Resource Adequacy Enhancements: Third Revised Straw Proposal Stakeholder Meeting

January 7-8, 2020

RA ENHANCEMENTS STAKEHOLDER MEETING – DAY 2

Agenda – January 8 (Day 2)

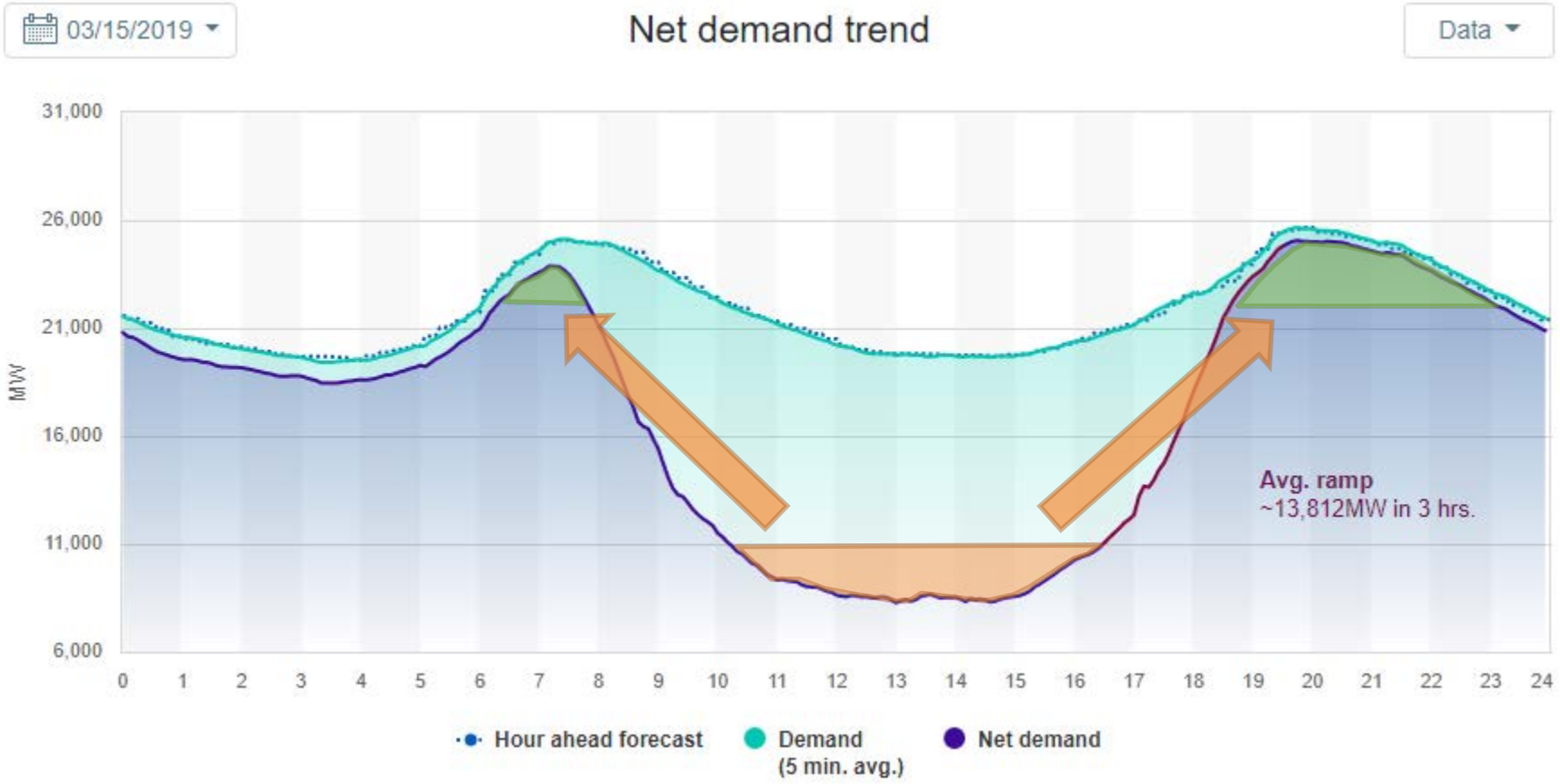
Time	Agenda Topic	Presenter
9:00-9:05AM	Welcome and Introduction	Isabella Nicosia
9:05-10:30AM	Operationalizing Storage	Gabe Murtaugh
10:30AM-12:00PM	Flexible RA	Karl Meeusen
12:00-1:00PM	LUNCH	
1:00-2:00PM	Local RA	Karl Meeusen
2:00-3:30PM	Backstop Capacity Procurement Provisions	Gabe Murtaugh
3:30-3:45PM	Next Steps	Isabella Nicosia

