

Mercator Research Institute on
Global Commons and Climate Change gGmbH

Paris Agreement and the future of bioenergy

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8th ISCC Global Sustainability Conference

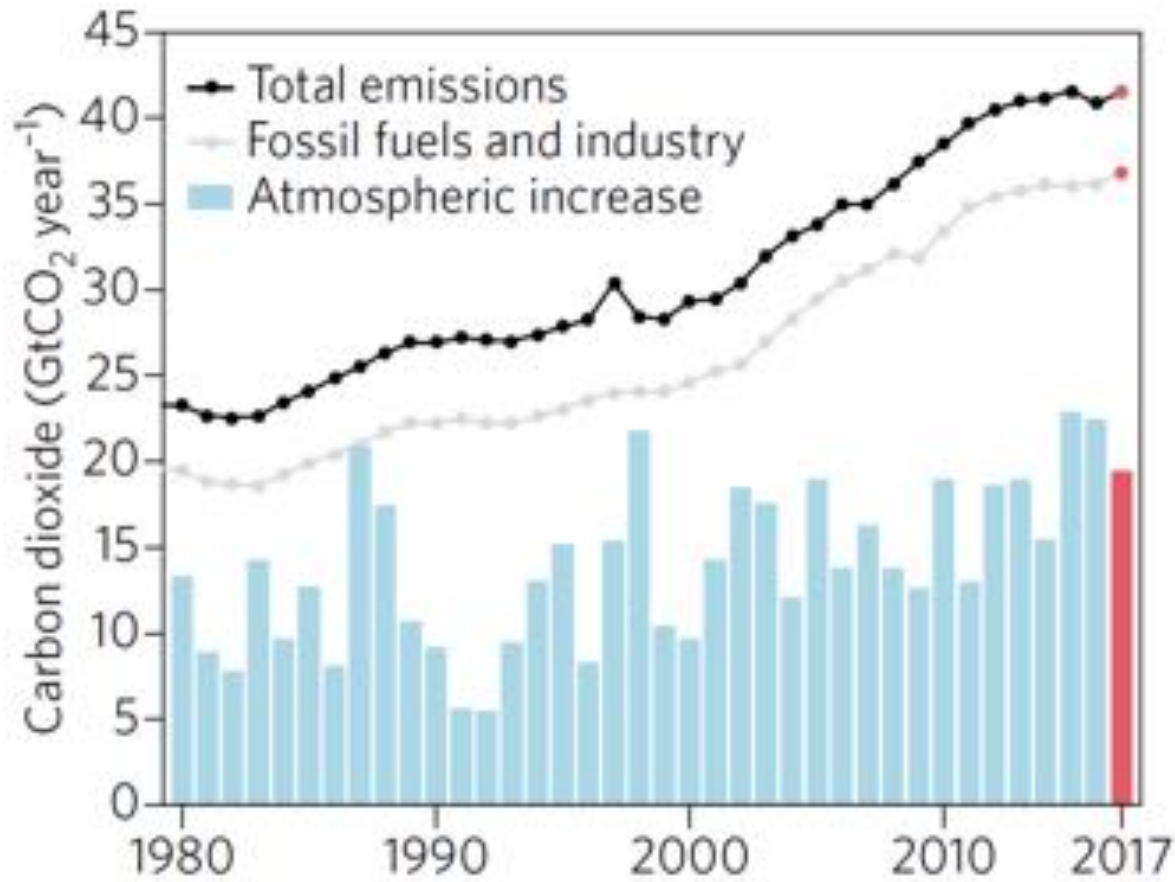
Brussels

20.02.2018

Overview

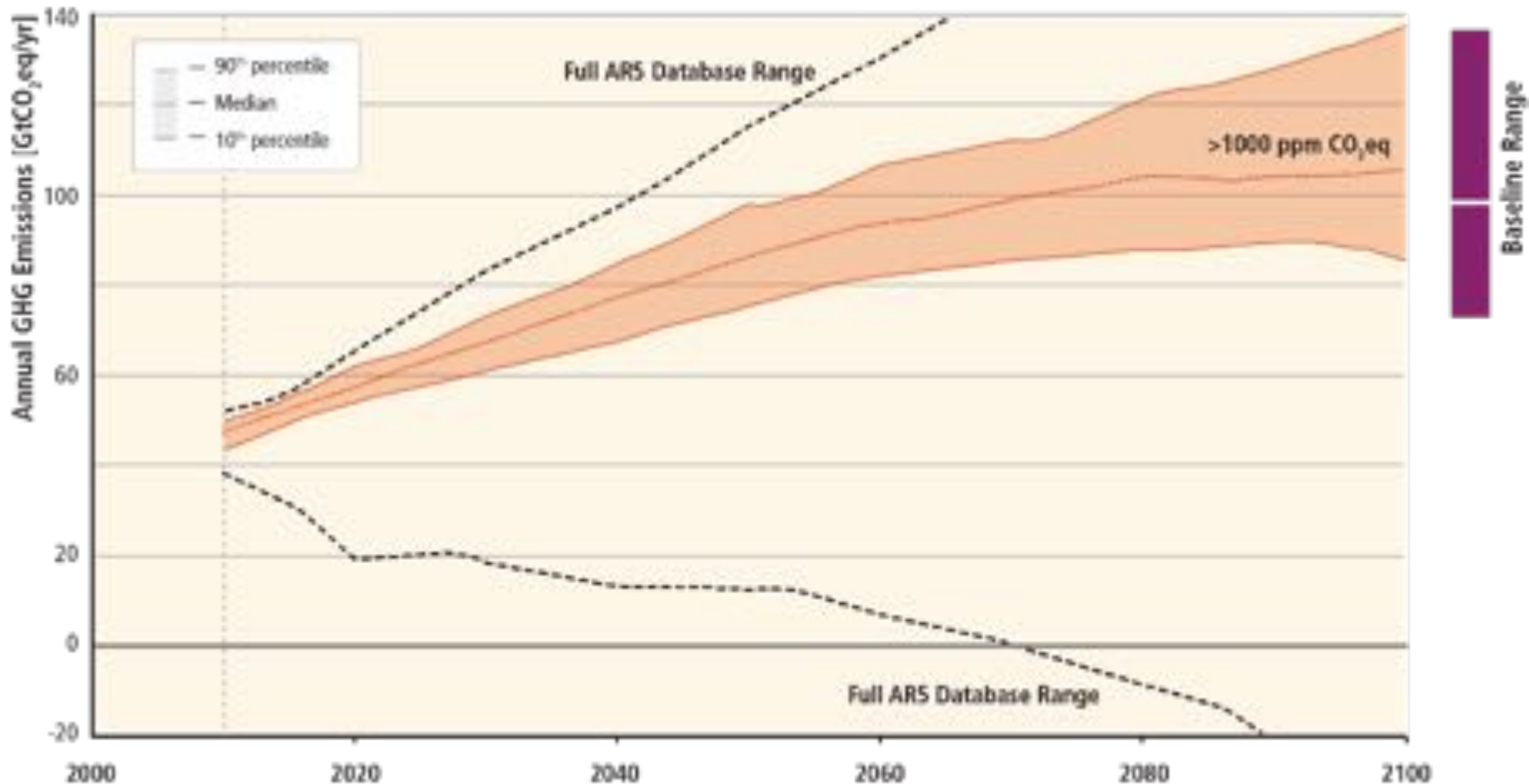
- Mitigation pathways consistent with 2°C limit
- The role of bioenergy in 2°C scenarios
- Enhancing mitigation to 1.5°C
- Negative emissions technologies

