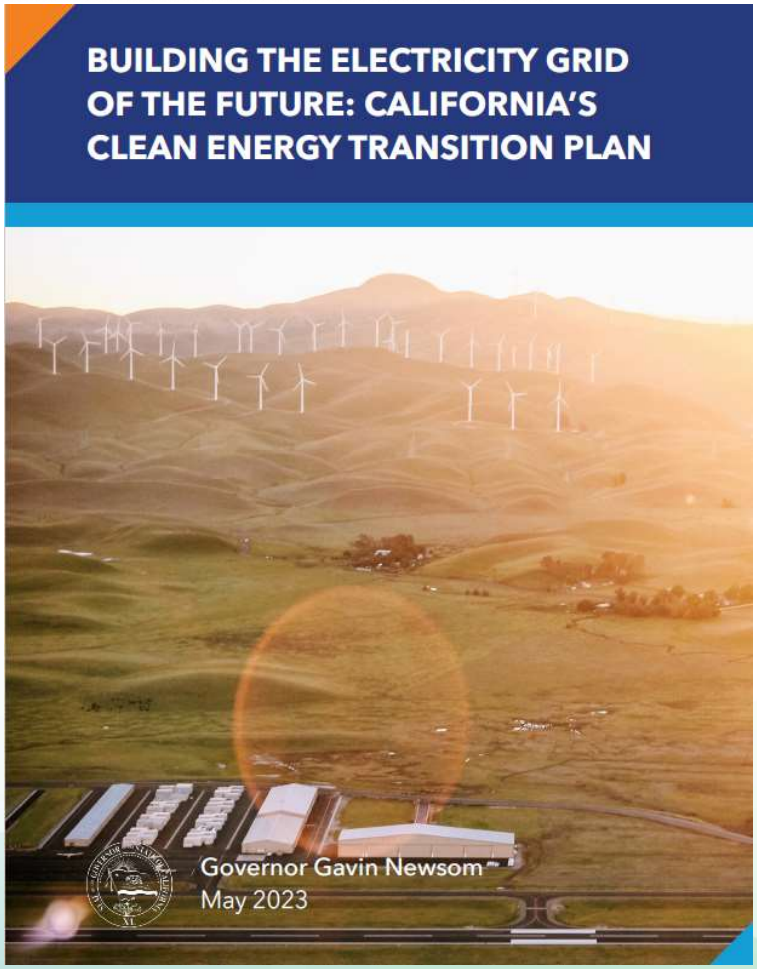
Summer 2023 Grid Reliability - Update

August 29, 2023

Transitioning to California's Clean Energy Future

- Electrifying our economy and decarbonizing the grid are cornerstones in California climate change leadership.
- California has long led the clean energy transition with 59% of the state's electric retail sales generated by renewable and zero-carbon resources in 2021.
- California has ambitious clean energy goals - 90% clean electricity sales by 2035, 95% by 2040 and 100% by 2045.
- Climate change is also causing unprecedented stress on our grid. Extreme heat, drought, flood and wildfire are increasing in frequency and intensity threaten reliability.
- The grid of the future is one that is clean, safe, affordable and reliable. It is not a question if, but how we transition to our clean energy future.



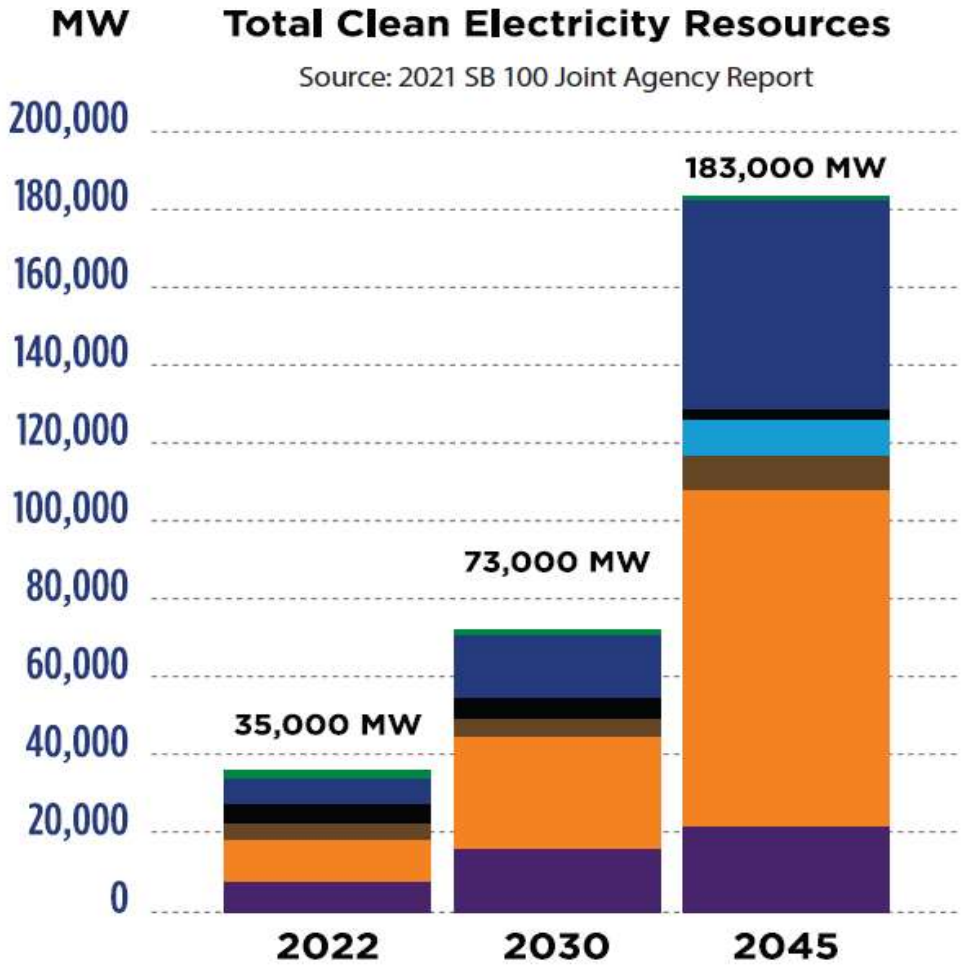
To provide 100% clean electricity by 2045,

