California ISO

Resource Adequacy Enhancements

Straw Proposal – Part 1

December 20, 2018

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1. Executive Summary

Under the Resource Adequacy Enhancements initiative, the ISO will perform a comprehensive review of the ISO's Resource Adequacy (RA) provisions and propose enhancements that ensure effective procurement of capacity to reliably operate the grid all hours of the year. This straw proposal – part one includes discussion and proposed enhancements on the following items: (1) Rules for import RA; (2) RAAIM enhancements, outage and substitution rules, and review of must offer obligations; (3) Local capacity assessment with availability limited resources; and (4) Meeting local RA capacity needs with slow demand response.

The ISO's straw proposal – part one considers the rules and requirements for import RA. The ISO is concerned about the potential for RA imports to represent speculative supply or be double counted for reliability. There are a number of potential modifications the ISO proposes to explore to address these concerns, including requiring specification of RA import resource's source balancing area or resource specific designation. Additionally, the ISO presents potential modifications to the bidding requirements and must offer obligations for RA imports as a way to mitigate potential speculative supply and create more comparable must offer obligations for imports and internal resources.

The proposal also considers potential enhancements to improve the efficacy of the Resource Availability Incentive Mechanism (RAAIM), including the possible addition of event based triggers and performance based incentives. This initiative also reviews RA must offer obligations and outage and substitution rules. The proposal presents options for planned outage rule modifications to address issues with resource availability. Forced outages are proposed to be assessed under the modified RAAIM or a new availability and performance assessment. The proposal includes discussion of potential trigger events that would initiate performance assessments and provides background on calculating availability and performance. The ISO also discusses the considerations for penalty structure pricing and allocation that would be needed under any modified availability and performance assessment provisions. The ISO recognizes that modifications to these key RA issues are critically connected to other elements in the scope of this issue paper and overall initiative. The ISO confirms that any final modifications to RAAIM or development of any new availability and performance assessment must work in concert with any changes to net qualifying capacity value counting rules, outage reporting, and must offer obligations.

Finally, the proposal presents two elements related to meeting local capacity needs. First, the ISO defines the term availability-limited and outlines Local Capacity Technical Study modifications that inform stakeholders of minimum availability needs in local capacity areas and sub-areas. Second, the proposal provides details about how the ISO can dispatch slow DR resources pre-contingency for these resources to respond to local area reliability concerns within the required timeframe to qualify for local RA.

2. Introduction and Background

The rapid transformation to a cleaner, more variable, and energy limited resource fleet is causing a need to re-examine all aspects of the ISO's Resource Adequacy program. In 2006, at the onset of the RA program in California, the dominant energy production technologies 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. However, as the fleet transitions to achieve the objectives of SB 100,[1] the ISO must rely on a very different resource portfolio to reliably operate the grid. In this stakeholder initiative, the ISO, in collaboration with the California Public Utilities Commission (CPUC) and stakeholders, will explore reforms needed to the ISO's resource adequacy rules, requirements, and processes to ensure reliability and operability under the transforming grid.

Currently, the CPUC is developing a multiyear local RA framework in Track 2 of its RA proceeding under rulemaking R.17-09-020. The ISO is an active participant in this proceeding and believes that much of what the CPUC is contemplating will require minimal to no ISO tariff modifications. However, the ISO will continue to assess the CPUC's multiyear RA framework and associated processes to determine if any new ISO tariff provisions are needed to directly support the CPUC's efforts, and if so, these will be considered under this initiative.

Apart from the CPUC's proposed changes to its resource adequacy program, the CAISO has identified certain aspects within the ISO's current RA tariff and 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. The following issues are of growing concern to the ISO:

- The current RA counting rules do not adequately reflect resource availability, and instead rely on complicated replacement and availability incentive mechanism rules;
- Flexible capacity counting rules may not sufficiently align with operational needs;
- The current calculation for available import capability and allocation may result in inefficient outcomes and withholding of import capabilities;
- The eligibility rules and must offer obligations for import resources may provide opportunities for economic withholding and/or non-delivery of energy;
- Current system and flexible RA showings assessments do not consider the overall effectiveness of the RA portfolio to meet ISO operational needs; and

[1] 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

- The growing reliance on availability-limited resources to serve local capacity areas where these resources may not have sufficient run hours or dispatches to maintain and serve the energy needs in local capacity areas and sub-areas.

The ISO proposes to conduct a holistic review of its existing RA tariff provisions to make necessary changes to ensure the above issues are addressed and the ISO's RA tariff authority adequately supports reliable grid operations.

Given the large scope of this initiative, the ISO's plan is to issue the initial straw proposal in two sequential parts prior to aligning all in-scope items later in the process under future revised straw proposals. The ISO believes this approach will allow for a thorough and manageable development and review of each of the items in scope for this initiative.

This document provides part one of the straw proposal and includes the following topics:

- Rules for Import RA
- RAAIM Enhancements and Review of Must Offer Obligations and Outage and Substitution Rules
- Local Capacity Assessments with Availability Limited Resources
- Meeting Local Capacity Needs with Slow Demand Response

Part two of the straw proposal will include the rest of the items in scope for this initiative, covering the following topics:

- RA Counting and Eligibility Rules
- System and Flexible Capacity Assessments and Adequacy Tests
- Maximum Import Capability Review
- CPM and RMR Enhancements

After both parts of the straw proposal are developed (i.e., an initial scoping and proposal has been issued on all items), the ISO will post a revised straw proposal encompassing all issues in this initiative as part of a single proposal. See section 0 below for the stakeholder initiative schedule, including when each iteration of the proposal will be issued.

3. Stakeholder Engagement Plan

Table 1 presents the schedule for this stakeholder initiative below. The ISO plans to seek ISO board approval in November 2019.

Table 1: Stakeholder Engagement Plan

Date	Milestone
Dec 20	Straw proposal (part one)
Jan 16	Hold stakeholder meeting on straw proposal (part one)
Jan 30	Stakeholder comments on straw proposal (part one) due
Feb 14	Straw proposal (part two)
Feb 21	Stakeholder meeting on straw proposal (part two)
Mar 8	Stakeholder comments on straw proposal (part two) due
Apr 9-10	Working group meeting
Apr 22	Stakeholder comments on working group meeting due
May 20	Revised straw proposal
May 28-29	Stakeholder meeting on revised straw proposal
Jun 10	Stakeholder comments on revised straw proposal due
Jul 8	Second revised straw proposal
Jul 16-17	Stakeholder meeting on second revised straw proposal
Jul 31	Stakeholder comments on second revised straw proposal due
Sep 9	Draft final proposal
Sep 24-25	Stakeholder meeting on draft final proposal
Oct-9	Stakeholder comments on draft final proposal due
Nov 13	**Present proposal to ISO Board**

4. Straw Proposal – Part 1

As noted above, the ISO is planning to issue the initial straw proposal in two sequential parts. Following are the issues addressed in part one.

4.1. Rules for Import RA

The ISO coordinates with the CPUC, other local regulatory authorities, and the California Energy Commission (CEC) to set system-level RA requirements. System RA requirements are based on LSEs' forecasted monthly peak load plus a planning reserve margin, typically 15 percent of monthly peak loads. LSEs are able to meet these system RA requirements with a mix of RA resources, which can include imports from outside of the ISO balancing authority area.

Import RA resources are not required to be resource specific or to represent supply from a specific balancing area. Import RA resources are only required to be shown, and make offers as shown, at a specific intertie point into the ISO system. Further, Scheduling Coordinators (SC) are only required to submit energy bids for RA imports in the day-ahead market. Import RA can be bid at any price below the offer cap and do not have any further obligation to bid into the real-time market if not scheduled in the day-ahead integrated forward market or residual unit commitment process.

In other stakeholder forums, some stakeholders expressed concerns with RA import rules potentially allowing speculative supply to count for RA capacity, undermining the integrity of the RA program and threatening system reliability. Additionally, the ISO's Department of Marking Monitoring (DMM) expressed similar concerns in their September 2018 DMM special report on import RA. In that report, DMM explained that the existing rules could allow a significant portion of resource adequacy requirements to be met by import RA that may have limited availability and value during critical system and market conditions. For example, import RA could satisfy their RA must offer obligation by routinely bidding significantly above projected prices in the day-ahead market to help ensure they do not clear the market, relieving them of any further offer obligations in real-time. [2]

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. [3] Thus, the quantities are not insignificant and have an impact on the RA program and ability to ensure reliability.

[2] DMM Special Report: Import Resource Adequacy, September 10, 2018: http://www.caiso.com/Documents/ImportResourceAdequacySpecialReport-Sept102018.pdf
[3] 2017 CAISO DMM Annual Report, p. 259: http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf

4.1.1. Scope of Policy Examination

The ISO proposes to include a review of import RA rules and provisions in the scope of this initiative. This review will include an assessment of the requirements and rules for the sources behind RA imports. Note that price caps for import RA bid submissions are out of scope for this initiative.

