Systemic considerations for sustainable and credible BioCCS deployment

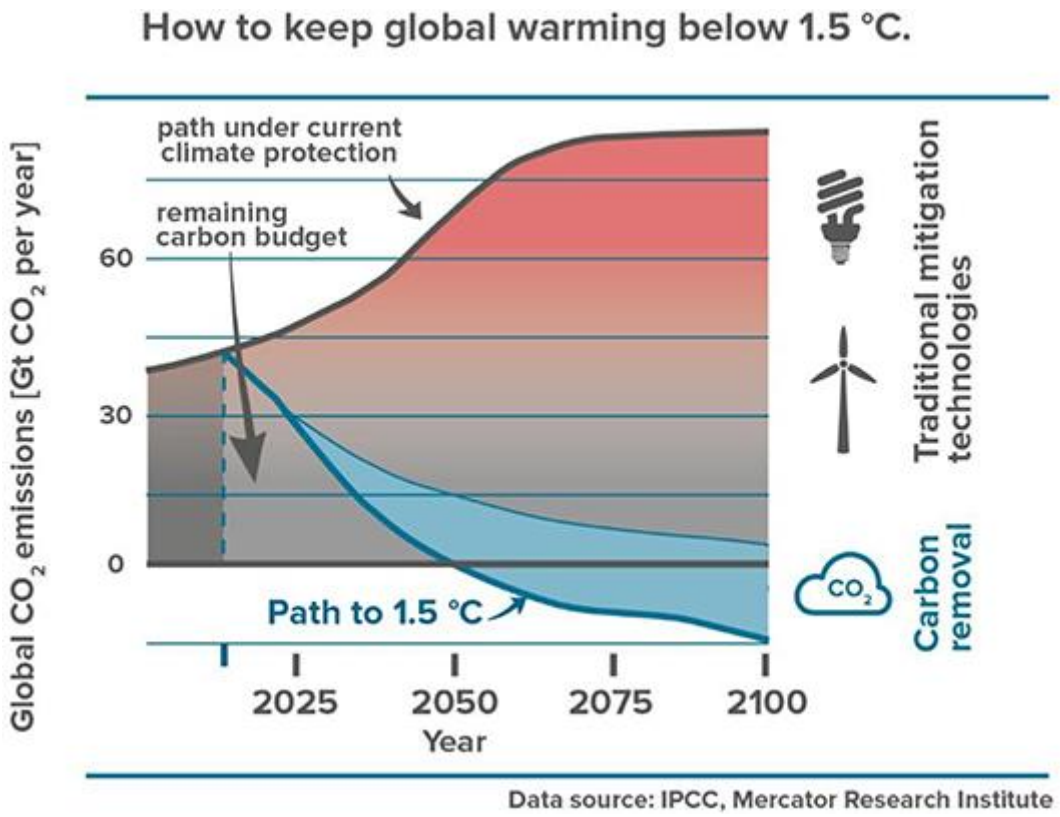
18th December 2023

ETIP/ZEP Bioenergy Webinar

Image Credit: NASA/Scientific Visualization Studio

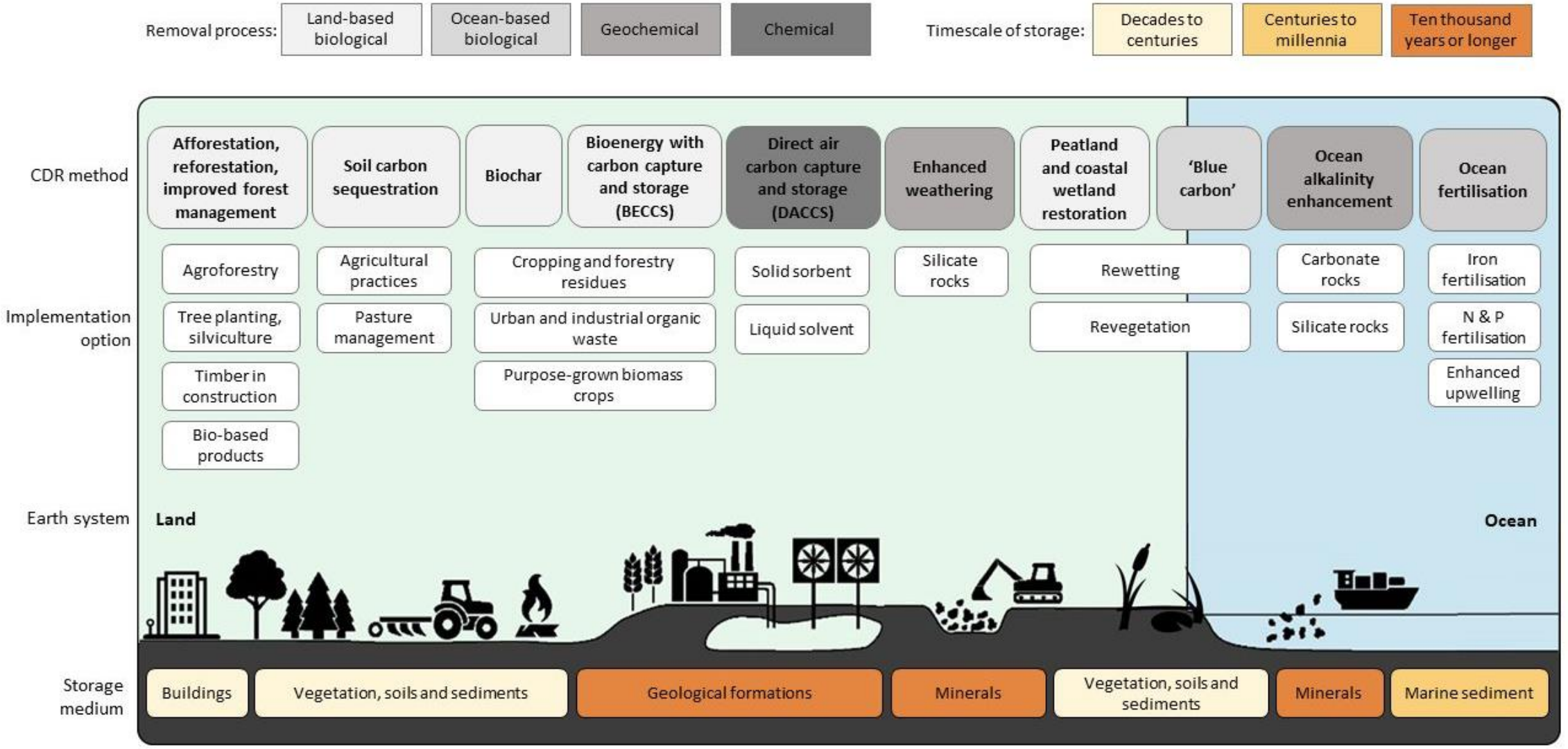