California will build an unprecedented amount of new utility-scale clean energy resources

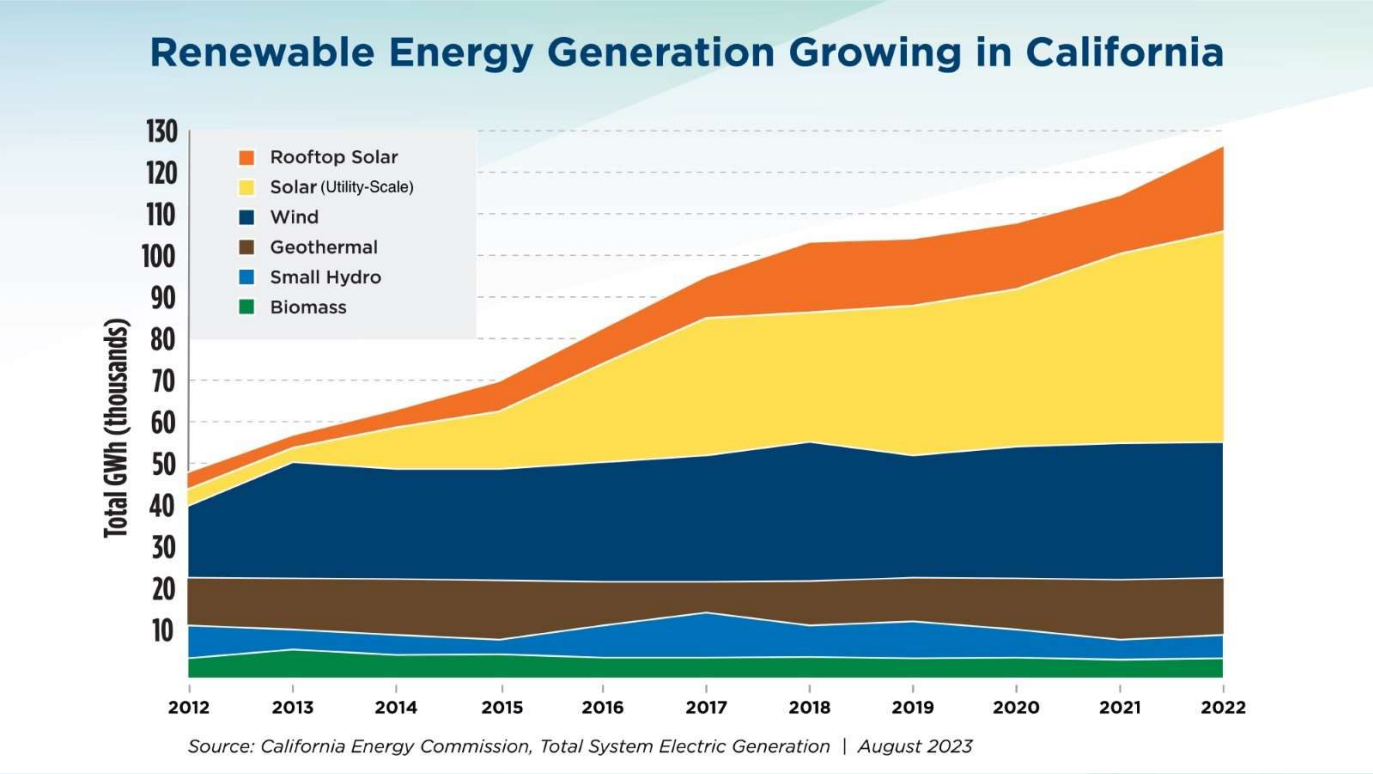
Totals represent new and existing resources. The 2021 SB 100 Joint Agency Report projects the need for 148,000 MW of new resources by 2045.

In addition, California also expects new capacity from energy efficiency, customer solar and demand response.

- Biomass
- Battery Storage
- Geothermal
- Offshore Wind
- Long Duration Energy Storage
- Utility-Scale Solar
- Wind

