The Power Grid for the Future

Experience from California

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November 12, 2022

California COP 27 Energy Delegation

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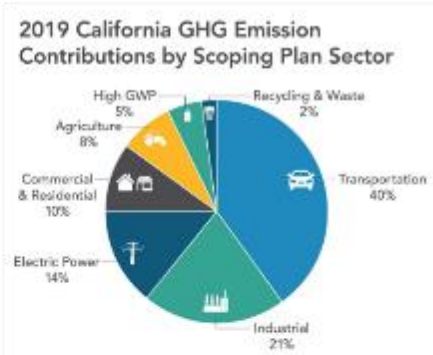
California's Climate Policy Framework

GHG Targets & Goals

Legislation & Executive Orders: Total GHGs (AB 32/SB 32) or sector targets (SB 1383/ SB 100), etc.



Scoping Plan

Actionable plan across all sectors

Action

Regulations & Incentives: Advanced Clean Cars, climate change investments, etc.

Projects

Examples: Building compost facilities, digesters, renewables, energy infrastructure, etc.

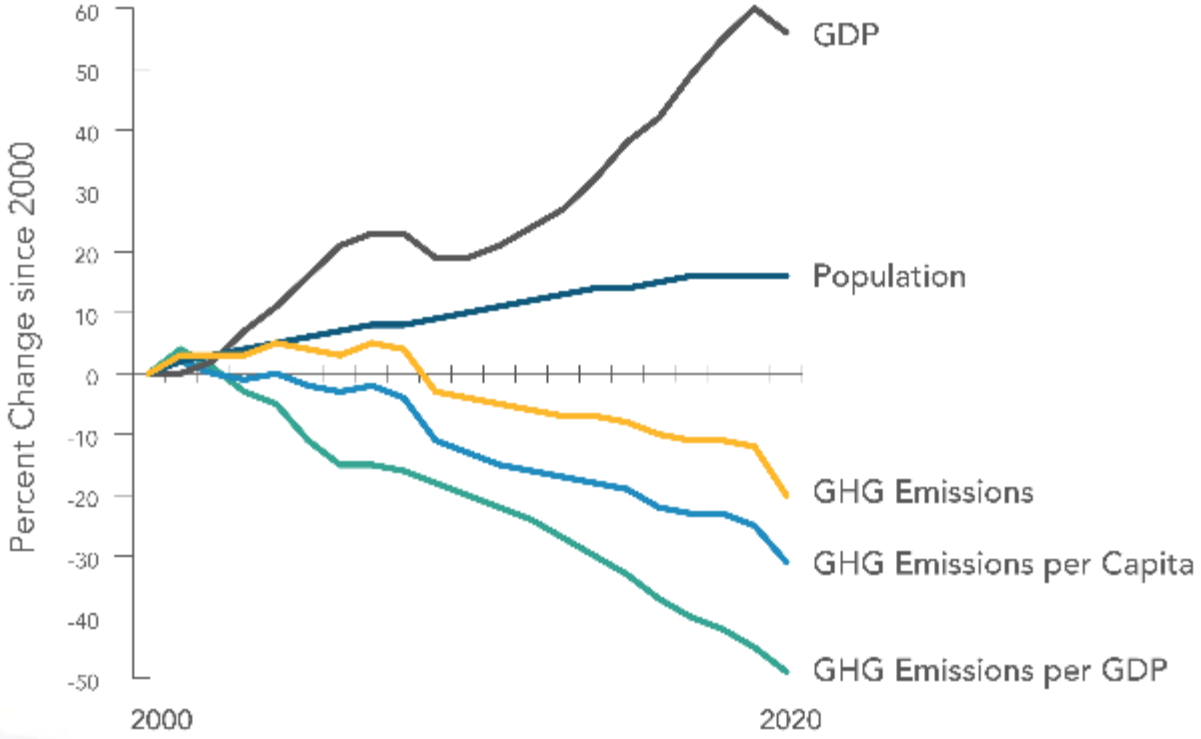
Legislature

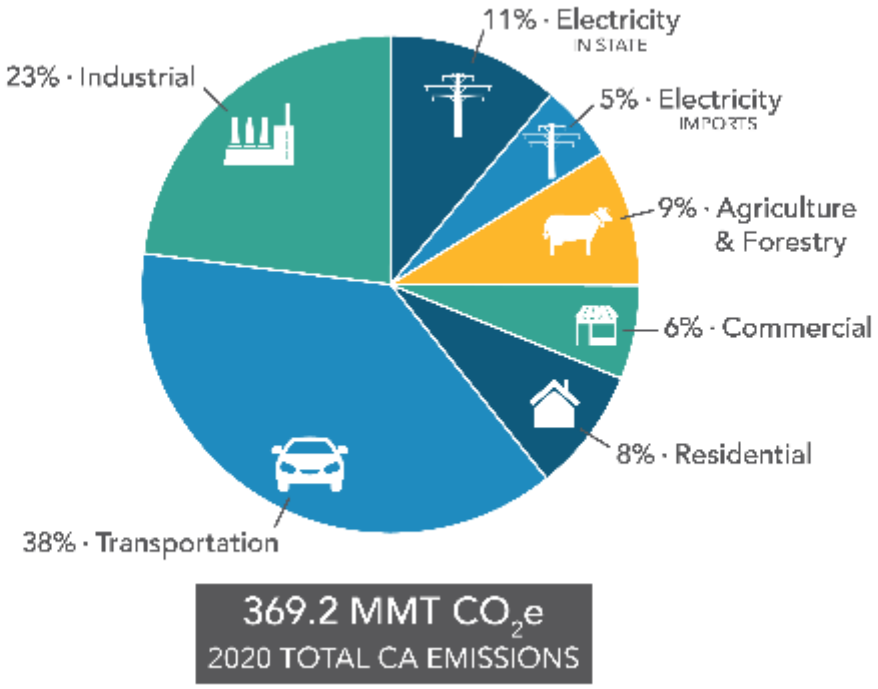
Air Resources Board

Public Utilities Commission and Energy Commission

Create Policies and Programs

California's GHG Trends

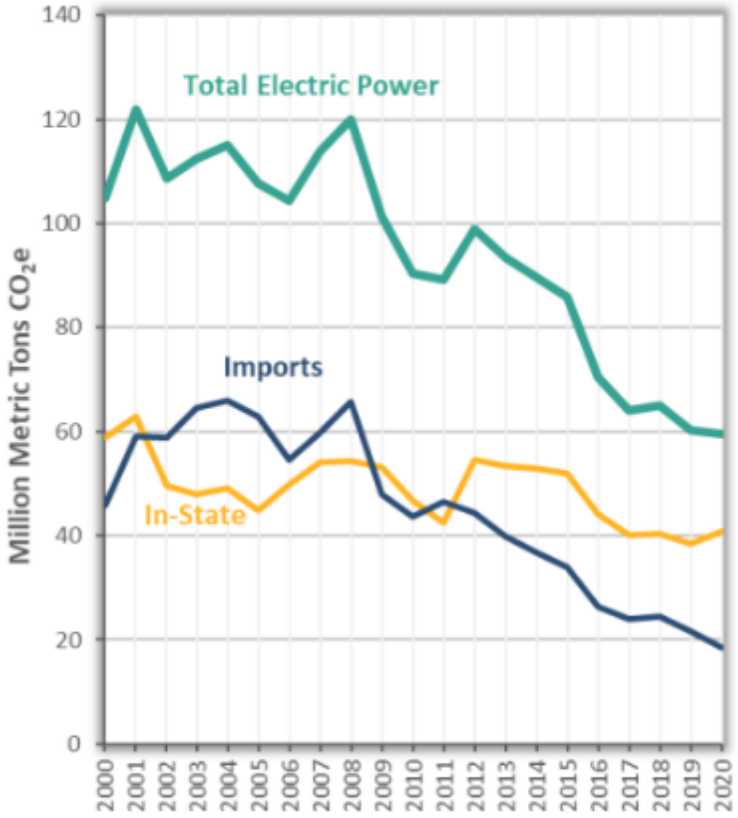




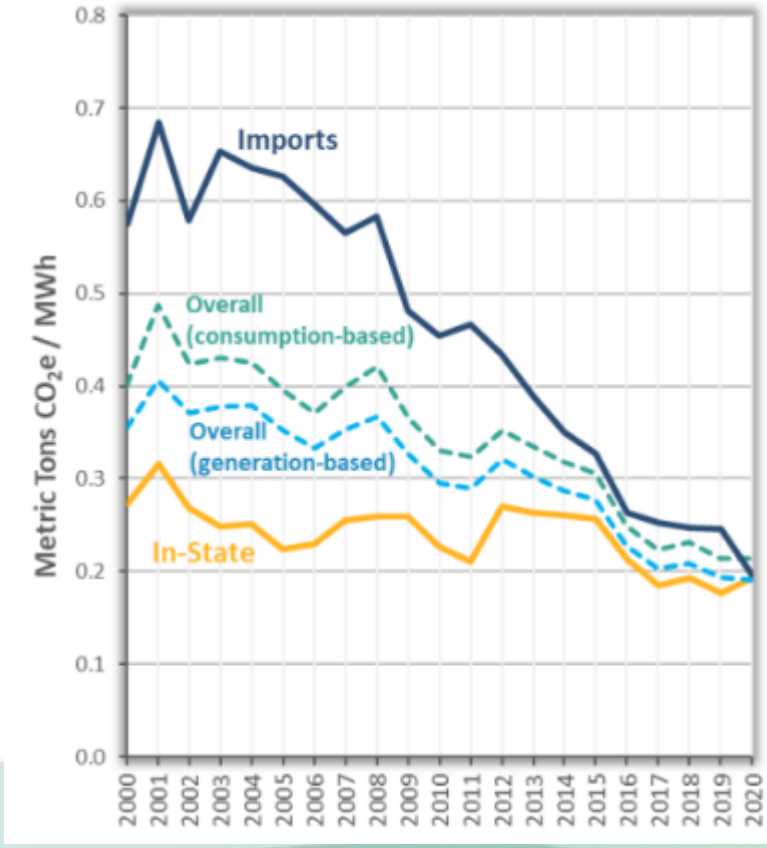
Source: 2022 Edition, California Greenhouse Gas Emission Inventory: 2000-2020

