Resource Adequacy Enhancements: Second Revised Straw Proposal Stakeholder Meeting

October 9, 2019

CAISO will focus on select topics that have advanced since the last proposal

Additional development

- UCAP need and supporting forced outage data (including RAAIM)
- Must-offer obligations
- Planned outage process
- RA Import assessment
- Flexible RA product and rules
- UCAP for Local
- Slow DR and availability limited resources in local areas*

*Moved to a separate DFP

No major changes from previous iteration

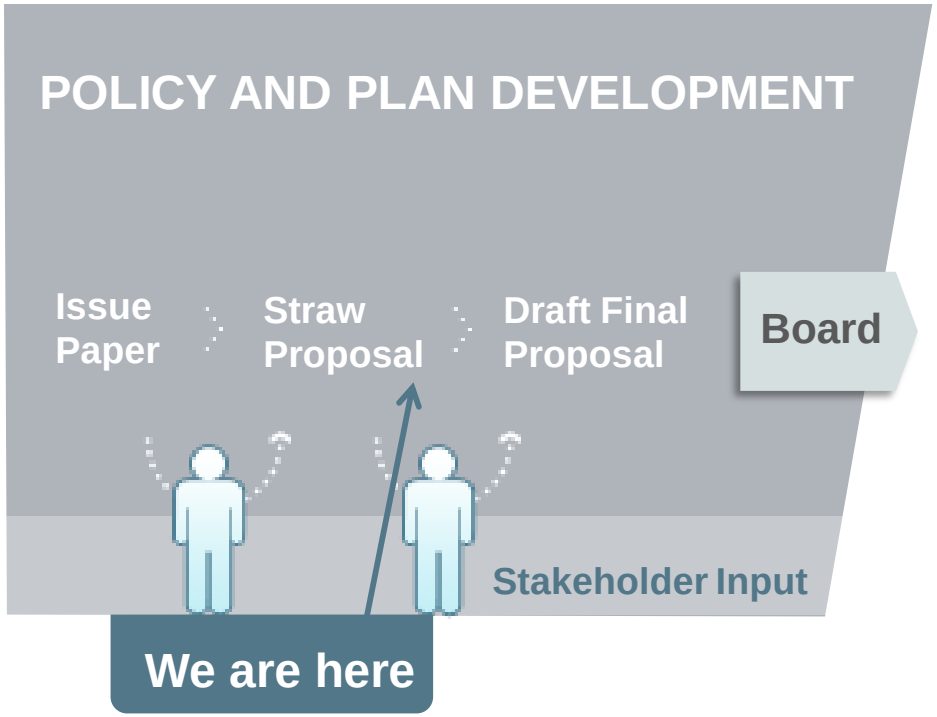
- Principles and objectives
- UCAP counting rules
- Portfolio test
- MIC**
- Backstop authority and deficiency tool

** Removed from scope and will receive its own stakeholder process

Agenda

Time	Agenda Topic	Presenter
10:00-10:05AM	Welcome and Introduction	Kristina Osborne
10:05-10:15AM	Principles & Objectives	Karl Meesuen
10:15-11:30AM	UCAP Needs and Analysis	Karl Meeusen
11:30AM-12:00PM	Must Offer Obligation and Bid Insertion Modifications	Lauren Carr
12:00-1:00PM	LUNCH	
1:00-1:30PM	Must Offer Obligation and Bid Insertion Modifications	Lauren Carr
1:30-2:15PM	Planned Outage Process Enhancements	Karl Meeusen
2:15-3:00PM	RA Import Provisions	Chris Devon
3:00-4:00PM	Flexible RA	Karl Meeusen
4:00-4:50PM	Local RA	Karl Meeusen and Lauren Carr
4:50-5:00PM	Next Steps	Kristina Osborne

Stakeholder Process



PRINCIPLES AND OBJECTIVES

Principle: The resource adequacy framework must reflect the evolving needs of the grid

- As fleet transitions to clean, variable, and energy-limited resources traditional resource adequacy must be revisited
- Including assessment of more than simply having sufficient capacity to meet peak demand
- RA requirements and assessments must reflect evolving needs
- RA framework must accurately evaluate and value resources that can meet CAISO's operational and reliability needs all hours of the year

Principle: RA counting rules should promote procurement of 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
- Transparent information on quality of resources available to load-serving entities will improve procurement
- Allow for the most reliable, dependable and effective resources to sell their capacity

Principle: RA program should incentivize showing all RA resources

- Modifications to existing RA structure should encourage showing as much contracted RA capacity as possible and not create disincentives or barriers to showing excess RA capacity
- CAISO must balance the impact that incentives may have on an LSE's willingness to show all contracted RA capacity

Principle: LSE's RA resources must be capable of meeting load requirements all hours

- RA targets should be clear, easily understood and based on reasonably stable criteria applied uniformly across all LSEs
- Traditional accounting approaches such as current summation of NQC values in a LSE's portfolio do not equate to resource adequacy alone
  - This approach does not assure an LSE can satisfy its load requirements all hours of the year
- RA also encompasses LSEs meeting their load requirements all hours of the year, not just meeting peak demand

Objectives – RA Enhancements

- Update RA framework to assess forced outage rates for resources
  - Incorporate forced outages into procurement process upfront in planning horizon
- Conduct RA adequacy assessments based on unforced capacity of resources and RA portfolio's ability to ensure CAISO can serve load and meet reliability standards
  - Incorporating forced outages into RA assessment will help inform which resources are most effective and reliable at helping California decarbonize its grid
- Simplify existing RA provisions that are complex and interrelated to extent possible while considering impacts to resulting incentives

Objectives – RA Enhancements

- Modifications must be coordinated and remain aligned with the CPUC process and decisions
- However, solely relying on installed-capacity-based PRM as the only basis for resource adequacy is not sustainable given the transforming grid
  - Increasing reliance on more variable, less predictable, and energy limited resources may show sufficient capacity to meet traditional PRM measures, but may not have sufficient capability to meet reliability needs and load requirements in all hours
- Utilization of both installed capacity (NQC) and unforced capacity (UCAP) values in CAISO's RA processes
  - Resulting Must Offer Obligations need to be tied to RA showing NQC values to accomplish these important changes

SYSTEM RESOURCE ADEQUACY

Overview of System RA Topics

- Determining System RA requirements
- Forced Outage Rates and RA capacity counting
- System RA Showings and sufficiency testing
- Must Offer Obligation and Bid Insertion modifications
- Planned Outage Process enhancements
- RA Import provisions
- Maximum Import Capability provisions

DETERMINING SYSTEM RA REQUIREMENTS

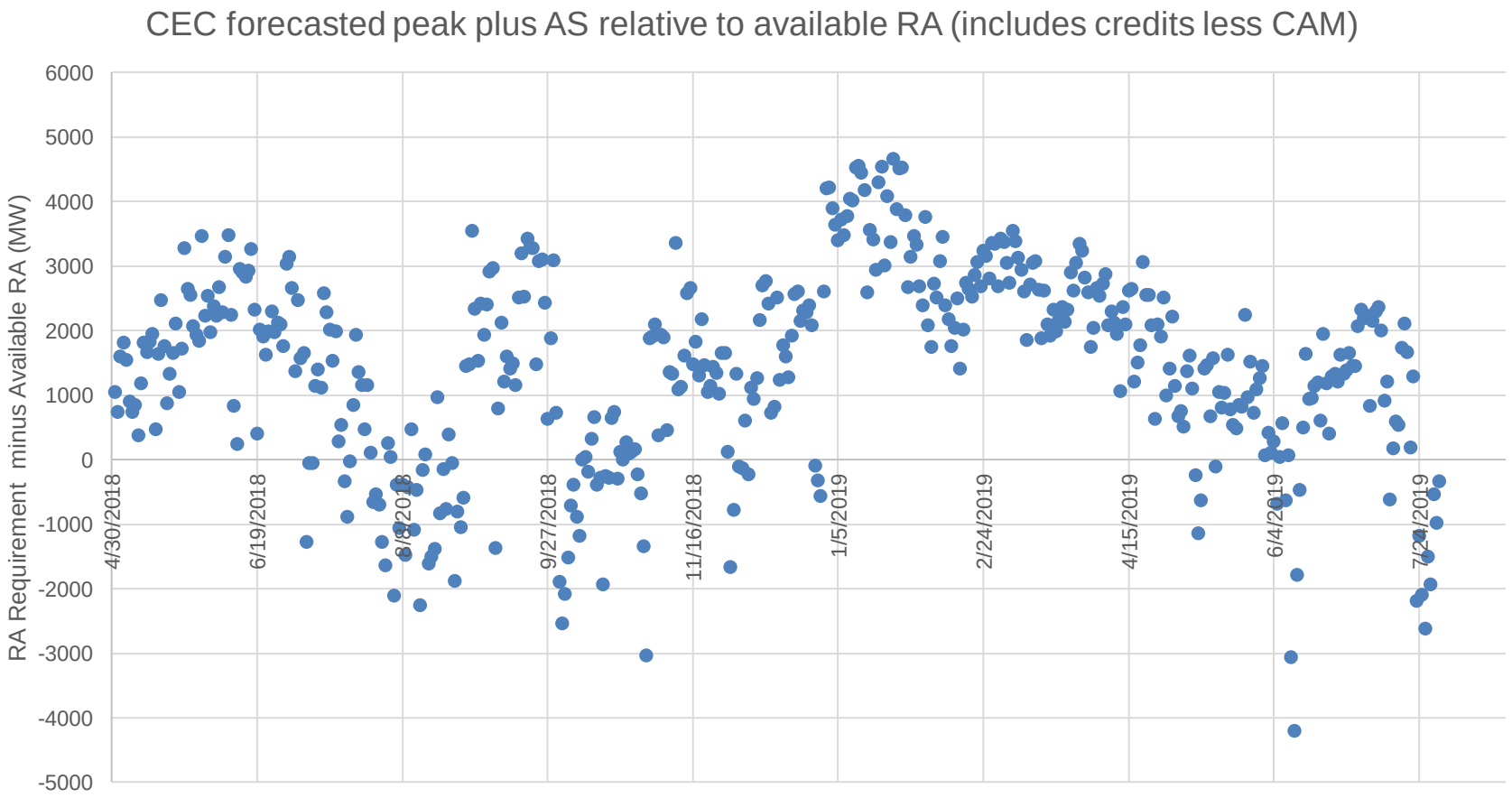
System UCAP requirement proposed to more adequately address forced outage risks

- CAISO has observed impacts of forced outages exceeding resource margins established by existing planning reserve margin requirements during some periods
  - This is a potential reliability concern
- To better address this risk posed by forced outages CAISO is proposing to establish a system unforced capacity (UCAP) requirement to more directly account for forced outages
  - Develop a minimum system UCAP requirement that all LSEs must meet and show as RA

Current RA requirements may be insufficient to address forced outages

- Current structure is designed to cover
  - peak forecasted load,
  - operating reserves,
  - forced outages, and
  - demand forecast error
- CAISO analyzed data from its CIRA system
  - How did the RA requirements do at covering expected needs
  - RA need was CEC 1-in-2 forecast plus 6 percent for reserves
    - Forecast error was excluded from the assessment
  - Compared need to available RA capacity
    - Shown RA capacity plus credits minus forced outages

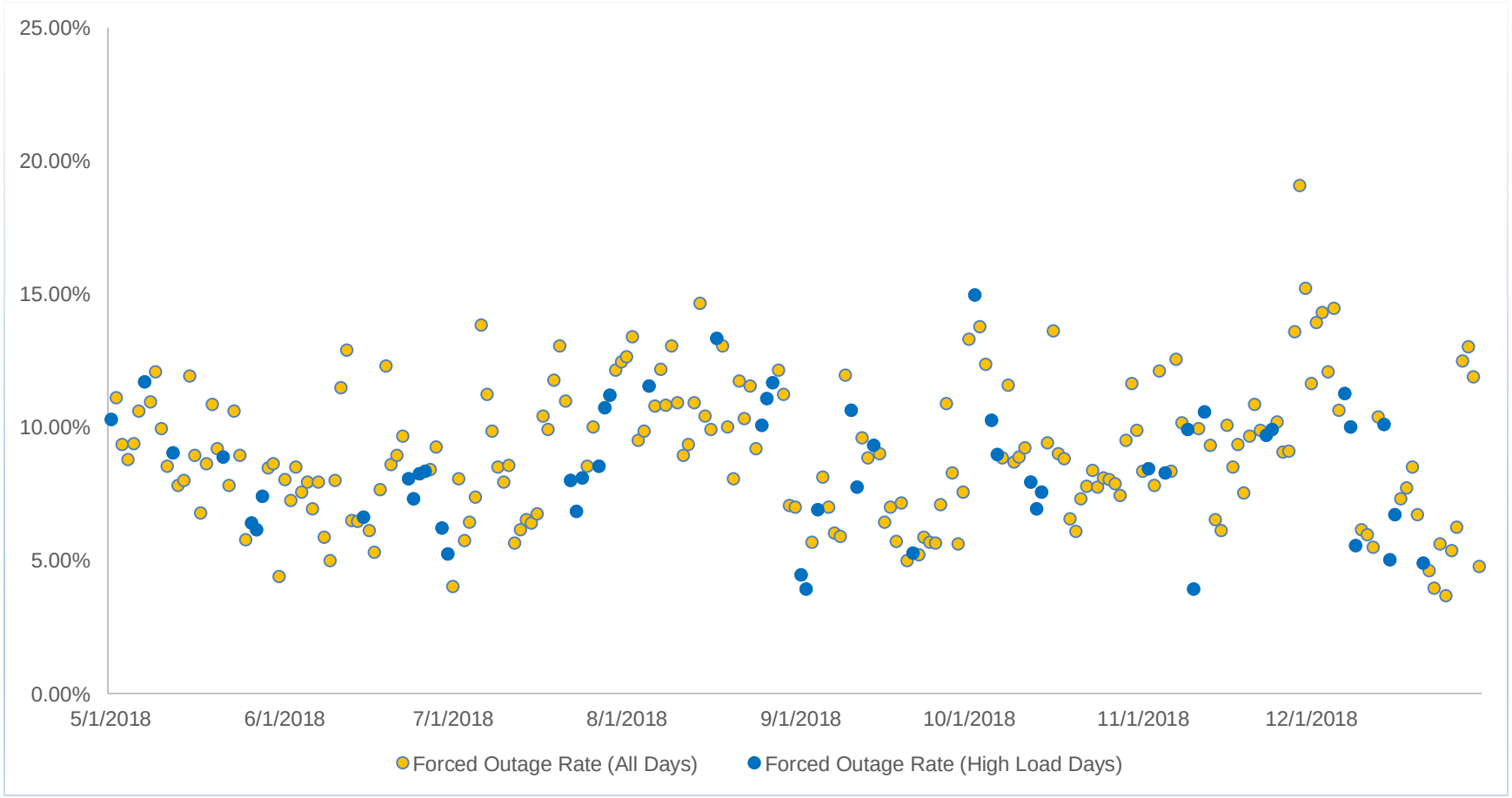
Data shows numerous instances of available RA capacity falling well below the minimum RA need



