CAISO RA Processes and CPUC's Slice of Day

Resource Adequacy Modeling and Program Design Working Group

~~January~~October 2024 – California Independent System Operator

Contents

Purpose

This document details interactions between the California Public Utilities Commission (CPUC)'s forthcoming Slice of Day Resource Adequacy (RA) framework and the California Independent System Operator (CAISO)'s RA processes for near-term implementation. This document answers stakeholder questions and provides examples regarding: (1) qualifying capacity (QC) values passed to the CAISO; (2) CAISO RA showings; and (3) CAISO RA processes based on the forthcoming CPUC Slice of Day framework. See links below for details pertaining to the CPUC's Slice of Day framework and implementation at the CPUC:

- CPUC Resource Adequacy Homepage
- CPUC Resource Adequacy History – Slice of Day Implementation
- CPUC Resource Adequacy Compliance Materials

Background

On November 8, 2023, CAISO held a Slice of Day (SoD) Near-Term Implementation workshop to review CAISO Resource Adequacy (RA) processes and systems in light of the CPUC's new ~~Slice of~~

~~Day~~SoD RA framework. ~~A~~The CPUC ~~Energy Division test year report~~is implementing the SoD framework for the ~~Slice of Day showings process is planned for by February 2024, and implementation is anticipated in~~ 2025~~.~~ compliance year. **The CAISO will not make any system or process changes ~~in the next year~~for 2025 as the CPUC transitions to the SoD framework**, but stakeholders are encouraged to bring observations or suggested changes for the longer term to the ~~CAISO's Resource Adequacy Modeling & Program Design~~CAISO's Resource Adequacy (RA) Modeling & Program Design working groups for discussion.

The CPUC's Decision ~~D.22-06-050~~(D.) 22-06-050 adopted the ~~Slice of Day~~SoD RA framework ~~under the CPUC. Decision~~.[1] Additionally, D.23-04-010 adopted ~~additional~~ program details and set a schedule for the 2024 test year, with a full transition to ~~Slice of Day~~SoD in 2025.[2] This was followed by D.24-06-004, which affirmed that 2025 will be the first year for SoD.[3] Under ~~Slice of Day~~SoD, the CPUC's ~~Resource Adequacy~~RA program will shift from a single capacity check in the coincident (across all load serving entities) peak demand hour to a capacity check in every hour of a 'day' (24 total) each month. The CPUC will continue to assess RA compliance on a year-ahead (YA) and ~~monthly~~month-ahead (MA) basis.

Slice of Day will also check storage charging sufficiency by adding battery charging to the hourly demand requirement. Under ~~Slice of Day~~SoD, counting rules for wind and solar resources will transition from effective load carrying capacity (ELCCs) to exceedance values. Although capacity counting for storage and demand response (DR) will not change under ~~Slice of Day~~SoD in 2025, these resources are subject to certain rules for showings across 24-hours.

Resource Counting Rules & Showings

Qualifying capacity (QC) represents a generating resource's capacity eligible to count towards meeting local regulatory authority (LRA) RA requirements. The CAISO tariff defers to LRAs—including the CPUC—— to establish QC criteria. After receiving 12 monthly QC values from the LRAs, the CAISO calculates a Net Qualifying Capacity (NQC) value for each month per resource (see more about NQC values in "CAISO Processes under Slice of Day" below).

- The CAISO will continue to receive a **single** monthly QC value from all LRAs, including the CPUC under the ~~Slice of Day~~SoD framework
- **Wind and solar**: Under ~~Slice of Day~~ SoD, wind and solar counting methodologies will shift from ELCC to an exceedance-based approach
  - The monthly QC values the CPUC will provide the CAISO for wind and solar will be based on the monthly system-coincident gross peak hour for each month.

[1] OP 14, "Decision (D.) 22-06-050 Adopting Local Capacity Obligations for 2023-2025, Flexible Capacity Obligations for 2023, and Reform Track Framework," in R.21-10-002 at 128.
[2] Appendix A, "Decision (D.) 23-04-010 on Phase 2 of the RA Reform Track," in R.21-10-002 at 85.
[3] "Decision (D.) 24-06-004 Adopting Local Capacity Obligations for 2025-2027, Flexible Capacity Obligations for 2025, and Program Refinements," in R.23-10-011 at 70.

- CPUC ~~Slice of Day~~SoD exceedance profiles and coincident monthly peak hours can be found in the CPUC's Master Resource Database (Tab 'VER Hourly QC'). Additionally, the CPUC's Master Resource Database specifies the monthly QC values for all resources (Tab 'Master Resource Database').
- If the monthly coincident peak hour exceedance value is zero, then the QC value passed to the CAISO is 0.1 MW (greater of monthly coincident peak value and 0.1 MW). This is because the CAISO's Customer Interface for Resource Adequacy (CIRA) portal currently only accommodates two decimal points and cannot accommodate resources with zero RA values. This rule also applies to wind or solar resources located outside of CAISO's BAA that participate in CAISO's market by dynamically scheduling or as a pseudo-tie resource. Note: As shown in the CPUC's 2024 Master Resource Database~~,~~ (MRD), this scenario only impacts certain solar resource QCs in January-February and October-December.

