California ISO

Year-ahead Showings Assessment: Review of Modeling and Preliminary Results

Resource Adequacy Modeling and Program Design
Track 1: Modeling, Defaults and Accreditation

October 8, 2024

Today's Agenda

Time	Topic	Speaker
9:00 – 9:15 AM	Welcome	Christina Guimera
9:15 – 9:45 AM	Working Group Policy Initiative Context	Ansel Lundberg
9:45 – 10:30 AM	Opening comments	Aditya Jayam Prabhakar
10:30 – 10:45 AM	Break	
10:45 – 11:15 AM	RA Overview	Mark Kootstra
11:15 – 12:00 PM	Year-Ahead Assessment: Inputs, Assumptions and Study Design	Sai Koppolu
12:00 – 1:00 PM	Lunch	
1:00 – 1:30 PM	Year-Ahead Assessment: Modeled Scenarios	Sai Koppolu
 1:30 – 1:45 PM 1:45 – 2:15 PM	Year-Ahead Assessment: Deterministic Results Probabilistic Results	 Xuping Li Sai Koppolu
2:15 – 2:30 PM	Mid-Term and Long-Term Assessment: Scope and Timeline	Mike Wu
2:30 – 2:45 PM	Next Steps	Aditya Jayam Prabhakar
2:45 – 3:00 PM	Adjourn	Christina Guimera

Housekeeping reminders

- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.

- These collaborative working groups are intended to stimulate open dialogue and engage different perspectives.

- Please keep comments professional and respectful.

Instructions for raising your hand to ask a question

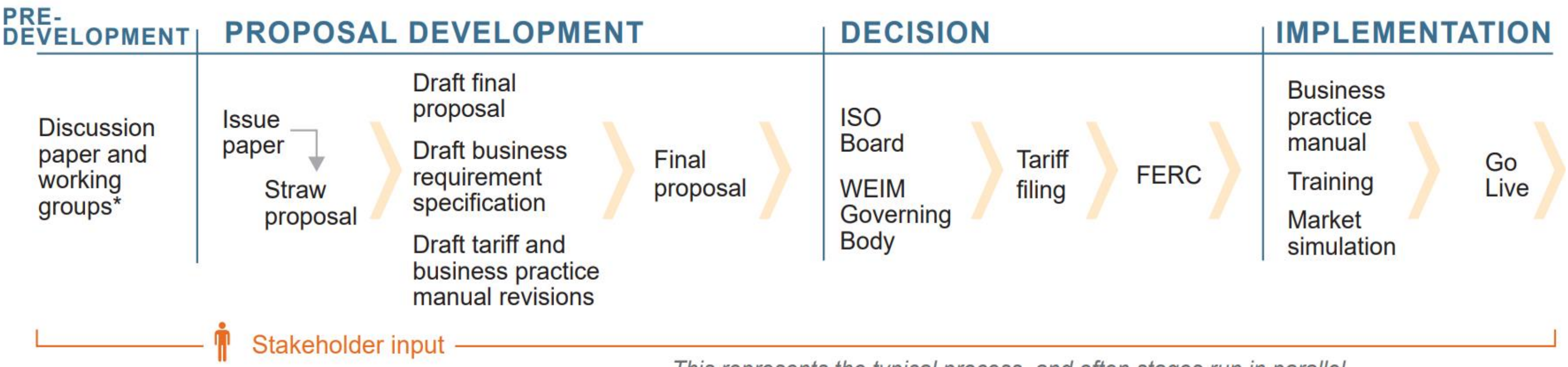
- If you are connected to audio through your computer, select the raise hand icon located on the bottom of your screen.
- If you dialed in to the meeting, press #2 to raise your hand.
- Please remember to state your name and affiliation before making your comment.
- You may also send your question via chat to all panelists.

Resource Adequacy Modeling and Program Design

Track 1: Modeling, Defaults, and Accreditation

WORKING GROUP – POLICY INITIATIVE CONTEXT

Working group in context



This represents the typical process, and often stages run in parallel.

Stakeholder meetings, working groups and workshops may occur throughout the stakeholder process.

We are here

This workshop reviews efforts to address the problem statements from a new RA policy initiative

Problem Statement:

Current processes and procedures and RA supply assessments do not provide the ISO sufficient visibility into the generation fleet to confidently qualify the level of system reliability. The ISO needs consistent, transparent, and timely information on the sufficiency of the RA fleet in the CAISO BAA.

Without this information, the ISO faces challenges in:

- Assessing and communicating the system-wide sufficiency of the CAISO BAA in light of the contracted RA fleet.
- Anticipating the amount of RA imports that the ISO can expect and the amount of RA eligible resources within CAISO that will be contracted to entities outside the state.
- Addressing such concerns around CAISO BAA system-wide RA sufficiency in a timely and efficient manner.

This workshop reviews efforts to address the problem statements from a new RA policy initiative

Sub-issues:

- A comprehensive evaluation of the sufficiency of the current or expected CAISO BAA RA portfolio in forward time frames (e.g., monthly, yearly, multi-year) does not exist today. Such an assessment would provide the ISO and stakeholders an understanding of the overall CAISO BAA level of system-wide reliability, LRA contributions to overall system reliability, and the implications of an RA resource fleet with an increasingly diverse mix of fuel and technology types.

- There is a need for additional information regarding the sufficiency of the LRA RA programs to meet 0.1 LOLE.

RA modeling is in service of ISO policy objectives as informed by the RAMPD stakeholder working group

Current Objectives:
Conduct a probabilistic assessment to provide a comprehensive evaluation of the sufficiency of the current or expected CAISO BAA RA portfolio in forward time frames to meet reliability objectives
Update CAISO default resource counting rules and PRM to reflect reliability contribution of different resource types and achieve a 0.1 LOLE
Address ambient derates and consider development of a UCAP mechanism

Modeling

- Stakeholder involvement throughout on inputs, assumptions, and results

Related Policies

- "Traditional" policy development process (issue paper, straw proposal, etc.)

RAMPD WG Track 1: Modeling, Defaults & Accreditation

OPENING REMARKS

What is the purpose of this initiative?

This initiative aims to:

- Assess the impact of changes in the supply mix and system attributes to inform future policy direction.
- Build a comprehensive assessment of the entire fleet.
- Evaluate the BAA reliability in the 1 to 10 year horizon.

This initiative is not:

- Designed to expand CAISO jurisdiction over resource adequacy.
- Aimed at setting *minimum* requirements.
- An assessment of individual LRA resource adequacy programs.

Resource Adequacy in CA is a shared responsibility with Local Regulatory Authorities (LRAs)

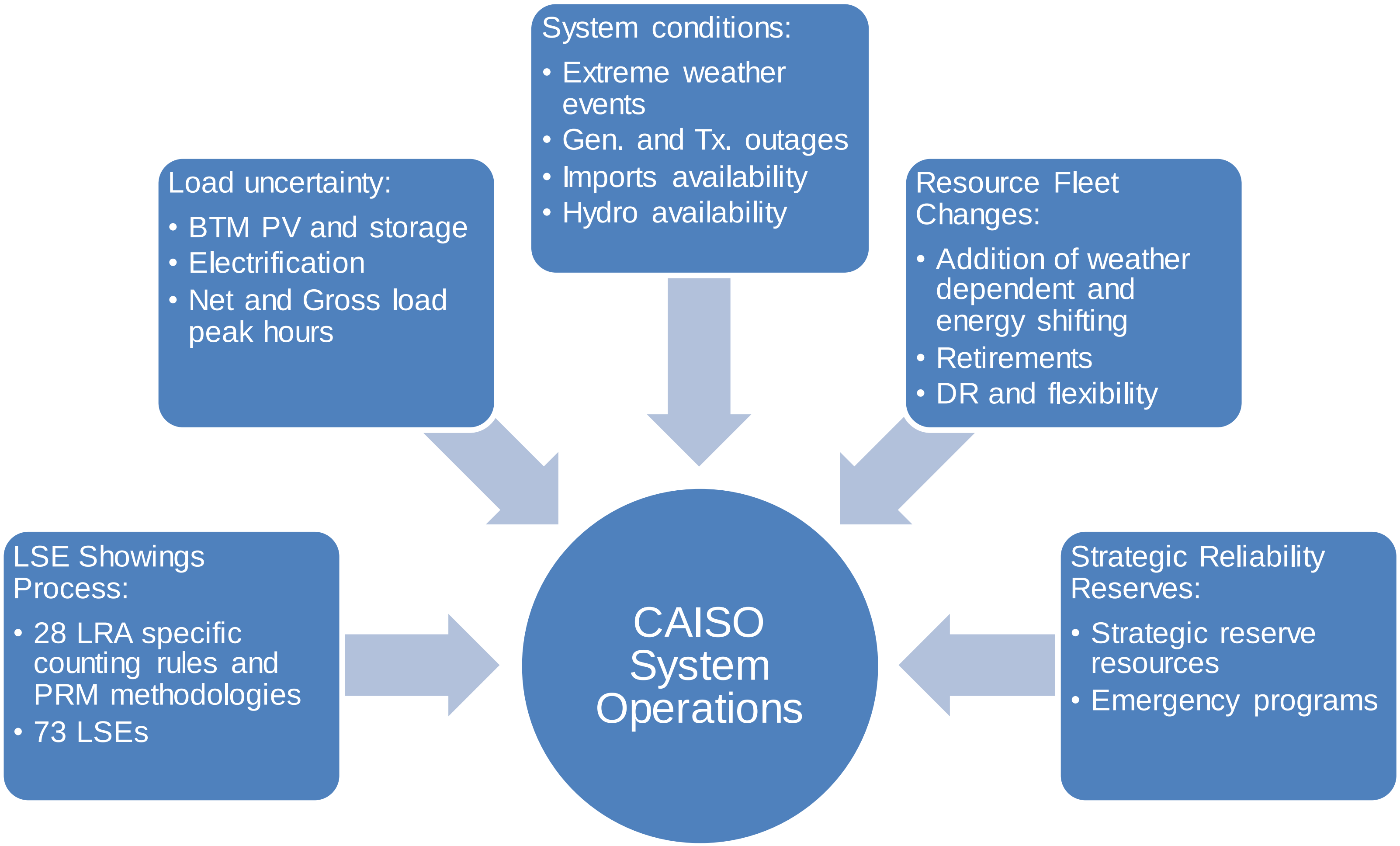
This initiative aims to enhance existing coordinated planning processes between the CAISO, CPUC, CEC

- Current coordination and roles for long-term electric system planning outlined in the MOU between the CAISO, CPUC, and CEC will continue.
  - The CPUC will remain responsible for developing forward resource portfolios in its Integrated Resource Plan (IRP) proceeding.
- The CPUC also conducts reliability assessments as part of its IRP and RA processes; likewise the CEC also conducts reliability assessments.
  - The CAISO will work closely with CPUC and CEC to align inputs and assumptions in respective assessments to the extent possible.

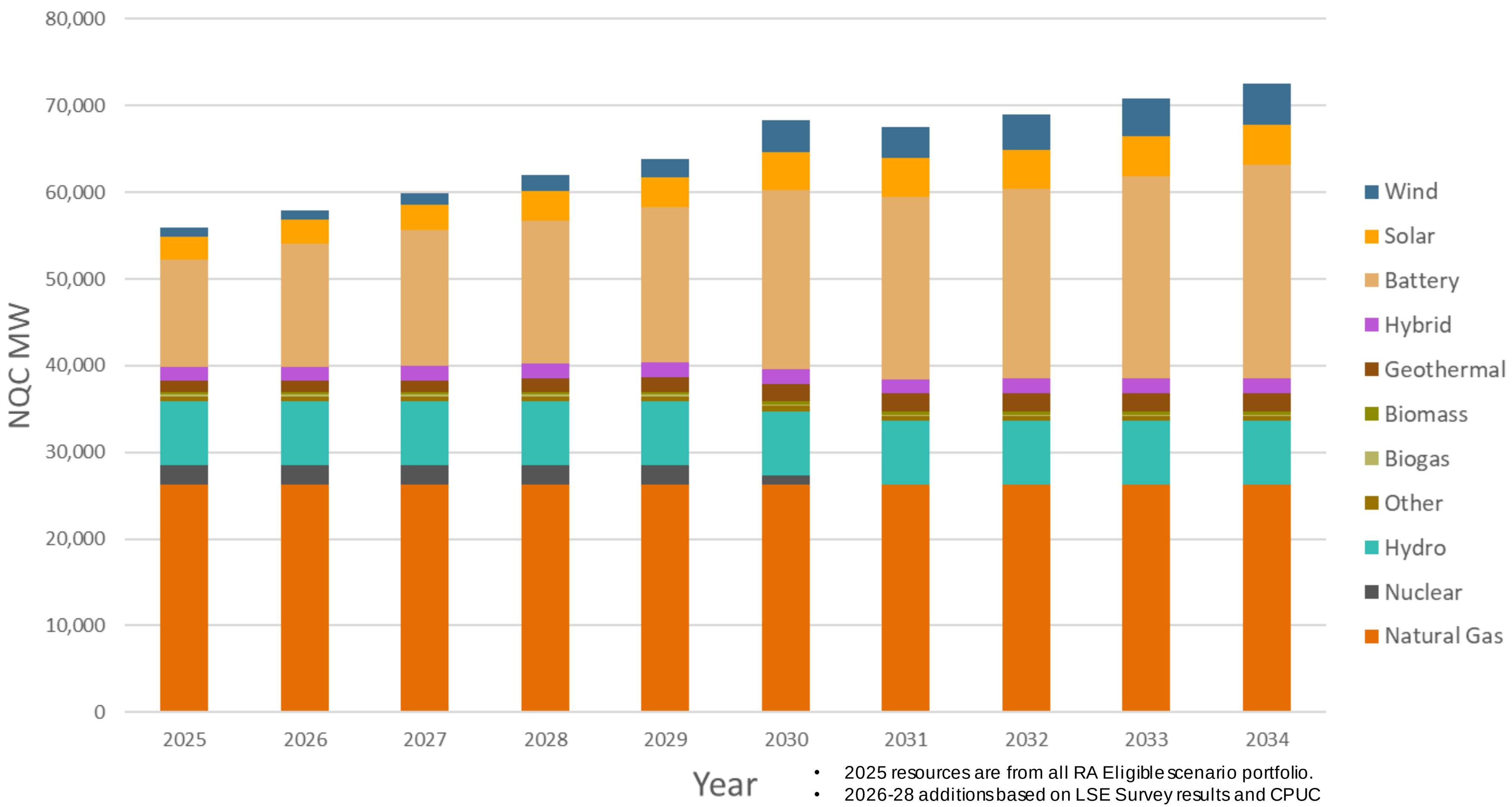
What are you going to see today?

- A comprehensive assessment of the entire BAA RA fleet.
- Draft CAISO's year-ahead assessment results:
  - We are looking forward to your feedback to help improve our modeling assumptions and methodology,
  - We will bring updated results in the coming months after incorporating stakeholder feedback,
  - Findings from this analysis can help inform the RAMPD WG proposal development/direction.
- Scope of the mid-term and long-term assessment.

CAISO system operations must ensure reliability in a changing system



Accelerated fleet transition:
Shift to energy-and availability-limited resources



- 2025 resources are from all RA Eligible scenario portfolio.
- 2026-28 additions based on LSE Survey results and CPUC contract information capped at Authorized Procurement.
- 2029-34 additions based on LSE Plans submitted to CPUC.
- LSE Plan nameplate MW converted to NQC MW based on July technology factors from 2024 NQC List.

