

DOCKETED	
Docket Number:	25-ERDD-01
Project Title:	Carbon Management Hub RFI
TN #:	261674
Document Title:	Carbon TerraVault Comments - Response to California Carbon Management Hub Request for Information
Description:	N/A
Filer:	System
Organization:	Carbon TerraVault
Submitter Role:	Public
Submission Date:	2/10/2025 12:56:14 PM
Docketed Date:	2/10/2025

*Comment Received From: Carbon TerraVault
Submitted On: 2/10/2025
Docket Number: 25-ERDD-01*

Response to California Carbon Management Hub Request for Information

Additional submitted attachment is included below.



February 10, 2025

California Energy Commission
Docket Unit, MS-4
RE: Docket No. 25-ERDD-01
715 P Street
Sacramento, CA 95814-5512

RE: California Carbon Management Hub Request for Information (RFI)

Thank you for the opportunity to provide input on the development of carbon management hubs in California. We appreciate the California Energy Commission's (CEC) commitment to the deployment of carbon capture and storage (CCS) and carbon dioxide removal (CDR) as State support is critical to accelerate development of these emerging industries.

California Resources Corporation (CRC), together with its carbon management line of business, Carbon TerraVault (CTV), is endeavoring to develop California's leading carbon management platform to help advance California's GHG reduction goals. CRC/CTV is on pace to deliver nearly half of the carbon sequestration capacity required by the state's 2022 CARB Scoping Plan. CTV's portfolio represents over 300 million metric tons (MMT) of CO₂ storage and is designed to support carbon management hubs across the State. Additionally, CTV has engaged with numerous emitters and technology providers across a variety of industries, including cement, power generation, hydrogen, biofuels, direct air capture (DAC), and biomass carbon dioxide removal and storage (BiCRS).

We believe that the State has opportunities to meaningfully support the development of carbon management hubs in California

Responses to RFI Questions

1.) Please describe your interest in partnering with other entities to apply for DOE funding and outline the role and expertise your organization would contribute to a carbon management hub. Include any relevant experience from prior collaborative projects that could help inform and strengthen a hub-based partnership.

CTV is actively engaged with a wide range of technical, academic, economic and community partners in executing current, and pursuing future, DAC Department of Energy (DOE) funding opportunities. Currently, CTV is partnering with DAC technology leaders Climeworks, Carbon Capture Inc, Avnos, Mosaic Materials and Siemens on three DOE Regional DAC hub awards: California DAC Hub/CalHub (Topic Area - 2), Aera DAC Hub – Kern (Topic Area - 1) and Siemens DAC Development (Topic Area – 1) under DOE FOA 2735. These awards, totaling over \$28 million in DOE, CEC, and non-government funding, place CTV at the forefront of DAC

development in California. These significant awards also put CTV and its DAC project partners, 40+ participants in CalHub alone, in prime position for additional, recently announced DOE funding for medium and large-scale DAC facilities and infrastructure.

CTV's upcoming application activity under the latest round of DOE DAC funding (FOA 3442) takes the next step in development by moving from design to execution. CTV is partnering with seven technical DAC providers, including 280 Earth, Heirloom, and Sustaera, in addition to those mentioned above, to develop a TA-1 application for up to \$250MM in federal funding to develop a regional DAC infrastructure and storage platform. Many of CTV's 40+ CalHub partners mentioned above will also participate. Each of the DAC technology companies partnering under the CTV TA-1 application will also be submitting their own TA-2 and TA-3 applications to build mid- and large-scale commercial DAC plants with CTV supporting the submittals. Concept Papers and Pre-Applications for FOA 3442 were submitted 1/31/25, with full applications scheduled for a deadline of 7/31/25.

Beyond DAC, CTV is aggressively decarbonizing CRC's internal emissions with plans to capture roughly 0.1 MMTPA from pre-combustion gas processing and 1.4 MMTPA via conventional post-combustion capture (PCC) from our existing 550 MW gas-fired power plant as part of the CTV I project at Elk Hills.

CTV has also announced partnerships totaling almost 7 MMTPA, including with BiCRS technology providers such as NLC Energy, InEnTec, Yosemite Clean Energy, and Verde Clean Fuels and third-party emitters such as Hull Street Energy and NetPower. CTV's strategy has been to build these partnerships around our industry-leading storage position, which at approximately 9 MMTPA injection capacity currently under EPA permitting consideration, is roughly 10% of the total injection capacity needed to reach the CARB Scoping Plan's 100 MMTPA carbon management target. CTV's stated ambition is to reach 1 billion metric tons of storage capacity in the state, which would provide an estimated 40 MMTPA injection capacity to supply 40% of the state's 100 MMTPA target.