OPERATIONALIZING STORAGE

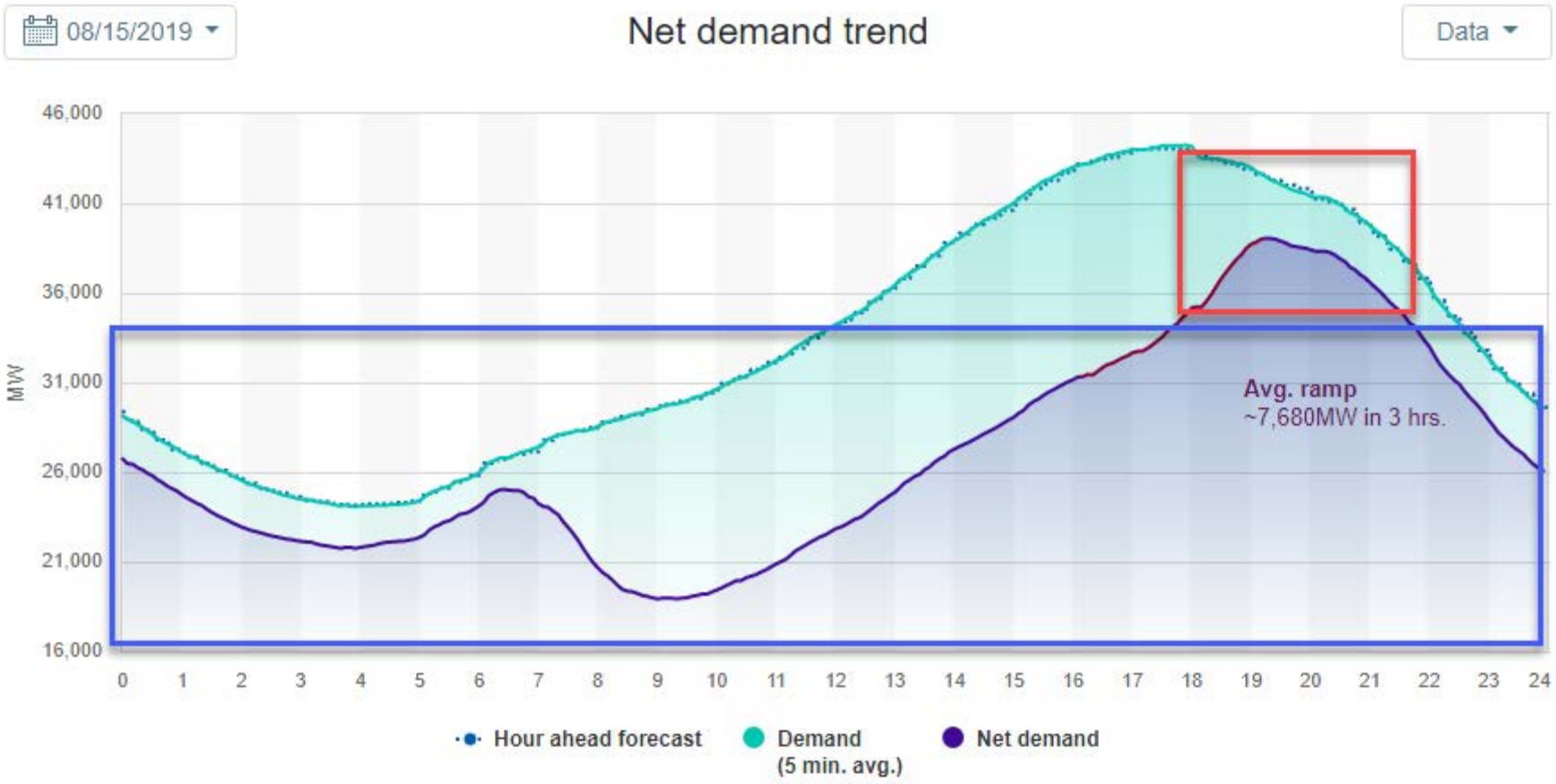
Battery storage may become a rapidly growing segment of California's resource mix

- The CPUC is ordering new resource procurement to replace older steam resources over the next 3 years
  - The retirement of a large nuclear resource in 2024 will likely require additional procurement
- Today there are about 150 MW of storage online, but the ISO may be dispatching thousands of MW shortly
- Much of the new procurement may come in the form of battery storage and hybrid (solar + storage) resources
- These resources bring new integration challenges
  - Market power mitigation is not currently applied to storage resources
  - CAISO does not have a tool to compel a storage resource to charge and be "ready" for discharge, outside of exceptional dispatch
  - Storage resources have 'use limitations'