Electricity Sector Improvements 2000-2020

GHG Emissions from the CA Electricity Sector

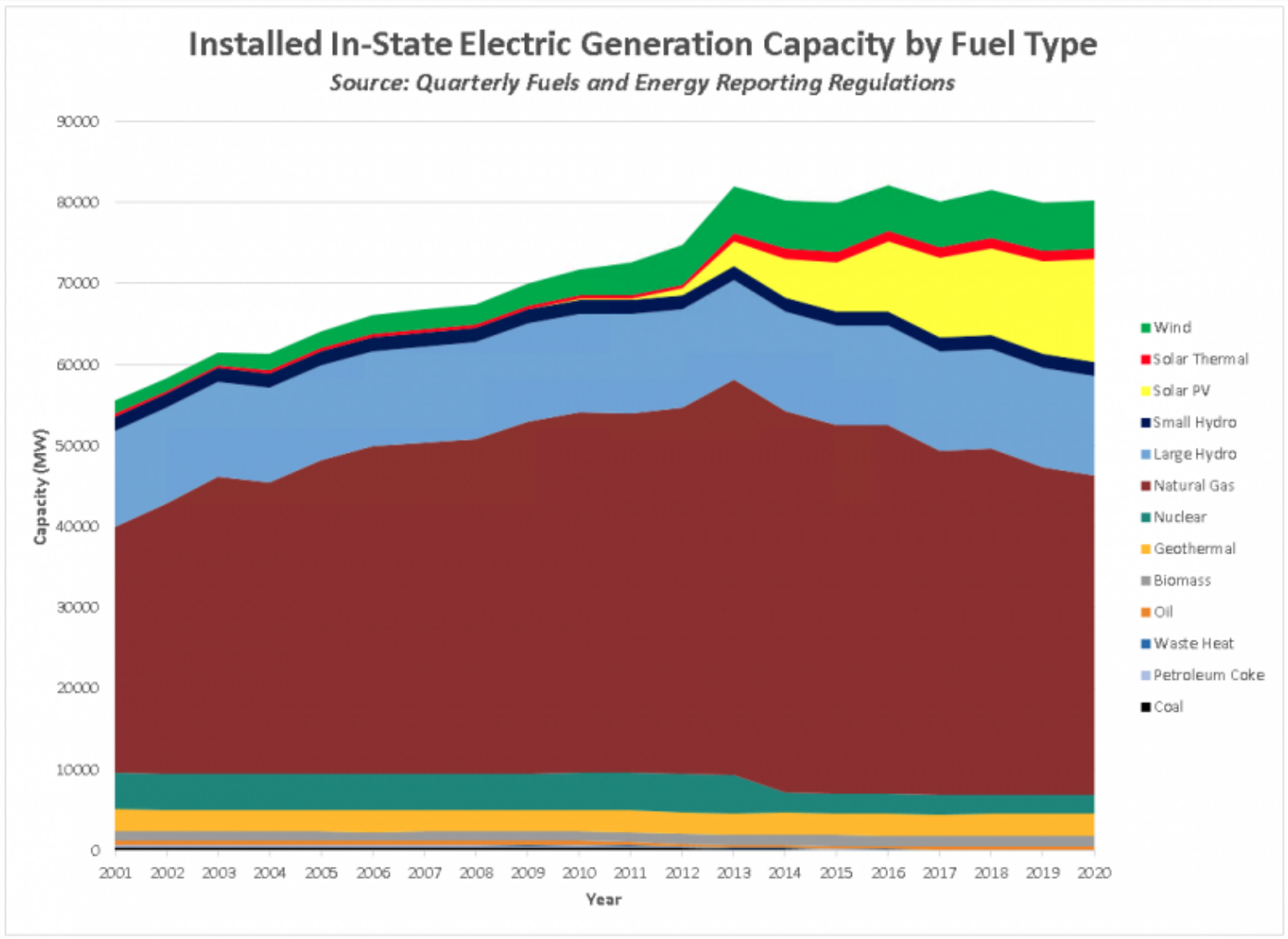


GHG Intensity of California Electricity

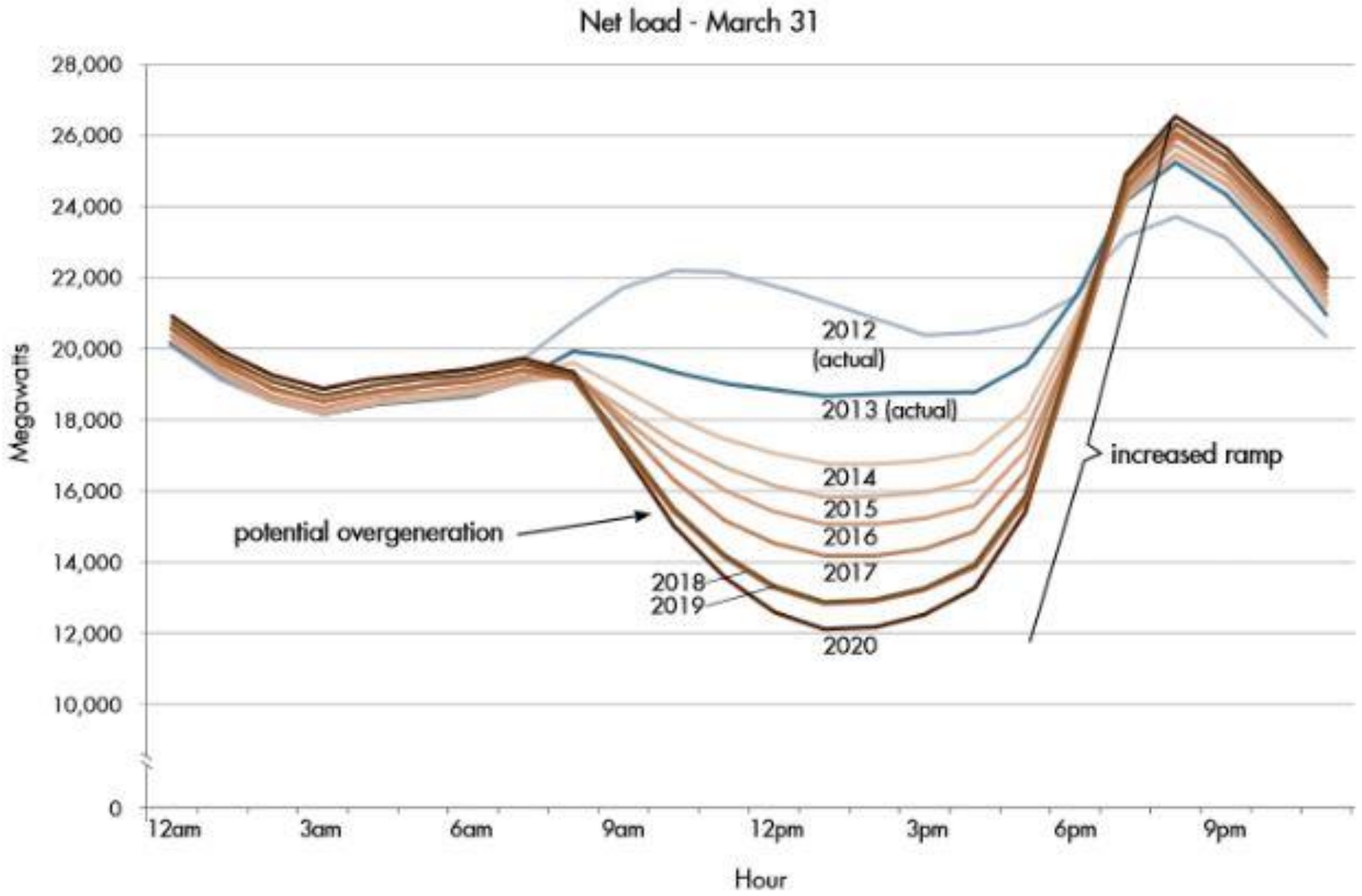


