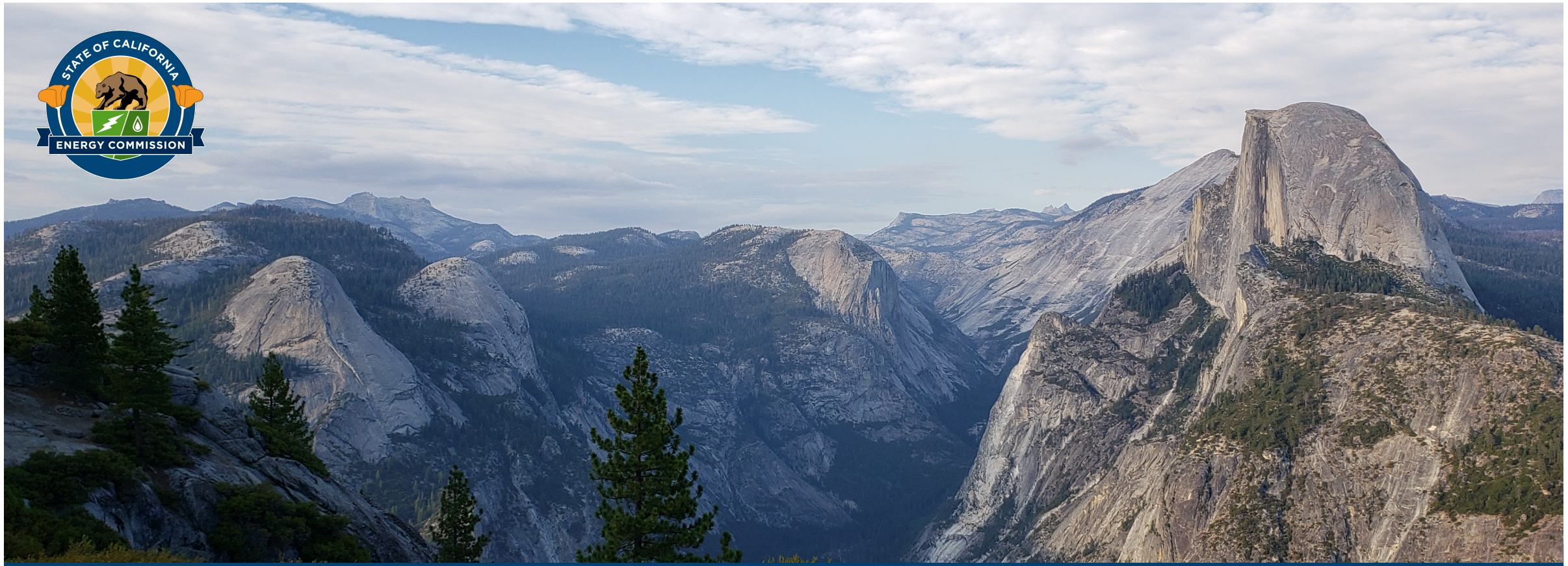


California Energy Decarbonization

An Overview of California's Clean Energy Policies and Efforts

J. Andrew McAllister, PhD, Commissioner, California Energy Commission

September 1, 2020

Severe West-wide Heat Wave

- High temperatures drove electricity loads August 14–19.
- Similar conditions across the West constrained imports into California.
- Planned outages August 14–15 (thermal).
- Unexpected loss of thermal generation (475 MW).
- Uncommon swings in wind resource during the evening ramp.
- Stage 3 Outages affected 408,000 customers for 2-4 hours.
- Efforts to conserve electricity and maximize existing resources led to **4,000 MW reduction** of peak demand and nearly **950 MW of temporary generation**.
- These actions avoided further outages.
- **Transition to Renewables was NOT a primary driver of outages.**

Maintaining Reliability

Build more in-state resources and secure imported electricity.

Review demand forecasts and existing reliability policies and programs, especially in relation to climate change.

LONG-TERM SOLUTIONS

Develop statewide view of available resources and resource adequacy obligations.

Establish process to allow distributed energy resources and load flexibility to actively support grid reliability.

Policy Drivers

Double energy efficiency savings by 2030

60% renewable electricity by 2030; 100% carbon-free by 2045

Decarbonize buildings and industrial processes

Electrify transportation and decarbonize fuels

Provide equitable low-carbon solutions for low-income residents and disadvantaged communities.

Carbon-free economy by 2045

Senate Bill (SB) 100

Expands Renewables Portfolio Standard

60% by Dec 31, 2030

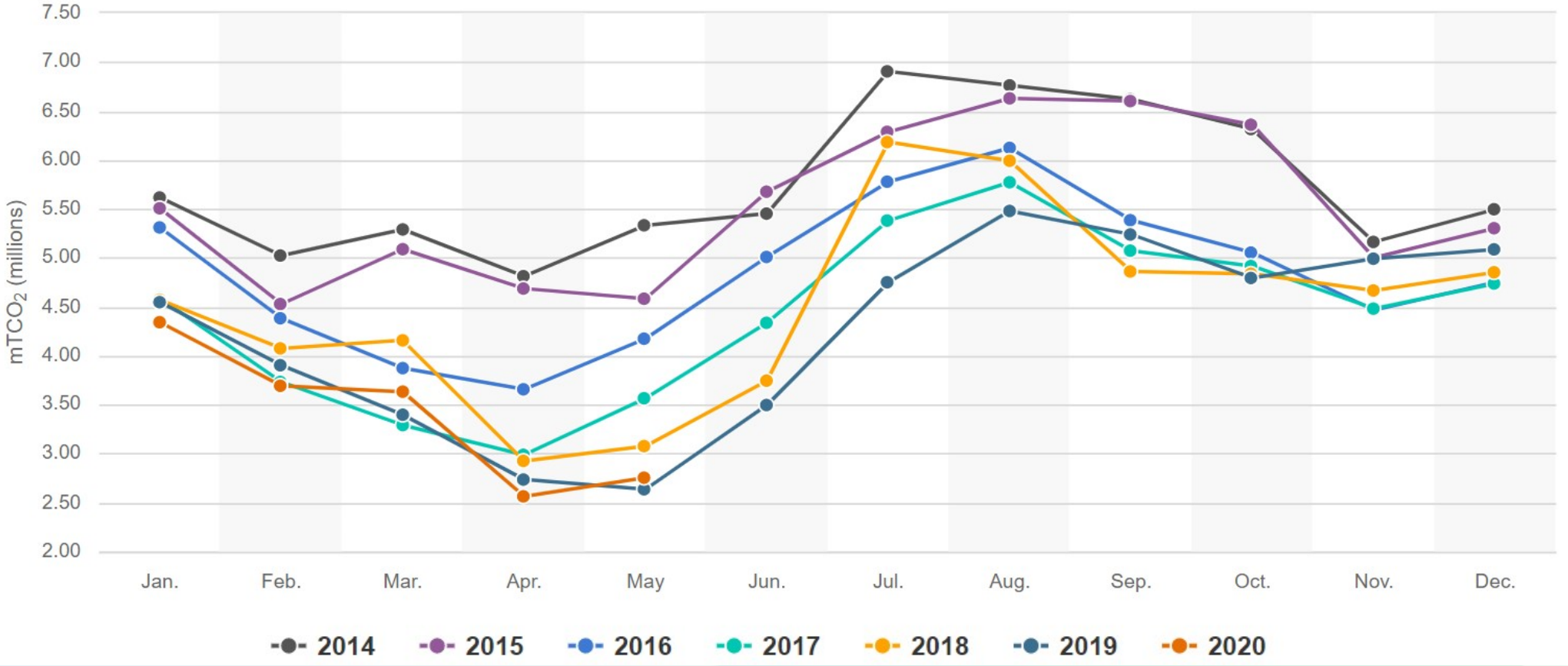
PUC 399.11 (a)

