Carbon capture and California climate policy

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DISCLAIMER

- I am not representing the UNFCCC Paris Agreement Article 6.4 mechanism Supervisory Body nor its Methodological Expert Panel, on which I serve.
- I have consulted previously for Isometric, a carbon dioxide removal carbon credit registry based in London. My disclosures are available here: https://www.ghgpolicy.org/consulting

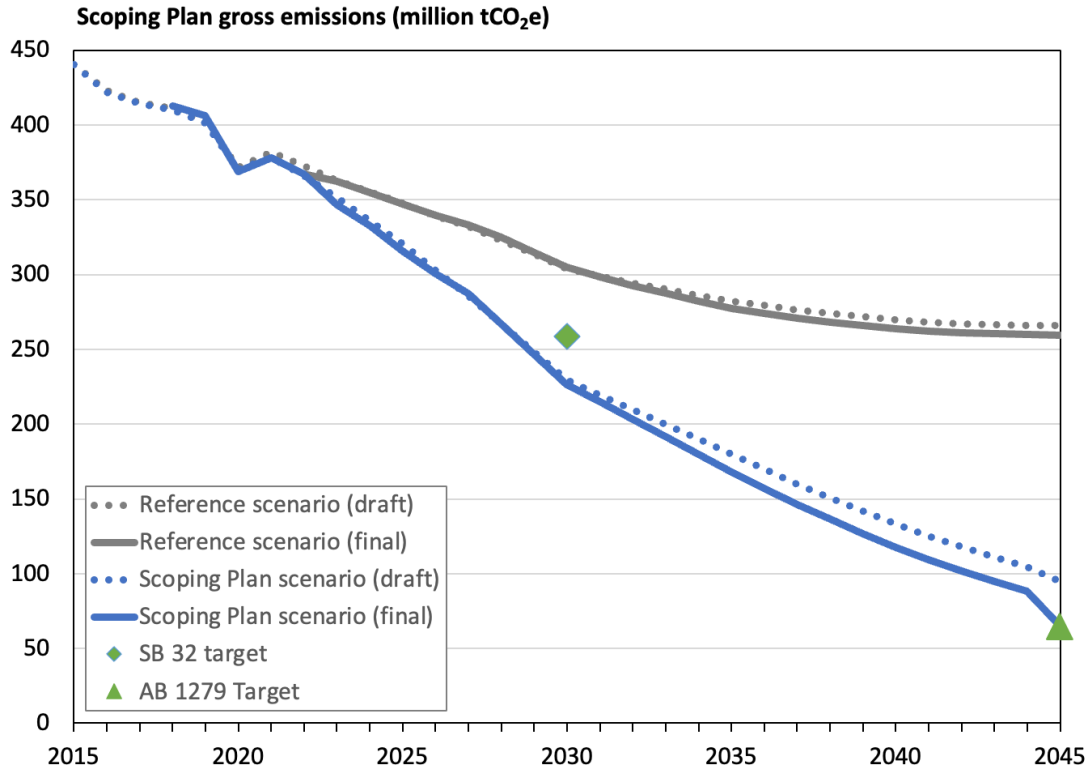
DEFINITIONS

- Carbon capture and storage (CCS): capturing and preventing a faction of carbon dioxide emissions from point-source facilities
- Carbon dioxide removal (CDR): approaches to reduce the atmospheric concentration of carbon dioxide
- Note: some CCS and CDR technologies share identical storage applications with underground injection of carbon dioxide in geologic formations

SCOPING PLAN HISTORY

- CARB's draft 2022 Scoping Plan — May 2022
- Governor Newsom's CCS/CDR letter — July 2022
- Asm. Muratsuchi's AB 1279 — September 2022
- CARB's final 2022 Scoping Plan — December 2022

SCOPING PLAN SCENARIO



- Two alternative scenarios explored 2035 net-zero targets
- One alternative scenario explored a less ambitious 2045 target
- No scenarios explored a more ambitious 2045 target

Source: CARB modeling (draft and final versions)

THE GOVERNOR'S LETTER

Advancing Carbon Removal

Achieving carbon neutrality will require us to continue to reduce our carbon emissions and ultimately eliminate most of these emissions, while also removing existing carbon from the atmosphere.

