

*The*  
**Wren Climate  
Collective**

EST.  2023

# How climate philanthropy is catalyzing carbon dioxide removal (CDR)

*Wren Climate Collective 2024 Giving Thesis*



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## Context

In December 2023, Wren formed a fiscally sponsored non-profit, the Wren Climate Collective, which provides a tax-deductible way for individuals and businesses to contribute to climate action. The Collective was created following Wren customers' requests for a simple and effective pathway to engage in climate philanthropy through Wren. In response, we established a method for Wren to accept funds from donor-advised funds, company matching programs, stock transfers, and more and pass on tax deductibility to donors.

The Wren Climate Collective complements Wren's Classic and Trailblazer Portfolio offerings, which have raised over \$12,500,000 for climate solutions worldwide as of November 2024. Our track record of successfully sourcing, evaluating, and funding climate projects positions us to deploy philanthropic funds for maximum impact via the Collective.

To replicate the success of our core offerings with the Wren Climate Collective, we spent six months crafting a strategic, evidence-based plan. Initially, the Wren Climate Collective adopted a holistic approach to climate action. In January 2024, the first round of grants supported a variety of projects, including climate policy, forest conservation, and carbon removal. Although this approach had a diverse impact, we realized that focusing our grantmaking on a specific sector could achieve two broad goals: 1) maximizing impact per dollar and 2) distinguishing the Collective from Wren's other offerings. With these objectives in mind, we collaborated for six months with researchers from UC Berkeley's Goldman School of Public Policy and the NYU Stern School of Business. This collaboration involved conducting stakeholder interviews, completing in-house research, and interrogating Wren's role in addressing the climate crisis.

These exercises helped refine the giving strategy for the Wren Climate Collective. In this document, we summarize our findings and define our giving thesis. The Collective founding team is excited to share this work with interested parties.



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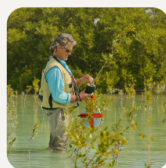
## **Accelerating Innovation to Meet Global Carbon Dioxide Removal Targets**

### **The Global Problem**

To align with the Paris Agreement, the world must rapidly decarbonize all sectors and remove 7–9 billion tonnes of carbon dioxide from the atmosphere per year by 2050<sup>1</sup> to limit global temperature change. Over the past decade, human activities have removed an average of around 2.2 billion tonnes of carbon dioxide from the atmosphere per year<sup>2</sup> and stored it in durable carbon sinks. However, there is considerable uncertainty surrounding this estimate. This carbon dioxide removal is primarily driven by natural systems, such as forests and oceans. These natural systems are vulnerable to climate change, and some ecosystems risk switching from sinks to sources of greenhouse gasses<sup>3</sup> if climate change accelerates. Only 1.35 million tonnes (less than 0.1%) of carbon dioxide is removed annually through novel methods<sup>4</sup> like enhanced rock weathering, biochar, and direct air capture.

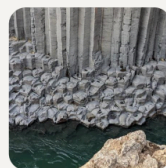


**Agroforestry**



**Wetlands  
Restoration**

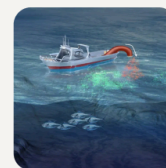
**Conventional CDR**



**Enhanced  
Weathering**



**Bio-oil  
Storage**



**Ocean  
fertilization**

**Novel CDR**

<sup>1</sup> Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., ... Vaughan, N. E. (2024). The State of Carbon Dioxide Removal - 2nd Edition. Retrieved from The State of Carbon Dioxide Removal website: <https://osf.io/f85qj>

