California ISO

2025 SUMMER LOADS AND RESOURCES ASSESSMENT

May 5, 2025

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Executive Summary

The 2025 Summer Loads and Resources Assessment (Summer Assessment) shows continued improvement in resource availability particularly driven by accelerated resource development. This results in an increase in projected capacity margins that exceed demand and reserve requirements, and have met performance target levels three years in a row. It is important to note that the results presented in the Summer Assessment do not take into account extreme events (*e.g.* extreme drought, wildfires and the potential for widespread regional heating events and other disruptions) that continue to pose a risk for emergency conditions to the CAISO grid.

Key highlights and observations from the Summer Assessment include the following:

- **3,372 MW of nameplate capacity have been added to the CAISO grid from September 1, 2024 through April 1, 2025** and an additional 2,163 MW of new resources are expected through June 30, 2025.
- The California Energy Commission's 1-in-2 forecasted peak load[1] for 2025 is **46,094 MW** in **September**, hour ending 18.
- The CAISO's **probabilistic assessment**[2] of "All Resource Adequacy (RA) eligible" resources shows a surplus of 1,451 MW for meeting a generally accepted "one day every 10 years loss-of-load expectation" ("1-in-10 LOLE") planning target.[3] This assessment measures the potential for calling on emergency measures, not actual loss of firm load.
- The CAISO's **multi-hour stack assessment** of the same "All RA eligible" resource fleet also indicates a reasonable margin above the planning reserve margin (PRM) required to achieve a 0.1 LOLE target.
- The **Weather outlook** for the months of June through August shows probability of above-normal temperatures across the West, with the highest probabilistic chances across the Intermountain West, and slightly lower chances of above-normal temperatures in coastal locations. First half of summer could have higher magnitude of above normal temperatures. Forecasts also show an increased chance of above-normal temperatures across the West in August and September 2025.
- The **Emergency supply** accessible through the state's Electricity Supply Strategic Reliability Reserve Program (ESSRRP) and emergency assistance on the interties totals around 3,379 MW.

The analysis indicates that there are sufficient resources to meet a wide range of system conditions in load, solar, wind generation, and generation resource outages.

The CAISO coordinates closely with California state agencies, utilities, and regional partners on summer readiness activities. This planning and coordination ensure we are well prepared to respond to potential grid events.

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[1] A 1-in-2 forecast assumes there is a 50 percent probability that the forecasted peak will be less than actual peak load and a 50 percent probability that the forecasted peak will be greater than actual peak load.

[2] The CAISO's probabilistic assessment of the expected resource fleet employs 500-iteration, full-year hourly chronological simulations, effectively capturing a wide range of system conditions in load, solar and wind generation, and generation resource outages.

[3] LOLE measures the number of days per year when the available generation capacity is insufficient to serve the demand at least once during that day. 0.1 LOLE or 1-day-in-10 LOLE equates to "1 day with an event in 10 years".

1 2025 Summer Assessment

Each year, the CAISO prepares an assessment of the expected supply and demand conditions for the coming summer for its balancing authority area (BAA). Publishing the summer assessment and sharing the results with state regulatory agencies, industry participants, and stakeholders is one of many activities the CAISO undertakes each year to be transparent and to prepare for summer system operations.

Summer Assessments are critical to prepare for potentially challenging summer conditions and high loads. Over the past decade, the CAISO's methodology for summer assessments has transitioned from a solely deterministic evaluation of anticipated summer conditions to a probabilistic approach centered on operational situational awareness. Over time, as shortfall conditions emerged and as system peaks shifted to later hours of the day due to the growth of customer-sited solar, the CAISO began to shift the focus of its summer reliability analyses. These changes include:

- Increased scrutiny on expected summer conditions;
- Increased focus on changes in demand requirements and resource additions; and,
- Assessing risk associated with extreme events and the availability of emergency mitigation measures.

In this Summer Assessment, the CAISO developed two distinct metrics, aligned with evolving stakeholder needs. These consist of: 1) First and foremost, a probabilistic assessment of expected 2025 summer portfolio including existing and planned RA-eligible resources and 2) A second perspective in the form of a multi-hour stack analysis for 2025 summer months (May – September) using the same portfolio of all RA eligible resources. Section 1.1 and Section 1.2 provide detailed results of these metrics to assess the reliability of CAISO BAA for summer 2025.

1.1 Probabilistic Assessment

The CAISO evaluated a resource portfolio that includes existing RA-eligible resources and those anticipated to be available by June 30, 2025, tested against a 1-in-10 LOLE planning target using probabilistic production cost simulations in the PLEXOS energy modeling software. As shown in Figure 1.1, the CAISO's stochastic approach utilizes 500-iterations of full year hourly chronological simulations and captures a wide range of system conditions with varying load, solar and wind generation, as well as generation resource outages. The model simulates 500 years with a unique combination of load, solar, wind and outage profiles for each year. The simulation runs chronologically to co-optimize generation dispatch, ancillary services and load following requirements subject to various operational and availability constraints. The resulting frequency distribution of capacity shortfalls is used to calculate the portfolio's LOLE level in days per year.

Figure 1.1 CAISO's probabilistic assessment process flow

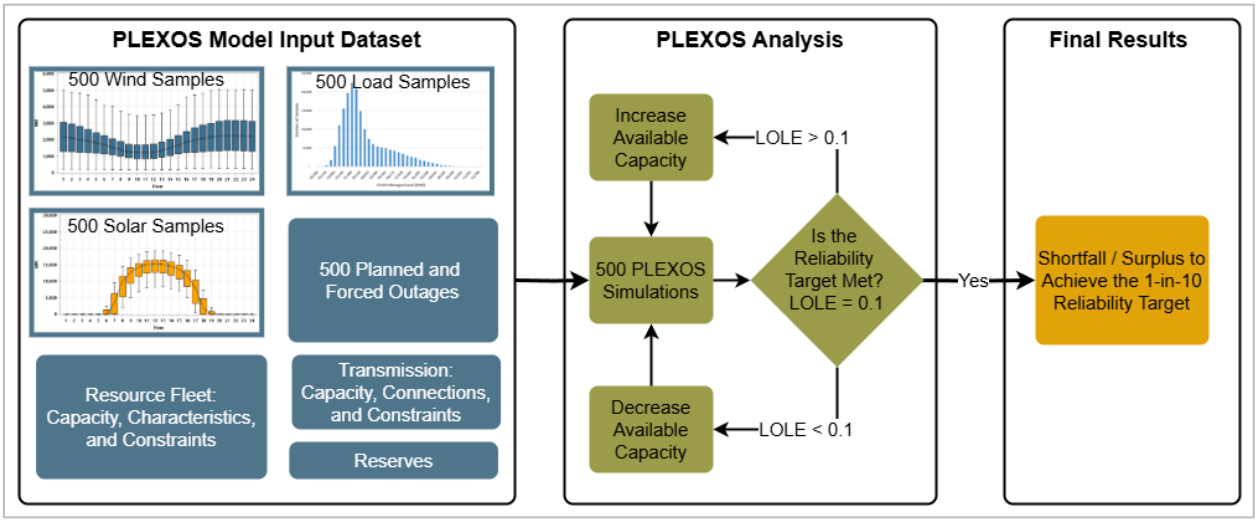
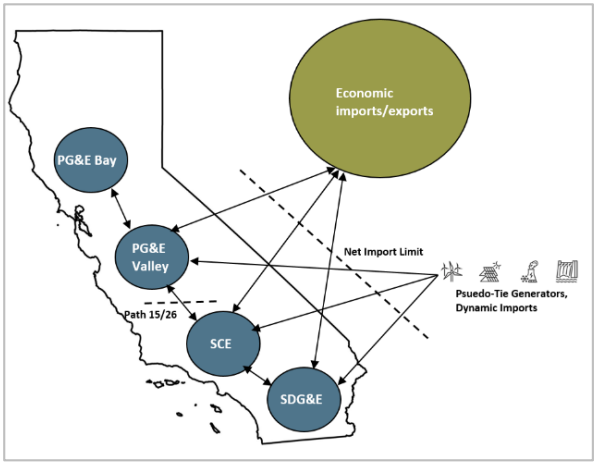


