California's Climate Change Challenge

Addressing Climate through Development & Implementation of Clean Energy Policies

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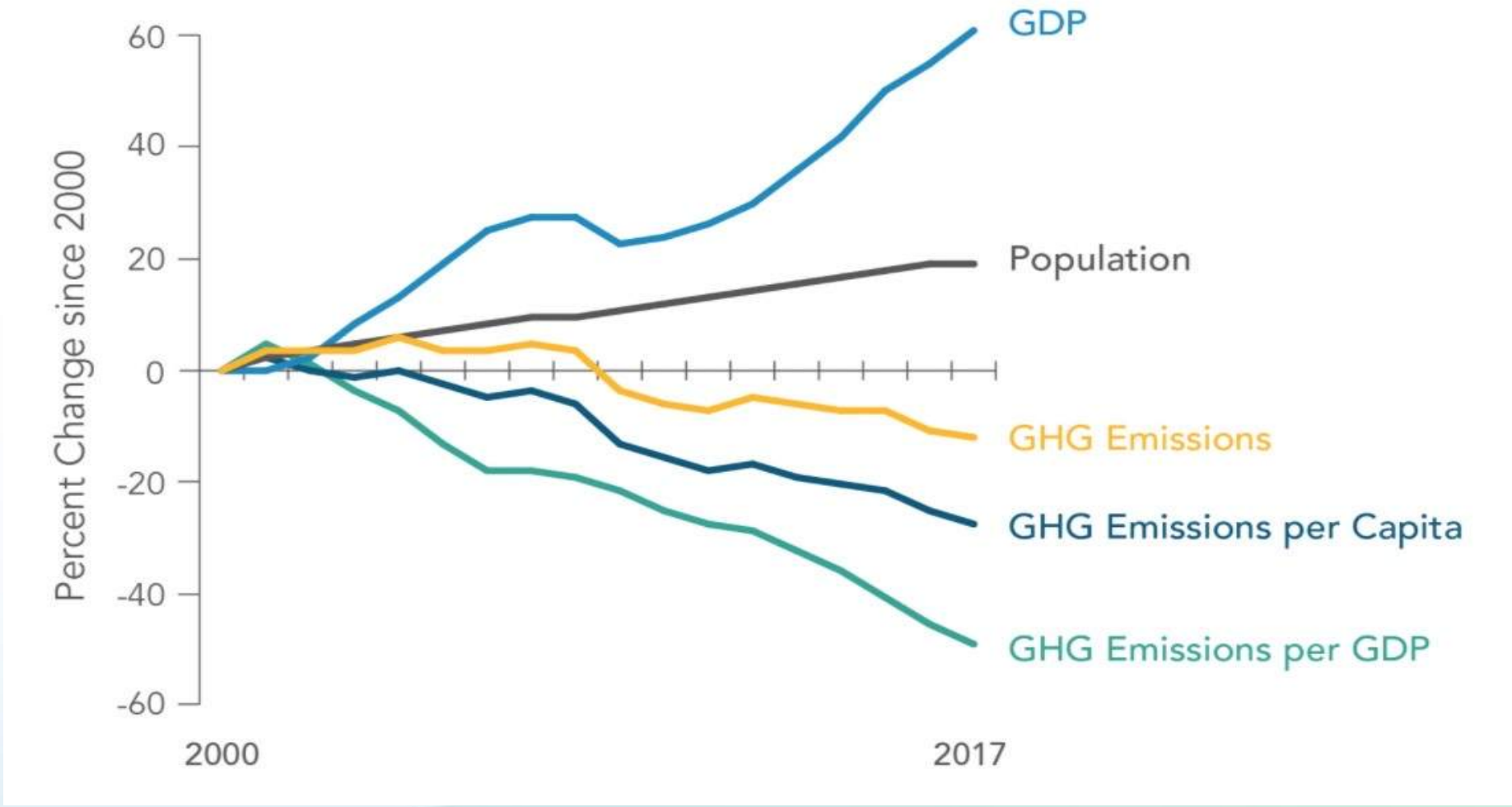
Engineering Change Lab - March 22, 2021