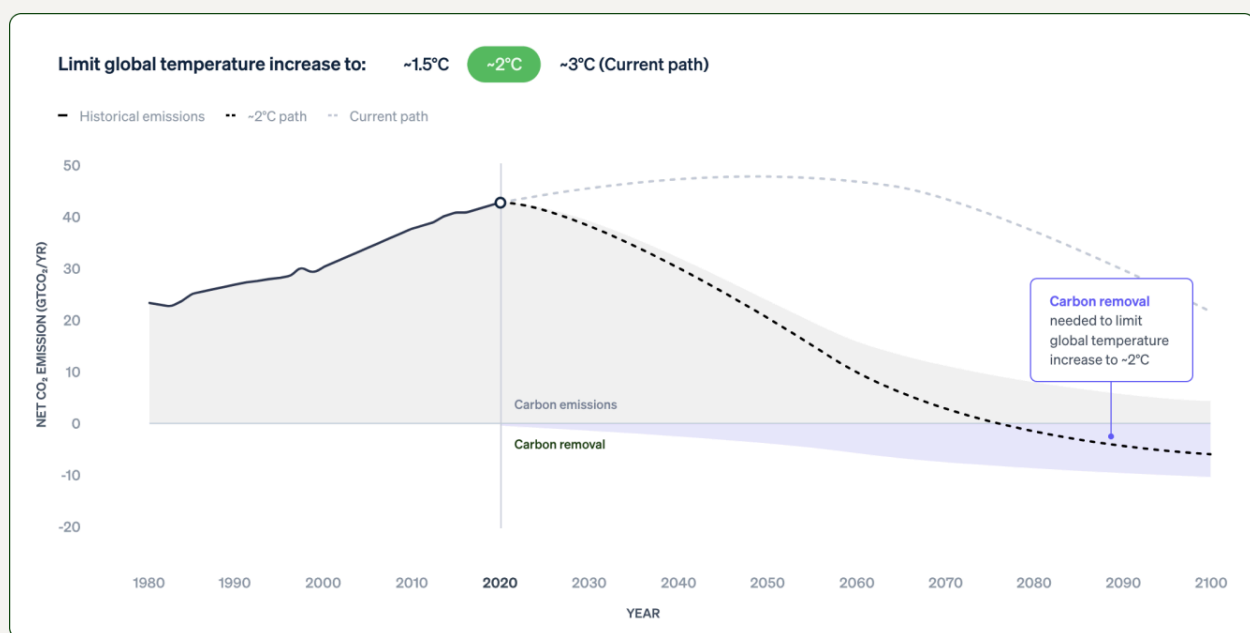
<sup>2</sup> Pongratz, J., Smith, S. M., Schwingshackl, C., Dayathilake, L., Gasser, T., Grassi, G., & Pilli, R. (2024). Chapter 7: Current levels of CDR, The State of Carbon Dioxide Removal - 2nd Edition. In S. M. Smith & et al. (Eds.), The State of Carbon Dioxide Removal - 2nd Edition. Retrieved from <https://osf.io/zxskb>

<sup>3</sup> Albrich, K., Seidl, R., Rammer, W., & Thom, D. (2023). From sink to source: changing climate and disturbance regimes could tip the 21st century carbon balance of an unmanaged mountain forest landscape. *Forestry: An International Journal of Forest Research*, 96(3), 399–409. doi:10.1093/forestry/cpac022

<sup>4</sup> Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., ... Vaughan, N. E. (2024). The State of Carbon Dioxide Removal - 2nd Edition. Retrieved from The State of Carbon Dioxide Removal website: <https://osf.io/f85qj>

The carbon dioxide removal (CDR) sector needs historic innovation to address the residual emissions that decarbonization alone cannot eliminate. However, scaling up CDR technologies is challenging due to high costs, energy demands, and infrastructure needs. To significantly increase CDR capacity, we need rapid advances in technology, infrastructure, and policy support.

This means developing more efficient and cost-effective capture technologies, enhancing natural carbon sinks, and creating scalable storage solutions. Additionally, innovative financial models and regulatory frameworks are necessary to incentivize large-scale investment and adoption of CDR methods. Only through unprecedented innovation and collaboration can we achieve the breakthroughs needed to remove billions of tonnes of CO<sub>2</sub> annually and mitigate the worst effects of climate change.



Visual from Stripe Climate: "Historical emissions via Global Carbon Project,<sup>1</sup> "Current path" shows SSP4-6.0,2,3 removal pathways adapted from CICERO.<sup>4</sup> For simplicity this chart only shows CO<sub>2</sub>, though the modeled scenarios account for other greenhouse gas emissions, all of which will need to be reduced."

## The Policy Problem

Demand and supply-side policy initiatives in North America and Europe are critical for advancing the development and deployment of these technologies. In the US, key policies include the 45Q Tax Credit, which provides tax incentives for direct air capture and carbon removal projects. The Infrastructure Investment and Jobs Act of 2021 allocates \$3.5 billion for regional direct air capture hubs, while the Bipartisan Infrastructure Law of 2021 allocates about \$5 billion for carbon capture, storage, and utilization projects. In 2024, the Department of Energy launched the world's first carbon removal purchasing program, committing \$35M to buy a range of carbon removal technologies. The Department of Energy's research initiatives further support carbon dioxide removal (CDR) efforts in the US.