Data shows numerous instances of available RA capacity falling well below the minimum RA need

- On just over 17.5 percent of the days, CAISO would not have adequate RA capacity to meet its planning targets
  - Assumes that 100 percent of all RA credits are available at the fully credited level (i.e. over 1000 MW of credited demand response)
- Increases to 25 percent of days if 500 MW of credited capacity is not available or responsive for any reason

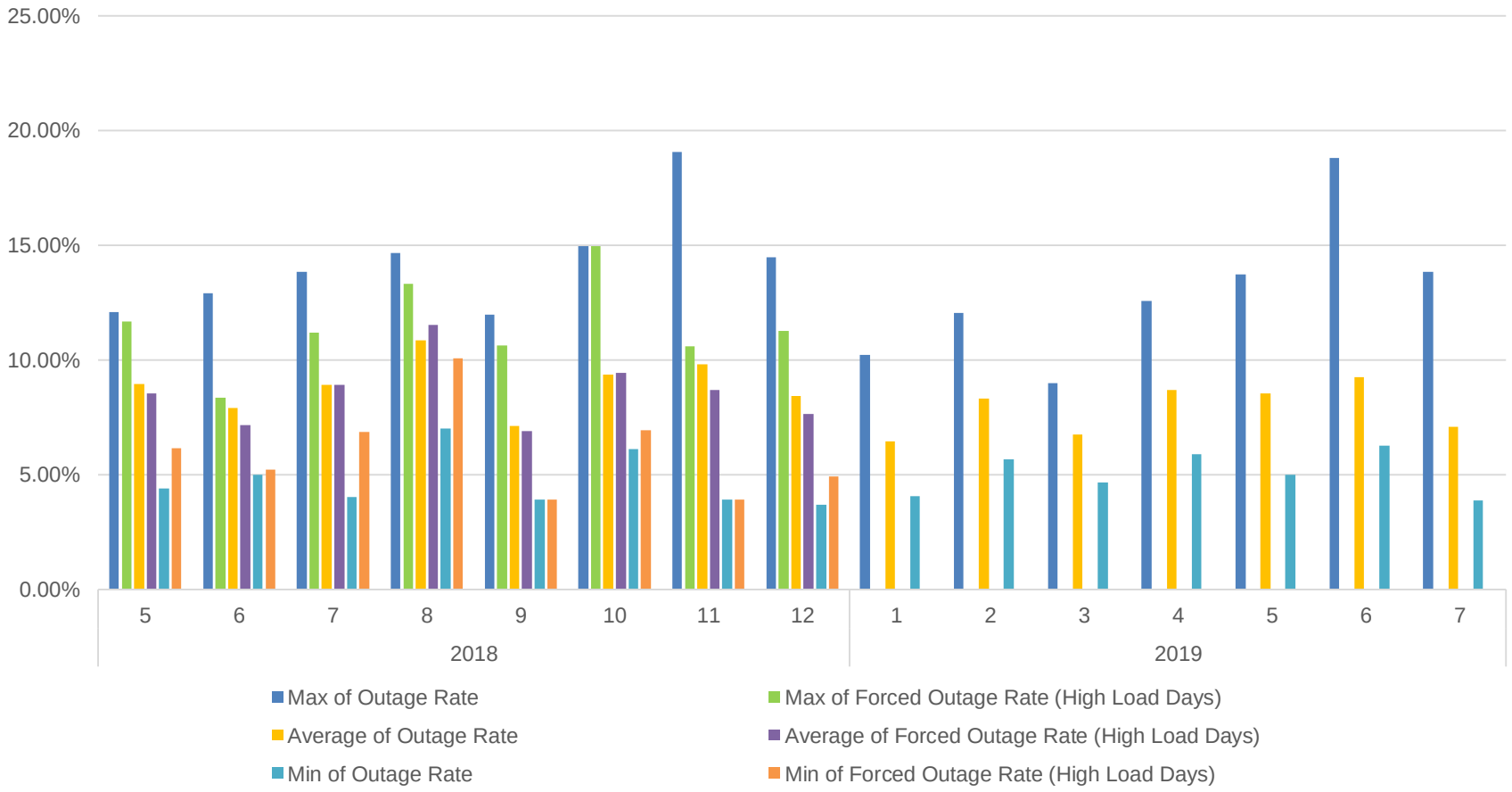
Forced outages rates do not appear to differ greatly based on load



A planning reserve margin should assume forced outage rates are the same regardless of load

- Forced outage rates are regularly in excess of ten percent
- Exceeds 15 percent on multiple occasions
  - Including higher load days
- LRA setting a planning reserve margin that accurately and thoroughly accounts for forced outages should include at least a 10-15 percent range on top of the forecasted peak demand

Forced outage rates regularly exceed ten percent



CAISO has examined a top-down and bottom-up approach to setting UCAP needs

- Top down approach assumes all units in a given tech type will have the same average forced outage rate
  - Problematic if there is a wide distribution of forced outage rates
- Bottom up looks at forecasted load need and examines each unit individually
  - Relies on an accurate forecast or one that adequately covers the risk of forecast error
- CAISO believes the bottom-up approach is best to establish a minimum system UCAP requirement
  - Ensures minimum RA requirements are achieved

Proposed CAISO system UCAP requirement

- CAISO believes bottom-up approach to establish a minimum system RA UCAP requirement is appropriate
- Will help ensure minimum resource adequacy requirements are achieved system-wide for all LSEs
- Multiple LRAs and potential variance in LRA PRM targets drives need for bottom up system UCAP requirement
  - Also mitigates potential for capacity leaning by LRAs and their respective LSEs
- CAISO is closely considering how to best ensure coordination of these important system RA modifications with CPUC and other LRA's RA programs

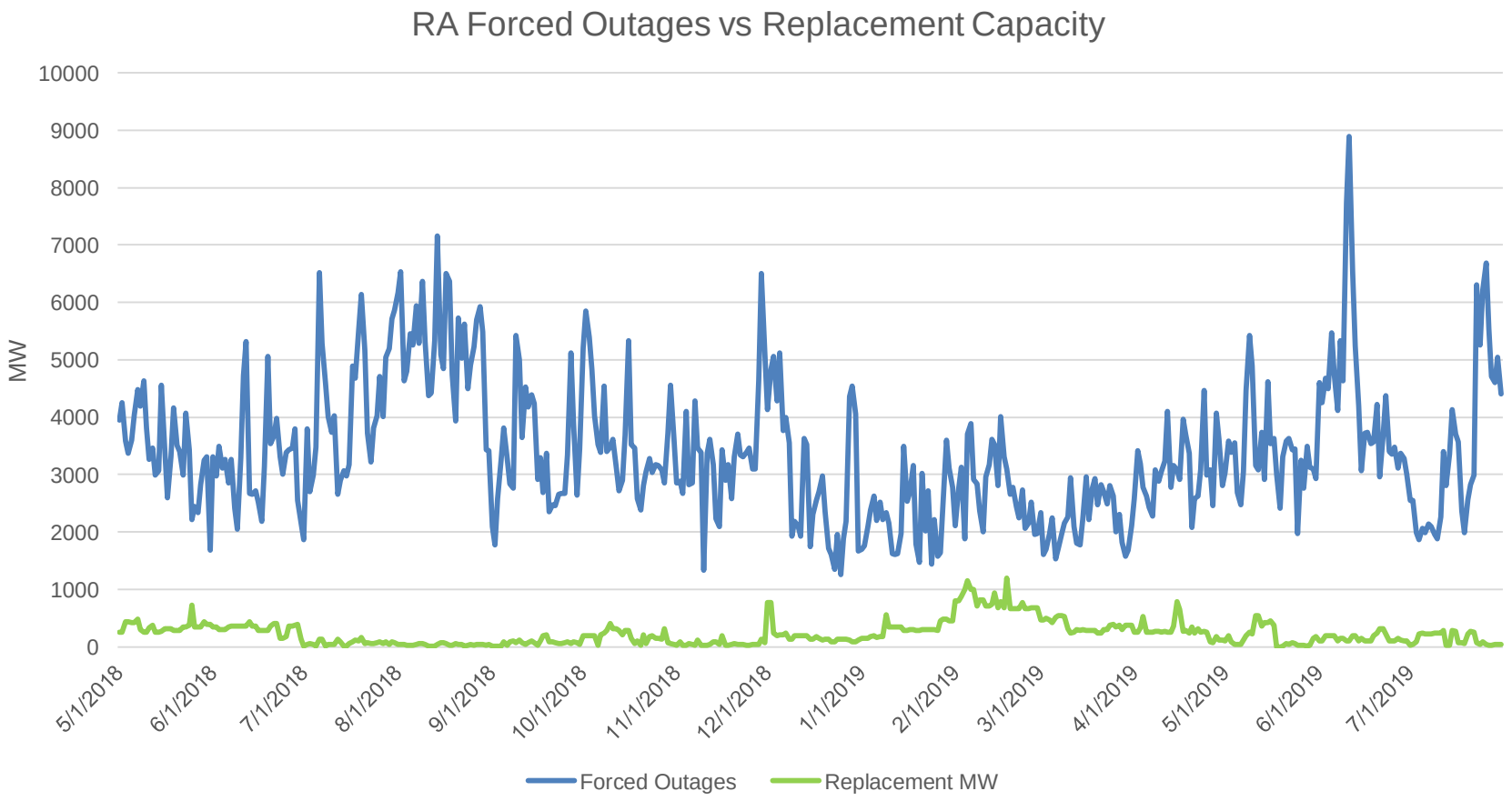
Regardless of approach, more conservative load forecast should be used

- Forecast error can be addressed by using a higher load forecast
  - Higher load forecast ensure more diverse load profiles can be addressed by RA procurement
- Does not address the fundamental and underlying issue of forced outages
- Minimum UCAP requirement must determine how to address under-forecasting risks
  - 1-in-10 = no additional error included in need
  - 1-in-2 = all additional error included in PRM