Emissions are rising, rising and rising.



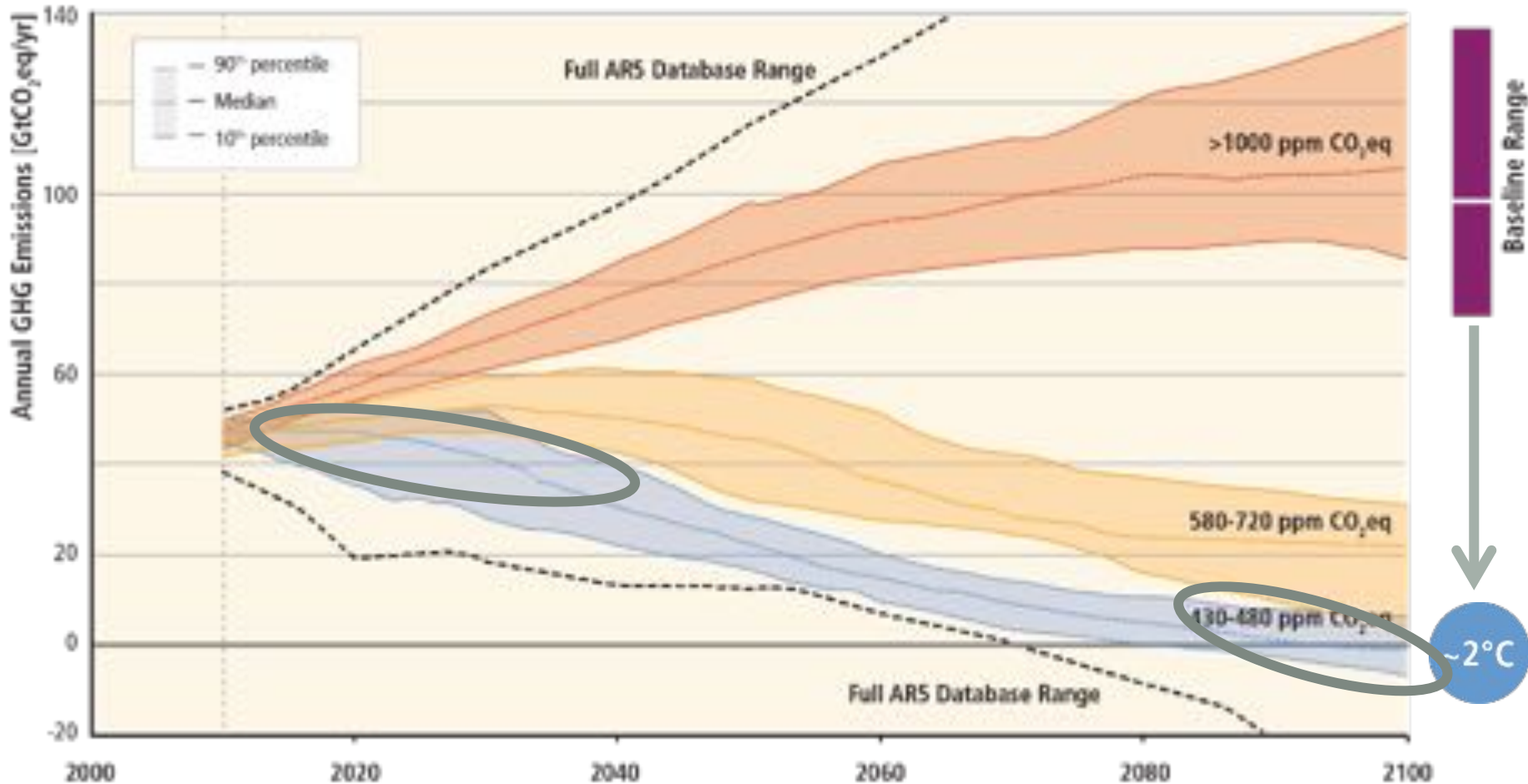
Source: Peters et al. (2017)

Limiting warming to well below 2°C requires a fundamental transformation of the world economy



Source: IPCC (2014)

