least cost option that meets the reliability need is selected. Additionally, when the CAISO makes any CPM designation, it posts information about the designation and supporting documentation outlining why the CAISO needs the resource.

Authority to make CPM designations for capacity currently includes the following designation types:

1. System annual/monthly deficiency – Addresses insufficient system RA capacity in year-ahead or month-ahead RA showings
2. Local annual/monthly deficiency – Addresses insufficient local RA capacity in year-ahead or month-ahead RA showings for one specific entity making showings
3. Local collective deficiency – Addresses insufficient local RA capacity in year-ahead RA showings to meet the reliability needs for one specific local area
4. Cumulative flexible annual/monthly deficiency – Addresses insufficient flexible RA capacity in the year-ahead or month-ahead showings for system needs
5. A “Significant Event” occurs on the grid
6. CAISO “Exceptional Dispatches” non-RA capacity

The CAISO proposes modifying its existing CPM authority to procure additional capacity in the following scenarios: (1) system UCAP deficiencies through the RA process; (2) inability to serve load in the portfolio analysis test; and (3) an identified need to procure local RA after a local area or sub-area fails to meet the energy sufficiency test.

The CAISO will seek additional CPM authority to procure capacity based on system UCAP deficiencies. The CAISO will not make these designations merely because some LSEs are

deficient, but instead will only make such designations when there are overall deficiencies based on all RA showings. To make these designations, the CAISO will compare all UCAP reflected in RA showings to the total requirements for UCAP, and may make additional designations based on that difference. This authority will be similar to the CAISO's existing authority to procure for system deficiencies, which are based on total shown NQC values. This new authority will be based on shown UCAP and will apply in the year-ahead and month-ahead timeframes. Similar to existing authority, CAISO will alert entities with shortfalls and provide those entities with a chance to cure any shortfall. CAISO backstop procurement will only occur after this cure period closes and deficiencies remain.

The CAISO is not seeking authority to procure additional backstop capacity merely because an individual entity shows less capacity than its requirement. CAISO procurement based on individual LSE shortfalls could result in the CAISO procuring more capacity than is necessary if other LSEs happen to show more capacity than they are required. By procuring only for system UCAP shortfalls, the CAISO will ensure it receives enough UCAP to reliably operate the grid. This approach is consistent with other categories of CPM procurement authority, where the CAISO only procures if there is a cumulative deficiency. However, procurement in this manner could result in entities "leaning" on other entities that show capacity in excess of their individual UCAP requirement. Because of these incentives, the CAISO also proposes to implement a UCAP incentive mechanism, discussed further below.

Section 4.1.3, above, provides details about the portfolio analysis the CAISO will conduct to determine if the resources procured through the RA process will be sufficient to meet the energy and peak capacity needs over the entire month. If the CAISO determines it is unable to meet these needs through this analysis, it can designate additional capacity using the CPM tool to pass the analysis. The CAISO will use this procurement authority at the same time it undertakes month-ahead designations for other CPM backstop designations. If the CAISO identifies a reliability concern through the portfolio analysis, it will continue to allow entities to first cure the identified deficiency before the CAISO makes any backstop designations.

Finally, the CAISO proposes additional backstop authority to ensure that procured local resources can meet energy needs in each local area and sub-area during the upcoming year. If CAISO identifies any capacity and/or energy shortfall, it will provide a cure period for entities to clear any deficiencies before exercising its backstop procurement authority.

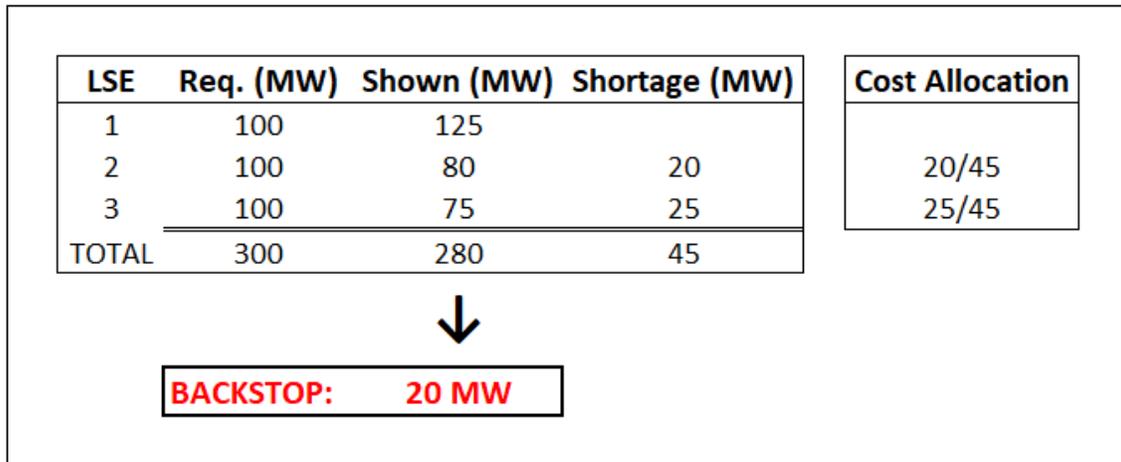
### **Example: UCAP Deficiency**

The CAISO provides the following brief example to explain a scenario where it could make a potential CPM designation for deficient UCAP procured in the RA process, after the cure period.