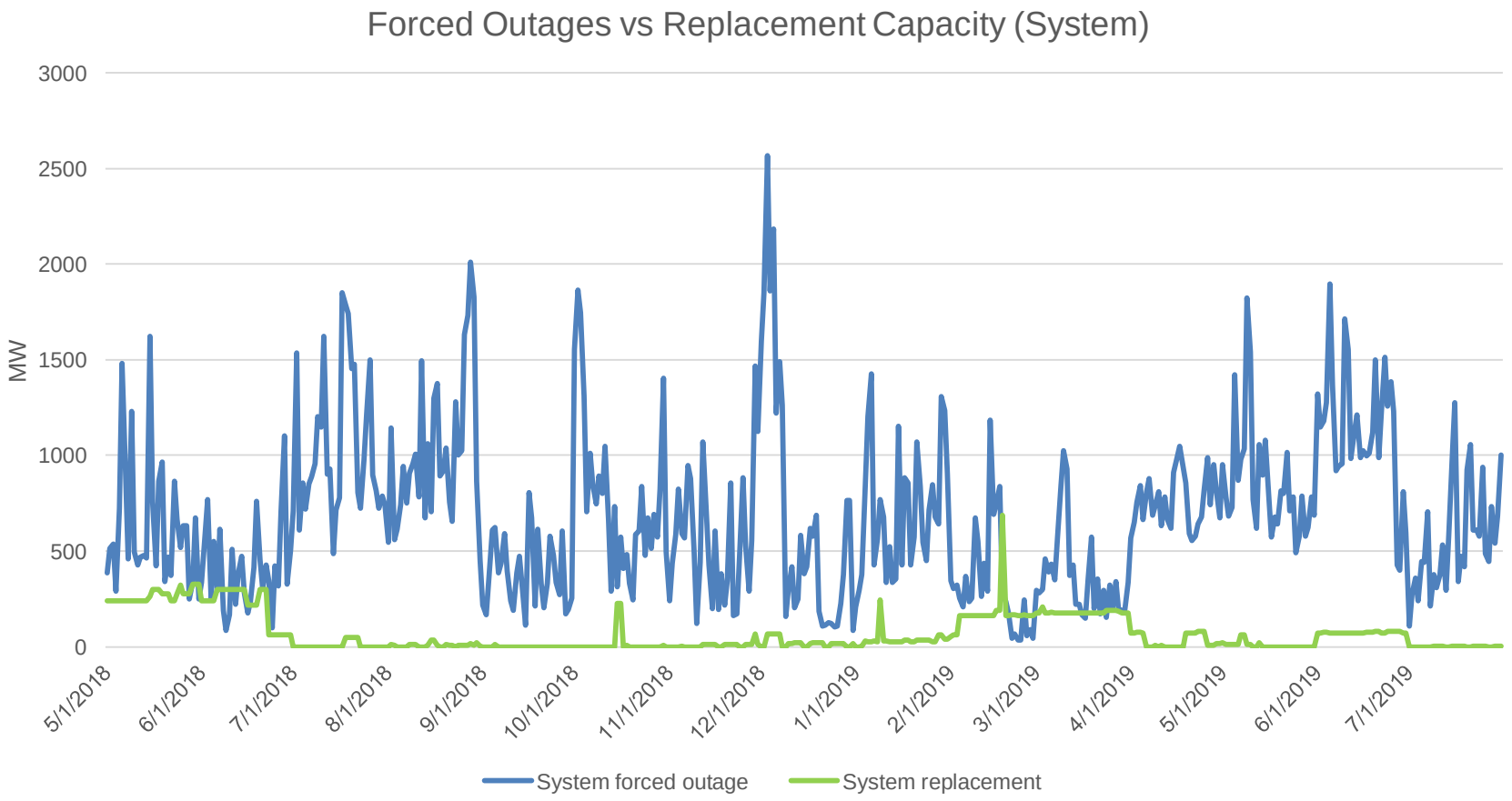
The CAISO studied how well RAAIM incentivized replacement during forced outages

- Compared the quantity of
  - Shown RA MW for a given day,
  - Reported MWs of capacity on forced outage, and
  - MWs of forced outage substitute capacity provided
- Did not differentiate the cause of the forced outage
  - i.e. RAAIM exempt or not
- Effectiveness of RAAIM is not simply an assessment of how much of capacity is replaced for certain outage types, but by how well it ensures there is adequate capacity available to CAISO

The CAISO received very little replacement capacity



The CAISO received very little replacement capacity even for system capacity



RAAIM is not providing adequate incentive to provide substitute capacity for forced outages

- The CAISO cannot ascertain whether the cause is due to
  - RAAIM charges already being incorporated into capacity pricing,
  - Insufficient RAAIM charges/revenues,
  - Excessive exclusions/exemptions,
  - The dead band applying for the first outages,
  - Some other reason
- It is reasonable to eliminate RAAIM when the CAISO has a capacity counting tool that provides no dead band and provides more limited exempt outages

Forced Outage Rate Data

- To determine these forced outage rates, CAISO considered two potential data sources:
  - CAISO's Outage Management System, and
  - NERC Generation Availability Data System (GADS)
- OMS data is not currently well configured
- GADS reporting only required for 20 MW and above and not publically available for individual resources
- More universal outage reporting for GADS purposes may not always align with all potential CAISO forced outage nature of work cards

The CAISO forced outage data efforts can be broken down into two objectives

1. Transitioning to UCAP
2. Long term outage collection and reporting

- Continuing to look at both GADS and OMS data while also considering potential for new outage reporting
- Ultimate solution should
  - Align outage reporting in CAISO systems and GADS
  - Provides incentive for individual resources to minimize forced outage rates

Differences between GADS and OMS, makes perfect estimate of UCAP in year one is unlikely

- Must balance precision with complexity and cost
  - Creates a reasonable initial estimate of forced outage rates while a long term system is implemented
- CAISO could initially rely and GADS data to generate UCAP values
  - Fleet averages, or
  - Resource reporting of three years of GADS
- The CAISO would then use these values to generate resource specific UCAP values
- Continuing to work with the existing OMS data

Long term, CAISO believes individual resource accountability is paramount

- CAISO seeks to have a system that more closely tracks to NERC reporting requirements.
- CAISO is considering numerous long-term, options
  - Requires all resources to submit GADS data in order to calculate UCAP values
  - Revisions to OMS to align the outage reporting and categories with these in the NERC standards
  - Not considering GADS fleet averages for anything more than as a transitional tool

CAISO is seeking stakeholder input to assess which of these is a preferred approach

FORCED OUTAGE RATES AND RA CAPACITY COUNTING

CAISO is considering how to apply forced outage rates to capacity values

- Current CAISO and CPUC RA framework does not account for system resources on forced outage beyond margins included in established planning reserve margin requirement
  - Instead, CAISO relies on substitution rules and Resource Adequacy Availability Incentive Mechanism (RAAIM)
- CAISO has proposed new rules to account for probability of forced outages and eliminate need for complicated replacement capacity rules
- Applying forced outage rates to RA values is intended to provide certainty CAISO will receive adequate resources prior to month from resources that will be available

Several advantages for integrating forced outages into resource RA capacity values

- Recognizing individual resource's potential contribution to reliability enables each resource to be compared and contrasted to the reliability of other resources
- Promotes procurement of better performing resources with improved operational reliability and availability
- Information on forced outage rates of resources can help buyers avoid risks and make better informed decisions when making bilateral trades or when procuring replacement RA capacity

Calculating unforced capacity values

- Unforced capacity value – or UCAP of a resource incorporates the availability of a resource using a derating factor referred to as the resource's Effective Forced Outage Rate – or EFOR

UCAP = (NQC) * (1 - EFOR)

- CAISO proposes to calculate and publish monthly NQC and UCAP values for all resources each year
- EFOR and resulting UCAP values will not be impacted by CAISO approved planned outages

CAISO is also considering calculating forced outage rates seasonally

- Contemplating two seasons: summer & winter (peak, off-peak)
- Once calculated, the forced outage rate would be set for each season for the upcoming RA year
- Seasonal calculations may add some complexity, but also better reflect resources' availability during peak and off-peak seasons

SYSTEM RA SHOWINGS AND SUFFICIENCY TESTING

CAISO will conduct two sufficiency tests for system capacity

1. Individual deficiency test

2. Portfolio deficiency test

Designed to ensure:

- Adequate UCAP to maintain reliability for peak load, and
- Portfolio of resources work together to provide reliable operations during all hours when combined and considered together

CAISO will conduct a portfolio deficiency test of only RA resources under various conditions

- Objective of a portfolio analysis is to assess if CAISO can serve load with shown RA fleet
  - CAISO will test forecasted gross, net-load peaks, and all other hours
  - CAISO will also test the ability to maintain adequate reserves and load following
- Need for this assessment is similar in concept to collective deficiency test CAISO conducts for local RA
  - CAISO must assess how the shown RA fleet works collectively to meet system needs
- Assessments conducted only on monthly RA showings
  - Only showing that provides 100 percent of the system, local, and flexible RA capacity requirements

MUST OFFER OBLIGATION AND BID INSERTION MODIFICATIONS

Any resource providing RA capacity is obligated to provide that capacity into the CAISO market

- Must offer obligations must be set at the resource's shown NQC value
  - For example: A resource shown for 100 MW of NQC with a 20% forced outage rate providing 80 MW of UCAP, would have a MOO to bid 100 MW of capacity into CAISO markets
- Allows CAISO to simplify forced outage substitution
  - The RA fleet effectively provides its substitute capacity upfront
  - CAISO proposes to eliminate the existing forced outage substitution rules in favor of UCAP proposal

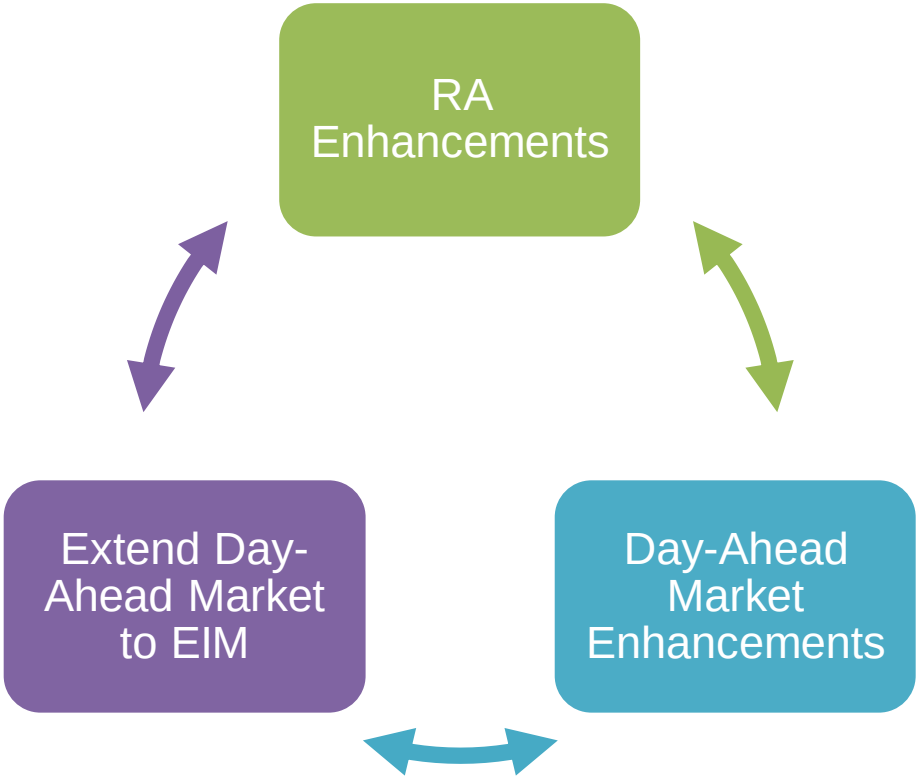
After considering stakeholder feedback and developments in DA Market Enhancements, the CAISO has modified the must offer obligation proposal

- Standard 24 by 7 MOO into day-ahead market
  - Economic bids or self-schedules into the **day-ahead market** for all RA capacity for all hours of the month the resource is not on outage
- Modified proposal to remove blanket 24 by 7 real-time must offer obligation for RA resources
- Day-ahead market awards, including imbalance reserves, will determine the real-time MOO
  - Bidding for imbalance reserves optional for resources shown for generic RA only
- Standard MOO and bid insertion rules will apply unless exempted by the CAISO

Some RA resources must continue to have a real-time must offer obligation due to program design or forecasting needs

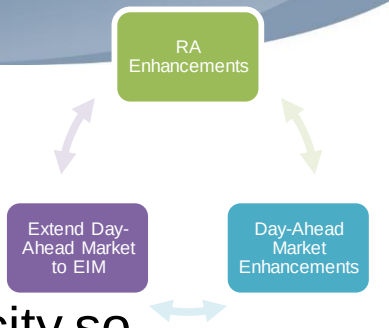
- Reliability Demand Response Resources (RDRR)
  - Only required to participate in real-time when the CAISO declares a warning or emergency, optional to bid in day-ahead
- Variable resources, including VERs and run-of-river hydro
  - Resources with intra-hour variability must bid into real-time to ensure bids reflect real-time availability
  - CAISO proposes run-of-river hydro submit forecasts into day-ahead and real-time
    - Forecasts inform CAISO of resource availability and ensure feasible dispatches
- CAISO is considering the timing of forecast submission and must offer obligations for variable DR in the ESDER 4 initiative

The CAISO will be implementing RA Enhancements, DAME, and EDAM simultaneously in Fall 2021



Need to consider interactions between initiatives during policy development

Each effort has a specific goal and purpose



Resource Adequacy ensures forward procurement of capacity so adequate supply is available and bid in to meet CAISO's load and reliability requirements

- **RA Enhancements** will align the RA requirements with the transforming needs of the CAISO grid

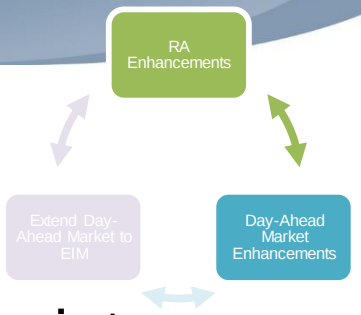
Day-Ahead Market co-optimizes energy and ancillary services to meet daily load and reliability requirements

- **Day-Ahead Market Enhancements** introduces imbalance reserves to meet ramping and uncertainty needs between the day-ahead and real-time markets and appropriately compensate resources to be available for real-time dispatch

Regional Markets allow multiple entities to share resources across a larger footprint to capture diversity and efficiency benefits

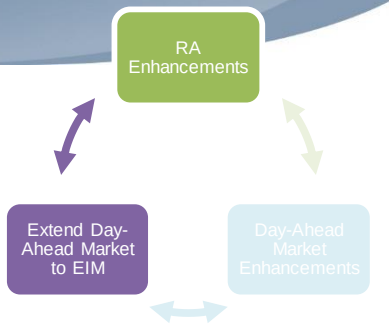
- **Extend Day-Ahead Market to EIM** will develop provisions to allow participation in the day-ahead market by EIM entities, e.g. recognizing different planning and procurement paradigms