Establishes 100% Clean Energy Policy

It is the policy of the state that **eligible renewable energy resources and zero-carbon resources supply 100 percent of all retail sales** of electricity to California end-use customers by **December 31, 2045** and 100 percent of electricity procured to serve all state agencies by December 31, 2045.

Declining Grid Carbon Content

Monthly CO_2 Emissions from CA's electricity grid

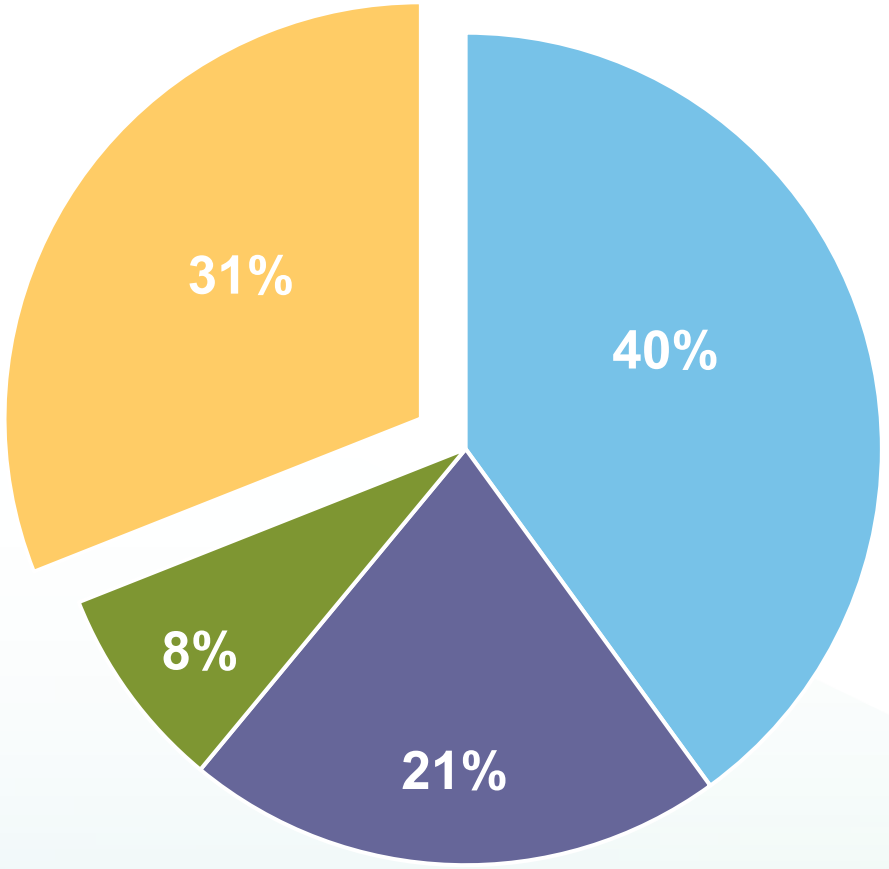


Source: California Independent System Operator (CAISO)