Assume in this example that there are three load serving entities, each with a requirement to show 100 MW of UCAP. The first entity shows 125 MW, or 25 MW above the requirement, while the second and third entities show 80 MW and 75 MW respectively, or 20 MW and 25 MW below requirements, respectively. In aggregate, at the system level the RA process procures 280 MW and does not meet the 300 MW requirement for UCAP. This indicates a 20 MW shortfall at the system level, for which CAISO could undertake backstop procurement. If CAISO procures backstop capacity, it will allocate costs for that backstop to the entities that were

deficient, in this case entities 2 and 3, per the LSE’s share of the overall deficiency. In this case, entity 2 will be assigned 44% (20/45) of the costs and entity 3 will be assigned 56% (25/45) of the costs to procure the additional capacity for this designation. The CAISO provides additional discussion, below, about how LSE 1’s showing can result in incentive payments for its 25 MW of excess capacity.

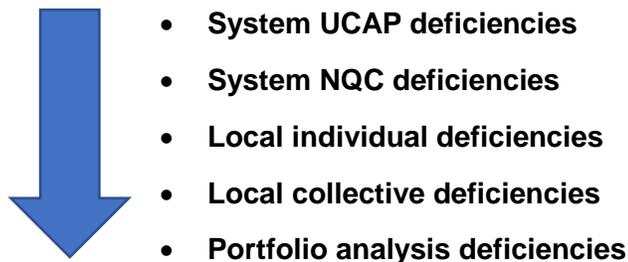
**Figure 10: UCAP Deficiency CPM Backstop**



**CPM Designation Order**

Today, if the CAISO makes multiple CPM designations for any single planning horizon, it first allocates costs and credits to individual entities that are deficient in their RA showings, then to all applicable LSEs for the residual collective deficiency. The CAISO will maintain the similar paradigm with the new authority. Going forward, the CAISO will first allocate the costs to system UCAP deficiencies, then to NQC system deficiencies, then to local individual deficiencies, then to local collective deficiencies, and finally to portfolio deficiencies. This order is illustrated in Figure 11 below. As with current practice, if the CAISO considered multiple designations in one timeframe, it would make designations that meet all of the necessary reliability needs at the least cost. This figure may be used to determine cost and credit allocation, if the CAISO makes multiple CPM designations using different CPM authority.

**Figure 11: CPM Designation Order**



**4.4.3. Making UCAP Designations**

Today, the CAISO uses net qualifying capacity as the basis for determining all designations for all CPM procurements. These quantities are used to determine the total capacity cost for the ISO/M&IP/I&RP

designations (Quantity x CSP price) and the total amount of credit that is allocated to load serving entities who incur these costs. With the proposed additions to the CPM authority discussion in the section above, the CAISO may procure for a specific MW quantity of UCAP, rather than NQC. The CAISO is not planning to change pricing rules, the soft offer cap or bidding rules under the existing CPM tool.

Each resource will have a UCAP and NQC value that is stored in CAISO databases used for resource adequacy calculations. These values can be used to inform a ratio, or conversion factor, between UCAP and NQC. With this ratio, a specific price can be determined for any quantity of UCAP designation, similar to any NQC designation. This may imply that a designation for UCAP may be awarded to a resource with a higher bid price, but better conversion factor.

An example of the UCAP counting is outlined in Table 16. This table shows two hypothetical resources, resource 1 and resource 2. In this example resource 1 has an NQC value of 200 MW with an accompanying UCAP value of 100 MW, and resource 2 has an NQC value of 150 MW and a UCAP value of 125 MW. Resource 1, bids into the competitive solicitation process for CPM at \$5/MW, while resource 2 bids at \$6/MW. If the CAISO makes a designation for NQC needs for a local deficiency it will first select capacity from resource 1 because the bid prices are less expensive for resource 2. However, if the CAISO is making a designation for UCAP, capacity from resource 2 will be selected first, as the effective bid prices for resource 2 are less expensive. In this example, the effective price for UCAP capacity for the resource 1 is \$10/MW, while the price is \$7.20/MW for resource 2.

**Table 16: UCAP CPM price example**

	NQC	UCAP	UCAP:NQC	Bid (\$/MW NQC)	Effective UCAP Bid (\$/MW UCAP)
Resource 1	200	100	0.5	\$5	\$10
Resource 2	150	125	0.8	\$6	\$7.20

#### 4.4.4. Reliability Must-Run Modifications

This proposal includes removing the RAAIM tool from CAISO processes and tariff provisions. RAAIM incentivizes those RA resources that bid shown RA capacity into the market during the availability assessment hours, and charges those RA resources that do not. The CAISO believes the RMR provisions already provide sufficient incentive for RMR resources to be available and perform. The CAISO is also proposing a new penalty structure for RMR resources, which would assess performance penalties if the resource was not available above some pre-determined threshold.

An appropriate penalty structure for RMR resources may be one similar to the existing RAAIM tool. The RAAIM penalty has predetermined thresholds for performance, with performance below 94.5% penalized and performance above 98.5% incentivized during any specific month. Through this initiative, the ISO is considering 1) if incentive payments are appropriate for RMR

resources, 2) changing the penalty parameter and availability thresholds that RMR resources are subject to, and 3) how incentive penalties should be distributed.

It may not be appropriate for RMR resources to receive a performance incentive payment similar to resources that are exposed to the RAAIM. RMR resources are individually contracted and include specific terms of service. It may not be appropriate for the agreement to include payments for higher performance, as the performance and needs of the system should already be internalized and expected in the contract. There is also a question about how additional incentive payments would be funded and if they would come from the same group of load serving entities that are already paying for the RMR designation, or from a different pool.

An appropriate performance threshold might not be 94.5% for RMR resources as it is for RAAIM. Since each RMR contract is tailored to the specific resource, it may make sense that performance targets are customized based on the past performance of the particular RMR resource. For example, a RMR resource may have a recent historic availability of 98% while another's is 85%. It seems appropriate to apply a higher performance threshold to the former resource than the latter.

Further, targets could be designed to vary with different seasons. This may be appropriate where critical need for a resource is during a particular time of year. Similar to the RAAIM penalty, the CAISO could calculate the availability on a monthly basis and assess penalties on those amounts. Unlike RAAIM, this tool might not be self-funding given the limited number of RMR units, and any collected penalties could be returned to the parties assessed costs for the RMR designation.