4.1.2. Specification of RA Import Resource Source

The ISO's current RA provisions allow for Non-Resource Specific Resources to qualify to provide System RA. As noted above, RA import resources are not required to be resource specific or to provide any greater certainty they represent supply from a specific Balancing Area. Instead they are only required to be shown as sourced on a specific intertie into the ISO system. The ISO previously explored the need for resource specific designations applied to RA imports to qualify as system RA capacity. However, this previous review of RA import rules under the regional RA initiative did not result in tariff modifications given changes contemplated were not brought to fruition due to the specific circumstances at the time of this prior review, yet current conditions warrant a comprehensive review of this issue.

Because of tighter supply in the West, the ISO is increasingly concerned about the potential for Non-Resource Specific RA import resources to be double counted for reliability. This may occur when a resource is shown to the ISO as RA while also relied upon by other regions or Balancing Areas (BA) to meet capacity or energy needs. To ensure all RA import resources are fully available and dedicated to the ISO for reliability, modifications to specify the source of RA imports need to be considered. This is an increasingly important matter as the ISO considers extending the day-ahead market to EIM entities, ensuring that resources outside of the ISO BA are not double counted for meeting resource sufficiency requirements.

With the extension of the day-ahead market to EIM entities, the ISO believes that, at minimum, RA import resources must specify the source Balancing Area. This potential modification would allow the ISO to ensure that RA imports are not double counted for EIM entities' resource sufficiency tests. The ISO believes that requiring a designation of the source Balancing Area ("Source BA") will be sufficient to assist in ensuring that RA imports are not being double counted for EIM resource sufficiency tests.

The ISO also wants to discuss with stakeholders the potential to require "resource-specific" designations as a qualification to provide RA imports with stakeholders. This option is the most conservative "book end" option the ISO wishes to explore and this modification to the RA imports rules would provide the greatest certainty that RA imports have not been double counted.

The ISO is open to considering additional options regarding the specification of RA import resource sourcing and seeks stakeholder feedback on this issue.

4.1.3. Bidding Rules and Must Offer Obligations for RA Imports

The ISO is increasingly concerned that the current RA import provisions may allow some RA import resources to be shown to meet RA obligations while also representing speculative supply, (i.e., no true physical resource or contractual obligation backing the RA showing) or being committed to other regions and double counted. Speculative RA supply can have negative impacts such as undermining the integrity of the California RA program and threating system reliability.

Therefore, as part of this initiative, the ISO is conducting a review of the bidding rules and must offer obligations for RA imports, with a goal of creating more comparable obligations between internal and external RA resources. This review will include consideration of bidding obligations into both day-ahead and real-time markets. However, imposing offer caps for import RA bid submissions, is out of scope for this initiative.

Real-Time Bidding Requirements for RA Imports

Currently, RA imports have a day-ahead must offer obligations, but only have a real-time must offer obligations if they receive a day-ahead award. The real-time must offer obligation for these RA import resources is only for the amount of MWs awarded in the day-ahead market. Specifically, the ISO's Reliability Requirements BPM provides the following bidding requirements for Non-Dynamic, Non-Resource-Specific System Resources (i.e., non-unit-specific RA imports):

> For IFM – Economic Bids or Self-Schedules are to be submitted for all RA Capacity consistent with inter-temporal constraints such as multi-hour run blocks or contractual limitations (e.g. 6 X 16). (ISO Tariff 40.6.1, 40.6.8.1, 40.8.1.12.2).
>
> For RT - Economic Bids or Self-Schedules must be submitted under the Resource ID registered as an RA Resource on RA Supply Plan. **Economic Bids or Self-Schedules are to be submitted for any remaining RA Capacity from resources scheduled in IFM or RUC. No RTM Bids or Self-Schedules are required for resources not scheduled in IFM or RUC** (ISO Tariff 40.6.2, 40.6.3).[4]

The ISO is proposing to extend the must offer obligations for RA imports into the real-time markets, including all shown RA capacity, not only for resources/MWs scheduled in IFM or RUC. One reason for this potential proposal is to mitigate the potential for suppliers/LSEs to provide RA showings that may include speculative supply.

This change would also provide more comparable treatment for RA imports and internal RA resources. The ISO believes that more comparable treatment between internal RA resources and RA import resources should be considered carefully because of the potential impacts to

[4] See the Reliability Requirements BPM, pp. 78 for Non-Dynamic, Non-Resource-Specific System Resources RA obligations.
https://bpmcm.caiso.com/BPM%20Document%20Library/Reliability%20Requirements/BPM%20for%20Reliability%20Requirements%20Version%2039.docx

internal installed RA resource viability. Internal RA resources currently represent a more certain capacity availability for meeting reliability needs so it is important to explore how the ISO may be able to create a greater level of comparability in the treatment of internal and RA import resources. The ISO seeks stakeholder feedback on this potential modification to RA import real-time offer obligations.

Expanding RA Import Must Offer Obligations to 24 by 7

The ISO is also considering expanding MOO requirements for RA imports to 24 hours, 7 days a week. This change ensures resource availability during all hours of the day to meet reliability needs that can occur at any time, not just during peak periods. Similar to the other potential RA import rule modifications, this change will also provide more comparable treatment for RA imports and internal RA resources. The ISO seeks feedback on this potential change to the RA import MOO provisions.

15 Minute Bidding and Scheduling Requirements for RA Imports

Lastly, the ISO proposes to explore the potential for modifications to the current provisions allowing for hourly block scheduling by RA imports. The ISO believes that an additional modification that can help to provide better comparability in the treatment of RA imports and internal RA resources would be to modify the bidding and scheduling rules to require all import RA resources to provide 15-minute bidding granularity. This change would only allow for non-RA import energy to be bid and scheduled in hourly blocks. The ISO seeks feedback on this potential change to the RA import bidding requirements.

4.2. RAAIM Enhancements, Outage and Substitution Rules, and Review of Must Offer Obligations

The RA program is designed to ensure the ISO has sufficient capacity available to serve load reliably. Any resource providing RA capacity to the ISO has an obligation to offer that capacity into the ISO market. The MOO for various RA products and technology types is listed in the ISO's Reliability Requirements BPM.[5] The ISO also relies on outage reporting to track whether or not resources are available at any given time. If there is sufficient notice given and capacity available, the ISO can grant outages without requiring replacement capacity. However, not all outages occur under those conditions, in which case, the ISO developed RAAIM.

RAAIM is designed to provide an incentive for resources on forced 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 to the Availability Assessment Hours (AAH). These hours and days differ depending on the RA product the resource is providing the ISO. All of the 2019 AAHs for each product are included in the appendix of this document. While RAAIM provides an incentive to provide substitute capacity, it also provides an incentive to only show

[5] See the Reliability Requirements BPM, pp. 77-82 for System and Local RA obligations and pp. 93-96 for flexible RA obligations.

the minimum RA capacity needed for each capacity type because showing additional capacity exposes that capacity to RAAIM non-availability charges.

The discussion above is a brief summary of the relationship between MOOs, RA substitution rules, and RAAIM. The reality of these relationships is that they combine to create a complex system of processes that differ vastly from other ISOs/RTOs. As part of this initiative, the ISO will conduct a holistic review of these concepts and relationships. For example, the ISO receives many questions regarding the differences between a resource's MOO and the AAHs, often using the two concepts interchangeably, or considering a resource's RA MOO to only be applicable during the availability assessment hours.

As an initial step, the ISO has examined its existing RAAIM tariff provisions to determine if they provide the proper incentives for resources to be available and perform when and where needed by the ISO. As noted above, the ISO recognizes there are critical relationships between RAAIM, outage substitution rules, and RA valuation based on outage rates. The current straw proposal focuses on outlining potential options to enhance RAAIM. In the RA Enhancements straw proposal – part two, the ISO will provide a holistic proposal for RAAIM, outage substitution rules, and RA valuations.

4.2.1. Scope of Policy Examination

The scope of the policy examination in the present straw proposal part one focuses on modifications to RAAIM and its application to various outages and resource types. Specifically, the ISO exploring moving from predetermined hours, i.e., availability assessment hours, to event based triggers. Additionally, the ISO is considering developing a mechanism that not only considers availability during these events, but also resource performance. The ISO initially envisions that the modified assessment provisions would only consider forced outages. The ISO is also exploring ways to resolve gaps in current planned outage approval process.