Source: 2022 Edition, California Greenhouse Gas Emission Inventory: 2000-2020

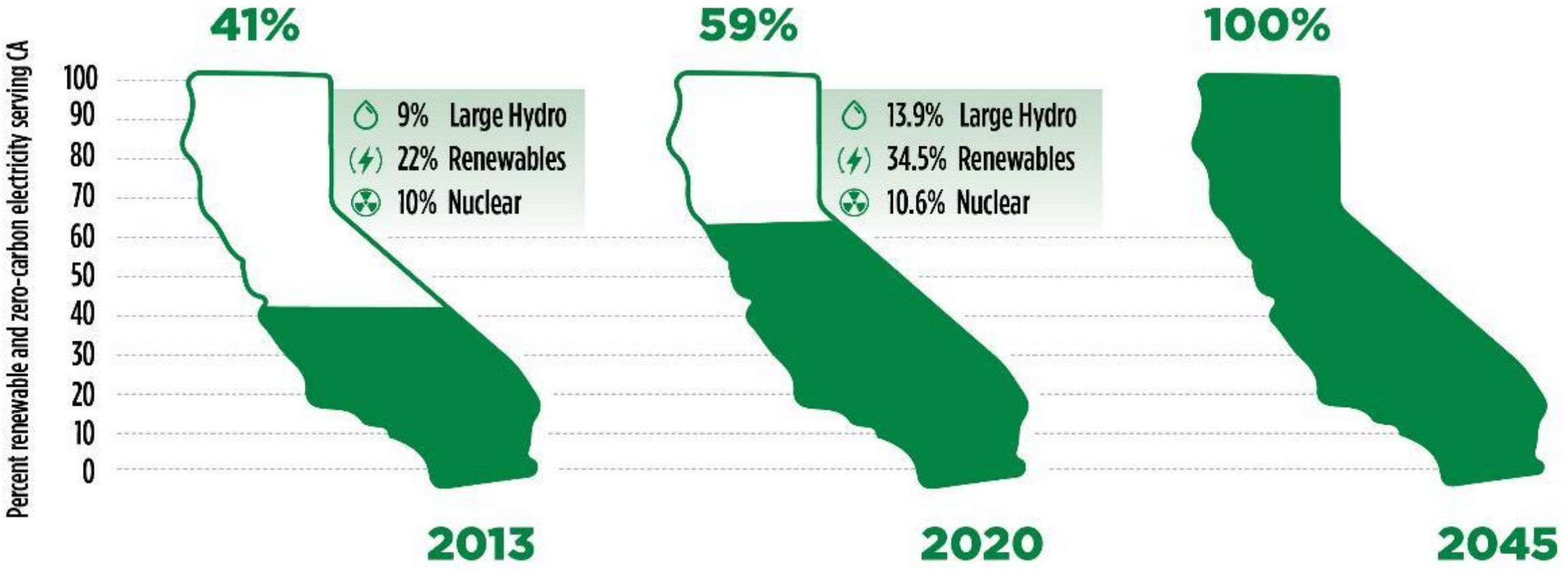
Electrification is a Critical Component of CA's Climate Policy



