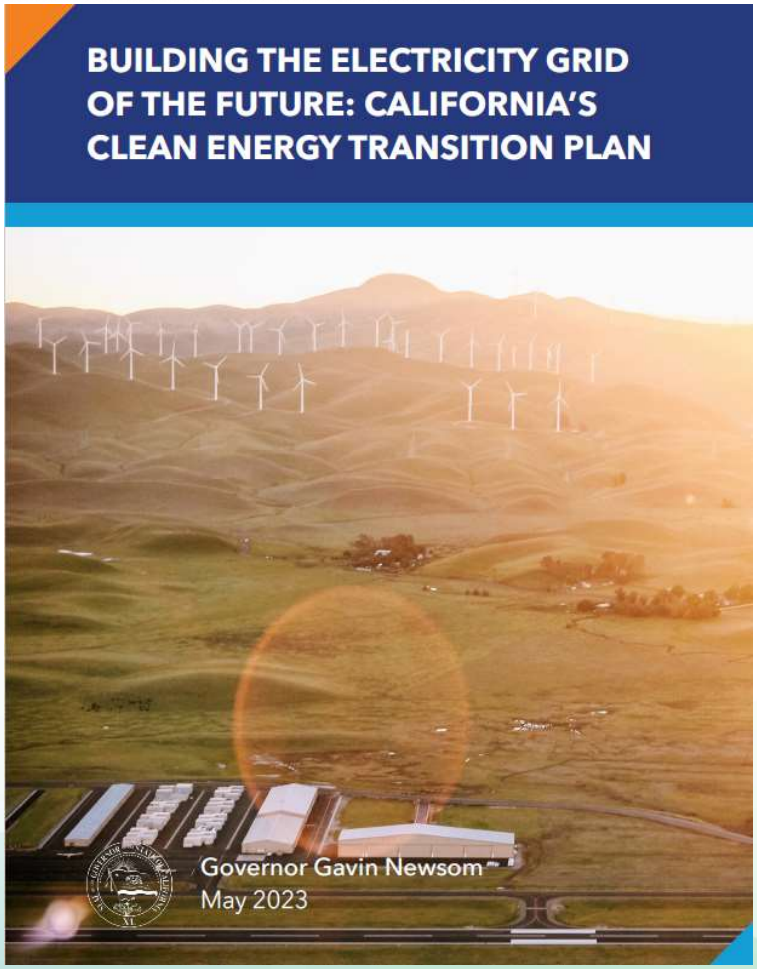
2024 Summer Grid Reliability

Senate Energy, Utilities and Communications Committee - Oversight Hearing

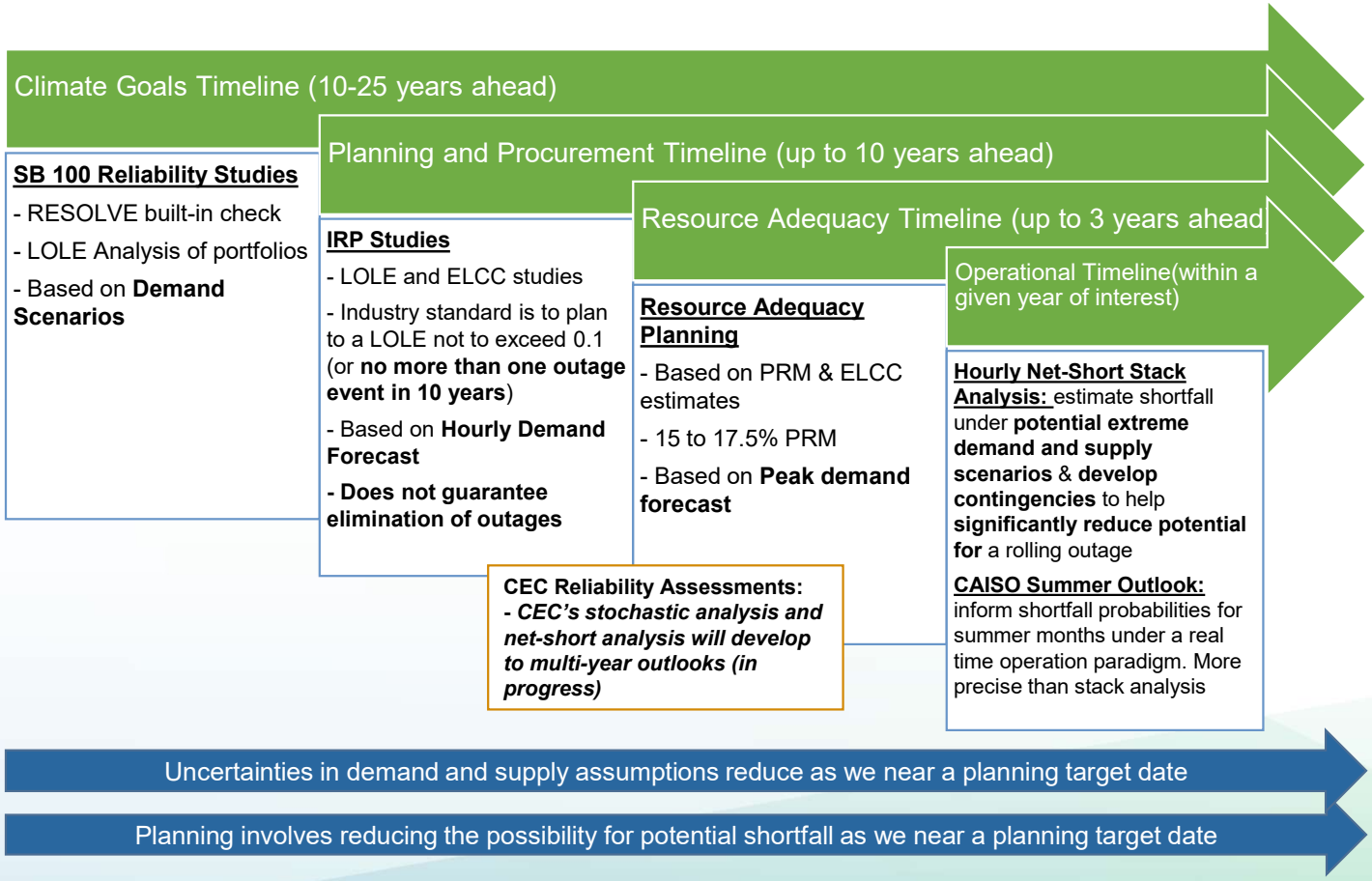
August 6, 2024

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 61% of the state's electric retail sales generated by renewable and zero-carbon resources in 2022.
- 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, and 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.