CTV's experience in developing key partnerships includes the following activities for shared CO₂ sequestration hubs with multiple carbon removal and abatement emissions sources:

- Assembling and leading collaborative consortiums with over 40 partner organizations (CalHub).
- Developing first-of-a-kind Carbon Dioxide Management Agreements (CDMA's), which define the pricing and commercial contract terms for carbon management services.
- Developing a market for local premium voluntary carbon removal credits that value California co-benefits, most notably our agreement with the Los Angeles Rams.
- EPA Class VI and local Conditional Use Permitting for shared sequestration hubs.
- Designing balance-of-plant infrastructure, including clean energy supply and CO₂ pipelines, for emissions sources.

- Early-stage development and advanced planning for construction and operations of DAC, BiCRS, and CCS facilities

2.) Which types of state-level support beyond grants — such as stakeholder convening, streamlined processes, technical assistance, research access, and community engagement — is your organization most interested in, and which does your organization believe would be most effective for advancing carbon management efforts, particularly with regards to a hub-based approach?

- California Environmental Quality Act (CEQA) Streamlining:** The largest opportunity for accelerating development of carbon management hubs in California is streamlining of the CEQA process. CEQA review, and associated litigation, adds years to project permitting timelines, significantly delaying final investment decisions (FID) and implementation, and eroding value for investors. This effect is compounded for hub projects which are developed in phases, where each new CO₂ source may undergo separate review under CEQA and be subject to additional delays. For California to reach its carbon sequestration and carbon removal goals, a streamlined CEQA process must be established for carbon management hubs. At a minimum, CCS, DAC, and BiCRS projects should be afforded judicial streamlining to limit the potential for years-long delays created by CEQA litigation.
- CO₂ Source Characterization Requirements:** By definition, a carbon management hub has multiple emission sources which may not be fully identifiable at the time of permitting. Currently, the US Environmental Protection Agency (EPA) requires that at least one CO₂ source be identified and fully characterized before a Class VI Underground Injection Control (UIC) permit can be issued. While characterizing the proposed CO₂ stream is important for assessing compatibility with well materials and reservoir rocks and fluids, storage site developers may need to obtain a Class VI permitting ahead of commercial agreements with emitters and before a CO₂ source is firmly secured. The State should serve in a convening role with EPA Region 9 and help to define a process for carbon management hubs which don't have well-constrained CO₂ sources to progress through the Class VI permitting process. A simple solution for this issue is to allow CO₂ storage developers to utilize a CO₂ specification as the basis for CO₂ stream analyses in a Class VI permit.
- Convening Discussions with Project Opponents:** While carbon management hubs are critical to achieve the State's climate goals and aim to bring meaningful investment to our local communities, projects have received opposition from some Environmental Justice (EJ) and Environmental Non-Governmental Organizations (ENGO). These organizations seek to block carbon management hubs because they are deemed to

“extend the runway” of fossil fuels, whereas these projects are actually complementary solutions to electrification for hard-to-abate sectors and aligned with CARB’s 2022 Scoping Plan. The State can play a critical role in convening conversations with these EJ and ENGO groups to advance this complementary-versus-competitive position with electrification for both carbon removal and abatement projects.

- d. **California’s Moratorium on CO₂ pipelines:** It will not always be possible for emitting facilities to be co-located with CO₂ sequestration sites and therefore, carbon management hubs will rely on pipelines to convey CO₂ to storage sites. Senate Bill (SB) 905 (Caballero, 2022) currently prohibits pipeline transfer of CO₂ outside of a single facility until the Pipeline and Hazardous Materials Safety Administration (PHMSA) completes rulemaking on CO₂ pipelines. In the interim, the State’s pipeline moratorium is likely to delay the development of carbon management hubs and materially postpone decarbonization of large swathes of the California economy. Until PHMSA or California adopt new regulations on CO₂ pipelines, the State should lift the pipeline moratorium and utilize existing PHMSA regulations to govern transport of CO₂ by pipeline, like many other US states have.
- e. **Back-up electricity rates and behind-the-meter power supply:** Carbon removal is energy intensive, particularly from DAC. Given California’s higher energy costs compared to other states, this creates a challenge as California tries to compete for projects, grants, and business investment. Preferential tariffs can be implemented by the California Public Utilities Commissions (CPUC) to support DAC development, similar to what was implemented for renewable development.

