

**DOCKETED**

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<b>Project Title:</b>	Business Meeting Agendas, Transcripts, Minutes, and Public Comments
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<b>Document Title:</b>	ITEM 2-Information Item on California Air Resources Board (CARB) Draft 2022 Climate Change Scoping Plan
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<b>Filer:</b>	Dorothy Murimi
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# Draft 2022 Scoping Plan



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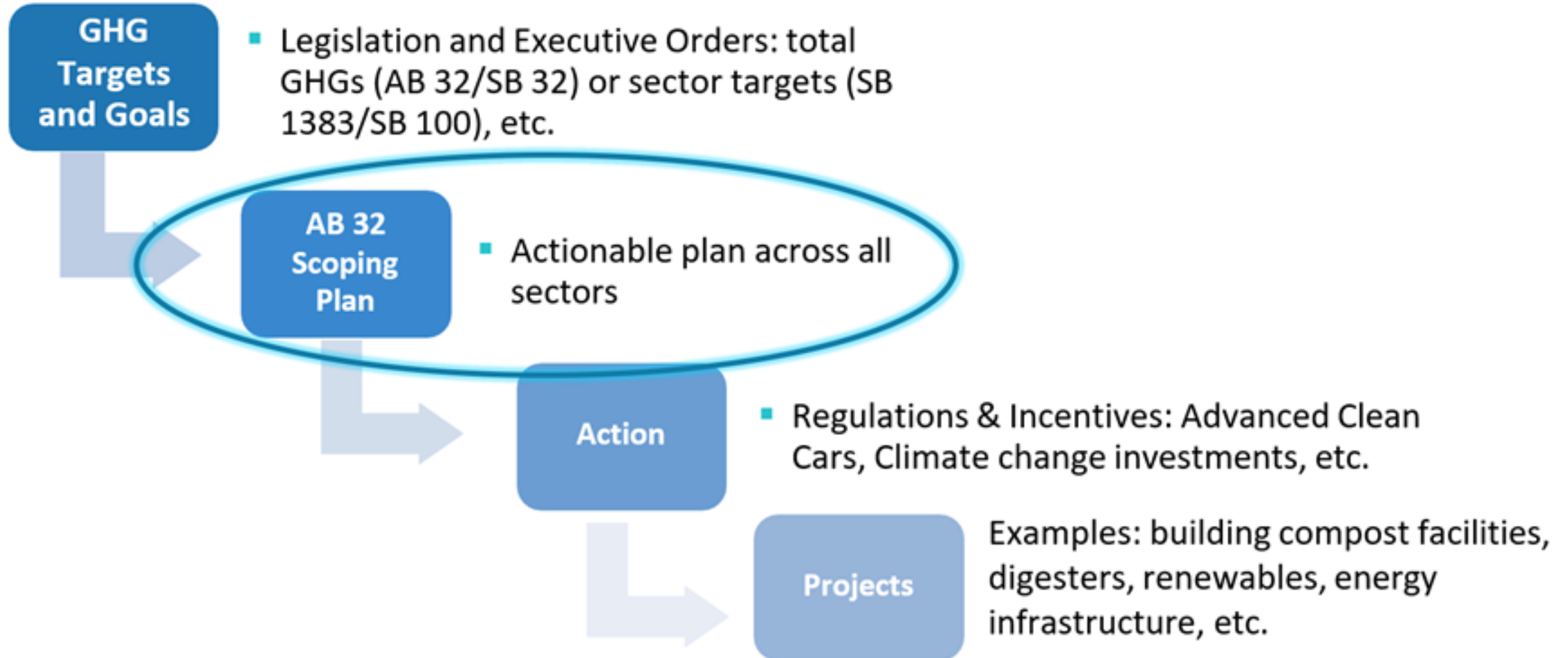
MAY 2022

# AB 32 Climate Change Scoping Plan Statutory Requirements

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- Scoping Plan(s) are action plans for CA to meet statewide GHG reduction targets
  - Scoping Plan(s) outline a suite of climate policies to address emissions across all sectors
  - Required to be updated at least every 5 years
  - 2017 SP (most recent) – cost-effective and technologically feasible path to achieve the 2030 target
- Provide direct GHG emissions reductions and air quality benefits
- Minimize emissions “leakage” – increase to non-CA GHG emissions
  - Ensure high-road jobs remain
- Facilitate sub-national and national collaboration
  - Develop exportable programs for partners to adopt
- Support cost-effective and flexible compliance

# California's Climate Policy Framework



# Incorporation of EJ Advisory Committee Recommendations

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- The EJAC met over dozen times since early last summer to help inform this Draft 2022 Scoping Plan
- Developed over 200 recommendations
- Incorporation of feedback into the Draft 2022 Scoping Plan Document
  - Modeling input incorporated into the design of the scenarios
  - Additional evaluation of phasing out refinery operations by 2045
  - 5 dozen references to EJAC Draft Recommendations in the Draft Scoping Plan
  - Categorizes recommendations that could not be incorporated into the Draft Scoping Plan as well as a process for following up

# AB 32 Sources Scenarios Overview

2035

Alternative 1: Nearly complete phaseout of combustion, limited reliance on engineered carbon removal, restricted applications for biomass derived fuels, and ambitious innovation in electric technology and aggressive consumer adoption trends (e.g. electric aviation adoption and 100% electrification by 2035).