The overall objective of this initiative is to ensure the ISO has sufficient capacity – system, local, and flexible – to meet its operational needs. The ISO recognizes that modifications to RAAIM are critically connected to other elements with the scope identified in the issue paper. Any final modification to RAAIM or development of any new availability/performance assessment must work in concert with changes that impact net qualifying capacity value counting rules, outage reporting, and MOOs. For example, the ISO must develop RAAIM penalties that focus on failures of capacity shown for RA, while changes to net qualifying capacity values should focus on ensuring the ISO only depends on resources for their reliable, dependable, deliverable capacity going forward. In other words, the two tools are intended to complement one another.

Additionally, to ensure both RAAIM and net qualifying capacity values reflect a resource's availability, the ISO must establish clear triggers for when RAAIM would apply and when net qualifying capacity would be impacted. This requires clear guidelines regarding resource MOOs and outage reporting. In summary, the ISO is very aware of the critical relationship between many of the items within this initiative's scope, and will work with stakeholders to strike the correct balance between them.

4.2.2. Addressing Planned and Forced Outage Issues

The ISO utilizes two types of outages: Planned and Forced. There are important distinctions between them, including the ISO's role in managing them. Resources that wish to take planned outages work with the ISO to schedule the outage and ensure that sufficient capacity is available. If the resource is shown as an RA resources, and the planned outage will result in a shortage of RA capacity or impair reliability, then the ISO may require the resource to provide substitute capacity or have that outage denied. If the resource SC decides to take the outage, then the ISO will treat the resource as a forced outage. Resources on forced outage, depending on the cause of the outage, may be subject to the RAAIM if the resource does not provide substitute capacity.[6]

The more notice the ISO has to review expected outages, the more opportunity it has to effectively manage those outages. Given the benefits of longer lead time for outages and different role of the ISO in approving or denying planned outages, the ISO is contemplating different criteria for the two different outage types. For example, to the extent the ISO approves a planned outage and there is sufficient additional RA capacity, then the ISO could elect to not apply any additional RAAIM penalties, even if other triggers activate. Therefore, the ISO is considering different rules for planned and forced outages. One goal of these rules should be incentivizing submission of planned outages over reliance on forced outages and provide resource SCs options for finding alternative resources while ensuring the ISO has sufficient capacity available.

Planned Outage Options

For planned outages, the ISO is contemplating two bookend solutions. The first option is resources on planned outages would have the option of ISO procuring capacity on the resource's behalf for any days on which it is on planned outage using the standing CSP bids, or cancel the outage. This allows the resource SC to determine if the outage is cost effective at that time or if they should defer to a later date. The resource on planned outage would not be subject to additional availability/performance assessment charges and there would be no impact on the resource's NQC for planned outages managed through this approach so long as they make the election more than 8 days prior to the outage. Any market requirements would then be the responsibility of the replacing resource. Any elections made after 8 days prior would be treated as a forced outage and availability/performance assessment charges incentives would apply. Additionally, the ISO is considering if potential NQC reductions should be imposed. This mechanism is intended to ensure the ISO has sufficient RA capacity at all times. It also should incentivize resources to provide sufficient lead time for the ISO to manage outages, and allow the resource SC to decide if the timing and cost of the outage makes sense.

The other bookend option under consideration is to prohibit resources taking planned outages during a month from providing RA capacity during that month. Under this option, the ISO would flag any resource taking a planned outage and reject any supply plans for that resource in

[6] See the Reliability Requirements BPM, Sections 9.2.2. and 9.3.3 for additional details regarding the various nature of work cards.

excess of the resource's remaining available capacity. If that resource appears on an RA showing for more than the resource's remaining available capacity, the ISO would note this as a discrepancy and notify all impacted SCs. The discrepancy could be resolved either by the resource SC cancelling the planned outage or by the LSE showing alternative capacity. If the discrepancy is not resolved, the ISO will defer to the resources supply plan. While this option gives deference to the resource's supply plan comparable to today, it offers the resource fewer options to resolve the discrepancy than the above option. Additionally, the ISO is concerned that this approach may actually create an incentive to not provide for planned outages. It may result in resources willing to accept a short forced outage simply to provide RA for the remainder of the month.

Forced Outages and Availability & Performance Assessments

For forced outages, the ISO is proposing to continue utilizing an availability incentive mechanism. However, the ISO is also considering new net qualifying capacity value counting rules, and the ISO is exploring eliminating options for replacement capacity for forced outages. Instead, the ISO is considering methods where net qualifying capacity values account for the probability of forced outages ahead of time, eliminating the need for complicated replacement capacity rules. Additionally, the ISO will shed greater light on resource availability by incorporating a performance aspect into the proposed availability/performance assessment. The remainder of this section provides greater detail on various aspects of the ISO proposal for a modified availability/performance assessment.

As noted above, the CAISO assesses RAAIM penalties based on resource availability during the AAHs. This assessment is done regardless of system conditions, including load and ramping needs. Additionally, the CAISO assesses resource availability relative to bidding behavior rather than to compliance with ISO dispatch instructions. By contrast, ISO-NE has a tool in place called the Forward Capacity Market Pay-For-Performance (PFP).[7] ISO-NE's PFP assessments are done only during scarcity events and the assessments are based on a resource's performance during scarcity events, which differs from the CAISO where only resource availability is assessed. Although ISO-NE's PFP provides one example of how an event-based availability mechanism could work, there are critical differences between ISO-NE and the ISO. Specifically, ISO-NE has a multiyear forward centralized capacity market that procures capacity for the entire year, while California has monthly RA obligations. Additionally, ISO-NE, unlike the ISO, does not have the other RA tools such as the Capacity Procurement Mechanism and Flexible RA. If the ISO adopts an event-based availability/performance assessment, these differences could result in multiple triggers applied to the availability/performance assessment.

Section 40.9.2 of the ISO tariff identifies resources that are exempt from various levels of RAAIM penalties. There are various other exemptions from system/local RAAIM only, flexible RAAIM only, and other specific resources. Further, there are additional specific exemptions based on the nature of the resource outage.[8] These exemptions have two impacts. First, they

[7] https://www.iso-ne.com/committees/key-projects/fcm-performance-incentives/
[8] See the ISO's Reliability Requirements BPM.

add to the complexity of RAAIM, causing a resource SC to determine if an outage is exempt and/or if they need to find substitute capacity for a given outage. Second, they degrade the effectiveness of the mechanism itself as resource SCs try to be either exempt outright or find ways to classify outages as RAAIM exempt and not subject to replacement capacity. This is not to say that some outages should not be exempt from availability incentives, but those exemptions should be limited to outages approved by the ISO or those that come as a result of a transmission outage, either forced or approved by the ISO.

In the current initiative the ISO proposes to eliminate exemptions from an availability/performance assessment and the need for substitute capacity for forced outages. The ISO's ability to achieve these two objectives will depend on 1) specifying availability/performance assessment triggers that are aligned with well-defined operational needs, and 2) the effectiveness and combined availability and performance incentives from NQC counting rules that consider forced outages and an availability/performance assessment. Further, given the ISO's goal of developing event based triggers tied to grid reliability and measuring both availability and performance, the ISO will review all existing RAAIM exemptions. The ISO will consider extending current exemptions so long as the resource can demonstrate that it is subject to a similar performance obligation tied to ISO operational needs.

The remainder of this section details options the ISO is currently considering for a RA availability/performance mechanism, including triggers and exemptions, availability/performance calculations, penalty structures – including pricing and allocation of collected penalties. Finally, the ISO notes that while it is exploring significant changes to – or elimination of – the existing RAAIM structure, the ISO remains open to maintaining or making targeted changes to the existing mechanism.

4.2.3. Availability & Performance Assessment Triggers

As noted above, the ISO is exploring alternative triggers for availability/performance assessment. These triggers should reflect specific ISO operational needs and the type of capacity a resource provides. Therefore, the ISO is exploring triggers that reflect system, local, and flexible capacity needs. Table 2 provides an initial list of potential triggers. Any proposed enhancements should simplify availability/performance assessment and expects that utilizing all of these elements is complex and unnecessary. However, the ISO seeks stakeholder feedback regarding which these potential triggers are needed and which ones may simply complicate an availability/performance assessment.