- **Storage**: The CPUC's QC methodology for energy storage has not changed; only how entities can show storage to the CPUC will change
  - Per CPUC rules, all RA resources must be able to deliver their QC value for four or more consecutive hours
  - The monthly QC value the CPUC will provide the CAISO is a MW level at which the storage resource is capable of discharging for four or more consecutive hours.
- **Demand Response**: The CPUC's QC methodology for demand response resources not changed. However, the CPUC adopted new rules around the showing process under the RA SoD framework.[4]
  - The current approved QC methodology for DR resources is the Load Impact Protocol ex-ante process.[5]
  - RA QC awards will be hourly, requiring at least four consecutive hours of positive QC within the RA measurement hours.[6]
  - The monthly QC value the CPUC will provide the CAISO will be based on the forecasted coincident gross peak hour each month. If the peak hour is 0 MW, the CPUC will submit a very small non-zero QC value.[7] The QC value – as informed by the CEC 2023 Integrated Energy Policy Report (IEPR)-forecasted[8] coincident gross peak hour within the 2025 Availability Assessment Hours (AAH) are as follows for 2025:

	Jan.	Feb.	Mar.	Apr.	May	Jun.
2025 AAH	HE 17-21	HE 17-21	HE 18-22	HE 18-22	HE 18-22	HE 17-21
2025 QC Value hour[9]	HE 19	HE 19	HE 19	HE 19	HE 19	HE 18

[4] Appendix-A, "Decision (D.) 23-04-010 on Phase 2 of the Resource Adequacy Reform Track," at A-3.
[5] OP 4 "Decision (D.) 08-04-050 Adopting protocols for Estimating Demand Response Load Impacts," at 35.
[6] OP 6, "Decision (D.) 23-06-029 Adopting Local Capacity Obligations for 2024 - 2026, Flexible Capacity Obligations for 2024, and Program Refinements," at 136.
[7] OP 20, "Decision (D.) 23-04-010 on Phase 2 of the Resource Adequacy Reform Track," at 108.
[8] CEC Adopted 2023 Integrated Energy Policy Report, February 14, 2024.
[9] Note that the hours in the CEC's IEPR forecast datasets– and reflected in this document – are in Pacific Standard Time. For months during which Daylight Savings Time is in effect, the peak hour needs to be adjusted by one hour (e.g. HE19 would represent the time period from 19:00 – 19:59).

	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2025 AAH	HE 17-21	HE 17-21	HE 17-21	HE 17-21	HE 17-21	HE 17-21
2025 QC Value hour	HE 17	HE 18	HE 17	HE 18	HE 18	HE 18

- **All Resources**: With the exception of off-peak imports and energy-only resources, per D.24-06-004, all resources must be shown at the same capacity level to the CAISO as what is shown to the CPUC.[10] For example, should an LSE contract for 70% of a resource's NQC-- and show the CPUC that level -- the LSE should also show 70% of the resource's NQC to the CAISO.

The below table shows a list of resource types, changes in CPUC QC counting rules under ~~Slice of Day~~SoD if any, ~~Slice of Day~~SoD showing rules, and the monthly QC value the CAISO will receive from the CPUC under ~~Slice of Day~~SoD.

Resource type	CPUC counting methodology	CPUC 24-hour showing	QC value to CAISO
Wind ~~&~~and solar	Shift to exceedance under ~~Slice of Day~~SoD	24~~-~~hour profile	Monthly coincident gross peak hour, or 0.1 MW if value if exceedance value is zero.
Energy storage	No change	Storage optimization	No change
Dispatchable resources	No change	Flat NQC value, subject to availability limits	No change
Non-dispatchable	No change	Flat NQC value, subject to availability limits	No change
Dispatchable hydro	No change	Flat NQC value	No change
Non-resource-specific Imports	No change	Flat value, subject to contract limits	No change
Demand response	No change for 2024-25 (Load Impact ~~Protocol - LIP~~Protocols - LIPs)	LIP profile	Monthly coincident gross peak hour

Example RA Showings

LSEs and RA suppliers should keep in mind that the general rule is there is no change from previous years to the CAISO RA showings process.

[10] OP 16, "Decision (D.) 24-06-004 Adopting Local Capacity Obligations for 2025-2027, Flexible Capacity Obligations for 2025, and Program Refinements," at 89.