2035

Alternative 2: Use full suite of technology options, including engineered carbon removal

2045

Alternative 3: Use a broad portfolio of existing and emerging fossil fuel alternatives and alignment with statutes and Executive Orders (staff is recommending this scenario)

2045

Alternative 4: Use existing and emerging technologies, slower rate of clean technology and fuel deployment and consumer adoption.

# What Carbon Neutrality Means

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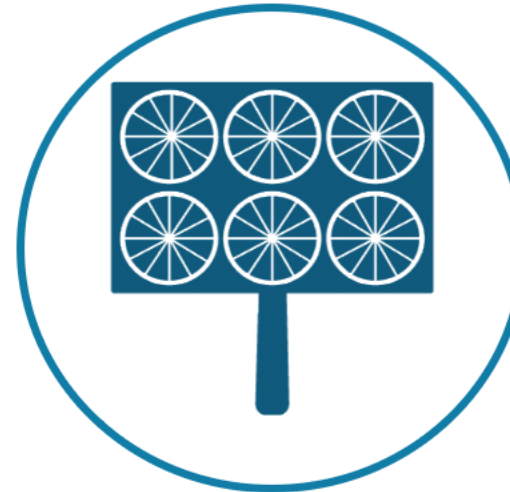
**Continue to reduce  
emissions from  
sources in the AB 32  
GHG Inventory**

