



CLEAN AIR  
TASK FORCE

APRIL 9, 2020

# CCUS in California: Climate Opportunity and Policy Need

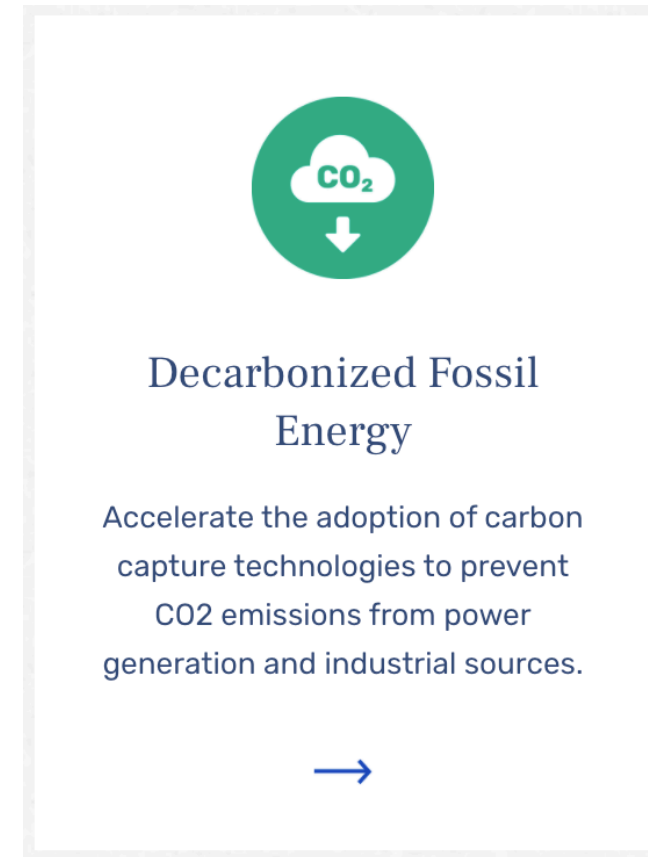
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# CATF

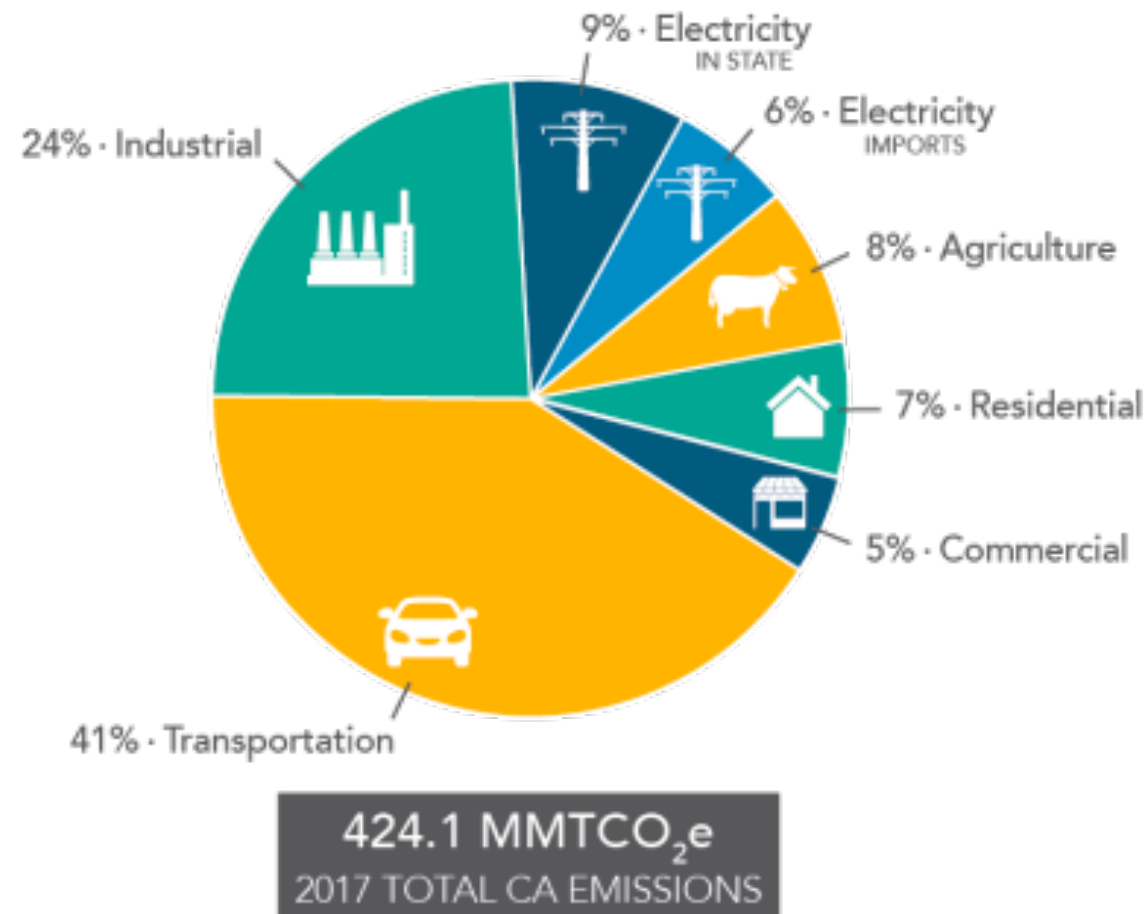
We examine all options with an open mind.



