2025 Summer Grid Reliability

Assembly Utilities and Energy Committee - Oversight Hearing

May 7, 2025

CALIFORNIA ENERGY ENTITIES

California Energy Commission (CEC)

California Public Utilities Commission (CPUC)

California Independent System Operator (CAISO)

California Air Resources Board (CARB)

California Department of Water Resources (DWR)

Primary Roles in Energy Supply Planning and Services

CARB

- Scoping Plan
- Air Regulations
- Carbon Market/Cap-and-Trade

CEC

- California Electric Demand Forecast
- Municipal Utility Renewable Portfolio Standard (RPS) Oversight

CPUC

- Integrated Resource Planning (IRP)
- Resource Adequacy (RA)
- Load serving entity RPS Oversight

CAISO

- Market Operation
- Transmission Operation and Generator Dispatch
- Transmission Planning

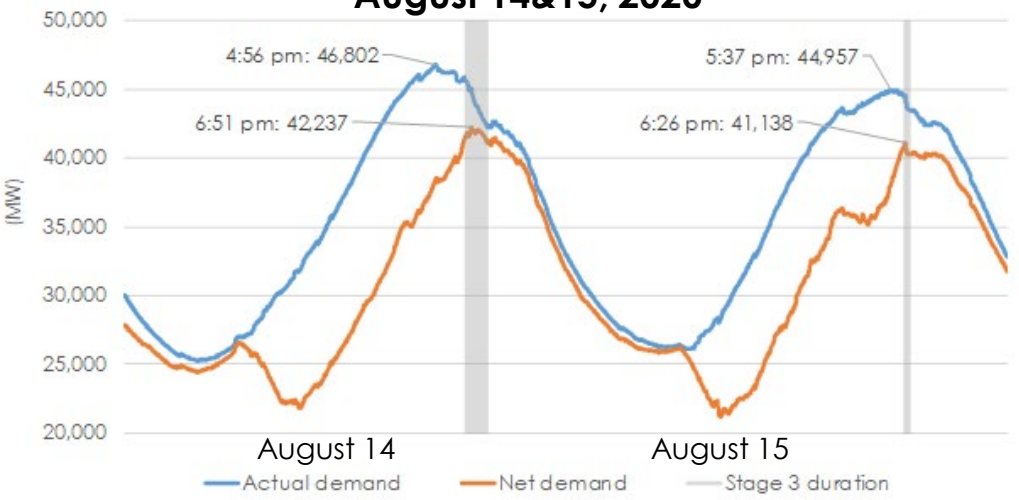
DWR

- Electricity backstop responsibilities such as the Electricity Supply Strategic Reliability Reserve Program and administering the Diablo Canyon Extension Fund

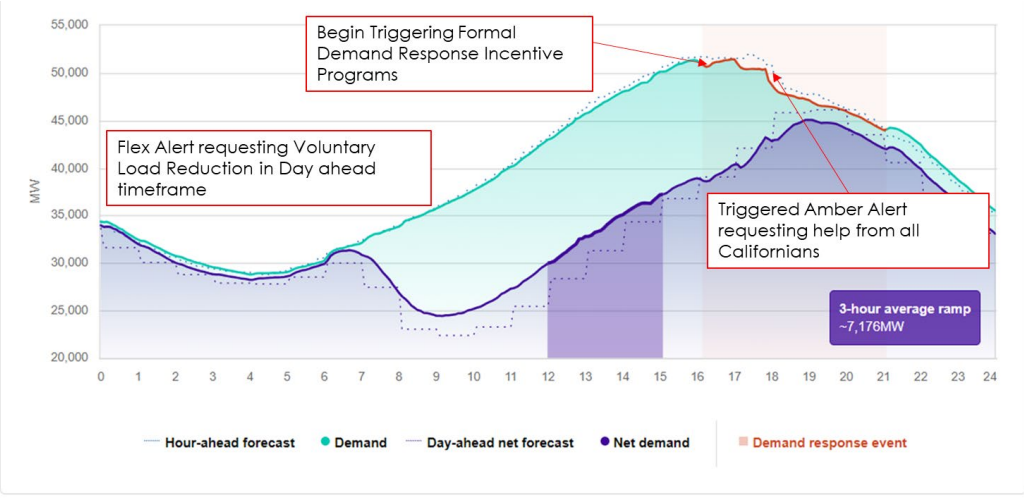
2020 & 2022 Grid Reliability Events

	2020 Rotating Outages	2022 Sept 6 Record Peak
Peak Demand	~47,000 MW	~52,000 MW
Outcome	Rotating outages (800k+ customers affected)	No outages despite historic heat and demand
Response	Late-stage emergency; limited DR activation	Early Flex Alerts, 2,000 MW drop after text alert
Key Lesson	Insufficient RA; market issue; coordination gaps	Demand flexibility and fast public response work