The CAISO may continue to use the CPM soft offer cap as the penalty price for poor performance for the RMR incentive tool, but may also elect to use a penalty price set at the RMR price. Using the CPM soft offer cap would be consistent with historic penalty rates assessed for resources, and using a rate equal to the rate of the specific RMR contract might set a price more appropriate for the specific resource receiving the RMR designation. The CAISO continues to seek stakeholder feedback on an appropriate availability incentive design to apply to RMR resources after the removal of the RAAIM tool.

#### **4.4.5. UCAP Deficiency Tool**

As noted above, the CAISO is not proposing new CPM authority to make a designation when a specific entity shows less UCAP than individual requirements as long as the system as a whole is adequate. However, the CAISO is proposing a new tool, called the UCAP deficiency tool, which will impose deficiency charges on entities with deficient UCAP showings. This tool is designed to prevent leaning and to incentivize entities to show above their individual UCAP requirements. Further, the CAISO notes that deficiency charges are not a novel idea. Other ISOs and RTOs impose similar deficiency charges on LSEs that fail to procure sufficient resource adequacy capacity. For example, MISO charges LSEs a Capacity Deficiency Charge if they elect not to procure all or a portion of their PRMR from auction or bilateral contracts. The Capacity Deficiency charge is the amount of deficient MWs multiplied by 2.748 times the Cost of

New Entry. This charge is then distributed on a pro rata basis to other LSEs who did not opt to pay the charge.<sup>86</sup>

The concept of the UCAP deficiency tool is to apply a charge to resources that show less than their UCAP requirement, and distribute those collected charges to resources showing above their requirements. Without this tool, one or more entities could choose to not procure their full UCAP requirement because they suspect that showings at the system level system will be sufficient to meet aggregate requirements or that the ISO will not make a backstop designation and no additional costs will be allocated. This constitutes leaning.

Ideally, the rules for a UCAP deficiency tool would result in a streamlined and straightforward mechanism where any entity that shows less than their requirements would be charged for the amount of capacity the entity is short. This proposal includes specifications that the deficiency price will be set at the CPM competitive solicitation soft offer cap, which is currently \$6.31/kW-month. All revenue collected will be distributed to entities that show above their UCAP, in proportion to the total amount shown above requirements for all entities.

Several stakeholders continue to object to the UCAP deficiency tool. Some stakeholders argued that the UCAP deficiency tool could be duplicative of other penalties and charges, and could further distort the bilateral RA market. The issue presented is a cost causation problem and should be addressed with a uniform approach for all capacity shown across all local regulatory authorities. Under the current construct showing less capacity than required, or leaning, increases the risk of a potentially costly CPM designation. When CAISO makes CPM designations they are done strictly for reliability and may not be preferred resources for load serving entities, and they may not consider other resources that were not shown to the CAISO. This proposed tool should help reduce CPM by applying an incentive structure for all load serving entities to show capacity up to their requirements.

Some stakeholders argue that the charges related to the proposed UCAP deficiency tool would be duplicative of the charges that could come from CPM designations. The deficiency tool is designed specifically to avoid that outcome. If an individual load serving entity is charged for capacity procured through the CPM tool that capacity is credited to the entity and will not be used for charges applied through the UCAP deficiency tool. **In other words, the CAISO will not procure CPM and impose a UCAP deficiency charge for the same MW of deficiency.** This is illustrated further in the examples below.

Stakeholders further commented that the UCAP deficiency tool may compel resources to withhold capacity. This seems unlikely. If load serving entities are struggling to contract for capacity, it is likely that they are unwilling to pay a price close to the soft offer cap to procure that capacity. Load serving entities that have excess capacity would likely desire to sell that excess capacity, for revenue certainty, rather than wait for a chance to split an unknown quantity of penalty payments. These UCAP incentive payments are distributed to any entity that is showing surplus supply. If there are multiple entities showing additional capacity, then each of those entities will only get a fraction of the incentive payment for the capacity that is short. Additionally, the deficient LSE would be guaranteed to pay the soft over cap, so entering into a

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<sup>86</sup> See MISOs Resource Adequacy Business Practice Manual BPM-011-r23 page 105

contract at some fraction would be more economically rational than choosing to pay the penalty. This is also illustrated in the examples below. In the examples below, there are financial trades between load serving entities that could take place such that the deficient load serving entity would pay less than the penalty and the LSE with surplus would be able to make more from the trade than it would from the incentive payment from the UCAP deficiency tool. This implies that the tool could be effective at incentivizing trades between load serving entities for capacity and getting those trades shown to meet resource adequacy requirements to ensure reliable grid operation.

The examples below include several scenarios that step through the details for how the UCAP deficiency tool could work in practice.

**Example: UCAP Deficiency Tool, with no CAISO backstop**

This set of examples presents three scenarios where CAISO would use the UCAP deficiency tool, but not make any CPM designation. The first scenario shows procurement above the UCAP requirements and therefore no CPM designation.

- In this example LSEs 1 and 2 show 10 MW and 15 MW above their 100 MW month-ahead requirements, respectively, and entity 3 shows 10 MW below its 100 MW requirement.
- Because there is no system shortfall for capacity, the CAISO will not make a CPM designation, but because the showing from LSE 3 is below the requirement, the UCAP deficiency will trigger, and LSE 3 is assessed a charge for 10 MW \* \$6.31/kW-month, or \$63,100.
- This charge is then allocated to LSE 1 and LSE 2, where entity 1 receives 10/25 = 40% or \$25,240 and entity 2 receives 15/25 = 60% or \$37,860.
- LSE 1 and 3 would have benefitted more from contracting with one another. Even if they had contracted for at least half of the soft over cap 10 MW\*\$3.16, LSE 1 would have earned \$31,600, which is \$6,360 more than they would have earned from UCAP Deficiency tool payment, and LSE 3 could have saved \$31,500. This demonstrates that this tool would not incentives withholding of excess capacity, because LSE 1 could profit more from selling to LSE 3 than taking the risk that they would receive the UCAP Deficiency Payment.