These policies, along with those in the European Union and elsewhere, reflect a growing recognition of the importance of CDR in achieving climate targets and fostering technological innovation.

As of July 2024, Wren has raised over \$850,000 to support climate policy and will continue our engagement in the policy landscape. However, policy can be slow to implement and be hampered by state and national politics. As industry advocates work to pass meaningful policies, it is important that promising companies don't go out of business while waiting for state and federal support. Non-dilutive capital can bridge the gap and keep CDR innovators on the playing field.



It's clear that the amount of federal funding for CDR is not commensurate with the role of CDR in achieving climate goals. Currently, federal CDR funding is less than a tenth of renewable energy funding. Additionally, the vast majority of US policy funding to date has been limited to direct air capture. This creates an over-reliance on one pathway and does little to support innovation across the industry, hampering our ability to reach the billion-ton scale.

## The Industry Problem

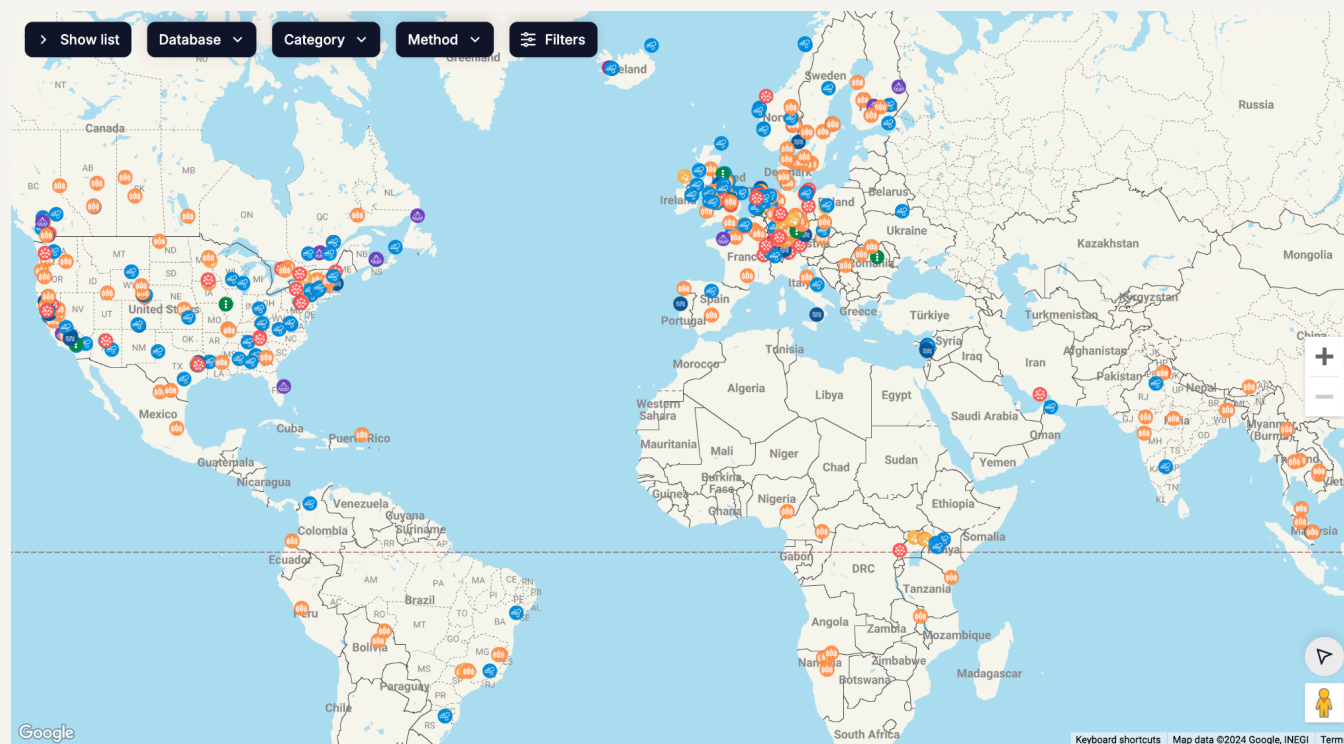
Industry initiatives to increase the pace and scale of carbon dioxide removal (CDR) have made great strides, yet more is needed. So far, advanced market commitments through platforms like Frontier<sup>5</sup>, pre-purchases, and offtake agreements for carbon removal credits that corporates can use toward environmental claims have driven demand for carbon removal. However, as of November 2024, only 11.8 million tonnes cumulatively of carbon dioxide removal are known to have been sold, according to [CDR.fyi](https://cdr.fyi), a carbon removal market reporting platform. In addition, three apparent risks hamper innovation and scale in the sector.

