BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Forward Resource Adequacy Procurement Obligations	Rulemaking 19-11-009 (Filed November 7, 2019)

FINAL TRACK 3.B PROPOSALS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

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EXECUTIVE SUMMARY

The CAISO presents six independent proposals to reform the Commission's existing resource adequacy program. These proposals are summarized below:

Proposal 1: Effective Load Carrying Capability Methodology for Variable-Output Demand Response – The Commission should adopt an effective load carrying capability methodology to calculate qualifying capacity values for variable-output demand response resources beginning in the 2022 resource adequacy year.

Proposal 2: Resource Adequacy Import Requirements – The Commission should set minimum requirements for resource adequacy imports. Specifically, the Commission should require that resource adequacy-eligible imports provide: (1) source specification, (2) an attestation the import is committed solely to the CAISO, and (3) minimum transmission service delivery requirements. The CAISO would incorporate these requirements into its tariff.

Proposal 3: Availability Limited Resource Procurement – The Commission should ensure central procurement entities and/or LSEs procure sufficient resource adequacy resources in each local capacity area and sub-area while accounting for availability-limited resource characteristics. The Commission should leverage the CAISO's hourly load and resource analysis from its 2021 and 2025 Local Capacity Technical Studies to adopt procurement guidance for availability-limited resources for the 2023 resource adequacy year.

Proposal 4: Unforced Capacity Methodology for System Resource Adequacy – The Commission should adopt an unforced capacity (UCAP) methodology consistent with proposal the CAISO ultimately adopts in its Resource Adequacy Enhancements initiative. The UCAP methodology will assess capacity needs and resource contributions taking into account resource availability in addition to deliverability. The UCAP methodology recognizes unit-specific forced outage rates and accurately reflects this information in procurement.

Proposal 5: Multi-Year System Capacity Requirements – The CAISO recommends that the Commission adopt multi-year system resource adequacy requirements for its LSEs. Multi-year system resource adequacy requirements are necessary to maintain near-term reliability and ensure continued operation of existing generation resources.

Proposal 6: Increased PRM for 2022 – The CAISO recommends that the Commission adopt multi-year system resource adequacy requirements for its load serving entities. Multi-year system resource adequacy requirements are necessary to maintain near-term reliability and ensure continued operation of existing generation resources.

The CAISO looks forward to working collaboratively with the Commission to develop these proposals and continue working to improve the resource adequacy program to meet changing system conditions and resource needs.

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FINAL TRACK 3.B PROPOSALS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

I. Introduction

The California Independent System Operator Corporation (CAISO) hereby provides its final proposals for Track 3.B2 per the December 11, 2020 *Assigned Commissioner's Amended Track 3.B and Track 4 Scoping Memo and Ruling* (Amended Scoping Memo).

II. Discussion

> The Amended Scoping Memo states Track 3.B of this proceeding will include an examination of the broader [resource adequacy] structure to address energy attributes and hourly capacity requirements, given the increasing penetration of use-limited resources, greater reliance on preferred resources, rolling off of a significant amount of long-term tolling contracts held by utilities, and material increases in energy and capacity prices experienced in California over the past years.[1]

The CAISO agrees with the scope of this proposed examination and proposes several major structural changes to the resource adequacy program. The CAISO originally submitted four independent resource adequacy proposals in its August 7, 2020 filing in this proceeding. The CAISO resubmits those proposals here with updates based on party feedback and stakeholder comments received in the CAISO's on-going Resource Adequacy Enhancements initiative. The CAISO also submits two new proposals for a multi-year system resource adequacy requirement and an increased planning reserve margin (PRM) for 2022. Finally, the CAISO provides brief comments on the August 7, 2021 joint proposal from Southern California Edison Company (SCE) and the California Community Choice Association (CalCCA).

The CAISO is committed to working with the Commission and parties to develop these

[1] Amended Scoping Memo, p. 4.

proposals and supporting data to work toward a more effective and reliable resource adequacy program. Table 1, below, provides a summary of the CAISO's proposals along with relevant information regarding CAISO stakeholder processes, targeted implementation timelines, and supporting attachments. The CAISO will continue to develop these proposals in collaboration with the Commission, both in this proceeding and concurrently in the CAISO's ongoing Resource Adequacy Enhancements initiative.

TABLE 1: SUMMARY OF CAISO PROPOSALS

Issue	Related CAISO Processes	Targeted Resource Adequacy Year	Additional References
Effective load carrying capability for variable output demand response resources	None	2022	Attachment A – Updated E3 ELCC Study
Availability-limited resource Procurement	Local Capacity Technical (LCT) Studies	2021 & 2022 bridge; 2023 binding	*See* 2018 CAISO Testimony and LCT Studies filed with August 7 initial proposals
Unforced capacity (UCAP)	Resource Adequacy Enhancements stakeholder initiative	2022 bridge; 2023 binding	Attachment B – Preliminary Portfolio Assessment Attachment C - Resource Adequacy Enhancements Draft Final Proposal
Resource adequacy import requirements	Resource Adequacy Enhancements stakeholder initiative	2022 bridge; 2023 binding	Attachment C - Resource Adequacy Enhancements Draft Final Proposal
Multi-year system resource adequacy requirements	Resource Adequacy Enhancements stakeholder initiative	2022	N/A
Increased PRM for 2022	None	2022	Attachment D – CAISO Opening Comments in R.20-11-003

A. Proposal 1: Effective Load Carrying Capability Methodology for Variable-Output Demand Response

The Commission should adopt an effective load carrying capability (ELCC) methodology to calculate qualifying capacity values for variable-output demand response resources beginning

in the 2022 resource adequacy year.

1. Background

Variable-output demand response resources are demand response resources whose resource adequacy qualifying capacity value can vary over the course of a day, month, or season because of production schedules, duty cycles, availability, seasonality, temperature, occupancy, and many other factors. Their unique characteristics can limit their use. These include strict use-limitations such as availability during limited hours, days of the week (such as weekends), or seasons. Demand response's load reduction capability is more akin to a variable energy resource (which the Commission evaluates using an ELCC methodology) than a conventional, fixed-capacity fuel-backed resource.

The Commission's current counting methodology for demand response—the load impact protocol (LIP)—does not consider the use-limitations, limited energy and carbon offsetting capabilities, or the variable nature of most demand response in establishing qualifying capacity (QC) values. As such, the LIP is limited in its ability to assess demand response resources' contribution to reliability. The LIP was more relevant when the resource adequacy program's primary concern was meeting gross peak capacity needs, but that is no longer the primary concern. At that time, energy sufficiency was a non-issue because the remaining gas, nuclear, and hydro resources could support system energy needs. However, circumstances have changed dramatically. The LIP may be a useful tool for estimating hourly operational capabilities, but the Commission should discontinue using the LIP to assess the capacity value for demand response resources because it can overvalue the contribution these resource make to grid reliability under current and expected future conditions.

The Commission should ensure any adopted demand response capacity counting methodology meets the following principles:

- **Assesses demand response's contribution to reliability across the year or seasons** – An approved qualifying capacity counting methodology should evaluate how demand response contributes to system reliability under a loss of load expectation, which considers how demand response contributes to the overall system reliability. This contrasts to the LIP, which is a resource/program specific peak hour(s) evaluation that does not consider overall system needs.
- **Assesses demand response's capacity value as a variable resource** – Demand response

resources are not fixed capacity resources, and any approved qualifying capacity valuation methodology must appropriately value the variable load curtailment nature of demand response and how its variability affects system reliability.

- **Assesses demand response's interactive effects with other resources** – Use- and availability-limited resources, like demand response, can saturate alongside similar use-limited resources; incremental amounts of the same or similar resource types add less and less additional capacity value to the system.
- **Is an industry-accepted capacity valuation methodology** – Loss of load expectation methodologies and evaluating a variable energy resources' contribution to reliability using ELCC is an accepted and growing industry-accepted capacity valuation practice.

The Commission recently adopted a new maximum cumulative capacity (MCC) bucket construct that allows LSEs to procure demand response resources for up to 8.3 percent of their total system resource adequacy requirement. The new limit allows demand response "growth of approximately 100 percent over the current levels when accounting for the 15 percent [PRM] adder."[2] This potential growth in demand response as a percentage of total installed system resource capacity necessitates establishing a proper and industry-wide accepted qualifying capacity counting methodology that ensures the resource adequacy program appropriately reflects demand responses resources' contribution to meeting system reliability.

2. Proposal

The Commission should approve using an ELCC methodology to assess the qualifying capacity of variable-output demand response resources. Unlike the LIP, an ELCC methodology more accurately captures the value of demand response by accounting for its use- and energy-limitations and variable-output nature in the context of overall grid needs. Additionally, an ELCC methodology assesses how the capacity value of supply-side demand response, as a peak reduction resource, declines and saturates as other energy-limited resources—like battery storage—compete to serve the same peak capacity hours.

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[2] Decision 20-06-031, *Decision Adopting Local Capacity Obligations for 2021-2023, Adopting Flexible Capacity Obligations for 2021, and Refining the Resource Adequacy Program*, June 30, 2020, p. 57. The CAISO separately opposes incorporating a PRM adder for demand response resources.

The CAISO engaged Energy+Environmental Economics (E3) to develop an ELCC methodology for variable-output demand response (E3 ELCC Study). This study used actual 2019 bid data provided by Pacific Gas & Electric Company (PG&E) and SCE to calculate the ELCC values for individual demand response programs.[3] The CAISO submitted the E3 ELCC study with its initial proposals on August 7, 2020. For this final proposal, the CAISO includes an updated E3 ELCC Study based on modified bid information from SCE. The CAISO recommends the Commission use bid data to develop ELCC values because bids should reflect the true availability of the resource considering both program parameters, such as hours of availability per day and variability caused by weather sensitivity, as well as other factors previously enumerated. Though bid data is likely the most robust information available to evaluate demand response availability, the Commission should require regular testing to ensure bids accurately reflect resource capabilities.

The E3 ELCC Study evaluated demand response as a resource of "last resort" on both a "first in" and "last in" basis. A "first in" ELCC measures marginal ELCC as if the resource was the only intermittent or energy-limited resource on the system, ignoring interactive effects of other resources. A "last in" ELCC measures the marginal ELCC after all other intermittent or energy-limited resources have been added to the system, thus capturing all interactive effects with other resources.

The E3 ELCC Study found the LIP methodology overvalues demand response capacity contributions by 19 to 30 percent. Notably, this overvaluation compares the LIP-derived NQC without the PRM and T&D losses versus the ELCC.[4] The E3 ELCC study more accurately reflects demand response resource reliability contributions for two main reasons: (1) demand response resources, in aggregate, do not bid into the CAISO market at levels equal to their net qualifying capacity because of variability and use-limitations, and (2) scheduling coordinators for demand response bid at times that are either not optimal or are for insufficient durations to earn full capacity value relative to system needs.

The E3 ELCC Study also developed an ELCC methodology that can evaluate different

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[3] As a result of the initial E3 ELCC Study, SCE identified and made modifications to their bids to increase the MW amount offered. E3 updated the study to incorporate change and to compare the ELCC to the NQC net PRM and T&D loss adders, rather than NQC. This updated study is included in Attachment A.

[4] Attachment A, E3 ELCC Study, p.14.

classes of demand response resources with different use and availability limitations. The E3 ELCC study achieved this result by allocating the overall demand response resource category ELCC to individual programs based on expected output during peak, maximum number of calls per year, and maximum duration per call. This addresses the purported concern that demand response programs are too heterogeneous to apply an ELCC methodology. This also addresses the Commission's Track 2 Decision request to specifically address bidding and dispatch assumptions.[5] The E3 ELCC Study found the determining factors are when, where, how much, and how fast the end-uses collectively respond and deliver load curtailment to the system. In other words, it is the demand program design that matters, not the specific and heterogeneous underlying end-uses that make up a demand response resource. In fact, demand response program designs are generally more similar than dissimilar when it comes to their use, availability, and response time–the factors that drive capacity value.

The Commission should apply an ELCC methodology to supply side demand response to modify its qualifying capacity value in ways relevant and meaningful to the needs of the transforming grid. The Commission should leverage the CAISO's work to consider how Energy Division staff can further vet and apply an ELCC methodology to supply-side demand response. The E3 ELCC Study demonstrates it is possible and appropriate to use an ELCC methodology to assess the value of demand response. Importantly, adopting an ELCC methodology for demand response consistent with the CAISO's aforementioned principles would enable the CAISO to justify and seek FERC approval of tariff revisions to treat demand response as a variable energy resource, similar to wind and solar resources. This would exempt demand response from RAAIM and eliminate the obligation to bid a fixed capacity amount.

An ELCC methodology more accurately reflects the capacity value for demand response resources than the LIP. In addition, the resulting ELCC values will allow the CAISO to adopt necessary tariff revisions to incorporate demand response resources into existing market processes more effectively. The Commission should affirmatively decide to transition to an ELCC methodology by the end of this Track 3.B cycle, with a new ELCC methodology employed for the 2022 resource adequacy program year.

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[5] Track 2 decision requested: "Future proposals to develop ELCC values for DR and storage should include specific proposals regarding the bidding and dispatch that should be assumed for different DR programs and energy storage facilities operating in the market and how these should be modeled in ELCC studies."

B. Proposal 2: Resource Adequacy Import Requirements

The CAISO proposes that the Commission modify its resource adequacy import rules to ensure its load has access to sustainable, reliable, and dependable resource adequacy imports, recognizing that California competes for imported energy and transmission service across a broad and diverse west-wide market. Given California's reliance on imports to support reliability, dependable resource adequacy import capacity and transfer capability must be secured in advance to meet California's system's capacity and energy needs, particularly as supply tightens across the west due to the changing regulatory landscape and resource retirements.

Under current resource adequacy rules, energy contracts with non-resource specific system resources whose energy can be transferred using non-firm transmission service across the entire delivery path can count as resource adequacy capacity. Unfortunately, such arrangements provide inadequate assurance of reliability and deliverability, and they do not address speculative supply and double counting concerns.

Speculative supply and double counting concerns remain unresolved under the Commission's Track 1 decision in this proceeding. Under the current rules, resource adequacy importers can continue to source and sell speculative capacity and fulfill resource adequacy must offer obligations using last-minute bilateral energy purchases. There is no assurance these bilateral energy purchases are anything but excess energy from resources that were never committed solely to California in the first instance and have no obligation to sell to California. When system resources are constrained across the west, there is no assurance this "excess energy" will still be available to meet California LSEs' needs. Instead, such energy will more likely flow to the native load of the entities that paid for that capacity upfront. Furthermore, failure to impose a transmission delivery requirement and allowing resource adequacy import energy to flow on hourly non-firm transmission means there is no assurance sufficient transmission transfer capability will be available to deliver energy to California, even if excess energy is available in the system. Hourly non-firm transmission has the lowest priority and is the first transmission product to be curtailed. Under these circumstances, the Commission should transition to a resource adequacy import framework that requires resource-specific capacity be dedicated solely to California and be secured in advance using high priority transmission service. This will ensure secured non-recallable power can actually flow to California, particularly during stressed west-wide system conditions.

In its ongoing resource adequacy enhancements initiative, the CAISO is considering setting minimum requirements for imports to provide resource adequacy capacity effective beginning with the 2023 resource adequacy year.[6] These minimum requirements are discussed below. The CAISO's proposal will effectively address the concerns described above and better ensure the availability of dependable and dedicated imports to meet California's energy needs. The Commission should adopt the CAISO's proposed minimum resource adequacy import requirements to address these concerns effectively. The Commission can also adopt additional, more stringent requirements to the extent deemed necessary for their jurisdictional LSEs. Meeting or exceeding the CAISO's proposed minimum resource adequacy import requirements will ensure that resource adequacy imports procured by Commission jurisdictional LSEs will address speculative supply and double counting and ensure that resource adequacy imports are reliable and dependable.

With this proposal, the CAISO also provides recent data regarding resource adequacy import bidding practices, which indicates a significant reduction in high economic bids over the last two years. The Commission's Track 1 decision imposed must flow, self-scheduling, requirements on non-resource specific resource adequacy imports based, in part, on August 2018 data indicating that 13.8% of non-resource specific resource adequacy import average hourly bids were above $500/MWh. However, data from the last two years indicates a significant reduction in resource adequacy import bids above $500/MWh to a low of 2.0% in August 2020. Considering this significant reduction in high resource adequacy import bids—and taking into account the incentives the CAISO proposal sets for resource adequacy imports to bid economically and competitively at marginal cost—it may be prudent for the Commission to consider whether the must flow, self-scheduling requirements are still necessary to address the Commission's original concerns.

1. Background

The CAISO previously submitted a proposal for resource adequacy imports in Track 1 of this proceeding to address potential speculative import supply and double counting by limiting

[6] The CAISO proposes a "bridge" year for the 2022 resource adequacy year with binding implementation for the 2023 resource adequacy year to allow a reasonable transition to the new resource adequacy import framework.

opportunities for physical withholding.[7] The CAISO further refined this proposal since its Track 1 filing. The changes made since the CAISO filed its Track 1 comments are detailed in the CAISO's draft final proposal for the Resource Adequacy Enhancements initiative published on December 17, 2020.[8]

2. Proposal

The Commission should set minimum requirements for resource adequacy imports. Specifically, the Commission should require that resource adequacy-eligible imports provide: (1) source specification, (2) an attestation the import is committed solely to the CAISO, and (3) minimum transmission service delivery requirements. The CAISO would incorporate these requirements into its tariff. These three aspects are discussed in detail below.

a. Source Specification for Resource Adequacy Eligible Imports

The CAISO proposes that only source-specific imports should be eligible to provide resource adequacy capacity. Non-resource specific system resources would not be eligible to provide resource adequacy capacity. Specifically, three types of imports would be eligible to provide resource adequacy import capacity:

1. Dynamically scheduled resource-specific system resources;
2. Pseudo-tied resources; and
3. Non-dynamic resource-specific resource adequacy imports[9] that consist of:
    a. a single resource;
    b. a specified portfolio or aggregation of resources within a single balancing authority area; or
    c. a balancing authority area's pool of resources.

Each type of import eligible to provide resource adequacy capacity will be required to identify the name of the physical resource(s) supporting the import and the single balancing authority area where the resource is/are located. To the extent the import type is a non-dynamic resource-specific resource adequacy import consisting of a balancing authority area's pool of

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[7] CAISO Resource Adequacy Track 1 Proposal, R.19-11-009, February 28, 2020.
[8] Attachment C, Resource Adequacy Enhancements Draft Final Proposal Phase 1 and Sixth Revised Straw Proposal, section 5.1.2, December 17, 2020.
[9] New term defined in the Resource Adequacy Enhancements Draft Final Proposal to more specifically define imports for resource adequacy purposes and differentiate these from Non-Dynamic Resource Specific System Resources which may not provide resource adequacy.

resources (system resources), only the single balancing authority area where the resources are located will need to be identified.

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 advanced procurement of real, physical and dedicated resource-specific capacity. Accordingly, contracts that do not identify or specify resources in support of the resource adequacy contract should not count as resource adequacy capacity. Economy 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 dedicated to California in advance, which is the purpose of the resource adequacy program.

Requiring source specification for import resource adequacy resources' quality and delivery obligations will treat such resources more comparably with internal resource adequacy resources. Adopting a source specification requirement for import resources will require host balancing authorities and suppliers to secure fuel and plan their resource commitments to meet their own needs and import commitments to the CAISO. The CAISO recommends the Commission require resource adequacy import capacity contracts to include source specification as noted above. The CAISO proposes that, effective for the 2023 resource adequacy year, the CAISO tariff would require identification of the physical resources supporting resource adequacy imports and the balancing authority area sourcing these, for the duration of the showing.

b. Attestation Requirement

The Commission should require all resource adequacy import contracts to have defined source specification demonstrating real, physical supply at the time of resource adequacy showings. Further, resource adequacy import contracts should include an attestation. The CAISO proposes that, effective for the 2023 resource adequacy year, the CAISO tariff would require Scheduling Coordinators to submit an attestation stating the supply plan meets following:

1. The capacity shown is owned or contractually secured;
2. The capacity shown has not been sold or otherwise committed to any other party;
3. The capacity can only be interrupted for reliability reasons as determined under the host balancing authority area's tariff, a transmission curtailment, or a plant outage; and

4. Transmission service of proper firmness has been reserved for the delivery of the identified import resource adequacy resource(s) to the CAISO's system.

Under current resource adequacy import rules, the CAISO and Commission cannot determine whether resource adequacy imports are double counted for load serving purposes. Neither LSEs nor import providers are required to demonstrate their resource adequacy import capacity has not been sold to a third party and is not otherwise being used to meet capacity obligations in another balancing authority area.

These attestation requirements will help ensure import contracts provide California with high quality, dedicated capacity and energy services when needed. The first two components of the attestation ensure the resource adequacy capacity is committed solely to California LSEs, and consequently to the CAISO. If the capacity is or will be committed to other parties or uses during the period of the showing, the attestation requirement will not be met. Additionally, the resource adequacy capacity can only be interrupted for reliability reasons—either by the host balancing authority area, a transmission curtailment on a path being delivered to the CAISO, or for a plant outage for non-reliability reasons. Contracts that provide for interruption in performance at the discretion of the seller or for non-reliability reasons, would not meet this requirement.

Contracts with force majeure interruption provisions satisfy this attestation element because a force majeure event would either lead to a plant outage or a host balancing authority area taking action for reliability reasons. Lastly, as will be discussed later, at the time the Scheduling Coordinator submits the supply plan, transmission arrangements need to be in place for delivery of the resource adequacy import to the CAISO in accordance with the transmission firmness requirements. Waiting until the day or hour prior to delivery to secure the necessary transmission, of the proper firmness, would not meet this requirement as it places the CAISO at risk for non-delivery to the extent the transmission is not available. The CAISO notes that other independent system operators and regional transmission organizations impose similar requirements to the attestation requirements the CAISO proposes here.

To count as resource adequacy capacity, import contracts must provide source specific information and the described attestation by established deadlines for the applicable year-ahead and month-ahead resource adequacy showings, with the exception that the fourth element of the attestation is applicable only in the month-ahead showings. Alternatively, the import contracts

should ensure that the resource adequacy import capacity can meet the CAISO tariff requirements which will incorporate the requirements described in this proposal.

The CAISO recognizes there may be some additional costs associated with more rigorous source-specification and attestation requirements, but the additional reliability and capacity security benefits far outweigh those costs. Requiring forward source specification from real, physical capacity committed to serving only the CAISO will address speculative import supply and bidding behavior concerns by helping ensure actual physical resource capacity is secured to serve California's reliability needs.

c. Transmission Service Requirements

i. Recommendations

The CAISO also recommends the Commission adopt a Firm point-to-point transmission service requirement on the last transmission leg to the CAISO (intertie), and a minimum Monthly Non-Firm point-to-point transmission service requirement on all intervening transmission legs for all resource adequacy imports. Specifically, resource adequacy contracts should specify NERC Transmission Service Reservation Priority 7-F on the last transmission leg to the CAISO and a Transmission Service Reservation Priority 5-NM or higher priority for all intervening transmission legs. For reference, NERC's transmission service priorities are listed below in Table 2.[10] Some Transmission Providers offer conditional firm transmission service with a Reservation Priority 6-CF, and those upstream transmission arrangements can also support resource adequacy import delivery.

Table 2: NERC Transmission Service Reservation Priorities

Transmission Service Reservation Priorities		
Priority	**Acronym**	**Name**
0	NX	Next-hour Market Service
1	NS	Service over secondary receipt and delivery points
2	NH	Hourly Service
3	ND	Daily Service

[10] NERC transmission service reservation priority table found here: https://www.nerc.com/pa/rrm/TLR/Pages/Transmission-Service-Reservation-Priorities-.aspx

4	NW	Weekly Service
5	NM	Monthly Service
6	NN	Network Integration Transmission Service from sources not designated as network resources
7	F	Firm Point-to-Point Transmission
	FN	Network Integration Transmission Service from Designated Resources

The firm transmission requirement on the last transmission leg to the CAISO will ensure resource adequacy imports have the highest level of deliverability paths where flows are generally near the total transfer capability limits, *e.g.*, at the California-Oregon Border (COB) and the Nevada-Oregon Border (NOB) interties. Firm transmission service (7-F priority) is the last type of transmission service to be curtailed, after all the lower priority transmission service types have been curtailed. Requiring transmission service no lower than Monthly Non-Firm point-to-point (5-NM priority) on all other transmission legs above the interties will provide added flexibility for suppliers to secure transmission across the different transmission systems where there are multiple paths for traversing the transmission networks to reach desired points of delivery, while still providing for greater deliverability assurance than other transmission service level options.

Transmission service on upstream transmission legs can be of a higher priority than 5-NM, including conditional firm (CF) service which, if offered by the Transmission Provider, has a level 6-CF priority in addition to permitting delivery on firm transmission service (7-F priority). Under this framework, weekly, daily, hourly duration, lower priority, non-firm transmission service would not support delivery of resource adequacy imports.
In addition, under this framework, the commitments made regarding the firmness of the energy arrangement, described above, would still hold, and would provide greater assurances that committed import resource adequacy is actually deliverable when needed.

iv. Policy Implementation

The Commission should consider adopting a two-step implementation process for new resource adequacy import requirements. The first step should be to use the 2022 resource

adequacy compliance year as a bridge to transition to the new framework. For 2022, the Commission should encourage LSEs to provide resource adequacy import contracts with source specification information and firm transmission as outlined above. Load-serving entities should also use 2022 to modify existing import contracts or enter into new ones as appropriate. Step two would implement full compliance with the resource adequacy import proposal for the 2023 resource adequacy compliance year.

v. Summary

The Commission and the CAISO should work collaboratively to implement the following minimum resource adequacy import requirements:

A. Eligible source specific import types:
    1. Non-dynamic resource-specific resource adequacy imports that are:
        i. a single resource;
        ii. a specified portfolio or aggregation of resources within a single balancing authority area; or
        iii. a balancing authority area's pool of resources.
    2. Dynamically scheduled resource-specific system, and
    3. Pseudo-tied resources.

B. Attestation requirement:
    1. The capacity shown is owned or contractually secured;
    2. The capacity shown has not been sold or otherwise committed to any other party;
    3. The capacity can only be interrupted for reliability reasons as determined under the host balancing authority area's tariff, a transmission curtailment, or a plant outage; and
    4. Transmission service of proper firmness has been reserved for the delivery of the identified import resource adequacy resource(s) to the CAISO's system.

C. Transmission Service Requirements:
    1. Firm transmission service (7-F priority) on the last transmission leg to the CAISO; and
    2. Transmission service no lower than monthly non-firm transmission service (5-NM priority) on all upstream transmission legs. This could include monthly

non-firm transmission service (5-NM priority), conditional firm service (6-CF priority), or firm transmission service (7-F priority).

D. Implementation:

1. Two-step process with 2022 as a transition year and full compliance in 2023 under the new resource adequacy import framework.

3. Additional data on resource adequacy import bidding practices

In the Track 1 decision, the Commission established a requirement that non-resource specific resource adequacy imports must be self-scheduled, or alternatively can be economically bid within a -$150 MWh to $0 MWh range. This limitation was intended as a measure to eliminate speculative supply by imposing a must flow obligation for non-resource specific resource adequacy imports and was based, in part, on August 2018 data published by the Department of Market Monitoring (DMM)[11] indicating that 13.8% of non-resource specific resource adequacy import average hourly bids were above $500/MWh. The concern was that the frequency of high bids by non-resource specific resource adequacy imports indicated the potential of speculative supply through high bids to avoid a CAISO award and then sell the energy elsewhere.

The CAISO believes its proposals will effectively address the concerns identified in the Track 1 proceeding, rendering the bidding requirements adopted therein unnecessary. The CAISO's proposed changes will ensure capacity is dedicated to CAISO LSEs and backed by high priority transmission service secured in advance, thus reducing the speculative nature of any supply. The CAISO also provides updated data on resource adequacy import bidding practices for the Commission to consider in determining whether the must flow/self-scheduling requirements the Track 1 decision imposed on non-resource specific resource adequacy is still appropriate.

New data comparing the frequency of non-resource specific resource adequacy import high bids from August 2018 to August 2019 and August 2020 indicates a significant decrease in instances of average hourly bids exceeding $500/MWh and far less reaching the $1000/MWh energy bid cap. Figure 1 illustrates the decrease in non-resource specific resource adequacy

[11] Department of Market Monitoring (DMM), Special Report: Import Resource Adequacy (September 10, 2018) at 1-2, available at: http://www.caiso.com/Documents/ImportResourceAdequacySpecialReport-Sept102018.pdf.

imports average hourly high bids for August 2019 decreasing to 2.8%, while Figure 2 shows the same analysis for August 2020 with high bids decreasing to 2.0% as compared to the 13.8% from August 2018.

Figure 1: Average hourly non-resource specific resource adequacy imports offered by bid price (weekday hours) – August 2019.

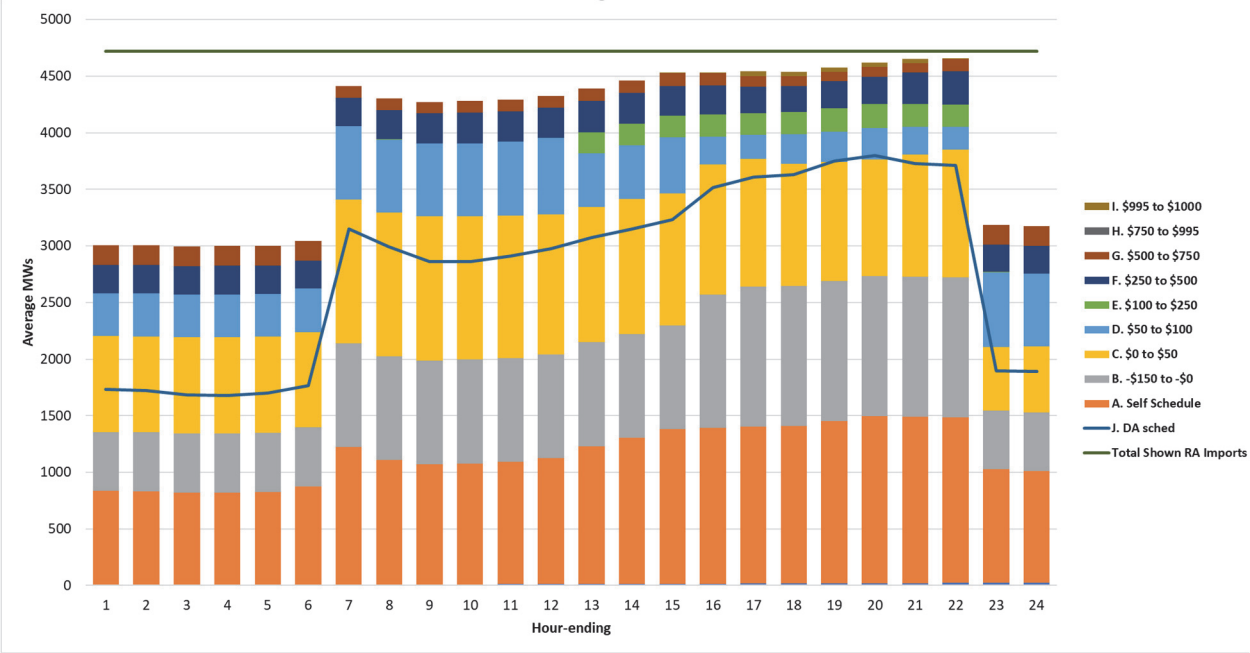
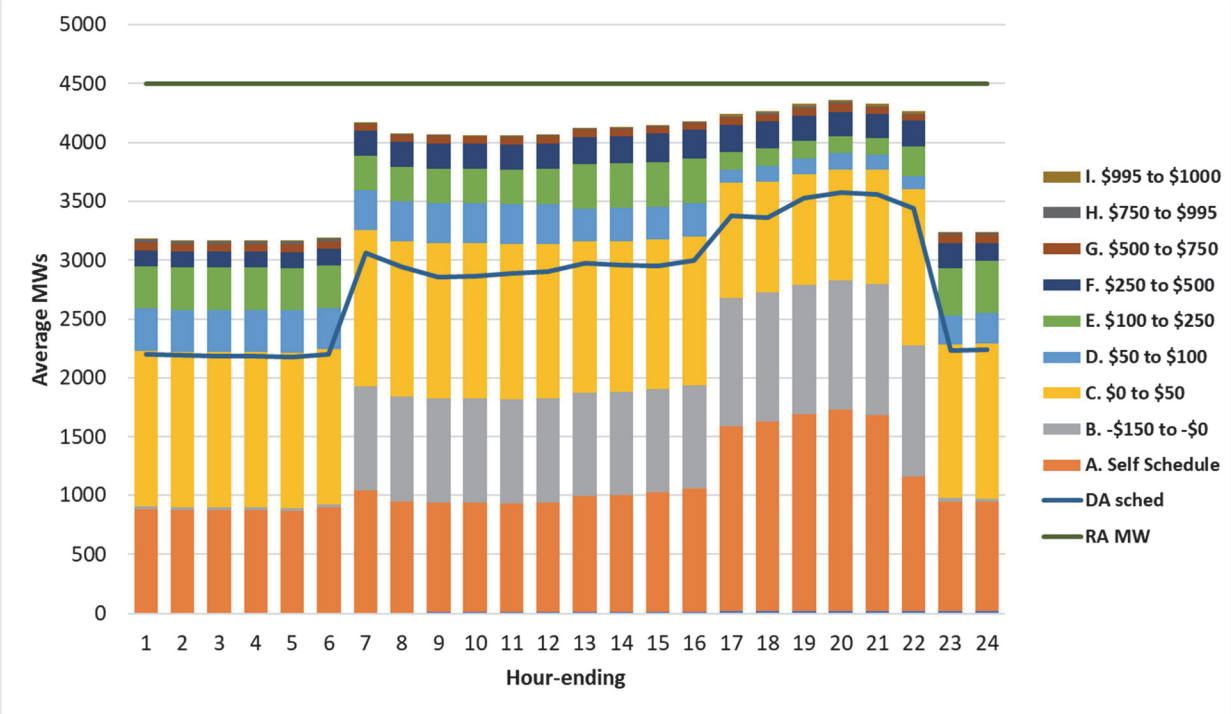


Figure 2: Average hourly non-resource specific resource adequacy imports offered by bid price (weekday hours) – August 2020.



Furthermore, Figure 3 below compares the percent of day-ahead (DA) bids above $500/MWh based on daily averages across the month for the month of August from 2018 to 2020 for non-resource specific resource adequacy imports. The data indicate the percent of bids above $500/MWh has decreased significantly for every hour of the day from 2018 to 2020. Moreover, bids at or near the energy bid cap of $1000/MWh while on average being 6.8% of the bids in August 2018, decreased to 0.2% for August of 2019 and 2020.

Figure 3: Percent of non-resource specific resource adequacy import day ahead bids above $500/MWh for August 2018, 2019, and 2020.

DA Bid	$500 to $750			$750 to $995			$995 to $1000		
HE	2018	2019	2020	2018	2019	2020	2018	2019	2020
1	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
2	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
3	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
4	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
5	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
6	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
7	5.5	2.2	1.3	1.9	0.0	0.1	7.2	0.0	0.1
8	5.5	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
9	5.5	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
10	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
11	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
12	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
13	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.0	0.1
14	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.0	0.1
15	5.3	2.4	1.3	2.2	0.0	0.2	7.1	0.1	0.2
16	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.1	0.2
17	5.0	2.0	1.3	2.4	0.0	0.2	7.0	0.8	0.4
18	4.9	1.8	1.3	2.6	0.0	0.3	6.8	0.9	0.4
19	4.8	1.8	1.6	2.6	0.0	0.3	6.8	0.9	0.4
20	4.7	1.8	1.6	2.6	0.0	0.3	6.8	0.9	0.4
21	4.7	1.8	1.2	2.6	0.0	0.2	6.8	0.9	0.4
22	4.7	2.3	1.1	2.6	0.0	0.2	7.1	0.1	0.4
23	4.3	3.6	1.6	1.9	0.0	0.5	6.5	0.0	0.1
24	4.2	3.7	1.6	1.9	0.0	0.5	6.4	0.0	0.1
Daily Average % RA Imports	4.9	2.6	1.5	2.1	0.0	0.3	6.8	0.2	0.2

In addition, the CAISO's proposed resource adequacy import requirements will incentivize competitive economic bidding by resource adequacy imports. First, resource adequacy imports will need to be source specific and, through the attestation, must be committed solely to a California LSE, and consequently to the CAISO, for the duration of the resource adequacy showing. This incentivizes them to economically bid, at competitive levels, in order to receive market awards because the capacity has been committed only to the CAISO. Second, through the proposed transmission delivery requirement, resource adequacy imports must be

delivered to the CAISO on firm transmission across the interties and transmission no lower than monthly non-firm service on all other upstream legs. If the importer does not currently hold those transmission rights, it will have to procure them, and will be incentivized to economically bid at marginal cost to recover costs. Third, separate from this proposal but through its Resource Adequacy Enhancements initiative, the CAISO is proposing to extend the must offer obligation for resource adequacy imports into the real-time market. Resource adequacy imports will need to remain available not only in day ahead, but also through real-time, to meet their 24/7 must offer obligation. Thus, they no longer will be able to bid high in the day-ahead market to avoid an award and then sell energy elsewhere. Lastly, as the CAISO raises the energy offer cap from $1000/MWh to $2000/MWh in accordance with FERC Order 831, the CAISO will implement a price screening methodology for resource adequacy import bids above $1000/MWh. This will place further protections on high resource adequacy import bids intended to avoid an award in the CAISO market.

Considering the new data indicating a significant decrease in high non-resource specific resource adequacy import bids, and the protections that CAISO's proposal provides to incent competitive economic bidding by resource adequacy imports, it may be appropriate for the Commission to reconsider the current must flow/self-scheduling requirement for resource adequacy imports. Retaining the Track 1 bidding limitation in light of the data and the CAISO proposal may further, and unnecessarily, impact the effectiveness of resource adequacy imports meeting system needs and decrease liquidity.

C. Proposal 3: Availability Limited Resource Procurement

The Commission should ensure central procurement entities and/or LSEs procure sufficient resource adequacy resources in each local capacity area and sub-area while accounting for availability-limited resource characteristics. The Commission should leverage the CAISO's hourly load and resource analysis from its 2021 and 2025 Local Capacity Technical (LCT) Studies to adopt procurement guidance for availability-limited resources for the 2023 resource adequacy year.

1. Background

Availability-limited resources are resources with significant dispatch limitations, such as

limited duration hours (*e.g.*, per year, season, month, or day) or event calls (*e.g.*, per year, season, month or consecutive days) that limit the resources' ability to respond to a contingency event within a local capacity area. This definition is currently limited to resources that count towards meeting a local capacity area or sub-area need, but similar considerations may apply on the system level as storage resources increase in quantity. In 2018 testimony, the CAISO described the proposed hourly load and resource analysis it would develop to inform this proceeding and corresponding load serving entity (LSE) or central buyer procurement efforts.[12] The CAISO included this testimony as Attachment B to its August 7 initial proposals.

In Decision (D.) 19-06-026 the Commission adopted the definition and agreed "it is important to consider availability limited resources, particularly when constructing new resources." The Commission also recognized the need "to work closely with the CAISO to ensure that availability needs are met in all local reliability areas."[13] The CAISO's current proposal provides new local capacity area details that will enable the Commission to direct procurement efforts to ensure local reliability needs are met.

2. Proposal

The Commission should ensure central procurement entities and/or LSEs procure sufficient resource adequacy resources in each local capacity area and sub-area while accounting for availability-limited resource characteristics. The CAISO completed the first phase of the hourly load and resource analysis in its 2021 and 2025 Local Capacity Technical (LCT) Studies.[14] For this first phase, the CAISO focused on identifying minimum availability requirements for battery storage resources to meet local area needs.[15] The CAISO presented the methodology and results in the CAISO's annual local capacity requirements stakeholder process.[16] In later phases, the CAISO will study other availability-limited resources, such as

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[12] *See* Attachment B to the CAISO's August 7, 2021 initial proposals.
[13] Decision (D.) 19-06-026, *Decision Adopting Local Capacity Obligations for 2020-2022, Adopting Flexible Capacity Obligations for 2020, and Refining the Resource Adequacy Program*, July 5, 2019, p. 53.
[14] This work as completed as part of the CAISO's 2021 Local Capacity Technical (LCT) Study. *See* Attachment C to the CAISO's August 7 initial proposals.
[15] For example, the CAISO queue registered 69,193 MW of energy storage projects in June 2020. *See* slide 3: http://www.caiso.com/Documents/Briefing-Renewables-EnergyStorage-Generator-Interconnection-Queue-Presentation-July2020.pdf
[16] No stakeholders expressed concern with, or opposed the CAISO's methodology or results. *See*: http://www.caiso.com/Documents/ISOResponsestoComments_2021and2025FinalLocalCapacityRequirementsTechn

demand response.

The CAISO's analysis estimated the battery storage resource characteristics—specifically the capacity (MW), energy (MWh), and discharge duration—required to seamlessly integrate into each local area and sub-area.[17] For battery storage resources to displace other local area resources, there must be sufficient transmission capability and local area generation resources, under the most limiting contingency, to recharge the batteries in anticipation of an outage continuing through a night and into the next day's peak load period.

The following example illustrates how to interpret the battery storage analysis. The example uses a peak day forecast load profile for the Placer sub-area.[18]

Figure 4: Placer LCR Sub-area 2021 Peak Day Forecast Profiles

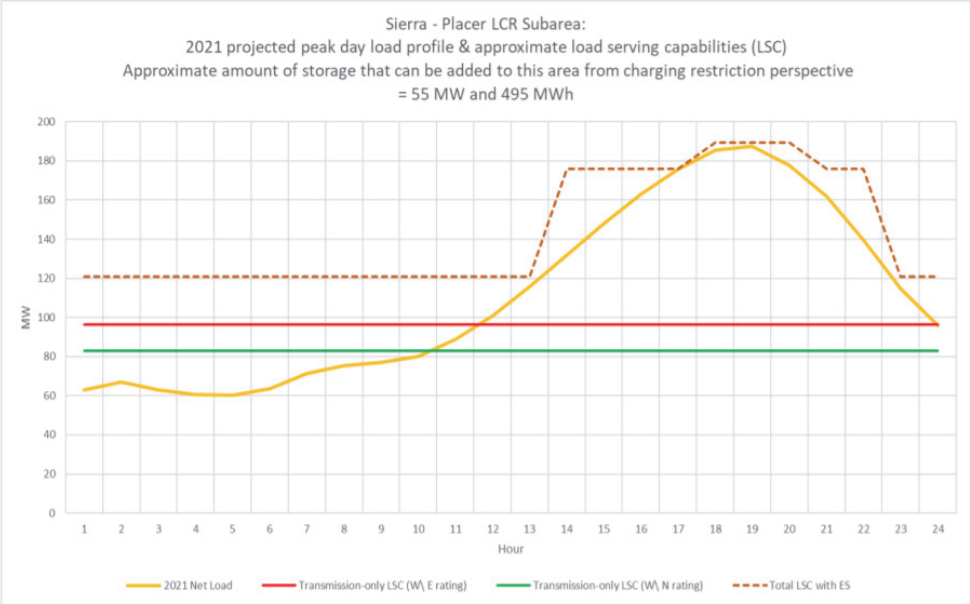

Figure 4 illustrates the load serving capabilities (LSC) in the Placer sub-area under three different scenarios. The brown dotted line reflects the total LSC with energy storage. This reflects the maximum level of battery storage in this sub-area that would still allow for

icalStudyResults.pdf

[17] For more details on methodology and analysis results, *see* Attachment C to the CAISO's August 7 initial proposals, Section 2.4: Estimate of Battery Storage Needs due to Charging Constraints in both the 2021 and 2025 Local Capacity Technical Studies.

[18] The CAISO reproduced this figure from the 2021 LCT Study. The full 2021 LCT Study was attached to the CAISO's August 7 initial proposals as Attachment C thereto.

recharging the battery under contingency conditions. The line provides the three dimensions CAISO used to evaluate battery storage characteristics: MW, MWh, and discharge duration. The approximate difference between the highest[19] and lowest point of the line is 55 MW, which represents the maximum battery capacity the Placer sub-area can accommodate. The approximate area under this line bounded by the lowest point of the line (120 MW) is 495 MWh, which is the energy requirement the battery storage needs to serve. The current resource adequacy program does not capture this energy requirement. The maximum required discharge duration is 10 hours, measured as the widest gap in the curve, between the thirteenth and twenty-third hour. Again, local resource adequacy requirements do not currently consider duration requirements. The CAISO has provided the same analysis for local capacity and sub-area in both the 2021 and 2025 LCT Studies.[20]

Under this example, the central procurement entity should ensure that if it procures 55 MW of battery storage, that storage should also deliver 495 MWh of energy with a maximum required discharge duration of 10 hours.[21] Furthermore, battery storage procured in excess of 55 MW would not offset the need for other local area resources due to charging limitations. Each LCT Study provides a summary table noting what resource types incremental battery storage resources would replace. In the 2021 LCT Study, the 55 MW (495 MWh) of incremental battery procurement in the Placer sub-area would only offset other required local area resources, which are mostly hydro resources.[22]

Installing battery storage with insufficient resource characteristics—in terms of MW, MWh or duration—will not result in a one-for-one reduction in local area or sub-area resource requirements. The overall resource adequacy portfolio for a local area or sub-area must include incremental capacity beyond the minimum LCR need (in MWs) if LSEs procure battery storage beyond the area charging capability or with incorrect resource characteristics (MW, MWh and duration). If LSEs do not provide resources with sufficient resource characteristics to meet contingency requirements, the CAISO may need to use the expanded local capacity procurement

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[19] The height differences are approximate as is the energy under the Total LSC with ES line.
[20] This includes each local area and sub-area except "non-flow-through" areas.
[21] This example assumes no batteries have previously been procured and all conditions remain the same in the Placer sub-area between the study and 2023.
[22] *See* Attachment C to the CAISO's August 7 initial proposals, Table 3.1-3 2021 Battery Storage Characteristics Limited by Charging Capability, 2021 LCT Study, p. 27.

back stop authority the CAISO is contemplating in its Resource Adequacy Enhancements stakeholder initiative.

The CAISO proposes that starting in 2023, the Commission should require central procurement entities and/or LSEs, as appropriate, to procure sufficient resource adequacy resources to account for identified availability limitations. LSEs should use the CAISO's analysis in the 2021 and 2025 LCT Studies immediately to inform battery storage procurement and recognize that each sub-area and local area has different resource requirements that may not be satisfied by new resources with minimum four-hour duration requirements. These studies can also inform the type of and level of retirement possible with additional battery storage procurement. Although it will be difficult for individual LSEs to coordinate on procurement in multi-LSE sub-areas and local areas, the CAISO believes the responsible local capacity central procurement entities will be better positioned to use the analyses to coordinate procurement across LSEs starting in 2023.

D. Proposal 4: Unforced Capacity Methodology for System Resource Adequacy

The Commission should adopt an unforced capacity (UCAP) methodology consistent with proposal the CAISO ultimately adopts in its Resource Adequacy Enhancements initiative. The UCAP methodology will assess capacity needs and resource contributions taking into account resource availability in addition to deliverability. The UCAP methodology recognizes unit-specific forced outage rates and accurately reflects this information in procurement.

1. Background

The rapid transformation to a more variable and energy-limited resource fleet and the migration of load to smaller and more diverse LSEs requires re-examining all aspects of the resource adequacy program. In 2006, at the onset of the resource adequacy program in California, natural gas, nuclear, and hydroelectric resources were the predominant generation technology types. Although some of these resources were subject to use-limitations due to environmental regulations, start limits, or air permits, they were generally available to produce energy when needed given they all had fairly dependable fuel sources. However, as the fleet

transitions to achieve the objectives of SB 100,[23] the CAISO must rely on a much different and more diverse resource portfolio to reliably operate the grid. In the Resource Adequacy Enhancements stakeholder initiative, the CAISO, in collaboration with Commission Energy Division staff and stakeholders, is exploring reforms to the resource adequacy rules, requirements, and processes to ensure continued reliability and operability under transforming grid conditions.

The State needs a vastly more robust framework to ensure future reliability as system conditions change rapidly, resources retire, and competition for limited capacity increases across the west. Accordingly, the CAISO is finalizing a proposal through its resource adequacy enhancements stakeholder initiative to move to a UCAP paradigm that would: (1) account for unit-specific forced outage rates ahead of showings (rather than through capacity substitution provisions and after-the fact charges); (2) help LSEs identify which resources contribute the most to reliability; and (3) incentivize resource owners to invest in proper maintenance to increase their resources' availability and, therefore, the amount of resource adequacy capacity they can sell.[24]

2. Proposal

The UCAP proposal the CAISO is considering in its Resource Adequacy Enhancements initiative has two primary elements. First, it incorporates a UCAP counting methodology to determine UCAP/NQC capacity values for generation resources.[25] Second, it establishes UCAP/NQC-based procurement requirements.

This UCAP counting methodology moves away from the current resource counting methodology, which derives net qualifying capacity value (NQC) by taking qualifying capacity value minus deliverability adjustments. A UCAP counting methodology will determine a resource's UCAP/NQC value by discounting its deliverable qualifying capacity value to account for recent historical unit forced and urgent outage rates during tight resource adequacy supply hours. This change is necessary because the current PRM assumes forced outage rates that are

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[23] 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

[24] Moving to an UCAP paradigm will also mean eliminating RAAIM.

[25] The CAISO uses the term UCAP/NQC to refer to the net qualifying capacity which incorporates derates for availability through the unforced capacity evaluation. We use this term to clarify that NQC will represent a different capacity valuation under the UCAP paradigm than NQC does today.

inaccurate (*i.e.*, unreasonably low). The low and static forced outage rate embedded in the PRM does not change as the fleet forced outage rate changes. Additionally, the tools the CAISO currently uses to incentivize resources to provide replacement capacity for forced outages are ineffective. The UCAP methodology will better incentivize LSEs to procure more reliable resources in the first instance and encourage resources to avoid forced outages. The CAISO proposes the Commission adopt the UCAP counting methodology to determine UCAP/NQC values for generation resources.

The second element of the CAISO's proposal is to establish UCAP/NQC-based procurement requirements. Setting requirements in terms of UCAP/NQC is the best approach to ensure that the CAISO can reliably meet system needs. The CAISO provides details regarding the efforts to help determine the minimum system UCAP requirements, but notes these efforts are still in progress. Over the course of this proceeding and through the CAISO's Resource Adequacy Enhancements stakeholder initiative, the Commission and CAISO should work collaboratively to set the correct UCAP system requirement levels and ensure the Commission's resource adequacy requirements support the CAISO's reliability requirements.

a. UCAP-Based Resource Counting Rules

Since the Commission implemented the PRM in 2006, the PRM has included an assumed system-wide forced outage rate at four to six percent of the total 15 percent PRM.[26] However, the CAISO has observed forced outage rates far exceeding this amount. Table 3 provides the average daily forced outage rates for resource adequacy resources from May 2018 through October 2020. In nearly all months, the resource adequacy fleet exceeded the static four to six percent forced outage rate assumed in the PRM. On average, the CAISO resource adequacy resources experienced a daily forced outage rate of 9.78 percent.

[26] D.04-01-050 adopts a 15-17 percent reserve level, which includes an operating reserve margin of seven percent. Given a forecasting margin of error of four percent, the estimated system forced outage rate is four to six percent. D.04-10-035 accelerates the full implementation of the 15-17 percent PRM from 2008 to 2006.

Table 3: Average monthly forced outage rates for all resource adequacy resources, May 2018 through April 2020

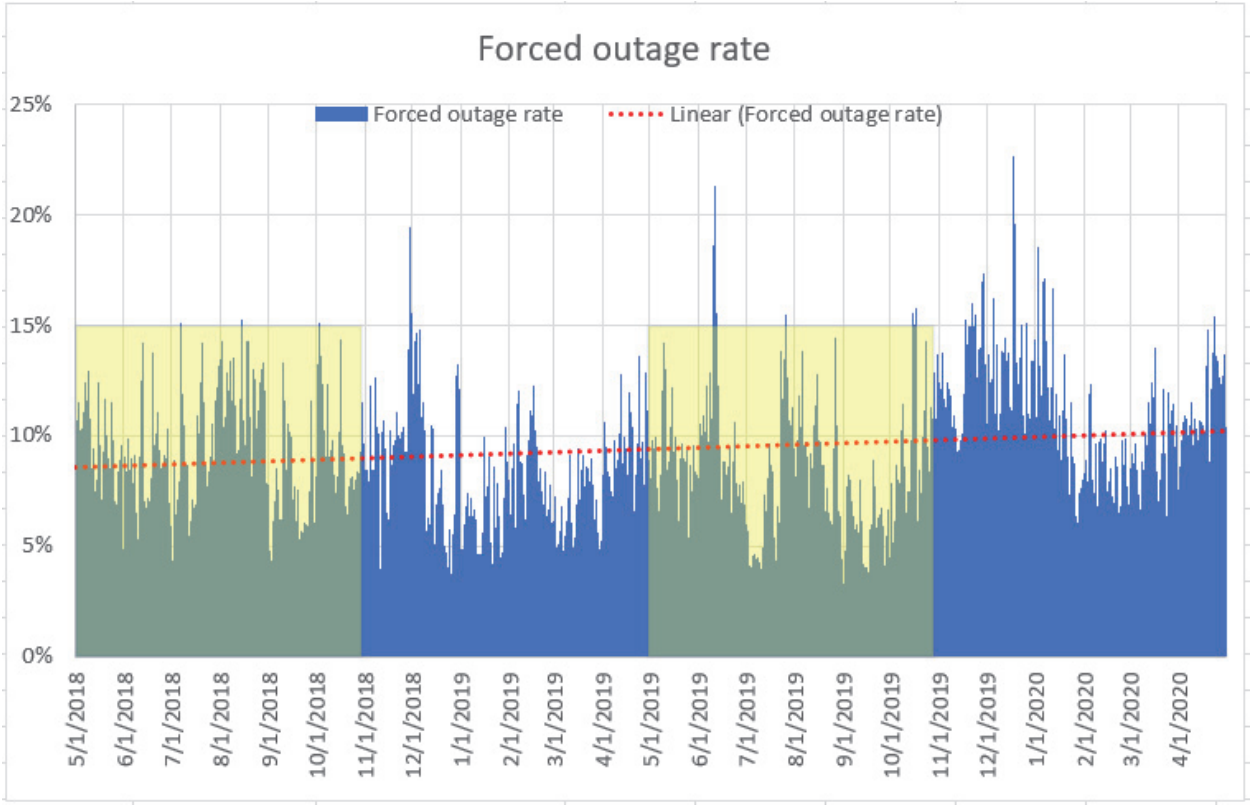
Month	2018	2019	2020	Mean
1		6.53	11.02	8.78
2		8.52	8.66	8.59
3		6.82	9.57	8.20
4		9.52	11.42	10.47
5	9.53	9.07	9.76	9.45
6	8.79	10.15	10.18	9.71
7	9.43	7.66	9.87	8.99
8	11.66	8.78	10.45	10.30
9	7.65	6.11	13.39	9.05
10	9.61	10.11	14.91	11.54
11	9.97	12.8		11.39
12	8.57	13.24		10.91
Average	9.40	9.11	10.17	**9.78**

Source: CAISO Customer Interface for Resource Adequacy (CIRA) data

Figure 5 below shows daily resource adequacy unit forced outage rates from May 1, 2018 through April 30, 2020. This figure shows forced outage rates regularly exceeded the fleet wide average of ten percent and exceeded 15 percent on multiple occasions, including on higher load days and during peak-load seasons. Further, the data shows that the resource adequacy resource forced outage rate increased over time as shown by the red dotted line in Figure 5, which reflects prevailing direction of the forced outages rates.[27]

[27] The trend line in Figure 5 was produced using the Excel functionality in which the data presented in Figure 5 was evaluated.

Figure 5: Daily forced outage rates, May 1, 2018 through April 30, 2020



Currently the CAISO relies on substitution rules and the resource adequacy availability incentive mechanism (RAAIM) to discipline capacity availability. However, experience shows these rules (1) may not ensure substitute capacity is provided in a timely manner, (2) create a perverse "capacity withholding" risk management incentive, (3) allow for cross-subsidization of outages within a Scheduling Coordinator's (SCs) portfolio of resources, and (4) do not provide an up-front incentive to reliably maintain resources.

The need to find substitute capacity for forced outages, by definition, happens with very little notice. Often, it is either impossible for the SC to find substitute capacity or the capacity costs more than the SC is willing to pay.[28] To mitigate the risk of being unable to find substitute capacity, an SC may withhold capacity from the bilateral market to self-provide substitute capacity. This decreases the amount of capacity available for both month-ahead resource adequacy sales and substitute capacity.

Additionally, most SCs have a portfolio of resources, which allows them to recoup

[28] The latter is particularly true if the resource is above the 94.5 percent availability.

RAAIM charges assessed against one resource through incentive payments paid to another resource. This cross-subsidization further reduces the incentive to procure replacement capacity, potentially leaving the CAISO with insufficient capacity. This increases backstop capacity procurement risk and can degrade system reliability. The CAISO assessed 2018 and 2019 RAAIM charges and found that many SCs recovered all or most of their RAAIM non-availability charges through RAAIM incentive payments to their other resources. Further, RAAIM only offers an after-the-fact penalty and does not actually incentivize or assure sufficient resource availability,[29] allowing resources to defer maintenance until the outage occurs. These represent some of the flaws the CAISO has identified with the existing RAAIM structure.[30]

Under the CAISO's proposed UCAP paradigm, the Commission would continue to determine qualifying capacity values, including ELCC values, for resources. The CAISO would then establish net qualifying capacity values using a two-step process. In the first step, the CAISO will conduct a resource deliverability assessment to adjust QC for deliverability to determine the deliverable qualify capacity (DQC). This DQC process will be the same as the current net qualifying capacity approach in effect today with no changes to the deliverability assessment. The second step will consider the resource forced and urgent outages and derates to calculate seasonal availability factors for the prior three years. The CAISO proposes to weight the most recent years more heavily to create a Weighted Seasonal Average Availability Factor. The CAISO will apply this Weighted Seasonal Average Availability Factors to the resource DQC, which will determine the final net-qualifying capacity (NQC). The resource's must offer obligation would be set at its shown DQC.[31] Annually, the CAISO would calculate and publish monthly DQC and NQC values for all resources.[32]

The CAISO proposes to calculate two seasonal availability factors for UCAP

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[29] *See* Attachment C.
[30] For additional details regarding challenges with RAAIM, *see* Attachment C.
[31] *I.e.*, shown NQC divided by the Weighted Seasonal Average Availability Factors.
[32] Once per year a unit will get a distinct DQC and NQC value for each month of the upcoming year which will take into account both its deliverability and availability. Given the relationship between DQC and UCAP/NQC, although a resources' Weighted Average Availability Factors will only be calculated on an annual basis, if a resource's DQC value increases mid-year, as allowed under the existing tariff, the CAISO will update the resource's DQC and UCAP/NQC value accordingly.

determination purposes, one for on-peak months (May-October) and one for off-peak months (November-April). UCAP values will not be affected by CAISO approved planned or opportunity outages.[33]

The CAISO and the Commission would use the resulting UCAP/NQC values to validate system, local, and flexible resource adequacy showings. The basic UCAP methodology described above would apply to dispatchable thermal and storage resources. For resources with qualifying capacity values calculated using an ELCC methodology,[34] the CAISO would use the ELCC value, with any reductions for deliverability, as the UCAP/NQC value because the ELCC methodology already accounts for forced outages. For non-dispatchable resources with qualifying capacity values that already take into account their forced outage rate, the DQC and UCAP/NQC values will be equal. The CAISO has also developed special UCAP methodologies for QFs, hybrid and co-located resources, hydro resources, and imports that best capture their availability. Specific details regarding the CAISO's current proposals for calculating UCAP values for these resource types are provided in Section 6.1.1 of the CAISO's Sixth Revised Straw Proposal in the Resource Adequacy Enhancements stakeholder initiative (Attachment C). As indicated above, the CAISO will continue to vet these matters further with the Commission and stakeholders.

b. UCAP-Based Procurement Requirements

Through this resource adequacy proceeding and the CAISO resource adequacy enhancements initiative, the CAISO proposes to work jointly with the Commission to apply the framework provided in its preliminary portfolio assessment and determine the appropriate metrics for establishing the appropriate level of procurement and measures of reliability. Historically in California, the PRM accounts for reserve requirements, load forecast error, and a static forced outage rate.[35] Under the CAISO's UCAP proposal, the PRM need not consider a

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[33] Opportunity outages are facility/equipment outages that did not meet the short range window requirements for planned outages but can be taken due to a change in system conditions, weather or availability of field personnel.
[34] While storage resources have an ELCC value, this is currently set to 1, so the CAISO will apply the basic UCAP methodology to storage resources to account for their forced outage rates.
[35] The purpose of the resource adequacy program is to ensure the CAISO can serve forecasted peak load while carrying 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, and must have sufficient resource adequacy capacity to provide regulation and the flexible ramping product. 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

forced outage rate because it will be embedded in the resource UCAP/NQC values. After removing forced outages, the PRM will only need to account for load forecast error and reserve requirements.

One of the core elements of the CAISO's Resource Adequacy Enhancements stakeholder initiative is developing and using a production simulation tool that can assess how likely the shown monthly resource adequacy fleet supports grid reliability all hours. The CAISO will conduct a monthly portfolio deficiency test of the shown resource adequacy fleet to determine if the resource adequacy 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 resource adequacy fleet in a stochastic production simulation to determine if the CAISO can serve forecasted gross and net-load peaks, and maintain adequate reserves and load following capability, in that resource adequacy compliance month. A stochastic monthly assessment of the resource adequacy fleet poses unique challenges that do not exist under the simple accounting tools currently used to ensure resource adequacy compliance. Two core challenges must be addressed:

(1) Establishing a defined reliability criteria (*i.e.*, probability of resource adequacy deficiency or loss-of-load expectation) that determines procurement targets and backstop procurement triggers; and

(2) Determining the quantity and attributes of capacity needed to address a portfolio deficiency.

In the resource adequacy enhancements stakeholder initiative, the CAISO has not explicitly answer these two questions. Instead, using actual resource adequacy showings from July 2020, the CAISO provided a framework to consider how to derive answers to further vet with stakeholders.[36]

The CAISO intends to bring a final UCAP proposal as part of the Resource Adequacy Enhancements stakeholder initiative to the CAISO Board in second quarter of 2021. The CAISO will conduct a shadow analysis of the UCAP methodology during the 2022 resource adequacy year. The CAISO proposes that the UCAP paradigm become binding for the 2023 resource

[36] A link to the portfolio assessment can be found at http://www.caiso.com/InitiativeDocuments/PreliminaryPortfolioAnalysis-ResourceAdequacyEnhancements.pdf

adequacy year. This timing is important because it avoids multi-year procurement that could be split between the current counting methodologies and the UCAP counting methodologies. The CAISO intends to coordinate this implementation timeline with its other proposals for availability limited resource procurement, resource adequacy imports rules, and a forthcoming proposal on multi-year flexible capacity procurement requirements.

E. Proposal 5: Multi-Year System Capacity Requirements

The CAISO recommends the Commission adopt multi-year system resource adequacy requirements for its LSEs. Multi-year system resource adequacy requirements are necessary to maintain near-term reliability and ensure continued operation of existing generation resources.

1. Background

In Decision (D.) 17-09-020, the Commission adopted a three-year forward local resource adequacy requirements.[37] The Commission did not adopt multi-year system or flexible requirements at that time, though it did provide that future resource adequacy proceedings should consider such requirements.[38] In in its August 7 submission, the CAISO did not propose a multi-year system resource adequacy requirement because of the ongoing market design work in the Resource Adequacy Enhancements and Day-Ahead Market Initiatives. However, the CAISO continued to support the core tenets of its 2018 testimony regarding the need for multi-year capacity procurement. After further review, the CAISO believes the Commission can implement multi-year system resource adequacy requirements now, notwithstanding any ongoing CAISO stakeholder initiatives.

2. Proposal

The Commission should adopt multi-year system resource adequacy requirements for its LSEs. Multi-year system resource adequacy requirements are necessary to maintain near-term reliability and ensure continued operation of existing generation resources. Since issuance of D.17-09-020, the need for a multi-year forward system capacity procurement has grown more acute, as indicated by the 3,300 MW system capacity procurement authorized under D.19-11-016 at the end of 2019. This emergency procurement, which the CAISO supported, notably

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[37] *See* the Proposed Decision, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M270/K469/270469481.PDF, at pp. 20-22.

[38]

addressed *peak system* capacity shortfalls in the resource adequacy program from 2021 through 2023. The Commission authorized procuring the incremental capacity through the procurement track of the integrated resource plan (IRP) proceeding because the resource adequacy program does not have a forward capacity mechanism to address peak system needs beyond a single year forward.

On the other hand, the CAISO's operational analysis showed that the greatest *system energy* need occurred in the hours after sunset when summer loads remain high, but solar resource production wanes. The maximum hourly energy need in the CAISO's conservative analysis was 4,400 MW in 2021 and 4,700 MW in 2022.[39] The CAISO has also consistently urged the Commission to authorize resource procurement to replace the loss of the Diablo Canyon Nuclear Power Plant (Diablo Canyon).[40] It is critical the Commission establish a multi-year system requirement to ensure there is sufficient forward visibility, planning, and procurement to address Diablo Canyon retirement and the resulting operational needs of the grid. Finally, the CAISO most recently submitted a resource stack analysis in the Commission's emergency electric reliability proceeding (R.20-11-003) showing potential system deficiencies in 2021, even with recently authorized procurement and continued reliance on once-through-cooling generation. These studies show the need to procure new resources and retain all resources in the existing fleet. A multi-year system resource adequacy requirement can help maintain these resources while appropriately avoiding the need for CAISO out-of-market procurement.

Based on these system needs, the CAISO recommends that the Commission adopt a three-year forward system resource adequacy requirement for its LSEs. The requirement targets should be set as follows:

Year	Requirement
Year 1	100%
Year 2	100%
Year 3	80%

[39] CAISO Reply Comments, R.16-02-007, August 12, 2019, p. 2.
[40] CAISO Reply Comments on Proposed Schedule, R.20-05-003, July 24, 2020, pp. 2-3

Setting relatively high multi-year system resource adequacy requirements will help maintain existing resources while avoiding CAISO out-of-market procurement. The CAISO recommends that the Commission adopt these multi-year system resource adequacy requirements for the 2022 resource adequacy year.

F. Proposal 6: Increased PRM for 2022

In the Commission's Electric Reliability proceeding regarding summer 2021 resource needs, the CAISO recommended the Commission adopt a 20% PRM that considers resource needs during the 8:00 p.m. hour for June through October 2021. The CAISO recommends the Commission adopt this same approach for summer 2022 as well. This increased PRM should serve as an interim measure to maintain reliability prior to implementing the other proposals discussed herein, particularly the UCAP proposal. Once that proposal has been implemented, the PRM could be adjusted downward, as described in the CAISO's UCAP proposal.

The CAISO includes its opening comments on the Electric Reliability Order Instituting Rulemaking to provide more details regarding its increased PRM proposal as Attachment D hereto.

G. Informational Update Regarding SCE-CalCCA Proposal on Setting Net Peak Requirements

On August 7, 2021, SCE and CalCCA submitted a joint proposal for setting procurement requirement to meet net peak demand needs.[41] The SCE-CalCCA proposal offers many positive elements, and the CAISO recommends the Commission and parties continue to vet, develop, and consider necessary and appropriate enhancements to the proposal for possible implementation in 2023. The CAISO has identified several additional issues regarding the proposal that first should be addressed, and the CAISO desires to help inform this process along with SCE, CalCCA, and other interested parties prior to adopting any final proposal.

The SCE-CalCCA proposal incorporates several important elements that are worth pursuing. For example, the proposal expands the current resource adequacy construct to incorporate energy sufficiency, which is consistent with the CAISO's concern of over-reliance on availability-limited resources given the needs of the transforming grid and the pursuit to

[41] Southern California Edison Company and California Community Choice Association's Track 3 Proposal, August 7, 2021.

replace the energy from traditional fuel-backed resources. The SCE-CalCCA proposal also aligns well with the CAISO's proposed transition to UCAP values and its proposed portfolio assessment to the set minimum system resource adequacy requirements. It achieves these goals largely by providing an explicit resource adequacy requirement based on net load. The CAISO strongly agrees that the resource adequacy program must adapt to consider system needs beyond just the system peak demand period and include the net-load peak demand period.

