Resource Adequacy Two-Slice Proposal

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About Gridwell Consulting

- Women-owned economics and energy consulting firm – www.gridwell.com
  - Educate, model, advise, and advocate
  - Experts in energy and ancillary service markets, resource adequacy, interconnection, and storage optimization and modeling for RFOs, due diligence, and bid strategy
- Carrie Bentley, co-founder and CEO
  - Designed CAISO's Capacity Procurement Mechanism, portions of forced and planned outage rules, and RA Availability Incentive Mechanism
  - Has evaluated or negotiated over 10,000 MW of long- and short-term RA contracts in California over last 5 years
  - Represent WPTF at the CAISO, full client list on website

Outline

- Two-slice Framework Overview
- Peak Load Requirement
- Net Peak Load Requirement
- Comparison between proposal frameworks

Two-Slice Framework Overview

Two-slice proposal overview

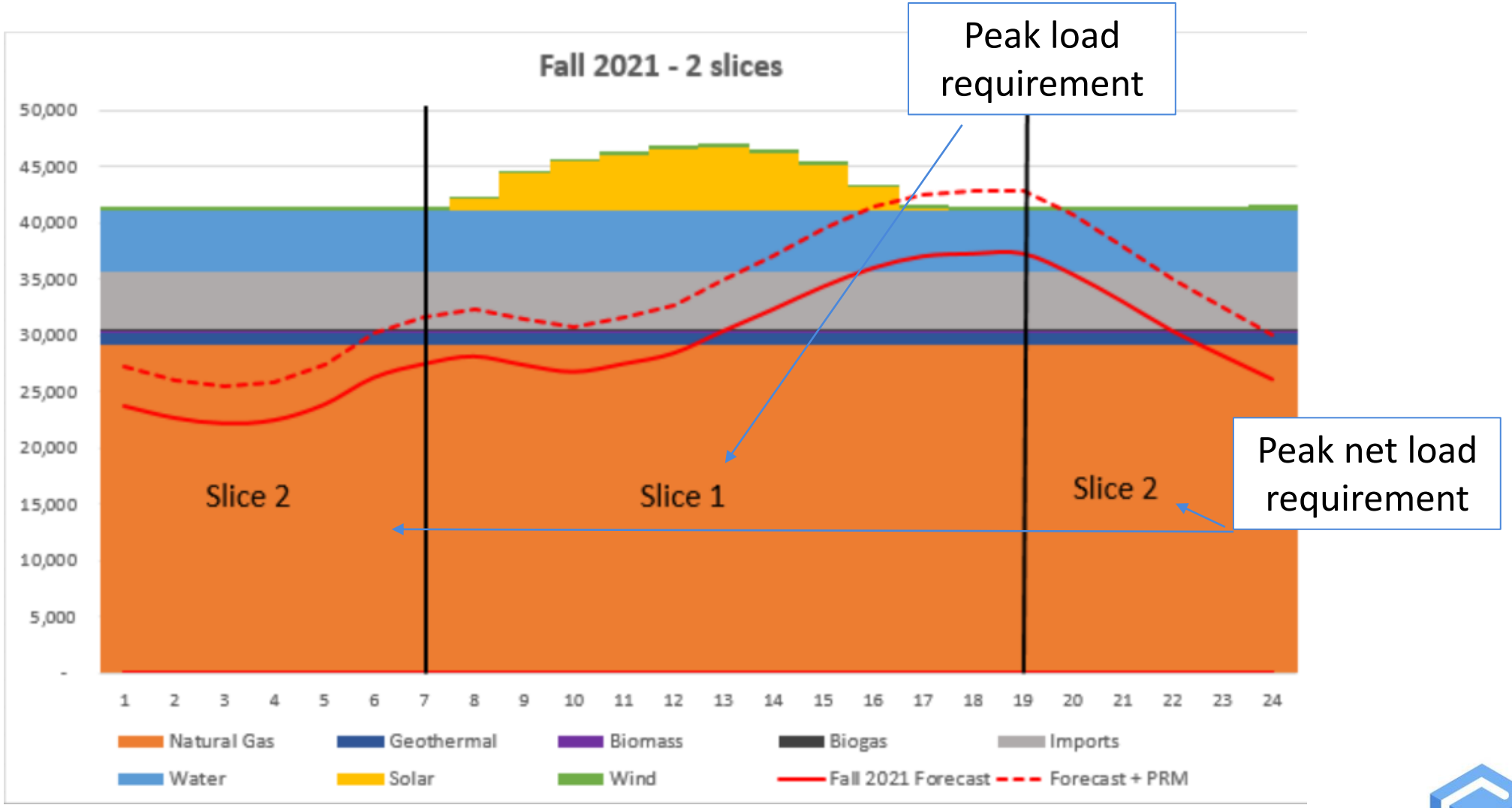
- Two-slice proposal enhances requirement methodology and counting rules, and adds a net peak requirement
- Modified from initial design based on written comments, feedback from Energy Division and California ISO, and individual discussions with parties:

1. Incorporates Vistra's peak requirement (slice 1) and net peak requirement options (slice 2)
2. Adds a buffer (epsilon term) to net load requirement to account for potential suboptimal battery dispatch
3. Proposes to be monthly framework (not seasonal)
4. Proposes more specific counting rules for resource types

