

# Decarbonizing the Electricity Sector

13th Annual Lesley K. McAllister Symposium on Climate and Energy Law | November 12, 2021

Siva Gunda, Vice Chair, California Energy Commission

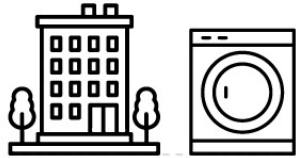




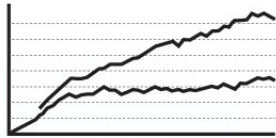
# 1974: WARREN-ALQUIST ACT PASSED



**Created the Energy Commission**



**Set building and appliance efficiency standards**



**Forecast electricity demand**



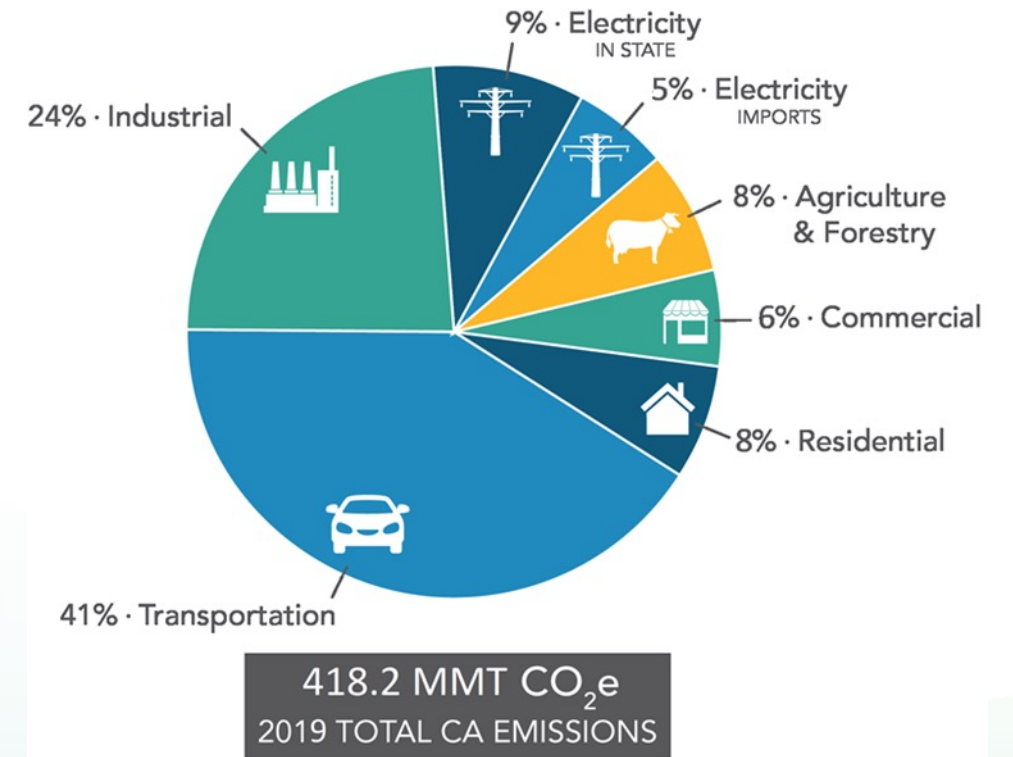
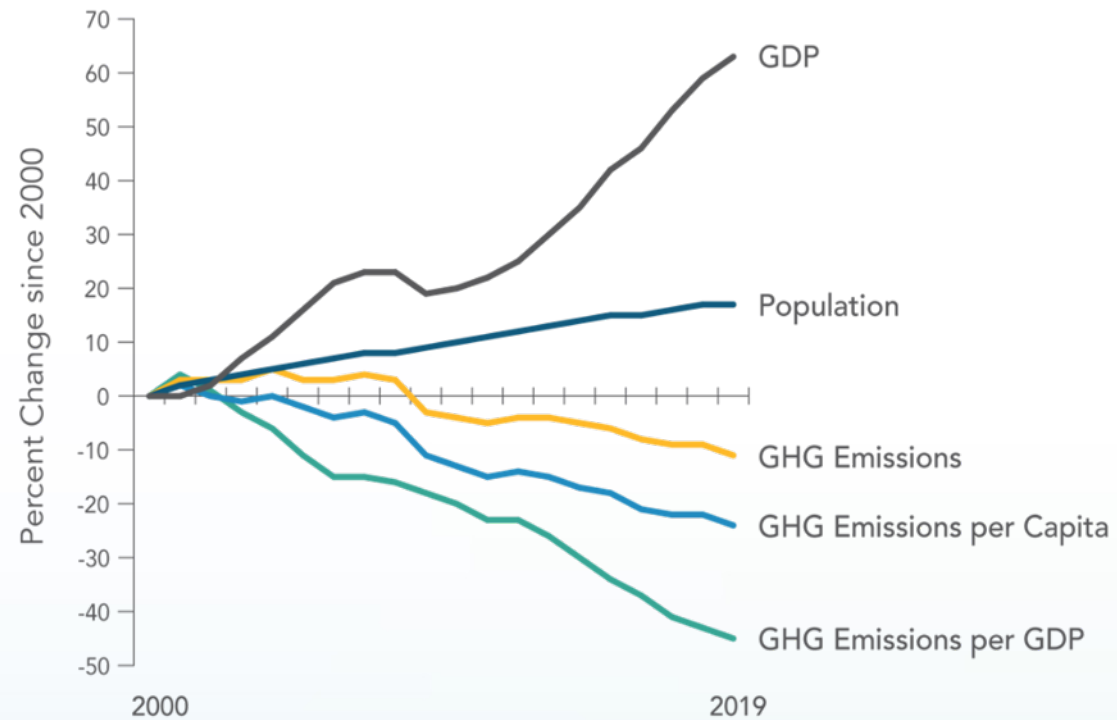
**Support R&D into non-conventional energy sources**