- LSEs and suppliers ~~are able to~~can show all RA resources to the CAISO reflected in the CPUC 24-hour showings (not to exceed each resource's NQC value)
- Partially contracted resources can show their total contracted amount (sum cannot exceed a resource's NQC)
- RA imports shown on supply plans must be paired with a corresponding amount of ~~MIC,~~Maximum Import Capability (MIC), even if a resource's NQC value is 0.1 MW

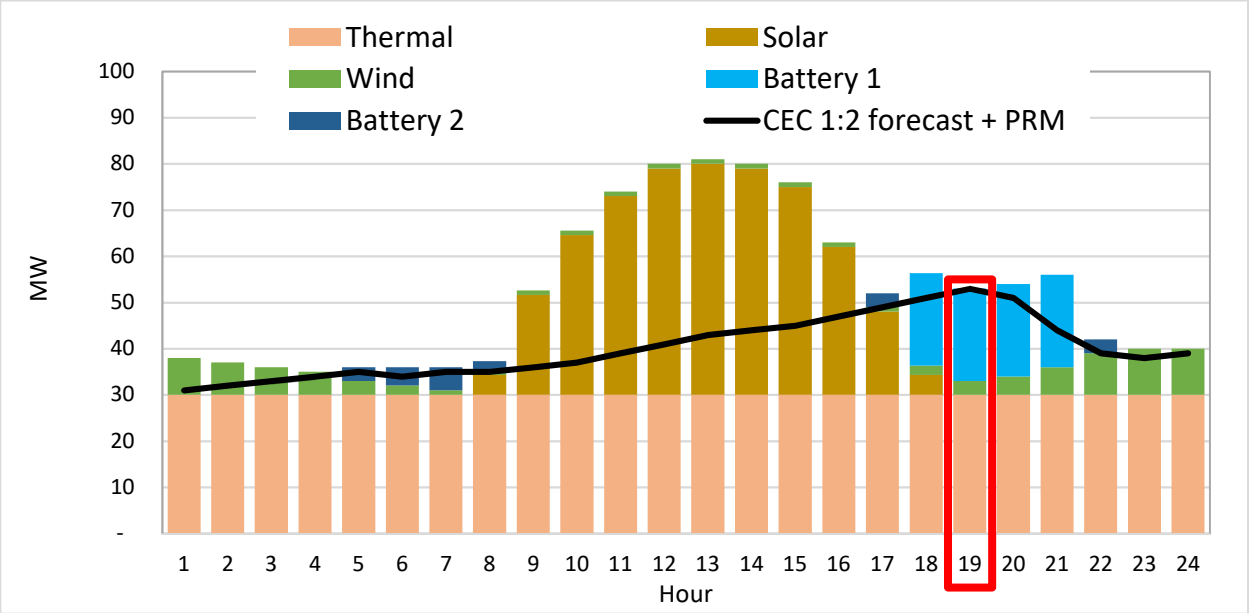
On December 6, 2023, the CAISO held a RA Modeling & Program Design working group that included a presentation on a detailed review of the RA showings process. A timestamped link to the recording can be found here. Additionally, below are two examples of hypothetical LSE showings to demonstrate key impacts from ~~Slice of Day~~SoD.

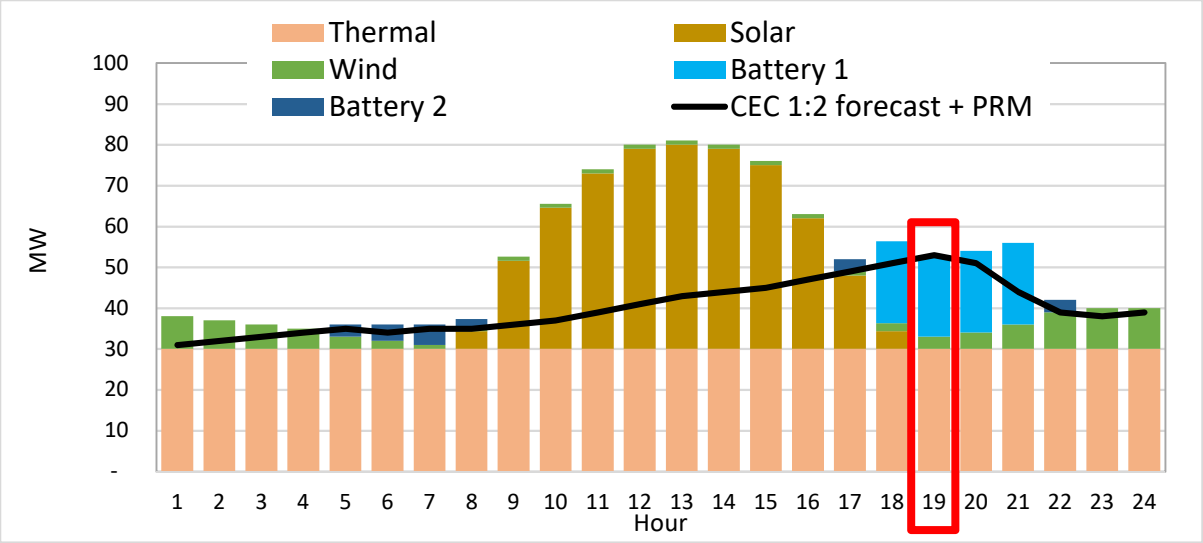
Example 1: Off-peak month (*e.g.*, October)

