Date of Hearing: July 16, 2025

ASSEMBLY COMMITTEE ON UTILITIES AND ENERGY
Cottie Petrie-Norris, Chair
SB 643 (Caballero) – As Amended June 26, 2025

**SENATE VOTE**: 37-0

**SUBJECT**: Carbon Dioxide Removal Purchase Program

**SUMMARY:** Establishes the Carbon Dioxide Removal Purchase Program (CDRPP) to support the development and deployment of carbon dioxide removal (CDR) technologies through a competitive grant program administered by the California Air Resources Board (CARB). Specifically, **this bill**:

1) Requires CARB to establish and administer the CDRPP, a competitive grant process for eligible CDR projects, to advance the development of CDR technologies in order to achieve the state's climate goals, while supporting the development of eligible CDR projects that provide economic, community, and environmental benefits within the state.

2) Requires CARB to do all of the following:

    a) Administer the competitive grant program, as specified.

    b) On or before January 1, 2028, and annually thereafter, conduct and publish on its internet website a survey of CDR projects existing or in development within the state, as specified.

    c) Conduct at least two public workshops to receive comments from the public.

    d) On or before December 31, 2027, and annually thereafter, publish on its internet website a report describing program activities completed CDR projects to date.

    e) On or after July 1, 2026, but on or before December 31, 2035, fund CDR projects totaling $50 million.

    f) Only fund eligible CDR projects that meet specified requirements.

    g) To the extent feasible, provide grants CDR projects operating in at least two of the following categories:

        i) Direct air capture.

        ii) Biomass carbon removal and storage.

        iii) Enhanced mineralization or enhanced weathering.

        iv) Marine carbon dioxide removal.

h) Prioritize specified criteria in selecting eligible CDR projects through the program.

i) On or before January 1, 2028, adopt guidelines for the program that include all of the following:

i) The definition of an eligible CDR project.

ii) A requirement that an eligible CDR project be physically located within the state.

iii) A requirement that an eligible CDR project incorporate or fund community benefit mechanisms commensurate with the eligible CDR project.

iv) A requirement that an eligible CDR project results in carbon dioxide removals that are verified in the claimed quantity by an independent third-party verifier using appropriate, industry-standard protocols.

v) A minimum duration of sequestration, elimination, or other storage of removed gases without leakage to the atmosphere that is sufficiently long enough to ensure that the risk of leakage poses no material threat to public health, safety, the environment, or the achievement of net zero greenhouse gas emissions in California, and shall not be less than 100 years.

vi) A prohibition against the use of CDR processes for purposes of enhanced oil recovery.

vii) A prohibition against the use of a biomass feedstock for CDR, unless it is for biomass carbon removal and storage, as defined.

3) Provides that implementation is subject to an appropriation by the Legislature.

**EXISTING LAW**:

1) Requires CARB, pursuant to the California Global Warming Solutions Act, to adopt a statewide greenhouse gas (GHG) emissions limit equivalent to 1990 levels by 2020 and to adopt rules and regulations to achieve maximum technologically feasible and cost-effective GHG emission reductions. (Health and Safety Code (HSC) § 38500 *et seq*.)

2) Requires CARB to ensure that statewide GHG emissions are reduced to at least 40% below the 1990 level by 2030. (HSC 38566)

3) Establishes, pursuant to the California Climate Crisis Act, the policy of the state to achieve net zero GHG emissions by 2045, maintain net negative GHG emissions thereafter, and ensure that by 2045, statewide anthropogenic GHG emissions are reduced to at least 85% below the statewide GHG emissions limit. (HSC 38562.2)

4) Requires CARB to prepare and approve a scoping plan, at least once every five years, for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions from sources or categories of sources of GHG emissions. (HSC § 38561)

5) Requires CARB to establish CDR targets for 2030 and beyond, taking into consideration the Natural and Working Lands Climate Smart Strategy, science-based data, cost-effectiveness, and technological feasibility. (HSC § 39740.2)

6) Requires CARB to establish a Carbon Capture, Removal, Utilization, and Storage Program and defines CDR as anthropogenic activities that use technologies or engineered strategies to remove carbon dioxide from the atmosphere and put it into long-term storage, including direct air capture. (HSC § 39741 and 39741.1)

**FISCAL EFFECT**: According to the Senate Appropriations Committee, the CARB estimates ongoing costs of approximately $2.4 million annually from the Greenhouse Gas Reduction Fund (GGRF) to implement the CDRPP. In addition, the program would require one-time grant funding totaling $50 million from the GGRF or another appropriate funding source to support eligible carbon dioxide removal CDR projects.

