Market and policy mechanisms to scale-up carbon dioxide removal

C2G side event
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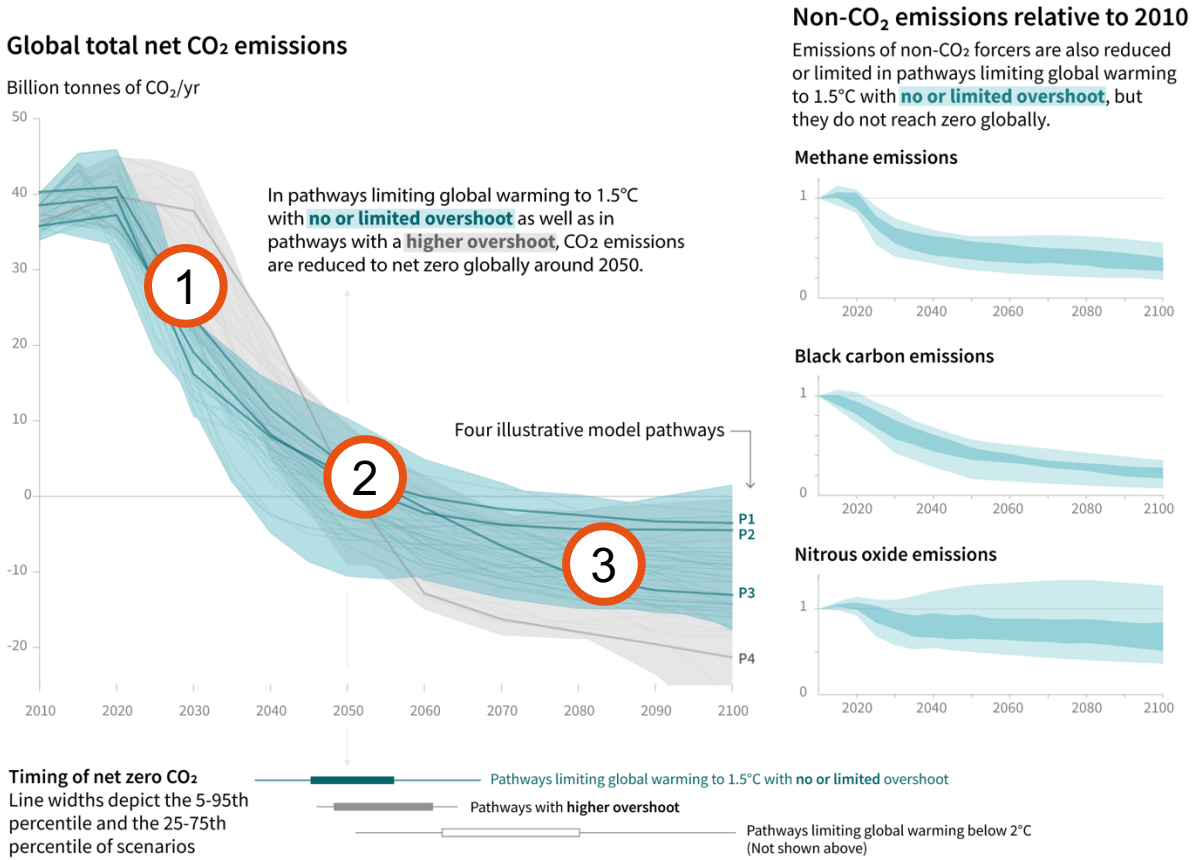
The challenge



Source: IPCC Special Report on Global Warming of 1.5°C

1. Emissions from all sectors and countries need to reduce drastically
2. Net zero CO2 emissions by 2050
3. Net negative CO2 after 2050

How to prepare for net negative emissions without diverting attention from reducing emissions?

Options for CO_2 removal

Technology	Sustainable potential ($GtCO_2/y$)	2050 IPCC 1.5°C Pathways ($GtCO_2/y$)	Maturity	Duration of CO_2 storage	Other benefits	Potential negative effects
Afforestation & reforestation (AR)	0.5-3.6	3.6 (afforestation) 1-11 (all AFOLU)	Mature	Medium	Biodiversity	Food security, biodiversity
Soil carbon sequestration (SCS)	Up to 5		Mature	Short	Fertility, water	Food security, biodiversity
Biochar	0.5-2	n/a	Mature	Medium	Fertility, water	Food security, biodiversity
Bioenergy with carbon capture and storage (BECCS)	0.5-5	0-8	Demo	Long	Energy, (CO_2 use)	Food security, biodiversity, health
Direct air carbon capture and storage (DACCS)	0.5-5 (max 40)	n/a	Demo	Long	(CO_2 use)	Health, energy requirements
Enhanced weathering	2-4	n/a	R&D	Very long	Soil amelioration, nutrient source	Ground water, mining, air pollution
Carbon mineralisation	?	n/a	R&D	Very long		Ground water