THE DUCK CURVE
(Net load chart)



Progress to 100% Clean Electricity



Foundations of Grid Transition

Clean

Reliable

Affordable

Equitable

California

Clean Electricity Resources

Projected to increase annual costs 6% above a 60% RPS baseline

* Includes in-state

** Includes in-state and out of state capacity

‡ New hydro and nuclear resources were not candidate technologies for this round of modeling and could not be selected

	Existing Resources	Projected New Resources	
	2019*	2030**	2045**
Solar (Utility-Scale)	12.5 GW	16.9 GW	69.4 GW
Solar (Customer)	8.0 GW	12.5 GW	28.2 GW
Storage (Battery)	0.2 GW	9.5 GW	48.8 GW
Storage (Long Duration)	3.7 GW	0.9 GW	4.0 GW
Wind (Onshore)	6.0 GW	8.2 GW	12.6 GW
Wind (Offshore)	0 GW	0 GW	10.0 GW
Geothermal	2.7 GW	0 GW	0.1 GW
Biomass	1.3 GW	0 GW	0 GW
Hydrogen Fuel Cells	0 GW	0 GW	0 GW
Hydro (Large)	12.3 GW	N/A‡	N/A‡
Hydro (Small)	1.8 GW	N/A‡	N/A‡
Nuclear	2.4 GW	N/A‡	N/A‡

