DAY 1: RA Enhancements Draft Final Proposal and Sixth Revised Straw Proposal

January 5-7, 2021

The CAISO has published a draft final proposal on phase 1 elements and a sixth revised straw proposal on most phase 2 elements

- **Phase 1 (Fall 2021 for RA Year 2022)**
  - March Board of Governors (Draft Final Proposal - Phase 1)
    - Planned outage process enhancements – phase 1 (Summer 2021)
    - RA Import requirements
    - Operationalizing storage
    - Backstop capacity procurement – CPM for local energy sufficiency
- **Phase 2 (Fall 2022 for RA Year 2023)**
  - May Board of Governors (Phase 2A)
    - Unforced capacity evaluations
    - Determining system RA requirements
    - System RA showings and sufficiency testing – individual assessments
    - Must offer obligations and bid insertion modifications
    - UCAP for local studies
    - Backstop capacity procurement – CPM modifications and availability penalty structure for RMR resources
  - September Board of Governors (Phase 2B – next straw proposal pending)
    - Planned outage process enhancements – phase 2
    - System RA showings and sufficiency testing - portfolio assessment
    - Flexible resource adequacy

Agenda – Day 1
Sixth Revised Straw Proposal

Time	Topic	Presenter
10:00 – 10:10	Welcome and Introduction	Isabella Nicosia
10:10 – 12:00	Unforced Capacity Evaluations	Bridget Sparks Lauren Carr
12:00 – 1:00	Lunch	
1:00 – 4:00	Unforced Capacity Evaluations (cont.)	Bridget Sparks Lauren Carr

*Agenda items may move times/days as time permits

Agenda – Day 2
Draft Final Proposal & Sixth Revised Straw Proposal

Time	Topic	Presenter
9:00 – 9:10	Welcome and Introduction	Isabella Nicosia
9:10 – 9:25	UCAP (continued from day 1) (6 RSP)	Lauren Carr
9:25 – 10:00	Planned Outage Process Enhancements (Draft Final Proposal)	Karl Meeusen
10:00 – 11:30	RA Imports (Draft Final Proposal)	Milos Bosanac
11:30 – 12:00	Must Offer Obligations (6 RSP)	Lauren Carr

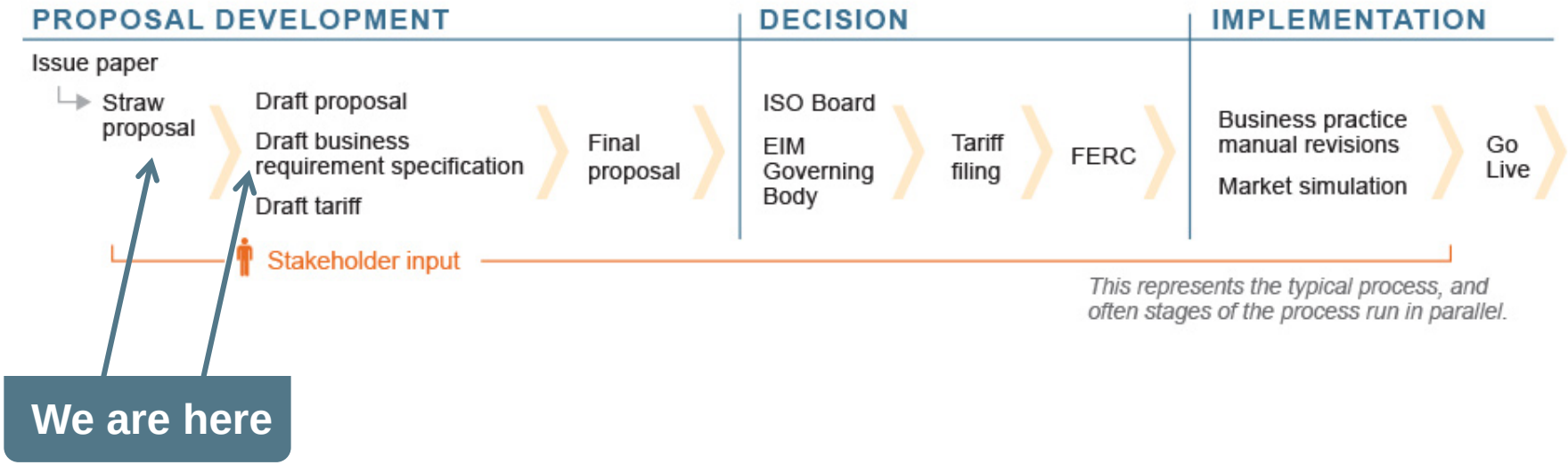
*Agenda items may move times/days as time permits

Agenda – Day 3
Draft Final Proposal & Sixth Revised Straw Proposal

Time	Topic	Presenter
1:00 – 1:10	Welcome and Introduction	Isabella Nicosia
1:10 – 1:40	Minimum System RA Requirement (6 RSP)	Karl Meeusen
1:40 – 3:00	Operationalizing Storage (Draft Final Proposal)	Gabe Murtaugh
3:00 – 3:50	Backstop Capacity Procurement (Draft Final Proposal and 6RSP)	Bridget Sparks
3:50 – 4:00	Next Steps	Isabella Nicosia

*Agenda items may move times/days as time permits

Stakeholder Process



Resource Adequacy Enhancements Policy Development Schedule

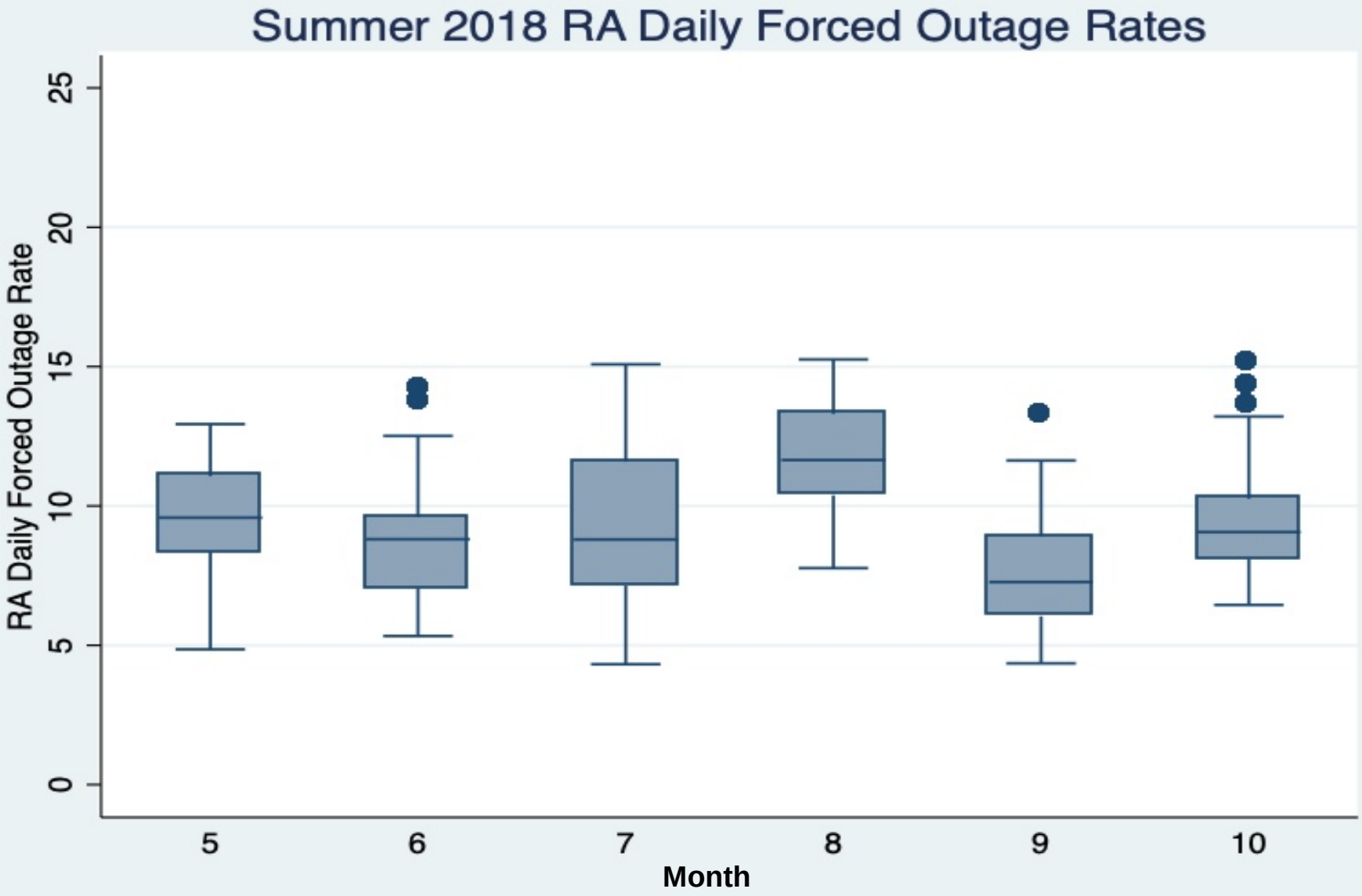
* Dates are tentative and subject to change

