



POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

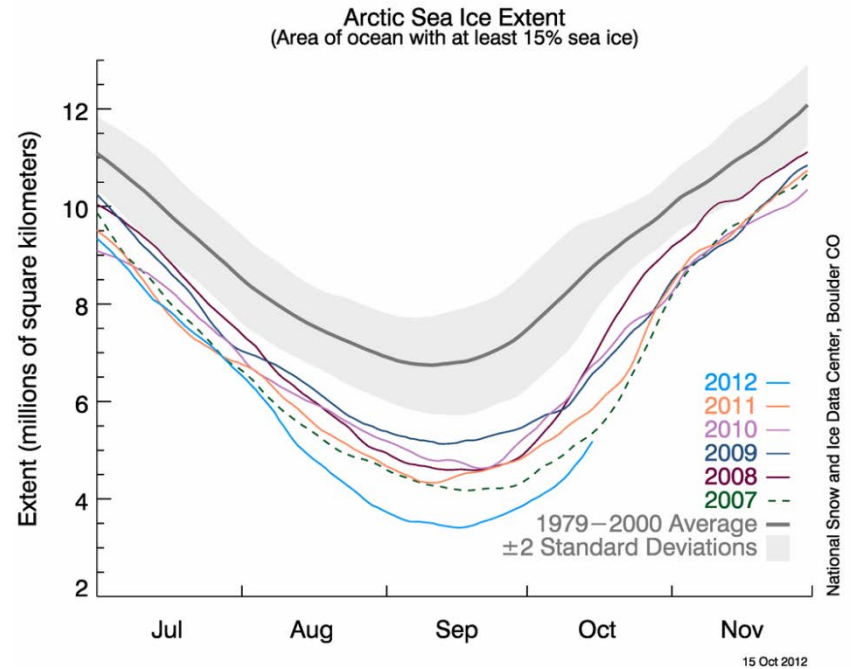
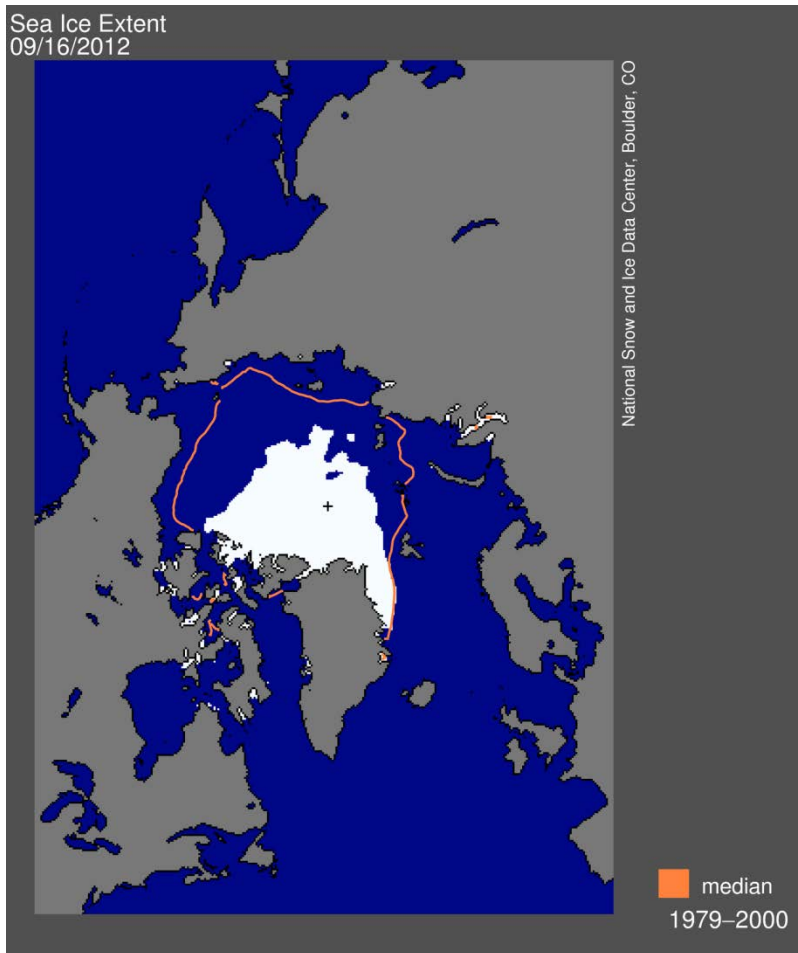
Energy transformation pathways towards 2°C stabilization