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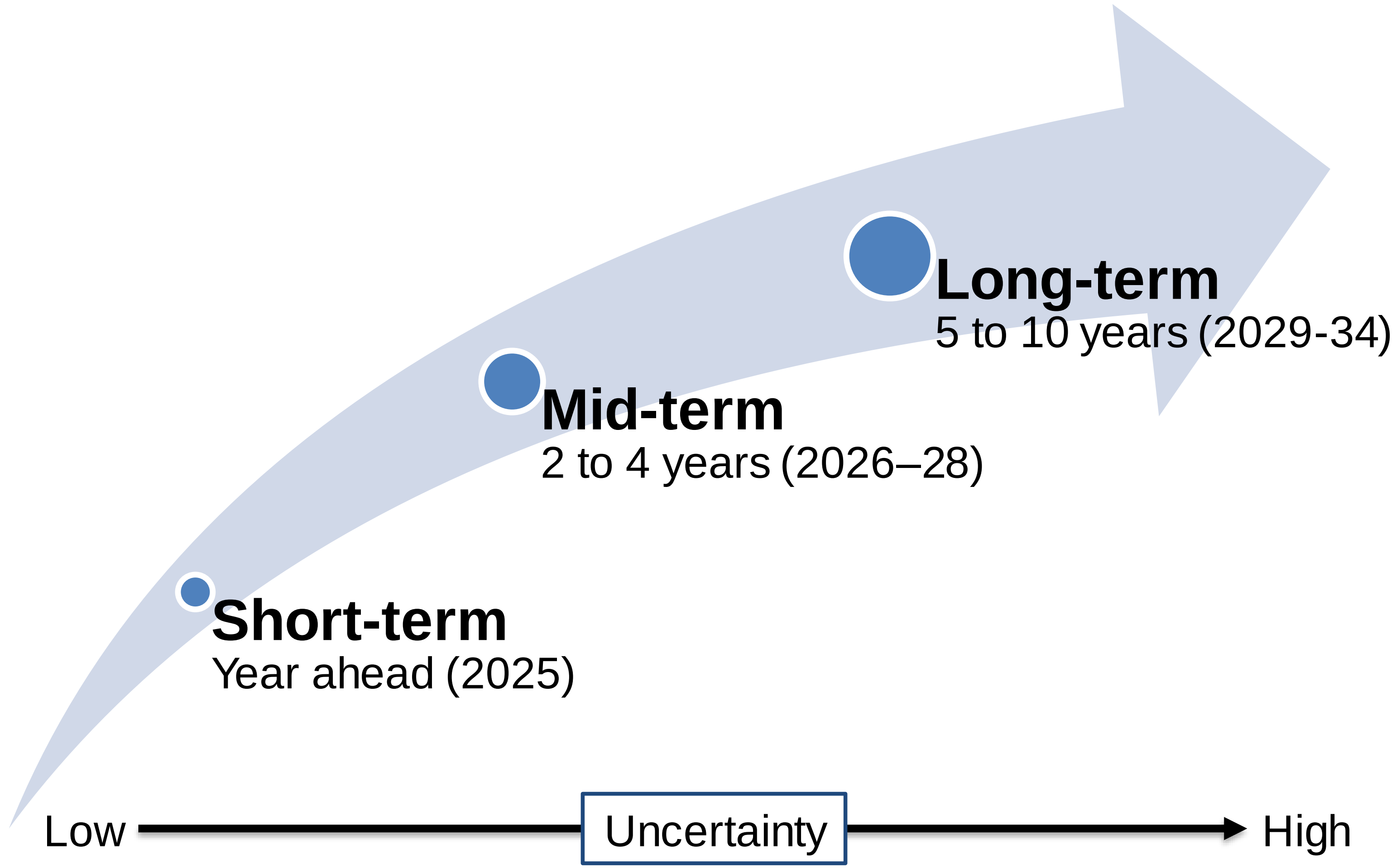
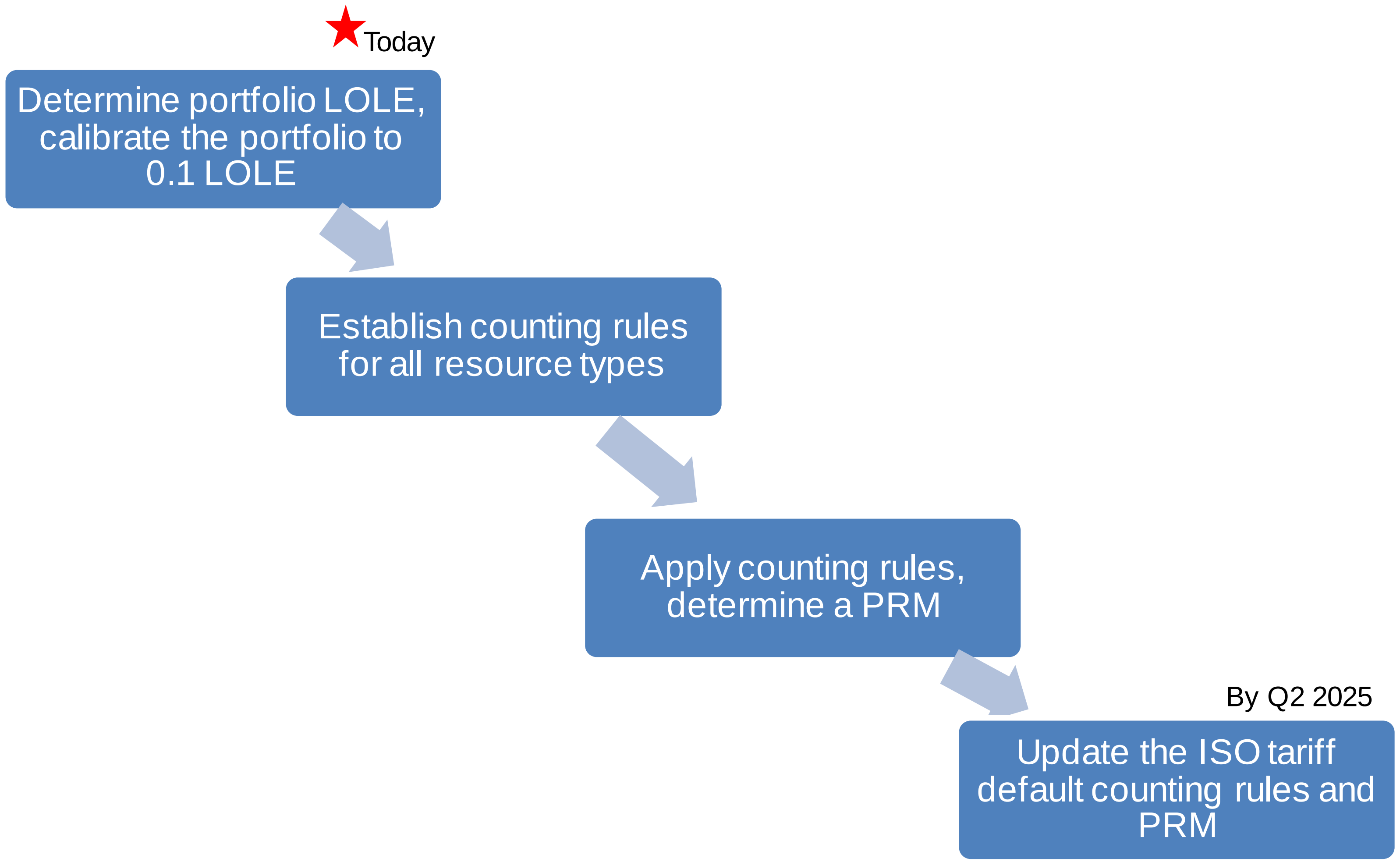
Ensuring resource adequacy with a rapidly transitioning fleet calls for forward looking assessments



CAISO proposes to use a 1-in-10 LOLE metric to assess if the ISO BAA has sufficient resources to ensure reliability

- Loss of Load Expectation (LOLE) modeling is a method to probabilistically determine the likelihood of loss of load under different grid conditions given a certain level of capacity on the system.
- LOLE modeling will measure whether the capacity on the system meets an agreed-upon reliability standard (1-in-10 LOLE).
- The probabilistic assessment measures the potential for calling on additional measures.

The next step in the analysis is to establish counting rules and associated PRM



CAISO's modeling effort is progressing and improved – all thanks to extensive stakeholder engagement

Completed

- LSE survey and data validation
- Draft modeling inputs
- Draft probabilistic assessment

Today

- Share inputs and assumptions (I&A)
- Present draft results
- Provide information on future work
- Seek stakeholder feedback on I&A

Nov/Dec 2024

- Consider and incorporate stakeholder feedback
- Finalize updates and rerun models
- Stakeholder discussion on mid- and long-term analysis

Q1/Q2 2025

- Propose default counting rules and default PRM options
- Incorporate default rules into CAISO tariff

Reliability is a shared responsibility

- California's electricity system is undergoing several changes including:
  - Evolving resource mix,
  - Load growth and changes to demand shapes, and
  - Climate change and extreme weather events have increased the frequency and unpredictability of demand and generation and transmission outages.
- Longer study horizons can help enhance CAISO and LRAs' awareness of future vulnerabilities and take the appropriate steps to adapt planning and operations to ensure reliability now and into the future.

What is Resource Adequacy?

The ability for supply to meet demand under reasonable expected situations

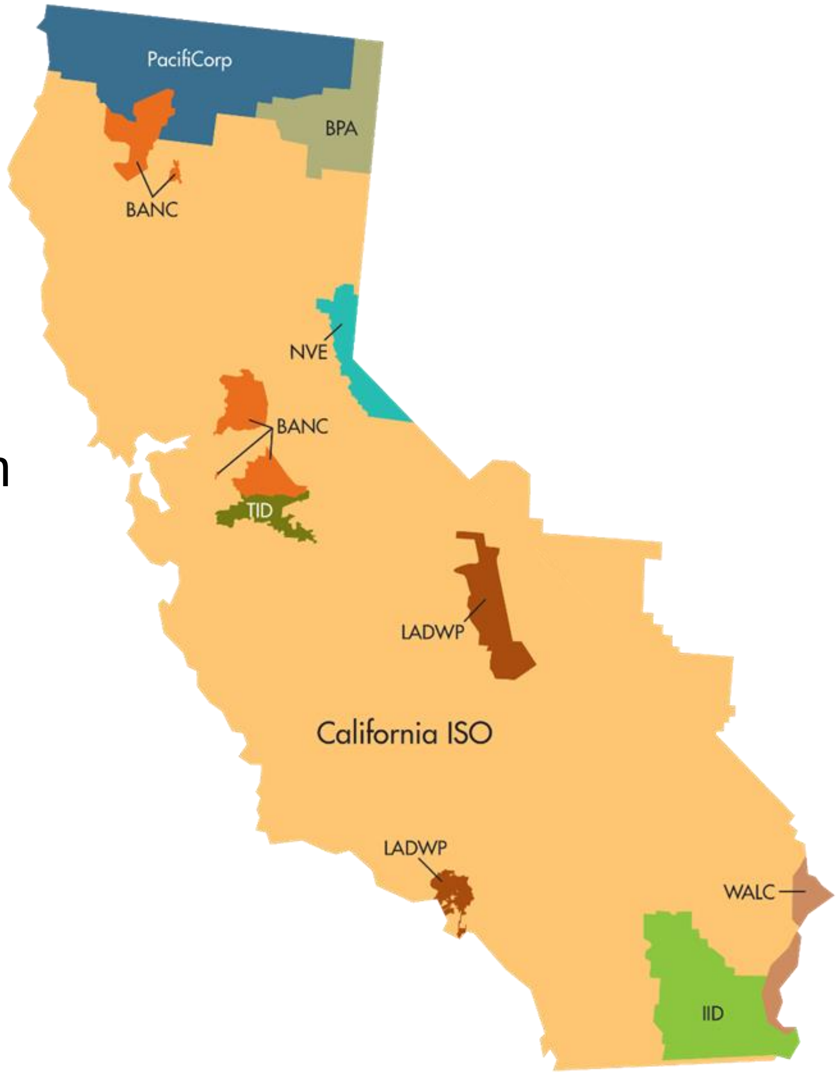
OBJECTIVES: RA OVERVIEW

CAISO BAA oversees 80% of California's electricity demand and a part of Nevada

- LRAs set their own Planning Reserve Margins (PRM) and resource counting rules.

- The ISO's default PRM and default counting rules apply when an LRA has not set either a PRM or counting rules.

- The ISO's default PRM is 15% of the LSE's peak load each month.



The RA program is a collaborative effort that is the fundamental to the reliability of the CAISO BAA

RA Program → Analysis → Demonstration and Assessments → Availability and Performance → Backstop

Requirements
- CEC IEPR Forecast
- LRA RA methodology
- LRA credits
- ISO flex requirements
- ISO local requirements

Studies
- Reliability
- Summer assessment

Showings
- Annual
- Monthly

Operations
- Must offer obligations
- Bid-insertion
- RAAIM

Procurement
- CPM
- RMR

Most LRAs' 2024 month-ahead PRMs are great than or equal to the CAISO default PRM of 15 percent

CAISO Tariff Section 40.2.2.1: "For the Scheduling Coordinator for a Non-CPUC Load Serving Entity for which the appropriate Local Regulatory Authority or federal agency has not established a Reserve Margin(s) or a CPUC Load Serving Entity subject to Section 40.2.1(b), the Reserve Margin for each month shall be no less than fifteen percent (15%) of the LSE's peak hourly Demand for the applicable month, as determined by the Demand Forecasts developed in accordance with Section 40.2.2.3."

Number of Local Regulatory Authorities (LRA)	2024 Planning Reserve Margin (PRM)	Percent of CAISO September Peak Load
3	≤10%	~1%
24	15% (Also the CAISO default)	~8.5%
CPUC LRA	17%	90.6%
Load Weighted Average	**16.7%**	**100%**

Current CAISO default qualifying capacity criteria (counting rules)

Resource type	Current CAISO Default QC Criteria
Wind & Solar	Based on monthly historic performance during that same month from HE13 to HE19
Energy storage	Based on CAISO testing of a resource's sustained output over a four-hour period (and not to exceed that resource's maximum instantaneous discharge capability)
Thermal	Based on "net dependable capacity" defined by NERC Generating Availability Data System information (GADS)
Dispatchable hydro	Based on net dependable capacity defined by GADS minus variable head derated based on an average dry year reservoir level
Demand response	Based on resource's average monthly historic demand reduction performance during that same month during the Availability Assessment Hours

- Qualifying capacity (QC) represents a generating resources' capacity eligible to count towards meeting LRA RA requirements.
- Net qualifying capacity (NQC) is calculated by the CAISO through a deliverability study, which may limit the QC of resources that are not fully deliverable.

CAISO tariff default counting rules are out of date given the current resource mix, load profiles, and reliability risks

- According to the current CAISO tariff: default rules apply only where the CPUC or Local Regulatory Authority has not established and provided to the CAISO criteria to determine the types of resources that may be eligible to provide Qualifying Capacity and for calculating Qualifying Capacity for such eligible resource types.
  - In practice, CAISO has not had to use the default counting rules included in the tariff to determine QC values.
  - Non-CPUC LRAs have indicated that they use CAISO default rules as a “starting point” in establishing their own values.

The CAISO grid has undergone substantial changes since the creation of the CAISO default PRM and counting rules

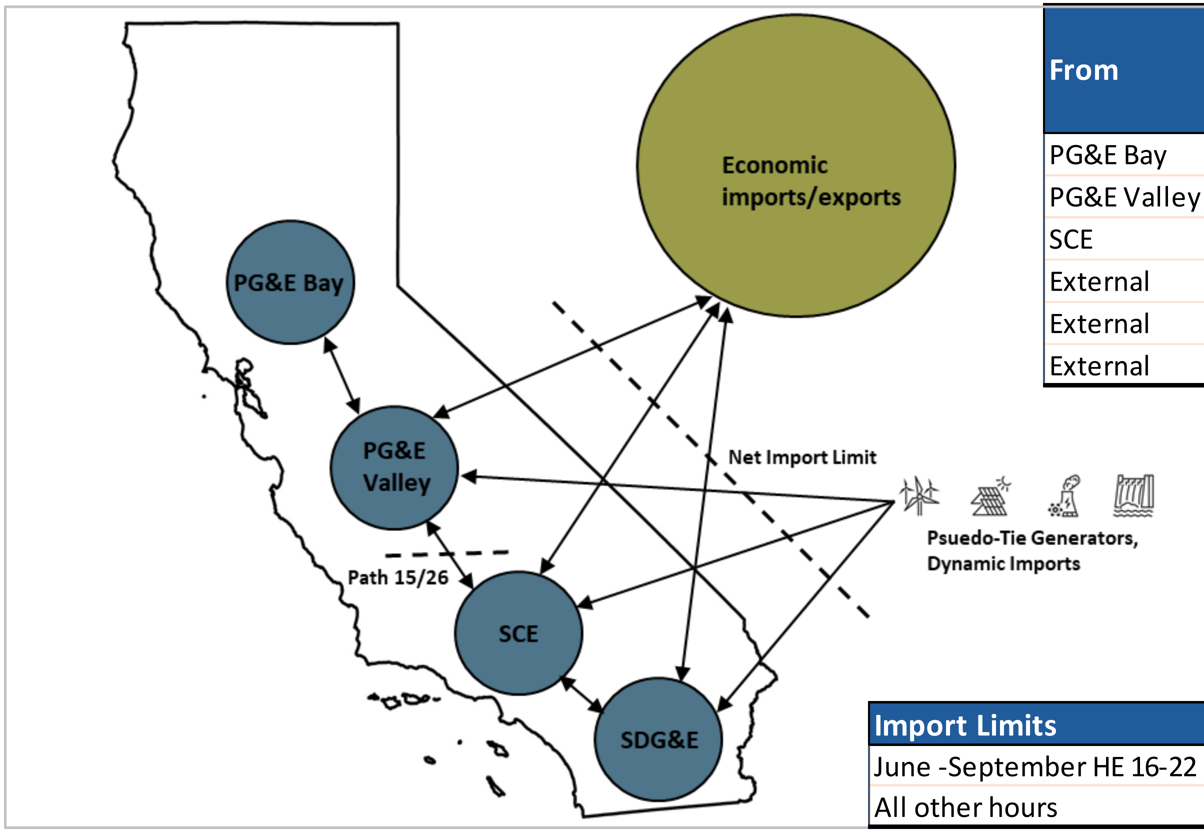
In summary:

- LRAs maintain their own RA programs and CAISO's default resource counting rules are used as a starting point by some.
- Most LRAs' PRM requirements are set at 15 percent (equal to the CAISO default value) or higher.
- CAISO default counting rules and PRM are outdated, and need to be updated to be consistent with system needs and better reflect LRA requirements.

Year-ahead RA assessment:

INPUTS, ASSUMPTIONS AND STUDY DESIGN

The model topography splits CAISO into four regions, with one external region



From	To	Min/Max Flow Ratings (MW)	Import/Export Hurdle Rate ($/MWh)
PG&E Bay	PG&E Valley	-15,000/15,000	0
PG&E Valley	SCE	-3,000/4,000	0
SCE	SDG&E	-2,500/4,104	0
External	PG&E Valley	-6,630/7,800	$10.48/$10.85
External	SCE	-12,538/13,502	$13.24/$10.85
External	SDG&E	-3,831/4,223	$13.24/$10.85

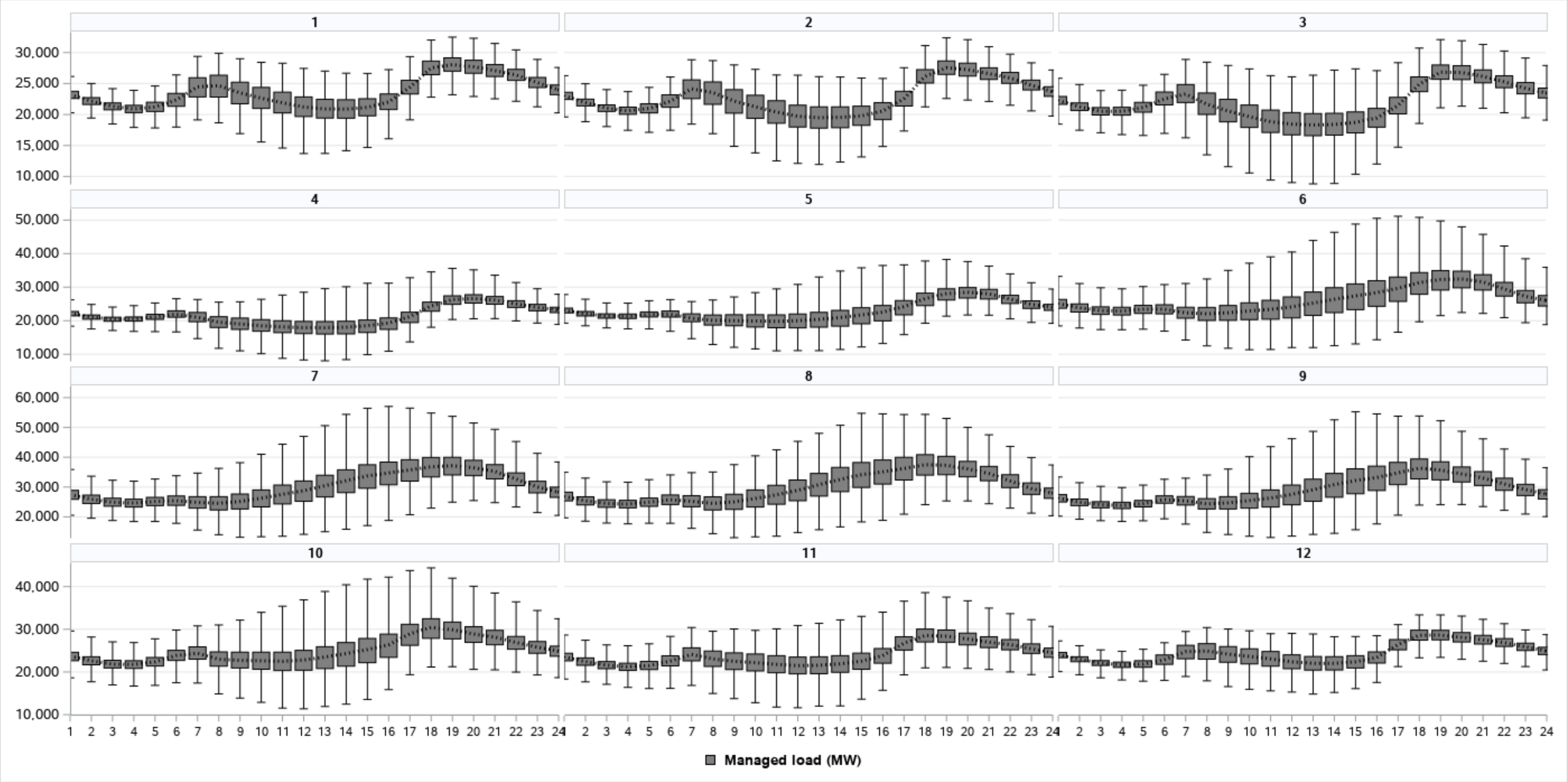
Import Limits	Limits
June -September HE 16-22	5,500 MW
All other hours	11,665 MW