Planning for storage resources has assumed ‘arbitrage’ of day-ahead energy prices



In the future storage could be critical on days with the highest ***net load*** peak



The current day-ahead and real-time market system accommodates gas resources relatively well

- Gas resources with a specific fixed cost may be scheduled in the day-ahead market during hours when prices are higher than those fixed costs
- The real-time settles at imbalance energy between day ahead and real-time awards
  - Generally when prices are higher in the real-time market resources are scheduled to produce more energy, and at lower prices resources produce less energy. Both increase total revenue, with fixed bids
  - A storage resource that does not charge early in the morning because of low prices may not be available for discharge later in the day
- The day-ahead market looks out 24 hours, and has enough runway to see opportunities (low prices) to charge resources for needs later in the day

Several things are different in the day-ahead market for storage resources

- The day-ahead market maintains the stat of charge parameter for storage
- Resource bid in the full range of operation from Pmin to Pmax (i.e. +/- 10 MW) into the energy market
  - Storage may be scheduled to charge based on prices lower than the negative (MW) portion of the bid curve
  - Storage may be scheduled to discharge based on prices higher than the positive (MW) portion of the bid curve
  - Storage resources may receive a charge/discharge paired scheduled based on the price "spread" of the bids in the curve
- The other constraints continue to apply which will result in batteries receiving the 'correct' schedules throughout the day

It is more challenging to operate storage resources efficiently in the real-time market

- The real-time market looks out 60 (advisory) minutes in advance of the current interval
  - This may not be enough time to charge a resource for later in the day
  - This may not allow for enough time to completely charge a storage resource, as most ISO storage resources have a 4 hour duration
  - This may be problematic as a need may last longer than the 60-minutes that the resource is capable of charging
  - This may also be problematic, if the battery is asked to charge in response to the largest net-ramp needs on the system
- These ideas are further illustrated in the example on the next two slides
  - Suppose a highly simplified model where there are only 2 resources: 1 gas resource (300 MW) and 1 storage resource (50 MW; 200 MWh)

The day-ahead market can schedule the gas resource to increase output to charge the storage resource

Hour	9	10	11	12	...	17	18	19	20	21	22	23	24
Load	190 MW	190	190	200	...	300	330	335	345	350	340	280	210
DA Bid ↓	$30/MWh	$30	$30	$30		$30	$30	$30	$30	$30	$30	$30	$30
DA Bid ↑	$60/MWh	$60	$60	$60		$60	$60	$60	$60	$60	$60	$60	$60
DA Price	$50/MWh	$50	$50	$50		$60	$100	$100	$100	$100	$100	$80	$70
DA Sched	-50 MW	-50	-50	-50		0	30	35	45	50	40	0	0
DA SOC	50 MWh	100	150	200		200	170	135	90	40	0	0	0

The necessary prices may not materialize in the real-time market to charge the storage resource

Hour	9	10	11	12	...	17	18	19	20	21	22	23	24
Load	190 MW	190	190	200	...	300	330	335	345	350	340	280	210
DA Bid ↓	$30/MWh	$30	$30	$30		$30	$30	$30	$30	$30	$30	$30	$30
DA Bid ↑	$60/MWh	$60	$60	$60		$60	$60	$60	$60	$60	$60	$60	$60
DA Price	$50/MWh	$50	$50	$50		$60	$100	$100	$100	$100	$100	$80	$70
DA Sched	-50 MW	-50	-50	-50		0	30	35	45	50	40	0	0
DA SOC	50 MWh	100	150	200		200	170	135	90	40	0	0	0
RT Bid ↓	$50/MWh	$50	$50	$50		$50	$50	$50	$50	$50	$50	$50	$50
RT Bid ↑	$100/MWh	$100	$100	$100		$100	$100	$100	$100	$100	$100	$100	$100
RT Price	$60/MWh	$60	$60	$60			$1,000						
RT Sched	0 MW	0	0	0	0								
RT SOC	0 MWh	0	0	0	0								

There are a number of potential ways to resolve this problem

1. Require day-ahead schedules to be completely self-scheduled into the real-time market
   - Lose all flexibility from resources
   - Hourly block scheduling in the real-time must be accounted for
   - Resources miss opportunities to respond to real-time price spikes
2. Minimum charge requirement based on day-ahead schedules for storage resources
   - Restrain resources from using energy that the day-ahead market requires for use during later hours
   - Allow resources to still respond to price spikes if requirement is met
   - Imposes a new constraint that could alter 'efficient' dispatch signals
3. Extend real-time market to look 16+ hours ahead
   - Solution may not be technologically feasible at this time