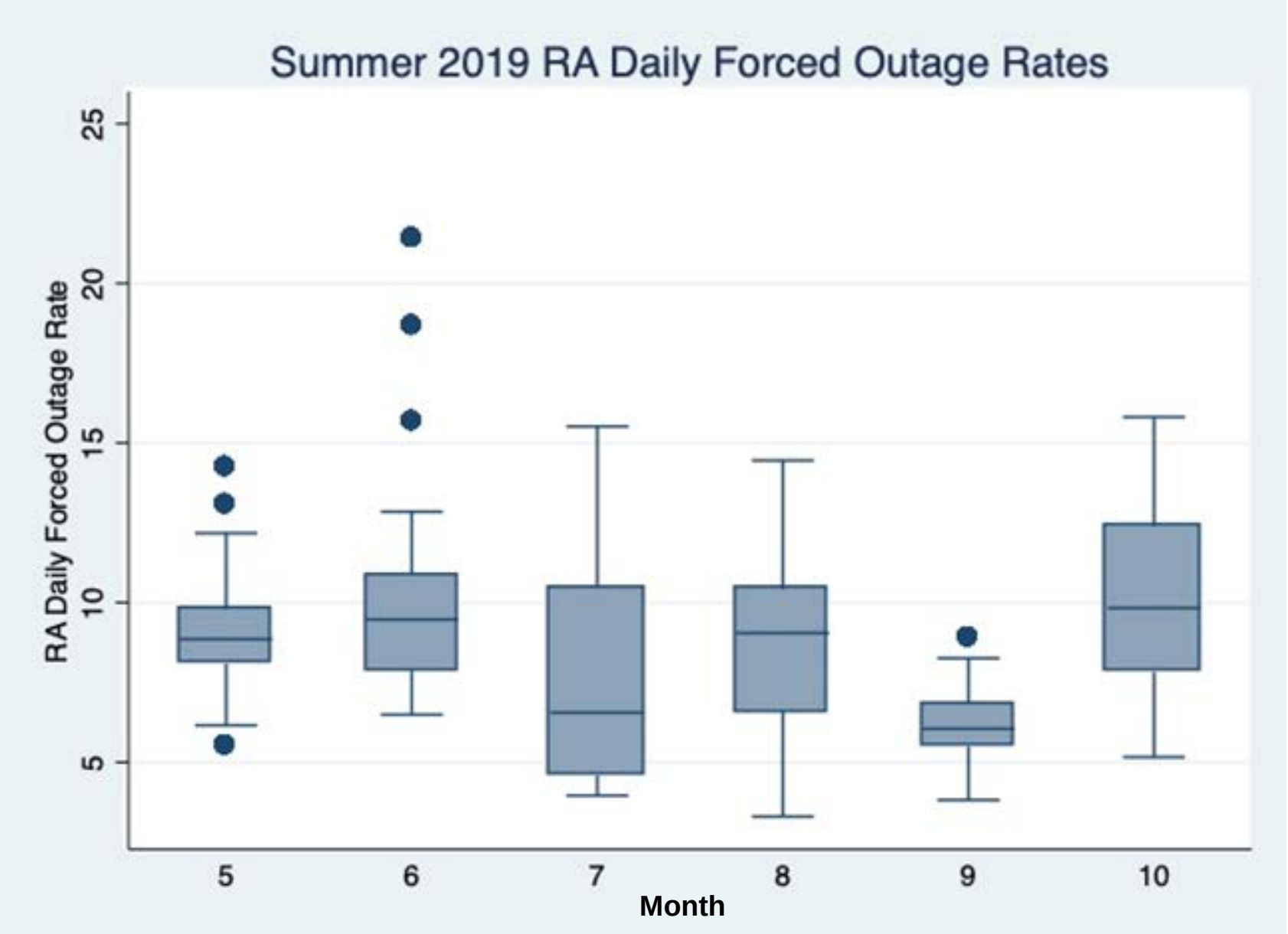
Date	Milestone
Dec 17	**Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal**
Jan 5-7 2021	Stakeholder meeting on Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal
Jan 21 2021	Stakeholder comments on Draft Final Proposal – Phase 1 and Sixth Revised Straw Proposal
Feb 2021	**Final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

UNFORCED CAPACITY EVALUATIONS

Observed Forced Outage Rate

- Daily forced outage rates on RA resources from CIRA demonstrate the average forced outage rates exceed the 4-6% forced outage rates accounted for in the current 115% PRM
- The following slides shows box and whisker plots for summer months 2018-2020 and shows the variation we have observed in forced outages
  - These charts show daily forced outage rates between 5-20%
  - In 2020, we observed average forced outage rates above 10%


Summer 2018 RA Daily Forced Outage Rates
RA Daily Forced Outage Rate
0
5
10
15
20
25
5
6
7
8
9
10
Month


Summer 2019 RA Daily Forced Outage Rates
RA Daily Forced Outage Rate
25
20
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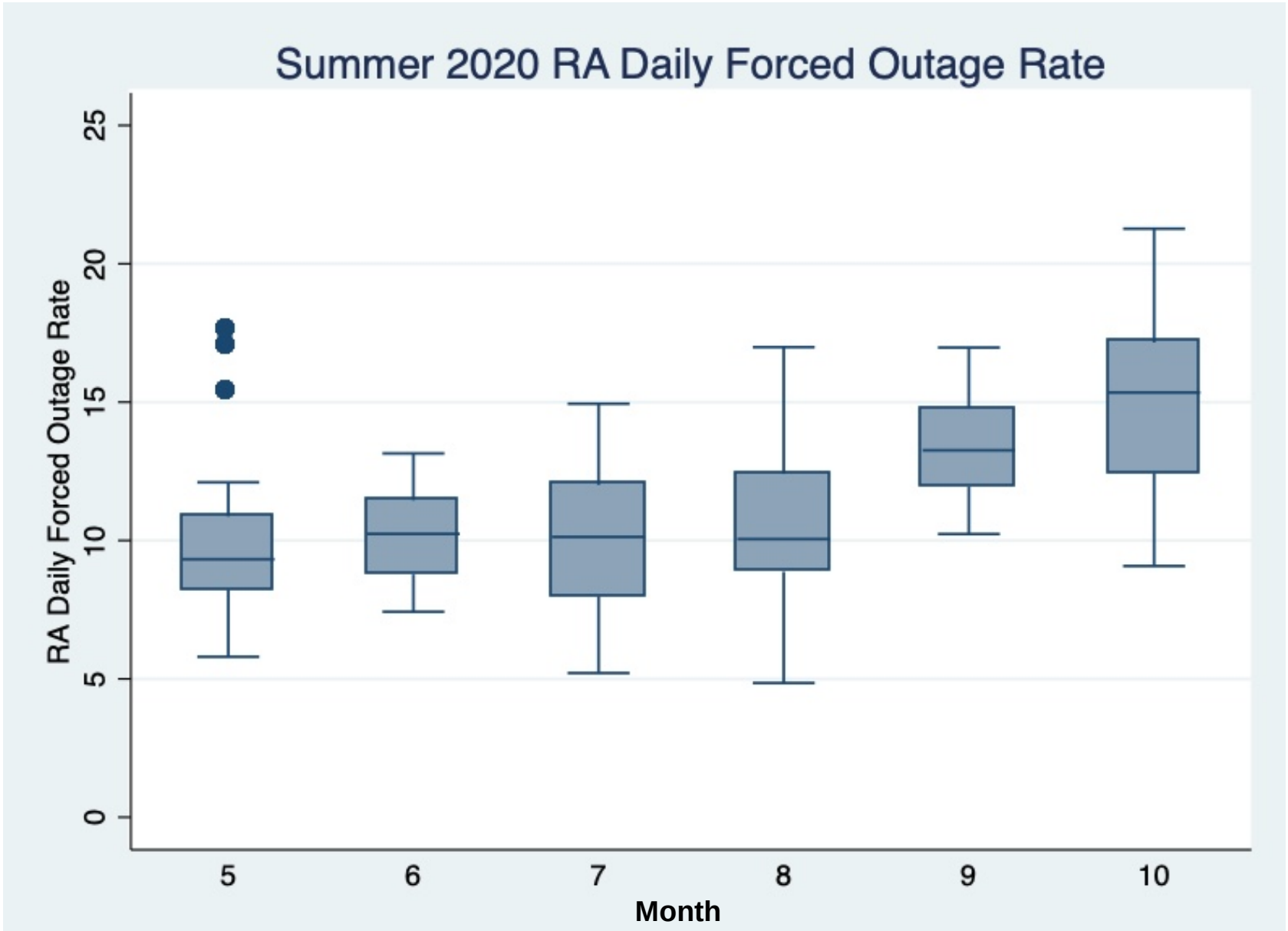
Month