Two-slice proposal

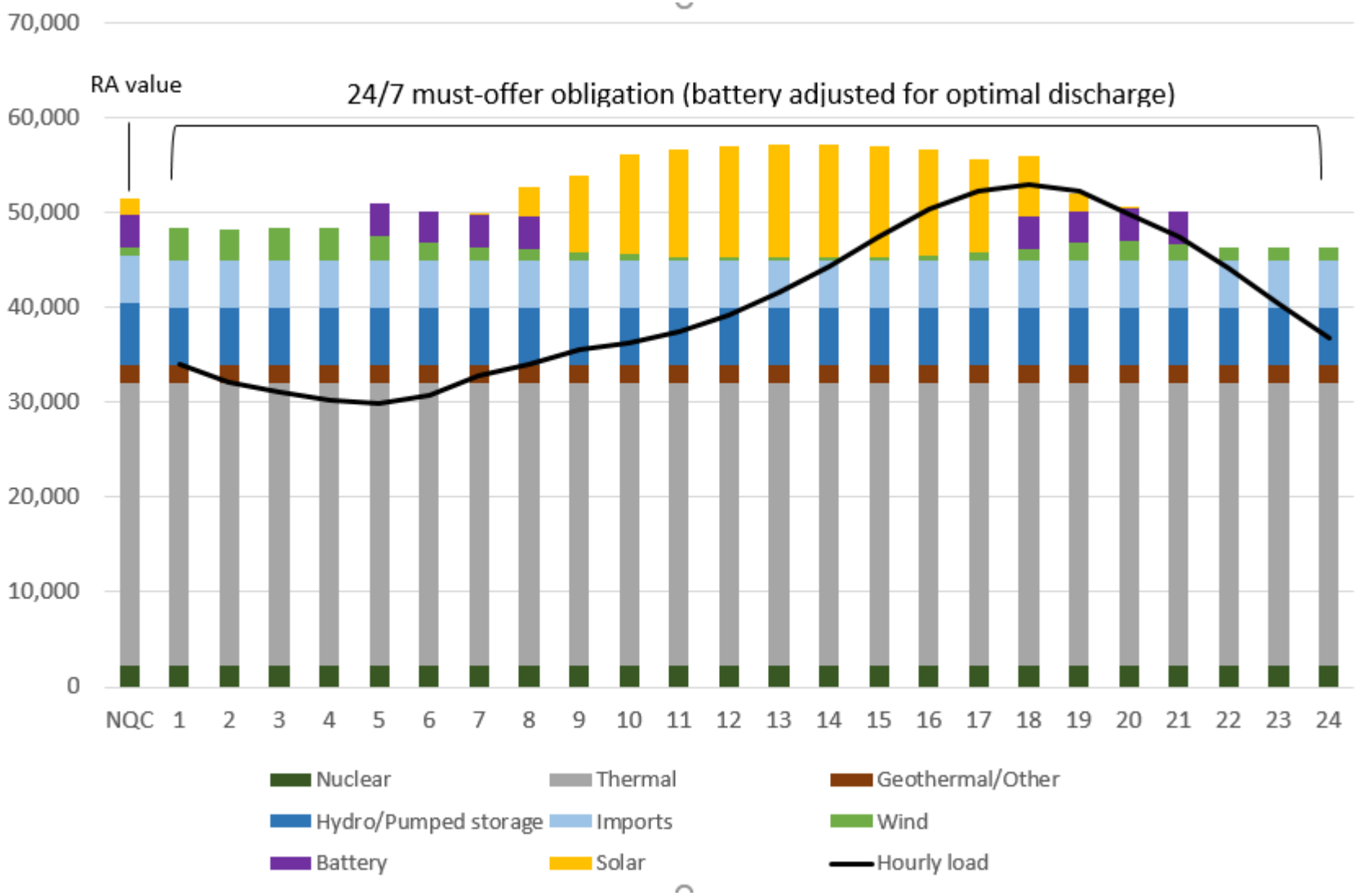
- Monthly showings, maintain alignment with local and flexible products
- System aggregate peak load requirement allocated based on coincident load ratio share (details in next section)
- Enhanced counting rules – depends on CAISO's UCAP analysis expected in January
  - Average ELCC for existing wind, solar, and batteries updated every two years
  - Average ELCC or UCAP for other operationally limited resources, including hydro
  - Ambient derate or UCAP for thermal resources
- System aggregate peak net load (non-solar hour) requirement
  - Adder (epsilon term) for expected battery dispatch inefficiency