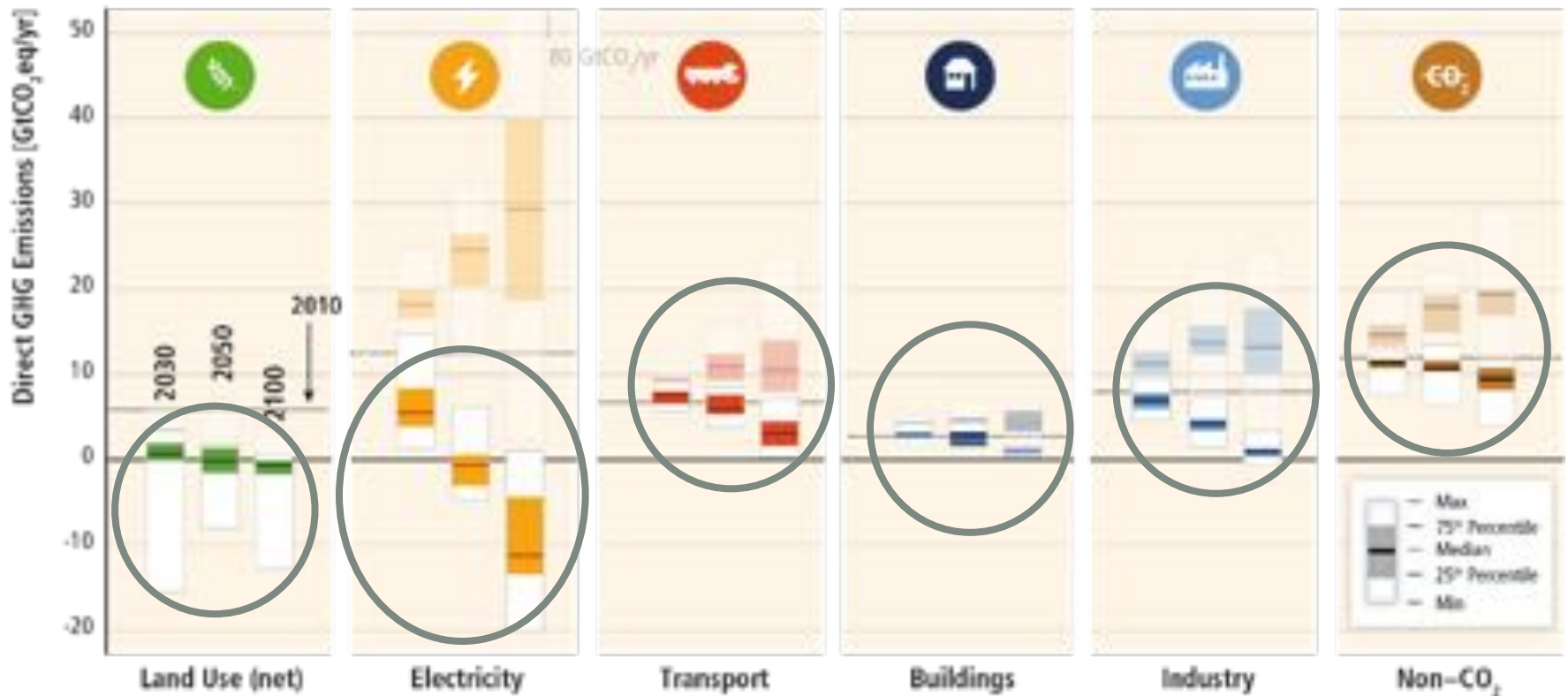
Limiting warming to well below 2°C requires a fundamental transformation of the world economy



Source: IPCC (2014)

For 2°C, deep emission reductions are required in all sectors.

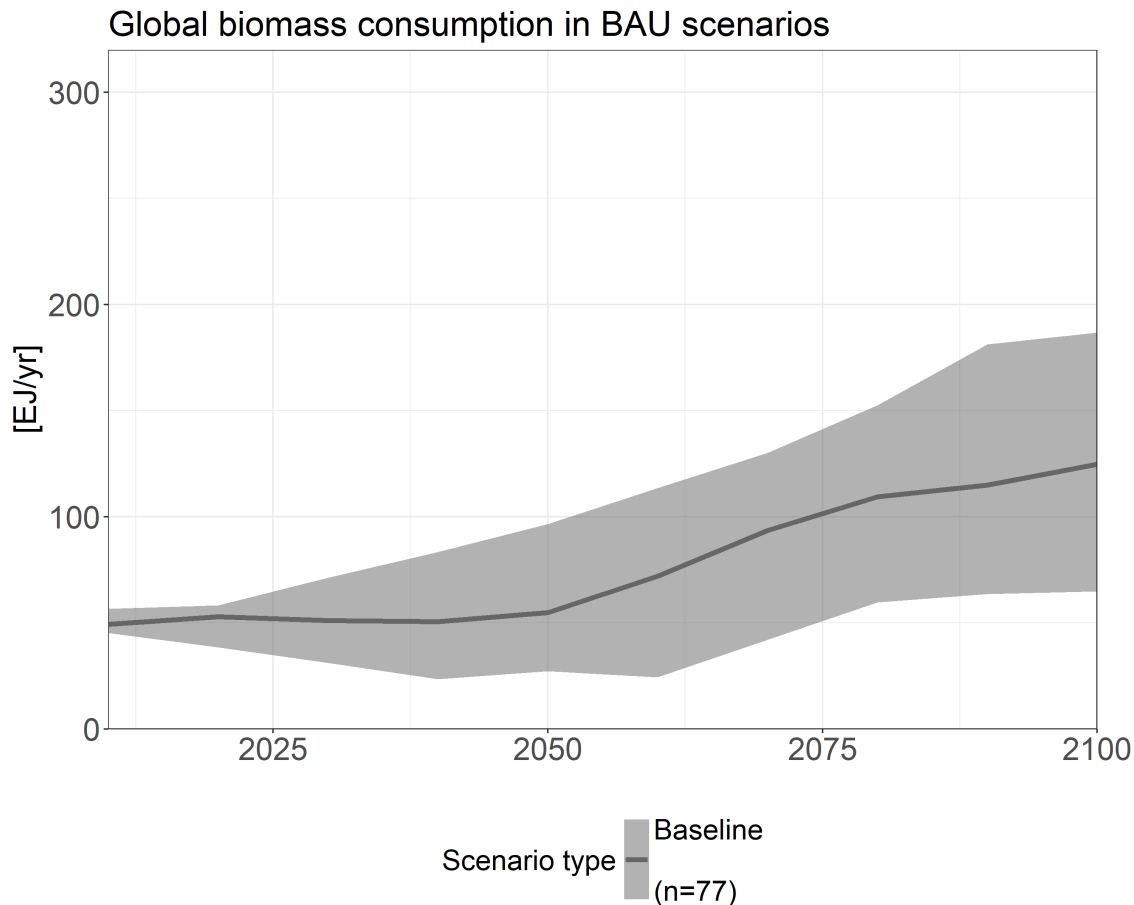
450 ppm CO₂eq with Carbon Dioxide Capture and Storage



