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Carbon Management in California's Cap-and-Trade Program

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Introduction

Carbon management is an issue of growing interest among California policymakers and regulators. While many of the policy issues around carbon management are beyond the traditional domain of the carbon market, some issues could soon interact with the carbon market in important ways. Looking forward, carbon management will likely become a more central focus of carbon market design and implementation. The 2023 Independent Emissions Market Advisory Committee report dealt with point-source carbon capture and subsurface carbon storage in detail and remains an important narrative of the opportunities and challenges related to carbon capture and storage.[1] **In this chapter, IEMAC aims to situate various carbon management strategies within the carbon market discussion, and surface considerations for policymakers as they determine the future shape and priorities of California's cap-and-trade program.**

It is important to understand the various carbon management strategies and which problem they aim to solve. Point source carbon capture (sometimes referred to as CCS or CCUS) is used to *reduce* the carbon dioxide emissions coming out of a facility.[2] This is emission reduction technology that is designed to directly reduce pollution going into the atmosphere. Carbon dioxide removal (CDR) is used to *remove* legacy carbon dioxide pollution from the atmosphere. Direct air capture (DAC) is a common example, but removal strategies include a wide range of technology- and nature-based climate solutions as well.[3] CDR is not an emission *reduction* strategy, but rather removes pollution that is already impacting the climate. Both are considered carbon mitigation strategies. The carbon dioxide captured from facilities and removed from the

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[1] https://calepa.ca.gov/wp-content/uploads/sites/6/2024/02/2023-ANNUAL-REPORT-OF-THE-IEMAC-final.pdf see pg 24-28.

[2] https://www.edf.org/sites/default/files/documents/carbon%20removal%20vs.%20carbon%20capture%20fact%20sheet_FINAL.pdf. A more comprehensive discussion of the wide range of approaches is available at https://www.google.com/url?q=https://nap.nationalacademies.org/read/25259/chapter/1&sa=D&source=docs&ust=1736438226719114&usg=AOvVaw3iwbs0GeAKRTLAE3mz2CpL.

[3] Ibid.

atmosphere through DAC is most commonly stored underground, which is discussed in further detail in the 2023 IEMAC report.

The 2022 Scoping Plan developed by the California Air Resources Board assumes that CCS will be deployed to achieve 85% reductions below the 1990 emission level by 2045 and that CDR will be deployed to reach net zero emissions by 2045. The 2022 Scoping Plan shows that point source carbon capture at industrial and electricity generating facilities is anticipated to capture 13 $MMTCO_2e$ by 2030 and 25 $MMTCO_2e$ by 2045, with industrial capture declining across the 2030s and an additional 17 $MMTCO_2e$ deployed in a single year (2045) in the power sector. The Scoping Plan assumes CDR deployment will total 7 $MMTCO_2e$ in 2030 and 75 $MMTCO_2e$ by 2045.[4] The Scoping Plan further assumes that technological CDR does not have any net energy consumption and that it is fully paid for by an unspecified mechanism, despite necessary funding reaching more than about $30 billion per year by the late 2030s.[5]

Governor Newsom has also endorsed CCS and CDR, directing CARB to accelerate development of projects with a target of 20 $MMTCO_2$ for 2030 and 100 $MMTCO_2$ for 2045.[6] California policy also supports nature-based climate interventions across landscape types, but anticipates that even with these strategies, carbon stocks on California's natural and working lands will decrease in the coming decades and constitute an approximately 7 $MMTCO_2$ per year source, on average, through 2045.[7] Beyond California, the Intergovernmental Panel on Climate Change (IPCC) recognizes that CDR is required to stay below 1.5 degrees of warming, though also emphasizes that CDR is not a substitute for significant emission reductions.[8]

We must recognize that as California gets closer to the 2045 goal of 85% emission reductions below the 1990 level and net-zero emissions, that the cap-and-trade program will become less about coordinating cost-effective emissions reductions and more about coordinating cost-effective carbon management. That is, there is likely to be a certain amount of residual emissions that must be captured or removed and stored permanently. As such, there will need to be regulatory direction and certainty. However, the current cost per ton of both captured and removed carbon dioxide ($180/ton to over $1000/ton, though this is likely to fall) is notably higher than the current carbon price (in the low-to-mid-$30s), and there remains uncertainty over technological readiness and efficacy. Taken together, in the near-term carbon management would be unlikely to play a significant role in the cap-and-trade program, even if other regulatory barriers were removed. Nonetheless, rules established in the near term will frame and constrain long-term regulatory design as well as investment in innovation, so understanding the role of various carbon management strategies, as well as potential options for action, is important.