Figure 1.2 shows a high-level representation of the CAISO's zonal topology used in the stochastic model. The CAISO's stochastic production cost simulation model maintains a detailed representation of individual generation resources and load inside the CAISO across four zones: PG&E Bay, PG&E Valley, SCE and SDG&E with inter-zonal limits enforced. Although transmission constraints may exist within a zone, the zonal model assumes no transmission limits within each zone. Such constraints may require local resources to be committed and dispatched in practice.

The figure also shows out-of-state resources (pseudo-tied and dynamically scheduled) are modeled as imports which are counted against the net import limit. Economic imports and exports are modeled as a single external market zone and are directly connected to the CAISO through the PG&E Valley, SCE and SDG&E zones. The interchange from the external zone is subject to the CAISO's net import limit as well. The net import limit requires the sum of all imports and exports to the CAISO system to be less than 5,500 MW from June through September during hours 17 – 23 (PDT). In all other hours, the net import limit is set to Maximum Import Capability (MIC) limit of 11,665 MW.

Figure 1.2 CAISO zonal topology in the stochastic model



The zones also have ancillary services and load following requirements modeled, either as fixed profiles or as a certain percent of their loads. The CAISO also has total ancillary service and load following requirements for PG&E, SCE, and SDG&E zones together. Internal resources and select resources outside the CAISO may provide capacity for the ancillary service and load following requirements. All iterations use a single set of deterministic regulation and load following requirements. Spinning and non-spinning reserves are modeled at 3 percent of load approximating actual requirements. Because load is a stochastic variable, the hourly values of spinning and non-spinning reserve requirements vary in each iteration.

The model uses mixed-integer programing (MIP) to co-optimize generation dispatch, ancillary services and load-following requirements, subject to various operational and availability constraints. The outcome of the co-optimization is a least-cost solution that meets load and ancillary service and load-following requirements simultaneously. As shown in Table 1.1, the model sets a priority order for meeting different requirements. If there is an upward shortfall, the shortfall occurs first in the load following up requirement. If the shortfall is large enough, it will cover non-spinning, spinning, regulation up and finally unserved energy. Alternatively, there are cases with shortfalls in the model with capacity still available, but the unused capacity is not capable of following the load ramp.

For this assessment, LOLE is the number of days per year where the modeled resources are insufficient to serve load, frequency response (headroom), regulation up, spinning or non-spinning reserves. Shortfalls of load following up reserves do not contribute to loss of load. The resulting frequency distribution of capacity shortfalls is used to calculate each portfolio's LOLE level in days per year.

As mentioned before, the model uses four stochastic variables – load, solar, wind and outages. The outage variable is independent of the other stochastic variables and generated for each resource in the CAISO BAA for the whole year. Detailed modeling assumptions and methodology used to derive load, solar, wind, and outage stochastic variables are discussed in a separate technical appendix report.[4]

Table 1.1 Modeled reserve products and contribution to LOLE[5]

Priority	Modeled Reserves	Description	Included in LOLE?
1	Unserved Energy (USE)	Unserved Energy is load that could not be met due to a shortage in generation and/or transmission capacity	Yes
2	Regulation up reserves	Jan - Mar (2025 requirements) Apr - Dec (2024 requirements)	Yes
3	Frequency response reserve	376 MW. Used to mimic the need for replacement reserve capacity frequency response.	Yes
4	Spinning reserves	3% of load	Yes
5	Supplemental or non-spinning reserves	3% of load	Yes
6	Load following (up/down)	Used to address intra hour differences in load	No

The modeled resource portfolio is based on existing resources on the system and the CAISO's projection of new resources as of June 30, 2025. Existing resources are those listed on the CAISO's Net Qualifying

[4] 2025 Summer Assessment Technical Appendix, May 5, 2025: https://www.caiso.com/library/seasonal-assessments

[5] Details on the CAISO's various ancillary service products, pg. 192: https://www.caiso.com/documents/2023-annual-report-on-market-issues-and-performance.pdf

