Toward a Carbon Negative Planet

The Stanford Carbon Removal Initiative seeks to create science-based opportunities and solutions for gigaton-scale negative emissions and atmospheric carbon removal.

The initiative will help to enable removal of atmospheric greenhouse gasses at scale by generating and integrating knowledge, creating scalable solutions, informing policies for technology deployment and governance, and demonstrating approaches and solutions with industry collaborators. All of this will be done with a focus on social acceptance and equity, as well as environmental, economic, and social costs.

In new areas of pursuit, the Stanford Carbon Removal Initiative will fund multi-year flagship projects with multiple subprojects under the leadership of Stanford faculty teams.

“We plan to launch a portfolio of foundational research projects to increase chances of a breakthrough in carbon removal.”
—Sally Benson
Co-Director, SCRI, and Professor of Energy Resources Engineering

“We must keep our finger on the pulse of the important economic and social issues, as well as the technology issues.”
—Chris Field
Co-Director, SCRI; Director, Woods Institute for the Environment; and Professor of Earth System Science and of Biology

The Stanford Carbon Removal Initiative (SCRI) is a membership-based industrial affiliates program. Membership is available to all interested companies, government agencies and non-profits. More information on back. Please contact Sarah Saltzer, Managing Director of SCRI for more information (sarah.saltzer@stanford.edu).
Initial Focus Areas for Flagship Projects

**ATMOSPHERIC RESTORATION**

The goal of this flagship project is to build prototypes and eventually a test facility to allow researchers to experiment with different techniques for GHG removal from concentrated sources as well as the atmosphere, in order to find new energy-efficient and scalable solutions.

**SUBPROJECTS:**

- **CH\(_4\)** Removal: Given the difficulty of reaching zero methane emissions from agriculture and energy use, atmospheric methane removal through in situ oxidation will likely be needed to reach net zero emissions for methane. Goal is to find solutions that work for non-flareable concentrations, from thousands of ppm down to 2 ppm, on a path to long term lifecycle costs < $100/t CO\(_2\).e.

- **CO\(_2\)** Removal: Most capture systems today have high energy penalty required to release bound CO\(_2\), which impacts the overall energy efficiency and, thereby, scalability to gigaton levels. Goal is for projects to focus on reducing lifecycle costs down to ~ $100/t. Assessments of novel techniques for industrial or geologic removal reliant on organic materials, mineralization and others are of interest as are techniques and examination of alternative reductants for releasing CO\(_2\) bound by sorbents or to produce syngas.

- **N\(_2\)O** Removal: Innovative solutions for removal and transformation of nitrous oxide, the third most important GHG in terms of radiative forcing.

**NATURAL CLIMATE SOLUTIONS**

The goal of this flagship project is to map the landscape of opportunities and barriers for natural climate solutions in California and other regions, with realistic potential for 2025, 2045 and 2100. The plan is to combine observations, earth system models, and empirical studies to provide high-resolution recipes for project-level and jurisdictional deployment of strategies for increasing carbon stocks in forests and soils, and for capturing energy from waste.

**SUBPROJECTS:**

- **Background ecosystem carbon sinks**: Improved understanding and a framework for quantifying double counting.

- **Reforestation, afforestation, and improved forest management**: Exploration of forest management, policy, and economic levers consistent with generating high confidence carbon removal in forests and forest products.

- **Soils**: Modeling and empirical studies to examine organic and inorganic paths for carbon storage in soils.

- **Waste to energy with CCS**: Evaluation of waste streams, value from potential products besides energy, technologies for collection, processing, and transportation, and the policy landscape in California.

**FUTURE FOCUS AREAS**

Carbon uses and disposition
- CCS (capture, storage, BECCS)
- Utilization
Integrated systems modeling
Community benefits and impacts

**Membership Tiers:**

- $500,000 - $1,000,000 – Founder
- $250,000 – Advisory board
- $100,000 – Regular member
- $25,000 – NGOs, non-profits, startups

*Above fees are due yearly*

**Membership Benefits include:**

- Engaging with Stanford faculty, post docs, and PhD students on cutting-edge research
- Connecting with other companies in shared research-related programming
- Attending annual affiliates meeting and workshops
- Invitations to Stanford Carbon Removal Initiative (SCRI), Precourt Institute for Energy, Woods Institute for the Environment and Stanford University events

“We need to get direct air capture energy requirements down, so that we can beat the price target of $100 per ton of carbon dioxide.”

–Arun Majumdar
Co-Director, SCRI, and Professor of Mechanical Engineering

“We need more research into removing other highly potent greenhouse gases such as methane.”

–Rob Jackson
Co-Director, SCRI, and Professor of Earth System Science