The SCE-CalCCA proposal requires additional vetting and issue resolution before implementation, but it is worthy starting point for Commission consideration. Prior to adopting the SCE-CalCCA proposal, parties and the Commission should develop solutions to several critical issues, including:

- **Ensuring adequate capacity at the gross peak** – Although the CAISO agrees ensuring adequate capacity during net load peak is an immediate concern, singular focus on meeting this need without an eye towards still ensuring resource adequacy can meet the gross peak needs may result in trading one shortfall for another (*i.e.*, serving net-load peak, but not gross load).
- **The treatment of use- and availability-limited resources** – The shift to a fleet more reliant on use- and availability-limited resources makes energy adequacy a critical component of defining resource adequacy. Thus, establishing rules for determining the net qualifying energy value for these resources is critical. Although some parties may wish to take an optimistic stance on energy potential for use- and availability limited resources, it is best to start with a conservative approach to ensure the LSEs are procuring adequate energy and evolve that approach based on operational experience.
- **Specific resource showing requirements and impact on must-offer obligations** – Resource adequacy is about providing transparency to the CAISO regarding which resources have an obligation to be available to its markets. This means wind and solar resources must still be shown as resource adequacy resources. This ensures that the CAISO has visibility of all resources it can rely on to meet gross and net load, and that those resources have an associated must-offer obligation.

The CAISO is committed to work with SCE and CalCCA to address these issues and providing more detailed recommendations in its reply comments on the SCE-CalCCA final proposal.

III. Conclusion

The CAISO appreciates the opportunity to submit proposals.

Respectfully submitted,

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Date: December 18, 2020

California Independent System Operator Corporation

R.19-11-009

Attachment A

Updated E3 ELCC Study

Energy+Environmental Economics

Demand Response ELCC

CAISO

December 2020

Zach Ming, Director
Vignesh Venugopal, Consultant
Arne Olson, Sr. Partner

Overview

- **In May 2020, E3 publicly released a study quantifying the reliability contribution of demand response in the CAISO**
  - This original study is contained in slides 3 – 35 of this presentation
- **In December 2020, E3 publicly released an update of the study based on new information provided by SCE**
  - This updated study results are contained in slides 36 – 40 of this presentation

Energy+Environmental Economics

Original Demand Response ELCC Study

CAISO ESDER Stakeholder Meeting
May 27, 2020

Zach Ming, Director
Vignesh Venugopal, Consultant

Overview

Background

- California has a unique approach to capacity procurement, where the CPUC administers a Resource Adequacy (RA) program to ensure sufficient resources to maintain an acceptable standard of reliability, but the CAISO retains ultimate responsibility for the reliable operation of the electricity system
- The CAISO was concerned that demand response (DR) was being overcounted in the Resource Adequacy program based on observed demand response bid data

Project

- The CAISO retained E3 to investigate the reliability contribution of DR relative to its capacity value in the CPUC administered RA program
- To the extent that DR is overvalued, the CAISO asked E3 to suggest solutions to issue
- E3 provided technical analysis to support the CAISO in this effort

Disclaimer required by the California Public Utilities Commission

This report has been prepared by E3 for the California Independent System Operator (CAISO). This report is separate from and unrelated to any work E3 is doing for the California Public Utilities Commission. While E3 provided technical support to CAISO preparation of this presentation, E3 does not endorse any specific policy or regulatory measures as a result of this analysis. The California Public Utilities Commission did not participate in this project and does not endorse the conclusions presented in this report.

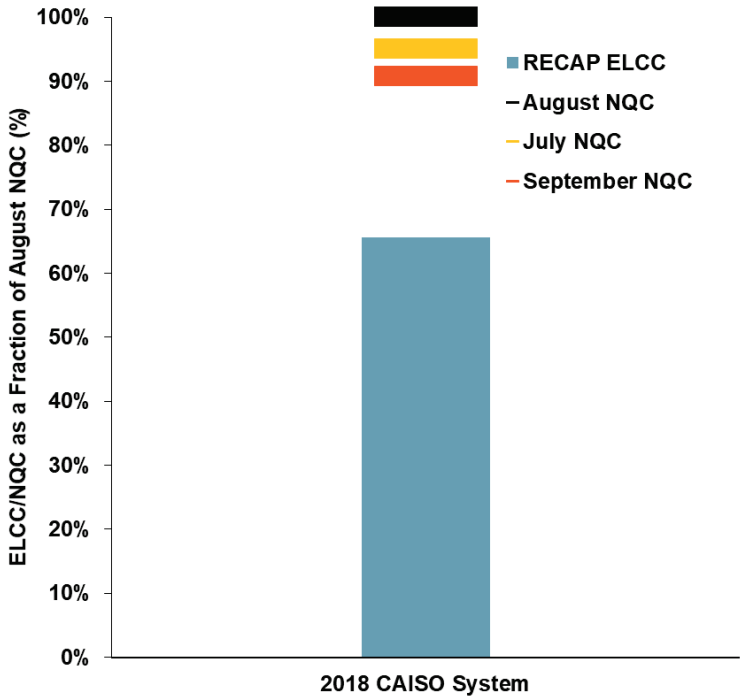
Outline

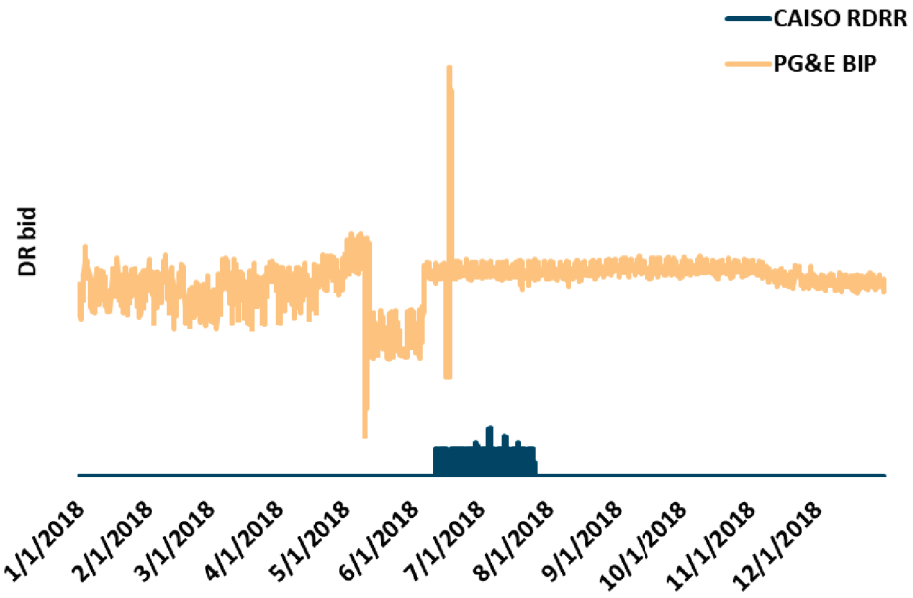
- **Refresher on March 3 CAISO stakeholder meeting presentation**
- **Background on ELCC**
- **Performance of Existing DR**
- **Characteristics of DR Needed for ELCC**
  - Time availability
  - # of calls / duration of calls
  - Penetration of DR
- **Incorporating DR ELCC into Existing CPUC RA Framework**
- **Questions**

Acronyms

Acronym	Name	Description
API	Agricultural and Pumping Interruptible	DR program to suspend agricultural pumping
BIP	Base Interruptible Program	Participants are offered capacity credits for reducing their demand up to a pre-determined level in response to an event call
CBP	Capacity Bidding Program	DR program where aggregators work on behalf of utilities to enroll customers, arrange for load reduction, receive and transfer notices and payments
DR	Demand Response	Reductions in customer load that serve to reduce the need for traditional resources
ELCC	Effective Load Carrying Capability	Equivalent perfect capacity measurement of an intermittent or energy-limited resource, such as DR
LCA	Local Capacity Area	Transmission constrained load pocket for which minimum capacity needs are identified for reliability
LIP	Load Impact Protocol	Protocols prescribed by the CPUC for accurate and consistent measuring (and forecasting) of DR program performance
LOLP	Loss of Load Probability	Probability of a load shedding event due to insufficient generation to meet load + reserve requirements
NQC	Net Qualifying Capacity	A resource's contribution toward meeting RA after testing, verification, and accounting for performance and deliverability restrictions
PDR	Proxy Demand Response	Resources that can be bid into the CAISO market as both economic day-ahead and real-time markets providing energy, spin, non-spin, and residual unit commitment services
PRM	Planning Reserve Margin	Capacity in excess of median peak load forecast needed fore reliability
RA	Resource Adequacy	Resource capacity needed for reliability
RDRR	Reliability Demand Response Resource	Resources that can be bid into CAISO market as supply in both economic day-ahead and real-time markets dispatched for reliability services
SAC	Smart AC Cycling	Direct air conditioner load control program offered by PG&E
SDP	Summer Discount Plan	Direct air conditioner load control program offered by SCE
SubLAP	Sub-Load Aggregation Point	Defined by CQAISO as relatively continuous geographical areas that do not include significant transmission constraints within the area

Refresher on March 3 CAISO ESDER Meeting





Established disconnect between ELCC and NQC

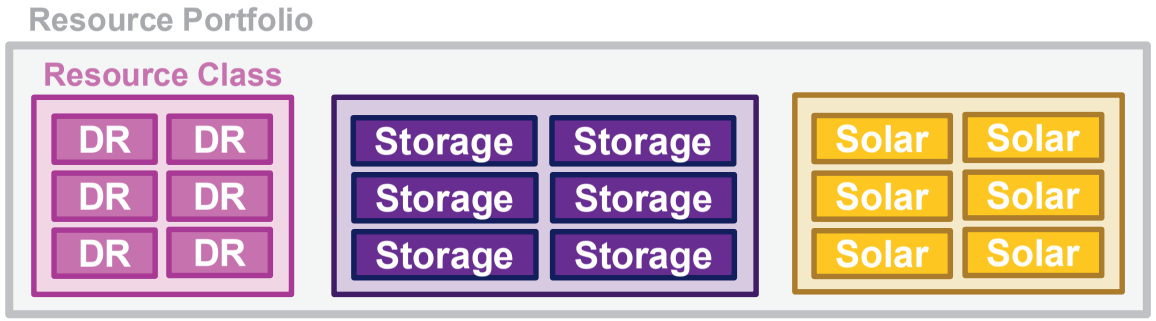
Provided E3 thoughts on how to match CAISO and utility DR bid data as well as techniques to extend this data over multiple historic weather years. Both points were addressed with the 2019 data.

Key Questions to Answer

1) How are demand response programs performing today, relative to what they are being credited for?

2) What characteristics of demand response are needed today and in the future?

3) How should a resource adequacy program be designed to allocate and credit both DR in aggregate and individual DR programs?



Energy+Environmental Economics

Background on ELCC

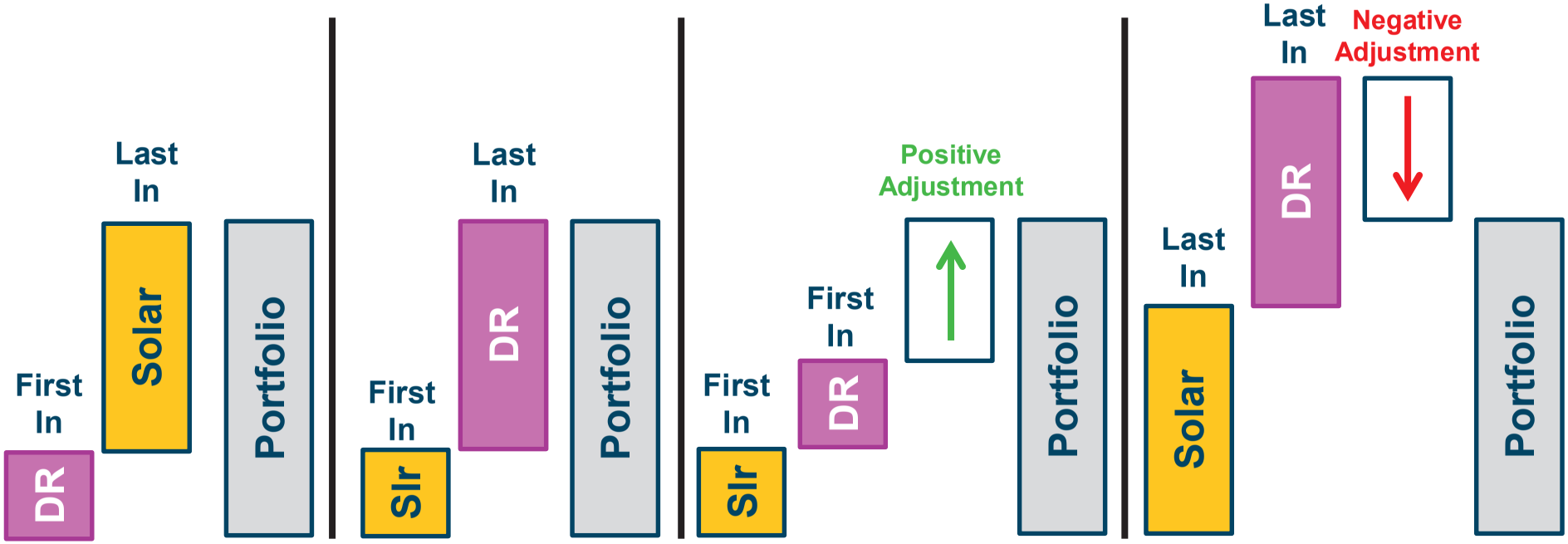
Effective Load Carrying Capability (ELCC)

- **Effective Load Carrying Capability (ELCC) is a measure of the amount of equivalent perfect capacity that can be provided by an intermittent or energy-limited resource**
  - **Intermittent resources:** wind, solar
  - **Energy-limited resources:** storage, demand response
- **Industry has begin to shift toward ELCC as best practice, and the CPUC has been at the leading edge of this trend**

A resource's ELCC is equal to the amount of perfect capacity removed from the system in Step 3

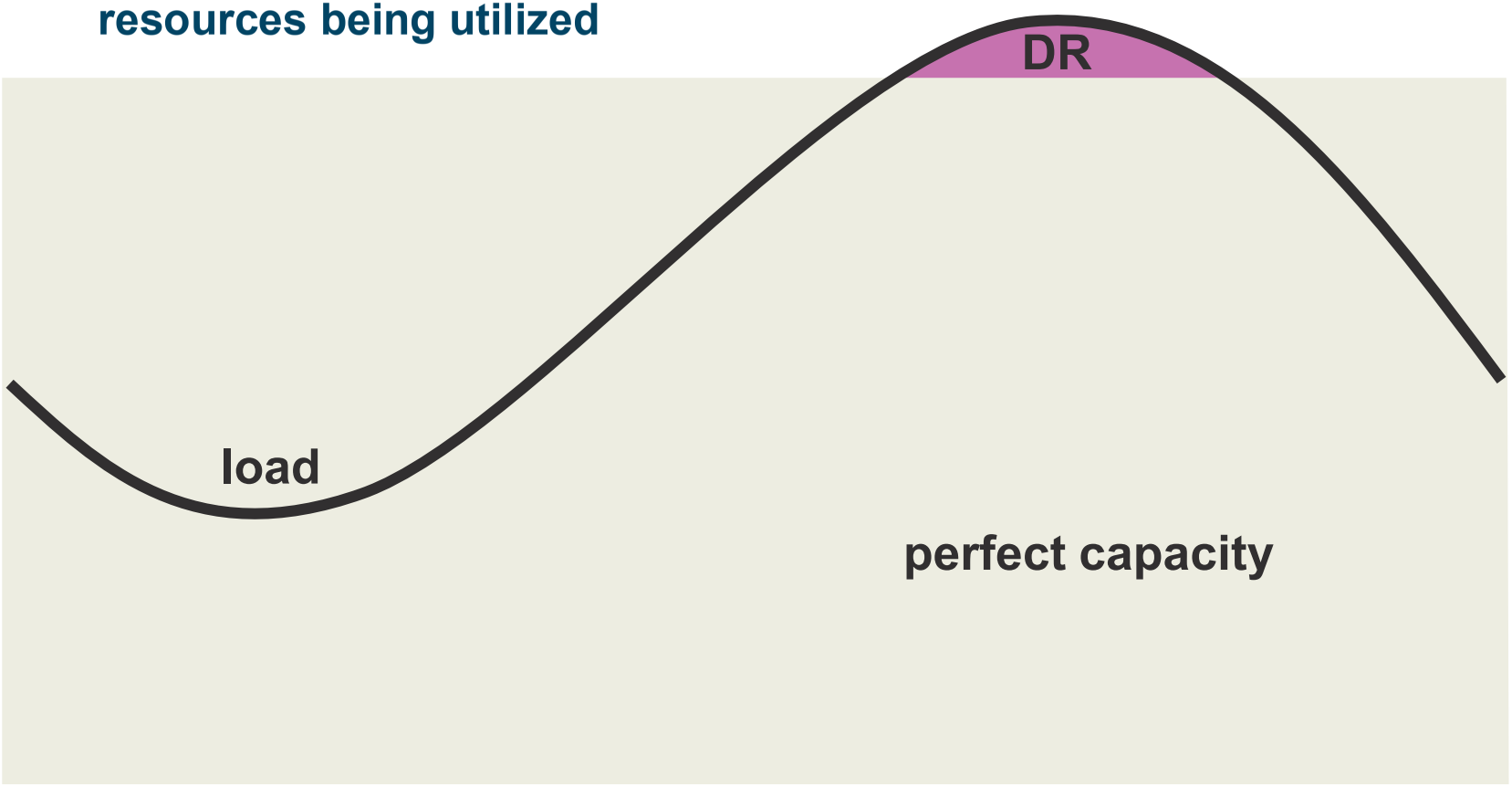
Measuring ELCC

- **There are multiple approaches to measuring the ELCC of a resource(s)**
  - **Portfolio ELCC:** measures the combined ELCC of all intermittent and energy-limited resources on the system
  - **First-In ELCC:** measures the marginal ELCC of a resource as if it were the only intermittent or energy-limited resource on the system, thus ignoring interactive effects
  - **Last-In ELCC:** measures the marginal ELCC of a resource after all other intermittent or energy-limited resources have been added to the system, capturing all interactive effects with other resources



"First-In" ELCC

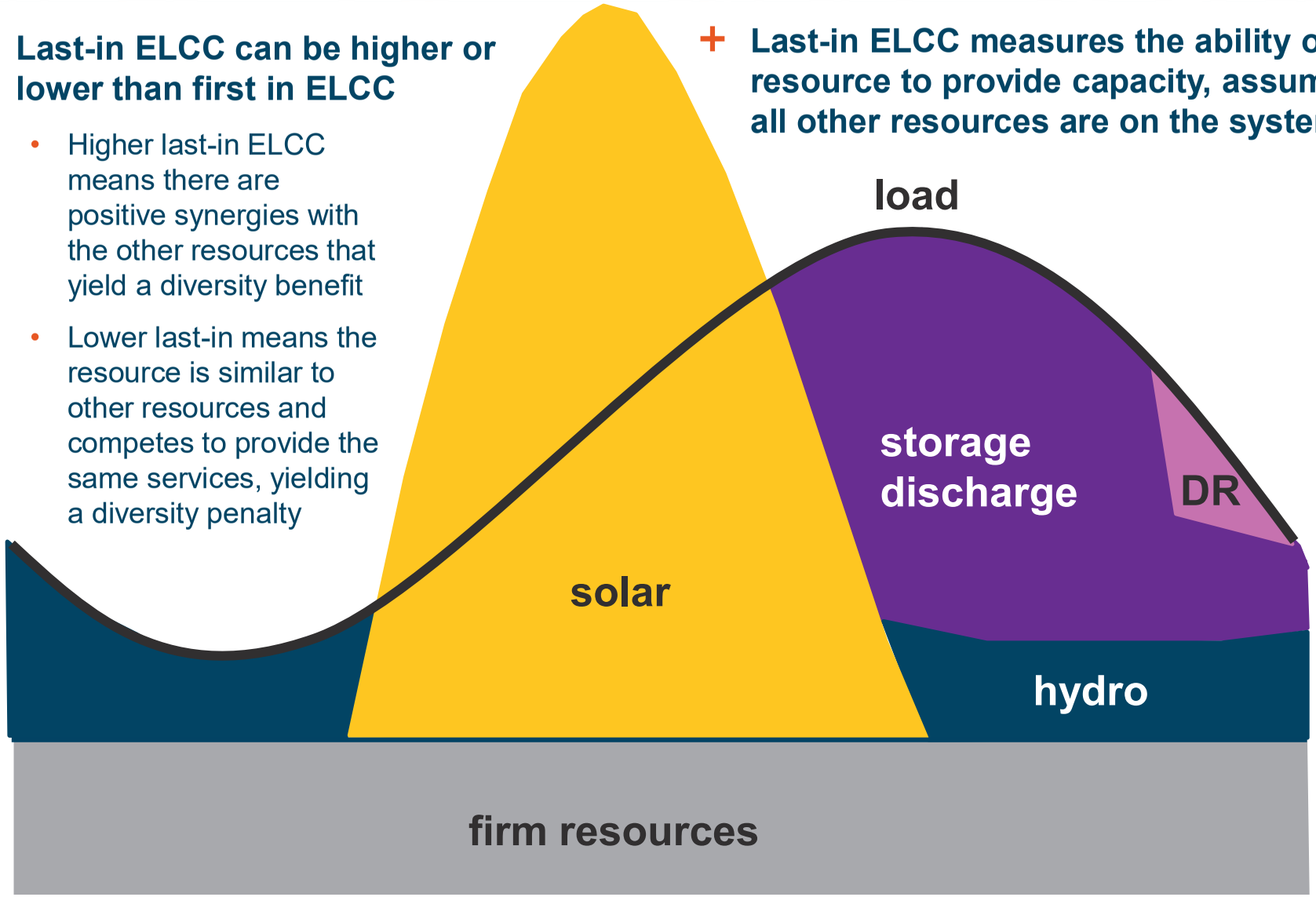
- First-in ELCC measures the ability of a resource to provide capacity, absent any other resource on the system
- This measures the ability of a resource to "clip the peak" and is often analogous to how many industry participants imagine capacity resources being utilized



"Last-In" ELCC

+ **Last-in ELCC can be higher or lower than first in ELCC**
  - Higher last-in ELCC means there are positive synergies with the other resources that yield a diversity benefit
  - Lower last-in means the resource is similar to other resources and competes to provide the same services, yielding a diversity penalty

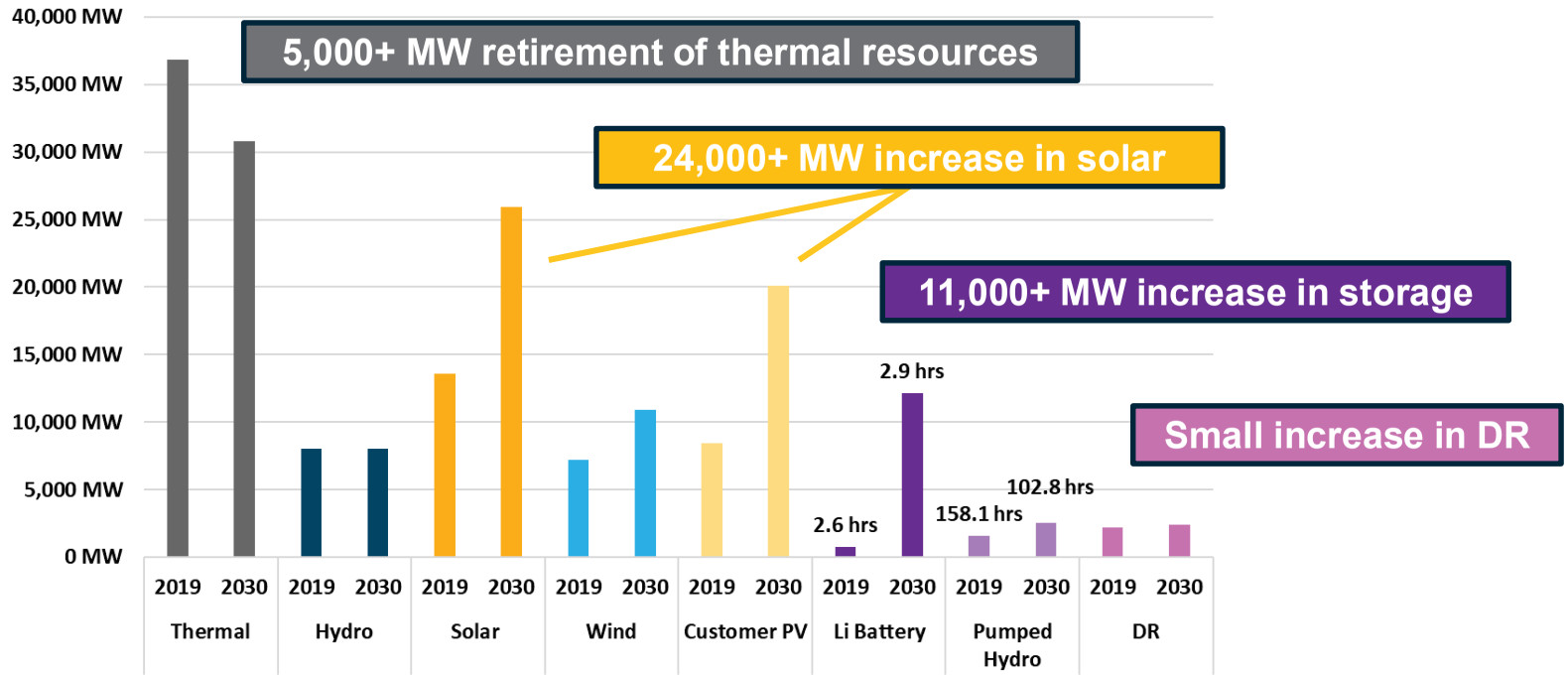
+ **Last-in ELCC measures the ability of a resource to provide capacity, assuming all other resources are on the system**



Today (2019) vs. Future (2030)

- E3 analyzed the value of DR to the CAISO system today (2019) and the future (2030) to assess how coming changes to the electricity system might impact value
- Primary changes are on the resource side (shown below) with modest changes to loads (49 GW 2019 peak load vs 53 GW 2030 peak load)

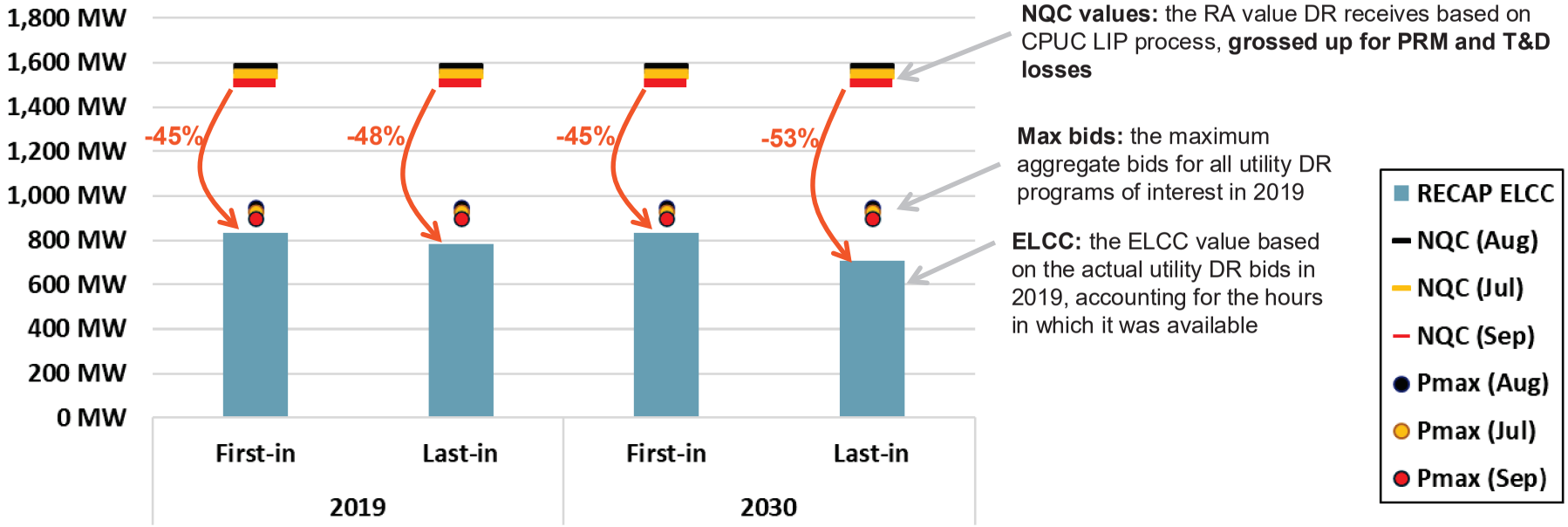
2019 and 2030 CAISO Resource Portfolio



Source: CPUC Integrated Resource Plan (IRP) Reference System Plan (RSP)

Performance of Existing PG&E and SCE event-based DR Programs

- **Demand response (DR) resource adequacy qualifying capacity is currently calculated using the load impact protocols (LIP), which are performed by the utilities under the oversight of the CPUC**
  - LIP uses regression and other techniques to estimate the availability of demand response during peak load hours
- **E3 has analysis suggests that LIP overvalues the capacity contribution DR relative to ELCC by 30%+ for two reasons:**
  1) DR does not bid into the CAISO market, in aggregate, at levels equal to its NQC value
  2) The times when DR is bid are either not at optimal times or not for long enough to earn full ELCC value



Load impacts are grossed up for transmission and distribution losses, as also the 15% PRM, owing to demand response being a demand reduction measure

$$NQC = LI * 1.15\,(PRM) * T\&D\ loss\ factor$$[1]

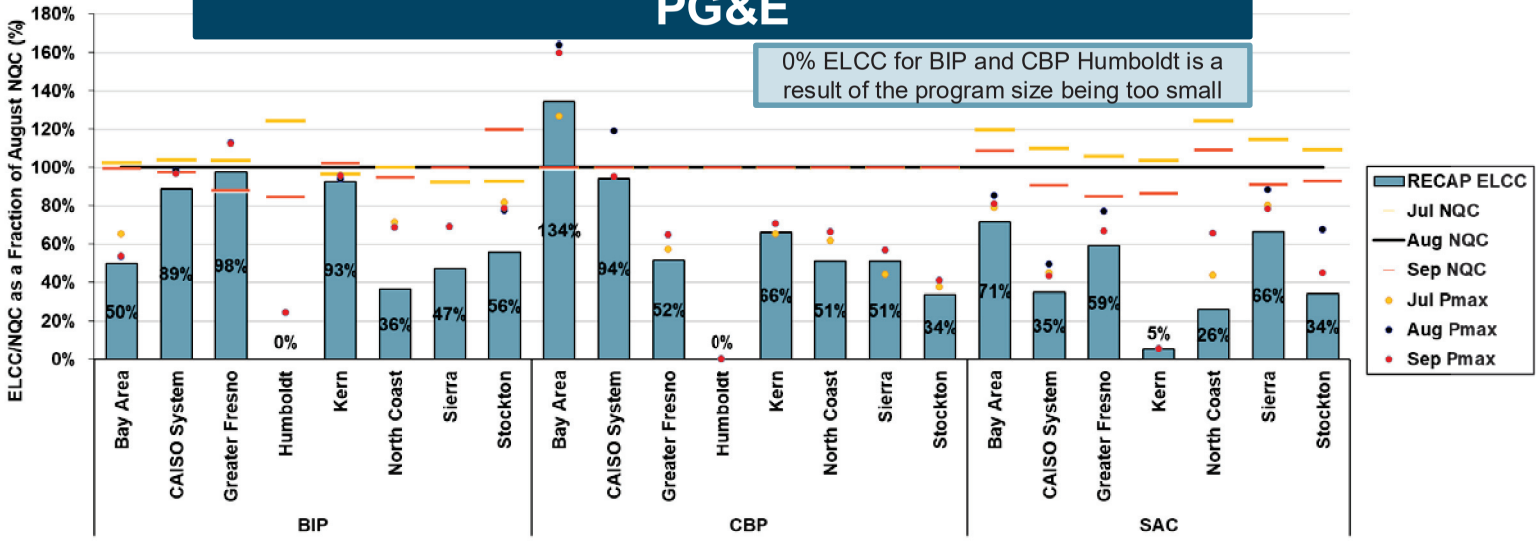
Load impacts for the year 2019 are referenced from the CPUC's RA Compliance documents[2]

Load impacts are defined on an LCA level from 1 pm to 6 pm, Apr to Oct, and from 4 pm to 9 pm in the rest of the year, both with and without line losses

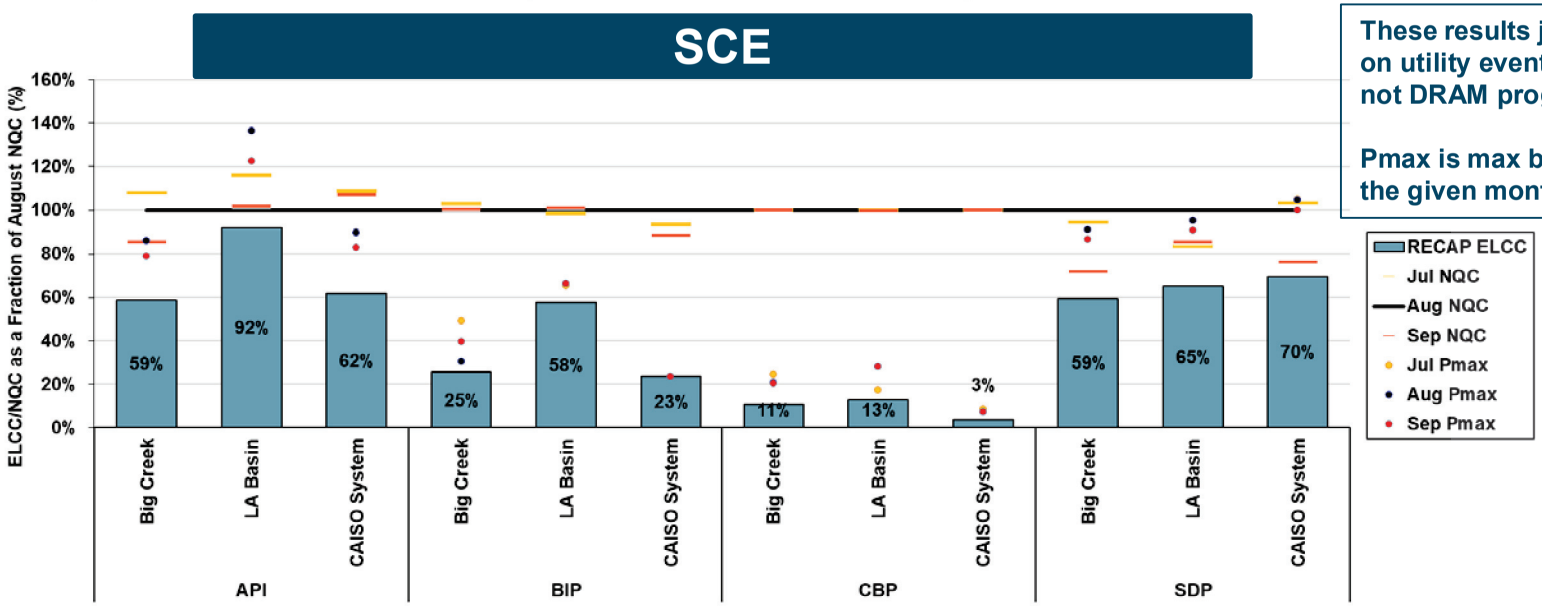
[1] CPUC 2019 RA Guide
[2] CPUC 2019 IoU DR Program Totals

First-in ELCC of PG&E and SCE Programs

PG&E



SCE



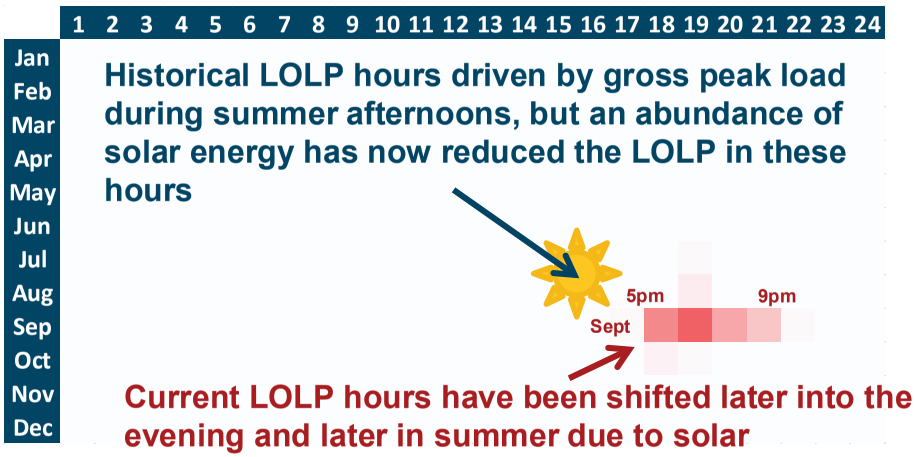
These results just focus on utility event-based DR, not DRAM programs

Pmax is max bid placed in the given month

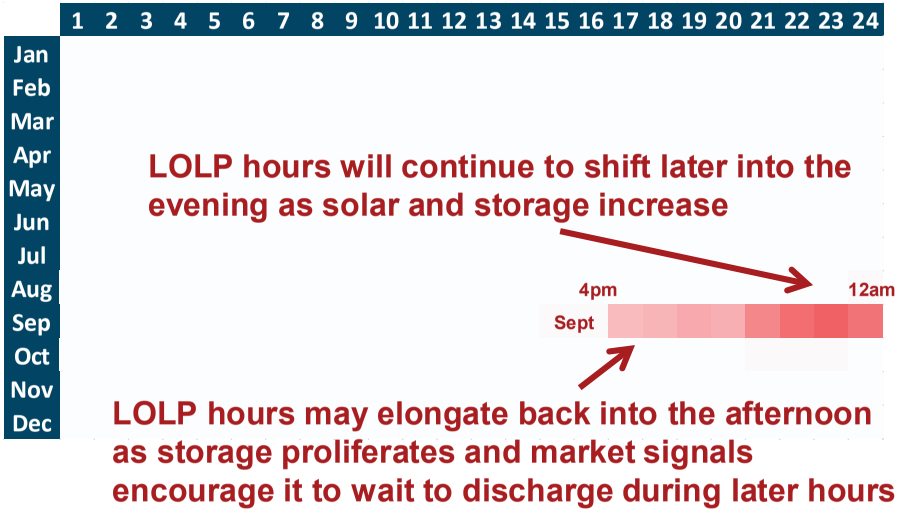
Time Window Availability Needs for DR in 2019 & 2030

- Month/hour (12x24) loss of load probability heat maps provide a quick overview of "high risk" hours
- Key findings from this project are showing that strong interactions between storage and DR may elongate the peak period by 2030

LOLP in 2019



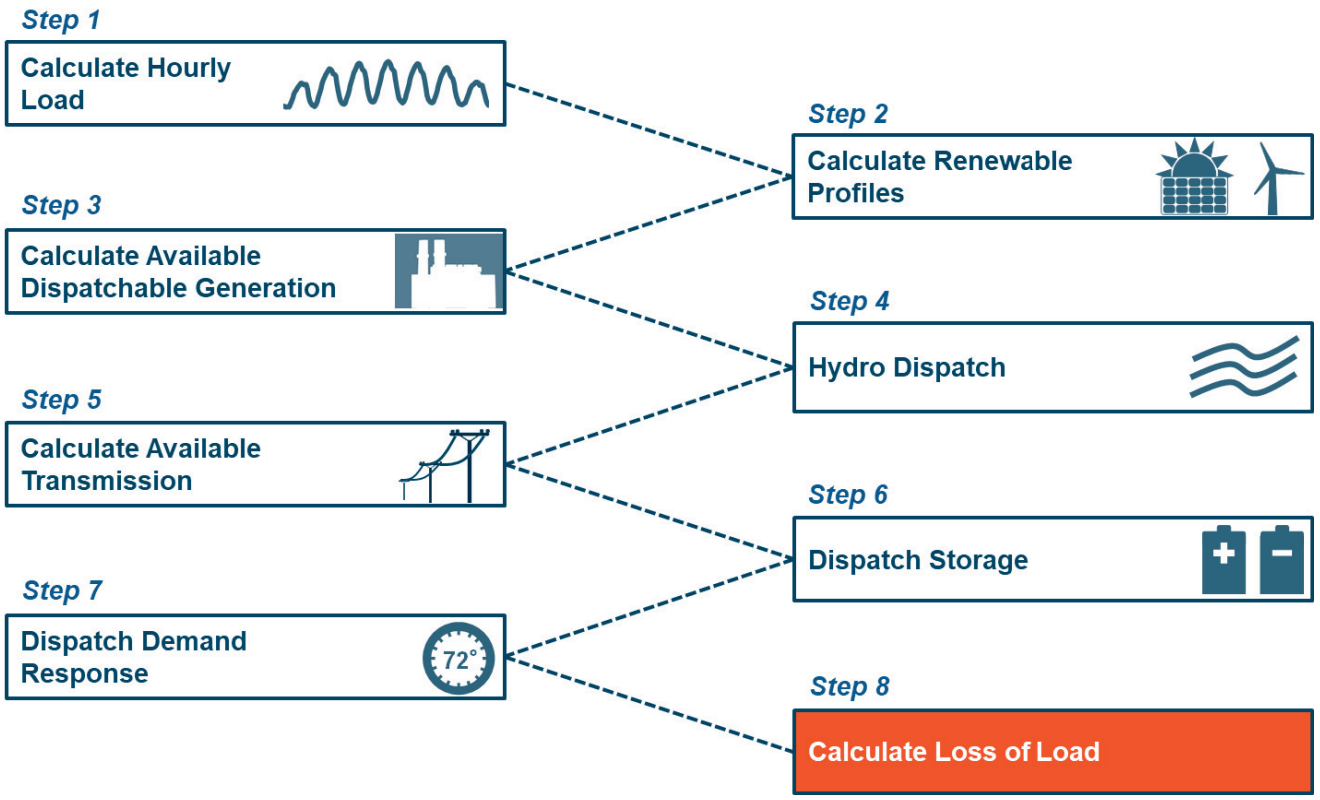
LOLP in 2030



DR Interaction with Storage

- Historically, DR is dispatched as a resource of "last resort" which is how RECAP dispatched DR
- A system with high penetrations of storage require much more coordination in the dispatch of DR and storage in order to achieve maximum reliability

E3 RECAP Model Methodology



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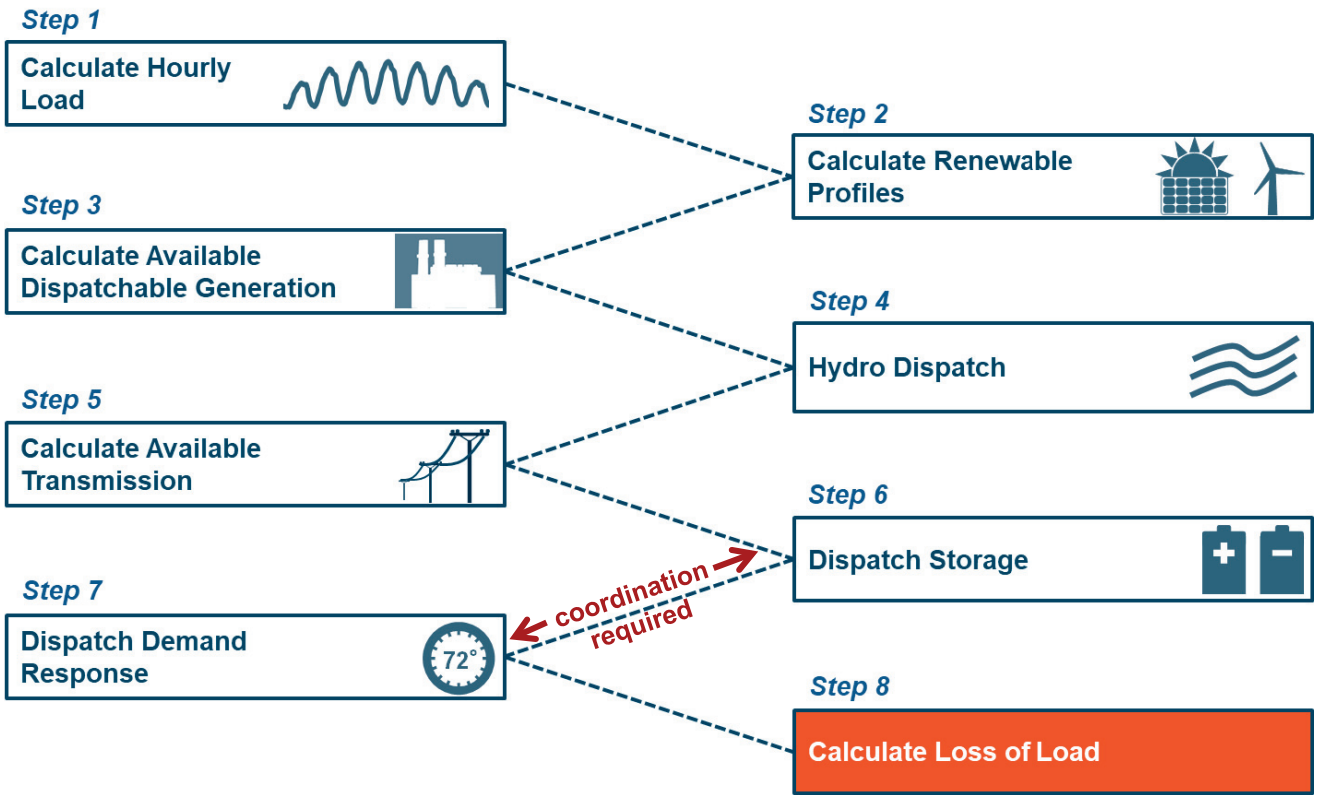
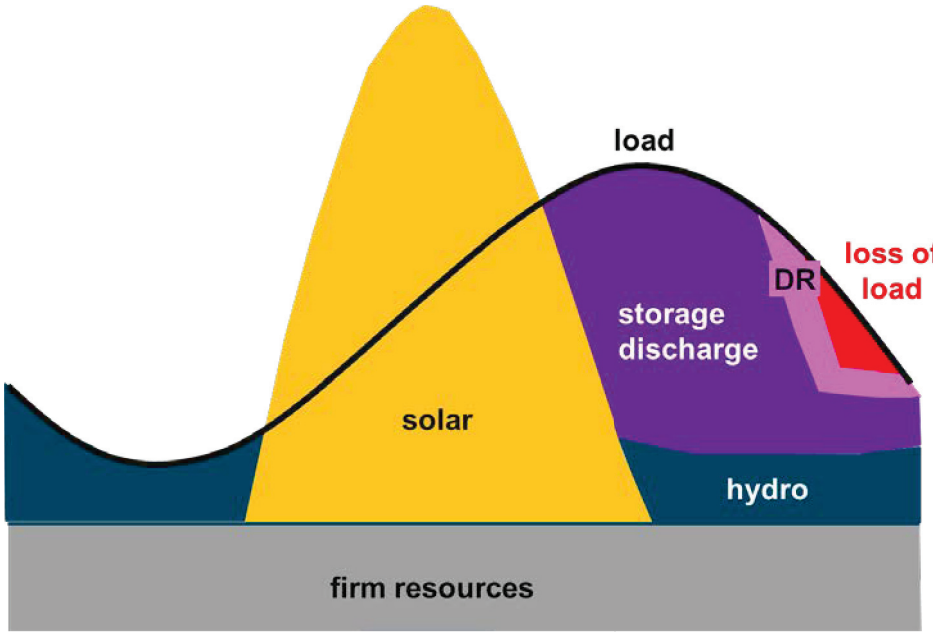


Last Resort vs. Optimal Dispatch

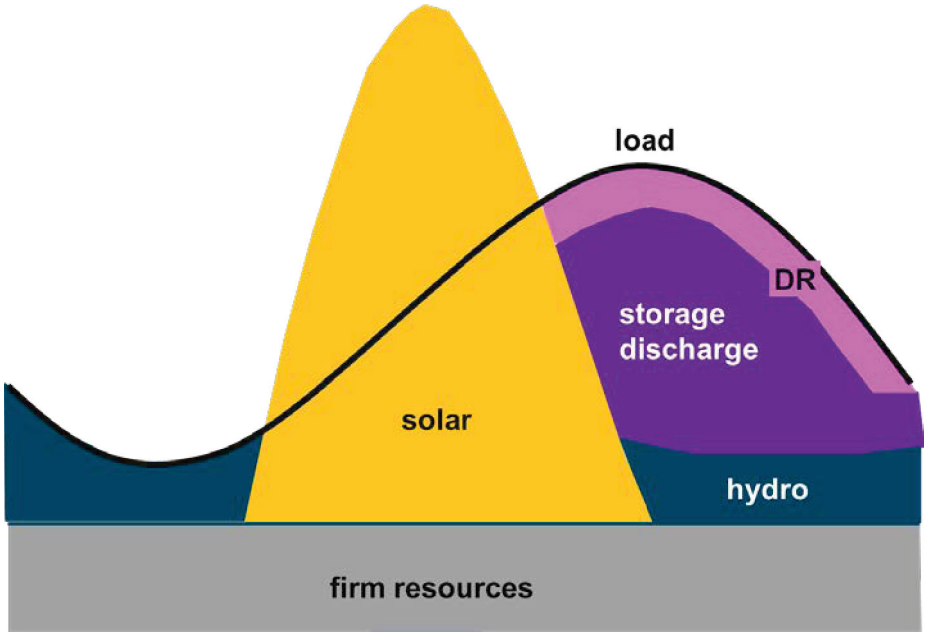
DR as Resource of Last Resort

When DR is dispatched as the resource of last resort, there is loss of load



DR Dispatch to Delay Storage Discharge

Preemptively dispatching DR to delay storage discharge eliminates loss of load event



Key takeaway: DR should be dispatched to delay storage discharge on days with potential loss of load

Call and Duration ELCC Results

First-in ELCC

2019

ELCC (% of nameplate)	Max annual calls						
Max call duration (hrs)	1	2	4	5	10	15	20
1	46%	50%	51%	51%	51%	51%	51%
2	63%	73%	78%	78%	78%	78%	78%
4	70%	81%	94%	95%	95%	95%	95%
6	70%	81%	94%	95%	95%	95%	95%
8	70%	81%	94%	95%	95%	95%	95%

No interactions with storage – therefore no expected significant differences

2030

ELCC (% of nameplate)	Max annual calls						
Max call duration (hrs)	1	2	4	5	10	15	20
1	41%	43%	43%	43%	43%	43%	43%
2	60%	65%	65%	65%	65%	65%	65%
4	72%	91%	95%	95%	95%	95%	95%
6	73%	92%	98%	98%	98%	98%	98%
8	73%	92%	98%	98%	98%	98%	98%

Last-in ELCC

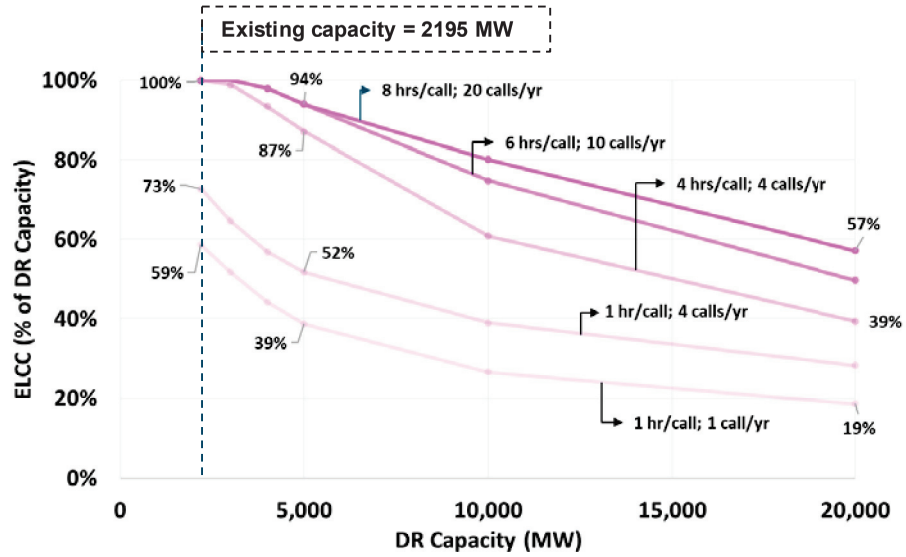
ELCC (% of nameplate)	Max annual calls						
Max call duration (hrs)	1	2	4	5	10	15	20
1	59%	73%	73%	73%	73%	73%	73%
2	74%	90%	94%	94%	94%	94%	94%
4	77%	98%	100%	100%	100%	100%	100%
6	77%	98%	100%	100%	100%	100%	100%
8	77%	98%	100%	100%	100%	100%	100%

Significant degradation in last-in ELCC in 2030 is driven by saturation of energy-limited resources, primarily storage

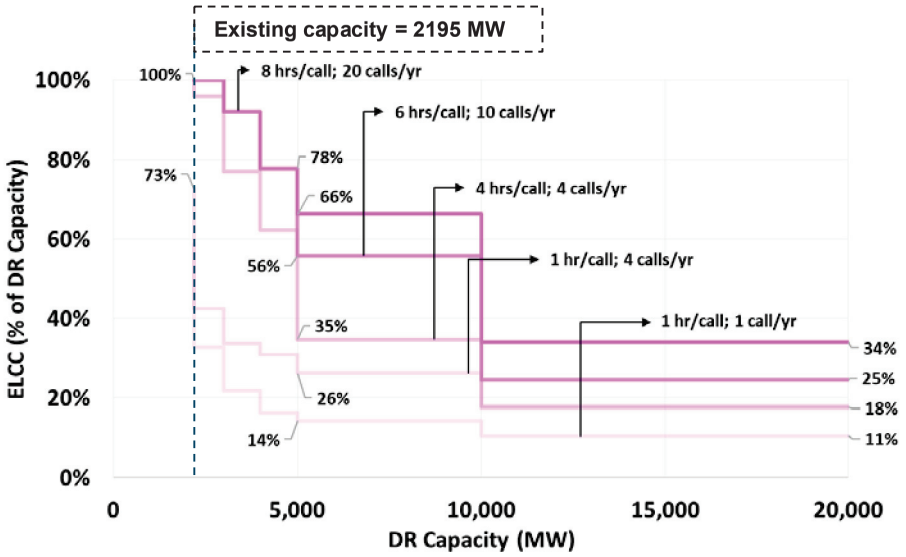
ELCC (% of nameplate)	Max annual calls						
Max call duration (hrs)	1	2	4	5	10	15	20
1	35%	37%	37%	37%	37%	37%	37%
2	44%	49%	49%	49%	49%	49%	49%
4	52%	65%	69%	69%	69%	69%	69%
6	56%	77%	77%	77%	77%	77%	77%
8	75%	91%	93%	93%	93%	93%	93%

DR ELCC Performance at Increasing Penetrations (2019)

Average Last-in ELCC



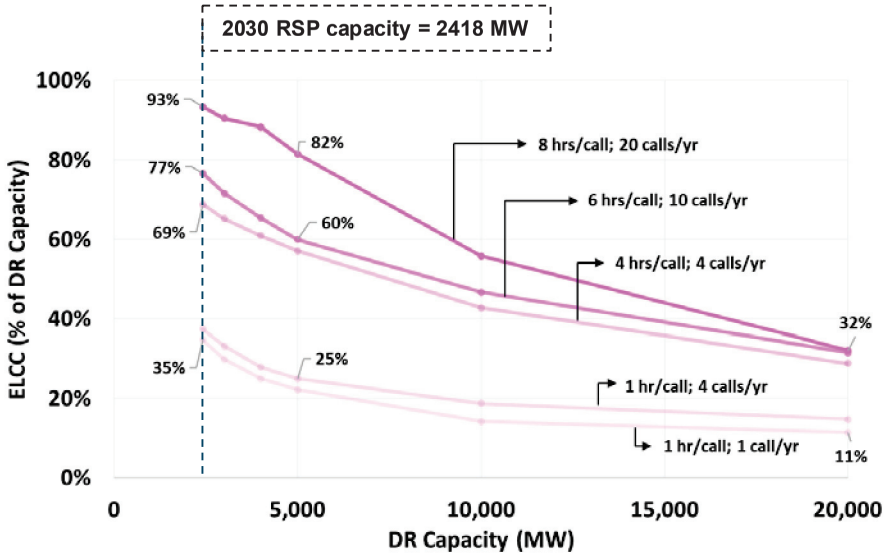
Incremental Last-in ELCC



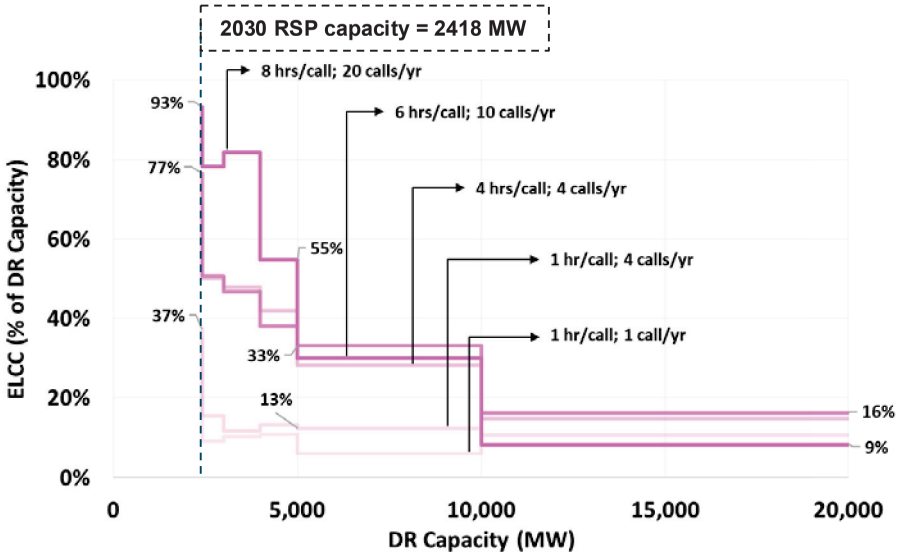
- **Average ELCC = Total Effective Capacity / Total Installed Capacity**
- **Incremental ELCC = Δ Effective Capacity / Δ Installed Capacity**
- **ELCC generally decreases as DR capacity on the system increases:**
  - Similarity in hours of operation and characteristics limits the incremental value that more of the exact same resource type can add to the system.
  - Degradation gets more severe as call constraints become more stringent.

DR ELCC Performance at Increasing Penetrations (2030)

Average Last-in ELCC



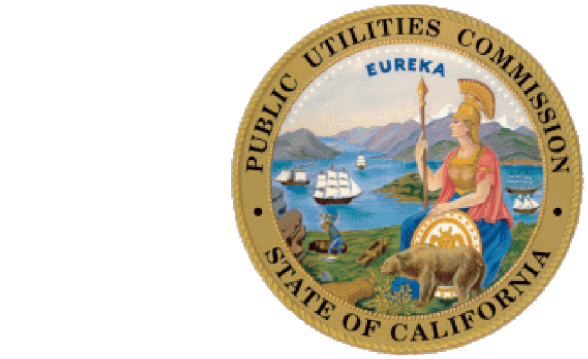
Incremental Last-in ELCC



+ **ELCC generally decreases as DR capacity on the system increases:**
  - Similarity in hours of operation and characteristics limits the incremental value that more of the exact same resource type can add to the system.
  - For a given DR capacity on the system, ELCC in 2030 is lower than that in 2019 owing to saturation of energy-limited resources on the system in 2030, particularly storage.