Simply put, it will not be possible to eliminate all emissions across our economy, so achieving carbon neutrality will rely on carbon sequestration. Science tells us that removing enough carbon to achieve carbon neutrality relies on both natural and engineered carbon removal. Our lands are currently a source of carbon emissions, and we must prioritize sustainable management of these lands as nature-based solutions to sequester carbon over the long-term. At the same time, engineered carbon removal is clearly needed to achieve the scale of carbon removal required to reach carbon neutrality. State agencies will facilitate safe and equitable engineered carbon removal and capture solutions that help achieve our climate goals while avoiding environmental or community impacts.

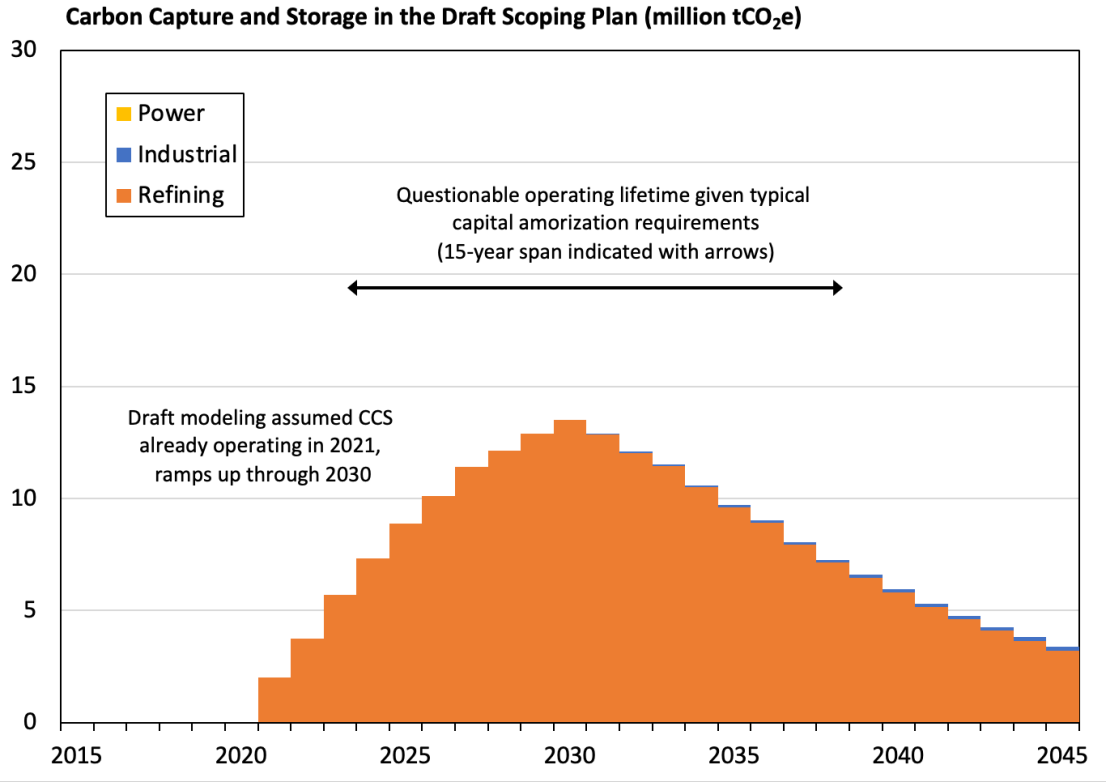
Given the need to accelerate development of natural and engineered carbon removal projects across the state, **I request that CARB set a 20 MMT carbon removal target for 2030 and 100 MMT carbon removal target for 2045.**