Propose to implement a minimum charge requirement (MCR) for all resource adequacy storage resources

- The state of charge is currently maintained for storage resources on the system
- Resources that are shown for RA will have dispatch constrained by a minimum charge requirement
- The constraint ensures that the day-ahead discharge schedule can be met for the resource
- Considers expected energy at the beginning of the day and day-ahead energy schedules awarded to the resource
  - May be 0 MWh if there is no discharge schedule
- The following two examples illustrate how this constraint will work

The same hypothetical resource is fully charged, and is scheduled to discharge 180 MWh in the evening

Hour	9	10	11	12	...	17	18	19	20	21	22	23	24
Load	190 MW	190	190	200	...	300	330	335	345	350	340	280	210
DA Bid ↓	$30/MWh	$30	$30	$30		$30	$30	$30	$30	$30	$30	$30	$30
DA Bid ↑	$60/MWh	$60	$60	$60		$60	$60	$60	$60	$60	$60	$60	$60
DA Price	$50/MWh	$50	$50	$50		$60	$60	$80	$80	$100	$100	$80	$70
DA Sched	0	0	0	0		0	0	20	30	50	50	30	0
DA SOC	200 MWh	200	200	200		200	200	180	150	100	50	20	0

In the real-time market the resource is required to maintain a 180 MWh state of charge

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

- Prices spike in HE 17: Energy schedule = 20 MW, not 50 MW
- HE 21: The resource is dispatched less than the day-ahead schedule and has a state of charge in excess of the requirement

The same hypothetical resource is charged partially in the morning and discharged in the evening

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

- The discharge is less than the full capacity of the resource

In the real-time the resource charges to meet the increasing minimum charge requirements

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

- HE 10: Resource is scheduled to charge economically above MCR
- HE 11: Resource is required to charge because of requirement
- HE 18: Resource is unable to respond to price spike b/c of MCR

Additional considerations for storage resources

- All minimum charge requirements will be determined on a 5-minute basis to match the real-time market
  - Additional examples may be provided in future proposal versions
- Storage resources, like other RA resources, will be required to bid in all RA capacity on a 24x7 basis
  - Continue to review alignment with policy for non-storage resources
- Storage resources will continue to receive their 4-hour capability for RA credit
  - Resources will have access to the end of hour state of charge parameters, which will be used as an input for the UCAP calculation
  - These parameters effectively reduce the ability for the market to access a resource's capacity, similar to a derate
  - The minimum charge requirement and resource bids will not impact the resource's UCAP