The model includes four stochastic variables – load, wind, solar and forced outage profiles

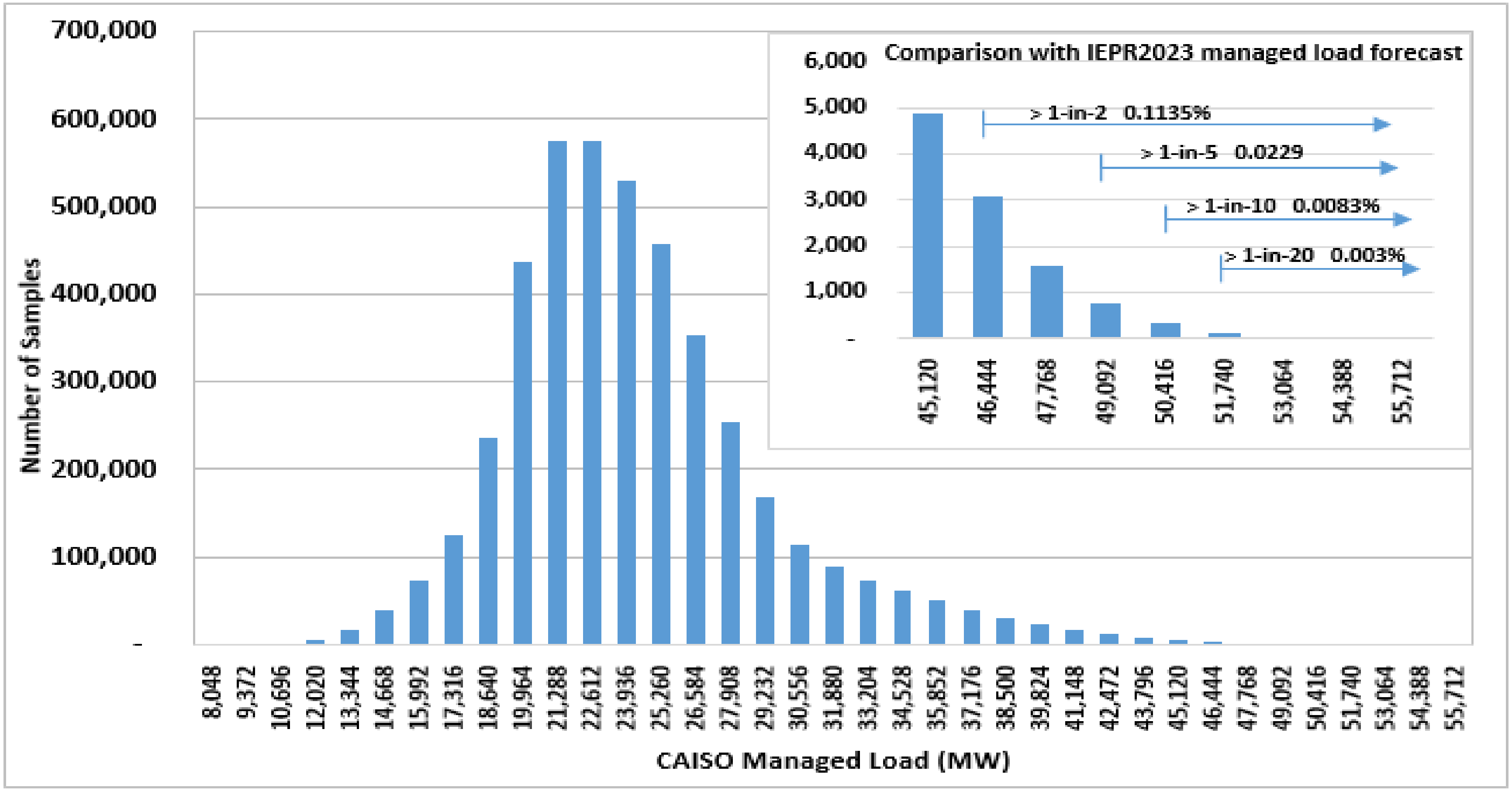
- Solar, wind, and load shapes:
  - Produced using a mean reversion stochastic model.
  - 500 samples are produced.
  - The single profile for each variable is allocated to the various zones based on the ratio of their contribution in the base profile.
- Forced outages are calculated as technology averages based on CAISO 2006-2012 actual outages.

Stochastic profiles methodology was filed as part of CAISO's expert testimony in the CPUC Long-Term Procurement Plan (LTPP) proceeding, Appendix A, pg. 5 – 19, Nov 20, 2014: https://www.caiso.com/documents/nov20_2014_liu_stochasticstudytestimony_ltpp_r13-12-010.pdf

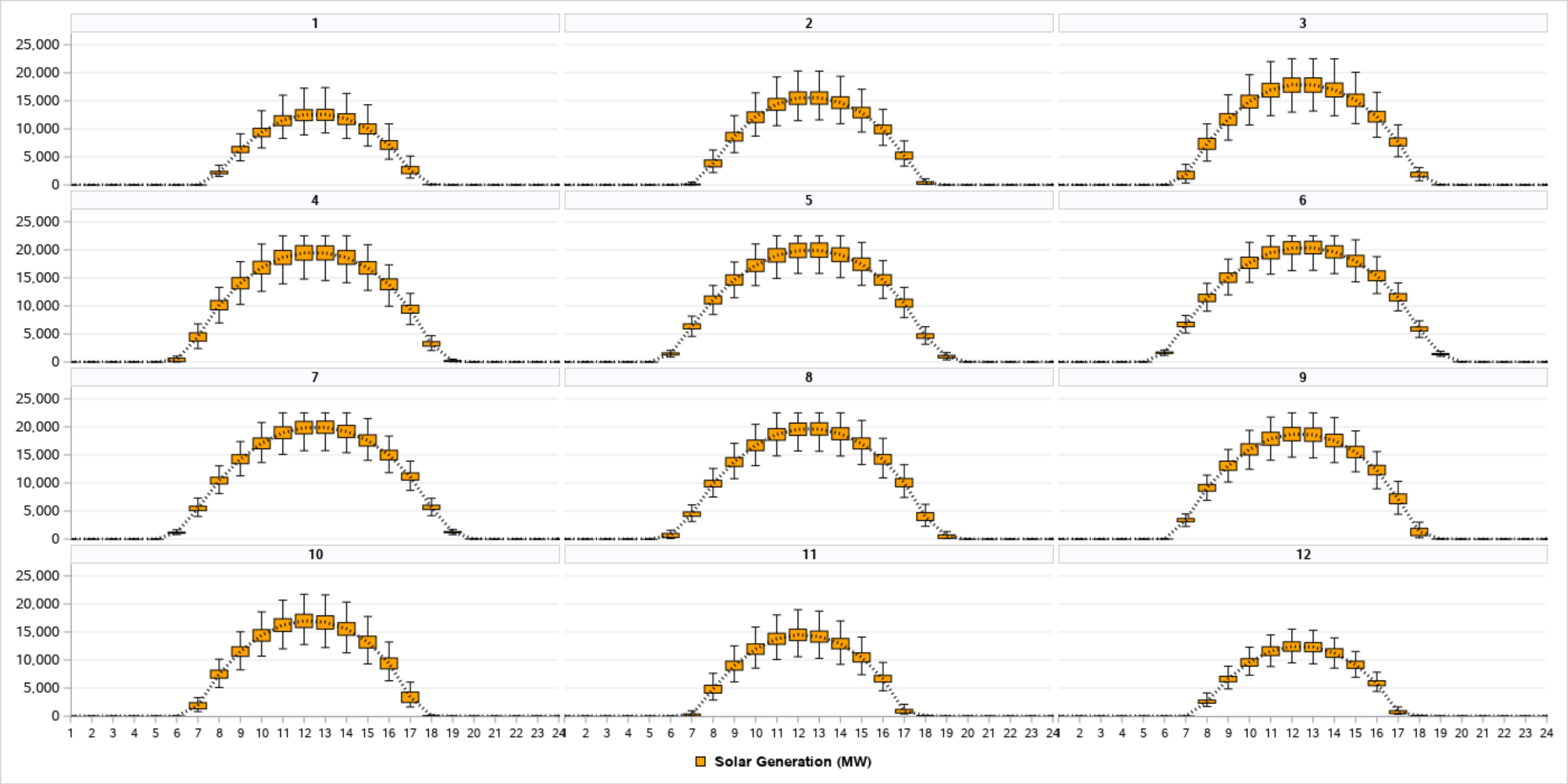
Load profiles are based on the CEC 2023 IEPR hourly forecast, with the CAISO historical load profiles used in the regression model



Frequency distribution of the loads in the stochastic model compared to the CEC 2023 IEPR Peak Forecast for the CAISO



Stochastic solar profiles use NREL data from 2010-2021 as the basis for the regression model



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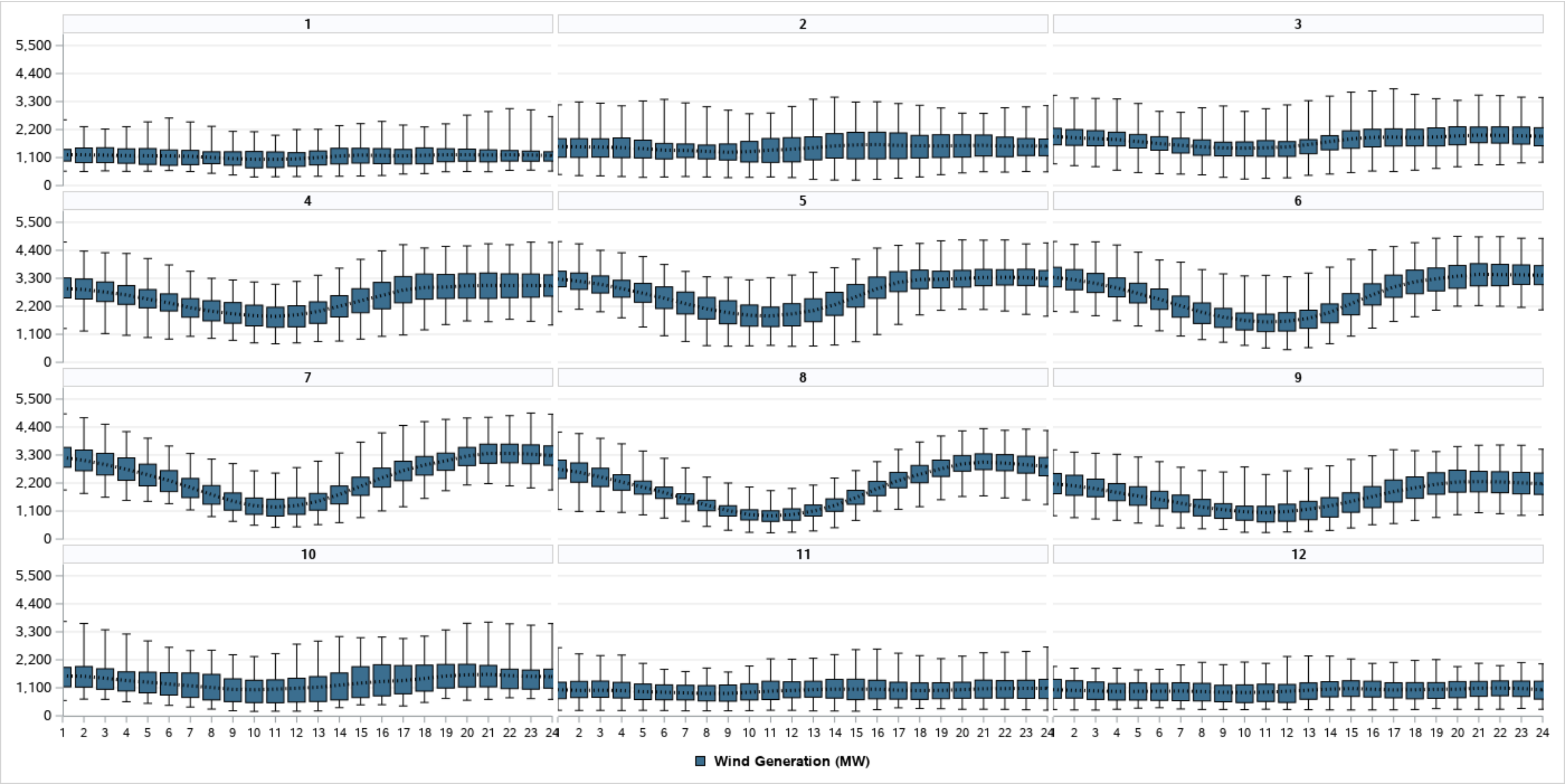
Stochastic wind profiles use CAISO actual wind generation from 2019-2023 as the basis for the regression model



Renewable resources are modeled on an aggregated basis by zone.

- Solar and wind are modeled with nameplate capacity.
- Solar and wind components of hybrid and co-located resources are aggregated and modeled separately and used in developing the stochastic profile, but subject to a maximum output constraint with the paired energy storage.
- Capacity for geothermal, biofuels, and small hydro vary by scenario.

Forced and maintenance outages are based on CAISO outage data last updated over 5 years ago

- 500 outage patterns are created using a converged Monte Carlo method so the percent of forced outages is approximately the same as historic forced outage rates.

Technology type	Forced Outage Rate	Maintenance Rate
Battery Storage	5.20%	
Biogas	7.60%	
Biomass	5.70%	
Cogen	4.57%	4.57%
Combined Cycle	5.82%	6.76%
Combustion Turbine	4.42%	4.53%
Geothermal	2.60%	
Steam Turbine	7.89%	9.11%
Pumped Storage	4.50%	8.65%

- Planned maintenance outages are scheduled in periods of high capacity reserves, but are not included in certain modeling scenarios where substitution is assumed.

Thermal plants are modeled at the unit level

- Plant details are sourced primarily from the CAISO's Master File and the WECC Anchor Dataset. Key operating characteristics include:
  - Minimum and maximum operating capacity.
  - Minimum up and down times.
  - Ramp up and down times.
  - Start-up times, cost, and fuel.
  - Variable operations and maintenance cost.
  - Heat rate curves.
- Plants may provide ancillary services and load following reserve modeling up to the unused capacity and ramping limits.
- Fuel prices are sourced from the CPUC's IRP process.

General I&A's are sourced from CAISO's 2024 Summer Assessment model and updated with 2025 inputs where applicable: https://www.caiso.com/library/caiso-irp-25-mmt-stochastic-plexos-models-with-cec-2023-iepr-load-forecast

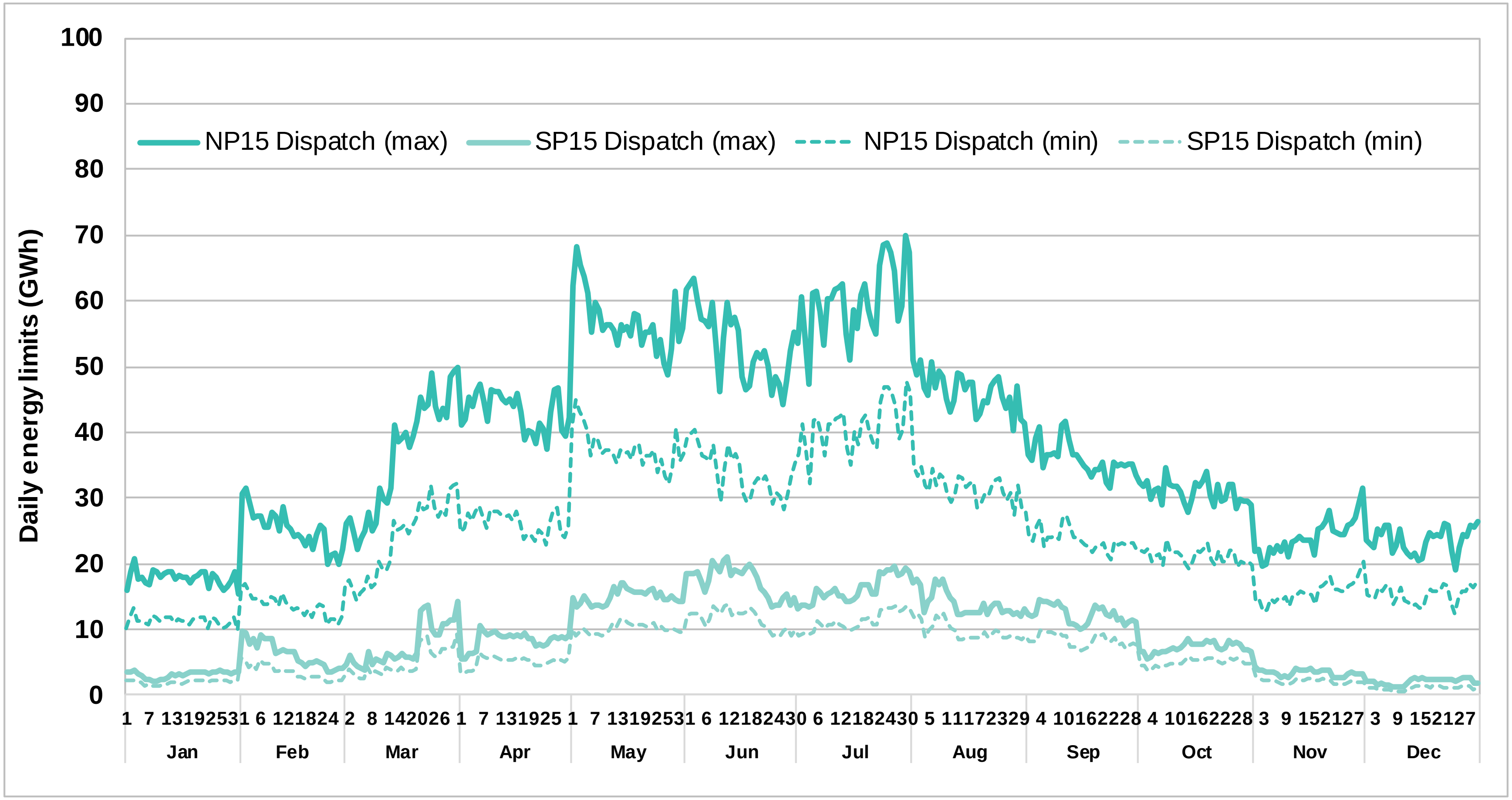
Battery energy storage and demand response modeling

- Battery energy storage may provide ancillary services and is modeled with 85 percent round trip efficiency.
- Hybrid and co-located resources are aggregated by zone and subject to respective Pmax and aggregate capability constraints.
- Demand response (DR) capacity comes from either the NQC list and or the LSE survey data, depending on the scenario. DR is modeled with:
  - High triggering prices calibrated to ensure that DR is called at a realistic frequency.
  - Maximum run time and daily start constraints.