We push change in technologies and policies needed to achieve a zero-emissions, high-energy planet at an affordable cost.



# Overview of CO<sub>2</sub> emissions in California by sector



# Relevant CO<sub>2</sub> reduction policies and goals

- Transportation sector:
  - Emissions addressed: 41% of 2017 annual emissions
  - Policy: Low Carbon Fuel Standard (LCFS) program.
  - Goal: 20% carbon intensity reduction relative to 2010 by 2030 and setting up a market for low carbon fuels and advancing new technology applications
- Power and other industrial sectors including those related to transportation sector:
  - Emissions addressed: 85% of 2017 annual emissions
  - Policy: Cap and Trade program
  - Goal: GHG cap declines by ~3% every year (~20% reduction in 2020 emissions relative to BAU as modeled)
- Power sector: goal to achieve 100% zero carbon electricity under SB 100 legislation by 2045.
  - Goal: 60% electricity by 2030 from renewables. 40% electricity from zero carbon sources.
- Economy wide: goal to achieve carbon neutrality by 2045 and negative emissions after 2045, no legislation yet

# Where does CCS fit?

- Since January 1, 2019, CCUS including Direct Air Capture (DAC) are approved pathways to generate credits under the LCFS for obligated parties. For instance, facilities making ethanol that is then supplied and blended into fuel used in California, or crude oil producers or refiners, can claim credits by using CCS. DAC projects irrespective of location are eligible to generate credits.
- In addition to 45Q, the LCFS credit market embracing CCS has enabled CCS projects to begin development:
  - White energy in Texas – ethanol CCS project, announced in 2018
  - CRC in California – CCS on power plant on-site of crude production, received DOE grant for feasibility study in 2019
- SB 100 does not exclude CCUS. Currently, three California agencies are taking public comments on their modeling plans in which different technology mix scenarios will be tested before implementation plans can be made.
- Cap and Trade program does not have a CCUS pathway, yet. No insight yet into when that might change.