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

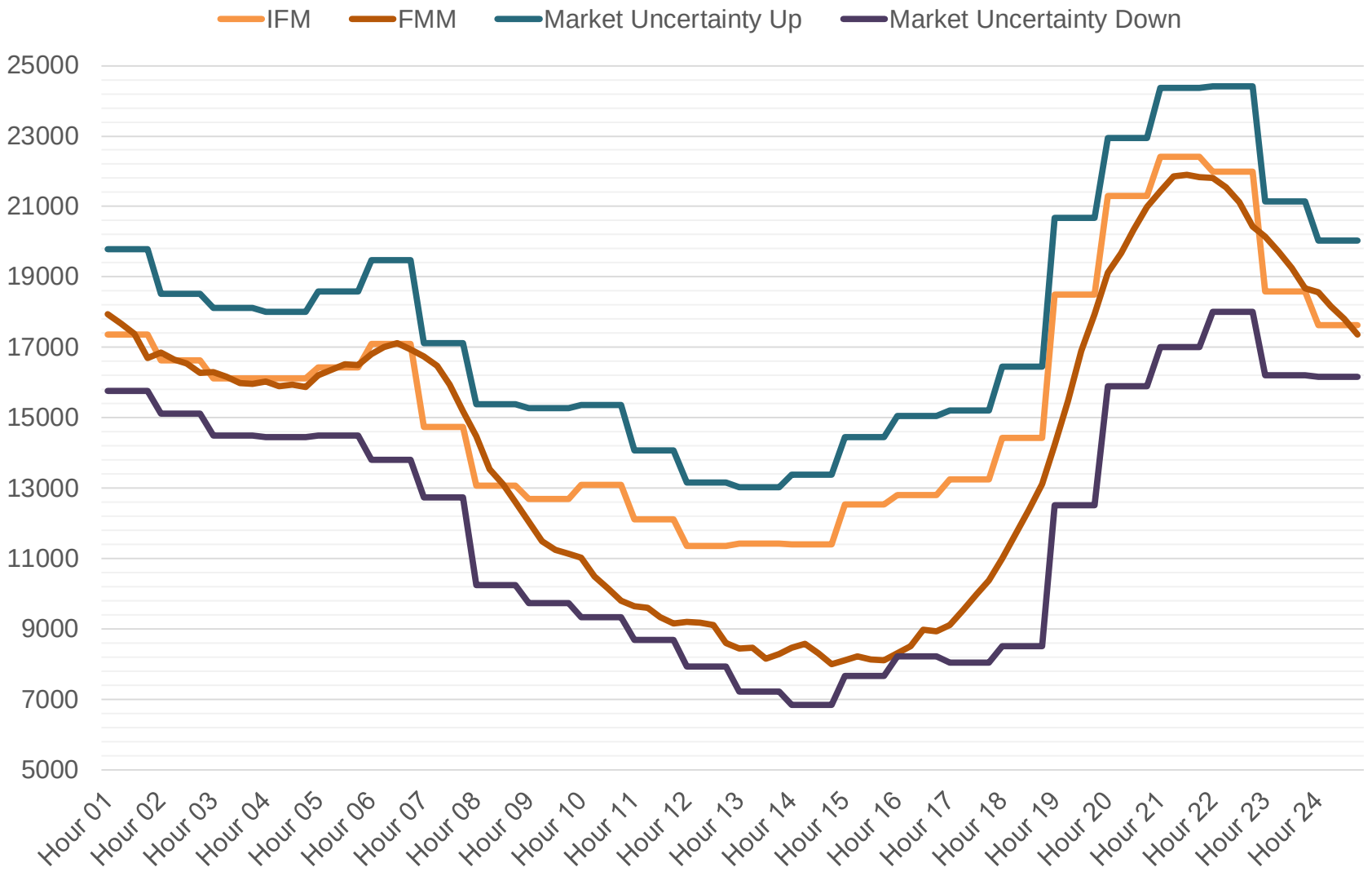
CAISO proposes a single flexible RA product to connect forward procurement and market and operational needs

- 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 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

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

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 considered 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

  CAISO is not proposing either at this time
- 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

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
    - LRA should provide CAISO with each of its jurisdictional LSE's allocation, not allocation methodology
  - 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

Resources providing flexible RA must submit economic bids covering the entire range of the resource above Pmin

- Necessary to ensure the CAISO has access to the operational range used to determine the EFC
  - For example, 500 MW resource, two ramp segments
    - 20 MW/min up to 300 MW
    - 10 MW/min from 300 MW to 500 MW
    - EFC would be calculated as 300 MW
  - If the resource self-scheduled the first 200 MW, CAISO would only have access to 200 MW of 15 minute ramp capability

CAISO considered allowing a resource to only bid its shown EFC

- Does not ensure adequate ramping speed is available
- Only works if the CAISO established the EFC for resources using their slowest 15 minute ramp capabilities,
  - Then only requiring the EFC to economically bid and provide imbalance reserves would be sufficient.
- Aligning the proposed EFC counting rules and must offer obligations require the entire resource to bid the entire range of the resource
  - *i.e.* Using the fastest ramp rate requires bidding of the entire dispatchable range

CAISO is proposing a day-ahead flexible capacity MOO for wind, solar, and non-generating resources

- Wind and solar resources providing flexible RA capacity must economically bid into the day-ahead market for the minimum of its forecast or shown EFC for
  - Energy
  - Any ancillary services it is eligible to provide
  - Imbalance reserves
- System and local capacity MOOs are not eliminated
- Consistent with allowing solar resources to provide EFC greater than their NQC
- NGR resources must submit economic bids to cover both the charge and discharge range of their shown EFC

LOCAL RESOURCE ADEQUACY

CAISO outlined a proposal to apply UCAP calculations for local capacity counting

- CAISO continues to prefer local RA procurement be done with NQC values
- Numerous parties supported the CAISO's proposal to apply a conversion factor after the local capacity studies have been completed.
  - SDG&E objects to the use of UCAP for local
  - PG&E and SCE asks for additional example to clarify how the CAISO would apply the various options for UCAP in local areas

The CAISO will continue running the local capacity studies exactly as is done today using NQC