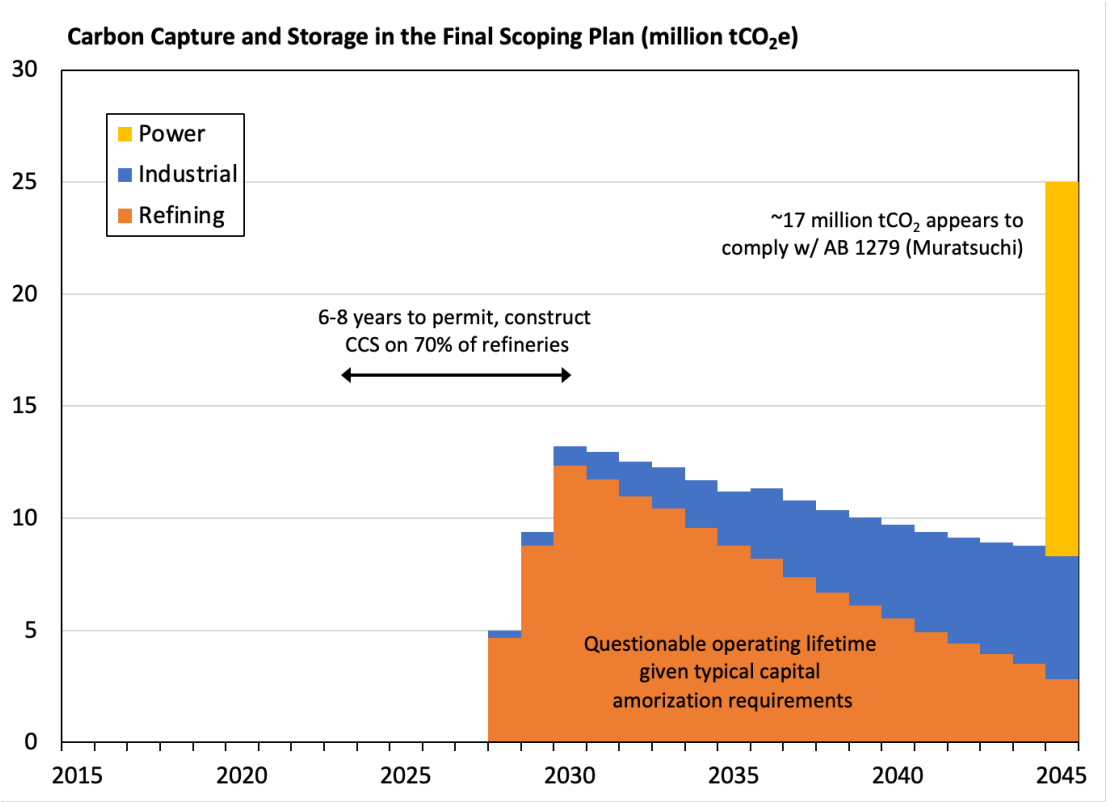
Table 2-3: GHG emissions and removals needed to achieve carbon neutrality and meet the 20 $MMTCO_2$ removal and capture target in 2030 and the 100 $MMTCO_2$ removal and capture target in 2045.[164]

	2030 ($MMTCO_2e$)	2045 ($MMTCO_2e$)
GHG Emissions	233	72
AB 32 GHG Inventory Sector Emissions	226	65
Net NWL GHG Emissions Across All Landscapes (annual average from 2025–2045)	7	7
Carbon Capture and Sequestration (CCS): Avoided GHG Emissions from Industry and Electric Sectors	(13)	(25)
Carbon Dioxide Removal (CDR) including natural and working lands carbon sequestration,[165] Direct Air Capture, and Bioenergy with CCS (BECCS).	(7)	(75)
Net Emissions (GHG Emissions + CDR)	226	(3)

Source: Governor's letter (p. 3); CARB 2022 Scoping Plan, Table 2-3 (p. 96)