Table 2: Potential Availability & Performance Assessment Triggers

Potential Trigger Options
System Based Trigger Options
• Exceptional Dispatch CPM – System

• System peak load and/or net load (Annual / Monthly)
• System emergency
• Insufficient reserves/scarcity condition
• Flex Alert
• Load forecasted to exceed a given percent of forecasted monthly peak (i.e., over 95 percent of forecast monthly peak)
• Restricted Maintenance
Local Based Triggers
• Exceptional Dispatch CPM – Local
• Restricted Maintenance
Flexibility Based Triggers
• Maximum monthly net load ramps
• Monthly Maximum deviation between Day-Ahead and Real-Time forecasts

4.2.4. Calculating Availability & Performance

The current RAAIM tool simply assesses whether or not an RA resource submitted an economic bid or self-schedule in the day-ahead and real-time markets during the AAHs consistent with the MOO for the given resource and RA capacity type. However, there is no consideration for how well a resource actually performs in response to ISO dispatch instructions. For example, a resource subject to RAAIM that bids full capacity into the day-ahead and real-time market and responds perfectly to ISO dispatch instructions will receive that same RAAIM incentive as a resource that bids full capacity and ignores all ISO dispatch instructions. The ISO believes any availability/performance assessment should include resource performance relative to ISO commitments and dispatch instructions in addition to fulfilling the MOO.

The ISO is contemplating an assessment based on two measures: availability and performance. The availability assessment would be a measure of the resource's obligation relative to the bid capacity. This would be designed to ensure the resource is made available consistent with its must offer obligation. The performance aspect would be a comparison between dispatch instruction and metered output to assess of the resource is actually following its dispatch. The ISO is contemplating assessing overall performance based on the greater of the resource's obligation or bid, minus the resource's metered output. This would ensure that both the bidding and performance obligations are reflected in the assessment. For example, a 150 MW resource

may be shown as for 100 MW of RA capacity, submit economic bids for 90 MW, receives a 75 MW dispatch instruction, and have a 60 MW actual dispatch. The ISO believes all of these aspects are important, and should be a part of a new availability/performance assessment. The ISO seeks stakeholder feedback on how it might incorporate each of these aspects into an availability/performance assessment.

Currently, RAAIM is developed as a self-funding mechanism where the charges for under-performance are used to fund over-performance. Currently, the assessment is limited to a resource's shown RA value. However, the ISO is contemplating if it should allow resources to eligible for this incentive on a given day if they provide capacity above its shown RA value and perform according to ISO dispatch instructions. This would create an additional incentive for resources to make capacity above its RA value available to the ISO. This assessment, similar to RAAIM today will look at resources availability on a single day. The ISO must ensure a resource is not able to avoid charges on one day for an outage with over-performance on another. The ISO is seeking stakeholder feedback on how to do so. Finally, assessments of both day-ahead and real-time bidding obligations have created numerous complexities in the RAAIM calculation. Although the ISO continues to believe compliance with day-ahead bidding obligations remains important, for purposes of any availability/performance assessment, the ISO is considering assessing only real-time bidding and performance. Again, the ISO seeks stakeholder input on the moving to a real-time assessment only.

4.2.5. Penalty Structure: Pricing & Allocation

Currently, RAAIM assesses all capacity types – system, local, and flexible – at the same monthly capacity price. This means that the ISO currently applies the price for RA capacity, regardless of whether the resource has been shown for one or all three types of capacity. However, given that the ISO is considering various event based triggers for an availability/performance assessment, it will also explore the option of seeking different pricing structures for each capacity type. This would mean that there could be three separate capacity values, one for each type of capacity. Although this could result in more accurate valuation for each capacity attribute and allow the ISO to receive the benefit of system capacity availability even if the resource self-schedules (i.e., does not provide its flexible capacity), the ISO must still determine what the correct price for each attribute should be given the current lack of capacity price transparency. Therefore, the ISO will explore different capacity prices for system, local, and flexible capacity for an availability/performance assessment, but seeks stakeholder input about how best to determine the prices for each attribute.

As noted above, RAAIM is currently developed as a self-funded incentive mechanism. This means that any applicable charges paid by under-performing resources are put into a pool that is used to pay resources that are available above the performance threshold. Those availability thresholds are currently 94.5 percent for penalties and 98.5 percent for incentives. There is a cap on total annual RAAIM incentive payments for a specific resource. Once this cap is exceeded RAAIM payments are credited back to load. If the ISO employs NQC counting rules, using forced outage rates, it is not clear that a self-funding mechanism still makes sense. If the ISO adopts new NQC counting rules that consider forced outages, then potential NQC

reductions should ensure resources are available as much as possible. The ISO believes it may be appropriate to allocate any availability/performance assessment penalties back to resources that bid above their RA value and perform well when dispatched and to load. The ISO will consider how to design a fair and effective allocation of funds collected under any penalty and is open to stakeholder input on these issues. The ISO also believes that performance relative to a resource's RA value should be considered the minimum standard. This means that it is probable that there would no longer be an incentive for performance above a given minimum performance threshold. However, it may still be appropriate to compensate resources that exceed that minimum threshold, if it is determined that some of the penalty funds should still be allocated to high performing resources. The ISO seeks stakeholder feedback on these performance and availability assessment concepts.

4.3. Local Capacity Assessments with Availability-Limited Resources

As a part of California's RA program, the ISO performs studies to ensure adequate capacity is procured in local areas to mitigate potential local reliability issues in those areas. As California transitions to a lower carbon grid, the ISO will likely depend more heavily on resources with availability limitations, such as limitations on run-time duration or event calls. It is important the ISO enhance its processes to ensure the RA program considers these limitations when determining the amount of procurement required in local areas.

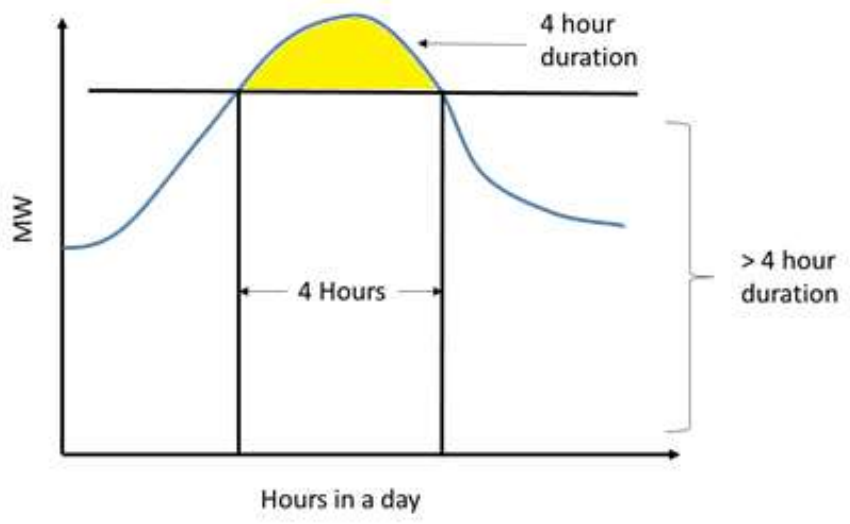
As discussed in Section 4.3.2, the ISO proposes to define availability-limited resources as those that have significant dispatch limitations such as limited duration hours (e.g., per year, season, month, or day) or event calls (e.g., per year, season, month or consecutive days) that would limit the resources' ability to respond to a contingency event within a local capacity area. As these resources make up an increasingly greater portion of the ISO's resource mix, the ISO believes it is important to evaluate local capacity needs considering these resources' availability limitations to help guide the effective procurement of local resource adequacy resources.

The RA program is currently based on meeting a peak capacity requirement defined in MWs without full consideration of resource availability needs, like resource duration or event calls. For example, today, availability-limited resources have a minimum duration requirement of four hours to qualify for resource adequacy. Under the current RA program, a 10 MW resource that is capable of producing for 4 hours, or 40 MWhs has the same resource adequacy capacity value as a 10 MW resource capable of producing for 8 hours, or 80 MWhs. However, if a local capacity area requires 10 MW of capacity for an eight hour period during a contingency event, only the latter is capable meeting this reliability need. Yet, from an RA perspective, these hypothetical resources are valued the same because the current RA program does not consider the availability limitations of the resources when determining RA capacity values. This has the potential for the ISO to be sufficient in MWs to meet peak demand needs but insufficient in MWhs to meet energy needs across all hours of the day and year.

Figure 1 demonstrates how the ISO can use availability-limited resources to meet the peak, but may need resources with a longer duration in order to meet energy needs in other hours of the

day. The black vertical lines reflect a four hour minimum availability threshold. Below the black horizontal line is load that will need to be served with resources with greater than four hours of availability.

Figure 1: Hourly Load Shape with Four Hour Minimum Availability Threshold



Each year, the ISO conducts its local capacity technical study to determine the minimum amount of local capacity area resources needed to address local area contingencies. In preforming the study and setting local capacity requirements, the current process does not consider hourly load and resource analysis. However, in recent transmission planning studies, specifically the Moorpark and Santa Clara studies, the ISO developed and performed detailed hourly load and resource analyses to determine whether there were binding availability limits in the local capacity sub-areas.[9] This allowed the ISO to determine local capacity procurement needs more precisely by evaluating both the capacity and energy needs in those local areas. These studies show that availability-limited resources with a four-hour minimum duration were insufficient in meeting the energy (i.e., total MWhs) required to fully address the contingency events identified in the local capacity criteria.