Further, next generation ultra-low emissions natural gas power production should be enabled by the CEC on a behind-the-meter basis to provide baseload power, lifting the unofficial moratorium on new gas fired power plants. These solutions, such as oxy combustion, have ultra-low criteria pollutant emissions and are designed for efficient and cost-effective CO₂ capture.

3.) What is the current Technology Readiness Level (TRL) of your technology and/or the development stage of your project (e.g., preliminary front-end engineering and design, demonstration)? Please provide potential outcomes from partnering with your organization, including estimated annual carbon capture capacity (in tonnes per year), description of product (if carbon utilization), co-benefits (e.g., hydrogen or water production), and other relevant details.

CTV’s DAC development under FOA 3442 (referred to as CalHub+) will offer significant opportunities for a gamut of DAC technology developers, ranging in TRL’s from 3-6. It will allow

these DAC technology providers to deploy small and mid-scale systems at a site with essential resources such as heat, power, and water and significant testing and analytic infrastructure. This setup provides a real-world environment to test systems rigorously and refine their functionalities, both of which are crucial for advancing the TRL of these innovations and attracting private investment. Once implemented, these emerging technologies will benefit from an integrated support system, including skilled technicians, precision measurement systems, and machine learning expertise. This infrastructure is designed to support a systematic testing regime that not only ensures progressive TRL advancement but also optimizes the developmental trajectory of the technologies.

CalHub+ will leverage internal and partner experience in managing large multidisciplinary teams to provide an integrated schedule and deliverables that are achievable in the defined period of performance. Phase 1 will install an estimated 250k TPA of capacity, with a ramp-up to above 1 MMTPA anticipated in the years following commissioning of the initial facility.

The DOE's investment in the Kern County projects will provide the initial funding needed to kick-start the development of a self-sustaining DAC industry across California. CTV envisions expanding the CalHub+ beyond the plans detailed in the TA-1 application. In particular, CTV envisions potentially scaling CalHub+ to other locations in Kern County, consistent with the County's Carbon Management Business Park (DOE Communities LEAP technical assistance grant award project) and to other regions of California, supporting California's goal of capturing 66 MMTPA via CDR.

Technical co-benefits are technology dependent and include net generation of fresh water for local communities, improved local air quality via reduced criteria pollutants, and generation of clean heat and power sources. Community benefits include quality jobs for local communities impacted by the energy transition and STEM and energy transition education programs.

CTV's conventional CCS and BiCRS projects are generally at higher TRL's than DAC, with most being proven at a TRL above 7. As with DAC, co-benefits vary by technology and include those cited above for DAC. Carbon abatement targets were previously shared in section 1, above.

4.) What challenges are you currently facing, particularly related to funding (e.g., offsetting construction or operating costs, securing offtake agreements)? What challenges – financial or otherwise - do you anticipate in scaling these technologies within a hub-based approach, and are there any challenges unique to establishing a hub in California?

Carbon management, including DAC, is capital intensive, requiring a solid business case before investment is made. In addition to government grants and tax credits, one of the greatest incentives for investments in emission reduction is regulated carbon markets such as California's Cap & Trade program. However, the program currently does not allow for emission and compliance cost reduction through CCS. Incorporating CCS into the regulation would provide a stronger business case for capturing and sequestering emissions, supporting carbon management efforts.

In addition to this, California needs to incorporate CDR into its carbon markets policies to align with climate goals. Given remaining GHG emissions from hard-to-abate sectors in 2045, CDR will be required to achieve carbon neutrality. CDR market policy could take the form of revisions to the Cap & Trade program, or new regulation that compliments Cap & Trade. By incorporating CDR into carbon market policy, California would create demand for CDR and bolster the business case for CDR investment.

Closing Remarks

CRC/CTV is a leader in carbon management hub development in California, as evidenced by our sizeable portfolio of CO₂ storage and carbon capture projects, multiple DOE Regional DAC Hub awards, and numerous carbon capture and carbon removal partnerships. We welcome the State's support to attract investment to this growing industry and believe California has an opportunity to meaningfully contribute through supportive state policies. We look forward to working with the State to decarbonize the economy and advance California's climate goals.

Regards,



Chris Gould
Chief Sustainability Officer, California Resources Corporation and
Managing Director, Carbon TerraVault Holdings