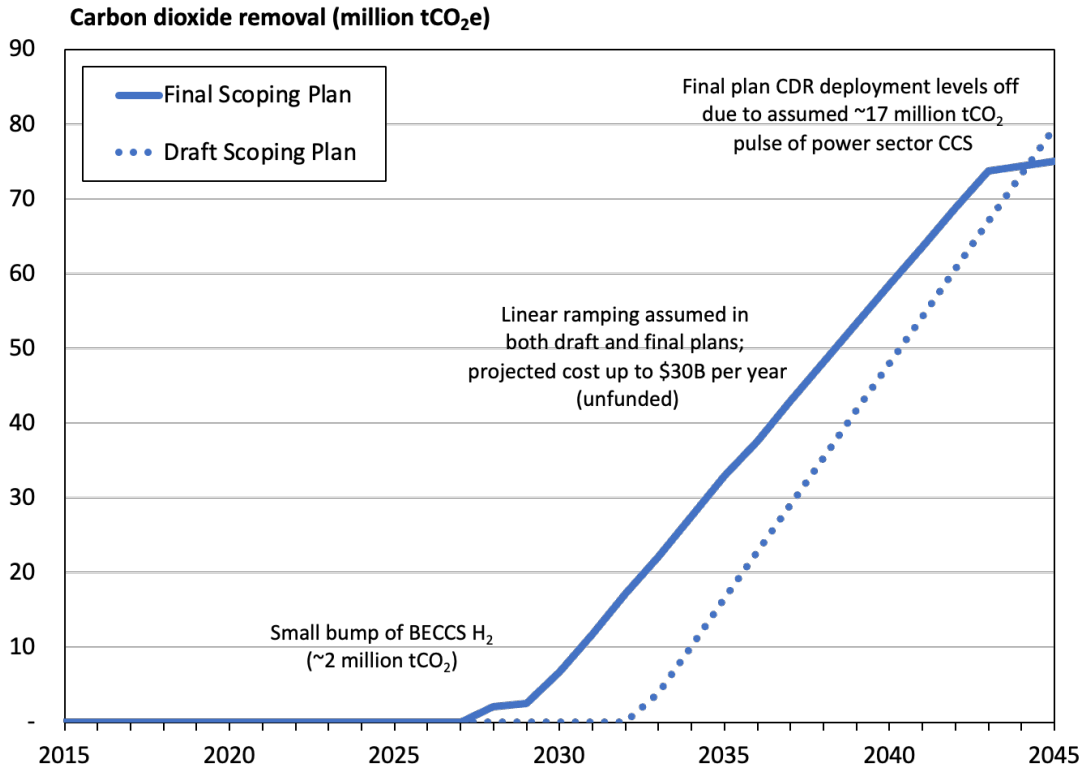
CCS IN THE SCOPING PLAN





Source: CARB modeling (draft and final versions)

CDR IN THE SCOPING PLAN



- Primarily modeled as direct air capture, powered by zero-carbon behind-the-meter solar
- 9 million tCO2/year by 2045 from hydrogen produced from bioenergy with CCS (BECCS)
- 1.5 million tCO2/year of "other" carbon removal in 2030

Source: CARB 2022 Scoping Plan, Appendix H (pp. 10-11)

REGULATORY FRAMEWORK

Federal

- 45Q tax credits
- Safe Drinking Water Act

State

- Low Carbon Fuel Standard
- SB 905 (Stat. 2022, Caballero)

FEDERAL TAX CREDITS (45Q)

	Oil production, utilization	Saline formation
Carbon capture and storage	$60/tCO$_2$	$85/tCO$_2$
Direct air capture	$130/tCO$_2$	$180/tCO$_2$

Values for 2026, assuming labor standards met (5X multiplier included)

Compensation based on gross sequestration (tons put underground)

Does not account for life cycle emissions (tons emitted to atmosphere)

SAFE DRINKING WATER ACT

Regulates underground CO_2 injection on a well-by-well basis

- Class II wells: enhanced oil recovery
- Class VI wells: saline and other geologic formations

Some states have “primacy” over permitting for one or more well classes; otherwise, U.S. EPA is the lead agency. California has not applied for primacy.

LOW CARBON FUEL STANDARD

Figure 3: Different types of CCS projects that can qualify to generate credits under the LCFS

	DIRECT AIR CAPTURE PROJECTS	CCS AT OIL & GAS PRODUCTION FACILITIES	CCS AT REFINERIES PROJECTS	ALL OTHER CCS PROJECTS (E.G. CCS WITH ETHANOL)
Location of CCS project	Anywhere in the world	Anywhere, provided they sell the transportation fuel in California	Anywhere, provided they sell the transportation fuel in California	Anywhere, provided they sell the transportation fuel in California
Storage site	Onshore saline or depleted oil and gas reservoirs, or oil and gas reservoirs used for CO_2-EOR			
Credit method	Project-based	Project-based, under the Innovative Crude Provision	Project-based, under the Refinery Investment Credit Program	Project-based or fuel pathway
Earliest date which existing projects eligible	Any	2010	2016	Any
Requirements	Project must meet requirements specified in the CCS Protocol			
Additional restrictions	None	Must achieve minimum CI or emission reduction	None	None

- CARB regulations allow for enhanced oil recovery, but do not include EOR emissions in the life cycle calculations.
- Most CCS requires a nexus to in-state fuel sales, but DAC can be located anywhere

Source: Global CCS Institute (p. 9); CARB LCFS CCS Protocol (2018)

SB 905

SB 905 (Stat. 2022, Cabellero):

- Clarifies various legal matters related to pore space rights
- Prohibits Class II wells in California (no effect on out-of-state LCFS projects)
- Authorizes a regulatory regime to provide for air, water, climate safeguards
- CARB is not implementing SB 905 and has no timeline for implementation

Source: Letter from Dr. Steve Cliff to CARB EJAC (July 16, 2024)

OPEN QUESTIONS

- Who will pay for carbon dioxide removal?
- How will compensation structures ensure that the outcome is net carbon removal, rather than replacing emission reductions with removal-based offsets?
- In the absence of state and federal regulation, but in the presence of incentives for gross sequestration outcomes, what guardrails will ensure good projects?
- What does the lack of implementation of SB 905 mean for CCS and CDR?