**Figure 12: UCAP Deficiency Tool, no Backstop**

LSE	Req. (MW)	Shown (MW)	Shortage (MW)	Penalty	Payment
1	100	110			\$25,240
2	100	115			\$37,860
3	100	90	10	\$63,100	
<b>TOTAL</b>	<b>300</b>	<b>315</b>	<b>10</b>	<b>\$63,100</b>	<b>\$63,100</b>

The second scenario shows a system shortfall, but CAISO does not issue a CPM designation.

- In this example LSE 1 and LSE 2 show UCAP below their 100 MW requirements, at 10 MW and 15 MW respectively, and LSE 3 shows five MW above its 100 MW requirement.
- In this scenario, the CAISO could potentially procure backstop capacity to cure the 20 MW system UCAP deficiency, but chooses not to make such a designation.
- In this case, the two LSEs that are short are assessed a charge for the capacity matching the UCAP deficiency. However, the charge is limited because a maximum payment of \$6.31/kW-month is reached for the payment recipient.
- Because LSE 1 is 10 MW of the 25 MW of total shortage it is assessed a charge of  $\$6.31/\text{kW} * 5 \text{ MW} * (10 \text{ MW} / 25 \text{ MW}) = \$12,620$  and LSE 2 is assessed a charge of  $\$6.31/\text{kW} * 5 \text{ MW} * (15 \text{ MW} / 25 \text{ MW}) = \$18,930$ .
- Because LSE 3 is the only entity showing above the requirements, all of the collected charges are allocated back to that LSE, in this case the total amount allocated is \$31,550 or  $\$6.31/\text{kW} * 5 \text{ MW}$ .
- Note that there is a mutually beneficial solution where LSE 3 could have paid LSE 1 less than the \$63,100 it was charged and that LSE 1 would have made more than the \$25,210 it received from the deficiency payment. This shows there is unlikely to be an incentive to withhold capacity under this mechanism.

**Figure 13: UCAP Deficiency Tool, with Aggregate Shortfall**

LSE	Req. (MW)	Shown (MW)	Shortage (MW)	Penalty	Payment
1	100	90	10	\$12,620	
2	100	85	15	\$18,930	
3	100	105			\$31,550
<b>TOTAL</b>	<b>300</b>	<b>280</b>	<b>25</b>	<b>\$31,550</b>	<b>\$31,550</b>

In the third example LSE 2 and LSE 3 both show below their 100 MW month-ahead requirements and LSE 1 shows exactly at its 100 MW requirement.

- In this scenario, the aggregate amount of UCAP shown is below the aggregate amount of UCAP required for the UCAP requirements.
- In this case, CAISO could potentially procure backstop capacity to cure the system UCAP deficiency.
- Irrespective of any CPM designation, CAISO will not charge any market participants for the shortfall, as there is no entity to allocate those charges.

Figure 14: UCAP Deficiency Tool, no Award Recipients

LSE	Req. (MW)	Shown (MW)	Shortage (MW)	Penalty	Payment
1	100	100			
2	100	80	20		
3	100	95	5		
<b>TOTAL</b>	<b>300</b>	<b>275</b>	<b>25</b>	<b>\$0</b>	<b>\$0</b>

**Example: UCAP Deficiency Tool with CAISO backstop**

In this example LSE 1 and LSE 2 both show below their 100 MW month-ahead requirements and LSE 3 shows above the 100 MW requirement.

- In this scenario, LSE 1 is again short 10 MW and LSE 2 is short 15 MW. Additionally, because LSE 3 only procures five MW above its requirement, there is a shortage between the aggregate amount of UCAP shown and the aggregate requirement.
- This shortfall triggers a CAISO CPM designation, for the 20 MW deficiency.
- CAISO then allocates eight MW of the CPM procurement to LSE 1 and 12 MW to LSE 2.
- The shortfall persists even with the adjustment for the CPM allocation, and the shortfall equals five MW or exactly the capacity that that LSE 1 showed above its requirement.
- Therefore, the remaining shortfall, inclusive of the CPM allocation, is two MW for LSEs 1 and three MW for LSE 2, which is then subject to the UCAP deficiency tool penalty.
- Penalties assessed are for \$12,620 for LSE 1 and \$18,930 for LSE 2.
- The \$31,550 of the collected revenues are then credited to LSE 3.

Figure 15: UCAP Deficiency Tool, with Backstop

LSE	Req. (MW)	Shown (MW)	Shortage (MW)	CPM Alloc (MW)	Adj Short (MW)	Penalty	Payment
1	100	90	10	8	2	\$12,620	
2	100	85	15	12	3	\$18,930	
3	100	105					\$31,550
<b>TOTAL</b>	<b>300</b>	<b>280</b>	<b>25</b>	<b>20</b>	<b>5</b>	<b>\$31,550</b>	<b>\$31,550</b>

↓

**BACKSTOP: 20 MW**

## 5. Implementation Plan

The CAISO understands this is a challenging and comprehensive initiative. Given these implementation considerations, the CAISO is planning a phased implementation. The first phase includes stand-alone elements that can be implemented relatively quickly. For UCAP and Portfolio analysis, phase one allows additional time for CPUC coordination, system development, and offline demonstrations prior to these elements becoming a part of the RA requirements. The second phase includes full implementation of foundational elements with interdependencies, including UCAP requirements and counting rules, the portfolio analysis, and elements that are needed to align with the day-ahead market enhancements and the extended day-ahead market initiatives. These targeted dates are tentative and subject to change.