Two-slice proposal – simplified picture

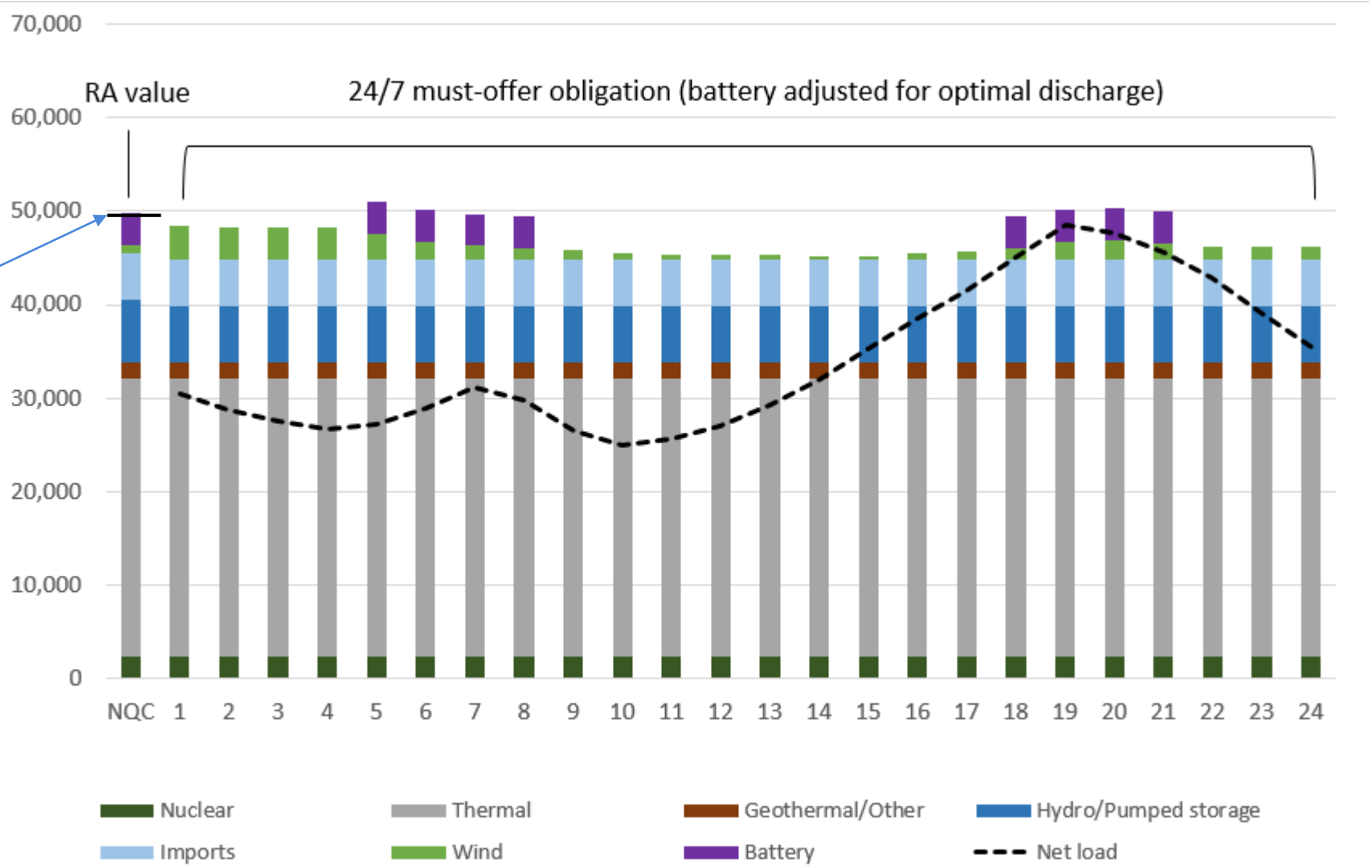


Slice 1 – peak load requirement with 24/7 must-offer

Illustrative September 2022



Slice 2 – peak net load requirement with 24/7 must-offer



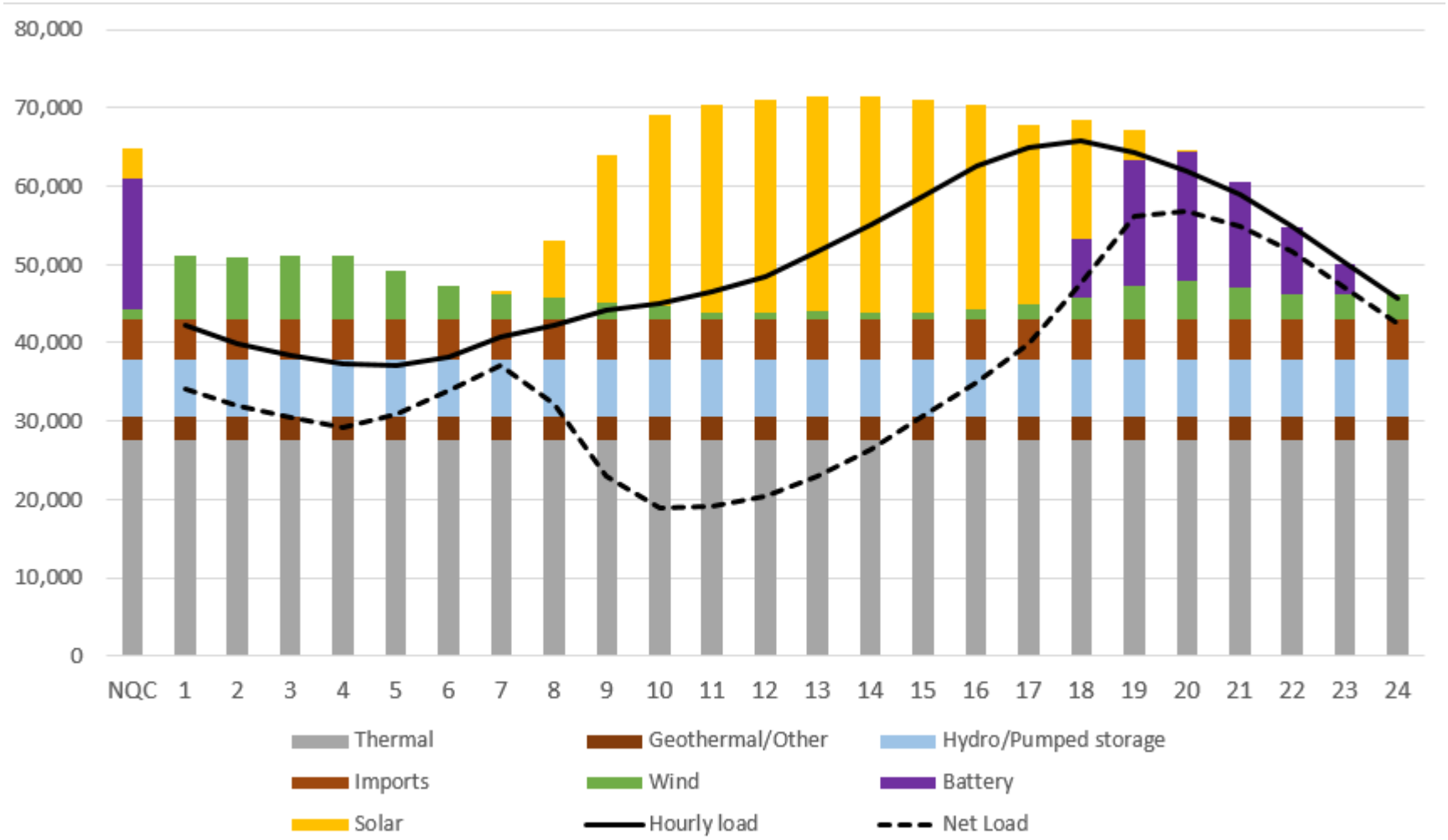
Net load plus epsilon

Illustrative September 2022

Not included in two-slice proposal

- Not included in proposal is a check that each LSE has sufficient energy to charge their shown batteries
- Why not?
  1. The goal is for batteries to be charged by *renewable* energy and this must be a constraint within the IRP and accounted for within REC rules
  2. There is sufficient energy to charge batteries in aggregate as far out as we have reliable data, so this is not a reliability issue that needs to be addressed in this proceeding

September 2030 peak load, net load, and supply



2030 – still sufficient renewable energy to charge batteries during summer peak under existing IRP build out

An individual LSE requirement will only increase costs for no reliability benefits

Recap

- RA is complicated, and we should seek to simplify
- One of the largest benefits of belonging to an ISO is that the system capacity requirement supports both load and supply diversity benefits
- Gridwell's Two-Slice proposal
  - Addresses hourly reliability through enhanced **counting rules** and non-solar hour requirement
  - Resolves all identified issues with existing framework and is flexible enough to accommodate future concerns (e.g., aging gas fleet, battery charging)
  - Coordinates with IRP and CAISO rules
  - Yields a transactable product
  - Preserves the significant cost savings to ratepayers that accrue from ISO system RA portfolio benefits

Peak Load Requirement

Need determination and related rules should address following current RA challenges

RA construct does not accurately capture value of use-limited resources in either reserve margin or counting rules	Tying resource capacity value to its ability to show up when needed and carry load through risks of loss of load improves reliability and reduces uncertainties in PRM
RA construct is not maintaining 1 in 10 planning standard such that CA is operating at lower reliability threshold than majority of US	Setting probabilistically determined PRM through LOLE study set to 1:10 standard that is updated regularly as system conditions change better supports reliability
Inconsistency across CPUC and CAISO RA programs (CPUC IRP, CPUC RA, CAISO RA, CAISO CPM)	Seeking consistency across rules will reduce regulatory uncertainty, complexity and administrative costs leading to more cost-effective and reliable outcomes
RA contracts are bundled across system, local, and flex if applicable	Recognizing any rule changes to valuing resource capacity value for system needs must apply to local needs and inform flex needs to result in rational outcomes