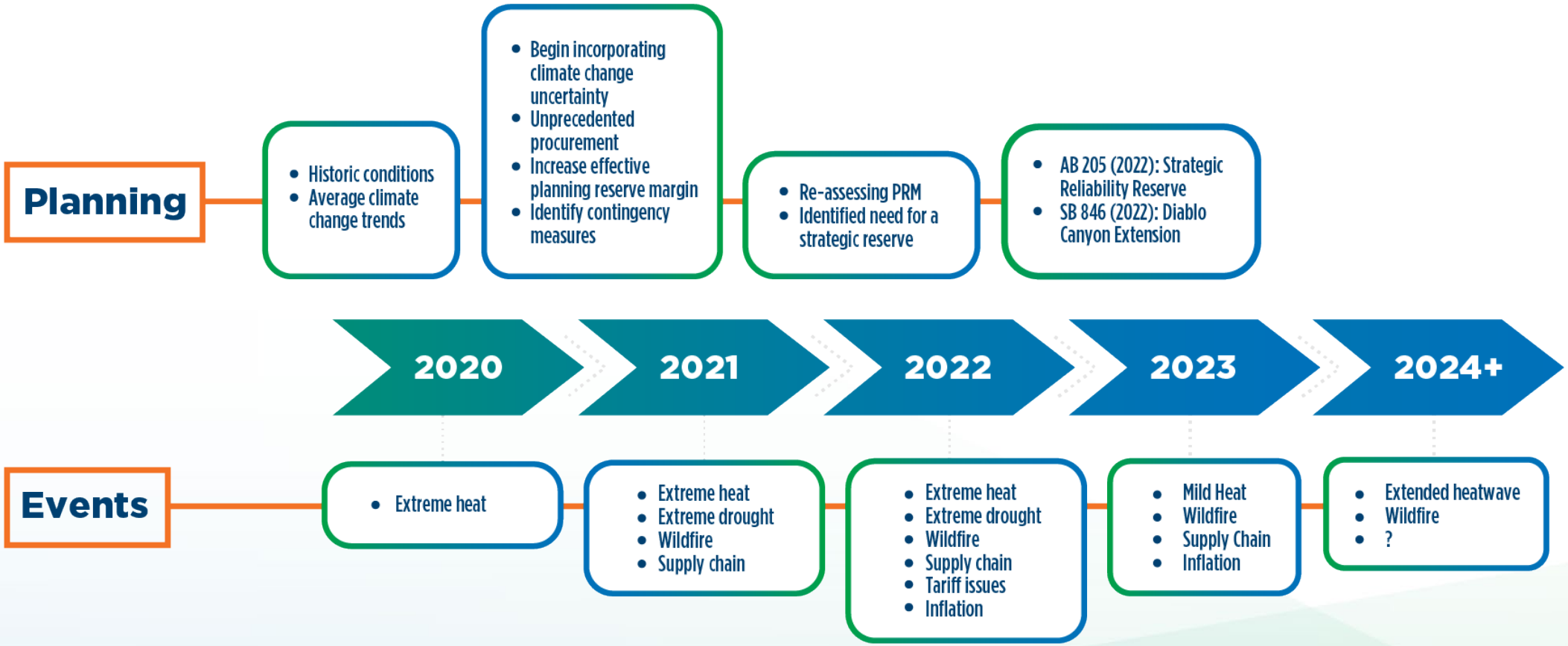
August 14&15, 2020



Sept 6, 2022



Changing Grid Conditions



Actions - Grid Reliability & Clean Energy Transition

- **Improving Grid Planning Processes**
  - Improvements to forecasting for climate change-induced weather variability and electrification
  - Ordering sufficient and diverse energy resource procurement
  - Improvements to Resource Adequacy process and requirements

- **Scaling Supply & Demand-Side Clean Energy Resources**
  - Track procurement
  - Improve interconnection & permitting process
    - Opt-In Permitting
  - SB 846 (2022) requirements, including demand flexibility goal

- **Preparing for Extreme Events (Strategic Reliability Reserve)**
  - Retain existing and construct new assets & procure energy imports to backstop uncertainties
  - Create emergency demand flexibility opportunities

2020-24 Grid Conditions Summary

Alerts	2020	2021	2022	2023	2024
Flex Alerts	10	8	11	0	0
Restricted Maintenance Operations	20	24	16	6	18
Transmission Emergencies	2	0	10	2	23
Energy Emergency Alerts					
Energy Emergency Alert Watch	16	4	9	2	1
Energy Emergency Alert 1	0	0	6	1	0
Energy Emergency Alert 2	6	1	5	0	0
Energy Emergency Alert 3	2	0	1	0	0
Total Emergency Alerts in CAISO Area	**24**	**5**	**22**	**3**	**1**
Total Emergency Alerts across RC West	**47**	**17**	**42**	**29**	**57**

2025 Summer Grid Readiness

2025 Summer - Grid Readiness & Outlook

- **The current 2025 demand/supply forecast shows a further improved outlook compared to recent years.**
  - No supply shortfalls expected under traditional grid planning conditions
  - No supply shortfalls expected even under extreme conditions like those experienced in 2022 and 2020
  - Battery storage capacity on the grid continues to scale significantly
  - Market and supply chain uncertainties remain elevated due to trade tariff risks and uncertainties

- **Long-lasting west-wide extreme heat conditions, if combined with sudden events like a fire affecting key electric transmission equipment, could still create tight conditions on the grid.**
  - Weather forecasts show potential for above normal temperatures and west-wide heat

- **Total "contingencies" reach up to 4,000 MWs, with the State Reliability Reserve's Once-Through Cooling (OTCs) generators contributing the largest share at 2,859 MWs.**

2022-2025 Summer Forecast Comparison

- Long lasting west-wide extreme conditions, coincidental or sudden onset events (e.g., wildfires) that impact key electric transmission equipment - as seen with the 2021 Bootleg Fire cutting 4,000 MW of imports - could still cause severe grid strain, with potential **shortfalls of up to 2,700 MW** during conditions similar to a 2022 extreme event.

September Forecast	Summer 2022	Summer 2023	Summer 2024	Summer 2025
	May 2022 Analysis	Aug 2023 Report	Jan 2024 Report	2025 Q1/2 Report
Demand (MW)				
Total Demand	**46,319**	**47,327**	**45,972**	**46,152**
Resources (NQC MW)				
Total Resources	**53,080**	**55,533**	**56,439**	**63,765**
Potential Surplus/Shortfall Before Contingencies Are Need (Resources – Demand) (MW)				
Standard Planning Event	40	2100	4020	5,500
2020 Equivalent Extreme Event	-3,000	-400	1500	2,900
2022 Equivalent Extreme Event	-7,000	-2,000	-90	1,300

2025 Summer - Contingencies

Type	Contingency Resource	MW Available			Note
		July	August	September	
Strategic Reliability Reserve	DWR Electricity Supply Strategic Reliability Reserve Program and State Power Augmentation Program	3079	3079	3079	
	CEC Demand Side Grid Support (DSGS)[1]	530	540	545	See Note
	CEC Distributed Electricity Backup Assets (DEBA)[2]	0	0	0	See Note
CPUC	Ratepayer Programs (Emergency Load Reduction Program, Power Saver Rewards etc.)[3]	106	104	103	See Note
	Imports Beyond Stack	25	25	25	Unchanged
	As Available Energy from Installed Resources	794	364	474	Unchanged
Non-Program	Balancing Authorities Emergency Transfers	300	300	300	Unchanged
	Thermal Resources Beyond Limits: Gen Limits Needing 202c	25	25	25	Unchanged
	Total	**4859**	**4437**	**4551**	