Hydroelectric generation is modeled in one of three ways

- Non-dispatchable run-of-river hydro is modeled as a fixed generation profile.
- Dispatchable hydro:
  - Uses an average hydro year of 2018 hydro year to set daily minimum and maximum energy limits.
  - May provide system capacity, ancillary service, and flexible capacity.
- Pump storage generators are modeled individually and are optimized subject to storage capacity, inflow and target limits, and cycling efficiency.

Dispatchable hydro daily energy limits for NP15 and SP15



Ancillary services and load following requirements

- The regulation up or down requirement is calculated using the maximum of net load differences between the 1-minute and 5-minute forecast values.
- Spinning and non-spinning reserve are each 3 percent of load.
- The load following up or down requirement is the maximum of net load differences between the 5-minute and hourly forecast values within the hour in an upward or downward direction.
- Frequency response reserve has a minimum provision of 376 MW to satisfy a NERC requirement. Only internal combined cycle and battery energy storage resources may provide this reserve.

Year-ahead RA assessment:

MODELED SCENARIOS

Three scenarios were assessed in the year-ahead timeframe

Scenario 1: Showings Capped at Obligation	Scenario 2: Showings Based on Historical Pattern	Scenario 3: All RA Eligible
Assess reliability with the minimum capacity needed to meet RA obligations	Assess reliability with capacity at historical excess over system obligation	Assess reliability with all RA eligible resources

Less → Modeled Capacity → More

Key assumptions for the 2025 year-ahead assessment

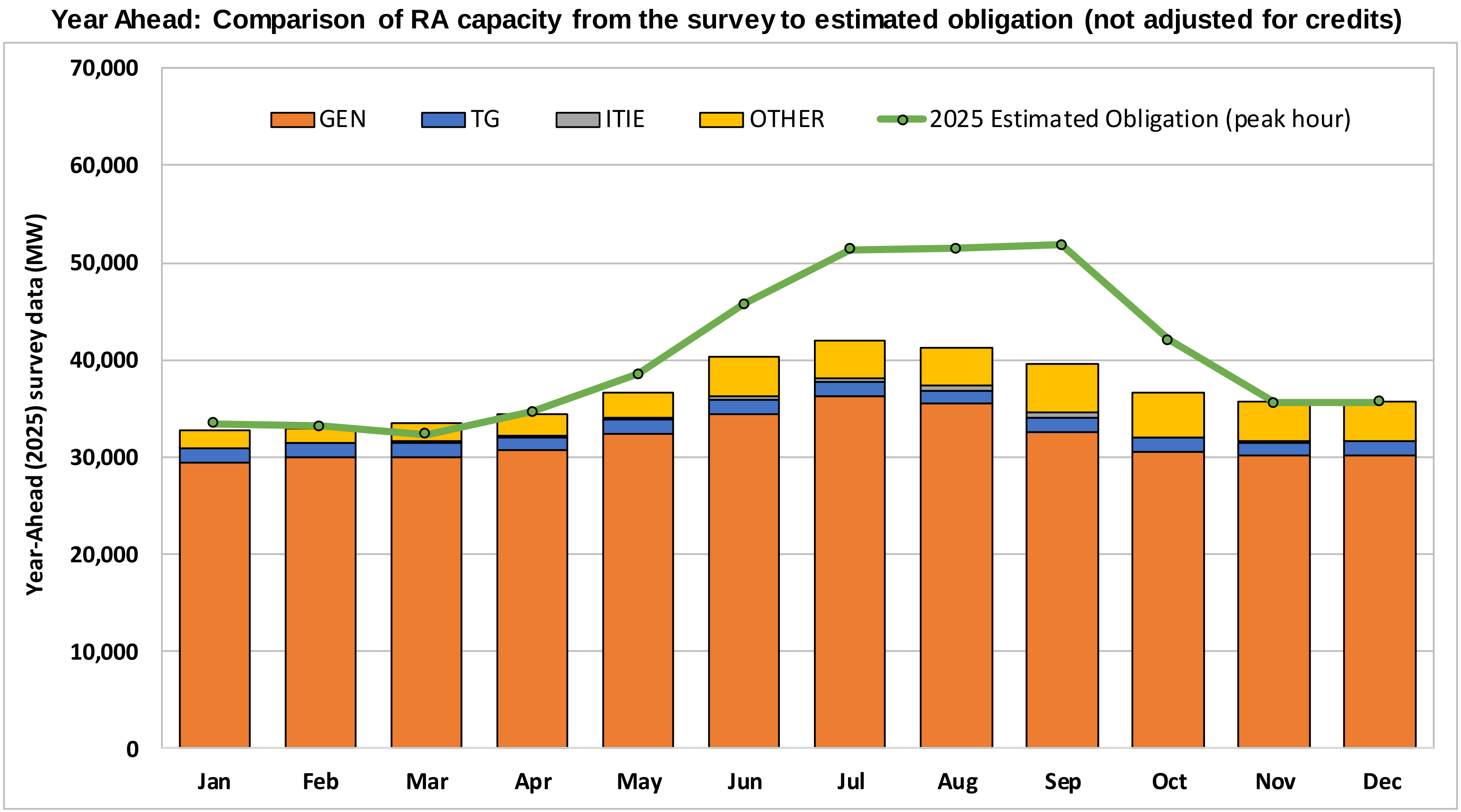
<table>
<tr><th>Category</th><th>Showings Capped at Obligation (Scenario 1)</th><th>Showings Based on Historical Pattern (Scenario 2)</th><th>All RA Eligible (Scenario 3)</th></tr>
<tr><td>Resource list</td><td colspan="2">LSE survey plus resource assumptions for LSEs without a survey response*</td><td>June 14, 2024 NQC list plus expected additions and retirements*</td></tr>
<tr><td rowspan="4">Resource Portfolio</td><td colspan="2">Shown RA resources only</td><td rowspan="2">All RA eligible resources from the NQC list, including energy-only resources to support on-site charging</td></tr>
<tr><td>System level capacity capped at the monthly obligation</td><td>System level capacity capped at monthly historical levels</td></tr>
<tr><td colspan="2">RA imports only (2019-2024 average shown RA)</td><td>Imports up to the net import limit</td></tr>
<tr><td colspan="3">Average hydro conditions</td></tr>
<tr><td rowspan="2">Outage Assumptions</td><td colspan="3">Class average forced outage rates</td></tr>
<tr><td colspan="2">Planned outages "not" modeled</td><td>Planned outages “are" modeled</td></tr>
</table>

*New RA resources with a 2025 COD provided in the LSE surveys were modeled.

Probabilistic assessments measure the potential to call on additional/emergency measures rather than actual loss of firm load

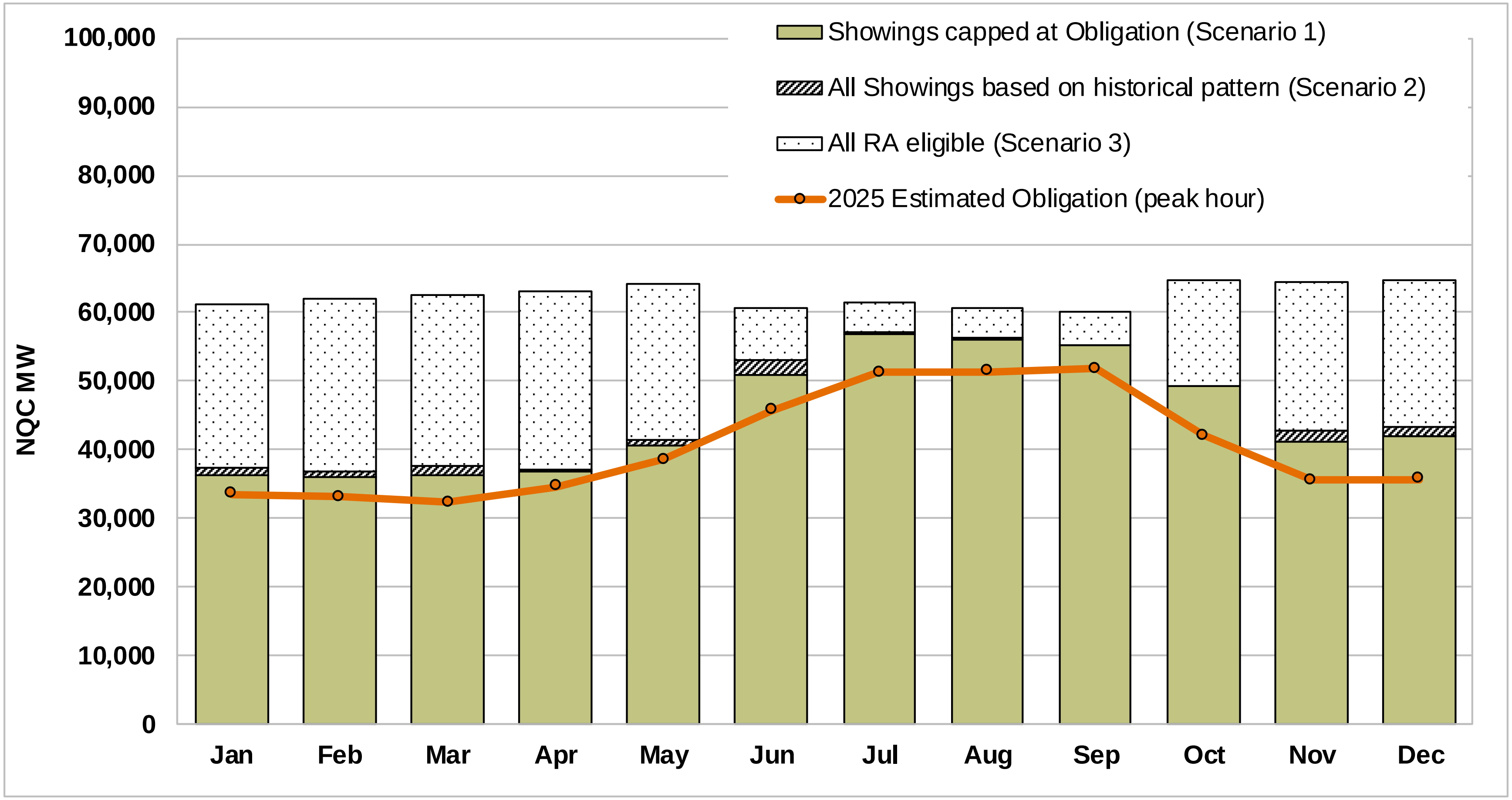
- Analyses do not include emergency/contingency resources including:
  - Energy Supply Strategic Reliability Reserve Program (ESSRRP),
  - Emergency Load Reduction Program (ELRP),
  - Demand-Side Grid Support (DSGS),
  - Emergency Assistance on interties, and
  - Thermal capacity beyond permitted or interconnection limits.
- The CPUC will continue to apply an “effective” PRM of 1,700 to 3,200 MW above the 17% PRM in 2025 summer months.
  - To the extent that LSEs reflect “effective” PRM resources on LSE surveys, this supply is included CAISO studies.
  - Additional “effective” PRM MWs may not be reflected in studies.

Estimated RA obligations and resources from the LSE survey cover 72 percent of the CAISO BAA load



"Other" category includes 2025 expected resources and any resources without a matching Resource ID in Master File.

Resource portfolios modeled in each of the three scenarios



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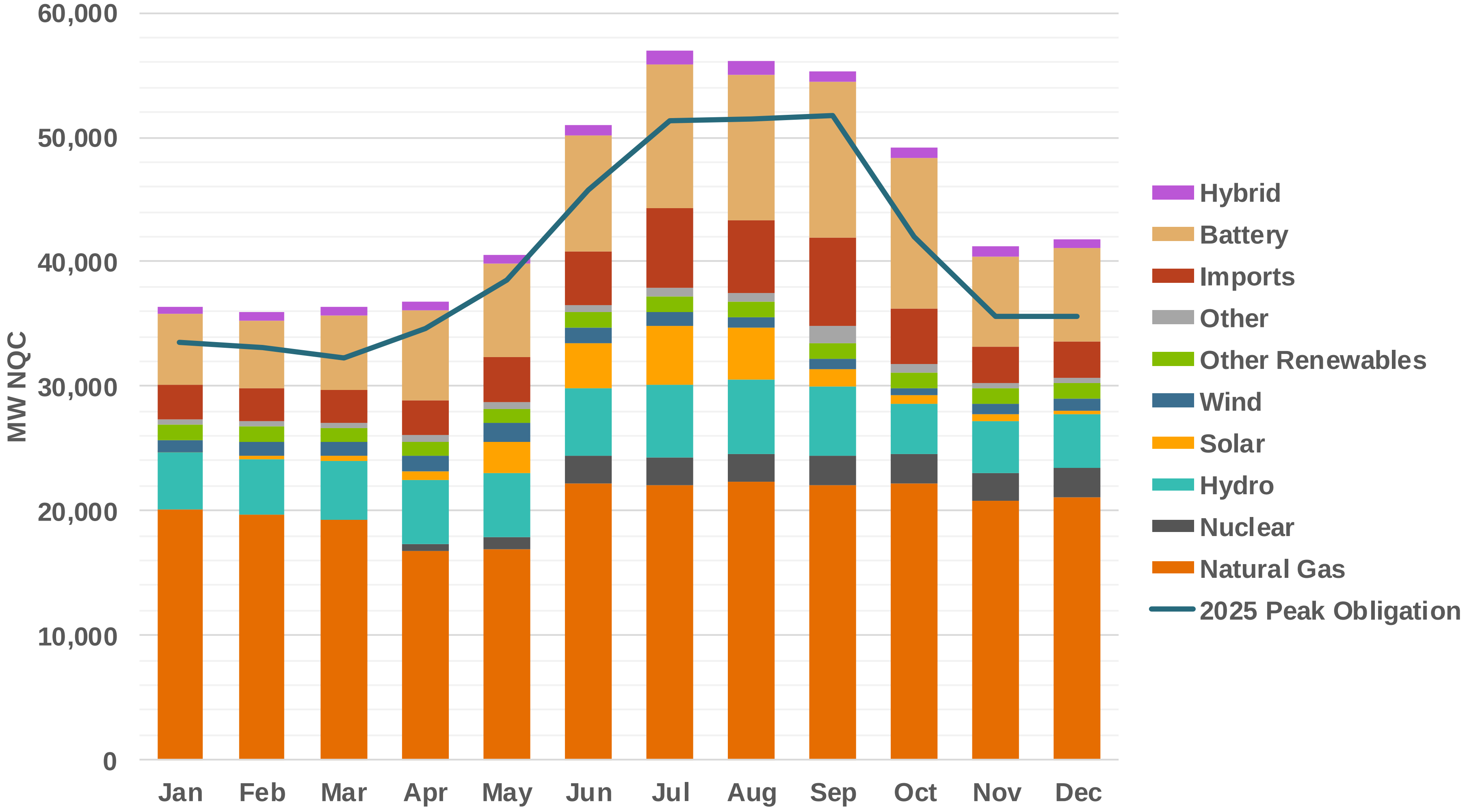
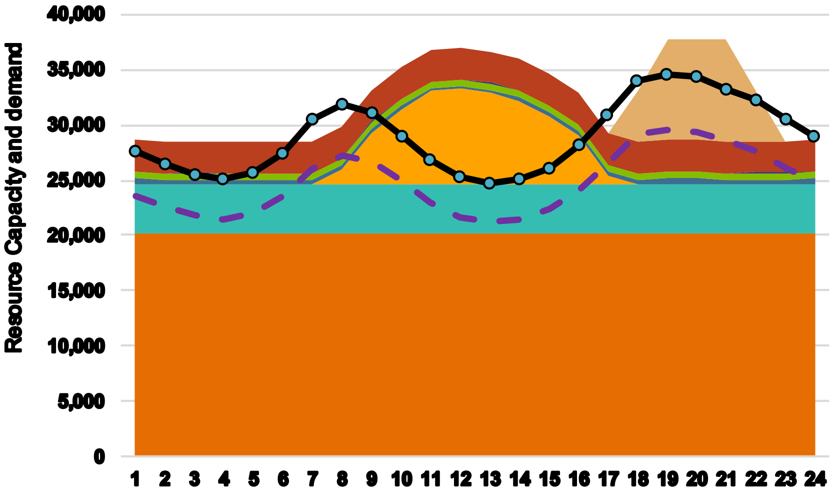
Resource portfolio for scenario 1: Showings capped at obligation

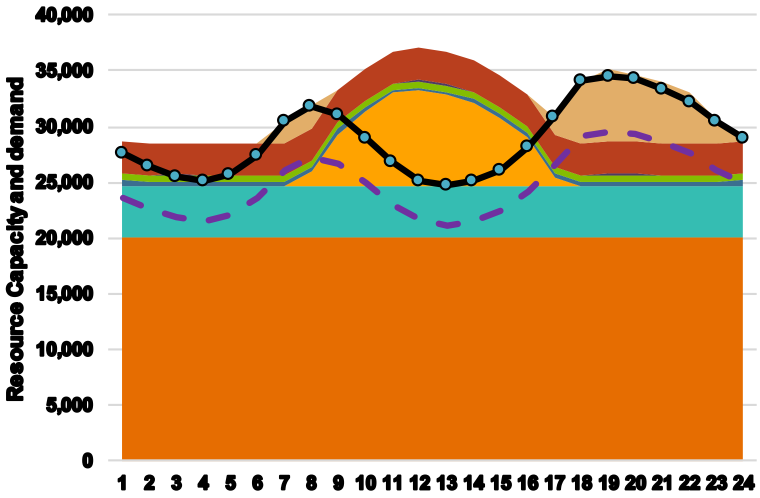


2025 monthly portfolio adjustments (storage re-dispatch or additional imports) were made to ensure reserve margins were met in all 24 hours