### **Phase One:** (2021 for RA year 2022)

- RA Import provisions
- Planned outage process enhancements
- Local studies with availability limited resources CPM clarifications
- Operationalizing Storage
- UCAP - Phase 1
- Portfolio Assessment - Phase 1

### **Phase Two:** (2022 for RA year 2023)

- UCAP - Phase 2
- Portfolio Assessment - Phase 2
- Must offer obligations and bid insertion rules
- Flexible resource adequacy

CAISO seeks stakeholder feedback on the proposed phases, including the order these policies must roll out and the feasibility of the proposed implementation schedule.

## 6. EIM Governing Body Role

For this initiative, the CAISO plans to seek approval from the CAISO Board only. This initiative falls outside the scope of the EIM Governing Body’s advisory role because the initiative does not propose changes to either real-time market rules or rules that govern all CAISO markets. This initiative is focused on the CAISO’s RA planning, procurement, and performance obligations. This process applies only to LSEs serving load in CAISO’s BAA and the resources procured to serve that load, and does not apply to LSEs outside CAISO’s BAA. The CAISO did not receive any specific feedback from stakeholders regarding the initial proposed EIM classification for this initiative. The CAISO continues to seek stakeholder feedback on this proposed decisional classification for the initiative.

## 7. Next Steps

The CAISO will discuss this third revised straw proposal with stakeholders during a stakeholder meeting on July 14-16, 2020. Stakeholders are asked to submit written comments by July 30, 2020 to [initiativecomments@caiso.com](mailto:initiativecomments@caiso.com). A comment template will be posted on the CAISO’s initiative webpage here:

<http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx>

## 8. Appendix

### 8.1. Resource Adequacy Enhancements Principles and Objectives

#### *Principles*

#### **The resource adequacy framework must reflect the evolving needs of the grid**

As the fleet transitions to a decarbonized system where fuel backed resources are replaced with clean, variable, and/or energy-limited resources, traditional measures of resource adequacy must be revisited to include more than simply having sufficient capacity to meet peak demand. The RA products procured and the means to assess resource adequacy must be re-examined and refreshed to remain relevant. Any proposed changes must assure that RA accounting methods effectively evaluate the RA fleet's ability to meet the CAISO's operational and reliability needs all hours of the year. The evolving fleet is altering the CAISO's operational needs. As more variable supply and demand interconnects to the system, the CAISO requires resources that are more flexible and can quickly and flexibly respond to greater levels of supply and demand uncertainty. RA requirements and assessments must reflect the evolving needs of the grid and the RA framework must properly evaluate and value resources that can meet these evolving needs.

#### **RA counting rules should promote procurement of the most dependable, reliable, and effective resources**

Both RA and non-RA resources should be recognized and rewarded for being dependable and effective at supporting system reliability. If a non-RA resource has a higher availability and is more effective at relieving local constraints relative to other similar RA resources, then such information should be publicly available to enable load-serving entities (LSEs) to compare and contrast the best, most effective resources to meet their procurement needs. Having this information publicly available to load-serving entities will improve opportunities for the most dependable and effective resources to sell their capacity. Thus, in principle, RA counting rules should incentivize and ensure procurement of the most dependable, reliable, and effective resources.

#### **The RA program should incentivize showing all RA resources**

Modifications to the existing RA structure should encourage showing as much contracted RA capacity as possible and not create disincentives or barriers to showing excess RA capacity. Although it may be appropriate to apply additional incentive mechanisms for availability, CAISO must balance the impact that such incentives may have on an LSE's willingness to show all of its contracted RA capacity.

#### **LSE's RA resources must be capable of meeting its load requirements all hours of the year**

RA targets should be clear, easily understood and based on reasonably stable criteria applied uniformly across all LSEs. For example, to date, the CAISO has relied on a planning reserve margin that is met through a simple summation of the shown RA resources' Net Qualifying

Capacity (NQC) values. Most Local Regulatory Authorities (LRAs) set a planning reserve margin at fifteen percent above forecasted monthly peak demand. However, some LRAs have set lower planning reserve margins. It is not possible to determine if those LSEs with lower planning reserve margins impair the CAISO system without comparing the attributes of the underlying resources in LSE's portfolios, relative to resources' attributes in other portfolios. In other words, the simple summation of NQC values in a LSE's portfolio does not guarantee there will be adequate resources and does not assure an LSE can satisfy its load requirements all hours of the year. As California Public Utilities Code section 380 states, "Each load-serving entity shall maintain physical generating capacity and electrical demand response adequate to meet its load requirements, including, but not limited to, peak demand and planning and operating reserves (emphasis added)."<sup>87</sup> In other words, resource adequacy also encompasses LSEs meeting their load requirements all hours of the year, not just meeting peak demand.

### **Objectives**

In evaluating RA enhancements, CAISO is reviewing NQC rules, forced outage rules, adequacy assessments, and availability obligations and incentive provisions. These existing rules are inextricably linked and require a holistic review and discussion. This review includes considering assessing the reliability and dependability of resources based on forced outage rates. Incorporating forced outages into the CAISO's RA assessment will help inform which resources are most effective and reliable at helping California decarbonize its grid.

Based on the CAISO's review of best practices and the diverse stakeholder support for further exploration of these matters, CAISO is proposing a new resource adequacy framework to assess the forced outage rates for resources and conduct RA adequacy assessments based on both the unforced capacity of resources and the RA portfolio's ability to ensure CAISO can serve load and meet reliability standards.