4.3.1. Scope of Policy Examination

This straw proposal documents a proposed definition for availability limited resources and outlines the enhancements to the local capacity technical study the ISO will make under its existing tariff authority to inform stakeholders of availability needs within local capacity areas and sub-areas.

[9] CAISO, Moorpark Sub-Area Local Capacity Alternative Study, August 16, 2017, http://www.caiso.com/Documents/Aug16_2017_MoorparkSub-AreaLocalCapacityRequirementStudy-PuentePowerProject_15-AFC-01.pdf; and Santa Clara Sub-Area Local Capacity Technical Analysis, June 18, 2018, http://www.caiso.com/Documents/2023LocalCapacityTechnicalAnalysisfortheSantaClaraSub-Area.pdf.

4.3.2. Defining Availability-Limited Resources

The ISO proposes to define availability-limited resources as those that have 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 would limit the resources' ability to respond to a contingency event within a local capacity area. This proposed definition is limited to resources that count towards meeting a local capacity area or sub-area need.[10]

4.3.3. Local Capacity Technical Studies

Each year, the ISO conducts its Local Capacity Technical Study (LCT Study), to determine the minimum amount of capacity needed in each local capacity area to ensure reliable grid operations. As part of this study process, the ISO reviews the study criteria, methodology, assumptions, and study results with stakeholders and receives stakeholder input. The ISO's LCT studies look out one and five years forward each year, and ten years forward every other year. The study results for year one determine the local RA requirements as required by ISO Tariff section 40.3. The long-term studies aide local regulatory authorities and LSEs in long-term procurement decisions.

As described above, the current study process determines the amount of capacity in MW, based on a 1-in-10 peak load forecast, required to mitigate local reliability problems. Moving forward, the ISO plans to enhance its study process to include consideration of availability limitations such that the ISO can ensure sufficient energy (MWh) is available in addition to MW of capacity. In future years, the ISO will include hourly load and available resource data within its existing Local Capacity Technical Study reports to guide resource procurement.

After load serving entities procure local capacity resources, the ISO will validate the annual RA showings based on power flow modeling to consider reactive power and locational impacts of the procured resources. The ISO will model the load and resource dispatch for each hour of the 24-hour period obtained from the hourly load and resource analysis in the power flow model as needed to confirm that the dispatch meets local capacity needs. If the dispatch in any hour failed to meet these needs, the ISO will use the existing process to allow load serving entities to cure any deficiencies. The ISO plans to incorporate the hourly load and available resource data into the one, five, and ten year study reports.

The ISO plans to maintain the existing LCT Study process with certain changes described below to determine availability needs in each local area and sub-area. The ISO will continue to conduct its annual LCT study to determine the capacity requirements (in MW) for each local capacity area and sub-area, but the hourly load and available resource data will provide additional information regarding availability needs in each local capacity area.

[10] See CAISO Track 2 Testimony Chapter 6: Availability Limited Resources: http://www.caiso.com/Documents/Jul10_2018_RAProceedingTrack2Testimon-Chapter6-AvailabilityLimitedResources_ProposalNo5_R17-09-020.pdf

Additional Inputs for Hourly Load and Available Resource Data

Additional inputs that are not included in the current LCT study include:

A. **Projected hourly load data** for each local capacity area and sub-area for each year of analysis. The projected load data should include the impact of behind-the-meter PV in order to determine the net-load shape. It should exclude the impact of supply-side demand response resources.

B. **Voltage stability or thermal area load limit** for the critical contingency for each local capacity area and sub-area, for each year of analysis. In the determination of the load limit, CAISO will assume all conventional (non-availability-limited, non-variable) resources that have not announced to retire will be available throughout the resource adequacy horizon. Voltage collapse or thermal overloads for contingency events are typically the most limiting condition and often sets the local area requirements.

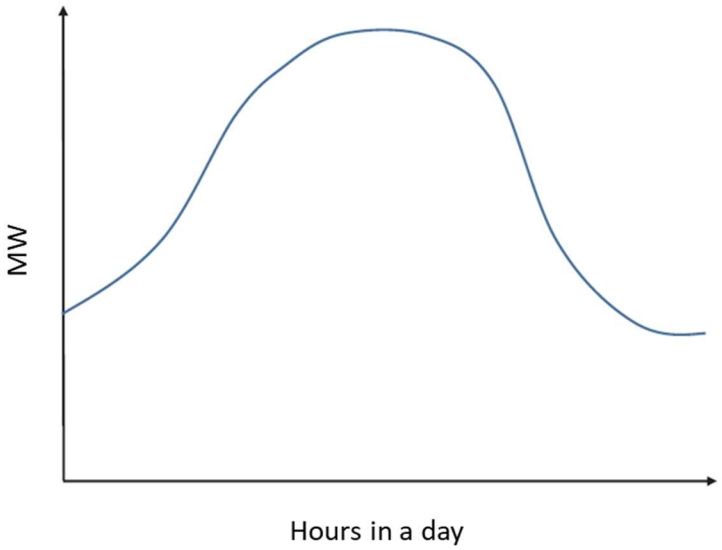
C. **Intermittent resource output at the time of the area or sub-area net peak** is required in order to evaluate if a resource is effective in mitigating the reliability needs.

Steps in Providing Hourly Load and Available Resource Data

Using the additional inputs and information available from the current LCT study (such as existing and expected online resources in each local area and sub-area), the ISO will provide a spreadsheet-based hourly load and available resource data for each local capacity area and sub-area. The ISO will perform the following steps as part of the hourly load and available resource data.

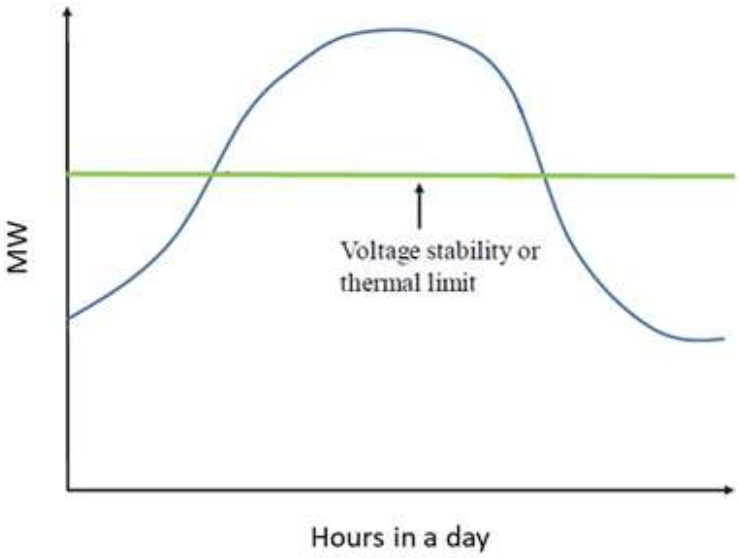
1. **Determine the hourly net load shape for each year of analysis** based on the hourly load forecast and output data from behind the meter solar PV within the local area or sub-area.

Figure 2: Illustrative Hourly Net Load Shape



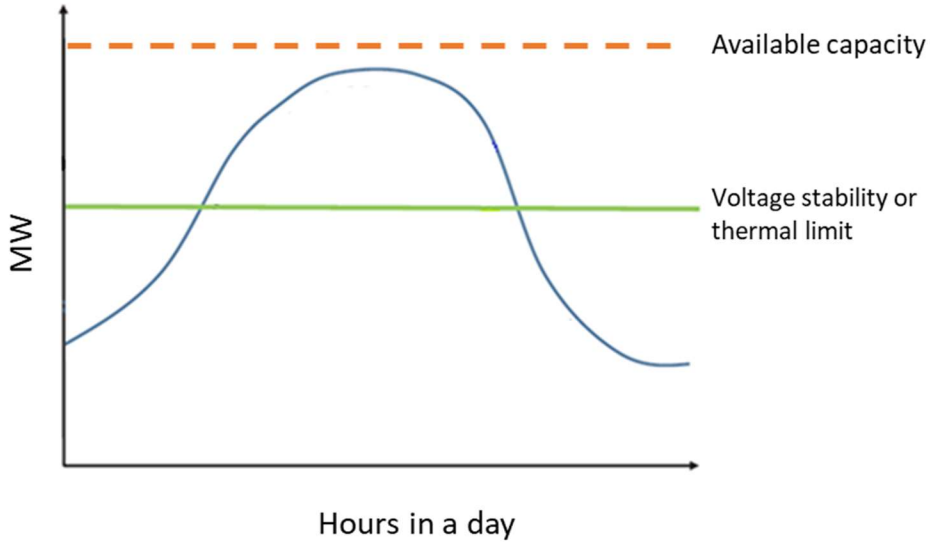
2. **Subtract the voltage stability or thermal area load limit (from input analysis) to derive the remaining load that may be served by local capacity area resources.** In Figure 3, this area is bounded by the voltage stability or thermal area load limit (green horizontal line) and the hourly net load. The area below the voltage stability or thermal area load limit represents load that can be served by generation outside the local area. The area above the voltage stability or thermal area load limit represents load that must be served from resources within the local area.