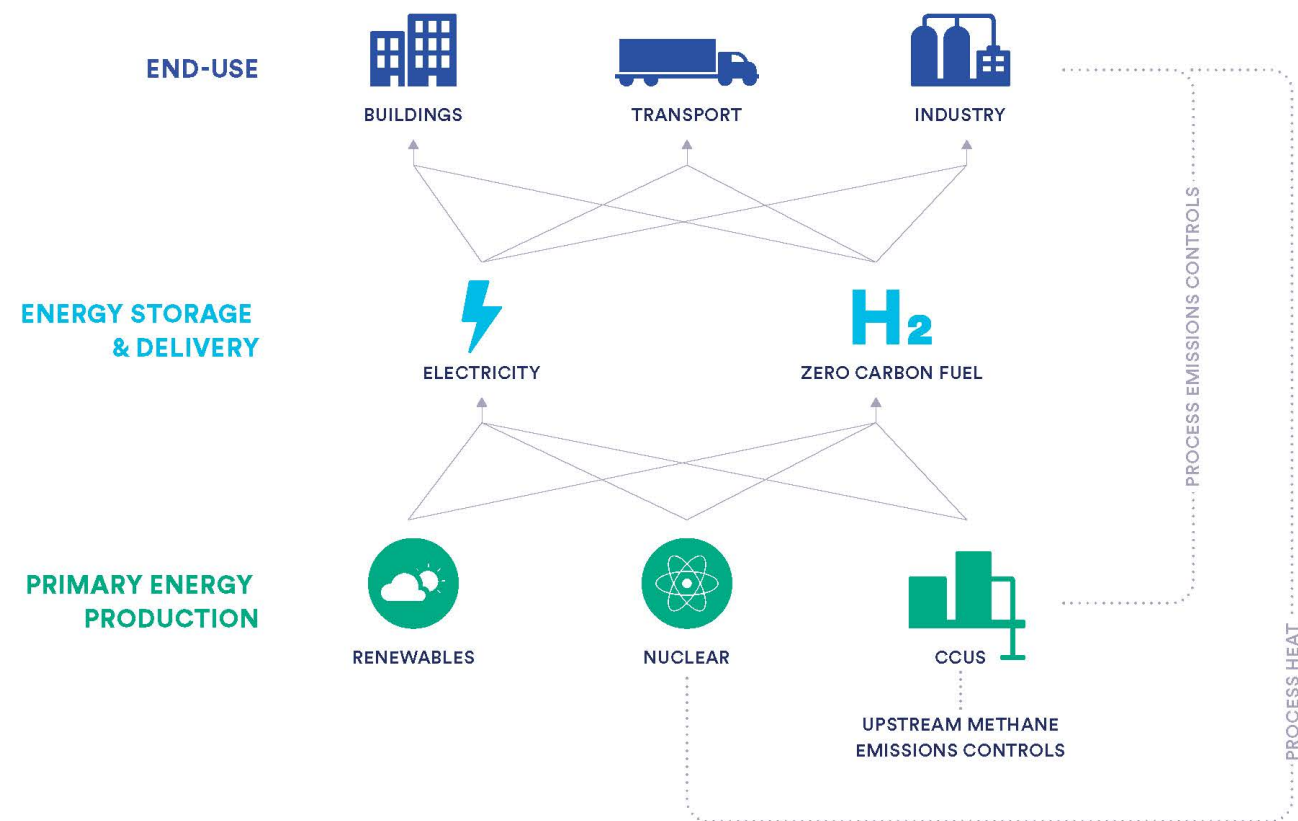
# Vision for a zero-carbon energy system

CCS can have a cross-sector impact on CO<sub>2</sub> emissions reduction

CCUS technologies can deliver zero carbon electricity and zero carbon liquid fuels.

CCUS can also decarbonize industrial processes that emit CO<sub>2</sub> into the atmosphere.

## Decarbonized Energy System



# California Geologic Storage Studies: Plenty of High-Quality Geologic Storage.

- Lawrence Livermore Laboratory (2020): **17-200 Gt**, This number represents an assessment of only 50% of likely Central Valley sites.
- WESTCARB, CEC (2005-2016): **75-300 Gt**, Statewide
- U.S. Geological Survey 2013: **67-120 Gt**, 4 Basins

# Where are the CO<sub>2</sub> emitters?

## CO<sub>2</sub> Source Types

- Ethanol
- Cement Plants
- Electricity
- Petroleum/Natural Gas
- Refineries/Chemical