Electric System Planning – *Layered Planning Horizons*



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Toplines for 2024

- **2024 summer reliability analysis shows an improved outlook compared to recent years**
  - No supply shortfalls expected under standard planning conditions
  - No supply shortfalls expected under extreme conditions, such as those experienced in 2022 and 2020

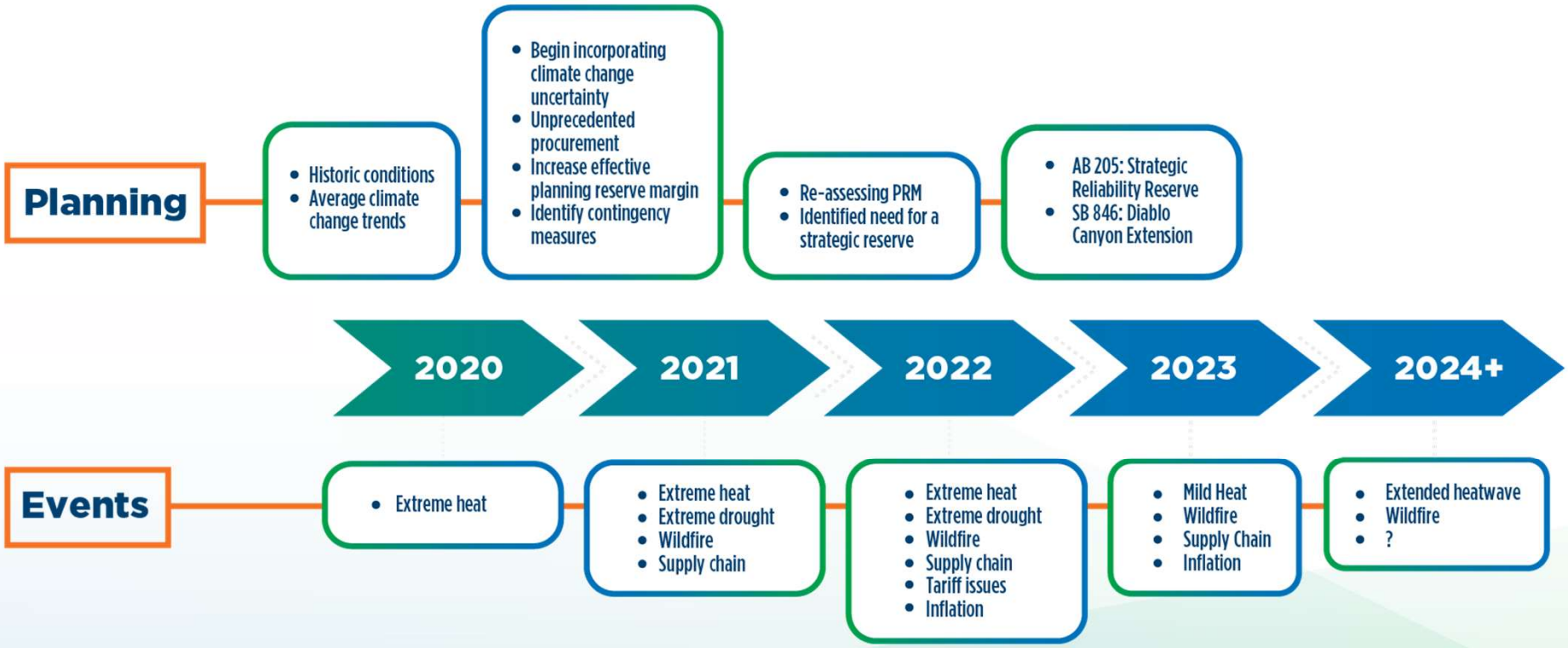
- **Long lasting west-wide extreme conditions, coincidental or sudden onset events could still create tight supply availability conditions on the grid**

- **Once-Through Cooling (OTCs) generators are now part of state's Strategic Reliability Reserve (SRR), bolstering contingency capacity by 2,859 MWs**
  - Other contingency resources in addition to the OTC resources, provide up to 4,300 MWs of contingency resources to meet demand during extreme events

- **Additional clean contingency resources will likely be needed in the SRR to replace the OTC generators and support long-term grid needs under extreme conditions**

Past Four Years (2020-24)

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
  - SB 846 (2022) requirements, including demand flexibility goal

