Carnegie Climate Geoengineering Governance Initiative
C2G2 POLICY BRIEFS

an initiative of
CARNEGIE COUNCIL for Ethics in International Affairs

Governing Large-scale Carbon Dioxide Removal

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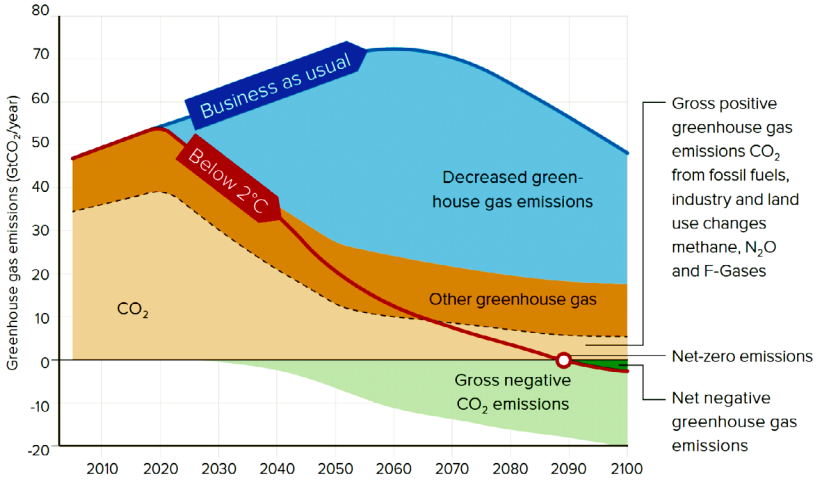
Large-scale Carbon Dioxide Removal (CDR), also known as Negative Emissions, or Carbon Drawdown, aims to address the primary human source of climate change by removing carbon dioxide permanently from the atmosphere to be stored underground or under the ocean floor. If deployed at a planetary scale, CDR could help prevent ocean acidification and slow the rate of global warming. **CDR is not a substitute for rapidly reducing greenhouse gas emissions, which is essential under any scenario.**

Removing atmospheric CO_2 is not a new idea. The UNFCCC has always considered mitigation to include both emission reductions and removals. What is new is the scale, nature and urgency of CDR being considered, and what this means for its effective governance.

The **IPCC Special Report on Global Warming of 1.5°C** says that all pathways with limited or no overshoot project the use of CDR on the order of 100–1000Gt over the 21st century.

There are however important differences between drawing down CO_2 and not emitting it in the first place. Some groups fear that focusing attention on large-scale CDR creates a **moral hazard** which could detract from reducing emissions. According to the IPCC Special Report, it is not one or the other, but both that are needed. CDR can impact the earth system as a single action, or as the sum of many actions.



Source: UNEP Emissions Gap report 2018.

CDR methods vary and include the use of biological 'sinks' and chemical processes; they also vary considerably in their potential, readiness, permanence, cost, and risks of negative side-effects. Save for some of the nature-based measures, none is currently ready to deploy at the speed or scale the IPCC states will be needed to help prevent an initial overshoot of the Paris temperature goals.

Why does large-scale CDR need to be governed?

Implementing large-scale CDR could require extensive amounts of land, energy or water and compete with food production or other activities. Some technologies could result in negative side-effects for biodiversity, air, ground water and soil quality. On the other hand, some measures such as soil sequestration of carbon could improve crop productivity and biodiversity. The effects of different types of CDR could affect communities unequally and create challenges around liability and compensation. Governance could help address these issues and strengthen accountability.

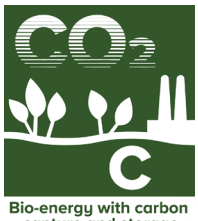
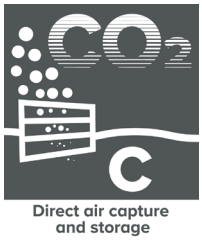
If society were to implement CDR at the speed and levels implied by the pathways assessed by the IPCC, governments would need to urgently create policy incentives that can spur significant investments in research and enable deployment, while ensuring that any research, testing or potential use is safe and effectively governed.

Who should govern large-scale Carbon Dioxide Removal?

Governance is required at multiple levels, from the global to the local. International governance is needed to address, inter alia, cross-border environmental, social and economic impacts, as well as issues around responsibility, liability, monitoring and accounting, as well as finance.

The UNFCCC has developed numerous elements which could form the basis of a governance framework. Additional governance via the UNFCCC may be needed given both the new types of CDR being considered and developed, and the massive scale of removals implied by many pathways assessed by the IPCC. Building on decisions taken through the Convention on Biological Diversity and London Convention/London Protocol, the issue may also be informed through other intergovernmental processes, such as the UN Environment Assembly.

Types of Carbon Removal, Maturity, Governance & Challenges

Proposed Method		Maturity/Governance	Challenges
	Planting of forests and restoration of ecosystems that result in long-term storage of carbon in above- and below-ground biomass.	• Technology available at large scale and ready for deployment; • Governance covered to some extent by customary international law, CBD decisions and UNFCCC Paris Agreement.	• Competing land uses; • Lack of incentives for adoption; • Risks for biodiversity and food security; • Requires on-going management; • Reversible.
	Biomass burning under low-oxygen conditions (pyrolysis) yields charcoal "biochar" which is then added to the soil to enhance soil carbon levels.	• Technology well established, but not yet demonstrated at scale; • Governance covered to some extent by customary international law, CBD decisions and UNFCCC Paris Agreement.	• Incentives for widespread adoption; • Costs of process; • Limited practice or policy support; • Environmental pollution from process; • Competition for land-use.
	Burning biomass for energy generation and capturing and permanently storing the resulting CO_2.	• Bioenergy from power plants well established but CCS not demonstrated at scale; • Governance covered to some extent by customary international law, CBD decisions and UNFCCC Paris Agreement.	• Costs; • Land use competition; • Food security concerns; • Biodiversity loss concerns; • Deforestation and forest degradation; • Health impacts; • Impacts on soil and water.
	Enhancing natural weathering of rocks by extracting, grinding and dispersing carbon-binding minerals on land, or adding alkaline minerals to the ocean to enhance carbon uptake.	• Technically ready, but not demonstrated at scale; • Governance somewhat covered by customary international law, CBD and LC/LP decisions and Paris Agreement. Not in carbon accounting agreements.	• Incentives for widespread adoption; • Potential human health risks associated with fine grained material; • Ecological impacts of massive mineral extraction and transport.
	Capturing CO_2 directly from ambient air by a chemical process, followed by permanent storage or use.	• A wide range of technologies at various stages of maturity, some at pilot plant scale. CCS not demonstrated at scale; • Governance covered to some extent by customary international law, CBD decisions & Paris Agreement.	• High capital and energy costs; • Leakage concerns; • Access to adequate low carbon energy and water needed for process.
	Fertilising ocean ecosystems to accelerate phytoplankton growth, which partly sinks to transport carbon from atmosphere to seabed.	• Technically feasible but various technical challenges; • Banned under LC/LP; • Governance covered to some extent by customary international law, CBD and UNFCCC Paris Agreement.	• Incentives for adoption; • Impacts on ocean and marine life; • Changes to nutrient balance; • Increased production of other greenhouse gases.