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<sup>5</sup> <https://frontierclimate.com>

## ***First, a lack of diversification introduces risk.***

Research grants, investments, and pre-purchases are concentrated on a few removal pathways in limited geographies. According to [CDR.fyi](https://www.cdr.fyi), just ten CDR companies represent 86% of the total tonnes sold in the Voluntary Carbon Market (VCM) sector, and three-quarters of purchases stem from a single corporate buyer. From 2000 to 2022, 40% of all active research grants on CDR and 59% of the research funding were concentrated in Canada or the United States<sup>6</sup>, with most active novel CDR projects situated in North America and Europe.<sup>7</sup>



Direct Air Capture (DAC) and Bioenergy with Carbon Capture and Storage (BECCS) have received the majority of public and private funding and are the primary pathways eligible for 45Q tax credits in the United States. According to [CDR.fyi](https://www.cdr.fyi), BECCS, in particular, has dominated the CDR offtake market, accounting for 63% of CDR pre-purchases as of July 2023.

## ***Second, limited access to non-dilutive funding restricts innovation.***

Novel CDR startups can innovate and bring new products to market quickly, but they struggle to move from the feasibility stage to commercialization. In a University of Oxford survey, these novel startups identified non-dilutive funding as a major bottleneck to innovation and scaling.<sup>8</sup>

<sup>6</sup> Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., ... Vaughan, N. E. (2024). The State of Carbon Dioxide Removal - 2nd Edition. Retrieved from The State of Carbon Dioxide Removal website: <https://osf.io/f85qj>

<sup>7</sup> Map screen captured from <https://www.cdr.fyi/carbon-removal-map> on November 1, 2024

<sup>8</sup> Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., ... Vaughan, N. E. (2024). The State of Carbon Dioxide Removal - 2nd Edition. Retrieved from The State of Carbon Dioxide Removal website: <https://osf.io/f85qj>

Available non-dilutive capital is slow to deploy and requires hiring additional staff to search for grant opportunities and write applications, which strains tight budgets. While investment finance is available, it often comes with unfavorable terms and depends on offtake agreements that require pilots to demonstrate viability.

This creates a chicken-and-egg problem: investors want offtake agreements before investing, offtakers need pilots and data before committing, but pilots and data collection require funding. As noted in Carbonx's report *Bridging the CDR Financing Gap: Strategies for Scaling Deployment*<sup>9</sup>, "non-dilutive funding for early-phase developments of scalable projects can make them more bankable later and be hugely catalytic in their growth phase."



***Third, a weak market for carbon removal tonnes limits revenue opportunities.***

CDR companies provide a public good—carbon removal and climate change mitigation—which complicates selling their product and generating revenue. Many CDR start-ups rely on the voluntary carbon market for income; however, the VCM is dominated by traditional emissions reduction and avoidance projects, like avoided deforestation and energy efficiency, which are drastically cheaper per credit compared to credits from novel CDR methods.

Although corporate buyers are increasingly interested in incorporating carbon removal into their climate strategies, many corporations, especially small and medium-sized businesses, lack the technical capacity to perform rigorous due diligence and the budgets to purchase high-cost, durable CDR credits. Furthermore, many innovative CDR solutions, particularly those operating in open systems like enhanced rock weathering, need time to develop and refine their monitoring, reporting, and verification (MRV) systems.

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<sup>9</sup> Cointet, I. (2024). Bridging the CDR Financing Gap: Strategies for Scaling Deployment. Retrieved from the Carbonx website: <https://carbonx.world/bridging-the-cdr-finance-gap-guide>



This creates uncertainty for buyers, who typically seek a specific number of tonnes to be removed within a set timeframe. Without secure demand, CDR innovators face challenges in establishing feasible business plans, making it difficult to attract private sector funding for research, development, and demonstration. There is a clear need to create a robust market and make CDR innovation financially viable.