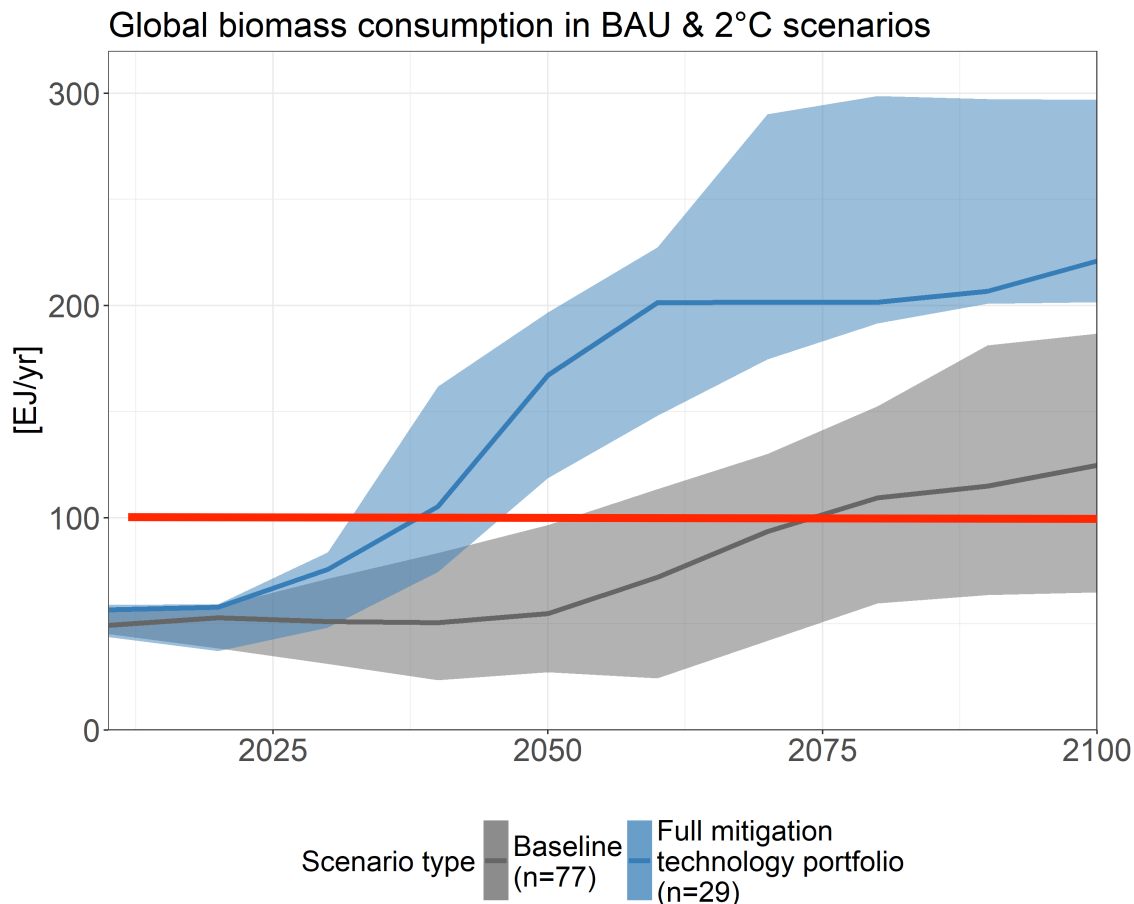
Source: IPCC (2014)