[1] *Estimates based on current enrollment and projected growth*
[2] *Nine projects were recommended for DEBA funding for a total of 297 MW. Includes 9.5 MW anticipated to be online in 2026 and ~287 MW online in 2027.*
[3] *Based on enrollment numbers and average per customer ex ante load reduction from filing year 2025 Load Impact Protocols*

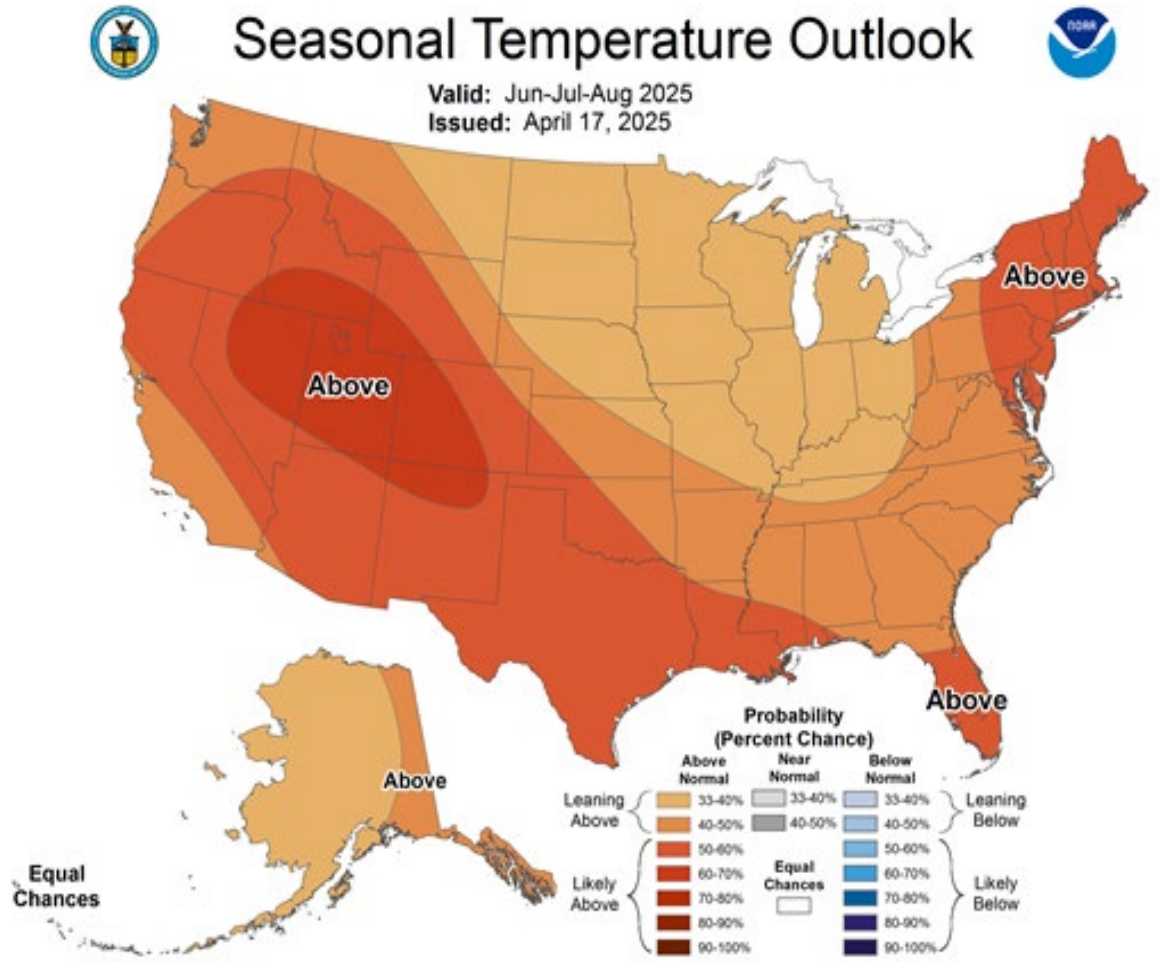
Contingencies as of 4.21.25

2025 Summer – Grid Operations Outlook

- Forecasted 2025 summer conditions continue to show progress in strengthening resource adequacy
- CAISO's probabilistic analyses show a reasonable supply margin to meet forecasted demand and reserve margins
  - The loss of load expectation target of 1-in-10 is forecast to be met with a margin of approximately 1,451 MW
- The CAISO also conducted a stack analysis and projects a surplus of capacity to meet projected demand in evening hours
- Wildfires and potential for widespread heat events and other disruptions continue to pose risks to the CAISO grid that we will closely monitor

Potential Extreme Weather Events

- Weather forecast guidance shows the potential for above normal temperatures across CA and the Western US
- Chance of higher-than-normal temperatures across CA and the Western US, particularly in the first half of summer
- Some diversity in forecasted temperatures across California, with lower chances of above-normal temperatures in coastal regions