CA Greenhouse Gas (GHG) Emissions

Total CA emissions
424.1 MMTCO$_2$e

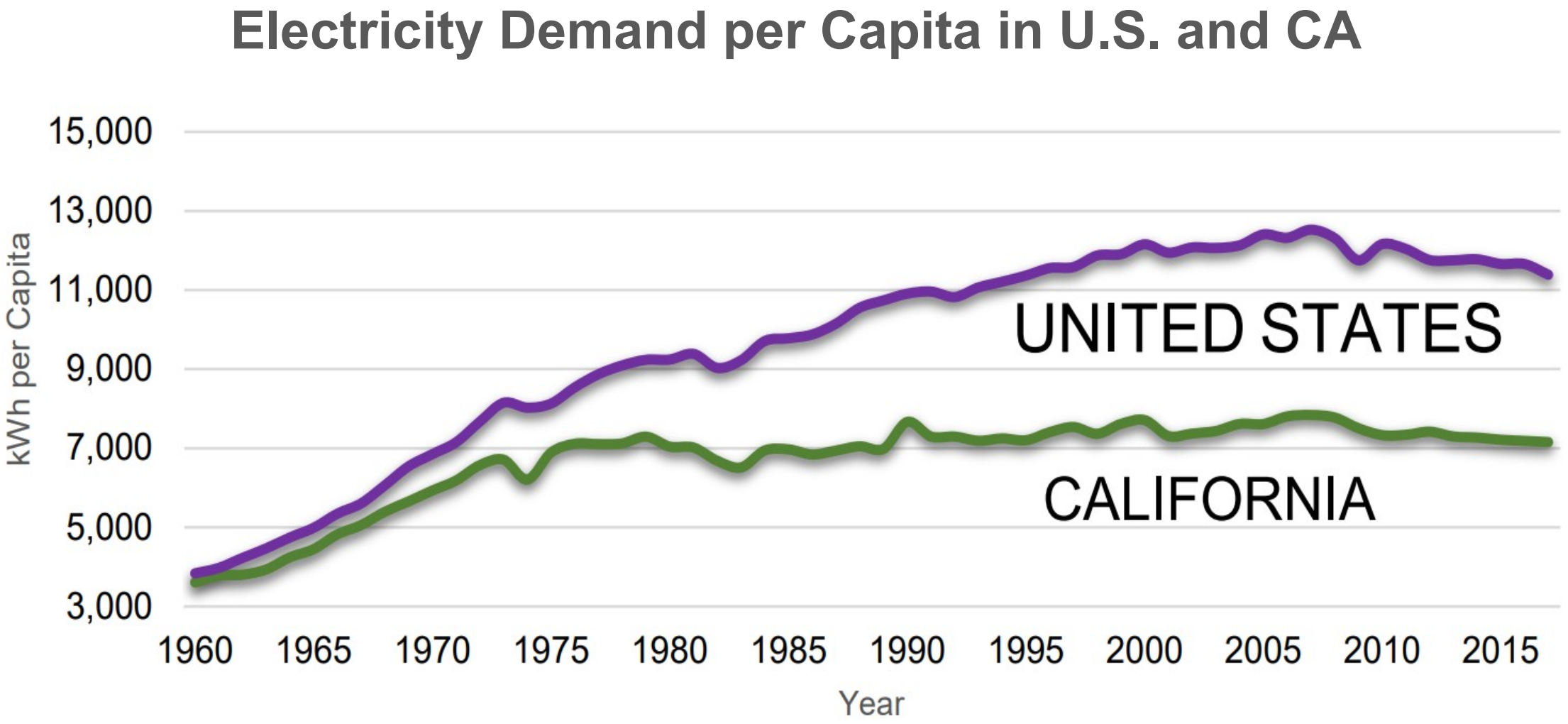
Total U.S. emissions
6,457 MMTCO$_2$e



CA is 6.57% of U.S. emissions and 14.6% of U.S. GDP

Source: California Air Resources Board GHG Inventory Trends from 2000 to 2017

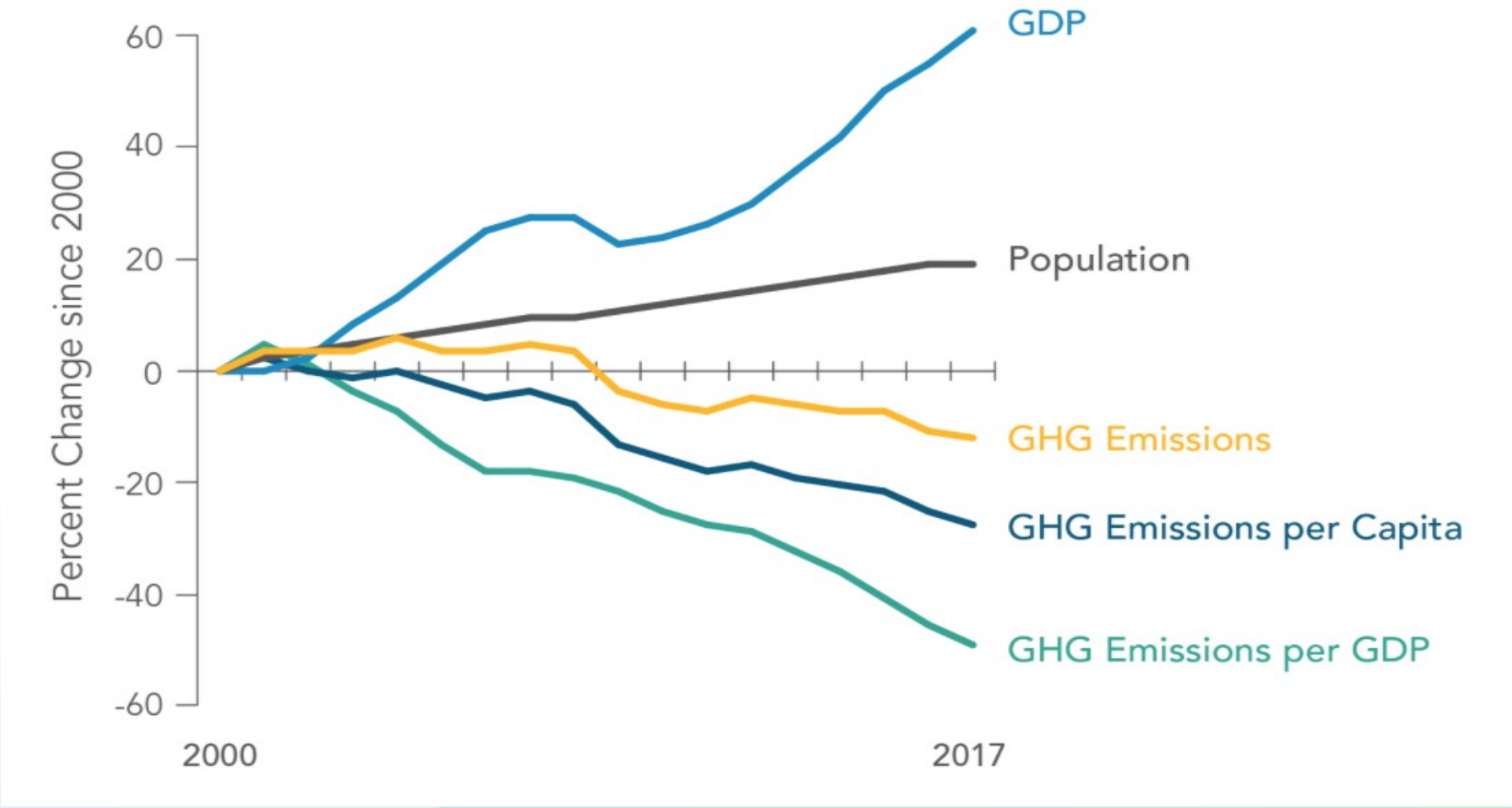
CA Economy is Energy Efficient



Source: CEC

CA GHG Emissions: GDP & Population

Change in California GDP, Population and GHG Emissions Since 2000

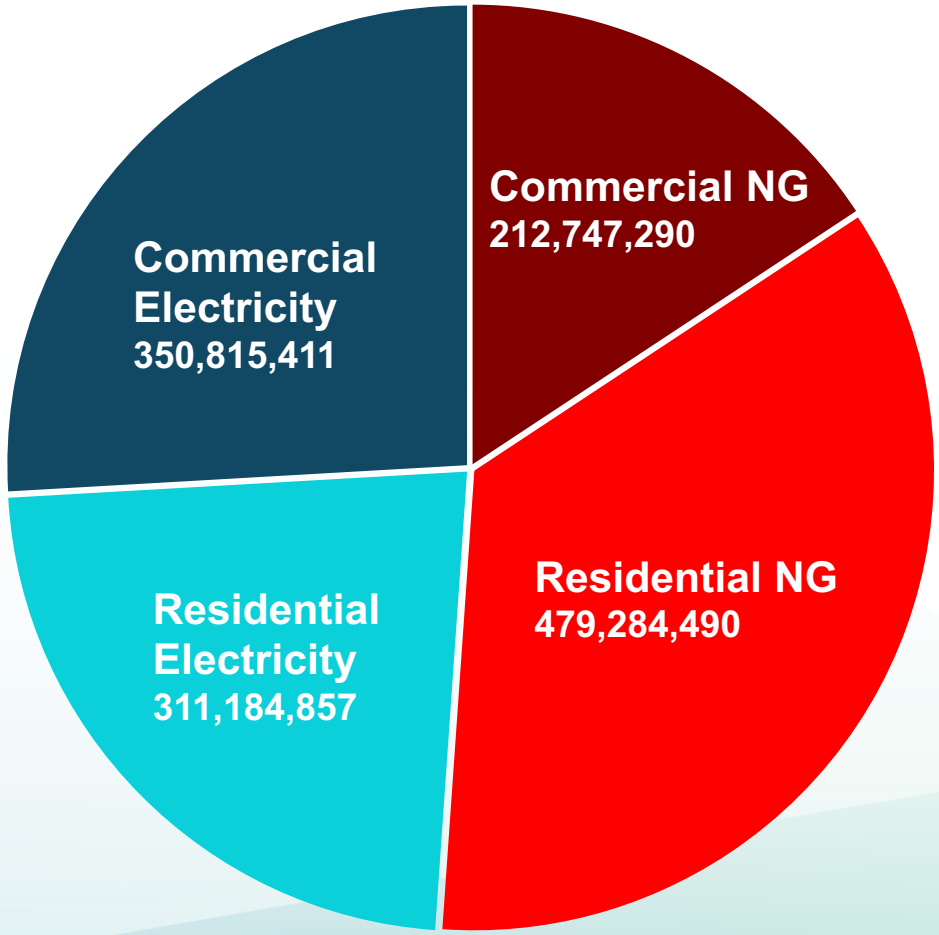


Source: California Air Resources Board

CA Energy Use in Buildings

2019 Energy Use in California Buildings (MMBtu)