RA Enhancements & DAME relationship



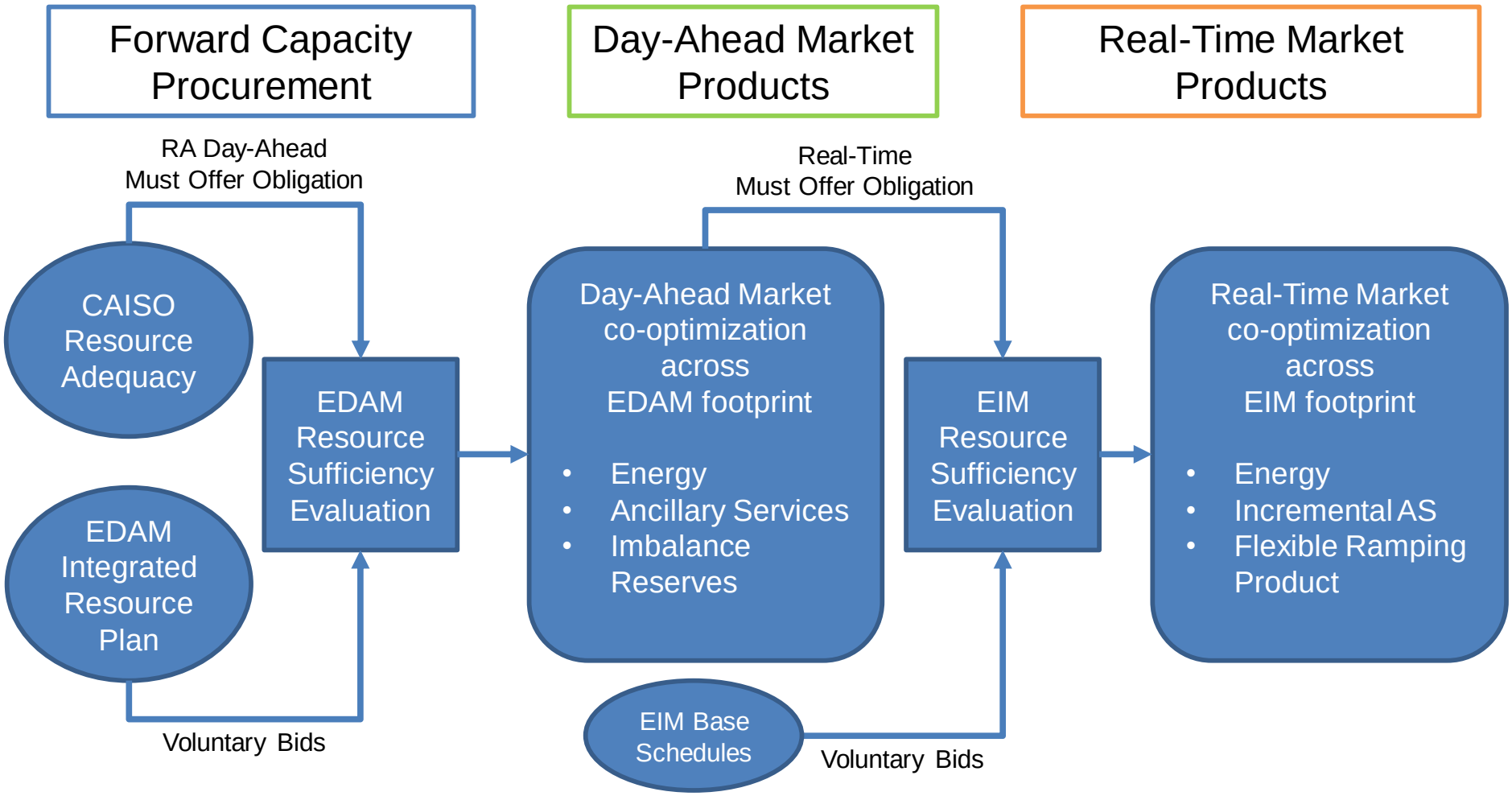
- RA establishes requirement to bid/self-schedule into the day-ahead market
- DAME proposes to introduce a real-time must offer obligation for awarded imbalance reserves
  - Imbalance reserves will replace the need for a resource adequacy real-time market must offer obligation
- Imbalance reserves will cover the incremental cost of making capacity available between the day-ahead and real-time market that is currently embedded in RA contracts

RA Enhancements & EDAM relationship



- Need to avoid double counting of resources in the resource sufficiency evaluation and in RA procurement
- RUC availability bids will be replaced with biddable imbalance reserves
- RA resources will not be required to provide imbalance reserve bids at $0 (as is done today for RUC) to enable efficient scheduling of capacity resources across the footprint

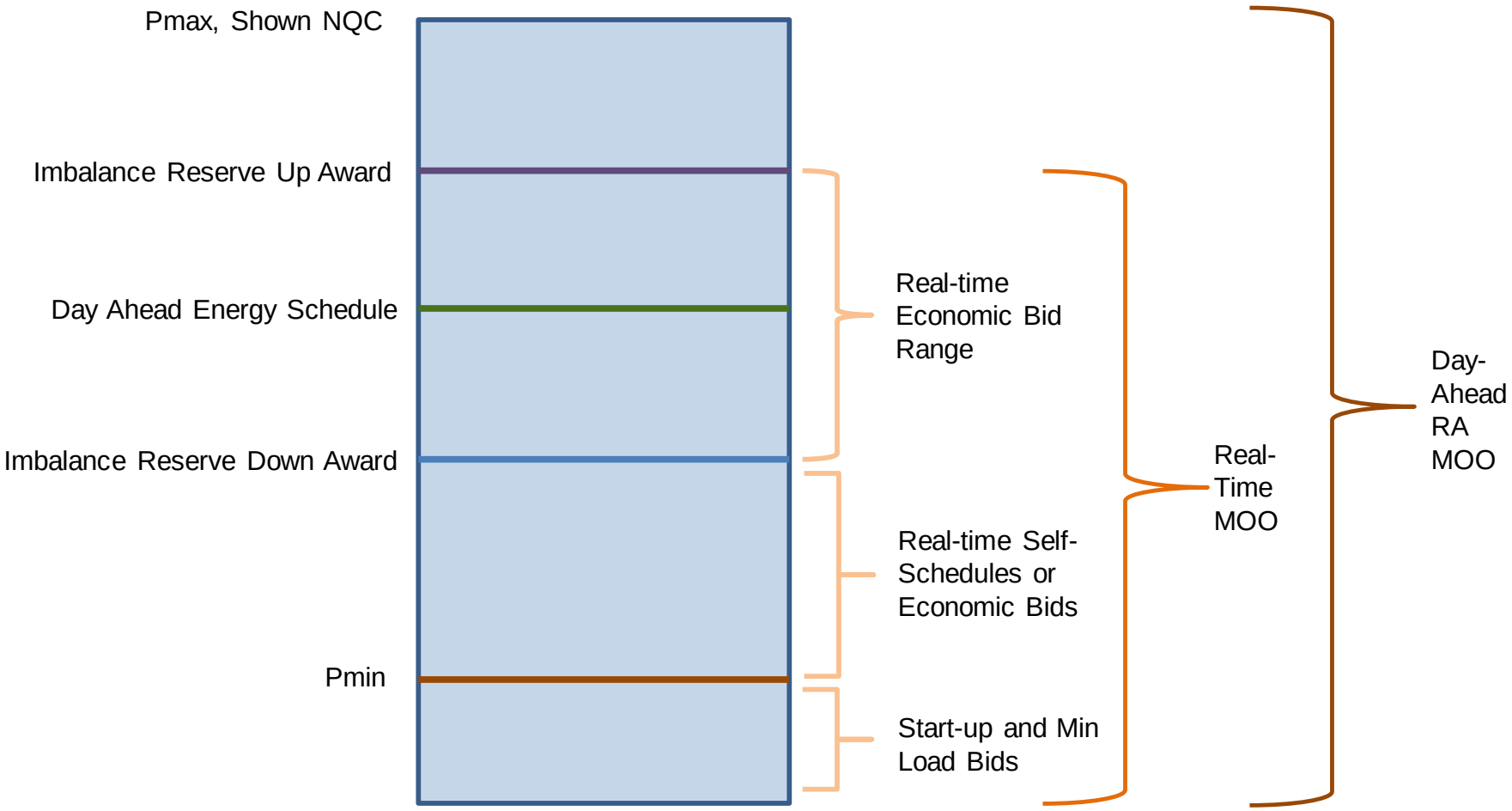
Overview of RA, DAME & EDAM relationship with CAISO market runs



Intended benefits of aligning RA must offer obligations with the imbalance reserve product

- Day-ahead market will be able to accurately commit and position resources to provide upward and downward ramp capability in the real-time market
- Imbalance reserves will allow the CAISO to efficiently manage the RA fleet by creating a real-time market must offer obligation for resources committed in day ahead
- Imbalance reserves should cover the incremental cost of making capacity available between the day-ahead and real-time market that is currently embedded in the RA contracts

Illustrative Must Offer Obligations



CAISO proposes to apply bid insertion to all resources that are not use-limited, and to registered use-limited resources with an opportunity cost

- Enhances CAISO's ability to identify forced outages
  - Resources would need to submit an outage to avoid dispatch
- Provides reliability to CAISO by ensuring bids in the market
- Exemptions required for certain resources that fall outside the categories of non-use-limited or registered use-limited

CAISO initially defines certain exemptions to the 24x7 MOO and bid insertion rules for certain resource types

- For an initial list of proposed exemptions, see table 5 in section 5.4.1 of the Revised Straw Proposal
- Specific proposed modifications to existing exemptions:
  - RDRR: Bid insertion at bid cap in real-time only (currently, no bid insertion for RDRR in DA or RT)
  - Regulatory Must Take (RMT): For any portion of the resource that is RA and RMT, resource must provide documentation of availability and bid per documented availability. For any portion of the resource that is RA and *is not* RMT, resources must bid per the standard MOO

CAISO initially defines certain exemptions to the 24x7 MOO and bid insertion rules for certain resource types

- Specific proposed modifications to existing exemptions (cont.):
  - System RA resources may not submit block bids or block self schedules greater than one hour
  - NGR: Resources participating under NGR must reflect charge and discharge capabilities (currently, MOO is only on the charging portion)
  - NGR resources must register under the non-REM option to provide system RA

PLANNED OUTAGE PROCESS ENHANCEMENTS

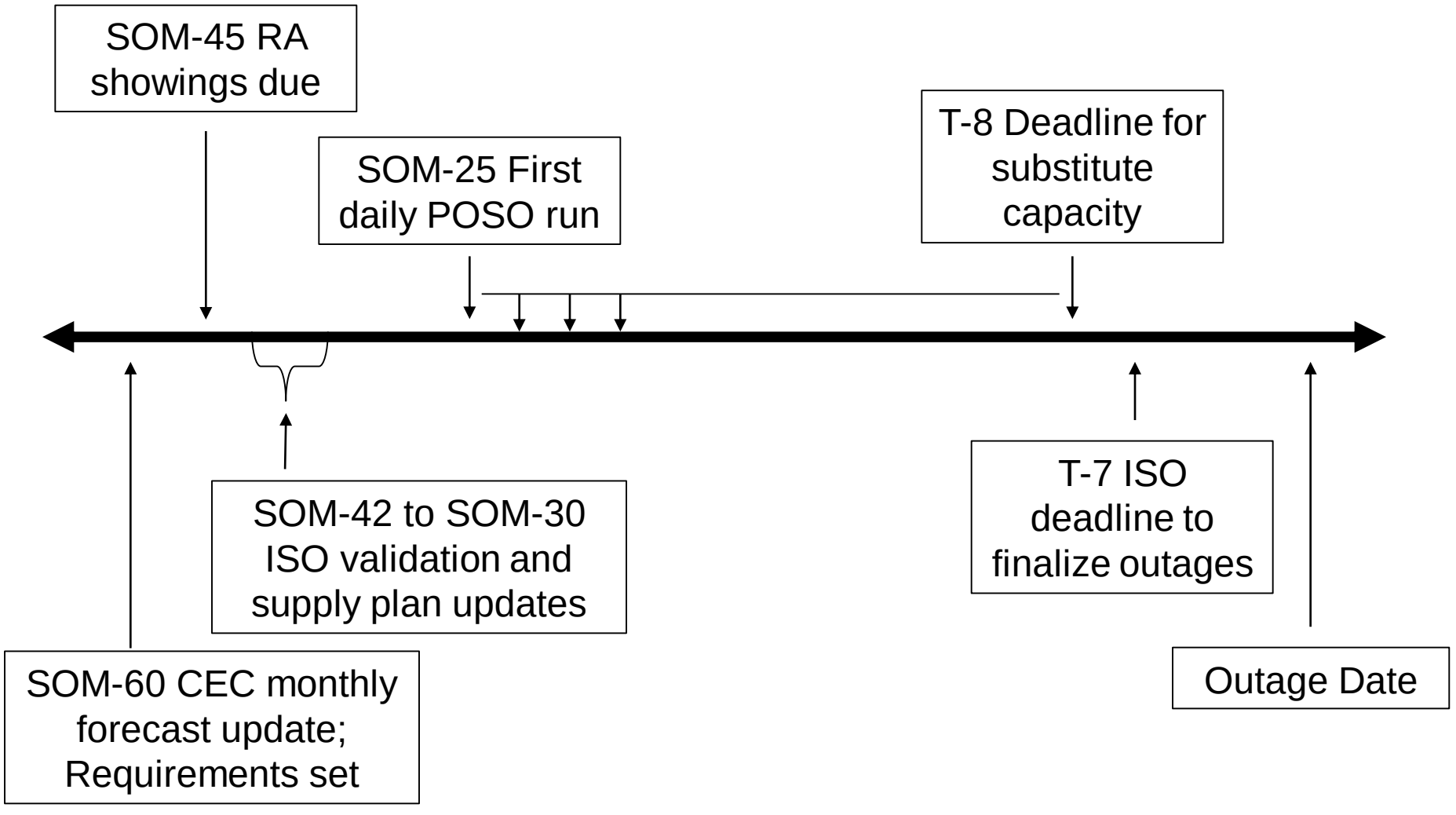
CAISO currently uses POSO for planned outages