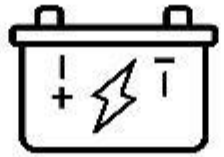
To Achieve Clean Energy

Development Needs To Rapidly Accelerate

Solar & Wind

3X

Solar and wind build rates need to nearly triple*



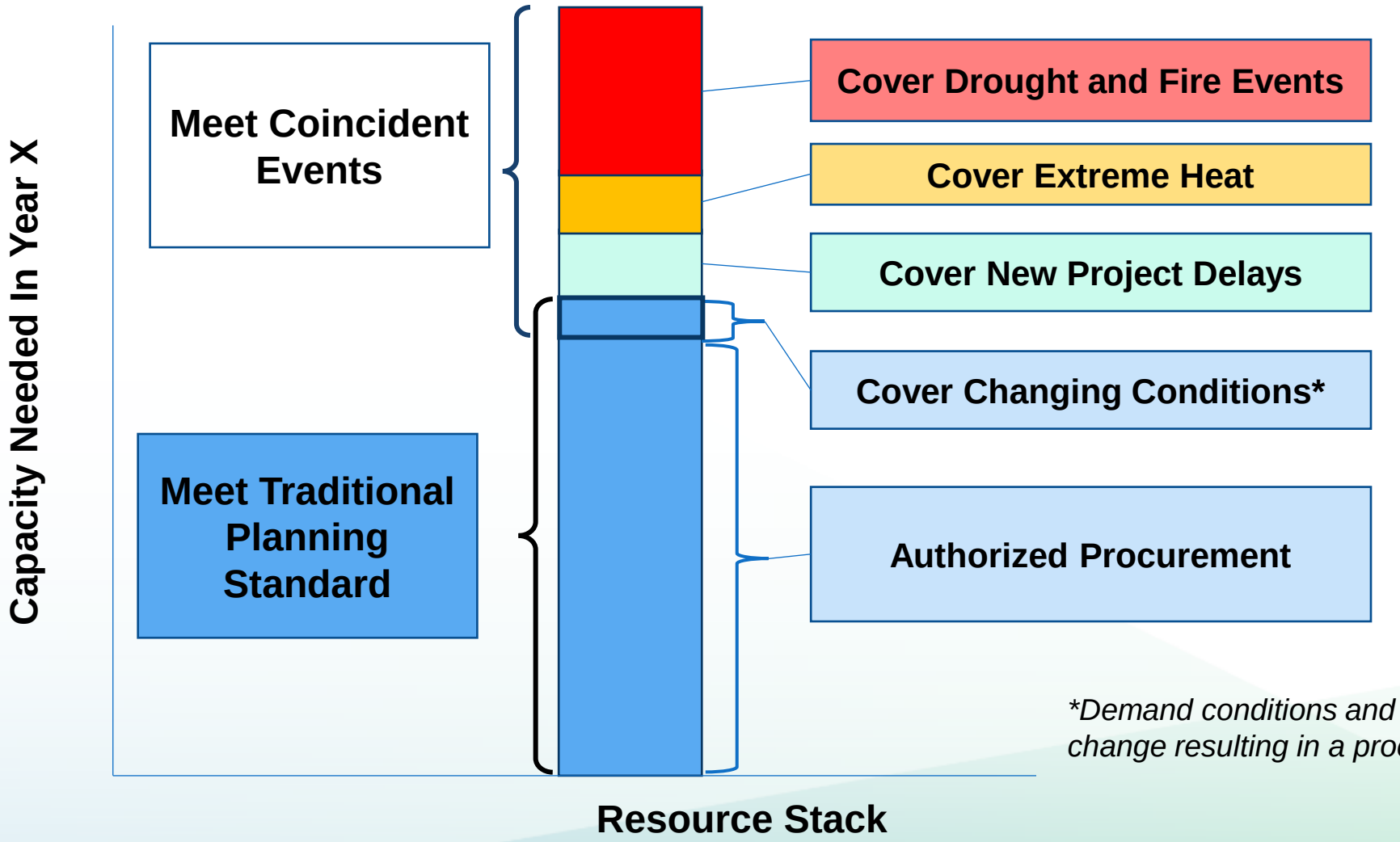
Battery

8X

Battery storage build rates need to increase by nearly eightfold**

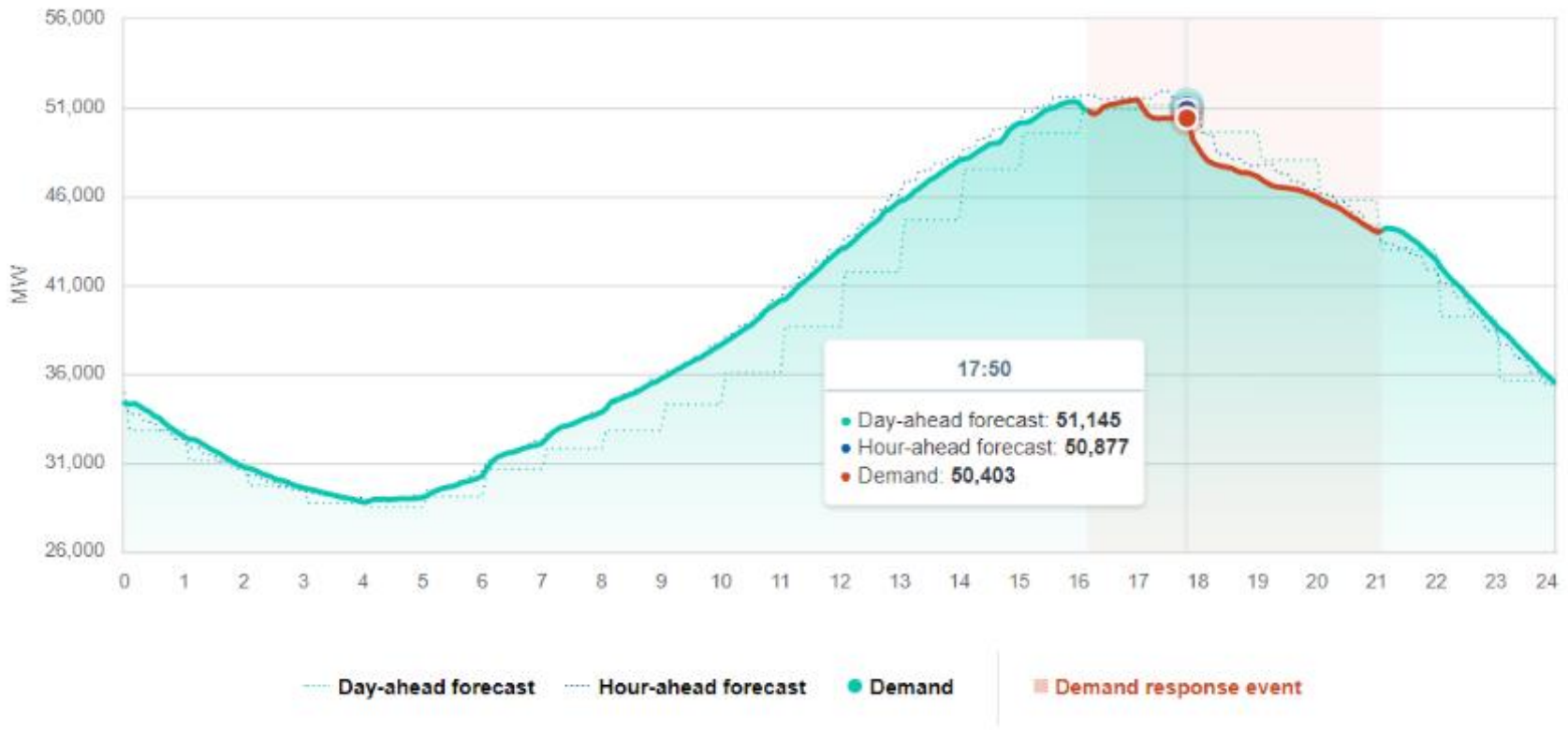
*Based on 10-year average | **Based on 2020