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

Procurement Ordered By CPUC

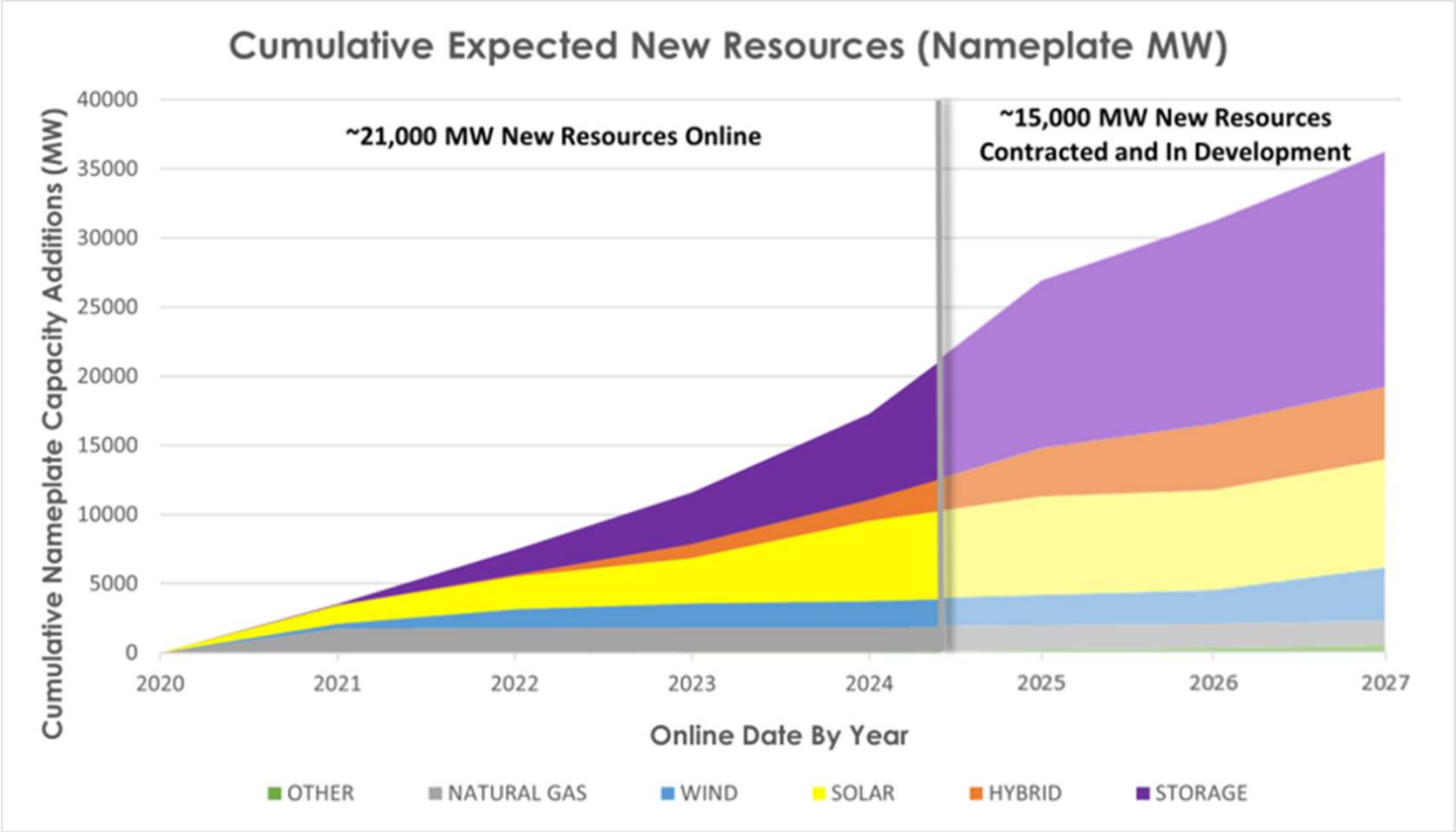
In Megawatts* (MW) By Year

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.*

Total New Energy Resources Online and Under Contract



- Over 21,000 MW of new resources came online between 2020 and 2024 to date
- By 2028, 36,000 MW of new resource additions expected online
- Annual new resources installed nearly **DOUBLED** in the last four years.
- Most of the new resources were solar PV and battery storage.

Central Procurement Function (CPF)

- AB 1373 (Garcia, 2023) enables the CPUC to request that the Department of Water Resources (DWR) conduct centralized procurement of certain eligible diverse, long lead-time (LLT, clean energy resources, on behalf of all load-serving entity customers.
- The CPUC released a Proposed Decision in July 2024, making a determination that the CPF should be activated to procure the following energy resource needs:

Resource Type	Maximum Quantity	Solicitations Beginning	Online by
Enhanced Geothermal Systems (EGS)	1 GW	2026	2031-2037
Long Duration Energy Storage (LDES): 12-hour + duration	1 GW	2026	2031-2037
LDES: Multi-day	1 GW	2027	2031-2037
Offshore Wind	7.6 GW	2027	2035-2037

Transmission Planning & Resource Interconnection

- In close coordination with state agency , the CAISO has developed transformative changes to transmission planning and interconnection queueing for energy resources to support state clean energy goals including:
  - A new approach to transmission planning, such as identifying zones that make the most economic and operational sense for new energy resource development.
  - Publishing an updated 20-year transmission outlook, which sets the stage for tranmission infrastructure planning out to 2045.
  - Significant reforms to CAISO's interconnection queueing processes to bring new energy resources into service as soon as possible:
    - New scoring criteria to prioritize and advance the most "ready" projects
    - More stringent viability criteria for projects in the queue, to ensure continued progress toward commercial operation

Summer 2024 Grid Outlook

2024 Q1-Q2 New Energy Resources Recap – *Nameplate Capacity*

- **Expected 2024 Q1-Q2 Resource Additions:**
  - Based on Q1 report projections: 4,177 MW (Total between Jan - Jun)
- **Q3 2024 update:**
  - 3,701 MW installed by 6/30/2024, currently equivalent to 2,007 MW NQC in September
  - 11% percent delay compared to January projections

2024 Monthly Progress Report - Cumulative* (MW)

Resource Type	Jan	Feb	Mar	Apr	May	Jun
Solar	0	190	640	785	1127	1127
Battery	40	792	952	2156	2423	3003
Hydro	0	0	0	0	0	0
Wind	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0
Natural Gas	48	48	48	48	48	48
Others	0	0	0	0	0	0
Total (Expected)	88	1030	1640	2989	3598	4177
Installed	**127**	**357**	**1,206**	**2,248**	**3,245**	**3,701**
Installed - Expected	**39**	**-673**	**-434**	**-741**	**-353**	**-476**
% Delay	**44%**	**-65%**	**-26%**	**-25%**	**-10%**	**-11%**