Figure 3: Voltage Stability or Thermal Area Load Limit



3. **Determine the available MWs of capacity from all resources in the local area** using generation expected to be online during the study period.

Figure 4: Available Capacity in the Local Area



This analysis enhances the RA program by allowing load serving entities to make procurement decisions for the upcoming year based on the quantity of capacity (in MW) *and* energy (in MWhs) that will need to be served by generation located within the local capacity area. Additionally, the ISO can inform longer term procurement and investment decisions by providing greater transparency into the ISO's duration needs multiple years out. The ISO plans to incorporate this analysis into the existing Local Capacity Technical Study process to guide resource procurement that is aligned with operational needs. The ISO will continue to coordinate with stakeholders when setting local RA requirements. To ensure procurement of resources with sufficient availability, the ISO will provide this data when setting local resource adequacy requirements, and will enforce them during the RA showings validation process. This will enable resource procurement that is better aligned with local capacity area needs by including the duration resources must be available to ensure local capacity area reliability. In providing this data, the ISO can ensure that sufficient resources are procured to meet operational needs in all hours of the day.

4.4. Meeting Local Capacity Needs with Slow Demand Response

For reliable operation of the grid, the ISO depends on adequate supply from resources in local areas to meet load. Demand response resources can help manage the system in local areas by reducing load when the local area is constrained. However, the characteristics of certain demand response resources lead to potential challenges that impact how the market dispatches these resources and how the ISO can use them to respond to a contingency. Specifically, "slow" demand response cannot respond to dispatch instructions provided by the ISO within 20 minutes for the ISO to reposition the system within 30 minutes, due to the additional notification time required for the resource to perform after it receives a dispatch instruction from the ISO.

While many demand response resources can quickly deliver energy at a scheduled time, demand response resource operators may require longer lead times to know specifically when to deliver that energy. The ISO market system issues instructions to each resource to operate at specific operating levels every five minutes. Resource operators must increase or decrease their resource's output to match these five minute instructions. Once online, conventional resources are prepared and ready to follow varying five-minute dispatches from the market. However, some demand response resource operators require longer notification times before they can perform and, therefore, cannot deliver energy following a varying five minute dispatch. To address this need, the ISO introduced block bidding options within the Energy Storage and Distributed Energy Resources Phase 3 (ESDER 3) initiative to provide longer notification times and extended real-time dispatch intervals, as discussed in the following sections.

The ISO and the California Public Utilities Commission (CPUC) have been working to ensure both "fast" and "slow" demand response resources are capable of meeting local reliability requirements.[11] For the purposes of this paper, the ISO defines slow demand response as demand response resources that cannot respond to an ISO dispatch instruction within 20 minutes. After a contingency occurs or when the system enters an N-1 insecure state (loss of a single critical element), the ISO must dispatch resources to return the system to an N-1 secure state within 30 minutes to minimize the risk the next contingency poses on the reliability of the system, accounting for a small amount of time for ISO operators to perform their real-time assessment and react to the contingency condition. After the contingency and real-time assessment, the ISO is left with approximately 20 minutes for resources to provide generation and load drop within the 30 minute timeframe.

Based on the need to reposition the system within 30 minutes, the ISO has three options:

1. Post-Contingency Dispatch: By assessing the system, issuing dispatch instructions, and having a response within 20 minutes
2. Pre-Contingency Dispatch: By dispatching resources pre-contingency so as to have sufficient energy (or load reduction) available before the contingency occurs
3. Pre-Contingency and Post-Contingency Dispatch: Using a combination of pre- and post-contingency dispatch.

In 2017, the ISO performed a study to assess the availability requirements of slow-response resources, such as demand response, to count for local resource adequacy.[12] The study found that at current levels, most existing slow-response DR resources appear to have the required availability characteristics needed for local RA if dispatched pre-contingency as a last resort, with the exception of minimum run time duration limitations. As discussed in the prior section, the ISO will address duration limitations through the annual Local Capacity Requirements

[11] https://www.caiso.com/Documents/BPMChangeManagementAppealsCommitteeDecision-PRR854.pdf
[12] CAISO-CPUC Joint Workshop, Slow Response Local Capacity Resource Assessment: https://www.caiso.com/Documents/Presentation_JointISO_CPUCWorkshopSlowResponseLocalCapacityResourceAssessment_Oct42017.pdf.

stakeholder process through hourly load and resource analysis. The study did not consider the use of these resources purely for economic purposes.

The ISO initiated the Slow DR effort to operationalize slow demand response resources so they can be eligible to provide local resource adequacy capacity. Slow demand response resources that cannot respond within appropriate timeframes following a system event, due to the need for longer notification times, can still be useful in maintaining system reliability in local areas. In this straw proposal, the ISO presents a methodology for allowing slow demand response resources to be economically dispatched through the market as a preventive measure in preparing for a possible contingency using the policy frameworks proposed in the CAISO's ESDER 3 and Contingency Modeling Enhancements (CME) initiatives. ESDER 3 will provide PDRs hourly and 15-minute block bidding options. The CME proposal will introduce a preventive-corrective constraint into the market optimization such that it produces a pre-contingency dispatch that keeps the post-contingency system conditions within safe operating limits. Under these proposals, the market will economically consider slow PDRs and dispatch them within a timeframe that will help resolve local reliability issues. The market will use these resources to provide local reliability by dispatching them pre-contingency for energy in the real-time market to prepare for potential post-contingency reliability concerns.

Additionally, this straw proposal includes an interim solution for pre-contingency dispatching slow demand response resources, to be used until the ESDER 3 and CME initiatives are implemented. While these initiatives are planned for implementation in the future, it is important the ISO has the ability to utilize these resources for local area reliability concerns in the interim. As detailed below, the ISO will use a modified approach to the existing Minimum Online Commitment (MOC) constraint as a way to dispatch slow demand response pre-contingency until the appropriate market mechanisms are implemented.

Finally, this straw proposal introduces qualifiers for resources to qualify for local RA, such that the ISO can ensure these resources can be used to mitigate local area contingencies.

4.4.1. Scope of Policy Examination

The ISO is examining avenues to facilitate the dispatch of slow demand response prior to a contingency in order for these resources to qualify for local RA. The ISO is focusing on market mechanisms to operationalize this pre-contingency dispatch as a long term solution. The ISO is also considering interim solutions that allow these resources to be used in local area reliability situations, such that the ISO can re-position the system within the appropriate time constraints.

The scope of this effort will include:

- The long term market based solution, including block bidding options proposed in ESDER 3 and the preventive-corrective constraint proposed in CME,
- An interim solution using a modified MOC to dispatch slow DR resources,
- Resource qualifications for local RA eligibility.

4.4.2. Long-Term Solution: Pre-Contingency Dispatch Slow DR through ESDER 3 and CME Implementation

Hourly and Fifteen-Minute Block Bidding Options Provide Extended Notification Time

As part of the ISO's ESDER 3 initiative, the ISO introduced real-time bidding options for PDR similar to the real-time bidding options for interties, including hourly block and 15-minute bidding options. The ISO incorporated these bidding options in its ESDER 3 initiative to provide longer notification times and extended real-time dispatch intervals to proxy demand resources (PDRs). The ISO believes that by providing these bidding options, PDR that requires notification time will be able to participate more effectively in the market by leveraging the market timelines and advance dispatch notice these new bidding options provide.

With the hourly block bidding option, the SC submits a day-ahead market bid for the entire hour. In the real-time market, the resource will submit an economic bid and receive a binding price for the first 15-minute interval and be a price taker for the next three 15-minute intervals of the hour. The binding real-time hourly block schedule is communicated at 52.5 minutes before the flow of energy.

With the 15-minute bidding option, the SC submits a day-ahead market bid for the entire hour. In the real-time market, if the 15-minute bid is economic, it will be dispatched and receive a binding schedule at the fifteen-minute market (FMM) price. The dispatch notification is communicated at 22.5 minutes prior to the flow of energy.