January portfolio with original storage assumption

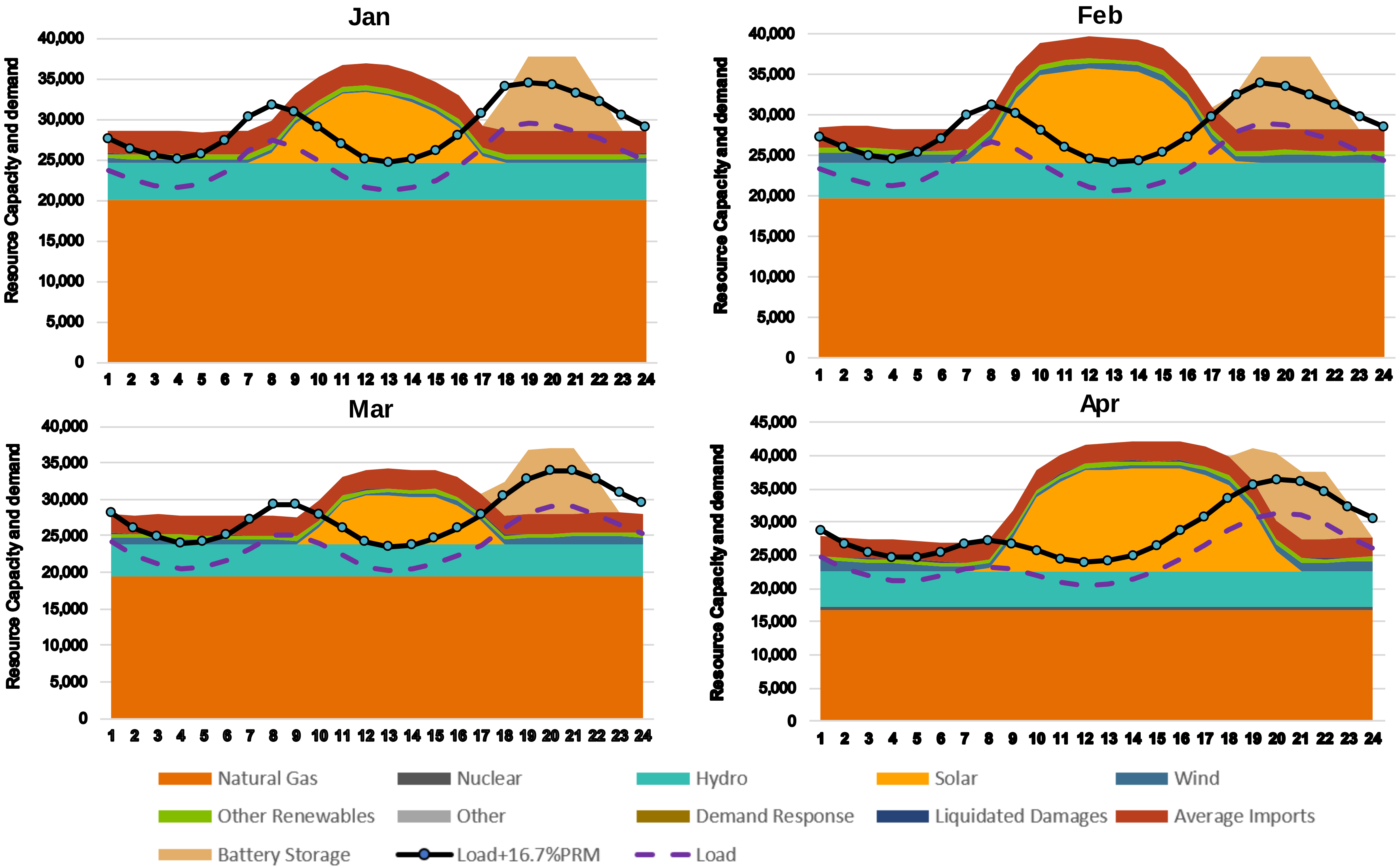


Reserve margins are met in all hours with storage adjustment



California ISO

Scenario 1: Showings capped at obligation



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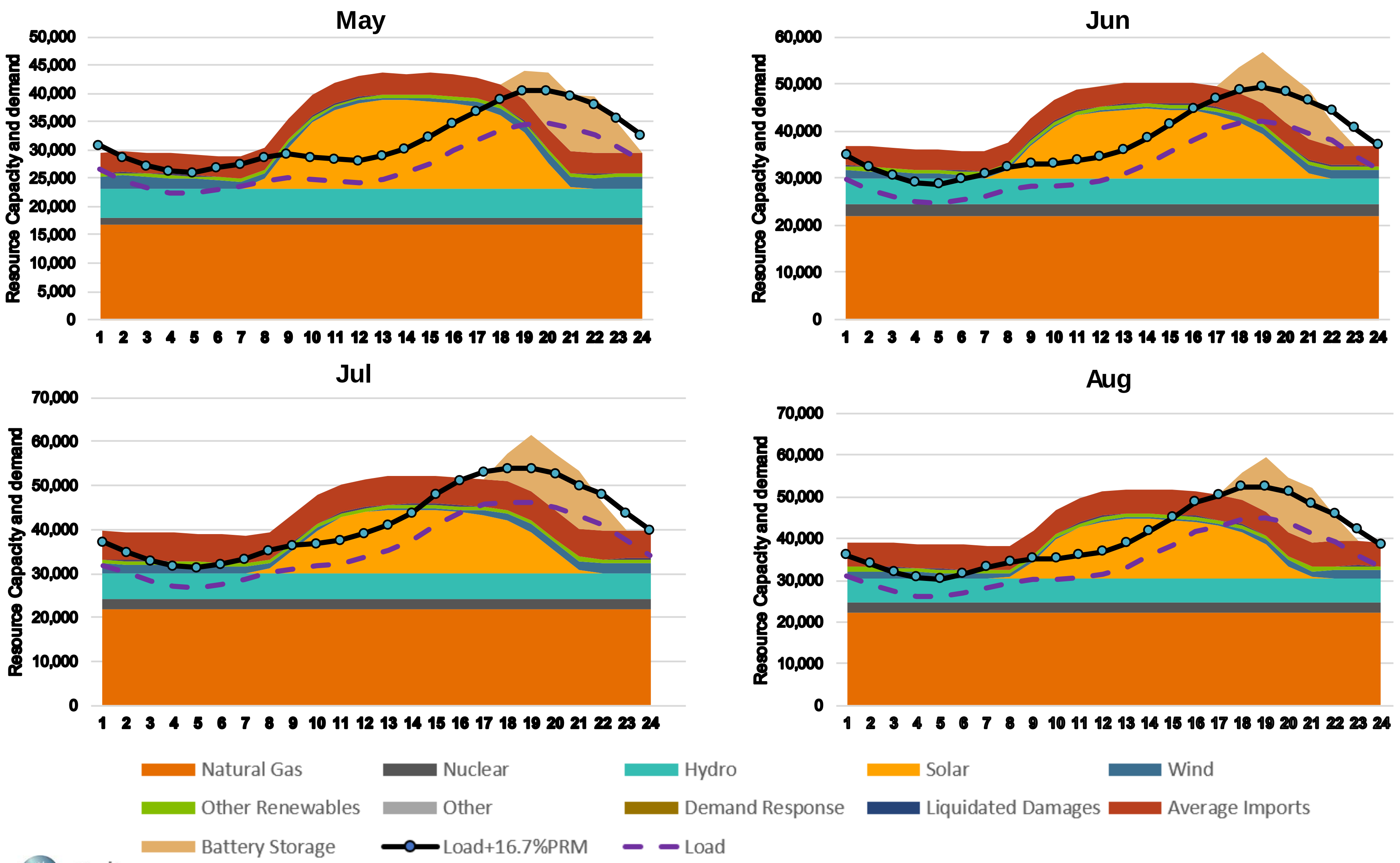

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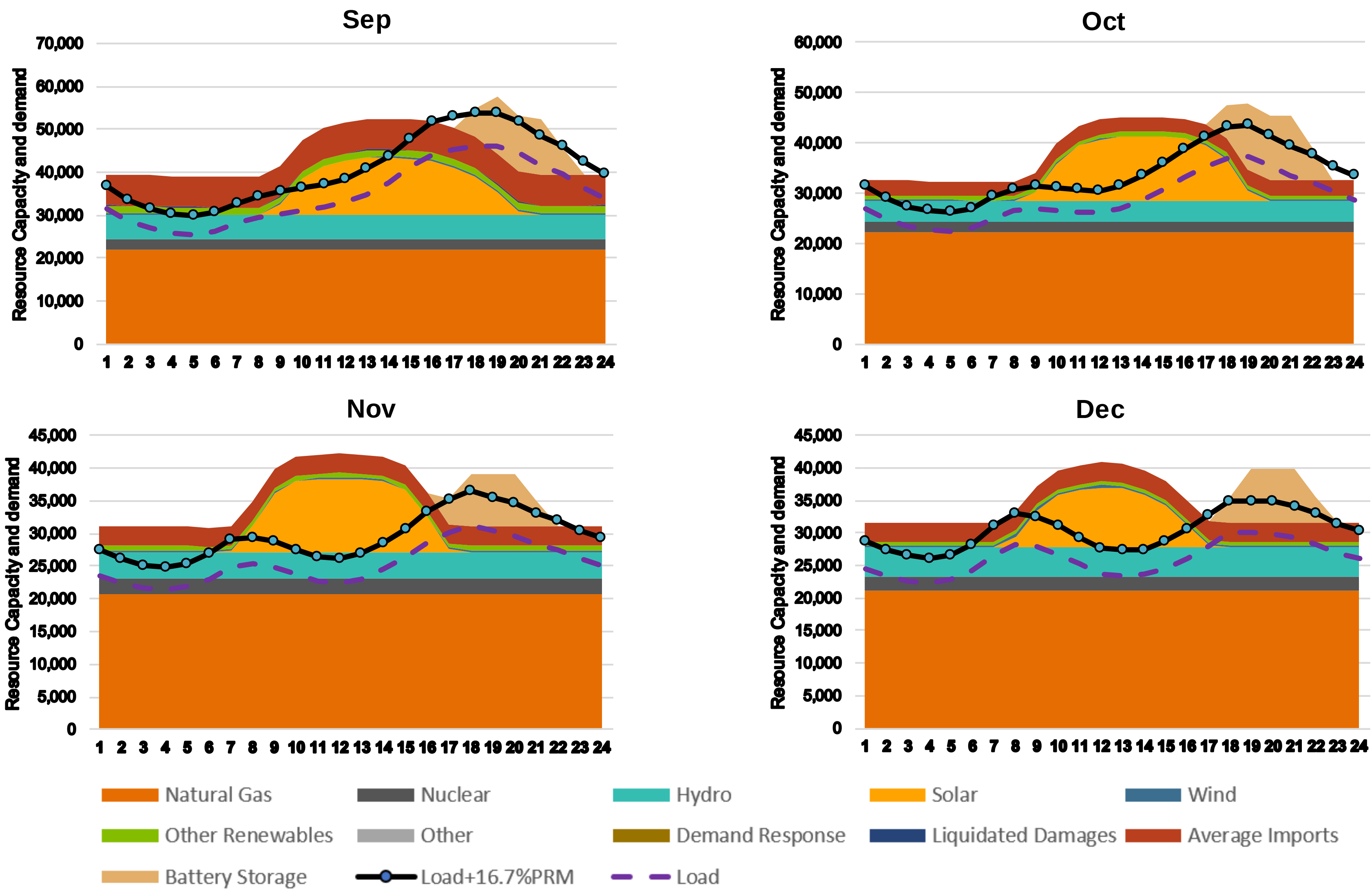

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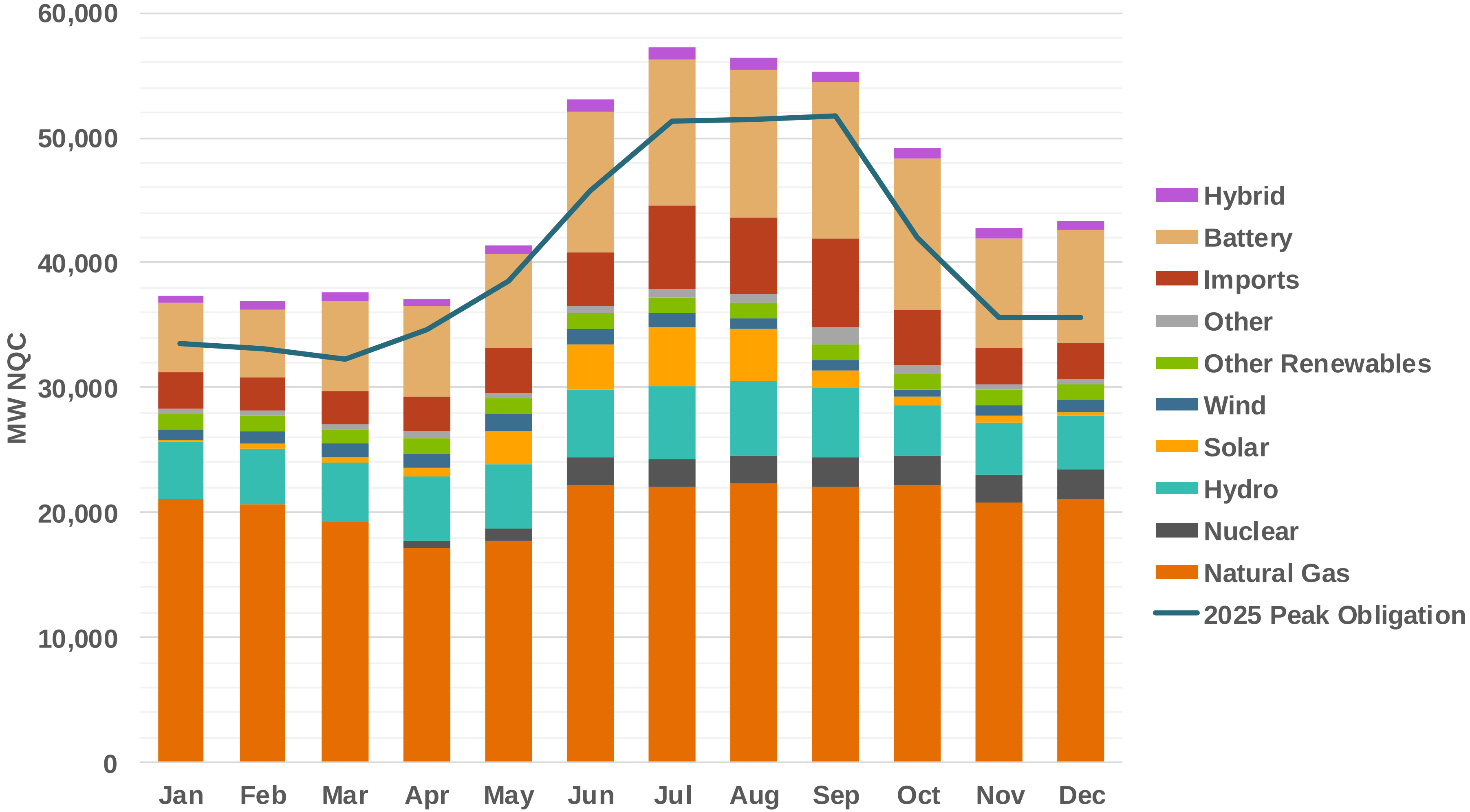
Resource portfolio for scenario 2: Showings based on historical pattern



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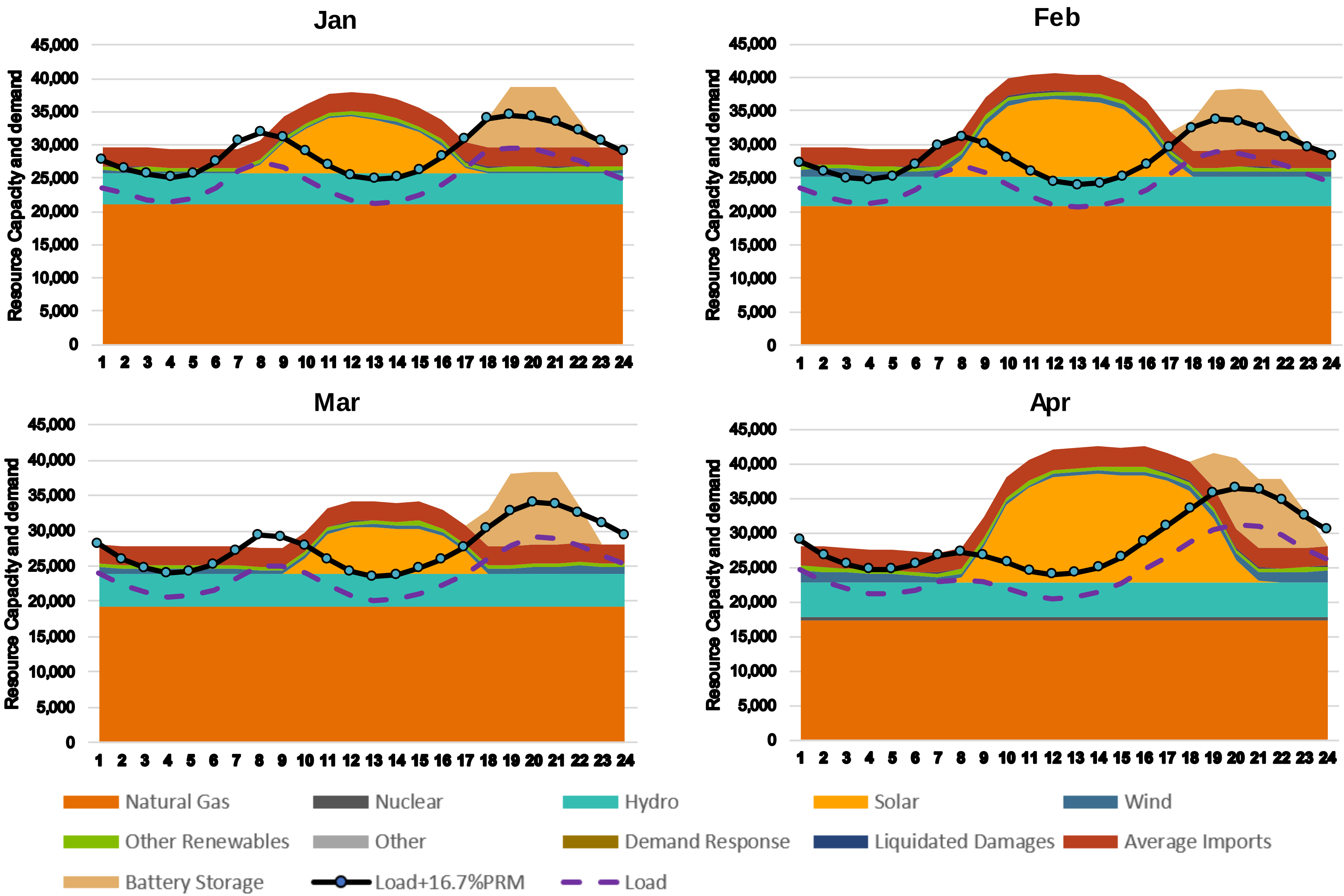
Scenario 2: Showings based on historical pattern