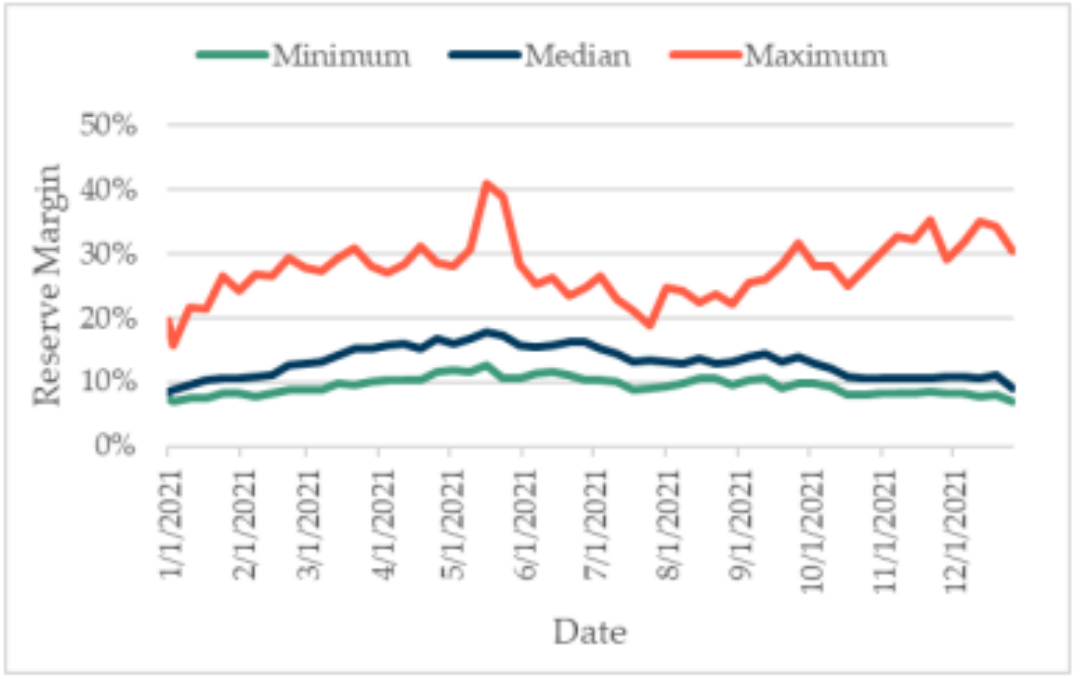
WECC Assessment RA Spotlight: CA & Mexico

- To account for increased variability challenges a probabilistic approach to LOLE is needed
- WECC provided analysis showing that planning reserve margins need to account for the demand and resource availability variations to better meet 1 in 10 standard
- WECC found annual PRM of 15% is enough to maintain median 1 in 10 threshold, however in May and June a PRM closer to 40% may be needed to maintain 1 in 10 during the month

WECC Assessment RA Spotlight: CA & Mexico

- WECC calculated PRM for every hour of the 2021 needed to meet 1 in 10 threshold
  - "The planning reserve margin in 2021 ranges from 7% to 41% with the lowest value occurring in January and the highest value occurring in May."
  - "There are 3,624 hours in which the planning reserve margin is at or above 15%."
  - "This means, if a flat 15% reserve margin were applied to all hours of the year, over 40% of the hours would not meet the ODITY threshold."
- Similar statistics provided for demand variability and resource variability which scenarios can inform LOLE

Figure 11: Planning Reserve Margin Plot—Percent



Source: Western Assessment of Resource Adequacy Subregional Spotlight: California and Mexico (CAMX)
https://www.wecc.org/Administrative/Western%20Assessment_California%20and%20Mexico%20Report.pdf

CPUC Energy Division shows similar results that annual needs are generally reliable at just above the 1 in 10 threshold sufficient but specific months are meeting lower thresholds

- CPUC noted in its November 23, 2021 presentation that "the current Planning Reserve Margin has become increasingly divorced from a LOLE study framework"
- Current PRM calculated in 2004 with a very different mostly thermal electric fleet, which is more dispatchable and less complicated to plan for
- Energy Division staff performed LOLE modeling for 2022 study year to compare portfolio that meets 0.1 based on 2019 IEPR
  - Note, the NQC used based on most recent technology factors posted which may be over accounting VERs resulting in these results potentially leading to even higher modeled PRM to meet 1 in 10 if the ELCC are updated
- From results for the two peak months, Aug and Sep, average of 9.5% and 17.6% UCAP is a 13.5% PRM or average of 25.6% and 20% equals a 22.8% PRM in a ICAP calculation.

CAISO LOLE results for 2022 study year

LOLE (expected outage events/year)	0.12208
LOLH (hours/year)	0.18693
LOLH/LOLE (hours/event)	1.531242
EUE (MWh)	136.23
annual load (MWh) – CAISO total	245,818,857
normalized EUE (%)	0.00005542%
Non-spin loss of Reserve Energy (MWh)	47,137.4
Spin loss of Reserve Energy (MWh)	0.0
Spinning Reserves Shortage (Hours)	0.0001
Normalized Non-spin loss of reserve energy (%)	0.01918%

Month	LOLE
1	0
2	0
3	0
4	0
5	0
6	0
7	0.035828
8	0.084415
9	0.001835
10	0
11	0
12	0

Source: Track 3.B Workshops: Day 2, https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy/energy_programs/electric_power_procurement_and_generation/procurement_and_ra/ra/track-3b-day-2-presentation.pdf

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Proposal: Use probabilistic LOLE to set monthly gross peak requirement (slice 1)

- Probabilistically determine Loss of Load Expectation capturing hourly needs
- Use Hourly Forecast Update – CAISO Mid-Mid Case in the most recent CEC full or updated IEPR as basis for projected load
- For target year model generation capacity online (Baseline Resources) plus potentially any projects with executed contracts for that year expected to achieve COD
- Perform Loss of Load Hourly calculation
  - Calculate Loss of Load Hours (LOLH) = sum of all hourly LOLP's in a year $(\frac{h}{y})$
  - Uses 8,760 hourly probabilities setting each ρ between 0 to 1
- Use probabilistic approach for uncertainties to produce distribution of outcomes (X_i)

Demand Variations | Forced outage risk | Substitution risk for planned outages | VER Availability Risks | Operational Uncertainty

- To ensure reliability threshold is met set the LOLE common LOLE reliability target to 0.1 event/year, or 1 outage event per 10 years (i.e., a 1-in-10 planning standard)

Proposal: Use probabilistic LOLE to set monthly gross peak requirement (slice 1) cont.