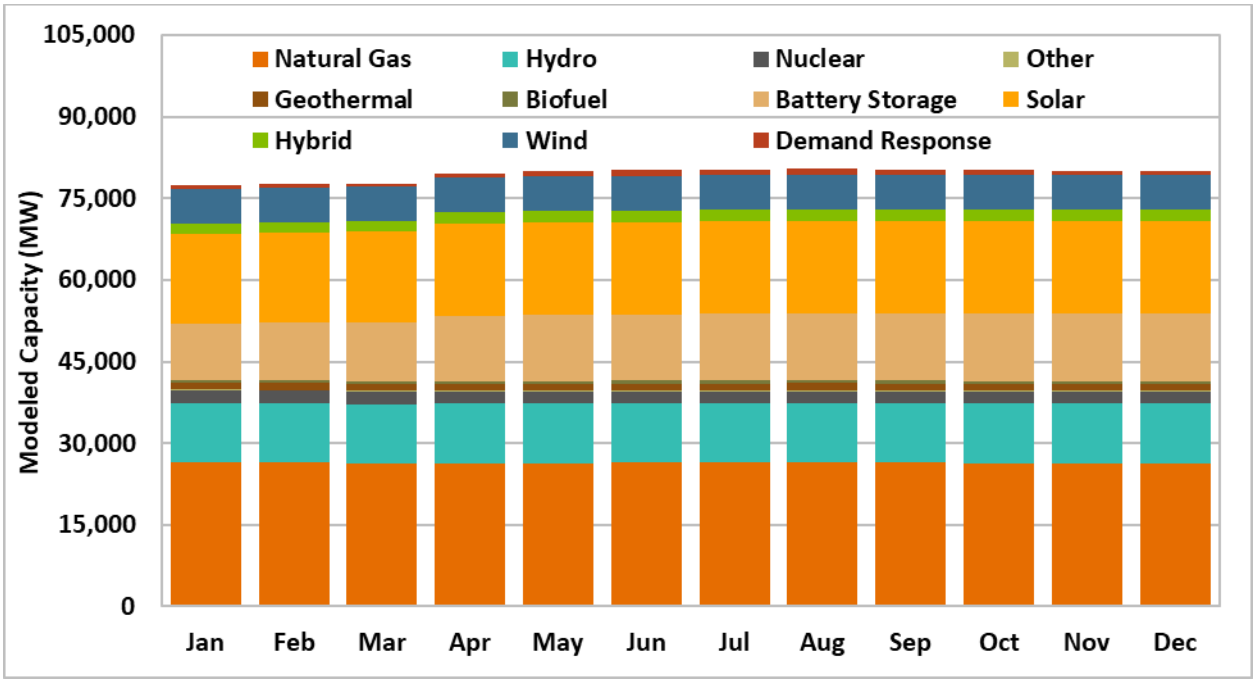
Capacity (NQC) list as of February 12, 2025.[6] Table 1.2 shows additions since September 1, 2024 and expected new resources that have a high likelihood of declaring commercial operation by June 30, 2025.

Table 1.2 Actual and expected additions from September 1, 2024 through June 30, 2025 (MW)

Resource Additions	Battery	Wind	Solar	Biofuel	Hybrid	Total Nameplate Capacity
September 1 to December 31, 2024	1,385	219	469		404	**2,478**
January 1 to April 1, 2025	595	0	299		0	**894**
April 1 to June 30, 2025 (Expected)	1,654		354	5	150	**2,163**
Total	**3,634**	**219**	**1,122**	**5**	**554**	**5,534**

Figure 1.3 shows the modeled capacity by resource type, including all existing RA eligible resources from the NQC list and any expected new resource additions not on the NQC list (80,350 MW as of Sept 2025). Average hydro profile based on 2018 hydro year is used for this assessment. The figure excludes pseudo-tied and dynamic imports from out-of-state generators. However, these resources are modeled and counted against the net import limit in this assessment. Resources in California's Strategic Reliability Reserve (SRR) program are excluded from the model. Detailed capacity assumptions and technology specific modeling considerations are discussed in a separate technical appendix report.[7]

Figure 1.3 Probabilistic assessment resource portfolio (2025)



[6] Final Net Qualifying Capacity Report for Compliance Year 2025, February 12, 2025: https://www.caiso.com/library/net-qualifying-capacity-nqc-and-effective-flexible-capacity-efc

[7] 2025 Summer Assessment Technical Appendix, May 5, 2025: https://www.caiso.com/library/seasonal-assessments

1.1.1 Modeling Improvements

The CAISO implemented several key enhancements to improve its summer assessment modeling in PLEXOS 11 simulation software:[8]

1. **Thermal operating characteristics are updated** at a unit-level using most recent Master File data; including ramp rates, minimum up/down times, and heat rate curves leading to efficient unit commitment and dispatch decisions.
2. **Battery storage resources are modeled as individual units** with detailed resource-specific parameters such as charge efficiency, duration, and state-of-charge limits.
3. **Hybrid and co-located resource components are modeled individually** with corresponding Pmax and aggregate capability constraints enforced, respectively.
4. **Improved Demand response (DR) representation** by including projected capacity from CPUC-jurisdictional utility-scale DR programs, net qualifying capacity values from third-party supply plan DR, and non-CPUC jurisdictional load serving entities (municipal utilities)[9]. DR capacity modeled includes both proxy demand response (PDR) and reliability demand response resources (RDRR).
5. **Resource-specific planned and forced outage rates are updated** based on the CAISO's Outage Management System (OMS) data from 2022 through 2024. Ambient temperature-based de-rates were also calculated using OMS data and applied to individual thermal generators in the model.
6. **Updated regulation up and down requirements** based on a combination of 2024 historical and actual values (Jan – Mar) for 2025. Resource eligibility to provide reserves is determined by the total capacity certified for each specific reserve type, as specified in the Master file.
7. In this year's analysis, a **shortfall in non-spinning reserves** was also considered an LOLE event, along with any **shortfall in serving load or maintaining regulation-up requirements, frequency response requirements and spinning reserves**. This aligns with CAISO operations, where releasing any contingency reserve capacity to serve firm load requires being in emergency conditions.[10]

The technical details are discussed in depth in a separate technical appendix report.[11]

[8] Previous summer assessments were performed in PLEXOS 8.3 or older.

[9] Non-CPUC jurisdictional load serving entities DR monthly capacity values sourced from Table 2.1 of DMM 2024 DR Issues and Performance report: https://www.caiso.com/documents/demand-response-issues-and-performance-2024-mar-14-2025.pdf

[10] In past years' studies, half of the contingency reserves (non-spinning) were allowed to be released to serve firm load within the LOLE analysis.

[11] 2025 Summer Assessment Technical Appendix, May 5, 2025: https://www.caiso.com/library/seasonal-assessments

1.1.2 Probabilistic Study Results

The probabilistic assessment of the CAISO's anticipated 2025 summer resource portfolio indicates there are sufficient resources to meet a broad range of load, solar, wind and outage uncertainties with an excess of **1,451 MW** satisfying the "one day every 10 years loss-of-load expectation" (1-in-10 LOLE) planning target. The assessment measured the risk of entering an Energy Emergency Alert (EEA) Watch condition or needing to call on emergency measures, rather than actual loss of firm load. It considered reasonable historical trends and history; it did not take into account extreme and emergency events.

Figure 1.4 shows that of loss of load hours across all 500 samples for the base portfolio (all RA-eligible resources) are concentrated in hours ending 19 to 21. The base portfolio's simulation results indicates a surplus for an assessment year because the model yielded 17 loss of load events across all 500 samples, which translates, to an LOLE of 0.034 (i.e., less than a 1-in-10 or 0.1 LOLE planning target).

To calculate the surplus (portfolio calibrated to 0.1 LOLE), the CAISO subtracts perfect capacity (e.g. imports) iteratively to the supply mix until the total loss of load event count reaches 50 (i.e., meets a 1-in-10 or 0.1 LOLE planning target). The calibrated portfolio results indicate that the CAISO is approaching summer of 2025 with a surplus of 1,451 MW, which exceeds the 1-in-10 LOLE planning target. Figure 1.5 shows the loss of load hours across the 500 samples for the calibrated portfolio spanning hours 17 through 22 (PDT).