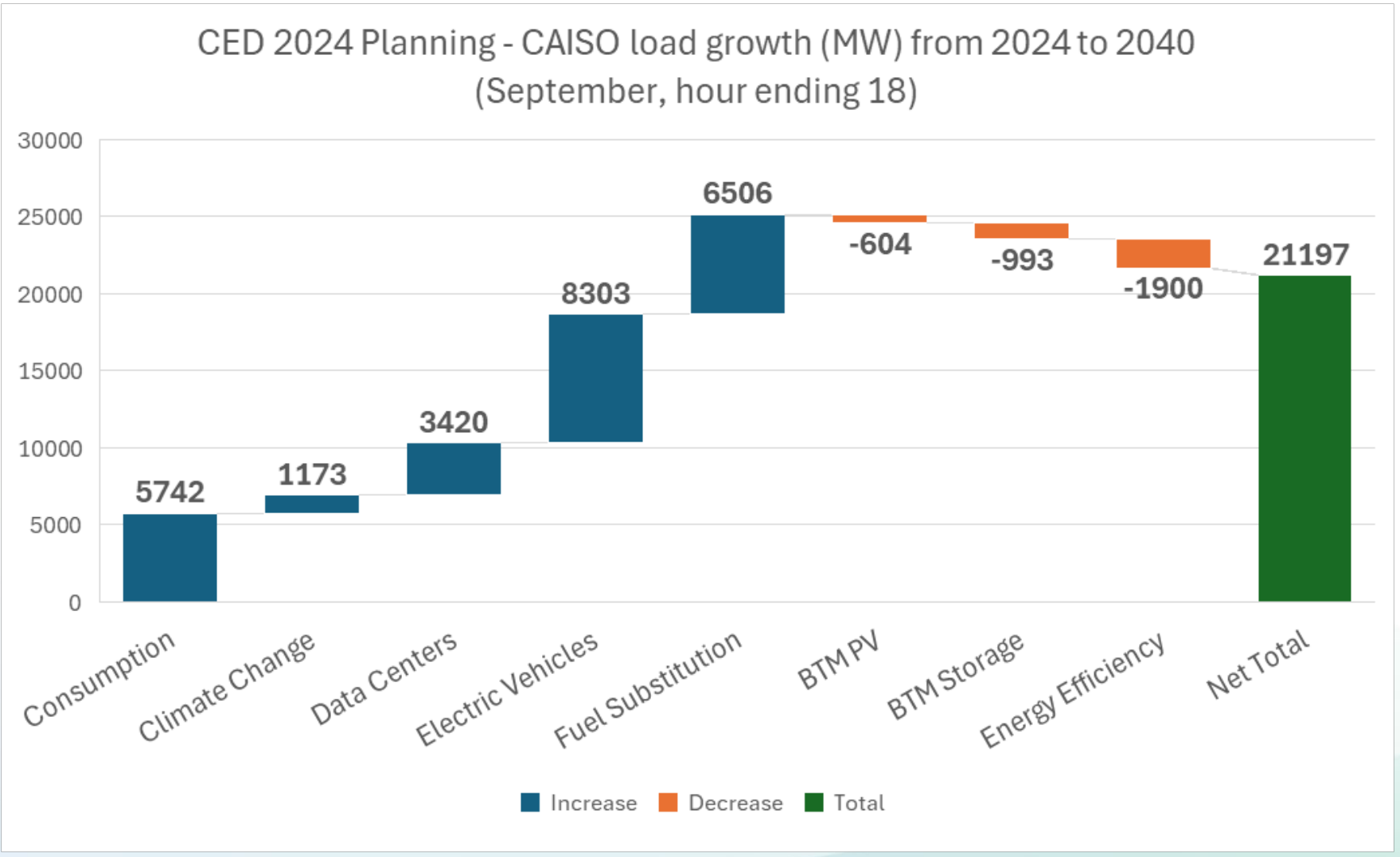


2025 Summer Topline – Grid Operations Well Positioned

- Over 11,000 MW of battery storage connected to the CAISO grid, which continues to perform well in evening hours when demand is still high and solar energy is ramping off the system
- The CAISO actively coordinates with state agencies and regional industry partners, engaging in summer readiness tabletop exercises and trainings
- The Western Energy Imbalance Market (WEIM) and Reliability Coordinator (RC) West continue to play a critical role in maintaining reliability, especially during extreme weather events

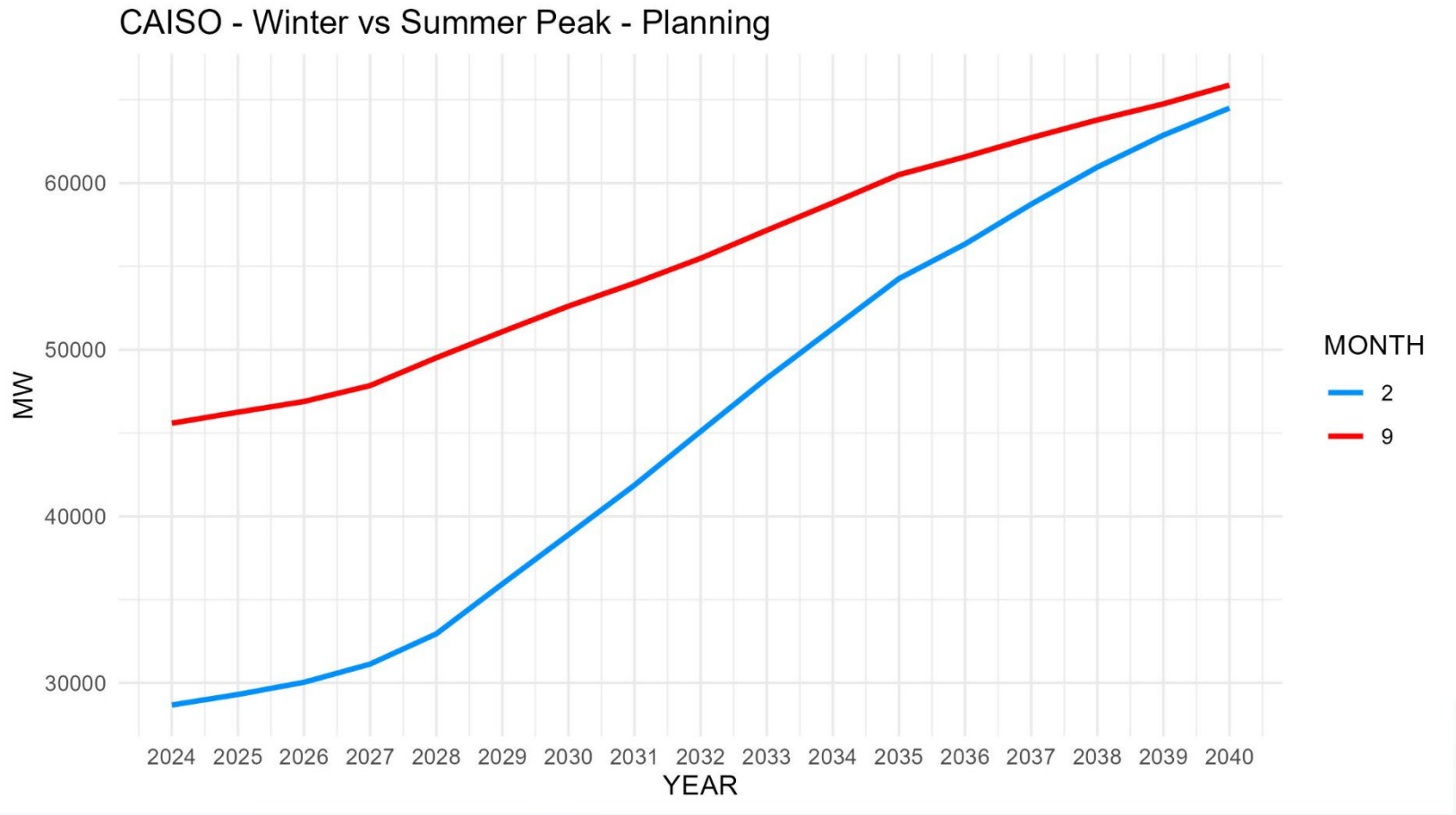
Future Grid Outlook

Forecast - Growth of Peak Demand



- Growth in the demand forecast is primarily driven by data centers and building and transportation electrification
- Growth in installed behind-the-meter solar PV and batter storage capacity is significant, but impacts are small during the system peak hour