2024 Q3 Expected New Energy Resources – *Nameplate Capacity*

- **Expected 2024 New Resource Additions:**
  - Increased from 7.5 GW to 10.2 GW
- **Remaining 2024 Resource Additions:**
  - 6,686 MW (Total)
  - 2,064 MW (Expected before September)

2024 Monthly Expected Report - Cumulative* (MW)

Resource Type	Jul	Aug	Sep	Oct	Nov	Dec
Solar	752	874	1,177	1,290	1,815	2,672
Battery	709	1,106	2,027	2,346	2,577	3,745
Hydro	0	0	0	0	6	6
Wind	0	30	54	54	54	134
Geothermal	0	0	13	13	13	13
Natural Gas	48	53	53	53	53	108
Others	2	2	2	5	5	8
Total (Expected)	**1,511**	**2,064**	**3,326**	**3,761**	**4,523**	**6,686**

Comparison with Last Report (Q3)

September Forecast	Summer 2024	Summer 2024	Changes
	2024 Q1 Report*	2024 Q2/Q3 Report**	2024 Q1 & Q2/Q3 Reports
Potential Surplus/Shortfall Before Contingencies Are Needed (Resources – Demand)			
Standard Planning Event	4000 MW	4765 MW	+765 MW
2020 Equivalent Extreme Event	1500 MW	2253 MW	+753 MW
2022 Equivalent Extreme Event	-90 MW	655 MW	+745 MW

*data collected 1/1/2024
**data collected 6/21/2024

Strategic Reliability Reserve

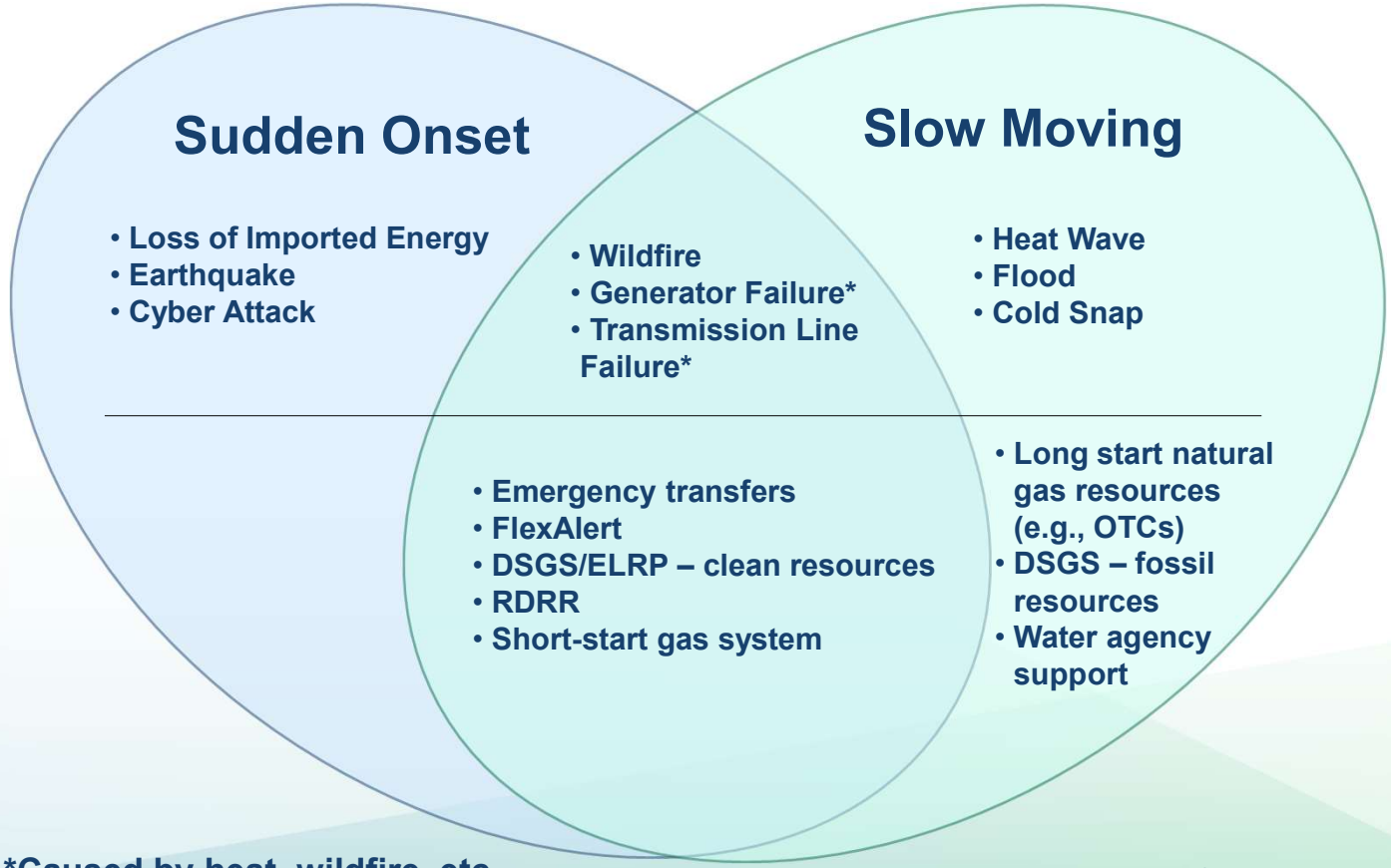
Types of Grid Emergencies & Support Resources