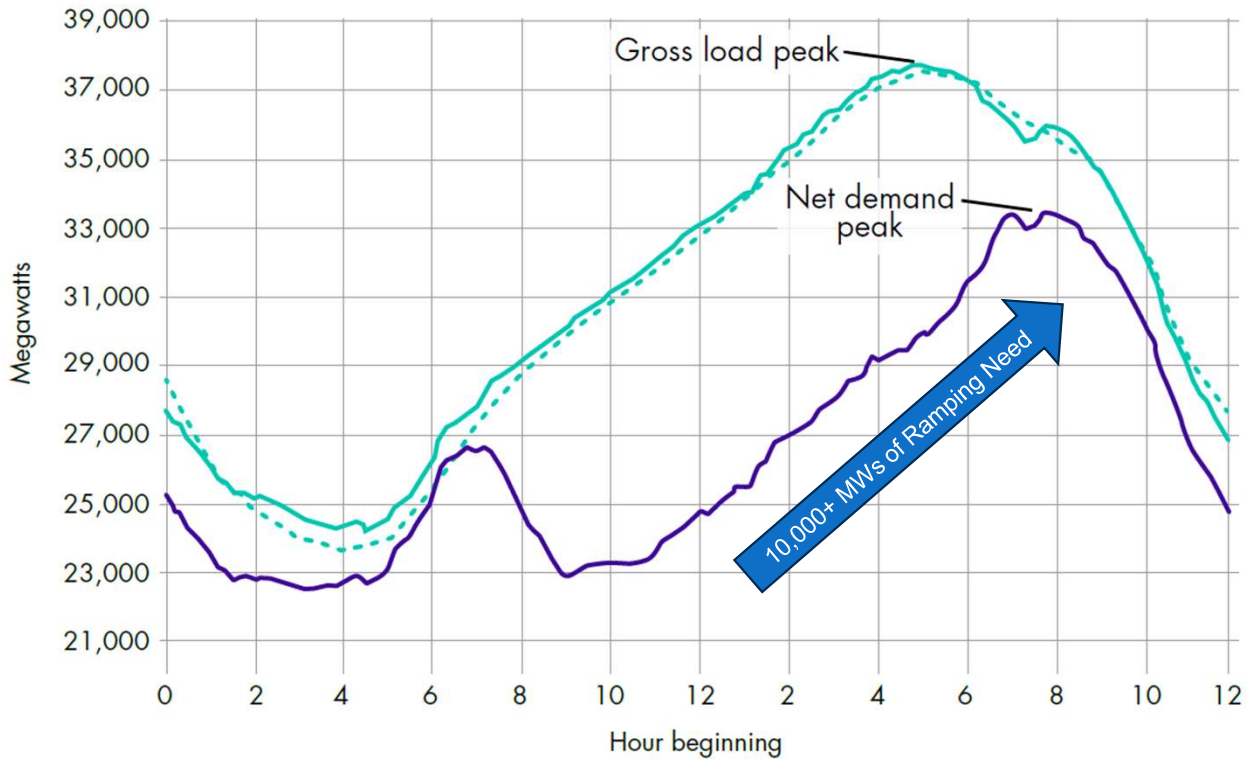


Clean Energy Progress



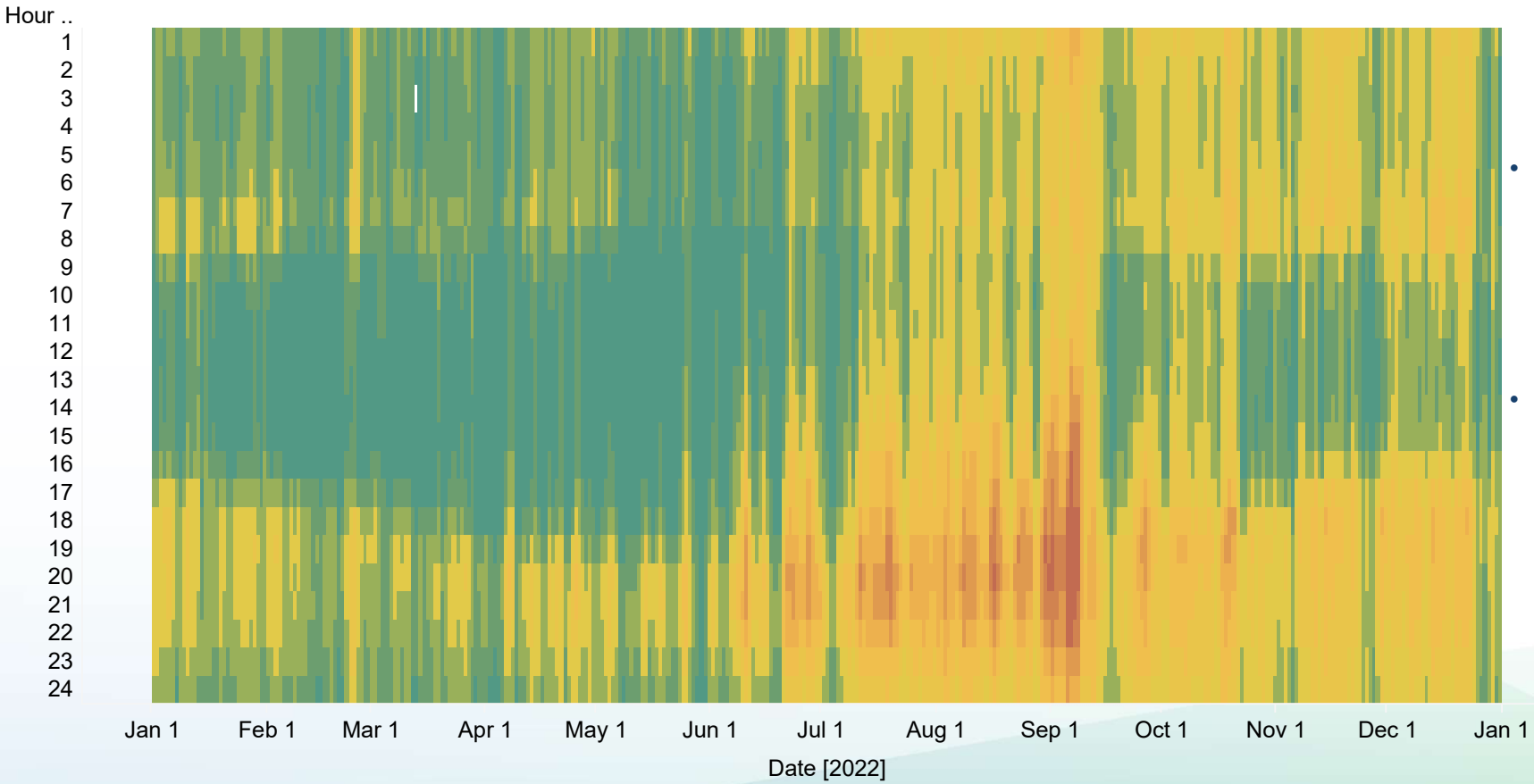
- In 2021 electric generation was 59% zero carbon
- Bulk Grid Storage grew from 200 MWs in 2019 to 5,600 MWs at the start of July 2023
- Over the last decade:
  - Solar generation surged 20x
  - Wind generation expanded by 63%
  - Natural Gas usage declined by 20%

Supporting Net Demand w/Ramping Resources



While the gross load peak on a typical day occurs in the late afternoon, the early evening net load peak is becoming increasingly critical during hot weather, as solar production ends and demand remains high.