**±**



**Emissions and  
sequestration  
from natural and  
working lands**

**-**



**Technological  
Carbon Dioxide  
Removal**

**=**

**Carbon  
Neutral**

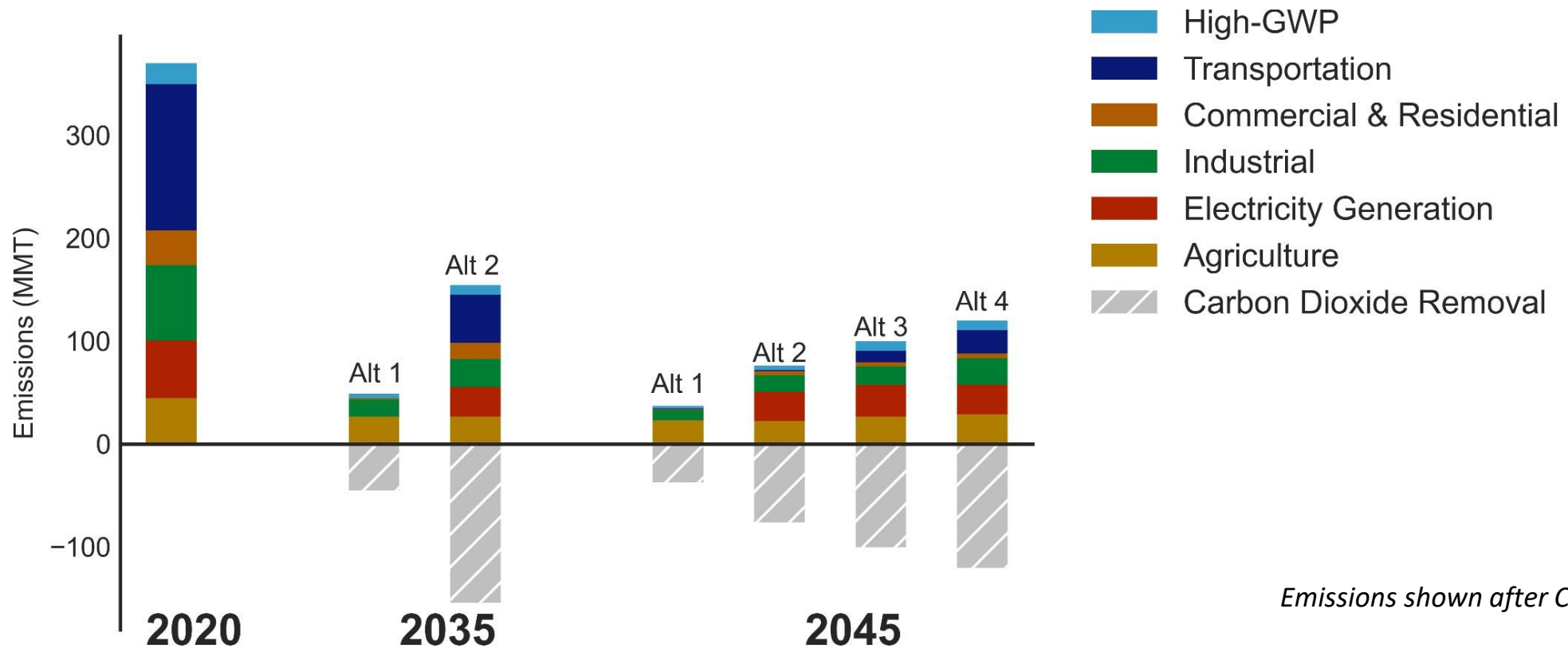
# Key Metrics

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
<b>Annual Build Rates</b> Historic Max Builds: Solar: 2.7GW Battery: 0.3GW	Solar: 10GW Battery: 5GW	Solar: 5GW Battery: 3GW	Solar: 7GW Battery: 2GW	Solar: 6GW Battery: 2GW
<b>Vehicle Early Retirements</b> US-wide Cash for Clunkers \$3B and 690k vehicles	LDV: 16M 5-16 yr. old MHDV: 1.4M 5-16 yr. old	LDV: 0 MHDV: 0.6M 10-20 yr. old		
<b>Residential Early Retirements</b>	7M electric homes. Appliances 5-16 yr old			
<b>Hydrogen Demand &amp; Electrolysis Need</b> Total CA Capacity: 83GW	Percent 2020 US: 19% Solar: 47GW	Percent 2020 US: 18% Solar: 44GW	Percent 2020 US: 17% Solar: 41GW	Percent 2020 US: 13% Solar: 31GW
<b>Petroleum Refining Remaining</b>	2035: 0% 2045: 0%	2035: 25% 2045: 8%	2035: 33% 2045: 13%	2035: 39% 2045: 18%
<b>Total CCS Needs</b> Industrial & Refining	2035: <1MMT 2045: <1MMT	2035: 8MMT 2045: 2.4MMT	2035: 10MMT 2045: 4MMT	2035: 11MMT 2045: 5MMT
<b>Residual Emissions</b> Current global DAC 0.01 MT/year	2035: 30MMT 2045: 22MMT	2035: 123MMT 2045: 60MMT	2035: 0MMT 2045: 80MMT	2035: 0MMT 2045: 99MMT