Gunnar Luderer

Potsdam Institute for Climate Impact Research

Why do we need a temperature limit?

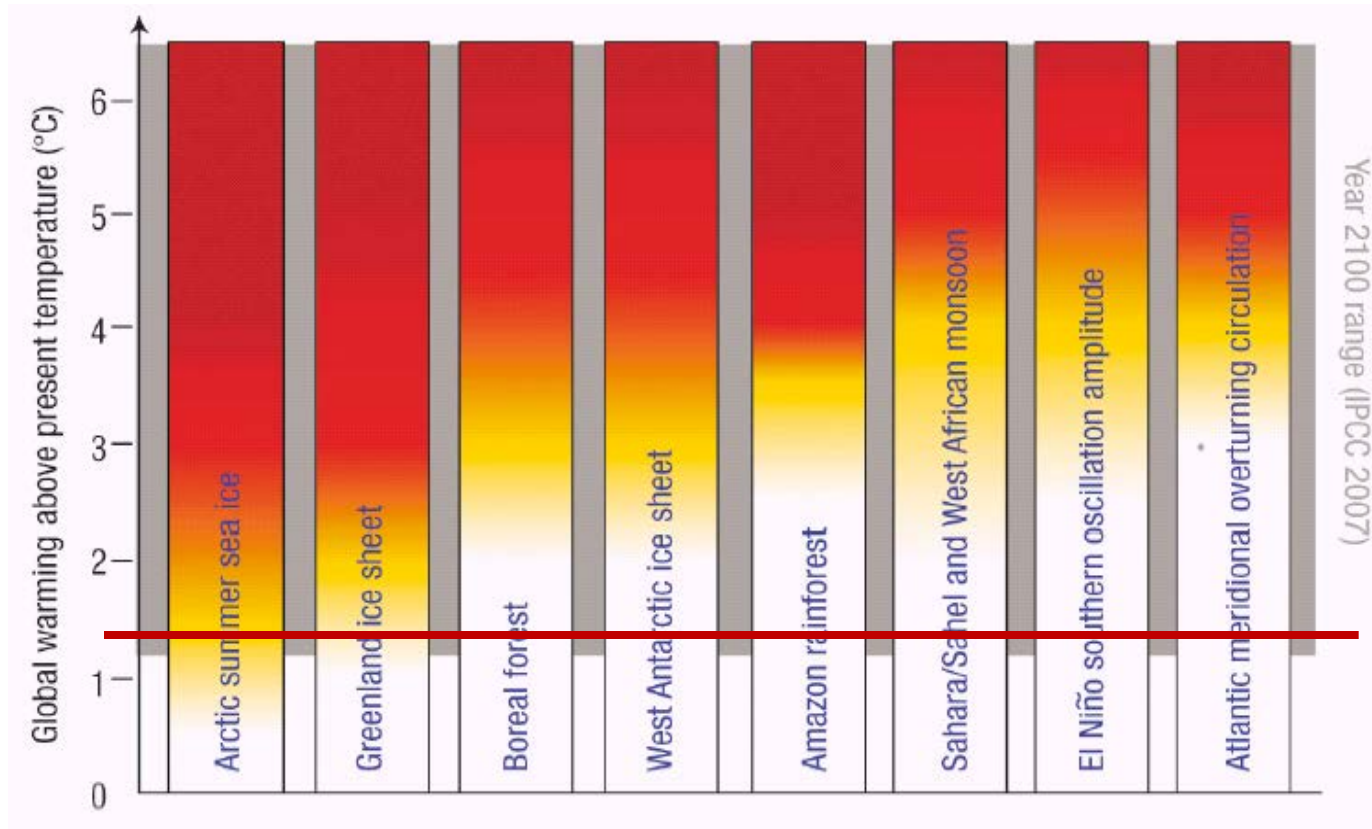
Arctic sea ice



NSIDC (2012)

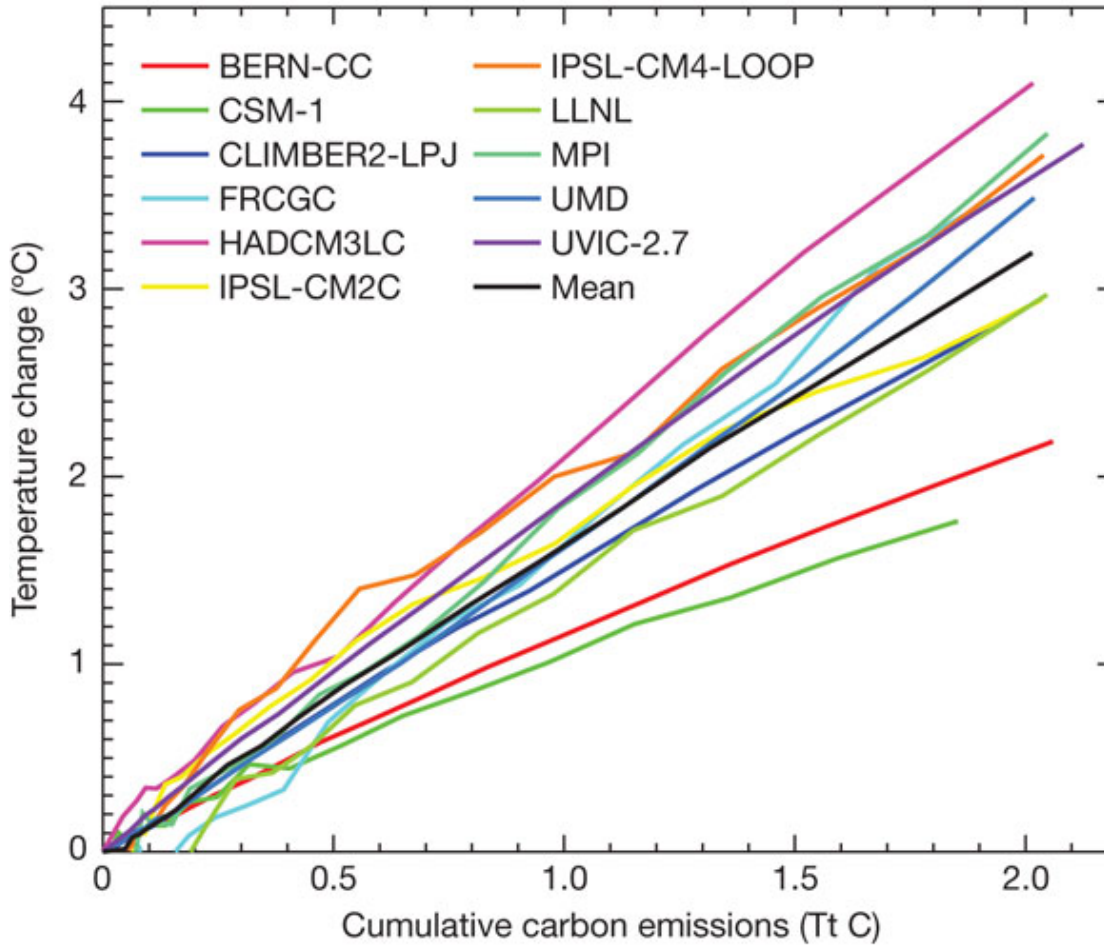
Why do we need a temperature limit?