Extreme Events

- Can be singular or coincidental, but most are driven by climate change

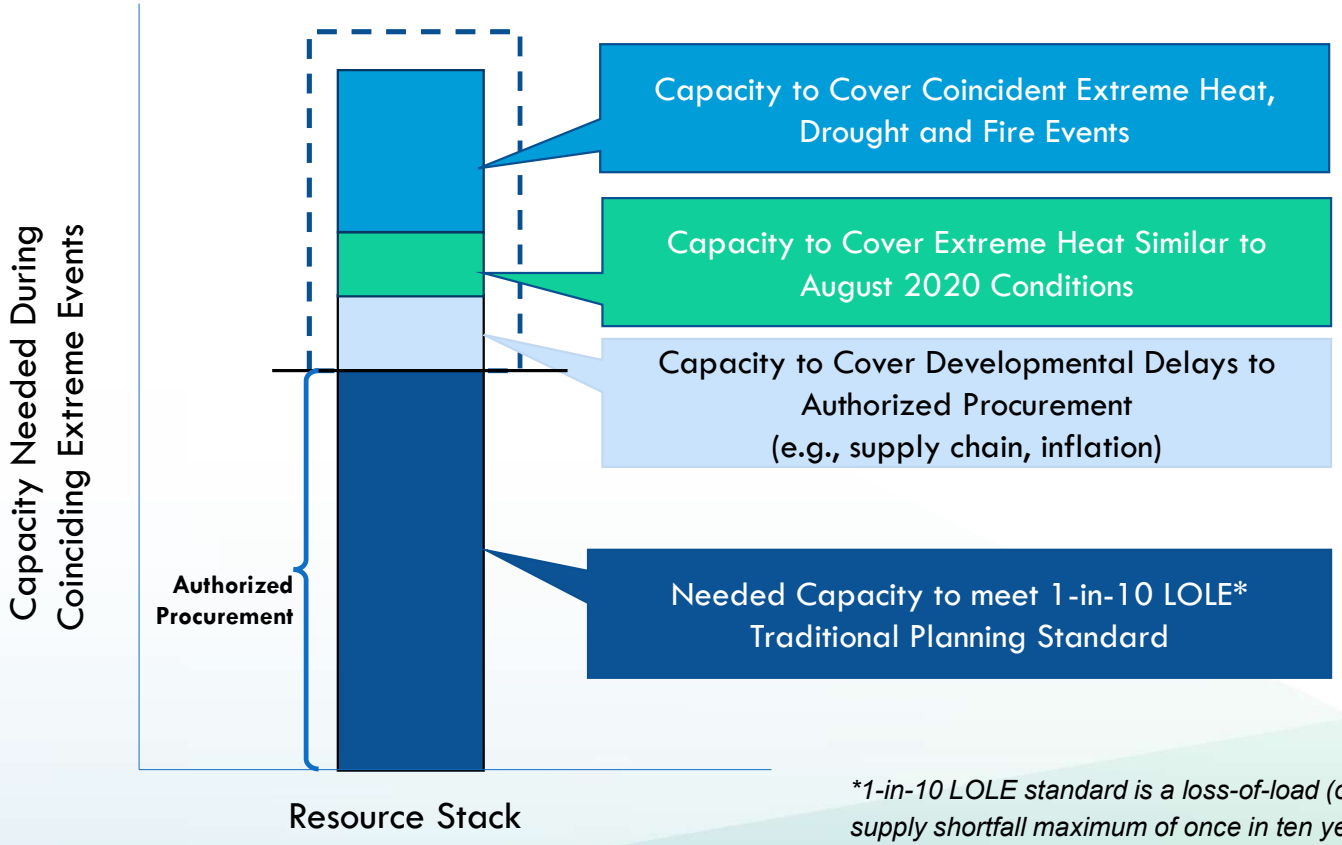
Energy Resources

- Up to 4,300 MWs of contingency resources in 2024
- Operational characteristics impact when they are useful, such as OTCs



*Caused by heat, wildfire, etc.

Why a Strategic Reliability Reserve?



**1-in-10 LOLE standard is a loss-of-load (outage) expectation due to supply shortfall maximum of once in ten years.*

2024 Contingencies (Q3)

Type	Contingency Resource	MW Available		
		July	August	September
Strategic Reliability Reserve	DWR Electricity Supply Strategic Reliability Reserve Program	3130	3150	3150
	CEC Demand Side Grid Support[1]	393	444	450
	CEC Distributed Electricity Backup Assets[2]	0	0	0
CPUC	Ratepayer Programs (Emergency Load Reduction Program, Smart Thermostats, etc.)[3]	217	209	202
	IOU Import Contracts[4]	25	25	25
	IOU Contracts with CHP Resources	159	186	93
Non-Program	Balancing Authorities Emergency Transfers	300	300	300
	Thermal Resources Beyond Limits: Gen Limits	40	40	40
	Thermal Resources Beyond Limits: Gen Limits Needing 202c	25	25	25
	Total	**4289**	**4379**	**4285**

[1] *Based on enrollment numbers*
[2] *Nine projects were recommended for DEBA funding for a total of 297 MW but not available in summer 2024*
[3] *Based on enrollment numbers*
[4] *Varies depending on IOU additional import procurements*

Overview - Electricity Supply Strategic Reliability Reserve Portfolio (ESSRRP)

	2022	2023	2024
Emergency & temporary natural gas resources for extreme events[1]	120.0 MW	147.5 MW	Up to 291.0 MW
Once-through cooling (OTC) natural gas fueled generators for extreme events[2]	0 MW	0 MW	2,859.3 MW
Firm energy import contracts[3]	3,349 MW *(47% low- or GHG-free)*	~3,400 MW	--
Temporary diesel generators[4]	82.4 MW	0	--

[1]Resource default is "off." Includes low emitting resources in 2024 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]Resource default is "off."
[3]Authorization for firm energy imports up through October 31, 2023. Data for 2023 pending final settlement verification.
[4]AB 205 (2022) only authorized diesel generator procurement until July 31, 2023. DWR closed this program early in favor of lower emission resources.