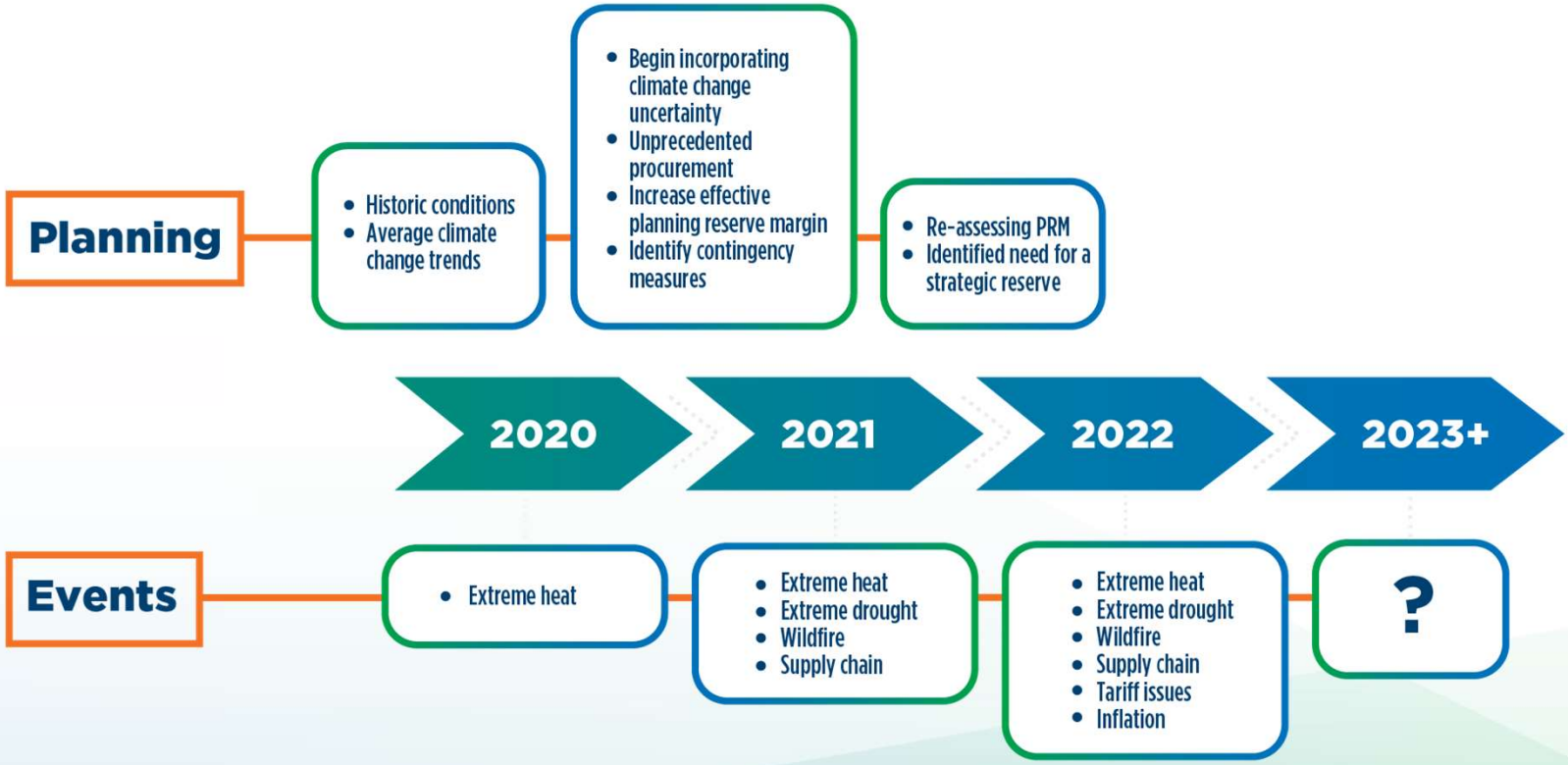
Heat Map of Gas Generation



- **Natural gas generation still needed during peak-demand hours and months to maintain grid reliability.**
- **Load flexibility and deployment of diverse clean energy resources will help reduce reliance on natural gas generation over time.**