The CAISO's proposal seeks to remain aligned with the CPUC process. However, CAISO notes that solely relying on an installed-capacity-based PRM as the basis for resource adequacy, as is the case today, is not sustainable into the future given the transforming grid and the new resource mix and its operational characteristics.

The CAISO must consider the express intent of the original legislated RA mandate: to ensure each load-serving entity maintains physical generating capacity and electrical demand response adequate to meet its load requirements. This is essential as California transitions to greater reliance on more variable, less predictable, and energy limited resources that may have sufficient capacity to meet a planning reserve margin, but may not have sufficient energy to meet reliability needs and load requirements all hours of the year. Given this growing concern, CAISO is proposing to develop a new resource adequacy test that will ensure there is sufficient

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<sup>87</sup> California Public Utilities Code Section 380:

[http://leginfo.legislature.ca.gov/faces/codes\\_displayText.xhtml?lawCode=PUC&division=1.&title=&part=1.&chapter=2.3.&article=6](http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=1.&title=&part=1.&chapter=2.3.&article=6)

capacity to not only meet peak load needs, but, just as importantly, to ensure sufficient energy is available within the RA fleet to meet load requirements all hours of the year.

As noted above, the current RA practices rely heavily on the existing NQC counting rules. CAISO believes that resources’ NQC values will continue to be an important aspect of the RA program in the future. CAISO envisions Must Offer Obligations being tied to NQC values. However, CAISO is also considering how to incorporate resource forced outage rates into system, flexible, and local RA assessments. Similar to the current provisions of other ISOs, the CAISO proposes calculating and publishing both installed capacity (NQC) and unforced capacity (UCAP) values and utilizing both figures in the CAISO’s RA processes.

## **8.2. Unit Outage Rate Analysis Examples**

The CAISO received feedback requesting analysis supporting the proposed inclusion of a unit’s forced outage rates for capacity valuation and conducted some preliminary analysis to assess the proposal’s potential impacts. NERC GADS data for WECC shows a WECC-wide average forced outage rate for all resource types providing outage data of approximately 8%. The CAISO analyzed a subset of unit outage data and included some examples of the resulting analysis in the following figures.

The CAISO made the assumptions and utilized the formulas below for determining the following example outage analyses.

### **Assumptions:**

- For any Forced Outages lasting over 7 days, change to planned outage
- For overlapping forced outages, sum of all outages are accounted for in calculations

### **Calculation formulas**

$$\text{Forced Outage Rate} = \frac{\sum_{area} P_{max} - \sum_{area} \text{Forced Avail MW}}{\sum_{area} P_{max}}$$

$$\text{Planned Outage Rate} = \frac{\sum_{area} P_{max} - \sum_{area} \text{Planned Avail MW}}{\sum_{area} P_{max}}$$

$$\text{Total Outage Rate} = \frac{\sum_{area} P_{max} - \sum_{area} \text{Total Avail MW}}{\sum_{area} P_{max}}$$

### **Example Outage Analysis Results**

The following figures provide the results of the CAISO’s outage analysis for two example resources. It illustrates the magnitude of outages these example resources had over the 2018 annual and summer periods. The CAISO’s analysis shows that resource availability related to forced outages varies over seasons and between resources. Significant variance in resource forced outage rates is precisely the issue the CAISO’s proposed UCAP modifications are intended to capture.