Contingency Modeling Enhancements Provide Market Mechanism to Dispatch Slow DR Pre-Contingency

The CAISO conducted the CME effort to explore ways in which the CAISO can more effectively address the need to reposition the system after a contingency within 30 minutes. These enhancements introduced the preventive-corrective market optimization model that considers post-contingency system conditions and co-optimizes both pre-contingency dispatches and post-contingency dispatches to meet reliability needs. To ensure the market has adequate resources available to reposition the system after a contingency, CME introduced a new market product, corrective capacity, so that the market can reserve capacity on resources to be used in the event of a contingency. The preventative-corrective model will reserve corrective capacity on resources with the ramping capability and the ability to respond to mitigate contingencies within the required timeframe. When a contingency occurs, corrective capacity is dispatched for energy using real-time contingency dispatch (RTCD) to return the system to normal operating levels within 30 minutes.

The CAISO will leverage the new real-time bidding options available to PDR to pre-contingency dispatch slow responding DR for energy above their Pmin when it is economic to do so using the preventative-corrective market optimization model. Using these tools will enable slow responding DR to qualify as local RA capacity and more effectively respond to contingencies in local capacity areas.

Operationalizing Slow PDR through CME and ESDER 3 Implementation

While slow responding PDR cannot respond to dispatches post-contingency within the required timeframe, these resources can be useful for maintaining reliability by reducing load in local capacity areas. This section discusses how slow responding DR resources can be dispatched pre-contingency to lower loads in anticipation of a contingency.

To receive longer notification times, PDR must elect either the hourly or 15-minute block bidding options proposed in ESDER 3. If the PDR resource elects these bidding options, the resource will not be eligible for corrective capacity awards under CME because the market cannot use these resources to resolve contingencies within the required timeframe if they are dispatched after the contingency occurs. However, while the market cannot reserve corrective capacity for slow response resources, the preventive-corrective constraint may find it economic to pre-dispatch slow response resources for load reduction in the Real-Time Unit Commitment (RTUC) intervals prior to a potential contingency, rather than relying on corrective capacity from other resources. This would occur when it would cost more to reserve corrective capacity from another resource than to economically drop load from the slow responding PDR prior to a contingency occurring. When economic, pre-contingency dispatch of slow responding PDR would decrease the amount of corrective capacity needed to satisfy the preventive-corrective constraint. This proposal is consistent with the proposals put forth in the Commitment Costs Enhancements Phase 3 initiative that allow PDRs to preserve their starts through the use of opportunity costs.

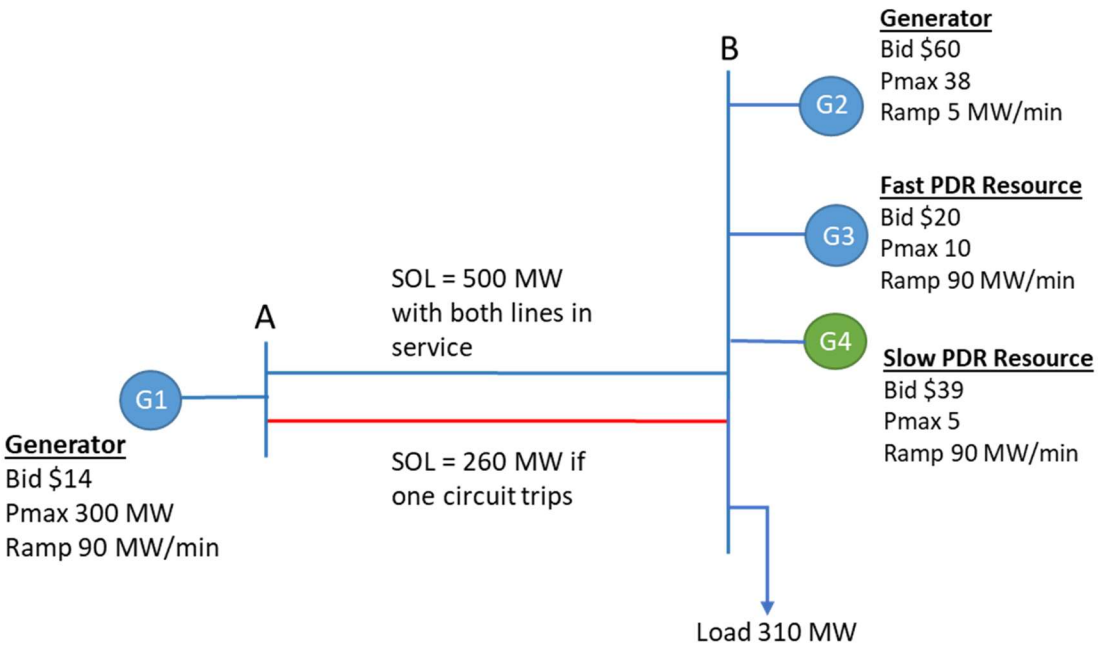
The following example demonstrates how slow responding DR can help lower load in anticipation of a contingency under the preventive-corrective model by receiving a dispatch in RTUC to reduce load in real-time.

Example: A Two-Node System with Two Traditional Generators and Two DR Resources

This example is a two-node system with two traditional generators and two PDRs. At node B, there are 2 PDRs, G3 and G4. G3 is not a slow response resource because can respond to 5 minute dispatches without the need for additional notification time. G4 requires a notification time of at least 50 minutes and therefore, is considered a slow response PDR. Under pre-contingency normal conditions, the limit on lines A-B is 500 MW. If a circuit trips and only one line is in service, the system would need to be repositioned to its post-contingency normal limit of 260 MW. When a contingency occurs, CAISO will have a total of 30 minutes (10 minutes for operator activities and 20 minutes for resource response) to get the system to the post-contingency normal rating of 260 MW.[13]

[13] The post-contingency emergency limit for the single line is now 500 MW.

Figure 5: A Two-Node System with Two Traditional Generators and Two DR Resources



Today, the market would dispatch G1, the cheapest generation, up to its Pmax of 300 MW on lines A-B and 10 MW from G3, the next cheapest generation, to serve the load of 310 MW at node B. This solution is demonstrated in Table 3.

Table 3: Energy Awards without CME

Energy Awards without CME		
Generator	**Energy Award (MW)**	**LMP ($/MW)**
G1	300	14
G2	0	20
G3 (PDR)	10	20
G4 (Slow DR)	0	20

This solution is blind to the post-contingency limit of 260 MW. If a contingency occurred, the flow on lines A-B would need to reduce from 300 MW to 260 MW within 20 minutes. This solution does not set up the system to be able to respond quickly enough through market dispatches to a contingency after it occurs because G3 is already dispatched to its Pmax of 10 MW, G2 would be dispatched to its Pmax of 38 and the system would still require 2 MWs to serve all the load at

node B. The slow responding DR cannot be accessed quickly enough post-contingency due to the notification time required for slow DR to be dispatched.

With CME in place, the market will consider the post-contingency limit in its solution, 260 MW in this example. If a contingency occurs, the system would need to decrease flow from A-B by 40 MW to stay within the post-contingency limit and increase generation by 40 MW at node B to serve all 310 MWs of load. This solution is demonstrated in Table 4.

Table 4: Energy and Corrective Capacity Awards with CME

Energy and Corrective Capacity Awards with CME				
Generator	**Energy Award (MW)**	**LMP ($/MW)**	**Corrective Capacity Award (MW)**	**LMCP ($/MW)**
G1	300	14	-40	0
G2	0	39	35	19
G3 (PDR)	5	39	5	19
G4 (Slow DR)	5	39	0	19

G1 receives a 300 MW energy award and a 40 MW downward corrective capacity award. The downward corrective capacity award is not priced because it is not constrained by its ramp rate, Pmax, or Pmin. To balance the 40 MW of downward corrective capacity at node A, the system will award 40 MW of upward capacity at node B. Because the G4 is a slow PDR and cannot respond within the required timeframe, it will not receive a corrective capacity award in the real-time. Instead, the system will award G2 35 MW of corrective capacity. G3 will receive a 5 MW corrective capacity award and a 5 MW energy award. G3 is constrained by its Pmax, and so the next most economic resource, the slow DR resource, will provide the rest of the energy required to serve the load. In this example, the market positions the system so that it serves all the load pre-contingency while reserving corrective capacity so that it can return the system to its post-contingency limit should a contingency occur.

In the event of a contingency, CAISO operations will run its real-time contingency dispatch (RTCD) to dispatch corrective capacity from capacity into energy. In the example above, RTCD would dispatch G1 from 300 MW of energy down to 260 MW of energy to reduce flow on the line to its post-contingency rating. To replace the 40 MW from reduced from G1, RTCD would dispatch G2 from 0 MW to 35 MW of energy and G3 from 5 MW to 10 MW of energy.

Slow DR resources cannot respond quickly enough within the post-contingency timeframe in order to mitigate local area contingencies within 30 minutes. As such, slow DR cannot receive corrective capacity awards and would not be dispatched by RTCD in the event of a contingency.