Source: California ISO Generation & Curtailment, 2022

Compounding Grid Reliability Risks



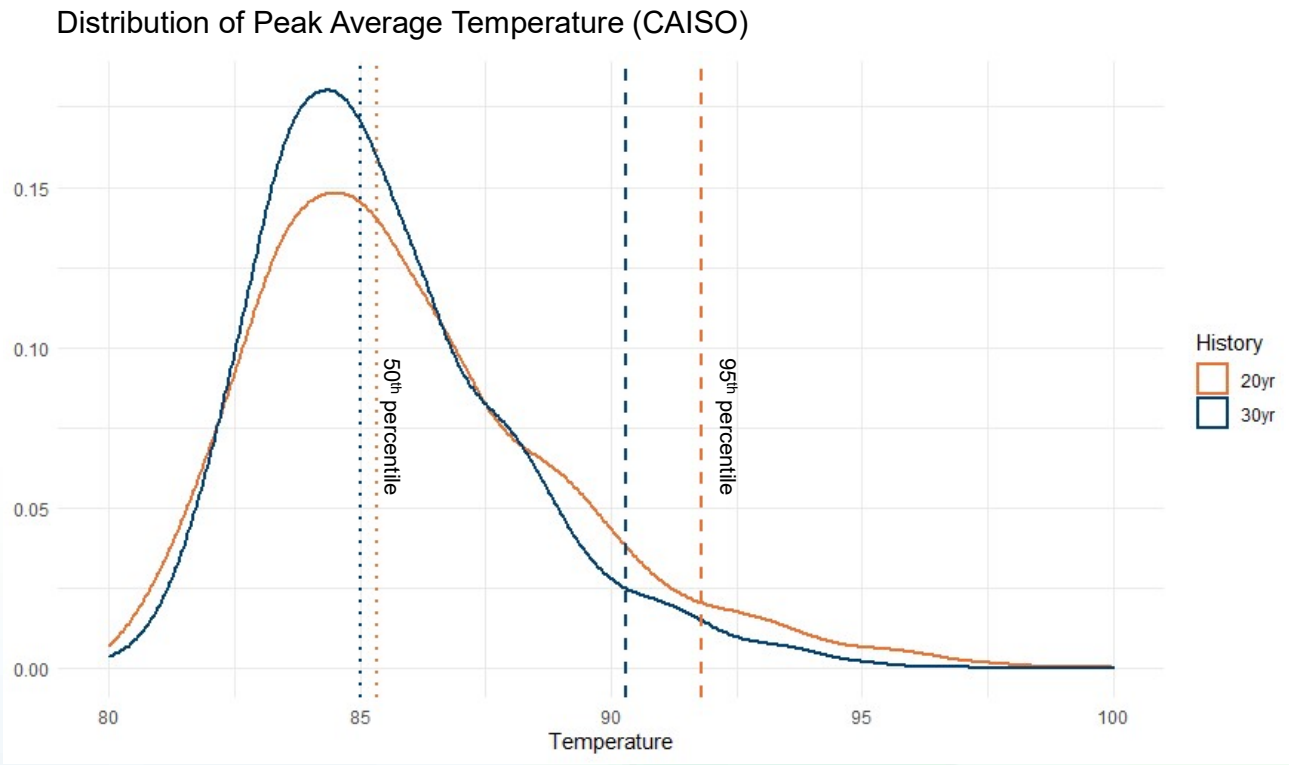
Actions - Grid Reliability & Clean Energy Transition

- **Improving Grid Planning Processes**
  - Improvements to forecasting for climate change-induced weather variability and electrification
  - Ordering sufficient and diverse procurement
  - Improve Resource Adequacy process
- **Scaling Supply & Demand-Side Clean Energy Resources**
  - Track procurement
  - Improve interconnection & permitting process
  - SB 846 requirements, including demand flexibility goal and Clean Energy Reliability Investment Plan
- **Preparing for Extreme Events (Contingencies)**
  - Retain existing and construct new assets & procure imports to backstop uncertainties
  - Create emergency demand flexibility opportunities

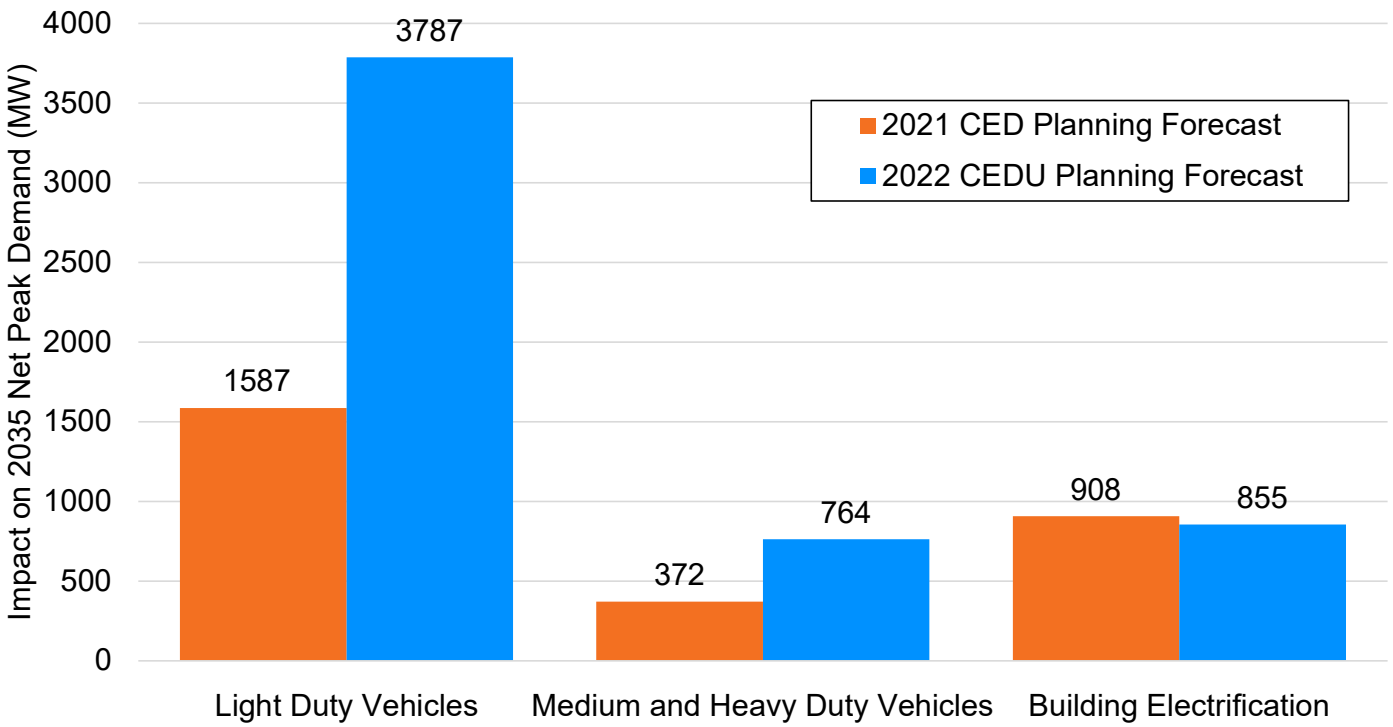
Grid Planning Processes - *Highlights*

Incorporating Extreme Events into Planning

- Recent years are characterized by generally higher temperatures
- Truncating the historical record has a greater impact on extremes than on median values
- Staff found the September 6, 2022, temperature to be a 1-in-14 event **based on a 20- year weather history vs 1-in-27 based on 30 years**