CPUC Role in RA & ELCC Implementation

- **The CPUC has been a leader in North America through the incorporation of intermittent and energy-limited resources into RA frameworks**
  - One of the first to adopt and implement **ELCC** framework to value wind and solar
  - Currently the only jurisdiction that recognizes and accounts for **interactive effects** of resources through allocation of a "diversity benefit" to wind and solar



Steps 5 and 6 - Different Diversity Allocations

The tables below show results from allocating storage diversity to wind or solar resources

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
R. 14-10-010 Previously Adopted Values	Wind	11%	17%	18%	31%	31%	48%	30%	27%	27%	9%	8%	15%
CPUC proposed values - Diversity to Solar		14%	12%	28%	25%	25%	33%	23%	21%	15%	8%	12%	13%
Split storage diversity btwn wind/solar		13%	11%	31%	30%	28%	33%	22%	20%	15%	8%	11%	13%
Allocate storage diversity to wind		13%	9%	35%	36%	31%	34%	22%	20%	15%	7%	11%	12%

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
R. 14-10-010 Previously Adopted Values	Solar	0%	2%	10%	33%	31%	45%	42%	41%	33%	29%	4%	0%
CPUC proposed values - Diversity to Solar		4%	3%	18%	15%	16%	31%	39%	27%	14%	2%	2%	0%
Split storage diversity btwn wind/solar		5%	4%	16%	12%	15%	31%	39%	28%	14%	2%	2%	1%
Allocate storage diversity to wind		5%	5%	13%	8%	12%	30%	39%	29%	14%	3%	3%	1%

- **The CPUC has recognized that the concept of "interactive effects" applies not only to renewables but to storage and other resources, but has not yet established an approach for allocation that incorporates them all**
- **Establishing a more generalized, durable framework for ELCC (capable of accounting for renewables, storage, and DR) will require a reexamination of the methods used to allocate ELCC and the "diversity benefit"**
- **This section examines alternative options for allocating ELCC among resources that could improve upon existing methods currently in use**

Allocating ELCC

- **Allocating Portfolio ELCC is necessary with a centralized or bilateral capacity market framework where individual resources must be assigned a capacity contribution for compensation purposes**
  - Directly impacts billions of dollars of market clearing transactions within California and other organized capacity markets
- **Allocating Portfolio ELCC can impact planning and procurement in California to the extent that entities procure based on the economic signal they receive in the RA program**
  - An allocation exercise is not necessary in vertically integrated jurisdictions or in systems with a centralized procurement process
- **There are an infinite number of methods to allocate Portfolio ELCC to individual resources and no single correct or scientific method, similar to rate design**

Sample ELCC Allocation Method Options

1. **Allocate proportionally to First-In ELCC**
2. **Allocate proportionally to Last-In ELCC**
3. **Allocate adjustment to First-In ELCC proportionally to differences between First-in and Last-In ELCC**
4. **Vintaging approach where each resource permanently receives Last-In ELCC at the time it was constructed**
5. **More**

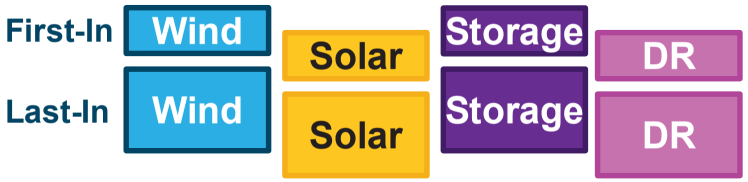
Framework to Incorporate DR ELCC Into CPUC RA Framework

- **This section presents a framework as one option for attributing capacity value to DR *within the current resource adequacy framework* administered by the CPUC**
- **This framework relies on several key principles:**
  1) **Reliability:** The ELCC allocated to each project/program should sum to the portfolio ELCC for all resources
  2) **Fairness:** ELCC calculations should be technology neutral, properly reward resources for the capacity characteristics they provide, and not unduly differentiate among similar resources
  3) **Efficiency:** ELCC values should send accurate signals to encourage an economically efficient outcome to maximize societal resources
  4) **Customer Acceptability:** ELCC calculations should be transparent, tractable understandable, and implementable

Overview of Framework

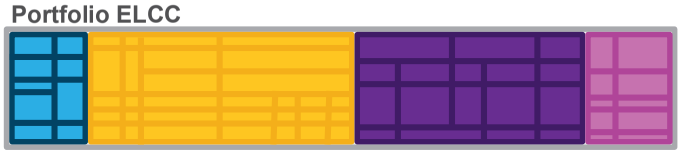
1. Calculate portfolio ELCC

2. Calculate "first-in" and "last-in" ELCC for each resource category



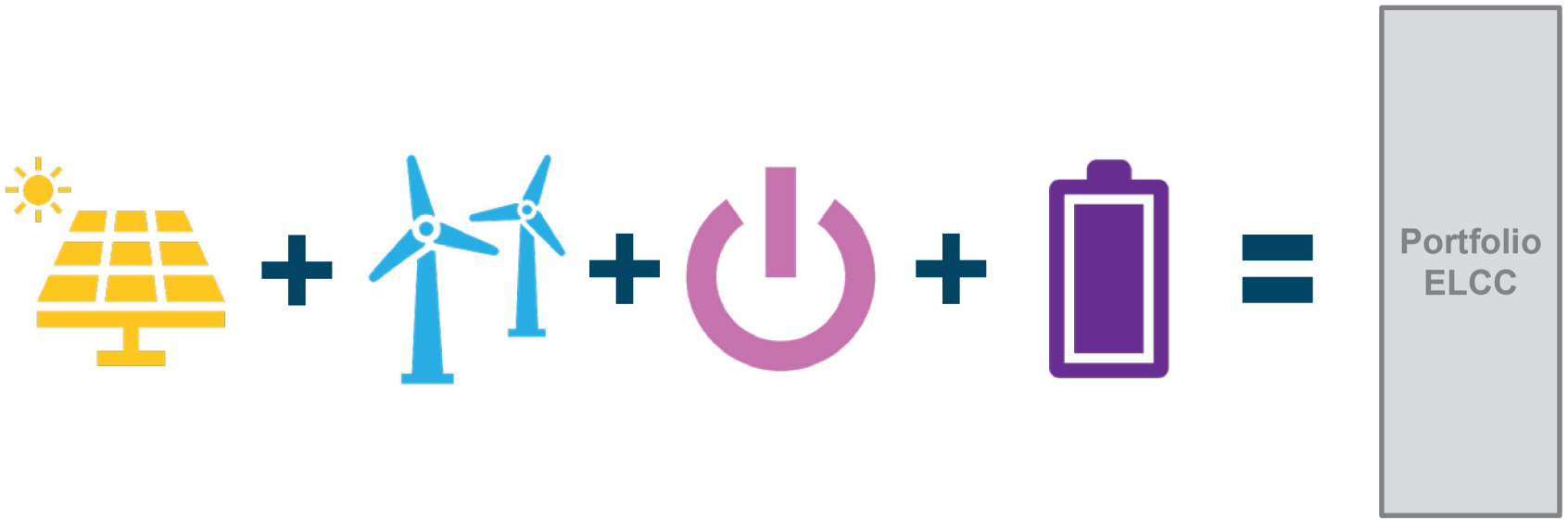
3. Allocate portfolio ELCC to each resource category

4. Allocate resource category ELCC to each project/program using tractable heuristic



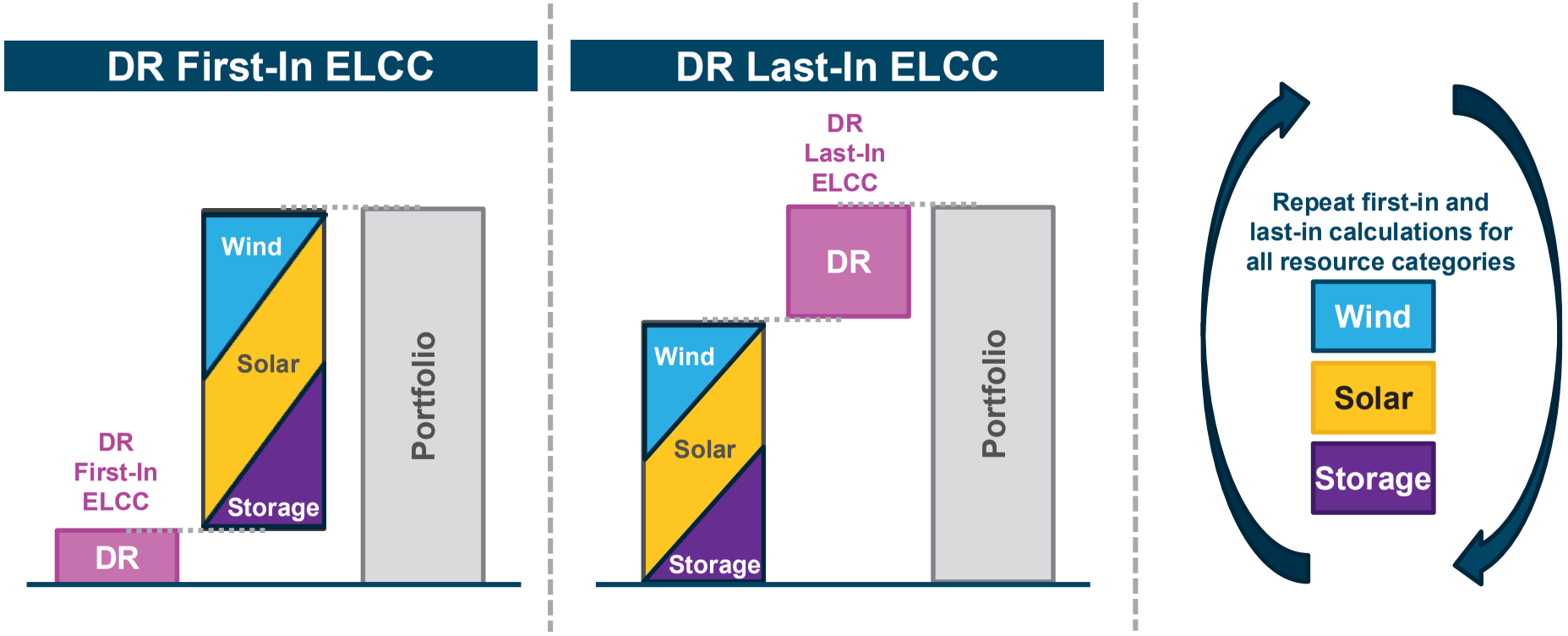
1) Calculate Portfolio ELCC

- **The first step should calculate the portfolio ELCC of all variable and energy-limited resources**
  - Wind
  - Solar
  - Storage
  - Demand Response



2) Calculation First-In and Last-In Resource Category ELCCs

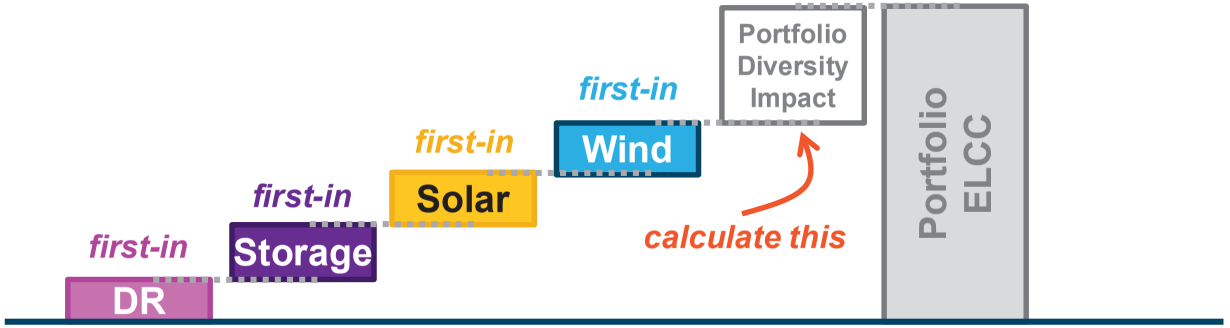
- The second step calculates the "first-in" and "last-in" ELCC for each resource category as a necessary input for allocation of the portfolio ELCC



3) Allocate Portfolio ELCC to Each Resource Category

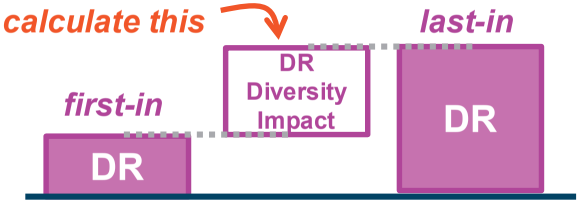
Calculate diversity impact as the difference between portfolio ELCC and sum of first-in ELCCs

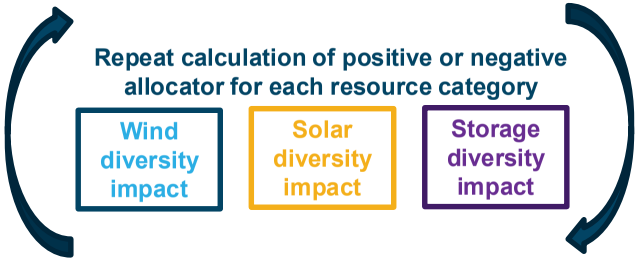
1



Calculate diversity impact for each resource category

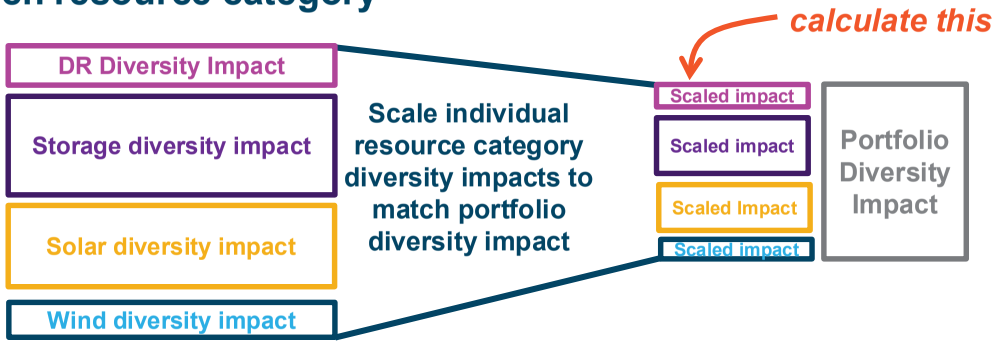
2

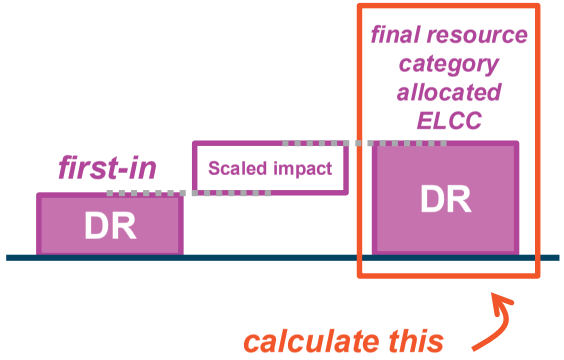




Allocate diversity impact in proportion to the difference between first-in and last-in ELCC for each resource category

3

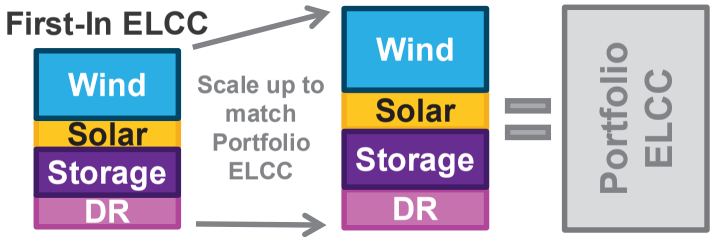




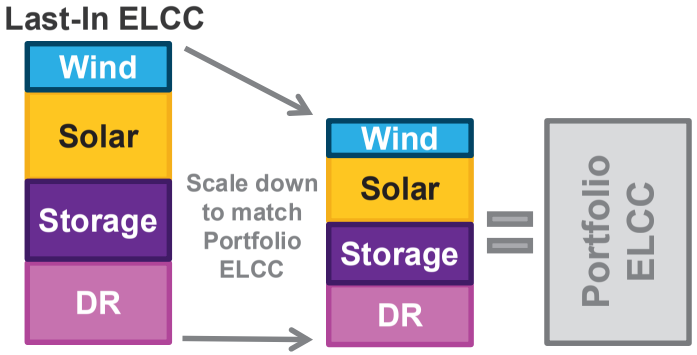
Benefits of this Approach

+ There are several options to allocate Portfolio ELCC to each technology category, two examples of which are shown below

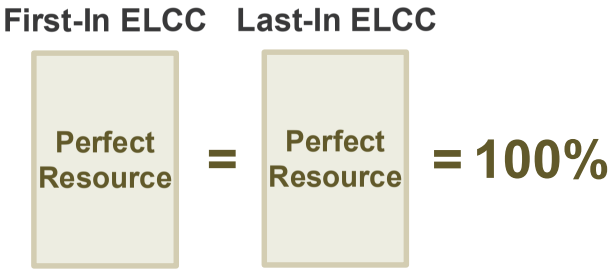
First-In ELCC Allocation Option



Last-In ELCC Allocation Option



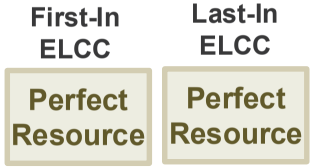
+ **Both of these options can lead to final ELCC allocations that fall outside the bounds of the first-in or last-in ELCC**
  - For example, in the case of a "perfect" resource (e.g. ultra-long duration storage, always available DR, baseload renewables, etc.), this should be counted at 100% ELCC and should not be unduly scaled up or down based on the synergistic or antagonistic impacts of other resource interactions
  - Scaling the first-in or last-in ELCC in any way would result in an ELCC of either >100% or <100% for this perfect resource



+ **The method presented in this deck scales resources based on the difference of their first-in and last-in ELCC in order to reflect their synergistic or antagonistic contributions to Portfolio ELCC**

Negative diversity impact leads to first-in ELCC being scaled up to match Portfolio ELCC

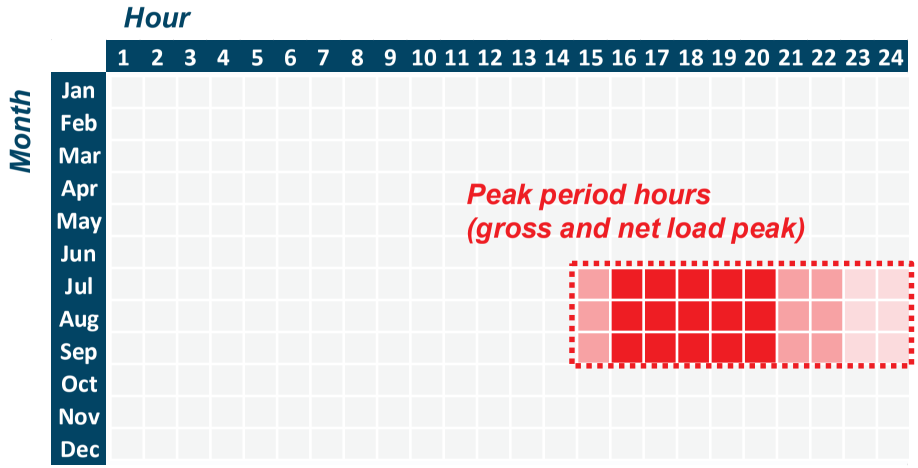
Positive diversity impact leads to first-in ELCC being scaled down to match Portfolio ELCC



No diversity impact leads to no scaling of first-in ELCC to match Portfolio ELCC

4) Allocate Resource Category ELCC to Individual Resource/Programs Using Heuristics

- **Each DR program submits the following information**
  - Expected output during peak period hours
  - Maximum number of calls per year
  - Maximum duration of call
- **Step 1) Calculate average MW availability during peak period hours (gross and net load)**
- **Step 2) Multiple MW availability from step (1) by lookup table de-rating factor to account for call and duration limitations**
  - DR category ELCC to individual program ELCC using first-in and last-in ELCC would work similarly to the allocation process of portfolio ELCC to resource category ELCC



First-In ELCC

Max call duration (hrs)	ELCC (% of nameplate)	Max annual calls						
		1	2	4	5	10	15	20
	1	41%	43%	43%	43%	43%	43%	43%
	2	60%	65%	65%	65%	65%	65%	65%
	4	72%	91%	95%	95%	95%	95%	95%
	6	73%	92%	98%	98%	98%	98%	98%
	8	73%	92%	98%	98%	98%	98%	98%

Last-In ELCC

Max call duration (hrs)	ELCC (% of nameplate)	Max annual calls						
		1	2	4	5	10	15	20
	1	35%	37%	37%	37%	37%	37%	37%
	2	44%	49%	49%	49%	49%	49%	49%
	4	52%	65%	69%	69%	69%	69%	69%
	6	56%	77%	77%	77%	77%	77%	77%
	8	75%	91%	93%	93%	93%	93%	93%

Questions?

Questions

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Thank You

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Updated Demand Response ELCC Study

CAISO

December 2020

Zach Ming, Director
Vignesh Venugopal, Consultant

Overview of DR ELCC Study Update

- **The DR ELCC study has been updated to reflect two primary changes**

1) SCE BIP Bid Values
   - The original DR bid data submitted to E3 from SCE reflected the actual BIP bid values but not the full capability of these resources
   - Due to discrete dispatch limitations and registration restrictions, SCE had been underbidding the full capability of its DR resources into the CAISO market
   - SCE has now modified its bidding procedures to reflect the full capability of these resources and has retroactively modified 2019 bid values to reflect its new bidding strategy

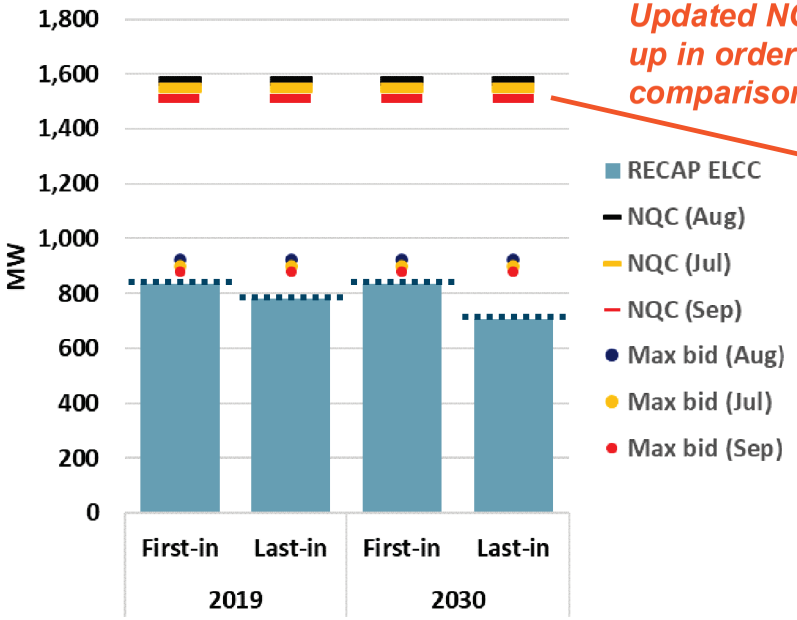
2) T&D Loss and PRM Gross Up
   - DR ELCC values are now compared to the DR NQC values net of T&D loss factors and PRM
   - Originally, both SCE and PG&E indicated to E3 that the demand response bid data was grossed up for T&D losses but after the May release of the study indicated it was not

Average Increase in SCE Hourly DR Bid Data

Avg Difference (MW)																								
Month/Hour (PST)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
1	127	126	125	125	130	137	142	147	148	151	158	148	146	144	140	137	127	125	125	124	124	141	143	139
2	122	121	121	121	125	132	137	140	140	140	143	144	140	136	134	132	129	128	127	125	125	134	135	131
3	113	113	113	116	122	128	132	131	132	141	138	133	129	126	125	123	123	122	121	120	124	126	124	118
4	207	289	456	187	205	193	210	220	230	219	260	202	192	188	186	179	177	187	179	180	185	199	204	186
5	137	137	134	137	144	150	153	157	152	153	157	156	149	148	145	140	133	142	141	145	147	140	138	131
6	108	107	105	108	115	119	123	125	120	123	125	124	119	119	115	111	103	112	110	114	115	109	107	106
7	92	92	89	91	98	103	109	110	101	105	107	106	103	101	99	95	88	96	95	98	98	93	91	90
8	99	99	95	97	104	109	117	119	112	115	116	115	117	117	115	111	105	103	101	105	106	101	97	96
9	86	88	85	87	93	98	102	105	99	102	103	102	99	98	94	90	84	91	89	94	95	90	86	86
10	101	102	98	101	105	108	111	117	115	119	121	117	112	112	109	106	98	107	104	109	110	104	99	98
11	88	89	89	90	92	97	102	108	104	110	111	153	105	103	101	101	101	101	97	87	84	91	97	93
12	72	68	67	66	69	75	77	80	79	77	95	78	79	79	77	76	74	71	76	76	75	80	79	77

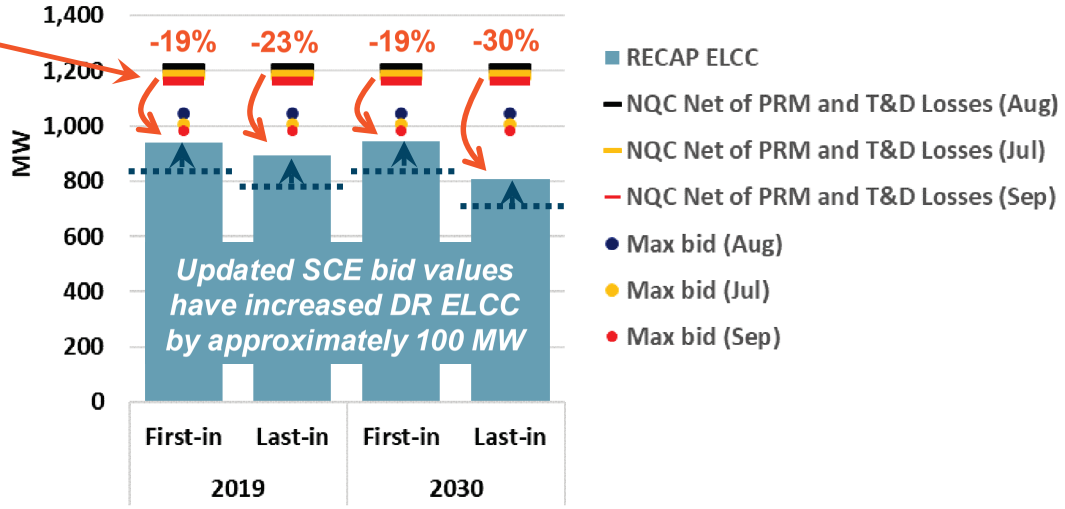
Updated November 2020 Results

Original May 2020 Results

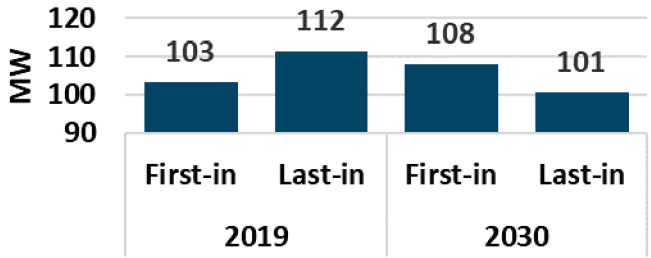


Updated November 2020 Results

Updated NQC values remove PRM and T&D gross up in order to ensure apples-to-apples comparison with DR bids



Nov – May Difference in Results



Key Finding

+ **DR ELCC is approximately 20 to 30% less than apples-to-apples NQC comparison**

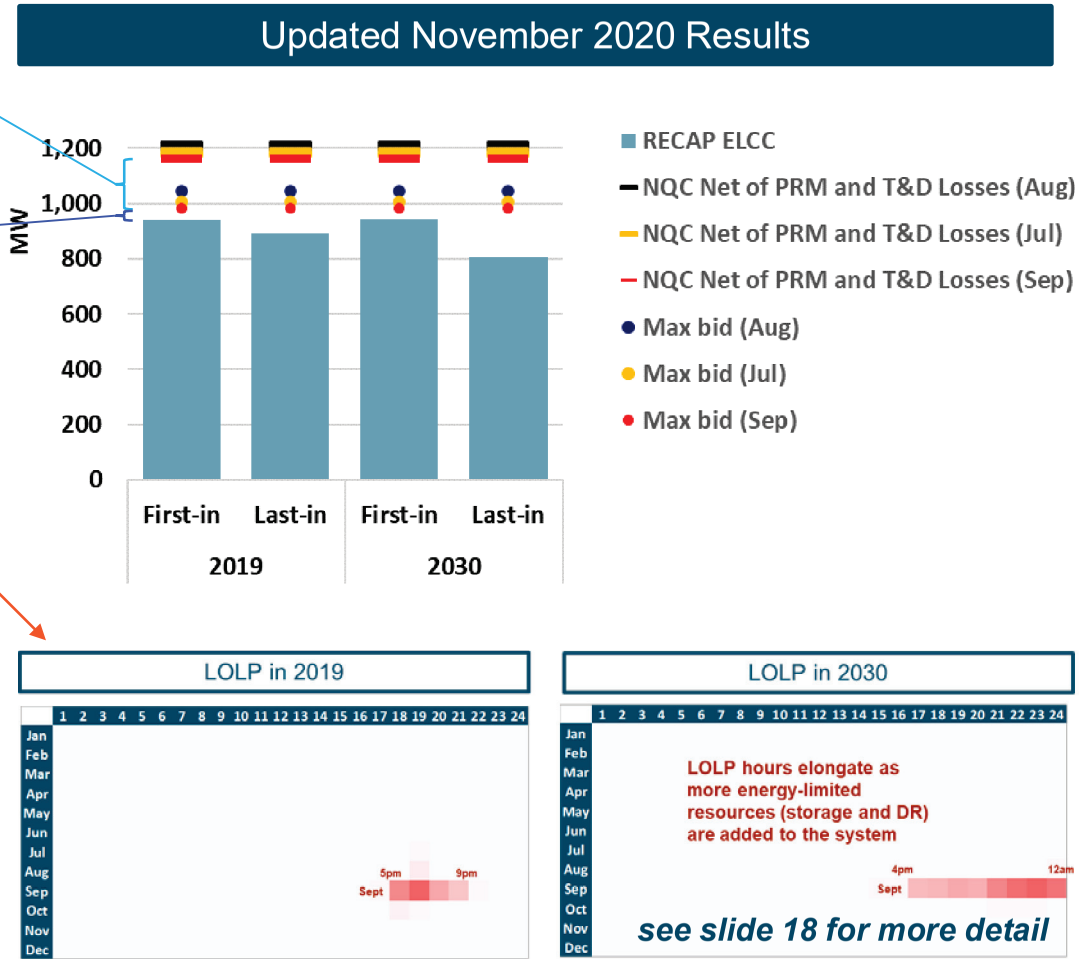
Factors Affecting Gap Between NQC* and ELCC

+ **The gap between NQC* and ELCC is driven by two primary factors**
  - NQC* implies NQC net of T&D losses and PRM

1 **Maximum aggregate bids are lower than NQC* in all hours**

2 **ELCC is lower than maximum aggregate bid because resources do not produce at this level in all loss of load hours**

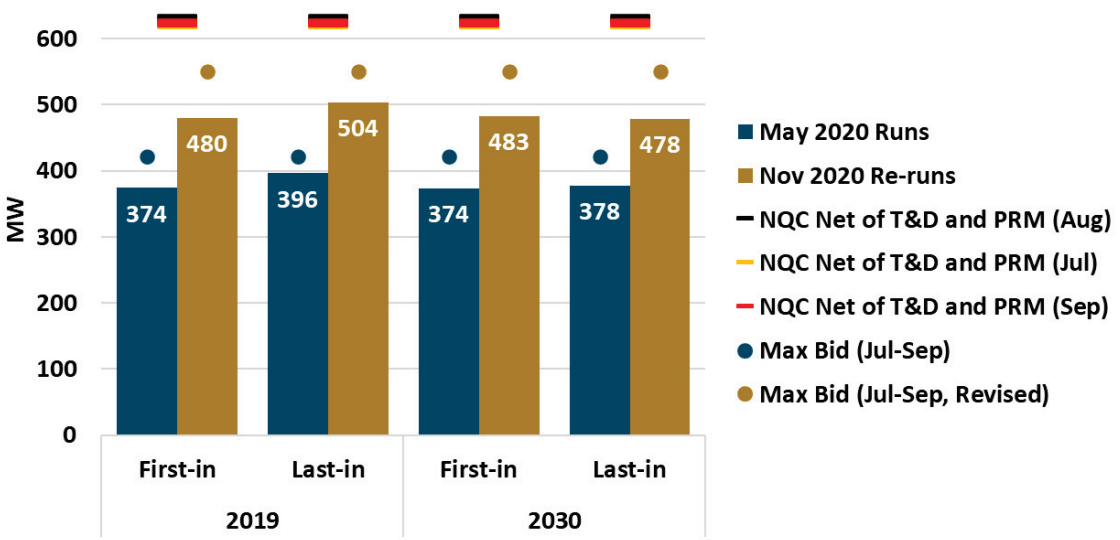
- As more storage is added to the system, it flattens the peak which **elongates** the period of loss of load hours beyond 4-9pm which further decreases the "Last-In ELCC" of DR
- This issue is expected to grow in the future as evidenced by declining Last-In ELCC in 2030



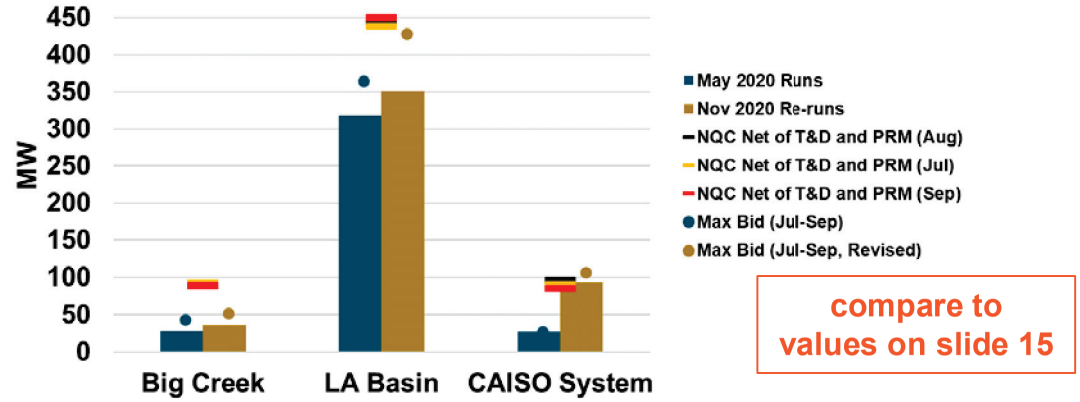
SCE-Specific Updated Results

- The update in the overall DR ELCC results are driven by updated bid data from the SCE BIP program
- SCE BIP ELCC has increased by approximately 100 MW across all cases
- First-in ELCC for BIP program in each LCA has increased

SCE BIP ELCC



First-In ELCC for SCE BIP Programs by LCA

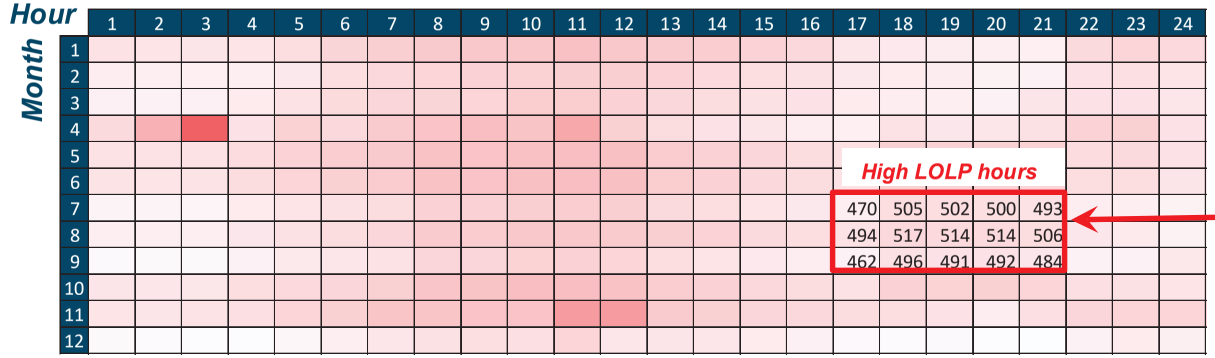


compare to values on slide 15

Comparing SCE BIP NQC to Nominations

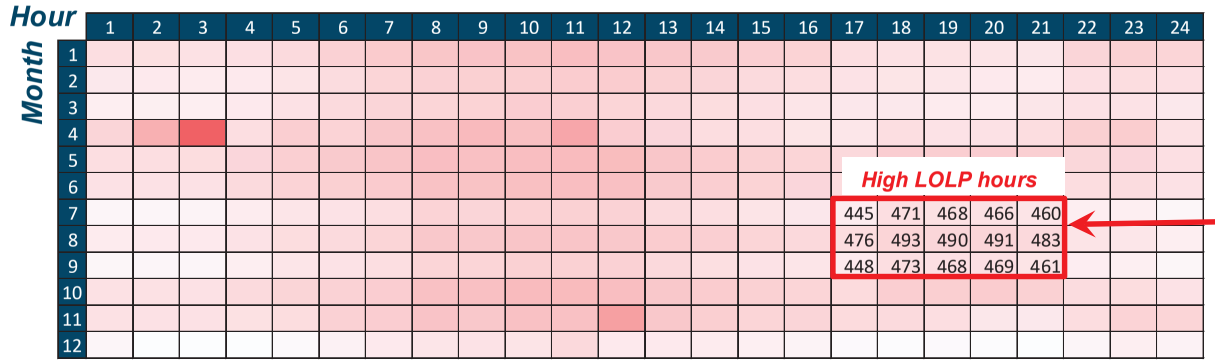
- The primary reason SCE BIP ELCC values are lower than NQC values (adjusted for T&D and PRM factors) is due to nomination values that are lower than the NQC values
- September SCE BIP NQC (net of T&D and PRM) is 624 MW

Maximum Nomination MW (2019 SCE BIP)



Maximum SCE BIP nomination during high LOLP hours is 517 MW

Average Nomination MW (2019 SCE BIP)



Average SCE BIP nomination during high LOLP hours is 471 MW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Appendix

NQCs as a Basis for Comparison with ELCCs

- NQCs are calculated using load impacts (LI) , i.e. load reductions expected during peak conditions, calculated in line with the Load Impact Protocols.
- Load impacts are grossed up for transmission and distribution losses, as also the 15% PRM, owing to demand response being a demand reduction measure.

$$NQC = LI * 1.15\,(PRM) * T\&D\ loss\ factor$$ [1]

- Load impacts for the year 2019 are referenced from the CPUC's RA Compliance documents[2]
- Load impacts were defined on an LCA level from 1 pm to 6 pm, Apr to Oct, and from 4 pm to 9 pm in the rest of the year, both with and without line losses
- The timing has since been revised to 4 pm to 9 pm year-round[3]

[1] CPUC 2019 RA Guide
[2] CPUC 2019 IoU DR Program Totals
[3] CPUC 2020 IOU LIP Workshop

Key Question: What Call and Duration Characteristics are Needed to Maximize DR ELCC?

- **E3 tested how two primary constraints impact the ELCC of demand response resources**
  - Max # of calls per year
    - How many times can a system operator dispatch a demand response resource?
  - Max duration of each call
    - How long does the demand response resource respond when called by the system operator?
- **Key Assumptions:**
  - DR portfolio is divided into 100 MW units, each of which can be dispatched independently of the other
    - In other words, 2-hour-100 MW units can be dispatched in sequence to avoid an unserved energy event 100 MW deep and 4 hours long
  - Each 100 MW unit is available 24/7, at full capacity of 100 MW, subject to call constraints defined above to establish a clear baseline for ELCC %'s
  - Pure Shed DR; No shifting of load; No snap-backs

Average ELCC as a function of DR Capacity on the System

First-in ELCC

2019

ELCC (% of DR capacity)	Call constraints							
DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	46%	51%	70%	94%	95%	95%	94%	95%
3,000	40%	47%	61%	92%	94%	96%	93%	96%
4,000	36%	42%	52%	78%	80%	86%	80%	86%
5,000	32%	39%	46%	73%	75%	83%	74%	84%
10,000	21%	30%	31%	51%	60%	65%	53%	70%
20,000	14%	21%	20%	33%	46%	44%	35%	52%

2030

ELCC (% of DR capacity)	Call constraints							
DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	41%	43%	72%	95%	95%	98%	98%	98%
3,000	38%	40%	66%	92%	93%	98%	97%	98%
4,000	35%	37%	56%	83%	88%	91%	85%	91%
5,000	32%	35%	50%	74%	80%	86%	77%	88%
10,000	23%	30%	33%	52%	62%	67%	55%	71%
20,000	15%	22%	22%	35%	47%	46%	37%	53%

Last-in ELCC

2019

ELCC (% of DR capacity)	Call constraints							
DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	59%	73%	77%	100%	100%	100%	100%	100%
3,000	52%	65%	67%	99%	100%	100%	99%	100%
4,000	44%	57%	63%	93%	98%	98%	93%	98%
5,000	39%	52%	59%	87%	94%	94%	88%	94%
10,000	27%	39%	38%	61%	75%	75%	61%	80%
20,000	19%	28%	25%	39%	53%	50%	40%	57%

2030

ELCC (% of DR capacity)	Call constraints							
DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	35%	37%	52%	69%	69%	77%	93%	93%
3,000	30%	33%	48%	65%	65%	72%	90%	90%
4,000	25%	28%	43%	61%	61%	65%	88%	88%
5,000	22%	25%	41%	57%	57%	60%	80%	82%
10,000	14%	19%	30%	43%	43%	47%	54%	56%
20,000	11%	15%	22%	29%	30%	31%	32%	32%

Incremental ELCC as a function of DR Capacity on the System

First-in ELCC

2019

ELCC (% of DR capacity) / DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	46%	51%	70%	94%	95%	95%	94%	95%
3,000	25%	36%	37%	86%	93%	99%	90%	99%
4,000	22%	29%	26%	34%	39%	57%	40%	58%
5,000	15%	23%	22%	52%	56%	69%	51%	73%
10,000	11%	22%	16%	30%	45%	47%	32%	57%
20,000	7%	11%	10%	16%	31%	23%	17%	33%

2030

ELCC (% of DR capacity) / DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	41%	43%	72%	95%	95%	98%	98%	98%
3,000	26%	28%	42%	81%	84%	96%	94%	96%
4,000	25%	28%	25%	53%	71%	72%	48%	72%
5,000	19%	25%	24%	39%	48%	65%	45%	76%
10,000	15%	26%	17%	31%	45%	49%	33%	53%
20,000	8%	13%	11%	17%	32%	25%	19%	36%

Last-in ELCC

2019

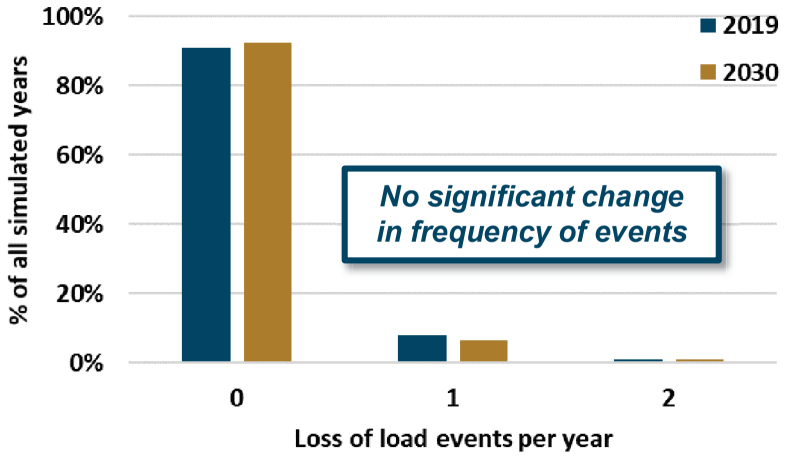
ELCC (% of DR capacity) / DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	59%	73%	77%	100%	100%	100%	100%	100%
3,000	33%	42%	37%	96%	100%	100%	96%	100%
4,000	22%	34%	53%	77%	92%	92%	77%	92%
5,000	16%	31%	40%	62%	77%	78%	67%	78%
10,000	14%	26%	18%	35%	56%	56%	34%	66%
20,000	11%	18%	12%	18%	30%	25%	18%	34%

2030

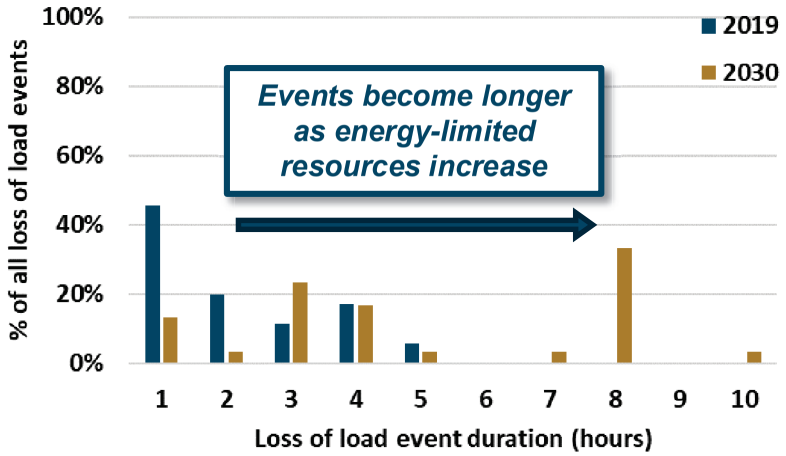
ELCC (% of DR capacity) / DR capacity (MW)	1 hour/call 1 call/year	1 hour/call 4 calls/year	4 hours/call 1 call/year	4 hours/call 4 calls/year	4 hours/call 20 calls/year	6 hours/call 10 calls/year	8 hours/call 4 calls/year	8 hours/call 20 calls/year
2,195	35%	37%	52%	69%	69%	77%	93%	93%
3,000	9%	16%	29%	50%	50%	51%	78%	78%
4,000	10%	12%	29%	48%	48%	47%	82%	82%
5,000	11%	13%	34%	42%	42%	38%	46%	55%
10,000	6%	13%	20%	28%	28%	33%	29%	30%
20,000	9%	11%	13%	15%	18%	16%	9%	8%

2019 vs 2030 Loss of Load Events

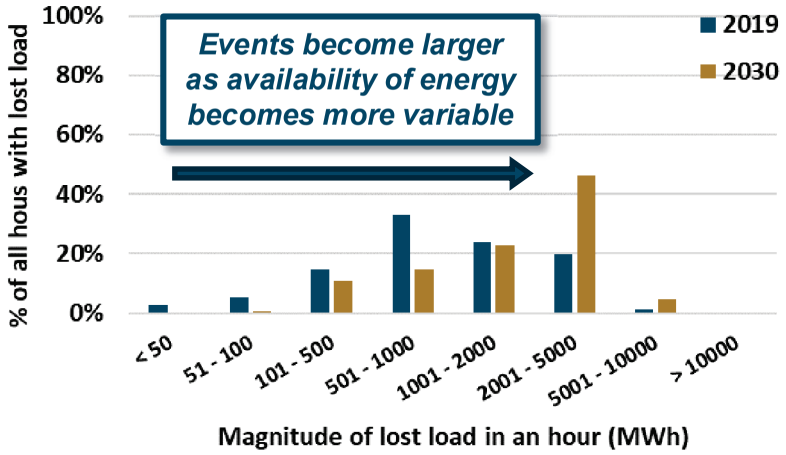
Frequency of Event Occurrence



Distribution of Event Duration



Distribution of Event Magnitude



Overview of Data

- **The 2019 PG&E and SCE DR ELCC results focus on "event-based" DR programs, as opposed to passive measures like dynamic pricing applicable throughout a season/year**
  - Does not consider SDG&E or Demand Response Auction Mechanism (DRAM) resources which are a significant portion of the data DR portfolio, due to data limitations
- **Data sources for RECAP ELCC calculations**
  1. Hourly PG&E DR bid data for 2019
     - BIP, CBP, and SAC
     - PSPS outage logs were provided by PG&E and used by E3 to identify and then fill gaps in DR bid data
  2. Hourly SCE DR bid data for 2019
     - API, BIP, CBP, and SDP

Data Benchmarking

+ E3 used utility data directly from PG&E and SCE for two reasons

- CAISO does not have data by utility program
- Wanted to ensure results were not predicated on CAISO data

+ E3 benchmarked utility data to CAISO data to ensure the veracity of the data

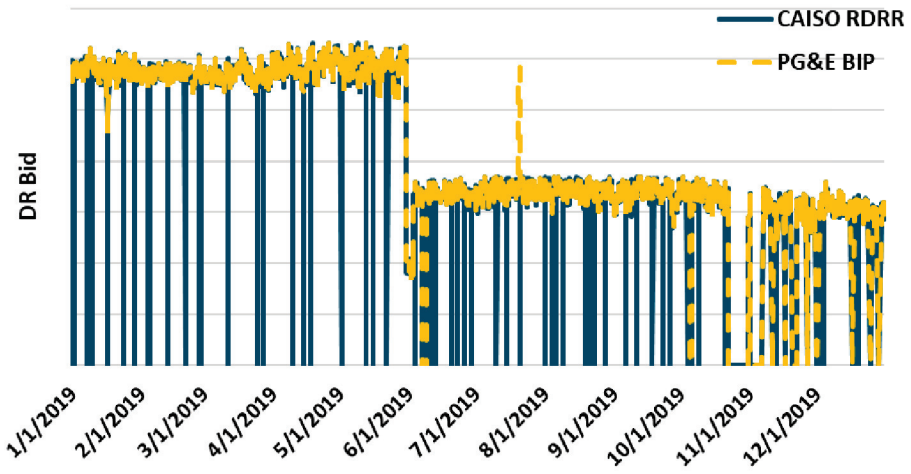
- Data generally benchmarked well
- A few inconsistencies were spotted in the RDRR data:
  - In ~1.3% of hours in the year, DR bids present in PG&E's data are missing in CAISO's data. Technical glitches in transmitting/recording systems may explain this.
  - DR bids in SCE data were slightly lower than bids recorded in CAISO data across significant portions of the year.

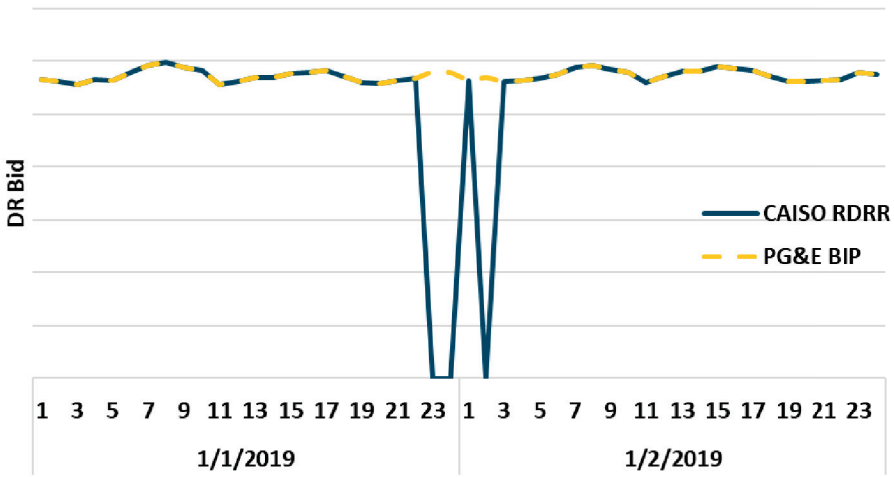
    Underlying reason is currently not known.

Benchmarking of 2019 Bid Data from PG&E and CAISO

- **PDR data from the two sources are identical**
- **There are a few hours (114 out of 8760) where RDRR data is inconsistent:**
  - Several instances across each of the 24 hours of the day
  - These are hours where data is missing in the CAISO dataset
  - Unclear if a bid was not placed, or if it was placed but not recorded due to technical glitches

Example comparison for one of the subLAPs over the entire year and a couple of days in specific

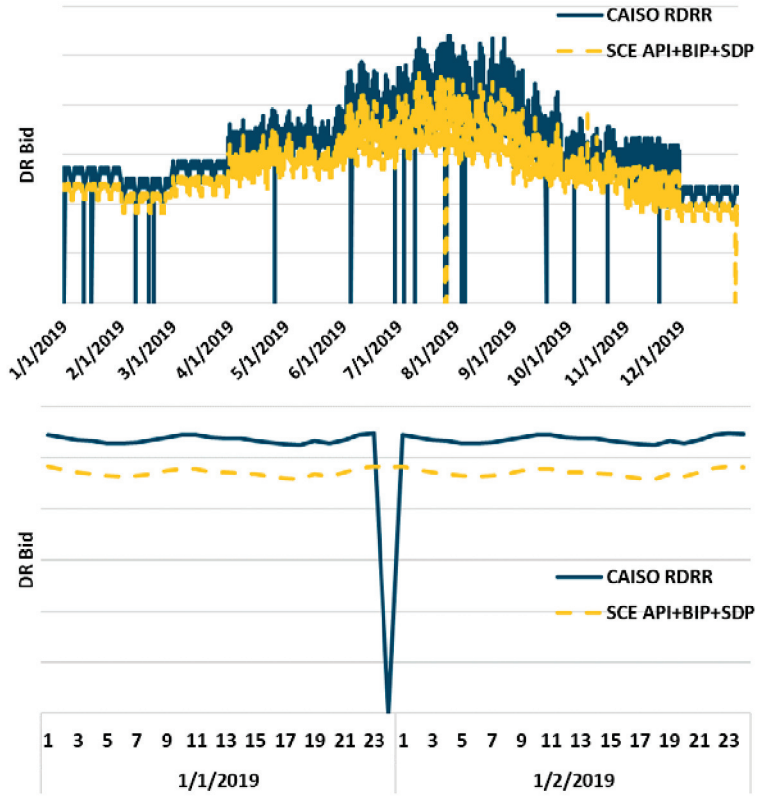


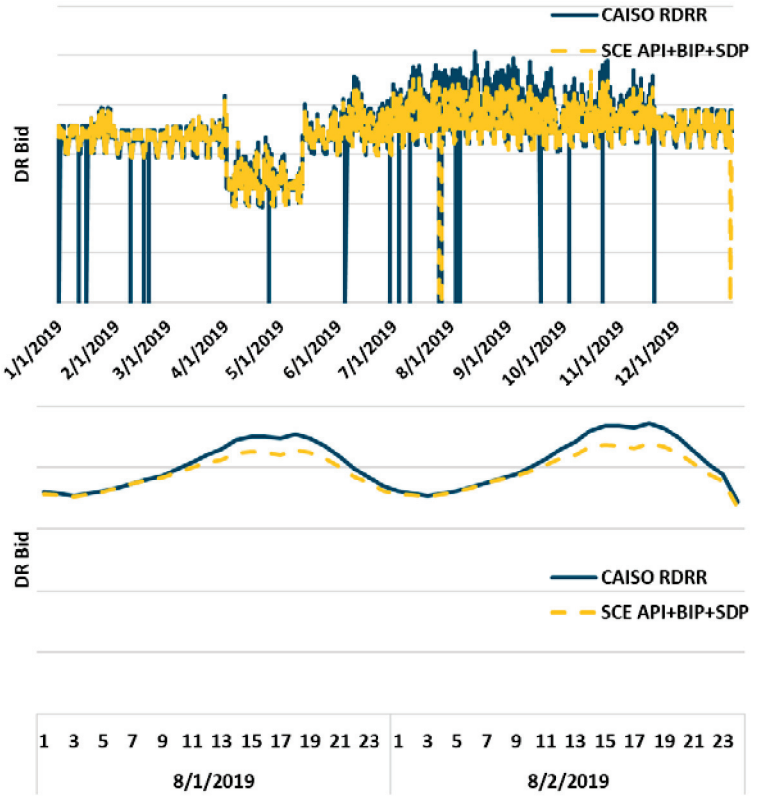


Benchmarking of 2019 Bid Data from SCE and CAISO data

- PDR data from the two sources are identical
- Inconsistencies exist in RDRR data – unclear if the difference is systematic and attributable to a single factor, like treatment of line-losses

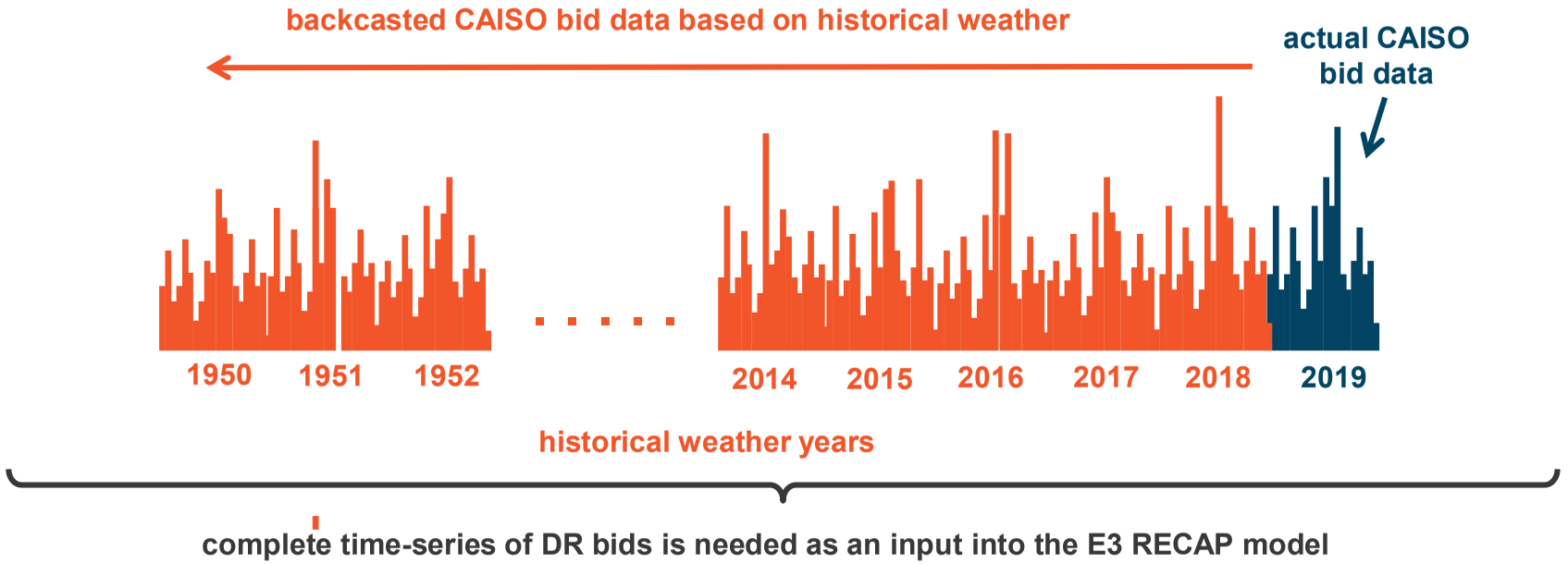
Example comparisons for 2 subLAPs- across the entire year and across a couple of days in specific





Extrapolation of DR Bid Data

- In order to calculate the ELCC of a DR program or portfolio, RECAP must predict how these programs will perform over many different conditions and weather years
- Therefore, E3 must extend actual 2019 data over the entire historical temperature record as a data requirement for the E3 RECAP model



- In response to stakeholder feedback from the May 3 CAISO ESDER meeting, E3 modified the backcasting approach to include temperature for temperature-dependent air conditioner DR programs
  - More details on this process and methodology can be found in the appendix

Process of Extrapolating Actual DR Bid Data to Entire Weather Record

Get daily max, min and average temperature data (1950-2019) from NOAA for every climate zone that DR program bids come from

↓

Use weather-informed day-matching to match every day from Jan 1, 1950 - Dec 31, 2018 to the "most similar" day from Jan 1, 2019 – Dec 31, 2019

↓

Use day-matching results to extrapolate hourly DR bids from just 2019 to 1950-2019

↓

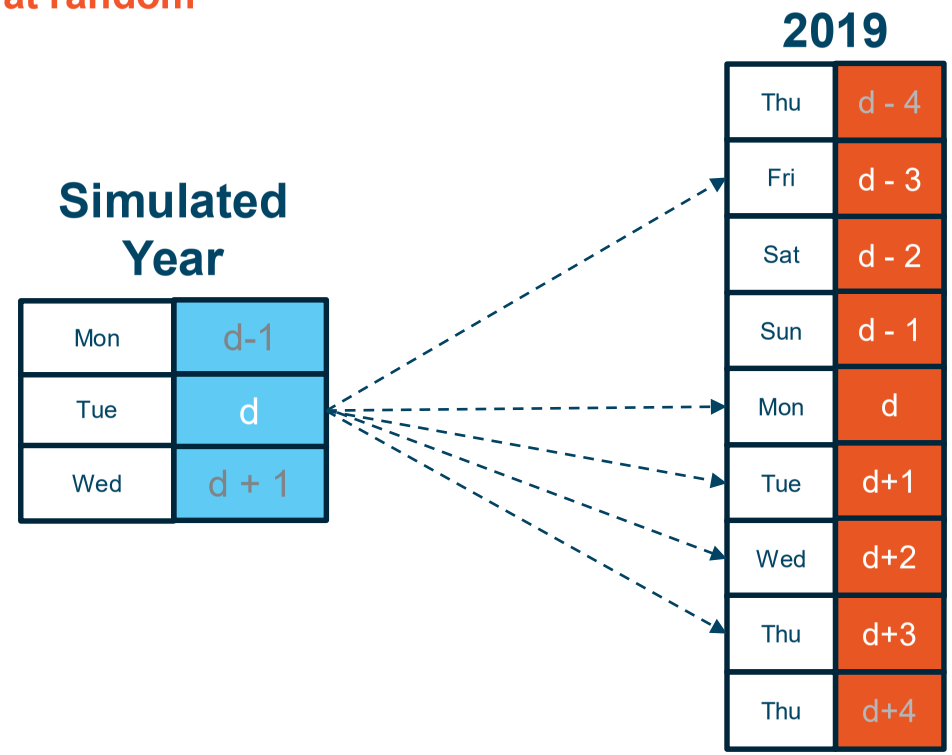
Aggregate extrapolated DR bids by program-LCA to allow for comparison with respective NQCs

↓

Each aggregated shape dictates the hourly availability of the corresponding DR program-LCA combination in RECAP

Simple Day-Matching Algorithm for CBP, BIP and API DR Programs

- As in the previous phase of this project, E3 used a simple day-matching approach for CBP, BIP and API programs
- DR bid forecasts for these programs were not as strong a function of the temperature as Smart AC
- For an individual DR program and a particular day, 'd' in a simulated year, pick one day out of +/- 3 calendar days, 'd+3' to 'd-3' of the same type (workday/holiday) from the actual 2019 data at random

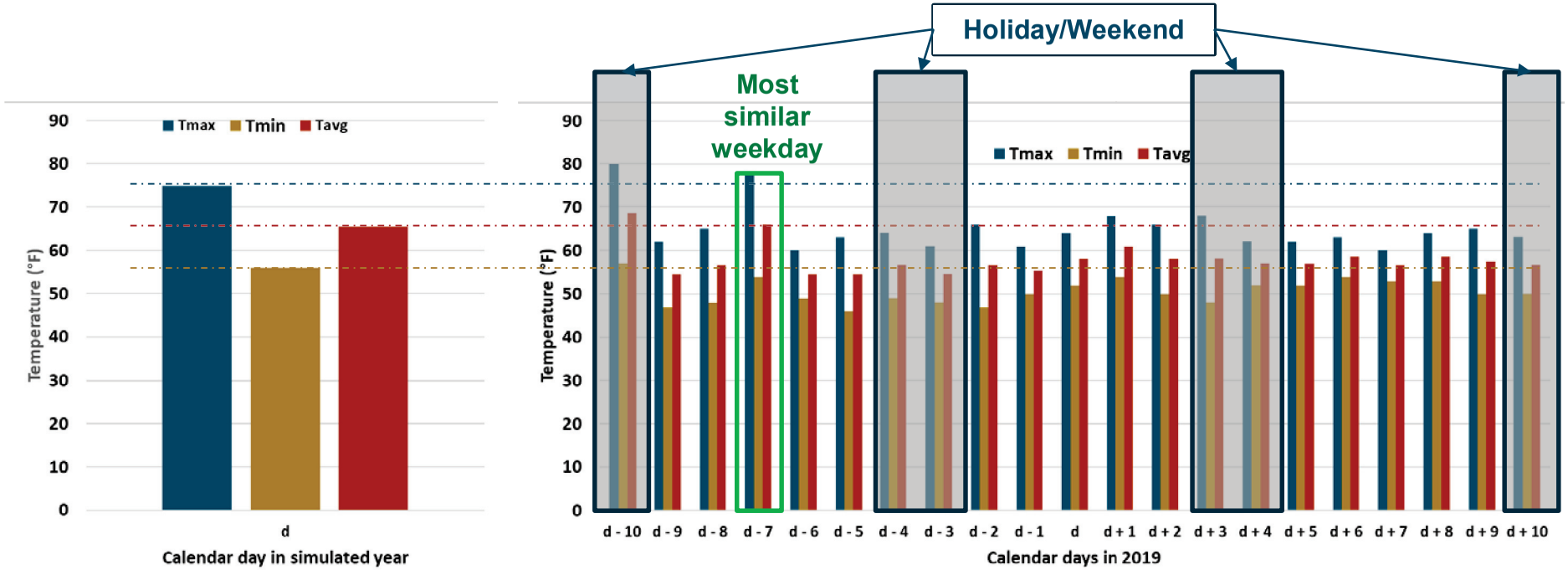


Weather-informed Day-Matching Algorithm for AC cycling DR Programs

- Inclusion of weather for air conditioner DR is in direct feedback to stakeholder comments from the May 3, 2020 CAISO ESDER meeting
- For an individual DR program and a particular day in a simulated year, pick one day out of +/- 10 calendar days of the same type (workday/holiday) from actual 2019 data with the closest T_{max}, T_{min} and T_{avg}
- Applied to PG&E's Smart AC program and SCE's Summer Discount Plan program data to account for influence of temperature on DR availability

Example weekday in simulated year

Candidate (2019) days for matching

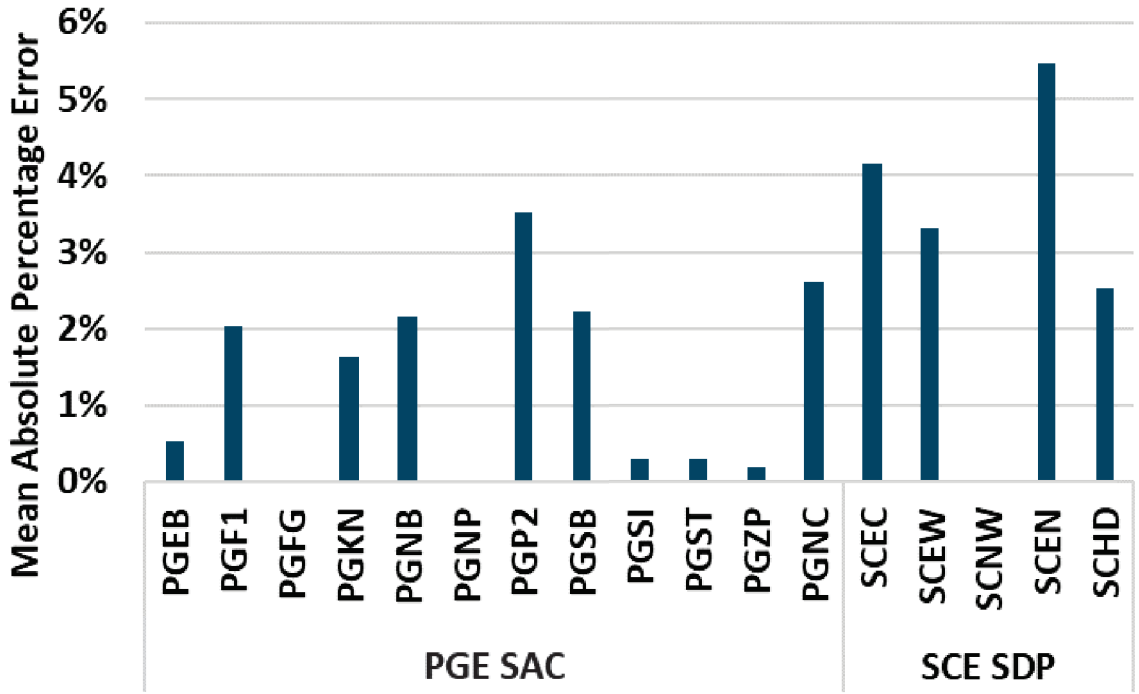


Comparison of day matched and real values

- The Mean Absolute Percentage Error (MAPE) is defined as:

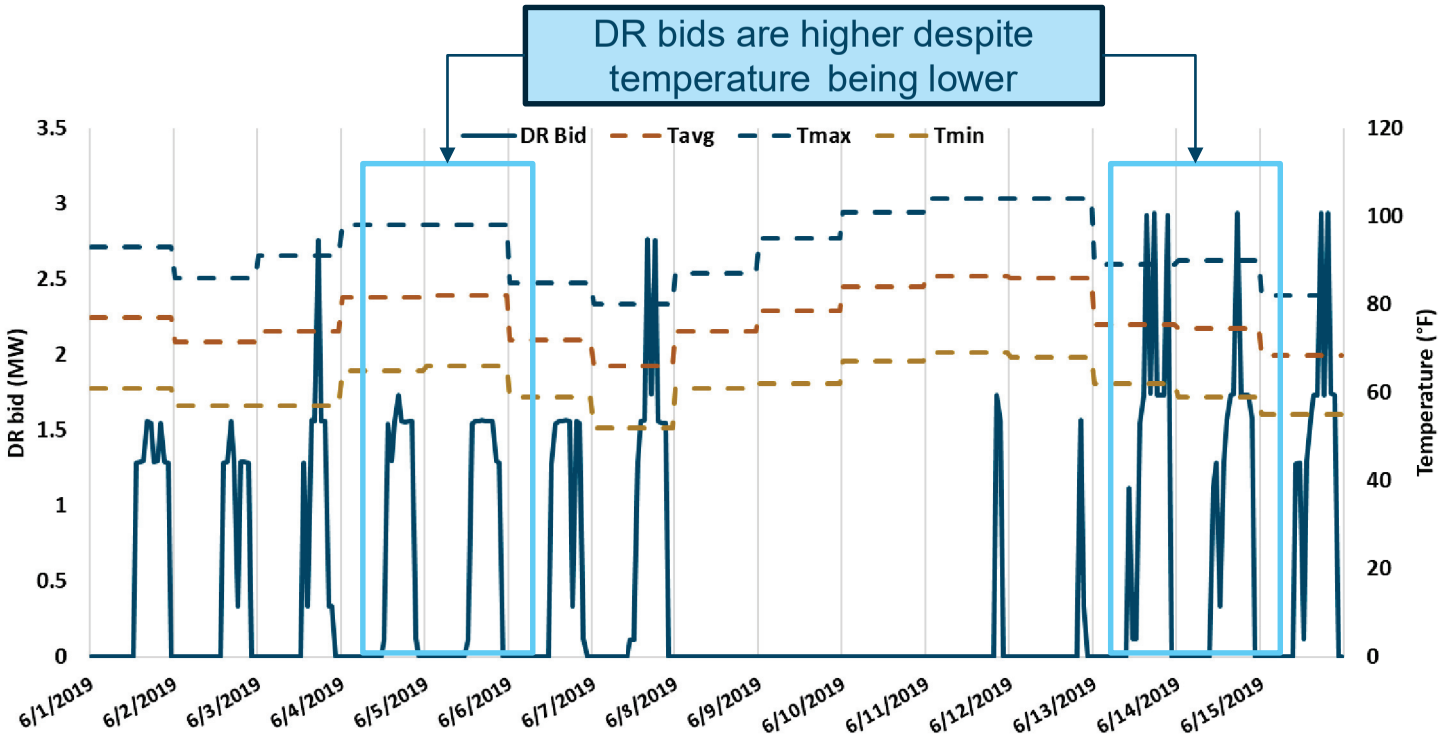
$$\frac{\text{Abs(Day–matched value – Actual Value) x 100}}{\text{Actual Value}}$$

- MAPE is calculated and shown below for July-September, 4 pm to 10 pm



Why Day Matching and not Regression?

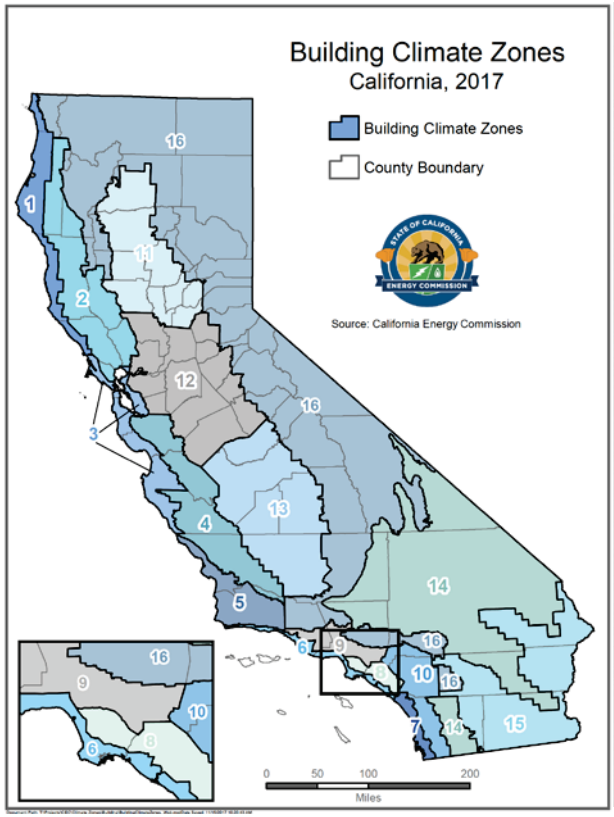
- **Regression based on temperature, month and day-type couldn't explain movement in DR bids. Potential reasons could be:**
  - Mismatch in temperature data used by E3 and IoUs.
  - Not accounting for other explanatory variables that IoUs use in their forecasts.
- **Absence of reliable hourly temperature records going back to 1950 meant only regression for daily DR bids was doable.**

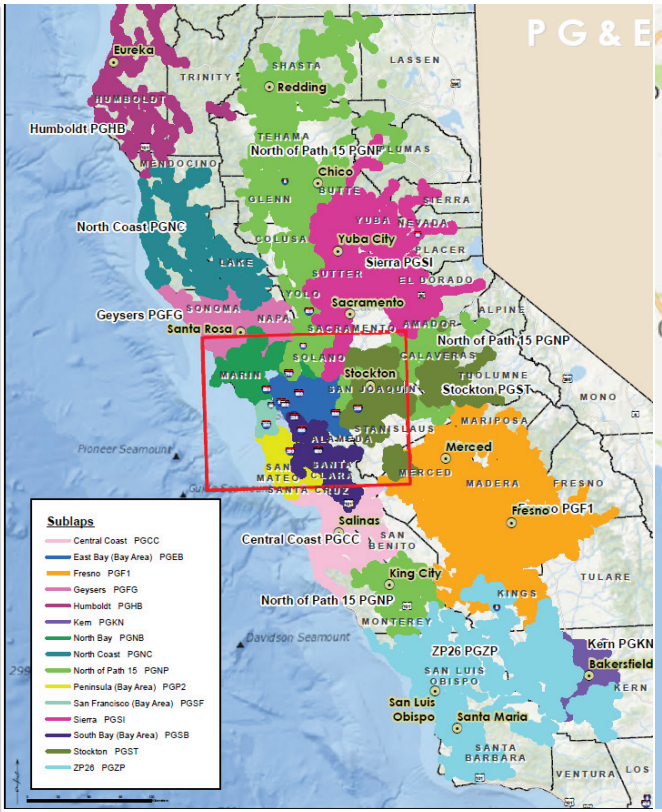


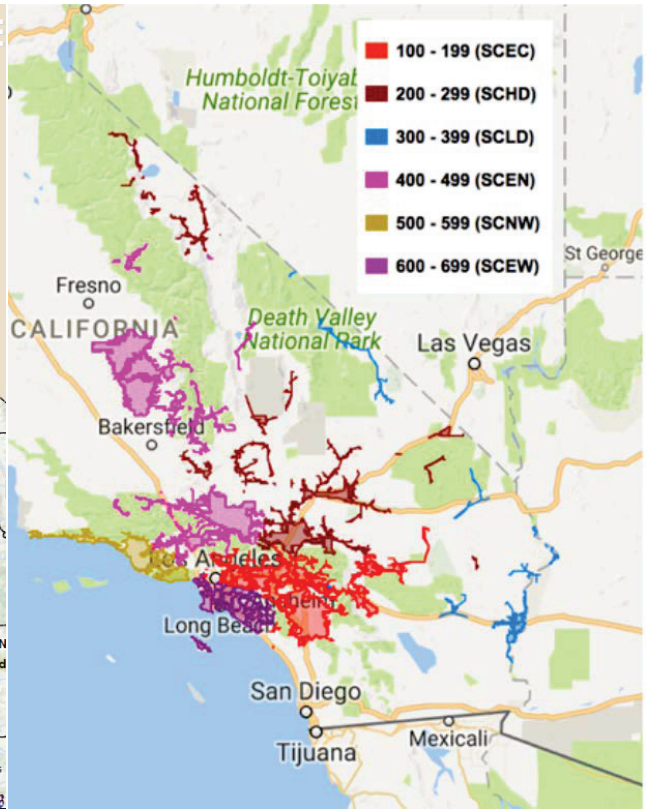
Assumptions on DR Program Characteristics

Utility	DR Program	Event Duration (hours/call)	Max. Events per Month	Max. Events per Year	Comments on RECAP Implementation
PG&E	BIP	6	10		
	CBP	6	5		30 hrs/month is interpreted as 5 events/month
	SAC	6		17	100 hrs/year is interpreted as 17 events/year
SCE	API	6	7		40 hours/month is interpreted as 7 events/month
	BIP	6	10		60 hours/month is interpreted as 10 calls/month
	CBP	6	5		30 hours/month is interpreted as 5 calls/month
	SDP	6		30	180 hours/year is interpreted as 30 events/year

Climate zones and sub-LAPs for reference







Sub-LAPs vs. Local Capacity Areas

Sub-LAP	Sub-LAP (long form)	Local Capacity Area
PGCC	PG&E Central Coast	Bay Area
PGEB	PG&E East Bay	Bay Area
PGF1	PG&E Fresno	Greater Fresno
PGFG	PG&E Fulton-Geysers	North Coast/North Bay
PGHB	PG&E Humboldt	Humboldt
PGKN	PG&E Kern	Kern
PGNB	PG&E North Bay	North Coast/North Bay
PGNC	PG&E North Coast	North Coast/North Bay
PGNP	PG&E North of Path 15 - non local	CAISO System
PGP2	PG&E Peninsula	Bay Area
PGSB	PG&E South Bay	Bay Area
PGSF	PG&E San Francisco	Bay Area
PGSI	PG&E Sierra	Sierra
PGST	PG&E Stockton	Stockton
PGZP	PG&E ZP26 (between Path 15 and 26) -non local	CAISO System
SCEC	SCE Central	LA Basin
SCEN	SCE North (Big Creek)	Big Creek/Ventura
SCEW	SCE West	LA Basin
SCHD	SCE High Desert	CAISO System
SCLD	SCE Low Desert	CAISO System
SCNW	SCE North-West (Ventura)	Big Creek/Ventura
SDG1	SDG&E	San Diego/Imperial Valley
VEA	VEA	CAISO System

California Independent System Operator Corporation

R.19-11-009

Attachment B

Preliminary Portfolio Assessment

Resource Adequacy Enhancements

Draft Final Proposal- Phase 1

and

Sixth Revised Straw Proposal

December 17, 2020

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1. Executive Summary

The California Independent System Operator Corporation (CAISO) is performing a comprehensive review and has been leading an extensive stakeholder process since October 2018 to enhance the CAISO's Resource Adequacy (RA) tariff provisions. The sole objective of this on-going effort is to ensure the CAISO's resource adequacy rules and tools remain relevant and guide the procurement of capacity that can reliably and sustainably support the rapidly evolving needs of the grid all hours of the year. This comprehensive review has identified important and non-trivial modifications to the CAISO's RA tariff provisions that affect System, Local, and Flexible RA needs, obligations, and requirements.