Forecast - Winter Peak Demand



- Fuel substitution impacts surpass 23,000 MW by February 2040 causing winter peak loads to approach summer peak levels.
- Electric space and water heating puts the winter peak in the morning (HE 8)

CPUC Procurement Orders

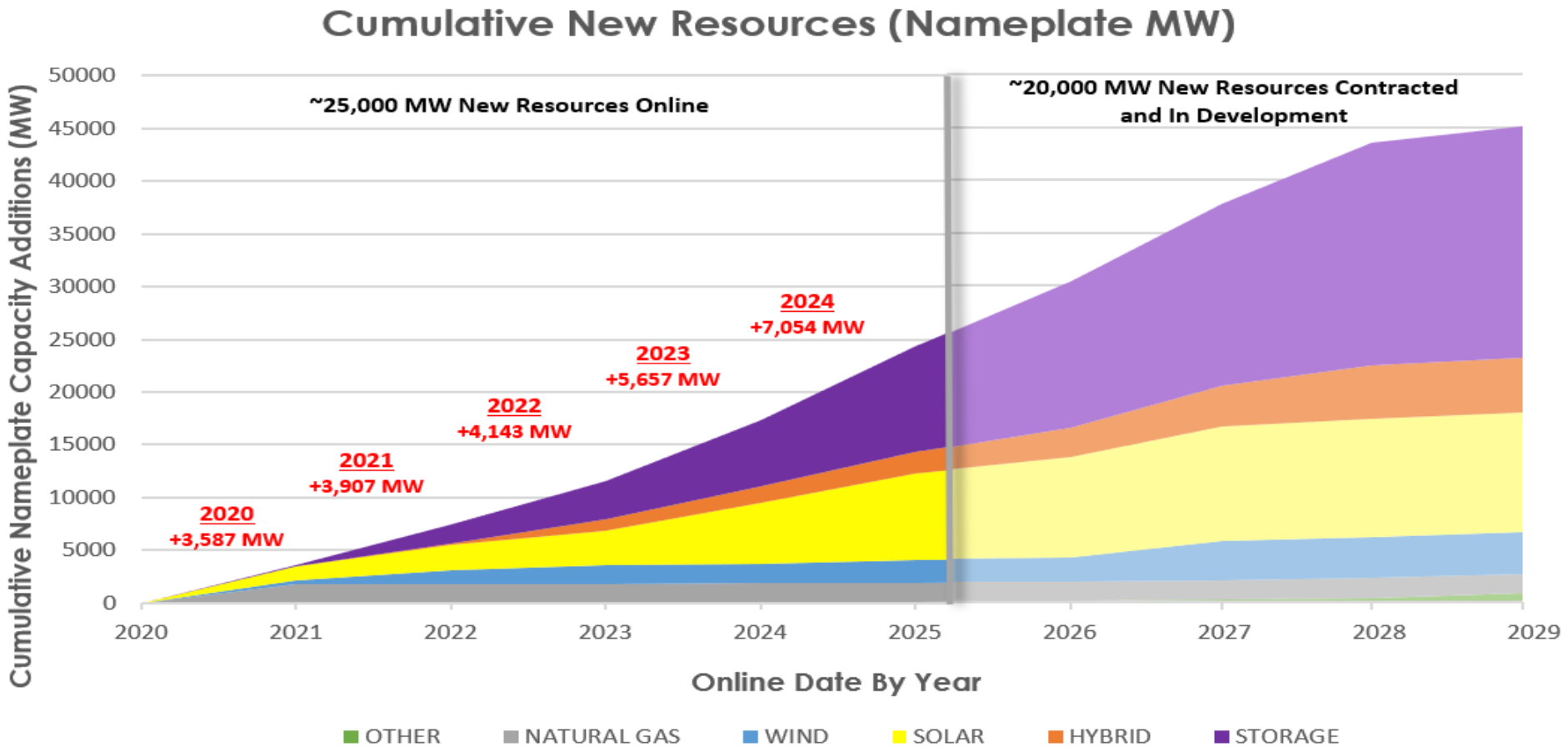
In Megawatts* (MW) By Year

CPUC Orders	Amount	2021	2022	2023	2024	2025	2026	2027	2028
Near-Term Reliability Ordered in 2019	**3,300 MW**	1,650	825	825	-	-	-	-	-
Mid-Term Reliability (MTR) Ordered in 2021	**11,500 MW**	-	-	2,000	6,000	1,500	-	-	2,000**
Supplemental MTR Ordered in 2023	**4,000 MW**	-	-	-	-	-	2,000	2,000	-
Total Recently Ordered Procurement	**18,800 MW**								

**Megawatts (MW) reflect Net Qualifying Capacity (NQC)*

*** The order requires LSEs to procure 2,000 MW of long-lead time (LLT) resources by 2028. Per D.24-02-047, LSEs may request extensions for their required LLT procurement for CODs no later than June 1, 2031.*