Summer 2020 RA Daily Forced Outage Rate
RA Daily Forced Outage Rate
0
5
10
15
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9
10
Month

CAISO proposes an unforced capacity construct to ensure resources' capacity values reflect availability

- CAISO observes a 10% average system forced outage rate
- Current PRM, forced outage substitution rules, and RAAIM have proven inadequate to replace capacity on forced outage
- Unforced capacity evaluations promote procurement of the most dependable and reliable resources up front by accounting for historical unavailability in their capacity value
  - Allows the ISO to eliminate complicated and ineffective forced outage substitution rules
- UCAP dynamically changes with the fleet's forced outage rate
  - Relying solely on the PRM, which is a static value, may lead to over/under procurement if future outage rates change

CAISO proposes to integrate unforced capacity evaluations into the NQC process

- CAISO will conduct a two step process to assess resources' QCs that include resources' deliverability and availability
  - Step 1: Conduct resource deliverability assessment and adjust QC for deliverability, creating Deliverable QC (DQC) for the resource
  - Step 2: Apply non-availability factor to DQC, resulting in the NQC value for the resource under the UCAP construct
    - Capacity value will still be expressed in terms of NQC, addressing stakeholder concerns about existing contracts
    - Must Offer Obligation will be in terms of DQC
- CAISO continues to propose to apply UCAP calculations for local capacity counting using a conversion factor after local studies have been completed

Unforced Capacity Evaluations- Outage Definitions

CAISO BA and RC West outage processes are designed to work in tandem but outage definitions are different under these processes

- In the CAISO balancing authority (BA) outage process, generator owners (GO) and participating transmission owners (PTO) submit outages to the CAISO BA
- In the RC West outages process, BAs and transmission operators (TOP) submit outages to the RC on behalf of generator owners and transmission owners
- Both processes include a long-range, mid-range, and short-range study window process for planned outages and a real-time process for other outage types
- Currently, outage definitions differ in the CAISO BA outage process and the RC West outage process

Purpose of outage definition proposal

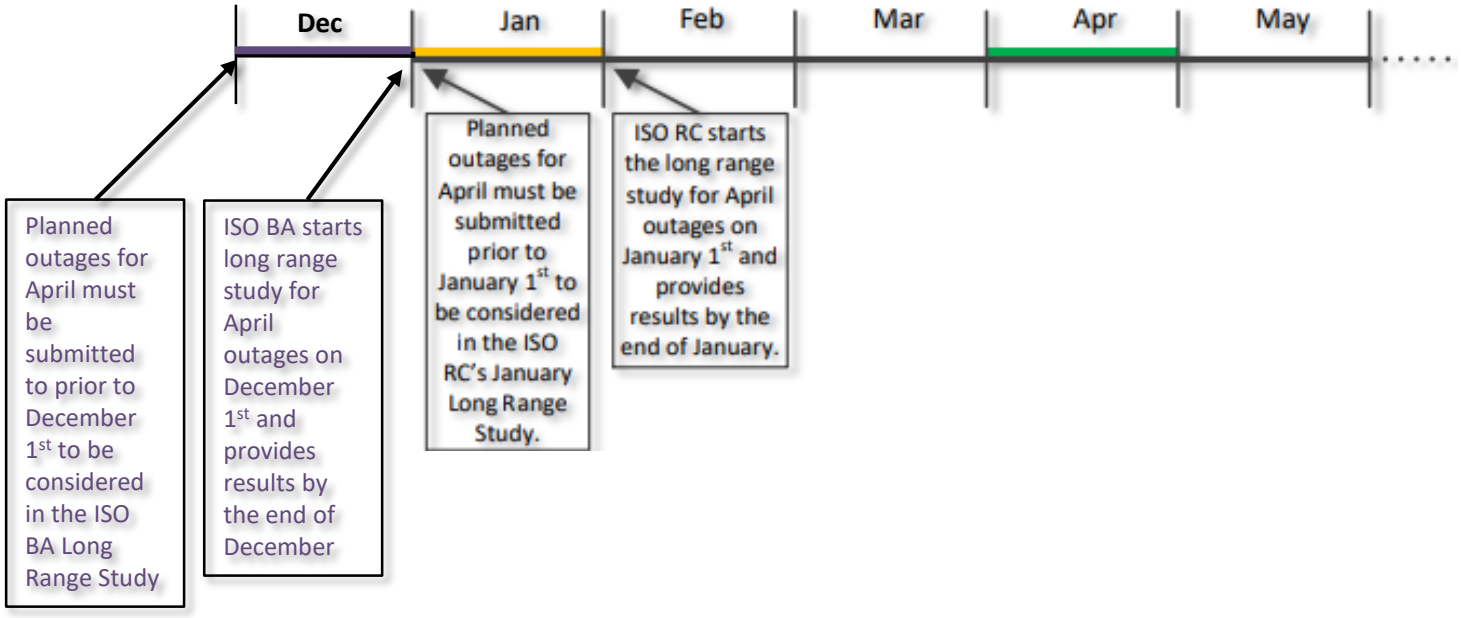
- Align CAISO BA outage definitions with existing RC outage definitions
- Classify outage definitions for UCAP purposes
- Maintain existing timelines for both the CAISO BA outage process and RC outage process, to the extent possible

Existing planned outage study windows and examples

Existing Long Range Study Window

- Long range study window process is optional
- Long range outage submission deadlines:
  - Generator Owners (GO) and Participating Transmission Owners (PTO) submit outages to CAISO BA: Prior to the first day of the month one full calendar month in advance of the Reliability Coordinator's (RC) Long-Range submission deadline
    - CAISO provides study results prior to the RC's Long-Range outage submission deadline
  - Balancing Authorities (BA) and Transmission Operators (TOP) submit outages to RC West: Prior to the first day of the month three months prior to the start of the month being studied
    - RC provides study results no later than the end of the month after outage submittal

Long Range Study Window Example

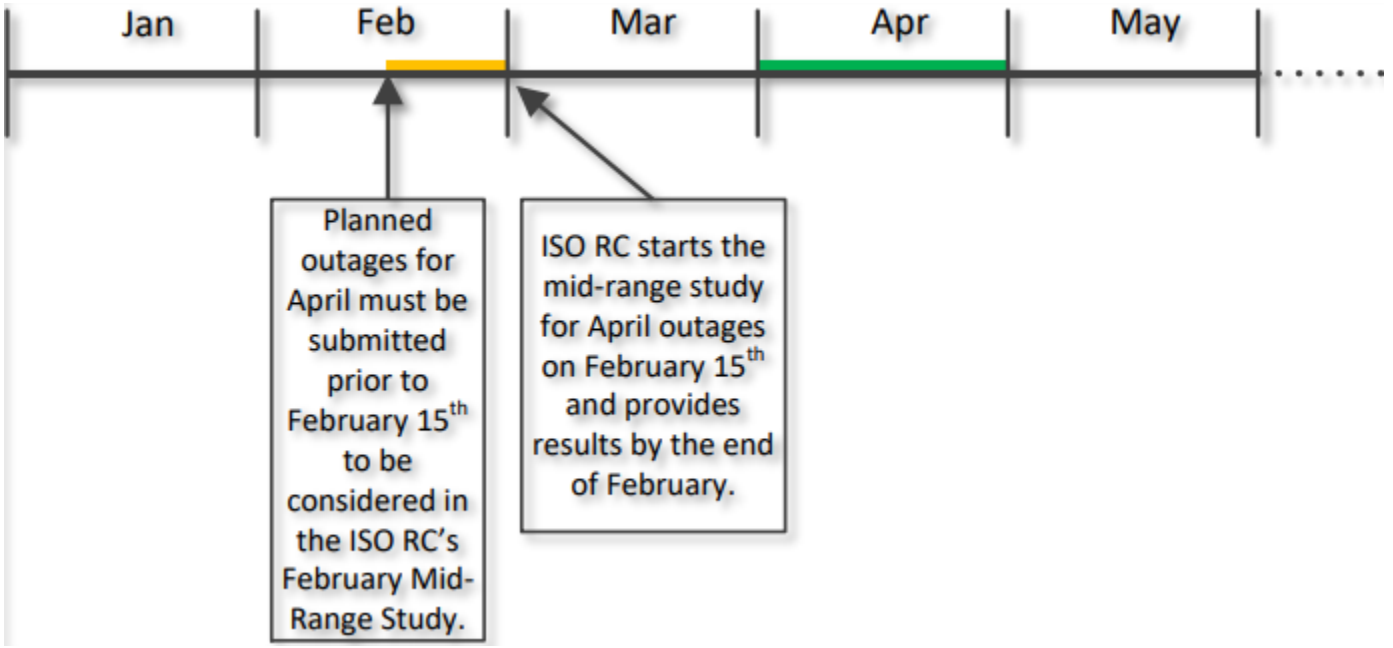


CAISO BA outage submission (GOs and PTOs submit to CAISO BA)
RC outage submission (TOPs and BAs submit to RC)