Figure 1.4 Loss of load hours across 500 samples, Base portfolio

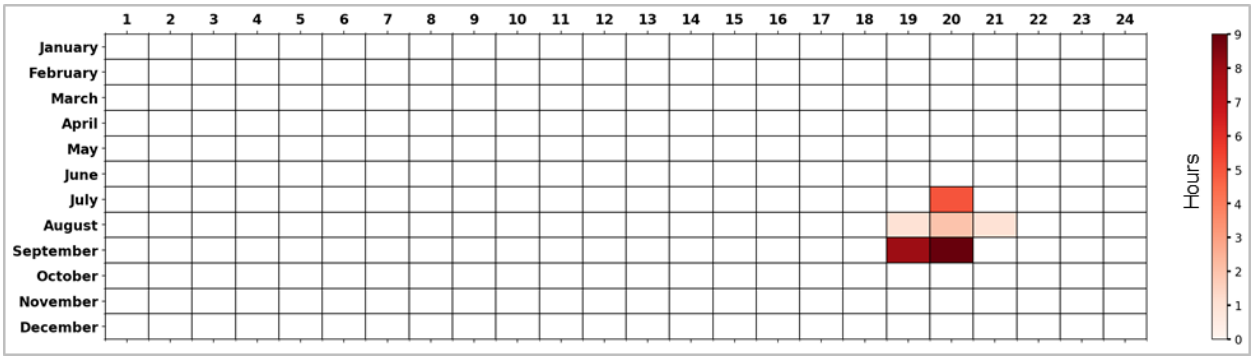
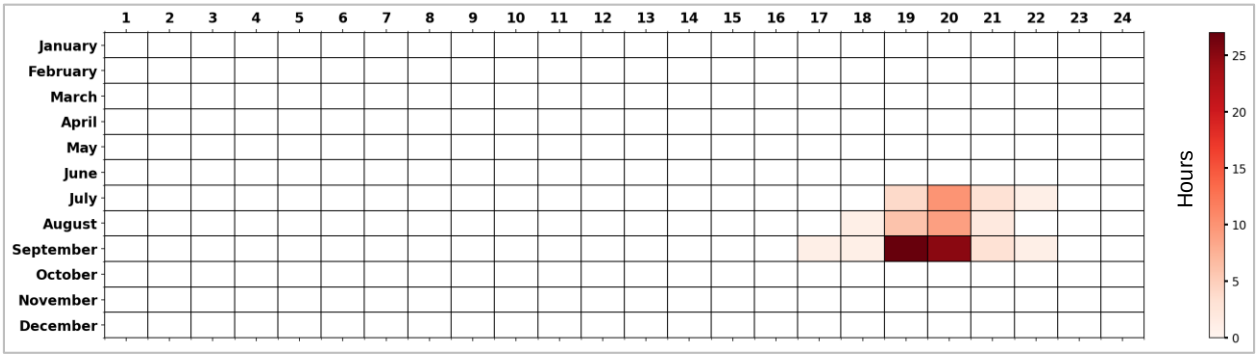


Figure 1.5 Loss of load hours across 500 samples, Calibrated to 0.1 LOLE



1.2 Multi-hour Stack Analysis

An hourly loads and resource contribution analysis was performed to analyze the hourly reserve margin for the expected "All RA eligible" fleet. The multi-hour stack assessment of this fleet indicates a reasonable margin above the planning reserve margin (PRM) required to achieve a 0.1 LOLE target.

The multi-hour approach for all RA eligible resource portfolio focuses on a reasonable expectation of resource availability during every hour of the peak day in each of the summer months. For most resource types, the NQC value provides a reasonable estimation of the contribution/availability of those resources every hour.

Assumptions and methodology

- **All RA eligible existing and new resources:**
  - Existing resources for the All RA Eligible portfolio are based on the 2025 NQC list published on February 12, 2025 and Master Control Area Generating Capability list on OASIS.
  - Expected new resources are those that are not on the NQC list, but are in the late stages of the CAISO queue and expected to be online by June 30, 2025. The NQC value of an expected resource (excluding wind, solar, and battery) were estimated based on technology factors in the 2025 NQC list.
  - Excludes resources contracted under the Strategic Reliability Reserve (SRR) program.
- **Load Forecast:** Load profiles from CEC's 2024 IEPR 1-in-2 planning forecast for CAISO for a peak day in each summer month of 2025 are used.

Table 1.3 Monthly peak load forecast (May 2025 – October 2025)

Month	May	June	July	August	September	October
Monthly peak load forecast (MW)	31,026	41,047	45,568	44,896	46,094	37,568

- **Energy storage:** Batteries are assumed to discharge during the net peak hours and are optimized to maintain the maximum possible surplus over hour ending 17 – 23 (PDT). This is achieved by first calculating the pre-battery discharge surplus and then distributing the battery energy to maintain a constant surplus during the net peak hours. The battery discharge profile is increased until 90 percent of the 4-hour energy limit is exhausted and a limit is enforced so that discharge cannot exceed 90 percent of the fleet Pmax in any individual hour. The 90 percent assumption is based on available years of historical state-of-charge data, which shows that the system-wide state-of-charge typically does not go below 5 percent or above 95 percent.
- **Nuclear:** Diablo Canyon nuclear capacity is included in the model, and capacity outside the CAISO footprint (Palo Verde dynamic import) is accounted under imports.
- **Wind and Solar:** Wind and solar profiles are derived from eight years of historical generation data (2017–2024) for the five highest load days, using exceedance methodology. Solar profiles are calculated at a 70 percent exceedance level, while wind profiles are calculated at an 80 percent exceedance level.