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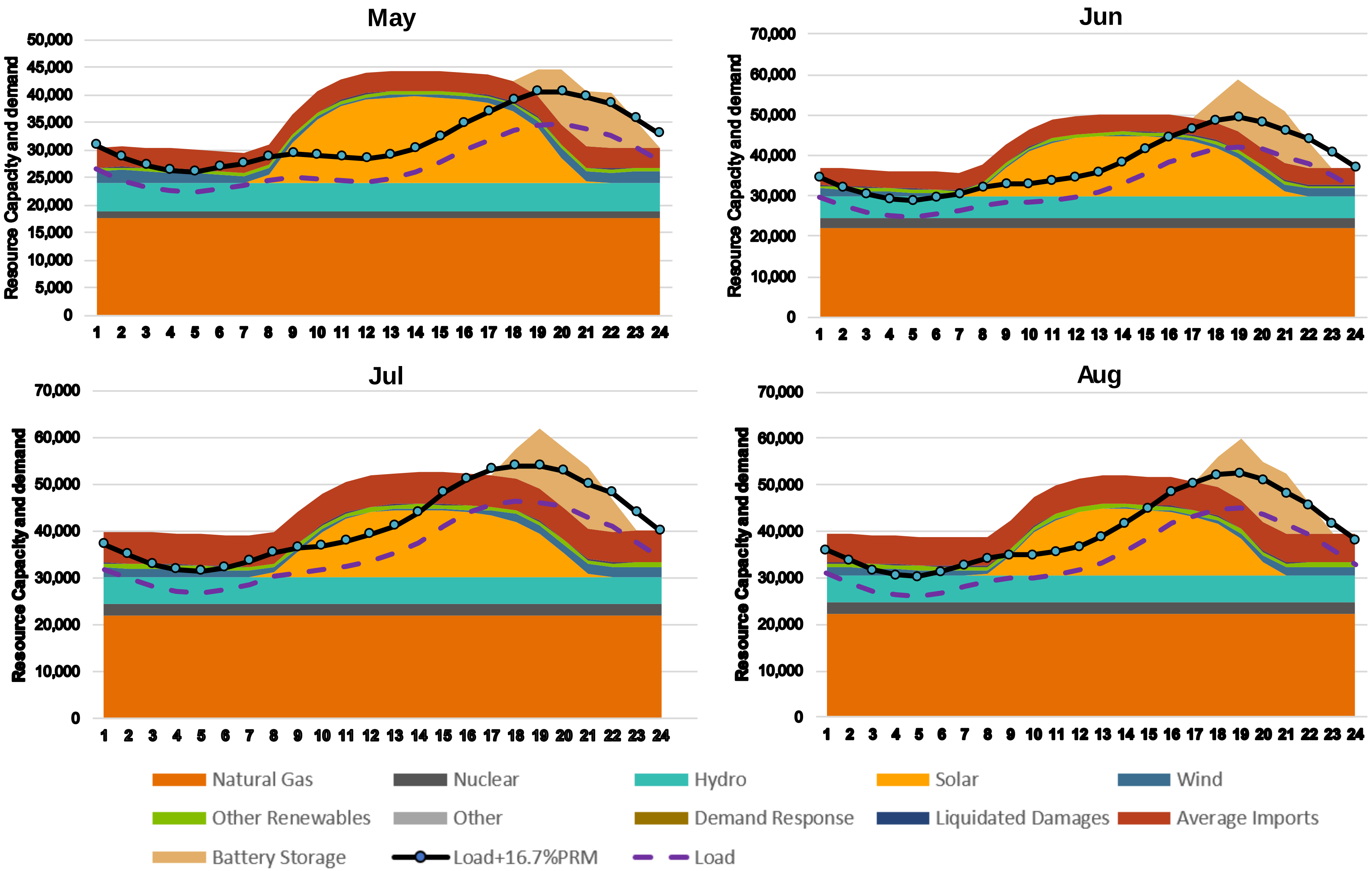
Scenario 2: Showings based on historical pattern



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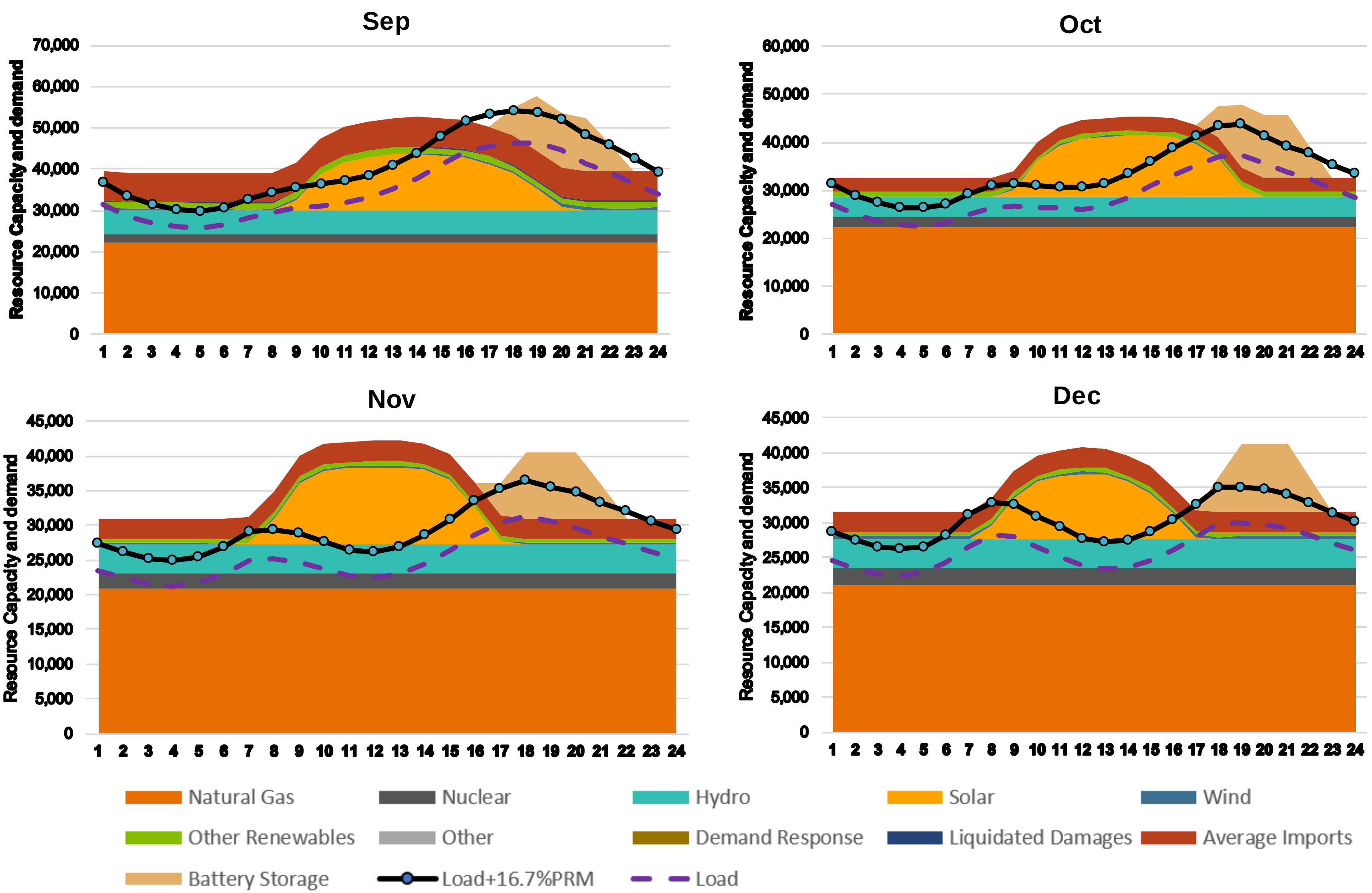
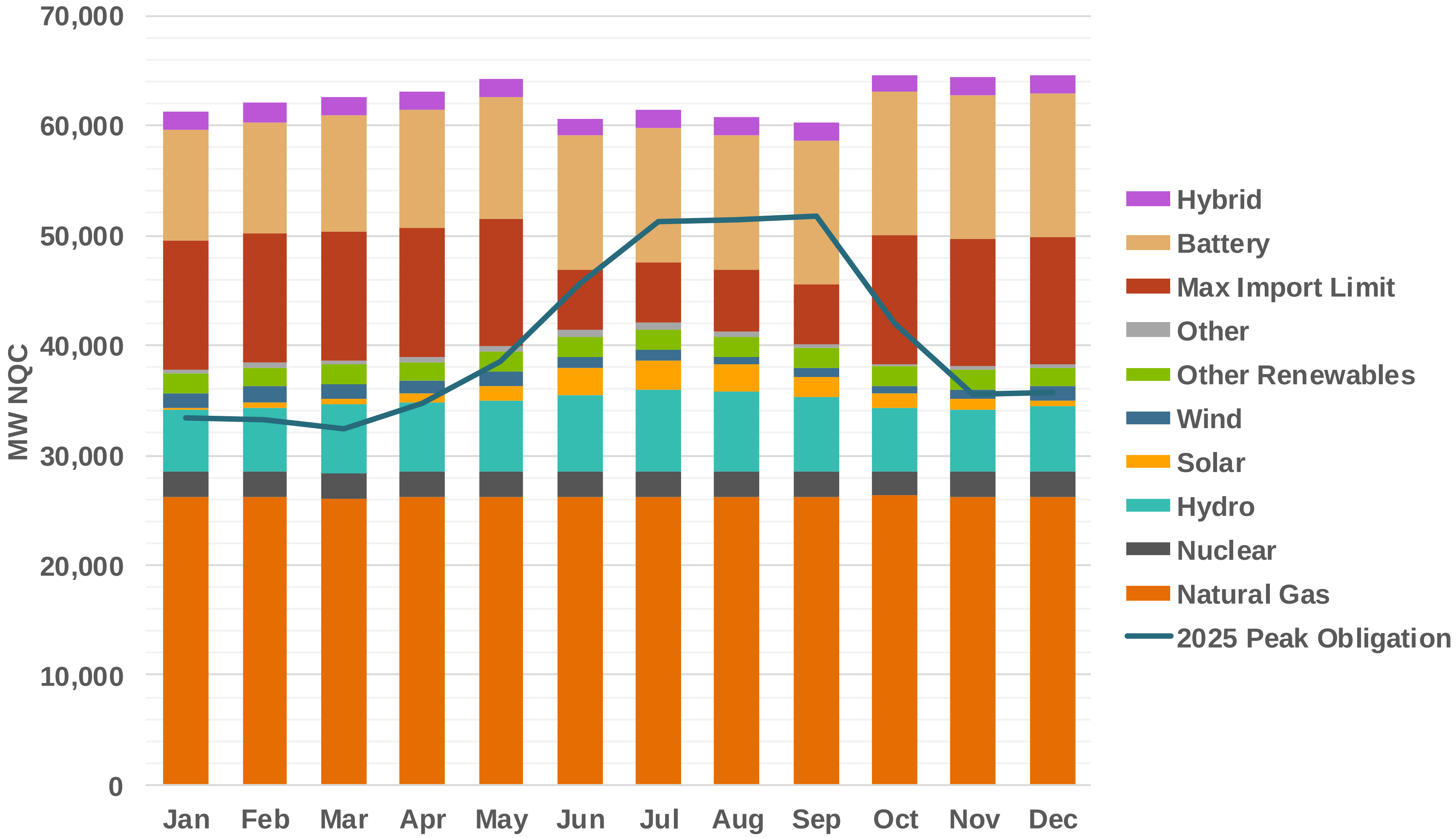
Scenario 2: Showings based on historical pattern



Resource portfolio for scenario 3: All RA eligible



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Year-ahead assessment:

STUDY RESULTS

CAISO uses both deterministic and probabilistic methods to assess reliability

Deterministic

- Peak day for each month
- NQC and exceedance capacity values
- Unit outages accounted for in the PRM
- Evaluate if supply exceeds a PRM target for each period

Probabilistic

- 8,760 hourly chronological modeling
- 500 samples performed
- Unit outages vary across samples
- Calculate expected unserved energy and loss of load probability

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Multi-hour Stack Analysis shows sufficient resources in Scenario 3

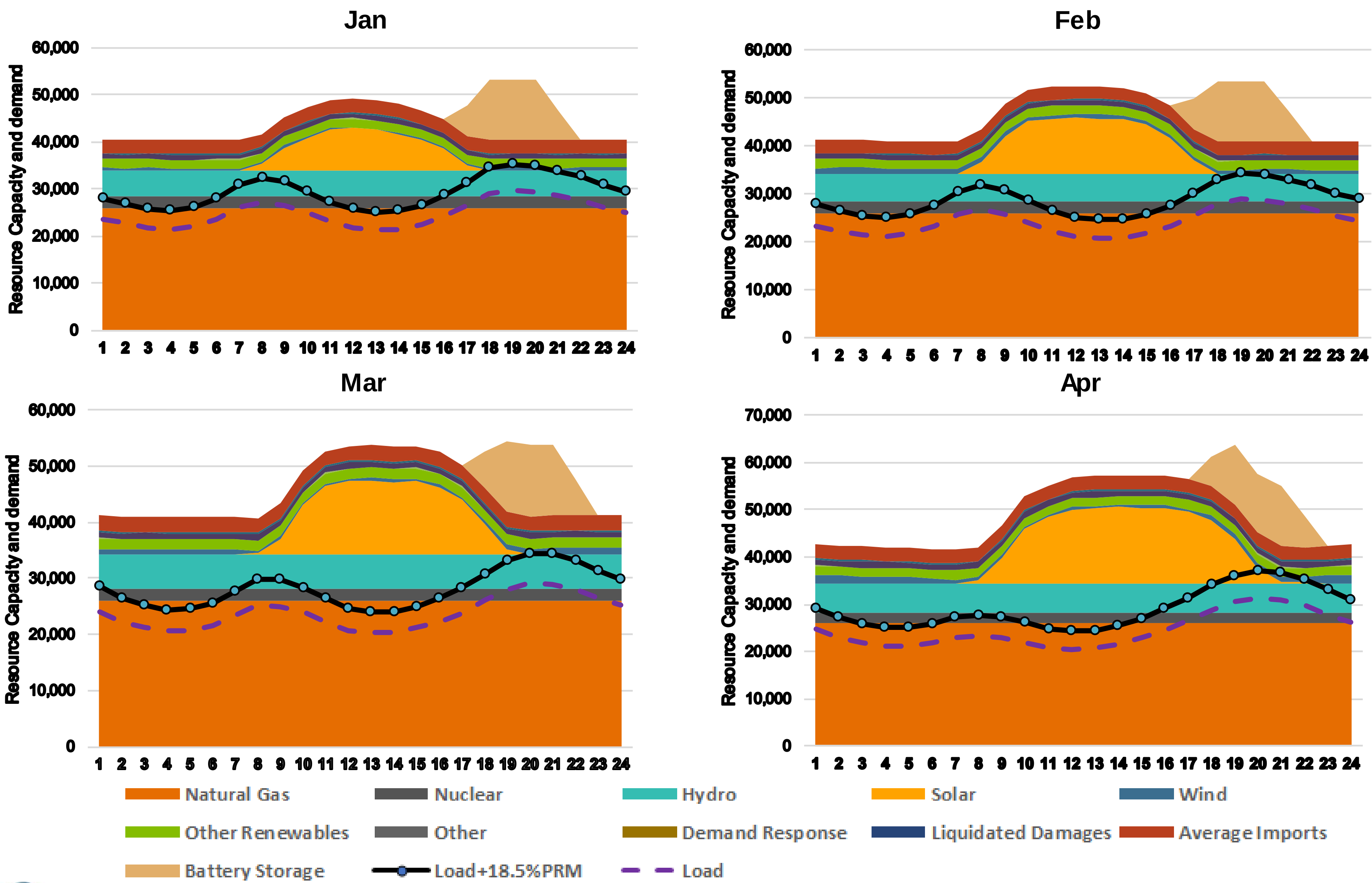
DETERMINISTIC RESULTS

Multi-hour approach estimates resource's availability across the peak day of each month

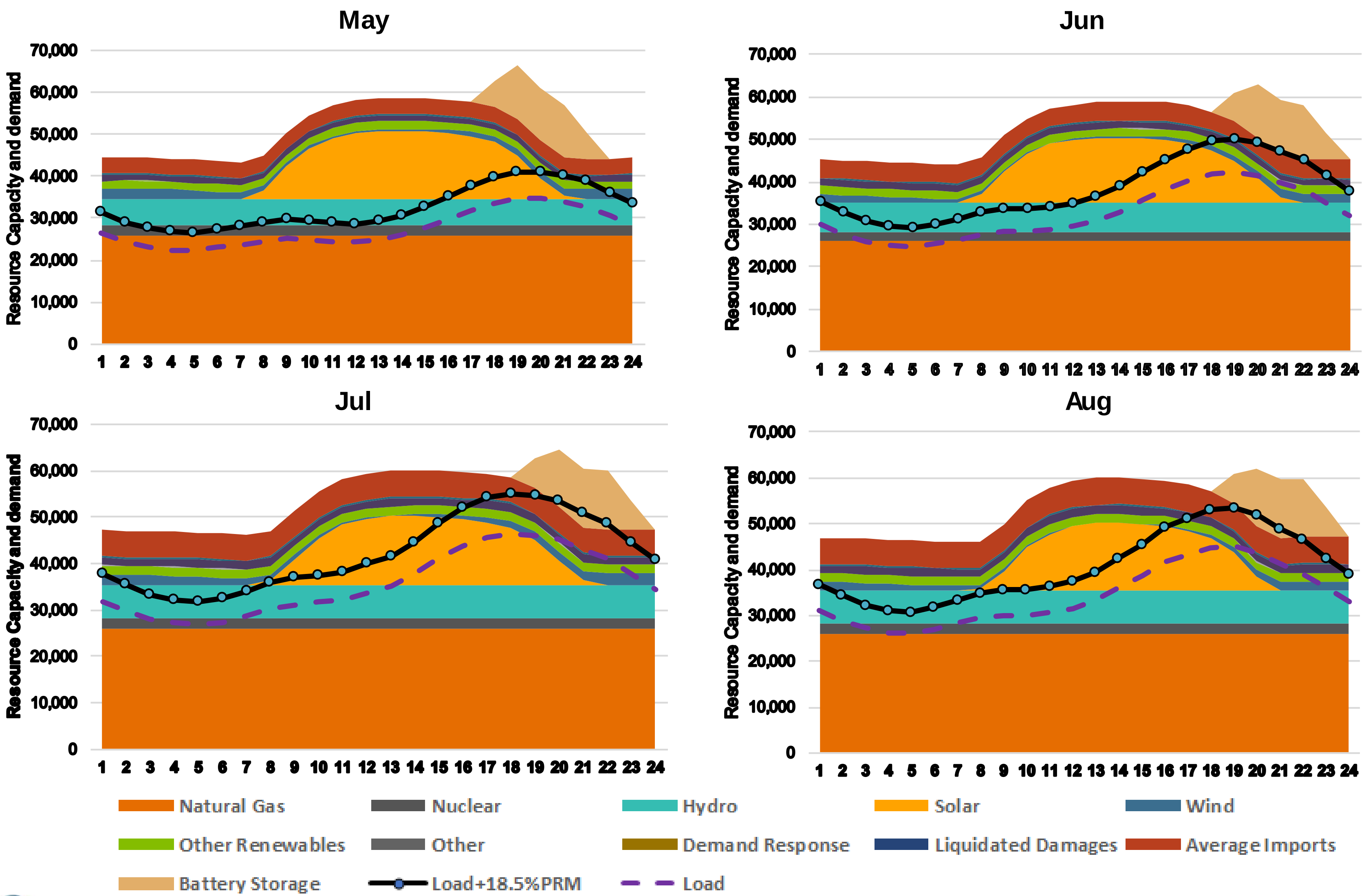
- Load forecast: CEC's 2023 IEPR 1-in-2 planning forecast.
- Resource representations:
  - Most resources represented by Net Qualifying Capacity (NQC) in every hour.
  - Solar and Wind: Exceedance values are derived based on the past eight (8) years (2016 – 2023) of generation data for the five (5) highest load days.
  - Battery Energy Storage: Energy discharge is spread across the at-risk hours to smooth the energy available above the reserve margin.
  - Imports: Intertie capacity is based on 5-year historical average monthly showings (2019-2024).