Figure 16: Example Unit #1 – Seasonal outage rate analysis: summer 2018

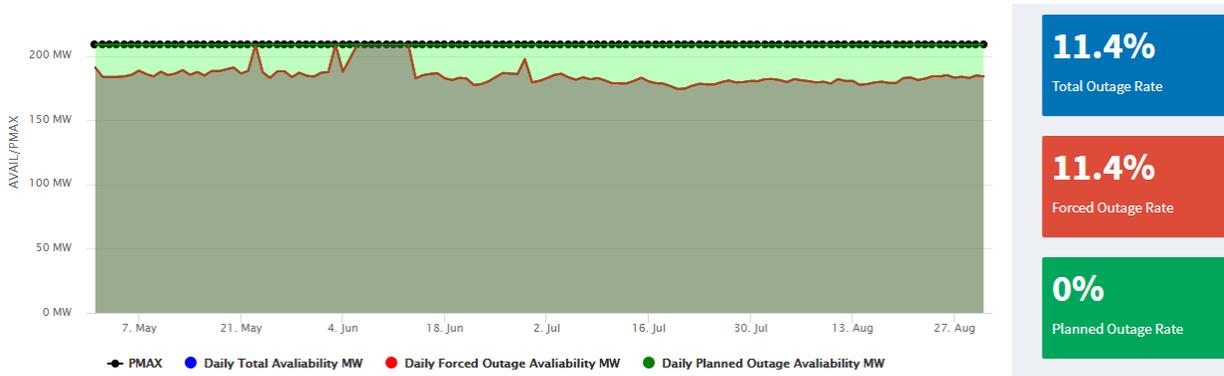


Figure 17: Example Unit #1 – Annual outage rate analysis: 2018

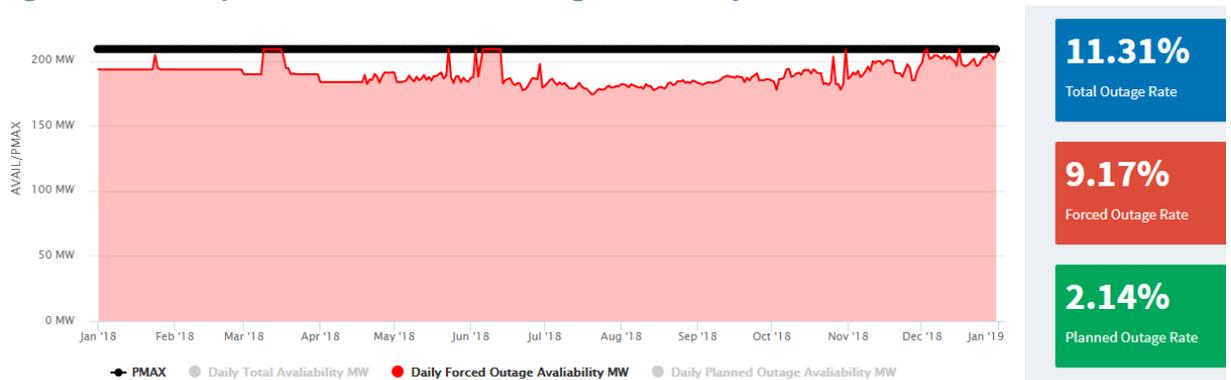


Figure 18: Example Unit #2 – Seasonal outage rate analysis: summer 2018

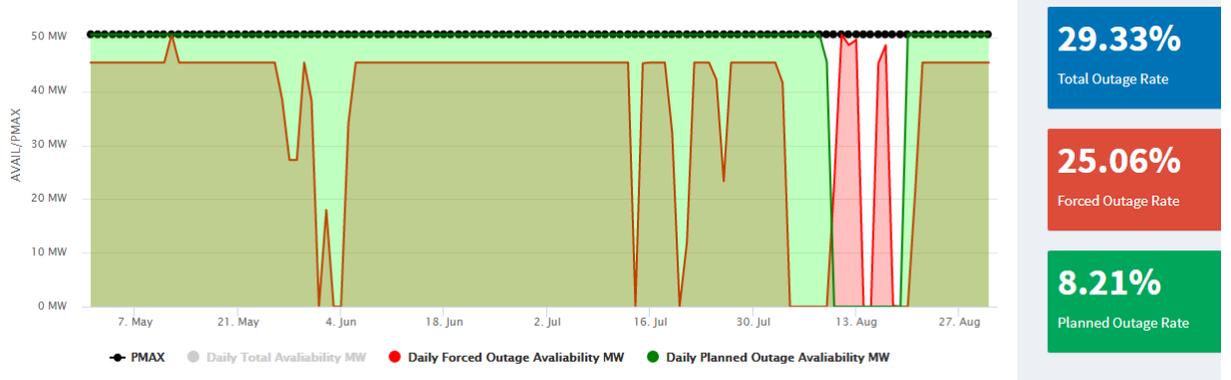
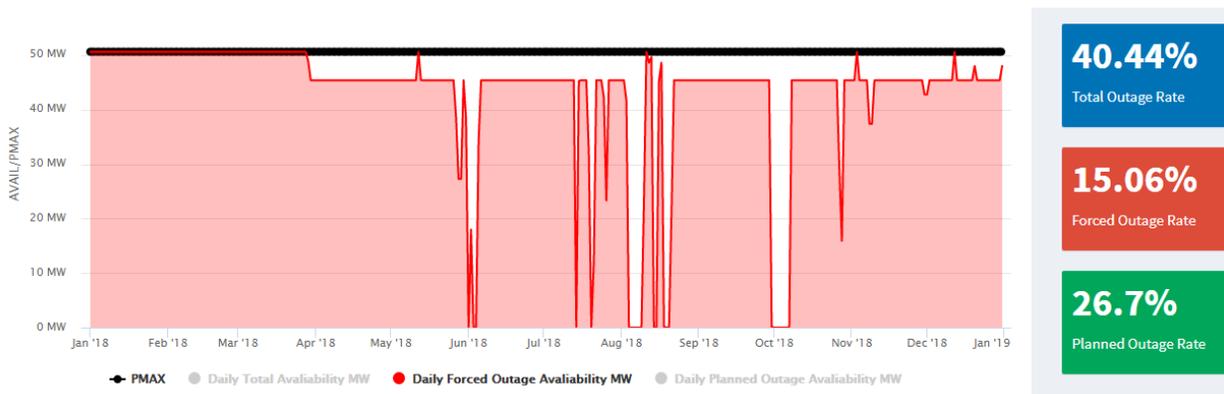


Figure 19: Example Unit #2 – Annual outage rate analysis: 2018



The example resource forced outage analysis is for illustrative purposes only and any final proposal will provide detailed calculation parameters and inputs.

### 8.3. RAIM and Forced Outage Substitution Analysis

The CAISO’s existing RAIM provisions rely on different availability assessment hours (AAHs) for determining the hours of greatest need for each capacity product, which adds significant complexity. The AAHs for generic capacity are the five peak load hours on non-holiday weekdays. The AAHs for flexible capacity differ in both hours and duration. Category 1 flexible capacity has a 17-hour assessment interval for all days designed to cover both the morning and evening ramps. Flexible capacity categories 2 and 3 have 5-hour assessment windows designed to cover the maximum net load ramp. Flexible capacity category 2 assessment hours covers all days and category 3 covers only non-holiday weekdays. The AAHs can change annually for both generic and flexible capacity.

The RA program is designed to ensure the CAISO has sufficient capacity available to serve load reliably through its market dispatch. Any resource providing RA capacity to the CAISO has an obligation to offer that capacity into the CAISO’s markets. The Must Offer Obligations (MOO) for various RA and technology types are listed in the CAISO’s Reliability Requirements BPM.<sup>88</sup> CAISO also relies on outage reporting to track whether resources are available at any given time. If there is sufficient notice given and capacity available, the CAISO can grant outages without requiring replacement capacity. However, not all outages occur under those conditions, and the CAISO developed RAIM to address these particular instances.