Existing Mid Range Study Window

- Mid range study window process is optional
- RC and CAISO BA study timelines are the same
- Mid range outage submission deadlines:
  - GO/PTO submit outages to CAISO BA and BAs/TOPs submit outages to RC West: prior to 45 days prior to the start of the month being studied (e.g., outages occurring in April must be submitted prior to 0001 on February 15th)
    - CAISO BA and RC provides study results no later than the end of the month of outage submittal

Mid-Range Study Window Example



CAISO BA outage submission (GOs and PTOs submit to CAISO BA) &
RC outage submission (TOPs and BAs submit to RC)

Existing Short Range Study Window

- Short range study process is mandatory
- Short range submission deadlines
  - GO/PTO submit outages to CAISO BA: No less than 5 full business days in advance of the Reliability Coordinator's Short-Range submission deadline
  - BA/TOP submit outages to RC West: one (1) week prior to the start of the week being studied

Short Range Study Window Example

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

CAISO BA outage submission (GOs and PTOs submit to CAISO BA)

RC outage submission (TOPs and BAs submit to RC)

Real-time Study Window

Outages submitted after the Short Range Submission Deadline – Current process

- Today, BA/TOP outages submitted after the short range study window are either an planned if its submitted before T-7 (T = start of the outage) or forced if it is submitted T-7 or after
  - Planned outages that fall between short range window and T-7 are currently studied as opportunity outages in the RC study process
  - Forced outages (submitted at T-7 or after) are submitted when resource has increased risk of breaking, or if outage happens in real time
- Today, RC opportunity, urgent, and forced outages can be used after the short range study window closes

Outages submitted after the Short Range Submission Deadline – Proposed process

- If outages are not submitted as planned (i.e., before the short range window ends), outages should be submitted as opportunity, urgent, or forced in alignment with the RC outage definitions
  - Opportunity and urgent outages should not be abused to avoid submitting outages in the planned outage timeframe
    - CAISO will have discretion over whether a submitted opportunity outage is studied and approved
    - Planned outages will be prioritized over opportunity outages
    - Because urgent outages have the same priority as forced outages, they will be subject to UCAP

Outage Definitions, Priorities, and UCAP Impacts

CAISO proposes to align CAISO BA outages with existing RC outage definitions (1 of 3)

- **Forced Outage** – Facility/equipment that is removed from service in real-time with limited or no notice
- **Urgent Outage** – Facility/equipment that is known to be operable, yet carries an increased risk of a Forced outage occurring
  - Facility/equipment remains in service until personnel, equipment and/or system conditions allow the outage to occur
  - Urgent outages allow facilities to be removed from service at an optimal time for overall system reliability
  - The work may or may not be able to wait for the Short Range outage window
  - An Urgent outage must have a justification of its urgency documented in the BA/TOP comments section of the outage submission

*Full requirements are documented in the RC0630 Procedure

CAISO proposes to align CAISO BA outages with existing RC outage definitions (2 of 3)

- **Planned Outage** – Facility/equipment outage with enough advance notice to meet short range submittal requirements
- **Opportunity Outage** – A Facility/equipment outage that can be taken due to a change in system conditions, weather or availability of field personnel
  - Opportunity outages did not meet the short range window requirements
  - Opportunity outages that cause reliability issues or conflict with other Submitted or Confirmed outages of a higher priority cannot be implemented
  - Opportunity outages should have an emergency return time of 8 hours or less

*Full requirements are documented in the RC0630 Procedure

CAISO proposes to align CAISO BA outages with existing RC outage definitions (3 of 3)

- **Operational Outage** – Transmission Facility/equipment that is removed from service in the normal course of maintaining optimal or reliable system conditions but remains available if needed upon short notice
  - For transmission only
- **Informational Outage** – Facility/equipment outage entered for informational reasons including increased situational awareness, for BA/TOP internal purposes or to satisfy the RC Data Specification in WebOMS
  - Do not cause derate or require engineering study
- These outages would also be adopted for the CAISO BA to ensure full alignment with RC outage definitions

Outage Priorities and UCAP impacts

- Outage priorities (from highest to lowest)
  - Forced Outage, Urgent Outage
  - Planned Outage
  - Opportunity Outage
- Forced and urgent outages will be considered in the UCAP calculation
- Planned and opportunity outages will not be considered in the UCAP calculation
- Outage type (planned, forced, urgent, or opportunity) will be submitted in addition to nature of work

Several stakeholders submitted comments on urgent outages

- Stakeholders requested additional clarity on the definition
- Urgent outages are outages with the same priority as a forced outage but unlike a forced outage where the facility is removed from service in real-time with little or no notice, the facility is still operable at the time of outage submission
- However, forced outage is imminent if the urgent outage is not taken, and as such cannot be treated as a planned outage or opportunity
  - Urgent outages are prioritized the same as a forced outage to avoid more significant and potentially longer forced outages

Several stakeholders submitted comments on urgent outages

- Other stakeholders suggested urgent outages should not be considered in the UCAP calculation, or should be weighted differently than forced outages in the calculation
- The CAISO does not adopt this suggestion
- UCAP should incentivize resources to properly plan maintenance within the CAISO's planned outage and opportunity outage processes to ensure resources do not wait until outages are imminent or already happening

CAISO modified proposal regarding forced and urgent outages that will not be included in UCAP calculation

- CAISO modified outage exemption proposal to ensure it:
  - Incentivizes resource maintenance and availability
  - Provides clear exemption criteria
- Following feedback from stakeholders, the CAISO will exclude outages in the UCAP calculation if they are caused by outage on transmission equipment or associated facilities that are a part of the CAISO Controlled Grid
  - CAISO Controlled Grid: The system of transmission lines and associated facilities of the Participating TOs that have been placed under the CAISO's Operational Control
  - If a resource is unavailable due to an outage on equipment that is not a part of the CAISO Controlled Grid, those outages will be included in the UCAP calculation

Existing Nature of Work Categories

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

UCAP Methodology: Seasonal Availability Factors

CAISO proposes a seasonal availability factor methodology to determine UCAP values

- CAISO proposes to utilize a seasonal availability factor based approach for UCAP determinations during the tightest system conditions by looking at the hourly RA Supply Cushion
- Resource availability factors will incorporate historical forced and urgent derates and outages to determine the resource's expected future availability and contributions to reliability
- Basic UCAP methodology will be used for thermal and storage resources
- CAISO recognizes that this baseline methodology will not be appropriate for all resource types and provides augmented methodologies to determine these resource's average availability

CAISO proposes to calculate resource availability on a seasonal basis measured on tight RA supply cushion hours

- Considers different impacts of availability during seasons across the year to better reflect unit reliability
- A low RA supply cushion indicates the system has fewer assets available to react to unexpected outages or load increases, indicating a high real-time system resource adequacy risk
- Stakeholder comments generally support seasonal approach
- Captures how tight the system would be if we only had the RA fleet to rely on - Makes no assumptions about economic energy, because with tightening conditions across the West this may no longer be a viable assumption, or prudent design of the RA program

Defining Top 20% Tightest RA Supply Cushion Hours

- **RA Supply Cushion = Daily Shown RA** (excluding wind and solar) **– Planned Outages – Opportunity Outages – Urgent Outages – Forced Outages – Net Load – Contingency Reserves**
- RA Supply cushion represents how much shown RA MWs are leftover after we take into account outages, serving net demand, and covering contingency reserves
- Contingency Reserves represents Regulation Up, Spin and Non-Spin Reserves
- Measured in MWs
- Because net load is a 5 minute measure, to convert the supply cushion into an hourly value we take the mean of the supply cushion across all 12 RTD intervals to represent the supply cushion in each operating hour

Defining Peak and Off Peak Months

- The CAISO initially proposed to define peak months as May-September and off-peak months as October-April
  - This decision was made in part to align with CPUC's definition of summer months
- Operations has observed continued high loads and temperatures into October and suggested we re-define October as a Peak Month for the purposes of UCAP
- Next slide presents the monthly hourly supply cushion distribution, and evidence supports reclassifying October as a Peak Month
- New proposal to calculate seasonal UCAP values for:
  - Peak Months- May - October
  - Off-Peak Months- November - April

Monthly distribution of the hourly RA supply cushion

P	1	2	3	4	5	6	7	8	9	10	11	12
1%	-692	-2641	-2268	-2127	1529	-3097	-4213	-2691	1937	-23	-3354	-3136
5%	1132	-597	-590	711	3704	955	-1518	1059	4650	2390	-1804	-720
10%	2158	626	662	2314	5229	3777	1050	3252	6884	4330	-609	400
20%	**4019**	**2444**	**2325**	**4924**	**7333**	**7228**	**4726**	**6678**	**10612**	**6648**	**1270**	**2432**
25%	4674	3308	3075	5855	8143	8230	6368	7981	11690	7634	2221	3279
50%	7801	6434	5798	9494	10949	11827	10836	12446	15627	11314	5257	6338
75%	10589	10624	9943	13299	14290	15630	16346	15942	18782	14353	7945	9469
90%	13697	14120	13794	17412	16958	19670	20620	18893	21739	17864	10827	12595
95%	15230	15570	15207	19164	17969	21436	23144	20680	23664	20227	12544	14348
99%	17753	18402	16842	20782	20325	23246	26594	24368	28161	22911	14710	17509
Mean	7857	6988	6549	9590	11068	11712	11097	11816	15099	11166	5178	6455