## Emissions (metric tons/yr)

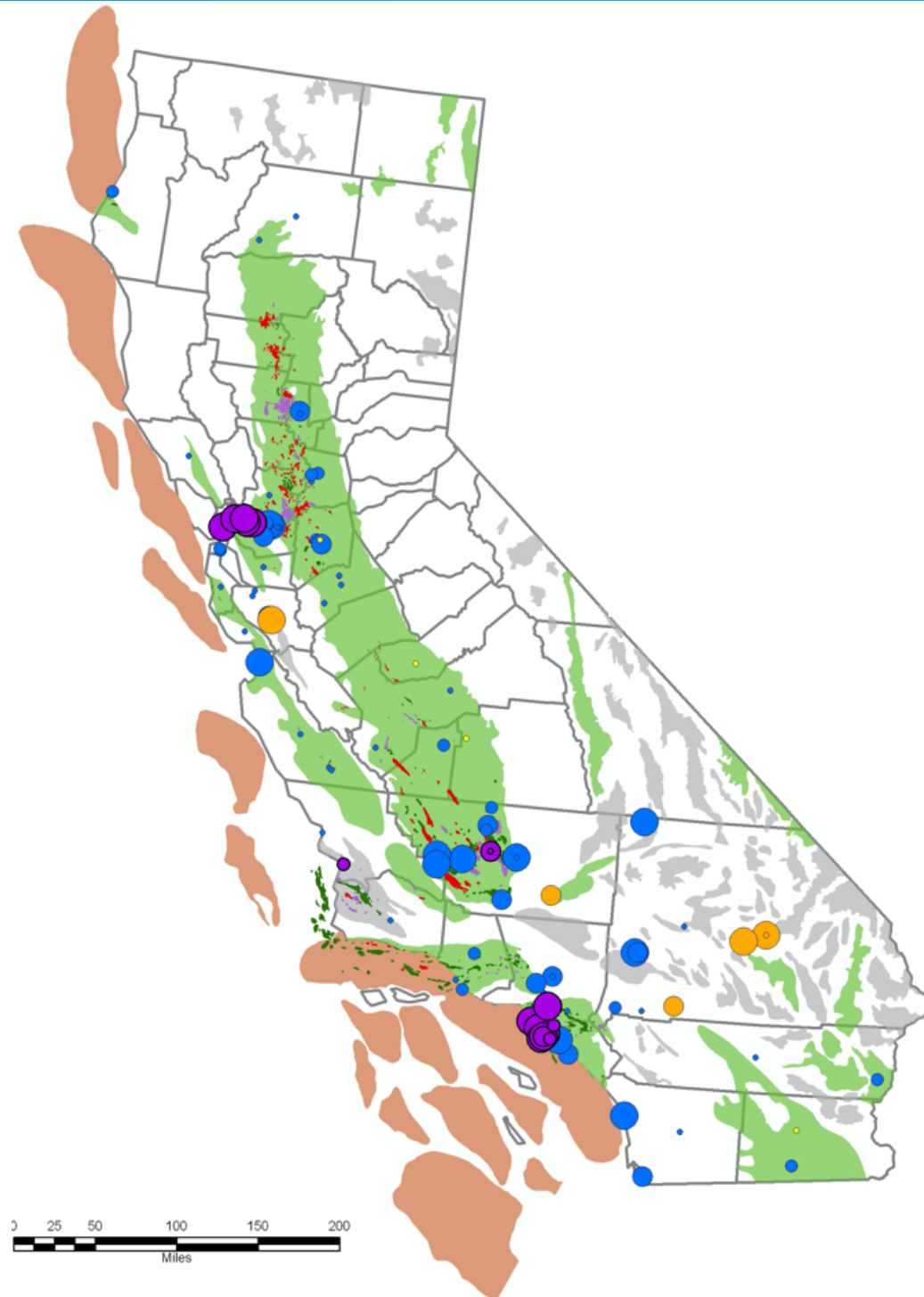
- 0 - 250,000
- 250,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 5,000,000

## Oil and Gas Fields

- Oil Fields
- Natural Gas Fields
- Undetermined (Oil or Gas)

## Sedimentary Basins

- Basins With Carbon Sequestration Potential
- Basins Lacking Carbon Sequestration Potential
- Offshore Basins With Unknown Carbon Sequestration Potential



Source: [http://gif.berkeley.edu/westcarb/images/maps/CA\\_basins\\_status\\_point.jpg](http://gif.berkeley.edu/westcarb/images/maps/CA_basins_status_point.jpg)



# CCUS policy opportunities in California

- SB100: CCUS on power plants and hydrogen produced using SMR+CCUS should be included as a zero-carbon source of electricity generation. Also, emerging zero carbon power technologies such as oxy-combustion should be considered.
- LCFS: CATF has interviewed developers that are considering CCUS projects under the LCFS protocol and their experience finds that they are unable to utilize the LCFS incentive to raise capital and are seeking solutions such as a price floor on the credit price. CARB should identify modifications to the LCFS to enable projects to monetize the incentive.
- CARB should incorporate CCS protocol into cap and trade to enable CCUS to play a role in addressing emissions from sources that currently contribute 85% of all emissions.
- Carbon Neutrality: University of California Davis and Santa Barbara are studying and modeling transportation fuels demand and supply in the context of a fully decarbonized sector. These planning exercises should consider zero carbon liquid fuels and the role of CCS in producing them, in addition to electrification.
- Infrastructure to incentivize CCUS: California should consider the concept of a CO<sub>2</sub> storage utility. The utility would manage CO<sub>2</sub> storage and transport such that emitters or DAC facilities could focus exclusively on capture of CO<sub>2</sub>.



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