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[4] https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf .
[5] https://ww2.arb.ca.gov/sites/default/files/2022-11/SP22-MODELING-RESULTS-E3-PPT.pdf Slide 23
[6] https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf
[7] https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/Californias-NBS-Climate-Targets-2024.pdf
[8] https://www.ipcc.ch/report/ar6/wg3/downloads/outreach/IPCC_AR6_WGIII_Factsheet_CDR.pdf

It is also important to be realistic about the scale of the funding needs associated with the CDR deployments assumed in the 2022 Scoping Plan. CARB projects that the cost of deploying the level of CDR it selected will reach tens of billions of dollars per year, peaking at nearly $30 billion by 2040, but did not identify a funding source for this money.[9] Whatever the policy instrument or instruments used to support the early deployment of CDR in California, the scale of what was assumed in the 2022 Scoping Plan is significant and will require substantially more financial support than is available in any one policy instrument in California today.

While the focus of this chapter is the potential nexus between the cap-and-trade program and carbon management, the compliance market is not the only avenue Legislators may wish to consider to develop high-integrity carbon management strategies. Options include::

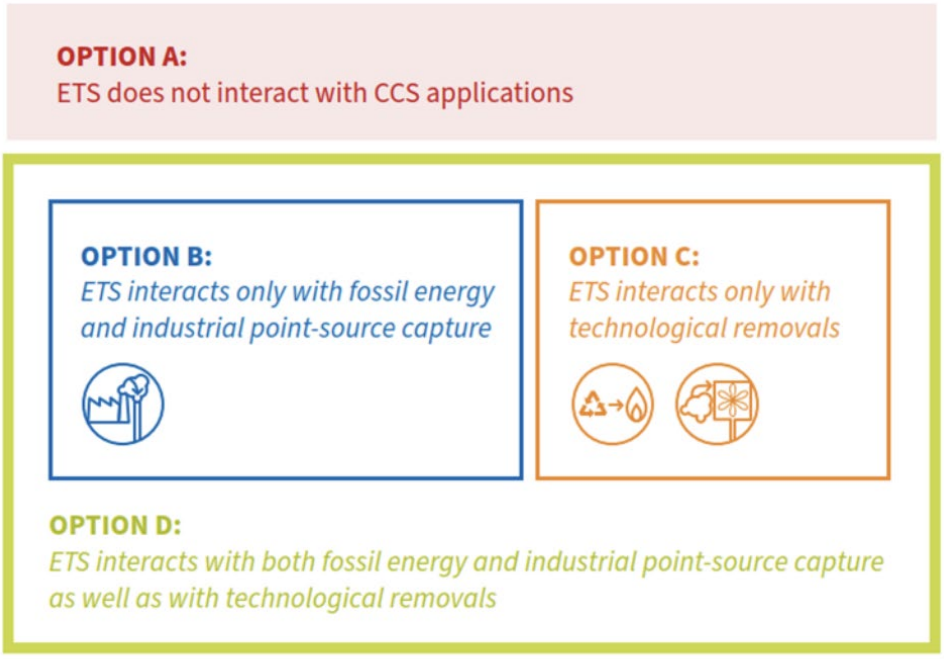
- Direct public funding of CDR projects, either through the Greenhouse Gas Reduction Fund or another funding source. State investment could help ensure greater accountability and oversight of nascent technologies, environmental integrity and community impacts. However, it could also be hard to appropriately scale with public money given budget limitations to achieve net-zero emissions no later than 2045 and maintain net negative emissions thereafter.
- An incentive-based approach such as state tax credits for developing or investing in supported CDR projects. This could be similar to the approach the federal government has taken under the Inflation Reduction Act (IRA). The IRA and related Bipartisan Infrastructure Law (BIL) have billions of dollars allocated to credits for both natural and engineered carbon removal strategies.[10] This option would rely on public finance, similar to the direct public funding option above; but it would delegate the selection of projects to market forces, similar to the stand-alone program described in the next bullet point.
- Establish a stand-alone program whereby identified emitters or sectors are required to procure CDR in addition to existing emission reduction requirements. This would require regulatory agencies to determine standards for which types of engineered and nature-based carbon removal strategies are approved, under what conditions, and how to calculate CDR outcomes net of the emissions involved in CDR projects' construction and operation. While this moves the cost burden onto emitters rather than directly on the state budget, it does potentially mean less direct control and oversight over specific projects.
- No further action beyond full implementation of SB 905 (Caballero, Skinner, 2022). Policymakers could decide this is sufficient regulation of point source carbon capture and underground storage. Even if the cap-and-trade regulations clarified whether or not CCS projects' captured emissions constitute a compliance obligation, the incentive produced by the cap-and-trade program's allowance prices may be too low to justify investment in CCS or CDR projects given their current and expected future costs.