DSGS/DEBA Updates - *Key Highlights*

- **Substantial growth in DSGS enrolled capacity ~ 444 MWs (Aug 2024)**
  - Over 3x growth relative to Oct 2023 enrollment
  - Energy Storage Virtual Power Plant (VPP) is the primary growth driver
- **DSGS supported the grid during July heat waves**
  - Storage VPP dispatched July 9−12 and July 23−25
  - Non-combustion resources dispatched during July 24 Energy Emergnecy Alert (EEA) - Watch

	Option #1	Option #2	Option #3
Incentive Type	Emergency Dispatch: Standby and Energy Payment	Incremental Market-Integrated Demand Response Pilot	Market-Aware Battery Storage VPP Pilot
Enrolled Providers	8	5	14
Participants Enrolled	32	223,120	32,093
Capacity Enrolled	149.5 MW	84.4 MW	210.3 MW

**Information as of August 2, 2024*

Summer 2024 Grid Update

Summer 2024 Grid Conditions

- High temperatures have persisted throughout the state and the broader West, but we have not experienced truly extreme load conditions in Calironia
- The CAISO continues to monitor the impacts of wildfires on transission infrastructure
  - Impacts on the bulk power system have been manageable to date
- Energy resources on the CAISO system have been effective to serve demand
  - The generation fleet, including nearly over 9 GW of battery energy storage, has performed very well
- The CAISO remains and continues coordinating closely with state partners as summer progresses, as we continue to have exposure to extreme conditions in August and September

CAISO & Regional Partner Actions

- Accelerated deployment of new, clean generation
- Strong planning and coordination with state agencies, load-serving entities, and regional partners
- During the recent July heat wave, State programs designed to provide grid support during extreme weather events were mobilized
- Demand response programs contributed to a reduction in demand from across peak and net peak hours on high load days
- The Western Energy Imbalance Market continued to be an essential tool in helping to balance supply and demand in the wider Western footprint

Emergency Notifications

Alerts	2020	2021	2022		2023		2024
	Total	Total	Through end of July	Total	Through end of July	Total	Through end of July
Flex Alerts	10	8	0	11	0	0	0
Restricted Maintenance Operations	20	24	1	16	0	6	10
Transmission Emergencies	2	0	2	10	2	2	19
Energy Emergency Alerts							
Energy Emergency Alert Watch	16	4	0	8	2	2	1
Energy Emergency Alert 1	0	0	0	6	1	1	0
Energy Emergency Alert 2	6	1	0	4	0	0	0
Energy Emergency Alert 3	2	0	0	1	0	0	0
Total Emergency Alerts in CAISO Area	**24**	**5**	**0**	19	**3**	**3**	**1**
Total Emergency Alerts across RC West	**47**	**17**	**5**	**42**	**16**	**29**	**39**

Ten-year Outlook

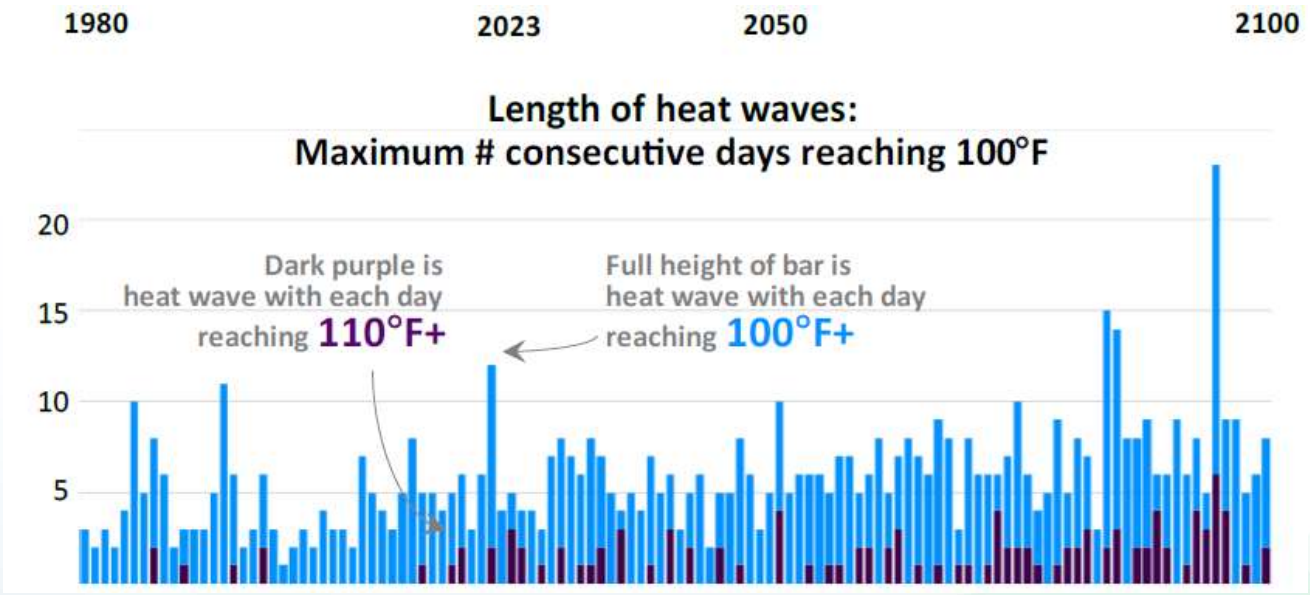
Climate Change Impacts on Grid Reliability

- **Increased Weather Pattern Variability:**
  - More frequent, intense and longer lasting extreme weather events anticipated
  - Greater challenges in maintaining grid reliability