Bioenergy is important for climate change mitigation

- Bioenergy is heavily deployed even in business-as-usual scenarios



Bioenergy is important for climate change mitigation

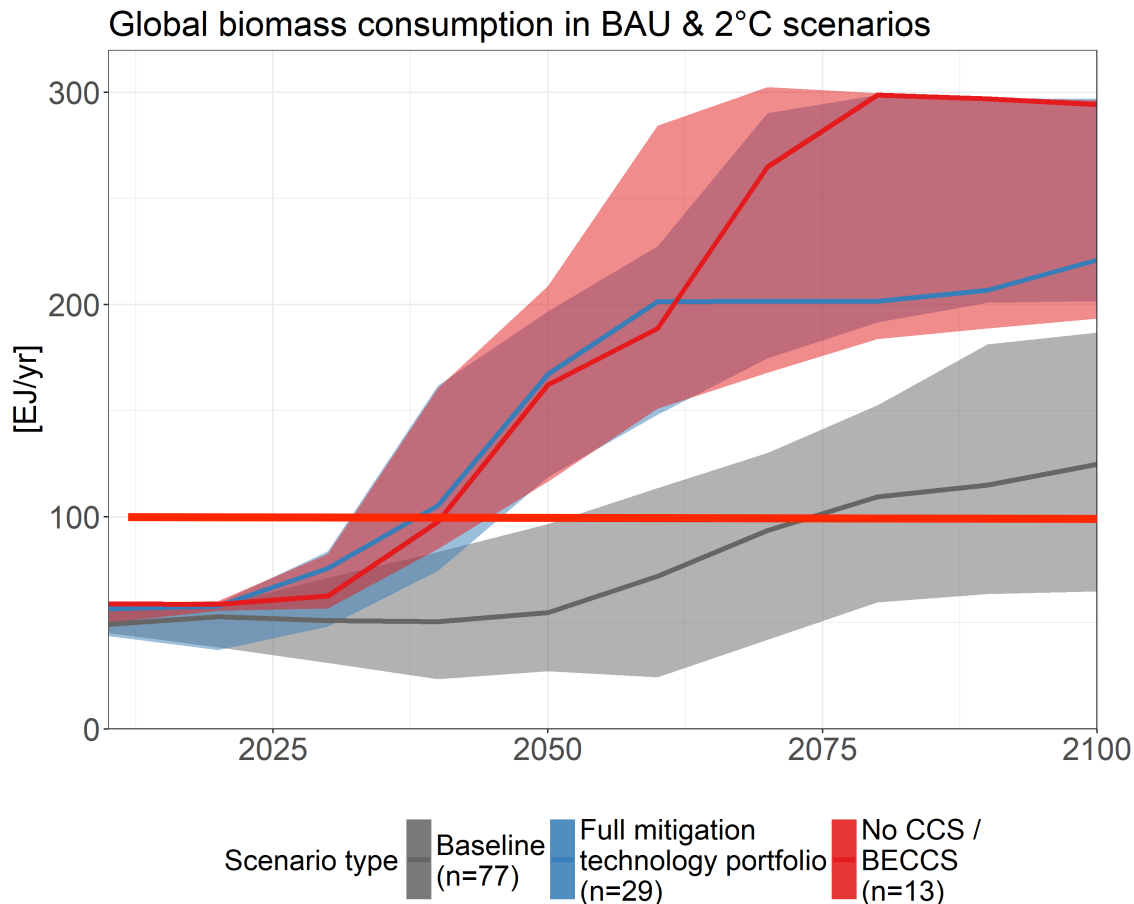


- Bioenergy is heavily deployed even in business-as-usual scenarios
- Rapid bioenergy upscaling between 2030 and 2060 in 2°C scenarios
- There are 2°C pathways where bioenergy is constrained to no more than 100EJ/yr

Figure: Jerome Hilaire

Data: AMPERE, LIMITS, ROSE, Rogelj et al. (2015); Luderer et al. (2013)

Bioenergy is important for climate change mitigation

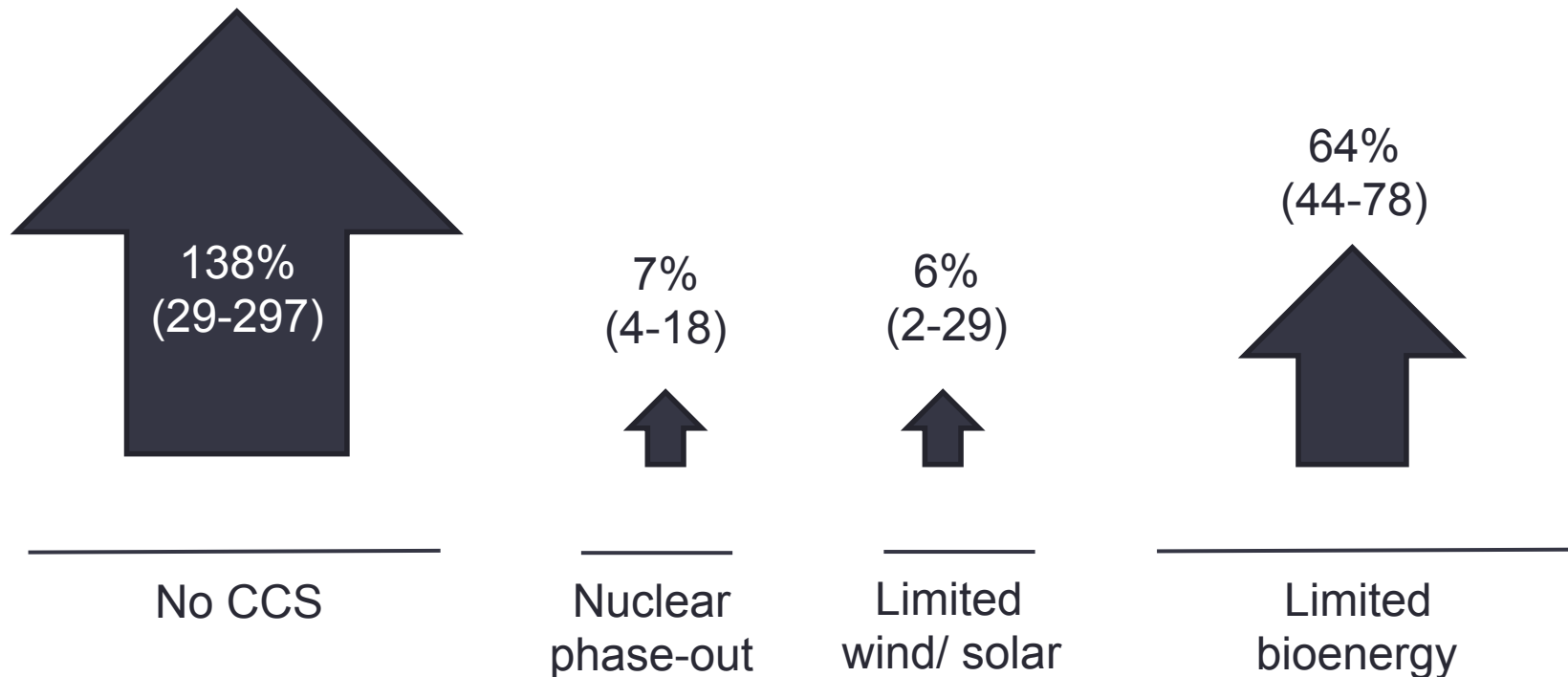


- Bioenergy is heavily deployed even in business-as-usual scenarios
- Rapid bioenergy upscaling between 2030 and 2070 in 2°C scenarios
- There are 2°C pathways where bioenergy is constrained to no more than 100EJ/yr
- Bioenergy is versatile. Relevance regardless of „negative emissions“