BioCCS in the CDR portfolio

Emissions reductions are falling short



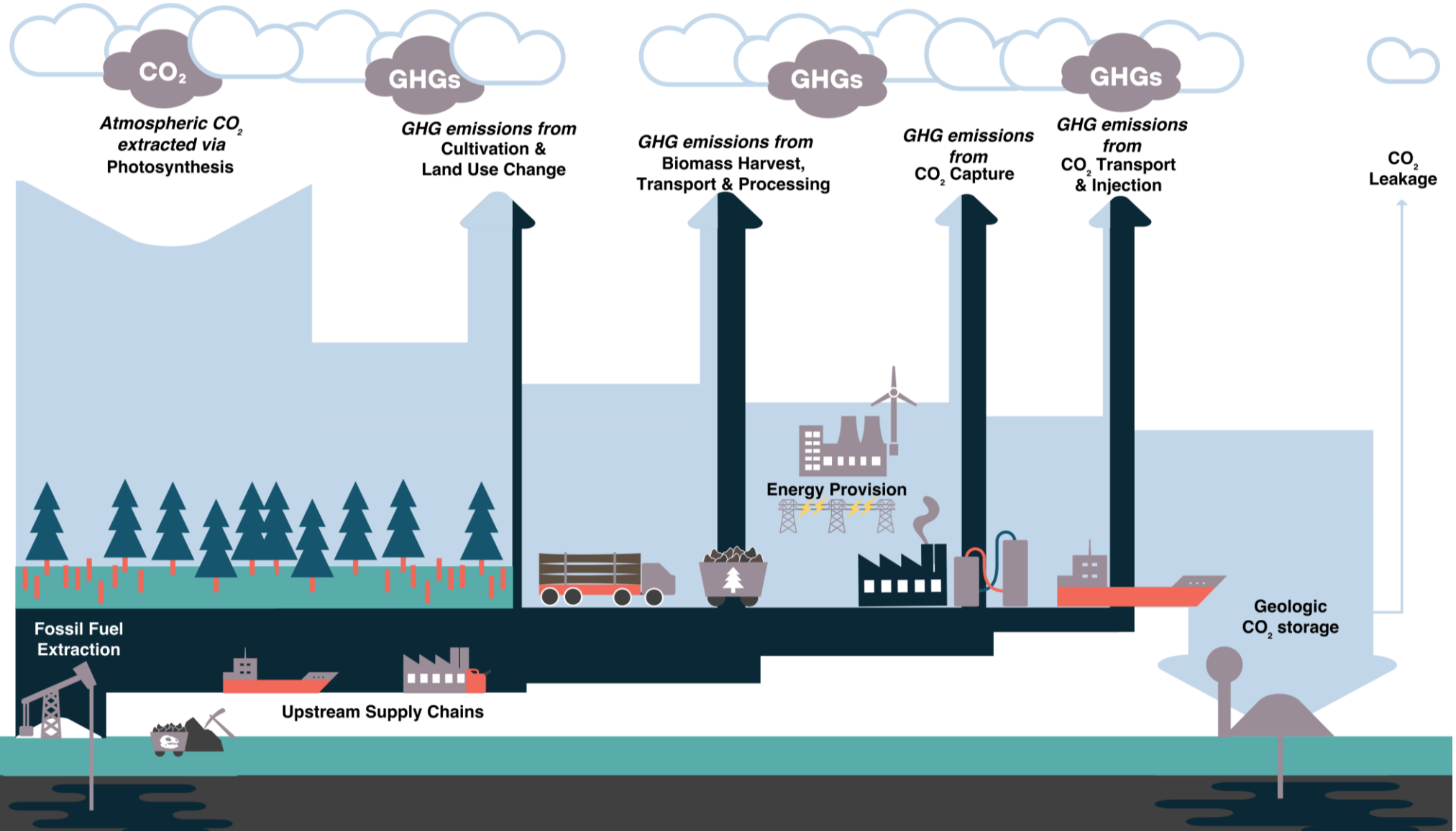
- Action to cut emissions has been slow (UNEP Emissions Gap Report 2023)
- The slower we cut emissions, the more our dependence of removals increases
- Current emissions gap between current policies and pathway to limit warming to 1.5°C (50% chance) is 26-34 $GtCO_2e$ by 2030 (UNEP 2023)

BioCCS is one of many CDR methods



Source: IPCC AR6 WGIII, Chapter 12 (Box 8, Figure 1)