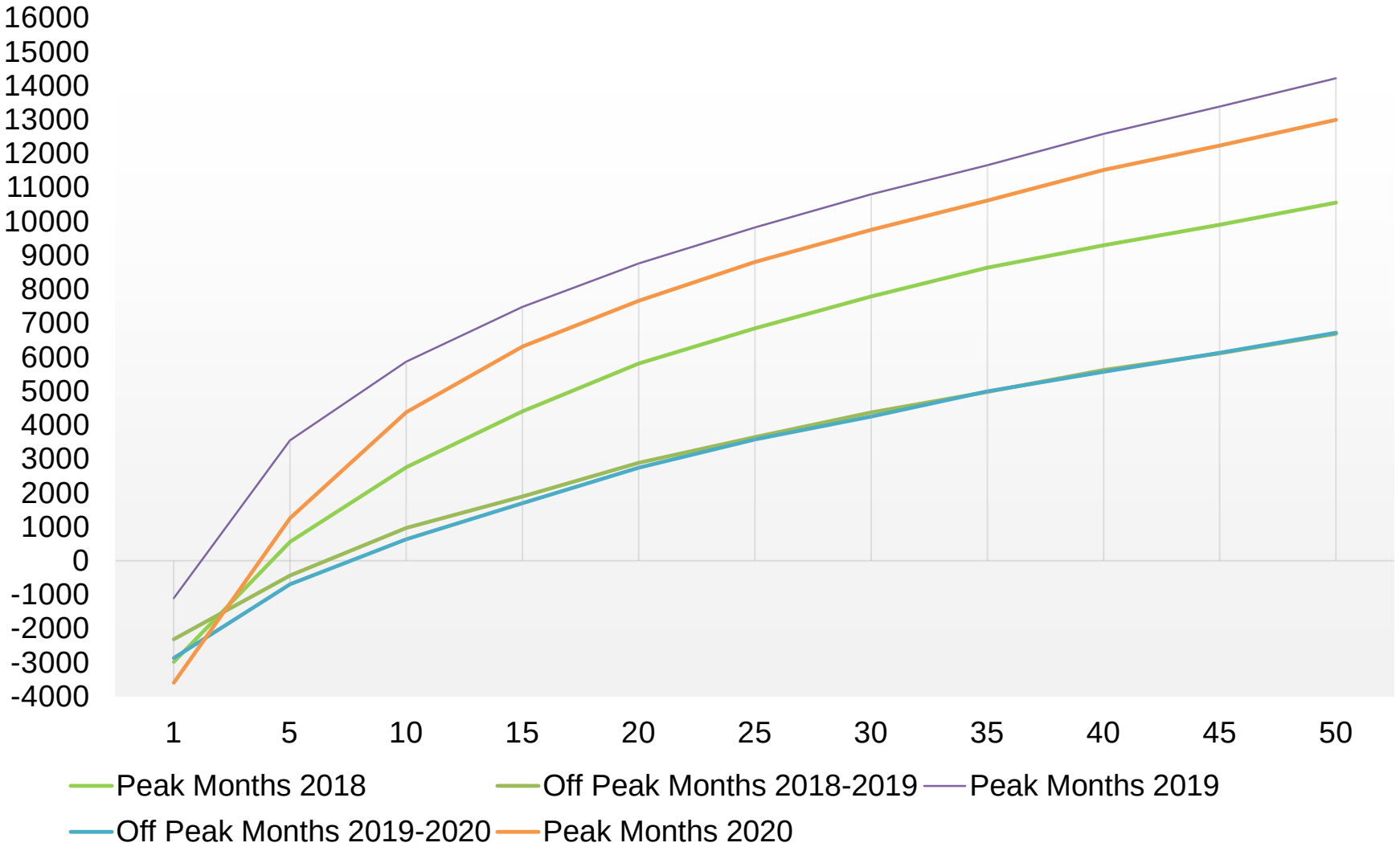
- The October distribution of hourly RA supply cushion looks more similar to Peak/Summer Months than an Off Peak Month
  - It has a similar high mean of 11,000+ MWs
  - The 20th percentile tends to be above 5000 for Peak Months and under 5000 for Off Peak Month, and October is over 5000 MMs, and thus similar to Peak Months

Distribution of RA Supply Cushion Hours (in MWs):

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

Note: A negative value indicates there was a capacity shortfall- did not have enough Shown RA to cover Outages, Net Load, and Contingency Reserves

RA Supply Cushion Hour Percentiles



CAISO proposes to assess applicable outages during the top 20% of tightest RA supply cushion hours

- Today we assess 5 RAAIM hours per day, which is roughly 20% of all hours
- Using RAAIM as basis, we are proposing to calculate UCAP based on the top 20% of tightest RA supply cushion hours for peak and off peak months
- Advantages
  - Penalizing resources for being on a forced outage when the grid needed them
  - These assessment hours can fall at any point in the day, and thus resources are incentivized to always be available
  - Simpler than an EFORd methodology (allows for utilization of OMS rather than GADs data), or weighting of all hours
  - Provides consistency across evaluation periods, and more predictable risk of any one outage on a resource's capacity value
  - Provides observations for majority of days and covers a large enough sample size

Stakeholder Comments on selecting the number of UCAP Assessment Hours

- The CAISO continues to advocate that we look at the top 20% tightest RA Supply Cushion Hours
- In Stakeholder Comments:
  - Wellhead has advocated that we selected the top 10% of tightest RA Supply Cushion Hours
  - CESA has advocated that we select the top 15% of tightest RA Supply Cushion Hours
- The next slide compares these three sampling frameworks, full data is available in Appendix slides

Summary of Comparison of three suggested Assessment Windows for UCAP

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

UCAP Assessment window trades off % of days with more hours between HE 18-22. CAISO continues to believe that the top 20% provides the strongest incentive to be available 24x7, while allowing for some outages during unstressed conditions

Stakeholder comments on RA Supply Cushion

- A few stakeholders during the Dec. 11th MSC call questioned whether only looking at the RA fleet was the correct measure to evaluate critical grid needs, and whether we should also consider economic energy or additional committed non-RA capacity
- The RA program should be designed so the CAISO can manage the grid under stressed conditions with capacity that has paid for and is subject to a Must Offer Obligation and bid insertion; there's no guarantee or hope that "unpaid" capacity will be there in the future, especially during tight supply hours
  - UCAP is meant to answer, in a world where we only had RA resources to rely on, what is the expected availability of these "procured and paid for" RA resources we depend on?

Summary of UCAP process steps

1. Determine UCAP Assessment Hours by identify which hours fall into the top 20% of tightest RA supply cushion hours for each season
2. Determine Hourly Unavailability Factors (HUF) for each UCAP assessment hours each season
3. Determine Seasonal Average Availability Factors (SAAF) using HUFs for each season of prior year
4. Determine Weighted Seasonal Average Availability Factors (WSAAF) using proposed weighting approach
5. Apply WSAAFs for each season of the prior 3 annual periods to determine monthly UCAP/NQC (On-peak and Off-peak) values for each resource

Proposed UCAP calculation steps

- CAISO will determine each resource's Hourly Unavailability Factor (HUF) for each of the 20% tightest RA Supply cushion hours per season

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

- CAISO will utilize the average of Hourly Unavailability Factors (HUF) for each season for each of the past 3 years to create a Seasonal Average Availability Factor (SAAF) for each resource

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

Proposed UCAP calculation steps (continued)

- CAISO proposes the following percentage weights for the availability factor calculation by year from most recent to most historic: 45-35-20%
- In other words, the following percentage weights will be applied to the seasonal availability factors:
  - 45% weight for the most recent year's seasonal availability factor
  - 35% weight on the second year
  - 20% on the third year
- CAISO will then apply proposed weighting to each of the three previous annual periods (for each on-peak and off-peak season) to create Weighted Seasonal Average Availability Factors (WSAAF)

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

Proposed UCAP calculation steps (continued)

- Once the Weighted Seasonal Average Availability Factors (WSAAF) are established for each season of each of prior 3 years, CAISO will sum the factors and apply them to each resource's DQC to determine the resource's seasonal UCAP/NQC ratings

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

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

Estimating fleet UCAP by fuel type: Natural Gas

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.886	20%	0.177
2	0.869	35%	0.304
1	0.875	45%	0.394
		Total = 100%	0.875
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.893	20%	0.179
2	0.901	35%	0.315
1	0.884	45%	0.398
		Total = 100%	0.892

Natural gas fleet WSAAF (Peak Months)	Natural gas fleet WSAAF (Off Peak Months)	Example DQC of Natural Gas resource	On-Peak NQC	Off-Peak NQC
0.875	0.892	500 MW	437.5 MW	446 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