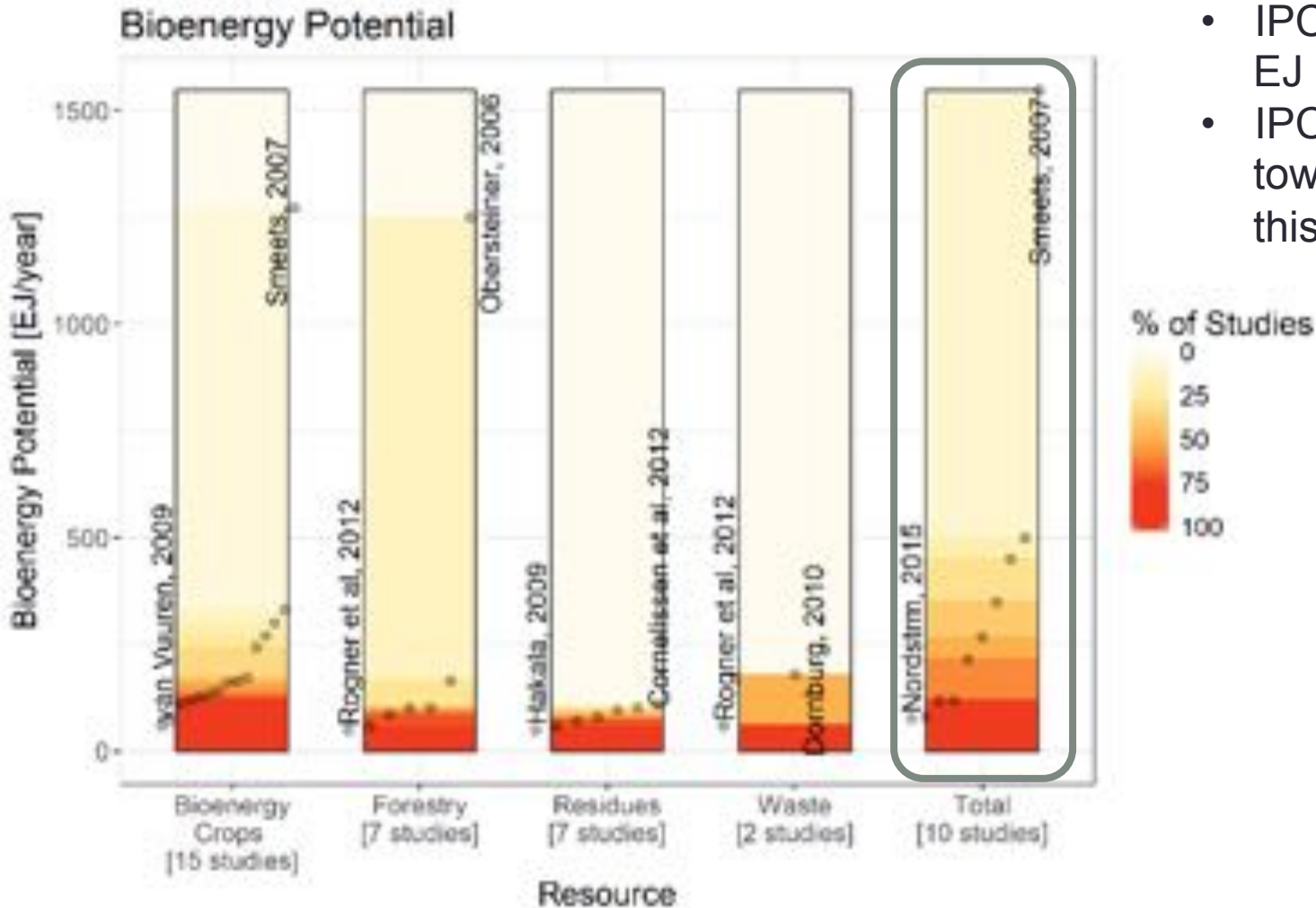
Figure: Jerome Hilaire

Data: AMPERE, LIMITS, ROSE, Rogelj et al. (2015); Luderer et al. (2013)

Constraints on bioenergy availability increases mitigation cost



Severe disagreement in scientific community what a sustainable level of bioenergy deployment is