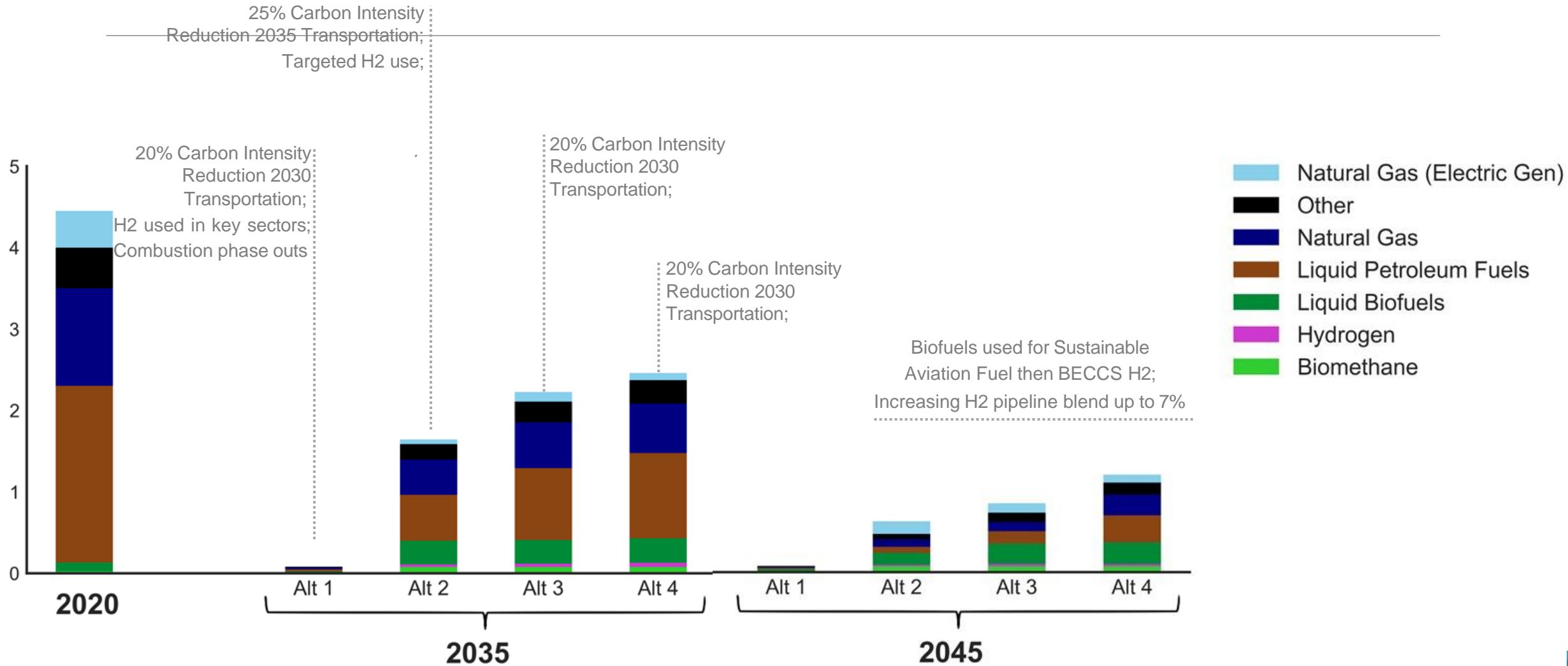
# Scenario Emissions

## Modeling



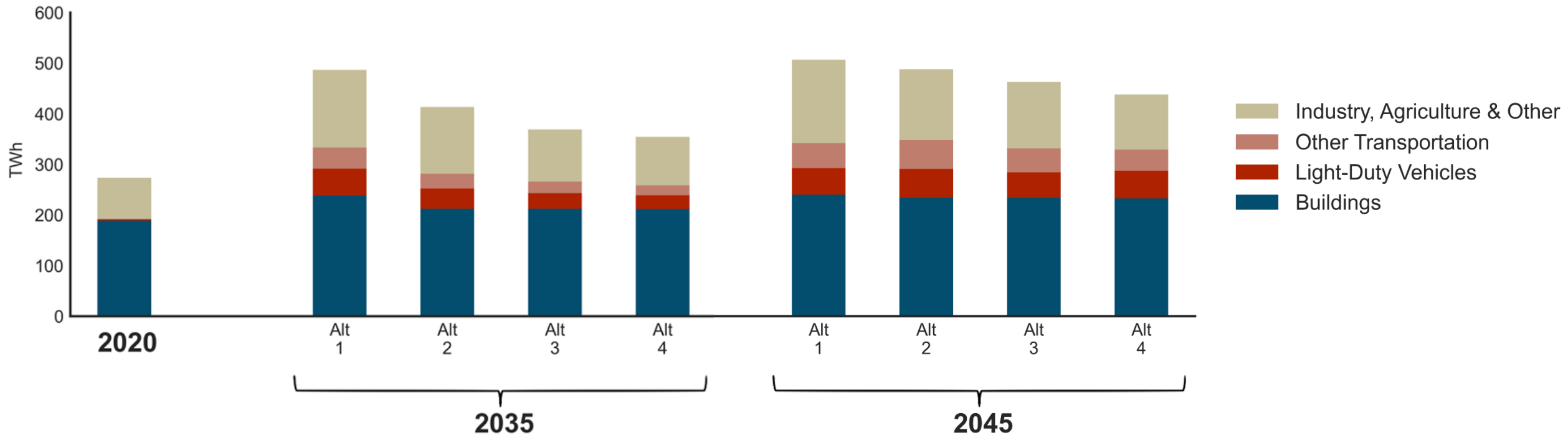
*Emissions shown after CCS, before CDR*

# Combustion Fuels Transition



# Loads by Scenario

- + Electric loads increase by 30-80% relative to today by 2035 and 60-90% by 2045
- + Loads for direct air capture and hydrogen production are assumed to be provided by off-grid renewables, and are not included in this graphic
- + **Other transportation** includes all non-LDVs and reflects electrification of things like passenger and freight rail, aviation, and ocean-going vessels (OGVs)



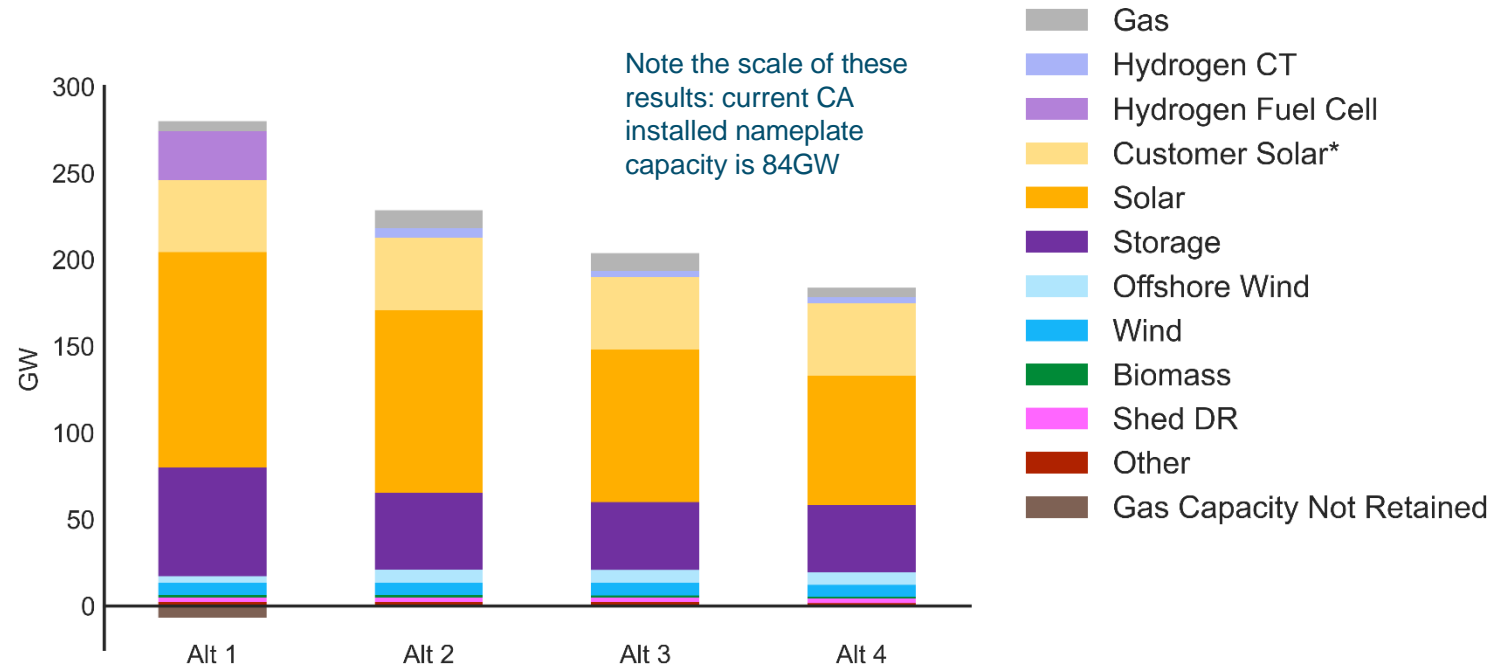
# Cumulative New Resource Capacity Build in 2045

