Introduction to CDR and Capture & Storage: what IPCC says about them

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Carbon Dioxide Removal (CDR)

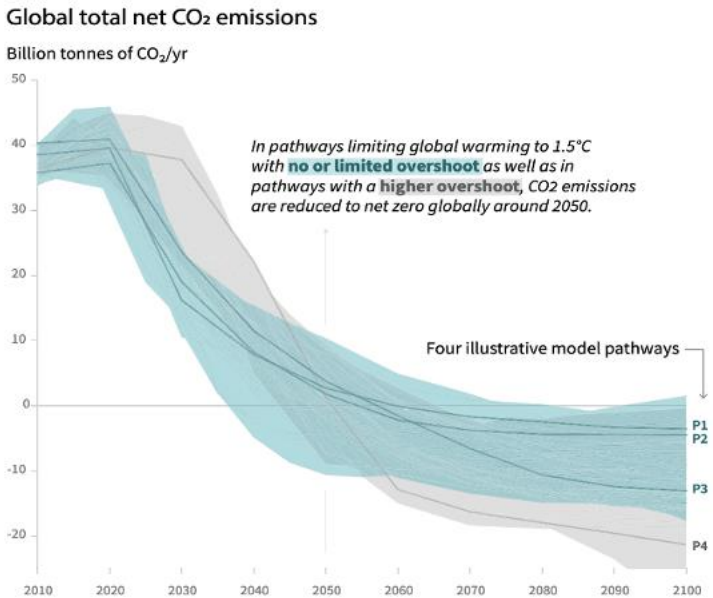
IPCC definition for Carbon Dioxide Removal – CDR:

- anthropogenic activities that deliberately remove CO_2 from the atmosphere and store it durably in geological, terrestrial or ocean reservoirs, or in products.

Processes on land and the ocean that can be used to remove CO_2 from the atmosphere:

- enhancing biological carbon sinks
- enhancing geochemical carbon sinks
- direct capture of CO_2 from air

Carbon Dioxide Removal (CDR)

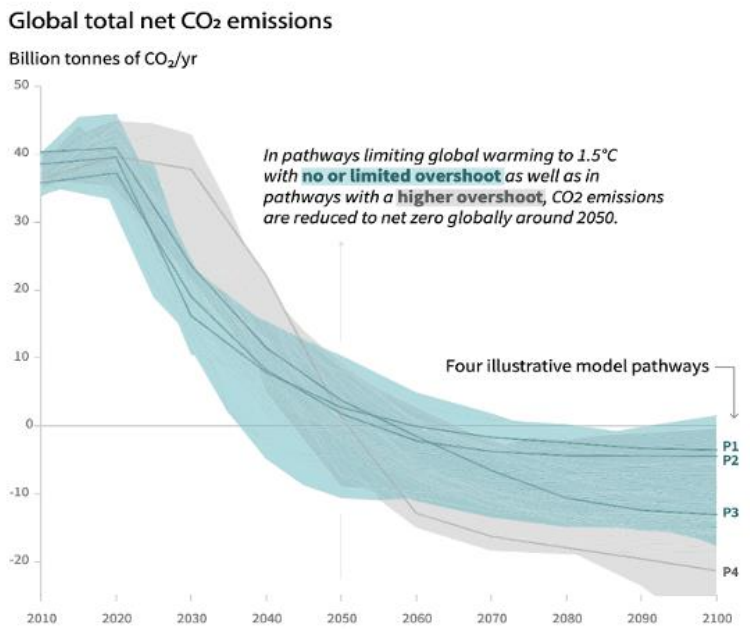


IPCC Special Report on Global Warming of 1.5°C:

- CO_2 emission pathways with limited or no temperature overshoot (blue)
  - ***Temperature overshoot****: temporary exceedance of a specified level of global warming (no more than 0.1°C)*
- CO_2 emission pathways with higher overshoot (grey)

In all scenarios, CO_2 emissions reach net zero by around 2050
Non-CO_2 emission reductions occurring in parallel