Throughout this initiative, the CAISO has highlighted key RA program features and elements that should change or be refined given the evolving needs of grid. For some time, the CAISO has raised the specter of emerging reliability challenges. The load-shed events of August 2020 illuminated and highlighted these challenges and support the CAISO's on-going comprehensive review of the resource adequacy program. To this end, the CAISO believes the set of elements in this initiative will help address these growing challenges and close important gaps in the existing RA program, and, once implemented, will help ensure a more stable and reliable transition to a decarbonized grid.

This document parses key elements of the resource adequacy enhancements initiative into a draft final proposal- phase 1 and a sixth revised straw proposal.[1] The draft final proposal represents those elements that are close to final in the policy development phase, and will be concluded in a final proposal that is scheduled for release in February and Board approval in March 2021. The draft final proposal includes certain refinements to the existing planned outage process, RA import provisions, minimum charge requirement, and local backstop procurement authority. The sixth revised straw proposal includes elements that require additional vetting, including proposals on unforced capacity evaluations, minimum system RA requirements, system RA showings and sufficiency testing, must offer obligations, local RA, and backstop capacity procurement provisions. These elements will be taken to the Board partly in May and also in September 2021.

Draft Final Proposal- Phase 1

In this draft final proposal, the CAISO is proposing several changes to the existing planned outage provisions and the planned outage process. Throughout this stakeholder process, the CAISO considered numerous different proposals from both the CAISO and stakeholders for modifying the planned outage process with varying degrees of support. 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 reflect the traditional NQC targets. This draft final proposal includes a planned outage process that requires substitution for all planned outages, to be implemented quickly. Under this proposal, the CAISO retains its full discretion to grant or deny all opportunity outages. Future

[1] A follow on draft final proposal (Phase 2) will be forthcoming as the policy elements in the sixth revised straw proposal are finalized.

proposals will continue to develop a longer term solution that accounts for the need for planned outages in the upfront procurement and eliminates the need for all planned outage substitution.

The CAISO proposes modifications to the RA import provisions including the identification of the types of resources that qualify to provide import RA capacity. Scheduling Coordinators submitting RA supply plans with import resources will be required to identify the resource(s) and/or the source balancing authority area (BAA) supporting the RA import, as well as meet identified RA import attestation requirements which are intended to ensure the RA import capacity is committed to the CAISO. Additionally, the CAISO will require that RA imports be supported by transmission service that provides a high level of certainty of deliverability. RA imports will be required to be delivered on Firm transmission on the last transmission leg to the CAISO, and transmission service of a priority no lower than Monthly Non-Firm point-to-point service on all upstream transmission legs. The CAISO will include these requirements in the tariff to ensure similar treatment among all LSEs and RA import suppliers.

The CAISO also developed a proposal for a minimum charge requirement, which will ensure that storage resources are sufficiently charged in the real-time market to meet day-ahead discharge schedules when storage resources are needed to meet the evening net-load peak.

Finally, the CAISO is expanding its backstop capacity procurement authority to fulfill any identified uncured local area energy sufficiency deficiencies.

Sixth Revised Straw Proposal

In the sixth revised straw proposal, the CAISO promotes RA counting rules that ensure RA capacity values properly reflect resource availability and that resource owners maintain resources to ensure high availability. This includes methodologies for calculating unforced capacity (UCAP) values 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. Implementing UCAP counting rules and minimum system RA requirements will ensure resources are procured upfront in the planning horizon to cover forced outages and eliminate complex forced outage substitution rules that, as CAISO analysis has shown, do not always cover the capacity need.

The CAISO is also refining its RA must offer obligation and bid insertion rules. The CAISO proposes modifications to ensure coordination with the Day Ahead Market Enhancements and Extended Day-Ahead Market initiatives to ensure all three proposals work in concert. 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 herein. The CAISO also proposes that RA resources are subject to bid insertion, unless exempted. RA resources will also have the same real-time must offer obligations they have today, until the conclusion of the transition period proposed in the Day-Ahead Market Enhancements initiative. The robust must offer obligations and bid insertion rules are proposed to minimize exemptions and ensure resources

are offered into the market to meet their RA obligations and enable the CAISO to meet load requirements with the RA fleet.

Finally, the CAISO is proposing additional modifications to its backstop capacity procurement provisions to align backstop authority with the resource adequacy counting rules and adequacy assessments.

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. However, as the fleet transitions to achieve the objectives of SB 100,[2] the CAISO must rely on a very different resource portfolio to reliably operate the grid.

Further, grid conditions during the August 2020 heat wave demonstrate the RA program must be reformed to ensure a reliable transition to a decarbonized grid. In this stakeholder initiative, the CAISO, in collaboration with the California Public Utilities Commission (CPUC) and stakeholders, explored 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

[2] 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

- 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 has conducted 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. Throughout the RA enhancements stakeholder process, the CAISO developed the proposals within this draft final proposal to address these concerns and ensure the CAISO's resource adequacy rules guide the procurement of capacity that can reliably meet system needs.

3. Resource Adequacy Enhancements Principles and Objectives

3.1 Principles

1. **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.

2. **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.

3. **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.

4. **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 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)."[3] In other words, resource adequacy also encompasses LSEs meeting their load requirements all hours of the year, not just meeting peak demand.

3.2 Objectives

In evaluating RA enhancements, CAISO has reviewed 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.

[3] 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.

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 capacity to not only meet both gross and net 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.

4. Stakeholder Engagement Plan

Table 1 outlines the schedule for this stakeholder initiative below. The CAISO plans to seek CAISO board approval on phase one elements in this RA Enhancements initiative in March 2021, and phase two elements in May and September 2021.

Phase 1 (Fall 2021 for RA year 2022)

March Board of Governors

- Planned outage process enhancements – phase 1 (Applicable prior to Summer 2021)
- RA Import requirements
- Operationalizing storage
- Backstop capacity procurement – CPM for local energy sufficiency

Phase 2 (Fall 2022 for RA year 2023)

May Board of Governors (Phase 2A)

- Unforced capacity evaluations
- Determining system RA requirements
- System RA showings and sufficiency testing – individual assessments
- Must offer obligations and bid insertion modifications
- UCAP for local studies
- Backstop capacity procurement – CPM modifications and availability penalty structure for RMR resources

September Board of Governors (Phase 2B)

- Planned outage process enhancements – phase 2
- System RA showings and sufficiency testing - portfolio assessment
- Flexible resource adequacy

Table 1: Stakeholder Engagement Plan

Date	Milestone
Dec 17	**Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal**
Jan 5-7 2021	Stakeholder meeting on Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal
Jan 21 2021	Stakeholder comments on Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal
Feb 2021	**Final Proposal – Phase 1 and Draft Final Proposal – Phase 2A**
Feb 2021	Stakeholder meeting on Final Proposal – Phase 1 and Draft Final Proposal – Phase 2A
Feb 2021	Stakeholder comments on Draft Final Proposal – Phase 2A
Mar 2021	**Present proposal on Phase 1 elements to CAISO Board**
Apr 2021	**Final Proposal – Phase 2A and Seventh Revised Straw Proposal - Phase 2B**
Apr 2021	Stakeholder meeting on Final Proposal – Phase 2A and Seventh Revised Straw Proposal Phase 2B
Apr 2021	Stakeholder comments on Seventh Revised Straw Proposal – Phase 2B
May 2021	**Present proposal on Phase 2A elements to CAISO Board**
June 2021	**Draft Final Proposal – Phase 2B**
June 2021	Stakeholder Meeting on Draft Final Proposal – Phase 2B
June 2021	Stakeholder Comments on Draft Final Proposal – Phase 2B
Aug 2021	**Final Proposal – Phase 2B**
Aug 2021	Stakeholder Meeting on Final Proposal – Phase 2B
Sept 2021	**Present proposal on Phase 2B elements to CAISO Board**

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5. RA Enhancements Draft Final Proposal – Phase 1

The following sections detail the CAISO's draft final proposal on enhancements to the resource adequacy program and provide the CAISO's rationale and supporting justification. The CAISO has organized the draft final proposal into sections covering System and Local RA and related sub topics, and a section covering proposed modifications to the CAISO's backstop procurement provisions. For elements still in the straw proposal phase, see section 6 and 7.

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

- System Resource Adequacy
    - Planned Outage Process Enhancements
        - Modifications – Phase one will require substitute capacity for all planned outages. Phase two will implement a planned outage replacement pool, and will be included in a future revised straw proposal.
    - Resource Adequacy Imports
        - Source specificity requirement
            - Modifications – Identifying the specific requirements for source specificity for the different types of RA imports, along with implementation elements.
            - Modifications – Introduction of term *Non-Dynamic Resource Specific Resource Adequacy (RA) Import* – to replace the term – *Non-Dynamic Resource Specific System Resource* – to refer to RA imports not pseudo-tied or dynamically scheduled to the CAISO.
        - Transmission delivery assurance
            - Modifications – Identification of the specific transmission delivery requirements needed to support RA imports.
        - Attestation requirement for RA imports
            - Modifications – Identification of the specific attestation requirement for RA imports including clarification on the entity meeting the attestation requirement.
    - Operationalizing Storage Resources
        - Modifications – Modified under what conditions the CAISO will impose the minimum charge requirement.
- Backstop Capacity Procurement Provisions
    - Capacity Procurement Mechanism Modifications
        - Modifications – Only seeking new CPM authority for local energy sufficiency test. Other CPM and RMR proposals included in sixth revised straw proposal.

5.1 System Resource Adequacy

5.1.1 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[4] 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 was generally divided between the two options.

Many stakeholders, including SCE, Calpine, MRP, CalCCA, and Wellhead offer some level of support for Option 1.[5] 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. In their view, Option 2 applies more direct causation to the resources taking the planned outages and offers more of a market based solution.

In the fifth revised straw proposal, the CAISO proposed to develop a planned outage reserve margin. The stakeholder community was split on this matter. On an initial review, the CAISO determined that this division was indicative of general lack of support for the planned outage reserve margin. As a result, the CAISO, in the September 17, 2020 working group meeting foreclosed this option, instead focusing on rules that require substitution for all RA resources. In comments on the workgroup, several stakeholders' clarified their comments to note that their opposition to the planned outage reserve margin was based, in part on the CAISO's proposed prohibition on planned outages during the summer months.

In addition to considering stakeholder feedback, the CAISO 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, with some having seasonal differentiation. Additionally, other ISO/RTOs can require up to two years of notice for planned outages. This allows the ISO/RTOs to include

[4] 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.
[5] SCE did not oppose the CAISO proposal, but had questions regarding the definition of a planned outage.

those planned outages in its LOLE studies when conducting annual capacity procurement. Because other LSEs have much greater visibility into the RA obligations of resources, the planned outage procedures are much cleaner. In contrast, the CAISO does not know which resources will be RA resources until 45 days prior to the RA compliance 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 proposes a two-phase approach to planned outage substitution. First, the CAISO proposes to implement an immediate requirement for summer 2021 that all planned outages for RA resources must bring full substitute capacity for the outage to be approved. In a second phase, the CAISO will vet in subsequent revised straw proposals, a longer-term proposal for a planned outage resource pool concept effective for RA year 2023 and beyond. Also, in response to some stakeholder's concern's, the CAISO will explore the possibility of allowing planned outages during the summer months, when and if operationally appropriate.[6] The details of the CAISO's proposed process are provided below.

Stakeholders continue to comment on the CAISO's view that, depending on circumstances, a generator can violate the tariff if it submits a forced outage after the CAISO has already rejected the same outage previously 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.[7] 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.[8]

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 6.1.1 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

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[6] Details regarding other options the CAISO considered, including the CAISO creating a planned outage replacement market, and the reasons the CAISO is no longer considering those options are contained in prior straw proposals.

[7] 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

[8] http://www.caiso.com/Documents/ExecutiveAppealsCommitteeDecision-PRR1122-Mar112020.pdf

relationship between outage reporting and the rest of the RA Enhancements proposal, it is most appropriate to address this issue within this initiative in Phase 2 under the UCAP proposal.

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.[9] 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.[10] 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
- 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
- Minimize or eliminate the need to require substitute capacity to greatest extent possible

Current Planned Outage Substitution Obligation Timeline

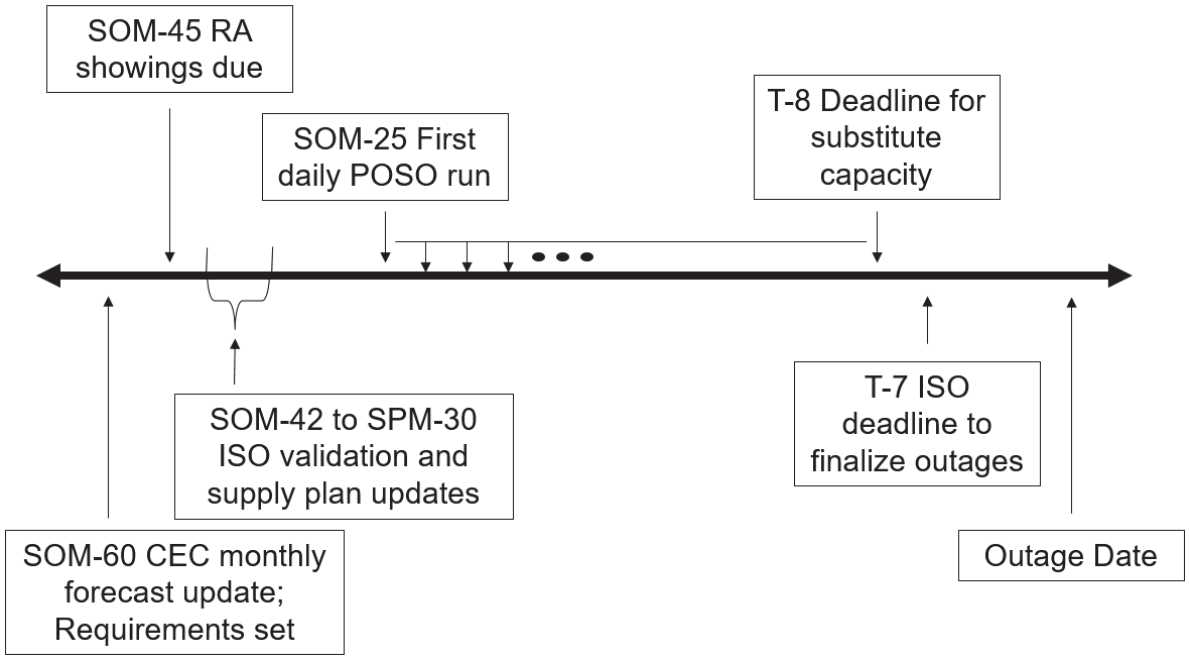
The current POSO timeline is provided in Figure 1 below. The current timeline provides the first POSO assessment at T-22, or 22 days prior to the start of the RA delivery month, for all outages submitted prior to T-25. This is the first instance when resource owners are provided with

[9] Outage management BPM: https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Outage%20Management

[10] 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.

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.

Figure 1: Current POSO timeline



Proposed Modifications to the Planned Outage Process

Based on recent events and stakeholder comments, the CAISO is proposing a two-phase process to enhance its planned outage process. The immediate phase 1 provisions will be applicable for summer 2021, and the longer-term phase 2 enhancements will be applicable for RA year 2023 and beyond. The goal in both phases is to ensure planned outages can be taken with minimal cancellation risk after the CAISO initially approves them. Additionally, the CAISO's ultimate goal is to remove obligations for outage replacement, and the associated negative incentives, to the greatest extent possible. The CAISO proposes to redesign the planned outage process in phase 2 to reflect the proposed system UCAP/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.

The first phase of the CAISO's proposed planned outage process would require all RA resources requesting planned outages to provide substitute capacity. This stage is designed to be very focused and easily implemented for summer 2021 and is included in the draft final proposal. The goal is to implement this policy promptly, to reduce reliability risks during future summer months.

The second phase of this process will continue to be vetted in revised straw proposals. In the second phase, the CAISO will continue to work with stakeholders to develop a planned outage

pool. The CAISO is targeting RA year 2023 to implement this "planned outage capacity pool" concept.

Phase one: Planned Outage Replacement Requirement – Summer 2021

As noted above, the current planned outage process allows RA resources to submit planned outage requests months in advance, but the CAISO does not provide its notification regarding the need for the resource to provide substitute capacity until 20 days prior to the month. During the time between the planned outage request and the CAISO's study, the resource does not know if substitution will be required. Though infrequent, the result of this process can be that a resource is required but unable to provide substitute capacity. The CAISO analyzed denied planned outages and found approved planned outages are subsequently denied less than two percent of the time. All subsequently denied planned outages were due to failure to provide substitute capacity.

In phase one, the CAISO's proposes to eliminate this uncertainty by requiring all RA resources requesting planned outages to submit substitute capacity. The specific timing of the substitute capacity submission depends on the timing of the planned outage request relative to the RA showings. Outages conditionally approved in long and mid-range outage windows, which occur prior to RA showings, will be conditionally approved subject to RA status and substitution obligation. The substitution must be made at the time of the RA showing or the CAISO will automatically deny the planned outage request. Even if the resource provides substitute capacity, the outage may still be denied if the CAISO's reliability assessment shows that the requesting resource is uniquely needed for reliability. Outages requested in the mid- or short-range window after RA showings have been made must provide substitute capacity at the time the outage request is submitted, otherwise, the CAISO will automatically deny the outage. As with the long and mid-range requests, short-range outage may still be denied subject to a reliability assessment. All outage requests submitted after the short range study window submission deadline will be treated as forced, urgent, or opportunity outages.

The CAISO also proposes changes to how it handles requests for extending planned outages. Currently resources on planned outages that request an outage be extended are typically granted. The basis for this is that denying the outage does not change the fact that the resource will still be on outage. However, this practice does not require substitution or provide adequate incentives to accelerate completion of the maintenance.

The CAISO proposes that the following objectives must be achieved by the proposed policy changes:

- Objective 1: Classify planned/forced outage correctly because this classification gets posted publicly
- Objective 2: Encourage SCs to replace RA when they can still replace the RA Capacity

The CAISO reviewed two different planned outage scenarios to illustrate the potential outcomes of different requests to extend planned outages based on various options for addressing these requests.

Example: Resource 1 has a planned outage that is scheduled for 3 weeks.

> **Scenario 1**: Once the outage starts, on the beginning of that outage the SC identified that they cannot return the plant and will need extension of that outage for another 4 weeks.
>
> **Scenario 2**: The outage starts well, however, in the last day of the outage, the SC identified that they cannot return the plant and will need extension of that outage for another 4 weeks.

To address the requested outage extensions, the CAISO considered three different options:

Option 1: Do not allow outage card extension – Require SC to always create a new outage card for extension

Consequence for Scenario 1:

- That outage extension will be classified as planned outage because they notify the CAISO ahead of time (beyond short term window)
- That outage will have an RA substitution obligation
- That outage extension will be denied if RA substitution is not provided
- There is no guarantee that SC will submit Forced outage card on-time for the CAISO's pre-day ahead processes – This will give this back to Real Time

Consequence for Scenario 2:

- That outage extension will be classified as Forced outage because they tell the CAISO at the last minute
- That outage will have an RA substitution obligation

Option 2: Do allow outage card extension (status quo)

Consequence for both Scenario 1 and 2:

- That outage extension will be classified as planned outage because the original card is a "Planned outage"
- That outage will have a substitution obligation
- That outage extension cannot be denied if RA substitution is not provided because it is one outage card

Option 3: Do allow outage card extension – But extensions are only allowed if they provide substitution

- OMS will check if the units are shown as RA

- If the units are shown as RA, it will only allow the outage extension if there is substitution
- The mechanics of this are still not certain because an outage can extend beyond the RA showing time frame.
    - i.e. SC can extend an outage for 4 weeks and it ended up extending to a month that has no RA showing timeline deadline yet.

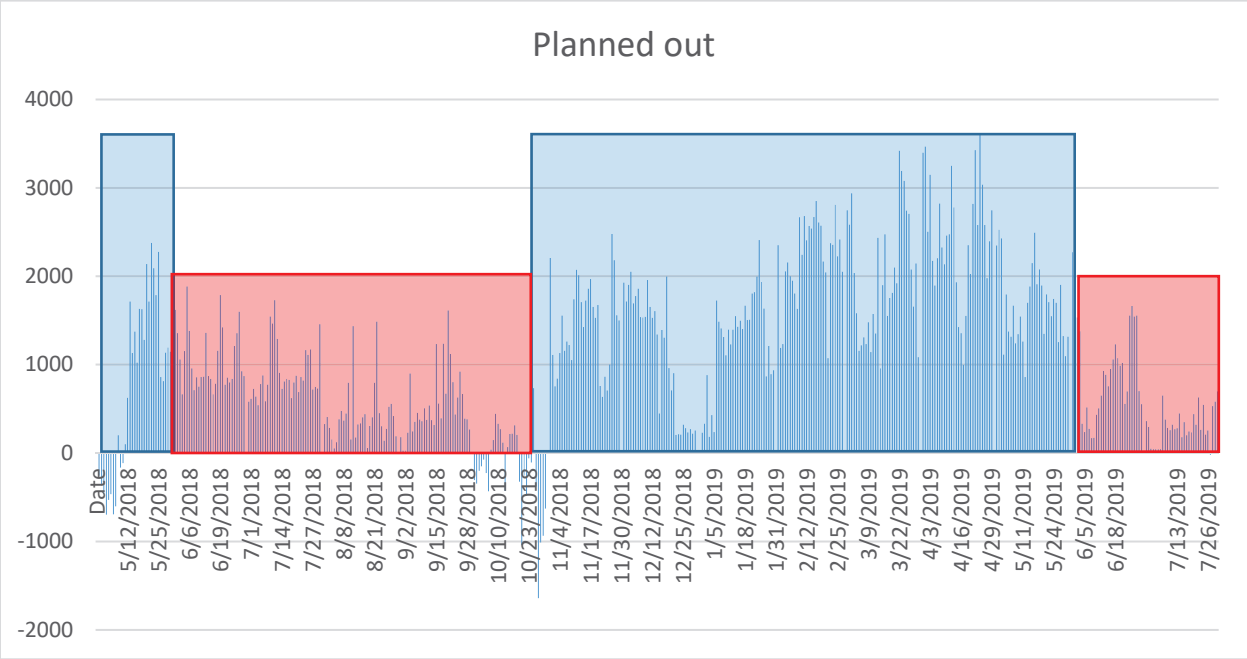
At this time, the CAISO proposes Option 1. This option is consistent with the rest of the CAISO's proposal to require substitution and provides the CAISO and resources with clear rules regarding how extensions will be handled and ensure the CAISO has adequate capacity to maintain reliability when resources cannot return to service consistent the originally approved outage.

Phase two: Planned Outage Replacement Pool – RA Year 2023 and Beyond

Phase two of the CAISO's efforts to improve the outage replacement process will focus on improving transparency and ensuring a pool of resources is available to provide substitute capacity. Additionally, the CAISO will seek to reduce any incentives to withhold capacity. To facilitate outage coordination and provide the greatest certainty regarding the timing of planned outages to both the CAISO and resource SCs, the CAISO will develop a planned outage replacement pool. Although the CAISO originally proposed to establish a pool only for non-summer months, in response to stakeholder comments, the CAISO will explore opportunities to develop a planned outage pool for summer months as well. The most significant challenge for developing a summer planned outage pool will be finding sufficient non-RA capacity to participate in the pool.

As can be seen from Figure 2 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 2: Approved Planned Outages (Both with and Without Substitution)[11]



The CAISO will continue developing this planned outage pool proposal in a future revised straw proposal, and will use many of the elements of the planned outage reserve margin provided in the fifth revised straw proposal as a starting point for this proposal. There are several potential benefits to load from developing a planned outage resource pool. First, the CAISO can eliminate 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 free up additional capacity during summer months, increasing overall supply and lowering costs.

In its phase 2 proposal, the CAISO seeks 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 when they plan their outages. Specifically, CAISO will develop a calendar that shows in advance and on a daily basis, the potential availability of additional system RA headroom or capacity in the planned outage pool. This transparency should allow resources to identify potentially superior calendar dates in advance of requesting planned outages. If the calendar shows no available

[11] Observations with negative values represent days when the quantity of substitute capacity exceed the quantity on approved planned outage.

headroom, then any RA resource requesting a planned outage will be required to show substitute capacity.

The CAISO will approve and deny outages through the planned outage tool discussed above. The CAISO will continue to evaluate and accept outages and substitute capacity[12] 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 request.

Figure 3 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 structure of the planned outage resource pool.

Figure 3: 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: 200 MW	14 Headroom: - MW	15 Headroom: - MW

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 6.1.1, regardless of which planned outage option is ultimately selected. Further, as noted in section 6.1.4, the CAISO is proposing to modify the RA must offer obligation after the end of the transition period proposed in the day-ahead market enhancements. After this transition, 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.

5.1.2 RA Import Requirements

Introduction

Imports of capacity from resources located outside of the CAISO BAA are an increasingly important component of the overall RA capacity made available to the CAISO to operate the market and manage the grid reliably. In developing the holistic RA imports policy described in

[12] The CAISO will consider the ability of substitute capacity to provide "like-for-like" capabilities.

this draft final proposal, the CAISO recognized that increasingly limited RA capacity, changing load patterns across the Western interconnection, and the rapidly changing regulatory landscape, affect the availability and delivery of RA import capacity to the CAISO.

In 2019, the CAISO identified several operational challenges facing the BAA including a capacity shortfall in 2020 and subsequent years.[13] This capacity shortfall occurring in the evening hours is driven largely by solar energy production decreasing faster than the load it was serving. During these net load peak hours, the ISO must largely rely on traditional gas-fired resources and imports to meet the load-serving needs of the grid. As California moves to achieve its clean energy goals and address capacity shortfall challenges, it is increasingly important that RA capacity from import resources be committed and deliverable to the CAISO. The proposed RA import policy changes address these issues.

Additionally, conditions across the entire Western interconnection are changing. As more Western states pursue clean energy regulatory policy goals, including enacting RPS targets, capacity conditions are tightening and other BAAs face capacity shortfall challenges similar to those the CAISO BAA faces. For example, recent studies show the Northwest is either capacity short today or will be capacity short in the coming one to two years driven by retirements of aging, baseload resources and expected load growth.[14] Moreover, ongoing studies and climate change modeling scenarios preliminarily indicate a shift in peak demand from winter to summer months across the Northwest region. This shift will place further pressure on capacity sufficiency across the western interconnection.[15] Finally, as the recent August and September heat waves demonstrate, severe west-wide weather events can negatively affect capacity availability across the entire Western Interconnection. Given tightening capacity in the west, future heat storm events will affect the availability of RA imports to the CAISO, which is a growing concern given existing RA import policy does not require resource specificity or commitment solely to the CAISO, and allows delivery on the lowest priority transmission service.

Based on the most recent stakeholder comments and comments on prior straw proposals, the draft final proposal strikes a balance between the CAISO's need for reliable and dependable RA imports with the need for an efficient and liquid market recognizing that California competes for imported energy and transmission across a broad and diverse west-wide market.

The compilation of proposed modifications in this draft final proposal supports and builds on the CAISO's RA import market participation rules and aligns directionally with the RA program rule

[13] California ISO, *Briefing on Post 2020 Grid Operational Outlook,* September 2019 Board of Governors Meeting - http://www.caiso.com/Documents/Briefing-Post-2020-GridOperationalOutlook-Presentation-Sep2019.pdf

[14] Northwest Power Pool, *Exploring a Resource Adequacy Program for the Pacific* Northwest, p. 20 (October 2019).

[15] California Energy Markets, *Climate Change Shifts Pacific Northwest Demand Peak,* October 16, 2020 (Link). The article is based upon the NW Power and Conservation Council Resource Adequacy Advisory Committee (RAAC) Technical Committed Webinar held on October 6, 2020. A presentation on the *Preliminary Resource Adequacy Assessment for 2025 and 2027,* slide 9, describes shifts in hydro generation and loads in Summer and Winter timeframes identifying the potential for changed conditions (Link).

changes the CAISO has been advocating in the CPUC's Track 1 and Track 3B RA proceedings. CAISO and CPUC alignment on RA imports coming out of the CPUC's Track 3B RA proceeding is important to ensure comparable treatment across all LSEs and avoid disconnects between the CAISO's and CPUC's RA import rules and regulations. Nevertheless, the CAISO sees the proposed policy elements as the minimum requirements for import resources to provide RA capacity to the CAISO BAA. The CPUC and other Local Regulatory Authorities (LRA) could consider imposing additional requirements or restrictions that go beyond the CAISO requirements.

Compared to the fifth revised straw proposal, in this draft final proposal the CAISO provides further clarifications and specifications on RA import source requirements, transmission delivery requirements, and the associated attestation requirement. The CAISO also addresses key themes raised in comments such as RA import bidding behavior and availability of Firm transmission across the Northern interties.

Implementing the proposed RA imports policy structure described in this draft final proposal will consist of a 2-step implementation process. RA compliance year 2022 would be a bridge year with RA importers encouraged to provide resource specific information and deliver the import on transmission as outlined in the proposal. Full compliance with the proposed policy for RA imports would be expected for RA year 2023. This implementation approach provides interested suppliers/importers additional time to modify existing contracts or enter into new ones as appropriate and adjust or develop strategies regarding transmission procurement to support delivery of RA imports.

Background

LSEs can meet system RA requirements with a mix of RA resources, including imports from resources located outside the CAISO Balancing Authority Area (BAA). 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. [16] In 2019, this increased to about 4,700 MW (or about 10 percent).[17] 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.

Under the existing policy construct, the CAISO tariff imposes limited requirements on RA import resources. The existing tariff does not require RA import resources be resource-specific or specify they represent supply from a specific balancing authority area (BAA), it does not specify the level of transmission firmness on which these RA import resources must be delivered, and it does not ensure the RA import capacity has not been committed to other parties. RA import resources are only required to be shown on RA supply plans with associated maximum import

[16] 2017 CAISO DMM Annual Report, p. 259: http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf
[17] 2019 CAISO DMM Annual Report, p. 266: http://www.caiso.com/Documents/2019AnnualReportonMarketIssuesandPerformance.pdf

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 does not receive an award in the day-ahead (DA) integrated forward market or residual unit commitment process. However, to the extent an import is not delivered it is subject to a non-delivery penalty.[18]

The current RA import policy framework can undermine the integrity of the RA program and threaten system reliability. The CAISO's Department of Market Monitoring (DMM) expressed similar concerns in its September 2018 DMM special report on import RA[19] stating 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 stated 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 commitment.

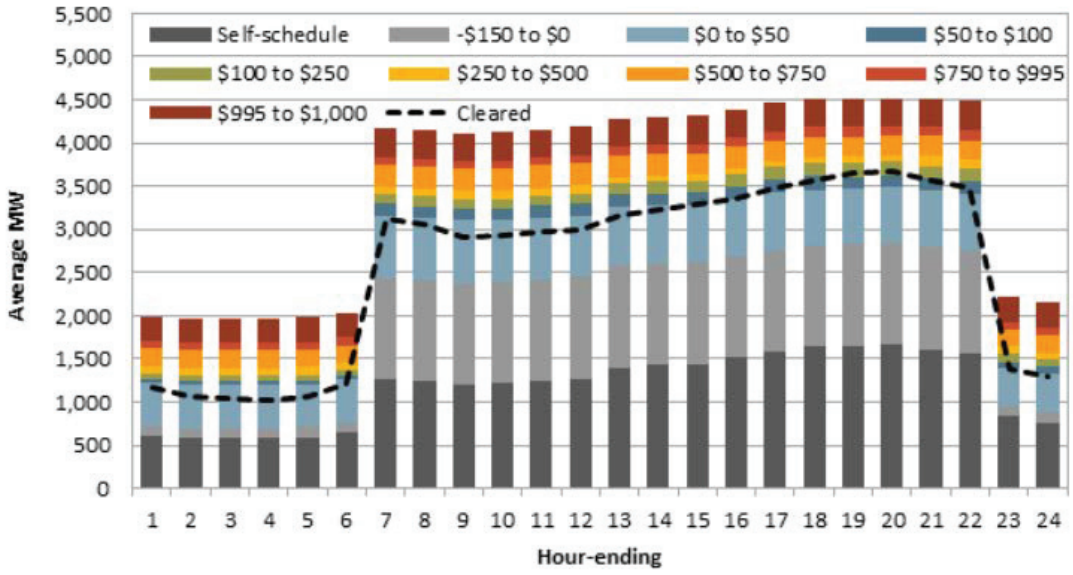
DMM provided specific examples of these bidding behaviors in its comments on the recent CPUC Proposed Decision clarifying RA Import rules (R17-09-020). Figure 4 shows the average hourly RA imports offered into CAISO's market at various price levels.[20] This information provides additional evidence that around 1000-1200 MW RA imports were submitting bids at bid levels in excess of $500/MW in August of 2018.

[18] The *Intertie Deviation Settlement Initiative,* approved by the CAISO Board in February 2019, provides for non-delivery penalty for imports equal to 50% of the maximum of the 15-min market or the 5-min real-time dispatch LMP, with a $10/MWh minimum, plus any imbalance energy charges that may be incurred. The policy will be implemented and go into effect on January 1st, 2021. The materials associated with the initiative can be accessed here: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Intertie-deviation-settlement

[19] DMM Special Report: Import Resource Adequacy, September 10, 2018: http://www.caiso.com/Documents/ImportResourceAdequacySpecialReport-Sept102018.pdf

[20] 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

Figure 4: Average hourly RA imports offered by price bid (weekday hours) August 2018



On February 28, 2020, the CAISO submitted a proposal in the CPUC's RA proceeding, R.19-11-009.[21] The CAISO's proposal 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 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/MWh. The CPUC noted it saw merit in the CAISO's proposal, but believed more robust verification and visibility was necessary before

[21] 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

implementation.[22] 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 here, providing additional clarification and modifications to support full implementation of new import eligibility rules, providing a bridge year, and including an interim real-time must offer obligation that would be in effect through the transition period proposed in the Day-Ahead Market Enhancements (DAME) policy which is, in part, evaluating replacement of a real-time must offer obligation.

Current RA Import Policy Framework – An Overview

Prior to delving into the different elements of the proposal, it is important to understand the current policy framework for RA imports. This will better place into context the proposed changes and how they will achieve the objectives of this initiative. This section will provide an overview of the current policy framework for RA imports under the CAISO tariff as well as the additional requirements or limitations imposed by the CPUC through Order D.20-06-028 on its jurisdictional LSEs.

Under the current RA import policy framework, there are three types of RA import resources: (1) Pseudo-Tie resource[23], (2) Dynamically Scheduled resource[24], and (3) non-resource specific system resources.[25] These three types of RA import resources have different modeling, Masterfile, contractual requirements and relationships with the CAISO, which will be outlined below.

Pseudo-Tie resources are physically located outside of the CAISO BAA but the output is telemetered into the CAISO BAA and the overall resource is treated as if it were in the CAISO BAA by taking on the BAA obligations for the resource. To Pseudo-Tie a resource into the CAISO BAA, the resource must be specifically identified and modeled in the CAISO full network model which requires following the new resource implementation process (identification of specific resource, data/information submission, testing, etc.), identification of Masterfile parameters for the resource, and relevant contract execution. The CAISO has a contractual relationship with the Pseudo-Tie resource through the *Pseudo-Tie Participating Generator*

[22] CPUC Track 1 Decision, D.20-06-028 (2020).
[23] Under the CAISO tariff, a Pseudo-Tie is defined as "a functionality by which the output of the generating unit physically interconnected to the grid in a Native Balancing Authority Area is telemetered to and deemed to be produced in the Attaining Balancing Authority Area that provides Balancing Authority Services for and exercises Balancing Authority jurisdiction over the Pseudo-Tie generating unit." CAISO Fifth Replacement FERC Electric Tariff, Appendix A (2020).
[24] Under the CAISO tariff, a Dynamic Schedule is defined as "a telemetered reading or value which is updated in Real-Time and which is used as an Interchange Schedule in the CAISO Energy Management System calculation of Area Control Error and the integrated value of which is treated as an Interchange Schedule for Interchange accounting purposes." CAISO Fifth Replacement FERC Electric Tariff, Appendix A (2020).
[25] Non-resource specific system resources is not a Tariff defined term, however, it is used to refer to non-Pseudo-Tie and non-Dynamically Scheduled resources for which the physical generating units are not identified.

Agreement,[26] which sets out the terms and conditions of the arrangement including compliance with the tariff requirement. Further, the resources are subject to compliance with *Pseudo-Tie Protocols,*[27] which set out operational requirements for Pseudo-Tie resources including the imposition of a requirement that these types of resources must be delivered to the CAISO on Firm transmission[28] and may be subject to exceptional dispatch.[29] The host BAA, where the Pseudo-Tie resource is physically located, also must execute an agreement with the CAISO to ensure coordinated operation and treatment of the resource.[30]

Dynamically Scheduled resources are physically located outside of the CAISO BAA and a telemetered value is sent to the CAISO and updated in real-time but, unlike Pseudo-Tie resources, the output is not deemed produced in the CAISO BAA. Dynamically Scheduled resources go through the same process as Pseudo-Tie resources in identifying the specific resource to be dynamically scheduled, and the resource is modeled in the full network model, Masterfile parameters identified, and relevant contracts are executed. The Scheduling Coordinator representing the Dynamically Scheduled resource executes a *Dynamic Scheduling Agreement for Scheduling Coordinators*[31] which provides the terms and conditions of scheduling the resource. Further, the *Dynamic Scheduling Protocol (DSP)*[32] set out the operational and scheduling requirements for Dynamically Scheduled resources including setting the requirement that Dynamically Scheduled Ancillary Services must be delivered on Firm transmission while only energy may be delivered on transmission lower than Firm.[33] The host BAA, where the Dynamically Scheduled resource is located, must execute an agreement with the CAISO regarding coordinated operation and treatment of the resource.[34]

Non-resource specific system resources, as the name implies, are resources that are neither Pseudo-Tie resources nor Dynamically Scheduled resources and the physical resource supporting the generation is not identified. The CAISO does not require that these resources be modeled in the CAISO's Full Network Model nor is there a contractual relationship with the CAISO. These resources also are not telemetered into the CAISO but rather are statically scheduled (non-dynamically). Historically, the CAISO has not required modeling of these types of resources nor has there been a need for a contractual relationship as these resources do not have unique scheduling and metering requirements unlike Pseudo-Tied and Dynamically Scheduled resources. Rather, these are imports which could be energy contracts or physical resources not identified to the CAISO, the more common type of RA import resource today. Traditionally, these have been the most prevalent type of RA import.

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[26] CAISO Fifth Replacement FERC Electric Tariff, Appendix B.16 (2013).
[27] CAISO Fifth Replacement FERC Electric Tariff, Appendix N (2020).
[28] *Id.,* section 1.2.1.5.
[29] *Id.,* section 1.2.1.3.
[30] The CAISO and the host Pseudo-Tie resource BAA execute a *Dynamic Transfer Balancing Authority Operating Agreement* which is a non-pro forma agreement that is not in the tariff but is rather filed with FERC for approval when executed.
[31] CAISO Fifth Replacement FERC Electric Tariff, Appendix B.5 (2013).
[32] CAISO Fifth Replacement FERC Electric Tariff, Appendix M (2018).
[33] *Id.*, section 1.5.1.
[34] CAISO Fifth Replacement FERC Electric Tariff, Appendix B.9 (2020).

Under the current RA rules, the CAISO tariff does not require a particular level of transmission firmness to support delivery of imported RA capacity. Thus, RA imports can be delivered on Firm or Non-Firm transmission across the different transmission legs with the exception of Pseudo-Tie resources which, under the terms of the agreement, are to be delivered on Firm transmission regardless of whether these are RA or non-RA resources. As discussed later in the proposal, delivery of RA imports on low priority Non-Firm transmission service increases the risk of non-delivery during stressed system conditions across the west. Additionally, the current policy framework does not require RA imports be resource-specific or be committed solely to the CAISO, meaning the physical resources supporting the RA import do not have to be identified. This is particularly true for non-resource specific system resources which could be energy contracts sourcing from multiple-BAAs. Without specification of the physical resources supporting the import RA and a requirement they be committed solely to the CAISO, the CAISO risks counting on capacity that is not committed to the CAISO, potentially counted to meet another BAAs capacity requirements, and not providing dependable delivery for the CAISO to rely upon in managing system reliability.

The CAISO imposes a non-delivery penalty for imports (whether or not they provide RA capacity) but the current penalties do not provide sufficient incentives for delivery. The CAISO's *Intertie Settlement Deviation Initiative*, scheduled for implementation on January 1, 2021, provides increased incentives for imports to deliver as scheduled. Under the new rules, import resources, including RA imports, will be subject to a non-delivery penalty equal to 50% of the maximum of the 15-minute market or the 5-minute real-time dispatch LMP, plus any imbalance energy charges that may be incurred.[35] The penalty will apply in instances where import resources are not delivered pursuant to a market award with the exception that the penalty will not be applied to the extent the non-delivery is due to a transmission curtailment.

In June of this year, CPUC Decision D.20-06-028 added new rules for CPUC-jurisdictional LSEs procuring import RA from non-resource specific system resources. Under that decision, to qualify for import RA, non-resource specific system resource must meet the following requirements:

(1) The contract is an energy contract with no economic curtailment provisions;
(2) The energy must be self-scheduled or economically bid at levels between negative $150/MWh and $0/MWh into the day-ahead and real-time markets at least during the Availability Assessment Hours throughout the RA compliance month; and
(3) The energy must be delivered to the LSE in accordance with the governing contract.

Thus, under the CPUC decision, starting with RA year 2021 non-resource specific RA imports procured by CPUC-jurisdictional LSEs must be self-scheduled or economically bid at prices

[35] The *Intertie Settlement Deviation* initiative proposed the identified penalty to incentivize delivering and tagging of all import resources, whether or not they are providing RA capacity. The initiative and the penalty structure were approved by the CAISO Board in February 2019, with FERC issuing a letter of acceptance in September 2020, with implementation being set for January 1, 2021 with the relevant tariff section being effective as of the implementation date. The initiative page, with the relevant background, can be accessed here - https://stakeholdercenter.caiso.com/StakeholderInitiatives/Intertie-deviation-settlement

below $0/MWh.[36] Non-CPUC-jurisdictional LSEs are not subject to the limitations of the CPUC decision noted above.

Taking into account the current policy framework for RA imports described above, this draft final proposal highlights the areas of proposed change in the sections 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. This is increasingly important in light of the CAISO's reliance on imports during stressed system conditions and the ever changing and tightening capacity constraints across the west. The CAISO has significant concerns with several aspects of the current RA import policy framework: (1) lack of resource specificity, (2) lack of a requirement the capacity be committed solely to the CAISO, and (3) uncertainty regarding the transmission priority level at which imports might be delivered to the CAISO.

First, 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 earlier, 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 (if any) specific resources are supporting an RA import. Speculative RA import supply can occur when RA imports shown on RA supply plans have no physical resources backing them up or the seller can recall or curtail them without limitation and/or have no firm contractual delivery obligations secured.

Second, there is no requirement the capacity underlying any RA import be sold solely to a CAISO LSE and no other entity. Thus, the CAISO does not know whether the underlying capacity has been committed to entities other than the CAISO. This practice can lead to double-counting of import RA resources which 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.

Third, the current RA program does not require RA imports be delivered to the CAISO at any specified transmission priority. This creates potential uncertainty regarding delivery of the RA import, particularly if the import is not being delivered on firm transmission.

Because of tightening supply across the West, the CAISO is increasingly concerned about non-resource specific RA imports not supported by real, physical capacity dedicated only to the CAISO. Such 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.

[36] During the RA imports CPUC proceeding, the CAISO expressed concern regarding the must-flow requirement. Specifically, the CAISO noted that a requirement to only self-schedule (or economically bid below $0/MWh) RA imports limits market efficiency because the self-scheduling occurs in blocks over the hour, whereas economic bidding allows for shaping across the hour to better address changes in load which is critical during the net peak load hours in the late afternoon when flexibility is most needed.

Similarly, 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. The CAISO is concerned reliability risks will 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. RA import requirements should foreclose (or at a minimum, discourage) speculative RA import supply and double counting.

Although the CPUC's recent decision D.20-06-028 directed that LSEs contracting with non-resource specific resources require such resources to self-schedule or bid at or below $0/MWh, there is no assurance these non-specified resources are backed by physical resources dedicated solely to the CAISO that will actually be available when the CAISO needs them. These new CPUC rules, on their own, are insufficient to prevent double counting, speculative supply, and non-delivery due to inadequate transmission reservations. Without specified resources dedicated solely to the CAISO BAA and assurances 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 or curtailed on more constrained paths.

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 and transmission service across a broad and diverse west-wide market.
- Coordinate import provisions with any related modifications being proposed through the 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.
- Ensure transmission service is secured in advance and of a high enough priority to ensure energy delivery under west-wide stressed system conditions.

RA Import Proposal

The CAISO summarizes the key principles and elements of the CAISO's RA imports proposal in this draft final proposal as follows:

- RA imports must be verifiable and resource specific

  - Eligible resource-specific RA types include:
    - Non-Dynamic Resource-Specific Resource Adequacy (RA) Imports
    - 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 RA imports definition encapsulates (1) a single resource, (2) a specified portfolio or aggregation of resources within a single BAA, or (3) a BAA's pool/system 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 or showing timeframe.

- The RA import capacity must be dependable and deliverable
  - RA imports must be delivered on Firm transmission (7-F priority) on the last leg of interest (intertie) and no lower than Monthly Non-Firm PTP transmission (5-NM priority) on all other upstream transmission legs.

- RA Import must offer obligation (MOO)
  - Day-ahead must offer obligation up to full shown RA amount
    - Bid insertion applies in DA
  - Interim real-time MOO requirement (up to full shown RA amount) until the end of the transition period proposed in the DAME initiative which will redefine all real-time must-offer obligations.
    - Bid insertion applies RT for interim period

To support these proposed requirements, the CAISO anticipates the CPUC would adopt similar requirements. Nevertheless, the CAISO deems these proposed requirements to be prudent policy changes to ensure reliable and dependable RA import supply, and thus deems these to be minimum requirements imposed through the tariff. The CPUC and other Local Regulatory Authorities (LRA) could impose further limitations or requirements on capacity contracts entered into by their jurisdictional LSEs. The CAISO believes 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.

RA Imports must be resource-specific and dedicated solely to the CAISO

In light of the recent CPUC decisions on RA imports and stakeholder feedback throughout this initiative supporting a source specification requirement, the CAISO proposes to require broadly defined source specification for all RA imports to ensure real, physical supply is secured at the time of RA showings and the supply is not speculative. Further, such capacity must be committed solely to CAISO LSEs and serve CAISO reliability, and cannot be committed to third

parties during the period of the RA showing. As indicated above, the CAISO does not know under current RA import provisions whether RA imports are being double counted, *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.

Resource-Specific RA Imports Types & Source Specific Information

Throughout this initiative, one of the key objectives has been to ensure RA imports are backed by physical and verified resources to ensure that same capacity is solely committed to the procuring LSE and consequently to the CAISO. Identifying the physical resources supporting that commitment would help ensure the capacity is not double sold and is committed to other parties, making it more reliable and dependable.

The CAISO continues to propose that all RA imports must be resource-specific. The following CAISO tariff-defined imports types will qualify as resource-specific RA import resources: (1) Dynamic Resource-Specific System Resources or Pseudo-Tie resources, and (2) Non-Dynamic Resource-Specific RA Imports. In previous iterations of the proposal, the CAISO utilized the tariff defined term – *Non-Dynamic Resource Specific System Resource* – to refer to RA imports that are neither pseudo-tied nor dynamically scheduled to the CAISO. In order to avoid confusion between Non-Dynamic Resource Specific System Resources which are RA imports and those which are non-RA imports, the CAISO proposes the use of a new term – *Non-Dynamic Resource Specific RA Imports* – to particularly refer to RA imports which are neither pseudo tied or dynamically scheduled to the CAISO. Non-Dynamic Resource Specific RA Imports, can be (1) a specific external resource, (2) a specified aggregation or portfolio of resources in a single external BAA,[37] or (3) if the BAA is the RA import supplier, the BAA's pool of resources (system resources) supporting the RA import.

Non resource-specific system resources would no longer qualify as a resource type that can provide RA import capacity. The CAISO fully supports non-resource specific system resources participating in the market for economic energy, but to ensure RA imports are backed by specific units, the CAISO proposes here that RA imports must be resource specific as either a Pseudo-Tie or Dynamically Scheduled resource, or a Non-Dynamic Resource Specific RA Imports.

Source specification information will be required at the time of submission of the annual and monthly RA supply plans by the Scheduling Coordinator submitting the supply plan. The Scheduling Coordinator will be required to identify (1) the name of the resource(s) supporting the RA import showing along with the associated source BAA e-tag identifier name or

[37] 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 define non-dynamic resource-specific RA imports to include resource aggregations or portfolios of resources in a single BAA. The resources supporting the aggregation or portfolio must be specified. The new definition will allow aggregations of resource to be classified as resource specific.

abbreviation for the resource and (2) the single balancing authority area where the resource(s) is/are sourced. For Non-Dynamic Resource Specific RA Imports which are an aggregation or portfolio of resources, each of the resources making up the aggregation or portfolio must be identified. However, for Non-Dynamic Resource Specific RA Imports which are a BAA system resources, it is sufficient to identify solely the source BAA rather than identifying each individual resource making up the BAA system resources.

The Scheduling Coordinator representing the RA import in the CAISO market and submitting the supply plan is in the best position to identify the source specific information for the resource(s) supporting the RA import since they will be bidding the import into the market in accordance with the must offer obligation. To the extent the Scheduling Coordinator does not own the resource, the CAISO encourages coordination between the Scheduling Coordinator and the supplier to identify and provide the appropriate source specification information.

From an implementation perspective, the template for the RA supply plan will contain additional columns which will require, for each RA import resource, the identification of the resource name(s) and the source BAA. To the extent the information is not provided in those columns for a RA import resource, validations will be in place through which the Customer Interface for Resource Adequacy (CIRA) tool will reject the supply plan submission due to an error. The CAISO may from time to time audit the source specification information provided in the RA supply plan against the e-tags submitted during delivery of the import comparing the ultimate source of the e-tags to the resource(s) supporting a RA import identified on the RA supply plan.

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. Also, a source specification requirement is consistent with the requirements in other ISOs and RTOs. 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.

Attestation Requirement

Throughout the initiative, the CAISO has considered the value of an attestation requirement which would provide further assurance that the capacity being shown meets certain requirements to ensure reliable and dependable RA imports. The primary concept discussed in the context of an attestation is that the RA import capacity being shown on a supply plan has been committed only to the LSE and consequently the CAISO, and that same capacity has not been sold or otherwise committed to any other parties for the duration of the showing. An attestation requirement would place the responsibility on the attesting party to ensure the RA import capacity being shown can meet those requirements, and to the extent the attestation requirements cannot be met the capacity could not be shown for RA purposes.

The CAISO proposes that Scheduling Coordinator submitting the supply plans, which include RA import resources, must attest to the following elements at the time of submission of the supply plan:

1. *The capacity shown is owned or has been contractually secured;*
2. *The capacity shown has not been sold or otherwise committed to any other party than the LSE identified on the plan;*
3. *The capacity can only be interrupted for reliability reasons as determined under the host BAA's tariff, a transmission curtailment, or a plant outage; and*
4. *Transmission service of proper firmness (cite tariff section) has been reserved for the delivery of the RA import resource(s) to the CAISO.*

The first element of the attestation requires that the RA import capacity being shown on the supply plan is owned or is under contract to the LSE by the time the supply plan is submitted. To the extent the capacity being shown on the supply plan is not owned or under contract, the attestation requirement would not be met. The intent of this element is to ensure the capacity shown is legitimate, is owned or controlled by the supplier, and is not speculative, and by being on the supply plan, it is committed to the CAISO.

The second element of the attestation requires that the RA import capacity being shown on the supply plans has been committed only to the LSE in the CAISO BAA and has not been committed to any other parties or uses. To the extent this same capacity being sold to the LSE is also committed to other parties during the period of the showing on the supply plan, the attestation requirement would not be met. The intent of this element is to further ensure the RA import capacity is dedicated solely to the CAISO for the period of the showing so the CAISO can reasonably rely on it during challenging system conditions at CAISO or across the region.

The third element of the attestation requires the RA import capacity, whether owned by the entity making the showing (if LSE is owner) or if under contract to the LSE, not be interruptible for reasons other than reliability as determined by the host BAA under its tariff, by a transmission curtailment, or a plant outage supporting the RA import capacity. The intent of this element is to ensure the capacity committed to the CAISO cannot be interrupted at the discretion of the supplier or for non-reliability reasons because the CAISO relies and depends upon this capacity to manage system reliability. To the extent, the contract provides for supplier interruption of performance for non-reliability reasons, the requirement would not be met. The CAISO recognizes that contracts commonly provide for interruption for "force majeure" reasons, and the CAISO believes this is captured within the attestation requirement because to the extent a force majeure event affects the supporting resources it would be reflected through a plant outage and to the extent it is a force majeure event at the BAA level, the BAA presumably would take the reliability-based action. Thus, contracts that allow interruption for force majeure reasons would meet this requirement.

The last element of the attestation requires that at the time of the RA supply plan submission, any RA import capacity shown be supported by transmission arrangements of the required level

of firmness. As discussed further in this proposal, RA imports must be supported by Firm transmission (7-F priority) on the last transmission leg to the CAISO (the intertie) and by transmission no lower than Monthly Non-Firm Point-to-Point (5-NM priority) on any of the upstream transmission legs. To the extent the RA import delivery is not supported by the type of transmission firmness required on the proper transmission legs, the attestation requirement would not be met. The intent of this attestation element is to ensure RA imports be supported by transmission with sufficiently high curtailment priority to ensure the CAISO can reasonably rely on this RA capacity being available and deliverable during challenging system conditions. Additionally, by attesting to the supporting transmission arrangements at the time of supply plan submission, it provides the CAISO with a greater level of certainty that the RA import is deliverable during the period of the showing. This element will only be attested to at the time of submission of the monthly RA supply plan and not the annual plan.

The CAISO proposes the Scheduling Coordinator (SC) submitting the RA supply plan be responsible for attesting to the elements identified above for the RA import shown on the supply plan. The SC submitting the RA supply plan is in the best position to evaluate whether the RA import comports with the attestation elements as they are or can be aware of the commercial commitments and transmission arrangements since they will be bidding and representing the resource in the CAISO market. To the extent the LSE is the owner and SC of the import capacity being shown on the RA supply plan, it should have direct knowledge of the commitments for the capacity being shown and associated transmission arrangements. To the extent the SC is not the owner of the resource supporting the RA import capacity being shown on the RA supply plan and it represents a supplier who owns the capacity under contract to the LSE, the SC should coordinate with the supplier to review the attestation requirements and determine whether those can be met at the time of the showing. The CAISO may not have a direct contractual relationship with the supplier of the RA import capacity and the SC, by representing a supplier in the CAISO market, assumes the responsibilities of attesting that the shown RA import capacity meets the attestation elements and other requirements for RA imports. The CAISO recognizes the SC may need to consider potential contractual provisions with the suppliers of RA imports it represents to ensure it can obtain the necessary assurances or information to meet the attestation requirement.

The proposed attestation language will be included in the CAISO tariff as part of the tariff changes supporting the initiative. Additionally, from an implementation perspective, the SC submitting the RA supply plan will be required to meet the attestation requirement when it submits the RA supply plan by checking an attestation checkbox which will be clearly labeled on the supply plan template and submitted through the Customer Interface for Resource Adequacy (CIRA) tool. To the extent the RA supply plan includes RA import resources, but the attestation checkbox has not been affirmatively checked by the SC, the supply plan will not be accepted by CIRA.

Contractual considerations - Non-specified energy contracts alone will no longer 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 advance procurement of real physical, resource-specific capacity. Accordingly, contracts that do not identify or specify resources in support of the RA contact 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. Under the CAISO's proposal, slice of system (system sales) and similar contracts for RA capacity from a BAA are considered resource specific. This is consistent with the practices of other ISOs and RTOs.

Non-Resource Specific Contracts

In Decision (D.)05-10-042, the CPUC disallowed liquidated damages (LD) energy contracts from internal supply because of the potential for double counting. In that decision, the term "LD contracts" was used to refer to contracts between LSEs and suppliers that did not specify the committed physical resources supporting the contract rather than contracts with certain types of liquidated damages provision.[38] 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.[39]

Decision D.05-10-042 explains, however, 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."*[40]

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 resource 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.

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[38] CPUC D.05-10-042, Footnote 17 (2005).
[39] *Id.*, p. 101
[40] *Id.*, p. 68.

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.

Resource Specific Contracts

As noted earlier, the CAISO proposes that all RA imports be source specific and identify the supporting committed physical resources. Moreover, SCs submitting RA supply plans which include RA imports will be required to attest to the elements identified earlier including that the capacity has not been committed to any other parties. The CAISO expects that agreements for RA import capacity that can meet the source specification requirements, the transmission delivery requirement, and the attestation requirement can qualify to provide import RA. This section will further discuss WSPP Schedule C[41] contracts as an example of contractual arrangements that could potentially meet the necessary requirements, as well as additional clarifications to help stakeholder consider whether their contractual arrangements can meet the requirements or may need to be modified to meet those requirements for RA imports.

The CAISO recognizes there are numerous contract types under which RA imports are or can be secured, including legacy agreements. In comments on the Fifth Revised Straw proposal, several stakeholders requested the CAISO consider and clarify whether WSPP Schedule C contracts are a type of arrangement that can provide RA import capacity as these are common types of arrangements in the Northwest and possess certain contractual qualities. During the September working group stakeholder meetings on the initiative, the CAISO provided further context on the type of WSPP Schedule C arrangements while proposing that these types of arrangements could, if all requirements are met, support RA imports.

WSPP Schedule C contracts generally include the following default provisions, which may be modified by parties to the agreement:

- Firm capacity sale from Seller's resources and backed by the Seller's capacity reserves;
- Firm service may be curtailed within mutually agreed timeframes due to force majeure, or to meet public utility or statutory obligations;
- If firm service is interrupted, Seller pays damages consistent with the terms of the WSPP agreement.

A RA import supported by a WSPP Schedule C agreement would nevertheless need to ensure it can meet the source specificity requirement, the attestation requirements, and the transmission firmness requirement. For example, a RA import system sale supported by a WSPP Schedule C agreement would need to ensure it can identify the single source BAA for the RA capacity. The SC representing the RA import would also need to ensure it can meet the transmission requirements and the attestation requirements specified earlier, including the element that the import cannot be interrupted for reasons other than reliability.

[41] WSPP Inc., *WSPP Agreement Description* - https://www.wspp.org/pages/Agreement.aspx

In the most recent comments on the RA Enhancements working groups in September, several stakeholders commented that the CAISO should allow consideration of contractual arrangements supporting RA imports other that WSPP Schedule C agreements. The CAISO clarifies it is not proposing or advocating one type of agreement over another and that WSPP Schedule C contracts were singled out in response to stakeholder comments/questions. It is simply one example of an arrangement that could support RA imports to the extent all the requirements are met. The CAISO recognizes there are numerous types of contractual arrangements for securing RA imports ranging from new agreements to legacy agreements executed years or decades ago. Under the proposal, a contractual arrangement supporting RA imports has to meet the identified requirements of source specificity, attestation requirements, and transmission delivery requirements.

The CAISO also recognizes parties may need to modify existing or legacy contractual arrangements supporting RA imports to ensure that the source specificity, attestation, and transmission delivery elements can be met. The implementation timeline for the RA Enhancements initiative provides additional time for any such contractual modifications because implementation is slated for RA year 2023, and parties will be encouraged to move to this new framework for RA year 2022, but it will not be required until 2023.

Recall of RA Imports by Host BAA

In prior iterations of the proposal, the CAISO explored the merits of requiring that the energy associated with RA imports cannot be recallable by the host BAA, allowing the energy to be available to the CAISO during emergency conditions. In comments to the September RA working group meeting, several stakeholders suggested that imposing this recall limitation on RA imports by the host BAA would further ensure RA imports are committed to the CAISO. In this draft final proposal, the CAISO declines to propose such a requirement. Limiting a host BAA's ability to interrupt service from generators interconnected to its facilities and operating under the pro-forma tariff would not only affect the BAA's ability to manage grid reliability during emergency conditions, it would also likely severely limit the availability of RA imports to the CAISO.

RA import resources are physically interconnected to the host BAA and have a contractual relationship through an interconnection agreement. Under the pro-forma tariff *Large Generator Interconnection Agreement (LGIA)*, the Transmission Provider has the tariff and contractual ability to interrupt service for as long as necessary to reliably operate and maintain the transmission system, including under emergency conditions.[42] Aside from Pseudo-Tie and Dynamically Scheduled resources, the CAISO does not have a contractual relationship with Non-Dynamic Resource-Specific RA Imports which are located outside of the CAISO BAA. Imposing a CAISO requirement on RA imports that these cannot be interrupted by the host BAA would likely violate the existing interconnection agreements between the specific resources

[42] Federal Energy Regulatory Commission (FERC), *Standard Large Generator Interconnection Agreement (LGIA)*, section 9.7.2 (2019) - https://www.ferc.gov/sites/default/files/2020-04/LGIA-agreement.pdf

supporting the RA import and the host BAA. From a practical perspective, the host BAAs and the generators would likely have to re-negotiate these contracts and change the terms of the pro-forma LGIA under their OATTs with the host BAA ceding the ability to interrupt service from these resources during the period that these are committed to the CAISO as import RA (whether the entire or partial output). The CAISO believes it is inappropriate to impose these restrictions on the generators because it may affect the BAA's ability to respond to their own system reliability and manage grid conditions during severe reliability events.

Additionally, under sections 13.6 and 33.2 of the *pro-forma* OATTs held by the Transmission Providers across the western interconnection, the Transmission Provider has the ability to take whatever actions are reasonably necessary to maintain the reliability of the transmission system and service to Native Load.[43] Imposing a requirement that RA imports cannot be interrupted by the host BAA would likely contravene the terms of this tariff section because the host BAA would not be able to interrupt service from RA imports committed to the CAISO. More practically speaking, imposing this requirement would likely require the host BAA to amend its tariff to limit its ability to take reliability based actions to recall energy from RA import resources committed to the CAISO. As noted earlier, the CAISO cannot usurp the existing *pro forma* OATT provisions and requirements for Transmission Providers across the western interconnection and limit their ability to manage grid conditions especially in emergency situations.

The *pro forma* OATT provides Transmission Providers/BAAs with tools to maintain system reliability, similar to the CAISO's tariff, including the ability to interrupt service from generators located in, and interconnected to, their system. These actions are rare and occur only after a variety of other measures have been taken to manage reliability, including seeking emergency assistance from neighboring BAAs for additional energy if the emergency condition can be resolved with additional import energy. Imposing requirements on RA imports that would conflict with host BAA tariff and interconnection agreement requirements would impact RA import liquidity in both the near and long-term because it is unlikely BAAs across the western interconnection would be willing to modify their tariffs making imports from those BAAs ineligible to provider RA capacity. Finally, limitations on the ability of the host BAA to interrupt service for generation located in its BAA and interconnected to its system goes beyond a discussion of RA imports due to the effects of such limitation, and it is better suited for a BAA to BAA discussion regarding response to emergency conditions.

The Dependability of RA Import Capacity

Transmission delivery requirements for RA imports

A key principle guiding the proposed RA import policy changes is ensuring import capacity is backed by physical resources, dedicated to the CAISO, and deliverable. By addressing these elements, the CAISO can plan in advance based on the resources identified in the supply plan and rely upon the higher quality RA imports to meet system needs. In this section of the draft

[43] Federal Energy Regulatory Commission (FERC), Order 890-A, *pro forma* sections 13.6 and 33.2 - https://www.ferc.gov/sites/default/files/2020-04/E-1_13.pdf

final proposal, the CAISO describes the proposed transmission delivery requirements for RA imports to ensure that the capacity is deliverable and can be relied upon during challenging system conditions.

Transmission delivery of RA imports is a key element of the overall policy. The higher the firmness of the transmission supporting delivery of RA capacity, the more assured the CAISO is that the RA import will be deliverable during stressed west-wide system conditions. Specifying a transmission delivery requirement is common practice in both organized markets and non-organized markets under the pro-forma Open Access Transmission Tariff (OATT). As outlined below, it is common practice among other ISOs to require RA imports be supported by Firm transmission from source to sink which has the highest curtailment priority. Similarly, under non-organized market *pro-forma* OATT, when it comes to service to Native Loads and Network Loads by "off-system" (import) designated network resources, these resources must be delivered to the BAA on Firm transmission service because these resources are critical to the LSEs ability to serve load.[44]

Organized market regions generally have more stringent transmission requirements than the CAISO does today. 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;"[45] Import capacity must document that neighboring and intervening control areas will afford the capacity the same curtailment priority as native load.[46] ISO-New England can get any and all information sufficient to show the ability of the generator to deliver capacity to ISO-New England.[47] 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.[48]

[44] The pro forma OATT defines a Network Resource as one that does not include any resource "that is committed for sale to third parties or otherwise cannot be called upon to meet the Network Customer's Network Load on a non-interruptible basis." In Order 890, paragraph 1091, FERC further clarified that the concept of "non-interruptible basis" refers to the requirement that off-system designated Network Resources from other control areas must be delivered on Firm transmission arrangements (or conditional firm). As an example, Transmission Provider business practices, in implementing the tariff provisions noted above, require that customers seeking to designate an import resource as a designated network resource to serve load in the Transmission Provider's BAA must demonstrate that it has Firm transmission service across the adjoining systems to deliver the resource to BPA's system. Bonneville Power Administration, *Network Integration Transmission Service* Business Practice Version 9, section E.3 (2019).
[45] ISO New England, Transmission, Markets and Services Tariff, Section 13.1.3.5.1
[46] *Id.* at Section 13.2.3.5.3.1
[47] Id. at Section13.1.1.2.7.
[48] ISO New England Attachment M-Manual 20, Sections 12-13.

- 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…;"[49] 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.[50] MISO has three categories: specific generator in external BAA;[51] slice of system;[52] 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.[53] NYISO also requires that in order to participate as external installed capacity suppliers, external resources must "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;"[54] 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.[55] 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.[56]
- 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.[57]
- SPP requires Firm Capacity to be supported firm service from external resource to load.[58] 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 recognizes LSEs are competing in a west-wide energy and transmission market where supply is shrinking. Additionally, the CAISO recognizes there are different degrees of firmness for Firm point-to-point service based on the length the service that is reserved. Figure 5 below identifies the North America Electric Reliability Corporation (NERC) transmission service reservation priorities which also, for curtailment purposes, represent the order in which transmission service is curtailed to manage congestion and flows across a transmission path or flowgate.

