"Negative Emissions" in Global Mitigation Strategies

or

The risks of relying on tomorrow's negative emissions to guide today's mitigation ambition

Sivan Kartha
Stockholm Environment Institute

Kate Dooley
The University of Melbourne

16 May 2016, Bonn SB44 / APA1

SEI STOCKHOLM ENVIRONMENT INSTITUTE

THE UNIVERSITY OF MELBOURNE

What are “negative emissions” options?

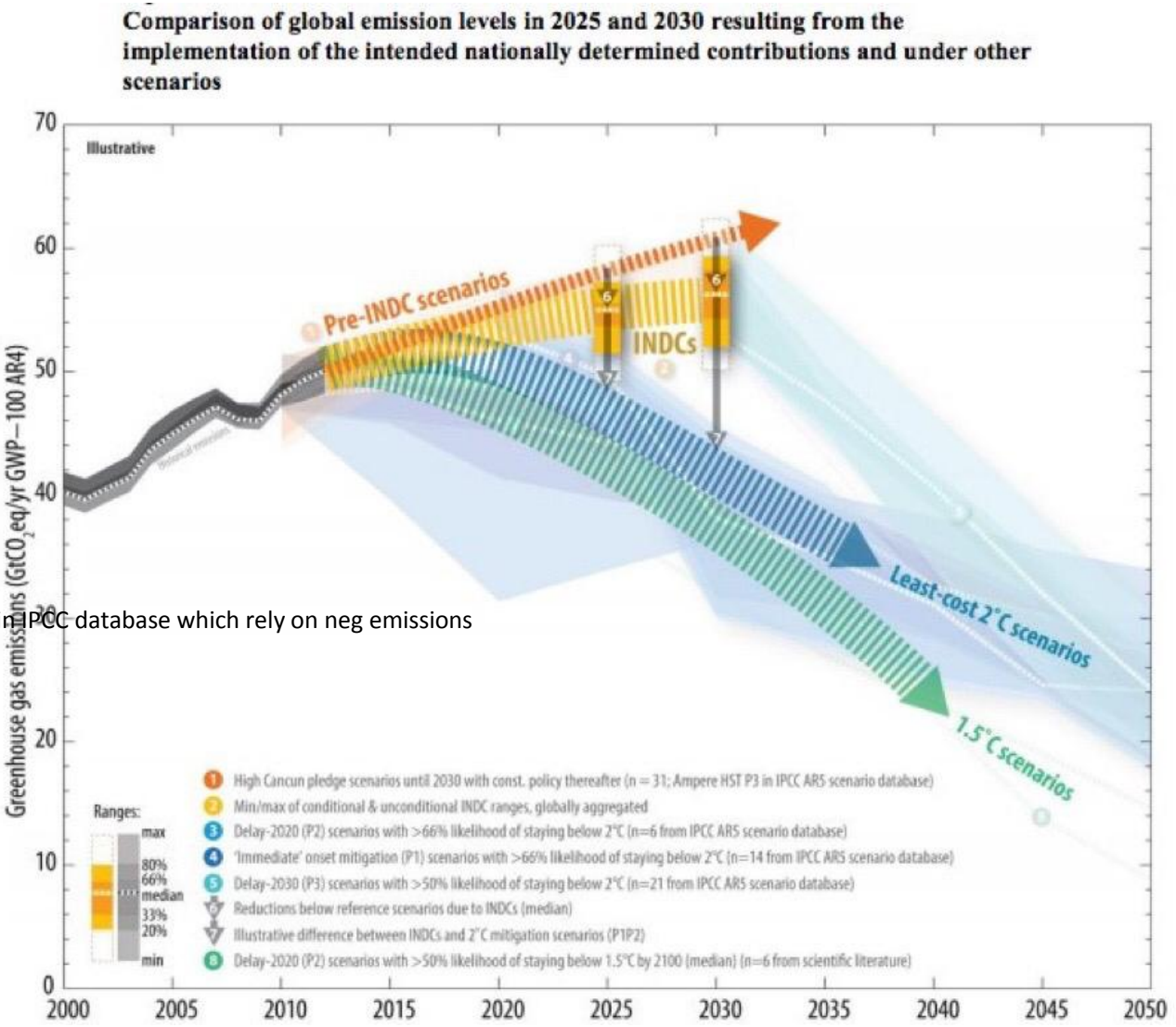
- Biomass energy with carbon capture & sequestration

- Forest ecosystem restoration

- Afforestation / Reforestation

- “Mosaic” landscape restoration

Why are we talking about negative emission options?



2C scenarios in IPCC database which rely on neg emissions

2°C scenarios in IPCC database which rely on neg. emissions

But, what if…

- …the negative emission options do not turn out to be technically feasible in the future when they are ultimately required?

- … it turns out they can only be deployed at the expected scale with unacceptable ecological and social impacts?

- …the negative emissions are reversed by human action (e.g., land clearing) or natural forces (e.g., fire, drought, pests etc., which could be exacerbated by climate change)?

➢ *Strategies relying heavily on future negative emissions are therefore very risky.*

Yet, in typical 1.5°C scenario models, 60-85% of energy emissions would need to be "removed" by negative emissions. In typical 2°C scenario models: 30-50% to be "removed" (ref. Rogelj et al., 2015)

Three risks of negative emissions measures

Risk 1: Infeasibility

Negative emission options do not prove feasible in the future when they are ultimately required.

Risk 2: Unnacceptable impacts

Negative emission options are feasible, but cannot be implemented at the required scale because of unacceptable ecological and social impacts.

Risk 3: Reversal

Negative emission options are implemented at the required scale, but human or natural forces, including climate change, compromise land-based sinks and reverse emission reductions.

A somewhat precautionary case		Cumulative sequestration (21st c.)
Avoided deforestation	Net forest loss halted by 2020, in line with SDG 15.2	Avoided emissions
Ecosystem Restoration	Extensive ecosystem restoration, at an average rate of 1.5 GtC/yr for 60 years until saturation.	330 $GtCO_2$
Reforestation	Optimistic levels of reforestation to meet the Bonn Challenge (reforest 150 Mha by 2020) and the New York Declaration on Forests (200 MHa more by 2030) Average negative emission of 0.7 GtC/yr, (IPCC range: 0.5 to 1.15 GtC/yr), over 60 years until saturation.	150 $GtCO_2$
Landscape Restoration and soil carbon	Uncertainty (especially with soil carbon) is presently too great to justify reliance on any such benefit at this point. (Future information may warrant inclusion.)	Unquantified
Bioenergy with CCS	Excluded on the basis that the technology is not yet proven, and can only contribute at large scale if other challenging conditions are also met relating to arable land and resource inputs.	0 $GtCO_2$
TOTAL	(Sufficient for approx. ½ of 2°C scenarios and approx. ⅓ of 1.5°C scenarios)	480 $GtCO_2$

Conclusions

- Many scenarios presuppose the feasibility, availability at large scale, and permanence of negative emissions
- But, there are serious risks:
  - Won't prove technically feasible
  - Impose unacceptable risks when eventually needed
  - Vulnerable to reversal, re-emission into atmosphere
- A "somewhat precautionary" case could possibly yield removals by sinks amounting to approx. 480 GtCO2.
- This provides some encouragement that 1.5°C is feasible using land mitigation options that we can reasonably expect to be available (though still has risks)
- In any event, such pathways would nevertheless require a rapid and dramatic transformation of the economy to shift away from fossil sources, and they do not allow for any delay.