DOCKETED	
Docket Number:	25-ERDD-01
Project Title:	Carbon Management Hub RFI
TN #:	261396
Document Title:	Graphyte Inc Comments - Graphyte Inc's Response to CEC RFI
Description:	N/A
Filer:	System
Organization:	Graphyte Inc
Submitter Role:	Public
Submission Date:	1/29/2025 7:19:24 AM
Docketed Date:	1/29/2025

Comment Received From: Graphyte Inc
Submitted On: 1/29/2025
Docket Number: 25-ERDD-01

Graphyte Inc's Response to CEC RFI

Additional submitted attachment is included below.

Response to California Energy Commission Request for Information

Context: California Energy Commission : Docket Log

Deadline: Wednesday 1/29/2025 at 5 PM PST

Graphyte's Role as Part of a Carbon Management Hub

Graphyte is actively seeking to expand projects to new locations, including California, and works with a variety of economic development, government, and industry partners to identify new project locations. As part of the CEC's new carbon management hubs, we envision a strong partnership with the state of California and the businesses in the state that we might engage with, bringing responsible and effective climate solutions into reality. Our role would be two-fold: first as a project developer and provider of carbon removal and secondly, as an addition to the state's network of experts in emerging climate solutions.

Graphyte delivers durable carbon removal through biomass-based technologies that are rapidly scalable, cost-effective, environmentally clean, and inherently safe. Our response to this RFI aims to articulate the distinctive capabilities of biomass carbon removal and storage (BiCRS) within the carbon dioxide removal (CDR) landscape, emphasizing its role as a net carbon removal technology that differs fundamentally from emissions mitigation. BiCRS offers a pragmatic, near-term solution for meaningful atmospheric carbon reduction, providing immediate and long-lasting carbon storage that complements other evolving CDR technologies. Critically, our approach integrates seamlessly into existing economic activities, requiring little to no supply chain restructuring, reduced competition for renewable energy resources, and very low demand for critical natural resources (like water), minimizing implementation barriers and operational overhead.

In addition, Graphyte brings a multidisciplinary team of experts uniquely positioned to advance carbon management hub development in partnership with the CEC. Our leadership includes strategic and financial executives with deep experience across multiple CDR pathways, ensuring economically viable and socially responsible project implementation. Our technical team comprises materials scientists, environmental scientists, and engineers with extensive backgrounds in CDR technologies, including development of direct air capture technology, nature-based solutions, and more. We actively participate in critical measurement, reporting, and verification (MRV) workshops, including collaborations with Lawrence Livermore National Laboratory and the NIST CDR Consortium. And finally, our network of academic and industry consultants offers sophisticated expertise in operational R&D, biophysical modeling, and advanced measurement techniques, providing comprehensive insights into biomass utilization and carbon removal strategies. We have secured several national-level awards including being selected as a Phase 2 finalist for the DOE Carbon Dioxide Removal Purchase Prize.

We look forward to collaborating with the CEC and associated parties in developing carbon management hubs with the best possible technologies and business model approaches on the market today.

BiCRS state-level support

Graphyte has identified several potential areas across the state ofCalifornia for project development. Graphyte projects can be constructed in 12-24 months depending on the target capacity. Our sites typically start at a capacity of 50,000 tCO2/yr but can be scaled up to 500,000 tCO2/yr and beyond depending the availability of low-cost biomass supply in the area. Graphyte works closely with local and state stakeholders to build successful projects. At our first facility in Arkansas, we have collaborated closely with local and state leadership from the beginning of the site selection phase. We have held numerous public meetings, surveys, and actively conducted outreach in the community to understand the opportunities and concerns associated with our project. As key highlights, we have developed local workforce development partnerships, hosted educational programs for K-12 and local universities, created a long-term stewardship arrangement for our sequestration site with a local land trust, and hosted numerous site visits for industry groups, government officials, and other community partners. This is all in the *first year* of our operations in Arkansas. We intend to bring the same collaborative approach to community engagement in all our projects, but particularly in California where we look forward to working with an active network of state and local partners to develop the best outcomes for our employees, schools, industry, and community partners.