**The Energy Commission is committed  
to promoting a **clean, affordable, and reliable**  
energy supply for **all Californians**.**



# ASSEMBLY BILL 32





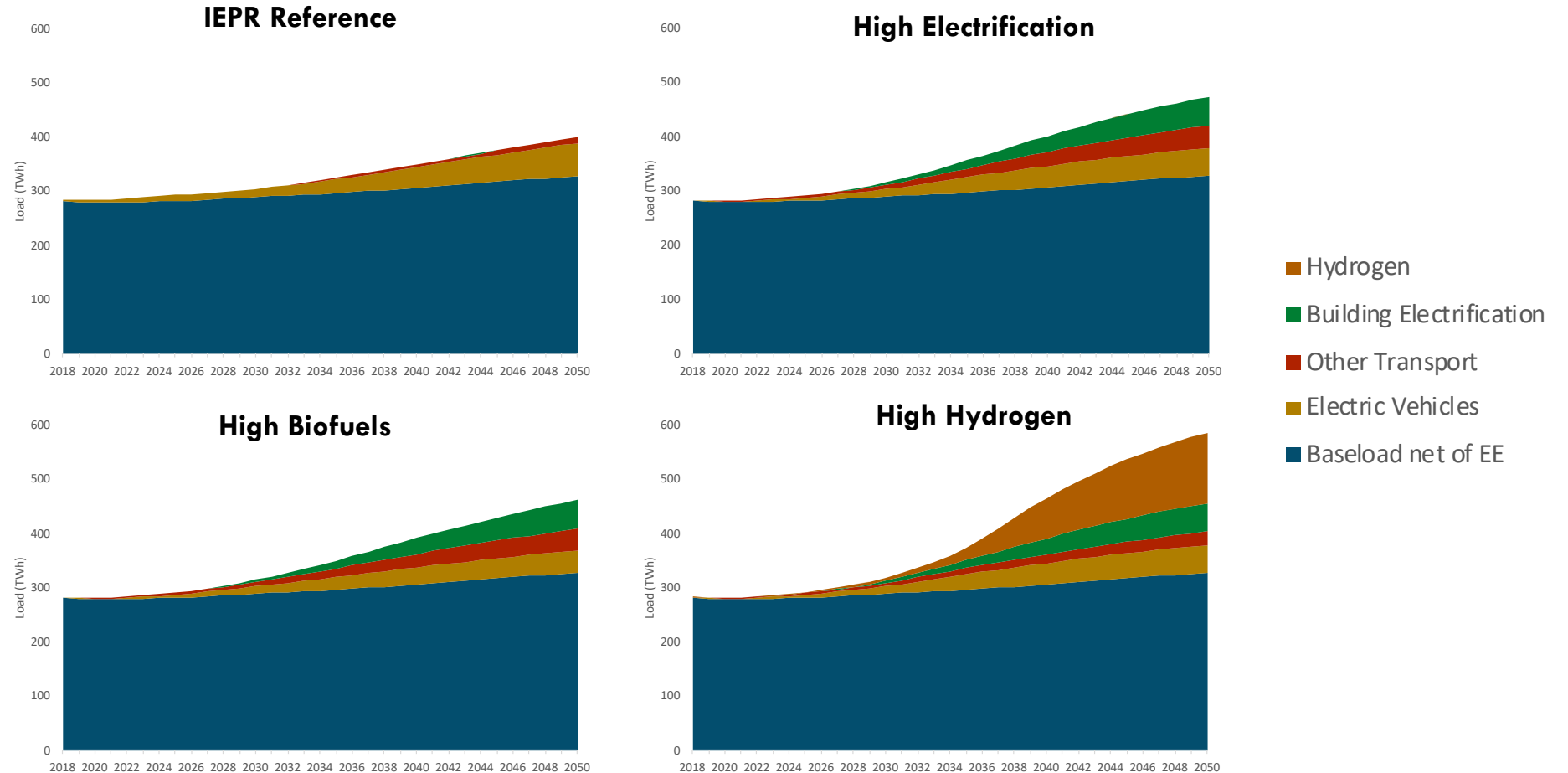
# ADVANCING DECARBONIZATION



- Assembly Bill 32 (2006)
- Senate Bill 350 (2015)
- Senate Bill 1383 (2016)
- Senate Bill 32 (2016)
- Senate Bill 100 (2018)
- Assembly Bill 3232 (2018)
- Senate Bill 1477 (2018)



# Decarbonization Pathways



# Senate Bill 100

Officially titled “The 100 Percent Clean Energy Act of 2018,”  
Senate Bill 100 (SB 100, De León):

- 1** Sets a 2045 goal of powering all retail electricity sold in California and state agency electricity needs with renewable and zero-carbon resources.
- 2** Updates the state’s Renewables Portfolio Standard to ensure that by 2030 at least 60 percent of California’s electricity is renewable.
- 3** Requires the CEC, CPUC, and CARB to use programs under existing laws to achieve 100 percent clean electricity and issue a joint policy report on SB 100 by 2021 and every four years thereafter.





# The 2021 SB 100 Joint Agency Report

The 2021 report is a first step to evaluate the challenges and opportunities in implementing SB 100.

**It includes an initial assessment of the additional energy resources and the resource building rates needed to achieve 100 percent clean electricity, along with the associated costs.**

**The estimates in this report will change over time as additional factors, such as system reliability, land use, energy equity, and workforce needs, are more closely examined.**



# 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

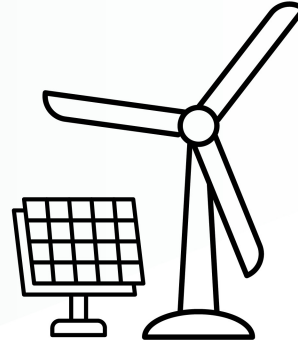