Carbon Dioxide Removal (CDR)



IPCC Special Report on Global Warming of 1.5°C:

All the modelled emission pathways include CDR

- to enhance mitigation actions
- to compensate for residual CO_2 emissions that could not be abated until near 2050
  - difficult or costly to decarbonize.
- to achieve net negative CO_2 emissions

Carbon Dioxide Removal (CDR)

- Reduction in atmospheric CO_2 levels through CDR
  - uptake by sinks > net CO_2 emissions
- Possible substantial delay between the initiation of CDR and net CO_2 emissions turning negative
- The time to reach net negative CO_2 emissions and the evolution of atmospheric CO_2 and climate thereafter:
  - dependent on the combined pathways of anthropogenic CO_2 emissions
  - Carbon Dioxide Removal
  - natural sinks
- The cooling due to CDR would be proportional to the cumulative amount of CO_2 removed from the atmosphere by CDR.

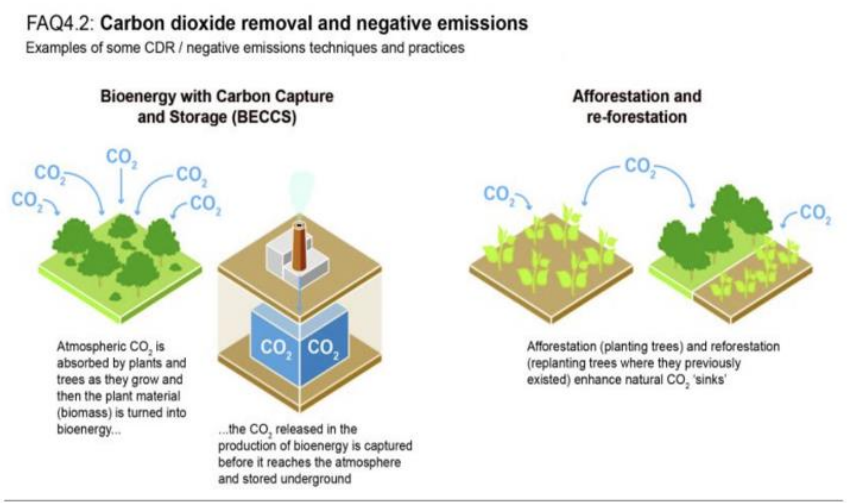
Carbon Dioxide Removal (CDR)

CDR options include:

- afforestation / reforestation
- soil carbon sequestration
- bioenergy with carbon capture and storage (BECCS)
- peatland and coastal wetland restoration
- ocean fertilization
- ocean alkalinity enhancement
- enhanced terrestrial weathering
- direct air capture and storage
- agroforestry
- Improved forest management

IPCC WG III explores the potential of different CDR options (removal potential, cost, co-benefits and side effects (see table 12.6)

Carbon Dioxide Removal (CDR)



- The larger the overshoot, the more net negative CO_2 emissions are required
- There may be risks from maladaptation and adverse side effects of some emission reduction and carbon dioxide removal measures
  - Deployment of afforestation in naturally unforested land, or poorly implemented bioenergy, can compound climate-related risks to biodiversity, water and food security, and livelihoods, especially if implemented at large scale and in regions with insecure land tenure

Carbon Dioxide Removal (CDR)

- CDR may have side effects which can either weaken or strengthen the carbon removal or colling potential of the options
- Deployment of CDR, especially if in large-scale and without a proper management can affect water quality and quantity, food production and scale
- The largest co-benefits are obtained with methods that seek to restore natural ecosystems or improve soil carbon sequestration

Carbon Capture and Storage (CCS)

CCS: option to reduce emissions from large-scale fossil-based energy and industry sources, provided geological storage is available

Barriers to CCS Implementation:

- technological
- economic
- institutional
- ecological-environmental
- socio-cultural barriers

Rates of CCS deployment are far below those in modelled pathways limiting global warming to 1.5^{o}C or 2^{o}C

THANK YOU
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