### Our solution: the Wren Climate Collective

Wren is well positioned to improve diversification and provide non-dilutive funding via its tax-deductible Climate Collective. Our goal with the Collective portfolio is to **launch the next wave of CDR innovation by providing flexible and fast grants to novel innovators that can scale operations to deliver carbon dioxide removals for less than \$100 per tonne.**



## Why Wren and CDR?

### Our track record in the CDR sector

Wren is in the top 25 of carbon dioxide removal (CDR) credit purchasers in the world, alongside Stripe, Watershed, and Nasdaq. As of November 2024, Wren had pre-purchased or signed offtake agreements for over 15,960 tonnes of CDR from UNDO, Mati, Charm Industrial, Pacific Biochar, and Graphyte. We have a proven track record and experience in vetting, funding, and working to scale carbon dioxide removal and maintain strong professional connections with industry stakeholders.

In four out of five cases, Wren was one of the first five companies to broker CDR purchase deals with our project partners. Additionally, our leadership team participates in industry conferences, round-tables, and alliances to advance CDR innovation and scale.

The Collective extends Wren's work in the sector, and support for low-technological-readiness CDR companies would complete a “CDR pipeline” on Wren. In other words, Wren could provide early capital to a new CDR technology, and as it matures, offer them a spot in our Trailblazer Portfolio, and eventually our Classic Portfolio.

### Wren CDR technological readiness pipeline:



So far, we’ve selected five CDR suppliers for funding, and all of them have received accolades within the industry.

- **UNDO**: XPRIZE Top 20 Finalist
- **Mati**: XPRIZE Top 20 Finalist, US DOE Carbon Removal Purchase Prize Finalist
- **Charm**: XPRIZE Top 60 Finalist, US DOE Carbon Removal Purchase Prize Finalist
- **Graphyte**: US DOE Carbon Removal Purchase Prize Finalist
- **Pacific Biochar**: 3rd in the world for CDR deliveries

### Our track record in fundraising for climate solutions

Additionally, Wren has a track record of successfully raising funds for climate solutions. Between 2019 and July 2024, Wren has raised over \$12M for climate solutions. This success in fundraising positions Wren to help fill the gap in philanthropic capital needed for CDR innovation and deployment.

### Why philanthropic capital is needed for CDR

Philanthropic capital for Carbon Dioxide Removal (CDR) is relatively scarce compared to other climate solutions. Most of the funding for CDR is tied to purchase orders aimed at fulfilling corporate climate pledges, which restricts the types and maturity levels of projects that can



receive support. However, three notable non-governmental organizations—Terraset, The Grantham Foundation, and Additional Ventures—are providing philanthropic funds to CDR innovators.

In 2023, the Grantham Foundation awarded significant grants for research and development in CDR but made only one direct grant to a CDR innovator, Climeworks, which received \$175,000. Climeworks ranks 10th in durable carbon removal tonnes sold in the VCM. Terraset, a newer NGO, lists eight grantees on its website. Five of these grantees have sold less than 50,000 tonnes in the VCM, half of which involve Direct Air Capture (DAC) technologies, and only one is based in the Global South. Terraset focuses on pre-purchasing carbon removal, a different approach from the Wren Climate Collective. Lastly, Additional Ventures' Outlier Projects concentrate exclusively on ocean-based pathways.



Due to the relative immaturity of the CDR sector, strategic philanthropic initiatives are still in their infancy. We know that non-dilutive funding for early-phase developments of scalable projects can make them more bankable later and be hugely catalytic in their growth phase. This sort of catalytic capital is “a valuable resource for the growth phase of CDR startups” and prepares them to secure debt from commercial lenders.<sup>10</sup>

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<sup>10</sup> Cointet, I. (2024). Bridging the CDR Financing Gap: Strategies for Scaling Deployment. Retrieved from the Carbonx website: <https://carbonx.world/bridging-the-cdr-finance-gap-guide>

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## **Wren's funding criteria**

Wren developed a funding thesis to address apparent gaps and accelerate the deployment of ethical CDR pathways, aware of current avenues for funding for CDR innovators.