Energy Resource Growth – New & Expected



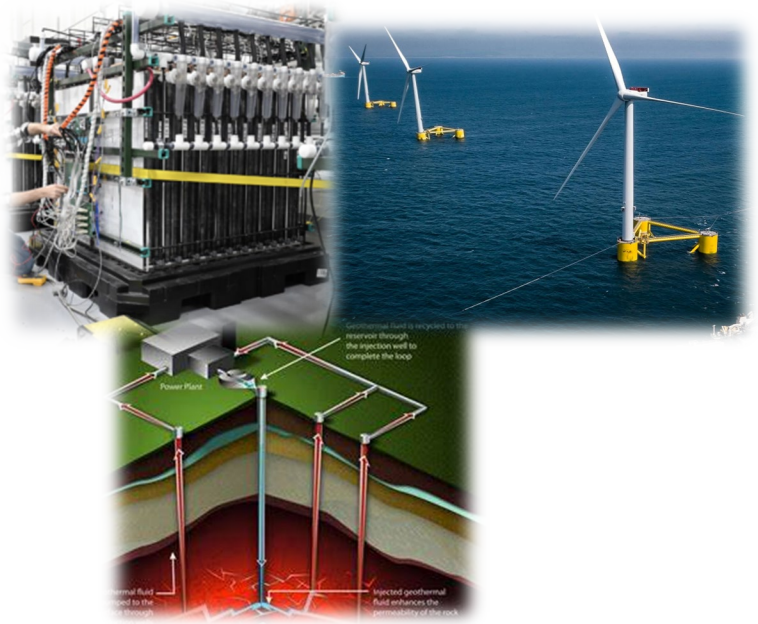
Note: Data shown here includes new resources added to CAISO grid, including imports. "Other" resources includes geothermal, biomass, biogas, and hydropower.

HIGHLIGHT: Central Procurement Function

- AB 1373 (2023) established this function at the Dept. Of Water Resources (DWR) to serve as an optional procurement mechanism to procure large, clean, diverse, long-lead time energy resources in furtherance of our 100% clean electricity by 2045 goal.

- In August 2024, the CPUC triggered this mechanism after reviewing LSE procurement plans relative to our clean electricity goals and identified a "need" for several resources to be procured through DWR managed competitive solicitations on behalf of all LSEs.

"Needed" Energy Resource Type	Quantity	Online by
Geothermal	1 GW	2031-2037
Long Duration Energy Storage (LDES): 12-hour + duration	1 GW	2031-2037
LDES: Multi-day	1 GW	2031-2037
Offshore Wind	7.6 GW	By 2037



- In February 2025, the CPUC released a Procurement Request confirming that DWR should move forward.

- Since then, the CPUC and DWR have been jointly preparing for the launch of the competitive solicitation

HIGHLIGHT: Resource Adequacy Reforms

- **Overview -**
  - Shorter-term (1-3 years) reliability planning program established in the early 2000s.
  - LSEs contract for capacity from generators, imports, and demand response, which then must bid into wholesale power markets (i.e., day-ahead and real-time).
  - Traditionally, each LSE had one system capacity requirement for each month, based on the CAISO-area peak load forecast for that month.
- **2025 Slice of Day Framework -**
  - Each LSE has 24 requirements in each month, based on each hour of the CAISO-area peak day that month.
  - More granular; helps ensure all hours are covered by appropriate energy resources.
  - LSEs are collectively meeting their requirements.

HIGHLIGHT: Electric Transmission Infrastructure Enhancements

General Order (GO) 131-E -

- Sets forth rules for permitting electric transmission facilities, including the lines, substations, and switching stations.
- Implements several bills passed over last several years (e.g., AB 2292 (2024), AB 1373 (2023) and SB 529 (2022))
- Updates expected to accelerate transmission permitting by modernizing rules, shifting environmental review earlier in the process, and reducing permitting requirements for smaller projects (including upgrades and expansions of existing infrastructure)

Other Activities -

- Developing an Electric Transmission Developer Guidebook, exploring alternative financing and advancing cost-effective Grid Enhancing Technologies

HIGHLIGHT: Transmission Planning Process (TPP)

- The CAISO leads the TPP for its balancing area, coordinated with load forecasts from the CEC and energy resource planning and procurement from the CPUC and other local regulatory authorities

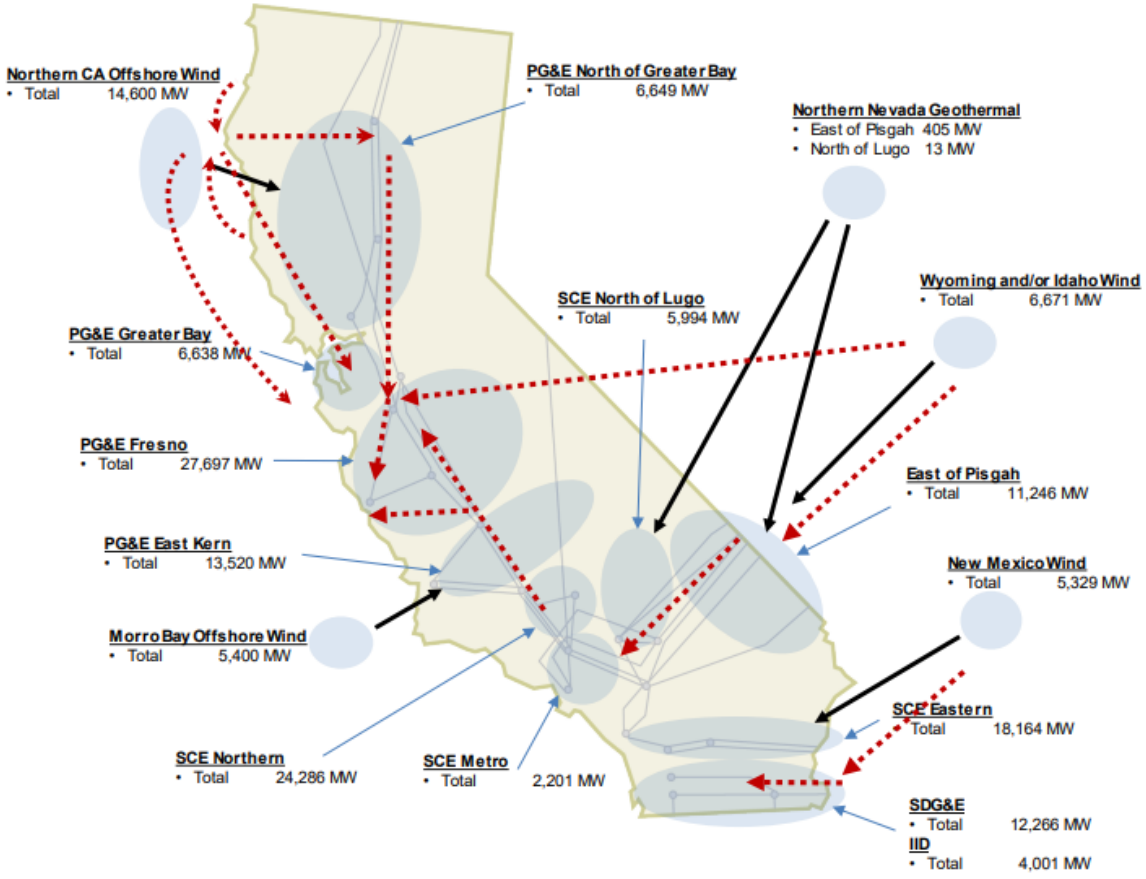
- 20 Year Outlook assesses longer term needs
  - First prepared in 2022, updated in 2024
  - Establishes a longer term view of transmission needs
  - Provides context for nearer term decisions