In Alt 1, builds ~62 GW of battery storage and ~30 GW of hydrogen fuel cells as clean firm capacity

Alt 1 builds ~124 GW of solar, compared to ~26 GW in the BAU

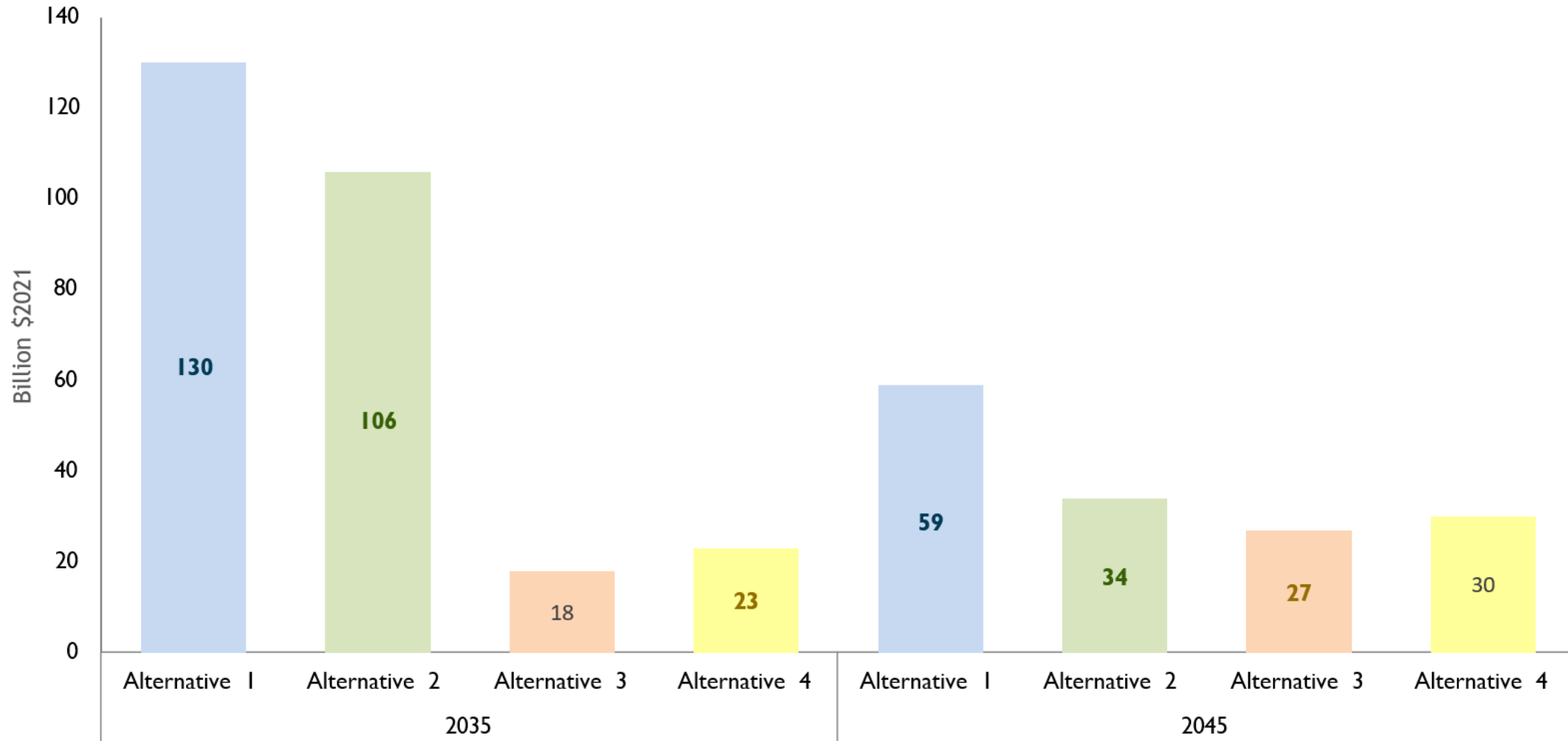
Alts 2 through 4 are similar in 2045 due to SB100 goal, while in Alt 1 the model builds significantly more clean energy resources to meet the 0 MMT, no combustion target

In Alt 3 scenario, model builds ~90 GW of solar and ~40 GW of batteries to meet SB100 retail sales target. All gas remains online and ~10 GW of new gas is built