Our funding centers on the idea that CDR suppliers must demonstrate 1) significant scalability, and 2) operational efficiency to prove the technology's maturity and readiness for large-scale deployment, to attract structured debt financing, venture equity, loans, and other project financing. To incubate CDR technology to the point they can successfully raise capital on their own, Wren seeks to provide grants with no expected returns.

Wren seeks to make grants to under-financed CDR pathways in under-financed geographies while emphasizing the importance of environmental justice and co-benefits. Our criteria include the following considerations:

1. **Removal pathway:** Currently, we are considering companies that leverage the following approaches to remove carbon dioxide:
  - Alkaline Waste Mineralization
  - Biomass Burial
  - Bioenergy with Carbon Capture and Storage (select project types)
  - Biomaterial Injection
  - Biochar
  - Direct Air Capture (select project types)
  - Direct Ocean Removal
  - Enhanced Weathering
  - Ocean Alkalinity Enhancement (electrochemical, harvest, no-harvest, mineral)
  - Terrestrial Biomass Sinking
  - In-situ mineralization
  - Electrochemical marine CDR
  - Other nascent approaches
2. **Durability of removal pathway:** Our preference is removal pathways that durably store carbon dioxide for over 1,000 years. However, Wren is willing to take risks on solutions that need more research, development, and demonstration data to show proof of

concept and establish durability claims, where basic principles are observed and the concept of the removal pathway is established.

- **Monitoring, Reporting, and Verification (MRV):** To demonstrate durability, we look to suppliers who are 1) committed to participating in credible, transparent, and replicable MRV processes and 2) contributing to a scientific understanding of carbon removal dynamics, particularly in open systems.
3. **Inclusivity of project design and implementation:** We prioritize CDR pathways that explicitly advance environmental equity and justice. We require that projects:
- Comply with international safeguards and principles to protect the rights of Local People and Indigenous communities
  - Use principles of Free, Prior, and Informed Consent
  - Establish equitable stakeholder participation processes and grievance mechanisms
  - Advance gender equity and lift up marginalized communities
  - Contribute to a just transition of the global economy
  - Seek to establish community benefit or community engagement plans
4. **Additionality:** Activities must exceed regulatory requirements and other legal mandates, and activities must be aimed at net removals of greenhouse gasses relative to a counterfactual scenario. Specifically, we consider:
- **Common Practice:** The project is compared to standard industry practices or common behaviors within a particular region or sector.
  - **Regulatory Surplus:** The project must go beyond the mandatory requirements set by existing laws, regulations, or policies. If the project's activities are already required by regulation, they are not considered additional.
  - **Barrier Analysis:** Projects must identify and document specific barriers that hinder their implementation. These obstacles can be financial, technological, institutional, social, or a combination.
5. **Mitigation of negative externalities:** The project must have clear plans to mitigate any potential harm to communities and ecosystems. This is evidenced by:
- Remediation plans (risk mitigation and emergency management)
  - Robust monitoring of ecosystem impacts, including local health impacts
  - Grievance mechanisms
  - Environmental Impact Assessments
6. **Maximize quantifiable co-benefits:** The project must have established, or be in the process of establishing, monitoring mechanisms to maximize benefits for local

communities and ecosystems and address more than five Sustainable Development Goals.

7. **Financial self-sufficiency and funding:** The organization must have a clear path to scaling operations and reduce costs to under \$100 per tonne of CO<sub>2</sub> removed/sequestered. In addition, we seek to support companies that have sold less than 50,000 tonnes to date.
8. **Policy alignment:** The proposed activities must be aligned with current regional, national, and international policies.
9. **Geographical Preferences:** Wren prefers projects located in the Global South because of the notable gap in CDR deployment outside of North America and Europe. However, Wren still considers companies based in the Global North that meet our other criteria.
10. **Technological Readiness Level:** 2-6



## How we evaluate success

The success of our grants is achieved when a project successfully demonstrates the scalability of its technology and operational efficiency. Key milestones for companies we fund include:

1. Offtake agreements
2. Institutional investment
3. Successful feasibility studies
4. Successful pilots
5. Successful government grants
6. Tonnes delivered

Every funding decision is shaped by our commitment to durability, additionality, and community benefits. We prioritize early-stage projects with potential for significant impact, particularly those operating in underserved regions. Through our approach, we hope to accelerate the development of a diverse portfolio of CDR solutions that are scientifically sound and socially responsible, contributing to global climate action efforts.