- RA resources currently enter planned outages into the CAISO outage system
- CIRA runs a daily POSO report with determination for a planned outage need for substitution
- Resources may submit outages between 25 and 8 days before for POSO consideration
- POSO compares the total amount of operational RA Capacity to the total system requirement
  - Requirements are established by CEC forecasts and are updated 60 days prior to the start of the month
  - Considering outages, if less capacity is available than requirements, CAISO assigns substitution obligations

Planned outage process modifications

- Stakeholder feedback requested changes to the current planned outage system
- Most stakeholders were interested in redesigning the current framework around the following principles:
  - Encourage resource owners to enter outages early
  - Generally not cancel approved planned outages
  - Identify specific replacement requirements for a resource
  - Allow owners to self-select replacement capacity
  - Include CAISO system for procuring replacement capacity

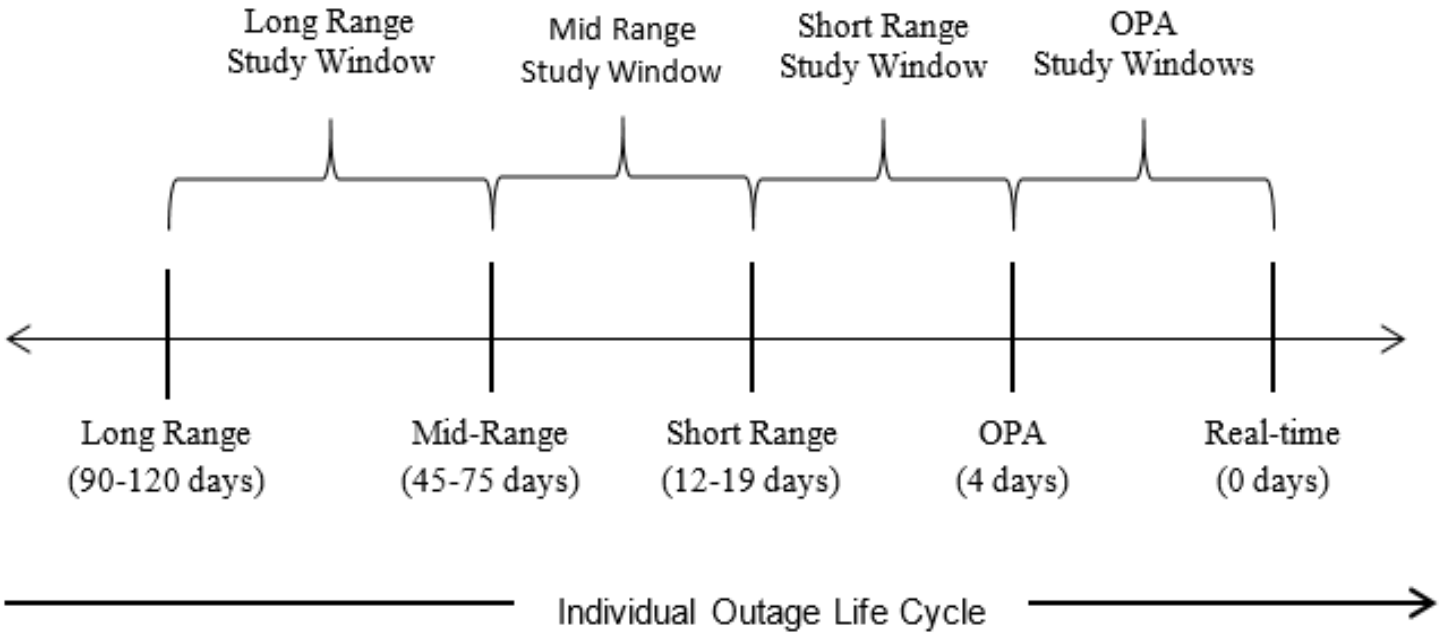
Current planned outage substitution obligation timeline



CAISO proposes to redesign the planned outage process based on stakeholder feedback

- Allow internal resources to be shown for subsets of a month
- Include an RA adequacy test before approving some planned outages
- Development of a planned outage calendar
- Development of a substitute capacity bulletin board

CAISO proposes to revise the RA planned outage process to align with Outage Management BPM



CAISO proposes to modify the opportunities and definitions for planned outage opportunities.

- CAISO proposes three different types of outages:
  - Planned outages – outages submitted at least 45 days prior to the RA month
  - Opportunity outages – outages submitted between 44 days prior to the month and eight days prior to the outage
  - Forced outages – outages taken seven or fewer days prior to the outage
- Each outage type will have different approval criteria and treatment on RA showings and supply plans

Planned outages must be submitted at least 45 days prior to the month

- Aligns with the timeline mid-range planned outages in Outage Management BPM
- Resource may not be on supply plan for planned outage days
  - Internal resources may be shown for RA for a subset of the whole month
  - Essentially are not providing RA capacity on those days
  - CAISO will still require all days have adequate RA capacity
- Resources SC must work with the LSE to provide capacity needed to address RA
- Outage approved or denied based on the existing CAISO reliability check
- Resources will also be excluded from the CAISO's portfolio analysis

Resources taking planned outages cannot extend a planned outage after 45 days prior to the month

- Outages expected to last beyond initially submitted outage dates must
  - Submit extension request prior to 45 before the month
  - Have the extension assessed as an opportunity or as forced outage and apply the appropriate standard
- If approved, outages will not be included in forced outage calculations
  - If denied, additional outage time will be considered forced and included in the resource's forced outage rate
- CAISO will notify the resource of a discrepancy it is still on an RA showing, then the and give an opportunity correct
  - If not corrected, the CAISO could:
    1. Cancel the planned outage (not preferred)
    2. Account for the planned outages in the RA adequacy assessment (i.e. identify RA deficiency) (preferred)

The CAISO seeks stakeholder feedback regarding which of these options is the preferred approach

Planned outages opportunities may arise from after RA showings have been made

- Outage submitted between 44 days prior to the month and 8 days prior to the outage will be considered opportunity outages
- CAISO will approve these outages if:
  - There is sufficient available RA capacity (i.e. no daily RA deficiency)
  - Outage approved through the CAISO reliability check
- These conditions will be assessed sequentially

CAISO will reject the outage without running the reliability check if outage causes deficient RA capacity

- Resource may provide substitute capacity to resolve RA deficiencies
- CAISO will run the reliability check only if
  - There are no RA deficiencies or
  - All deficiencies are resolved
- The CAISO will run the reliability check with replacement capacity
  - Outage approved only if reliability check is passed
- If outage approved, the new resource takes on RA MOO
  - RA MOO transfer lasts for duration of approved outage
  - If outage rejected, RA MOO reverts back to original resource
- Requested extensions must be made more than eight days prior to the last day of the approved outage window
  - If approved, outages will not be considered forced outages
  - Extensions made after that date will be treated as forced

All outages requested seven days or less prior to the outage will be treated as forced

- Outages will be included in the resource's forced outage rate
- Incentivizes a resource to either
  - Notify CAISO as soon as possible it is going on outage or
  - Complete the planned outage within the CAISO-approved window
- Outages after that time have already be considered with the RA UCAP requirements
  - CAISO runs the final reliability check eight days prior to the operating day

Outage calendar offers visibility into shown resource adequacy compared to requirements

- Proposing to develop a calendar that shows potential availability of additional system headroom on daily basis
  - This headroom may allow resources to take planned outages without specifying substitute capacity
  - If the calendar shows no available headroom, then any RA resource requesting planned outage on those dates will be required to show substitute capacity
- Exploring providing a daily MW value for UCAP headroom in excess of the RA requirements

RA IMPORTS PROVISIONS

Clarifying RA Import rules concerns

- RA Import provisions may cause reliability concerns
- Two main issues for Import RA rules:

1. Double counting
   - CAISO should be able to ensure resources shown as import RA are not also relied upon by native BA to serve native load or otherwise be sold to a third party or relied upon to meet capacity needs of others in addition to CAISO load – not possible to be sure today
2. Speculative supply
   - Speculative RA import supply occurs when RA imports shown on RA supply plans have no physical resource backing the showing or no firm contractual delivery obligation secured at time of the showing
   - RA import provisions should foreclose (or at a minimum, discourage) speculative RA import supply

Objectives for RA import rules modifications

- Create more comparable treatment to internal RA resources for RA imports
- Ensure that NRS-RA imports are backed by physical capacity and reserves with firm transmission delivery
- Ensure coordination with Extended EIM and DA Markets Enhancements initiatives

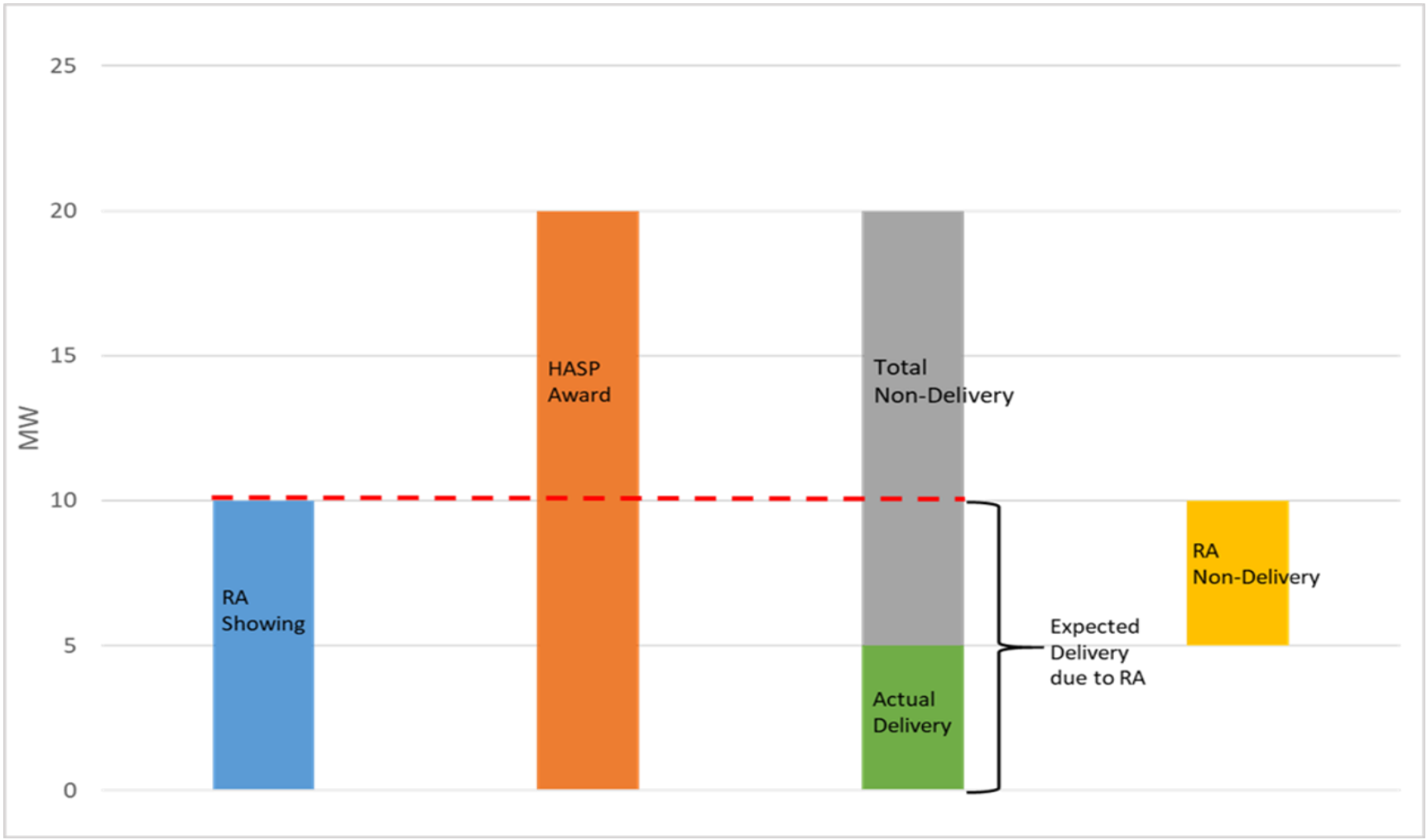
Ongoing analysis efforts updated for greater accuracy

- Analysis to determine delivery patterns and behavior for import RA resources
- Updated analysis that incorporates day ahead market participation
- CAISO has analyzed data on NRS-RA import RA showings
  - DA bids and awards, HASP bids and awards and real-time RA delivered/non-delivered quantity
- Identifies magnitude of bidding/ self-scheduling compared to RA showings and also shows non-delivery magnitude