Option A: Set monthly requirement using LOLE capacity requirement output

- Use LOLE modeling to determine total generation capacity needed for each month to meet 1 in 10
  - Note, PRM method needs to be updated depending on whether resource capacity valuation will include outage risks, substitution risk, operational risk, availability risk directly in the NQC or not
- Set slice 1 requirement for each month as the monthly total capacity needed to meet 1 in 10 identified in the LOLE modeling
- Allocate to each LSE same as today

Both Option A and Option B arrive to the same monthly requirement, they are just different ways if there is a strong preference to "set" a PRM. Alternatively, in Option A the PRM can be calculated more as a reliability metric too.

Option B: Set monthly requirement using reserve margin on top of CEC monthly forecasts

- Calculate Planning Reserve Margin for each month
- Use LOLE modeling output for total generation capacity needed for each month
- Use Managed 1-in-2 Monthly Peak Load CAISO Coincident System Peak Load for each month
  - From recent CEC full or updated IEPR
- Apply the percent difference to the monthly CAISO coincident peak to set monthly need

$$PRM = \frac{LOLE\ Capacity\ to\ Meet\ 0.1}{Managed\ 1in2\ Monthly\ CAISO\ Coincident\ Peak}$$

$$Requirement = Monthly\ CAISO\ Coincident\ Forecast * PRM$$

- Allocate to each LSE same as today

Slice 1 Gross Peak Slice Requirement Proposal Implementation Considerations

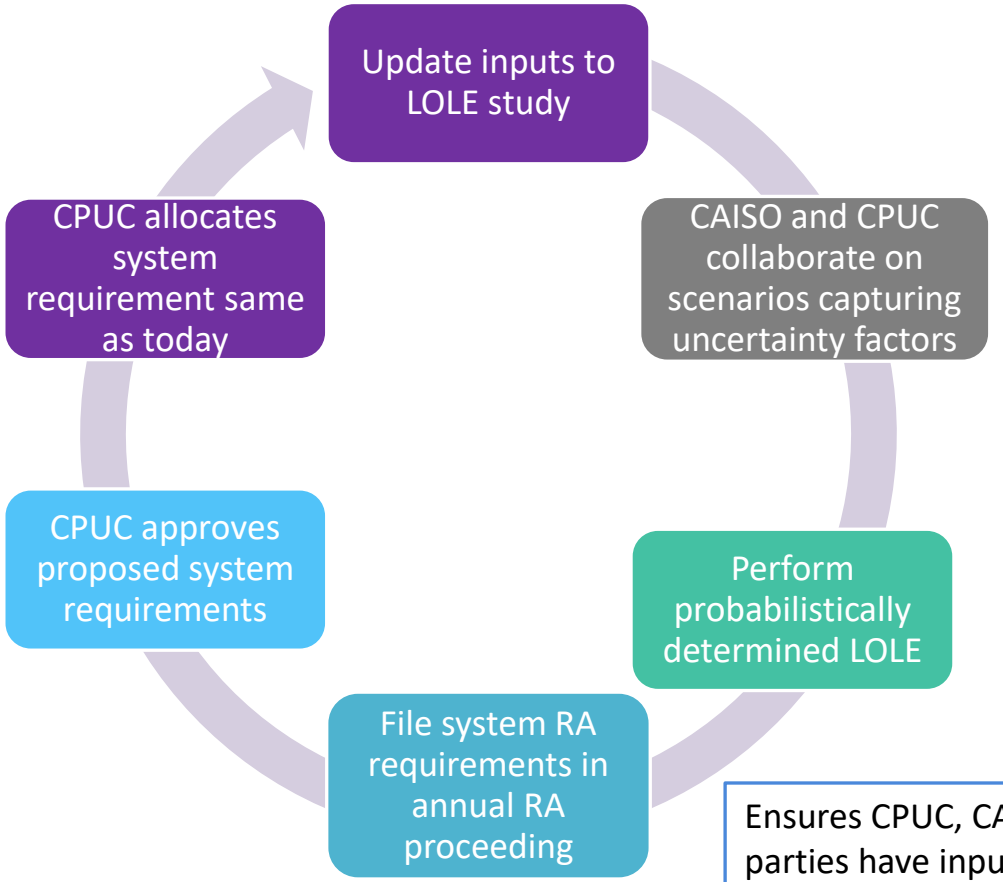
- Energy Division discussed California's approach to LOLE at November 23, 2021 workshop and some considerations for potentially using LOLE studies to determine system RA needs
- LOLE modeling being done by the CPUC Energy Division generally accomplishes the goals of this proposal, with the need for incremental modeling improvements rather than wholesale redesign
  - Models 8,760 hours capturing hourly probabilities and expected output scenarios. The dispatch scenarios may need to be reviewed, especially for storage or use limited resources.
  - Uses a probabilistic approach to assess range of conditions. The range of conditions and uncertainties need to be reviewed and updated as appropriate.
  - Uses CEC forecast. It may warrant reviewing the specific CEC forecast in more detail but at a minimum ensuring that the most recent CEC forecast is being used for each hour.
  - Sets the reliability threshold to 1 in 10. Counting rules need to be updated to boost confidence.
- Greater involvement from CAISO is needed to ensure there is a shared view of the reliability need
  - CAISO and CPUC should coordinate more closely in the LOLE modeling
  - CAISO needs at a minimum to have more agency in informing the uncertainties as these are observed in the operational time frame that CAISO has best information and experience with.
- LOLE studies must be updated regularly, ideally annually but no more than every two years, to update the system RA need for slice 1 – gross peak
- ELCC for each bucket should be updated after each LOLE study for use in next LOLE study