UCAP Methodologies for Non-Conventional Resources

Summary of UCAP methodologies for non-conventional resources

- **Hydro:** Longer term historical year weighted average assessment
- **Non-dispatchable resources:** if the QC methodology already accounts for forced outages, DQC=UCAP/NQC
- **Wind and Solar:** Use ELCC values as UCAP
- **Demand Response:** Use ELCC if adopted, otherwise use performance metric at the DRP level
- **QFs:** Performance relative to dispatch
- **Imports:** Consider transmission curtailments for non-frim transmission in addition to outages
- **Hybrids:** Consider dynamic limits in the HUF calculation
- **New Resources:** Start with DQC and weight early years of availability data more heavily until 3 years of data are reached

CAISO proposes a hydro UCAP counting methodology that generally aligns with CPUC decision on hydro counting

- Hydro resource output depends heavily on snowpack water availability, which can vary drastically from year to year
- CAISO proposes an alternative to the standard UCAP calculation, which would use a longer term historical-year weighted average assessment of resource availability during the 20% tightest supply cushion hours
  - Consider outages due to both water availability and mechanical outages for the previous 10 years
  - The CAISO proposes to use the historical availability during the RAAIM hours for years prior to calculating supply cushion

The following steps would be used to calculate UCAP for hydro resources

- Use historical bid in capacity to calculate a 50 percent exceedance and a 10 percent exceedance value
  - Weight the 50 percent value by 80 percent and the 10 percent value by 20 percent to determine the UCAP value
    - **UCAP = (.8*Median+.2*10th percentile)**
- If capability can be better estimated closer to the operation month, the resource can be shown more conservatively in the year-ahead and increase in the month-ahead timeframe up to the UCAP value
- Resources can incorporate infrastructure upgrades that increase the maximum output of the resource proportionally to years prior to the infrastructure upgrades
  - These should only include infrastructure upgrades that increase the maximum capability of the resource, not maintenance that reduces the likelihood of forced outages

For non-dispatchable resources and resources with QC values calculated using ELCC, CAISO will use the QC/ELCC value as the UCAP/NQC value

- Non-dispatchable resources: if the QC methodology already accounts for forced outages, DQC=UCAP/NQC
- CAISO will rely on an ELCC methodology when applicable
  - ELCC will establish UCAP values for wind and solar resources
  - Currently, the CPUC only applies this methodology to wind and solar resources, but could expand it to cover other variable energy resources such as variable output DR

CAISO will use ELCC value as the UCAP value for two main reasons

1. Other ISOs equate wind and solar UCAP values with a statistical assessment of resources' output
2. ELCC already takes into account the probability of forced outages for wind and solar resources

- By using ELCC, these technologies have already had QCs reductions for expected forced outages and derates
- CAISO understands there are some shortcomings of this approach but believes this is the most appropriate option for the application of UCAP for these resource types

Resources that do not have ELCC based QC methodology but have a need for alternative UCAP determination approach

- For DR and QF resources their availability is often variable or limited to certain periods dictated by program hours or end-use customer needs
  - CAISO believes these resources should be assessed in a different manner to establish their UCAP values
- If LRAs do not adopt an ELCC based QC methodology for these variable and availability-limited resources, CAISO will apply an alternative UCAP determination

DR and QF resource: alternative performance based UCAP determination

- For DR and QF resources CAISO will evaluate resource performance relative to their dispatch instructions for periods when they received market awards and tests
- CAISO will track each resource's historical performance over the prior 3 years and compare dispatches and tests to actual performance to establish their UCAP value
- For DR providers, CAISO proposes to apply this approach at the DRP-level, rather than an individual resource level
  - Intended to prevent poorly performing DR providers from receiving UCAP values equal to the DQC simply by changing or creating a new resource IDs that have no historical data

UCAP treatment for RA imports - Outage reporting obligations

	Outage Rule	
Import Type	RA	Non-RA
Pseudo-tie	Per Appendix A, this is a Generating Unit. Normal rules apply.	Per Appendix A, this is a Generating Unit. Normal rules apply.
Dynamic resource specific system resources	No reporting for planned outages. Notify ISO of forced outages within 60 minutes of discovery. §§ 9.3.10.3 & 9.3.10.3.1	No reporting for planned outages. Notify ISO of forced outages within 60 minutes of discovery. §§ 9.3.10.3 & 9.3.10.3.1
Non-dynamic resource specific system resources **Note: These rules will be applied to the new Non-dynamic resource specific RA Imports**	No reporting for planned outages. Notify ISO of forced outages within 60 minutes of discovery. §§ 9.3.10.3 & 9.3.10.3.3	No reporting for planned outages. Notify ISO of forced outages within 60 minutes of discovery. §§ 9.3.10.3 & 9.3.10.3.3

- For Dynamic and Pseudo-tie RA resources, CAISO will apply the relevant UCAP methodology based on the underlying resource type, for example a Pseudo-tie Storage resource would apply the UCAP methodology for Storage, and a Dynamic gas generator would get the thermal UCAP methodology

UCAP treatment for RA imports*: Interplay of transmissions and resource outages

Forced Outages		
Resource Outage? (OMS record)	**Transmission Cut? (E-tag record)**	**UCAP Evaluation**
Yes	N/A [fails before flow]	Yes
No	Yes - Non-firm	Yes
Yes	Yes - Firm [fails in hour]	Yes
No	Yes - Firm	No

UCAP for:

- Forced outages on import resource reported in OMS
- Non-firm transmission cut reported in E-tag will be incorporated as an outage in the HUF

*Pseudo-ties treated as internal generation for UCAP calculation

UCAP treatment for Non-Dynamic Resource Specific RA Imports

- CAISO proposes to apply UCAP for Non-dynamic Resource Specific RA Import resources at the SC level, rather than an individual resource level
  - This SC-level approach enables the CAISO to track availability for RA imports with unique transaction IDs created when scheduled, as opposed to resource IDs
- UCAP would be assessed on an SC level using their shown RA and forced outages (and transmission cuts if using alternative non-firm transmission option)
  - $$\textbf{Hourly Unavailability Factor} = \frac{\textit{Non}\text{-firm Transmission Curtailments} + \text{Forced \& Urgent Outage } \textit{Impacts}}{\text{Contracted } \textit{MWs}}$$
  - For example, if an SC shows two import RA resources, 100 MW and 50 MW, then they would be evaluated on 150 MW subject to forced outages and transmission cuts in a given year

UCAP Treatment for Co-Located and Hybrid Resources

- Co-located: UCAP methodology applied to individual components (e.g. solar + storage: ELCC for solar component, UCAP for storage component)
- How will outages and dynamic limits be incorporated in the UCAP calculation for hybrid resources?
  - Hybrid resources will submit mechanical outages to the CAISO via the outage management system
  - Hybrid resources will have the ability to manage variable output through the ‘hybrid dynamic limit’ tool
    - Ambient derates, absence of variable generating capability, limitations on generation due to state of charge and on-site charging can be submitted through the dynamic limit tool

UCAP Treatment for Hybrid Resources

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

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

- Where the Dynamic Limit Impact is equal to:

$$\boldsymbol{Dynamic\ \ Limit\ Impact} = \boldsymbol{Average}(\boldsymbol{Pmax - Dynamic\ Limit})$$

- There will be no changes to the Seasonal Average Availability Factor or Weighted Seasonal Average Availability Factor described above. Finally, to determine the final UCAP value, the CAISO will multiply the relevant WSAAF to the Pmax of the resources:

$$\boldsymbol{On\ Peak\ UCAP} = \boldsymbol{Pmax} * \boldsymbol{Weighted\ Seasonal\ Average\ Avaliability\ Factor}_{\boldsymbol{On\ Peak}}$$

$$\boldsymbol{Off\ Peak\ UCAP} = \boldsymbol{Pmax} * \boldsymbol{Weighted\ Seasonal\ Average\ Avaliability\ Factor}_{\boldsymbol{Off\ Peak}}$$

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

Example Hybrid Resource Calculations

Example 1: Hybrid Resource A (100 MW Solar+ 50 MW Storage)

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

Example 2: Hybrid Resource B (100 MW Solar+ 100 MW Storage)

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

By taking the minimum of the UCAP or QC, the CAISO avoids double counting of outages or limitations on the VER component

UCAP for New Resources

- For new resources, the CAISO will set the resources UCAP/NQC equal to its DQC
- The subsequent two years of availability data more be weighted more heavily, and the DQC value would quickly roll off until the resource has three years of operational data
- The CAISO proposes the following weights:
  - Year 0 (i.e. before operational data is available): DQC
  - Year 1 70% Year 0 SAAF; 30% DQC
  - Year 2 55% Year 1 SAAF; 45% Year 0 SAAF
  - Year 3 45% Year 2 SAAF; 35% Year 1 SAAF; 20% Year 0 SAAF