Reserve Requirement	% of Expected Load	Additional Capacity Need
Operating reserves	6%	To carry 6 percent of expected load as contingency reserves as required by NERC. This capacity is accessible for operational needs in EEA3 condition only.
Regulation reserves	1%	To meet operational needs like frequency response and regulation requirements
Forced outage rates	7.5%	To account for overall forced outage rates of the existing fleet
Load forecast uncertainty	4%	To meet a 1-in-5 load forecast level (~4 percent above the 1-in-2 level)
An 18.5 percent reserve margin above 1-in-2 load forecast is used in this assessment.		

Scenario 3: All RA eligible resources



Scenario 3: All RA eligible resources



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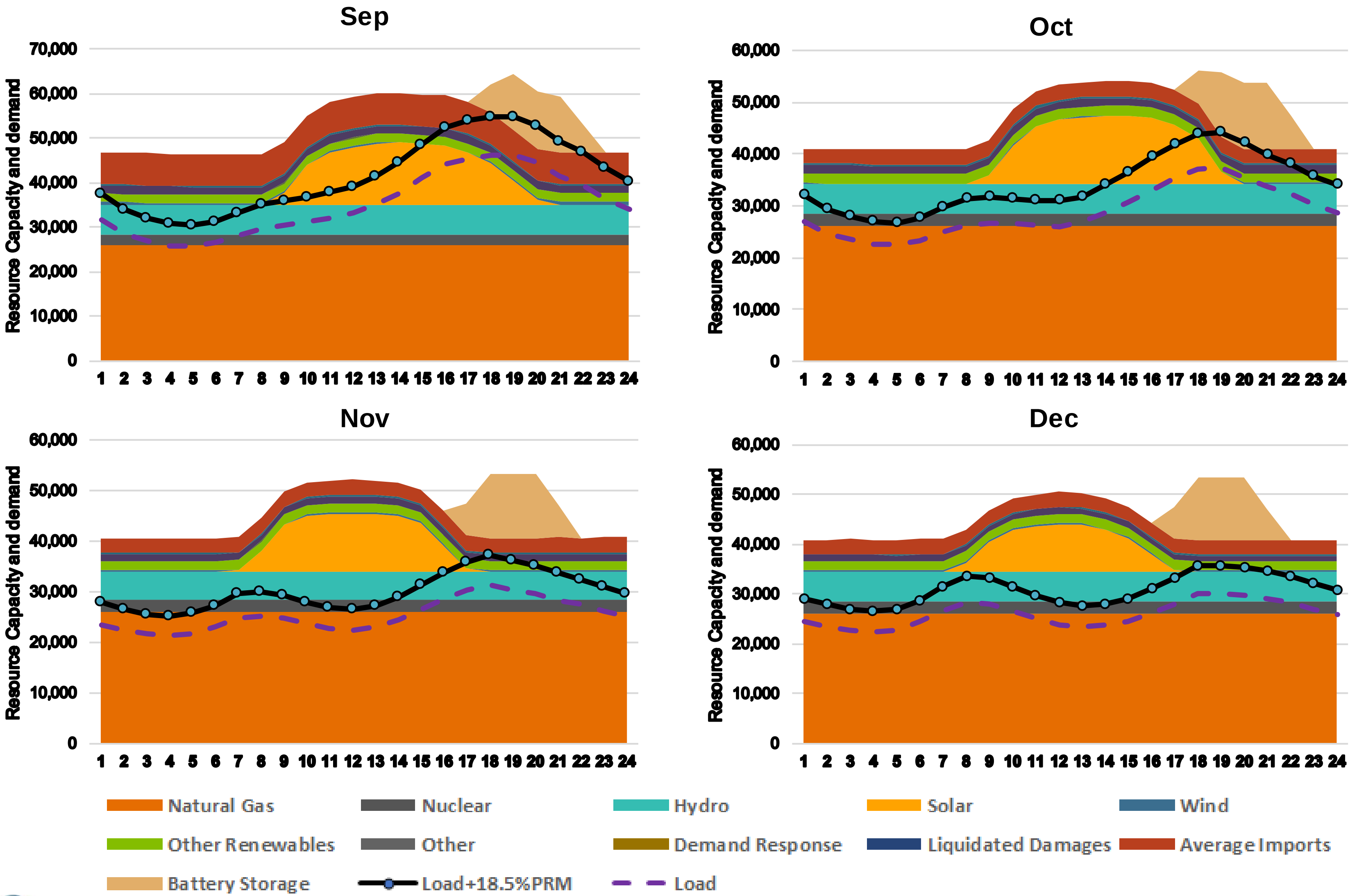
Scenario 3: All RA eligible resources



STOCHASTIC ANALYSIS

PROBABILISTIC RESULTS

What do the different reliability metrics tell us?

Metric	Abbreviation	Units	Definition
Loss of Load Expectation	LOLE	Days/Year	Average number of event-periods per year across all of the random samples simulated. The LOLE metric for this study is based on event-days per year.
Loss of Load Hour	LOLH	Hours/Year	Average event-hours per year across all of the random samples simulated.
Expected Unserved Energy	EUE	MWh/Year	Average load not served per year due to shortfall events across all of the random samples simulated.
Surplus/ Shortfall		MW (NQC)	Estimated excess capacity to be removed to calibrate the portfolio to a 0.1 LOLE. Shortfalls are represented as negative numbers and represents additional capacity needed to reach 0.1 LOLE.
Maximum Shortfall	Max Shortfall	MW	The maximum unserved energy for one hour of the simulation.
Longest Event		Hours	Maximum number of hours in a day that include unserved energy.

Source: Resource Adequacy for A Decarbonized Future, EPRI 2022, with modification by CAISO staff.

The all RA eligible scenario (#3) has a capacity surplus of 1,810 MW over what is needed to reach a 0.1 LOLE target

Scenario	LOLE (Days/Year)	LOLH (Hours/Year)	EUE (MWh/Year)	Max Shortfall (MW)	Longest Event (Hours)	Additional resources available to address deficiencies before loss of firm load
1. Showings capped at obligation	0.782	1.256	1,521	6,849	7	"Effective" PRM, Non-shown RA, Non-RA, Contingency and Emergency resources
2. RA showings based on historical pattern	0.308	0.468	510	5,101	6	
3. All RA Eligible, base case	**0.024**	0.086	169	5,642	6	Non-RA, Contingency and Emergency resources
3a. All RA eligible, 1-in-10 Calibration	**0.1**	0.228	428	8,026	6	

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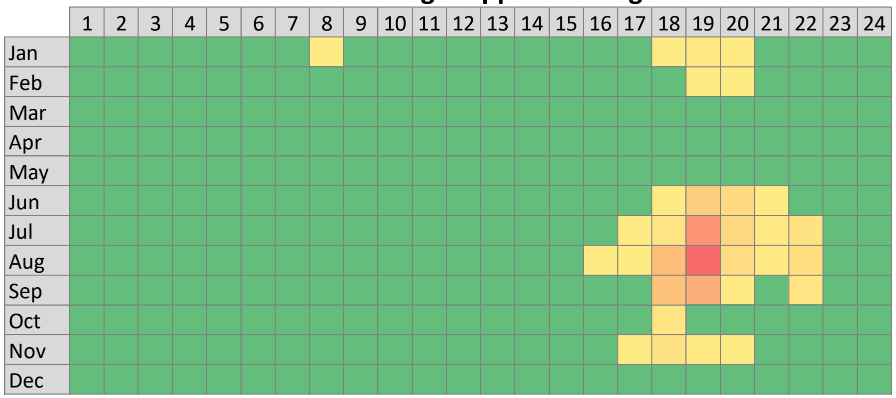
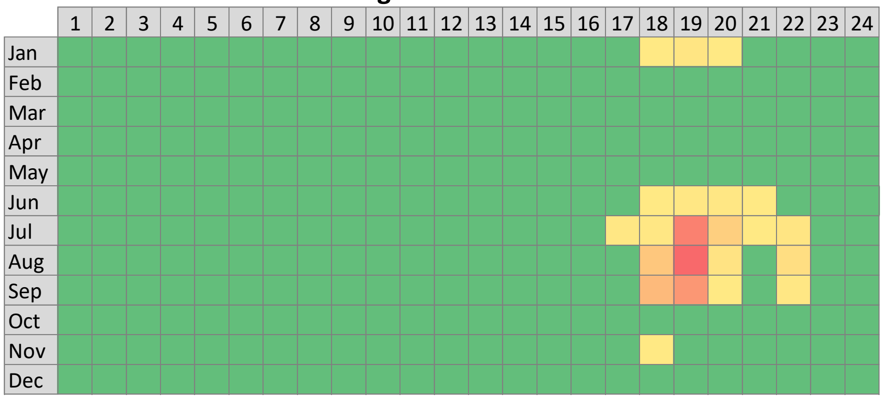
Without additional RA capacity, risk is observed in non-summer months also

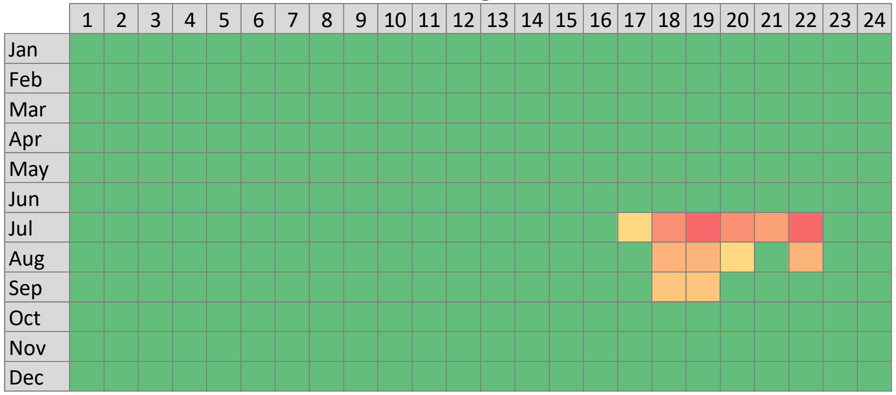
Scenario 1: Showings Capped at Obligation



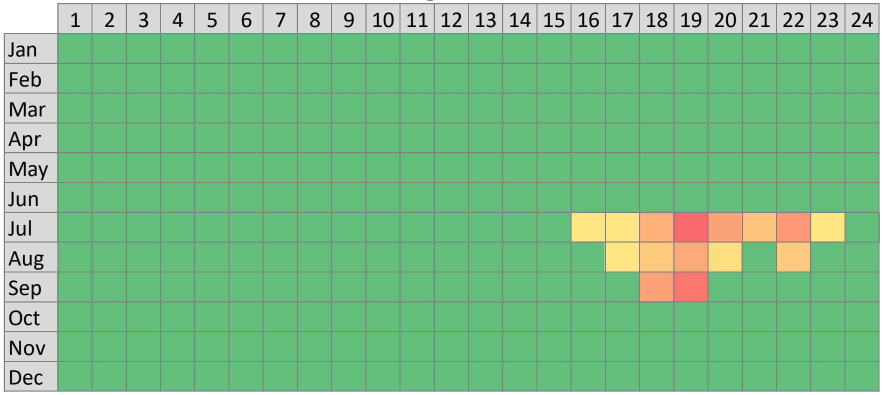
Scenario 2: Showings Based on Historical Pattern



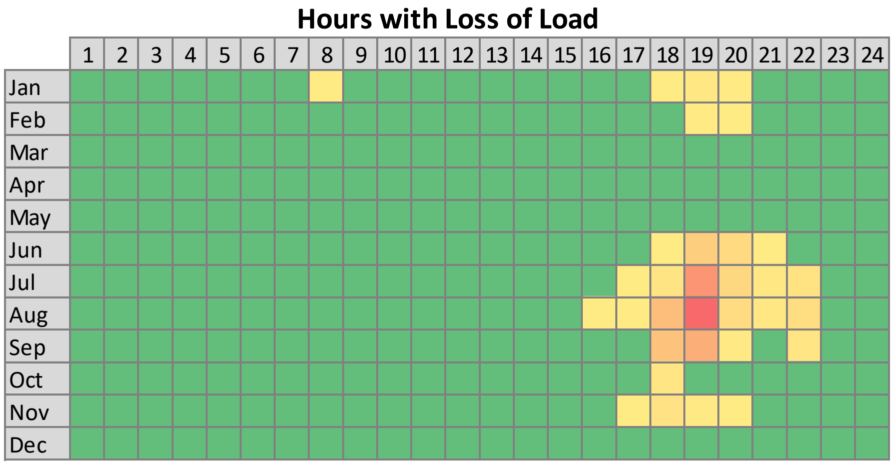
Scenario 3: All RA Eligible Base Case



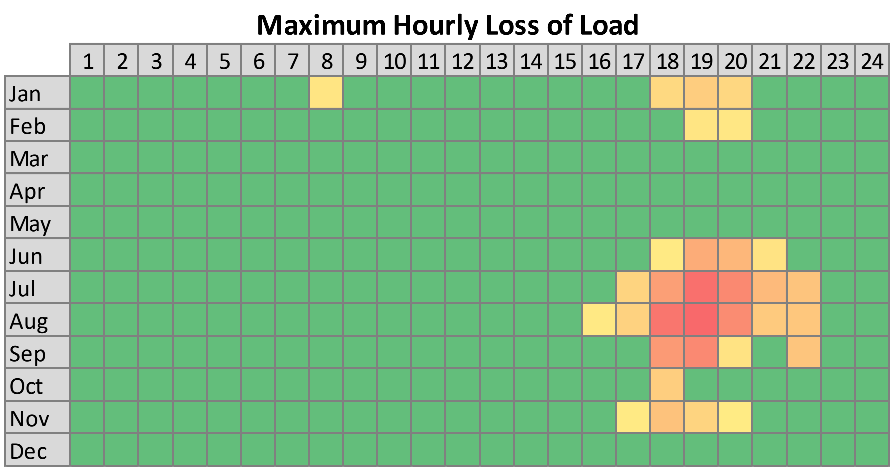
Scenario 3a: All RA Eligible, 1-in-10 Calibration

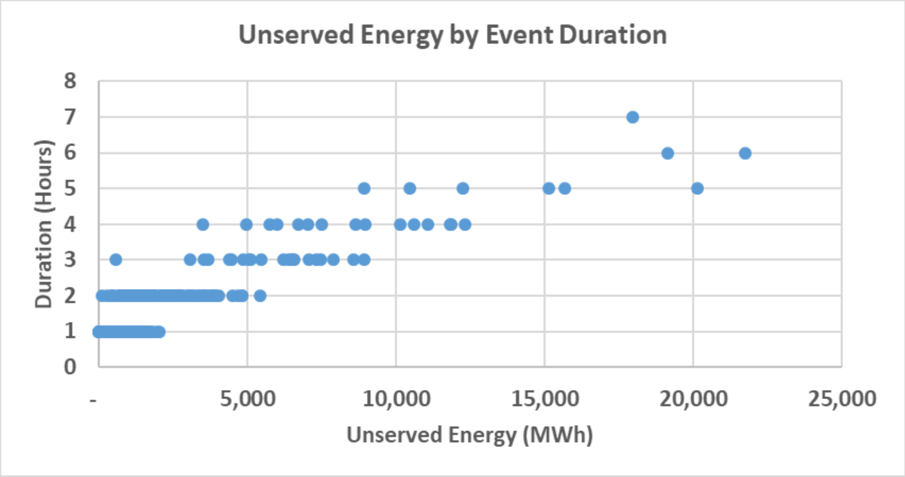


Scenario 1: Showings capped at obligation
Shows significant need for RA resources above obligations



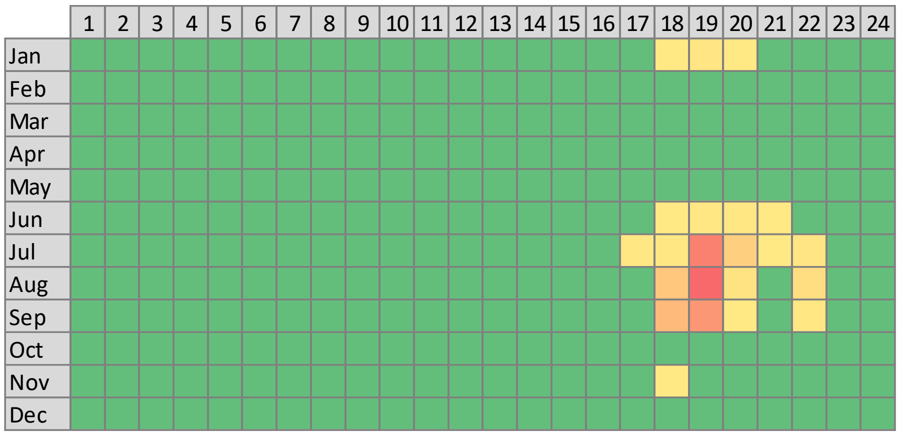
Metric	Value	Units
LOLE	0.782	Days/Year
LOLH	1.256	Hours/Year
EUE	1,521	MWh/Year
Max Shortfall	6,849	MW
Longest Event	7	Hours