- **<u>Specific Examples of Climate-Driven Grid Stress:</u>**
  - **2020 West wide Heat Event:** Rotating outages implemented on August 14-15 due to extreme heat
  - **2021 Oregon Wildfire:** Transmission line damage from wildfires led to:
    - Loss of 3,000 MW imports to CA ISO territory
    - Overall import capacity reduction of 4,000 MW to the state
  - **2022 California Heatwave:** Record high temperatures between August 31-September 9, 2022
    - New peak load record set at 52,061 MW on September 6, exceeding the previous record by nearly 2,000 MW
  - **Late July 2023 Western Heat Event:** Extreme heat outside California caused challenging market dynamics

Extreme Temperature Events -
Increased Frequency Projected

Extreme Temperature Projections — E.g., Sacramento Region



10-Year Outlook

- A 4,000 MW fire risk impact was added to the 10-year outlook
  - 4,000 MW of fire risk is associated with loss of transmission capacity
  - Average conditions with fire risks are manageable
  - Fire risk, extreme events and resource build out delays happening simultaneously may be challenging

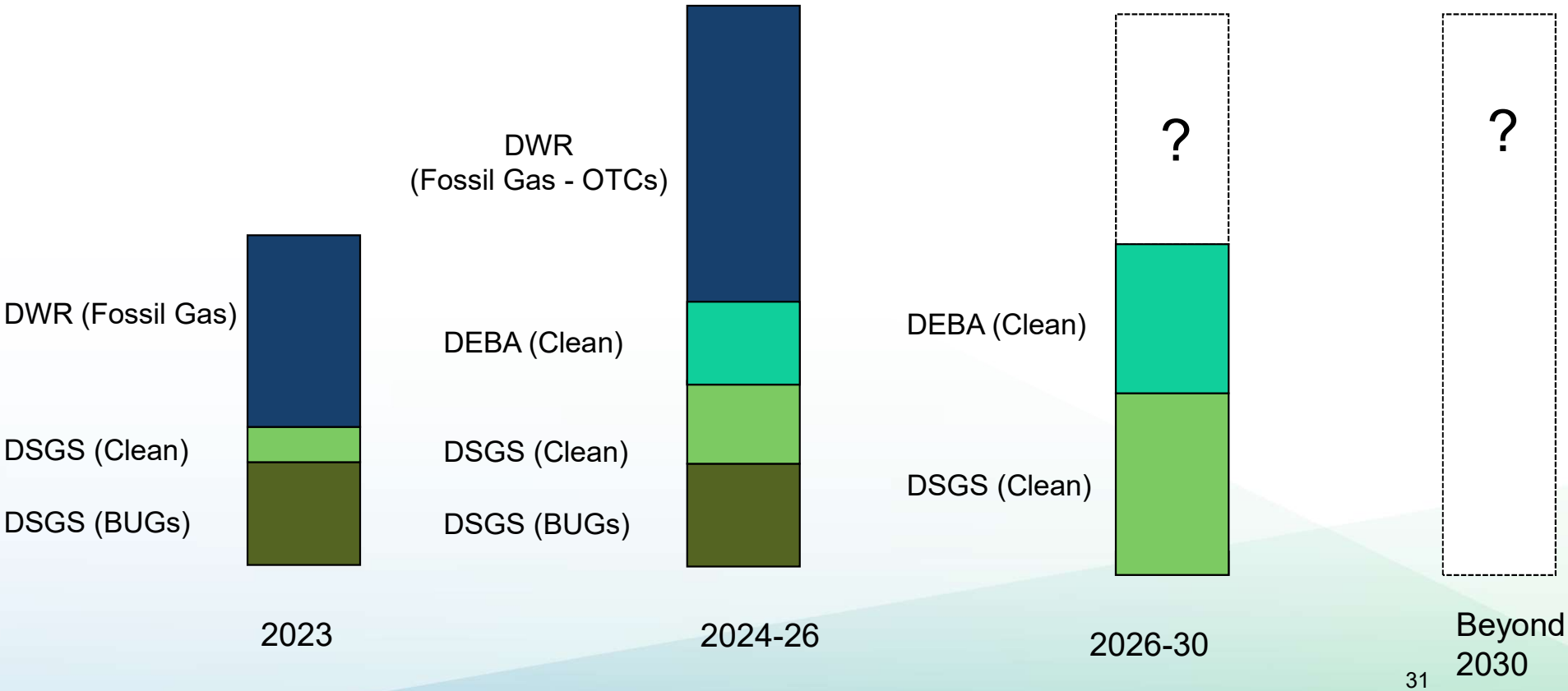
- It is prudent to continue to develop and support contingency resources to maintain grid reliability

		Year										
	Delay Percent	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
2022 Equivalent Event	40	-5593	-4,179	-3,394	-3,380	-3,610	-4,000	-4,000	-4,732	-6,216	-8,501	-10,374
	20	-4842	-3,683	-3,148	-3,228	-3,439	-4,000	-4,000	-4,732	-6,216	-8,501	-10,374
	0	-4090	-3,187	-2,903	-3,075	-3,267	-4,000	-4,000	-4,732	-6,216	-8,501	-10,374
2020 Equivalent Event	40	-3995	-2,566	-2,089	-2,049	-2,250	-2,602	-2,617	-3,370	-4,803	-7,035	-8,852
	20	-3243	-2,070	-1,842	-1,897	-2,078	-2,602	-2,617	-3,370	-4,803	-7,035	-8,852
	0	-2492	-1,857	-1,597	-1,744	-1,906	-2,602	-2,617	-3,370	-4,803	-7,035	-8,852
Planning Standard	40	-1483	-31	-37	44	-111	-406	-443	-1,231	-2,583	-4,733	-6,461
	20	-731	106	209	196	60	-406	-443	-1,231	-2,583	-4,733	-6,461
	0	20	151	454	349	232	-406	-443	-1,231	-2,583	-4,733	-6,461