As mentioned above, CPUC monthly QC values for storage will not change under ~~Slice of Day (will continue~~SoD (the CPUC continues to require 4 hours of continuous discharge capability). However, the CPUC adopted new rules for how storage resources may be **shown** to the CPUC. Below is a hypothetical ~~load serving entity~~LSE showing to the CPUC. A few notes:

- Storage resources should be shown to the CAISO up to the NQC (or up to the contracted share of the NQC), which represents a four-~~-~~hour RA value.
- Battery 2 is not shown in Hour 19 (peak hour) in the CPUC ~~Slice of Day~~SoD showings.
  - Battery 2 (5 MW/20 MWh) is part of the LSE's RA portfolio. As such, the LSE should show Battery 2 to the CAISO in order for the CAISO to recognize the resource as RA.
  - For Battery 2, the LSE should show 5 MW to the CAISO.
- For Battery 1 (20 MW/80 MWh) the LSE should show 20 MW to the CAISO
  - If the LSE contracted for half of Battery 1 (10 MW/50 MWh) then the supplier/LSE should show up to 10 MW to the CAISO, regardless of how the storage resource is shown to the CPUC.
- In Hour 19, the solar exceedance value is 0 MW in the CPUC ~~Slice of Day~~SoD showing. As discussed above, due to CIRA constraints, LSE should show 0.1 MW (its NQC value) to the CAISO for the solar resource.

