

# *The role of CDR in IPCC pathways to limit global warming to Paris goals*

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## *Background information to this presentation*

- All findings presented in this introduction are from the assessed literature by the ***Intergovernmental Panel on Climate Change*** (IPCC) in the following report:
  - Special Report on Global Warming of 1.5°C (2018)
  - Information on Carbon Dioxide Removal (CDR) is also available in the contributions of Working Groups I and III to AR5 (2013/2014)

## *One of the aims of the Paris Agreement*

*“... hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change”.*

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INTERGOVERNMENTAL PANEL ON climate change

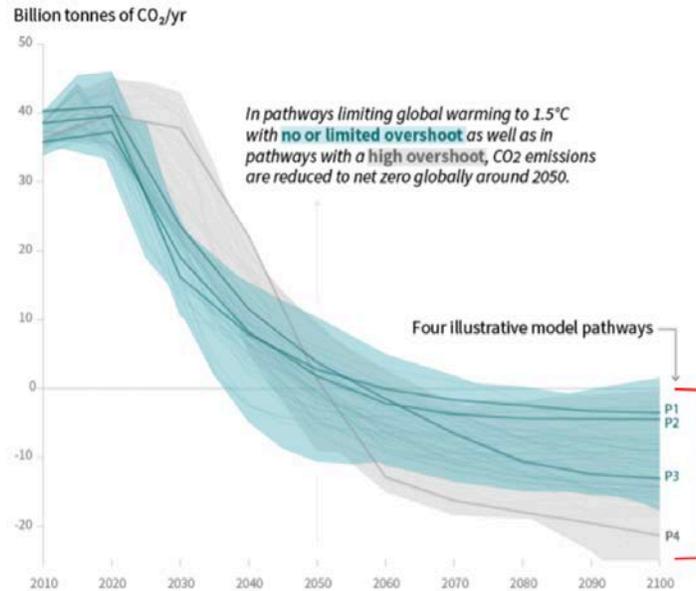


## Special Report on 1.5°C

- Focus on **impacts** of global warming at this level, above pre-industrial levels and **related global greenhouse gas emissions pathways**
- **Emission pathways:**
  - modelled trajectories of global anthropogenic emissions over the 21<sup>st</sup> century
    - assumptions about economic growth, technology development and lifestyles
- **Different pathways assessed:**
  - **No overshoot:** pathways limiting global warming to below 1.5°C
  - **Limited overshoot:** pathways limiting global warming to below 1.6°C and returning to 1.5°C by 2100
  - **Higher overshoot:** pathways exceeding 1.6°C but still returning to 1.5°C by 2100

# Global emissions pathway characteristics

Global total net CO<sub>2</sub> emissions

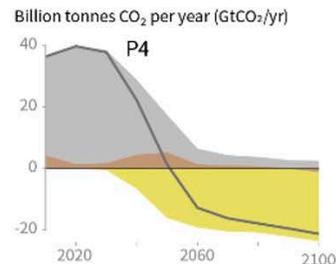
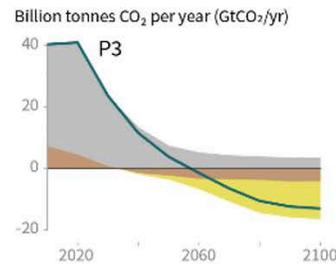
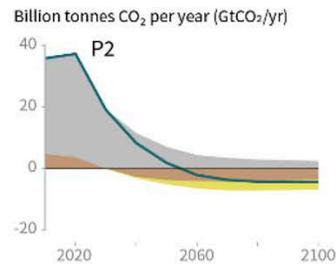
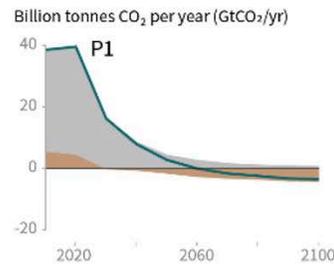


CO<sub>2</sub> emissions are reduced to **net zero** globally around 2050

- carbon dioxide removal (CDR) techniques may be required to offset **residual CO<sub>2</sub> emissions**

For overshoot pathways

- CDR will be required to achieve net **negative emissions** to return global warming to 1.5°C



● Fossil fuel and industry  
● AFOLU  
● BECCS

AFOLU = Agriculture, Forestry and Other Land Use  
BECCS = Bioenergy with Carbon Dioxide Capture and Storage

**What types of CDR have been assessed?**

*Bioenergy with Carbon Capture and Storage*

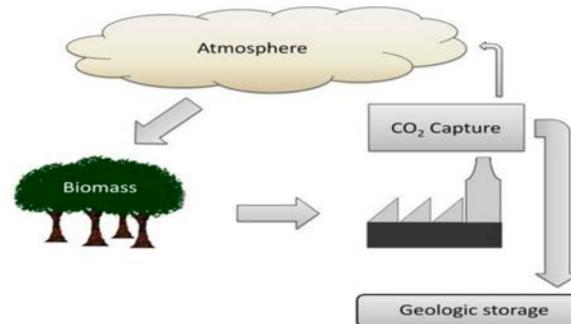
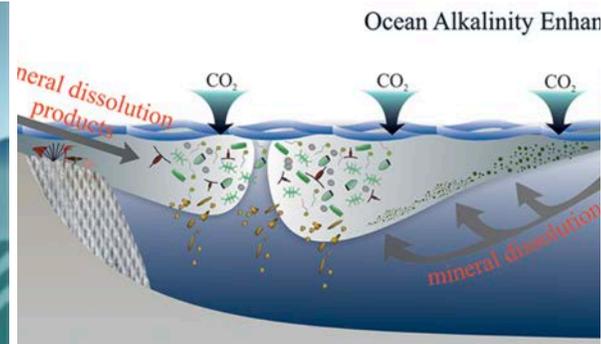
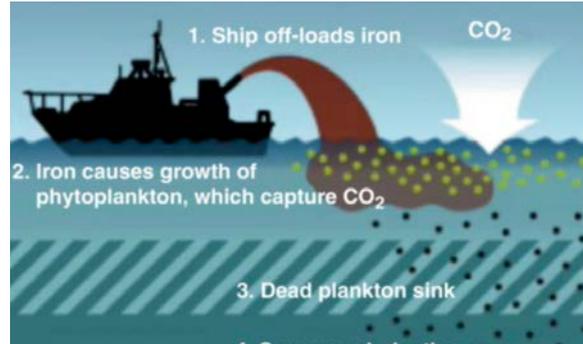
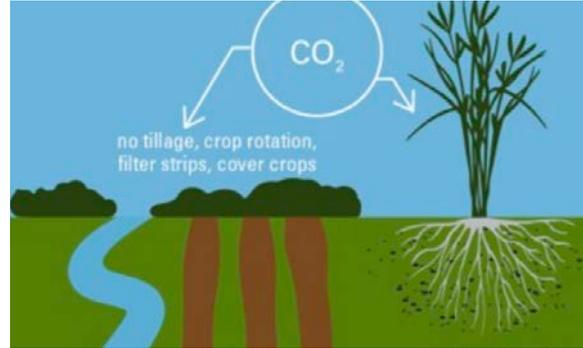
*Afforestation / Reforestation*

*Soil Carbon Sequestration and Biochar*

*Enhanced Weathering and Ocean Alkalinization*

*Direct Air Carbon Dioxide Capture and Storage*

*Ocean Fertilization*



## *Some findings of the IPCC in SR 1.5 (Chapter 4)*

- Most CDR options face multiple feasibility constraints
  - limiting the potential for any single option to sustainably achieve the large-scale deployment required in the 1.5°C-consistent pathways
- Most of the assessed 1.5°C pathways in SR 1.5°C relied on:
  - bioenergy with carbon capture and storage (BECCS)
  - afforestation and reforestation (A/R)
  - BECCS + AR
    - to neutralize emissions that are expensive to avoid
    - to draw down CO<sub>2</sub> emissions in excess of the carbon budget

## *Some issues related to BECCS*

- **The carbon intensity of bioenergy** (chapter 4, page 324)
  - key for BECCS as a CDR measure is still a matter of debate
    - availability of coordinated policies and management to minimize negative side effects and trade-offs
      - food security, livelihood and equity considerations depends on management
    - direct and indirect land-use change emissions
    - the type of feedstock used
    - time frame
    - direct and indirect land-use change
    - availability of safe storage for CO<sub>2</sub>

## *Some issues related to Afforestation*

- Large potential of A/R and the co-benefits if implemented appropriately (e.g., on biodiversity and soil quality)
  - diminish over time (forest saturation)
- Differences in the literature for the potential contribution from afforestation
  - 1 – 7 billion tonnes of CO<sub>2</sub>/yr
  - down to 0.5 – 3.6 Gt CO<sub>2</sub>/yr
- Constraints:
  - biogenic is not permanente
  - forest sinks saturate
  - potentials are heterogenously distributed
  - forest governance structures
  - monitoring capabilities

## *Some final notes...*

SR indicates that there are still scientific uncertainties related to the implementation of large-scale CDR.

- Ambitions systems transitions in all sectors, behaviour change and demand-side management (*chapter 3, page 317*)
  - significantly reduce emissions
  - substantially limit the reliance on CDR to limit warming to 1.5°C

SR 1.5 recognizes that... *“unless affordable and environmentally and socially acceptable CDR becomes feasible and available at scale well before 2050, 1.5°C-consistent pathways will be difficult to realize, especially in overshoot scenarios”* (*chapter 4, page 319*)

*More to come...*

- Additional scientific findings will be made available in the ***Sixth Assessment Report*** of the IPCC (AR6) (2021/2022)

## References

- Special Report on Global Warming of 1.5°C (2018)
  - [https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15\\_Chapter4\\_Low\\_Res.pdf](https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter4_Low_Res.pdf) (pages 347 - 352)
- Working Groups I and III to AR5 (2013/2014)
  - **WG I** - <https://www.ipcc.ch/report/ar5/wg1/>
    - **Chapter 6**, section 6.5, pages 547-551
    - **Chapter 7**, *Frequently Asked Questions: Could geoengineering counteract climate change and what side effects might occur?*
  - **WG III** - <https://www.ipcc.ch/report/ar5/wg3/>
    - **Chapter 6**, section 6.4, pages 462-464
    - **Chapter 13**, section 13.5, pages 1023-1024