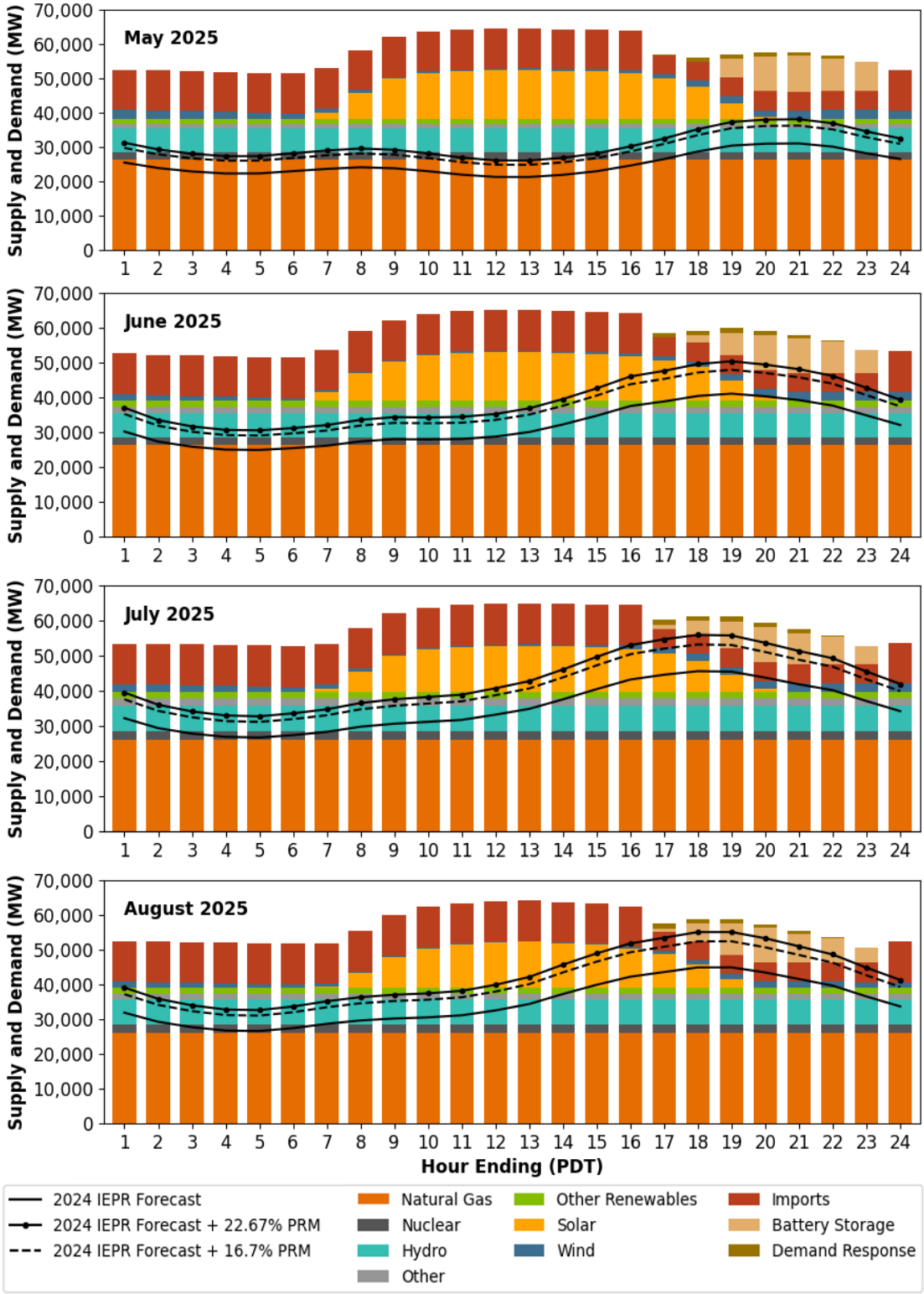
- **Demand Response:** Demand response capacity is assumed to be available from HE 17 to 22 and is sourced from CPUC's utility projections for PG&E, SCE and SDG&E and from the 2025 NQC list for third party providers.
- **Imports:** Maximum Import Capability (MIC) limit of 11,665 MW during off-peak hours and 5,500 MW during the evening net peak hours (HE 17 – 23). Import limits account for both the contribution of tie generators and non-resource specific imports from neighboring BAA's.
- **Planning reserve margin (PRM) calculation methodology:** The CAISO considered several sets of parameters to determine the appropriate PRM against which to assess the resource fleet including:
  1. *PRM required to meet a 0.1 LOLE:* The estimate of the PRM is calculated in two steps:
     i. The model constructs the resource stack and optimizes battery dispatch to maximize surplus during the evening peak hours in September (17 – 23), achieving an hourly surplus of 11,900 MW. This results in an 'achieved PRM' of 25.82 percent based on the current portfolio.
     ii. The model then integrates results from the probabilistic study, which identifies 1,451 MW of surplus that can be removed to achieve a 0.1 LOLE target. After evenly distributing this reduction across all hours, the surplus during September peak hours (17 – 23) decreases to 10,449 MW. The model subsequently recalculates the PRM, resulting in a requirement of **22.67 percent** to meet the reliability target.
  2. *Load-weighted PRM of LSE monthly RA obligations:* The majority of LSE's are under CPUC jurisdiction and are required to meet a 17 percent PRM for their RA obligation; the remaining LSE's have a mix of PRMs depending on their Local Regulatory Authority (LRA). The **16.7 percent** is the load-weighted average PRM across all LSE's.

Analysis

The multi-hour stack analysis of "All RA Eligible" portfolio indicates that September remains the most stressed month on the grid, driven by high loads and reduced solar availability as shown in Figure 1.7. The CEC's 2024 IEPR 1-in-2 managed annual peak load forecast reaches 46,094 MW on September 3, 2025 hour ending 18, which is 526 MW higher than that of the next highest peak in July 2025. While July has a similar load profile, it benefits from approximately 3.5 GW of more solar generation during the peak hour compared to September.