CPUC ~~Slice of Day~~SoD RA Showing Example 1: Graph



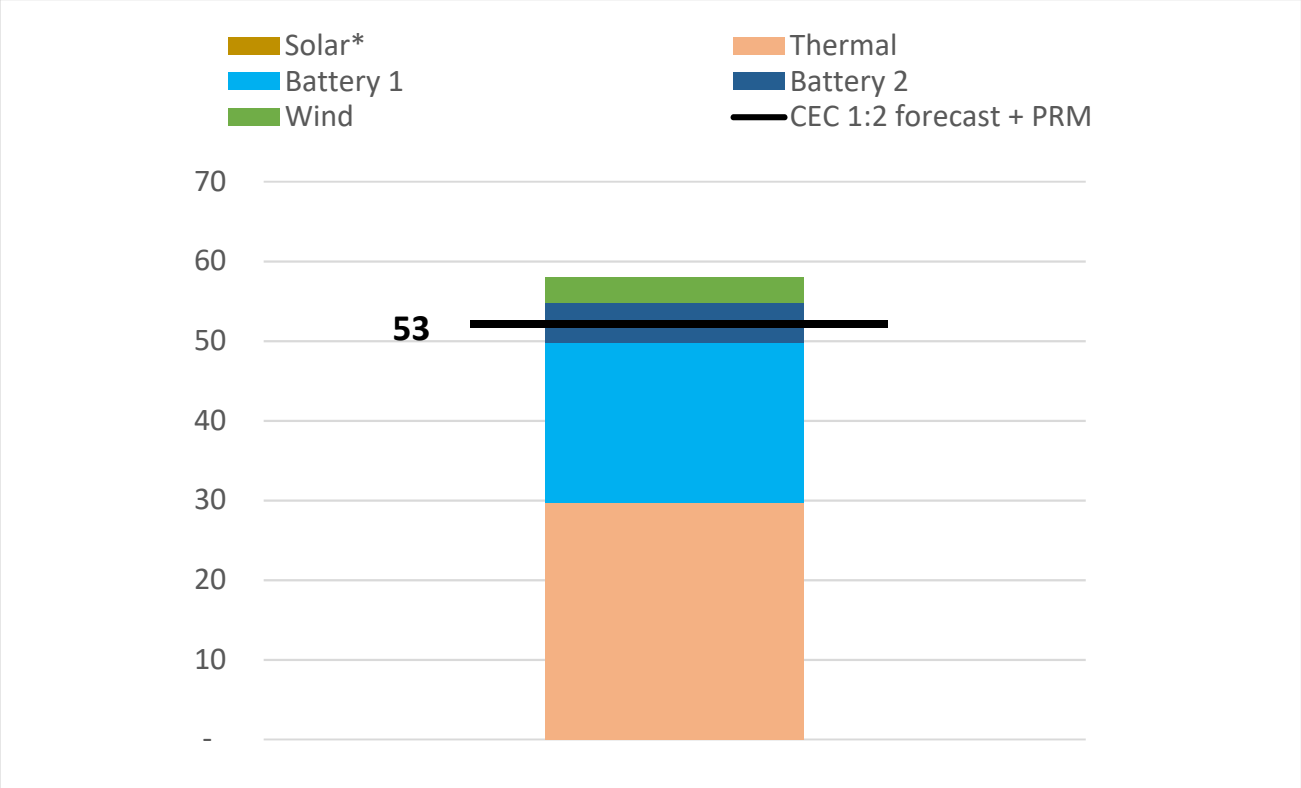


CPUC ~~Slice of Day~~SoD RA Showing Example 1: Table

Hour	CEC 1:2 forecast + PRM	Solar	Thermal	Battery 1	Battery 2	Wind
1	31	-	30	-	-	8
2	32	-	30	-	-	7
3	33	-	30	-	-	6
4	34	-	30	-	-	5
5	35	-	30	-	3	3
6	34	-	30	-	4	2
7	35	-	30	-	5	1

8	35	4	30	-	2	1
9	36	22	30	-	-	1
10	37	35	30	-	-	1
11	39	43	30	-	-	1
12	41	49	30	-	-	1
13	43	50	30	-	-	1
14	44	49	30	-	-	1
15	45	45	30	-	-	1
16	47	32	30	-	-	1
17	49	18	30	-	3	1
18	51	4	30	20	-	2
19	53	-	30	20	-	3
20	51	-	30	20	-	4
21	44	-	30	20	-	6
22	39	-	30	-	3	9
23	38	-	30	-	-	10
24	39	-	30	-	-	10
Battery MWh (Sum)				80	20	
Battery 4-~~hour~~hr. RA value				20	5	

CAISO RA Showing Example 1

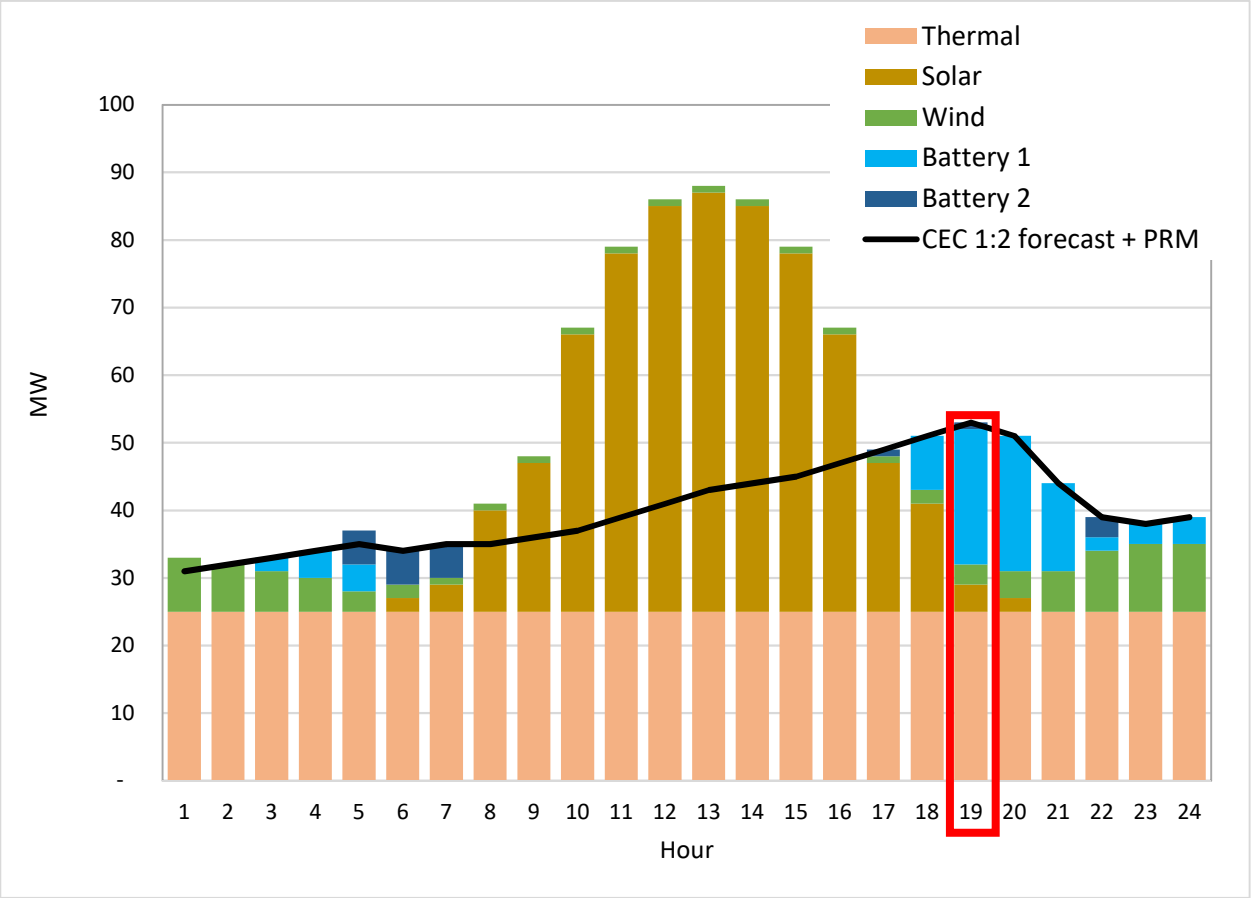


*The solar resource is included in the CAISO showing at 0.1 MW (its full NQC value) if fully under contract with the LSE.