- IPCC SRREN: 100-300 EJ
- IPCC AR5: points towards lower end of this range

Even faster bioenergy upscaling in 1.5°C scenarios

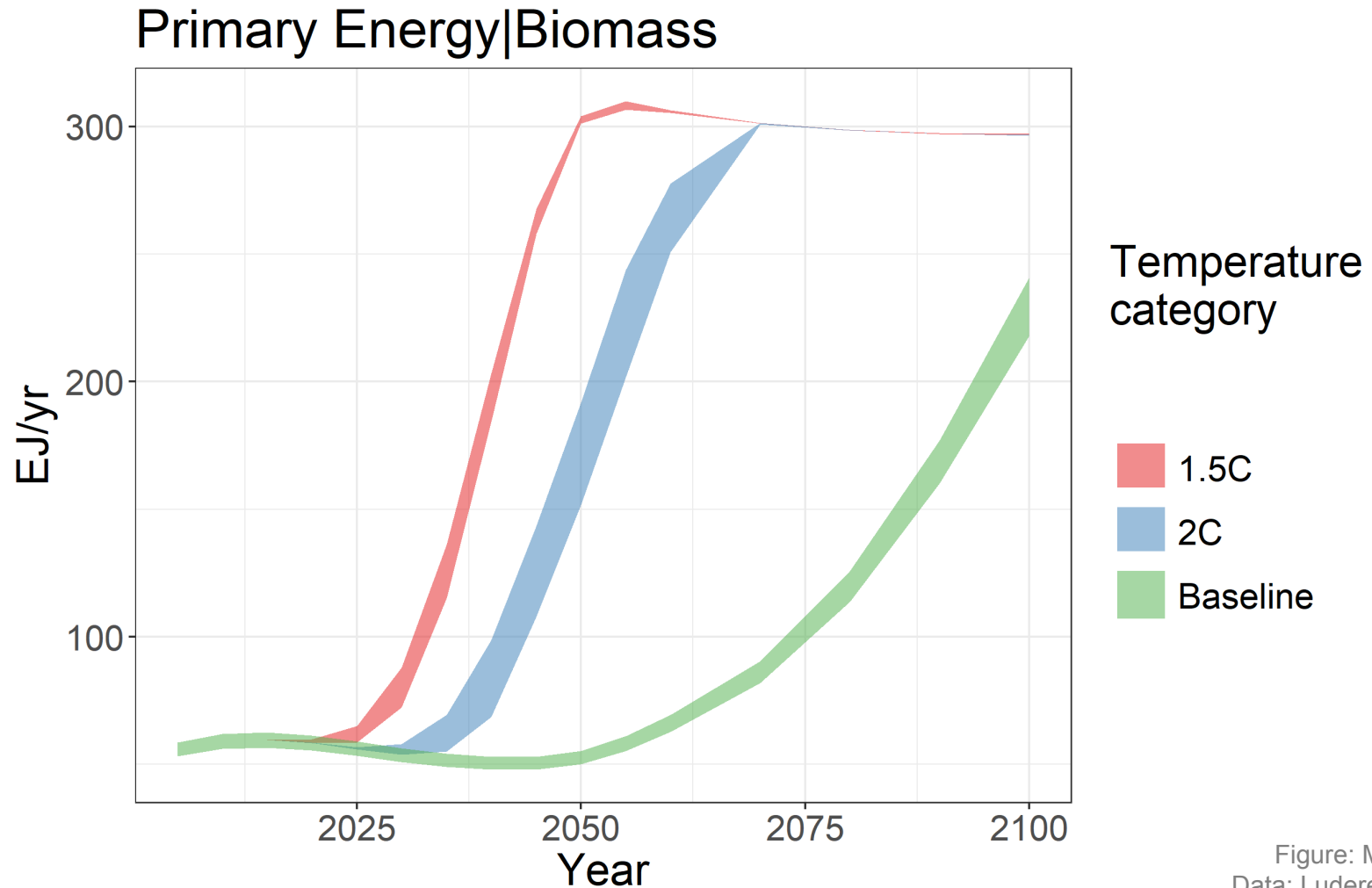
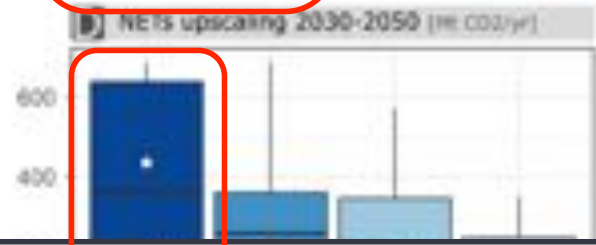
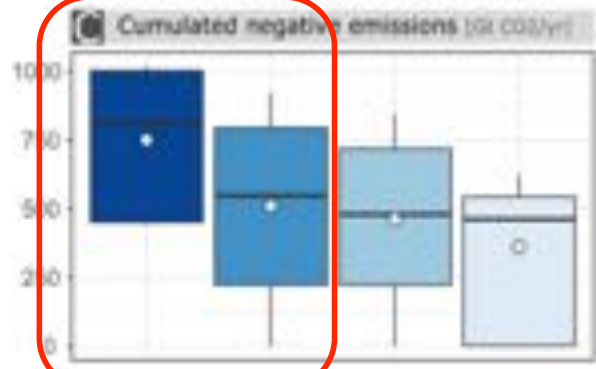
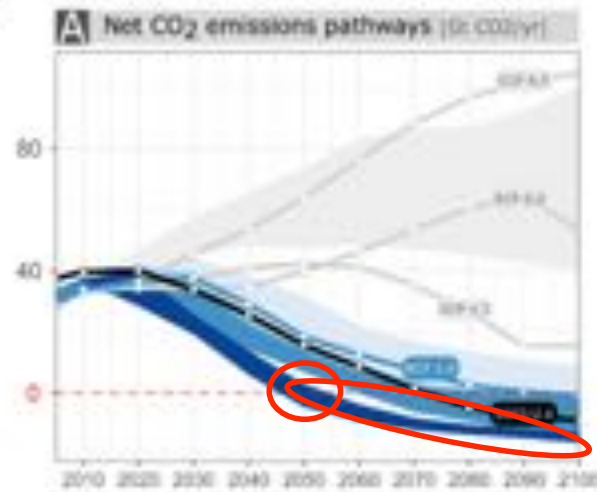


Figure: Max Callaghan
Data: Luderer et al. (2013)

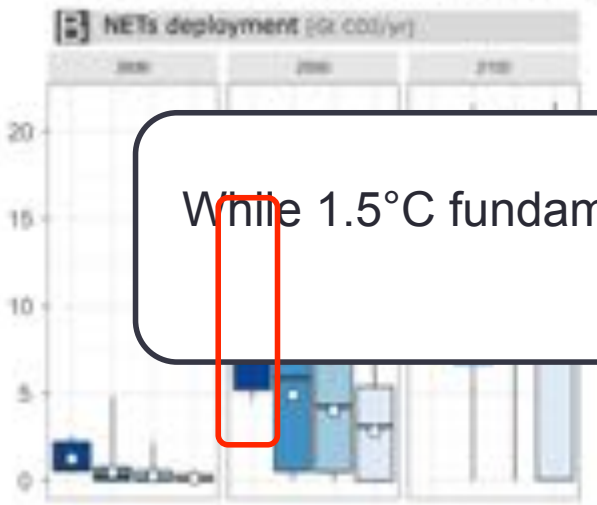
1.5°C scenarios are distinct from 2°C scenarios



Characteristics of 1.5°C scenarios

- Fully decarbonized world economy by 2050 (sharp emissions reductions)
- Sustained period of deep net negative emissions thereafter

While 1.5°C fundamentally depend on negative emissions, this is not the case for 2°C scenarios



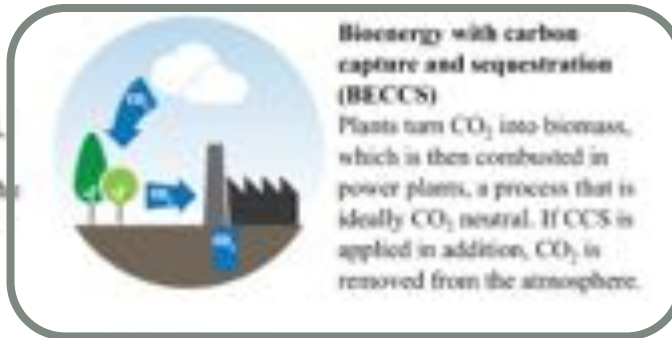
higher

Source: Fuss et al. (re-submitted)

Negative emissions can be generated by a diverse set of technologies



Afforestation and reforestation
Additional trees are planted, capturing CO₂ from the atmosphere as they grow. The CO₂ is then stored in living biomass.