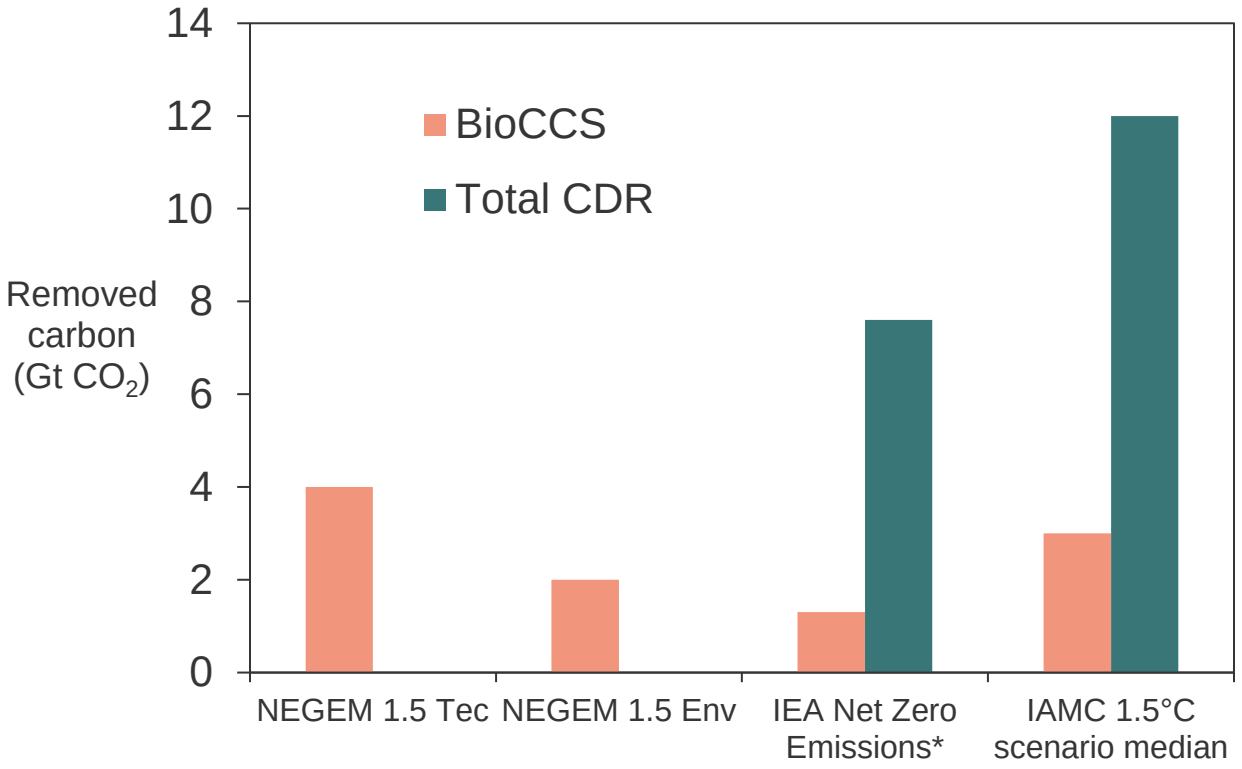
A simplied example: BioCCS



- ✓ Low fossil resources, low mineral/metal demand
- ✓ Produces energy (heat, electricity)
- ✓ Permanently stores carbon

- × Potential land use conflict e.g. for food production, conservation
- × Requires sustainable feedstock/biomass sourcing
- × Requires transport of captured carbon to storage

BioCCS could make an important contribution to the CDR portfolio in future.



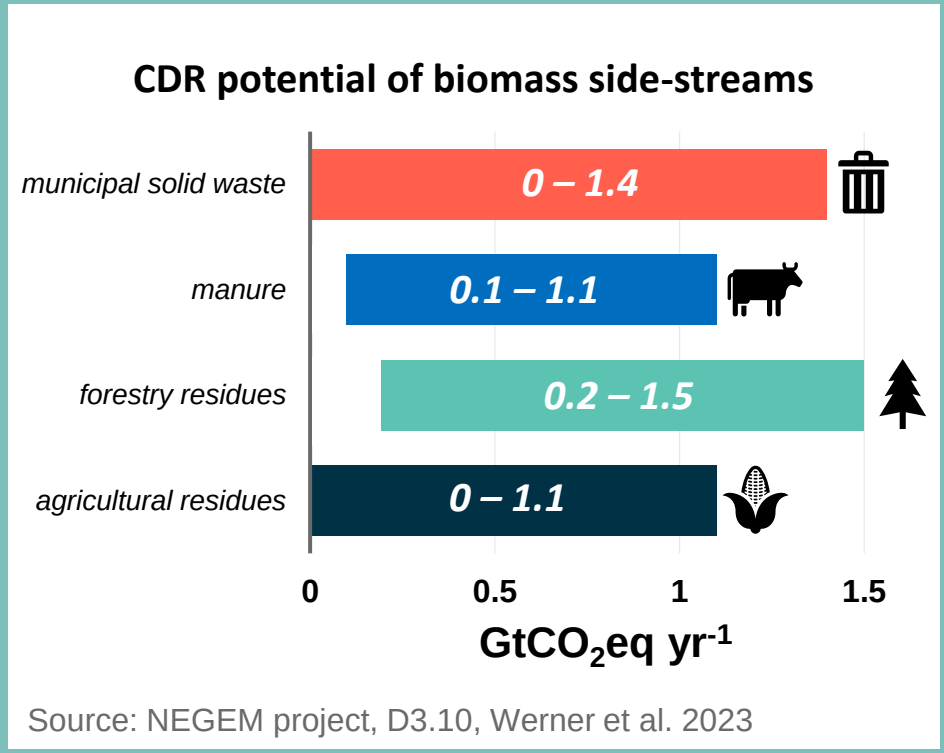
* Total refers to total captured carbon. Source: IEA, Net Zero Roadmap for 2050, https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf, accessed 18/12/2023

** Source: IAMC 1.5°C Scenario Explorer and Data hosted by IIASA, https://zenodo.org/records/3363345

Systemic resource constraints on BioCCS upscaling potential

More BioCCS will need more sustainably sourced feedstock/biomass and geological storage capacity.

- **Sustainable feedstock**
  - Additional dedicated bioenergy crops would exacerbate pressure on planetary boundaries (fresh water, biosphere integrity, land system change, biogeochemical flows), especially for irrigated crops
  - Biomass side-streams such as waste and residues could be utilised.
  - Risk: Climate warming may reduce yields (BioCCS capacity, food security)



Source: NEGEM project, D3.10, Werner et al. 2023

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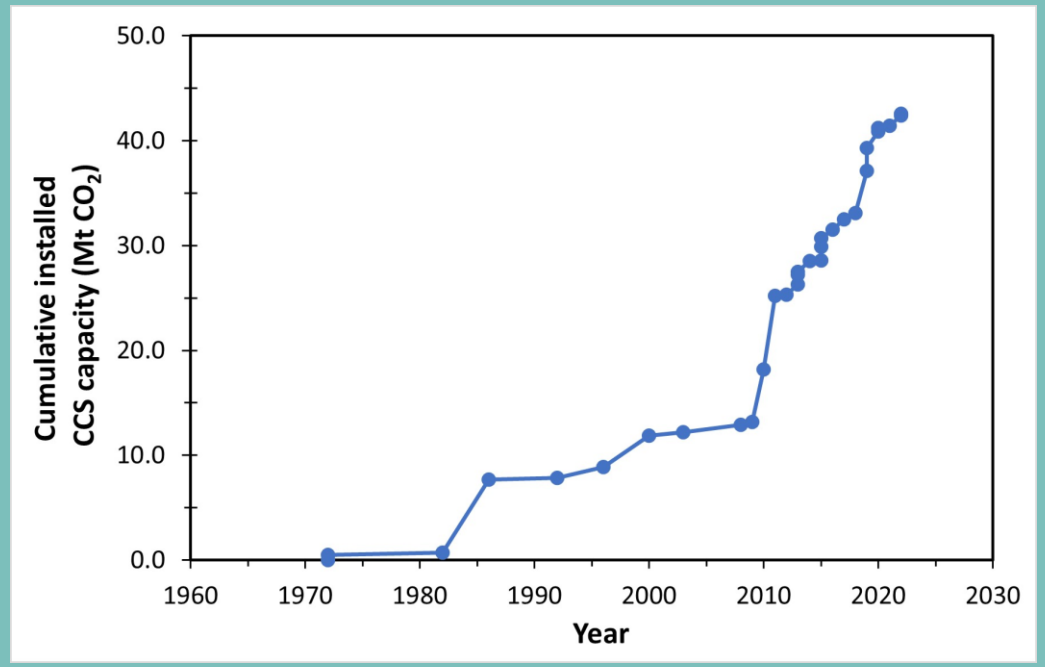
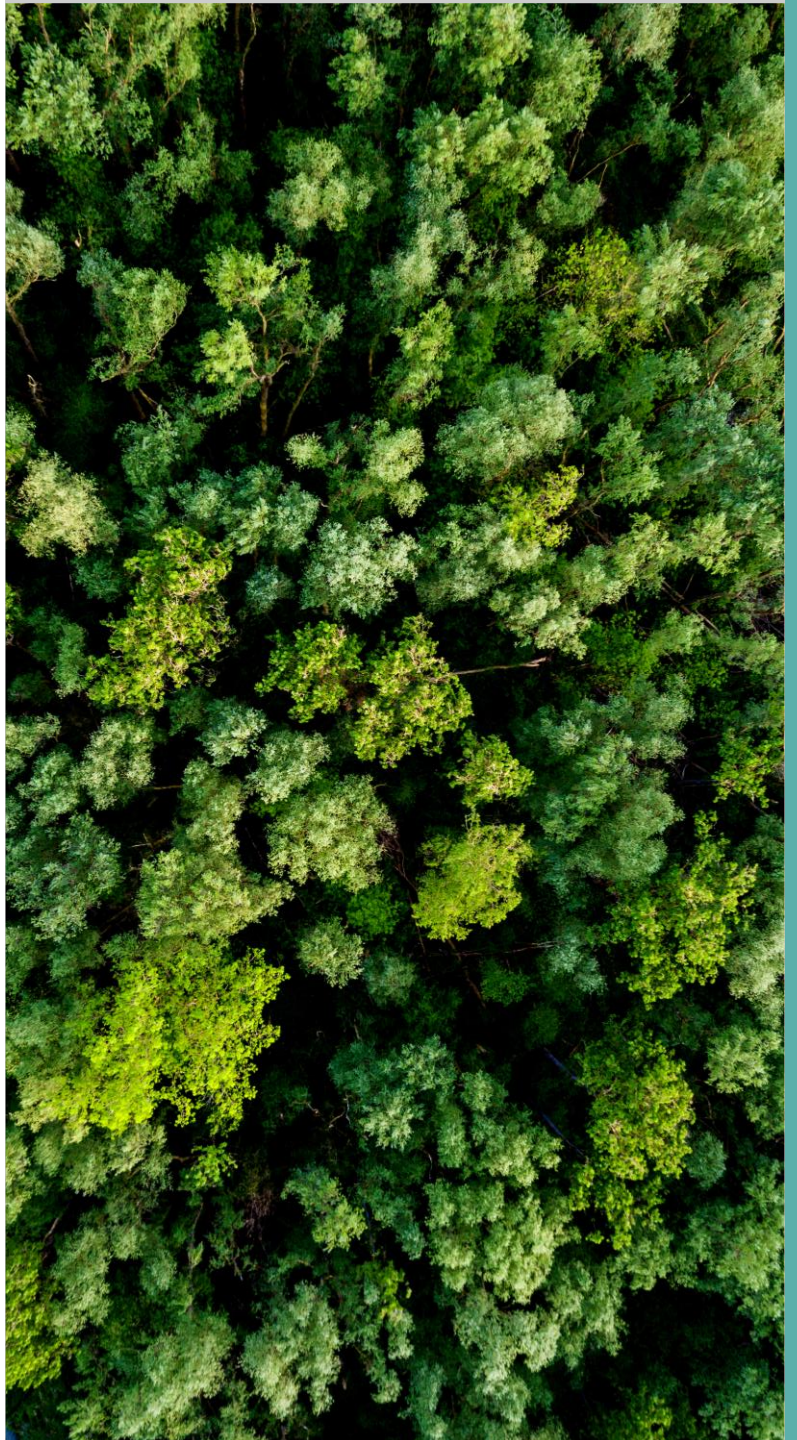
- **Geological storage capacity**
  - Scale-up rates for transport and storage facilities may be below demand.
    - Current operational capacity (2022) ~ 44 $MtCO_2$/yr
    - Planned = 250 $MtCO_2$/yr



Source: Global CCS Institute: https://status22.globalccsinstitute.com/wp-content/uploads/2023/03/GCCSI_Global-Report-2022_PDF_FINAL-01-03-23.pdf

BioCCS today



Current/planned applications include:

- Heat and power plants
- Cement plants (clinker production + CCS)
- Pulp/paper mills
- Hydrogen production

Credible BioCCS projects:

- Use sustainable biomass streams to replace fossil fuel use
- Do not use biomass to displace use of renewable energy sources
- Do not use biomass replace direct electrification

IEA Bioenergy with Carbon Capture and Storage, https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/bioenergy-with-carbon-capture-and-storage accessed 14/12/23

We already use biomass in many different ways.

We need to think if we are using the biomass in the **best** way.

Do we need a cascade of biomass combustion?

e.g. for heat generation, electricity or other sectors where zero carbon alternatives such as direct electrification exist

CDR system boundaries

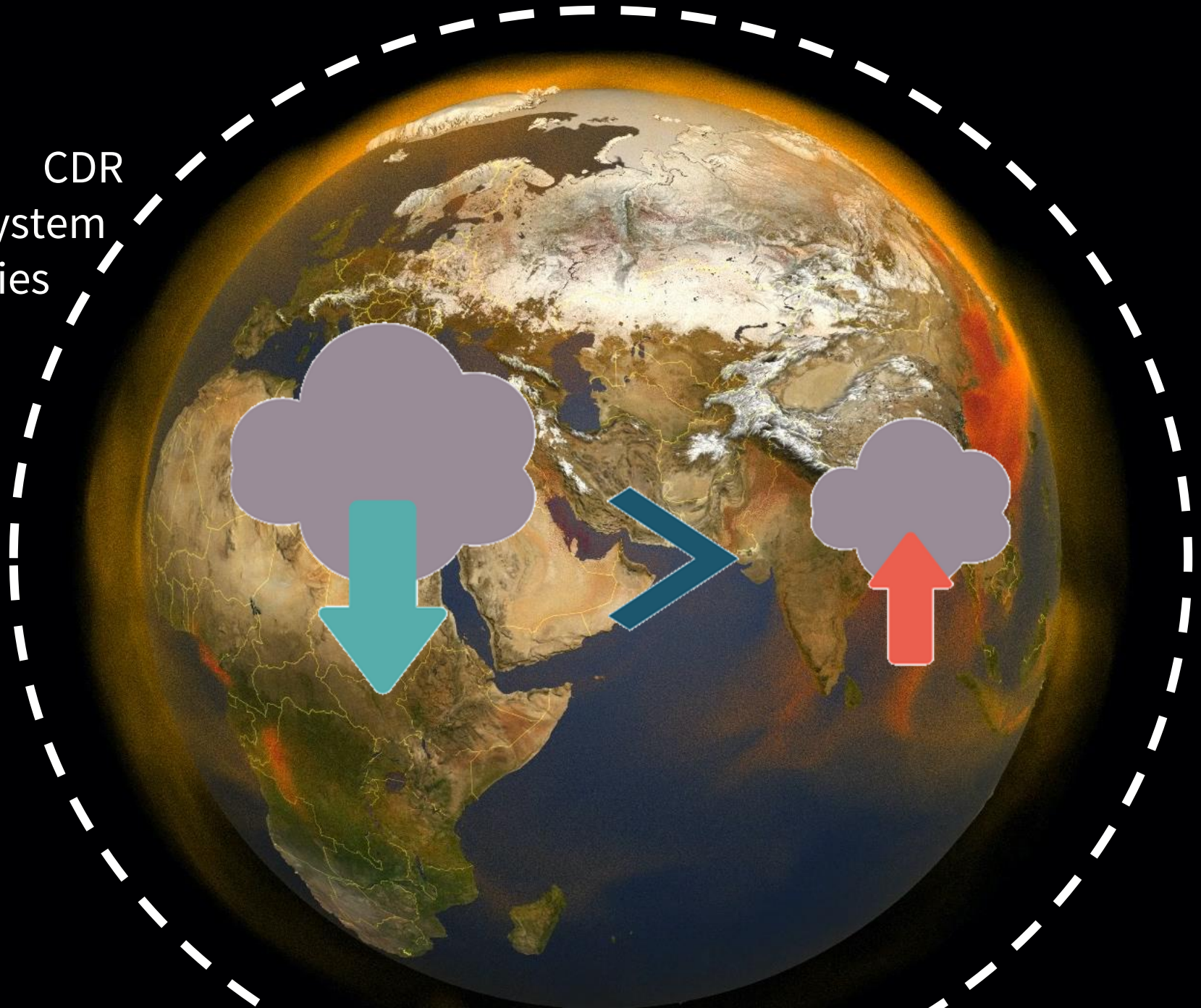


Image Credit: NASA/Scientific Visualization Studio

Ensuring a physical climate benefit

Climate action means minimising all GHG emissions.

Current capture ~ 2 Mt CO_2 per year but less than 50% of this is stored in dedicated storage.

Does zero-rating of biomass need revising?

IEA Bioenergy with Carbon Capture and Storage, https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/bioenergy-with-carbon-capture-and-storage accessed 14/12/23

Positive incentives are needed to ensure carbon from biomass utilisation is captured.

The overall goal is to prevent CO_2 emissions regardless of origin.

Systemic considerations for BioCCS

BioCCS will be one of numerous ways to remove and store carbon permanently.
It must be considered within the Earth system for it's benefits and impacts.

Contribution to carbon dioxide removal portfolio.

Use of sustainable biomass or feedstock use.

Potential limitations on upscaling due to pressure on planetary boundaries.

Ensuring it is displacing fossil fuels rather than renewable energy sources.

Recommendations

Consider best use of biomass and side-streams.

Use positive incentives to ensure all carbon is captured, regardless of origin.
(Prevention is better than cure)

Manage expectations of overall scale of BioCCS for carbon removal.

Get in touch!

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Thank you