Climate Change is Here

CA GHG Emissions: GDP & Population

Change in California GDP, Population and GHG Emissions



Source: California Air Resources Board

Policy Drivers

Double energy efficiency savings by 2030

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

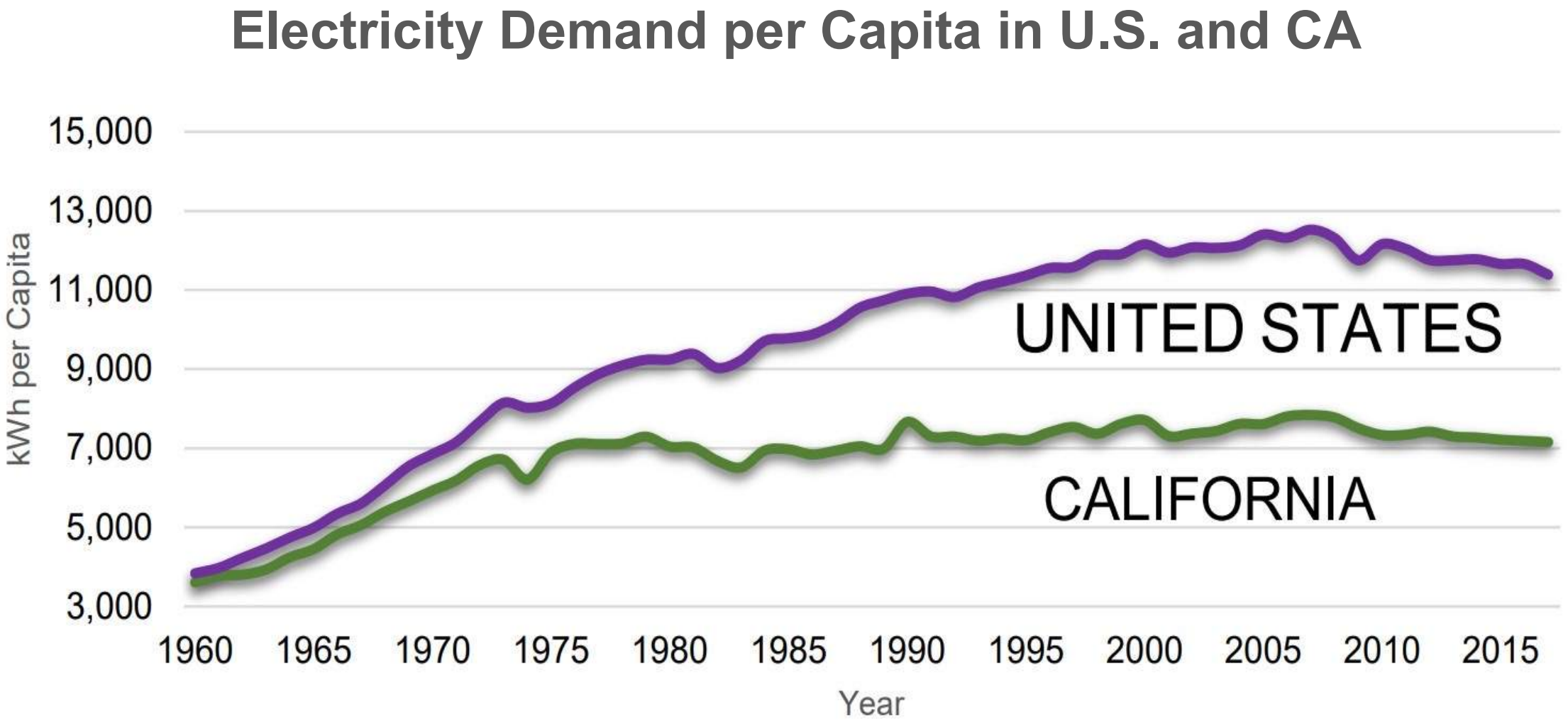
Decarbonize buildings and industrial processes