Graphyte's projects fit within the existing wood and agricultural products economies, leveraging existing supply chains, logistics routes, and often even facilities to convert waste byproducts into durable carbon removals. As such, we can often follow existing planning, permitting, and investment approaches. We can also partner with programs by state and federal agencies seeking to increase biomass utilization in certain markets, such as wildfire fuel mitigation strategies. Lastly, Graphyte's industrial operations are energy-efficient and can draw on existing grid energy. All of these factors combined, show that Graphyte's BiCRS projects have a low barrier to entry that allows us to proceed quickly once a site has been selected and a community is engaged. We are able to efficiently use existing resources to deploy our innovative projects.

However, to build a project in California we would seek the active support of state stakeholders like the CEC for stakeholder convening and community engagement. In particular, we seek support with:

- Identification of state and local partners key to deploying BiCRS projects (including but not limited to: government leaders, state agencies, industry groups, community and nonprofit organizations)
- Engagement with technical counterparties to discuss BiCRS impact on air quality, groundwater, land use, and other environmental concerns
- Engagement with grants and financing counterparties for project financing or for advancing sustainable biomass utilization programs
- Confirming a permit pathway that allows Graphyte facilities to deploy in <18 months in California. The permit should be appropriate for long-term storage of inert biomass waste in shallow underground facilities. Graphyte has already received permits for its Arkansas operations and is actively developing projects in 2 other states with clear permit pathways.

Technology Readiness and Potential Outcomes

Graphyte's Carbon Casting technology utilizes readily available waste biomass to efficiently remove CO_2 from the carbon cycle. We dry and compress biomass into carbon blocks protected by an environmentally safe, impermeable barrier, and store these blocks in underground sites implementing well-tested landfill design technology with state-of-the-art monitoring systems.

Carbon Casting is immediately scalable today, integrating off-the-shelf commercial equipment. Our core process has achieved a TRL of 9 evidenced by Graphyte's Loblolly Project in Pine Bluff, Arkansas, which has already stored durable carbon underground and generated registry verified carbon credits. Total annual carbon removal capacity is based on unique constraints for each CDR pathway. In contrast to other CDR technologies, the main limitation to carbon removal capacities for BiCRS operations is the waste biomass supply itself (Sanchez et al., 2025), not the availability of renewable energy, other unique inputs, or pre-existing infrastructure. In California, biomass wastes from forestry and agricultural operations represent a significant amount of potential carbon removal and facilities can scale to meet biomass availability. With sufficient supply of waste biomass, Graphyte's facilities can scale up to as high as 500,00 tCO2e of carbon removal per year.

The IPCC underscores the critical but limited role of carbon dioxide removal (CDR) in climate solutions, positioning it as a complementary strategy to primary decarbonization efforts. While emerging CDR technologies hold promise, they currently face significant barriers, particularly the opportunity cost of renewable energy. Direct air capture (DAC) technologies, for instance, compete with grid decarbonization efforts, where the climate benefit of renewable energy for general consumption outweighs its use for carbon removal.

BiCRS represents a different but complementary component to long-term climate strategies. By utilizing waste biomass and requiring minimal energy input, our technology can deliver carbon removal today without diverting critical renewable resources or significantly increasing energy demand. This approach provides an immediate carbon removal solution that bridges the gap while next-generation CDR technologies continue to mature and renewable infrastructure expands.

Graphyte's Carbon Casting technology also represents an exceptionally clean industrial process with minimal resource requirements. Our method requires zero water input, contrasting with liquid sorbent direct air capture technologies that can demand up to 2:1 water-to-CO2 ratios (WRI, Keith et al. 2018). While some DAC technologies claim water production, their efficiency varies critically with atmospheric humidity—potentially becoming water-consuming in dry climates like California's. By eliminating water demands entirely, we remove a significant operational and environmental constraint.