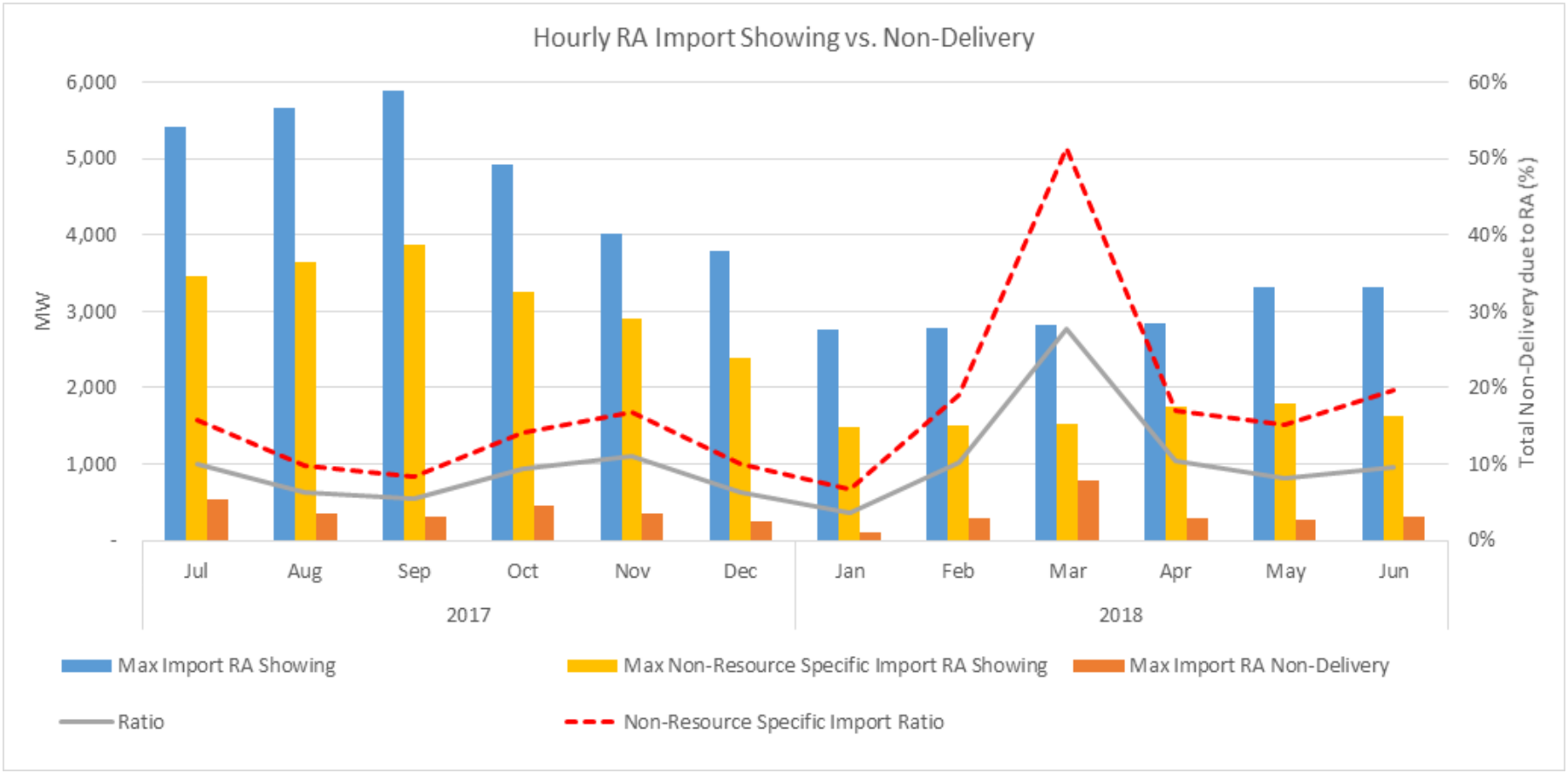
Analysis has been refined for better accuracy

- CAISO defines “non-delivery” as the MWh quantity that did not meet the real-time schedule
  - Because RA imports are scheduled hourly, the non-delivery quantity is determined by comparing the HASP schedule to the RA delivery quantity
- Bidding and awards can exceed amount of MWs shown for RA on NRS-RA import (ITIE) resource IDs
- CAISO noted in revised straw proposal that actual non-delivery results shows a maximum non-delivery of RA imports of about 10% on average
  - CAISO has identified some tie gen resources (pseudo-tie or dynamic schedule) resources were also included in the sample previously analyzed – after removing these resources data shows that actually 17% maximum non-delivery

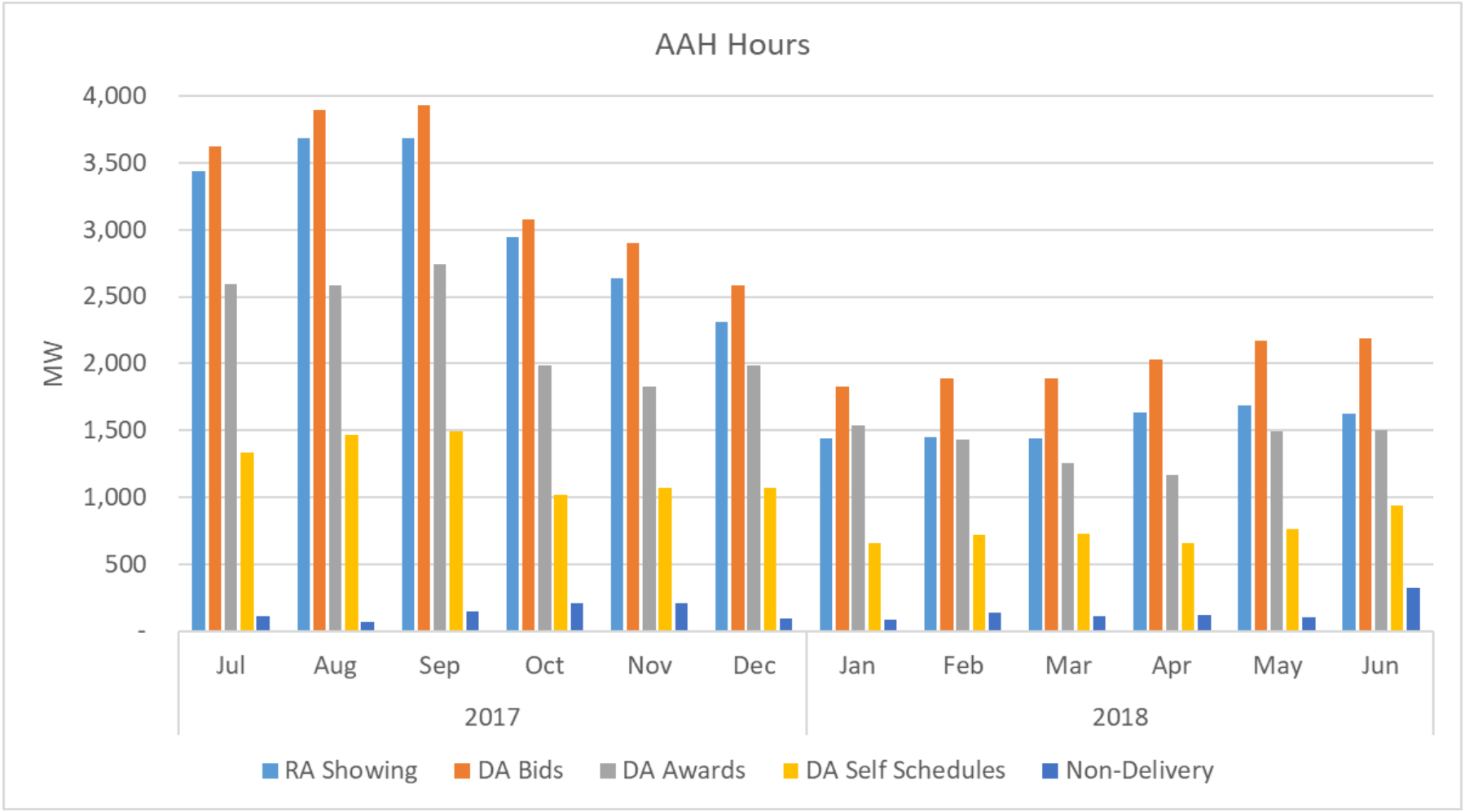
Clarifying analysis of potential concerns related to RA import delivery



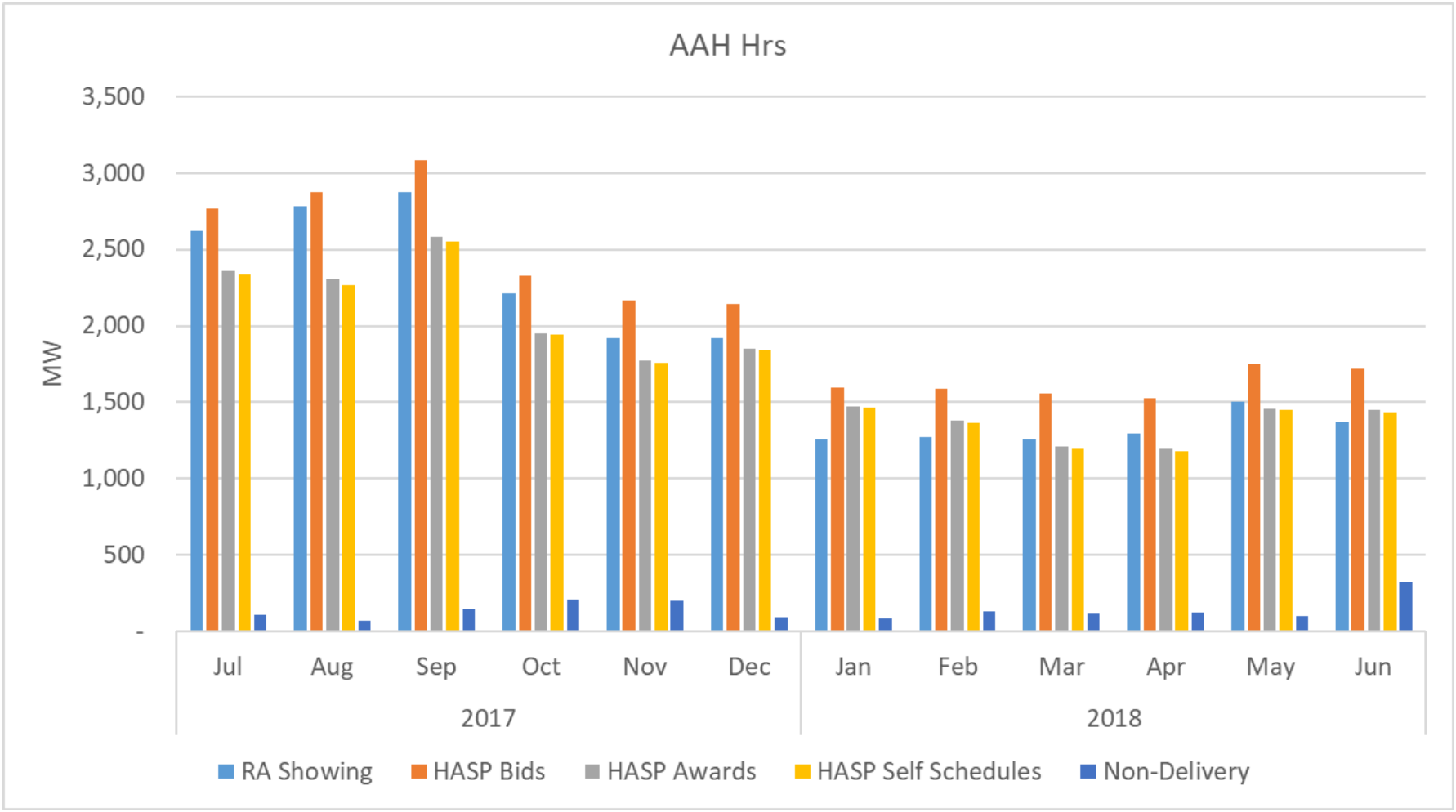
Observed undelivered NRS-RA import resources accounts for about 17% of RA showings (average of monthly maximum observations)



Day Ahead bids, awards, self-schedules, and actual non-delivery: average during AAH hours