**CUSTOMER COST IMPACTS:** Unknown

**BACKGROUND:**

*California's Climate Goals.* California has established an ambitious goal to achieve net zero greenhouse gas (GHG) emissions by 2045—a target first outlined in Governor Brown's Executive Order B-55-18 and later codified in Assembly Bill 1279 (Muratsuchi, Chapter 337, Statutes of 2022). The statute requires the state to reduce anthropogenic GHG emissions by at least 85% below 1990 levels by 2045, with the remaining 15%—estimated at approximately 65 million metric tons (MMT)—to be offset through carbon dioxide removal (CDR) or other long-term carbon management strategies. According to CARB's 2022 Scoping Plan, achieving the goal will require approximately 75 MMT of CDR annually by 2045 to compensate for residual emissions that cannot be fully eliminated through direct reductions alone.[1]

Addressing these residual emissions requires the use of carbon dioxide removal (CDR), which involves removing carbon dioxide directly from the atmosphere. When applied to legacy emissions—those already present in the atmosphere—it functions as a negative emissions strategy. To prevent re-release into the atmosphere, the captured $CO_2$ is typically stored in deep geological formations, such as former oil and gas reservoirs, deep saline aquifers, or coal beds.

*Pathways to Carbon Dioxide Removal.* Carbon dioxide can be removed from the atmosphere through a wide range of biological and engineered processes—from natural pathways like photosynthesis to technological methods such as direct air capture using specialized materials. Each approach has distinct characteristics and must be carefully evaluated for its effectiveness, feasibility, and role within a broader climate strategy. For example, the U.S. Department of Energy's Carbon Negative Shot initiative evaluates CDR pathways based on factors such as

[1] Conservation Strategy Group, "Final Scoping Plan identifies key role for carbon dioxide removal"; https://www.csgcalifornia.com/blog/final-scoping-plan-identifies-key-role-for-carbon-dioxide-removal

scalability, cost-effectiveness, energy use, land and water intensity, and durability of carbon storage.[2]

**COMMENTS**:

1) *Author's Statement*. According to the author, "CDR refers to removing carbon dioxide from the atmosphere and permanently storing it in places like cement, or deep underground in geologically secure locations or in the ocean. It does not refer to capturing CO2 from industrial smokestacks. ARB's 2022 Scoping Plan for Achieving Carbon Neutrality stated that "there is no path to carbon neutrality without carbon removal and sequestration" and established CDR targets of 7 million metric tons (MMT) annually by 2030 and 75 MMT annually by 2045. Over the last several years, a small number of companies have voluntarily purchased CDR removals as part of their own carbon neutrality goals, but none of the CDR removals have occurred in California. To meet the urgent need to reach carbon neutrality by 2045, this bill directs ARB to fund and track CDR projects. By accelerating CDR development and deployment, the bill is an integral step to remove carbon dioxide from the atmosphere and meet the state's climate goals.

2) *California's Approach to Carbon Dioxide Removal.* This measure directs the CARB to support the development and deployment of carbon dioxide removal (CDR) technologies as part of the state's climate strategy. The statute identifies four categories of CDR approaches eligible for state support: direct air capture, bioenergy with carbon capture and Storage (BECCS): enhanced mineralization, and marine CDR.

    a) Direct air capture*:* Direct air capture (DAC) removes carbon dioxide directly from the atmosphere using engineered materials—either liquid solvents or solid filters—that chemically bind with $CO_2$. Once saturated, the material is heated or depressurized to release a concentrated stream of $CO_2$, which is then compressed and transported for long-term storage, typically in deep geological formations such as saline aquifers or oil and gas reservoirs.

    b) BECCS*:* BECCS involves using biomass—such as agricultural residues, forestry waste, or dedicated energy crops—to produce energy through combustion or fermentation. As the biomass grows, it absorbs $CO_2$ from the atmosphere. When the biomass is converted into energy, the resulting $CO_2$ emissions are captured and stored underground, rather than released. Notably, BECCS is considered carbon negative even though it uses CCS technology because the carbon dioxide being captured off of the process was recently removed from the atmosphere (i.e. the biomass pulled it from the atmosphere when it grew). This stands in contrast to fossil fuel-based CCS, which captures $CO_2$ that had been locked underground for millions of years. In that case, the technology prevents additional emissions but does not remove existing atmospheric carbon—making it carbon-neutral at best.