Example 2: Summer month (*e.g.*, August)

Below is an additional hypothetical ~~load serving entity~~LSE showing example. This example illustrates a summer month showing, which includes a substantive solar QC (and NQC) value in the peak hour.

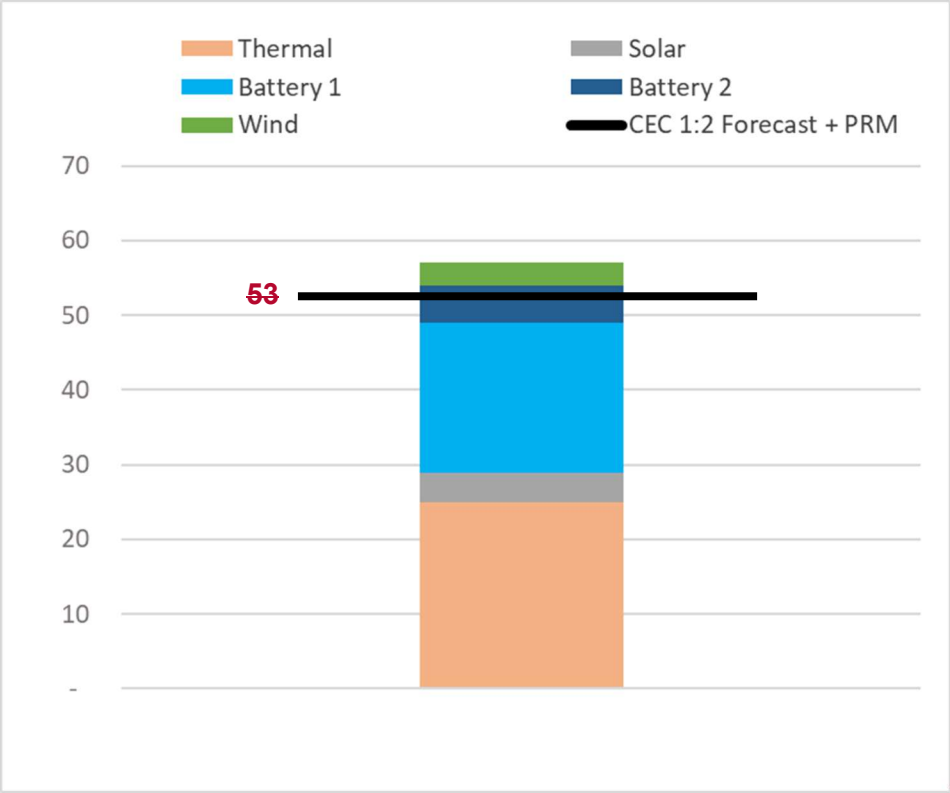
CPUC ~~Slice of Day~~SoD RA Showing Example 2: Graph