ELECTRICITY
662,000,268 MMBtu (49%)



NATURAL GAS (NG)
692,031,780 MMBtu (51%)

Source: CEC

GHG Emissions in Buildings

REDUCTION PATHWAYS

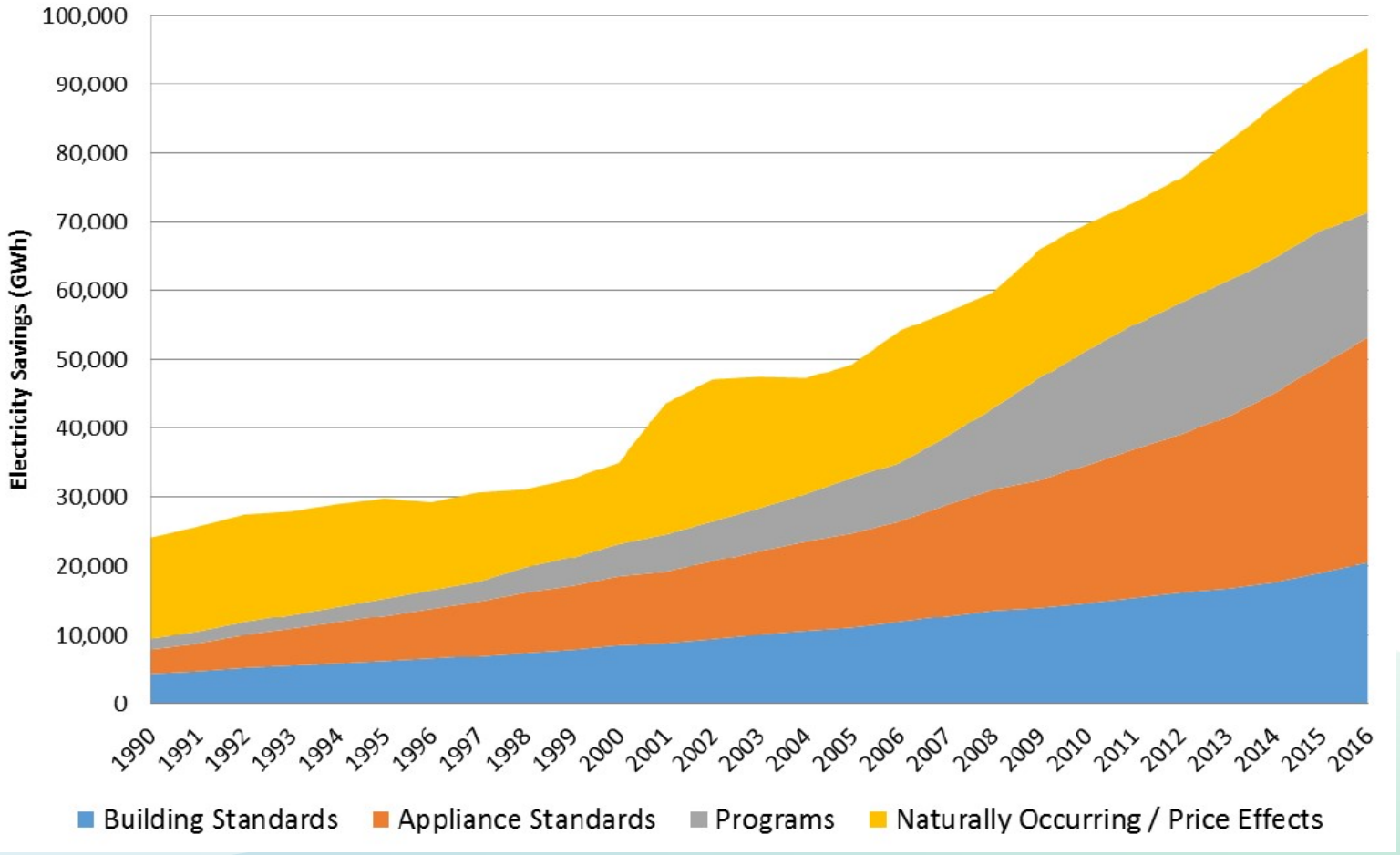
Harness decarbonizing electric grid + load flexibility	Energy Efficiency	Lower emissions intensity from existing natural gas
• SB 100 • Load Management Standards • SB 49 Load Flexibility Appliance Standards • SB 1477 BUILD Program	• Title 20 Appliance Efficiency Standards • Title 24 Building Standards • Existing building upgrades: market development and financing strategies.	• Explore feasibility of renewable natural gas (RNG) and hydrogen.