Reliability Challenges



**Demand conditions and assumptions may change resulting in a procurement lag*

CA Experienced a Historic Heat Wave in Sept '22



Demand Volatility is becoming more and more common

Average Demand for Sept 2022 was forecasted to be ~44,600 MW

We were on track for a peak of ~53,000 before demand side load reductions were called on

Critical Elements Along CA's progress

Floating Offshore Wind

Kincardine Offshore Wind Project
Aberdeen, Scotland

Source: https://www.offshorewindca.org/photo-gallery

Long Duration Storage

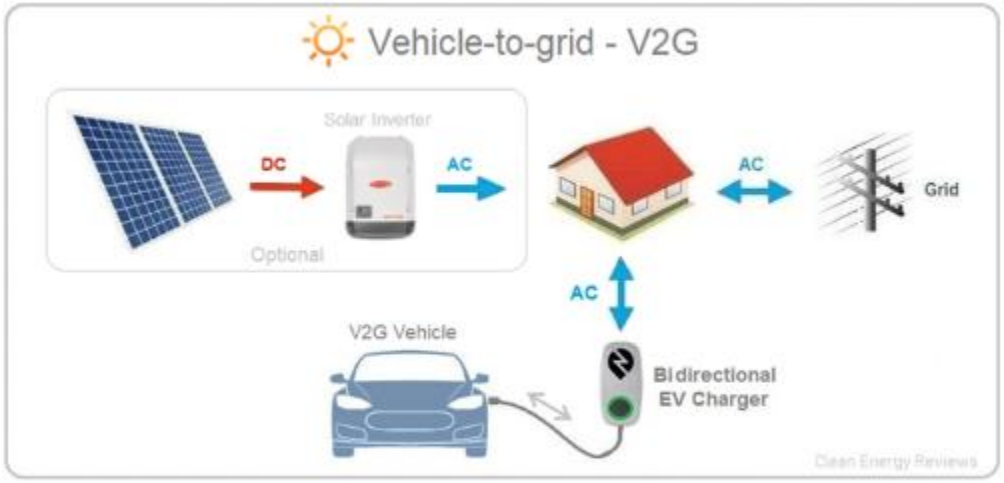
California Energy Commission recently awarded $31 Million grant to Viejas tribe

Distributed Energy Resources

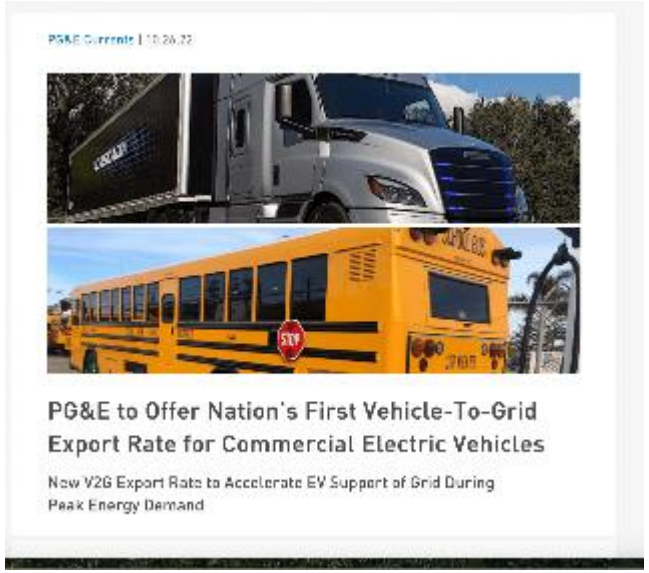
Source: https://www.contextlabs.com/

Seeking Ways to Leverage CA Leadership on Electric Vehicles for Reliability

- All new passenger vehicle sales in CA will be electric by 2035
- Expecting 7-8 Million EVs by 2030
- Investing $4B in Zero Emission Infrastructure including V2G
- Just 5 million bidirectional EVs store enough energy to power every home in California for a day



Vehicle to Grid (V2G) energy flow diagram using a DC bidirectional charger.