- CAISO will publish the local capacity requirements in terms of NQC
- The CAISO will provide a translation table from NQC local requirements to UCAP local requirements
  - Translations will be done by TAC
- For each TAC, the total local UCAP requirement will be defined as follows:
- $$\boldsymbol{Total\ TAC\ UCAP\ responsibility} = \left(\sum \boldsymbol{of\ TAC\ wide\ NQC\ requirements}\right) \times \left[\frac{\sum\ \boldsymbol{of\ TAC\ wide\ UCAP\ values}}{\sum\ \boldsymbol{of\ TAC\ wide\ NQC\ values}}\right]$$

NQC and UCAP *values* used in the conversion factor are given by all available values in the previous year's NQC/UCAP list for resources already in-service

- Using the NQC and UCAP values from the current year is both an infeasible and undesirable result
  - The LCR studies run from December-May
  - The annual NQC deliverability study is done in June-July
  - NQC list is currently completed August/September
- LCT study and UCAP translation needs to be final by May 30 – 120 days before the showings get here
  - CPUC requires draft LCR study April 1 and final by May 1
- Avoids complications derived from including estimated NQC and estimated UCAP values for new resources

The CAISO will calculate LSEs' local load-share ratio responsibility in terms of UCAP at the TAC level

- LRAs will be given their share UCAP to allocate to their LSEs
  - The LRA may allocate these responsibilities using its preferred methodology
  - If the LRA does not allocate their entire responsibility to their jurisdictional LSEs the CAISO will allocate the difference
- LSEs' individual compliance in meeting their given local allocation is calculated in UCAP
  - An LSE will be determined to be individually adequate if its shown UCAP is equal or greater than its allocated share

CAISO will convert UCAP values back into NQC values and run its compliance studies of all RA showings with local technical criteria and requirements

- In addition to deficiencies caused by effectiveness factors that exist today, the CAISO must also ensure there are adequate MWs in a given area.
  - For example, the CAISO may receive adequate UCAP to meet individual obligations, but not enough MW to serve peak load in a local capacity area
- Deficiencies will be defined as either
  - Insufficient MW of NQC to meet the LCR
  - Insufficiently effective capacity

The CAISO will notify LSEs of any deficiencies and provide them an opportunity to cure

- If still short, the CAISO may purchase capacity from remaining non-RA resources through its CPM authority cure the deficiency
- The cost will be allocated
  1. Pro rata to each LSESC based on the ratio of its LCR Deficiency to the sum of the deficiency of LCR deficiency within a TAC Area, then
  2. If anything else is required the cost allocation will be based on the SCs proportionate share of Load in such TAC Area(s)

The CAISO may assess a number of variables to determine which resources to offer CPM designations to cure deficiencies

- Variables include, but are not limited to
  - Cost
  - Effectiveness, and
  - Reliability
- The CPM cost will be divided to the LSEs per the different varieties of CPM
- The LSEs that receive cost allocation for the CPM will get a capacity credit commensurate with their CPM cost ratio allocation
  - The amount of the credit is based on the quantity of UCAP purchased, not the NQC value

BACKSTOP CAPACITY PROCUREMENT PROVISIONS

Backstop authority, via CPM, exists for a number of procurement scenarios

Existing CAISO CPM authority

1. System annual/monthly deficiency
2. Local annual/monthly deficiency
3. Local collective deficiency
4. Cumulative flexible annual/monthly deficiency
5. Significant event
6. Exceptional dispatch
7. Risk of retirement*

* Authority moving to RMR in the RMR-CPM enhancements initiative

With changes to the resource adequacy additional CPM authority is necessary

- Portfolio deficiency CPM
  - Procure deficiencies identified in the ISO portfolio analysis, when procured resources cannot meet system energy and reliability needs
  - Costs will be allocated on a load ratio share basis
- Local availability limited deficiency test (extension of collective)
  - If Load shapes in local capacity technical studies reveal deficiencies
- System UCAP test
  - System UCAP deficiencies would trigger CPM procurement, with cost allocation to deficient LSEs
  - Similar to CPM today, tests are performed on annual and monthly resource adequacy showings

Example of system UCAP CPM designation

LSE	Req.	Shown	Shortage	Cost Allocation
1	100 MW	125 MW	-	
2	100 MW	80 MW	20 MW	20/45
3	100 MW	75 MW	25 MW	25/45
TOTAL	**300 MW**	**280 MW**	**45 MW**	

- System UCAP CPM designations would work similar to existing “collective deficiency” designations
  - Cost assessed and allocated by deficiency share
  - A period to cure deficiencies will be offered to deficient LSEs
  - ISO will procure 20 MW with a CPM designation
- Consistent with this proposal, this CPM authority will only apply to system – not local – deficiencies

Expand CPM authority to procure for deficiencies identified in the system portfolio assessment