Electrify transportation and decarbonize fuels

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

Carbon-free economy by 2045

CA Economy is Energy Efficient



Source: CEC

Senate Bill (SB) 100

Expands Renewables Portfolio Standard

60% by Dec 31, 2030

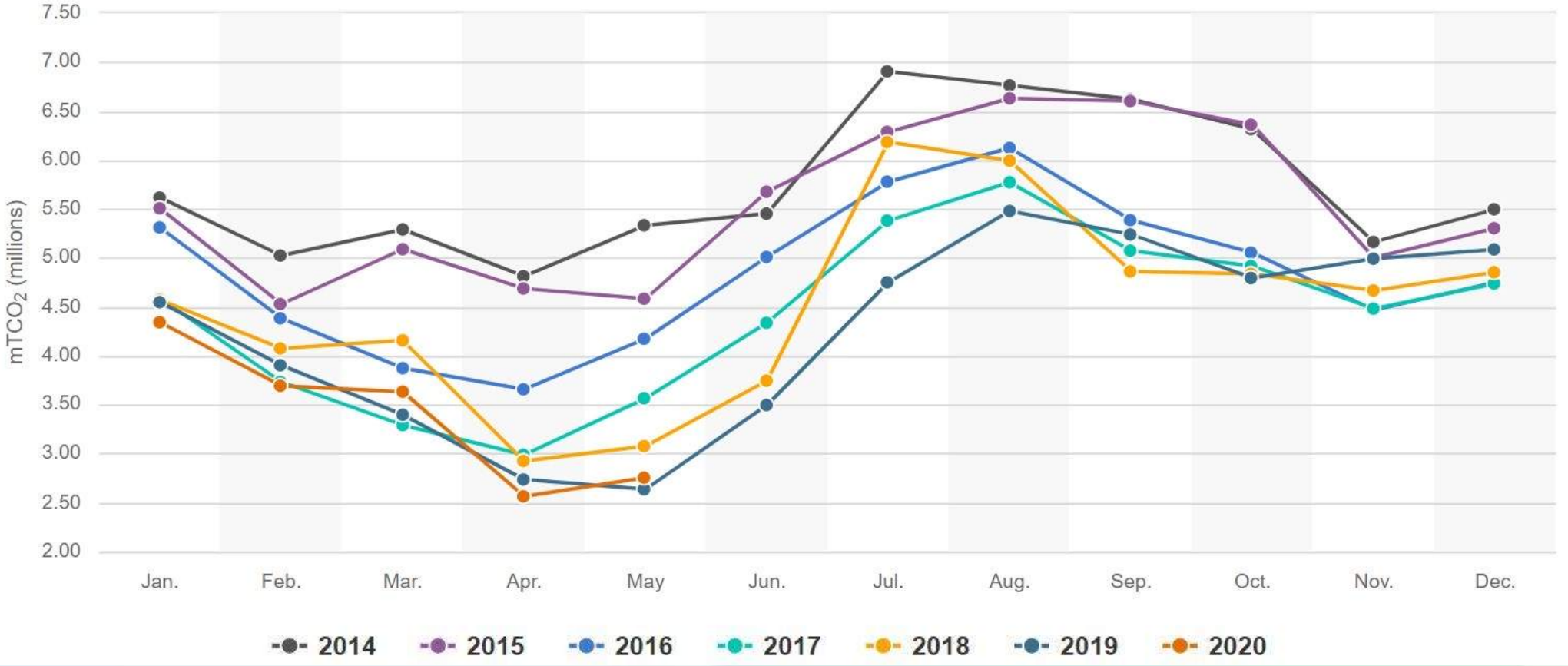
PUC 399.11 (a)

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.