[49] MISO Tariff, Module E, Sheet 69A.3.1.c
[50] MISO Business Practice Manual 11, Section 4,2.5.
[51] If MISO is in an emergency service will be interrupted only if the specific generator is on an outage.
[52] Curtailment is pro-rata with load in external BAA if the external BAA is in emergency conditions.
[53] NYISO MST - Market Administration and Control Area Services Tariff (MST), Section 5.12.2.1 and NYISO ICAP Manual, Section 4.9.3.2.
[54] NYISO MST - Market Administration and Control Area Services Tariff (MST), Section 5.12.2.1
[55] NYISO ICAP Manual, Section 4.9.1.
[56] *Id.*
[57] PJM Manual 18: PJM Capacity Market, Section 4.2.2
[58] SPP Open Access Transmission Tariff, Attachment AA, Sections 7.3 and 7.5.

Figure 5: NERC Transmission Service Reservation Priorities

Transmission Service Reservation Priorities

Transmission Service Reservation Priorities		
Priority	**Acronym**	**Name**
0	NX	Next-hour Market Service
1	NS	Service over secondary receipt and delivery points
2	NH	Hourly Service
3	ND	Daily Service
4	NW	Weekly Service
5	NM	Monthly Service
6	NN	Network Integration Transmission Service from sources not designated as network resources
7	F	Firm Point-to-Point Transmission
	FN	Network Integration Transmission Service from Designated Resources

Transmission service with priority 0-NX, 1-NS, or 2-NH (depending on the services the transmission provider offers under its OATT) are the first to be curtailed to manage transmission flows across a path. To the extent flows continue to exceed path limits and/or an issue is not resolved, the Transmission Provider may further curtail transmission service in ascending order of transmission priority noted in the table.

Under the current RA import policy framework and tariff, the CAISO does not identify specific transmission delivery requirements to support RA imports. As such, the transmission arrangements supporting RA imports can be on Firm or of Non-Firm transmission service across the different systems and paths to deliver energy to the CAISO. RA import deliveries on Non-Firm transmission, of lower transmission reservation priority, are particularly problematic because a transmission curtailment across the path first affects deliveries on Non-Firm transmission. This would affect the deliverability of RA imports directly depending on the level of Non-Firm service procured (whether it is Hourly, Daily, Weekly, or Monthly duration Non-Firm transmission service). For example, the Bonneville Power Administration (BPA) currently sells unlimited[59] Non-Firm Hourly transmission service (2-NH priority), and some RA imports being delivered from or across BPA's transmission system utilize this type of transmission as it readily can be reserved. However, because of the low priority accorded to Hourly Non-Firm transmission service (2-NH), any transmission curtailment would first affect this type of transmission service, and RA imports using this transmission service type would be undeliverable to the CAISO (in whole or in part) for the duration of the curtailment. On the other hand, Firm transmission service (7-F priority) is the last type of transmission service to be curtailed and only to the extent the curtailment of lower priority transmission service did not resolve the reliability event. Firm transmission service, due to its priority, represents the other end of the spectrum with the highest service priority and, thus, lowest risk of curtailment if utilized to deliver RA imports.

[59] Bonneville Power Administration, *Requesting Transmission Service* BPA Transmission Business Practice Version 38, section H.2.c (2020). This section notes that Hourly Non-Firm transmission service requests are not evaluated for Network Flowgate impacts and thus being granted upon submission.

With this context in mind, in prior iterations of the proposal and during the September RA Enhancements working group meetings, the CAISO shared two approaches for consideration in setting transmission delivery requirements for RA imports: (1) requiring Firm transmission (7-F priority) from source to sink across all intervening systems to the CAISO; or (2) requiring Firm transmission (7-F priority) on the last line of interest (intertie) and transmission service with a priority no lower than Monthly Non-Firm PTP service (5-NM priority) on all upstream intervening transmission systems. In evaluating these approaches, the CAISO looked to balance the need for reliable and high quality RA imports with the potential effects on liquidity of imposing specific transmission delivery requirements which are not in place today. In comments on the September RA Enhancements working group meetings, stakeholders were generally split in their views. Some supported identifying specific transmission delivery requirements through Option #1 or Option #2, while others supported not specifying a transmission delivery requirement or at least not requiring Firm transmission on any leg to the CAISO system. The latter group expressed concern with requiring Firm transmission on any of the transmission legs due to perceived limited ability to acquire those transmission rights. Stakeholder comments and feedback are discussed in greater depth below.

Having considered the principles identified above, the need for reliable and high quality RA imports, and stakeholder comments, the CAISO proposes that RA imports must be delivered to the CAISO on Firm transmission (7-F priority) on the last line of interest (intertie) and transmission service with a priority no lower than Monthly Non-Firm PTP service (5-NM) priority on all upstream transmission systems. This approach provides needed assurance that RA imports are deliverable with a high level of certainty during west-wide system conditions and allows the CAISO to reasonably rely on RA supply plans with RA imports submitted 45 days in advance of the month. Firm transmission on the last leg of interest (intertie) ensures that on this most critical leg, transmission is of the highest priority with lowest risk of curtailment. On upstream transmission systems, RA imports can be delivered on Monthly Non-Firm PTP (5-NM priority) or higher priority, which should provide a sufficiently high level of assurance of delivery (not as high as Firm transmission). It will also provide suppliers with added flexibility and opportunity to secure transmission service on those transmission systems while improving liquidity of RA imports.

As discussed in the context of RA import attestation requirements, the CAISO further proposes that the transmission arrangements supporting RA imports be secured by the time monthly RA supply plan showings due 45 days prior to the start of the RA month (T-45D). At the time it submits the monthly RA supply plan, the Scheduling Coordinator submitting the plan will be required to attest that the transmission arrangements supporting RA import delivery have been secured. Requiring transmission arrangements be in place by the time of the monthly RA supply plan showing will further ensure the RA import is deliverable for the duration of the showing and will be available and dedicated to the CAISO. The CAISO considered potentially permitting transmission delivery arrangements to be secured closer to real-time. However, showing RA imports on supply plans 45 day prior to the start of the month without also showing the proper supporting transmission does not provide the CAISO the dependability needed to ensure the RA import is deliverable during the month. Otherwise a risk exists that transmission of proper firmness may not be available by time of delivery, and the RA import either becomes

undeliverable or is delivered on low priority transmission service that is more prone to curtailment. Depending on CAISO system conditions, the potential non-delivery of RA imports because of a failure to secure proper transmission service prior to delivery could jeopardize the CAISO's ability to manage system conditions. The CAISO must have sufficient confidence that RA imports on supply plans are dependable and deliverable during the period of the showing.

In comments on the September RA Enhancements working group meetings, several commenters expressed concern with requiring specification of a transmission delivery service level and particularly requiring Firm transmission. They argued this could lead to additional costs in securing a higher priority of transmission service to support RA imports. The CAISO recognizes the proposal introduces more robust transmission delivery requirements than exist today and this may increase the costs of RA imports. To the extent the importers do not currently hold Firm transmission rights for delivery of imports to the CAISO, this transmission deliverability requirement may potentially lead to higher costs because it would require securing those transmission rights whether through original requests for transmission from the Transmission Provider or through resale of transmission rights. Nevertheless, the CAISO also recognizes the importance and reliability benefit of RA imports being deliverable based on a higher priority transmission service. This will help ensure the capacity can be delivered to the CAISO under challenging system conditions and be relied upon to meet system needs. Permitting RA imports to be delivered on low priority transmission service, such as Hourly Non-Firm (2-NH) priority, would practically ensure they are curtailed first during a Transmission Provider initiated curtailment, consequently affecting the deliverability to the CAISO.

Other stakeholders, including SDG&E, expressed concern regarding the ability to acquire transmission rights because transmission capability, whether Firm or Non-Firm, is calculated or released the day prior to flow and is not readily available for reservation prior to real-time. As a starting point, it is important to recognize that the NERC sets the standards for calculating Available Transfer Capability (ATC) across Transmission Provider systems. NERC MOD-001-1a describes the associated requirements for calculating and recalculating ATC and for the different transmission products that a Transmission Provider offers.[60] Each Transmission Provider is then further required to describe the ATC methodology for the different product types through the publication of an *Available Transfer Capability Implementation Document (ATCID)* that includes information described in the MOD-001-1a standard.[61]

Focusing on BPA's processes, which have been the primary focus of stakeholder comments, BPA calculates ATC for both Firm and Non-Firm transmission. BPA offers Firm (including Conditional Firm), and Non-Firm transmission products of different duration – Hourly, Daily, Weekly, Monthly, and Yearly (only Firm) – and calculates ATC for each of those products.[62]

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[60] North American Electric Reliability Corporation (NERC), Standard MOD-001-1a – Available Transmission System Capability - https://www.nerc.com/files/MOD-001-1a.pdf

[61] *Id.,* section R.3.67

[62] Bonneville Power Administration, *Available Transfer Capability Implementation Document (MOD-001-1a)* pg.2, October 21, 2020 - https://www.bpa.gov/transmission/Doing%20Business/ATCMethodology/Documents/ATCID.pdf

Hourly values are calculated up to 168 hours in advance, Daily values are calculated for days 3 through 90, Monthly values are calculated for months 2-13 and these values are recalculated and updated at least once per day.[63] For Non-Firm ATC, BPA calculates ATC for the real-time horizon (begins at 10 p.m. of the pre-schedule day for the 24 hours in the next day) and beyond real-time (hourly values for hours after the real-time horizon, as well as daily and monthly calculations).[64] Parties seeking transmission beyond the real-time horizon have access to the different transmission products because BPA calculates ATC for each of the products, whether Firm or Non-Firm transmission. Thus, importers can request the necessary transmission across the different time horizons. Approaching real-time, BPA releases unscheduled Firm transmission capacity as Non-Firm (at 10 p.m. of pre-schedule day) further bolstering availability of Non-Firm transmission aside from the Hourly Non-Firm product being unlimited. Nevertheless, holders of Firm transmission rights under existing reservations are able to continue scheduling those rights (because they pay for those rights) all the way into real-time. To the extent there are more schedules across a path (Firm and Non-Firm) than the Total Transfer Capability (TTC) across a path prior to the hour of flow, BPA may issue curtailments in transmission priority order to bring schedules to or below the TTC limits prior to flow. As will be discussed further below, parties are able to seek and procure transmission from BPA, whether Firm or Non-Firm, well in advance of the real-time horizon since BPA calculates ATC for each of their products depending on duration of the transmission product.

The proposed transmission delivery requirement would be memorialized in the tariff and also be part of the proposed attestation requirement. When it submits the monthly RA supply plan, the Scheduling Coordinator will be required to attest that the transmission arrangements to support the RA import have been secured. The CAISO will not require supporting documentation at the time of attestation to show those transmission rights are in place, but the CAISO reserves the right to audit the attestation requirement and request any supporting documentation. The CAISO proposes, however, to track compliance with the transmission requirement for RA imports. The CAISO will monitor e-tag data, after the fact, and will flag any RA imports delivered on lower transmission reservation priority for further investigation and may refer the case to DMM or FERC for investigation of a potential tariff violation.

From a tagging perspective, in prior iterations of the proposal the CAISO had considered special tagging requirements – a T-45 days tagging requirement for Monthly Non-Firm Service of upstream transmission and a 10am tagging deadline in the Day Ahead timeframe for Firm transmission on the intertie. Because the CAISO is proposing an attestation element that would require transmission arrangements supporting RA imports be secured at the time of submission of the RA supply plan (T-45D), the CAISO no longer proposes special tagging deadlines for RA imports. Under the *Intertie Deviation Settlement* initiative which was approved by the CAISO Board in February 2019 and is planned for implementation January 1, 2021, the following tagging deadlines were established for all imports: (1) a T-40 minute deadline for submission of a valid e-tag with a transmission profile equal to the economic bid or self-

[63] *Id.*
[64] *Id.,* p.40.

schedule, and (2) a T-20 minute deadline for revising the energy schedule on the e-tag.[65] Once implemented in 2021, these tagging requirements will be applicable to all imports including RA imports.

The sections below will further discuss the transmission delivery requirement on the last line of interest (intertie) and, separately, on the upstream transmission systems. In these sections the CAISO will further discuss stakeholder comments relevant to the transmission delivery element of the proposal.

Transmission Delivery Requirement – Firm Transmission on Last Leg of Interest (Intertie)

The CAISO proposes that RA imports be supported by Firm transmission (7-F priority) on the last leg of interest (intertie). The focus on this issue heretofore has been on transmission delivery requirements between the California and the Northwest, but the proposed policy would apply to deliveries of all RA imports to the CAISO regardless of where the physical resources are located and across any physical ties with the CAISO. For stakeholder benefit, Operating Procedure 2150A[66] identifies the physical tie points between the CAISO and adjacent BAAs. Additionally, Operating Procedure 2150B[67] identifies the tagging templates associated with paths and adjoining BAAs.

For example, data indicates actual flows on the California-Oregon Border intertie (COB) and the Nevada-Oregon Border intertie (NOB) are close to the respective limits on these lines especially during the summer season. Figure 6 illustrates the trajectory of actual flows in August 2020 to total transfer capability (TTC) limits on the COB intertie showing that during late afternoons particularly, flows tend to reach near the TTC limit. Similarly, Figure 7 illustrates a similar trend on the NOB intertie although less pronounced, that actual flows tend to reach the TTC limits.

When actual flows on the COB and NOB interties are close to TTC limits, it is important to ensure RA imports are delivered on Firm transmission to minimize the curtailment risk on these paths. When the intertie's actual flows are close to the limit, the risk of curtailment is higher because the risk of flow exceeding the limit is higher. To the extent there is congestion or flows exceeding TTC limits, a curtailment would occur in reservation priority order with Non-Firm transmission service being curtailed first (based on reservation priority) to decrease flows below the limit. Permitting RA import delivery on Non-Firm transmission, across the interties, would place delivery at unreasonable risk especially in summer months when flows tend to reach TTC limits. Requiring RA import delivery on the last leg of interest (intertie) to be on Firm transmission (7-F priority) would provide the highest possible level of certainty the RA import will

[65] California ISO, *Intertie Settlement Deviation* initiative (2019) - https://stakeholdercenter.caiso.com/StakeholderInitiatives/Intertie-deviation-settlement
[66] CAISO Operating Procedure 2150A, *POR-POD Scheduling Path Cross Reference,* section 1.2 (2020) - http://www.caiso.com/Documents/2510A.pdf
[67] CAISO Operating Procedure, 2150B, *ISO Tagging Templates* (2020) - http://www.caiso.com/Documents/2510B.xls

be deliverable to the CAISO under the high flow conditions on the interties because Firm transmission is the last type of transmission to be curtailed.

Figure 6: Comparison of actual flows on COB intertie to total transfer capability. (Graphic courtesy of Morgan Stanley)

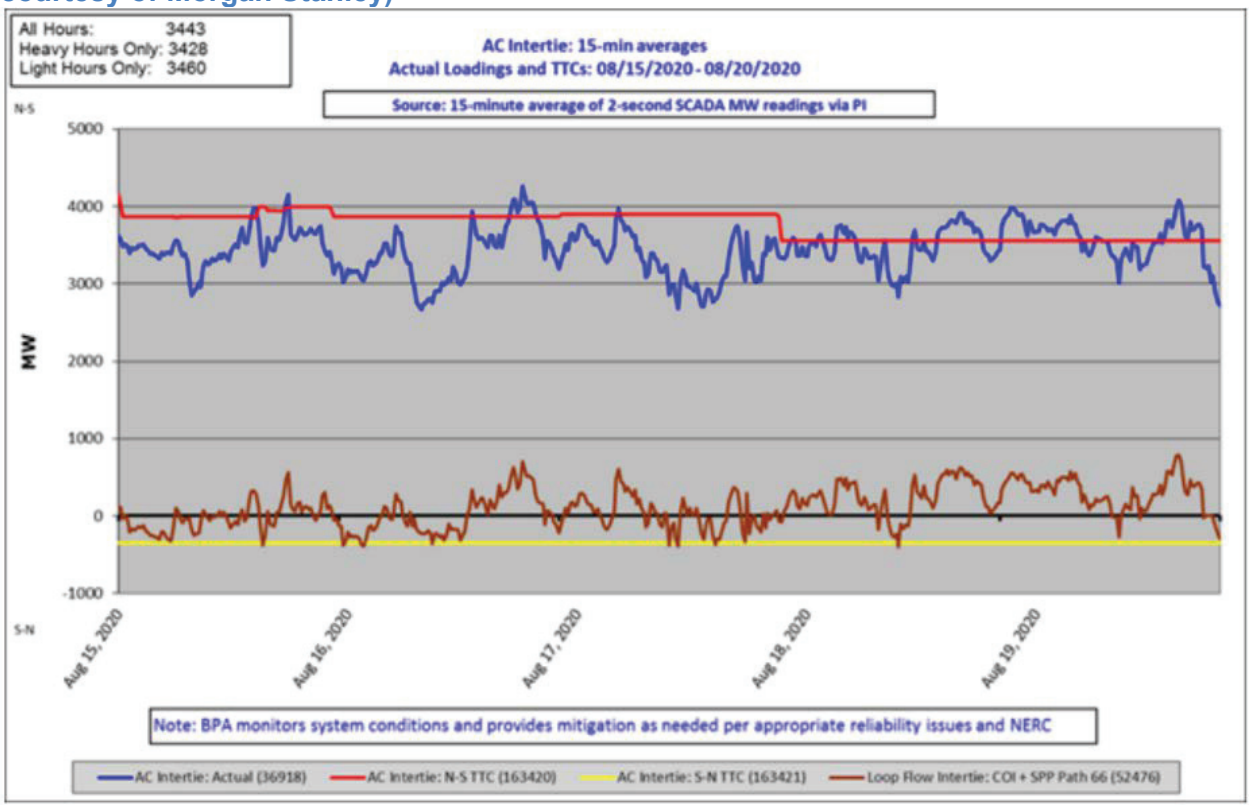
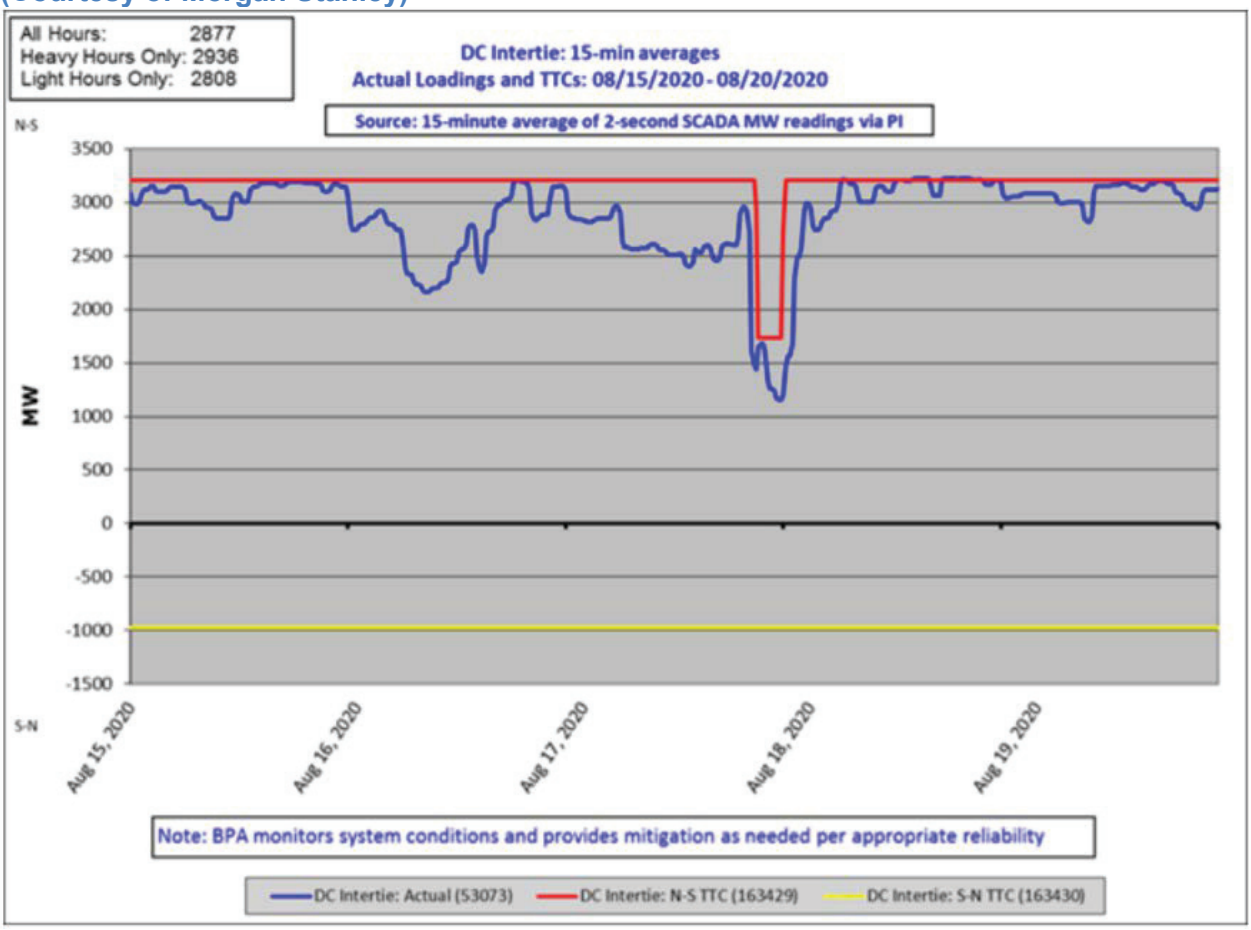


Figure 7: Comparison of actual flows on NOB intertie to total transfer capability. (Courtesy of Morgan Stanley)



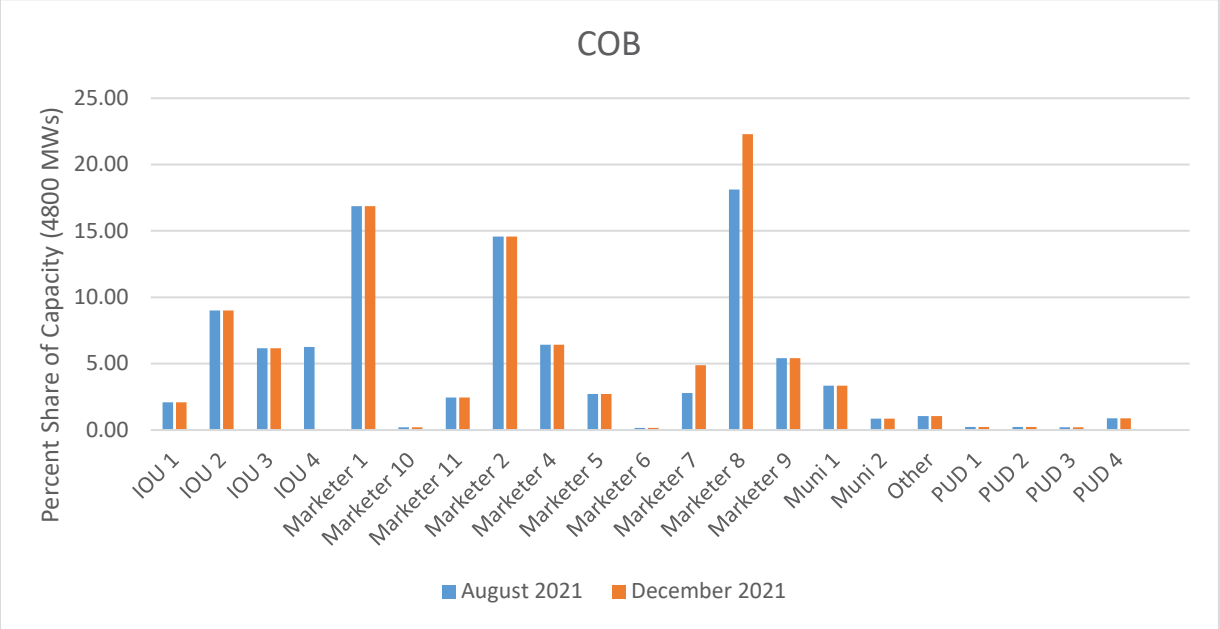
Although some stakeholders support the Firm transmission delivery requirement, CalCCA, Silicon Valley Power, and other stakeholders alleged that a Firm transmission delivery requirement on the last transmission leg of interest (interties) might lead to the entities currently holding Long-Term Firm transmission rights on these paths exercising transmission market power given the COB and NOB interties are fully subscribed. Further, stakeholders argued the current Long-Term Firm rights holders could seek excessive rents for these rights limiting the ability to procure transmission and deliver RA imports. Those stakeholders suggest the CAISO permit delivery of RA imports across these paths on Non-Firm transmission as a check on transmission market power and those parties holding Firm transmission rights.

As the CAISO noted in the September RA Enhancements initiative working group meetings, any concern associated with the exercise of market power should be addressed in the context of the respective Transmission Provider's OATTs or supplier's market based rate authority and should be raised with FERC. However, it is important to acknowledge that Firm transmission capacity across the COB and NOB interties is not only utilized for delivery of RA imports, but Firm transmission capacity on these interties is and has been valuable across the west historically to support other transactions. Any assertions of the potential for the exercising transmission market power should be considered in this broader context. Firm transmission rights on

interties are used to meet the needs of utilities across the west as opposed to it being solely triggered by CAISO proposing RA imports should be delivered on Firm transmission to ensure reliable and deliverable import capacity.

Currently, more than twenty entities hold Long-Term Firm transmission rights on the COB and NOB interties under the various Transmission Provider OATTs (the owners which make the capacity available for sale under their OATTs). This should address the concern that Long-Term Firm transmission rights on the interties are concentrated in the hands of two or three entities and should provide a broader pool of counterparties who potentially might offer Firm transmission capacity through resale to the extent the supplier currently does not hold those rights. Figure 8, below, identifies the current Long-Term Firm transmission rights holders on the COB intertie for the months of August and December since some entities hold seasonal transmission rights. As shown in the figure, eight entities hold more than 5% (240 MW) of the Long-Term Firm transmission rights on the intertie.

Figure 8: Long-term Firm transmission rights holders on the COB intertie in August and December months represented as percentage of total intertie capacity.

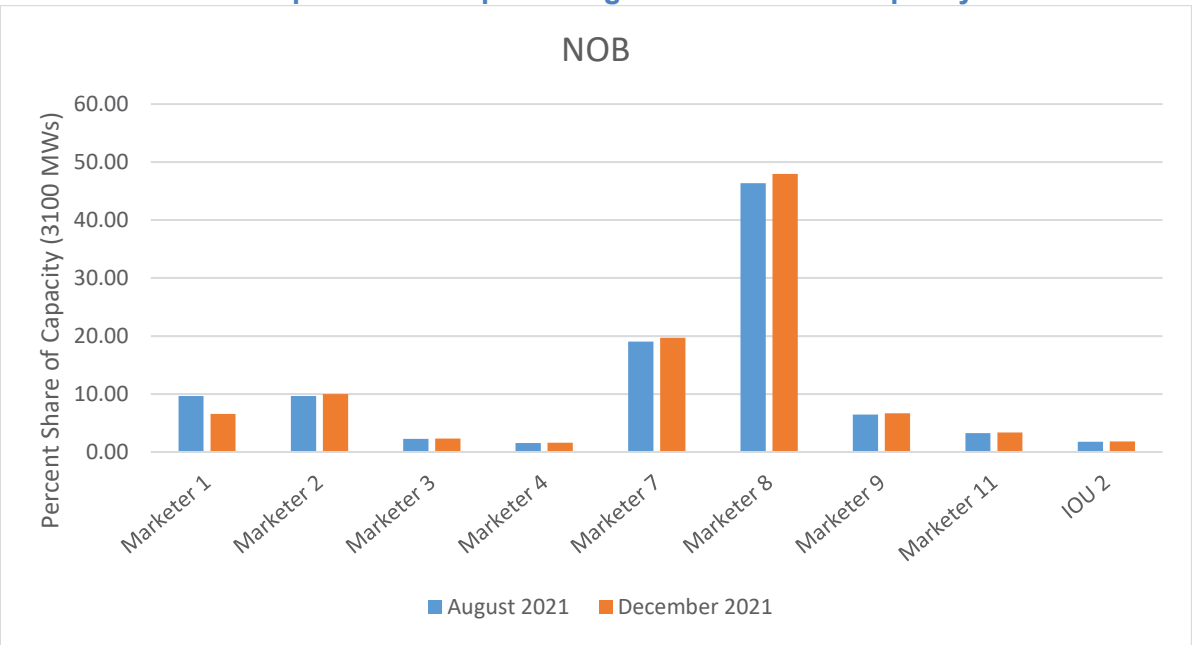


Furthermore, currently twelve (12) entities hold 100 MW or more of Long-Term Firm transmission rights on the same intertie which should provide opportunities for resale of Firm transmission rights to parties currently not holding Firm transmission rights and selling import RA capacity.

Conditions on the NOB intertie are different than on the COB intertie regarding Long-Term Firm transmission rights.

Figure 9 below identifies the current Long-Term Firm transmission rights holders on the NOB intertie focusing particularly on the August and December months as well to contrast the seasonal rights held.

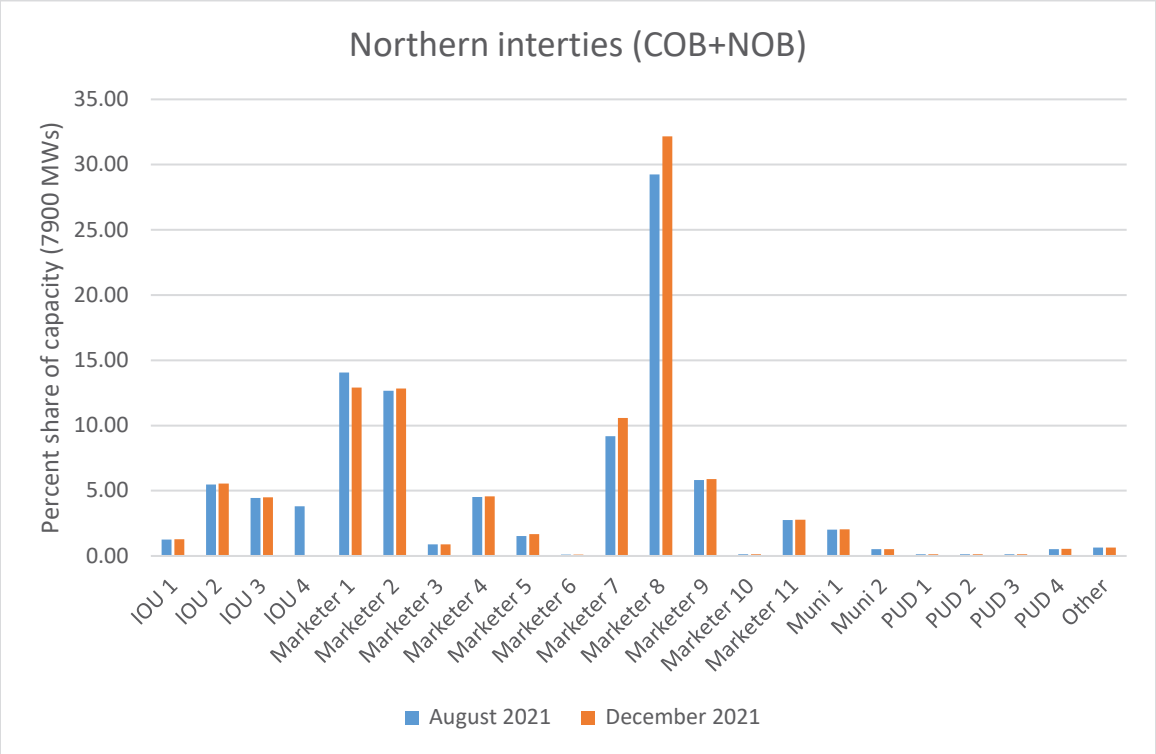
Figure 9: Long-term Firm transmission rights holders on the NOB intertie in August and December months represented as percentage of total intertie capacity.



Four (4) entities hold at least ten percent (over 300 MW) each on the intertie, and seven of the nine entities hold at least 100 MW of Long-Term Firm transmission rights providing the potential for resale of transmission rights to those providing import RA capacity to the CAISO.

Finally, Figure 10 illustrates the combined COB and NOB intertie Long-Term Firm transmission rights held across twenty two different entities. As indicated, both load serving entities and marketers hold substantial Long-Term Firm transmission rights. Some of these entities are currently supporting delivery of RA imports on these Firm transmission rights and this should provide an opportunity for obtaining Firm transmission rights, through resale, from a diverse set of entities.

Figure 10: Long-term Firm transmission rights holders on the COB and NOB interties in August and December months represented as percentage of total intertie capacity.



The CAISO recognizes that although the figures represent the current Long-Term Firm transmission rights holders, these transmission rights are being utilized today by the holding entities – whether utilities or marketers – for meeting their own load and business needs. As the CAISO increasingly competes for RA capacity across the western interconnection, there may be a need to compete for Firm transmission capacity as well for the delivery of RA imports. Besides the number of marketers holding these transmission rights, there are several LSEs holding rights as well. Although LSEs likely utilize those transmission rights to deliver generation to serve their load needs, there may be opportunity to consider resale of transmission rights to the extent use of those rights is seasonal and the LSEs consider the economics of reselling transmission rights and serving load with resources that do not require delivery across the intertie. Nevertheless, the CAISO believes that Firm transmission is critical, especially across the interties, to ensure the CAISO can operationally rely on dependable RA imports. Other ISOs and RTOs require firm transmission to support RA imports. There is no reason the CAISO should rely on less dependable transmission service.

As noted in the preceding paragraphs, Long-Term Firm or Monthly Firm transmission service can be procured and reserved directly through the Transmission Provider or it can also be acquired via resale from parties who have already reserved those transmission rights for a period of time. Resales of transmission service are required to be posted on OASIS of the Transmission Provider which administers those transmission rights. This posting requirement provides transparency on both the transmission rights being resold and the pricing of resales. In the case of Long-Term Firm transmission rights on the COB and NOB interties, parties not currently holding those rights can seek to procure the transmission through a resale of

transmission rights from other holders of rights, based on the terms of the Transmission Provider's OATT and business practices. The transparency provided for transmission resales can inform whether parties may be exerting high transmission resale prices compared to prior resales. For example, BPA's business practice requires that all resales of transmission rights must be posted on OASIS and the resale must include the price in $/MWh.[68]

Finally, CalCCA suggests the CAISO should allow RA imports to be delivered on Non-Firm transmission (of any Non-Firm priority) as a way to counter the potential of current Long-Term Firm transmission rights holders imposing high prices for the resale of transmission. However, as the CAISO has noted before, delivery of RA imports on Non-Firm transmission exposes RA imports to non-delivery in the event of a curtailment especially on the interties where flows are generally close to the TTC limits in the summer. More importantly, unlike requests for Long-Term Firm transmission service requests, reserving Non-Firm transmission service to support RA imports does not send the necessary signals to the Transmission Provider to support potential transmission system expansion.

It is important to recognize transmission upgrades are driven by the demand for Long-Term Firm transmission service because a committed long-term use of transmission capacity assures use and revenue needed to support these upgrades. Suppliers submitting requests for Long-Term Firm transmission service provide signals to the appropriate Transmission Providers to consider expansion of intertie transmission capacity or other upgrades to grant service on a Long-Term basis. Non-Firm transmission service, which is lower priority and shorter duration, does not drive transmission upgrades. The CAISO recognizes that transmission upgrades can take many years to complete, but reliance on Non-Firm transmission to support RA imports in perpetuity does not drive change and places CAISO system reliability at risk in instances where the RA imports are non-deliverable due to transmission curtailments of low priority Non-Firm transmission.

Transmission Delivery Requirement – Upstream (above intertie) transmission service must be of a priority no lower than Monthly Non-Firm PTP Service (5-NM)

The second proposed component of the transmission delivery requirement for RA imports is that the transmission priority on the transmission legs upstream of the intertie with the CAISO must be no lower than Monthly Non-Firm PTP service (5-NM priority). The proposal would permit transmission arrangements supporting RA imports to be of higher priority including Conditional Firm service (6-CF priority) and Firm service (7-F priority). However, as noted in the UCAP section of this draft final proposal, RA import deliveries on 5-NM and 6-CF priority transmission, if curtailed, will be considered in calculating resources' UCAP levels because the supplier has chosen to deliver the imports on a transmission priority lower than Firm (7-F) transmission service. RA imports delivered on Firm transmission will not be subject to UCAP consideration to the extent Firm transmission is curtailed.

[68] Bonneville Power Administration, "*Resale of Transmission Service"* Transmission Business Practice (2020).

In the draft final proposal the CAISO proposes to permit Non-Firm transmission service to support RA imports on transmission lines upstream of the interties, but the transmission service must be at least of the highest priority Non-Firm service – Monthly Non-Firm PTP (5-NM priority). This is the highest priority Non-Firm service since it is curtailable by the Transmission Provider only after Hourly Non-Firm (2-NH), Daily Non-Firm (3-ND), and Weekly Non-Firm (4-NW) PTP service. Permitting Monthly-Non Firm PTP service to support RA import deliveries, while subject to UCAP consideration if the service is curtailed, is intended to provide additional flexibility in acquiring transmission service across the relevant transmission systems and improving liquidity in RA imports made available to the CAISO.

Conditional Firm service (6-CF) may be offered by some, but not all Transmission Providers. This type of service is a form of Long-Term Firm transmission service that allows the Transmission Provider to curtail the transmission service as a priority level 6-CF in certain system conditions or a particular number of hours during the year as determined by the Transmission Provider and associated business practices. Outside of these system conditions or hours, the transmission customer tags transmission deliveries on Firm transmission (7-F priority) but when those conditions or hours are triggered, the transmission service priority decreases to Conditional Firm (6-CF priority) which is higher than Non-Firm PTP transmission service. To the extent a RA import is supported by or delivered on Conditional Firm service, because it has 6-CF priority during the system conditions or hours that trigger this service and rest of the time it is Firm (7-F), it is an acceptable form of transmission service to meet the upstream transmission delivery requirement.

Reserving Transmission Service across BPA's transmission system

Several stakeholders submitted comments noting concern with the ability or inability to reserve Monthly Non-Firm (5-NM) transmission service, or higher priority transmission service across BPA's transmission system to support delivery of RA imports. They requested the CAISO allow delivery on lower priority transmission service including Hourly Non-Firm (2-NH priority) which is sold unlimited on BPA's system. Morgan Stanley, for example, shared its experience requesting Monthly Non-Firm PTP service but being unable to obtain a reservation. Other stakeholders requested additional information on the process for reserving transmission service across BPA's system to ensure there is adequate opportunity to secure the necessary transmission rights to support RA imports. In this section the CAISO addresses those comments and provides further insights into the different processes and options that interested parties may have in reserving transmission across BPA's system or other Transmission Provider systems.

There are numerous ways parties can acquire transmission service under the respective Transmission Provider OATT's. In this case, we will focus on reserving transmission service across BPA's transmission system which has been the focus of comments since deliveries of RA imports from the Northwest and across the COB and NOB interties cross BPA's transmission system. A supplier wishing to reserve transmission service across BPA's transmission system, can submit a request for transmission service directly to BPA which will evaluate, based on the status of their available transfer capability, whether it is able to grant the request. Alternatively, the supplier can potentially seek transmission service through resale

from other parties holding transmission rights across the necessary path. Another viable approach or feature of BPA's OATT is the ability to redirect existing transmission rights from its original path to the new path being sought which may have the same flowgate impacts to grant the redirected service. We will discuss these approaches further below as examples of approaches that can be utilized to reserve transmission service to support RA imports. Nevertheless, importers or interested parties should work directly with the Transmission Providers for any questions or options for reserving transmission service across their systems.

As a starting point, we will discuss the process of securing Long-Term Firm transmission service (1-year or longer in duration) to support RA imports. Parties can seek to reserve original transmission service from BPA by submitting a transmission service request.[69] To the extent a party is seeking Long-Term Firm transmission service, the request will be evaluated in queue order with other requests seeking Long-Term Firm service. BPA calculates and posts Long-Term Firm Available Transfer Capability (ATC) across each flowgate on OASIS and when a request is received, it is evaluated in queue order to determine if sufficient ATC is available on a flowgate by flowgate basis taking into account higher queued requests. To the extent ATC is available on each flowgate, the request for Long-Term Firm transmission service is granted. To the extent ATC is not available on one or more flowgates, generally, the Long-Term Firm transmission service request remains in queue awaiting study under BPA's study processes to identify transmission network upgrades which would allow granting of the request. Alternatively, it may be granted at a later point in time to the extent ATC is otherwise made available on one of more flowgates needed to accommodate the request for service. The study processes for system expansion (whether a cluster study or individual study) only applies to Long-Term Firm transmission service request and requests for Non-Firm transmission service are not studied for system expansion as these types of short-duration service do not drive system expansion, neither in duration or firmness.

BPA posts the long-term transmission service pending queue[70] on its website, which identifies the Long-Term Firm transmission service requests awaiting ATC on at least one flowgate or awaiting a network upgrade that is in progress. Additionally, BPA posts a document that identifies the ATC on each flowgate minus the long-term pending queue which identifies, as of the date of creation of the document, the amount of ATC remaining after all queued Long-Term Firm transmission service requests are considered and in turn this should identify whether there is sufficient ATC on the needed flowgates to grant the request after all previously submitted queued requests for service are considered.[71] To the extent the importer does not currently hold Long-Term Firm transmission rights, due to the size of BPA's pending queue for Long-Term Firm transmission service it may be difficult to obtain this type of service immediately absent completion of pending network upgrades or participating in a new network upgrade through BPA's study and system expansion processes. Nevertheless, to the extent a supplier is

[69] Bonneville Power Administration, *Requesting Transmission Service* BPA Transmission Business Practice Version 38, section B (2020).
[70] Bonneville Power Administration, *AFC/ATC and Conditional Firm Inventory,* https://www.bpa.gov/transmission/Reports/TransmissionAvailability/Documents/long_term_atc.xlsx
[71] Bonneville Power Administration, *AFC/ATC Less Pending Queued Request Inventory,* https://www.bpa.gov/transmission/Reports/TransmissionAvailability/Documents/atc_less_pending.xlsx

considering providing RA import capacity to CAISO, it may be prudent to consider requesting Long-Term Firm transmission service to support those deliveries and provide a signal to the Transmission Provider that transmission upgrades may be needed across a path to support future business needs.

Some stakeholders suggested that the CAISO should permit any and all types of Non-Firm transmission service to support RA imports. BPA offers Non-Firm transmission service of Hourly (2-NH priority), Daily (3-ND priority), Weekly (4-NW priority) and Monthly (5-NM priority) duration. Hourly Non-Firm transmission service is currently sold on an unlimited basis on BPA's network, meaning that a request for this type of service is guaranteed to be granted when requested and a number of importers have noted that this is the type of service they currently rely on to deliver RA imports due to the unlimited nature of the product. Other Transmission Providers may sell Non-Firm Hourly on a limited basis meaning that it may be granted to the extent there is sufficient ATC across a path to grant it, but it is not guaranteed. A few stakeholders noted that the CAISO should permit RA imports to be delivered on any Non-Firm transmission service due in part to the low frequency of transmission curtailments across BPA's transmission system.

The current frequency of transmission curtailments on a transmission system does not necessarily indicate the frequency of curtailments in the future since transmission curtailment events can be driven by predictable and unpredictable events. Transmission Providers strive to achieve a low frequency of curtailment events as these are an indication of the reliability of the transmission system or a particular transmission path. But infrequent transmission curtailments does not mean that when a curtailment does occur there are no impacts to parties who are curtailed or are expecting delivery of energy. To the extent RA imports were to be delivered on Hourly Non-Firm transmission service (2-NH priority), any instances of curtailment of transmission service on BPA's system or on any other system will affect the RA import delivery due to the low priority of transmission service. Regardless of the type/priority of transmission service reserved on other transmission legs, a curtailment on any transmission leg makes the RA import non-deliverable to the CAISO. With changing (and more challenging) conditions across the west as outlined in the introduction of this paper, the CAISO cannot reasonably rely and depend upon RA imports supported by transmission service of lower curtailment priority and placing system reliability at risk. Similarly, Non-Firm Daily (3-ND priority) and Non-Firm Weekly (4-NW) transmission service due to their low curtailment priorities, cannot support RA imports.

Monthly Non-Firm transmission service (5-NM priority) is the highest priority of Non-Firm transmission service. The CAISO is willing to allow for this type of service to support RA imports. Monthly Non-Firm transmission service is curtailed only after all Hourly, Daily, and Weekly Non-Firm transmission service has been curtailed. Monthly Non-Firm service is rarely requested on BPA's system and this is likely due to two main reasons: (1) it is more expensive (higher rate) than lower priority service increments, and (2) Hourly Non-Firm service is unlimited

and a lower rate.[72] Those seeking Non-Firm service for a short period of time are more likely to request Hourly Non-Firm service for a lower rate and lower duration than reserve Monthly Non-Firm service at a higher rate and longer duration. In comments to the September RA Enhancements initiative working group, Powerex shared examples of transmission service being awarded across BPA's system to the intertie[73]. The CAISO independently shared a few transmission Monthly Non-Firm transmission service reservation scenarios with BPA, of different MW amounts and duration, which upon evaluation represented service that would have been granted if requested at that point in time.

A critical element for reserving Monthly Non-Firm transmission service, at least on BPA's system, is not to wait until the last moment to reserve the transmission service – a day or two before flow – but rather to plan ahead and request service well in advance as that provides the best opportunity. Under BPA's business practices, Monthly Non-Firm PTP service can be reserved no earlier than 60 days before delivery.[74] As noted earlier, the CAISO proposes that at the time of monthly RA supply plan showings (45 days prior to start of the month), the SC submitting the plan must attest that the supporting transmission to deliver the import is in place for the duration of the showing. In order to support a RA import shown on the Monthly RA supply plan, submitted 45 days prior to the start of the RA month, Monthly Non-Firm transmission service should be requested in advance of that and as close to the reservation window opening 60 days prior to the day of delivery (the first of the month).

Similarly, an importer could request to reserve Monthly Firm transmission service to support RA imports because Firm service has a 7-F priority for curtailment purposes and can be reserved sufficiently in advance to support RA imports shown on RA supply plans. Monthly Firm transmission service can be requested and reserved up to 365 days prior to delivery[75] and thus could potentially be reserved further in advance to support RA imports than Monthly Non-Firm transmission service which can be reserved up to 60 days prior to delivery. Monthly Firm transmission service, while having a higher priority (7-F), has the same rate as Monthly Non-Firm transmission service across BPA's system. The longer in advance of delivery date Monthly Firm transmission service is sought, the better the likelihood is of obtaining the transmission service.

Turning to the concept of resales of transmission service by parties who currently hold transmission rights, BPA has a robust transmission resale market across its system in part driven by limited access to Long-Term Firm transmission service and by the ability to redirect transmission service from one path to another. Resale of transmission service refers to the assignment of scheduling rights from a party currently holding those scheduling rights through a

[72] Bonneville Power Administration, *2020 Transmission, Ancillary and Control Area Services Rate Summary* (October 1, 2019), https://www.bpa.gov/Finance/RateInformation/RatesInfoTransmission/FY20-21/2020%20Transmission%20Rates%20Summary.pdf
[73] Powerex Corp. comments to CAISO's September 15 and 17 RA Enhancements Working Group - https://powerex.com/sites/default/files/2020-10/2020-10-01%20Powerex_comments_on_RA_enhancements.pdf
[74] Bonneville Power Administration, *Requesting Transmission Service* Version 38, section F.2 (2020).
[75] *Id.*

transmission reservation for PTP service to another party for a defined duration for a specific path on the reservation. All resale transactions between parties are posted on BPA's OASIS and must include the price in $/MWh.[76] Suppliers that may not be able to obtain the proper increment or type of transmission service from BPA to support RA imports (Monthly Non-Firm, Monthly Firm, Conditional Firm, Long-Term Firm PTP), may consider obtaining transmission service through resale from parties holding those rights which is a common practice across BPA's system.

Finally, another option is redirect capability of transmission rights across BPA's transmission system. Redirect capability allows transmission rights associated with an existing transmission reservation to be redirected from the original point of receipt and point of delivery, to alternate points of receipt or delivery.[77] The redirecting of transmission rights is a common practice across BPA's transmission system as it does not entail paying for additional service, but it is considered the redirecting of exiting PTP transmission rights which are already subject to a rate and term. Similarly, it is common practice for parties to procure PTP transmission rights through resale from another party holding those rights with an original point of receipt and point of delivery, and then redirect those transmission rights to the desired points since the original reservation procured through resale likely did not source or sink at the desired locations. A request to redirect transmission service is submitted to BPA for evaluation and to the extent that the original reservation (being redirected) holds sufficient transmission capacity across the same flowgates, the request will be granted. To the extent additional ATC is needed on a particular flowgate to accommodate the redirect request (since the original request may not be impacting the same flowgates or to the same extent), BPA conducts an evaluation of whether sufficient ATC may be available to grant the request.

It is important to recognize that the ability to redirect transmission service across BPA's system applies primarily to transmission reservations for Firm service (Long-Term to Long Term Firm, Long Term Firm to Short Term Firm, Short Term Firm to Short Term Firm). There is no ability to redirect Firm service to Non-Firm service, or vice versa, or Non-Firm to Non-Firm.[78] In the context of the CAISO proposal, importers could consider redirecting existing Long-Term Firm transmission rights to (on a Long-Term or Monthly basis) to a different path (to the intertie) to support RA import delivery across BPA's system to the intertie or potentially procuring Long-Term Firm or Monthly Firm PTP via resale and then redirecting those rights to a path supporting RA import delivery to the intertie.

As noted in this section, there are several options for importers who currently do not hold the necessary transmission rights to pursue acquiring these. Aside from the types of transmission service that can support RA imports on upstream transmission systems – Monthly Non-Firm

[76] Bonneville Power Administration, *Resale of Transmission Service* Business Practice, Version 11 (2020), https://www.bpa.gov/transmission/Doing%20Business/bp/tbp/Resale-of-Transmission-Service-BP-V11.pdf

[77] Bonneville Power Administration, Redirects Business Practice, Version 23 (2020). https://www.bpa.gov/transmission/Doing%20Business/bp/tbp/Redirects-BP-V23.pdf. The only exception in this context is that Hourly Firm service can be redirected to Hourly Non-Firm.

[78] *Id.,* section A.2.

PTP, Monthly Firm PTP, Conditional Firm PTP, Long-Term Firm PTP – there are also a numerous different paths or strategies for acquiring these types of transmission service – original requests, resales of transmission, redirect capabilities. The CAISO envisions that for RA year 2022 the proposed RA import policy changes will be optional as parties position themselves and modify necessary contracts to provide dependable and reliable RA imports with RA year 2023 making the policy changes mandatory. Stakeholders concerned with the ability to meet the proposed transmission delivery requirements for RA imports are encouraged to consider different approaches and strategies, engage with the relevant Transmission Providers, and take the necessary steps to position themselves to be able to support RA imports with the proper transmission service by RA year 2023.

Interim real-time bidding requirements for RA imports

Under current rules, RA imports have a Day Ahead (DA) must offer obligation up to the full shown RA amount, and they 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 obligations in the real-time market. RA imports are subject to DA market bid insertion rules up to the full shown RA amount to the extent a bid is not submitted.

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-tie resources, however, are generating units. Therefore, short-start and medium-start Pseudo-Tie resources must bid their entire RA capacity into the real-time market today. As an interim step, and until the CAISO modifies the real-time must offer obligations in the Day Ahead Market Enhancements (DAME) 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. This concept is currently being discussed and will be decided through the DAME initiative.

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 RA Imports. 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 interim period, with non-dynamic resource-specific RA 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.
  - Bid insertion: Yes
- 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 matches the status quo.
  - Bid insertion: Yes

Post-DAME transitionary period:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into day-ahead market.
  - Bid insertion: Yes
- Real-Time Market Must Offer Obligation.
  - To be determined through DAME initiative.

2) Non-dynamic Resource Specific RA Imports

Pre-DAME Interim Period:

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

Post-DAME transitionary period:

- Day-Ahead Market Must Offer Obligation.
  - Must offer full RA capacity into day-ahead market.
  - Bid insertion: Yes
- Real-Time Market Must Offer Obligation.
  - To be determined under DAME initiative.

In comments to the September RA Enhancements initiative working group, AWEA requested clarification that pseudo-tied or dynamically scheduled RA import resources, which are hybrid resources or storage resources, be subject to the same must offer obligation as resources internal to the CAISO of the same technology type. Additionally, LSA and SEIA requested

clarification that Variable Energy Resource (VER) RA imports have the same must offer obligation as internal resources. The CAISO proposes to continue the current practice of treating Pseudo-Tie and Dynamically Scheduled resources consistent with internal resource of the same technology type for purposes of applying the must offer obligation. Section 6.1.5 of this document, as part of the sixth revised straw proposal, identifies the proposed applicable must offer obligations for certain technology types including Energy Intermittent Resources (EIR) that include VERs. Because the CAISO models pseudo-tied and dynamically scheduled resources in its full network model and requires identification of resource type and Masterfile parameters along with execution of supporting agreements, it is appropriate to extend the same must offer obligation as internal resources of the same technology type. This is consistent with the policy today. On the other hand, non-dynamic resource specific RA imports will not be modeled in the full network model nor will these be required to provide the full resource parameters. These resources will be subject to the standard must offer obligation in DA and RT as described earlier. If an import resource wants a must offer obligation associated with a particular energy type, they need to be pseudo-tied or dynamically scheduled to the CAISO and fulfill requirements associated with these types of resources.

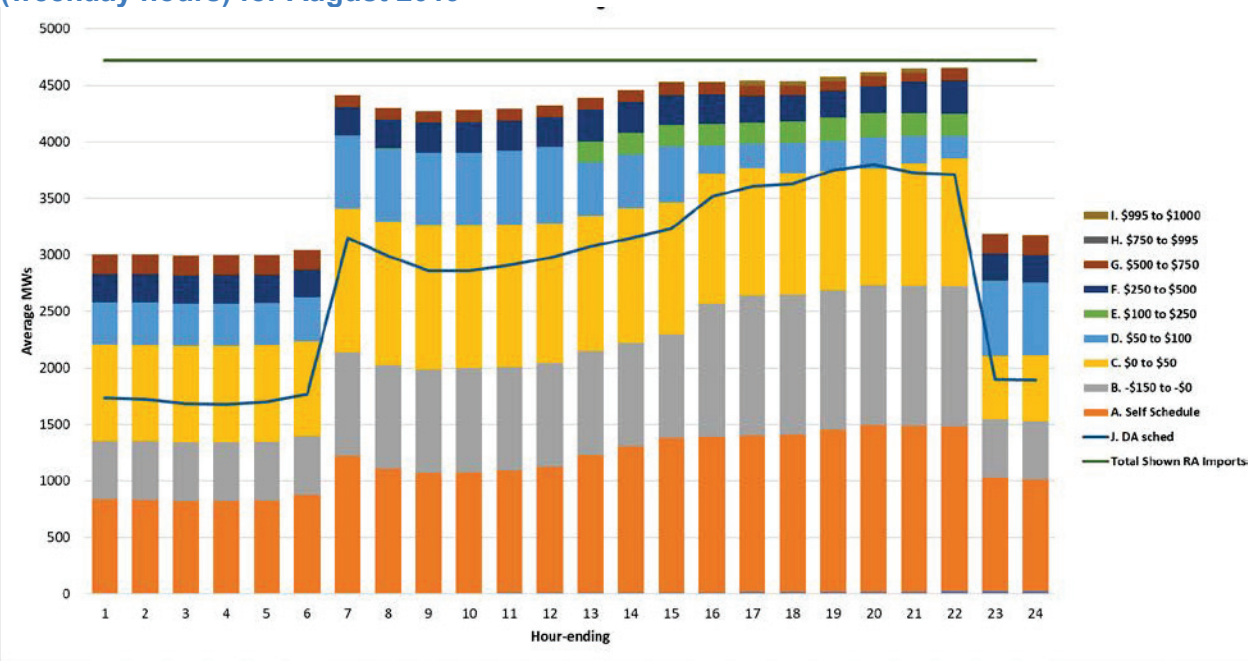
RA Import Bidding Concerns

In comments throughout the different iterations of the RA Enhancements initiative proposals and during the September RA Enhancements working group meetings, several stakeholders raised concerns that under the current policy framework RA imports could circumvent providing energy to the CAISO by simply bidding high to meet their DA must offer obligation and avoid obtaining an award, thus being able to sell the energy elsewhere. This concern primarily stems from data shared by the DMM in comments to the CPUC RA Imports proceeding which indicated that, for August 2018, 13.8% of non-resource specific RA Imports average hourly bids were above $500/MWh.[79] Figure 4 of this draft final proposal, shared in an earlier section, identifies the DMM data and graphic for August 2018.

The CAISO has gathered data on August 2019 and August 2020 RA import bids to compare with the August 2018 data originally produced by DMM to assess the trend in bidding practices. It is important to recognize that the simple fact of a RA import bidding high does not necessarily indicate an intent to avoid an award. As the data shows, there has been a significant decrease in RA import average hourly bids above $500/MWh in August 2019 and August 2020 compared to August 2018, indicating that the practice of RA imports bidding high is not a prevalent practice. Figure 11 shows that for August 2019 only 2.8% of non-resource specific RA import average hourly bids were above $500/MWh on compared to the 13.8% for August 2018.

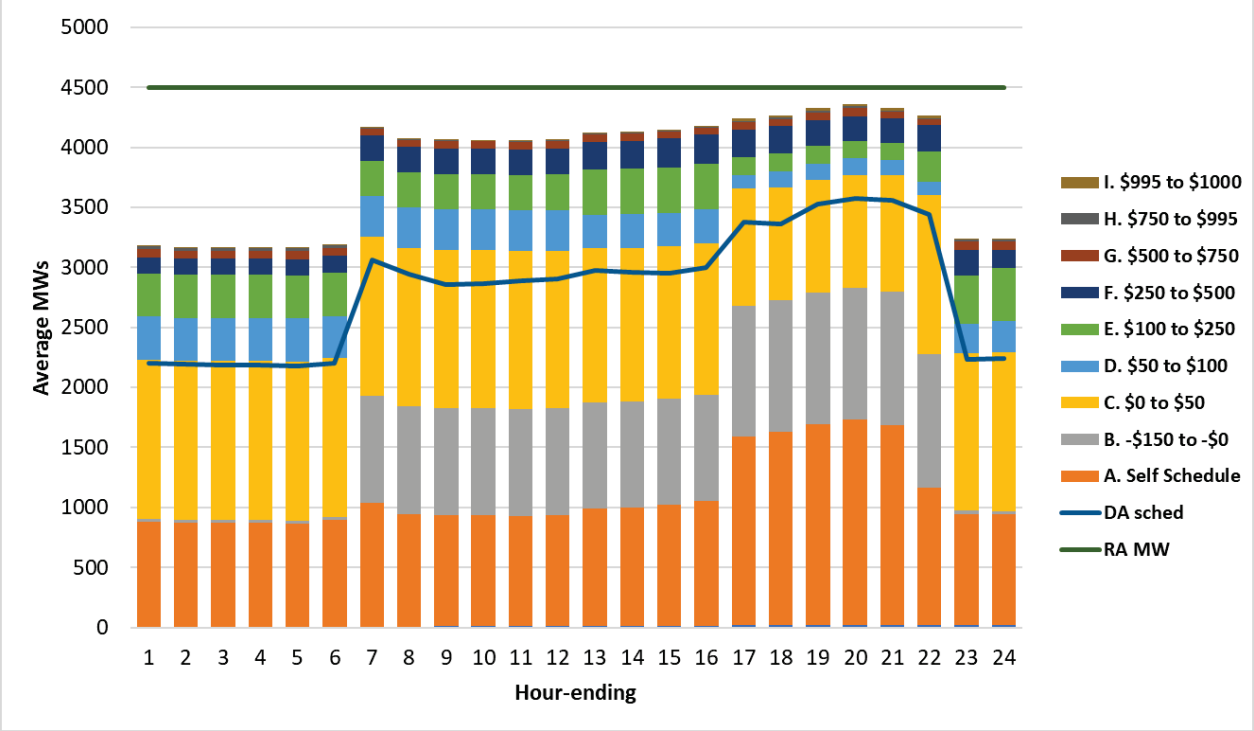
[79] DMM comments on CPUC Proposed Decision clarifying RA Import rules (R17-09-020). September 26, 2019: http://www.caiso.com/Documents/CommentsofDepartmentofMarketMonitoringonProposedDecisionClarifyingRAImportRules-R17-09-020-Sept262019.pdf.

Figure 11: Average hourly RA Non-Resource Specific imports offered by bid price (weekday hours) for August 2019



For August 2020, the number of average hourly bids above $500/MWh decreased even further. Figure 12 shows that for August 2020, only 2.0% of RA import average hourly bids were on above the $500/MWh amount further decreasing compared to August 2019 (2.8%) and August 2018 (13.8%).

Figure 12: Average hourly RA Non-Resource Specific imports offered by bid price (weekday hours) for August 2020



For comparison purposes, Table 2 shows the average of DA bids, by hour, for August 2018, 2019 and 2020 across different ranges illustrating the significant decrease in high bids (above $500/MWh) across the same timeframe. Furthermore, for August 2019 and 2020 bids near the cap of $1000/MWh were practically non-existent.

Table 2: Percent of RA Non-Resource Specific Import DA bids above $500 /MWh for August 2018, 2019, and 2020

DA Bid	$500 to $750			$750 to $995			$995 to $1000		
HE	2018	2019	2020	2018	2019	2020	2018	2019	2020
1	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
2	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
3	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
4	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
5	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
6	4.3	3.7	1.5	1.9	0.0	0.5	6.3	0.0	0.1
7	5.5	2.2	1.3	1.9	0.0	0.1	7.2	0.0	0.1
8	5.5	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
9	5.5	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
10	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
11	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
12	5.6	2.2	1.3	1.9	0.0	0.2	7.2	0.0	0.1
13	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.0	0.1
14	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.0	0.1
15	5.3	2.4	1.3	2.2	0.0	0.2	7.1	0.1	0.2
16	5.3	2.3	1.3	2.2	0.0	0.2	7.1	0.1	0.2
17	5.0	2.0	1.3	2.4	0.0	0.2	7.0	0.8	0.4
18	4.9	1.8	1.3	2.6	0.0	0.3	6.8	0.9	0.4
19	4.8	1.8	1.6	2.6	0.0	0.3	6.8	0.9	0.4
20	4.7	1.8	1.6	2.6	0.0	0.3	6.8	0.9	0.4
21	4.7	1.8	1.2	2.6	0.0	0.2	6.8	0.9	0.4
22	4.7	2.3	1.1	2.6	0.0	0.2	7.1	0.1	0.4
23	4.3	3.6	1.6	1.9	0.0	0.5	6.5	0.0	0.1
24	4.2	3.7	1.6	1.9	0.0	0.5	6.4	0.0	0.1
Daily Average % RA Imports	4.9	2.6	1.5	2.1	0.0	0.3	6.8	0.2	0.2

The CAISO also believes the elements outlined in this draft final proposal better incentivize RA imports to bid economically and competitively to receive a market award, comparable to bidding incentives for internal RA resources. These modifications likely will further decrease instances of RA import bidding practice to avoid awards. First, the CAISO is proposing a RT must offer obligation for RA imports up to the full shown RA amount regardless of whether they received an award in DA. With the RT must offer obligation, RA imports will not be released from their obligation if they are not awarded in DA; they will need to stay available through RT to meet the must offer obligations. This is consistent with the must offer obligations of RA resources internal to the CAISO BAA.

Second, importers will be required to identify the physical resources supporting the RA import capacity shown on a supply plan and attest that the capacity has not been committed to any

other parties. By identifying specific resources and attesting that the capacity has not been committed to any other party, the RA import is committed to the LSE procuring the capacity and consequently to the CAISO. The supplier has an incentive to bid the capacity competitively because it has committed the capacity to the CAISO whereas, without this requirement and under current rules, the capacity could potentially be committed to multiple parties, and the importer could choose to bid high to sell the associated energy elsewhere. By bidding economically their marginal costs, the importer (and associated SC) could recover associated costs or gain additional revenues depending on market conditions. To the extent the RA capacity is sold elsewhere, the seller would be violating its attestation and the tariff, potentially subjecting itself to subject to investigation and referral to DMM and/or FERC.

Third, the CAISO is proposing that RA imports must be supported by Firm transmission service (7-F) on the intertie and a minimum of Monthly Non-Firm (5-NM) on all other intervening transmission legs. Importers providing RA imports will need to consider associated transmission costs potentially by procuring transmission ahead of time to support RA imports. This further incentivizes the supplier (the SC) to bid competitively into the DA and RT market to recover costs associated with acquisition of transmission to support RA imports.

Finally, the CAISO is in the process of implementing a process for cost verification for bids, including RA import bids, above $1000/MWh. FERC Order 831 required ISOs to make a compliance filing raising energy offer caps to $2000/MWh. As part of implementation, for RA imports with bids above $1000/MWh the CAISO will conduct a cost-verification process by reducing the bids to the greater of (1) highest resource specific verified cost, (2) maximum allowable import bid index, or (3) $1000/MWh. To the extent a supplier economically bids a RA import above $1000/MWh, the cost verification provisions will be triggered. While this does not necessarily provide protection for high bids below $1000/MWh threshold, it will provide protection for RA import bids above $1000/MWh to ensure the bids are justified.

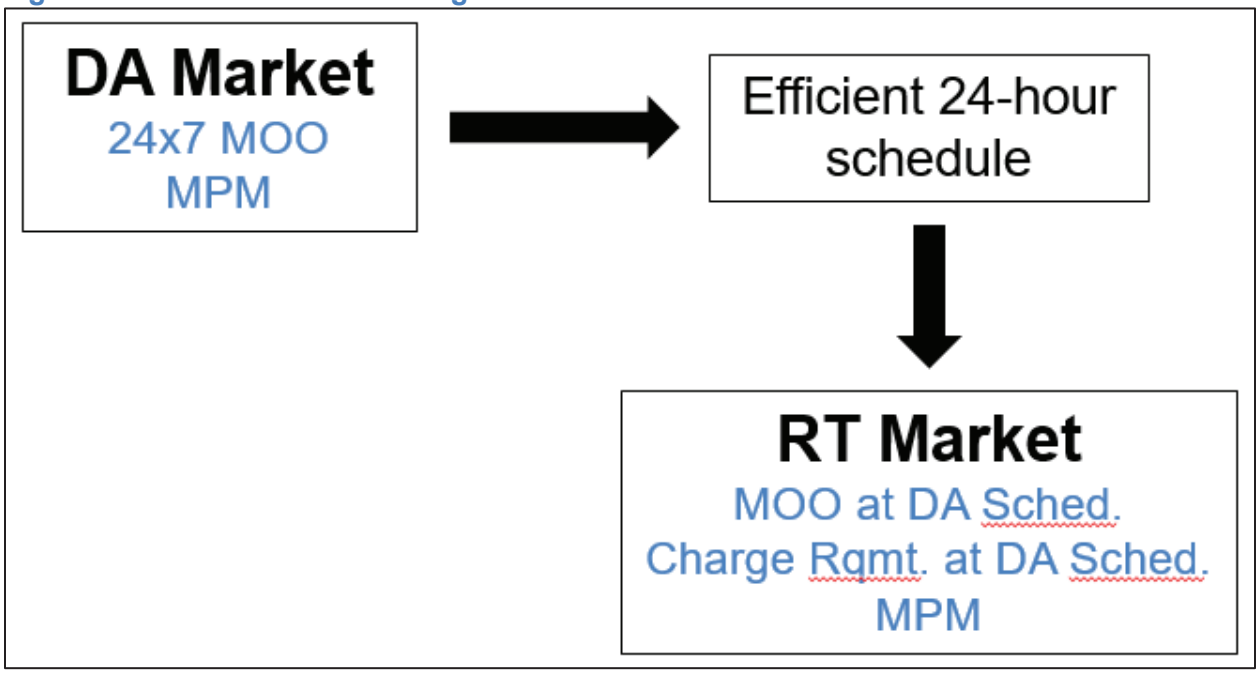
In its comments, PG&E further suggested that the CAISO should impose a “deliverable energy maximum” of $1000/MWh to ensure the CAISO gets the power at or below the cap. Additionally, PG&E suggests RA imports should have deliverable energy at a maximum of $1000/MWh unless there is a demonstration that a specific resource has gas fuel costs and heat rates that would reflect higher prices regardless of prices in neighboring areas. As the CAISO noted above, with implementation of FERC Order 831, the CAISO will be verifying RA import bids above $1000/MWh and reducing these to one of the three options described. Additionally, it is important to recognize that one of the objectives of the initiative is to treat RA imports more comparably with CAISO internal RA resources. Imposing a maximum “deliverable energy maximum” of $1000/MWh for RA imports would add a limitation that does not apply to internal resources. The CAISO believes, as described earlier in this section, there are sufficient protections in place to incentivize RA imports to bid competitively to obtain an award and RA import bids above $1000/MWh will be verified and reduced as appropriate.