- Annual 10-Year transmission plan is the formal approval document for expansion planning in our footprint
  - Ramped from 10-year average of $650 million per year to $3 billion in 2021-2022 plan, $7.3 billion in 2022-2023 plan and $6.1 billion in 2023-2024 plan
  - Responded to accelerating load growth and escalating renewable energy needs
  - Identifies most efficient and effective transmission solutions – including Grid Enhancing Technologies and non-wires solutions

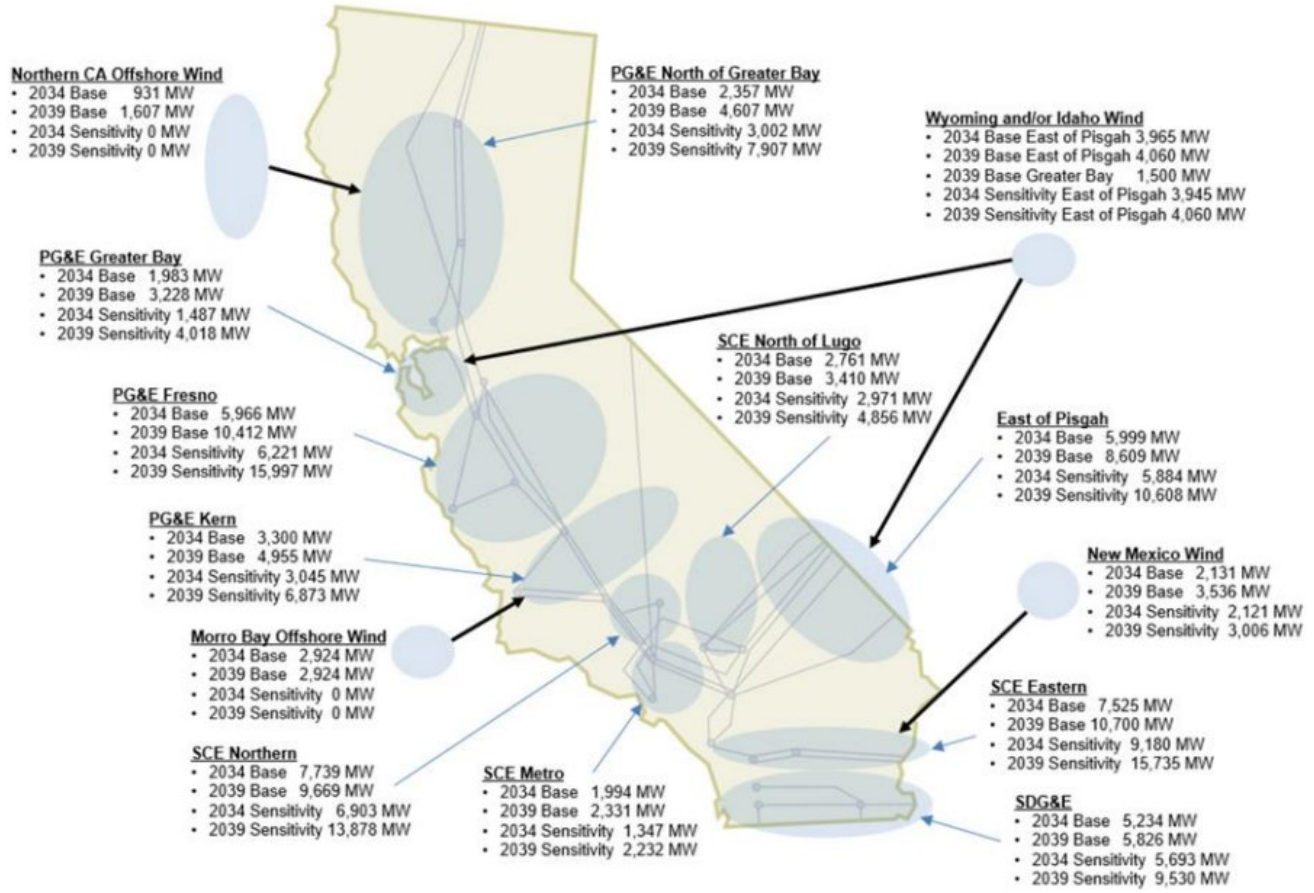
- FERC Order No. 1920 will require changes and add new considerations to regional transmission planning

HIGHLIGHT: Annual Transmisson Plan & 20-Year Transmission Outlook

Both are designed to ensure California has sufficient transmission infrastructure to reliably meet policy goals and demand growth



CAISO 20-year Transmission Outlook - 2024



CAISO Draft 2024-2025 Transmission Plan

HIGHLIGHT: Inter-Regional Transmission Opportunities

- Consistent with the state's integrated resource planning, the CAISO is working with utilities and independent developers to advance innovative transmission opportunities throughout the West
- Transmission development increases access to renewable resources and fortifies the western electric grid
- Permitting and siting support for transmission projects remains an ongoing challenge

HIGHLIGHT: Energy Resource Grid Interconnection Reform

- The CAISO has implemented transformational changes to its energy resource grid interconnection process
- The CAISO received record-breaking volumes of grid interconnection requests in 2022-2023, and worked with stakeholders to design major reforms to unclog the queue and move viable projects forward
- FERC fully approved these reforms in September 2024
- Within months, the CAISO saw a 67% reduction in the number of interconnection requests moving through the application process to the grid impact study process
- These reforms support efficient onboarding of NEW energy resources
- Focus remains on ensuring projects come online as scheduled