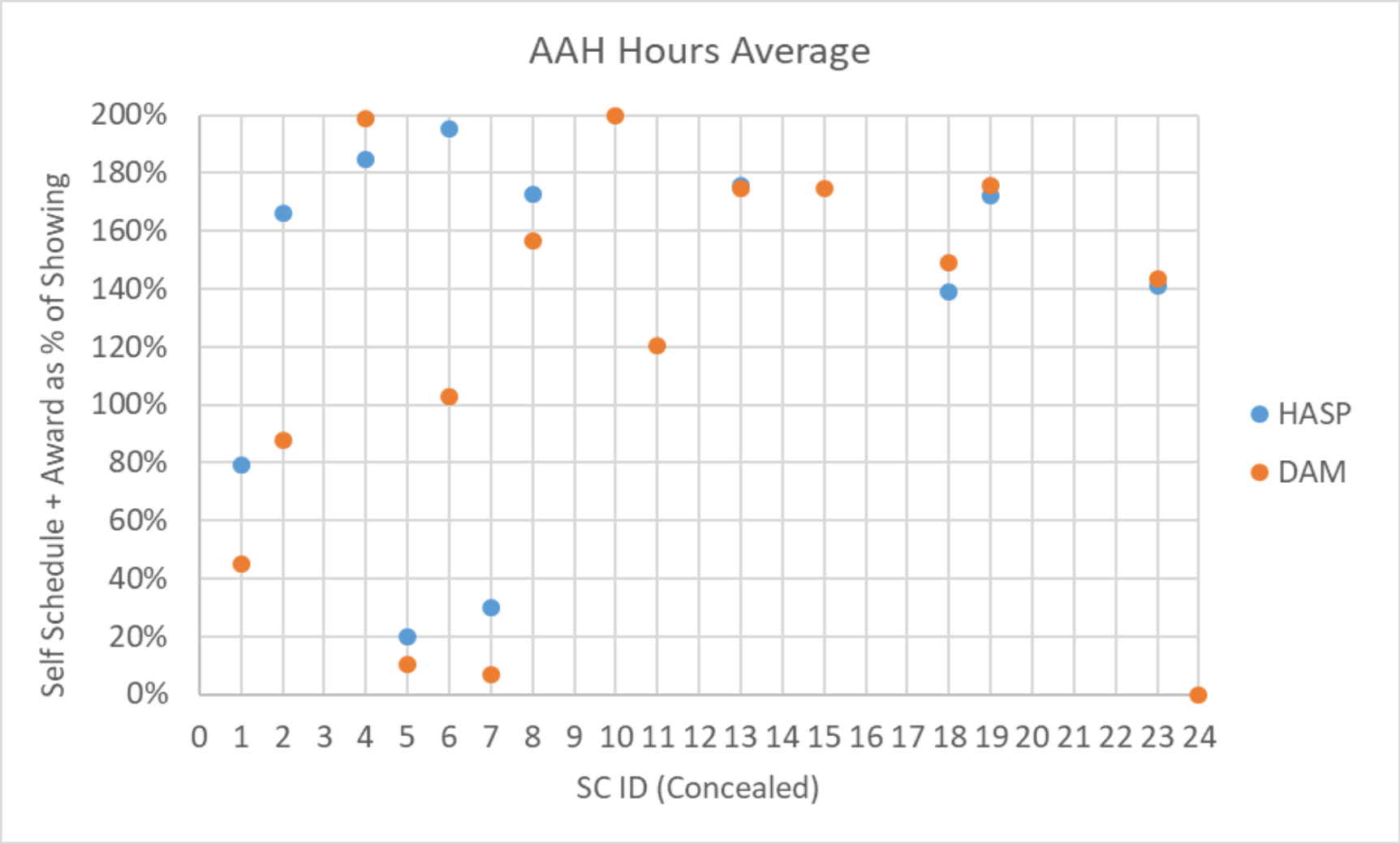
HASP bids, awards, self-schedules, and non-delivery: average during AAH hours



Analysis shows behavior generally consistent with requirements and expected participation by NRS-RA

- Day Ahead and HASP bidding / self-schedules and awards for AAH hours (on average)
  - Charts indicate non-delivery is relatively low, and generally consistent with expected forced outage rates of internal RA resources
- NRS-RA import behavior is generally consistent with requirements and expected participation by NRS-RA import providers – bidding and/or self scheduling of RA showing MWs during AAH hours
- SC level analysis also provided helps to differentiate the general statistics

SC Awards and Self Scheduled as % of RA showings: average during AAH hours (July 2017–June 2018)



SC level analysis indicates most SCs participation is consistent with expectations for NRS-RA imports

- Chart shows most SCs providing NRS-RA imports likely provide physical capacity secured in advance with firm delivery and operating reserves
  - High ratio of awards and self-scheduled import RA to RA showings by most SCs providing NRS-RA imports
- 20 out of the 24 NRA-RA import SC's awards and self-schedules were all at or near 100% of their NRS-RA showing amounts, on average

Limited number of SCs may be providing NRS-RA imports that could represent speculative supply

- Appears a few SCs may be providing NRS-RA imports that could represent speculative supply and/or imports not backed by sufficient reserves or firm transmission necessary to support delivery of energy at time of showing
  - 4 of these SC's awards and self-schedules were far below their NRS-RA showing amounts on average
  - Additionally, in day-ahead, 3 SCs averaged <10% awards and self-schedules compared to NRS-RA import showing MWs
- Results are not unexpected given the current RA import provisions, but CAISO believes proposed modifications will help ensure NRS-RA imports are backed by physical capacity with firm transmission

Proposed RA Import modifications

- CAISO proposes to require specification of the Source BA for all RA imports on monthly showings
- CAISO also proposes to adopt and codify provisions similar to current CPUC RA program rules and regulations for RA imports to provide physical capacity and firm transmission in CAISO tariff to ensure similar treatment among all LSEs

Specification of RA Import resource Balancing Area source

- RA import resources are not required to be resource specific or to provide any greater certainty they represent supply from a specific Balancing Area
  - Only required to be shown as sourced on a specific intertie into CAISO's system
- CAISO proposes to require specification of the Source BA for all RA imports on RA and Supply Plans for monthly showings
  - Will help to ensure that NRS-RA resources are not double counted
  - Also needed for Extended EIM sufficiency tests

Specification of RA Import resource Balancing Area source

- With potential extension of day-ahead market to EIM entities RA import resources must specify source Balancing Area at minimum
  - Proposed modification would allow CAISO to ensure that RA imports are not double counted for EIM resource sufficiency tests
- SCs can update BA source through CIRA
- BA source specification is needed prior to Day-Ahead market to be certain that EIM sufficiency tests are accurate
  - Seeking feedback on ability/need to switch BA source through CIRA after RA showing timeframe (between T-45 and Day-Ahead)

Incorporating documentation into RA import provisions

- Requirement LSEs provide documentation to reflect unspecified imports being used to meet RA requirements have physical capacity with operating reserves behind them and firm transmission
  - Documentation can be contract language or an attestation from import provider that confirms RA import is supported by physical capacity and operating reserves
- CAISO believes it is appropriate to incorporate documentation provisions for RA imports in its tariff
  - ALL SCs must submit supporting documentation for any unspecified RA import resource being shown on RA and Supply plans has physical capacity and reserves backing them and firm transmission at the time of showing

Proposed modifications will provide greater certainty that unspecified imports represent physical supply

- Establishing documentation requirements should help ensure that imports have physical capacity and reserves and are not double counted and will be provided with firm transmission delivery
- CAISO does not believe new or modified E-tagging requirements are necessary to support the proposed documentation at this time
  - Seeking additional input on the need to include changes to e-tagging requirements
  - Some feedback suggested day-ahead tagging requirement would be helpful to support objectives – pros and cons?

Bidding requirements for NRS-RA imports

- Not proposing modifications to real-time bidding requirements for RA imports
  - After review of stakeholder feedback and considering the consequences of extending RA import bidding requirements into real-time for all shown import MWs, CAISO does not believe it is appropriate
  - Extending RA import bidding requirement into real-time would also be misaligned with the current DA market enhancements (DAME) initiative proposal and MOO proposal
  - Also considered impact to efficient utilization of transmission system

Maximum Import Capability provisions

- CAISO previously discussed Maximum Import Capability (MIC) provisions under RA Enhancements initiative
  - Prior iterations provided review of MIC provisions and proposed modifications to MIC allocation process
- CAISO has identified a need to remove discussion of MIC provisions from scope of this initiative and plans to establish a stand-alone initiative to address changes to MIC provisions
- Process change to address MIC provisions is necessary due to need to address recently identified 2021 RA year capacity shortfall and potential adoption of a multi-year RA framework through settlement process at CPUC

FLEXIBLE CAPACITY

CAISO seeks to close gaps by developing a flexible RA framework that captures both CAISO's operational needs and the predictability of ramping needs

- Changes to the flexible capacity product and flexible capacity needs determination should closely align with CAISO's actual operational needs for various market runs (*i.e.*, day-ahead market and fifteen-minute market)
- FRACMOO2 initiative was placed on hold, the objectives and work from that initiative have been integrated into the present initiative
  - At this time, CAISO is closing the FRACMOO stakeholder process

CAISO requires several different types of flexibility, but not all need to be procured through resource adequacy

Primary – Frequency Response, RA procurement required: No

- Obligation of interconnection
- CAISO needs to ensure resources are able to and incentivized to meet their obligations, not a prescription of availability

Secondary – Regulation, RA procurement required: No

- Market product that provides sufficient incentives through the market to ensure adequacy

Tertiary – Market flexibility needs, RA procurement required: Yes

- Markets require sufficient economic bid range is provided to dispatch around load and resource variability (or inflexibility)
- CAISO should always have sufficient flexible capacity to pass ramp sufficiency tests

There are numerous benefits of forward procurement of flexible RA capacity

Examples of benefits from forward planning for tertiary or market flexibility needs include:

- Realization of full EIM benefits
- Predictable and economic retirement of resources
- Facilitate state environmental policy at lowest cost
- Mitigate random price spikes
- Provide for lower cost, more reliable dispatches
- Ensure CAISO can maintain reliability during highly variable weather conditions

CAISO observes two primary reasons for flexible capacity

1. Predictable: known and/or reasonably forecastable ramping needs
   - Require a set of resources economically bidding into CAISO's day-ahead market to properly shape the day-ahead market
   - Allows CAISO to create a feasible market dispatch in the day-ahead market
2. Unpredictable: ramping needs caused by load following and forecast error
   - CAISO must rely on real-time market dispatches to account for unpredictable ramps caused by uncertainty

Load and generation are creating uncertainty between day-ahead and real-time markets

- Uncertainty after RUC, including both load following and forecast error, must be addressed by:
  - Resources previously committed in the day-ahead market, or
  - Faster starting resources available for commitment in the real-time market
- There can be significant differences between the IFM and FMM based on forecast error and time granularity
  - This is particularly true during sun rise and sun set

Objectives of flexible RA capacity

- CAISO clearly states, quantifies, and justifies flexible capacity needs and how LSEs are able to meet them
- Resource capabilities are procured, shown and made available to the CAISO well in advance of market ops
- Market solves using economic bids, not penalty parameters
- Resources are justly compensated for the attributes they provide, ensuring adequate supply of each attribute
- Meets EIM Resource Sufficiency Tests

Economic bids allows the CAISO to shape day-ahead awards and maximizes benefits to load

- CAISO relies on LSE resource procurement to address net-load ramps
  - Deeper pool of economic bids in the day-ahead market with sufficient ramping capabilities improves the efficiency of CAISO dispatch and management of renewable resources
- LSE procurement should consider the trade-off between capacity costs, ramp speeds, and RPS obligations
  - Slow/fixed output resources will result in renewable curtailment to ensure adequate capacity and ramping capabilities
  - Long-term, procurement of inflexible resources may put renewable energy goals at risk

CAISO proposes a single flexible RA product to connect forward procurement and market and operational needs

- Will ensure CAISO has flexible capacity to address uncertainty between day-ahead and real-time markets
- Product will align directly with Imbalance Reserve product, including the
  - Requirements,
  - Flexible RA counting rules, and
  - Must-offer obligations
- Defers RPS/GHG goals to LSE procurement
- CAISO will eliminate existing three-hour net load ramping requirement
  - Will not have a flexible RA product for predictable ramping needs

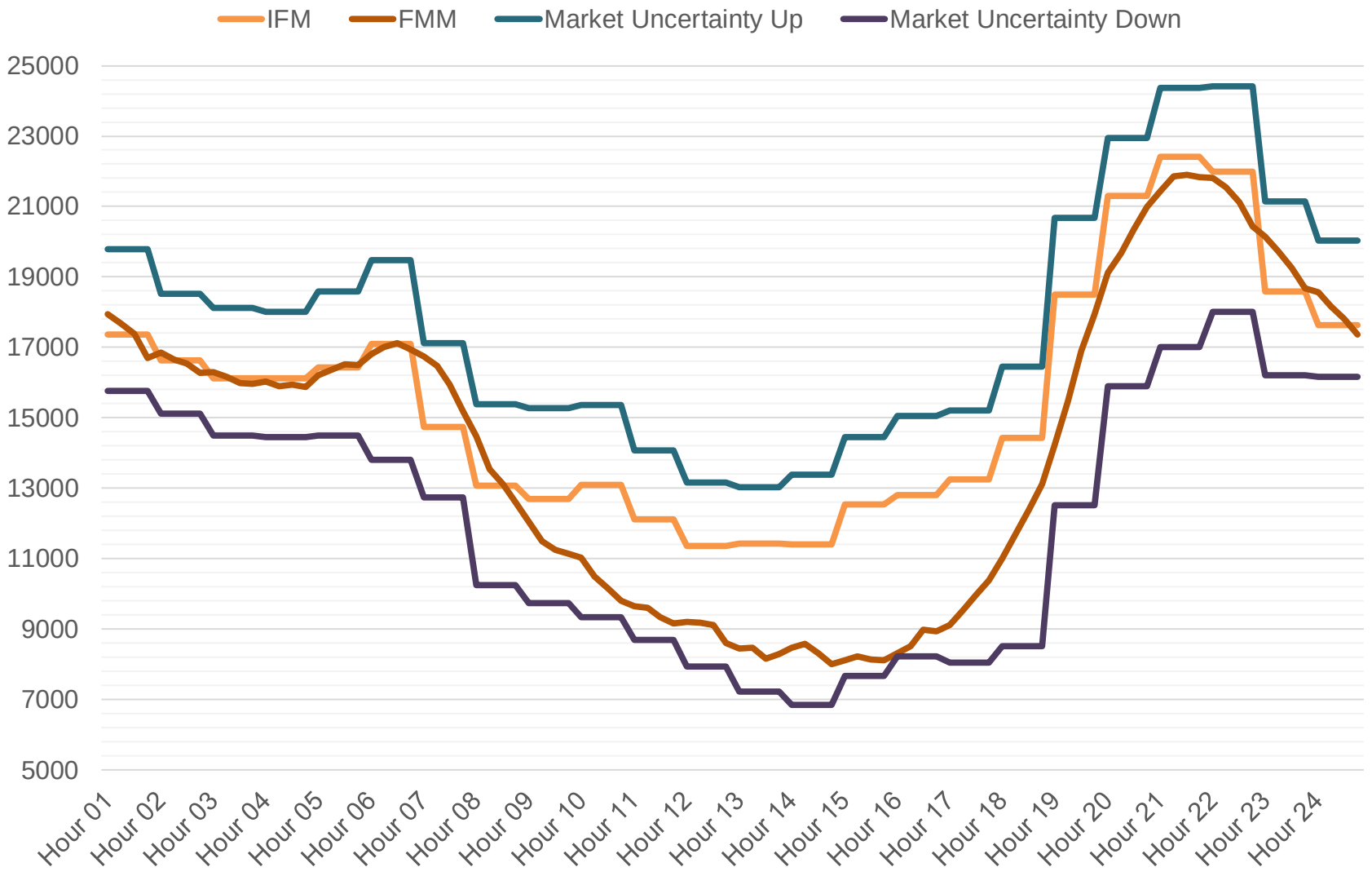
CAISO will not have a flexible RA product for predictable ramping needs