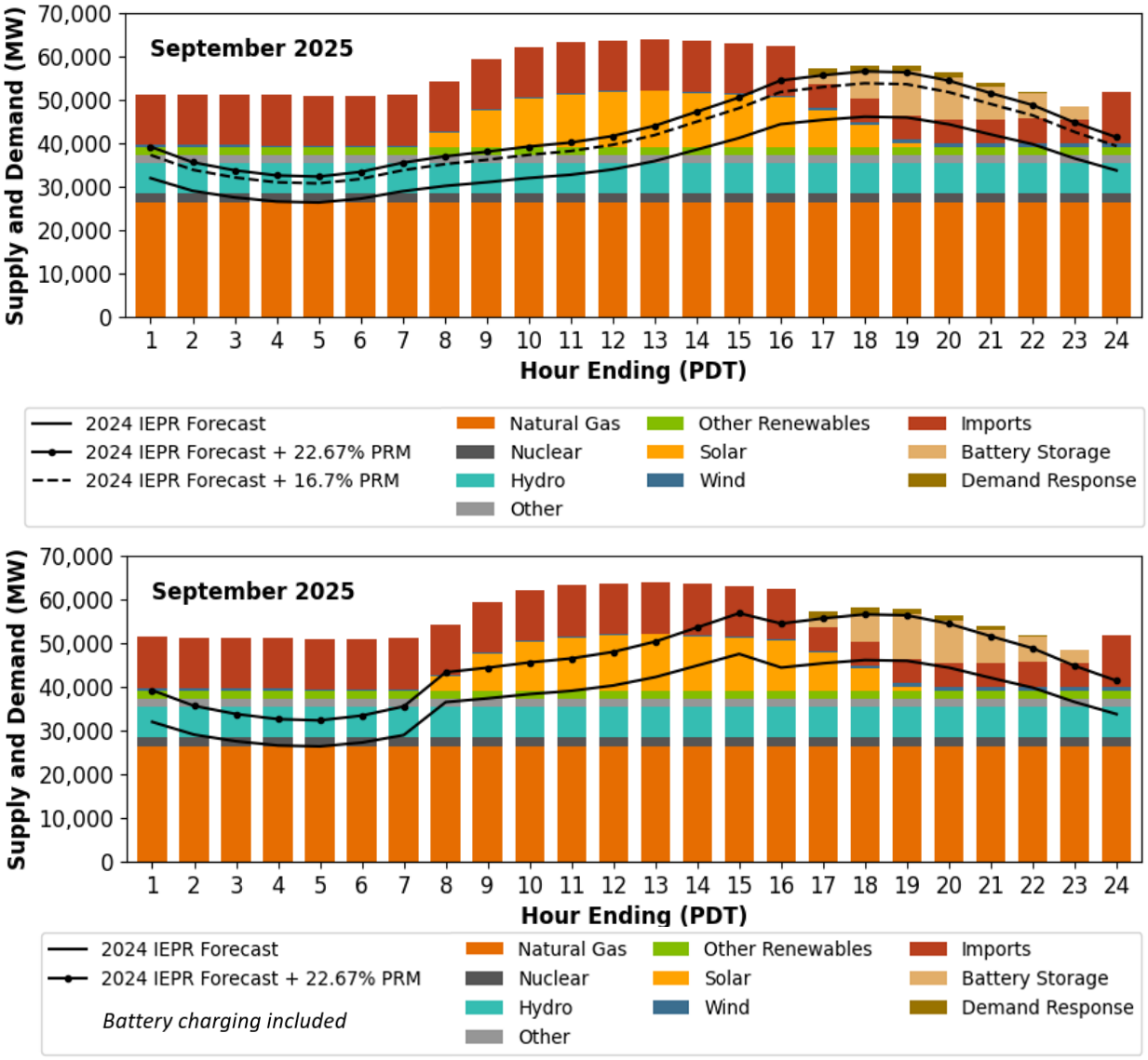
Figure 1.6 presents multi-hour stack charts for May through August 2025 using the "All RA Eligible" portfolio. The figure shows that the "All RA Eligible" portfolio can meet the CEC's 2024 IEPR forecasted demand plus a 22.67 percent planning reserve margin (PRM) across all summer months in 2025.

Figure 1.6 All RA eligible portfolio multi-hour stack for peak days from May to August 2025



To assess the impact of battery charging on grid conditions, the CAISO estimates the additional energy needed to charge the entire battery fleet before the evening net peak. The analysis assumes an 85 percent round-trip efficiency for battery resources and models charging over an eight-hour period, typically between 8 a.m. and 3 p.m., with exact hours varying by month. Figure 1.7 shows the results of this sensitivity for September, showing that in some hours, the system must rely on imports to meet the reserve margin when battery charging is included. As battery deployment continues to grow, batteries' positive contributions to grid operations will increase.

Figure 1.7 Multi-hour stack analysis for September peak day



2 Emergency Resources

For summer 2025, supply accessible through the Electricity Supply Strategic Reliability Reserve Program (ESSRRP) and emergency assistance on the interties totals around 3,379 MW. As stated earlier, the CEC and CPUC will provide estimates of state emergency demand response programs and other contingency resources in the CEC's California Reliability Outlook published in May 2025. The CAISO details processes for operation of various emergency resources in the CAISO's Emergency Procedure 4420.[12]

Following the extreme and widespread heat events of 2020, the CAISO, the California Legislature, and state entities have taken several measures to ensure grid reliability under extreme events, beyond conventional planning standards. These measures and programs include pursuing and approving procurement of additional resources, retaining existing resources in service, and improving operational readiness measures to access resources or load reductions when the risk of shortfalls exists. Several emergency resource programs have also emerged since summer 2021, which provide grid support during system emergencies and extreme events. These programs include both conventional generation assets and voluntary load reduction programs administered by state agencies such as the Department of Water Resources (DWR), the CPUC and the CEC. Many of these programs are triggered by various CAISO emergency notifications.

Table 2.1 Emergency supply accessible through various programs

<table>
<tr><th>Program</th><th>Description</th></tr>
<tr><td>Strategic Reliability Reserve (SRR)
The SRR was developed in 2022 under Assembly Bill 205 to expand resources capable of managing or reducing demand during extreme events. The SRR provides funding to secure additional resources to address extreme events beyond traditional</td><td>Electricity Supply Strategic Reliability Reserve Program (ESSRRP) [13]: DWR oversees the ESSRRP to provide additional generation during extreme events to support grid reliability in California BAAs.
<table>
<tr><th>Resource Name</th><th>BAA</th><th>Max Capacity (MW)</th></tr>
<tr><td>Alamitos Gen Sta. Unit 3</td><td>CISO</td><td>326.8</td></tr>
<tr><td>Alamitos Gen Sta. Unit 4</td><td>CISO</td><td>334.4</td></tr>
<tr><td>Alamitos Gen Sta. Unit 5</td><td>CISO</td><td>480.0</td></tr>
<tr><td>Huntington Beach Gen Sta. Unit 2</td><td>CISO</td><td>226.8</td></tr>
<tr><td>Ormond Beach Gen Sta. Unit 1</td><td>CISO</td><td>741.3</td></tr>
<tr><td>Ormond Beach Gen Sta. Unit 2</td><td>CISO</td><td>750.0</td></tr>
<tr><td>Channel Islands Power</td><td>CISO</td><td>27.5</td></tr>
<tr><td>Greenleaf 1</td><td>CISO</td><td>49.2</td></tr>
<tr><td>Enchanted Rock (Lodi & Claribel)</td><td>CISO</td><td>96 (48 MW each)</td></tr>
<tr><td>Enchanted Rock Marshall Unit 1-4</td><td>TIDC</td><td>46.8 (11.7 MW each)</td></tr>
<tr><td colspan="2">Total ESSRRP Capacity (MW)</td><td>3,078.7</td></tr>
</table></td></tr>
</table>

[12] CAISO Operating Procedure 4420, System Emergency: http://www.caiso.com/Documents/4420.pdf