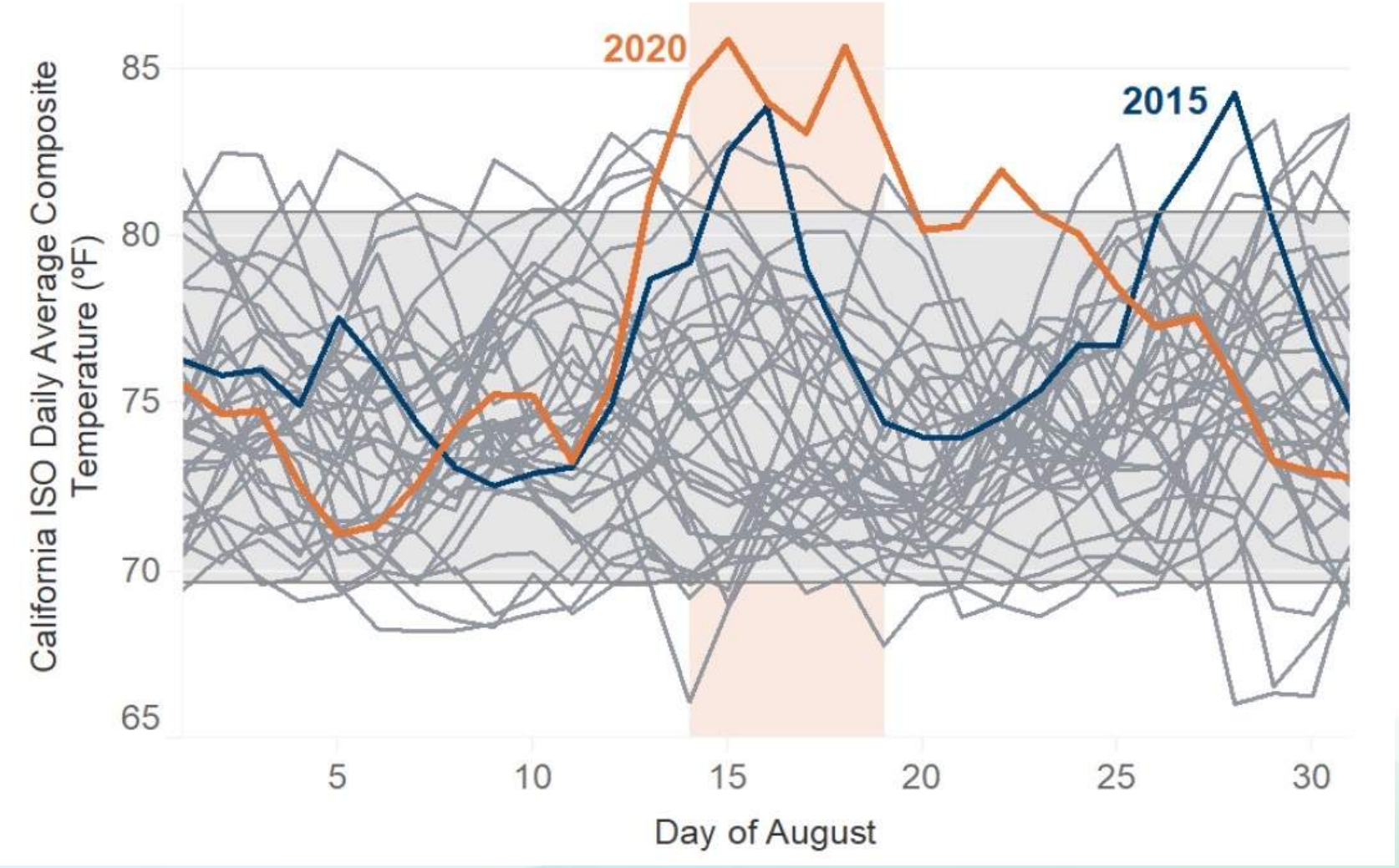
Declining Grid Carbon Content

Monthly CO_2 Emissions from CA's electricity grid



Source: California Independent System Operator (CAISO)

August Temperatures 1985-2020



Source: CEC Weather Data/CEC Analysis

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.