CAISO pulled CIRA data to estimate the fuel type WSAAF to assess fleet impact

- Stakeholders requested more data on how the move to UCAP might impact the value of the RA fleet
- Daily Outage rates where taken from CIRA and merged with the UCAP Assessment Hours for May 2018- October 2020
- Year 3 Off Peak WSAAF was estimated as the average of Year 1 and 2
- While individual resource's outage data may vary from the fleet wide fuel type average, this data can provide some estimation of the impact of moving towards a UCAP paradigm
- Appendix slides provide estimates for Bio-gas, Bio-mass, Coal, Natural Gas, Geothermal, and Storage (assumes all resources are dispatchable)

June RA showings converted from DQC to NQC (UCAP)

Fuel Type	Peak Month WSAAF	June DQC Shown	June NQC Estimate
Battery	0.964	110.00	106.04
Biomass	0.849	540.00	458.46
Coal	0.965	18.00	17.37
Demand Response*	0.984	235.00	231.24
Gas	0.875	27,002.00	23,626.75
Geothermal	0.868	984.00	854.11
Hydro*	0.816	5,544.00	4,523.90
Nuclear	0.940	1,640.00	1541.60
Pump Hydro*	0.816	1,285.00	1048.56
Interchange*	0	4,118.00	4118.00
Solar	ELCC	3,303.00	3,303.00
Wind	ELCC	1,688.0	1,688.0
HRCV	0.933	29.00	27.06
Other	0.984	0.13	0.13
Pumping Load		59.00	59.00
Total		46,555.13	41,603.22

- Taking the RA showings for June 2020, we applied the Peak Month WSAAF to estimate the new NQC value of the June 2020 RA Showings
- Shows a 10.64% reduction, which matches the roughly 10% forced outage rate of the system.
- Note DR, Hydro, and interchange resources are estimates based on forced outage rates, which differs from the proposed methodologies
- Does not distinguish b/ween dispatchable and non dispatchable resources
- Appendix slides provide more details on WSAAF calculations by Fuel Type

August RA showings converted from DQC to NQC (UCAP)

Fuel Type	Off Peak Month WSAAF	Aug. DQC Shown	Aug. NQC Estimate
Bio-Gas	0.864	155.02	133.91
Bio-Mass	0.849	320.24	271.86
Coal	0.965	492.10	474.99
Natural Gas	0.875	28,151.80	24,635.47
Geothermal	0.868	1,090.00	945.98
Heat Recovery	0.933	1.85	1.73
Imports	--	4,498.12	4,498.12
Nuclear	0.940	2,797.20	2,628.43
Other	0.984	161.18	158.61
Solar	ELCC	2,968.02	2,968.02
Storage	0.964	105.61	101.76
Waste	0.872	59.24	51.65
Water	0.816	6,663.09	5,438.76
Wind	ELCC	1,268.37	1,268.37
Total		48,740.80	43,577.66

- Taking the RA showings for August 2020, we applied the Off Peak Month WSAAF to estimate the new NQC value of the Aug. 2020 RA Showings (doesn't include mid-August increase in showings following subsequent CPMs)
- Shows a 10.59% reduction, which matches the roughly 10% forced outage rate of the system.
- Note DR, is included in the Other category
- Does not distinguish b/ween dispatchable and non dispatchable resources
- Appendix slides provide more details on WSAAF calculations by Fuel Type

November RA showings converted from DQC to NQC (UCAP)

Fuel Type	Off Peak Month WSAAF	Nov. DQC Shown	Nov. NQC Estimate
Bio-Gas	0.892	153.94	137.31
Bio-Mass	0.842	215.10	181.11
Coal	0.946	259.48	245.47
Natural Gas	0.892	25,027.63	22,324.65
Geothermal	0.78	1,103.74	860.92
Heat Recovery	0.883	28.62	25.27
Imports	---	1,139.80	1,139.80
Nuclear	0.946	2,039.75	1,929.60
Other	0.981	185.14	181.62
Solar	ELCC	243.17	243.17
Storage	0.946	144.42	136.62
Waste	0.862	59.46	51.25
Water	0.857	3,563.24	3,053.70
Wind	ELCC	685.37	685.37
Total		34,848.86	31,195.87

- Taking the RA showings for November 2020, we applied the Off Peak Month WSAAF to estimate the new NQC value of the Nov. 2020 RA Showings
- Shows a 10.48% reduction, which matches the roughly 10% forced outage rate of the system.
- Note DR, is included in the Other category
- Does not distinguish b/ween dispatchable and non dispatchable resources
- Appendix slides provide more details on WSAAF calculations by Fuel Type

APPENDIX: COMPARING UCAP ASSESSMENT HOUR THRESHOLDS

Top 20% of Tightest RA Supply Cushion Hours by Operating Hour

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

Top 15% of Tightest RA Supply Cushion Hours by Operating Hour

HE	Peak Months 2018		Off Peak Months 2018-2019		Peak Months 2019		Off Peak Months 2019-2020		Peak Months 2020	
	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.
1	1	0.15	2	0.31	7	1.06	1	0.15	8	1.21
2	0	0.00	1	0.15	3	0.45	1	0.15	0	0.00
3	0	0.00	1	0.15	1	0.15	0	0.00	0	0.00
4	0	0.00	1	0.15	1	0.15	0	0.00	0	0.00
5	0	0.00	1	0.15	1	0.15	1	0.15	0	0.00
6	0	0.00	2	0.31	6	0.91	4	0.61	0	0.00
7	3	0.45	34	5.22	13	1.96	29	4.43	2	0.30
8	4	0.60	28	4.30	8	1.21	21	3.21	1	0.15
9	1	0.15	2	0.31	2	0.30	5	0.76	0	0.00
10	1	0.15	1	0.15	1	0.15	2	0.31	0	0.00
11	0	0.00	0	0.00	1	0.15	0	0.00	0	0.00
12	0	0.00	0	0.00	1	0.15	0	0.00	1	0.15
13	2	0.30	0	0.00	4	0.60	0	0.00	1	0.15
14	9	1.36	0	0.00	6	0.91	0	0.00	10	1.51
15	15	2.27	0	0.00	9	1.36	0	0.00	16	2.42
16	25	3.78	6	0.92	16	2.42	5	0.76	29	4.38
17	32	4.82	29	4.45	27	4.08	38	5.80	41	6.19
18	51	7.70	78	11.98	46	6.95	97	14.81	64	9.67
19	103	15.56	110	16.90	90	13.60	115	17.56	93	14.05
20	129	19.49	128	19.66	124	18.73	123	18.78	123	18.58
21	127	19.18	116	17.82	126	19.03	113	17.25	110	16.62
22	97	14.65	80	12.29	103	15.56	71	10.84	91	13.75
23	53	8.01	27	4.15	51	7.70	25	3.82	52	7.85
24	9	1.36	4	0.61	15	2.27	4	0.61	20	3.02
Total	662	100.00	651	100.00	662	100.00	655	100.00	662	100.00

Top 10% of Tightest RA Supply Cushion Hours by Operating Hour

HE	Peak Months 2018		Off Peak Months 2018-2019		Peak Months 2019		Off Peak Months 2019-2020		Peak Months 2020	
	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.	# of Obs.	% of Obs.
1	0	0.00	1	0.23	2	0.45	1	0.23	0	0.00
2	0	0.00	1	0.23	1	0.23	0	0.00	0	0.00
3	0	0.00	1	0.23	1	0.23	0	0.00	0	0.00
4	0	0.00	1	0.23	0	0.00	0	0.00	0	0.00
5	0	0.00	1	0.23	1	0.00	0	0.00	0	0.00
6	0	0.00	0	0.00	1	0.00	1	0.23	0	0.00
7	1	0.23	13	3.00	4	0.90	14	3.20	0	0.00
8	1	0.23	8	1.84	2	0.45	12	2.75	0	0.00
9	1	0.23	0	0.00	1	0.23	4	0.92	0	0.00
10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
12	0	0.00	0	0.00	1	0.23	0	0.00	0	0.00
13	0	0.00	0	0.00	1	0.23	0	0.00	1	0.23
14	3	0.68	0	0.00	4	0.90	0	0.00	4	0.90
15	9	2.04	0	0.00	6	1.36	0	0.00	10	2.26
16	13	2.94	2	0.26	11	2.49	2	0.46	20	4.52
17	22	4.98	24	5.53	18	4.07	22	5.03	28	6.33
18	33	7.47	56	12.90	32	7.24	68	15.56	48	10.86
19	73	16.52	84	19.35	65	14.71	95	21.74	71	16.06
20	98	22.17	98	22.58	95	21.49	97	22.20	88	19.91
21	98	22.17	83	19.12	101	22.85	68	15.56	83	18.78
22	66	14.93	51	11.75	63	14.25	42	9.61	57	12.90
23	22	4.98	8	1.84	25	5.66	10	2.29	25	5.66
24	2	0.45	2	0.46	7	1.58	1	0.23	7	1.58
Total	442	100.00	434	100.00	442	100.00	437	100.00	442	100.00