In addition to the high TRL and low resource intensity of our core process, Graphyte's scalability stems from multiple strategic advantages. First, we utilize established permitting frameworks familiar to waste management and industrial sectors, which reduces friction in project

establishment. Second, our approach relies on existing logistical infrastructure and standard industrial equipment making it deployable across a wide range of geographies. Third, proven community engagement strategies result in rapid and collaborative project development that adheres to the principals outlined in the sustainable development goals (SDGs, United Nations 2012). And finally, by plugging in to existing supply chains and utilizing waste, Graphyte's model avoids complex cost-benefit tradeoffs that further reduce the speed to climate-relevant carbon removal. Overall, low startup and operational costs combined with these strategic approaches to project implementation create financial and social efficiencies which foster rapid deployment of Graphyte's CDR technology.

Partnering with Graphyte also has the potential to create additional co-benefits.

Value Creation:

- Graphyte's BiCRS process transforms waste materials into a valuable resource, supporting circular economics in California's growing industrial landscape.

Wildfire Mitigation Support:

- By utilizing biomass residues from forest fuel reduction efforts, Graphyte provides an offtake market for materials that currently lack economic value, simultaneously addressing wildfire risk and generating carbon removals.

Environmental Remediation:

- Graphyte uses degraded sites like disused mines for carbon storage, applying environmental restoration techniques to transform non-vegetated areas into functional ecosystems.
- By diverting biomass residuals from combustion or land application, Graphyte improves local air quality outcomes by reducing production of CH4, CO2, and particulate matter.

Challenges

To summarize the previous sections, the major challenges facing a Graphyte project deployment in California are:

- Ensuring that Carbon Management Hubs include a role for BiCRS projects in carbon dioxide removal, such as issuing RFP's for certain volumes, timelines, and pricing for these ready-to-deploy projects
- Aligning California's permit approach for long-term biomass storage with the precedent Graphyte has achieved in other states, and ensuring such permits can be secured in <18 months
- Identification of state and local partners key to deploying BiCRS projects (including but not limited to: government leaders, state agencies, industry groups, community and nonprofit organizations)

References

Keith, David W., et al. "A process for capturing CO2 from the atmosphere." Joule 2.8 (2018): 1573-1594.

Sanchez, Daniel L., et al. “Carbon removal efficiency and energy requirement of engineered Carbon Removal Technologies.” RSC Sustainability, 2025, https://doi.org/10.1039/d4su00552j.

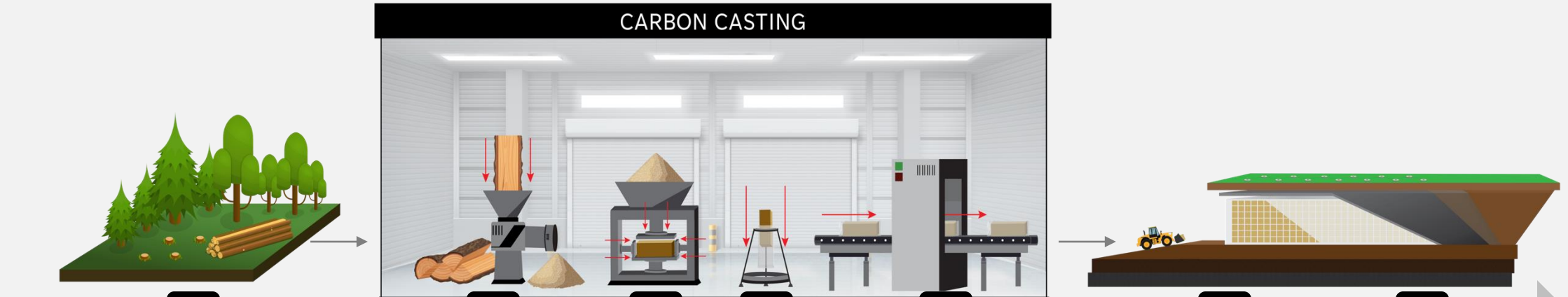
INTRODUCTION TO GRAPHYTE

December 2024

GRAPHYTE

The carbon casting process

Graphyte's carbon casting approach creates carbon blocks that can be stored underground