[2] U.S. Department of Energy, "Strategy for the Carbon Negative Shot"; January 2025

c) Enhanced mineralization or weathering: Enhanced mineralization is a carbon removal strategy that accelerates the natural process of rock weathering**,** in which certain types of rocks—such as basalt or olivine—chemically react with carbon dioxide ($CO_2$) in the atmosphere. This reaction forms stable carbonate minerals**,** permanently locking away the $CO_2$ in solid form. To speed up this process, the rocks are typically ground into fine particles and then spread on land or in coastal environments.

d) Marine CDR*:* Although still more conceptual and less technologically proven than other CDR methods, marine CDR could potentially include a number of approaches to leverage natural oceanic systems to store carbon. These could include:[3]

- Artificial upwelling and downwelling to move nutrient-rich or carbon-rich waters between ocean layers, potentially enhancing carbon uptake or long-term storage;
- Deep sea storage, where captured carbon dioxide is injected or sequestered in the deep ocean;
- Electrochemical ocean CDR, which uses electricity to remove carbon dioxide directly from seawater;
- Ocean alkalinity enhancement, which involves adding alkaline substances (like ground minerals) to seawater to increase its capacity to absorb atmospheric carbon dioxide.

3) *Opposition.* This legislation allocates $50 million to carbon removal technologies such as BECCS and marine geoengineering—an approach opposed by environmental groups who argue it diverts resources from more effective climate strategies. These groups contend that BECCS can compromise sustainable land-use practices, while marine CDR remains unproven and could disrupt ocean ecosystems. Rather than committing public funds to unproven technologies, they urge the state to prioritize cutting emissions at the source and scaling up nature-based carbon removal through the protection and restoration of forests, wetlands, grasslands, and seagrass beds—solutions that provide both climate benefits and ecological resilience.

4) *Related Legislation.*

SB 285 (Becker, 2025) requires carbon removal done for the purposes of net zero emissions to be "qualified carbon dioxide removal", as defined, and to counterbalance greenhouse gas emissions using only forms of carbon sequestration with substantially similar durations. Status: Held in Senate Appropriations Committee.

*5) Prior Legislation.*

SB 308 (Becker, 2023) would have required CARB to establish rules and processes for certifying carbon dioxide removal processes that can be used for negative emissions credits. It required CARB to adopt a regulation requiring certain emitting agencies to

[3] Ocean Visions, "Marine Carbon Dioxide Removal"; https://oceanvisions.org/ocean-based-carbon-dioxide-removal/

purchase negative emissions credits equal to a specified percentage of their GHG emissions, with that percentage increasing over time. Status: Died in Assembly Appropriations Committee.

SB 905 (Caballero) directed CARB to establish a CCRUS Program to evaluate the efficacy, safety, and viability of CDR and CCRUS and facilitate their implementation where appropriate. This bill requires CARB to track the deployment of CCRUS and CDR and adopt regulations for financial responsibility for CO2 capture, removal, or sequestration projects. This bill also directs the California Geological Survey to establish a Geologic Carbon Sequestration Group that identifies injection wells capable of maintaining integrity for at least 1,000 years, identifies appropriate monitoring of injected carbon dioxide and identifies hazards. Status: Chapter 359, Statutes of 2022.

**REGISTERED SUPPORT / OPPOSITION**:

**Support**

4 Corners Carbon Coalition
Airminers
Airmyne, INC.
Alkali Earth
Altasea At the Port of Los Angeles
Andes
Anvil Capture Systems INC
California State Pipe Trades Council
Carbon Blade Corporation
Carbon Capture, INC
Carbonbuilt
Carbonfuture
Cdr.fyi
Charm Industrial
City of King
Clarity Tech
Climeworks
Crew Carbon
Direct Air Capture Coalition
Equatic Tech INC
Heirloom Carbon
Indigenous Greenhouse Gas Removal Commission
Neocarbon Gmbh
Noya
Offstream
Openair
Openair Collective
Our Carbon
Pacific Coast Legacy Emissions Action Network
Parallel Carbon
Partnerships for Tribal Carbon Solutions
Patch Technologies INC

Project 2030
Restore the Delta
Rethinking Removals
Sitos Group, LLC
Stripe, INC.
US Biochar Coalition
Vycarb
World Resources Institute
Xprize
Yosemite Clean Energy, LLC

**Opposition**

350 Humboldt
Biofuelwatch
Center for Biological Diversity
Center on Race, Poverty & the Environment
Environmental Protection Information Center
Forests Forever
Green America
John Muir Project
Mount Shasta Bioregional Ecology Center
Partnership for Policy Integrity
Sonoma County Climate Activist Network (SOCOCAN!)
We Advocate Thorough Environmental Review

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