Achieving 100% Clean Electricity in California

		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***

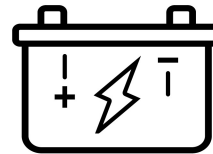
Development Needs  
To Rapidly Accelerate



**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





## Additional Scenarios: Preliminary Findings

### Study Scenarios

The agencies also explored scenarios outside their interpretation of SB 100 to inform broader state planning efforts



#### High Demand Flexibility:

Increased flexibility may lower overall resource needs and systems costs



#### No-Combustion:

Reduces criteria air pollution but results in higher costs



#### Zero-Carbon Firm Resources:

Commercialization of emerging technologies or cost decreases in existing firm resources may lower overall system costs



#### Accelerated Timeline:

These targets may be achievable but may increase overall costs



# SEVEN BROAD STRATEGIES OF BUILDING DECARBONIZATION

1. Building end-use electrification
2. Decarbonizing electricity generation system
3. Distributed energy resources
4. Refrigerant conversion and leakage reduction
5. Energy efficiency
6. Demand flexibility
7. Decarbonizing gas system



# THE FUTURE IS FLEXIBLE (DEMAND)

## Active Efficiency and Load Flexibility

- Highly efficient, grid-interactive buildings and appliances facilitate integration of renewable generation, distributed energy resources and demand-side services.
- Automated communications and control will enable cost-effective load shifting.
- Demand flexibility can minimize the grid's cost drivers and carbon content (SB 100) **AND** enhance reliability (Root Cause Analysis).
- Demand flexibility will provide the best outcomes for CA ratepayers.