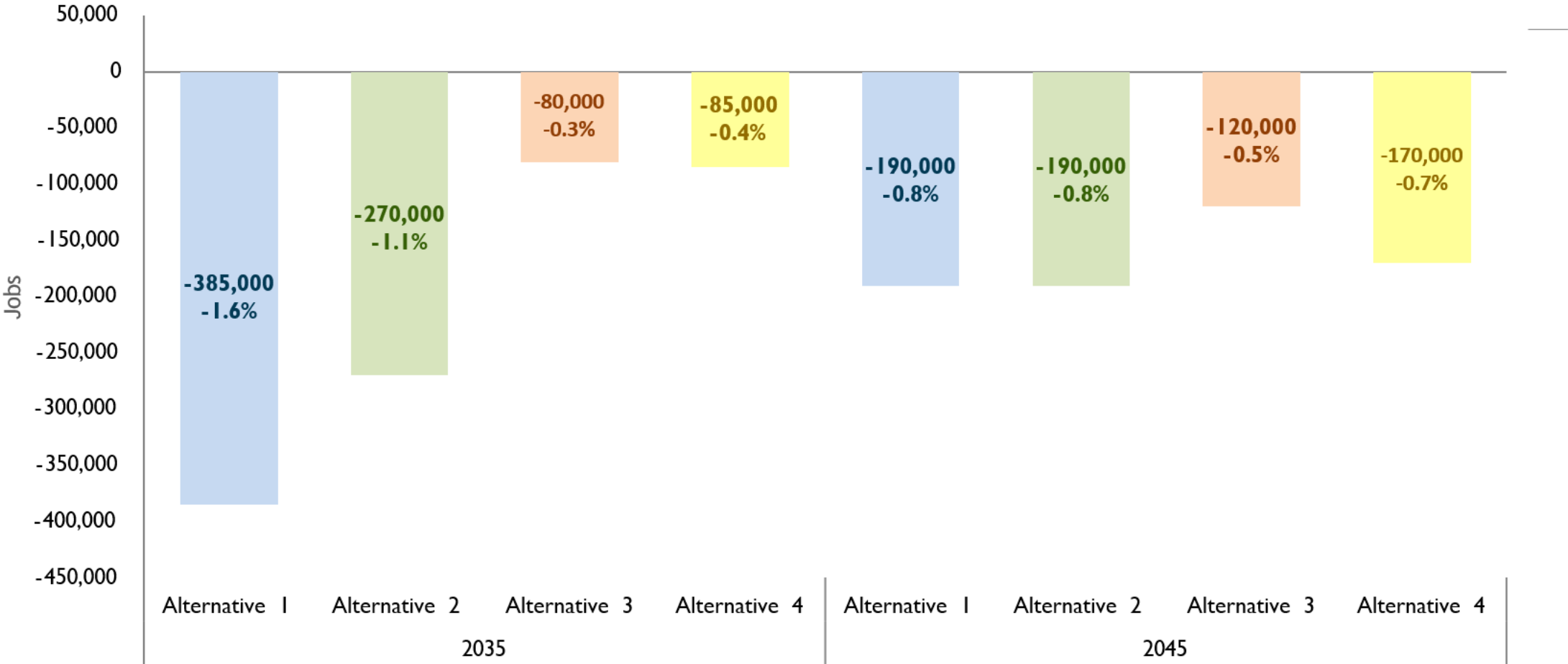
# Direct Cost by Scenario, 2035 and 2045

Costs from PATHWAYS in a single year relative to the growing California



# Employment by Scenario Including CDR, 2035 and 2045

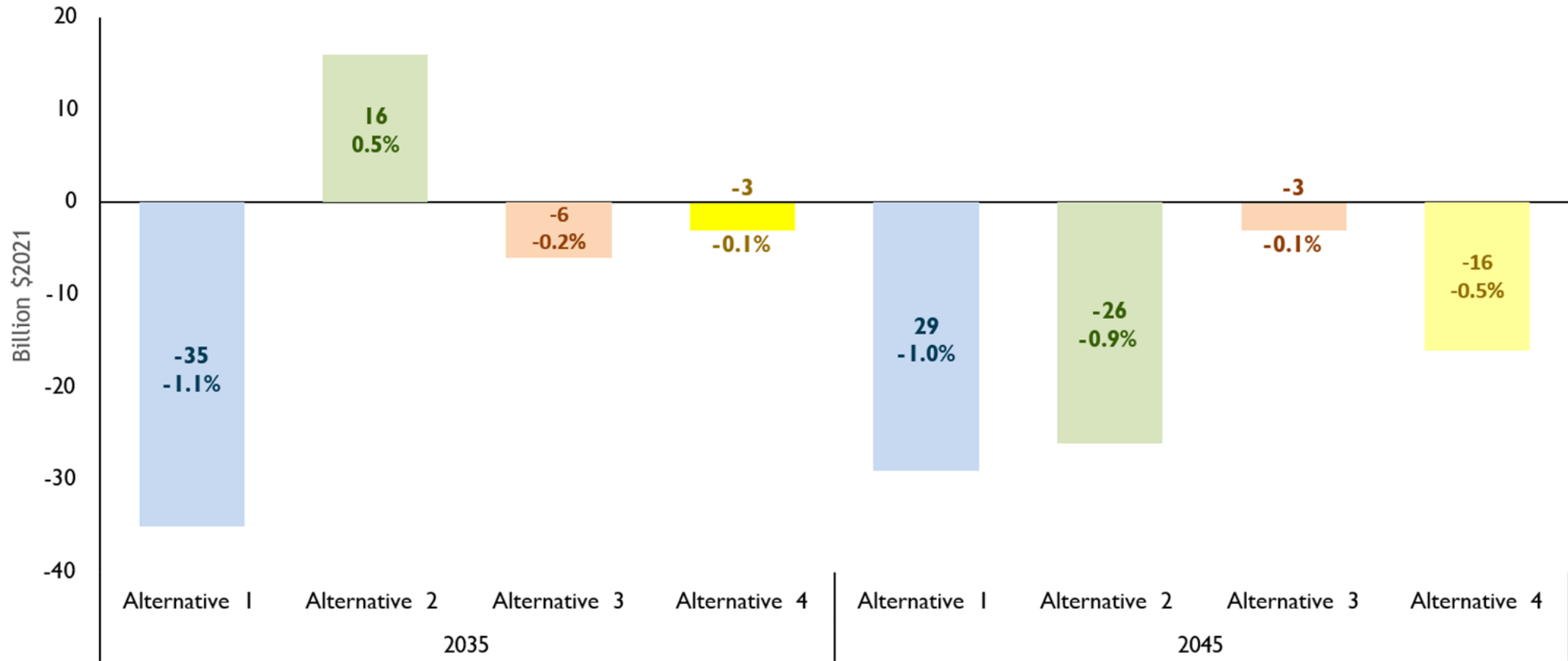
Impact from IMPLAN in a single year relative to California employment that grows from 23.5 million in 2021 to 27.7 million in 2045