Ways to support CO_2 removal technologies

Support options	Examples
Investment in research and innovation	• Research grants in UK and USA • Demonstration projects in Japan, US, EU
Regulation and standards	• Removal targets (not present)
Economic incentives	• Tax credits (US 45Q) • Emission reduction credits (Californian low carbon fuel standard) • Carbon pricing (Norway)
Private	• Seed funding for start ups (mostly from philanthropy and oil companies) • Voluntary contributions • Voluntary (carbon) markets

Example: Forest compensation

Petrol company „**compensates**“ fuel emissions by planting trees

e.g. 10 USD/tCO_2

e.g. Australian Emission Reduction Fund

Pros

- Forest sink is supported, which is per se a good thing

Cons

- Gives false impression that fuel emissions were neutralized. Fuel emissions need to be reduced to zero AND forests need to be enhanced
- Forest may (probably will) be cut and release captured CO_2

Example: Air capture compensation

Petrol company "**compensates**" fuel emissions through direct air capture project

E.g. Californian low carbon fuel standard

Pros

- Support for a currently expensive technology, that may be needed in the future

Cons

- Gives false impression that fuel emissions were neutralized. Fuel emissions need to be reduced to zero AND CO2 needs to be removed
- Additional electricity need (possibly from fossil fuels)
- Captured CO_2 may be released later

Example: Air capture support

Petrol company **supports** direct air capture project (*not* claiming to be carbon neutral)

E.g. Stripe and Shopify provide voluntary commitment of min. $1 million/year to removal

Pros

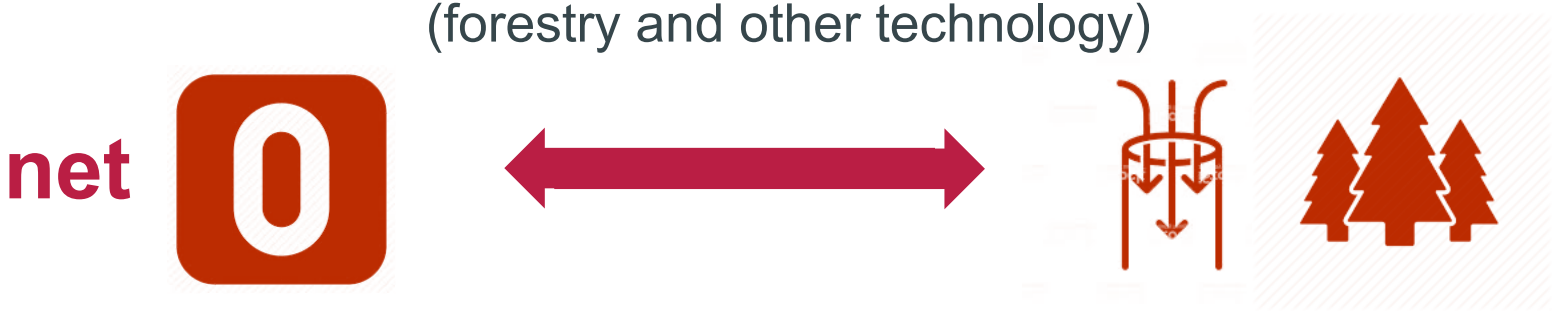
- Support for a currently expensive technology, that may be needed in the future

Cons

- May divert attention from reducing fuel use. Fuel emissions need to be reduced to zero AND CO_2 needs to be removed
- Worse to communicate than compensation

Example: Net zero target

Country/company sets net zero emissions target with full use of negative emissions (forestry and other technology)



E.g. Norway, Sweden, UK

Pros

- Objective to find cost efficient solution to zero emissions
- Supporting carbon removal, which is needed for net negative emissions

Cons

- Diverts attention from reducing emissions
- Captured CO_2 may be released later
- Allows for residual emissions, that may be problematic in the net negative phase

Example: Separate removal target

Country/company sets zero emissions target
for fossil fuel emissions AND separate carbon removal target

0

- X Gt

E.g. many countries have separate short term forestry targets

Pros

- Clear responsibility for reducing emissions AND removals
- Preparing for net negative phase
- Not so relevant that captured CO2 may be released at a later date

Cons

- Target values need to be set in a way to provide certainty and balance

Potential ways forward

- **Treat removal options separate**
  - Natural removal (afforestation, reforestation, biochar and soil carbon sequestration)
  - Technology removal (BECCS, DACCS, enhanced weathering and carbon mineralisation)
- **Offsetting emissions by removals is risky:** "Compensation" may weaken overall mitigation
  - Divert attention from reductions
  - Carbon may be released at a later date
- **Support but not "compensation"**
  - Provide direct financial support to start-up companies on removal technologies like BECCS, DACCS, enhanced weathering and carbon mineralisation
  - Not alternative to reductions and not compensation
- **Set separate carbon removal target**
  - Emission reduction target and separate removal target
  - Governments could purchase carbon removal from service providers or require companies to do so

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