POLICY & PLANNING

- California Energy Efficiency Action Plan (2018)
- AB 3232 Assessment (December 2020)
- 2021 Integrated Energy Policy Report (IEPR)

Efficiency Standards

Since 1975, minimum energy efficiency standards have saved California well over $100 billion in electricity costs.



Source: CEC

Appliance Standards

- Set minimum feasible and attainable efficiency levels for energy and water consumption.
- Standards must be **cost-effective** to consumer over a product's lifetime.
- States are preempted from adopting more stringent standards for federally covered products.
- Covered products must meet standards in order to be legally sold or offered for sale in California.

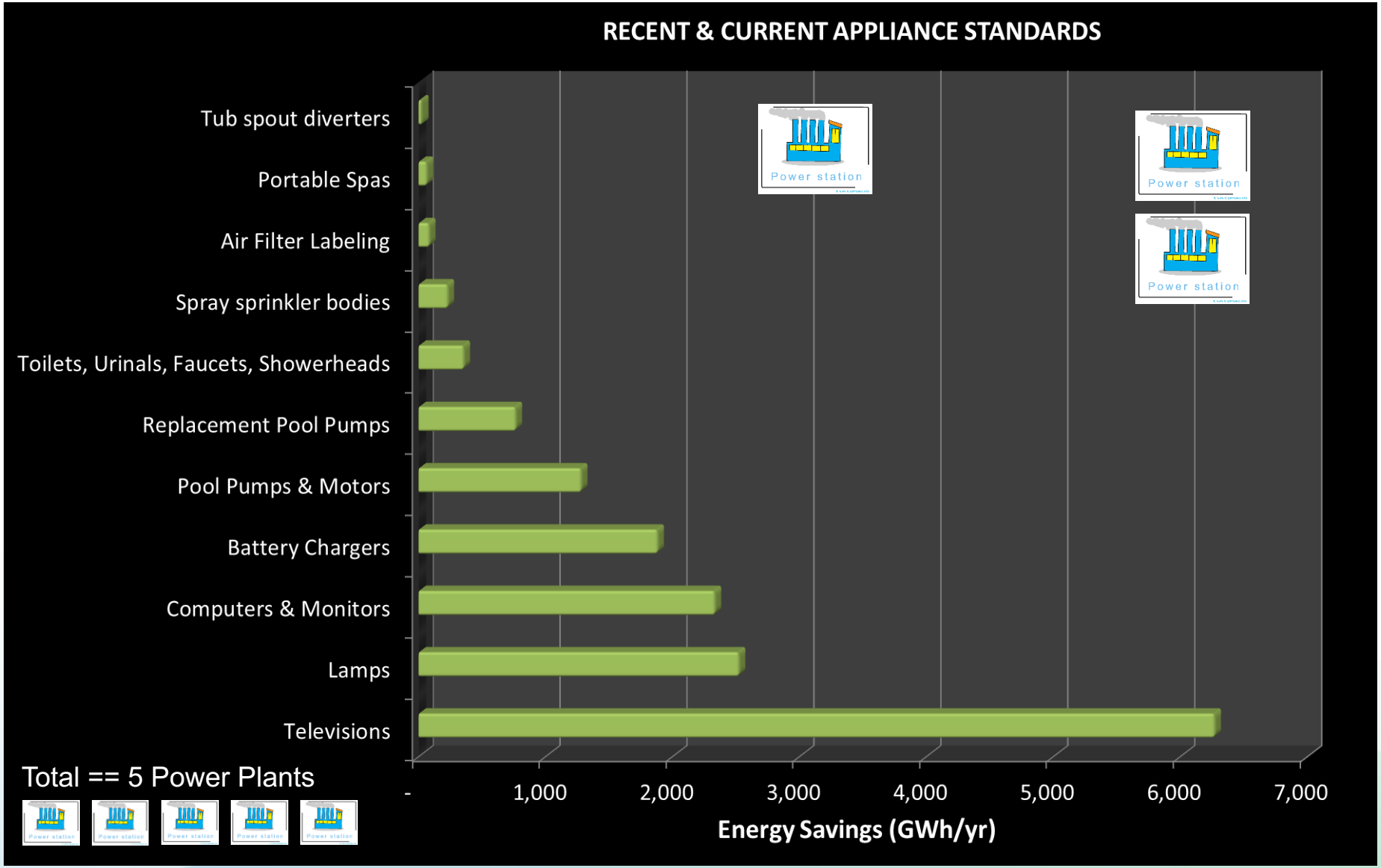
Recently adopted standards

- Air compressors
- Spray sprinkler bodies
- General service lamps
- Pool pump motors

Future standards

- Computers and monitors update
- Residential air filter labeling and marking
- Gas hearth products
- Commercial and industrial fans and blowers