Benefits of regularly updated requirements

Requiring annual filings ensures the system RA requirement reflects current need increasing market confidence

Increases market certainty that CPUC and CAISO share same view of need, which better supports forward procurement by reducing regulatory risks

Provide CAISO greater engagement to inform/provide uncertainty scenarios to increase CAISO confidence in the results



Uses understood LOLE/EUE metrics that address hourly energy sufficiency while also balancing complexity and costs

CPUC is the final decision maker on requirements vetting that they meet the CPUC standards

Ensures CPUC, CAISO, and RA parties have input into the proposed system requirements

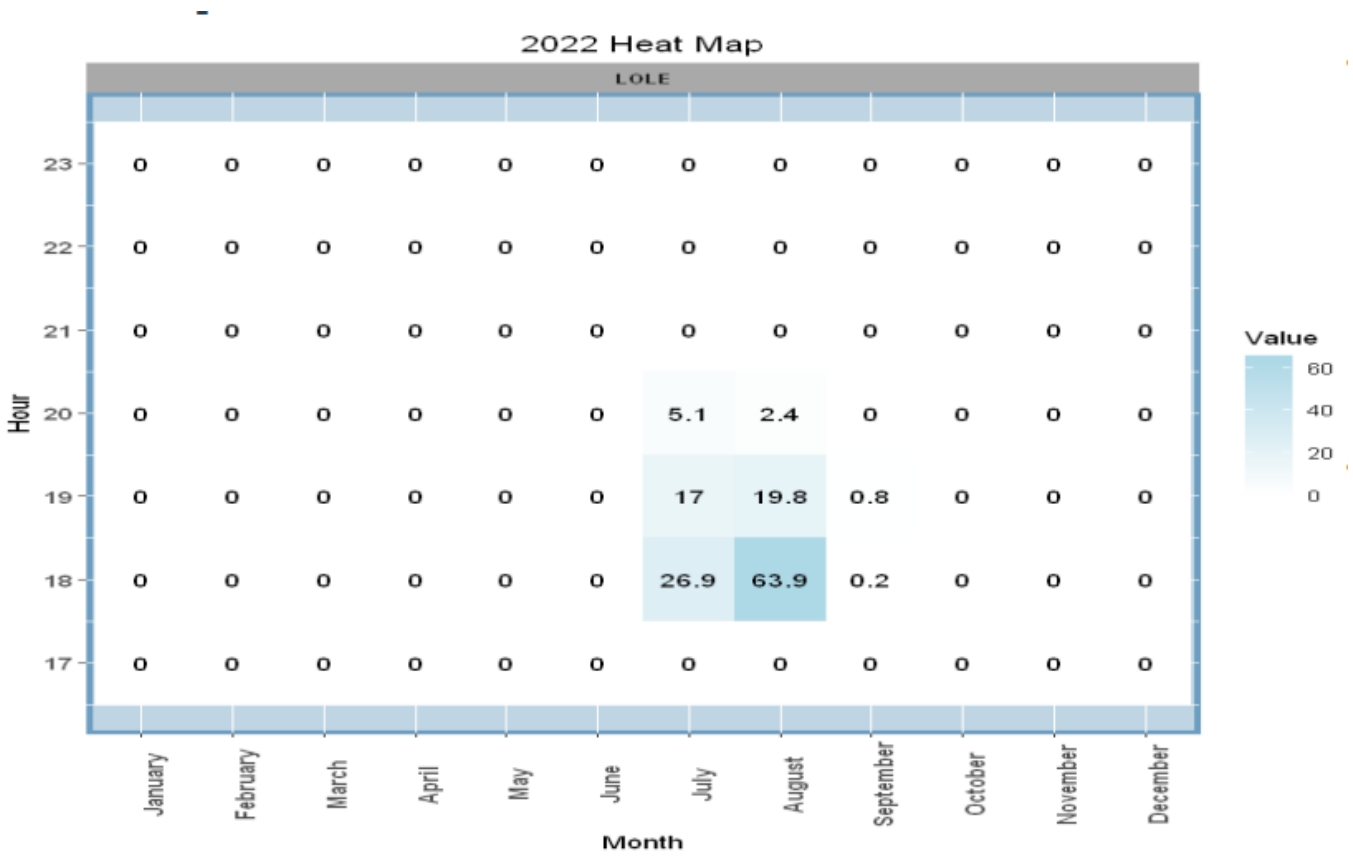
Peak Net Load Requirement Options

Purpose of peak net load requirement is to capture non-solar hour reliability

- Currently the CAISO has the most trouble with reliability during peak net load hours due to the shift from relying on solar to relying on other resource types
- While ELCC and exceedance measure solar availability, any amount cannot capture that solar simply isn't available at night
- Thus, there needs to be an explicit check that during peak demand after sunset can be served by non-solar resources
- Multiple ways to do this check:
  1. Hourly requirement overnight (most complex)
  2. Peak net load requirement using CAISO local methodology
  3. Peak net load requirement using CAISO flexible RA methodology
  4. Requirement based on peak net solar hour demand (least complex)