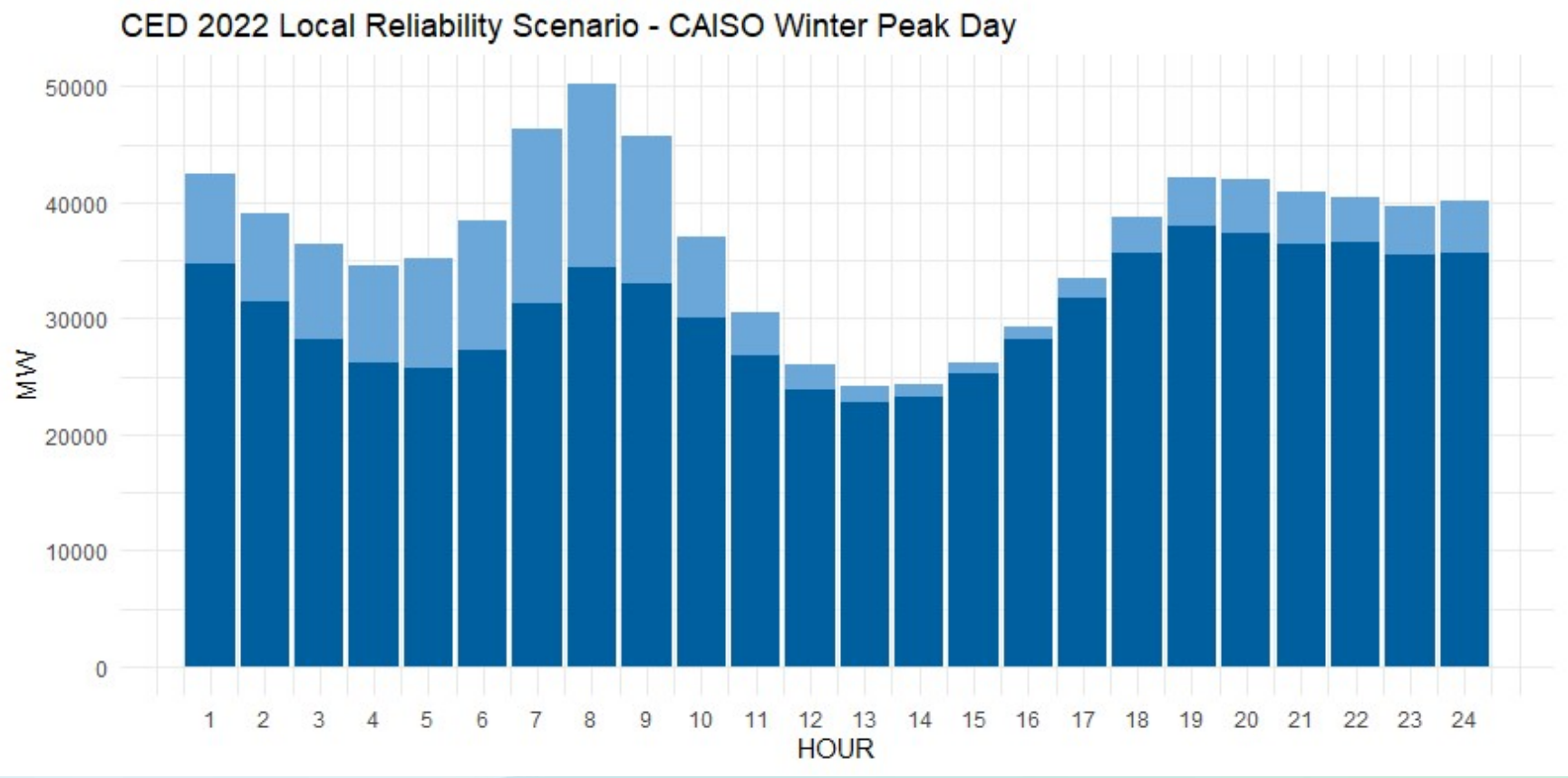


Scenario – 2035 Electrification Impact on Summer Peak Hour



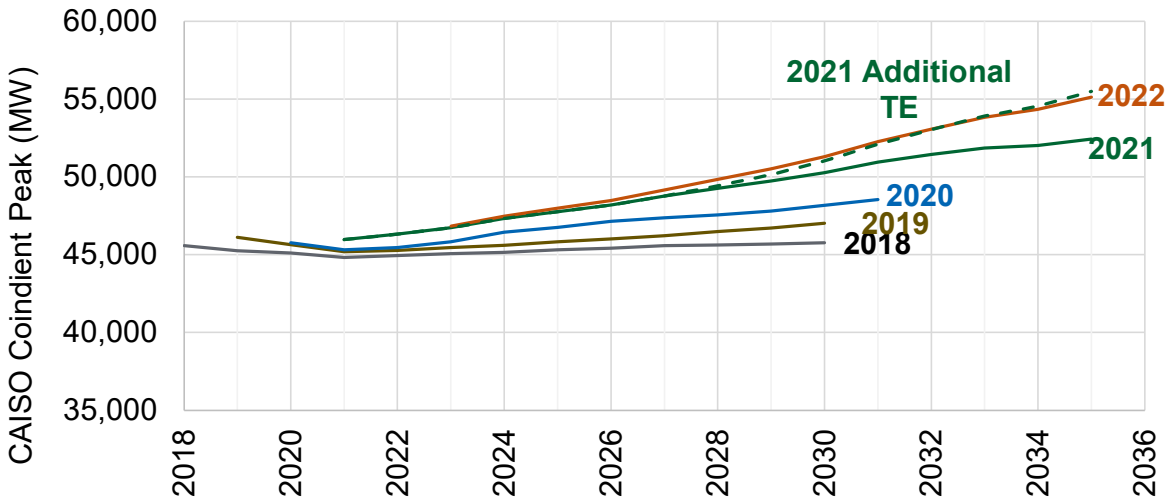
- Peak occurs in hour 19
- CARB's regulations for Advanced Clean Fleets 2 and Advanced Clean Fleets were added to the 2022 Forecast