[9] E3 Inc., CARB Scoping Plan: AB32 Source Emissions Final Modeling Results (Oct. 28, 2022) at slide 23, https://ww2.arb.ca.gov/sites/default/files/2022-11/SP22-MODELING-RESULTS-E3-PPT.pdf.
[10] https://www.wri.org/update/carbon-removal-BIL-IRA

There are numerous variations of each of these options, but broadly speaking, California will eventually need to decide if it wants to incorporate carbon management within the carbon market and if so, then how. The answer need not be the same for point source carbon capture and carbon removal, and it is likely more than one strategy will be needed to support the necessary scale of carbon management. If managed outside of the carbon market, California will also eventually need to determine another mechanism to ensure that there are sufficient removals by mid-century to meet the 2045 net-zero goal and maintain net negative thereafter.

The figure below, taken from a 2023 report, provides a conceptual framework for thinking about alternative ways to define the relationship between carbon management and carbon markets. Option A is no interaction between carbon management and the carbon market, Option B is point-source carbon capture is incorporated into the carbon market, Option C is technological CDR is incorporated, and Option D is both CCS and technological CDR are incorporated into the market.

Figure ES. 4 – Four options for interaction between ETSs and CCS



Source: S. La Hoz Theuer and A. Olarte. (2023). Emissions Trading Systems and Carbon Capture and Storage: Mapping possible interactions, technical considerations, and existing provisions. Berlin: International Carbon Action Partnership. Pg 7.

By way of example, the European Union Emissions Trading System (EU ETS) and the United Kingdom Emissions Trading System (UK ETS) both currently allow for captured and stored emissions to be subtracted from a covered entities' compliance obligation, though as of January 2023 no facilities were using these provisions of the ETS.[11] These are examples of Option B.

[11] Ibid. 10

No system currently allows for mechanical carbon dioxide removal such as DAC, Option C. California's program would currently be classified under Option A.

Point source carbon capture

The California Legislature has already laid out significant guidance and direction to CARB with respect to point source carbon capture or CCS in the passage of SB 905. Duplication of those efforts is perhaps unnecessary in the current discussion of cap-and-trade reauthorization. However, direction could be given to CARB to establish criteria for captured and stored carbon regarding permanence, liability, monitoring, etc. pursuant but not limited to SB 905, which if met, would ensure that properly captured and stored carbon dioxide does not constitute an emission subject to a compliance obligation. At minimum, these criteria should include: (1) guardrails regarding permanent storage, monitoring, and verification; (2) how to account for a potential storage "reversal" and liability for reversals when a storage reservoir leaks; (3) how emissions from transportation of captured carbon dioxide and other support equipment should be accounted for in a compliance obligation; (4) how to account for emissions from any increased demand in electricity; (5) whether and how to reduce the direct allocation of allowances to facilities employing CCS; (6) what kind of new regulatory oversight is required; and (7) provisions to avoid double-counting of climate benefits.[12]

The current cap-and-trade program regulations are ambiguous as to whether captured CO_2 emissions constitute a compliance obligation. Clarifying that captured emissions that are stored pursuant to SB 905 do not create compliance obligations for the party whose emissions are captured would provide an incentive to capture those emissions. The appropriateness of that determination would depend on the robustness of the SB 905 regulations, including whether the SB 905 regulations manage the possible reversal of stored emissions. This liability could be assigned to the party storing CO_2 pursuant to SB 905 regulations; however, policymakers may need to consider alternative environmental safeguard mechanisms if a storage project goes bankrupt, such as an adjustment to cap-and-trade program allowance supplies (as is done for emissions leakage in the CAISO Energy Imbalance Market and was done to address the consequences of Ontario's departure from the linked cap-and-trade program).

Summary Recommendation: The robust implementation of SB 905 is a priority and is necessary to inform the interaction of CCS and CDR with the cap-and-trade program. CARB may also consider other policies that need to be updated to reflect final SB 905 rules, potentially including but not limited to the cap-and-trade regulation.

