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Yggdrasil Trees Comments - Yggdrasil Trees Carbon Management Hub RFI

Additional submitted attachment is included below.

Yggdrasil Trees

Carbon Management Hub RFI

California Energy Commission
January 29, 2025

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.

Yggdrasil Trees is developing a decentralized, multi-functional direct air capture (DAC) solution designed for integration into urban environments, making our approach go beyond carbon capture and create co-benefits. We aim to remove 800 tonnes of CO_2 per unit per year from the atmosphere and are actively researching various sorbents, including electrochemical options to further optimize energy needs and enhance capture efficiency based on our requirements. Our company values are not limited to capturing carbon; they also include protecting vulnerable communities, advancing institutional climate goals, and driving sustainable innovation in DAC technology.

Our multi-purpose design makes Yggdrasil Trees a comprehensive DAC solution with several key functionalities:

- **Carbon Capture and Sequestration:** Our core function is the efficient removal of CO_2 from the atmosphere. We are initially focusing on licensing existing sorbent materials for rapid deployment.
- **Community Engagement and Empowerment:** We are actively seeking to partner with local organizations to ensure communities have a voice in the project and benefit directly from improved environmental conditions.
- **Urban Areas and Co-benefits:** We are exploring partnerships with renewable energy developers to power our DAC units sustainably, and are investigating potential co-benefits like reduction of urban heat.

From an IP standpoint, Yggdrasil Trees positioned itself as a project developer focusing on licensing sorbent materials to accelerate deployment and minimize initial development time. Currently, we are in discussions with various DAC companies and technology developers to license their IP based on their technology's suitability for specific environments for our initial deployment. Additionally, we are engaged with potential partners including government entities and institutions to explore pilot opportunities.

Our interest in partnering with other entities to apply for DOE funding:

- **Institutions**: Collaborating on our pilot projects with their research and development with a focus on direct air capture and energy

- **DAC Companies**: Licensing their IP
- **Government Entities**: Aligning with federal and state carbon management policies, accessing DOE funding, and advancing climate goals
- **Renewable Energy Developers**: Establishing clean energy integration to power DAC units efficiently in urban areas
- **Community Organizations**: Engaging underserved communities
- **Channel Partnerships**: We plan to collaborate with established manufacturing and logistics partners to ensure high-quality, scalable production while reducing operational complexity. By working with manufacturers experienced in renewable energy systems, urban infrastructure, and advanced materials, we aim to optimize our supply chain and streamline mass production and distribution.

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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?

To align with our short-term and long-term approach mentioned above, here are the different types of state-level support that we are interested in beyond grants:

Research Access and Collaboration: Access to state-supported research facilities and expertise is vital for optimizing our DAC technology and contributing valuable IP to a carbon management hub. We are particularly interested in collaborating with researchers at universities specializing in advanced direct air capture materials, and energy production suitable for urban environments. Connecting with these researchers would accelerate our technology development and improve the efficiency and cost-effectiveness of our solution.

Community Engagement Support: Our solution is designed to be deployed within communities, and therefore, community buy-in is crucial. State-level support for community engagement, including funding for outreach programs, workshops, and educational materials, would be extremely beneficial. This support would help us build trust, address community concerns, and ensure that our project aligns with local needs and priorities. We envision collaborating with state agencies on the benefits and opportunities of DAC within the community, specifically targeting underserved neighborhoods. This community engagement is essential for the long-term success of any hub-based carbon management effort.

Engagement with Urban Developers and Local Governments: Engaging urban developers and local governments is crucial for scaling our decentralized DAC solution and achieving widespread adoption within a hub-based carbon management approach. State support in facilitating connections with key developers involved in relevant projects (e.g., new developments, redevelopment) is essential.

Streamlining Permitting: Deploying DAC technology in urban settings involves navigating complex regulations. To accelerate implementation, we need clear zoning and regulatory pathways to facilitate DAC in urban areas.

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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.

Our project comprises multiple components at varying Technology Readiness Levels (TRLs). The prototype is currently at TRL 4, with proof-of-concept prototypes for our core technology being constructed and demonstrated. Once these components are fully integrated and tested, we will reach TRL 6. Data collection is in progress using an initial testing sorbent. Based on calculations, each Yggdrasil Tree unit is projected to capture 800 tonnes of CO_2 per year, requiring 8 gigajoules per tonne of CO_2. We are actively researching various sorbents including electrochemical options for energy optimization and enhanced efficiency. Our DAC units are designed with a renewable-first approach and engineered to maximize natural airflow for optimal efficiency.

There are many co-benefits that Yggdrasil Trees bring to the table while removing carbon from the atmosphere, we also transform urban spaces and create climate-resilient neighborhoods while fostering environmental justice, public awareness, and economic inclusion.

Environmental Justice: Our systems target urban areas that are disproportionately affected by the climate crisis. By improving these spaces with Yggdrasil Trees, we enhance biodiversity, address environmental inequities, and help build climate-resilient communities.

Public Awareness: Yggdrasil Trees serve as tangible symbols of climate action, sparking public awareness and engagement with sustainability. We aim to connect individuals with our technology and inspire future environmental advocates through partnership-based programs and community organizations.,

Job Creation: We prioritize hiring locally and creating economic opportunities in underrepresented and disadvantaged communities. By focusing on roles in construction, maintenance, and climate technology, Yggdrasil Trees fosters green workforce development.

Improving Urban Spaces: The improvements in urban settings create a ripple effect of positive outcomes, including enhanced public spaces, increased real estate value, and boosted local economic activity through foot traffic and support for nearby businesses. In addition, through equitable deployment, Yggdrasil Trees aims to build a more sustainable and inclusive future. By addressing environmental disparities and empowering disadvantaged communities, we are creating a lasting impact that benefits both people and the planet.

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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?

Yggdrasil Trees' approach is unique and without a traditional DAC development tied to established university labs, accessing funding typically earmarked for more conventional research paths. This makes it difficult to offset the significant construction and early operating costs associated with building and testing our prototypes. While our hub-based strategy offers a promising pathway to overcome these challenges through collaboration and resource sharing, we recognize the following challenges:

Anticipated Key Challenges:

- **Material Cost:** Sorbent, solvent, or other supply chain issues might affect scalability and cost
- **Permits and Policies:** Navigating permits, policies, and funding outside of the US might create regulatory uncertainties
- **Natural Resources** constraints in California, particularly related to water and electricity availability
- **Securing Offtake Agreements & Market Development**: The voluntary carbon market and long-term offtake agreements for captured CO_2 remain uncertain
- **Technology Integration & Energy Requirements:** Ensuring consistent access to renewable energy sources (solar, wind, waste heat, etc.) for urban DAC hubs remains a challenge as well as grid interconnection and optimizing energy efficiency for decentralized DAC deployment require additional research and infrastructure investments.
- **High Costs of Land, Labor, and Infrastructure:** California's high costs of land and construction make it difficult to secure affordable sites for DAC deployment in addition to labor costs and regulatory compliance further increasing expenses compared to other states with lower-cost energy and workforce availability.

Conclusion

To overcome these challenges, state-level support in the form of funding assistance, streamlined permitting, and clearer carbon market incentives will be crucial. We believe that our unique approach, combined with a strong collaborative network within a California based hub, will enable us to overcome these challenges and contribute significantly to achieving net-zero goals. Yggdrasil Trees is actively seeking public-private partnerships, collaborations, and policy alignment to help scale DAC hubs efficiently within California and beyond.