Scenario – 2035 Electrification Impact on Winter Morning Peak



Changes to Forecasted Peak Demand

Planning Forecast Peak Demand for the 2018-2022



Changes are due to:

- Changes to peak normalization process to better reflect climate change
- Transportation electrification policies
- Economic, demographic, and rate projections as well as other baseline model updates

Scaling Supply and Demand - *Highlights*

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**								

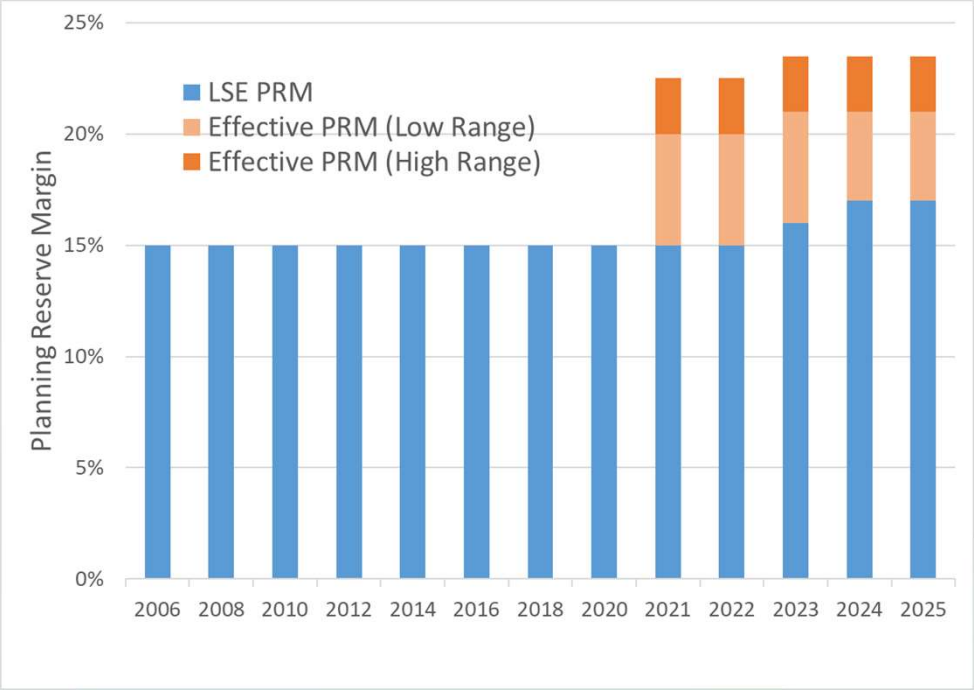
**Megawatts (MW) reflect Net Qualifying Capacity (NQC) which is the capacity of a resource available to serve around system peak load time and used for resource adequacy*

*** In 2028, the orders require 2,000 MW of long-lead time resources.*

Resource Adequacy (RA) Program

- RA program requires all load-serving entities (LSEs) to procure sufficient system, flexible and local capacity to meet peak demand.
- System RA requirements establish a Planning Reserve Margin (PRM) to ensure reliability, above the load forecast.
- CPUC has ordered PRM increases recently to handle changes in grid conditions:
  - 2006-2022 **15 percent PRM**
  - 2023 **16 percent PRM**
  - 2024 and 2025 **17 percent PRM**
- CPUC targets an even higher *effective* PRM:
  - 2021 – 2022 **20 - 22.5 percent effective PRM**
  - 2023 **21 - 23.5 percent effective PRM**
  - 2024 - 2025 **21.5 - 23.5 percent effective PRM**

Changes in Planning Reserve and Effective PRM



Expected - New Clean Energy Resources

Total September Megawatts (MW) Under Contract

Resource Type	2023	2024	2025	2026	Total
Solar	147	57	25	2	**231**
Battery Storage	1,931	3,822	834	208	**6,795**
Paired/Hybrid	1,020	1,304	393	87	**2,804**
Wind	14	0	17	29	**60**
Geothermal	21	60	75	61	**217**
Biomass/Biogas	123	0	0	0	**123**
Totals	**3,192**	**5,243**	**1,344**	**387**	**10,230**

Chart reflects MWs under contract to CPUC-jurisdictional load serving entities; and MWs shown in terms of net qualifying capacity (NQC), which is the capacity of a resource available to serve around system peak load time and used for resource adequacy

Data Vintage: April 2023; Source: resource-tracking-data-may-2023-release.pdf (ca.gov)

- Contracting is underway to meet procurement orders.
- Majority of new resource MWs are battery storage.
- Long lead time resources – including long duration storage and "clean, firm" energy – are ordered to be online by 2028.

New Clean Energy Resource – Tracking Development

- **Between January 2020 and July 2023, over 5,000+ megawatts (NQC) of new clean energy resources have come online to serve load.**
  - This translates to over 10,000 MW nameplate in new resources.

- **For 2023, load serving entities report that 3,000 MWs (NQC) will be brought online.**

- **To support this pace of procurement, GO-Biz, CPUC, CAISO and CEC are coordinating on the Tracking Energy Development (TED) Task Force that assists with permitting, interconnection, or supply chain issues raised by developers.**
  - TED Task Force members meet with project developers, utilities, and local agencies to ensure that communication is occurring to reduce project delays.
  - TED Task Force members participate in bi-weekly CPUC interconnection tracking calls with the utilities.