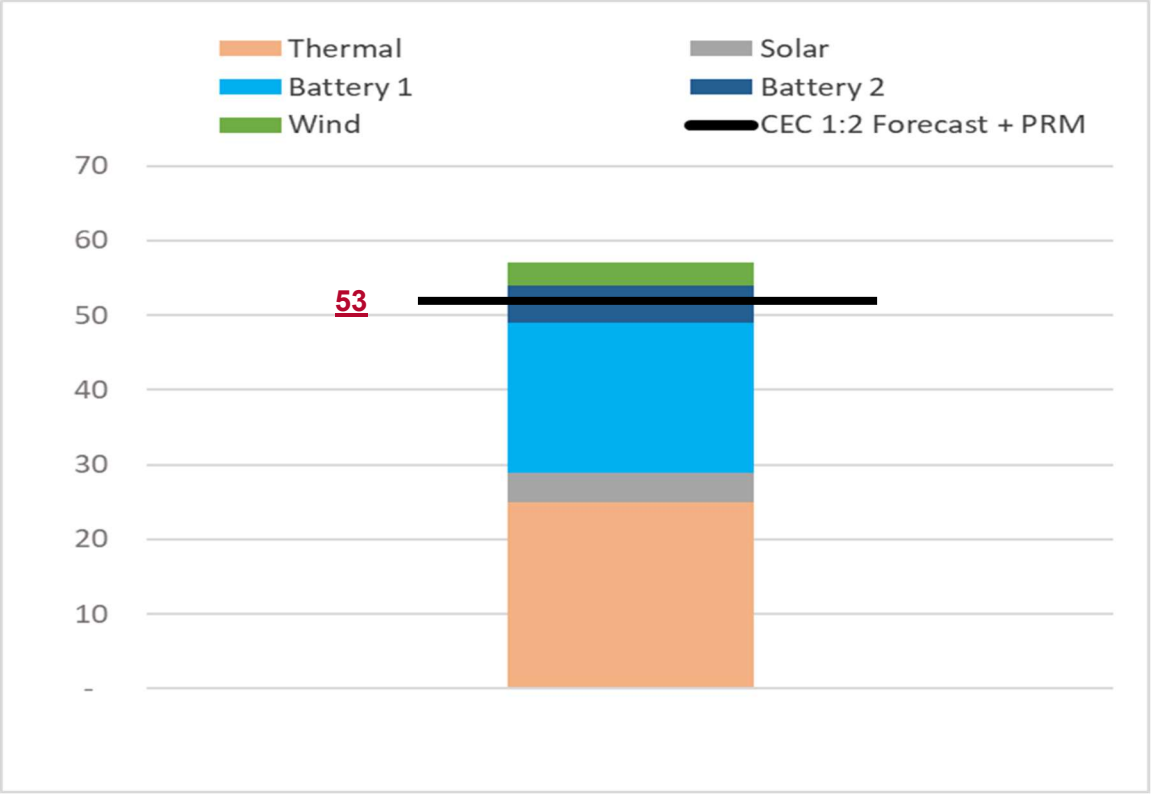


CPUC ~~Slice of Day~~SoD RA Showing Example 2: Table

Hour	CEC 1:2 forecast + PRM	Solar	Thermal	Battery 1	Battery 2	Wind
1	31	-	25	-	-	8
2	32	-	25	-	-	7
3	33	-	25	2	-	6
4	34	-	25	4	-	5
5	35	-	25	4	5	3
6	34	2	25	-	5	2
7	35	4	25	-	5	1
8	35	15	25	-	-	1
9	36	22	25	-	-	1
10	37	41	25	-	-	1
11	39	53	25	-	-	1
12	41	60	25	-	-	1
13	43	62	25	-	-	1
14	44	60	25	-	-	1
15	45	53	25	-	-	1
16	47	41	25	-	-	1
17	49	22	25	-	1	1
18	51	16	25	8	-	2
19	53	4	25	20	1	3
20	51	2	25	20	-	4
21	44	-	25	13	-	6
22	39	-	25	2	3	9
23	38	-	25	3	-	10
24	39	-	25	4	-	10
Battery MWh (Sum)				80	20	
Battery 4- ~~hour~~hr. RA value				20	5	

CAISO RA Showing Example 2





CAISO Processes under Slice of Day

NQC determination

When the CPUC provides a single monthly QC value to the CAISO for each resource under ~~Slice of Day~~SoD, the CAISO calculates a Net Qualifying Capacity (NQC) value for that resource. According to the CAISO tariff (see sections below), QC values *may be* reduced for the following reasons ~~in order~~ to establish an NQC value:

- 40.4.4 Reduction for Testing:
  - Direct (per latest Pmax Test), and
  - Indirect per Interconnection Agreement (Pmax<=IAmax)
- 40.4.5 Reductions for Performance: *Currently not used*
- 40.4.6 Reduction for Deliverability: Transmission constraints

Thus, RA suppliers and LSEs should show up to the NQC value of each contracted resource to the CAISO (a lesser amount, for partially- contracted resources).

Deliverability & Maximum Import Capability

The CAISO's deliverability study informs resources' NQCs (see above), and thus may limit QC values based on deliverability. These studies determine deliverability based on stressed system conditions—the concept of deliverability is based on resources' status at these stressed system

conditions including highest load hour. Off peak hours are not considered in CAISO deliverability studies because they do not represent the highest-stress system conditions. The deliverability test results in:

- Fully deliverable resources
- Partial deliverable resources
- Non-deliverable resources

The levels resources are dispatched to in the CAISO deliverability test have no direct correlation with the QC established by the LRAs. So, the dispatch level assumed in the deliverability study does not act as a cap (or adder) to the QC values established by LRAs. Deliverability studies are simply a "pass, partial, or fail" test, and result in granting a deliverability status to each resource.

Maximum Import Capability (MIC) represents a quantity, in MWs, determined by the CAISO to be simultaneously deliverable to the aggregate of load in the CAISO Balancing Authority Area (BAA) and it is split according to each particular intertie per FERC approved rules.