5.1.3 Operationalizing Storage Resources

The CAISO has a rapidly growing number of storage resources operating on the grid today. This trend will continue over several more years in response to replacement capacity needed to allow gas and nuclear facilities to retire. Storage resources are different from other resources in that they do not produce energy, and they must first charge from the grid to discharge and provide energy back to the grid later. The CAISO's current real-time 5-minute market looks ahead 65 minutes, but most storage resources take several hours to fully charge. Further, this short time horizon does not allow market runs when prices are lowest and energy availability is greatest the ability to account for the most stressed system market conditions that will occur during the evening net-load peak. 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.[80] 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 has proposed 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 state of charge requirement. [81]

Figure 13: Market rules for storage resources



[80] 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.

Figure 13 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-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 to meet 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 period, 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 state of charge requirement. This minimum state of 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

[81] Market power mitigation for storage resources is a proposal in the ESDER 4 initiative: http://www.caiso.com/StakeholderProcesses/Energy-storage-and-distributed-energy-resources.

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 state of 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 state of 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 require 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 or set lower threshold of state of charge threshold applied each interval for the resource, 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 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 as it could result in more market inefficiencies and increased burden during tight ramp or system conditions.

Stakeholders also asked about additional compensation for storage resources for providing a 'state of charge' or 'potential energy' service. The ISO does not necessarily disagree with these arguments and asks that entities building or contracting for storage consider these costs when negotiating resource adequacy compensation. One topic discussed in the ESDER 4 initiative was to consider implementing a market product for such a service, however, this was not developed further during that policy. The ISO may consider such a product for local and system use in the future.

Settlement rules for the minimum state of charge requirement would be consistent with other settlement rules that the ISO has in place today. If a storage resource is charged on a schedule per the ISO's dispatch (including the minimum charge requirement) and the actual costs are above bids, this resource will remain eligible for bid cost recovery for the day. The ISO believes that negative revenues resulting in bid cost recovery payments will likely be infrequent, as the minimum state of charge requirement will charge resources during the lowest cost periods of the day or in the same hours that they were economically scheduled to charge in the day-ahead market.

Proposed Changes from the Previous Version

To address stakeholder comments, the ISO proposes several changes from the previous proposal. First, the ISO proposes to not impose the minimum state of charge requirement every day, but rather only on days when there is specific need. The ISO proposes a test for review after the day-ahead market is complete comparing load and non-storage resource availability.[82] If non-storage resources are able to meet the 110% of the load, no constraint will be imposed. Otherwise, the ISO will plan to impose the minimum charge requirement, as storage resources may be needed to meet the evening peak load.

Second, the ISO intends to relax the requirement that a resource begin charging at the period in the day-ahead schedule when the resource has state of charge to meet discharge schedules. Instead the resource will be required to charge at the later of that time or the time when day-ahead prices are lowest at that resources location. This will prevent instances when a resource starts the day at a high state of charge in the day-ahead market, and is then precluded from participating in the real-time market until the discharge hour. Instead, the resource would only

[82] The metric would include any resources committed through the residual unit commitment process.

begin to have a minimum state of charge requirement imposed during the lowest priced hours of the day-ahead market.

Finally, the ISO also acknowledges that some storage may be dispatched to attain a certain state of charge to maintain reliability in a local area in the event of an N-1 or an N-1-1 contingency. The ISO intends to impose minimum state of charge requirements on these resources as well, to ensure reliability in local areas in the real-time market.

Minimum Charge Requirement

The minimum state of 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 would be imposed at the later time either when charging occurs based on day-ahead market awards or during the least cost periods hours in the day-ahead market that could sufficiently charge the storage resource to meet its day-ahead discharge award. Several examples of the mechanics of this tool work were provided in the fifth revised straw proposal.

The ISO does not intend to impose the minimum state of charge requirement every day. After the day-ahead market runs, the ISO will compare the total net-load period and the availability of all other non-storage resources to meet load. If the non-storage resources are able to meet 110% percent of net-load, then the minimum state of charge requirement will not be imposed on any storage resources. If, however the non-storage generation is unable to meet that target, then the ISO will impose the minimum online constraint during those days. The ISO chose to select an additional 10% to account for some variability in forecasts from the day-ahead market to the real-time market and potential unavailability of resources between the two markets.

Storage resources may be charged specifically in the day-ahead market for local area reliability concerns. These requirements are set by the ISO's operation engineering team on specific days when local conditions are particularly tight in local areas and generation there is required to ensure reliability in the event of a contingency. If these imposed requirements result in charging storage resources in the day-ahead market, the minimum state of charge requirement will also maintain this state of charge in the real-time market.

The charge requirements will be smoothed over the hour, so they are achievable within 5-minute dispatch instructions. For example, if the minimum state of charge requirement is zero MWh in the prior hour and 12 MWh for the current hour, then the minimum state of 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.

It is important for resource owners to understand how the minimum state of 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.

RA Implications

As discussed above, storage resources providing RA capacity are 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, the RA capacity value for the resource is reduced in the UCAP process. Because the 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.

5.2 Local Resource Adequacy

In previous iterations, 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. A discussion of how to apply UCAP counting to local RA is now included in the sixth revised straw proposal located in section 6.

5.3 Backstop Capacity Procurement Provisions

In this draft final proposal the CAISO proposes to seek new CPM authority to procure resources when the CAISO identifies a need to procure local RA after an area or sub-area fails to meet the energy sufficiency test. Stakeholder comments generally support this extension of CPM authority.

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 if the CAISO identifies a need to procure local RA after a local area or sub-area fails to meet the energy sufficiency test. 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.

The rest of the proposals modifying the CAISO's backstop authority are included in the sixth revised straw proposal.

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6. RA Enhancements Sixth Revised Straw Proposal – Phase 2A

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

- System Resource Adequacy
  - Unforced Capacity Evaluations
    - Modifications – Modified seasonal approach and hourly unavailability factors to determine resource's UCAP/NQC values. Updated counting methodologies for new and non-conventional generation.
  - Determining Minimum System RA Requirements
    - Modifications – Included a minimum system UCAP/NQC requirement that all LSEs must meet and show as RA Capacity under the CAISO tariff.
  - System RA Showings and Sufficiency Testing
    - Modifications –Portfolio Assessment moved to Phase 2B pending elements.
  - Must Offer Obligation and Bid Insertion Modifications
    - Modifications – Retained existing real-time must offer obligations until the end of the transition period proposed in the day-ahead market enhancements initiative. Included RUC must offer obligations.
- Flexible Resource Adequacy
  - Modifications – Moved to Phase 2B pending elements.
- Local Resource Adequacy
  - UCAP in Local RA Studies
    - Modifications – Modified language to align with new DQC and UCAP/NQC terminology.
- Backstop Capacity Procurement Provisions
  - Capacity Procurement Mechanism Modifications
    - Modifications – CPM authority for deficiencies identified through the portfolio analysis moved to Phase 2B pending elements.
  - Making UCAP/NQC Designations
    - Modifications – Clarified how existing CPM authority for system deficiencies would work under new UCAP/NQC counting rules and requirements.
  - Reliability Must-Run Modifications
    - Modifications – New availability penalty structure to replace RAAIM
  - UCAP Deficiency Tool
    - Modifications – Removed from proposal.

6.1 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. As such, the CAISO intends to preserve the current process for derating Qualifying Capacity values (QC) based on deliverability. These calculations will result in the deliverable QC (DQC) for the resource.

For all resources with DQC values, the CAISO proposes to establish UCAP values to identify the unforced capacity value (DQC discounted for units' forced outage rates) to determine the net qualifying capacity (NQC) for use in system, local, and flexible RA showings and assessments. The UCAP/NQC 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/NQC value, and individual LSE sufficiency tests should be measured based on meeting UCAP/NQC requirements each month. The following section provides the CAISO's proposed modifications to incorporate these changes into CAISO RA processes and tariff.

6.1.1 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 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 create a new two-step de-rate process to a resource's qualifying capacity (QC). The first step will conduct a resource deliverability assessment to adjust QC for deliverability to determine the deliverable qualify capacity (DQC). The DQC process will be the same as the current net qualifying capacity approach with no proposed changes to how the CAISO assesses deliverability. The second step will consider the resource's forced and urgent outages and derates to calculate seasonal availability factors. This will result in applying the Weighted Seasonal Average Availability Factors (described in detail below) to the resource's DQC, which will determine in the final net-qualifying capacity (NQC) of the resource. The resource's must offer obligation would be set at its shown DQC (*i.e.* shown NQC divided by the Weighted Seasonal Average Availability Factors). Annually, the CAISO would calculate and publish monthly DQC and NQC values for all resources (*i.e.*, once per year a unit will get a distinct DQC and NQC value for each month of the upcoming year which will take into account both its deliverability and availability).[83]

More specifically, 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 or are non-dispatchable resources with a QC that takes into account forced outages. For resources with QC values calculated using an ELCC methodology, the CAISO will use the ELCC value as the UCAP/NQC value. For non-dispatchable resources, the CAISO will use the DQC as the UCAP/NQC 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 RA supply condition hours. This outage and derate data is the 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 RAAIM exempt. However, the CAISO has

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

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 CAISO BA and RC West outage processes are designed to work in tandem. In the CAISO balancing authority outage process, generator owners and participating transmission owners submit outages to the CAISO BA. In the RC West outages process, BAs and transmission operators submit outages to the RC on behalf of generator owners and transmission owners. Both processes include a long-range, mid-range, and short-range study window process for planned outages and a real-time process for other outage types. Aligning the outage definitions CAISO BA outage process and the RC West outage process will clarify existing treatment of outages in each of these timelines and establish clear criteria for outages' impact on a resource's UCAP.

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.[84] 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.
>
> *Planned Outage* – Facility/equipment outage with enough advance notice to meet short range submittal requirements.[85]

[84] RC Procedure RC0630, p13-15: http://www.caiso.com/Documents/RC0630.pdf.
[85] 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.

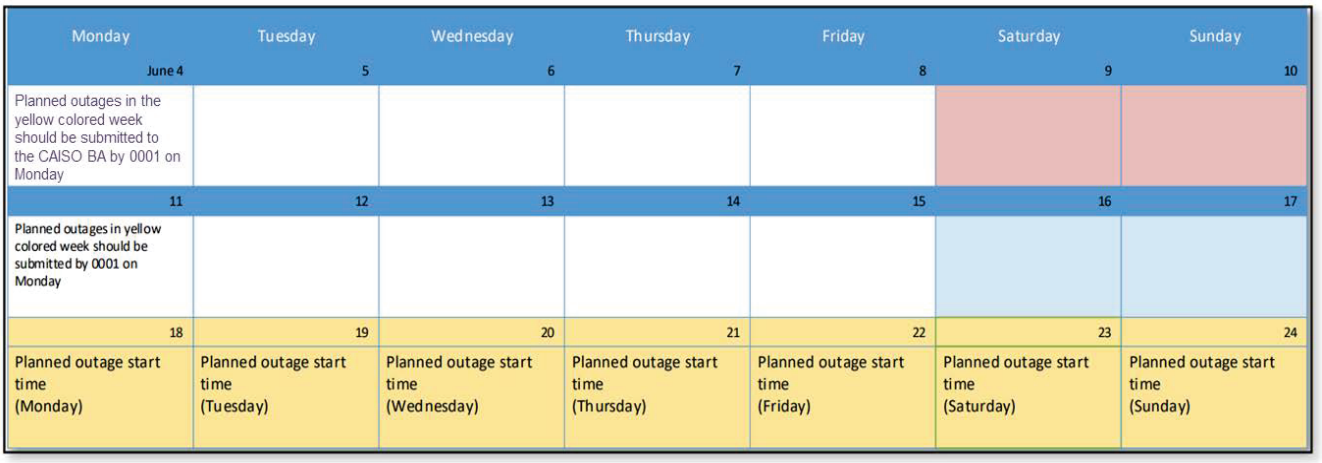
Operational Outage – Transmission Facility/equipment that is removed from service in the normal course of maintaining optimal or reliable system conditions but remains available if needed upon short notice. (This outage type may be either planned or real-time. Work is not being performed on the equipment/facility, 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. Additionally, outage submission requirements and outage priorities outlined in the procedure will apply. As such, forced and urgent outages will have the highest priority, followed by planned outages, and finally by opportunity outages. 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.

Planned outages can be submitted for the CAISO to study in the long-range, mid-range, or short-range study windows. Submitting outages in the long and mid-range study windows is optional, but outages must be submitted in the short-range study window for them to be considered as planned outages. Per the Outage Management BPM, generator owners must submit outages to the CAISO BA no less than five full business days in advance of the RC's short range submission deadline for the outage to be considered planned in the RC outage coordination process. The RC short range submission deadline is one week prior to the start of the week being studied. Figure 14 below shows an example.

Figure 14: Short Range Study Window Submission Deadline Example



Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
June 4	5	6	7	8	9	10
Planned outages in the yellow colored week should be submitted to the CAISO BA by 0001 on Monday						
11	12	13	14	15	16	17
Planned outages in yellow colored week should be submitted by 0001 on Monday						
18	19	20	21	22	23	24
Planned outage start time (Monday)	Planned outage start time (Tuesday)	Planned outage start time (Wednesday)	Planned outage start time (Thursday)	Planned outage start time (Friday)	Planned outage start time (Saturday)	Planned outage start time (Sunday)

SCs should plan for and submit maintenance outages within the planned outage study window and not purposely wait to report such planned maintenance after the short range study window ends. If outages are not submitted as planned (*i.e.,* before the short range study window ends) outages should be submitted as either opportunity, urgent, or forced in alignment with outage definitions. CAISO will have discretion over whether submitted opportunity outages are studied and approved and they must meet the special requirements outlined in the RC procedure, including having an emergency return time of 8 hours or less.[86] Additionally, planned outages will be prioritized over opportunity outages.

Several stakeholders requested additional clarity on urgent outages. Urgent outages are outages with the same priority as a forced outage, but unlike a forced outage where the facility is removed from service in real-time with little or no notice, the facility is still operable at the time of outage submission. This allows facilities to be removed from service at an optimal time for overall system reliability but the work may or may not be able to wait for the Short-Range outage window because a forced outage is imminent if the urgent outage is not taken, and as such cannot be treated as a planned outage or opportunity. Other stakeholders suggested urgent outages should not be considered in the UCAP calculation, or should be weighted differently than forced outages in the calculation. The CAISO disagrees. UCAP should incentivize resources to properly plan maintenance within the CAISO's planned outage and opportunity outage processes to ensure resources do not wait until outages are imminent or already happening. Not including urgent outages in the UCAP calculation would undermine this incentive.

Additional details on how forced outage rates will be used to calculate UCAP values are described in detail below. The CAISO will reconfigure its existing systems or develop an alternative system to accurately track and store resources' forced outages and derates to generate resource specific UCAP values.

[86] RC Procedure RC0630, p.15: http://www.caiso.com/Documents/RC0630.pdf.

UCAP Exempt Outages

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.[87] The NYISO exempts outages caused by equipment failure that involves equipment located beyond the generator and including the step up transformer. The exemption does not apply to other outages that might be classified as outside management control.[88] PJM also includes forced outages and derates.[89] 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.[90] AESO, which uses a similar availability factor method as proposes 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.[91]

The CAISO previously proposed an approach most similar to PJM, which would only exclude outages caused by rare outlier events with a large impact on a resource's UCAP value. The purpose of this proposal was to closely capture the actual forced outage rate of the resource, and ensure the UCAP values reflect the availability and reliability of RA fleet. However, following feedback from stakeholders, the CAISO agrees that it is more appropriate to exclude outages in the UCAP calculation if they are caused by a failure of or outage on transmission equipment or associated facilities that are a part of the CAISO Controlled Grid.[92] These facilities are not owned, operated, or maintained by the generator. The CAISO has modified the UCAP proposal to align with this principle. This proposal provides the appropriate incentives to perform maintenance in the planned outage timeframe to minimize forced and urgent outages and maintain a high UCAP value.

Table 3 below shows the existing nature of work categories for forced outages. The CAISO proposes that for each outage, the SC for the resource will submit the outage type (forced, urgent, planned, or opportunity) and the outage's nature of work. The CAISO will use the nature of work designation and outage type to determine whether or not an outage will be incorporated in the UCAP calculation.

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[87] 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.

[88] Installed Capacity Manual, NYISO: https://www.nyiso.com/documents/20142/2923301/icap_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338

[89] Manual 22, PJM: https://www.pjm.com/-/media/documents/manuals/m22.ashx

[90] PJM Reliability Assurance Agreement, Schedule 5, Section B.

[91] 3 Calculation of Unforced Capacity (UCAP), AESO: https://www.aeso.ca/assets/Uploads/CMD-2.0-Section-3-Calculation-of-UCAP.pdf

[92] CAISO Tariff Definition of CAISO Controlled Grid: http://www.caiso.com/Documents/AppendixA-MasterDefinitionSupplement-asof-Dec1-2020.pdf

Table 3: Existing Nature of Work Categories

Nature of Work	Impacts UCAP?
Ambient Due to Temperature	Yes
Ambient Not Due to Temperature	Yes
Ambient due to Fuel insufficiency	Yes
AVR/Exciter	Yes
Environmental Restrictions	Yes
Short term use limit reached	Yes
Annual use limit reached	Yes
Monthly use limit reached	Yes
Other use limit reached	Yes
ICCP	Yes
Metering/Telemetry	Yes
New Generator Test Energy	No
Plant Maintenance	Yes
Plant Trouble	Yes
Power System Stabilizer (PSS)	Yes
Ramp Rate	Yes
RTU/RIG	Yes
Transitional Limitation	Yes
Transmission Induced	No
Technical Limitations not in Market Model	No
Unit Supporting Startup	Yes
Unit Testing	No – if CAISO initiated Yes- if other test
Off Peak Opportunity	N/A – included as separate outage type under RC definitions

Short Notice Opportunity	N/A – included as separate outage type under RC definitions
RIMS testing	Yes
RIMS Outage	Yes

Transmission induced outages should be submitted if a resource is unavailable due to an outage on transmission equipment that is a part of the CAISO Controlled Grid. These outages will not be included in the UCAP calculation. If a resource is unavailable due to an outage on equipment that is not a part of the CAISO Controlled Grid, those outages should be submitted as a separate nature of work category and will be included in the UCAP calculation.

In addition to the list above, outages caused by natural disasters, act of the public enemy, war, or insurrection submitted with justification will not be included in a resource's UCAP calculation.

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 and Storage resources. The next section details modifications to the underlying methodology detailed below for Hydro, DR, QFs, Imports and Hybrids that better captures their true availability and ensure a resource is not double penalized.

The CAISO continues to propose to calculate hourly availability factors for each resource during the tightest RA supply cushion hours in each season. RA supply cushion is a measure of real-time system resource adequacy risk. A large RA supply cushion indicates less real-time system resource adequacy risk because more energy remains available to respond to unplanned events. A low RA 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 RA 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 in the 3rd revised straw proposal, the CAISO had proposed to evaluate a resource's availability during the top 100 tightest RA 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

questioned why the CAISO is not proposing to consider all 8760 hours. DMM suggested the CAISO 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, and an 8760 approach may over penalize a resource's UCAP value in hours when there was a low real-time system resource adequacy risk.

When looking at the distributions of the seasonal RA supply cushion, there is no obvious cut off point in which to determine how many hours to evaluate (Table 4 below).Today, the CAISO evaluates five RAAIM Assessment Hours, which roughly translate to 20% of all hours (including weekends).[93] Using RAAIM as a template, the CAISO continues to propose to evaluate a resource's UCAP value based on the top 20% of tightest RA supply cushion hours. This translates to 883 hours during the Peak Months (May through October) and 869 hours in the Off-Peak Months (November 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) allows the CAISO to leverage existing data through its OMS systems, rather than requiring new data reporting, such as GADS, from resources; 4) 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; 5) utilizing a percentage of hours rather than specific number of hours provides consistency across seasons and years, and ensures that outages are weighted evenly across the two seasons.

The CAISO defines RA supply cushion as:

$$\begin{aligned}\boldsymbol{RA\ Supply\ Cushion} \\ &= \boldsymbol{Daily\ Shown\ RA(excluding\ wind\ and\ solar) - Planned\ Outage\ Impacts} \\ &\boldsymbol{- Forced\ Outage\ Impacts - Urgent\ Outage\ Impacts} \\ &\boldsymbol{- Opportunity\ Outages - Net\ Load - Contingency\ Reserve}\end{aligned}$$

The RA supply cushion thus represents how much Shown RA remains after serving net load, meeting Contingency reserves, and accounting for all outages. CAISO excludes wind and solar resources from the shown RA because their capacity value is much lower than their actual production in real-time in certain hours and higher in others. Also looking at Net Load rather than Gross Load further accounts for the actual production of these variable resources. Net load values are taken from the 5-minute market. To convert the RA supply cushion into an hourly measure, CAISO takes the average of the RA supply cushion of all 12 RTD intervals to represent the hourly supply cushion value.

In response to stakeholder requests for further data analysis, the CAISO calculated the hourly RA supply cushion values for May 2018 through October 2020. CIRA provided daily shown RA

[93] RAAIM calculations do not currently consider weekends. However, it is important to note that tight supply cushions may also occur on weekends. Therefore, the CAISO has included them for this assessment.

and daily forced and planned outage impacts.[94] 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,[95] whichever was larger. Table 4 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 resource's forced outage rates from the beginning LSEs will be able to procure sufficient, reliable capacity to cover real time operation needs.

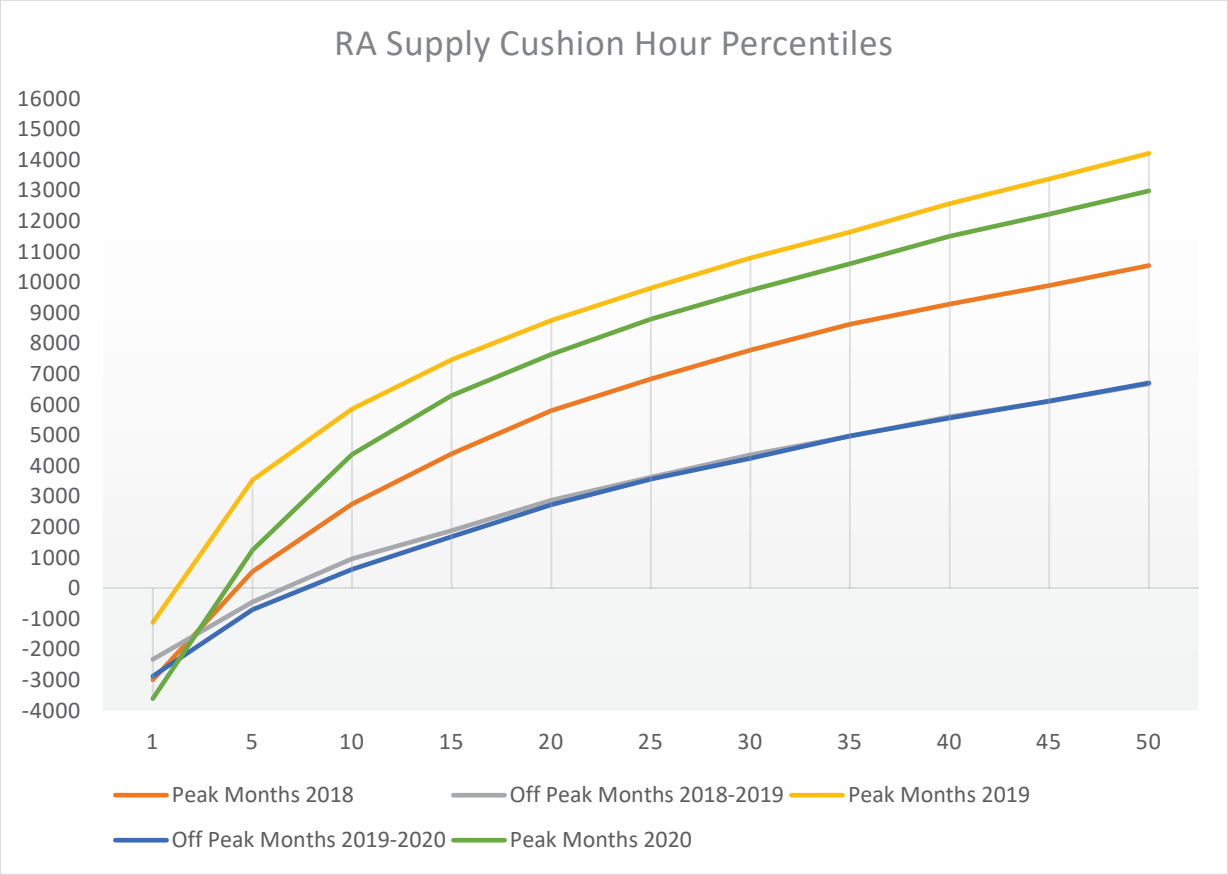
Table 4: Percentile distribution of average hourly RA supply cushion

Percentile	Peak Months 2018	Off Peak Months 2018-2019	Peak Months 2019	Off Peak Months 2019-2020	Peak Months 2020
1	-2985	-2318	-1109	-2868	-3598
5	554	-439	3545	-697	1251
10	2752	967	5866	628	4377
15	4394	1888	7478	1694	6303
20	5806	2878	8759	2734	7653
25	6843	3639	9820	3573	8800
30	7783	4368	10797	4247	9744
35	8633	4974	11649	4987	10608
40	9292	5616	12576	5565	11511
45	9899	6109	13377	6126	12235
50	10551	6687	14217	6715	12990
75	13895	10030	17923	10790	16939
90	16709	13478	21237	14322	20696
95	18298	14993	23135	16741	22473
99	20999	17376	26522	20018	24829

[94] CIRA currently only reports the largest forced and planned outage rate for the day. To implement this proposal the CAISO would update CIRA to report hourly planned, forced, urgent, and opportunity outage rates.
[95] 2,500 MW is an estimate for the Most Severe Single Contingency.

Looking at the 20th percentile, there is variability in the size of the RA 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 5,806 MWs and below in 2018 to 8,759 MWs and below in 2019. Whereas in Off-Peak Months the supply cushion during UCAP Assessment Hours ranged from 32734 to 2878 MWs and below. The differences in the distribution of the RA supply cushion is likely driven by the lower monthly requirements in off-peak months coupled with higher planned outage rates. The exact MW threshold for UCAP Assessment Hours is variable, and what matters more is that we will be evaluating forced outages during the worst 20% of hours in each season regardless of how large the RA Supply Cushion happened to be during that assessment period. Additionally looking at 20% of hours ensures sufficiently large sample sizes each year (869-883 hours) to provide robust estimates of the units average forced outage rate during critical hours. Figure 15 provides the 1% through 50% percentiles for each season visually, and demonstrates both the divergence between Peak and Off Peak months, variability across years, and that there isn't a very clear inflection point at which to determine the percentage of hours to look at to calculate the average forced outage rate.

Figure 15: RA Supply Cushion Hour Percentile



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 20th percentile and tabulated the number of Assessment Hours across all 24 hours, and the results are presented in Table 5 below. As

expected, the majority of UCAP Assessment hours fall within the evening ramp periods HE 18-22 (rough 68.8% of observations). In Off-Peak Months, there is 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 RA supply cushion hours to evaluate, UCAP values will 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 and half year period, on average 81% of days were included, which is similar to RAAIM today which covers roughly 71% of days. Table 6 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 RAAIM. Together these tables show that assessing UCAP based on the top 20% of tightest RA supply cushion hours rather than the top 100 hours will address many concerns of stakeholders that "luck" will be driving UCAP values rather than a resource's true forced outage rate.

Table 5: Distribution of UCAP Assessment Hours by Operating Hour

HE	Peak Months 2018		Off Peak Months 2018-2019		Peak Months 2019		Off Peak Months 2019-2020		Peak Months 2020	
	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.
1	3	0.34	4	0.46	18	2.04	5	0.57	16	1.81
2	1	0.11	2	0.23	7	0.79	2	0.23	2	0.57
3	0	0.00	1	0.12	4	0.45	1	0.11	0	0.00
4	0	0.00	1	0.12	4	0.45	1	0.11	0	0.00
5	0	0.00	2	0.23	5	0.57	1	0.11	0	0.00
6	2	0.23	8	0.92	17	1.93	9	1.03	2	0.23
7	12	1.36	54	6.21	26	2.94	51	5.84	12	1.36
8	9	1.02	38	4.37	17	1.93	34	3.89	12	1.36
9	2	0.23	8	0.92	5	0.57	10	1.15	0	0.00
10	2	0.23	2	0.23	4	0.45	5	0.57	0	0.00
11	1	0.11	0	0.00	3	0.34	3	0.34	0	0.00
12	1	0.11	0	0.00	5	0.45	0	0.00	1	0.11
13	7	0.79	0	0.00	6	0.68	0	0.00	7	0.70
14	14	1.59	1	0.12	8	0.91	1	0.11	14	1.59
15	24	2.72	4	0.46	13	1.47	2	0.23	25	2.83
16	33	3.74	8	0.92	23	2.60	12	1.37	35	3.96
17	40	4.52	40	4.60	32	3.62	54	6.19	50	5.66
18	78	8.83	95	10.93	61	6.91	106	12.14	77	8.72
19	119	13.48	127	14.61	106	12.00	127	14.55	119	13.48
20	152	17.21	147	16.92	129	15.74	133	15.23	145	16.42
21	151	17.10	143	16.46	143	16.19	129	14.78	138	15.63
22	125	14.16	114	13.12	125	14.16	112	12.83	110	12.46
23	78	8.83	56	6.44	79	8.95	56	6.41	77	8.72
24	29	3.28	14	1.61	34	3.85	19	2.18	38	4.30
Total	883	100.0	869	100.0	883	100.0	873	100.0	883	100.0

Table 6: Tabulation of days by number of UCAP Assessment Hours

# of tight supply hours per day	Peak Months 2018		Off Peak Months 2018/2019		Peak Months 2019		Off Peak Months 2019/2020		Peak Months 2020	
	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days
0	25	13.59	28	15.47	36	19.57	46	25.27	34	18.48
1	8	4.35	2	1.10	7	3.80	2	1.10	5	2.72
2	13	7.07	8	4.42	10	5.43	4	2.20	21	11.41
3	26	14.13	24	13.26	23	12.50	10	5.49	21	11.41
4	20	10.87	19	10.50	25	13.59	13	7.14	22	11.96
5	34	18.48	29	16.02	21	11.41	22	12.09	12	6.52
6	9	4.89	23	12.71	15	8.15	29	15.93	14	7.61
7	9	4.89	13	7.18	7	3.80	18	9.89	9	4.89
8	13	7.07	12	6.63	11	5.98	17	9.34	12	6.52
9	6	3.26	14	7.73	12	6.52	6	3.30	9	4.89
10	8	4.35	2	1.10	4	2.17	5	2.75	5	2.72
11	3	1.63	0	0.00	3	1.63	3	1.65	7	3.80
12	4	2.17	4	2.21	1	0.54	3	1.65	5	2.72
13	3	1.63	3	1.66	0	0.00	1	0.55	5	2.72
14	1	0.54	0	0.00	1	0.54	1	0.00	0	0.00
15	1	0.54	0	0.00	1	0.54	0	0.00	1	0.54
16	0	0.00	0	0.00	0	0.00	1	0.55	1	0.54
17	1	0.54	0	0.00	1	0.54	0	0.00	1	0.54
18	0	0.00	0	0.00	3	1.63	0	0.00	0	0.00
19	0	0.00	0	0.00	2	1.09	1	0.55	0	0.00
20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
21	0	0.00	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	0	0.00
23	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
24	0	0.00	0	0.00	1	0.54	0	0.00	0	0.00
Total	184	100.00	181	100.0	184	100.0	182	100.0	184	100.0

Stakeholder Comments:

In the Working Group Meetings held in September, stakeholders generally supported re-classifying October as a Peak month. CalCCA, Calpine, and Wellhead generally supported the seasonal approach based on the top 20% of tightest RA Supply cushion hours. CESA suggested assessing UCAP on the top 15% of tightest RA Supply cushion hours. Table 7 below compares the sample of UCAP Assessment Hours when we use the top 20%, top 15%, and top 10% of tightest RA Supply Cushion Hours. This table shows that there is a tradeoff between what percent of the hours fall between evening net load ramp (HE 18-22), the percent of days covered, and the median number of UCAP Assessment Hours per day. Due to the fact that the CAISO wants to incentivizes resources to be available on a 24x 7 basis, the top 20% threshold provides more observations outside the net load ramp and covers a greater number of days will provide stronger incentives for resources to invest in maintenance to keep their availability high.

Table 7: Comparing UCAP Assessment Hour thresholds

	Top 20%	Top 15%	Top 10%
Number of UCAP AH during Peak Months	883	662	442
Number of UCAP AH during Off Peak Months	873-869	655-651	437-434
% of UCAP AH between HE 18-22	68.80%	76.20%	82.54%
Median number of UCAP AH during Peak Months	4	3	2
Median Number of UCAP AH during Off Peak Months	5	4	2
% of Day covered by sample	81.53%	72.14%	57.72%

Some stakeholders, disagree with the approach to base the UCAP on backwards looking Assessment Hours rather than publishing them up front as is done with RAAIM. This suggestion would undermine the implicit incentive structure of UCAP for resources to minimize their forced outage rates and lead to gaming behavior of outage timing to avoid capacity derates, as the CAISO has observed today with RAAIM penalty avoidance behavior. CESA and others have asked that the CAISO publish the UCAP assessment hours after the fact, which the CAISO will do following implementation.

In the Market Surveillance Committee Meeting held on December 11th, stakeholders also re-raised the issue of whether the current RA Supply Cushion Hour was the correct measure of supply tightness, and advocated for looking at all Supply- RA or Not to assess "true" supply tightness. Some argued that especially in Off Peak Months, although the RA Supply Cushion for that hour may only be 2000 MWs, there is likely sufficient excess economic energy participating in the market, and so it might be rational for a generator to go on an urgent outage during that period. They argue that we may not want to assess forced outage rates under conditions where there is likely to be sufficient economic energy to cover grid needs regardless of the current RA supply cushion for that hour, and that we may need to look at the supply cushion taking into account all forms of energy- economic and RA- to get a true measure of the most critical grid hours and assess forced outage rates during these hours.

While the CAISO has considered such an approach, it disagrees that this is the correct methodology for assessing the availability or that generators have that much control over the timing of a forced outage (other than investing in proper planned maintenance), and we delve into this logic below.

The CAISO developed a metric based on using the planning tool available to us, largely the CPUC's RA program, which is the only assurance the CAISO has that we will have adequate capacity. The goal is not to assess every hour because not all hours are created equal in terms of needing resources to be available. A 24x7 assessment will make an outage at 2:00AM equal to an outage 6:00PM and therefore a 24x7 assessment for UCAP is not beneficial as a means to get and incentivize capacity to be available when we most need it. This leaves open the

question around what is the correct/best subset of hours to calculate outage rates. The RA Supply Cushion hourly metric is designed to test the days when RA relative to load is most scarce. RA is a planning exercise to provide the ISO with a guaranteed set of resources to be available throughout the RA compliance month to serve load, particularly peak. When that guaranteed RA fleet capacity shrinks and is unavailable due to unplanned outages relative to load serving needs that is when the RA planning process fails. The very fact that our base "assured" RA capacity shrinks degrades resiliency and increases the CAISO's risk of being unable to serve load since the CAISO must, instead, rely on non-RA resources that have no express obligation to be available to the CAISO.

RA resource owners taking forced or urgent outages don't and can't really know or consider how much economic energy is available to the CAISO at any time. Having sufficient economic energy when there is a high RA forced outage rate is somewhat coincidental. In other words, the fact that there is adequate economic energy when there is high RA resource forced outage rate is a "nice to have" and helps ensure efficient outcomes in the DA and RT markets, but is not a guarantee and not a substitute for ensuring sufficient RA capacity exists at all times on the system per RA resource must offer obligations.

This is the logic that drives the CAISO's reasoning for measuring the 20% of hours when RA resource are tightest when compared to net load – i.e. 1) Not all hours are created equal in terms of risk 2) we are counting on the set of RA resources we planned to be available to actually be available, 3) we are assuming no or limited non-RA resources make themselves available to the CAISO, i.e. we are dependent on the RA fleet, and 4) when those resources take urgent and forced outages, they do so regardless of what alternative sources are available to the ISO.

As an alternative, we had also considered using the delta between all available energy and net load. There were several reasons we thought this didn't work as well. The first reason is the inverse of why we choose RA capacity only (i.e. non-RA could go anywhere, including on outage, and they have no must offer obligation to the ISO). Additionally, we thought about when we were at greatest risk of shortfalls and how that might correlate to overall scarcity. Specifically, the probability of being short on the net peak load of the summer is the greatest. Thus we want a framework that was very impactful during those critical intervals. However, we also wanted to recognize a couple other important issues. For example, just because we saw the majority of challenges during those critical intervals, this doesn't mean those are the only challenging intervals. So we wanted to develop an approach that was flexible enough to capture other intervals, such as the morning ramp. We also wanted to develop a tool that could work in all seasons. Although there might be more economic energy in the non-summer months, the metric we have proposed works in both summer and non-summer months. For these reasons, the CAISO continues to advocate that availability of RA resources be assessed in hours where if the CAISO only had RA resources to rely on it would be most at risk of being unable to meet its net load, contingencies reserves, and cover outages.

Some stakeholders, such as SDG&E, WPTF, MRP do not support the CAISO proposal to move to a UCAP counting methodology. They argue that other ISO/RTOs that utilize the UCAP framework have annual RA requirements and capacity markets, and they state that UCAP

would be incompatible with California's bilateral contracting and monthly construct. The CAISO disagrees that UCAP is incompatible with California's current bilateral and monthly construct. First, the UCAP methodology detailed below is designed in such a way that the UCAP value of resources are driven by persistence of forced outage rates and should be relatively stable over time assuming the generator follows good maintenance practices**.** Second, many contracts already have contract provisions to deal with changes in capacity values. Third, CAISO expects secondary markets and contract mechanism to provide parties with sufficient tools to manage and hedge against risks. As stated above, the CAISO will be derating the resource's deliverability and availability to reach the final NQC value. Today, many contracts already have existing provisions to deal with annual and even monthly changes in the NQC value of the resource. Most contract terms are also set at a $ per MW of NQC. By incorporating UCAP into the resource's NQC values, any changes in the NQC value caused by increases in the resource's forced and urgent outage rates this will result in decreased capacity payments. This provides the financial incentives to invest in proper maintenance of facilities to keep capacity payments high. Additionally changes in UCAP/NQC in a multi-year bilateral framework could also be handled through call options with other generators. Parties could also hedge by selling less NQC to self-insure against any future changes in the total NQC value of the resource due to changing outage rates.

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 (Pmax) for each of the 20% of tightest RA supply cushion hours per summer season, May-October (on-peak), and the 20% of tightest RA supply cushion hours per winter season, November-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:

$$\textbf{Hourly Unavailability Factor} = \frac{\textbf{Derates} + \textbf{Forced} \,\&\, \textbf{Urgent Outage Impacts}}{\textbf{Pmax}}$$

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

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

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:

$$\textbf{Weighted Seasonal Average Availability Factor} = \textbf{Annual Weighting} * \textbf{Seasonal Average Availability Factor}$$

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 DQC to determine the resource's seasonal UCAP ratings that will represent its new NQC value as follows:

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

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

Therefore, a resource's NQC/UCAP value will never be greater than their deliverable capacity.

Stakeholder Comments:

Stakeholders generally support the weighting scheme, and the decision to look at three years of historic outage data, instead of five years as initially proposed on the 3rd revised straw proposal. This structure helps to emphasize the most recent outage rates in resources UCAP/NQC value, and if a resource happens to have a bad year, this weighting scheme allows the impact of that year to diminish over time, while continuing to incentivize investment in longer term maintenance to improve and maintain high availability of the resource.

In the September working group meetings, the CAISO presented the new formula to determine the Hourly Unavailability Factor that changed the denominator from NQC to Pmax of the resource. This change was made because outages reported in OMS are in relation to the Pmax of the resource not its deliverable capacity. When outages were taken as a percentage of NQC this lead to HUFs over 1, which would lead to inaccuracies in the average outage rate of the resource.

Stakeholders also expressed some confusion and disagreement about how deliverability and availability will be subtracted from nameplate capacity and whether this would represent double counting. SDG&E raised in their comments to the 3rd RSP and September working group. Today resources are able to further derate their NQC values for limitations beyond deliverability such as temperature derates or environmental restrictions etc., and some stakeholders felt that the CAISO could potentially double count by multiplying the WSAAF (which includes these outages) by NQC because operators still have to submit outage cards for thermal derates that may already be captured in the NQC. The CAISO clarifies here that when UCAP is implemented, the deliverable capacity or DQC will only be derated based on deliverability and generators will no longer have the option to include thermal derates or diminish this value further beyond what the CAISO assess in its deliverability studies. This concept of DQC more

closely aligns with the Installed Capacity (ICAP) concept used by other ISO/RTOs. For instance PJM clarifies that ICAP cannot exceed the interconnection rights and is adjusted for the summer net capability, which is similar to the deliverability assessments of the CAISO. PJM then defines UCAP as the ICAP not on forced outage.[96] This is similar to the CAISO applying the WSAAF to the DQC to get the final NQC/UCAP. SDG&E provided an example of a 500 MW Pmax resource has 10% forced outage rate, and an NQC of 490 (which they state also includes something like thermal de-rates and does not just include deliverability). They argue that by multiplying the outage rate by NQC, the UCAP value would equal 441 MW instead of 450 by derating from Pmax, which they view as over penalizing the resource. However, this is a flawed example because when UCAP is implemented, resources will no longer be able to further derate their deliverable capacity prior to applying the WSAAF, and there should no longer be this double counting risk. For this same 500 MW resource with 10% forced outage rate i.e. WSAAF=.90, if we assume they are 100% deliverable the final NQC/UCAP would be 450 MW. If they were only 95% deliverable and had a DQC of 475 MW they would have a final NQC/UCAP= 427.5 MWs. This insures that RA resources' must offer obligation will be set at their deliverable capacity, and their NQC value represents what proportion of that deliverable capacity is available to the CAISO on average.

UCAP methodology for new and non-conventional resource types

New resources

The CAISO initially considered two approaches for calculating UCAP for new resources without three full years of operating history. Option 1 was a class average approach. Class averages would be based on outage rates for similarly designed resources of the same technology type. 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. Under Option 2, resources would begin with their DQC the first year, and places heavier weights on actual performance in the initial years. Under this approach, resources will start with a higher capacity value, but actual performance will have a more significant impact early on.

In comments to the working group meeting on June 10th, stakeholders provided an even split between the two options. Option 1 was supported by CalCCA, NRG, and the Public Advocates Office. Option 2 was supported by CESA, EDF- Renewables, and LS Power. In comments to the September working groups, CESA also suggested modifications to the proposed weighting scheme that would slightly lower the impact of the first year of performance on the resource's UCAP value to Year 1 weighted 60% performance and 40% NQC. Many in the storage community suggested a class based approach would not be appropriate for new storage resources due to the small number of resources currently on the system. Among stakeholders, there was also growing concerns about how best, and when, to construct new class averages for new technology types, such as flow batteries or different battery chemistries, which complicates the implementation of Option 1. Option 2 provides greater incentives to keep outage rates low to maintain high UCAP values, whereas under Option 1 resources would have

[96] See PJM Manual 21 for further details.

to wait for their UCAP values to increase over time which may diminish their incentive to keep outage rates low and rather conform to the class average.

In light of this feedback, the CAISO has decided to go with a slightly modified version of Option 2 for new resources where the initial UCAP/NQC value would equal the resource's deliverable capacity, and weight the subsequent two years of performance data more heavily, and quickly roll off the DQC value, until the resource has three years of operational data. The CAISO proposes the following weights:

- Year 0 (i.e. before operational data is available): DQC
- Year 1 70% Year 0 SAAF; 30% DQC
- Year 2 55% Year 1 SAAF; 45% Year 0 SAAF
- Year 3 45% Year 2 SAAF; 35% Year 1 SAAF; 20% Year 0 SAAF

The CAISO believes that this approach will balance the concerns that Option 2 would overvalue the resource's UCAP value by not sufficiently derating it for its availability by rolling off the DQC value more quickly. It provides even stronger incentive to keep outage rates low to maintain high UCAP/NQC values. It also eases implementation by allowing new technology types to be integrated faster into the CAISO, and decreases the arbitrariness of defining the class for these new technology types.

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.[97] 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.[98] 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.

[97] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M338/K277/338277501.PDF
[98] For newer resources, if operational history is not available for 10 years, the ISO will consider as much outage data that is available.

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 8: 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 9: Existing hydro counting methodology

	Fuel Unav.	Avail (w/water)	****Uses 10 years of availability**
HE1	0	100	
HE2	0	100	
HE9	0	100	
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 10: Proposed Hydro UCAP methodology

	Fuel Unavailability	Mechanical Outage	Tot. Unavailability	Availability	****Uses 10 years of availability**
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, and the CAISO will 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.

In stakeholder comments, SCE suggested two modifications to the hydro UCAP proposal. The first is to allow increases on hydro UCAP value during the month-ahead showing process based on more up to date hydro resource availability. The second is to change the look-back period from the 10 years to 3 years in order to more quickly realize the benefits of maintenance and infrastructure upgrades that increase the output of the resource. The CAISO believes the 10 year exceedance approach provides a reasonable estimate of hydro resource availability considering both water availability and mechanical outages but certain elements of SCE's suggestions can be incorporated to improve this methodology. If the resource operator can

better assess the capability of the resource closer to the operation month, the resource can be shown more conservatively in the year-ahead and increase in the month-ahead timeframe up to the UCAP value. In addition, the CAISO finds it reasonable to incorporate infrastructure upgrades that increase the maximum output of the resource proportionally to years prior to the infrastructure upgrades. These should only include infrastructure upgrades that increase the maximum capability of the resource, not maintenance that reduces the likelihood of forced outages, which would undermine the incentives of including mechanical forced outages in the UCAP calculation.

Storage

In previous versions of the proposal, the CAISO had considered different methodologies to include the new optional end-of-hour state-of-charge parameter in the hourly unavailability factors. This was largely unsupported by stakeholders. The CAISO is no longer moving forward with a unique counting methodology for storage resources. The basic UCAP methodology using seasonal availability factors described above will be applied to storage resources. Considering stakeholder feedback and other tools such as the minimum state of charge requirement (See section 5.1.3) and new rules around the must offer obligation (See section 6.1.4), the CAISO has concluded there is not a need for an alternative methodology for storage resources.

Hybrid Resources

In the working group meetings held in September, the CAISO put out a preliminary proposal around how the CAISO would calculate UCAP for hybrid resources that would take into account both the forced and urgent outages and the dynamic limit tool to determine the availability of the resource. In the CAISO's Hybrid Initiative Phase 2 Final Proposal, the CAISO describes the dynamic limit tool, which allows scheduling coordinators to submit the upper limit the resource can provide to the real time market on a five minute granularity.[99] This allows them to represent any limitations in the VER component (such as onsite charging of the storage component or lack of production during non-solar hours) as well as state of charge limitation for the battery component of the hybrid resource. The SC for a hybrid resource should ensure that when they submit both the dynamic limit and an outage card that these not represent overlapping unavailable MWs to further ensure against double counting. Since the majority of UCAP Assessment Hours fall outside of solar production hours it is necessary to include the dynamic limit impacts in determining the true availability of the resource.

Stakeholder responses largely expressed concerns that the CAISO would double penalize the resource since the CPUC QC methodology already takes into the limited contribution of the VER component and reductions in availability due to charging the onsite storage. The CAISO believes that these comments were largely the result of a lack of clarity on how the proposal would be implemented, and provides the necessary details below to outline its full proposal, as well as provide simulated QC and UCAP/NQC for two example hybrid resources.

[99] See Hybrid Initiative Phase 2 Final Proposal: http://www.caiso.com/InitiativeDocuments/RevisedFinalProposal-Redlined-HybridResources.pdf

The CAISO continues to propose that a co-located resource's UCAP/NQC values should be calculated for the individual components, such that co-located VERs will be assigned the ELCC value of the resource, and the storage component will be assessed the generic UCAP methodology for storage and thermal resources.

For hybrid resources, the CAISO proposes to take the minimum of the CPUC qualifying capacity or Weighted Seasonal Average Availability multiplied by the Pmax of the resource, limited to the point of interconnection for each month. Today, the CPUC determines the hybrid's QC equal to the Effective Storage QC+ Effective Renewable QC. Where the Effective Renewable multiples the name plate capacity by the production profile of the resource, subtract the necessary MWh to fully charge storage component, and then divide the remaining MWh by the production profile to reach the Effective Renewable MW. This is then multiplied by the relevant ELCC value for the month in question. The Effective Storage QC is nameplate capacity if the resource can be fully charge by VER component, otherwise it is limited to the MWh the VER is capable of producing divided by four hours.

The CAISO proposes to modify the basic UCAP methodology steps by calculating the Hourly Unavailability Factor as:

$$Hourly\ Unavalability\ Factor = \frac{Forced + Urgent\ Outages + Dynamic\ Limit\ Impact}{Pmax}$$

Where the Dynamic Limit Impact is equal to:

$$Dynamic\ \ Limit\ Impact = mean(Pmax - Dynamic\ Limit)$$

Since the Dynamic Limit can be updated every 5 minutes, the CAISO will take the average across the 12 RTD intervals and include the average MW unavailable from Pmax into the numerator of the HUF. There will be no changes to the Seasonal Average Availability Factor or Weighted Seasonal Average Availability Factor described above. Finally, to determine the final UCAP value, the CAISO will multiple the relevant WSAAF to the Pmax of the resources:

$$On\ Peak\ UCAP = Pmax * Weighted\ Seasonal\ Average\ Avaliability\ Factor_{On\ Peak}$$

$$Off\ Peak\ UCAP = Pmax * Weighted\ Seasonal\ Average\ Avaliability\ Factor_{Off\ Peak}$$

The final monthly NQC would be the minimum of QC or UCAP, limited to the point of interconnection.

To illustrate this process we provide a simulated example for two example hybrid resources. Hybrid Resource A is a 100 MW Solar+ 50 MW Storage resource, and Hybrid Resource B is a 100MW Solar+100 MW Storage resource. For simplicity we assume 100% round trip efficiency of the storage component. To calculate the QC value for each resource we used the Production Profiles per MW Installed Capacity chart values presented in the CPUC's Track 3B workshop,

and the steps described above.[100] Table 11 and Table 12 shows the interim steps to calculate the qualifying capacity of each example Hybrid Resource.

Table 11: CPUC Qualifying Capacity for Hybrid Resource A

Hybrid Resource A: 100 MW Solar+ 50 MW Storage												
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Production Profiles per MW Installed Capacity	4.05	5.17	6.23	7.89	8.5	9.54	8.78	8.5	7.73	6.65	4.67	3.81
MWh	405	517	623	789	850	954	878	850	772	665	467	381
MWh needed to charge storage	200	200	200	200	200	200	200	200	200	200	200	200
MWh remaining for grid services	205	317	423	589	650	754	678	650	573	465	267	181
Effective Renewable MW (MWh remaining / Production Profile)	50.62	61.32	67.90	74.65	76.47	79.04	77.22	76.47	74.13	69.92	57.17	47.51
ELCC (Remaining MW* monthly ELCC)	2.02	1.84	12.22	11.20	12.24	24.50	30.12	20.65	10.38	1.40	1.14	0.00
Effective Storage MW	50	50	50	50	50	50	50	50	50	50	50	50
QC (ELCC+ Storage MW)	52.02	51.84	62.22	61.20	62.24	74.50	80.12	70.65	60.38	51.40	51.14	50.00

Table 12: CPUC Qualifying Capacity for Hybrid Resource B

Resource 2: 100 MW Solar +100 MW Storage												
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Production Profiles per MW Installed Capacity	4.05	5.17	6.23	7.89	8.5	9.54	8.78	8.5	7.73	6.65	4.67	3.81
MWh	405	517	623	789	850	954	878	850	772	665	467	381
MWh needed to charge storage	400	400	400	400	400	400	400	400	400	400	400	400
MWh remaining for grid services	5	117	223	389	450	554	478	450	372	265	67	-19
Effective Renewable MW (MWh remaining / Production Profile)	1.23	22.63	35.79	49.30	52.94	58.07	54.44	52.94	48.12	39.85	14.35	0.00
ELCC (Remaining MW* monthly ELCC)	0.05	0.68	6.44	7.40	8.47	18.00	21.23	14.29	6.74	0.80	0.29	0.00
Effective Storage MW	100	100	100	100	100	100	100	100	100	100	100	95.25
QC (ELCC+ Storage MW)	100.05	100.68	106.44	107.40	108.47	118.00	121.23	114.29	106.74	100.80	100.29	95.25

To simulate the UCAP, we used the fleet average solar production from the publically available 2018-2020 Production and Curtailment dataset to estimate the dynamic limit impacts, and the

[100] See CPUC Track 3B Presentation on Page 123-127 : https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Electric_Power_Procurement_and_Generation/Procurement_and_RA/RA/Track%203B%20Day%202%20Presentation.pdf

average outage rate for the storage component from the RA Fuel Type report generated from CIRA. Table 13 and Table 14 provide the results for example Hybrid Resource A & B. The lower UCAP values vs. the QC is driven by the fact that the majority of UCAP Assessment Hours fall outside solar production hours, and the final NQC values generally reflect the average availability of the storage component. The final NQC would also be limited to the point of interconnection, but in these examples we assume a 115 MW POI limitation for simplicity. These tables clearly outline that the CAISO would not be double counting outages or limitations from the VER component by taking the minimum of either the CAISO calculated UCAP value or CPUC QC value for the final NQC value of the hybrid resource which address stakeholders main concerns with this approach.

Table 13 : Hybrid Resource A (100 MW Solar+ 50 MW Storage)

Month	1	2	3	4	5	6	7	8	9	10	11	12
QC	52.02	51.84	62.22	61.20	62.24	74.50	80.12	70.65	60.38	51.40	51.14	50.00
UCAP	49.19	49.19	49.19	49.19	64.73	64.73	64.73	64.73	64.73	64.73	49.19	49.19
Final NQC	49.19	49.19	49.19	49.19	62.24	64.73	64.73	64.73	60.38	51.40	49.19	49.19

Table 14: Hybrid Resource B (100 MW Solar + 100 MW Storage)

Month	1	2	3	4	5	6	7	8	9	10	11	12
QC	100.05	100.68	106.44	107.40	108.47	118.00	121.23	114.29	106.74	100.80	100.29	95.25
UCAP	96.49	96.49	96.49	96.49	112.90	112.90	112.90	112.90	112.90	112.90	96.49	96.49
Final NQC	96.49	96.49	96.49	96.49	108.47	112.90	112.90	112.90	106.74	100.80	96.49	95.25

Wind and Solar

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.

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.[101] 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.

Demand Response and QFs

The CAISO notes that some DR resources also need an alternative approach for determining their UCAP values. This is because a 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 has examined the application of an ELCC methodology to DR resources.[102] 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

[101] Forced outages are accounted for by using actual production data to inform the wind and solar production profiles in the ELCC modeling.
[102] ESDER 4 Stakeholder Initiative Webpage: http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_DistributedEnergyResources.aspx

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 the demand response provider (DRP) level to prevent poorly performing DR providers from receiving UCAP values equal to the DQC 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 and test events to their actual performance during those periods to establish the availability that will be applied to their UCAP value.

Imports

For RA Imports, the UCAP counting rules will depend on the resource type underlying the contract. For Dynamics and Pseudo-ties that represent a single resource with a stable resource ID and that are fully modeled, the UCAP methodology that applies to the underlying resource type used for internal resources will apply. For instance, if the dynamic was an external thermal or storage resource then the generic UCAP formulas would apply, and the final WSAAF would be multiplied by the DQC, or the deliverable contracted MWs. If it was a Pseudo-tied hydro resource, the hydro counting rules described above would apply, and so on and so forth.

For Non-dynamic Resource Specific Resource Adequacy (RA) imports, since the CAISO does not require all of the underlying resources be fully modeled, there is the possibility that these resources can change Resource IDs every year as the underlying portfolio of resources changes. Like DR resources, there is the need to assess the UCAP values at a higher aggregation level. In this case, the CAISO believes the scheduling coordinator (SC) is the proper level to evaluate these resources because SC IDs are harder to change year over year, and SCs tend to represent a similar portfolio of resources year over year. While there is the risk that an SC's WSAAF might be impacted by an outgoing resource it represents, there remains the incentive for SCs to represent the most reliable resources to keep their WSAAFs high. SCs can also mitigate this risk by only representing dynamic and pseudo-tied resources.

Although internal resources will be exempted from forced outages cause by transmission induced outages on equipment that is part of the CAISO controlled grid, the CAISO's RA Imports rules allow RA Imports to flow on monthly non-firm service on upward legs (see Section 5.1.2 RA Import Requirements above). Since they have some choice on the level of firmness in which they contract, the CAISO believes it is appropriate to include any transmission curtailments that occur during a UCAP Assessment Hour on non-firm service (less than 7-F transmission service) in the UCAP calculation. If the resource has firm transmission source to

sink they will also not penalized if any leg of service gets curtailed. Therefore, the basic hourly unavailability factor for RA Imports will be:

$$\text{Hourly Unavailability Factor} = \frac{\text{Non} - \text{firm Transmission Curtailments} + \text{Forced \& Urgent Outage Impacts}}{\text{Contracted MWs}}$$

Timing and coordination of new counting methodology

The CAISO proposes a clean transition from the current NQC to the new UCAP-based NQC 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/NQC RA requirements and showings. The 2023 RA year would transition to binding RA requirements and showings in terms of UCAP/NQC and Must Offer Obligations set at DQCs. 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, citing potential 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 the CAISO transition to UCAP in 2024 to remain more consistent with CPUC rules.

Coordination of UCAP Counting with LRA RA Programs

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 continue to work with LRAs to align RA programs with the CAISO's proposal. The CAISO has submitted its proposed counting rules into the CPUC RA proceeding and will continue to vet this proposal in that forum and others as required.[103]

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.

[103] CAISO's initial track 3B proposals: http://www.caiso.com/Documents/Aug7-2020-InitialTrack3BProposals-Comments-AdditionalProcess-ResourceAdequacy-R19-11-009.pdf

Removing Forced Outage Replacement and RAAIM application to forced outage periods

CAISO's analysis in Appendix 11.2 shows that RAAIM does not effectively ensure adequate capacity through forced outage substitutions will be provided to the CAISO and, therefore, it is reasonable to eliminate RAAIM 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 RAAIM creates a complex system of processes that differ vastly from other ISOs/RTOs. In light of the data in Appendix 11.2 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.

Minimum Standards for QC Counting

Historically, the CAISO has deferred to the local regulatory authorities to establish the qualifying capacity values of RA resources. If local regulatory authorities set different QC values, the CAISO has accepted the highest QC value submitted. Finally, if the local regulatory authority does not establish a qualifying capacity counting methodology, the CAISO will apply the default qualifying capacity criteria defined in tariff section 40.8. The CAISO will continue to defer to LRAs and apply default criteria when no QC method is adopted, but the CAISO has identified a need to ensure the same resource ID is treated comparably among the LRAs when establishing the QC. For example, under today's rules, a solar resource whose QC value is determined using ELCC under one LRA could receive a QC based on Pmax in another LRA.

To better ensure reliability and avoid over-counting of resources, under this proposal, the CAISO will not accept a QC value for a resource that is more than 10% greater than the lowest QC value adopted by any other LRA for the same resource ID. This will ensure QC values for the same resource is comparable among LRAs. The CAISO will enforce this for all resource types with default QC criteria in section 40.8 in the CAISO tariff.

6.1.2 Determining Minimum System RA Requirements

CAISO will coordinate with the CPUC and LRAs to the greatest extent possible to ensure alignment with individual LRA requirements. The CAISO, however, has observed some LRAs are setting unusually low requirements or are attempting to meet the RA requirements with only RA "credits" that do not have a commensurate showing on a supply plan of the RA credited resources. As a result, the CAISO believes it is necessary and appropriate to set a minimum system RA obligation to avoid LRA leaning and ensure LRAs meet a minimum equitable level of reliability. The goal of setting a minimum RA requirement is to ensure that all market participants are procuring adequate RA capacity and contributing to the overall system adequacy needs to serve load, reserves, and uncertainty, which their very participation in the BAA creates. Finally, the CAISO expresses these requirements in terms of UCAP/NQC context

as defined in section 6.1.1, above. However, the need for these minimum requirements exist under any RA counting structure.

Minimum System UCAP Requirement

Historically in California, a PRM has accounted for three things: reserves, load forecast error, and forced outages.[104] Under the CAISO's proposal it will be unnecessary to consider forced outage rates in determining the PRM because the forced outage rate of resources is embedded in the UCAP/NQC value. After removing forced outages from the PRM, what remains is forecast error and reserves. As members of a power pool, LSEs should make available to the CAISO a minimum amount of UCAP/NQC sufficient to serve forecasted peak load and reserve requirements. Therefore, the CAISO is proposing a minimum system UCAP/NQC requirement that all LSEs must meet and show as RA Capacity under the CAISO tariff. LRAs may set their specific RA requirements for their LSEs at any level above this minimum threshold.

The CAISO proposes to establish the minimum RA threshold using a "bottom-up" approach, building on the foundation of forecasted peak demand and reserves.[105] The primary benefit of the bottom-up approach is it does not rely on any assumptions about forced outage rates for various technology types or the composition of the RA fleet. Only individual resource outage rates are needed and then only for procurement and RA showing purposes. Average forced outage rates are not used because this information will be embedded in resource UCAP/NQC values. The bottom-up approach most effectively establishes a minimum system UCAP/NQC RA requirement and ensures minimum resource adequacy requirements are achieved to maintain reliability. This is necessary given the number of LRAs and the wide variance the CAISO sees in certain LRAs' PRM targets, which can lead to leaning concerns.

To set the minimum UCAP/NQC requirements, the CAISO must determine the appropriate forecast load level to use. The CAISO believes setting the minimum requirement based on forecast rather than forecast error is more appropriate for two reasons. First, for planning purposes, forecast and forecast error are inversely related. For example, using a 1-in-10 year forecast 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 virtually all under-forecasting error be included in the planning reserve margin. The second reason is that the need for ancillary services is directly related to load levels. To maintain this connection it is better to set the minimum requirement on a reasonable forecast level. For example, using a 1-in-2 forecast plus a higher PRM means that the expected reserves need would either be too low or need to be included in the forecast error. Both of

[104] The basis for RA is to ensure the CAISO can serve forecasted peak load while carrying 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, and must have sufficient RA capacity to provide regulation and the flexible ramping product. 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

[105] A 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/NQC requirement.

these points demonstrate it is more transparent and requires fewer assumptions about potential load conditions to select the forecast and not address forecast error.

The CAISO proposes to use the CEC 1-in-5 forecasted peak lead plus six percent of that forecast to set the minimum RA requirement. This ensures the minimum planning standard addresses a broader range of potential load conditions, many of which are higher than the average load. However, the CAISO is not, at this time proposing to apply any additional forecast error. Additionally, the CAISO proposes to include an additional six percent of this forecasted peak in the minimum requirement. This six percent is needed to ensure the CAISO also has sufficient reserves to meet that peak (i.e. reserves equal to three percent load and three percent of generation). The practical effect of the CAISO's proposal is similar to setting the requirements based on a 1-in-2 forecast with a 10 percent PRM. For example, 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.

LRAs may set RA requirements that exceed this minimum threshold, but requirements cannot set requirements below the minimum threshold level. If a LRA does not set the minimum obligation, or sets an obligation lower than the minimum threshold level, the CAISO will set the obligation to the minimum default level. If LSEs fail to show resource adequacy capacity to meet the minimum threshold requirement or any applicable higher requirement, the CAISO may undertake backstop procurement if the overall system RA showings are deficient. In such cases, the CAISO proposes to allocate the costs first to LSEs that did not meet a minimum showing of their forecast load plus the applicable reserve requirement.

6.1.3 System RA Showings and Sufficiency Testing

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. This sixth revised straw proposal contains the CAISO's proposal for the individual deficiency test. The CAISO will continue policy development on the portfolio deficiency test in a future revised straw proposal. Additional information is located in Section 7 below. The CAISO will also conduct tests for flexible and local capacity needs, described in Section 6.3.

Individual Deficiency Assessments

The CAISO will assess LSE RA showings and resource supply plans to ensure there is sufficient UCAP/NQC shown to meet the identified UCAP/NQC need described above. Because the CAISO will be assessing system capacity showings based on UCAP/NQC values, the CAISO proposes that LSEs and resource SCs need only submit and show resources' UCAP/NQC values. Once shown, the CAISO will consider each resource's UCAP value to conduct its UCAP/NQC 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 DQC and UCAP/NQC 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/NQC value of the resource. There are two reasons CAISO cannot allow this. First, the UCAP/NQC 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 DQC will be assessed as being shown for 45 MW of UCAP/NQC RA).

LSEs that fail to meet the UCAP/NQC 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 6.3 below.

6.1.4 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 this proposal. 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 DQC shown for RA, not the amount of UCAP/NQC shown;
- Resources have a 24 by 7 must offer obligation into the day-ahead market, and real-time market through the day-ahead market enhancements transitionary period, unless exempt, and;
- Resources will receive bid insertion, unless exempt.

Must Offer Obligations Under UCAP Construct

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 DQC value. For simplicity, the CAISO will refer to this quantity as shown DQC. This is consistent with the

practice in other ISO/RTOs.[106] More specifically, if a 100 MW resource with a 20 percent forced outage rate is shown for 80 MW of UCAP/NQC, then it has shown its full 100 MW of DQC. It must then bid 100 MW of capacity into CAISO's markets when the resource is not on outage.[107] 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 DQC 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 DQC 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 DQC-based resource bidding. This concept is addressed in greater detail in Section 6.1.1 above.

Resource Adequacy Must Offer Obligations

The CAISO is proposing several new capacity products in separate initiatives called reliability capacity, imbalance reserves, and corrective capacity.[108] 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.

In the day-ahead market enhancements initiative, the CAISO is proposing a transition period with maintains the existing must offer obligation of the current RA program. During the transition period, resource adequacy resources will still be required to meet their real-time must offer obligations regardless if the resource has received a reliability capacity or imbalance reserve award. During this time, the resources will bid $0.00 for both reliability capacity and imbalance reserves; however, the resources will be paid the marginal price for both reliability capacity and imbalance reserves. While the marginal price should be zero in most cases, there can be instances where a resource is scheduled out-of-merit for energy, resulting in an

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[106] 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."

[107] If a resource only shows a portion of its DQC as RA, the must offer obligation is set at the portion of the DQC that is shown for RA, not the full amount.

[108] 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

opportunity cost that is compensated through the price of reliability capacity and imbalance reserves.

The rationale for this transition period is to allow the CAISO to observe how the new market performs under the existing resource adequacy must offer obligation paradigm and to align with the need to make this paradigm shift as part of the extended day-ahead market initiative. The transition period will end at the start of the calendar year in which EIM entities will onboard into the extended day-ahead market. For example, the day-ahead market enhancements are scheduled to be implemented in fall 2022. The extended day-ahead market is planned for implementation in fall 2023 to support onboarding in spring 2024. The current schedule would result in the transition period ending on January 1, 2024. In the event the extended day-ahead market onboarding occurred in spring 2025, the transition period would be extended another year.

After the transition period proposed in the day-ahead market enhancements initiative, 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.

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 after the proposed transition period in the day-ahead market enhancement initiative expires. Must offer obligations for resources providing flexible resource adequacy will be developed in the flexible resource adequacy portion of this initiative.

Until the transition plan proposed in the day-ahead market enhancements initiative fully replaces the real-time RA must offer obligation with the must offer obligations tied to imbalance reserves and reliability capacity, RA resources will have the same real-time must offer obligations as

today, with the exception of RA imports described in section 5.1.2. Modifications to these real-time must offer obligations will be defined in the day-ahead market enhancements initiative.

The CAISO performed a comprehensive review of the day-ahead must offer obligations for all resource types in the tariff and Reliability Requirements BPM and clarifies the current 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.[109] Pseudo-ties and dynamically scheduled imports must follow the same obligation as an internal resource of the same technology type.

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. [110]

Standard residual unit commitment (RUC) must offer obligation: RUC availability bid for all RA capacity not reflected in the day-ahead schedule for all hours of the month the resource is not on outage.

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. Under this offer obligation, resources should still bid into the day-ahead market for all hours the resource is not on outage. A resource should have bids 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. If the resource is not available, it should submit an outage, consistent with current practice.