Evolving the Strategic Reliability Reserve

Strategic Reliability Reserve (SRR) – *Long-Term Vision*

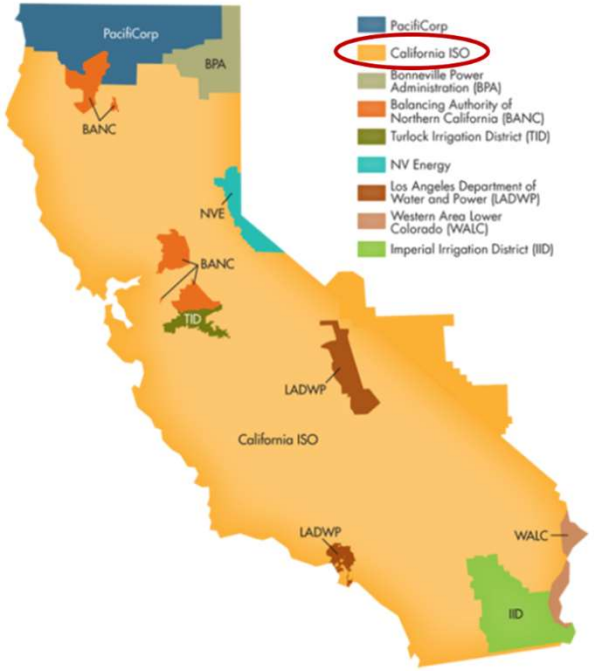
DSGS / DEBA help transition SRR to clean contingency resources – away from dependency on OTCs



The Pathways Initiative

CAISO - *Current Dual Role Functions*

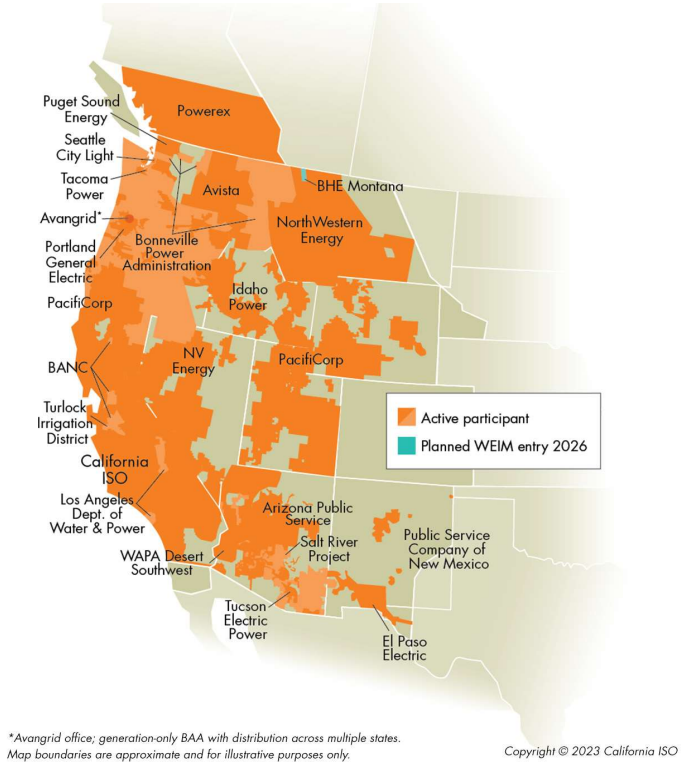
Balancing Authority (BA)	Regional Services Operator
• Design and oversight of BA rules • Operate transmission grid within the CAISO footprint • Maintain generation interconnection process within CAISO footprint • Maintain reliability within CAISO • NERC compliance	• Design and oversight of market rules • Physical operation and optimization of regional dispatch • Settlement of market transactions • Reliability coordinator for much of the West



CAISO - *Regional Energy Markets*

- CAISO currently runs an energy imbalance market – Western Energy Imbalance Market (WEIM) – that allows participants to buy and sell available electricity in **real time**.
  - Since 2014, this energy market has generated roughly $5.85 billion in gross benefits for participants.

- CAISO will soon enable Western participants to buy and sell energy in the **day-ahead timeframe** – Extended Day-Ahead Market (EDAM).
  - This market structure is the next logical step in enhancing regional markets and achieving even greater economic and reliability benefits.



Value of a West Wide Market

- An organized regional market with the largest footprint offers economic and reliability benefits to all participants
- CAISO's real time energy market (WEIM) represents 79% of the load in the Western Interconnection and has been able to demonstrate economic and reliability benefits
- CAISO's EDAM is seen as the next logical step in enhancing regional markets, but currently does not capture the widest regional footprint
- A larger west wide market could build upon existing CAISO market structures and maximize ratepayer benefits via the largest possible footprint that includes California
- Pathways offers a new approach to explore options for increased west wide coordination including a regional governance structure

Pathways Initiative Step 1 – *WEIM/EDAM Governance*

- The Step 1 Proposal seeks to achieve a more independent governance structure for the EDAM and WEIM

- Step 1 Proposal on West Wide Governance Pathways Initiative Phase 1 Straw Proposal (Step 1 Proposal) submitted to CAISO on June 5, 2024
- Lays out a governance framework that enhances independence:
  - WEIM Board primary authority
  - Dispute resolution process with jump ball FERC filings
  - CAISO board retains sole FERC filing rights for exigent circumstances
  - Public interest added to WEIM board charter
  - Triggered with 70 percent of CAISO load joining

Next Steps

- **June 5, 2024** Launch Committee submitted Step 1
- **August** expected vote by CAISO board on Step 1 at joint board meeting
- **July – August** Pathways public workshops on next steps
- **September – December**
  - Pathways Launch committee to prepare a Draft and Issue Final proposal on the next step on evolving regional markets

Thank You!

Senate Energy, Utilities and Communications Committee - Oversight Hearing

August 6, 2024