- Three-hour and one-hour net load ramps are largely forecastable
  - The vast majority of the net load ramping need can be addressed through day-ahead market commitments
- Imbalance reserves will procure adequate real-time flexibility to address deviations from day-ahead forecasts
  - Ensures sufficient upward and downward dispatch capabilities are available in real-time market, with sufficient speed
- No reliability concerns from day-ahead market awards
- Eliminating three-hour net load ramping requirement

CAISO proposes flexible RA capacity requirements to align with the proposed imbalance reserves

- CAISO is developing market rules to procure imbalance reserves as part of its Day-Ahead Market Enhancements stakeholder initiative
  - The objective is to ensure the day-ahead market has sufficient resources awarded with upward and downward ramping capabilities to address real-time imbalances
  - Captures speed need by having 15-min ramp capable capacity
  - Resources that receive an imbalance reserve award will have a must offer obligation in the real-time market
  - The energy bids associated with the imbalance reserve award will enable the real-time market to address uncertainties that materialize between the day-ahead market and real-time market through economic bids

Example of Imbalance Reserves



Any new flexible RA capacity requirements should meet basic criteria

- Easily procurable bilaterally
- Each requirement is clearly defined and quantified
- Resources' ability to meet each requirement is known and quantified
- Mitigates regulatory risks for procuring LSEs

Flexible RA will be a single product designed to ensure adequate imbalance reserves

- CAISO is proposing to use three years of seasonal historic data to determine:
  - Maximum difference between IFM and FMM forecasts, and
  - The rate of change in that difference
- CAISO will combine calculated forecast error with and expected growth in wind and solar
- CAISO will extrapolate the need for the uncertainty requirement for the upcoming RA year
- CAISO can reexamine once there is sufficient data available from the imbalance reserves market

CAISO seeks stakeholder input on this approach to determining the requirements for uncertainty

Resource must meet all of the following criteria to be eligible to provide Flexible RA capacity

- Either be a non-use limited resource or a use-limited resource with a use limitation CAISO can model in its energy market or through an opportunity cost adder
- Not be a Conditionally Available Resource
- Be dispatchable in at least 15 minute increments (including imports)
- Not be a regulation energy management resource

The CAISO seeks stakeholder input regarding what additional eligibility criteria should be included

Imports must demonstrate they are deliverable to the CAISO

- Import resources may not be tied to a specific resources like internal flexible RA capacity
- Any LSE using an import resource for flexible capacity must demonstrate it has sufficient MIC capacity
- The resource must identify its BAA of origin and the interconnection point with CAISO system
  - CAISO must ensure the flexible capacity is credited to the CAISO balancing area authority for purposes of the EIM sufficiency tests
  - EIM sufficiency tests will credit CAISO with any flexible RA capacity from resources in an EIM BAA

These eligibility criteria leave two primary issues unresolved

- Accounting for energy limitations
  - EFC counting rules ensure the resource is capable of producing energy for a given time period
  - Eligibility criteria do not address the ability of the resource to have available energy when needed
- Requirements for starts or ramping frequency
  - Current Base Ramping flexible RA capacity product requires two starts or two ramps per day
  - CAISO is not proposing minimum start or ramp requirements

These eligibility criteria leave two primary issues unresolved (cont.)

- Risk having resources no longer being able to meet its day-ahead commitment
  - For example, resources with one start per day receiving a day-ahead award for an evening start and then being committed in the morning of the operating day
  - A similar scenario can exist for storage resources that are not able to recharge during the day

The EFC for all resources will be assessed over a 15 minute interval

- EFC values will only be calculated for resources that are eligible to meet the given requirement(s)
- The CAISO will no longer consider those elements start-up time or weighted average ramp rate
  - Pmin for a resource is either completely included or excluded from a resource's EFC (i.e. Pmin of the resource cannot be split)
- CAISO will calculate the EFC using the largest range a resource can move over 15-minute interval capped at the resource's UCAP
  - Capping EFC at UCAP provides the same forced outage benefits for flexible RA that UCAP offers for system RA
- The CAISO will calculate resources from warm start
- Will consider the full range of the resource from its lowest operating limit to max output

LSEs and resource owners must determine how much flexible capacity to procure from imports

- Unlike internal resources, imports do not have
  - Defined ramp rates
  - Minimum operating levels
- CAISO is unable to calculate an EFC for imports in the same way it does for internal resources
- The CAISO will allow imports to provide EFC up to the UCAP of the resource

CAISO is exploring unique EFC rules for Solar and non-generator resources (NGR)

- Solar NQCs are based on their ELCC values
  - May not reflect availability during all hours of the day
  - Limited to provide imbalance reserves during sun-up hours
- CAISO in considering a couple options for solar resources including:
  1. Limits on the amount of flexible RA from solar resources
  2. Create a separate flexible RA product/bucket
- NGRs can balance uncertainty by charging and discharging
- CAISO proposes to count NGRs EFC based on the resource's ability range (positive and negative) over a fifteen minute period
  - Allows NGR resources to potentially receive EFC values that include their full charge and discharge ranges

CAISO seeks stakeholder feedback on which of these options (need to finish this thought)

Each LSE must demonstrate it can meet its proportionate share of requirement

- CAISO will provide each LRA its jurisdictional LSEs' contribution to each requirements
  - LRAs can then determine its own allocation of each of the requirements
    - CAISO is not looking for LRAs to provide an allocation methodology, instead, the LRA should provide CAISO with each of its jurisdictional LSE's allocation
  - Load-Following, Metered Sub-System LRAs will not receive an allocation for any forecasted flexible RA capacity needs attributable to changes in load
  - If the LRA does not provide an allocation, then CAISO will allocate to each LSE based on its allocation methodology

Each LSE must demonstrate it can meet its proportionate the requirement (cont.)

- CAISO is considering an allocation based on LRAs' share of peak load, and MW of wind and solar
  - Reflects that these factors, although not the only drivers, are the major drivers of uncertainty
  - CAISO is seeking stakeholder input on this option and others
- LSEs required to meet 100 percent of its flexible capacity requirements year ahead and month ahead RA showings
- CAISO will assess the showings independently of system and local
  - Flexible RA showings should be submitted in terms of EFC

Each LSE must demonstrate it can meet its proportionate share of each of the requirements (cont.)

- Once CAISO receives flexible RA capacity showings, it will do two things
  - Notify all LSEs if they have provided adequate flexible capacity and notify the LSE if it was at risk of potential backstop procurement cost allocation
  - Assess the adequacy of Flexible RA at a system level
- If CAISO finds a deficiency in any flexible RA capacity requirement, it will assess individual showings and notify LSEs of the system deficiency
  - LSEs will be provided an opportunity to cure the deficiency
  - This cure period will align with the cure period for other RA requirements

CAISO will assess the showings for each requirement independently

- Showings should be submitted in terms of EFC for each requirement
- CAISO will assess the long-ramp showings independent of the fast-ramp, and uncertainty showings
- LSEs can have a resource on one, two, or all three of its flexible RA capacity showings

CAISO proposes to simplify the must offer obligations for flexible capacity

- Different offer obligations have created a significant amount of confusion for market participants
- UCAP values determined resource forced outage rates over a 16-hour window between 5:00 AM and 9:00 PM
  - CAISO data shows the uncertainty tends to be higher during the same 16 hour window
- Must strike a balance between
  - Multiple must offer obligations
  - Ensuring CAISO has sufficient capacity available during the intervals of need
  - Aligning flexible capacity and generic capacity rules
    - Many flexible RA resources will also provide multiple flexible RA requirements and system or local capacity

CAISO proposes to simplify the must offer obligations for flexible capacity

- Flexible RA capacity must submit economic bids for energy, ancillary services, and imbalance reserves into day-ahead market
- Must cover at least from 5:00 AM to 9:00 PM for all shown flexible RA capacity.
  - CAISO is still assessing the appropriate MOO for wind and solar resources
  - NGR resources must submit economic bids to cover both the charge and discharge range of their shown EFC

LOCAL RESOURCE ADEQUACY

The CAISO has separated two local resource adequacy items into their own draft final proposal

- Local Studies with Availability Limited Resources
  - 2020 Local Capacity Technical Studies incorporate new information to guide resource procurement to meet energy needs of the local load shape
  - Tariff clarifications for existing CPM authority will continue to be included in RA Enhancements under CPM Modifications
- Slow Demand Response
  - New tool will be developed to dispatch slow PDR on a pre-contingency basis prior to the operating day
    - Slow RDRR will not be considered by the tool
  - New tool expected to be implemented in Fall 2020
  - Coordination with CPUC required

Stakeholders asked CAISO to develop a proposal for local RA that aligns with proposed system UCAP rules

- In revised straw proposal, CAISO proposed to leave local RA studies largely unchanged
  - System values would be measured under UCAP, local would remain under NQC and flexible under EFC
- In order to utilize UCAP for local RA, one of two things must be done
  1. Run existing studies and convert local capacity requirements into a UCAP equivalent value, or
  2. Determine the local capacity requirements using resources UCAP values in the study process
- CAISO does not propose to adopt a specific methodology, but explores both options in greater detail

Utilizing UCAP for local may present significant issues

- Does not align with other planning study processes
  - Not probabilistic or deterministic.
  - Will result in slightly higher values of capacity need with no clear technical basis
    - Can only point to the consensus agreement as basis for the use of the UCAP values.
- CAISO might not be able to credibly advance transmission to address a deficiency due to the different study approaches
- Likely major implications for areas of different size

Option 1: Convert LCRs into UCAP after the study process

- Run the local capacity studies exactly as is done today
- Publish the local capacity requirements in terms of NQC
- Convert those values into a UCAP equivalent
  - Requires UCAP conversion factor (i.e. multiply the LCR times the average UCAP for all resources located in a local area)

There are at least three immediate implications that come with using a UCAP conversion factor

- Assumes that the UCAP value of the resources procured is at least greater than or equal to this value on average
  - If procured resources fall below the average capacity conversion factor, then CAISO may still identify deficiencies in local areas - this is somewhat similar to the situation that exists today where the ISO assumes that the most effective units (due to location in the local capacity area) are dispatched first, so deficiencies are expected if less effective units are procured
- It is not immediately clear how such conversions will work across local areas and sub-areas

Maintains consistent assessment of local areas across other CAISO planning efforts such TPP

- When approving new transmission capacity, CAISO will still assess the needs using output at the time of the peak not to exceed Pmax or net qualifying capacity, not UCAP

- The disconnect between the LCR and TPP study processes would only occur after the initial study results are completed and the conversion factor is applied to the LCR results

Option 2: Use UCAP values in the study process

- Conduct the local capacity studies using the UCAP values for all generating resources
  - As UCAP values are lower than NQC values, more generating units overall would be required to meet the local capacity need

- Current study process assumes that all resources except the contingencies being tested are in service
  - System forced outage rates can often be between 10-15 percent

- However, the reality is that UCAP values are affected most heavily by outages for shorter periods of time, not by partial de-rates of 10 to 15% across the whole year

This approach does not explicitly rely on any assumptions about what resources are procured

- The requirement is set and addressed using UCAP values instead of NQC values
- One major downside is that this option diverges from the methodology applied in the TPP
  - The TPP is done using established methodologies based on output at the time of the peak not to exceed Pmax or net qualifying capacity values
  - TPP study process assumes that all resources except the contingencies being tested are in service,
    - This is how forced and planned outages are accounted for in the transmission planning reliability standards
  - Transmission planning standards are not based on UCAP values
  - The TPP might not necessarily support upgrades to address local capacity requirement deficiencies

CAISO has determined that it is possible to conduct local studies using either methodology

- Given the pros and cons of each option, CAISO seeks additional stakeholder input on which is the preferred approach

- Whichever methodology is applied will only be applied to the LCR study process and might not be applied to any other planning study

NEXT STEPS

Next steps

- Stakeholder written comments due October 24, 2019
  - Submit to initiativecomments@caiso.com
  - Comments template available at http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx