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POLICY BRIEF

Governing Large-Scale Carbon Dioxide Removal

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Carbon Dioxide Removal (CDR), also known as negative emissions, aims to address the primary driver of climate change by removing carbon dioxide (CO_2) from the atmosphere and ensuring its long-term storage. If deployed at a large-scale, CDR could slow the rate of global warming and help prevent ocean acidification.

Removing CO_2 is not a new idea. The United Nations Framework Convention on Climate Change (UNFCCC) has always considered mitigation to include both emission reductions and removals. What is new is the scale, nature and urgency of CDR now being considered, and what this means for its effective governance.

According to the Intergovernmental Panel on Climate Change (IPCC), all pathways to keep global warming under 1.5°C project the need for CDR to remove between 100 – 1000 Gigatonnes of accumulated CO_2 from the atmosphere by 2100. CDR methods vary and include the use of nature-based approaches, such as afforestation and enhancing wetlands, or engineering-based approaches to directly capture CO_2 from ambient air; they also vary considerably in their potential, readiness, permanence, cost, and risks of negative side-effects. Apart from some nature-based approaches, no CDR techniques are currently ready to deploy at the speed or scale necessary to prevent overshooting the 1.5 – 2°C temperature goal agreed under the UNFCCC.

While CDR is likely to become an important element of any plans to reach net zero, it is important to remember that it cannot be a substitute for rapidly reducing emissions of CO_2, and other greenhouse gases. It is also important to note that the impact of CDR deployment on global temperature change is not immediate, and any action taken now is likely to take decades to affect temperatures.

The need for governance

Large-scale CDR could require extensive amounts of land, energy or water and might compete with food production or other activities. Some technologies could result in negative effects for biodiversity, air, ground water and soil quality. On the other hand, other approaches, such as soil sequestration of carbon could improve crop productivity and biodiversity. Different CDR methods could affect communities unequally, creating liability and compensation issues. Governance could help address these issues and strengthen accountability.

There is a risk that focusing attention on large-scale CDR creates a moral hazard as it might delay efforts to reduce emissions. According to the IPCC, it is not one or the other, but both that are needed. Governance is required to ensure that as societies scale up, necessary large-scale CDR does not impede vital emissions reductions efforts.

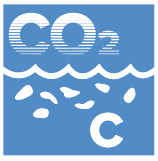
If CDR is to be implemented at the speed and scale suggested in the IPCC pathways, governments and other stakeholders will have to act urgently to create policy incentives that drive research investment and enable deployment, while ensuring that any research, testing or potential use is safe and effectively governed.

Who should govern large-scale CDR?

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 numerous elements which could form the basis of a governance framework but may require strengthening given both the new approaches to CDR being considered and developed, and the massive scale of removals implied by the many pathways assessed by the IPCC. Building on decisions taken through the Convention on Biological Diversity (CBD) and the London Protocol to the London Convention on the Prevention of Marine Pollution (LC/LP), the issue may also be informed through other intergovernmental processes, such as the United Nations Environment Assembly (UNEA).

CDR Techniques, Readiness and Governance Challenges

Proposed Technique	Readiness and potential	Governance Challenges
 **Afforestation and forest ecosystem restoration** Planting and restoration of forests that result in long-term storage of carbon.	• Already widely practiced. • Could be deployed at scale with little further development.	• Questions remain regarding social justice (i.e., land-use issues). • Better monitoring, reporting and verification (MRV) required.
 **Enhancing soil carbon content** Land management changes that increase soil carbon concentration and biochar.	• No significant barriers. • Some have adopted the practice. • Limited knowledge of the techniques in the agriculture community.	• Better MRV required. • Incentives for widespread adoption.
 **Bio-energy with carbon capture and storage** Burning biomass for energy generation and capturing and long-term storage of the resulting CO_2.	• Bioenergy from power plants established and carbon capture and storage demonstrated at small scale. • Governance covered to some extent by customary international law, and UNFCCC Paris Agreement.	• Scalability. • Land use competition. • Food security and biodiversity loss concerns.
 **Enhanced weathering and ocean alkalinity** 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. • A new global industrial infrastructure would need to be created to deliver materials in volume required. • Governance somewhat covered by customary international law, CBD and LC/LP decisions and Paris Agreement.	• Incentives for widespread adoption. • Potential human health risks associated with fine grained material. • Ecological impacts of massive mineral extraction and transport.
 **Direct air capture and storage** Capturing CO_2 directly from ambient air by a chemical engineering process, followed by long-term storage or use.	• A wide range of technologies. • Small-scale operations are demonstrating capacity to remove carbon. • Governance subject to nation state terms.	• High capital costs. • Access to adequate low carbon energy and water needed for process. However, some demonstrators are carbon neutral, manufacturing fuels from sequestered carbon.
 **Ocean fertilisation** Fertilising oceans to accelerate phytoplankton growth, which absorbs CO_2 then dies transporting carbon from the atmosphere to seabed.	• Technically feasible – 12 field trials to date. • Questions around permanence. • Regulated by the LC/LP and viewed as a de facto moratorium on commercial activity.	• Research addressed under Article 4 of the LC/LP and United Nations Convention on the Law of the Sea (UNCLOS) • Incentives for adoption. • Environmental impacts uncertain.
 **Building with biomass** Using carbon embedded in biomass (such as timber) in construction.	• Widely practiced.	• May require agreement on carbon credits allocations. • Potential governance issues around land-use change. • Better MRV required.

This briefing is based on the latest literature. Please notify contact@c2g2.net of any suggested corrections.