Preparing for Extreme Events - *Highlights*

Long Term Need for Contingencies

	Projected September Need for Contingencies					
	2025 MW Projection	2026 MW Projection	2027 MW Projection	2028 MW Projection	2029 MW Projection	2030 MW Projection
Planning Standards	**No Shortfalls Projected**					
2020 Equivalent Event	Up to 1,000	Up to 500	Up to 1,000	Up to 700	Up to 600	Up to 1,500
2022 Equivalent Event	Up to 2,600	Up to 2,000	Up to 2,500	Up to 2,000	Up to 2,000	Up to 3,000

Does not include catastrophic coincident fire event

Source: Diablo Canyon Power Plant Extension – CEC Analysis of Need to Support Reliability, March 2023

Summary of Contingencies

Type	Contingency Resource
Strategic Reliability Reserve (AB 205)	DWR ESSRRP (Long start, short start, imports)
	Demand Side Grid Support
	Distribute Energy Backup Assets (under development)
CPUC Ratepayer Programs	Ratepayer Programs (ELRP, Smart Thermostats, etc.)
	Capacity at Co-gen or Gas Units Above Resource Adequacy
Non-Program	Balancing Authority Emergency Transfers
	DWR State Water Project
	Thermal Resources Beyond Limits: Gen Limits
	Thermal Resources Beyond Limits: Gen Limits Needing 202c

Strategic Reliability Reserve – DSGS & DEBA

	Demand Side Grid Support (DSGS)	Distributed Electricity Backup Assets (DEBA)
Funding	$295 Million (Over 5 Years)	$595 Million (Over 5 Years)
Incentivized Activities	Use of load reduction resources during extreme events	Purchase of cleaner and more efficient distributed energy assets that would serve as on-call emergency supply or load reduction
Eligibility	Statewide	Statewide
Program Status	Launched Aug 2022 Now accepting applications and incorporation lessons learns	Launching Oct 2023

Strategy Reliability Reserve – ESSRRP

Electricity Supply Strategic Reliability Reserve Program

	2022	2023	2024
Emergency & temporary natural gas resources[1]	120.0 MW	Up to 291.0 MW	291.0 MW
Once-through cooling natural gas resources for extreme events	0 MW	0 MW	2,859.3 MW
Firm energy import contracts[2]	3,349 MW *(47% low- or GHG-free)*	*Forthcoming*	--
Temporary diesel generators[3]	82.4 MW	0	0

[1]Includes low emitting resources in 2023 based on similar technology that has achieved California Air Resources Board's Distributed Generation certification. https://ww2.arb.ca.gov/our-work/programs/dgcert

[2]Authorization for firm energy imports up to October 31, 2023.

[3]AB 205 (2022) only authorized diesel generator procurement until July 31, 2023. DWR closed this program early in favor of lower emission resources.

Summer Grid Reliability – 2023

CEC Summer Stack Analysis - Results

Overall improved outlook for summer 2023 under all scenarios due to increased storage.

- Improved hydro is largely offset by increased pumping loads

Grid remains vulnerable to high loads and availability of imports during widespread heat events, especially in late summer

Hours of most vulnerability are declining and continue to shift to hours after sunset

Total contingencies for summer ~2,000 MW

	Projected September Surplus or Need for Contingencies	
	2022 Projection	2023 Projection
Planning Standards	-1,700	2,200
2020 Equivalent Event	-3,000	-400
2022 Equivalent Event	-7,000	-2,000

Green is surplus, Red is shortfall

Shortfalls do not include coincident catastrophic fire risk

August 2023 Capacity Procurement Mechanism

- The Capacity Procurement Mechanism (CPM) allows the CAISO to procure additional capacity to meet specific needs, including collective deficiencies in resource adequacy (RA) showings
- The CAISO issued CPM designations for August to cure a 186 MW month-ahead system RA deficiency
  - Load-serving entities collectively did not show sufficient RA capacity to the CAISO for the month of August
- The CAISO cured the deficiency by issuing CPM designations to six resources before the start of the month

Grid Conditions Summar 2022 vs 2023

	Sept. 6, 2022	July 20, 2023
RC West	130,986 MW	123,199 MW
WECC	167,499 MW	160,468 MW
CAISO	52,061 MW	42,275 MW

- **September 2022:**
  - Record peak demand on September 6, and record temperatures
  - Severe drought and below average hydro conditions

- **Summer 2023:**
  - Strong hydro-electric year in California, while the Northwest hydro year was not as robust
  - Prolonged, record heat in the desert southwest
  - WECC demand on July 20 was 96% of last year's record

July 2023 - Events

ISO issued energy emergency alerts (EEAs) in July on three days:

Date	Alert	Timeframe	Definition
July 20	EEA1	7:30—8:30pm	All resources in use or committed for use, and energy deficiencies are expected.
July 25	EEA Watch	7:26—10:00pm	All available resources committed or forecasted to be in use, and energy deficiencies are expected.
July 26	EEA Watch	6:00—10:00pm	

- July 20 – Rapid changes in ISO supply and in the West during steep solar ramp down required immediate repositioning of resources and rebalancing among neighboring areas
- July 25 - Similar conditions as 7/20; system congestion limited the ability to move power to the south
- July 26 - Based on prior events and projection of similar conditions, CAISO issued an EEA Watch

July 2023 – Lessons Learned

- As the July events unfolded, the CAISO took several measures to ensure stability of the grid:
  - Added margins to address uncertainties and help position resources in advance of the critical solar ramp down
  - Limit reliance on projected energy transfers into California to position state resources in advance
  - Steps to ensure exports are scheduled at a level that can be reliably supported
  - Coordination with neighboring balancing areas

Key Takeaways

- California is increasingly powering its economy with clean energy resources BUT we face challenges with scaling up clean energy resources, while retiring fossil fueled resources and maintaining grid reliability during climate induced extreme events.

- However, California has new investments, tools and mechanisms in place that is enabling a comprehensive, focused and multi-pronged electric supply and demand approach to ensure grid reliability during peak-demand summer months.

- We need to SUSTAIN our existing efforts, while considering new policy and investment approaches, constructs and options that place the state in a position to proactively address our challenges now and going forward.

Questions?