Initial results from PATHWAYS costs assuming CDR is liquid solvent DAC technology powered by off-grid solar relative to BAU. Jobs are defined in IMPLAN as an annual average that accounts for seasonality and follows the same definition used by the BLS and BEA. Percentage change is relative to CARB 2035 and 2045 employment forecasts.

# Gross State Product by Scenario Including CDR, 2035 and 2045

Impact from IMPLAN in a single year relative to the California economy that grows from \$3.2 trillion in 2021 to \$5.1 trillion in 2045

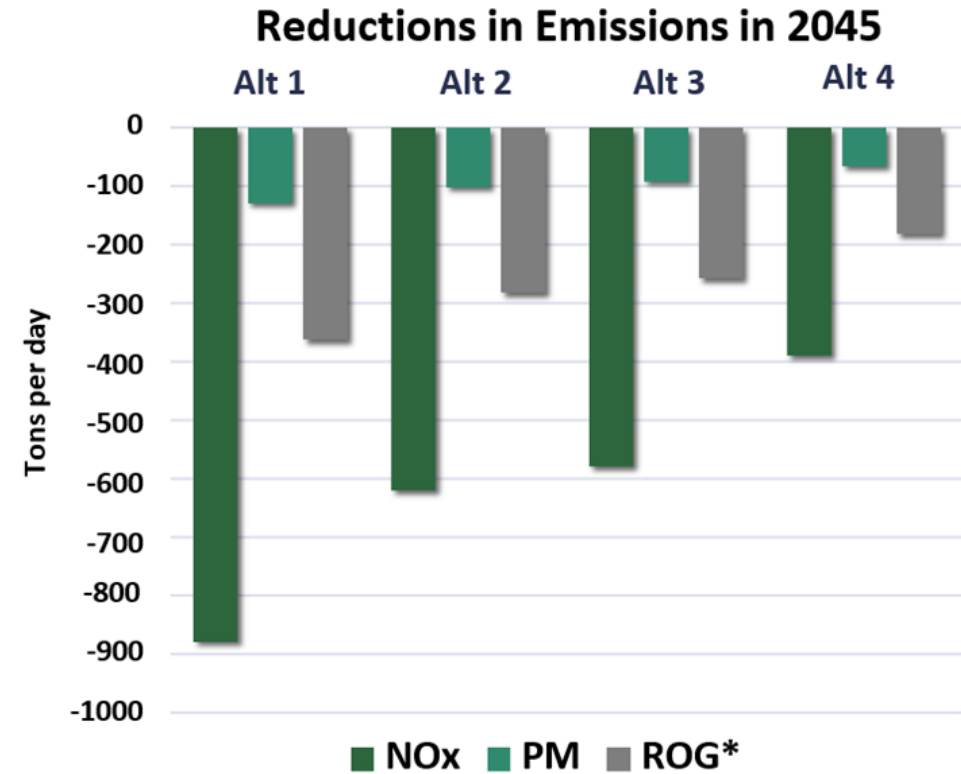
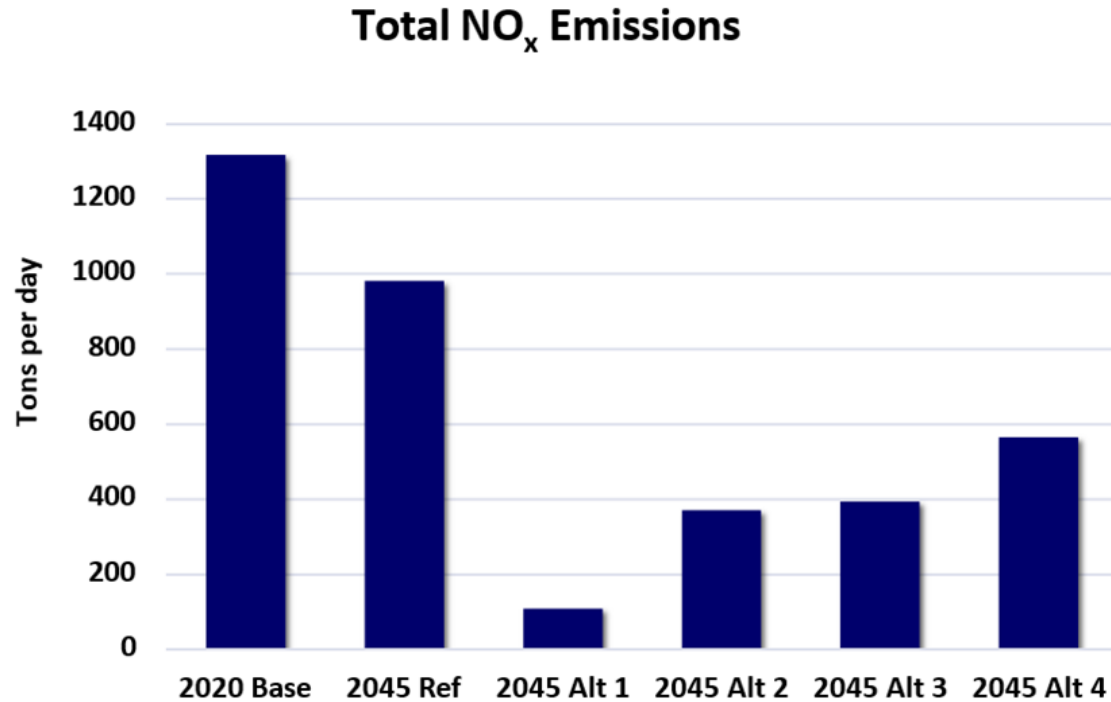