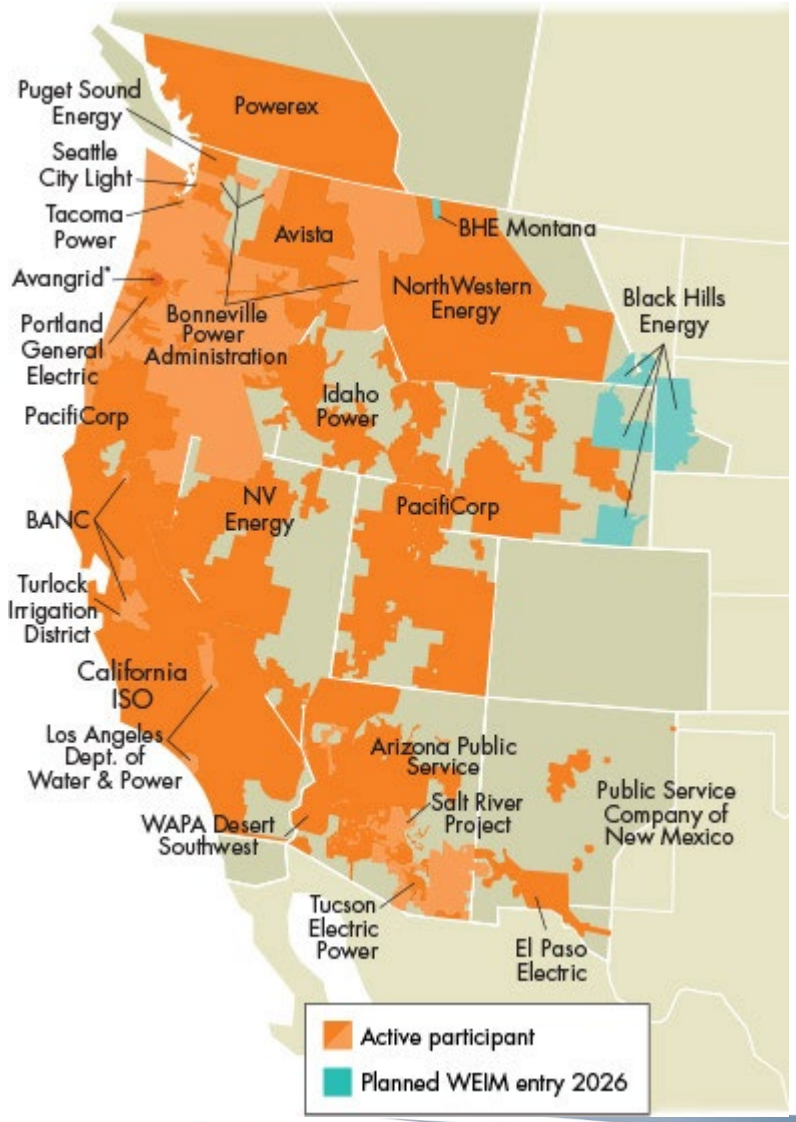
HIGHLIGHT: Western Energy Imbalance Market (WEIM)

- Delivers economic, reliability and environmental benefits
- A voluntary market that provides a sub-hourly economic dispatch of resources for balancing supply and demand every five minutes
- Allows utilities to efficiently manage power imbalances between generation and load, honoring transmission and reliability constraints
- Benefits accrue to all participating utilities and provide cost reductions for retail customers
- As of Q1 2025, the cumulative economic savings for the WEIM participants has increased to $6.99 billion

Eleven Western states

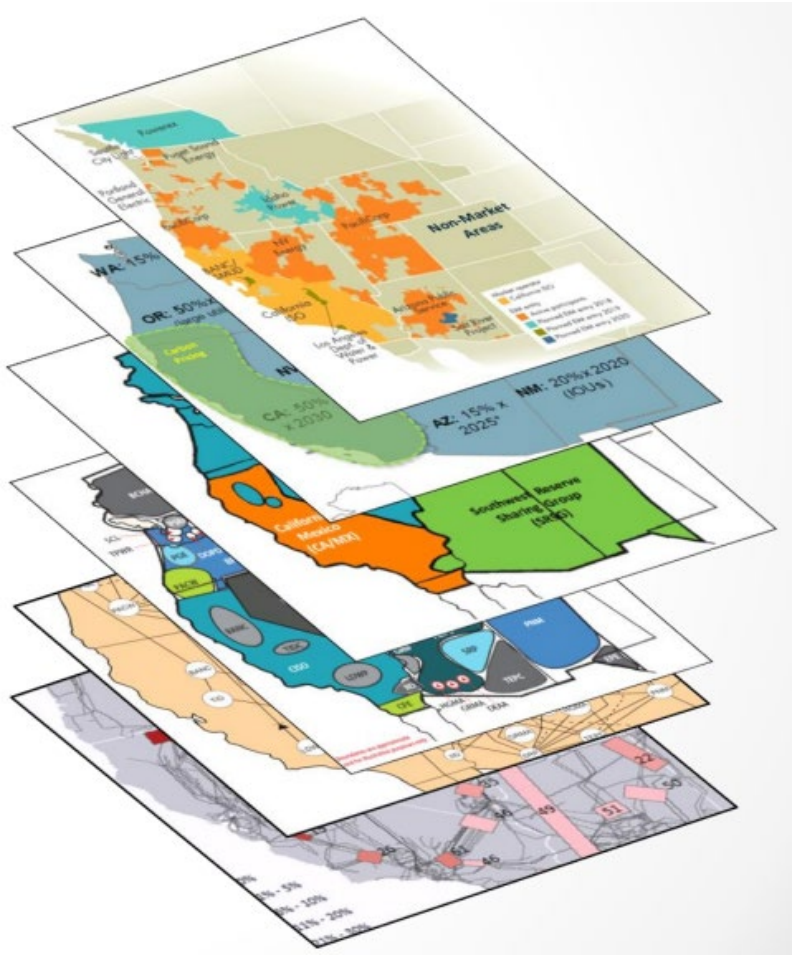
80% of demand in the West

$6.99 billion in benefits since 2014



HIGHLIGHT: Extended Day Ahead Market (EDAM)

- Extending the day ahead market across the West allows for optimized commitment of energy resources in the day ahead timeframe
- Builds on the WEIM, providing additional economic, reliability, and environmental benefits
- Balancing areas continue to retain key responsibilities: resource planning, transmission planning and reliability operation functions
- Approved by FERC December 2023; go-live scheduled for spring 2026



Thank You!

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