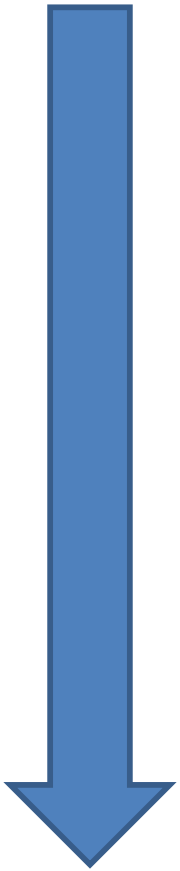
- It is essential that CAISO has resources available to reliably operate the grid
  - May not align with UCAP analysis
- CAISO may make backstop designations to ensure that aggregate energy needs for the system are met
  - This analysis will not focus only on peak needs
- As discussion continues on the portfolio analysis, the backstop mechanism will continue to develop as well
  - ISO and CPUC are working to update MCC bucket for procurement to help align the RA program with portfolio needs
- CAISO will continue to publish study information behind CPM designations made as a result of this authority

The ISO may make procurement for UCAP or for NQC shortfalls, but the CSP will remain unchanged

- Authority will still be available to procure for NQC deficiencies, in addition to UCAP
  - These may occur for curing local deficiencies
- Bids are available for NQC capacity in the competitive solicitation process for CPM designations
  - The bidding rules and the soft offer cap will remain unchanged
- Least cost options will still be awarded designations
  - The conversion between UCAP and NQC will be applied
- CPM bidding rules and requirements will be retained

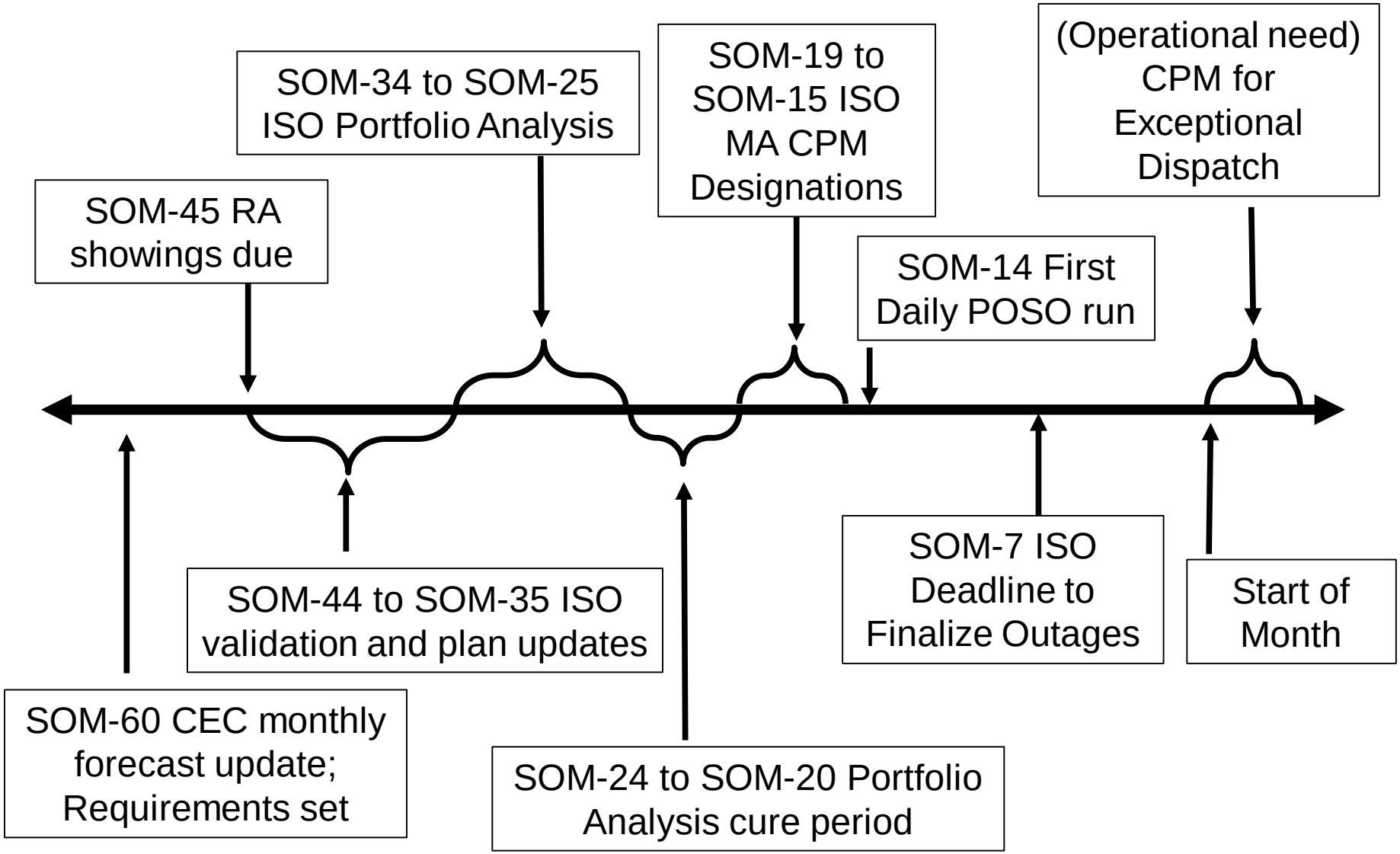
	NQC	UCAP	UCAP:NQC	Bid ($/kW-month NQC)	Effective UCAP Bid ($/kW-month UCAP)
Resource 1	200	100	0.5	$5	$10
Resource 2	150	125	0.8	$6	$7.20