Initial results from PATHWAYS costs assuming CDR is liquid solvent DAC technology powered by off-grid solar relative to BAU. IMPLAN reports value added which is equivalent to an industry's contribution to Gross State Product or GSP. Percentage change is relative to CARB 2035 and 2045 Gross State Product forecasts.

# Emissions Modeling

Scenarios achieve large reductions in emissions due to shifts to zero pollutant emission fuels and reductions in energy consumption

- Reductions in total NO<sub>x</sub> from the Reference scenario range from 89% in Alt 1 to 58% in Alt 4



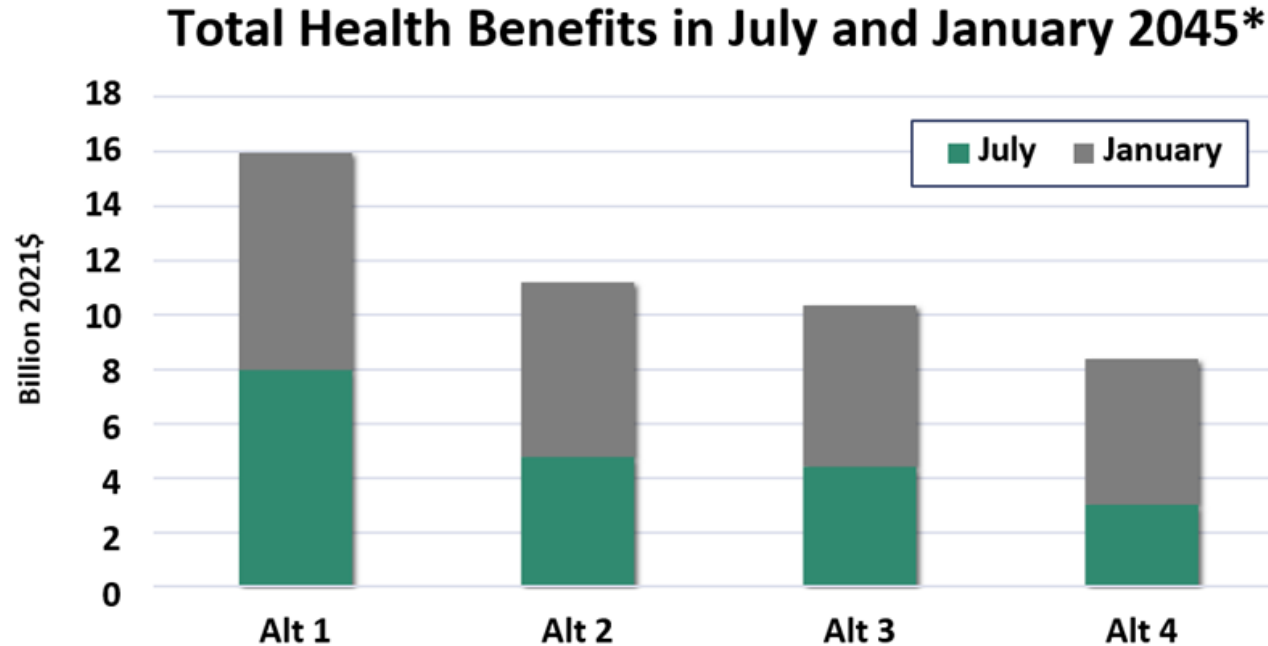
\*ROG: Reactive Organic Gases



# Health Impact Results

The implementation of the Scoping Plan scenarios achieves notable public health benefits relative to the Reference Scenario

- Total combined benefits range from \$8.3 billion in Alt 4 to \$15.9 billion in Alt 1 in Improvements in winter PM<sub>2.5</sub> provide significant benefits



\*Represents the mean value reported by BenMAP

# 2022 Scoping Plan Update Schedule