[13] Electricity Supply Strategic Reliability Reserve Program Update, January 21, 2025: https://www.energy.ca.gov/filebrowser/download/6933?fid=6933

resource planning targets.	In August 2023, the State Water Board extended the once-through cooling (OTC) policy compliance dates for Alamitos, Huntington Beach, and Ormond Beach generating stations for three years from December 31, 2023, to December 31, 2026, contingent on these resources participating in the ESSRRP. These OTC resources represent about 2,859 MW of generating capacity through the end of 2026, which will help to maintain electric grid reliability during extreme events. These resources are offline, except for testing or until a California balancing area issues an EEA or the CAISO balancing area determines that exceptional dispatches of these long-start resources are necessary to address system operations.
	Demand Side Grid Support (DSGS) Program: The CEC administers the DSGS program. This program provides incentives for electric customers to provide load reduction and backup generation to support grid reliability during extreme events from May through October. DSGS program participants can select different incentive options for each eligible load reduction resource type.[14]
	Distributed Electricity Backup Assets (DEBA) Program: The CEC administers the DEBA program. This program incentivizes the construction of clean and efficient distributed energy assets that serve as emergency supply or load reduction for the electric grid during extreme events. The DEBA program is a statewide program, intended to procure clean and efficient distributed energy assets that will serve as on-call emergency supply or load reduction during extreme events. Since August 2024, the CEC has approved 11 grant agreements under a Notice of Proposed Awards under the DEBA program. The projects related to these grant agreements are expected to come online through summer 2027, but no contingency resources are expected to be online in summer 2025.
Emergency Load Reduction Program (ELRP)	ELRP is a five-year demand response pilot program managed by the state's three investor-owned utilities (IOUs) – PG&E, SCE, and SDG&E. It is a voluntary demand response program designed to compensate customers for reducing energy consumption in the summer months (May - October) during a grid emergency. As a voluntary program, there are no penalties to customers for non-participation and no requirements to reduce load by a particular amount during an ELRP event. ELRP events are triggered by the CAISO's emergency notifications or, in some cases, a CAISO-issued Flex Alert.
Emergency Assistance on the Interties	The CAISO is authorized to take actions during system emergencies on whether to receive or provide emergency assistance on the interties in the real-time market.[15] Imports coming from emergency assistance reflect energy imported from neighboring BAAs with whom the CAISO has contractual agreements during emergency conditions. For summer of 2025, the CAISO projects about 300 MW of emergency assistance available on the interties.

[14] Demand Side Grid Support (DSGS) Program Guidelines, Fourth Edition, January 14, 2025: https://efiling.energy.ca.gov/GetDocument.aspx?tn=261090

[15] CAISO Operating Procedure 4410, Emergency Assistance: http://www.caiso.com/Documents/4410.pdf

NERC Energy Emergency Alert Designations

Effective May 1, 2022, the CAISO changed its messaging system to align with NERC's Energy Emergency Alert (EEA) designations. There are three levels of EEAs, which the CAISO may progress through in any order if system conditions warrant. The CAISO made this change to align its emergency levels with Reliability Coordinators and neighboring BAA procedures, and to ensure that everyone is using consistent terminology during supply shortages. Table 2.2 outlines the notification and emergency levels the CAISO currently uses.

Table 2.2 CAISO balancing authority area emergency notifications[16]

Emergency Declarations	Circumstances
CAISO BAA Declarations	
Flex Alert	A Flex Alert is a call to consumers to voluntarily conserve electricity when the CAISO anticipates energy supply may not meet high electricity demand.
Restricted Maintenance Operations (RMO)	When high demand is anticipated, the CAISO will caution utilities and transmission operators to avoid taking grid assets offline for routine maintenance to assure that all generators and transmission lines are available.
Transmission Emergency	Declared by CAISO for any event threatening or limiting transmission grid capability, including line or equipment overloads or outages.
CAISO/RC West Declarations	
EEA Watch	Analysis shows all available resources are committed or forecasted to be in use, and energy deficiencies are expected. Market participants are encouraged to offer supplemental energy. Consumers are encouraged to conserve energy. This notice can be issued the day before the projected shortfall or if a sudden event occurs.
EEA 1 (All available generation resources in use)	Real-time analysis shows all resources are in use or committed for use, and energy deficiencies are expected. Market participants are encouraged to offer supplemental energy and ancillary service bids. Consumers are encouraged to conserve energy.
EEA 2 (Load management procedures in effect)	CAISO requests emergency energy from all resources and has activated its emergency demand response programs. Consumers are urged to conserve energy to help preserve grid reliability.
EEA 3 (Using load as reserves)	CAISO is unable to meet minimum contingency reserve requirements and has asked utilities to prepare for the possibility of rotating power outages.
EEA 3 (Firm load interruption)	Energy supply is insufficient to meet demand, and utilities have been directed to initiate rotating power outages.

[16] RC West System Emergencies Procedure: https://www.caiso.com/Documents/RC0410.pdf

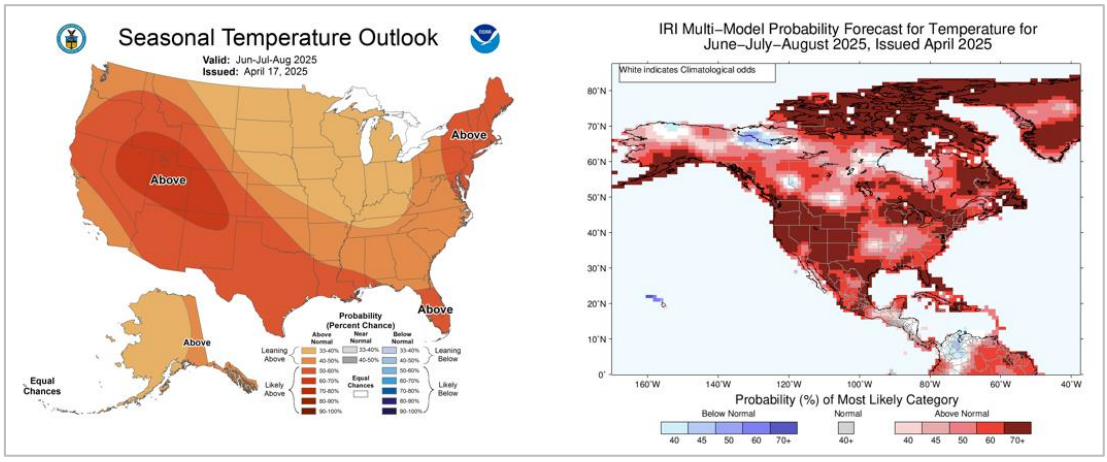
3 Weather Outlook

Weather conditions—such as temperature, cloud cover, and precipitation—directly affect system operations by influencing hydro output, renewable generation, and load. For the months of June through August 2025, forecasts show the probability of above normal temperatures across the Western U.S, with the highest chances of above normal temperatures across the Intermountain West and into the Pacific Northwest and slightly lower chances in coastal locations. In August and September of 2025, forecasters continue to see an increased chance of above normal temperatures across the West.