California's Climate Commitment | 2021-2022 Budget Agreements

$13.8 Billion
Transportation

$10 Billion
Zero-Emission Vehicles

$9.1 Billion
Clean Energy & Reliability

$8.7 Billion
Drought & Water Resilience

$5.7 Billion
Climate Resilience

$2.3 Billion
Wildfire & Forest Resilience

$1.1 Billion
Agriculture

$975 Million
Climate Homes

$723 Million
Climate Schools & Research

$525 Million
Climate Innovation

$460 Million
Circular Economy

$346 Million
Climate Health

$315 Million
Climate Jobs

$54.1 BILLION TOTAL

September 2022

Strategic Electricity Reliability Reserve (AB 205)

$2.4 Billion

Strategic Reliability Infrastructure Assets

$700 Million

Distributed Electricity Backup Assets

$295 Million

Demand Side Grid Support

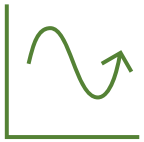
$3.4 BILLION TOTAL

*As of September 2022

Clean Energy Alternatives for Reliability (SB846)

$1 Billion Clean Energy Reliability Investment Plan

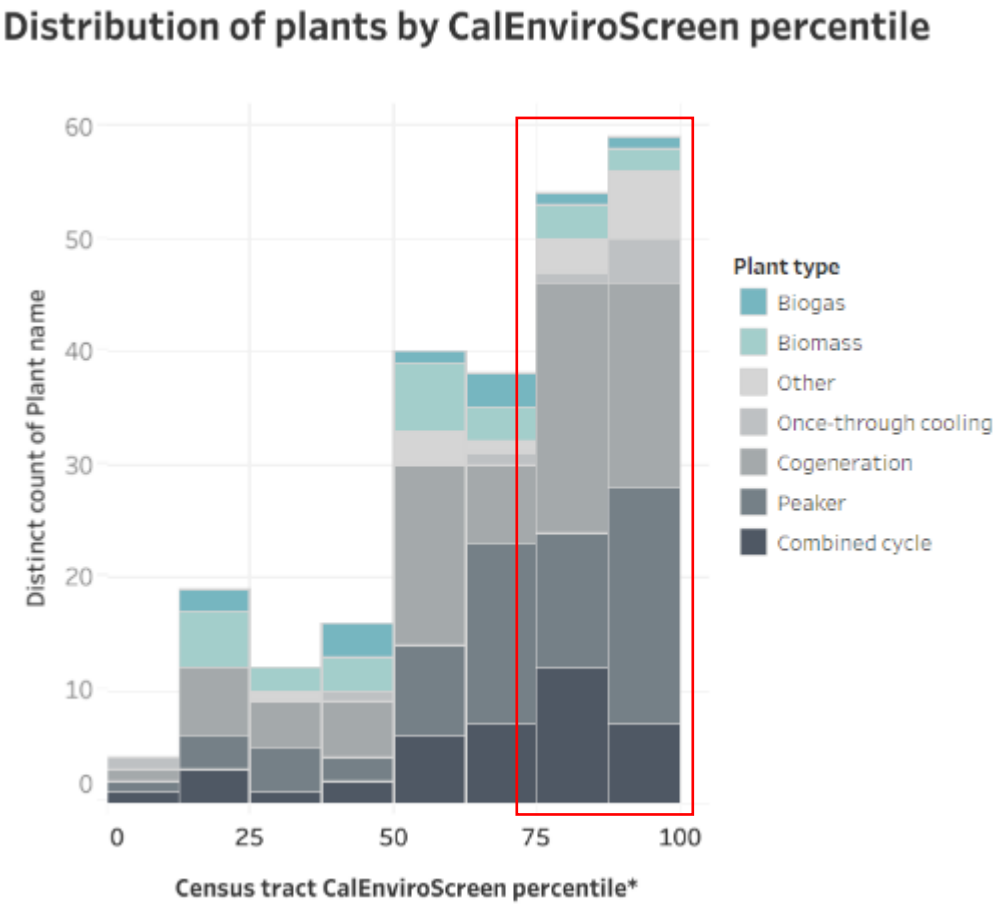
- Electric supply and demand needs for near- and mid-term reliability
- 100 percent zero-carbon and renewable energy by 2045
- Greenhouse gas emissions reduction target for electricity
- Preferred resources, such as demand response and energy efficiency



Load Shift Goal

- Adopt a goal for load shifting to reduce net peak electrical demand
- Increase demand response and load shifting
- Do not increase GHG emissions or electric rates

Power Plants are Disproportionately Located in Disadvantaged Communities



Source: PSE Healthy Energy California Power Map

Equity and Justice Has to Be Foundational

1) **Words matter.** It is *our* energy system, not *the* energy system.
2) **Timing matters.** We must engage early, often, and meaningfully with tribes, communities, and local leaders.
3) **People matter.** We must be thoughtful about inviting people, who represent and work closely with the residents to make sure we are getting a comprehensive set of voices at the table.
4) **Build trust.** We must build true relationships with partners and communities to carry out our work equitably. We will achieve more and do better when we work and act together.
5) **Consistency and communication matters.** Equity relies critically on consistent commitment of resources and communication to build those relationships and break down silos.
6) **Conflict is necessary.** To achieve equity, change is required and when change happens, conflict arises. Rather than run away from this conflict we need to lean into it to learn from it and make progress.

The Great Implementation Will Require Finding Common Ground

1. Start with what we agree on
2. Align on where we are going
3. Recognize there will be tradeoffs along the way

…and lean into conflict!

Thank You