Hourly Carbon Content Heat Map

2019 System Average Metric Ton CO_2 per MWh

24-hour cycle

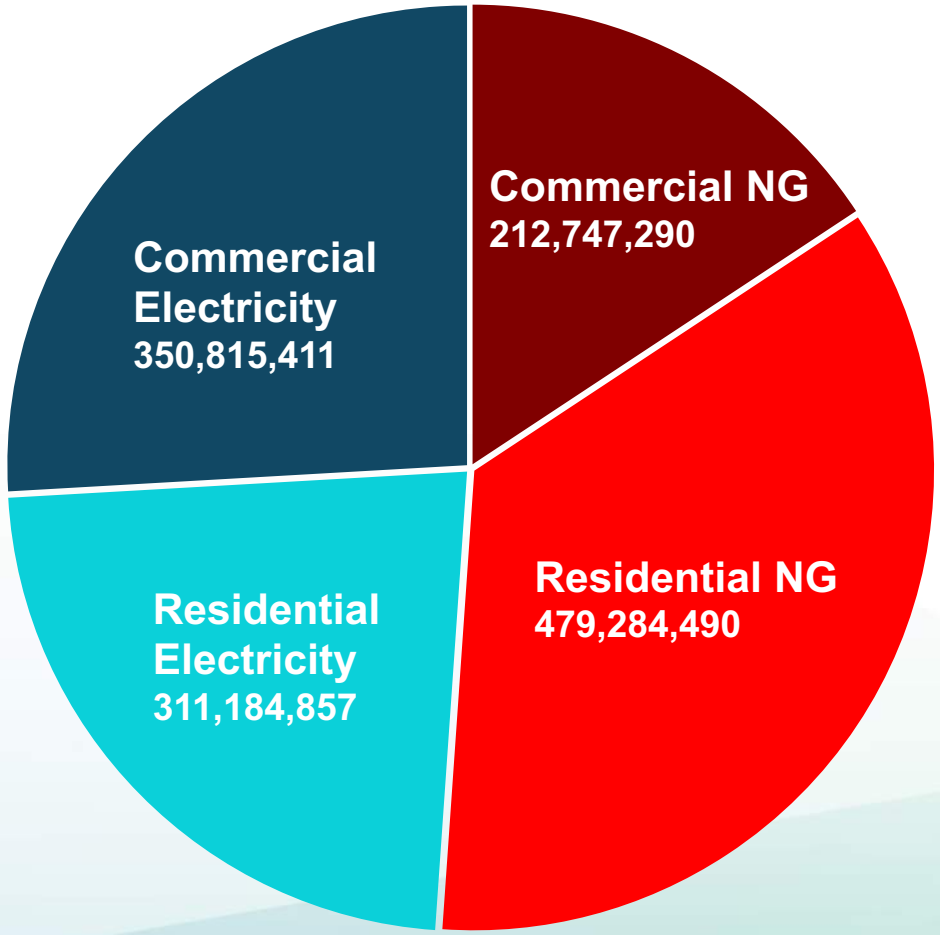
2020	January	February	March	April	May	June	July	August	September	October	November	December
1	0.23	0.22	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
2	0.23	0.23	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
3	0.23	0.22	0.20	0.17	0.17	0.18	0.23	0.26	0.26	0.25	0.24	0.24
4	0.23	0.22	0.20	0.17	0.17	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

CA Energy Use in Buildings

2019 Energy Use in California Buildings (MMBtu)

ELECTRICITY
662,000,268 MMBtu (49%)