Recent Energy Savings from Appliance Standards



Source: CEC

Building Standards

2019 Building Energy Code

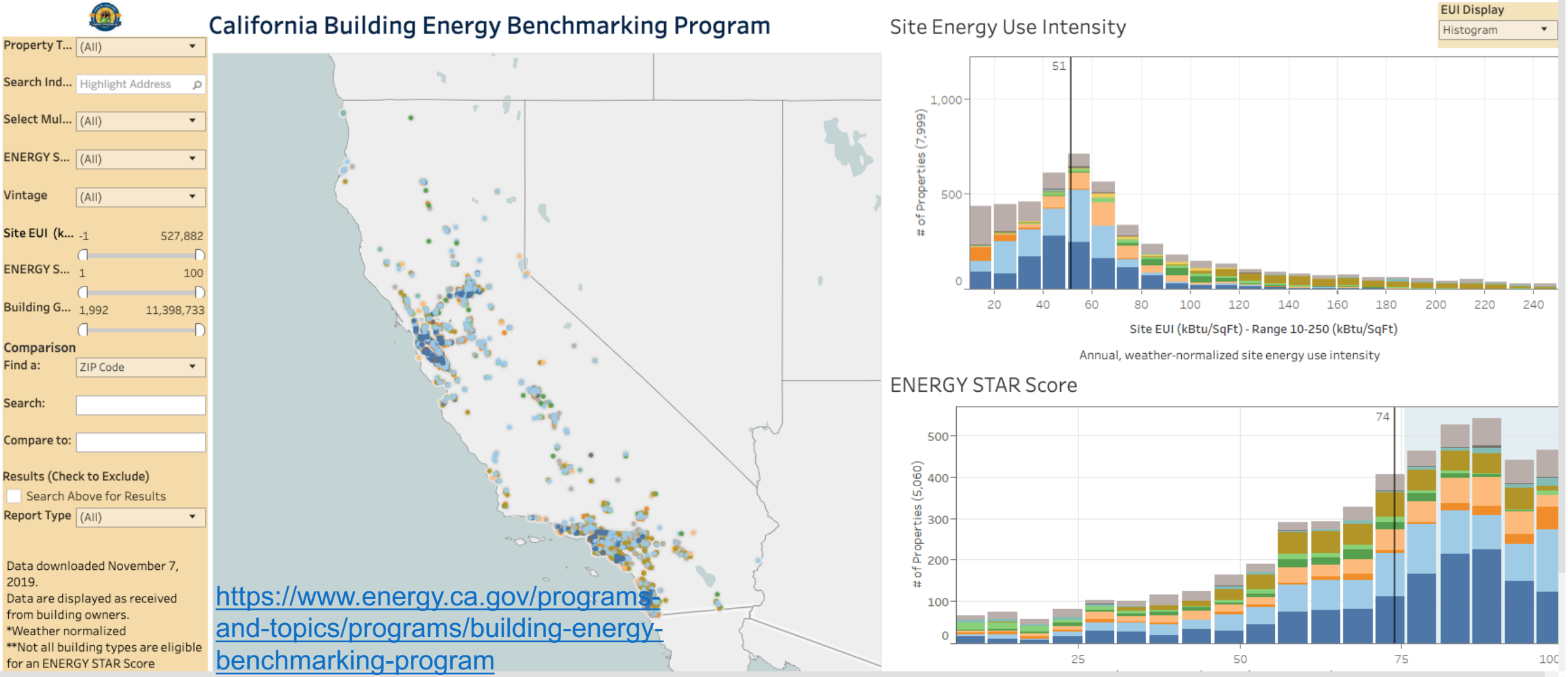
- High performance envelopes
- Solar PV requirement to offset expected annual electricity
- All-electric performance baseline for low-rise residential buildings, including performance credits for heat pump water heaters (HPWH).

2022 Building Energy Code – in development

- Energy performance metric will align with GHG
- All-electric performance baselines for certain sectors (e.g. high-rise residential and commercial buildings)
- Evaluating solar PV standards for non-residential buildings

New Tools - Existing Buildings

- Data and analytical tools for policy development and market activation.



The Future is Flexible (Demand)

Active Efficiency and Load Flexibility

- Highly efficient and grid-interactive buildings and appliances will facilitate better integration of distributed energy resources and demand-side services.
- Automated communications and control will enable cost-effective load shifting.
- Demand flexibility will enable energy usage management that minimizes the grid's cost drivers and carbon content.
- Demand flexibility will provide the best outcomes for CA ratepayers.

Hourly Carbon Content Heat Map

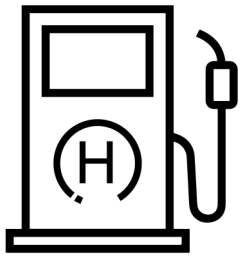
2019 System Average Metric Ton CO_2 per MWh

24-hour cycle

2020	January	February	March	April	May	June	July	August	September	October	November	December
1	0.23	0.22	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
2	0.23	0.23	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
3	0.23	0.22	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
4	0.23	0.22	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
5	0.23	0.22	0.20	0.16	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
6	0.23	0.21	0.18	0.15	0.16	0.17	0.23	0.25	0.25	0.24	0.23	0.23
7	0.22	0.20	0.18	0.15	0.15	0.17	0.22	0.25	0.24	0.23	0.22	0.22
8	0.21	0.19	0.17	0.15	0.15	0.15	0.20	0.23	0.24	0.23	0.21	0.22
9	0.20	0.17	0.16	0.13	0.13	0.13	0.19	0.20	0.21	0.21	0.19	0.20
10	0.18	0.14	0.13	0.12	0.11	0.12	0.17	0.18	0.19	0.18	0.17	0.18
11	0.16	0.13	0.12	0.10	0.11	0.11	0.16	0.17	0.18	0.17	0.16	0.17
12	0.16	0.13	0.11	0.10	0.10	0.10	0.15	0.17	0.17	0.16	0.16	0.16
13	0.16	0.13	0.11	0.10	0.10	0.10	0.15	0.16	0.17	0.16	0.16	0.16
14	0.16	0.13	0.12	0.10	0.10	0.10	0.14	0.16	0.17	0.17	0.16	0.17
15	0.17	0.14	0.12	0.10	0.10	0.10	0.14	0.16	0.18	0.17	0.18	0.18
16	0.20	0.17	0.14	0.11	0.10	0.10	0.14	0.16	0.18	0.19	0.20	0.21
17	0.20	0.19	0.16	0.13	0.10	0.11	0.14	0.16	0.18	0.19	0.20	0.21
18	0.19	0.18	0.16	0.13	0.11	0.12	0.15	0.17	0.19	0.19	0.19	0.19
19	0.18	0.17	0.15	0.13	0.12	0.13	0.16	0.18	0.19	0.19	0.19	0.19
20	0.19	0.18	0.15	0.13	0.13	0.14	0.17	0.19	0.20	0.20	0.19	0.19
21	0.19	0.18	0.16	0.14	0.14	0.15	0.19	0.21	0.22	0.21	0.20	0.20
22	0.20	0.19	0.17	0.14	0.15	0.16	0.20	0.22	0.23	0.23	0.21	0.21
23	0.22	0.20	0.18	0.16	0.15	0.17	0.21	0.24	0.24	0.24	0.22	0.22
24	0.23	0.21	0.19	0.16	0.16	0.17	0.22	0.25	0.26	0.25	0.23	0.23