Collect biomass from any source, including wastes

Dry the biomass and remove all microbial activity

Compress the biomass into carbon blocks

Wrap the biomass in an environmentally safe barrier

Quantify carbon content stored in each block

Store in a purpose-built site for sequestration

Monitor With state-of-the-art sensors and tracers

Halt biomass decomposition

Ensure decomposition does not restart

Eliminate all risk of re-emissions

Loblolly Project, Arkansas

We began producing carbon blocks from our facility in Arkansas in April, 2024. We hosted a ribbon cutting event with the community earlier this year.

We purchased a 70-acre site to store our carbon blocks. We received a permit in July from the Arkansas Department of Environmental Quality.

ISOMETRIC

We have stored carbon and received our first verified credits from Isometric in September, 2024.

Carbon Direct

American Airlines

Terraset

wren

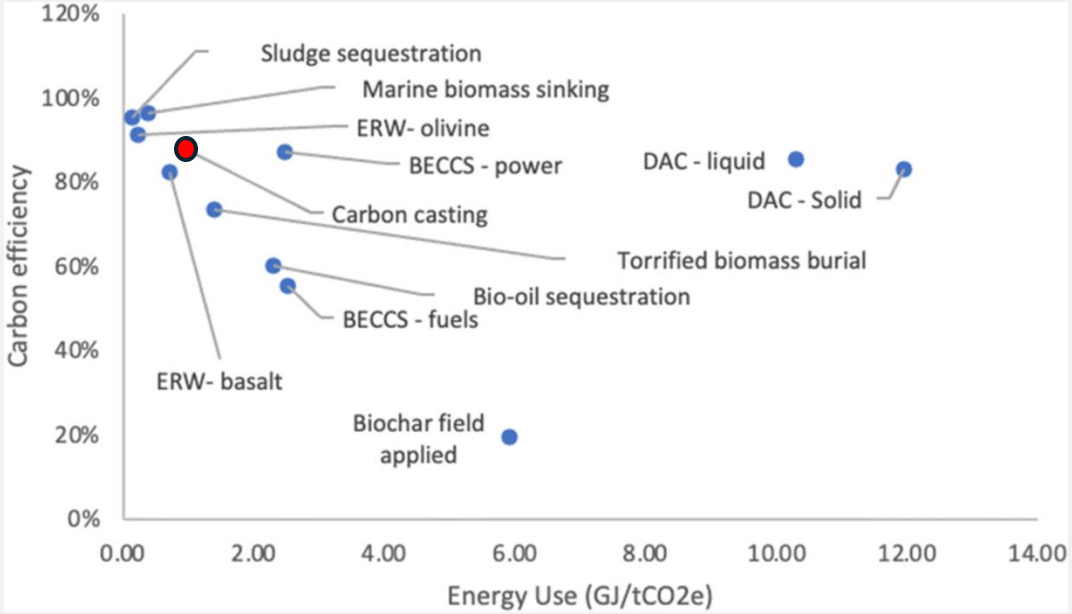
Breakthrough Energy

U.S. DEPARTMENT OF ENERGY

We are working with leading buyers and partners in this space including Carbon Direct, American Airlines, and the U.S. Department of Energy.

In just a year since formation, Graphyte has built one of the largest carbon removal facility in the world. The Loblolly Project has a capacity of 15,000 tCO2e per year. **That is 15X the biggest operational DAC plant in the US today.**

Carbon Casting Compared to Other CDR Pathways



A comparison of the energy use requirements for sequestering one ton of carbon dioxide equivalent

Among biomass-based CDR technologies that have a TRL of 9+, carbon casting has the highest potential for net carbon removal per ton of biomass utilized