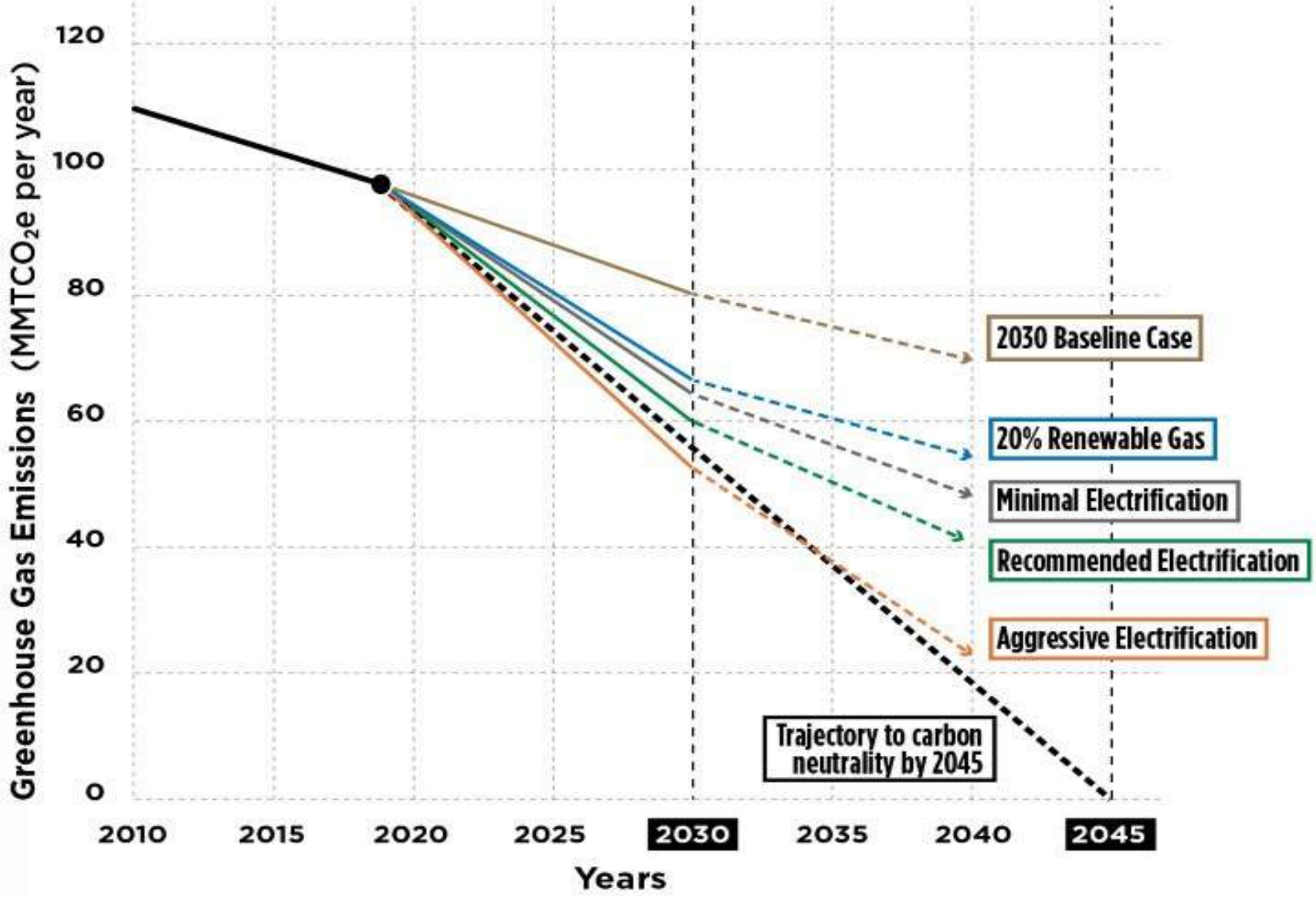
NATURAL GAS (NG)
692,031,780 MMBtu (51%)

Source: CEC

Emissions from Buildings

Straight Line Carbon Trajectories

Trajectories toward 2045 shows the relative closeness in 2030 of all the scenarios, but the long term shows large differences in trajectories