Source: CEC

Clean Transportation Policy Goals



ZEV Infrastructure

- **250,000** electric vehicle chargers, including **10,000** DC fast chargers, by 2025
  - Current: **51,200** electric vehicle chargers and **4,255** DC fast chargers
- **200** hydrogen refueling stations by 2025
  - Current: **39** hydrogen fueling stations with 25 more planned

ZEV Fleet

- **1.5 million** electric vehicles by 2025
- 5 million zero-emission vehicles by 2030
  - Current: **600,000** plug-in electric vehicles, **6,300** hydrogen fuel cell cars

Set the climate and market goals.

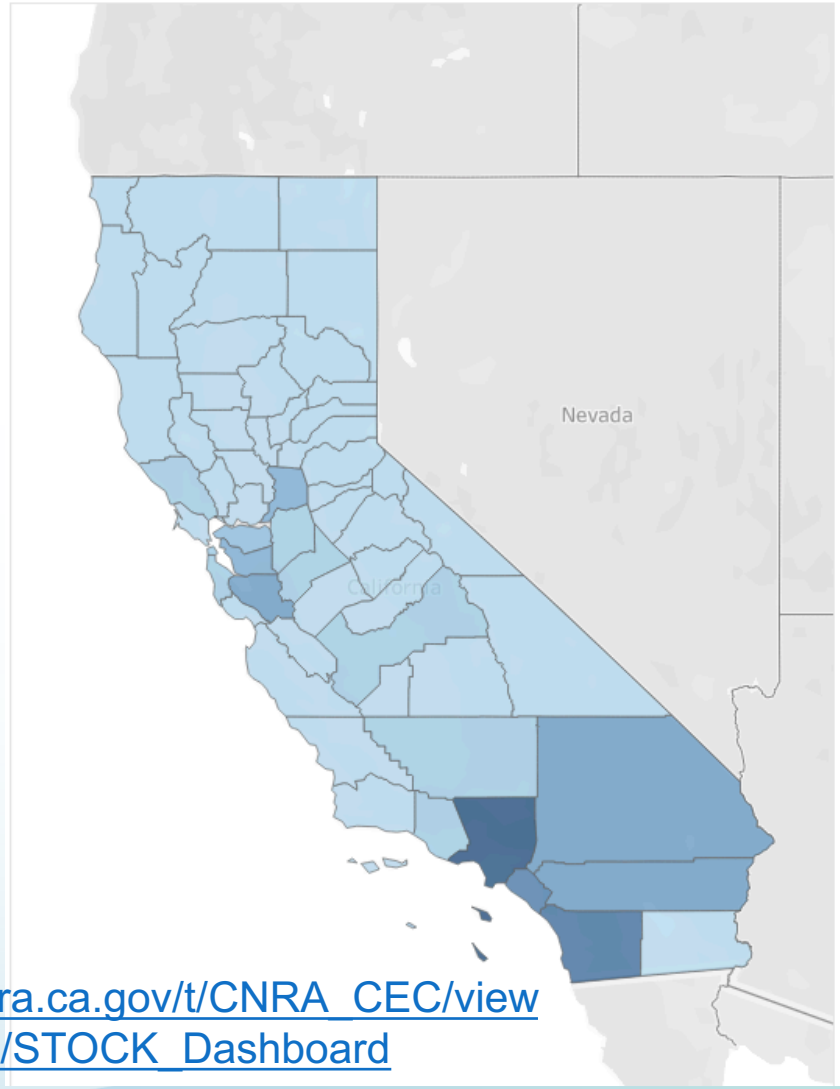
Develop and build advanced clean transportation technology.

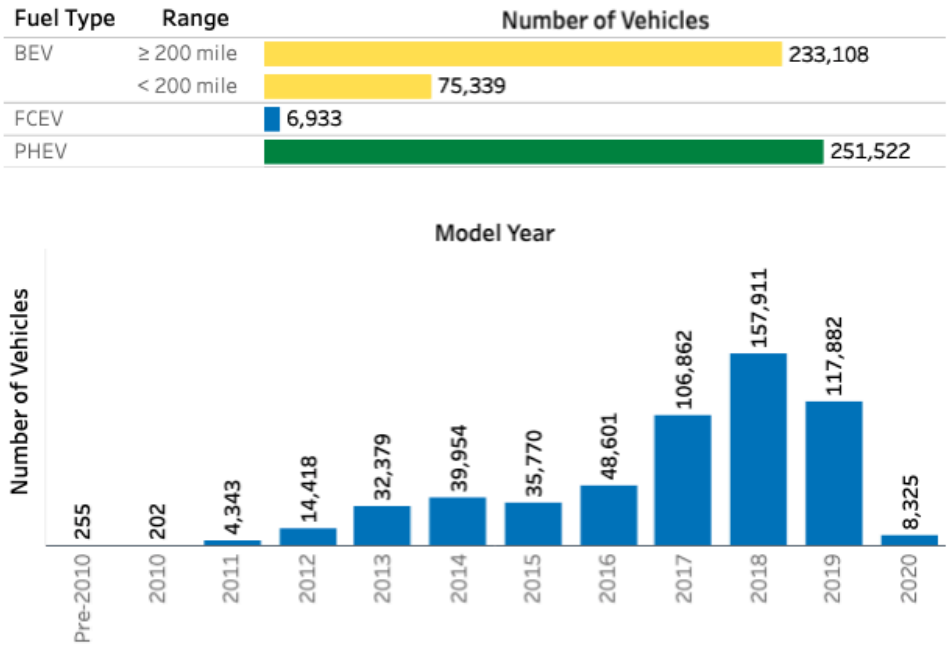
Adopt the new technology for consumers and businesses.