CPUC Energy Division LOLE analysis highlighted that there is increased net peak need

- CPUC noted in its November 23, 2021 presentation that "Reliability risk continues to move to the evening, particularly in July and August with a smaller risk in September"
- Maps showing amounts of Expected Unserved Energy identified under its LOLE modeling for target year 2022 for each hour and month
  - Show when loss-of-load risks are expected to occur and show expectations of magnitude
  - CPUC Energy Division saw that LOLP periods are likely during HB18-HB20 for now



Source: Track 3.B Workshops: Day 2, https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy/energy_programs/electric_power_procurement_and_generation/procurement_and_ra/ra/track-3b-day-2-presentation.pdf

CAISO recognizes need to ensure sufficient capacity during slice 2 net peak slice

- Flexible RA already includes an approach for determining net-load requirements and solar and wind profiles, where CAISO:
  - Relies on NERC accepted metric of net-load where "Net-load is the aggregate of customer demand reduced by variable generation power output" [1]
  - Uses CEC 1-in-2 IEPR forecast Managed Net Load
  - Includes an approach for generating load profiles, solar profiles, and wind profiles

- Local RA already incorporate sufficient net peak approach, where CAISO[2]:
  - Uses the CEC managed peak demand in the CEDU 2020-2030 Baseline Forecast
  - Incorporates the Peak Shift so that the actual peak hour is later in the day
  - Caps the capacity value of variable energy resources cannot exceed historical/projected output values at time of managed shifted peak load $(\min(NQC, Output_{shifted\ peak}))$
    - CEC provided solar output shapes for managed peak hour (ISO creates if CEC does not provide shapes)
    - Wind and QF capacity are also limit based on similar assumptions used in Transmission Planning Process

1 http://www.caiso.com/InitiativeDocuments/Presentation-2022FlexibleCapacityNeedsAssessment-Jan272021.pdf
2 http://www.caiso.com/InitiativeDocuments/Presentation-2023LocalCapacityTechnicalStudyCriteriaMethodologyandAssumptions.pdf

CAISO recognizes need to ensure sufficient capacity during slice 2 net peak slice cont.

- CAISO expressed interest in the Track 3B2 workshops considering a framework similar to that being proposed, stating in its opening comments on the PD:

> "For example, rather than starting with six time slices as the Slice-of-Day proposal suggests, the **CAISO encourages parties to move from a single monthly peak load requirement to include a monthly net demand peak requirement as an important first step.** The CAISO could support the systems changes needed to accommodate this program change for resource adequacy year 2023." [2]

- CAISO expressed concern that planning processes should better incorporate net demand in response to Integrated Resource Planning process as well:

> "A 1-in-2 average demand forecast may be appropriate if paired with an allowance for higher than average load during the peak and net demand peak periods."[3]

3 http://www.caiso.com/Documents/Jun30-2021-OpeningComments-ProposedDecision-Track3B2-RestructureResourceAdequacyProgram-R19-11-009.pdf
4 http://www.caiso.com/Documents/Mar26-2021-Comments_AdministrativeLawJudgeRuling-IntegratedResourcePlanning-R20-05-003.pdf

Proposal: Set monthly net peak requirement (slice 2)

- For CPUC compliance purposes only, CPUC would perform a slice 2, net peak slice, sufficiency test
- Set a net load requirement
- Would apply consistent approach to valuing the contribution of solar, wind and QF during net peak managed hour to that which is being performed in local RA
  - Need CAISO to provide greater detail on this method and coordinate with CPUC Energy Division to identify whether a new, improved approach might be adopted or retain CAISO current approach
  - Caps the capacity value of variable energy resources cannot exceed historical/projected output values at time of managed shifted peak load

Deficiency Determination

Proposal: Set monthly net peak requirement (slice 2) cont.

- CPUC should first determine if there is a deficiency in slice 2 net peak slice in aggregate
- If there is an aggregate net peak slice deficiency,
  - Each LSE RA portfolio is validated against the LSE's coincident net peak load
  - Allocated to short LSEs based on percent short compared to total shortfall
- Timelines:
  - Annual Showings: LSEs have a 43-day after last business day in Oct opportunity to cure for annual showings (same as today in Annual CSP timeline)
  - Monthly Showings: LSEs have T-30 day before first day of RA month to cure for monthly showings (same as today in monthly CSP timeline)
- Any remaining deficiency is considered a system RA shortfall under existing rules

Appendix

September 2021 peak day energy profile