Tipping elements in the Earth system



Lenton et al. (2008)

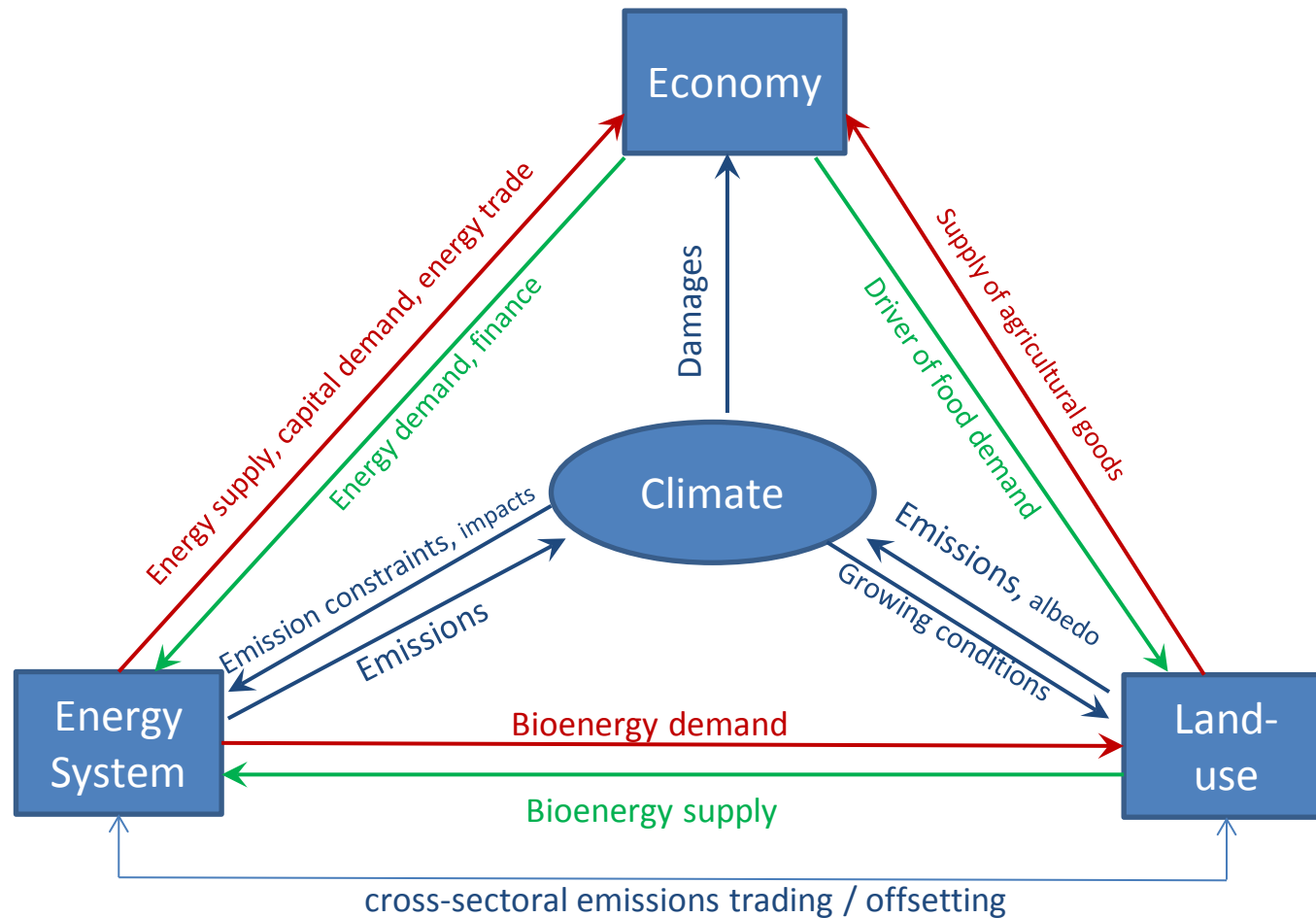
Cumulative emissions matter



