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CARBON DIOXIDE REMOVAL

Need, options, and responsible scaling

AGENDA

1. Carbon removal vs. carbon capture
2. Why we need carbon removal and its roles over time
3. Carbon removal options
4. Responsible scaling – what this means, how it's being addressed, and what gaps remain



CARBON CAPTURE V. CARBON REMOVAL

CARBON CAPTURE, UTILIZATION AND SEQUESTRATION (CCUS)

Capture of CO₂ at emissions source
(e.g., industrial or power facilities)
to prevent it from going into the air



Carbon is **sequestered underground** or **used in products**
(e.g., concrete, chemicals, synthetic fuels)

CARBON DIOXIDE REMOVAL (CDR)

Activities that **remove CO₂ that's already in the air**, including the following



DIRECT AIR CAPTURE



BIOENERGY WITH CARBON CAPTURE AND SEQUESTRATION



FOREST RESTORATION



CARBON MINERALIZATION



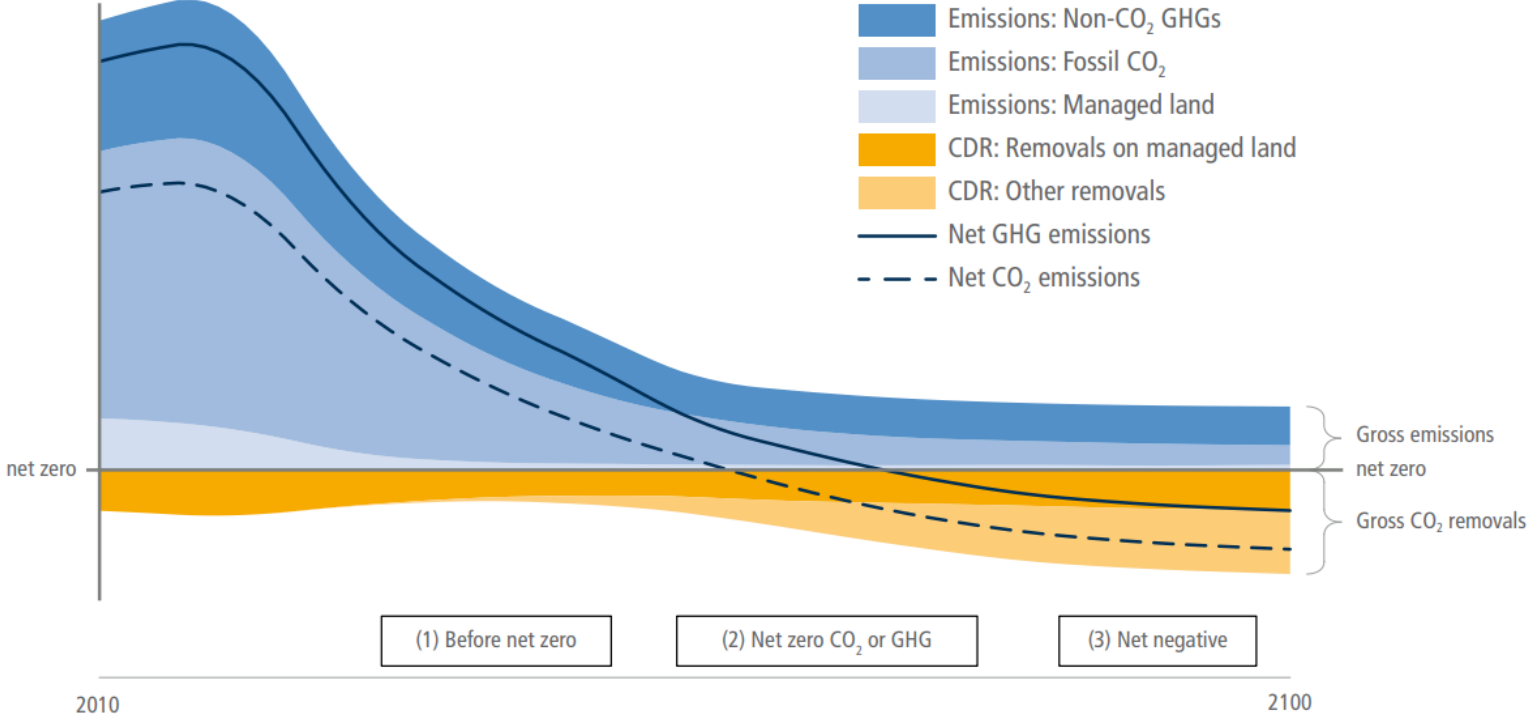
Carbon is **stored in tree biomass**



Carbon is **stored as solid carbonates**

WHY DO WE NEED CDR?