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

Top 15%: # of tight supply hours per day	Peak Months 2018		Off Peak Months 2018/2019		Peak Months 2019		Off Peak Months 2019/2020		Peak Months 2020	
	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days
0	46	25.00	44	24.31	53	28.80	55	30.22	57	30.98
1	9	4.89	6	3.31	13	3.26	2	1.10	12	6.52
2	14	7.61	13	7.18	6	7.07	9	4.95	14	7.61
3	33	17.93	24	13.26	26	14.13	15	8.24	22	11.96
4	25	13.59	29	16.02	29	15.76	25	13.74	11	5.98
5	17	9.24	17	9.39	16	8.70	31	17.03	20	10.87
6	8	4.35	16	8.84	9	4.89	21	11.54	6	3.26
7	5	2.72	18	9.94	8	4.35	6	3.30	13	7.07
8	9	4.89	6	3.31	11	5.98	10	5.49	8	4.35
9	8	4.35	4	2.21	4	2.17	4	2.20	7	3.80
10	3	1.63	4	2.21	0	0.00	1	0.55	5	2.72
11	3	1.63			0	0.00	1	0.55	4	2.18
12	3	1.63			4	2.17	0	0.00	2	1.09
13	1	0.54			3	1.63	0	0.00	2	1.09
14					1	0.54	1	0.55	1	0.54
15					0	0.00	0	0.00		
16					0	0.00	1	0.55		
17					0	0.00				
18					0	0.00				
19					0	0.00				
20					0	0.00				
21					1	0.54				
22										
23										
24										
Total	184	100.00	181	100.0	184	100.0	182	100.0	184	100.0

Top 10%: # of tight supply hours per day	Peak Months 2018		Off Peak Months 2018/2019		Peak Months 2019		Off Peak Months 2019/2020		Peak Months 2020	
	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days	# of Days	% of Days
0	75	40.76	72	39.78	77	41.85	73	40.11	90	48.91
1	13	7.07	11	6.08	9	4.89	5	2.75	8	4.35
2	16	8.70	15	8.29	19	10.33	25	13.74	16	8.70
3	27	14.67	22	12.15	30	16.30	24	13.19	11	5.98
4	18	9.78	15	8.29	16	8.70	17	9.24	16	8.70
5	11	5.98	22	12.15	8	4.35	15	8.24	12	6.52
6	6	3.26	16	8.84	10	5.43	11	6.04	7	3.80
7	5	2.72	4	2.21	3	1.63	4	2.20	6	3.26
8	3	1.63	3	1.66	5	2.72	5	2.75	10	5.43
9	7	3.80	1	0.55	2	1.09	1	0.55	2	1.09
10	2	1.09	0	0.00	1	0.54	1	0.55	3	1.63
11	1	0.54	0	0.00	3	1.63	0	0.00	3	1.63
12					0	0.00	0	0.00		
13					0	0.00	0	0.00		
14					0	0.00	1	0.55		
15					0	0.00				
16					0	0.00				
17					0	0.00				
18					0	0.00				
19					1	0.54				
20										
21										
22										
23										
24										
Total	184	100.00	181	100.0	184	100.0	182	100.0	184	100.0

APPENDIX: WSAAF BY FUEL TYPE

Estimating fleet UCAP by fuel type: Bio Gas

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.854	20%	0.171
2	0.819	35%	0.290
1	0.882	45%	0.397
		Total = 100%	0.864
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.891	20%	0.178
2	0.882	35%	0.309
1	0.901	45%	0.405
		Total = 100%	0.892

Bio-gas fleet WSAAF (Peak Months)	Bio-gas fleet WSAAF (Off Peak Months)	Example DQC of Bio-gas resource	On-Peak NQC	Off-Peak NQC
0.864	0.892	30 MW	25.92MW	26.76 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: Bio Mass

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonl\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.848	20%	0.170
2	0.830	35%	0.291
1	0.872	45%	0.392
		Total = 100%	0.849
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.838	20%	0.168
2	0.819	35%	0.287
1	0.857	45%	0.387
		Total = 100%	0.842

Bio-mass fleet WSAAF (Peak Months)	Bio-mass fleet WSAAF (Off Peak Months)	Example DQC of Bio-mass resource	On-Peak NQC	Off-Peak NQC
0.849	0.842	50 MW	42.45 MW	42.10 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: Coal

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.915	20%	0.183
2	0.979	35%	0.343
1	0.977	45%	0.430
		Total = 100%	0.965
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.942	20%	0.188
2	0.901	35%	0.315
1	0.984	45%	0.443
		Total = 100%	0.946

Coal fleet WSAAF (Peak Months)	Coal fleet WSAAF (Off Peak Months)	Example DQC of Coal resource	On-Peak NQC	Off-Peak NQC
0.965	0.946	10 MW	9.65 MW	9.46 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: Natural Gas

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.886	20%	0.177
2	0.869	35%	0.304
1	0.875	45%	0.394
		Total = 100%	0.875
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.893	20%	0.179
2	0.901	35%	0.315
1	0.884	45%	0.398
		Total = 100%	0.892

Natural gas fleet WSAAF (Peak Months)	Natural gas fleet WSAAF (Off Peak Months)	Example DQC of Natural Gas resource	On-Peak NQC	Off-Peak NQC
0.875	0.892	500 MW	437.5 MW	446 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: Geo-Thermal

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.893	20%	0.179
2	0.848	35%	0.297
1	0.872	45%	0.392
		Total = 100%	0.868
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.788	20%	0.158
2	0.877	35%	0.307
1	0.699	45%	0.315
		Total = 100%	0.780

Geo-thermal fleet WSAAF (Peak Months)	Geo-thermal fleet WSAAF (Off Peak Months)	Example DQC of Geo-thermal resource	On-Peak NQC	Off-Peak NQC
0.868	0.780	35 MW	30.38 MW	27.3 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: HRCV (Heat Recovery)

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.959	20%	0.192
2	0.879	35%	0.308
1	0.962	45%	0.422
		Total = 100%	0.933
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.876	20%	0.175
2	0.809	35%	0.283
1	0.944	45%	0.425
		Total = 100%	0.883

HRCV fleet WSAAF (Peak Months)	HRCV fleet WSAAF (Off Peak Months)	Example DQC of HRCV resource	On-Peak NQC	Off-Peak NQC
0.933	0.883	15 MW	13.99 MW	13.25 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating Fleet UCAP by Fuel Type: LESR (Energy Storage)

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.975	20%	0.195
2	0.964	35%	0.337
1	0.958	45%	0.431
		Total = 100%	0.964
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.948	20%	0.190
2	0.969	35%	0.339
1	0.927	45%	0.417
		Total = 100%	0.946

Storage fleet WSAAF (Peak Months)	Storage fleet WSAAF (Off Peak Months)	Example DQC of Storage resource	On-Peak NQC	Off-Peak NQC
0.964	0.946	25 MW	24.09 MW	23.65 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary.

Estimating fleet UCAP by fuel type: Nuclear

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.983	20%	0.197
2	0.999	35%	0.349
1	0.875	45%	0.394
		Total = 100%	0.940
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.957	20%	0.191
2	0.946	35%	0.331
1	0.968	45%	0.436
		Total = 100%	0.958

Nuclear fleet WSAAF (Peak Months)	Nuclear fleet WSAAF (Off Peak Months)	Example DQC of Nuclear resource	On-Peak NQC	Off-Peak NQC
0.940	0.958	800 MW	751.7 MW	766.4 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Estimating fleet UCAP by fuel type: Waste

$$\mathbf{NQC} = \sum \mathbf{Weighted\ Seasonal\ Average\ Availability\ Factors}^{\mathbf{Season}} * \boldsymbol{DQC}$$

Year	Peak Months SAAF	Annual Weight	Weighted SAAF (Summer / On-Peak)
3	0.957	20%	0.191
2	0.857	35%	0.300
1	0.846	45%	0.380
		Total = 100%	0.872
Year	**Off Peak SAAF**	**Annual Weight**	**Weighted SAAF (Winter / Off-Peak)**
3	0.860	20%	0.172
2	0.894	35%	0.313
1	0.835	45%	0.376
		Total = 100%	0.862

Waste fleet WSAAF (Peak Months)	Waste fleet WSAAF (Off Peak Months)	Example DQC of Waste resource	On-Peak NQC	Off-Peak NQC
0.872	0.862	15 MW	13.08 MW	12.93 MW

Note: Based on daily outage rates weighted by the number of UCAP assessment hours, actual resource NQC values will vary

Next Steps

- Join us for the next call tomorrow, January 6, from 9 a.m. – 12 p.m. Topics include:
  - *UCAP (continued from day 1) (6 RSP)*
  - *Planned Outage Process Enhancements (Draft Final Proposal)*
  - *RA Imports (Draft Final Proposal)*
  - *Must Offer Obligations (6 RSP)*
- Meeting details are available on the RA Enhancements initiative webpage at http://www.caiso.com/StakeholderProcesses/Resource-adequacy-enhancements.

END DAY 1