# Gas System Transition

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- Key emerging gas issues:
  - Impact of building electrification on gas demand
  - Interdependencies between gas and electricity reliability
  - Potential role of renewable gas and renewable hydrogen
  - Defining pathways for gas system decarbonization



# Lessons from 2020 & 2021

- Climate crisis is here; and current planning does not comprehensively consider the impacts into demand and supply modeling
  - Heat waves, drought, fires
  - Historically high volatility of load in shoulder months
- Net peak period continues to be very tight
  - Imports play a critical role
- The electric system and markets are rapidly transitioning and not enough historical information
  - Diversity of resources is important
- Reliability and equity are key to a clean transition
- Demand Side Management is critical
- Need coordination and collective action



# Thank you!

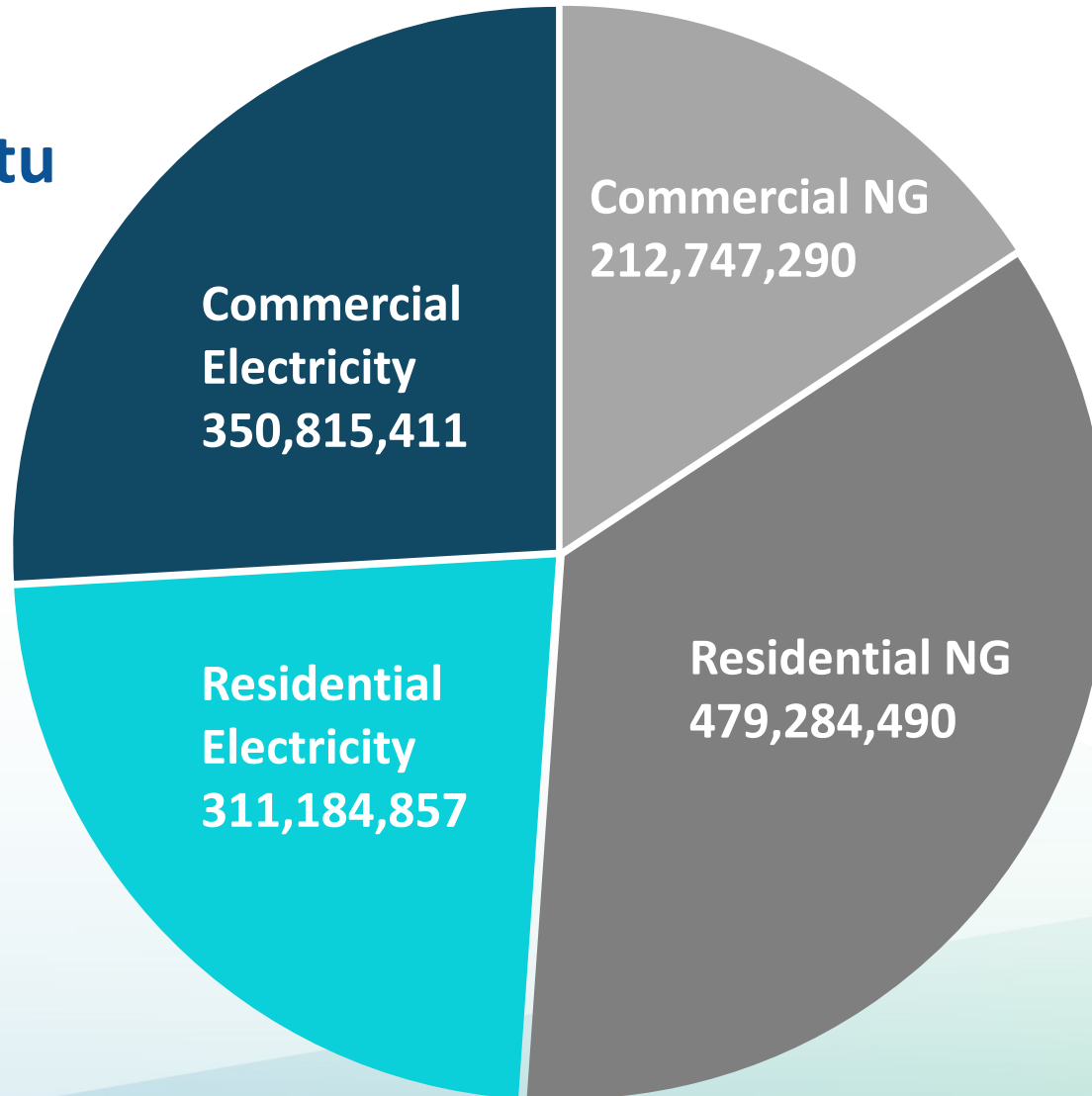




# 2019 ENERGY USE IN CALIFORNIA BUILDINGS (MMBtu)

## ELECTRICITY

**662,000,268 MMBtu  
(49%)**



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



# ASSEMBLY BILL 3232 (AB 3232)

- CEC must assess potential to reduce GHG emissions:
  - In residential and commercial buildings
  - By at least 40% below 1990 levels
  - By January 1, 2030.
- Seven broad strategies of building decarbonization
  - Building end-use electrification
  - Decarbonizing the electricity generation system
  - Distributed energy resources
  - Refrigerant conversion and leakage reduction
  - Energy efficiency
  - Demand flexibility
  - Decarbonizing the gas system