- The CAISO tests both the deliverability of internal resources and the deliverability of imports to ensure all RA resources are simultaneously deliverable.
- LSEs' RA import showings are limited for each intertie to its share of MIC for that tie.
- MIC quantities are calculated yearly by the CAISO~~,~~ and allocated yearly by the CAISO to LSEs.
- LSEs must ensure sufficient MIC to show import capacity as RA at each intertie

System, flex & local RA assessments

The gross peak hour showings at the CPUC and the showings at the CAISO (currently based on the gross peak hour) should largely align. There are a few areas for potential discrepancies that the CAISO will continue to assess:

- If suppliers or LSEs show storage resources outside of the peak hour to the CPUC, the supplier/LSE can still show that resource to the CAISO. As usual, if an LSE wants to meet its obligation in the CAISO system RA check, they need to show enough RA capacity to do so. In system RA assessments, this may result in additional capacity the CAISO considers in the gross peak system hour check versus the CPUC's showings in the peak hour.
- In late fall/winter months for certain solar resources, exceedance values at the coincident peak hour may be zero. To accommodate CIRA constraints, entities should show 0.1 MW (their entire NQC value) to the CAISO for these resources, if fully under an RA contract, to ensure they are recognized as RA. The sum of these non-zero values may result in differences between CPUC showings at the peak hour and shown RA to the CAISO.
  - Based on the CPUC's November 17, 2023, Master Resource Database~~,~~ (MRD), this effect impacts about 29 MW of solar capacity in late fall/winter months.
- In the November 8, 2023, workshop~~,~~ parties discussed potential impacts of less than 4-~~-~~hour batteries. For example, a battery may have a PMAX greater than its 4-hour RA value (*e.g.*, 25 MW RA value, 100 MWh maximum state of charge, 100 MW PMAX) and show the 100 MWh in less than four hours, resulting CPUC showings that exceed the RA value in certain hours.

- Based on the CPUC's November 17, 2023 ~~Master Resource Database~~, MRD, 40 MW of battery storage is 1 hour duration, and 380 MW are 2-~~-~~3-~~-~~hour duration (5 resources total)

System RA: RA shown by LSEs/suppliers is compared to coincident peak demand forecast plus LRA-designated planning reserve margins (PRMs) to determine whether each LSE has met their share of the system requirements. The CAISO then compares aggregate showings to aggregate system RA requirements.

Flex RA: Flex RA shown by LSEs/suppliers is compared to their assigned flex requirement, to determine whether each LSE met their share of the flex requirements. The CAISO then compares aggregate showings to aggregate flex RA requirements.

Local RA: Local RA shown by LSEs/suppliers/Central Procurement Entities (CPEs) is compared to their assigned local requirement, to determine whether each LSE/CPE met their share of local requirements. The CAISO then compares the aggregate of all showings to all local RA requirements in order to ~~see~~determine if they are all met. Each RA resource is dispatched with its expected output at the time of that local area peak up to its NQC value.

Backstop procurement via Capacity Procurement Mechanism (CPM)

If there is a deficiency in system/flex/local RA as described in the assessment above, the CAISO can utilize its backstop procurement authority and procure RA through the CPM process in order to cure the deficient amount of system/flex/local RA. Generally, there is no change to the CAISO's existing CPM process. As mentioned above, the December 6, 2023, CAISO presentation on RA showings included a review of existing CPM processes. A timestamped link to the recording can be found here

Substitution

CAISO substitution requirements will continue to be based on shown RA values. For more details, see Section 9 of the CAISO Business Practice Manual for Reliability Requirements.

Showing timelines

The timelines for LSEs to make RA showings to the CAISO do not change upon SoD implementation. The CPUC adopted changes to the cure period for showings to the CPUC on an interim basis. However, these changes do not impact CAISO showing timelines.

Additional Q&A

How should an entity show a storage resource with less than 4-hour duration, such as a 1-hour battery? An entity should show this type of resource to CAISO only up to its NQC value (4-~~-~~hour RA value).

If a resource is shown to the CPUC as an energy-only resource, providing charging energy to a co-located storage resource, should this resource be shown to the CAISO? Energy only

resources have an NQC value of 0. If a resource has a zero NQC value, it cannot be shown to CAISO regardless of what's shown to CPUC, and therefore will not be counted in CAISO RA assessments. This is the case today and will continue after ~~Slice of Day~~SoD implementation.

If an off-peak import resource is shown to the CPUC to meet SoD requirements during off-peak hours, should this resource be shown to the CAISO? No, Per the CPUC's Decision (D).24-06-004, "To ensure that all SOD resources are flagged as such in CAISO's systems and processes, and subject to CAISO's RA rules, deliverable resources on SOD RA plans need to be shown to CAISO, **with the exception of Q3 2025 off-peak imports that are being shown only to the Commission to meet SOD requirements**."[11]

In general, is it acceptable to have differences between the CPUC ~~Slice of Day~~SoD showings in the coincident peak hours and the CAISO RA showings? CAISO rules do not require that LSEs/CPEs show the CAISO everything shown to their LRA. However, LSEs/CPEs should still meet their RA obligation at CAISO, as represented by their system requirement (load forecast plus a planning reserve margin) plus their assigned flex and local requirements. Note that energy-only resources *cannot* be shown to the CAISO for the reasons stated above.

[11] *Ibid.*