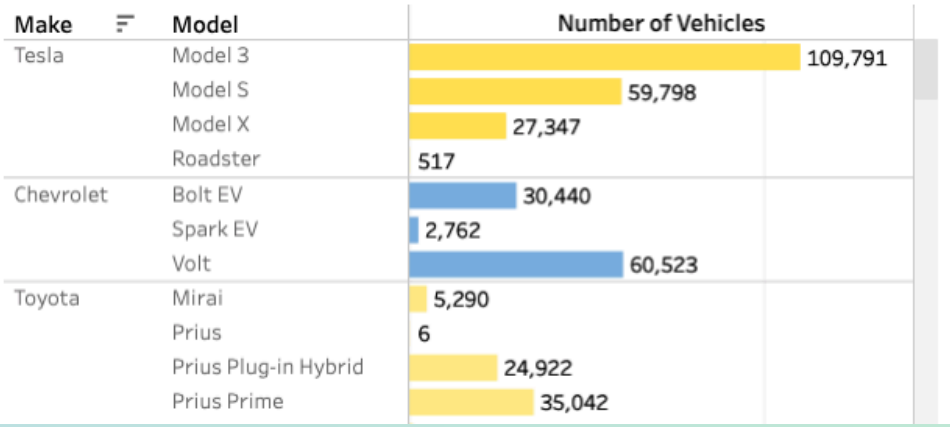
Pave the way for other states to join the transition.

Data Access - Transportation

- Data and analytical tools for policy development and market activation.





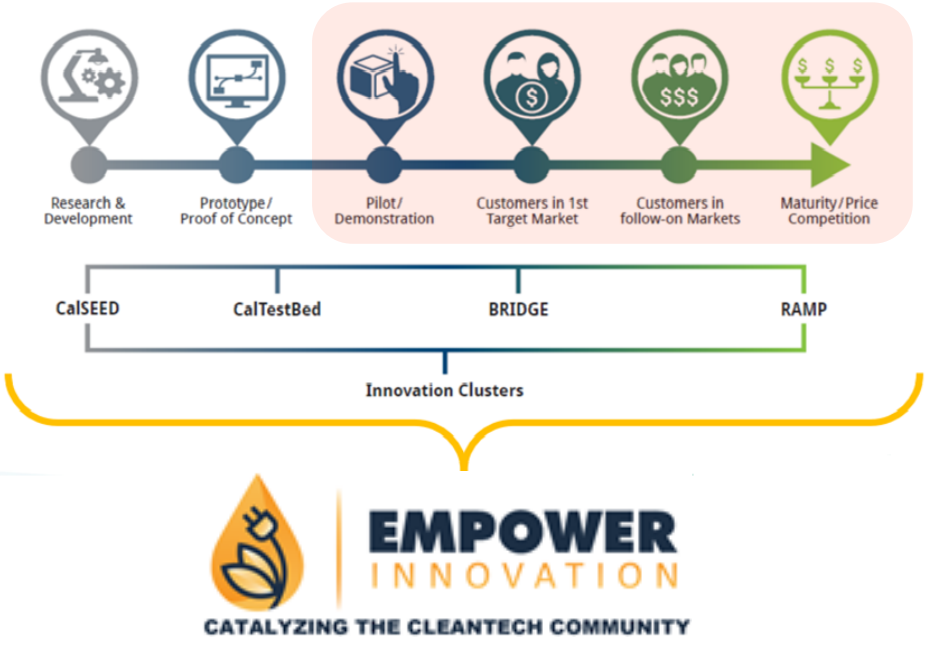


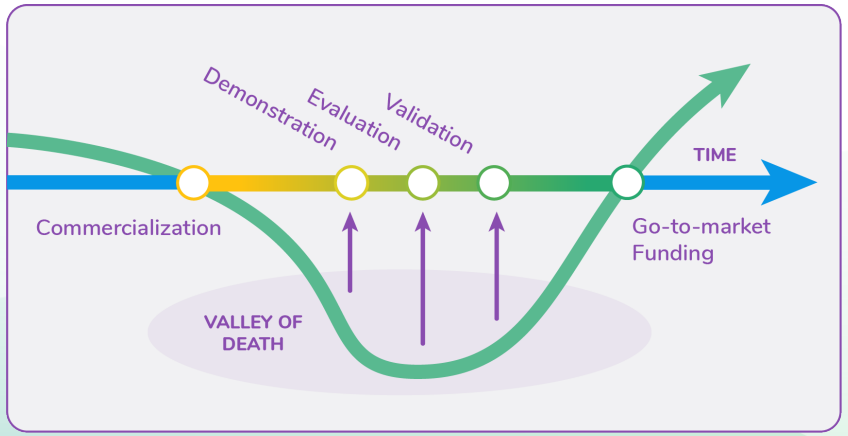
https://tableau.cnra.ca.gov/t/CNRA_CEC/views/DMVDataPortal/STOCK_Dashboard

Research, Development, and Market Deployment

Electric Program Investment Charge (EPIC)

- Funded by electricity ratepayer funds
- Awards through competitive solicitation process
- Assist technologies in overcoming barriers to market
- Recent research focused on building electrification, distributed energy resources, energy storage, and industrial and agricultural innovation.
- Reauthorized in August 2020: **$1.5 billion** over 10 years through 2030
- Upcoming projects:
  - **Flexible Load Research and Deployment Hub**
  - **The Next EPIC Challenge: Re-imagining Affordable Mixed-Use Development in a Carbon Constrained Future**





Thank you!