Instead, they would be dispatched pre-contingency when they are economic over awarding another resource a corrective capacity and should preform based on their energy dispatch in RTUC whether or not a contingency occurs in real-time.

4.4.3. Interim Solution: Use Modified MOC to Provide Day-Ahead Pre-Contingency Dispatch

Along with the study on slow response local capacity resources and the real-time block bidding options, the CAISO introduced the Minimum Online Commitment (MOC) Constraint as a mechanism for pre-contingency dispatching slow DR.[14] MOC constraints are market mechanisms enforced in the day-ahead market used to ensure sufficient unit commitment is available that is effective in addressing specified contingencies. The MOC ensures real-time reliability by committing resources in the day-ahead market to ensure system reliability following a contingency in real-time. Currently, MOC constraints are defined by engineering analysis to identify the minimum generation capacity requirements within local areas. MOCs then commit resources to their Pmin to meet these requirements.

The ISO believes the MOC as it currently exists is insufficient in operationalizing slow DR for two reasons. First, the MOC would commit DR resources to their Pmin, often zero. Once committed, the DR resource must submit bids into the real-time market, and they may be dispatched by the market above their Pmin without the notification time they require. Second, there is currently no constraint in the real-time market to enforce the pre-contingency dispatch of slow DR. Therefore, the CAISO proposes to develop a modified MOC constraint, referenced here as minimum online dispatch (MOD), that can commit resources above their Pmin and maintains their schedule from the MOD in day-ahead through real-time. These MODs will be defined in local areas that show potential for reliance on slow DR based on transmission planning studies. The ISO will define MODs in these local areas in which MODs could effectively dispatch slow DR to resolve local area contingencies.

The ISO plans to define MODs in local areas with slow demand response. Only resources that require pre-contingency dispatch will be included in the MOD, and they will be dispatched when load in the local capacity area is greater than the import capability plus the generation availably to the day-ahead market. The MOD requirement will be determined as follows:

MOD Requirement = Local Area Load – Import Capability – Available Generation, where:

- MOD Requirement = A MW value of slow DR the needs to be dispatched prior to a contingency occurring as a preventive measure
- Local Area Load = Day-ahead load forecast of local capacity area load
- Import Capability = import capability into the local capacity area

[14] CAISO-CPUC Joint Workshop, Slow Response Local Capacity Resource Assessment: https://www.caiso.com/Documents/Presentation_JointISO_CPUCWorkshopSlowResponseLocalCapacityResourceAssessment_Oct42017.pdf.

- Available Generation = MWs bid into the day-ahead market from generation within the local capacity area

When the MOD requirement is greater than zero, the MOD will dispatch resources for energy, rather than only committing them to Pmin as MOCs do today, based on their bids into the day-ahead market and their effectiveness at resolving the constraint. Because there is currently no constraint in the real-time market to dispatch slow DR resources pre-contingency, the day-ahead market dispatches provided by the MOD must be binding through real-time in order to preserve the pre-contingency dispatch. The ISO is currently exploring potential options for ensuring binding day-ahead dispatches for resources committed through the MOD. One option is the creation of an operating procedure instructing resources to follow their day ahead dispatch when committed by the MOD. Another option is added market functionality to recognize these dispatches and self-schedule them through real-time.

4.4.4. Qualifications for Local RA Eligibility

Eligibility for local RA is subject to availability requirements determined by the CAISO and the California Public Utilities Commission for availability-limited resources. The CAISO is refining local capacity assessments to include an assessment of the impact of availability-limited resources on local capacity needs within the Local Capacity Requirements stakeholder process.[15] Additionally, the ISO proposes to include the following qualifications for a resource to be eligible for local RA.

Operationalizing Slow DR Resources through Block Bidding Options

In the interim, the ISO will continue to count resources that require a day-ahead notification as local RA because the MOD will provide dispatches to slow demand response resources in the day-ahead. However, once the ISO transitions to the long term solution, only slow demand response resources that are dispatchable in real-time through the hourly or fifteen-minute block bidding options will be eligible for local RA.

The block bidding options allow the market to access the resource in the day-ahead and real-time market, while also giving the resource adequate notification time. Additionally, the block bidding options ensure that the resource receives a binding dispatch instruction in the fifteen minute market, and will not be re-dispatched in the five minute market. Because the market adjusts a resource's scheduled output for each market run, slow DR must use the hourly or 15-minute block bidding option to ensure it is not re-dispatched in the five-minute market intervals. Therefore, once the slow DR receives a hourly block or fifteen-minute energy award, the award is binding, the resource will not be re-dispatched in RTD, and it must perform according to its RTUC energy award in real-time.

Resources that require a day-ahead notification of a binding dispatch will not be eligible for local RA once the ISO transitions to the long term solution. Under the existing market timelines, the ISO provides unit commitments (i.e., starts) and schedules in the day-ahead but does not

[15] Local Capacity Requirements Stakeholder Initiative Webpage: http://www.caiso.com/informed/Pages/StakeholderProcesses/LocalCapacityRequirementsProcess.aspx

dispatch units in the day-ahead. Additionally, extending pre-contingency dispatches beyond the existing real-time market time horizons limits the ISO's the ability to adjust resource output in response to changes between day-ahead and real-time system conditions.

Slow Reliability Demand Response Resources

As discussed in previous comments submitted to the CPUC's RA proceeding, slow Reliability Demand Response Resources (RDRR) are not able to be dispatched pre-contingency due to its unique dispatch limitations, and as such, should not be eligible to count as local RA.[16] While PDRs participate in the ISO market and offer their services when they are economic, RDRR resources are not selected for normal dispatch in real-time unless the ISO declares a Warning or Emergency. Upon this declaration, the ISO operator may choose to activate the software flag that allows these resources to be dispatched.[17]

Because RDRR is a reliability resource and only dispatched after the ISO calls a Warning or Emergency, the ISO must exclude slow responding RDRR (i.e., those resources that cannot respond to contingencies within 20 minutes) from qualifying for local RA. The ISO cannot declare Warnings or Emergencies pre-contingency in anticipation of an emergency to access RDRR. Therefore, the ISO cannot depend on the pre-contingency dispatch of slow RDRR to address local contingencies.

While slow RDRR cannot provide local RA, fast responding RDRR, or RDRR that can respond within 20 minutes post-contingency, is eligible to count towards local area capacity because it can receive a dispatch and preform in the appropriate time after a contingency occurs.

5. EIM Governing Body Role

For this initiative, the ISO plans to seek approval from the ISO 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 ISO markets. This initiative is focused on ISO RA planning, procurement, and performance obligations. This process applies only to LSEs serving load in the ISO BAA and the resources procured to serve that load, and does not apply to LSEs outside the ISO balancing authority area. The ISO seeks stakeholder feedback on this proposed decisional classification for the initiative.

6. Next Steps

The ISO will discuss this issue paper with stakeholders during a stakeholder meeting on January 16, 2019. Stakeholders are asked to submit written comments by January 30, 2019 to initiativecomments@caiso.com. A comment template will be posted on the ISO's initiative webpage here: http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx

[16] CAISO Comments on Resource Adequacy Proposals, September 28, 2017. Page 4: http://www.caiso.com/Documents/Mar7_2018_Comments-ResourceAdequacyProposals_R17-09-020.pdf
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7. Appendix

7.1. Availability Assessment Hours

2019 System and Local Resource Adequacy Availability Assessment Hours

Summer: April 1 – October 31

Availability Assessment Hours: 4pm – 9pm (HE17 – HE21)

Winter: November 1 – March 31

Availability Assessment Hours: 4pm – 9pm (HE17 – HE21)

2019 Flexible Resource Adequacy Availability Assessment Hours and must offer obligation hours

Flexible RA Capacity Type	Category Designation	Required Bidding Hours	Required Bidding Days
January – April, October – December			
Base Ramping	Category 1	05:00am to 10:00pm (HE6-HE22)	All days
Peak Ramping	Category 2	2:00pm to 7:00pm (HE15-HE19)	All days
Super-Peak Ramping	Category 3	2:00pm to 7:00pm (HE15-HE19)	Non-Holiday Weekdays*
May – September			
Base Ramping	Category 1	05:00am to 10:00pm (HE6-HE22)	All days
Peak Ramping	Category 2	3:00pm to 8:00pm (HE16-HE20)	All days
Super-Peak Ramping	Category 3	3:00pm to 8:00pm (HE16-HE20)	Non-Holiday Weekdays*

This information can also be found in the ISO Reliability Requirements BPM in Section 7.1.1, here: http://www.caiso.com/rules/Pages/BusinessPracticeManuals/Default.aspx.