RAIM was designed to provide an incentive for resources on outage to minimize the duration of the outage or to provide substitute capacity. Additionally, RAIM provides an additional incentive payment to generation that is available over a predetermined measurement. RAIM does not apply to all hours; it only applies during the Availability Assessment Hours. These hours and days differ depending on the RA product the resource is providing to CAISO. Although RAIM provides an incentive to provide substitute capacity, it also provides an incentive to only show the bare minimum RA capacity needed for each capacity type, because

<sup>88</sup> See the Reliability Requirements BPM, pp. 77-82 for System and Local RA obligations and pp. 93-96 for flexible RA obligations.

showing additional capacity exposes that capacity to RAIM non-availability charges – without providing any corresponding benefit to the LSE to which that resource is contracted.

The CAISO reviewed the effectiveness of RAIM to incentivize resources to provide replacement during forced outages. As a starting point, CAISO reviewed data from the CIRA, system. Data was pulled from May 1, 2018 through July 31, 2019. CAISO compared the quantity of shown RA MW for a given day, the reported MWs of capacity on forced outage, and the MWs of forced outage substitute capacity provided. The CAISO did not differentiate the cause of the forced outage, including whether or not the outage was exempt from RAIM. At the core, the effectiveness of RAIM should not be measured simply by how much of capacity is replaced for certain outage types, but by how well it ensures there is adequate capacity available to CAISO. Even if the vast majority of outages are RAIM exempt, CAISO may be left with insufficient capacity. Figure 20 shows that, overall, very little substitute capacity is being provided to the CAISO in response to forced outages. Additionally, the CAISO understands that there may be limited capacity available in some local areas to provide substitute capacity. The CAISO conducted a similar assessment of system level capacity and found, with very limited exceptions, similar results. These results are shown in Figure 21.

**Figure 20: Forced Outages vs Replacement Capacity (All)**

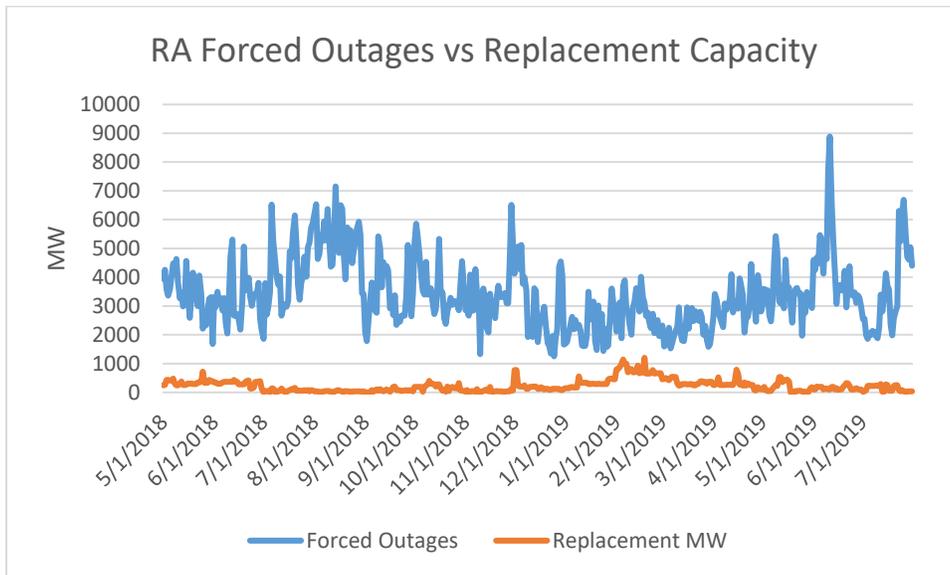
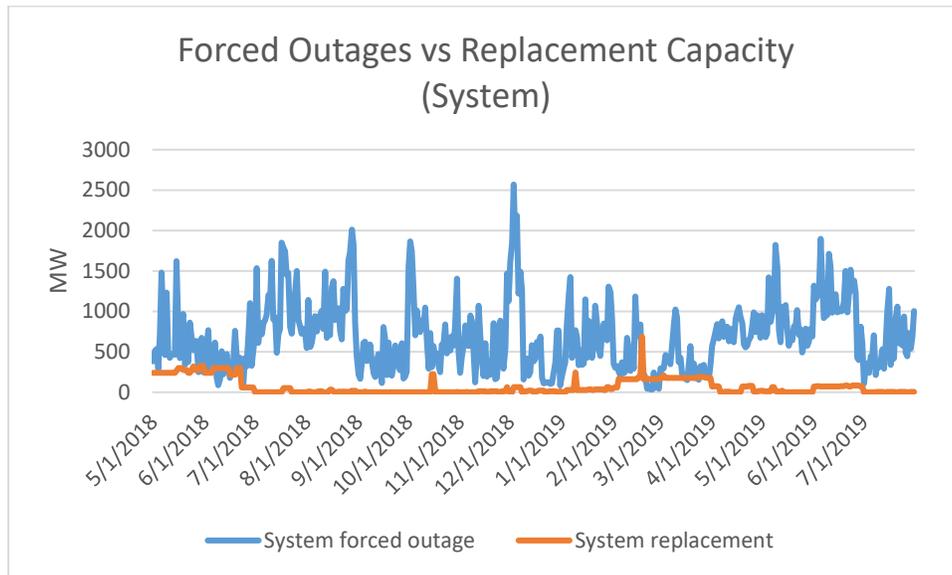


Figure 21: Forced Outage vs Replacement Capacity (System Only)



The CAISO concludes that RAIM is not providing adequate incentive to provide substitute capacity for forced outages and proposes to eliminate it once UCAP is implemented. The CAISO cannot ascertain if the risk of RAIM charges is already incorporated into capacity pricing, if RAIM costs are not high enough, or if benefits are spread too thin to motivate substitution. Other factors could include portfolio effects (*i.e.*, an SC receives similar RAIM charges and incentives, balancing each other out), too many RAIM exclusions/exemptions, the dead band applying for the first outages, or some other reasons.