The CAISO proposes to apply the standard must offer obligation to use-limited resources and conditionally available resources, unless the underlying technology has a different offer obligation. [111] Use-limited resources have access to outage cards that can be used when use limitations are met. Conditionally available resources are also able to use outage cards to manage their conditionally available outages and derates.

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. This proposal applies to battery storage resources participating

[109] The CAISO is not proposing changes to how load-following metered subsystems are treated under the existing tariff section 40.2.4.
[110] 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.
[111] Tariff Definition of Use-Limited Resource and Conditionally Available Resource: http://www.caiso.com/Documents/AppendixA-MasterDefinitionSupplement-asof-Sep28-2019.pdf

under the NGR model regardless of the point of interconnection (*i.e.* transmission or distribution), and hybrid resources with a battery component.

As described in section 6.1.1, the CAISO no longer proposes to include end-of-hour state of charge restrictions in the UCAP value of storage resources. Instead, battery storage RA resources will not be able to set their end-of-hour state of change parameter in a way that prevents them from meeting their day-ahead schedule. For example, a +/- 25 MW storage resource with a day-ahead energy schedule to discharge 25 MW in one hour could not set an maximum end of hour state of charge less than 25 MWh during the previous hour. Similarly if the same resource went into the hour with the 25 MW schedule at 50 MWh of charge, it could not set a minimum end of hour state of charge for the end of that hour at a level greater than 25 MWh. If the same resource had a day-ahead schedule to discharge 25 MW for 3 consecutive hours, the resource could not set an maximum end-of-hour state of charge below 75 MWh in for the end of the hour directly preceding the first hour the resource is scheduled to discharge.

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.

The CAISO recently developed policy for market participation of hybrid resources. Hybrid resources providing resource adequacy will be subject to must offer obligations, like all other resources providing resource adequacy capacity. Hybrid resources must bid their full expected capability (including charge and discharge portions) of the resource in all hours. The CAISO recognizes that hybrid resources with storage components may have multiple hours during the day while they are using on-site generation to charge storage components and that a significant portion of the resources capacity may not be available for dispatch during these times. Also, hybrid resources with VER components will be unavailable when the VER portion is not producing. Hybrids may also have conditions when storage components are completely charged or completely depleted precluding the resource from dispatch in a portion of the potential operating range. Finally, the resource may have ambient unavailability precluding full range of dispatch. Hybrid resources will have access to the dynamic limit tool to alert the CAISO during these conditions when they are unavailable to the market. Other conditions precluding operation, such as mechanical outages, will be reported through the typical outage management system.

The CAISO also clarifies the must offer obligations for demand response. Absent adoption of an alternative counting methodology for demand response by the LRAs, the CAISO will apply the following must offer obligations for demand response.[112] For proxy demand resources, the CAISO will defer to program parameters established or approved by the LRA to determine the

[112] In the ESDER 4 initiative, the CAISO explains alternative bidding requirements that could be adopted under a counting methodology that considers the variability and use-limitations of demand response. https://stakeholdercenter.caiso.com/StakeholderInitiatives/Energy-storage-and-distributed-energy-resources

hours of the must offer obligation. The days and hours in which the demand response resources are obligated to bid into the market must be clearly communicated through LRA-approved documentation, such as contract provisions or decisions. During those hours, the resource must bid all its RA capacity not on outage. If no parameters are established by the LRA, resources must follow the standard must offer obligation.[113] Reliability demand response will continue to have the option to bid into day-ahead, and are required to bid into real-time consistent with the program parameters established or approved by the LRA.

Currently, eligible intermittent resources are not required to bid into the day-ahead market, and are required to offer their full forecasted amount in real-time. This will continue under this proposal. However, the CAISO clarifies here that while the RA value produced by the ELCC may be lower or higher than what the resource can produce in the operational timeframe (because the RA value is static and the resource capability varies), the RA capacity under offer obligation to the CAISO is for all energy necessary to derive the shown RA value. This means that the energy from these resources above the NQC value cannot be used to support an export from non-RA capacity.

The CAISO will continue not to require RUC availability bids from certain RA resources as defined in tariff section 40.6.4.2, with the exception of CARs for the reasons described above. These include: Pumping Load[114], Reliability Demand Response Resources, Combined Heat and Power Resources, Regulatory Must-Take Generation, Run-of-River Resources, and Eligible Intermittent Resources.

Bid Insertion

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 most 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 proposes to apply bid insertion to use-limited resources and conditionally available resources, unless the underlying technology is exempt. The CAISO allows use-limited resources to include approved opportunity costs in their market bids. This ensures more effective and efficient use of resources in the market to facilitate regular and consistent market participation from resources with certain use limitations. Use-limited resources also have access to outage cards that can be used when use limitations are met. Conditionally available resources, which have regulatory or operational limitations that do not qualify as use-limited, will not be exempt from bid insertion. Conditionally available resources are able to use outage cards to manage their conditionally available outages and derates. The CAISO requires that

[113] PDR bidding requirements are specified in CAISO tariff Section 30.6.1 – Bidding and Scheduling of PDRs.
[114] The CAISO is not proposing changes to the must offer obligation for participating load that is pumping load under the existing tariff section 40.6.4.3.

conditionally available resources submit outage cards when unavailable, similar to all other resources on the system.

The CAISO NGR resources currently do not receive bid insertion and do not have default energy bids (DEBs). However, DEBs have been developed within the ESDER 4 initiative and once implemented, will allow energy storage resources to receive bid insertion as part of this proposal.

With the exception of use-limited resources, CARs, and energy storage, the CAISO will continue to exempt resources from bid insertion as defined in tariff section 40.6.8(e). These include Non-Generator Resources without default energy bids, Variable Energy Resources, Hydroelectric Generating Units (including Run-of-River resources), Proxy Demand Resources, Reliability Demand Response Resources, Participating Load, including Pumping Load, Combined Heat and Power Resources, Non-Dispatchable Resources, and resources providing Regulatory Must-Take Generation.

6.2 Local RA

6.2.1 UCAP in Local RA Studies

The CAISO will continue running the local capacity studies exactly as is done today using DQC values and will publish the local capacity requirements in terms of DQC. At the beginning of the CAISO's local capacity study report, the CAISO will include a translation table from DQC to UCAP/NQC 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/NQC requirement will be defined as follows:

$$\boldsymbol{Total\ TAC\ UCAP\ responsibility} =$$

$$\left(\sum \boldsymbol{of\ TAC\ wide\ DQC\ requirements}\right) \times \left[\frac{\sum \boldsymbol{of\ TAC\ wide\ UCAP\ values}}{\sum \boldsymbol{of\ TAC\ wide\ DQC\ values}}\right]$$

The CAISO's local capacity study report is done by May 1 and local requirements are sent out in July before the UCAP/NQC list for the next compliance year is available (September). Therefore, the DQC and UCAP/NQC *values* used in the second term (*i.e.* the conversion factor) are given by all available values in the previous year's UCAP/NQC list for resources already in-service. This is necessary to avoid complications derived from including estimated DQC and estimated UCAP/NQC 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 DQC and UCAP/NQC 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.[115] The annual DQC

[115] 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.

deliverability study is done in June-July timeframe and, per CAISO Tariff and BPM, LCR allocations are released mid-July. The DQC list is currently completed in August (sometimes early September). Therefore, it is not possible to utilize actual DQC and UCAP/NQC 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 DQC. Given the timing of the studies, this is necessary even though those values will not be the actual DQC values used in RA showing made in the subsequent October or later. Similarly, given that DQC 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/NQC, waiting for the new UCAP/NQC is not needed.

The CAISO will calculate LSEs' local load-share ratio responsibility in terms of UCAP/NQC at the TAC level. As is done today, LRAs will be given their share UCAP/NQC 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/NQC[116] (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/NQC is greater than its allocated share. As all RA showings will be made in terms of UCAP/NQC, the CAISO will convert UCAP/NQC values back into DQC values and run its compliance studies of all RA showings with local technical criteria and requirements using DQC 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/NQC 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 DQC to meet the LCR as well as the existing insufficiently effective capacity.

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

[116] This is consistent with existing ISO Tariff sections 43A.8.1 and 43A.8.2.

their CPM cost ratio allocation. The amount of the credit is based on the quantity of UCAP/NQC purchased, not the DQC value.[117]

6.3 Backstop Capacity Procurement Provisions

In this initiative the CAISO is: (1) proposing new authority to make CPM designations, (2) proposing a new RMR performance mechanism when RAAIM is retired, and (3) no longer proposing a new tool to encourage load to procure resources up to full UCAP/NQC requirements and discourage load serving entities from leaning on capacity procured by other entities.

Since the CAISO will be incorporating UCAP into the new NQC value of resources, it will continue to make system deficiency designations in terms of UCAP/NQC as is done today, and will clarify the tariff as needed to align current CPM processes with the new RA requirements and counting rules under this shift to a UCAP/NQC paradigm. As the portfolio analysis policy advances in development, the CAISO will continue to develop the policy around seeking new CPM authority to cure deficiencies identified in that analysis, and those details will be incorporated into those policy discussions (see Section 7 below).

6.3.1 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

[117] 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/NQC value.

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

As described in the draft final proposal above, the CAISO proposes modifying its existing CPM authority to procure additional capacity if we identified need to procure local RA after a local area or sub-area fails to meet the energy sufficiency test.

The CAISO believes that its current CPM authority to procure capacity based on system NQC, can be used to cure system deficiencies even with the redefinition of NQC to include both delivery and availability limitations, and will modify the relevant tariff sections as necessary to provide clarity under this new counting methodology. 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/NQC reflected in RA showings to the total requirements for UCAP/NQC, and may make additional designations based on that difference. CAISO will continue to 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 shortfalls, the CAISO will ensure it receives enough UCAP/NQC 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 had proposed to implement a UCAP incentive mechanism, but stakeholder comments did not support moving forward with this proposal at this time.

Finally, and as described in the draft final proposal, 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/NQC Deficiency

The CAISO provides the following brief example to explain a scenario where it could make a potential CPM designation for deficient UCAP/NQC 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/NQC. 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.

Figure 16: UCAP/NQC Deficiency CPM Backstop

LSE	Req. (MW)	Shown (MW)	Shortage (MW)
1	100	125	
2	100	80	20
3	100	75	25
TOTAL	300	280	45

Cost Allocation
20/45
25/45

↓

BACKSTOP: 20 MW

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/NQC deficiencies, then to local individual deficiencies, then to local collective deficiencies, and finally to portfolio deficiencies. This order is illustrated in Figure 17 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 17: CPM Designation Order

- **System UCAP/NQC deficiencies**
- **Local individual deficiencies**
- **Local collective deficiencies**
- **Portfolio analysis deficiencies**[118]

Stakeholder Comments:

Stakeholders understand the additional need to make CPM designations for a failure of the portfolio assessment, but seek additional clarity on 1) how the CAISO would know if the additional capacity would cure the deficiency since we are not able to re-run the portfolio assessment with this additional capacity; 2) how would the CAISO identify what kind of resource may cure the deficiencies to help guide the backstop procurement. Answers to how the CAISO would CPM based on the portfolio assessment will continue to be worked out in subsequent iterations of the portfolio analysis paper.

6.3.2 Making UCAP/NQC 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 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 changes to RA requirements and counting rules, the CAISO may procure for a specific MW quantity of UCAP/NQC, rather than deliverable capacity as is done today. 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/NQC and DQC 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/NQC and DQC. With this ratio, a specific price can be determined for any quantity of UCAP/NQC designation. This may imply that a designation for UCAP/NQC may be awarded to a resource with a higher bid price, but better conversion factor.

An example of the UCAP/NQC counting is outlined in Table 15. This table shows two hypothetical resources, Resource 1 and Resource 2. In this example Resource 1 has a DQC value of 200 MW with an accompanying UCAP/NQC value of 100 MW, and Resource 2 has a DQC value of 150 MW and a UCAP/NQC 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 a local deficiency it will first select capacity from Resource 1 because the bid price is less expensive than Resource 2. However, if the CAISO is making a designation for system UCAP/NQC designation, capacity from Resource 2 will be selected first, as the effective bid price for Resource 2 is less expensive. In this example, the effective price

[118] While the CAISO is not moving forward with new CPM authority for deficiencies identified in the portfolio analysis in this draft final proposal, it will continue to develop this policy concurrent to the development of the portfolio analysis in subsequent iterations.

for UCAP/NQC capacity for the Resource 1 is $10/MW, while the price is $7.23/MW for Resource 2.

Table 15: UCAP CPM price example

	DQC	UCAP/NQC	UCAP:DQC	Bid ($/MW DQC)	Effective UCAP/NQC Bid ($/MW UCAP/NQC)
Resource 1	200	100	0.50	$5	$10
Resource 2	150	125	0.83	$6	$7.23

6.3.3 UCAP Deficiency Tool

As noted above, the CAISO is no longer moving forward with its proposal for a new tool, called the UCAP deficiency tool, which would have impose deficiency charges on entities with deficient UCAP/NQC showings. Majority of Stakeholders continued to object to the UCAP Deficiency Tool arguing that it would duplicate non-compliance penalties administrated by the CPUC which covers 90% of load. Many also argued that the risk of incurring CPM costs was a sufficient enough deterrent to meet their RA Requirements, and an additional penalty structure wouldn't be needed to prevent leaning. Parties continued to voice concerns that this penalty may further distort the bilateral market. With the modification to planned outage substitutions and the implementation of UCAP which would get rid of forced outage substitutions, there would be less incentive to withhold additional capacity from the bilateral market to provide substitutions for outages, however parties worried that the potential to get an incentive payment from the UCAP Deficiency Tool might lessen the incentive to sell off this excess capacity.

The CAISO has decided not to move forward with this proposal. However, if leaning becomes a significant issue in the future, the CAISO may revisit this proposal in a future initiative.

6.3.4 Availability Penalty Structure for RMR Resources

Today the CAISO uses a combination of must offer obligations and the resource adequacy availability incentive mechanism (RAAIM) to ensure that sufficient capacity is bid and available to reliably operate the grid. RAAIM incentivizes RA resources to bid shown RA capacity during the availability assessment hours. This tool imposes charges those RA resources have availability below a 94.5%, and provides incentive payments for resources with availability above 98.5%.

With the transition from the current counting methodology to UCAP, the CAISO proposes to remove the RAAIM tool from CAISO processes and tariff provisions. However, in a prior initiative[119], the CAISO replaced legacy incentive mechanisms for reliability must run (RMR)

[119] For more information see https://stakeholdercenter.caiso.com/StakeholderInitiatives/Reliability-must-run-and-capacity-procurement-mechanism-enhancements

resources and began applying RAAIM for those purposes. The CAISO believes a penalty structure is necessary to ensure RMR resources are meeting their obligations. The CAISO proposes a simplified availability mechanism for RMR resources that adapts the current RAAIM structure to address some of the unique characteristics of RMR resources and streamlines processes across the CAISO.

CAISO proposes an RMR availability penalty structure (APS) that would access RMR resources on a 24x7 basis. All RMR resources would have an availability target of 94.5% for the month, assessed through bids submitted to the market. At the end of the month, if the resource submitted bids less than 94.5% of the hours, they would be assessed a penalty at the RMR fixed monthly price and this would be credited back to the LSE's responsible for paying for the RMR capacity.

The CAISO recognizes that RMR resources are unique, and while we believe that the basic penalty structure will work for most resources, we are also contemplating modifying existing RMR contract provisions so they can be utilized to cover lost daily fixed cost revenues associated with major maintenance outages that may impact the resource's ability to meet the 94.5% target. Under these circumstances and potentially with certain modifications to the proforma RMR agreement, parties would be able to utilize the RMR Article 7 and Schedule L[120] request and approval process to reimburse the resource for longer-term outages needed to keep the resource operational outside of this availability target, and would allow the resource to true-up costs of not meeting the APS availability target by adjusting the RMR daily fixed costs moving forward, to ensure that the resource is compensated for lost daily fixed cost revenues while the unit was on the maintenance outage.

7. Phase 2B Pending Enhancements

There are elements of the RA Enhancements initiative that the CAISO has not advanced in this paper. The CAISO will advance these items in a revised straw proposal. The first of these elements is the portfolio assessment element of the System RA Showings and Sufficiency Testing, and the associated backstop authority provisions for portfolio deficiencies. The proposed portfolio assessment will ensure the shown RA capacity is collectively adequate to meet the CAISO's operational needs in all hours. This proposed portfolio assessment is a core element of the RA enhancements initiative and will determine if the RA portfolio is adequate to serve load under various load and net load conditions during all hours of the day. This element is critical to the RA program given the growing reliance on use- and availability-limited resources as part of the RA fleet. As the fleet transitions, the RA program must ensure the shown RA fleet satisfies all operational needs in all hours, including both capacity and energy. The CAISO has developed and vetted with stakeholders a stochastic production simulation model that assesses the RA fleet's ability to reliably operate the grid under a variety of conditions. The CAISO will

[120] While the current Schedule L-1 doesn't specifically contemplate outage costs, the CAISO is examining modifications to the contract that could accommodate this.

continue to refine these proposals based on additional production simulation runs and discussion with stakeholders.

The second item, as noted early in this document is the continued development of a planned outage pool. Although the CAISO has proposed a very focused short-term solution for planned outages to improve system reliability, the CAISO believes additional benefits can be achieved by continuing to develop a monthly planned outage resource pool and the development of a calendar that shows in advance and on a daily basis, the potential availability of additional system RA headroom. Resources in this pool will allow planned outages to be taken without providing substitute capacity.

The third pending element is flexible resource adequacy. 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. 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.

These elements are not advanced in this document but will be further refined and published in a future revised straw proposal in the near future.

8. Implementation Plan

Given the comprehensive nature of this initiative, the CAISO is planning a phased implementation. The first phase includes stand-alone elements that can be implemented relatively quickly. The second phase includes full implementation of foundational elements, including system requirements and UCAP counting rules, the portfolio assessment, 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 – phase 1
- Local studies with availability limited resources CPM clarifications
- Operationalizing storage

Phase Two: (2022 for RA year 2023)

- UCAP

- Minimum System RA Requirements
- Portfolio assessment
- Planned outage process enhancements – phase 2
- Must offer obligations and bid insertion rules
- Availability Penalty Structure for RMR
- Flexible resource adequacy

9. EIM Governing Body Role

For this initiative, the CAISO will 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 received comments from CalCCA and the Six Cities in support of this determination.

10. Next Steps

The CAISO will discuss this draft final proposal and sixth revised straw proposal with stakeholders during a stakeholder meeting on January 5-7, 2021. Stakeholders are asked to submit written comments by January 21, 2021 through the commenting tool. A comment template will be posted on the CAISO's initiative webpage here: http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx

11. Appendix

11.1 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

$$\boldsymbol{Forced\ Outage\ Rate} = \frac{\sum_{area} \boldsymbol{Pmax} - \sum_{area} \boldsymbol{Forced\ Avail\ MW}}{\sum_{area} \boldsymbol{Pmax}}$$

$$\boldsymbol{Planned\ Outage\ Rate} = \frac{\sum_{area} \boldsymbol{Pmax} - \sum_{area} \boldsymbol{Planned\ Avail\ MW}}{\sum_{area} \boldsymbol{Pmax}}$$

$$\boldsymbol{Total\ Outage\ Rate} = \frac{\sum_{area} \boldsymbol{Pmax} - \sum_{area} \boldsymbol{Total\ Avail\ MW}}{\sum_{area} \boldsymbol{Pmax}}$$

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

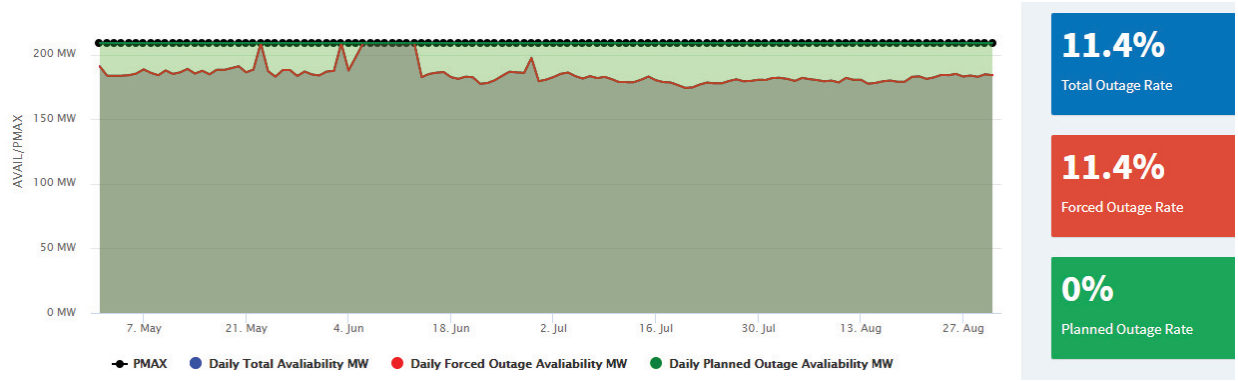


Figure 19: Example Unit #1 – Annual outage rate analysis: 2018

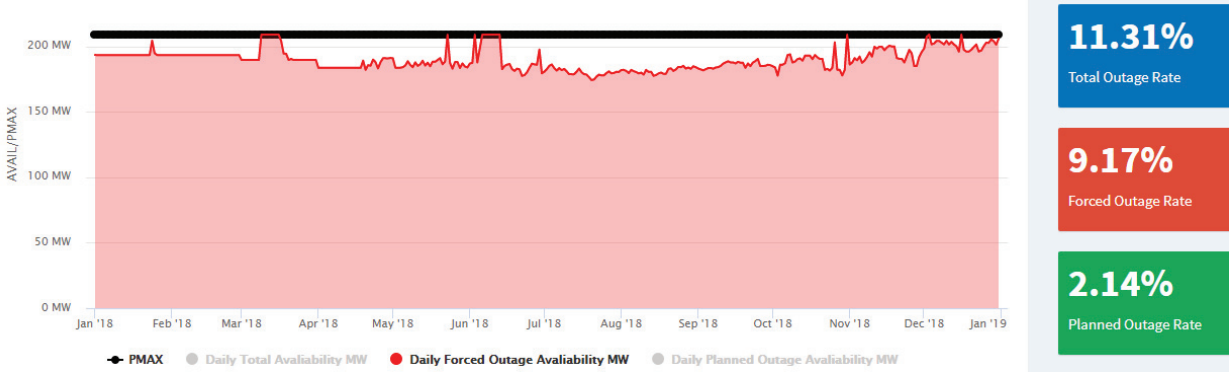


Figure 20: Example Unit #2 – Seasonal outage rate analysis: summer 2018

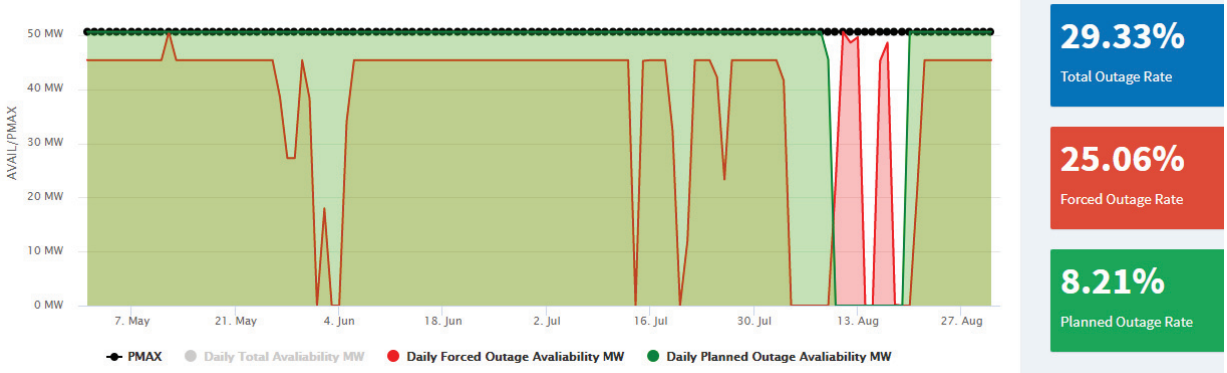
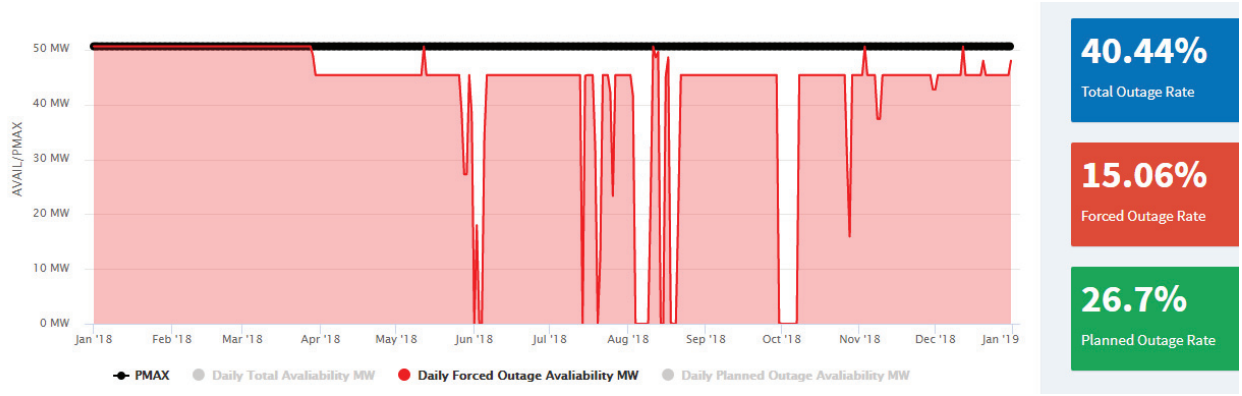


Figure 21: Example Unit #2 – Annual outage rate analysis: 2018



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

11.2 RAAIM and Forced Outage Substitution Analysis

The CAISO's existing RAAIM 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.[121] 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 RAAIM to address these particular instances.

RAAIM was designed to provide an incentive for resources on outage to minimize the duration of the outage or to provide substitute capacity. Additionally, RAAIM provides an additional incentive payment to generation that is available over a predetermined measurement. RAAIM 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 RAAIM 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

[121] 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 RAAIM non-availability charges – without providing any corresponding benefit to the LSE to which that resource is contracted.

The CAISO reviewed the effectiveness of RAAIM 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 RAAIM. At the core, the effectiveness of RAAIM 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 RAAIM exempt, CAISO may be left with insufficient capacity. Figure 22 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 23.

Figure 22: Forced Outages vs Replacement Capacity (All)

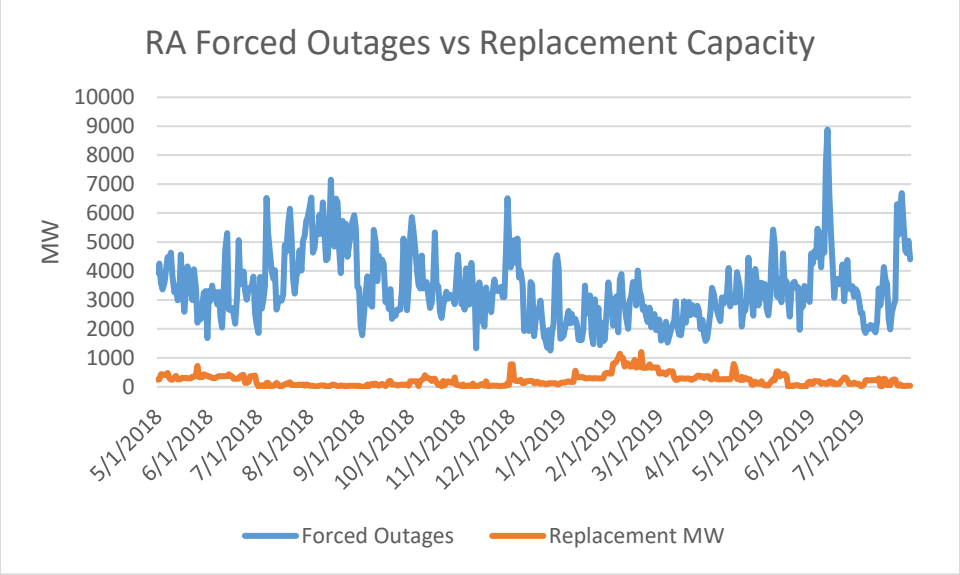
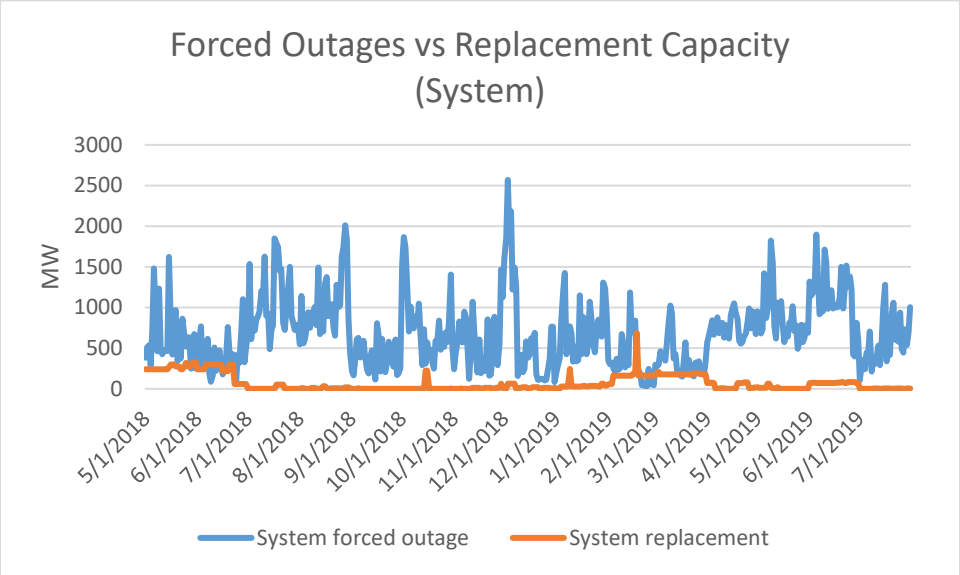


Figure 23: Forced Outage vs Replacement Capacity (System Only)



The CAISO concludes that RAAIM 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 RAAIM charges is already incorporated into capacity pricing, if RAAIM 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 RAAIM charges and incentives, balancing each other out), too many RAAIM exclusions/exemptions, the dead band applying for the first outages, or some other reasons.

California Independent System Operator Corporation

R.19-11-009

Attachment C

Resource Adequacy Enhancements
Draft Final Proposal

California ISO

Resource Adequacy Enhancements:

Supplemental Report – Preliminary Portfolio Assessment

Supplement to the Fifth Revised Straw Proposal

November 6, 2020

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1. Executive Summary

One of the core elements of the CAISO's RA Enhancements stakeholder initiative is the development and use of a production simulation tool that can assess how likely the shown monthly RA fleet supports grid reliability. The CAISO will conduct a monthly portfolio deficiency test of the shown RA fleet to determine if the RA 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 can serve forecasted gross and net-load peaks, and maintain adequate reserves and load following capability in that relevant RA compliance month.

This paper provides the RA portfolio assessment results using July 2020 RA showings. This paper's objective is to provide insight and transparency into the CAISO's assessment model, methods, and initial findings that inform the portfolio assessment. The results presented here are instructive, though not conclusive. The CAISO will conduct further modeling using other months' RA showings to complete the picture about how likely the RA fleet meets grid reliability needs across all months. The CAISO expects that additional monthly assessments will provide more robust results and definitive findings about the level of reliability the existing RA fleet supports. Even though the CAISO is not making a final recommendation for a reliability metric or framework now, the study results and recent reliability events confirm the need to take interim measures that focus on ensuring sufficient RA resources are available during the net-load peak and the hours immediately following, not just during the gross load peak. This could be accomplished by setting an additional planning reserve margin that must be met with RA resources across these critical evening hours. Lastly, the CAISO provides thoughts on an initial framework for determining the desired level of reliability RA procurement will provide. The framework focuses on the questions that must be asked and answered to inform this question, as well as some examples of how these questions could be answered.

For the current study process, the CAISO used the stochastic production simulation tool used for the Summer Loads and Resources Assessment (Summer Assessment) study on the July 2020 RA showings. In addition to testing the July 2020 RA fleet, the CAISO also tested a "Thermal Scenario." The Thermal Scenario was designed to approximate a baseline level of reliability for the original RA design by recreating a fleet similar to a 2005 RA fleet.

A stochastic monthly assessment of the RA fleet poses unique challenges that do not exist under the simple accounting tools currently used to ensure RA compliance. Two core challenges must be addressed:

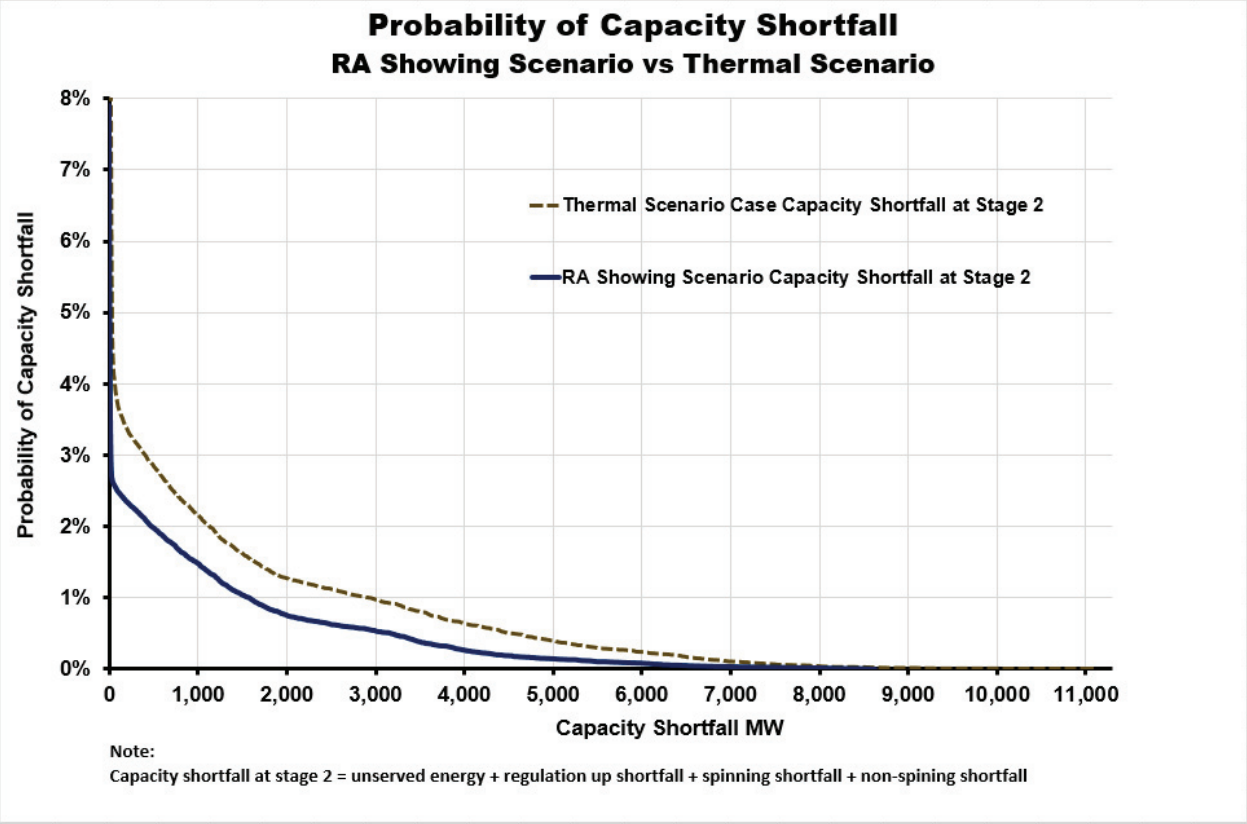
(1) Establishing a defined reliability criteria or loss-of-load expectation that determines procurement targets and backstop procurement triggers; and
(2) Determining the quantity and attributes of capacity needed to address a portfolio deficiency.

At this time, the CAISO does not explicitly answer these two questions. Instead, using actual RA showings from July 2020, the CAISO provides a framework to consider how to derive answers to these questions so that these two issues can be further vetted with stakeholders.

Figure ES 1, below, shows the probability of a daily deficiency of a given size. As noted above, the RA Showing Scenario had lower overall probability of a shortfall than the Thermal Scenario, 7.9 percent compared to 15.5 percent. However, as shown in Figure ES 1, many of these

shortfalls are very small. For example, the probability of shortfall of greater than 50 MW is 2.6 percent and 4.1 percent for the RA Showing and Thermal Scenarios respectively.

Figure ES 1: Probability of capacity deficiency



As a final measure, the CAISO reviewed a collection of frequency distributions with respect to the duration, frequency and timing of deficiencies. Each of these are critical to ensuring the correct capacity is procured to resolve the deficiency. These distributions can be informative when trying to assess potential additional risks that may be present and provide guidance on the type of resource needed to deal with the deficiencies.

To establish resource procurement obligations, it is necessary to determine an acceptable level of service reliability given the probability of a capacity shortfall and potential for involuntary load shedding. In this context, service level reliability refers to the targeted level of reliability to firm load, taking into account some marginal level of accepted probability of interruption due to supply shortage. For example, is a level of service reliability based on a three percent probability of a capacity shortfall acceptable, or should it be higher or lower? The answer is determined at the intersection of service reliability and the cost to protect against a possible capacity shortfall.[1]

Three decisions help inform this issue:

1) <u>The granularity of the RA program: Annual, Seasonal, or Monthly?</u>

[1] The use of three percent in this instance already assumes that it is possible to make up for deficiencies smaller than 50 MW.

Should the existing monthly RA program be maintained or transitioned to an annual or seasonal construct. It must also examine the benefits of multi-year procurement obligations. This will determine, in part, how reliability provided by the RA program is measured because it will determine how an annual reliability metric is allocated over the year.

2) The application of an annualized planning standard
If a monthly RA program is maintained, an annual planning standard must be allocated over twelve individual months. There are at least two ways to apply an annual standard over a full year: Uniformly of shaped.
3) The desired service level reliability target
The desired service level reliability target is defined by determining an acceptable loss of load probability when setting RA procurement targets. That is not to say that the CAISO would shed firm load during each instance of an RA shortage, but it does mean the CAISO would likely lean more heavily on backstop procurement.[2]

2. Background of the CAISO's Proposed Portfolio Assessment

One of the core elements of the CAISO's RA Enhancements stakeholder initiative is the development and use of a production simulation tool that can assess how likely the shown monthly RA fleet supports grid reliability. The CAISO will conduct a monthly portfolio deficiency test of the shown RA fleet to determine if the RA 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 can serve forecasted gross and net-load peaks, and maintain adequate reserves and load following capability in that relevant RA compliance month. This test will be done for system level needs. Local capacity needs will continue to be assessed under the existing methods. The need for this assessment is similar in concept to the collective deficiency test CAISO conducts for local RA. 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 RA compliance month. However, the CAISO must assess how the shown RA fleet works collectively to meet system needs over all hours and under a broad range of load conditions.

This paper provides the RA portfolio assessment results using July 2020 RA showings. This paper's objective is to provide insight and transparency into the CAISO's assessment model, methods, and initial findings that inform the portfolio assessment. The results presented here are instructive, though not conclusive. The CAISO will conduct further modeling using other months' RA showings to complete the picture about how likely the RA fleet meets grid reliability needs across all months. The CAISO expects that additional monthly assessments will provide

[2] The CAISO has various tools to help maintain system reliability. For instance, if non-resource adequacy capacity remained available, the CAISO would exercise its backstop procurement authority before turning to involuntary firm load shedding.

more robust results and definitive findings about the level of reliability the existing RA fleet supports. Even though the CAISO is not making a final recommendation for a reliability metric or framework now, the study results and recent reliability events confirm the need to take interim measures that focus on ensuring sufficient RA resources are available during the net-load peak and the hours immediately following, not just during the gross load peak. This could be accomplished by setting an additional planning reserve margin that must be met with RA resources across these critical evening hours. Lastly, the CAISO provides thoughts on an initial framework for determining the desired level of reliability RA procurement will provide. The framework focuses on the questions that must be asked and answered to inform this question, as well as some examples of how these questions could be answered. The CAISO considered a variety of deterministic, stochastic, and hybrid modelling approaches for this portfolio analysis. Based on stakeholder feedback and additional CAISO assessments, the CAISO determined that a stochastic approach offers the greatest opportunity to assess the widest array of load, wind, and solar profiles as well as historic outage profiles for fully dispatchable resources.

A stochastic monthly assessment of the RA fleet poses unique challenges that do not exist under the simple accounting tools currently used to ensure RA compliance. Two core challenges must be addressed:

(1) Establishing a defined reliability criteria or loss-of-load expectation that determines procurement targets and backstop procurement triggers; and
(2) Determining the quantity and attributes of capacity needed to address a portfolio deficiency.

At this time, the CAISO does not explicitly answer these two questions. Instead, using actual RA showings from July 2020, the CAISO provides a framework to consider how to derive answers to these questions so that these two issues can be further vetted with stakeholders.

In addition to testing the July 2020 RA fleet, the CAISO also tested a “Thermal Scenario.” The Thermal Scenario was designed to approximate a baseline level of reliability for the original RA design by recreating a fleet similar to a 2005 RA fleet. This provides information about the probabilities of shortfalls the RA program generated at the outset. Specifically, the CAISO replaces all wind and solar capacity with thermal resources to reach a 115 percent planning reserve margin. This allows the CAISO to compare the relative needs created by the RA fleet in 2005, when the fleet relied on a significant share of thermal generation, and the resources used for the July 2020 RA month. Specifically, the CAISO can compare probabilities, time of day, duration, and magnitudes of deficiency. It is important to note that the Thermal Scenario in no way represents the actual levels of reliability offered since 2005. The excess levels of capacity in the CAISO and across the west allowed the CAISO to utilize economic energy from non-RA resources and provide a higher level of reliability. However, over the last 15 years this excess capacity has steadily dried up. These tightening supply conditions have lead the CAISO to conduct this assessment to measure the expected level of reliability if that economic energy was not there. In other words, the goal of this assessment is to measure the expected level of reliability if the CAISO was to rely solely on the shown RA fleet to meet gross and net-load peaks, and maintain adequate reserves and load following capability.

The CAISO sought to leverage its existing production simulation expertise and modeling by relying on existing tools and methods. 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. For the current study process, the CAISO used the production simulation tool used for the Summer Loads and Resources Assessment (Summer Assessment) study.[3] The CAISO has used this production simulation tool to conduct this study since 2016, updating the model annually to create a robust tool for CAISO to convey potential risks for the upcoming summer needs. More specifically:

> The 2020 Summer Loads and Resources Assessment ("2020 Assessment") provides an assessment of the upcoming summer supply and demand outlook for the California Independent System Operator (CAISO) balancing authority area. In developing the supply and demand forecasts and identify potential issues concerning upcoming operating conditions for the summer 2020, the CAISO uses internal sources of information, third party modeling tools, and public information from various state agencies, generation and transmission owners, load serving entities, and other balancing authorities (BAs). The 2020 Assessment considers the supply and demand conditions across the entire CAISO balancing authority area, and to a more limited extent, the entire Western Electricity Coordinating Council (WECC).[4]

Although the Summer Assessment was developed for a slightly different purpose, the core modelling functions are identical to what the CAISO needs for an RA portfolio analysis. For example, the model is a detailed representation of load and resource characteristics across the CAISO. It can also model resources across the WECC, allowing for energy imports into the CAISO based on availability. The model commits resources based on load, unit minimum and maximum capacities, start times, ramp rates, minimum down times and unit specific forced outage rates to meet CAISO needs, including operating reserves, regulation, and load following. One exception to this rule is that the model does not currently model use-limitations that extend beyond a single day (i.e. monthly or annual use-limitations). 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 specific sensitivities.

The Summer Assessment assumes that all resources are available to the CAISO to meet peak summer loads. However, the portfolio assessment only models the shown RA resources to assess the probability and magnitude of capacity shortfalls. The only exception to this rule is that the CAISO modeled all wind and solar capacity. Although wind and solar capacity above the RA showing does not have an explicit must offer obligation to the CAISO, known RPS goals provide the CAISO with similar confidence that this capacity will be available comparably to RA capacity. Energy provided in the CAISO's day-ahead or real-time markets from non-RA resources, including non-RA resources internal to the CAISO and non-RA economic energy imports, represents non-firm economic energy substitutes, which will not be considered in the portfolio assessment. These resources can improve the outcome of day-ahead and real-time markets, but they do not have the same availability obligation as the modeled RA resources and

[3] 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

[4] http://www.caiso.com/Documents/2020SummerLoadsandResourcesAssessment.pdf at p. 1.

cannot be relied upon to determine if adequate forward procurement has occurred such that the CAISO is able to reliably operate the grid.

The remainder of this supplement report provides:

1) The CAISO's definition of a deficiency
2) Details regarding:
    a. Model outputs
    b. Modelling iterations
    c. Inputs and assumptions, including System configurations, loads, and resources
3) The results of this model for both the RA and Thermal Scenarios
4) Framework for determining capacity needs

3. Stakeholder Engagement Plan

Date	Milestone
November 6	**Supplement to the Fifth revised straw proposal**
November 12	Stakeholder working group meeting on supplement to the fifth revised straw proposal and other RA Enhancements elements
November 13	Market Surveillance Committee meeting
November 25	Stakeholder comments on supplement to the fifth revised straw proposal and working group meetings due
December 14	**Draft final proposal**
January 5-7	Stakeholder meeting on draft final proposal
January 21	Stakeholder comments on draft final proposal
August – Q1 2021	Draft BRS and Tariff
Q1 2021	**Final proposal**
Q1 2021	**Present proposal to CAISO Board**

4. Overview of the CAISO's Production Simulation Model

As noted in 2, to conduct the portfolio assessment, the CAISO will use the same base model used in its Summer Assessment, but modified to account for only RA resources. This section provides details regarding all of the relevant inputs into the CAISO's model.

4.1. Defining "deficiency"

For the portfolio assessment, the CAISO believes that maintaining operational reserve requirements should be used to set the reliability standard. Currently, the CPUC and LRAs are responsible for defining service level reliability by establishing the RA requirements the LSEs

under their jurisdiction must meet. Based on these requirements and subsequent RA showings, the CAISO must determine if the portfolio of resources it is provided under the RA program are sufficient to meet its real time operational requirements, including NERC and WECC reliability standards. At a Stage Two Emergency the CAISO begins using spinning reserves to serve load and sets up firm load to be shed as contingency reserve in its place. This process complies with NERC and WECC operating standards. Therefore, the CAISO defines a deficiency as follows:

> Any hour in which the production simulation shows the CAISO would have to call a Stage Two Emergency. This means the model shows the CAISO would have inadequate capacity to meet the aggregate of non-spin, spin, regulation, and load.[5]

4.2. Iterations and output

The CAISO's model is run using 2,000 month-long iterations. Each iteration pulls from data sets containing various load, wind, solar, and resource outage profiles. Once all iterations are complete, the CAISO can compute the probability of a portfolio deficiency. The model output can be expressed in terms of the probabilities of occurrence for the range of deficiency magnitudes observed. The CAISO expresses the results in different levels of granularity, including hourly, daily, and monthly. Hourly level data is primarily used to assess the hours during which the CAISO is most likely in need of additional capacity and the duration of deficiencies. The daily level results reflect the probability that any day within the production simulation is deficient. The magnitude of the deficiency for that day is the largest observed deficiency for the day. There are 62,000 daily observations in a 31 day study month. Similarly, the CAISO provides data on an iteration level. This data shows the instances where the RA fleet provided was not able to achieve a reliable outcome for a given iteration based on the defined parameters for reliable grid operation for the month.

4.3. Model details

This section provides the specific details of the model structure,[6] load, and resource inputs into the portfolio assessment.

4.3.1. CAISO system

The model simulates 35 WECC zones and 91 WECC interchange paths between zones, with the CAISO represented by three of those zones. The zonal interchange path limits were set based on the WECC Path Rating Catalog and net imports into the CAISO are limited to the amount of RA imports shown each month during on peak periods (hour-ending 16-21). Net imports during off peak hours (hour-ending 1-15, 22-24) are allowed to historical off peak levels, currently 11,666 MW. Transmission limits within the zones were not modeled and the model cannot provide results related to local capacity requirements.

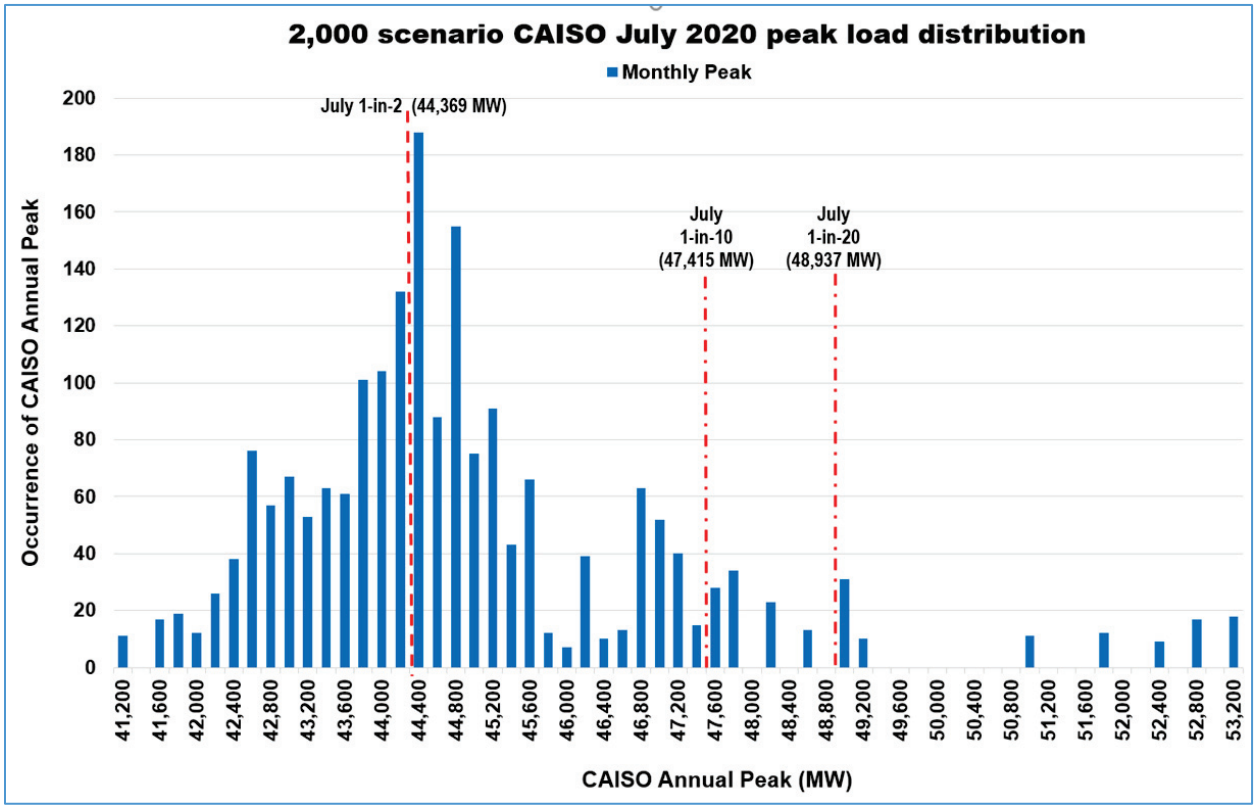
4.3.2. Load inputs

The CAISO used the exact same load inputs in both the RA Showing and Thermal Scenarios. The CAISO load inputs into the model are based on the CAISO's load forecast process used for

[5] Though included in the model, shortfalls in load following alone are not flagged as deficiencies.
[6] Additional details regarding the model are available in the CAISO's Loads and Resources Study, at http://www.caiso.com/Documents/2020SummerLoadsandResourcesAssessment.pdf

the CAISO summer assessment.[7] For comparison, the CAISO's 1-in-2 peak load forecast for July 2020 is 44,369 MW compared to the CEC IEPR forecast of 44,217 MW for July. The CAISO uses 25 years of historical weather data from 1995 through 2019 and produces seven different weather scenarios for each historical year to simulate calendar effects across the weekdays. This process generates 175 weather scenarios used as inputs to the forecast model to produce 175 hourly load profiles. The process produces a distribution of load profiles that include monthly peaks ranging from the mildest to the most extreme weather events as represented in each month's historical weather data. Forecasts for specific load events such as 1-in-2, 1-in-5, 1-in-10 and 1-in-20 can be determined from the range of forecasts produced[8]. In the CAISO's assessment of the probability of entering into problematic operating conditions, overall, the probability these events follows the declining probability of the weather event as the event becomes more extreme. As an example, Figure 1 shows the distribution of the daily peak loads used in all 2,000 iterations for the month of July.

***Figure 1**: Distribution of peak loads used for July production simulation*



4.3.3. Resource Inputs

In running the two scenarios, the CAISO tried to maintain consistent resource inputs to the greatest extent possible. The resource mix used by the CAISO in the RA showing scenario

[7] In future studies, 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. Pending the completion of the CEC hourly load set, the CAISO will utilize its own load forecast set.

[8] As the load level increases from 1-in-2 to 1-in-20 and higher, the probability of the load occurring continually decreases.

includes all generating resources provided on LSE RA showings. A side-by-side comparison of the resource inputs is provided in Table 1. The remainder of this section provides details about how resources have been modeled in the production simulation.

***Table 1**: Aggregate NQC values of resources used in the RA Showing and Thermal Scenarios*

Fuel Type	RA Showing Scenario	Thermal Scenario
Battery	106	106
Biomass	535	535
Coal	11	11
Demand Response*	1289	1289
Distribution	165	165
Gas*	27,512	27,512
Geothermal	994	994
Hydro	4,316	4,316
Nuclear	2150	2150
Pump Hydro	1391	1391
Interchange*	6335	6335
Solar (RA)	4,233	--
Wind (RA)	1,222	--
HRCV	29	29
Other	45	45
Pumping Load	131	131
Generic CCGT	--	3932
Generic SCGT	--	2621
Total RA	50,466	50,466
Solar (non-RA)	333	--
Wind (RA)	0	--
Total	50,799	51,593
*** Includes both RA showings and credits**		

For wind and solar resources, the CAISO relies on the same wind and solar profiles generated for its Summer Assessment, which includes the actual generation profiles from all participating wind and solar resources. This is a more reasonable approach to modeling wind and solar resources than trying to model simply the shown NQC capacity. The NQC somewhat accounts for these types of production profiles when calculating the resources' ELCC used in the NQC calculation. This makes modeling wind and solar based on actual historical operating profiles fairly consistent with wind and solar resources' RA capacity values. Furthermore, non-RA wind and solar resources have RPS production obligations and will have availability similar to their RA counterparts. The CAISO assessed the average of the coincident peak output of all solar resource profiles to be 11,708 MW. Applying the CPUC's July ELCC adjustment of 0.39 to this peak output results in approximately 4566 MW of solar capacity. Averaging the maximum solar output across all profiles results in the equivalent 333 MW of additional capacity above the RA showings.

The CAISO has also reviewed all RA "credits" allowed by LRAs to ensure all capacity used to meet RA obligations are reflected. These credits are discussed in greater detail below. CPM/RMR resources are not specifically included in an RA showing, but are included in the

model. Finally, the CAISO includes all capacity used for RA obligations, with the production simulation using CAISO confidential Masterfile parameters for each resource. As a result, the production simulation honors individual resource constraints such as minimum run time, minimum down and ramp rates, but is currently not configured to model individual resource use-limitations such as maximum starts or run hours per month. The CAISO recognizes that this will result in a more optimistic result than if all use-limitations were modelled.

For the Thermal Scenario, the CAISO used all of the same resources as were included in the RA Showing scenario except for the wind and solar resources. In this scenario, the CAISO removed all of the wind and solar resources, replacing them with sufficient generic thermal resources to meet a 115 percent planning reserve margin. To reach this threshold, the CAISO added 6,553 MW of capacity using a 60-40 split of combined cycle and simple cycle gas turbine resources.

To determine the resource availability in both scenarios, the simulation model generates a unique forced outage profile for each of the 2,000 simulation scenarios based on historical forced outage rates for each dispatchable resource from the CAISO's Outage Management System (OMS). The generic resources used in the Thermal Scenario use the average forced outage rate for their respective technology type. Outage profiles for non-dispatchable resources[9] are modeled using fixed hourly generation profiles based on aggregated historical hourly generation profiles, which has forced outage rates embedded within these profiles. These outage rates and profiles serve as the basis for resource availability in the production simulation monthly runs. The model respects Masterfile limitations regarding minimum run and down times.

Hydro resources are modelled using actual hydro MWh generation from similar hydro years based on comparison of the current year's and historical snow water content and other water year conditions. Maximum production levels for dispatchable hydro units are capped at the shown NQC. While the resource may be capable of producing more than NQC, the CAISO's objective was to test the shown RA values. Additionally, based on the CAISO's preliminary review of hydro resource availability, NQC seems to provide a reasonable cap on its overall maximum availability.

Imports are modelled up to the shown RA value. The production simulation respects all specific intertie line limits, but will not limit imports to MIC designated ties. For example, if an intertie has a 1,000 MW capacity and sum total of used MIC on the line equal to 500 MW, then the production simulation would allow for that line to flow 1,000 MW. Imports are based on the intertie limits and the model's least cost dispatch using the cost of surplus resources in other BAAs, capped at the level of imports shown for the month.

Shown demand response resources are modelled as supply side resources that have triggering conditions in the simulation model. Whenever the model depletes all available resources before meeting the load and ancillary service requirements the model will utilize demand response programs. It is important to note that the model assumes these demand response resources

[9] Non-dispatchable resources are technologies that are dependent on a variable fuel source and are modeled as energy production profiles based on historical generation patterns. Non-dispatchable technologies include biofuels, geothermal, wind, solar, run-of-river hydro, and non-dispatchable natural gas.

are available regardless of time or day of the week. Although not explicitly considered in this study, additional research may be needed to assesses the frequency with which DR is used and during which hours.[10] This will provide important insight regarding how useful existing DR resources are at mitigating the probability of deficiencies or how future DR programs should be designed.

The CAISO receives RA "credits" from various LSEs. These credits refer to capacity that an LSE uses to meet its RA obligation, but may not represent as specific capacity resource (i.e. a generating resource with a specific resource ID shown on an RA showing) for the LSE. These credits include Cost Allocation Mechanism (CAM), Demand Response, Liquidated Damage (LD) Contracts, and CPM/RMR. The CAISO has reviewed all of these credits to ensure there is no exclusions or double counting. Based on the CAISO's review, CAM credits have been removed since that resource backing those credits must appear on another LSE's RA showing. Demand response credits have been included in the model and adjusted their available capacity based on CAISO operational experience, currently 75%. LD contract credits are included and modeled by adding to the shown import resources, increasing the import limit. CPM/RMR credits are excluded to avoid double counting because all CPM/RMR resources are already modelled as specific resources. Included in the capacity shown in Table 2, above, are the following "credited" capacity:

- RMR: 289 MW,
- DR: 1,025 MW, and
- LD: 471 MW
- Total: 1,785 MW

5. Results

Stochastic monthly assessments pose unique challenges that do not exist under the simple accounting tools currently used for RA showings or even a simple deterministic production simulation. In those two approaches, there are clear yes-no answers regarding the adequacy of the portfolio of resources. However, a stochastic production simulation provides a distribution of potential outcomes. The results are expressed in terms of probabilities, not yes-no. In this results section, the CAISO attempts to provide a clear, transparent overview of the results both for the Thermal and RA Showing scenarios. At this time, the goal of this results section is not to derive a specific solution regarding the adequacy of the portfolios modeled. Instead, the goal is to establish the data needed to build the framework to determine (1) the adequacy of a given portfolio and (b) how much additional capacity may be needed if the fleet is determined to be inadequate.

Both scenarios result in observations with inadequate capacity. This result is typical for stochastic production simulations. These deficiencies provide the CAISO with a robust data set to determine when the portfolios are unable to provide the necessary level of reliability. Perhaps the most surprising result of the assessment is that, in many instances, the RA Showing Scenario performed slightly better than the Thermal Scenario. The CAISO attributes this to two factors. First, as noted above, the CAISO included, on average, 333 MW of

[10] This is particularly important since most DR programs have monthly or annual limitations, which are also not modeled

additional solar capacity in the RA Showing Scenario. Although this will not impact deficiencies that occur in the non-solar production hours, it can resolve some deficiencies during solar production hours. Overall, this will lower the probability of shortfall in some hours. Additionally, as discussed in greater detail below, the window over which deficiencies are observed are more compact for the RA Showings Scenario than it is for the Thermal Scenario. Specifically, the Thermal Scenario showed shortfalls over a much wider range of hours than the RA Showing Scenario. This is consistent with a flat gross load curve and a more "peaky" net-load curve. Finally, the relative quantity of load at the time of deficiency is lower in the RA Showing Scenario than in the Thermal Scenario, occurring after the net-load peak as compared to overall peak. The availability of DR resources hours 19-21 in the model may also result in under-estimating the probability of shortfalls in the RA Showing Scenario. It is reasonable to assume that DR is available in the middle of the day for the Thermal Scenario, however, it likely a generous estimate is DR's incremental load drop capabilities in the mid- to late-evening hours.

While the model assesses all hours of each month, the CAISO primarily focuses on the probability of a deficiency at a daily granularity. This means that the CAISO calculates the probability of a deficiency looking at the whole day. The CAISO also considered using both iteration (monthly) and hourly level granularity. However, the CAISO selected daily granularity for several reasons. First and foremost, solving for the maximum shortfall in a given day will typically also solve any smaller deficiencies on that same day. The CAISO applied this same logic to using a full monthly iteration as the reporting metric. However, there is sufficient variability over any given monthly profile to make the connection more difficult. Additionally, by using monthly granularity, the CAISO would be sacrificing the robust data created by looking at 62,000 different days as opposed 2,000 months. As an extreme case, if the CAISO used monthly granularity, it would treat an iteration with one hour of shortfall the same as it would an iteration that was short for all hours or all days of the month. Finally, using daily granularity is consistent with the unit of measure applied to the CPUC's Integrated Resource Planning Process.

A single daily observation will yield a 0.0016 percent increase in the loss of load expectation (LOLE). A single 31 day iteration can have no more than a 0.05 percent cumulative increase on the loss of load expectation. In other words, if all 31 days of a given iteration are deficient, the daily LOLE would increase by 0.05 percent. As discussed in greater detail below, most iterations are deficient less than five days.

Figure 2, below, shows the probability of a daily deficiency of a given size. As noted above, the RA Showing Scenario had lower overall probability of a shortfall than the Thermal Scenario, 7.9 percent compared to 15.5 percent. However, as shown in Figure 2, many of these shortfalls are very small. For example, the probability of shortfall of greater than 50 MW is 2.6 percent and 4.1 percent for the RA Showing and Thermal Scenarios respectively. Table 2, below provides a break out of the probabilities and MW deficiencies.

***Figure 2**: Probability of capacity deficiency*

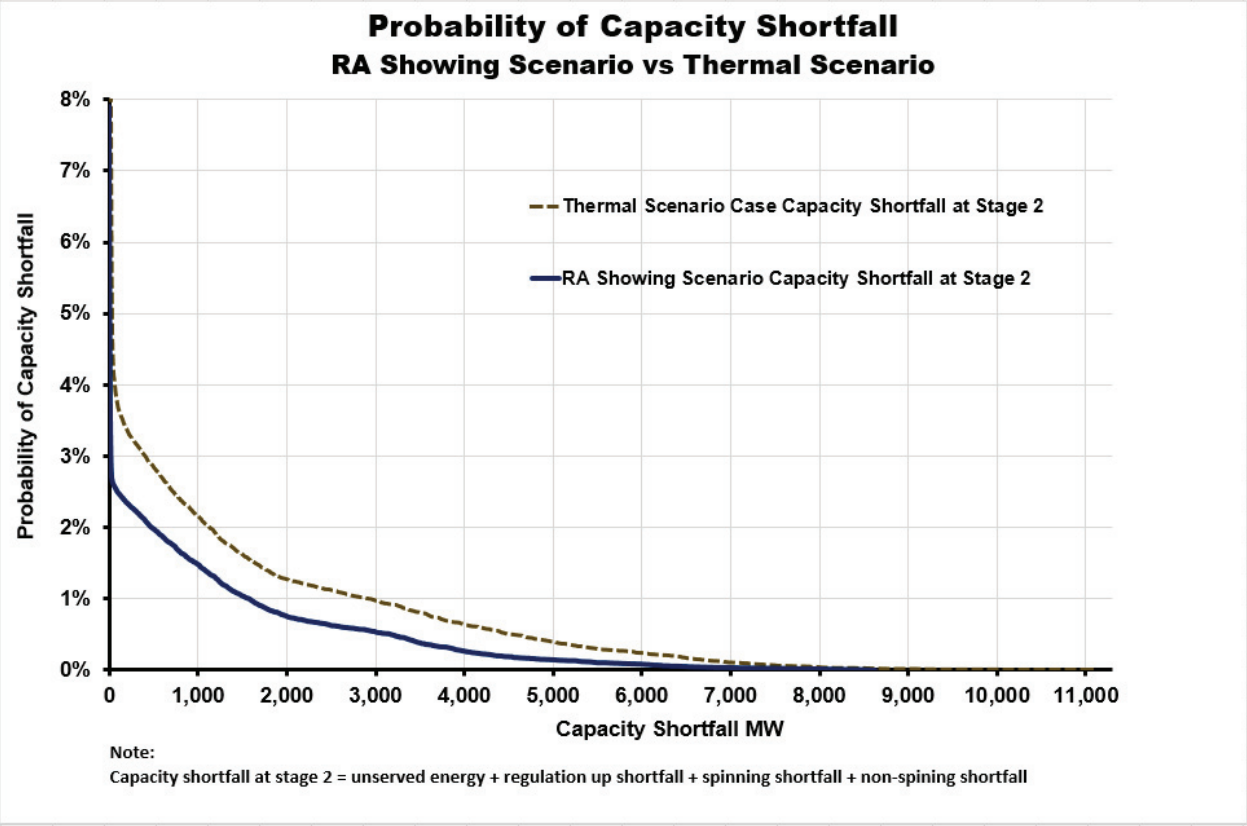


Table 2: Break out of probabilities of MW shortfalls and shortfalls at various probabilities

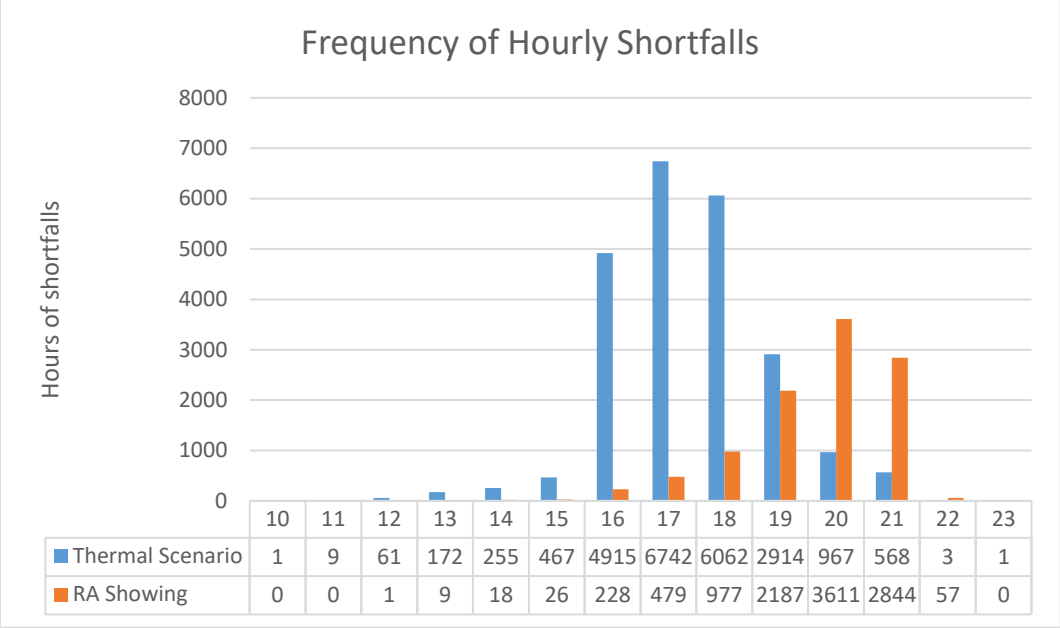
Probability of a shortfall greater than X MW			MW shortfall at X probability		
MW shortfall	RA Showing	Thermal	Probability	RA Showing	Thermal
500	1.98	2.82	4	12	56
1000	1.49	2.14	3.5	15	147
2000	0.75	1.27	3	21	397
3000	0.54	0.97	2.5	94	709
4000	0.26	0.63	2	483	1124
5000	0.15	0.39	1.5	983	1636
6000	0.09	0.23	1	1585	2905
7000	0.04	0.1	0.5	3183	4487
8000	0.02	0.03	0.01	5706	7035

As a final measure, the CAISO reviewed a collection of frequency distributions. These distributions can be informative when trying to assess potential additional risks that may be present and provide guidance on the type of resource needed to deal with the deficiencies.