[12] For a discussion regulatory options both within and separate from a carbon market see: https://icapcarbonaction.com/system/files/document/La%20Hoz%20Theuer%20%26%20Olarte%20%282023%29.%20ETSs%20and%20CCS_ICAP.pdf

Carbon dioxide removal

Unlike with point source carbon capture, the California legislature has yet to give clear direction on rules and strategy regarding carbon dioxide removal, other than to recognize its necessity in meeting the 2045 net-zero goal and maintaining net negative emissions thereafter pursuant to AB 1279 (Muratsuchi, 2022). The net-zero and net-negative goals are importantly coupled with the 85% reduction below the 1990 baseline, which helps to ensure that CDR cannot "crowd out" the emission reductions that are also essential to mitigating climate change, assuming regulations account separately for reductions and removals. In order to meet the net-zero and net-negative goals, as well as the nature-based climate solutions targets required under AB 1757 (C. Garcia, 2022),[13] California must support increased investment in and ensure environmental integrity of both engineered carbon removal strategies like DAC and nature-based climate solutions such as enhancing natural carbon sinks.

To the extent the Legislature decides to address carbon removal within the cap-and-trade program, there are numerous considerations. Fundamentally, the cap-and-trade program should treat removals separately from emission reductions. Removal strategies should be considered a separate category of compliance instruments, similar to how offsets are a separate category of compliance instruments from allowances. CDR removes carbon dioxide from the atmosphere, regardless of where it came from; it does not reduce the emissions coming directly from a specified source.[14] Establishing a class of CDR credits separate from allowances would clearly differentiate carbon management strategies and help ensure appropriate and separate accounting of reductions and removals, as well as to draw relevant distinctions between the durability of different carbon storage reservoirs.

Legislators could consider giving direction to CARB as to which general types (direct air capture, wetland restoration, enhanced mineralization, etc.) of CDR projects they want considered for inclusion in the cap-and-trade program or other regulatory approaches identified above, if any. Among other factors, this direction should consider market readiness, scalability, and the ability to accurately quantify net carbon removal outcomes using robust and well-tested methodologies, along with environmental and community safeguards such as ongoing monitoring, financial assurances, public engagement, and provisions for reversals. If the Legislature wants to integrate CDR crediting into the cap-and-trade program, it may also want to direct CARB to establish a removal credit usage limit, similar to how offset credits currently have

[13] https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/Californias-NBS-Climate-Targets-2024.pdf

[14] There are different perspectives on which strategies should be considered "removals." For instance, bioenergy with carbon capture and storage (BECCS) converts biomass to bioenergy and captures the associated CO2. Because biomass is a carbon sink, burning it can be a carbon neutral process, so capturing the associated emissions qualifies as CO2 removal. Others would consider this process avoided (or reduced) emissions because the biomass is doing the removal and the CCS creates a durability enhancement in the carbon storage from short (fast carbon cycle for plant carbon) to long (geologic storage).

a usage limit. Accounting for removal credits “under” the cap would avoid any unintentional inflation of the emissions cap. An example of this mechanism exists in Washington State’s cap-and-invest program. When offsets are turned in for compliance an equal number of allowances from under the cap are retired from the program. There is further discussion of this approach in the offsets chapter of this report [cross-reference], but generally CARB should take an approach to any removal-based credits that does not *increase* the overall number of compliance instruments in the program above the annual budget required to meet the 2045 emission reduction goal.

Summary Recommendation: The Legislature could consider giving guidance to CARB or other regulatory agencies to develop rules and financial mechanisms to support the development of carbon removal projects, which are estimated in the 2022 Scoping Plan to cost tens of billions of dollars per year. IEMAC members were divided as to whether the initial phase of CDR deployment should include formal crediting in the cap-and-trade program. If the Legislature provides guidance to incorporate CDR crediting into the cap-and-trade program, it should direct CARB to count removal of emissions separately from emission reductions, and ensure that the inclusion of removal credits does not increase the overall number of compliance instruments in the program.

Conclusion

Numerous carbon management strategies will be necessary for California to achieve its 2045 climate goals, as well as its nature-based climate solution goals. Both the Scoping Plan developed by CARB and California’s Nature-Based Climate Solutions established by CNRA assume a wide array of carbon reduction and/or removal strategies. But until the SB 905 regulations are complete, it is difficult to assess an appropriate or preferred role of CCS or CDR within the cap-and-trade program.

This brief summary is intended to build upon the 2023 IEMAC report chapter on CCS and subsurface carbon storage, and to provide options for lawmakers interested in carbon management as they consider reauthorization of the cap-and-trade program, as well as potential uses for the Greenhouse Gas Reduction Fund. Lawmakers have an opportunity, if they desire, to provide high-level direction to CARB and CNRA regarding the development of a carbon removal strategy, as well as the separate accounting of greenhouse gas removals and reductions.