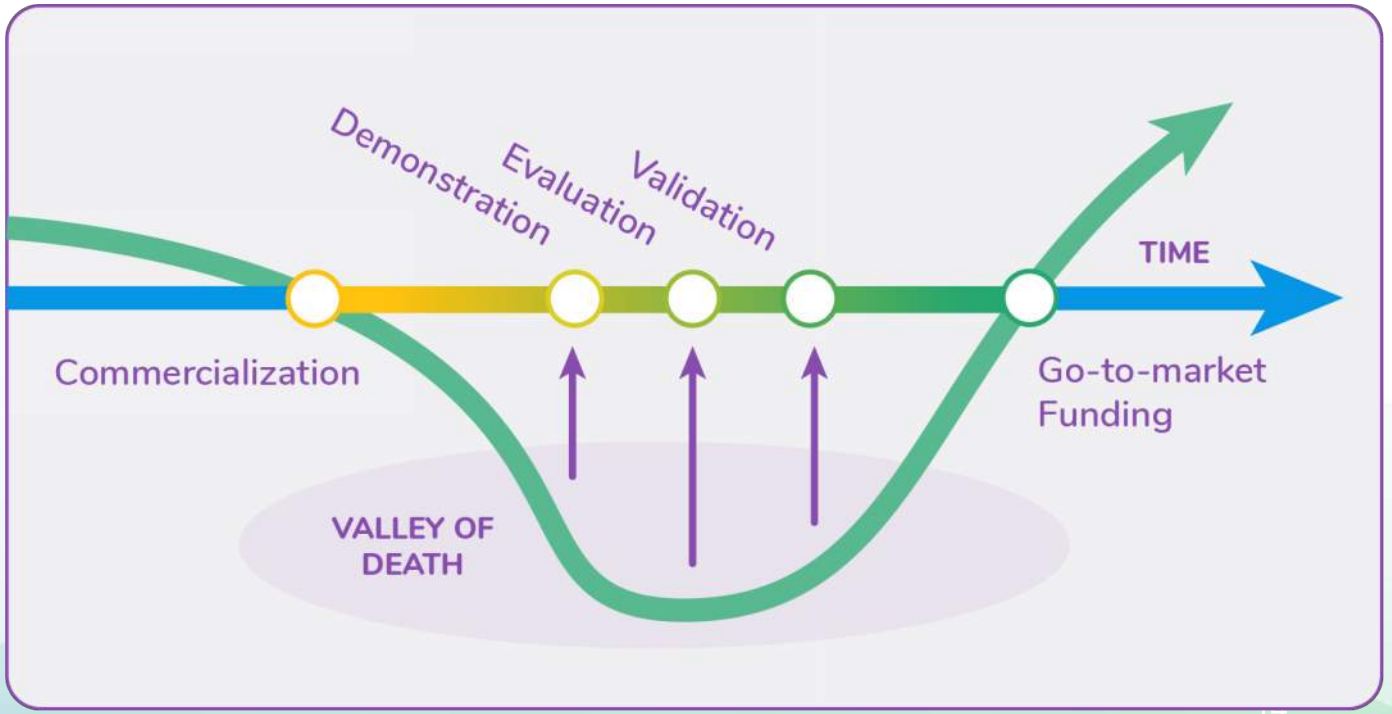
The Future is Flexible (Demand)

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.

Fostering Innovation Across the Energy Sector

CEC Invests ~200M each year in energy-related research, Development, Demonstration & Deployment. Core mission: strategically invest funds to catalyze change and accelerate achievement of policy goals



EmpowerInnovation.Net

Empower Innovation strives to accelerate your clean tech journey with easy access to funding opportunities from the Energy Commission and other funding providers, curated resources and events, and connections to people and organizations.

FIND A PARTNER
Announce your interest in this funding opportunity and message other interested parties to find potential partners.

RESOURCES & TOOLS
Browse the collection of resources for clean tech innovators including Resource Libraries, Funding Sources, Tools, and Databases.

Thank you!