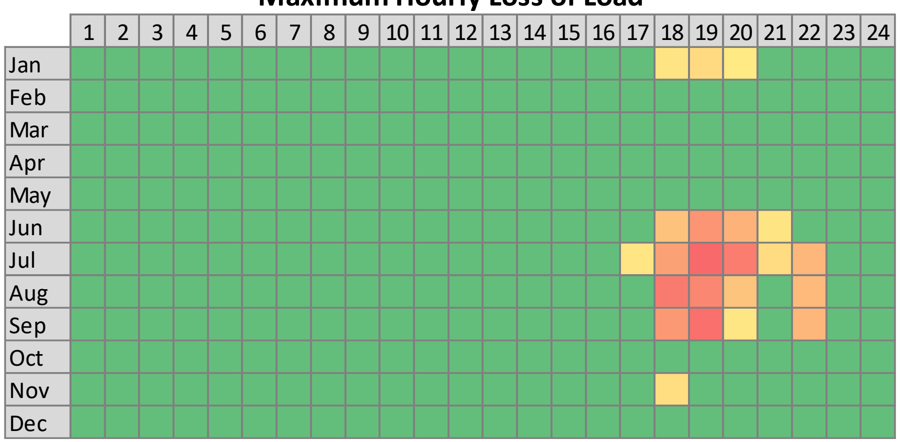
Scenario 2: Showings based on historical pattern Insufficient to meet reliability, and require dependence on RA resources above levels typically shown to the CAISO

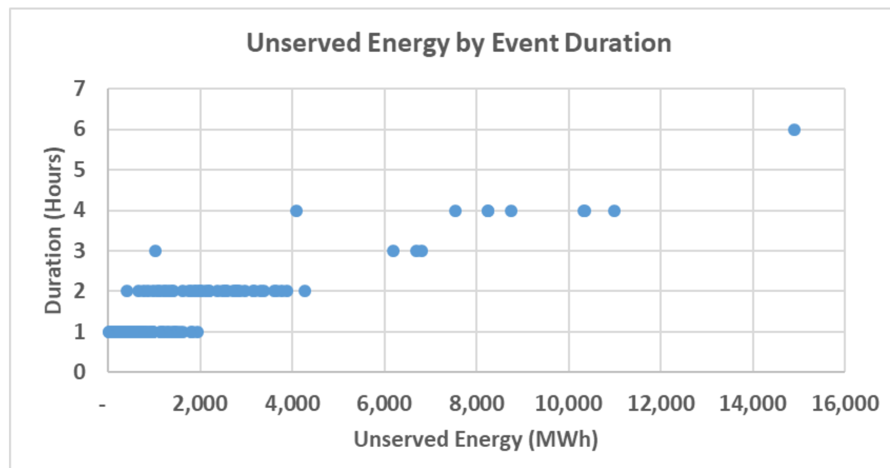
Hours with Loss of Load



Metric	Value	Units
LOLE	0.308	Days/Year
LOLH	0.468	Hours/Year
EUE	510	MWh/Year
Max Shortfall	5,101	MW
Longest Event	6	Hours

Maximum Hourly Loss of Load

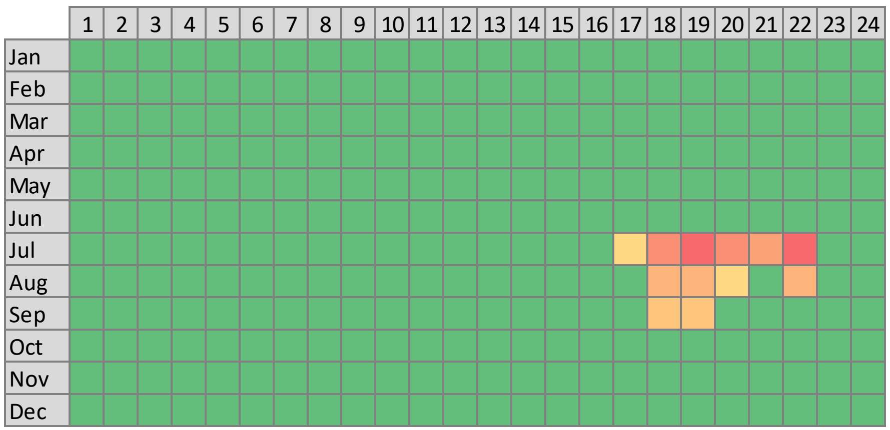




Scenario 3: All RA eligible, base case

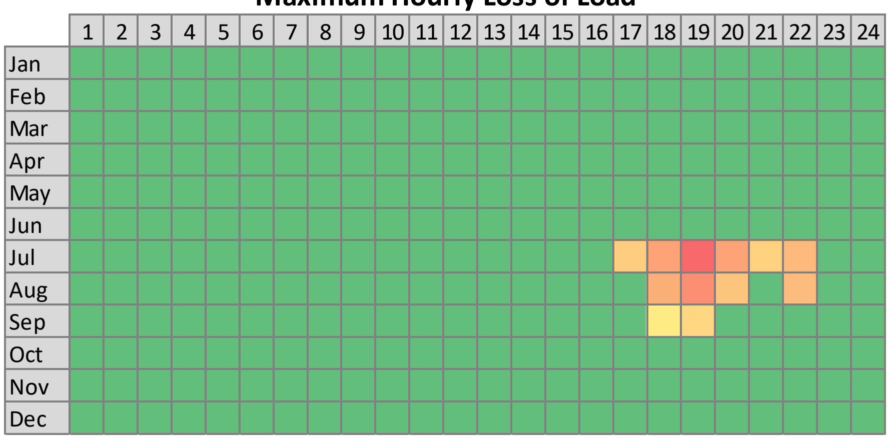
Resources are sufficient to serve load with a 1,810 MW capacity surplus

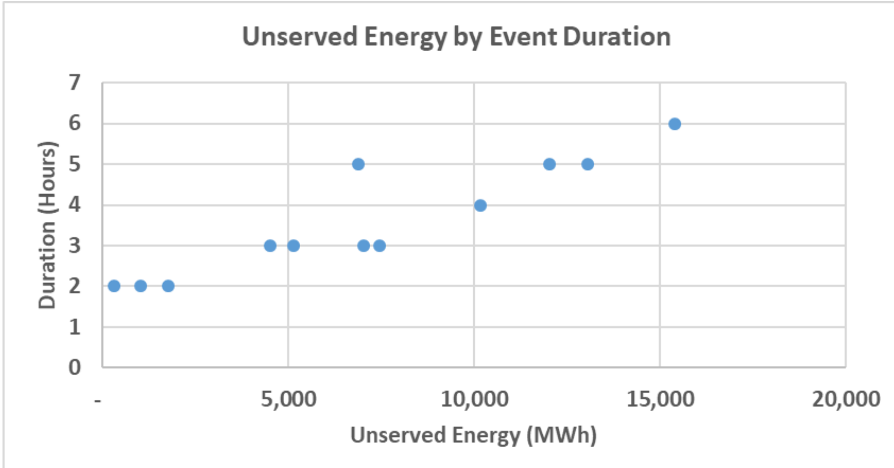
Hours with Loss of Load



Metric	Value	Units
LOLE	0.024	Days/Year
LOLH	0.086	Hours/Year
EUE	169	MWh/Year
Max Shortfall	5,642	MW
Longest Event	6	Hours

Maximum Hourly Loss of Load





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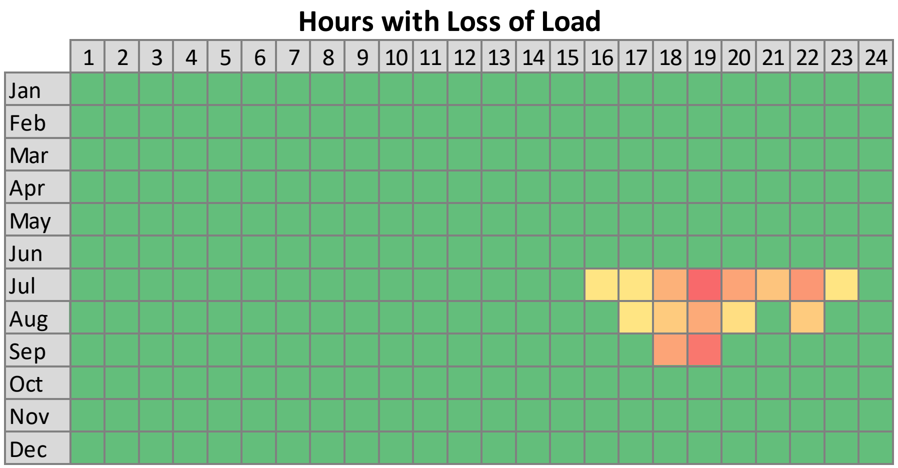
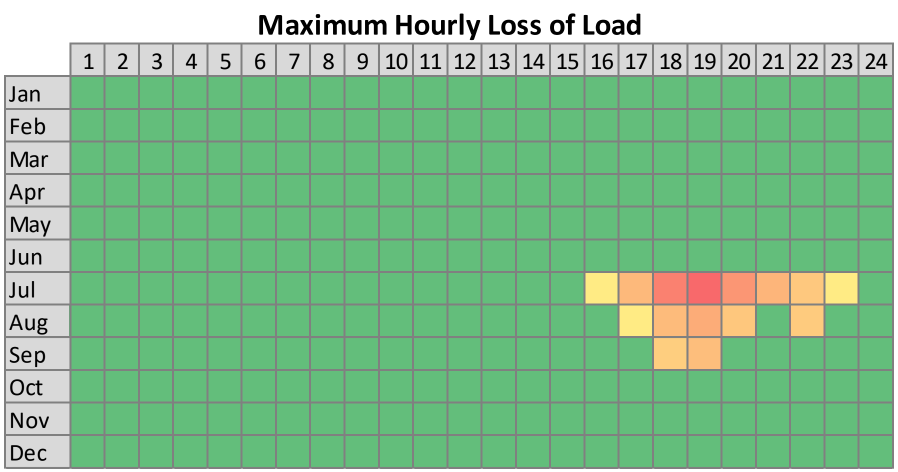
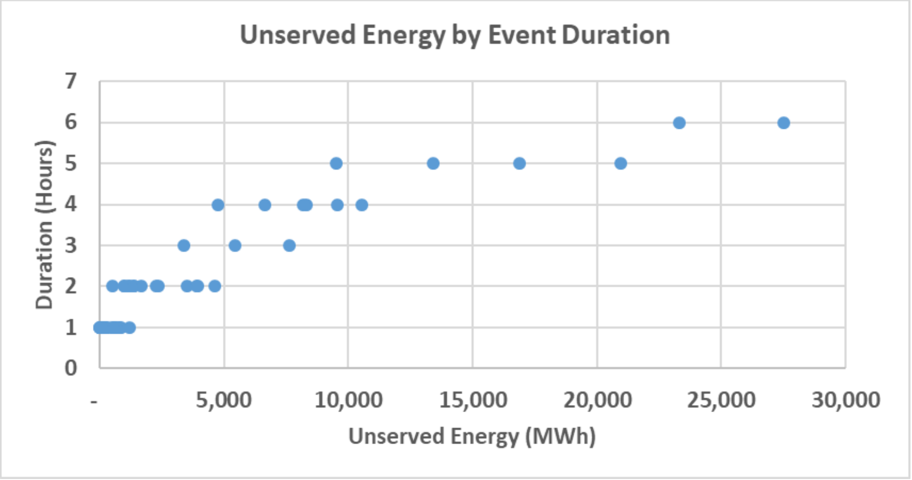
Scenario 3a: All RA eligible resources calibrated to a 1-in-10 LOLE



Metric	Value	Units
LOLE	0.1	Days/Year
LOLH	0.228	Hours/Year
EUE	428	MWh/Year
Max Shortfall	8,026	MW
Longest Event	6	Hours





All RA eligible resources are more than sufficient to meet a 1-in-10 planning target in the CAISO BAA

- The total RA eligible scenario projects CAISO BAA to have sufficient resources required to meet a 1-in-10 LOLE target for 2025 with a 1,810 MW capacity surplus.
- Without additional RA capacity shown, risk is observed in non-summer months also.
- Shown RA capacity only up to the obligation amount may not be sufficient to meet load without making use of the remaining RA resources, non-RA resources, contingencies, and/or emergency declarations.

Scope and Timeline

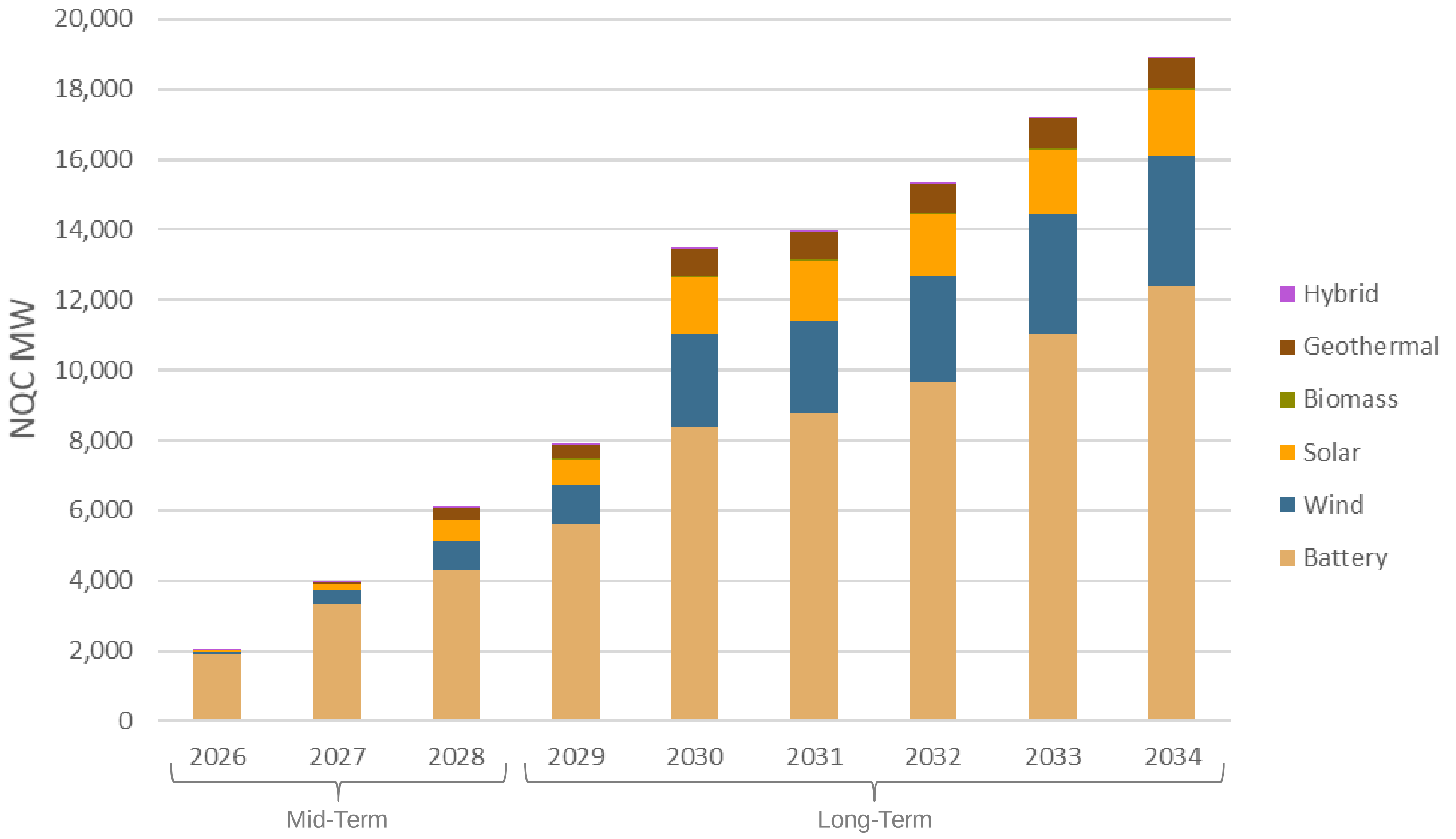
MID-TERM AND LONG-TERM ASSESSMENT

The mid-term and long-term analyses have a different approach than the short-term analysis

Short-Term	Mid-Term	Long-Term
Year-Ahead	Years 2-4	Years 5 to 10
100% RA showings	Existing RA and authorized procurement	LSE resource plans
Are RA showings and existing resources sufficiently reliable?	Is authorized procurement and contracted capacity sufficient?	Are long-term plans sufficient to meat reliability targets?
PLEXOS	SERVM	SERVM

Less —— Uncertainty ——→ More

Cumulative resource additions for the mid-term and long-term analysis, based on LSE plans



- Diablo Canyon retirements in 2029-30 not shown here.
- LSE reported thermal unit contracts with start and end dates that net to zero are not included here.

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Mid-term and long-term results will include:

- Outage statistics, such as LOLE, LOLH, EUE and maximum capacity unserved.
- Outage information:
  - Unserved energy by month and hour,
  - Number of hours with outages by month and hour,
  - Maximum capacity shortfall by month and hour, and
  - Duration of outages.
- Capacity surplus/shortfall.

NEXT STEPS

We all have a shared responsibility to anticipate and prepare for the changing electric grid

- The CAISO default counting rules and PRM are outdated, and need to be updated to be consistent with system needs and better reflect LRA requirements.
- Increased CAISO visibility of the available resources can help improve grid reliability.
- Longer study horizons help enhance CAISO and LRAs' awareness of future vulnerabilities and prepare for them.

The next step in the analysis is to establish counting rules and associated PRM

★Today

Determine portfolio LOLE, calibrate the portfolio to 0.1 LOLE

Establish counting rules for all resource types

- What accreditation approaches should the CAISO use?
- How will this impact the PRM?

Apply counting rules, determine a PRM

- How often should the default PRM change?
- Should the PRM be based on the peak hour?
- Should there be an energy sufficiency requirement in default rules?

By Q2 2025

Update the default counting rules and PRM

California ISO

We would like to hear your feedback on the analysis

- Please provide your organization's feedback on the draft inputs and assumptions.
- Please provide your organization's feedback on the preliminary results.
- Please provide your organization's input on what types of capacity accreditation methods and PRM approaches should be studied.
- Please provide any feedback not already captured.

Next steps

- Please submit written comments on the October 8th working group meeting by Tuesday, October 29, 2024, through the ISO's commenting tool using the link on the working group webpage: [California ISO - Resource adequacy modeling and program design (caiso.com)]
- CAISO staff is available for Office Hours for meetings with individual stakeholders.
- CAISO is planning a stakeholder meeting on Nov. 19th to share preliminary results of the mid-term and long-term analysis.
- RA policy issue papers are being finalized for posting and will be subject of a future workshop.

Aditya Jayam Prabhakar- ajayamprabhakar@caiso.com

QUESTIONS?