Bioenergy with carbon capture and sequestration (BECCS)
Plants turn CO₂ into biomass, which is then combusted in power plants, a process that is ideally CO₂ neutral. If CCS is applied in addition, CO₂ is removed from the atmosphere.



Biochar and soil carbon sequestration (SCS)
Biochar is created via the pyrolysis of biomass, making it resistant to decomposition; it is then added to soil to store the embedded CO₂. SCS enhances soil carbon by increasing inputs or reducing losses.



Enhanced weathering
Minerals that naturally absorb CO₂ are crushed and spread on fields or the ocean; this increases their surface area so that CO₂ is absorbed more rapidly.



Ocean fertilization
Iron or other nutrients are applied to the ocean, stimulating phytoplankton growth and increasing CO₂ absorption. When the plankton die, they sink to the deep ocean and permanently sequester carbon.

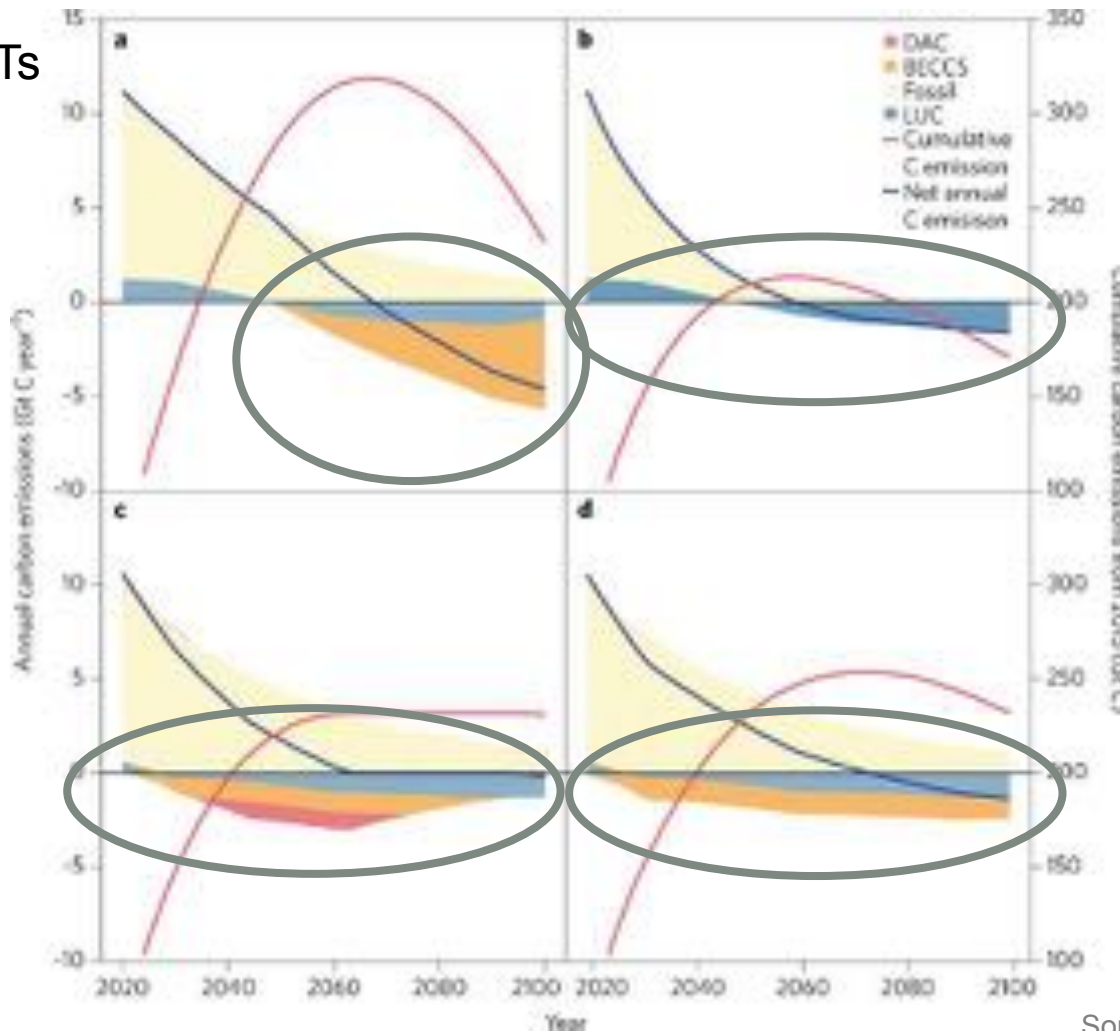


Direct air capture (DAC)
Chemicals are used to absorb CO₂ directly from the atmosphere, which is then stored in geological reservoirs.

There are multiple „negative emission worlds“ that need to be explored

Late century NETs

Rapid decarbonization



No overshoot

Minimize NETs

Source: Obersteiner et al. (2018)

Conclusion

- Achieving the international climate goals of the Paris Agreement requires a full decarbonization of the world economy.
- Bioenergy plays an important role for meeting the climate goals of the Paris Agreement.
- The absence of substantial amounts of bioenergy makes such mitigation more difficult and costly
- Substantial disagreement on what a sustainable bioenergy potential may be
- Bioenergy is versatile and important regardless of scale of carbon dioxide removal („negative emissions“)
- Enhancing mitigation ambition to 1.5°C makes „negative emissions“ obligatory
- Need a broader discussion of possible „negative emissions worlds“ – and the role of bioenergy therein

Thanks!

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