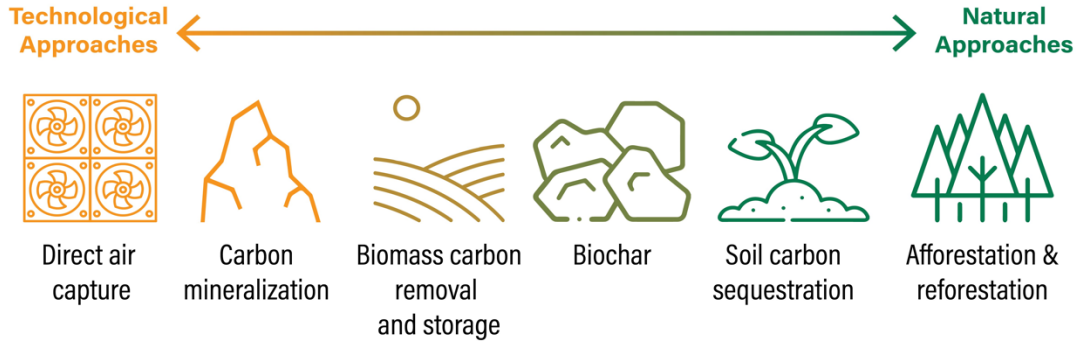
Greenhouse gas emissions (stylised pathway)



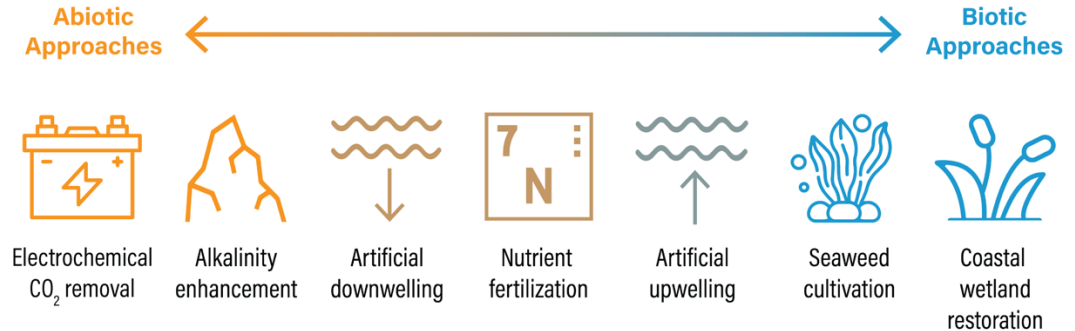
Source: [IPCC](https://www.ipcc.ch/), 2022

CARBON REMOVAL IS MANY THINGS

Carbon removal approaches on land



Carbon removal approaches in the ocean



SCALING CARBON REMOVAL RESPONSIBLY

Climate

Right-sized in relation to emissions reductions, e.g., by setting **separate targets** for reductions and removals

Compensating for **residual emissions**

Credible and consistent **measurement, reporting and verification**

Maximize **net-negativity**, including by using renewable energy

People

Transparency around expected social impacts of project; minimize negative impacts

Development of **project agreements** to benefit communities

Fit for purpose regulation for **safety and liability**

Early and consistent **community engagement** to inform project siting and design

Nature

Assess and minimize negative **environmental and ecological impacts**

Focus on wastes and residues for **biomass feedstocks**

Minimize **natural resource** usage (e.g., water, land)

Monitor ecological impacts as part of measurement, reporting, and verification process

U.S. CARBON REMOVAL POLICY

Policy and other safeguards:

- Bipartisan Law funding requirements:
 - Community Benefits Plan
 - Reporting on workforce development, equity, EJ, etc.
- Responsible Carbon Management Initiative
- Existing environmental and permitting regulation
- State regulation:
 - California: SB308, SB905

Some gaps in existing policy/ regulation:

- Regulation or policy to ensure that CDR is compensating for residual emissions
- Unified standards for measurement, reporting and verification (MRV), including environmental impacts
- 45Q tax credit lacks lifecycle assessment requirement
- No requirement to turn CBPs into CBAs
- Guardrails on biomass feedstocks



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THANK YOU!