System CPM costs will be allocated first for shortfalls in portfolio procurement then UCAP and finally NQC



- Procurement necessary to backstop for UCAP deficiencies, allocated to entities with deficiencies
  - Credit will be given for attributes of resources procured, allocated on same basis
- Procurement for “traditional” system NQC shortages, with same cost allocation
- Local deficiencies will be cured and allocated to deficient entities (similar to allocation today)
  - Including Local “load shape” deficiencies are allocated locally
- Any additional procurement necessary as a result of the portfolio analysis will be made and allocated on a load ratio share basis

Timeline for CPM backstop procurement



This proposal includes the removal of the RAAIM tool, which is currently applied to RMR resources

- Removal of the RAAIM tool, will remove the incentive mechanism currently in place for RMR resources
  - RAAIM currently has a 96.5% monthly availability target, with a +/-2% dead band for determining incentive or penalty payments
- A tool resembling RAAIM could be used for RMR
  - Consider removing incentive payments
  - Use load as counter-party for penalties collected for non-performance
- Other modifications could be considered
  - Availability targets could vary seasonally (i.e. summer availability may be high, while shoulder season time availability may be less)
  - The penalty price need not be based on the CPM soft offer cap, but could instead be set at a price equal to the RMR fixed payment

UCAP deficiency tool will incentivize LSEs to procure UCAP at least up to and beyond requirements

- Backstop authority is used to ensure that enough UCAP is procured to meet system needs
- The UCAP deficiency tool will incentivize LSEs to show as much capacity as possible, to receive payments
  - Dis-incentivizes LSEs from ‘free riding’ on neighbors
- Tool will prevent leaning between LSEs, by charging deficient LSEs the soft offer cap for the CPM
- Tool helps reduce backstop procurement
- Process would be self funded and settled in the month-ahead and year-ahead time frame when RA showings and backstop procurement is complete

In addition to the expanded CPM authority a mechanism to prevent LSE leaning is proposed

- LSEs that show below requirements would be charged a penalty price
  - The price will be set at the soft offer cap for CPM
- Penalties distributed to LSEs that show above requirements
- The capacity incentive mechanism would work in tandem with the system UCAP test

Examples of UCAP deficiency tool

- Example 1: No system deficiency, but LSE 3 leans for 10 MW

LSE	Req.	Shown	Shortage	Cost Allocation
1	100 MW	110 MW	-	$25,240
2	100 MW	115 MW	-	$37,860
3	100 MW	90 MW	10 MW	-$63,100

- Example 2: 25 MW system deficiency, with no resources ‘over-showing’

LSE	Req.	Shown	Shortage	Cost Allocation
1	100 MW	100 MW	-	-
2	100 MW	80 MW	20 MW	-
3	100 MW	95 MW	5 MW	-

Examples of UCAP deficiency tool

- Example 3: System deficiency of 20 MW, which is cured through CPM, and LSE 1 and 2 leaning on LSE 3

LSE	Req.	Shown	Shortage	Backstop	Cost Allocation
1	100 MW	90 MW	10 MW	8 MW	-2 MW * $6.31
2	100 MW	85 MW	15 MW	12 MW	-3 MW * $6.31
3	100 MW	105 MW	-		5 MW * $6.31

NEXT STEPS

Next steps

- Stakeholder written comments due January 22, 2020
  - Submit to initiativecomments@caiso.com
  - Comments template available at http://www.caiso.com/informed/Pages/StakeholderProcesses/ResourceAdequacyEnhancements.aspx