The CAISO assessed the frequency distribution for when shortfalls occurred in each scenario. As expected, the results show the hours in which a deficiency was most likely to occur shifted

from the mid-day gross-peak hours in the Thermal Scenario to the evening net-load peak hours in the RA Showing Scenario. Figure 3 shows the distribution of all observed deficiencies by hour.

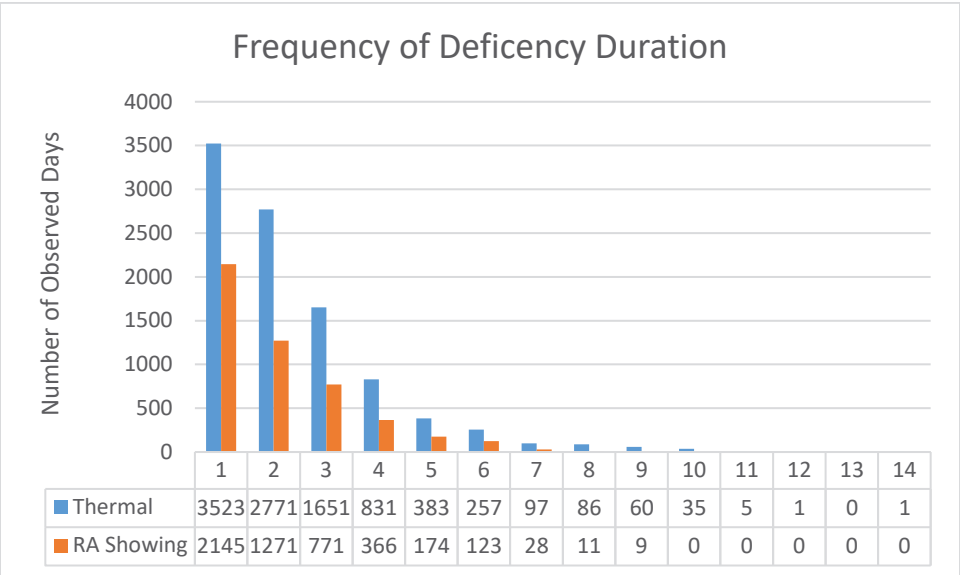
***Figure 3**: Frequency of observed deficiencies by hour*



	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Thermal Scenario	1	9	61	172	255	467	4915	6742	6062	2914	967	568	3	1
RA Showing	0	0	1	9	18	26	228	479	977	2187	3611	2844	57	0

In addition to assessing the timing of the deficiencies, the duration of the deficiencies is important to determining the both nature of the deficiency and potential solutions. For example, if the expected duration of the deficiencies exceeds four hours, then procuring additional four-hour battery storage may not resolve the deficiency. As shown in Figure 4, in both scenarios over 90 percent of the days with deficiencies had deficiencies of less than four hours in duration.

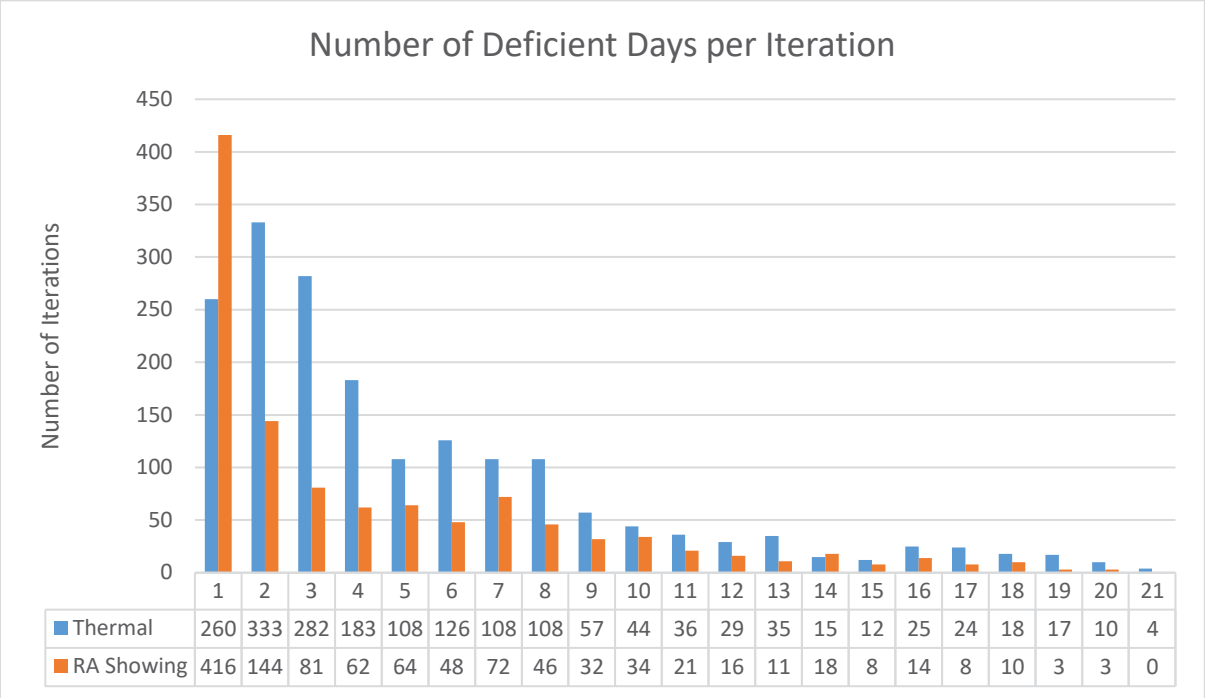
***Figure 4**: Frequency of Deficiency Duration*



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Thermal	3523	2771	1651	831	383	257	97	86	60	35	5	1	0	1
RA Showing	2145	1271	771	366	174	123	28	11	9	0	0	0	0	0

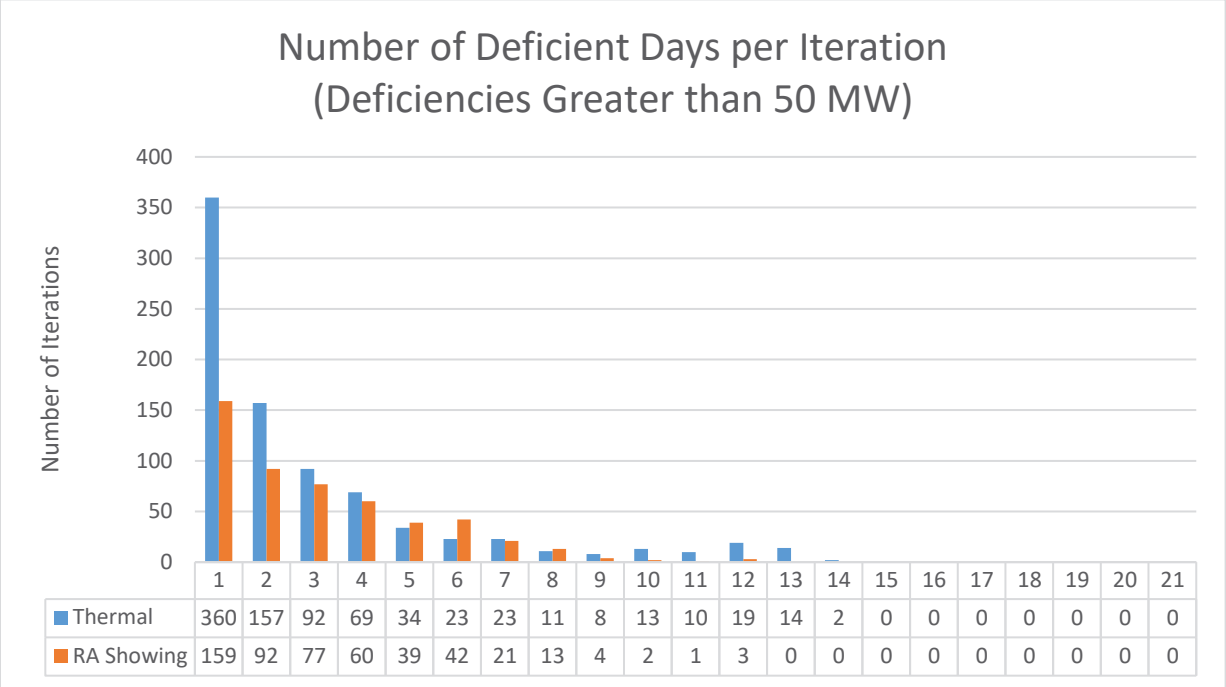
Finally, with respect to frequency, it is also important to assess the distribution of the number of days within an iteration that have a deficiency. As noted above, and shown in Figure 5, most iterations have 5 or fewer deficient days. There was a 17 percent probability and 33 percent probability that an iteration had more than 5 days deficient in the RA Showing and Thermal Scenarios, respectively. These drop to 4 and 11 percent probabilities that an iteration had more than 10 days. These probabilities do not consider the magnitude of any of the deficiencies. This becomes more pronounced when looking only at deficiencies greater than 50 MW, as shown in Figure 6. This data is useful to determine how use-limitations should be considered when resolving deficiencies.

***Figure 5**: Number of deficient Days per Iteration - All*



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Thermal	260	333	282	183	108	126	108	108	57	44	36	29	35	15	12	25	24	18	17	10	4
RA Showing	416	144	81	62	64	48	72	46	32	34	21	16	11	18	8	14	8	10	3	3	0

***Figure 6**: Number of deficient Days per Iteration – Deficiencies greater the 50 MW*



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Thermal	360	157	92	69	34	23	23	11	8	13	10	19	14	2	0	0	0	0	0	0	0
RA Showing	159	92	77	60	39	42	21	13	4	2	1	3	0	0	0	0	0	0	0	0	0

6. Interim Needs

The results of this study further emphasize that a sole resource adequacy procurement target focused on the gross peak load misses the growing and more urgent reliability needs that occur during the net-load peak and the hours immediately following. Therefore, the CAISO believes that in addition to the current gross peak requirements, a secondary resource adequacy reliability requirement must be promptly instituted to ensure sufficient RA capacity is available across the net-load peak hours. In the CPUC's RA proceeding, SCE has proposed to transition to only a net-load peak requirement. The CAISO agrees that a net-load peak RA requirement is essential, but believes it is premature to remove the gross load peak requirement. For this interim period, these additional net load RA requirements could be set on deterministic modeling with a planning reserve margin. Therefore, the CAISO will work LRAs and market participants to develop a net-load RA procurement requirement for the 2022 RA year. The two requirements would stay in place until there is additional information and vetting of these portfolio assessment results to inform and develop a more comprehensive measure for resource adequacy. The data produced in these CAISO studies should provide more and better insight into the specifics for setting that reliability metric.

7. Framework

As the grid operator, the CAISO carries the ultimate obligation for maintaining the reliability of the bulk power system. The RA program is the first line of defense in this effort. The last line of defense is controlled involuntary firm load shedding. Therefore, RA procurement is really a means to provide for a certain probability of service level reliability with a chance that some amount of load shed of different quantities might occur. In this context, service level reliability refers to the targeted level of reliability to firm load, taking into account some marginal level of accepted probability of interruption due to supply shortage. Service level reliability differs from

system level or grid reliability in that it is possible to maintain system level reliability (i.e. avoid uncontrolled load shed across the BAA) by using controlled load shedding, which reduces service level reliability but maintain system or grid reliability. As shown in Figure 2, above, the RA program has provided enough capacity in July 2020 to ensure service level reliability at approximately a 96-97 percent probability. If the RA program was to guarantee a service level reliability level of near 100 percent, based on modeling results, it would need an additional 8,637 MW of capacity.[11]

To establish procurement obligations it is necessary determine if some level of load shedding is acceptable. For example, is the three percent shown above, or some other probability, acceptable? As an alternative, procurement requirements could be set at a level to procure sufficient capacity ensure a near zero probability of load shedding. A key consideration for determining the desired service level reliability is willingness to incur the costs needed to insure a given probability.[12]

The CAISO has provided data to establish a foundational framework to answer the primary questions provided above in Section 2. The two core challenges that must be addressed are:

(1) Establishing a defined reliability criteria or loss-of-load expectation that determines procurement targets and backstop procurement trigger,
(2) Determining the quantity and attributes of capacity needed to address a portfolio deficiency.

To answer the first question, three decisions must be made:

1) The correct granularity of the RA program: Annual, Seasonal, or Monthly?
2) The application of an annualized planning standard
3) The desired service level reliability target

Regardless of the desired level of reliability ultimately selected, the standards must be made uniformly across all entities within the CAISO footprint. It is neither possible nor desirable for different LRA's to plan to different standards. When the CAISO system is stressed and load shed is imminent, grid operators are attempting to use all means to maintain system reliability. They rely on the entire pool of resources within its footprint and across the WECC for help. LRAs planning to lower standards means they are leaning on other LRAs and members of the pool since the CAISO manages the reliability of the grid uniformly.

Granularity of RA Program

Currently, the CPUC employs a monthly RA program. The structure must be reevaluated to determine the efficiency and efficacy in meeting the desired reliability standard. Alternatives to the monthly program transitioning to an annual or seasonal construct. This will determine, in part, how reliability provided by the RA program is measured because it will determine how an annual reliability metric is allocated over the year. It must also examine the benefits of multi-

[11] Though it does not technically ensure a zero percent probability of a shortfall, 8,637 MW was the largest observed deficiency in the RA Showing Scenario.
[12] The use of three percent in this instance already assumes that it is possible to make up for deficiencies smaller than 50 MW.

year procurement obligations.[13] Historically, planning standards have been done on a yearly basis with the goal of a one day in ten years (1-in-10) loss of load expectation.[14] This standard, ensures that there is enough capacity available to serve firm load except during extremely rare events. California is unique in the sense that the RA program is administered monthly. All other organized markets with RA programs are run annually. This means that applying an annual standard is measured over all twelve months at the same time. However, because the CPUC – which has jurisdiction over LSEs serving just over 90 percent of the CAISO's load – runs a monthly program, it is not possible to apply the same test. Instead, it must predetermine twelve monthly probabilities. However, the application of annual standard is necessary to ensure that all 12 months are bound together by a single guiding reliability standard. Maintaining a monthly standard adds complexity to setting procurement targets to meet an annual reliability goal.

Application of a planning standard

If a monthly RA program is maintained, then an annual planning standard must be allocated over twelve individual months. There are at least two different ways it could apply an annual standard over a full year: Uniformly of shaped. For example, an annual standard could be applied uniformly over all twelve months. If applying a 1-in-10 LOLE standard, or a 0.1 day over the year, then each month could have 0.008 days in any given month. Alternatively, the standard could be shaped over the year to balance procurement costs and reliability. This approach would allow for higher probabilities of loss of load in the peak months by setting procurement targets closer to forecasted peak because capacity is scarce and more costly to procure. This, in turn, requires lower probabilities of loss-of-load in the off-peak months and higher levels of procurement relative to the forecasted monthly peak. A similar approach could be applied in a seasonal construct. For example, if all of the LOLE was focused on the summer months, then procurement in the non-summer months should be set to achieve a zero probability LOLE. Although this seems like an extreme example when applied to a monthly program, the results of this example would largely mirror those of an annual assessment.

Desired service level reliability standard

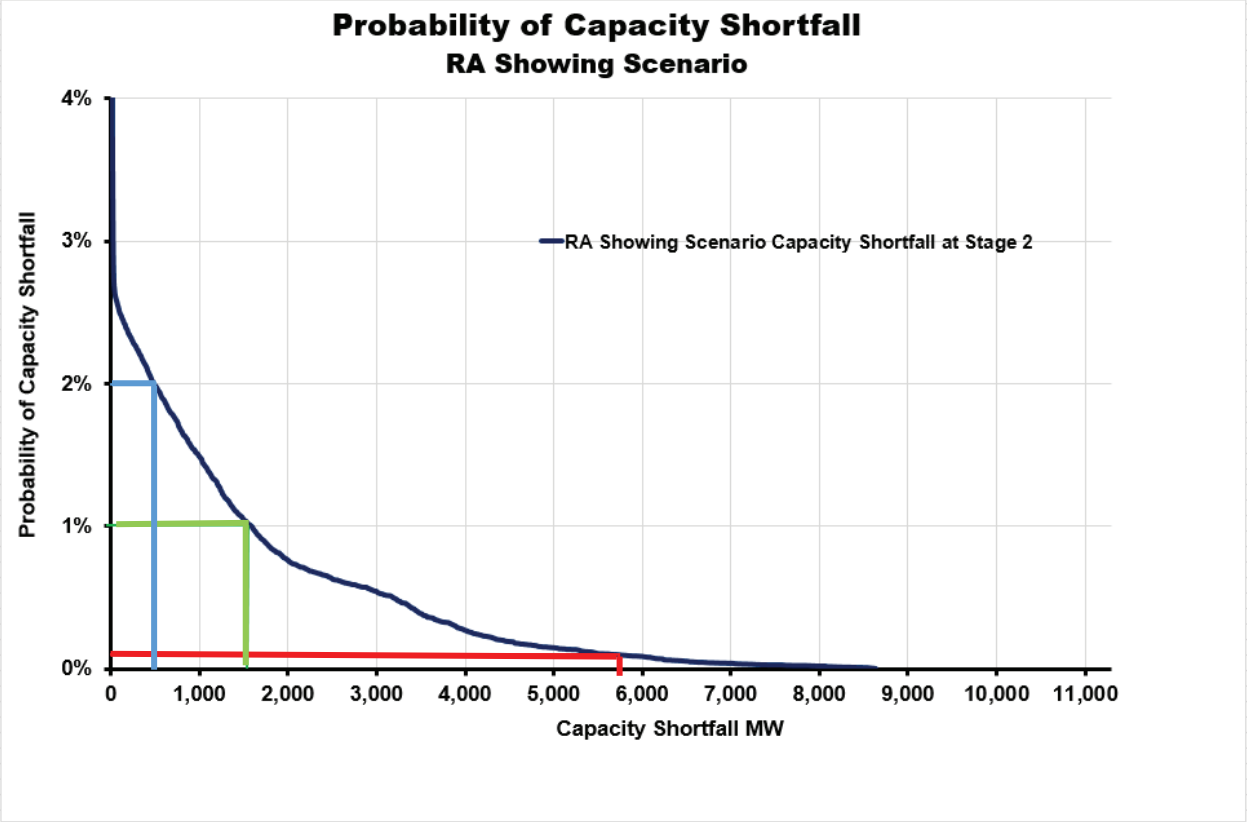
The desired service level reliability standard is defined by determining an acceptable loss of load probability when setting its RA procurement targets. As noted above the CAISO's Thermal Scenario was designed to provide a baseline for the level of reliability the RA program offered at its onset. Figure 7 provides a closer view of the probabilities of a deficiency in the RA Showing Scenario. Where that probability intersects the curve will define the amount of capacity needed to achieve the desired service level reliability through forward procurement. In this instance, the standard is applied monthly, but could be established seasonally or annually. The CAISO reiterates, that any monthly standard must be connected to an over-arching annual standard. However, based on the results from the CAISO's study, the July 2020 RA showing would provide for approximately a three percent LOLE. This probability translates to a 0.93 days expected loss of load in July. If July is representative of all 12 months, then there would be a three percent LOLE for RA showings for all twelve months. This would result in an equivalent 10.95 days LOLE for the year. That is not to say that the CAISO would shed firm load during each instance when it is short of RA, but it does mean the CAISO would lean more heavily on

[13] Currently, the CPUC only requires multi-year procurement for local RA obligations.
[14] The use of 1-in-10 LOLE should not be confused with 1-in-10 load levels.

backstop procurement.[15] For example, the CAISO is unlikely to shed load in March, but it may issue CPM designations to non-RA resources.

Figure 7, shows one estimation of how much additional capacity would be needed to meet a higher service level reliability. For example, approximately 500 MW and 1,500 MW of additional capacity are needed to go from a three percent to a two percent and one percent, loss-of-load expectation respectively. Finally, to reach a 0.008 days per month (i.e., the monthly equivalent of an annual 0.1 loss-of-load expectation) monthly equivalent,[16] approximately 5,800 MW of capacity would be needed.

***Figure 7**: Estimating capacity needs to achieve service level reliability standards*



Once the appropriate framework is vetted and set, the second primary question must be answered – what actions are necessary in the event that the amount of capacity shown is insufficient to achieve the desired service level reliability. Specifically, the CAISO must determine which resources can cure the deficiency given the desired reliability standard, how much capacity to backstop to meet that standard and the time of day and duration of the capacity shortfall.

As noted above with Figure 7, the quantity of capacity needed to cure the deficiency can be estimated by assessing how much capacity is needed to have the curve of the probability of a deficiency intersect the horizontal axis at the desired level of expected loss-of-load. However,

[15] The CAISO has many tools for maintaining system reliability. The CAISO will use backstop procurement is before it turns to firm load shed.
[16] This monthly equivalent was find using a uniform distribution across all months.

this is only an estimate. The CAISO's ability to take adequate supplemental action will be directly impacted by the choice regarding the granularity of the RA program. For example, if a monthly RA program is maintained, then study and notification timelines will be very condensed. The CAISO will have limited opportunity to notify LSE of deficiencies and allow LSE to cure deficiencies. It will also not have an opportunity to rerun the study process. Alternatively, an annual or seasonal process with enough lead time could allow for a more robust assessment of the study results and supplemental procurement by LSEs.

As shown in Figure 3 through Figure 5, the duration, frequency and timing of the need are critical to ensuring the capacity will resolve the deficiency. For example, a four-hour DR resource that can drop 100 MW through the midday for 6 days a month may not provide the capacity needed to resolve an identified deficiency. The CAISO will provide these details from the study process to LSEs to facilitate any supplemental procurement. However, the CAISO will need sufficient discretion in its backstop procurement authority to ensure it can address these factors.

8. Next Steps

The CAISO will discuss this report with stakeholders during a stakeholder meeting on November 12. Stakeholders are asked to submit written comments by November 25, 2020 through the CAISO's commenting tool.

California Independent System Operator Corporation
R.19-11-009

Attachment D

CAISO Comments
(R.20-11-013)

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021.	Rulemaking 20-11-003 (Filed November 19, 2020)

COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION ON ORDER INSTITUTING RULEMAKING EMERGENCY RELIABILITY

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Dated: November 30, 2020

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thus export to the grid) and receive compensation for the load reduction, including exported energy, under ELRP? Should this capability be expanded to include BTM stand-alone storage as well? Are there any Rule 21 or safety and reliability considerations that need to be addressed to permit storage, with or without NEM pairing, to export energy while participating in the ELRP? How should any safety and reliability issues be addressed? 8

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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021.	Rulemaking 20-11-003 (Filed November 19, 2020)

COMMENTS OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION ON ORDER INSTITUTING RULEMAKING EMERGENCY RELIABILITY

I. Introduction

The California Independent System Operator Corporation (CAISO) submits its comments on the *Order Instituting Rulemaking Emergency Reliability* (OIR) issued by the California Public Utilities Commission (Commission) on November 19, 2020.

The CAISO greatly appreciates the Commission's OIR establishing this proceeding and providing a procedural venue through which the Commission can direct incremental procurement under its existing resource adequacy program. This OIR is crucial to ensure the State can immediately address the resource planning recommendations from the joint Preliminary Root Cause Analysis (PRCA) for summer 2021. The CAISO submits these comments in the spirit of collaboration with a fundamental goal of advancing the reliable decarbonization of the California grid.

The Commission, the California Energy Commission (CEC) and the CAISO prepared the PRCA, which identified important changes to the resource adequacy program to consider the evolution of the generation fleet necessary to support the State's decarbonization goals. The PRCA found that the heat events this past summer resulted in demand for electricity that exceeded the existing resource planning targets and clearly recommended a transition to planning targets that will better support a reliable, clean, and affordable electric resource mix to meet demand in the early evening hours. The PRCA indicated that the current 15% planning reserve margin (PRM), which is instrumental in setting the procurement targets and CAISO backstop authority, was not sufficient to

cover net demand during the critical hours after the load peaked. During these hours, which the CAISO refers to as the net demand peak period, the load levels decreased but did not drop as fast as the energy output from solar resources.

The current 15% PRM covers a 6% operating reserve requirement and a 9% allowance for a combination of forced outages and higher than average load. The PRM currently applies to a monthly "1-in-2" peak demand forecast taken from the CEC's hourly forecast. This construct has not kept up with the performance of the evolving fleet and changes are necessary to ensure the State can continue to operate the electric grid reliably without having to shed load during heat events. The CAISO recognizes that a complete transition to alternative planning targets that consider the net demand after peak are not feasible to achieve by next summer. However, as noted in the PRCA, immediate action is necessary to prevent similar circumstances from threatening near-term reliability. The joint entities and the State should be focused on updating the resource and reliability planning targets to better account for heat storms and the transitioning resource mix necessary to meet the clean energy goals during critical hours.[1]

With this in mind, the CAISO suggests changes to the Commission's resource adequacy program to expedite the regulatory and procurement processes to procure additional resources by summer 2021. Specifically, the CAISO proposes to increase the PRM to 20% for the months of June through October 2021 and apply the PRM to both the gross peak as well as the most critical hour after peak when solar production is very low or zero.

An increase in the PRM to 20% is necessary to reflect the forced outage rate of resources shown in the CAISO's analysis as previously submitted to the Commission.[2] Further, to assist the Commission in its efforts to undertake needed incremental procurement for next summer, the CAISO has prepared a resource stack analysis that identifies additional resource procurement needs. The stack analysis compares existing and soon-to-be online resources plus an average level of resource adequacy imports against the suggested 20% PRM that considers the most critical hour after peak.

[1] PRCA Letter from the CAISO, Commission, and CEC to the Governor at 3.

[2] *See* the CAISO's August 7, 2020 Initial Track 3.B Proposals and Comments on Additional Process, p. 10. http://www.caiso.com/Documents/Aug7-2020-InitialTrack3BProposals-Comments-AdditionalProcess-ResourceAdequacy-R19-11-009.pdf.

The CAISO's stack analysis identifies the need to procure as soon as possible to address a resource gap in the existing fleet that ranges from 450 to 3,300 MW from July through September 2021 based on the 20% PRM. The greatest system resource needs occur in September and will require incremental capacity beyond the currently available and soon-to-be online net qualifying capacity. The CAISO's stack analysis also reveals that although the needed capability may be available in the existing fleet for June and October, because the current PRM construct does not capture the most critical hour after peak, it is not clear this capacity will be procured and available absent the changes the CAISO proposes to the PRM for next summer. Therefore, the Commission should work to adopt the changes to the PRM for June through October to secure resources physically capable of providing energy or curtailing load for a minimum of four consecutive hours, between 4 p.m. to 9 p.m.

The analysis supports the need for four major actions that need to be taken as soon as possible to assist the State in avoiding load shedding events in summer 2021. First, the State must secure imports backed by firm transmission rights and not recallable by the host balancing authority when system conditions are tight throughout the West. Second, the State should access any additional capability from the existing gas fleet that may be available with upgrades to existing facilities. These first two actions will secure needed incremental capacity missing from the existing fleet, which the analysis shows is particularly acute in the months of July through September. The CAISO notes as well that preparations for contracting for such resources should be expedited to the maximum extent possible. Third, the State must seek to secure resources that are leaning towards retirement, but are still needed to meet system or local reliability needs. The proposed PRM changes will enable procurement of resources that may otherwise be at risk of retirement and will minimize actions outside of the resource adequacy program to secure those resources. Finally, the State must ensure storage resources are installed, charged and ready to perform during the net demand peak period. Although, much of the storage resources have already been contracted for, the proposed PRM changes will signal the need for new contractual arrangements that support storage resources being charged and available during the net demand peak period. The CAISO stands ready to work with storage providers and load serving entities to ensure a successful summer 2021 storage

operation and explore longer-term enhancements to support the commercial and operational success of storage as a key reliability resource for California.

The incremental procurement required in this proceeding should be part of the Commission's resource adequacy program for 2021 overall so that procured capacity is subject to the same downstream requirements under the CAISO's tariff and associated processes—such as the must-offer requirements and the ability for the CAISO to backstop for deficiencies under the Capacity Procurement Mechanism (CPM).[3] Because it is crucial that the incremental procurement occur prior to the time the load serving entities must submit their monthly showings under the Commission's resource adequacy program, the Commission should issue a proposed decision for June through October 2021 procurement by mid-March, to ensure the Commission can vote on a final decision at its April 15, 2021 business meeting.

The changes adopted in this proceeding should apply for calendar year 2021 and 2022. If the Commission does not extend the changes proposed and adopted in this proceeding to 2022, the Commission should adopt these same interim PRM changes in the annual resource adequacy proceeding for the 2022 compliance year. Incremental procurement for new capacity may have to be addressed simultaneously in the integrated resource plan (IRP) proceeding. Given the discussions in the resource adequacy proceeding and the CAISO's Resource Adequacy Enhancements Stakeholder initiative,[4] the CAISO expects a long-term, holistic solution to be in place for resource adequacy year 2023. That long-term solution will address unit-specific outages and other aspects of the PRM as well as system forecast demand basis.

Finally, the CAISO recommends the Commission limit the scope of discovery in this proceeding. The Commission Scoping Memo should specify that unit specific resource performance and bidding data are not discoverable within the scope of this proceeding. Although aggregated unit performance may be relevant to the issues under consideration in this proceeding, requests for individual unit performance are not likely to

[3] By increasing the Commission's resource adequacy requirement for its LSEs, the CAISO will also be able to validate compliance with the local regulatory authority's requirements via resource adequacy showings and use the CAISO's backstop CPM authority to address any deficiencies.

[4] Details regarding this stakeholder initiative is available at https://stakeholdercenter.caiso.com/StakeholderInitiatives/Resource-adequacy-enhancements.

lead to admissible evidence. Also, such data requests are likely to be unduly burdensome, expensive, and intrusive. The Commission should limit these burdensome data requests in the Scoping Memo, to allow the CAISO and other parties to focus on producing information that is relevant to forward-looking grid needs.

The CAISO welcomes feedback on these recommendations and looks forward to working closely with the Commission, the CEC, and parties to ensure the reliable operation of the electric grid through summer 2021.

II. Discussion

In this section, the CAISO responds to the specific questions posed in the OIR. The CAISO reproduces the relevant questions prior to providing its response. This section omits any questions for which the CAISO does not have a response at this time.

Question 1: Should the Commission consider directing the IOUs to design a new paid advertising program for distributing CAISO's Flex Alerts in various outlets, including social media? If so, how should the Commission authorize a budget dedicated to this purpose and what measures and budget level should be considered?

Yes, the Commission should direct the IOUs to design a new paid advertising program for distributing CAISO's Flex Alerts in various outlets, including social media and enhanced social media mechanisms. The outlets should include direct-to-customer messaging that the CAISO can trigger during a Flex Alert event. The budget should allow translating Flex Alerts messaging into multiple languages. In addition, the funding should enable modernized messaging, *e.g.*, using smart devices, to encourage consumers to take proactive steps toward reducing demand, such as pre-cooling homes during hours prior to the critical demand period. Testing may be necessary for new messaging to ensure comprehension and effectiveness.

Question 2: Should the Commission modify the Critical Peak Pricing (CPP) program to increase the number of allowed events per year, modify other attributes, or provide guidance on when the program should be dispatched?

Yes, the Commission should seek to modify the CPP and other similar programs that can reliably reduce load during the net demand peak period from 4 p.m. to 9 p.m. Such load reduction must be reliable and verifiable to inform and appropriately adjust the load forecast because CPP is a load modifying resource. The Commission should ensure

sufficient coordination and data sharing with the CEC so CPP and other load modifying programs are appropriately reflected in the demand forecast.

Question 3: Should the Commission explore potential options to encourage non-IOU LSEs to develop programs similar to CPP?

Yes. See response to Question 2. The Commission should coordinate with the CEC to ensure non-IOU LSEs demand forecasts consider similar pricing programs adopted by such entities.

Question 4: Should the Commission increase IOU marketing funds to increase enrollment in CPP or take other actions to increase customer participation in the program?

Yes. See response to Question 2 and 3.

Question 5: Should the Commission establish a new out-of-market and outside the RA framework emergency load reduction program (ELRP) that could be dispatched by CAISO/IOUs under specified conditions where participants are compensated only after the fact and based only on the amount of load reduction achieved during the dispatch window? If so, what are the key program design elements (e.g., dispatch conditions, compensation level, load reduction measurement considerations, target customer segments, etc.) that should be considered or incorporated? What other issues (such as interactions with existing supply-side and load-modifying programs) need to be considered in order to establish an ELRP? How should these issues be addressed?

The CAISO appreciates this innovative approach for meeting electric system needs and strongly agrees any such program must remain separate and distinct from the resource adequacy program. Although ELRP can help reduce load reduction during net demand peak period, it is critical such programs not reduce load serving entities' resource adequacy obligations because these resources are out-of-the-market. Furthermore, the ELRP should provide load curtailment rather than generation export, as the CAISO explains in response to Question 6.

The CAISO will work closely with the Commission and investor owned utilities (IOUs) to develop the appropriate dispatch trigger and dispatch window for the ELRP. As an example, the dispatch trigger could be a Warning or Stage 1 emergency or its equivalent.[5] The ELRP could have multiple dispatch windows. For example, one

[5] The North American Electric Reliability Corporation (NERC) uses slightly different terminology.

dispatch window could be from 5 a.m. through 9 p.m., while another narrower window could be set during the net demand peak period (*i.e.*, 4 p.m. to 9 p.m.). Customers could choose a dispatch window consistent with their energy needs, and the different options could have different compensation structures.

As discussed in greater detail in response to Question 13, the Commission should instruct resource adequacy compensated emergency demand response to be available for dispatch before the CAISO issues a Warning and preferably in the day-ahead timeframe. This will better ensure these resources are dispatched before the CAISO utilizes and depletes non-resource adequacy resources. The ELRP program could allow voluntary non-resource adequacy emergency load curtailment dispatch at a Warning or Stage 1 emergency, and compensate resources for the provided emergency load curtailment. The ELRP would provide "insurance value" beyond what is provided by resource adequacy, and in doing so, would protect against extreme events—like the one experienced in August 2020—that otherwise could lead to involuntary load shedding.

If the Commission implements an ELRP, it should ensure there is a process to verify associated load reduction given the after-the-fact financial settlement. In addition, there must be assurance that these load modifying actions are incremental to existing supply-side and load-modifying programs. The CAISO also will need hourly estimates of the potential demand reduction (in MW) and after-the-fact verification information regarding the ELRP to accurately inform its short-term load forecasting processes for day-to-day market operations. Lastly, the CEC may ultimately need such information to inform and appropriately adjust the long-term forecast used in the Commission and CAISO planning processes.

The CAISO defers to the Commission and IOUs regarding the appropriate target customer segments, but the CAISO understands that during the mid-August heat wave a broad range of participants—from data centers equipped with backup generation to military installations—provided a variety of helpful emergency load reductions.[6]

[6] PRCA, Section 5: Actions Taken During August 16 Through 19 to Mitigate Projected Supply Shortfalls.

Question 6: Should the Commission allow BTM hybrid-solar-plus-storage assets to participate and discharge their available capacity in excess of onsite load (and thus export to the grid) and receive compensation for the load reduction, including exported energy, under ELRP? Should this capability be expanded to include BTM stand-alone storage as well? Are there any Rule 21 or safety and reliability considerations that need to be addressed to permit storage, with or without NEM pairing, to export energy while participating in the ELRP? How should any safety and reliability issues be addressed?

As the CAISO noted in response to Question 5, the ELRP should not qualify as resource adequacy capacity, nor should it reduce LSE resource adequacy requirements. The ELRP's purpose should be to provide insurance value beyond the resource adequacy program. Furthermore, the ELRP must be verified as incremental load reduction compared to existing supply-side and load-modifying programs.

As proposed, the ELRP seems to be an out-of-the-market program, which may have a CAISO or IOU trigger, but it is not a market-integrated resource dispatched by CAISO systems or operators. Therefore, the CAISO would not directly compensate any "exported" energy as a sale of energy in the wholesale electricity market. If the "exported" ELRP energy is not settled by the CAISO—similar to a NEM transaction—then the Commission should ensure this energy is appropriately accounted for in load forecasts (as requested in response to Question 5) and that it meets and maintains the safety and reliability of the distribution system. The Commission should study energy exported onto both the distribution and transmission system under the appropriate interconnection processes, including Rule 21 safety and reliability considerations. Developing an emergency program in this proceeding should focus on creative funding opportunities to unlock latent and untapped load reduction capabilities, but it should not be used to bypass current reliability and safety processes.

Question 8: Should the Commission consider expedited procurement, including through the cost allocation mechanism for additional reliability procurement (*e.g.,* expansion of existing gas-fired resources) that could be online for Summer 2021 and 2022? If so, how could this occur in order for the additional capacity to be online on time to address summer reliability needs. If not, why not?

The CAISO strongly supports expedited reliability procurement of incremental physical resources that can address grid needs during the net demand peak period after the gross peak for summer 2021 and summer 2022. The Commission should order this

expedited procurement as soon as possible in order to allow load serving entities to contract for additional resources prior to summer 2021.

The PRCA correctly points to the net demand peak period as the most critical for system reliability. This period represents the most critical system conditions because significant renewable penetration has "shifted" the net demand peak to later in the day. The PCRA notes that "[o]n hot days, load later in the day may still be high, after the gross peak has passed, because of air conditioning demand and other load that was being served by behind-the-meter solar com[ing] back on the system."[7] To address this concern while maintaining reliability during the gross demand peak, it is critical that the Commission order expedited procurement for resources incremental to the existing fleet. However, these resources should not merely substitute for or replace existing capacity under contract, because existing capacity under contract remains necessary to meet the gross demand peak.

To ensure that the necessary resources are procured to meet both the peak and the most critical hour after peak, the CAISO recommends that the Commission adopt a 20% PRM for its load serving entities for the months of July through October 2021. As the CAISO explains in response to Question 9 below, this increased PRM should apply to both the peak demand hour and most critical hour after peak when solar production is very low or zero. Temporarily increasing the PRM will incentivize load serving entities to both procure additional resources and show those resources to the CAISO for resource adequacy purposes.

The interim update to the PRM the CAISO proposes in this proceeding will provide a mechanism for contractual arrangements necessary to provide resources a reasonable assurance of recovering the costs of any necessary capital investments to produce additional capability. For example, to the extent additional investments are ncessary to capture additional capacity from the existing gas fleet, the incremental procurement directed by the Commission would enable those arrangements. Similarly, the procurement directives would enable any additional investments needed to ensure imports are backed by firm transmission and non-recallable energy.

[7] PRCA, p. 79.

The CAISO understands that it may be difficult for load serving entities to conduct additional procurement to meet a 20% PRM by summer 2021, but the increased PRM will allow the CAISO to use its CPM to backstop for additional capacity in the month-ahead timeframe if load servings entities are unable to meet the 20% PRM for 2021. Increasing the PRM and providing for appropriate cost recovery measures, will ensure that the Commission, load serving entities, and the CAISO have the tools to procure all available resources necessary to meet summer 2021 needs.

Question 9: If the CEC, CAISO, or the CPUC conducts additional analyses regarding Summer 2021 load forecasts, should the Commission consider a mechanism to update RA requirements in April for the summer of 2021 or would it be appropriate for CAISO to use its capacity procurement mechanism (CPM) to procure additional capacity for the summer of 2021, should it be deemed necessary?

The CAISO supports immediate, interim resource adequacy program changes to enable additional resource adequacy procurement for summer 2021 and 2022. Although the Commission should make additional changes to the resource adequacy program beyond 2022, the specific, additional changes the CAISO recommends herein would only apply for 2021. Discussions in the Commission's resource adequacy proceeding and the CAISO's Resource Adequacy Enhancements stakeholder initiative indicate a more long-term, holistic solution is expected to be in place for resource adequacy year 2023 and beyond.

The CAISO requests the Commission take the following actions for 2021: (1) temporarily increase the PRM to 20% for the months of July through October for the peak and most critical hour after peak to ensure necessary incremental capacity is procured; (2) immediately authorize procurement through the resource adequacy program based on the CAISO's 2021 resource stack analysis; and (3) develop a schedule that permits a final decision no later than the April 15, 2021, business meeting.

Increasing the PRM is a foundational element of the CAISO's proposal. As the CAISO explained in response to Question 8, the increased PRM will incentivize load serving entities to both procure additional resources and show those resources to the CAISO. Acknowledging that it likely will be difficult for load serving entities to conduct additional procurement to meet a 20% PRM by summer 2021, the increased PRM will

allow the CAISO to use its CPM to backstop for additional capacity in the month-ahead timeframe if load serving entities are unable to meet the 20% PRM for 2021. Without increasing the PRM, the CAISO's CPM backstop authority is limited to the operational timeframe. If the Commission increases the PRM, the CAISO can use its CPM to backstop to meet the higher requirement in the month-ahead timeframe.

The Commission Should Temporarily Increase the Planning Reserve Margin to 20%

The PRCA recognized that current resource planning levels are not designed to fully meet an extreme heat storm like the one experienced in mid-August 2020. This has led to LSEs procuring insufficient resources to meet demand in the early evening hours. The CAISO agrees with revising the existing 15% PRM to better account for both unit-specific forced outages and higher than average load.

In the long-term, the CAISO supports adopting a new "bottom-up" approach to establishing a reliable PRM considering unit-specific forced outage rates.[8] This approach would establishes minimum system resource adequacy requirements based on unforced capacity (UCAP) values for generators to maintain reliability. This approach is necessary to equitably address the growing number of local regulatory authorities and their potential variance in PRM targets. A resource adequacy requirement based on UCAP should also help mitigate the potential for capacity leaning among load serving entities. The CAISO's proposal can also accommodate a higher than 1-in-2 load forecast level. The CAISO is advancing its proposal in both the resource adequacy proceeding and the CAISO stakeholder process and is targeting implementation for the 2023 resource adequacy year.

However, to address the immediate summer 2021 needs, the CAISO proposes that the Commission temporarily implement a 20% PRM for both the peak and the most critical hour after peak when solar production is very low or zero. This will ensure sufficient procurement occurs to meet summer 2021 reliability needs and will provide the CAISO with an adequate basis to use its CPM backstop authority in the month-ahead timeframe. In addition, by requiring a 20% PRM at both the peak and most critical hour

[8] CAISO, Aug 7, 2020 Initial Track 3.B Proposals and Comments on Additional Process, R.19-11-009, August 7, 2020.

after peak, load serving entities will be precluded from substituting new incremental capacity in place of existing resource adequacy capacity that would otherwise be under contract.

The current 15% PRM accounts for a 6% operating reserve requirement and a 9% allowance for a combination of forced outages and higher than average load. The Commission should increase the PRM to 20% for June through October 2021. This 20% PRM reflects a 6% operating reserve requirement, 10% for forced outages, and 4% for higher than average 1-in-2 system load. As noted in CAISO's Resource Adequacy Enhancements stakeholder process, the average forced outage rate on the CAISO system is approximately 10%.[9] The 4% allowance for higher than average load is approximately the difference between a 1-in-2 and 1-in-5 system demand.[10]

The Commission Should Apply the 20% Planning Reserve Margin from June Through October 2021 to the Peak and Most Critical Hour After Peak

Consistent with current practice, the 20% PRM should apply to the peak hour. Additionally, the Commission should apply the 20% PRM to the most critical hour after peak when load is still relatively high, but intermittent resource generation is below its capacity value and output is rapidly declining. The PRCA specifically points to the net demand peak period—the peak of load net of solar and wind generation resources—as an especially challenging period for grid operations during the August 2020 heat storm. Significant renewable penetration has "shifted" the peak to later in the day and "[o]n hot days, load later in the day may still be high, after the gross peak has passed, because of air conditioning demand and other load that was being served by behind-the-meter solar comes back on the system."[11] To immediately address this need, the Commission should

[9] *See* http://www.caiso.com/InitiativeDocuments/Presentation-ResourceAdequacyEnhancements-Sep15-17WorkingGroup.pdf at slide 47 for the CAISO demonstration of this estimate. See also CAISO's proposal for developing resource-specific outages in: CAISO, Aug 7, 2020 Initial Track 3.B Proposals and Comments on Additional Process, R.19-11-009, August 7, 2020.

[10] The 20% PRM is also directionally consistent with Energy Division staff analysis presented at the Track 3.B resource adequacy workshop. CPUC Energy Division Staff, Presentation 3: 2022 Loss of Load Expectancy Study Preliminary Results, Track 3.B Workshops: Day 2, November 23, 2020. Analysis focused on 2022 and did not consider maintaining non-spinning reserves.

[11] PRCA, p. 79.

ensure capacity and energy procurement resulting from this OIR can physically provide energy or load curtailment during the net demand peak period as described below.

To address 2021 resource needs, the Commission should target the required procurement for the months of June through October, rather than the summer months period of May through October typically used in the resource adequacy proceeding. Although May is also a critical month for resource needs, this slight adjustment recognizes the timing in this proceeding likely does not allow for additional resource adequacy procurement for May 2021. However, if the Commission adopts a decision by April 15 or earlier, it could still be possible to increase resource adequacy capacity shown on supply plans for June 2021 (due 45 days before June 1).

The Commission Should Authorize Procurement Immediately Based on Guidance Provided by CAISO Analysis

As noted in response to Question 8, the CAISO strongly supports expedited reliability procurement for incremental physical resources that can address grid needs during the most critical hour after peak. To support procurement, the CAISO submits herewith a stack analysis focused on meeting load plus a 20% PRM during the most critical hour after peak for each month June through October 2021. The CAISO conducted its analysis on the hour that ends (hour ending, HE) at 8 p.m. Pacific Daylight Time (PDT) because solar generation is or is almost at zero by the end of the hour but the load remains relatively high compared to the peak.[12] Table 1 below shows this relationship. In July and August, the load for HE 8 p.m. PDT is over 1,000 MW lower than the peak of the month, which occurs an hour or two earlier. For June, September, and October, the difference is much smaller.

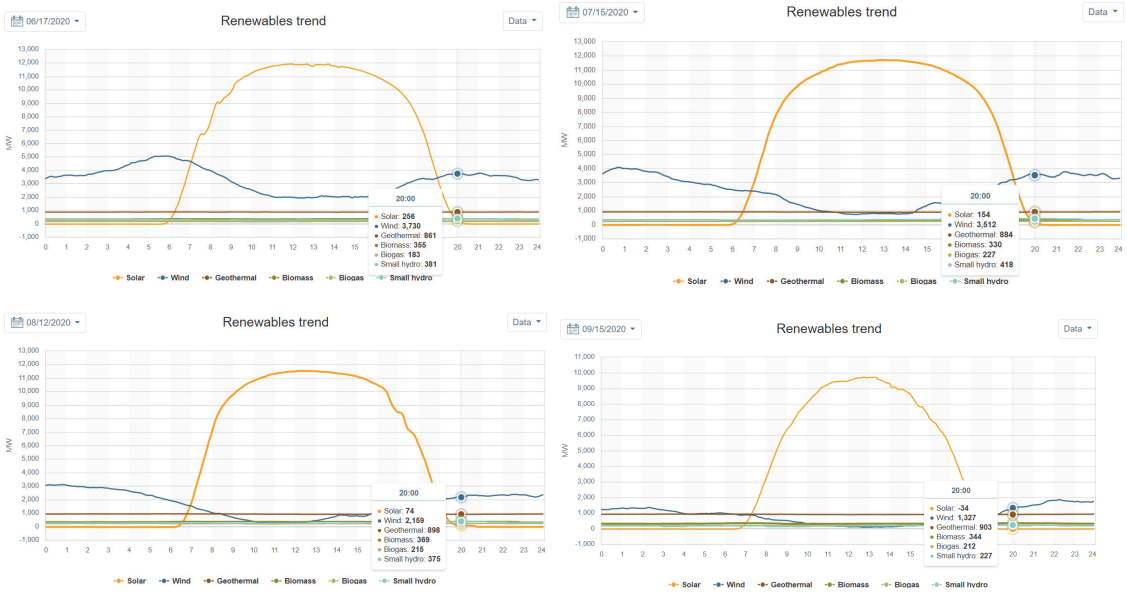
[12] The net demand peak does not always occur between 7 p.m. and 8 p.m. PDT. All times throughout this filing are noted in PDT.

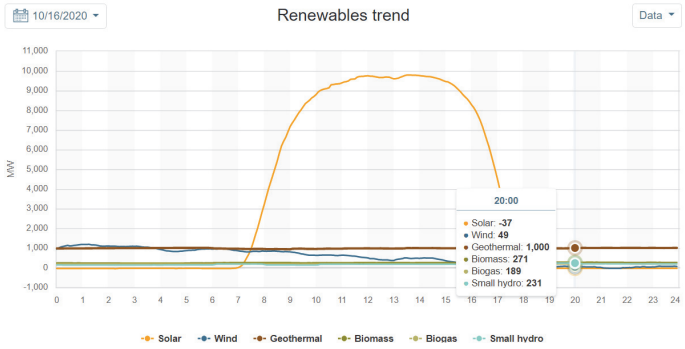
Table 1: Comparison of June-October 2021 Peak Demand and Load for HE 8 p.m. PDT

Month	Peak demand (MW)	Peak demand hour ending (PDT)	Load for HE 8 p.m. PDT	Peak demand minus HE 8 p.m. PDT load ([B] - [D])
[A]	[B]	[C]	[D]	[E]
June	41,421	7 p.m.	41,104	317
July	44,485	6 p.m.	43,306	1,179
August	44,679	6 p.m.	43,644	1,035
September	45,184	7 p.m.	44,861	323
October	37,271	8 p.m.	37,271	0

Figure 1 below shows five illustrative snapshots of renewable generation in the CAISO market from the middle of each month from June through October 2020. Each figure shows that by 8:00 p.m. PDT (shown as military time 20:00) solar generation declines from a peak of approximately 10,000 MW or more to less than 300 MW.

Figure 1: Illustrative Snapshots of Renewable Generation in CAISO Footprint mid-June-October 2020





For simplicity and as a conservative measure, the CAISO assumed zero solar generation in the stack analysis. For all other resources, the analysis reflects the 2021 net qualifying capacity (NQC) values available for each month, resources that are expected to be online by summer 2021 by month, and resource adequacy imports based on the historical average from 2015 through 2020 for each month. The total resource stack is compared to the California Energy Commission's (CEC's) 2019 Integrated Energy Policy Report (IEPR) mid-mid managed 2021 hourly demand forecast for the CAISO footprint plus a 20% PRM.[13] Attachment A contains inputs, assumptions, and a description of the methodology, and Attachment B contains the spreadsheets.

Figure 2 below shows the stacked resource columns for June through October 2021 compared with the load for HE 8 p.m. PDT plus a 20% PRM. Table 2 below provides the numerical comparison between the total resource stack versus the load for HE 8 p.m. PDT plus a 20% PRM. For illustrative purposes the table also includes a 15% PRM applied to the load for HE 8 p.m. PDT.

[13] Note that the CEC IEPR data is in Pacific Standard Time, which does not reflect daylight saving.

Figure 2: June – October 2021 Resource Stack vs. Load for HE 8 p.m. PDT Plus 20% PRM

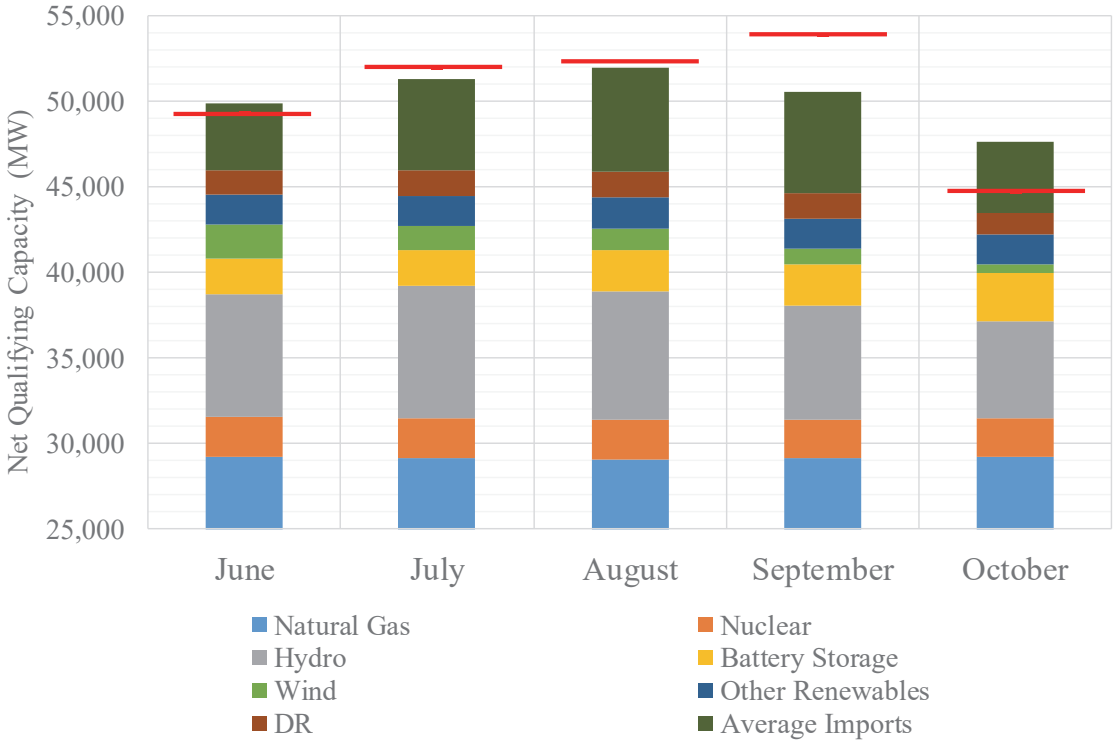


Table 2: Comparison of 2021 Total Resource Stack and Load for HE 8 p.m. PDT Plus 15% and 20% PRM

Month	Total resource stack with average RA imports (MW)	15% PRM plus load for HE 8 p.m. PDT	20% PRM plus load for HE 8 p.m. PDT	Total resource stack minus 15% PRM plus load ([B] - [C])	Total resource stack minus 20% PRM plus load ([B] - [D])
[A]	[B]	[C]	[D]	[E]	[F]
June	49,855	47,270	49,325	2,585	530
July	51,241	49,802	51,967	1,439	(726)
August	51,921	50,191	52,373	1,730	(452)
September	50,518	51,591	53,834	(1,073)	(3,316)
October	47,601	42,861	44,725	4,740	2,876

The results show a distinct difference between the five months. For June and October, the 20% PRM level (shown as horizontal red lines in Figure 2) is below the total resource stack. This signals that for June and October there may be sufficient net qualifying capacity (NQC) available for procurement to satisfy a 20% PRM. In other

words, for these two months load serving entities may be able to contract with existing resources to sufficiently respond to the most critical hour after peak. Table 2 contains the exact numbers. The Commission should order procurement immediately to ensure load serving entities can contract with available resources that can effectively serve load and meet the increased PRM at peak and during HE 8 p.m. PDT. As with all resource adequacy capacity, the Commission should ensure load serving entities procure resources physically capable of providing energy or curtailing load for a minimum of four consecutive hours, between 4 p.m. to 9 p.m. Although the stack analysis shows the required flexibility is possibly available given the resources listed on the 2021 NQC list, it is not certain that they will be procured to meet both peak and the most critical hour after peak. This illustrates why it is important that the Commission require the incremental procurement for the months of June and October.

On the other hand, the resource stacks in July through September fall below the 20% PRM level for HE 8 p.m. PDT as shown on Figure 2. This means there is insufficient capacity to meet the requirement even when including all of the resources on the NQC list, new resources expected online by summer 2021, plus an average level of resource adequacy imports. For July and August the shortfall between the total resource stack capacity and the load plus 20% PRM is approximately 700 MW and 450 MW, respectively, (shown as a negative value in Table 2, column [F]). However, the gap for September is over 3,300 MW (shown as a negative value in Table 2, column [F]) based on a 20% PRM. Even with the current 15% PRM there is almost a 1,100 MW shortfall in September (shown as a negative value in Table 2, column [E]). The gaps for the months of July through September must come from capacity not currently in the resource stack. The Commission should authorize procurement as soon as possible for: (1) resource-specific imports with firm transmission that are non-recallable by the host balancing authority; (2) expedite any incremental procurement from Decision (D.) 19-11-016; (3) incremental physical capacity from existing and new resources; and (4) incremental load curtailment.

The Commission Should Authorize Procurement Through the Resource Adequacy Program

The Commission should use the resource adequacy program to direct procurement of the additional capacity to ensure there is downstream coordination with CAISO processes such as CPM and resource adequacy validation. First, the Commission should encourage load serving entities to show all owned or contracted capacity to the CAISO so that such resources are reflected as resource adequacy capacity in the CAISO's systems. If capacity is not specifically identified as resource adequacy capacity, market participants can designate that capacity in support of their export self-schedules, which will have a higher priority in the CAISO day-ahead and real-time markets than exports that are not so designated. Designating the resources as resource adequacy capacity will help ensure energy is offered and prioritized to serve internal CAISO load rather than being offered as non-resource adequacy resources that could be used to explicitly support exports.

Second, increasing the PRM and procuring resources through the resource adequacy program means that the Commission is leveraging the appropriate "front stop" mechanism to increase the resource adequacy requirement. If there is insufficient resource adequacy procurement to meet the revised RA requirements, the CAISO can then use its CPM authority to backstop for any RA deficiencies. If the timing of this OIR does not allow for changes to the resource adequacy program to fully take effect and/or allow for additional procurement prior to summer 2021, the CAISO will work with the Commission to consider other options for procuring the resources necessary to maintain reliability.

The Commission Should Develop a Schedule that Allows for Adoption of a Final Decision No Later Than the April 15, 2021 Business Meeting

The Commission should expedite the schedule for this proceeding to ensure there is sufficient time for load serving entities to procure the additional resources required to maintain reliability for June through October 2021. The current schedule targets a Proposed Decision no later than April 30, 2021, which means the Commission cannot approve a decision until its June 3, 2021 business meeting, at the earliest. The CAISO urges the Commission to issue a proposed decision no later than mid-March so that it can

adopt a final decision no later than its April 15, 2021 business meeting, preferably earlier.[14]

Question 10: Should the Commission undertake a stack analysis of the amount of resources that would be necessary for Summer of 2021?

See response to Question 9.

Question 11: Should the Commission consider requiring that load serving entities expedite the IRP procurement they have scheduled to come online? How would the Commission provide equitable incentives so that the expedited process does not disproportionately increase costs for that LSE? If so, please explain how this would work. If not, why not?

Yes, the Commission should require load serving entities to expedite the IRP procurement they have scheduled to come online. For 2021, there likely is limited ability to advance online dates, but even expediting on-line dates by one month—from August to July—will be helpful in meeting the proposed 20% PRM. Expediting online dates is likely more feasible for 2022 and 2023. Otherwise, the Commission will have to rely on the updates the CAISO proposes to the PRM for next summer to provide the incentives for any capital investments needed to expedite resources coming online for summer 2021.

Question 12: Are there other opportunities for increasing supply for the summer of 2021 and/or reduce demand that the CPUC has not considered? If so, please provide details of these supply or demand resources and please explain how they can address reliability needs in the timeframe discussed in this OIR.

See response to Question 9.

Question 13: Should the Commission consider revisions to the reliability DR programs (Base Interruptible Program-BIP, Agriculture Pump Interruptible-API, AC cycling) that allow these programs to be triggered before the Warning stage (*e.g.*, after an Alert in the day-ahead timeframe)? If so, under what conditions and how would this work? If not, why not?

The Commission should require reliability demand response resource (RDRR) programs to bid into the CAISO's day-ahead market so they can be considered in both the integrated forward market and residual unit commitment processes. Currently RDRR is activated only in real-time after the CAISO calls a Warning Stage event or higher.

[14] Based on the current Commission voting meeting schedule, there is only one meeting in April 2021. *See*: https://www.cpuc.ca.gov/General.aspx?id=6442466589

This leaves little time for CAISO to integrate RDRR into the market and for consumers to prepare for load curtailment. Specifically not having access to RDRR in the day-ahead market means other resources, including non-resource adequacy resources, clear the market and receive market awards before programs the Commission has expressly funded for this purpose. In fact, appeals for voluntary public conservation via Flex Alerts are often sent out in the day-ahead timeframe before these fully funded programs are used.

The Commission should require these programs be shown on resource adequacy supply plans and bid into the day-ahead and real-time markets on a daily basis. As designed, the resources already bid in at very high prices (*e.g.*, $950/MWh) so they only clear the market in extreme circumstances if needed. Moreover, if RDRR is not emergency-triggered, the CAISO can pre-dispatch the resources and provide customers with earlier notification.

Question 14: Are there other changes to the BIP that would make it more effective to meet load under a variety of conditions during the summer of 2021 (*e.g.*, expansion of the 2% cap, mid-year enrollment, trigger notification time, etc.)?

See response to Question 13. Regardless of the changes, BIP and RDRR should be shown on resource adequacy supply plans. The Commission should not expand the 2% cap on BIP resources if the program continues to count as resource adequacy capacity *and* maintains an emergency-only trigger, even if the trigger is earlier than a Warning. It is imprudent to expand the resource adequacy program to include resources that are dispatchable only during emergency events. The Commission struck the appropriate balance in this OIR in categorizing ELRP as outside of the resource adequacy program, so this pool of emergency-only load curtailment does not erode the integrity of the resource adequacy program.

Question 18: Should the Commission consider measures to minimize potential attrition and loss of capacity in existing utility DR programs, such as increasing incentives, reducing dispatch activity limits, and clarifying expectations regarding when programs are dispatched?

The CAISO supports increasing incentives, reducing dispatch activity limits, clarifying expectations, and other efficiency improvements. The goals of this OIR should be to increase the Commission's and CAISO's ability to conduct resource planning and

grid operations under conditions of increased uncertainty and variability. The Commission should expand demand response programs to provide more flexibility (*e.g.*, more calls, longer durations) and optionality (*e.g.*, include weekend response). Customer fatigue and attrition should be addressed in other ways such as creating larger customer pools and rotating through them to limit the exposure for any particular pool, while ensuring overall program flexibility and optionality. Similarly, storage-backed and price-responsive programs may offset attrition.

III. Conclusion

The CAISO appreciates the opportunity to submit these comments in the spirit of collaboration with a fundamental goal of advancing the reliable decarbonizing the California grid. The CAISO looks forward to working with the Commission, CEC, and parties to implement the necessary steps to maintain system reliability.

Respectfully submitted

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ATTACHMENT A

CAISO Inputs, Assumptions and Methodology for Resource Stack Analysis

Attachment A

CAISO Inputs, Assumptions and Methodology for Resource Stack Analysis

The CAISO prepared a resource stack analysis that identifies additional resource procurement needs for the 2021 summer months. The stack analysis compares existing and soon to be online resources plus an average level of resource adequacy imports against an increased planning reserve margin (PRM) that considers the most critical hour after peak. Table A-1 below summarizes the input assumptions for Table 1, Table 2, and Figure 2 for June through October 2021. For completeness, the CAISO workbook (Attachment B) also includes May 2021 data and analysis.

Table A-1: CAISO Load and Resource Assumptions for Stack Analysis

System Requirement	
System Requirement	CAISO proposed 20% planning reserve margin applied to load for the peak hour and hour ending (HE) 8 p.m. Pacific Daylight Time (PDT). Current system requirement is based on a 15% PRM applied to load for the peak hour.
Load	• California Energy Commission 2019 Integrated Energy Policy Report (2019 IEPR) 1-in-2 system peak Mid-Mid Load • Used 2021 forecast for HE 8 p.m. Pacific Daylight Time (PDT) which is HE19 Pacific Standard Time (HE19 PST) in 2019 IEPR data. IEPR dataset is entirely in PST, which does not consider daylight saving. https://efiling.energy.ca.gov/GetDocument.aspx?tn=231555&DocumentContentId=63372

Planning Reserve Margin (PRM)	20%comprised of:
	• 6% for operating reserves
	  ○ https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf
	  ○ https://www.nerc.com/_layouts/15/PrintStandard.aspx?standardnumber=BAL-002-WECC-2a&title=Contingency%20Reserve&jurisdiction=United%20States
	• 4% for load above 1-in-2 system demand
	  ○ Reflect the approximate difference between a 1-in-2 and 1-in-5 peak forecast. For example, CAISO footprint coincident peak for 2021 is 45,184 MW for the 1-in-2 forecast. The 1-in-5 forecast from the same data set is 47,108 MW, or 4.3% higher. An increase from the 1-in-2 to the 1-in-10 forecast reflects a 6.6% increase in the peak demand.
	  ○ https://efiling.energy.ca.gov/GetDocument.aspx?tn=232306&DocumentContentId=64306
	• 10% for forced outages
	  ○ See slide 47: http://www.caiso.com/InitiativeDocuments/Presentation-ResourceAdequacyEnhancements-Sep15-17WorkingGroup.pdf. See also CAISO's proposal for developing resource-specific outages in: CAISO, Aug 7, 2020 Initial Track 3.B Proposals and Comments on Additional Process, R.19-11-009, August 7, 2020

Generation	
Net Qualifying Capacity	Final Net Qualifying Capacity (NQC) Report for Compliance Year 2021: http://www.caiso.com/Documents/NetQualifyingCapacityList-2021.xlsx (Version dated November 13, 2020.) Resource IDs from the NQC list were cross-referenced with CAISO MasterFile for resource category verification.
Gas Generation	
Existing Gas Generation	Existing generators from 2021 NQC list based on values for each month of analysis. Includes once-through cooling (OTC) units: Alamitos Units 3, 4, and 5; Huntington Beach Unit 2; Ormond Beach Units 1 and 2; and an extension of Redondo Beach Units 5, 6, and 8. Does not include Announced Retired and New Units. Dynamic scheduled generators included in Imports.

New Units	Based on CAISO confidential interconnection queue information. Only includes aggregate of new resources with expected in-service date (ISD) prior to each month.
Hybrid resources	
Hybrid resources	For this expedited analysis, hybrid resources are reflected as the individual components of the hybrid system. In future, the CAISO may improve the analysis to reflect the hybrid system.
Hydro (including Pumped Storage)	
Large Hydro	>30 MW hydro resources within the CAISO footprint. Qualifying capacity based on 2021 NQC list based on monthly values. Dynamic scheduled generators included in Imports.
Small Hydro	≤30MW, RPS eligible resources within the CAISO footprint. Qualifying capacity based on 2021 NQC list based on monthly values.
Pumps with net qualifying capacity	Pumps designated to provide ancillary services with an NQC value. Qualifying capacity based on 2021 NQC list based on monthly values.
Pumped Storage	Includes Eastwood, Helms, Lake Hodges, and San Luis.
Nuclear	
Nuclear	Diablo Canyon only. Qualifying capacity based on 2021 NQC list based on monthly values. Dynamic scheduled generators included in Imports.
Solar	
Existing Solar	Total installed values from 2021 NQC list based on monthly values. Qualifying capacity based on effective load carrying capability for each month from D.19-06-026. For HE 8 p.m. PDT assumed generation is zero.
Incremental Solar	Based on CAISO confidential interconnection queue information. Only includes new resources with expected in-service date (ISD) prior to each month. Qualifying capacity based on effective load carrying capability for each month from D.19-06-026. For HE 8 p.m. PDT assumed generation is zero.

Wind	
Existing Wind	Total installed values from 2021 NQC list based on monthly values. Qualifying capacity based on effective load carrying capability for each month from D.19-06-026.
Incremental Wind	Based on CAISO confidential interconnection queue information. Only includes new resources with expected in-service date (ISD) prior to each month. Qualifying capacity based on effective load carrying capability for each month from D.19-06-026.
Other Renewables	
Other Renewables	Includes Biomass, Biogas, Geothermal, Heat recovery, Waste and Other. Qualifying capacity based on 2021 NQC list based on monthly values.
Battery	
Existing batteries	Total installed values from 2021 NQC list based on monthly values.
Incremental batteries	Based on CAISO confidential interconnection queue information. Only includes new resources with expected in-service date (ISD) prior to each month.
Demand Response	
Demand Response	Demand response is the sum of two data sources: (1) Total proxy demand response (PDR) from 2021 NQC list based on monthly values; and (2) CPUC credited historical 2020 investor owned utility demand response without PRM adjustment by month. This credit is assumed to approximate NQC capacity.
Imports (based on total maximum import capability of 10,805 MW)	
Contracted resource adequacy imports	Based on average of historical contracted imports from 2015 through 2020 for each month, which includes both drought and non-drought years. Includes Palo Verde and Hoover and dynamically scheduled resources. Average values are: June: 3,922 MW July: 5,340 MW August: 6,095 MW September: 5,921 MW October: 4,171 MW