Temperature Outlook

Figure 3.1 shows the probability of above- or below-normal temperatures across the U.S. for June through August 2025, based on forecast models from the Climate Prediction Center and Columbia University. In California, the Climate Prediction Center projects varying probabilities of above-normal temperatures. Coastal regions—especially Southern California—have the lowest chances, while inland areas show higher probabilities. Seasonal models suggest a warm start to summer in the interior during June and July, with coastal regions likely staying cooler due to increased marine air. Looking ahead to late summer and fall, forecasts indicate continued above-normal temperature potential across the West, with the highest chances remaining in the Intermountain West.

Figure 3.1 Temperature outlook for June, July and August issued by the Climate Prediction Center[17] (left) and Columbia University[18] (right)



The greatest uncertainty in the Climate Prediction Center's forecast is whether the Pacific Northwest will experience a warmer-than-normal summer. This depends on the potential development and position of a heat dome—a high-pressure system that can drive extreme heat. Typically, this high pressure sets up over the Desert Southwest, concentrating heat there. However, if the ridge shifts farther west or north, it could push hotter temperatures into northern California and the Pacific Northwest. Model guidance is

[17] NOAA's Climate Prediction Center three-month temperature outlook as of April 7, 2025: https://origin.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=3

[18] Columbia University's Climate School three-month temperature outlook, Issued March 2025: https://iri.columbia.edu/our-expertise/climate/forecasts/seasonal-climate-forecasts/

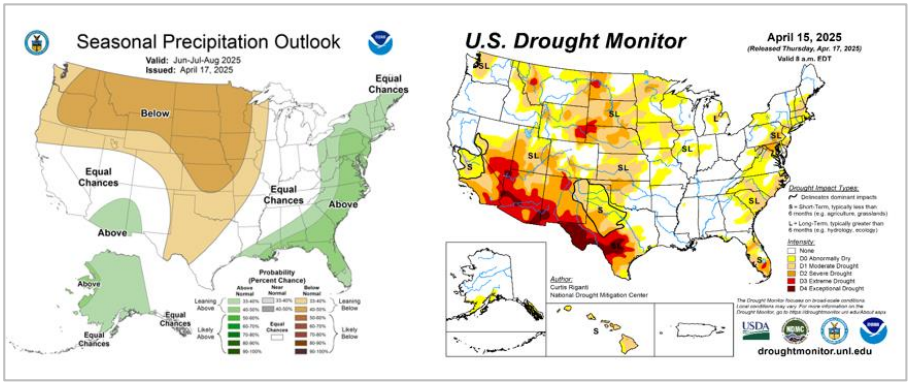
uncertain about the exact location of this high-pressure system. As a result, northern California and the Pacific Northwest may have an increased chance of above-normal temperatures. This potential is reflected in Columbia University's IRI model, shown on the right in Figure 3.1. Latest model guidance also suggests that the most intense heat is likely to occur earlier in the summer rather than later.

Both forecast sources agree that the Pacific Northwest, Intermountain West, interior California, and the Four Corners region have the highest likelihood of above-normal temperatures. This could mean more frequent, longer lasting, or higher magnitude extreme heat events—or a combination of all three.

Precipitation Outlook

Like temperature forecasts, precipitation outlooks show the probability of above- or below-normal rainfall over a three-month period. Figure 3.2 shows the outlook for June through August 2025 issued by the Climate Prediction Center on the left.[19] Historically, most of California sees very little rainfall during this time, except for the southeastern deserts, which can receive moisture from the North American monsoon. The forecast shows equal chances of above or below normal precipitation across California, indicating no strong climate signals for increased summer rainfall. However, past events like Hurricane Hilary in 2023 and Hurricane Kay in 2020 show that tropical systems can still bring rainfall to the region during dry summer months. This year's cooler sea-surface temperatures in the Pacific suggest a less active eastern Pacific hurricane season, reducing the likelihood of tropical storms influencing rainfall and moisture across California from June through September 2025.

Figure 3.2 Precipitation outlook for June, July and August Center (left) and drought monitor across the United States as of April 15, 2025[20] (right)



The Pacific Northwest may see below-normal rainfall this summer, while the Desert Southwest could receive above-normal rainfall due to a potentially more active North American monsoon. Many regions already facing drought—especially those forecasted for little to no summer rainfall—are likely to see worsening conditions, as seen on the right in Figure 3.2. Continued drought could also increase the risk of above-normal temperatures in these areas.

[19] NOAA's Climate Prediction Center three-month temperature outlook as of April 7, 2025: https://origin.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=3

[20] U.S. Drought Monitor as of April 8, 2025: https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

4 Preparation for Summer Operations

As stated earlier, the Summer Assessment report is one of many activities the CAISO undertakes each year to prepare for summer system operations. The CAISO also fine-tunes market and operational metrics to ensure the effectiveness of the planned resource fleet in times of system stress, and enhances operational coordination with state agencies and the industry to access contingency reserves should the system face the risk of shortfalls due to more extreme events.

As noted, the CAISO, state entities, and stakeholders have employed a number of contingency measures to continue to improve system preparedness and performance. These include pursuing and approving procurement of additional resources, with a significant amount going into operation over the past year; ensuring existing resources are retained in service; managing planned maintenance;[21] and improving operational coordination around resources or load reductions accessible under stressed grid conditions. The CAISO processes for operation of various emergency resources are detailed in the Emergency Procedure 4420.[22] The CAISO developed a public Extreme Weather Process and Communications document, which provides detail on CAISO timelines for operational coordination and communication channels for CAISO emergency notices, which trigger the use of various emergency resources.[23]

Other activities include coordinating meetings on summer preparedness with the WECC, California Department of Forestry and Fire Protection (Cal Fire), natural gas providers, transmission operators and neighboring BAs. For 2025, the CAISO will continue to engage the appropriate entities in a tabletop exercise simulating stressed grid conditions. The CAISO's ongoing coordination with these entities helps ensure that everyone is prepared for the upcoming summer operational season.

The ISO coordinates closely with California state agencies, utilities, and regional partners on summer readiness activities. These efforts include reviewing and updating the ISO's operational playbook, which outlines processes, potential operational actions, and communication touchpoints in advance of and during a potential grid event. The ISO and its partners also engage in tabletop exercises and trainings to practice and test operational processes, communications protocols, and sequencing of various emergency programs under different operational scenarios. Planning and coordination with state and regional partners prepares us to respond to potential grid events.

[21] Spring is the season of managing planned maintenance for RC West, CAISO Energy Matters Blog, March 5, 2025: https://www.caiso.com/about/news/energy-matters-blog/spring-is-the-season-of-managing-planned-maintenance-for-rc-west

[22] CAISO Operating Procedure 4420, System Emergency: https://www.caiso.com/Documents/4420.pdf

[23] CAISO, Extreme Weather Event — Process And Communications: http://www.caiso.com/Documents/extreme-weather-event-process-and-communications.pdf