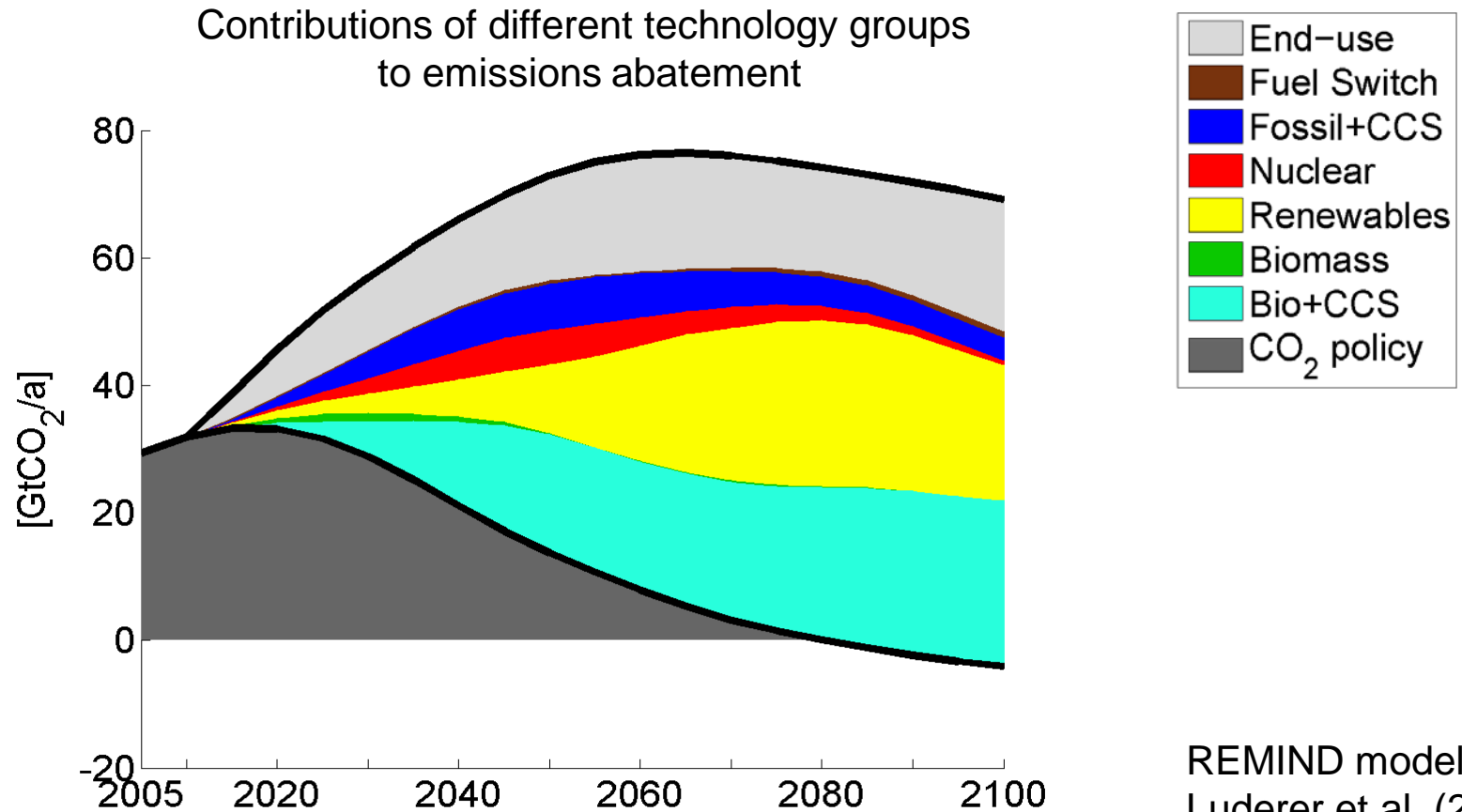
**Near-zero emissions
are required to stabilize
climate!**

Matthews et al. (2009)

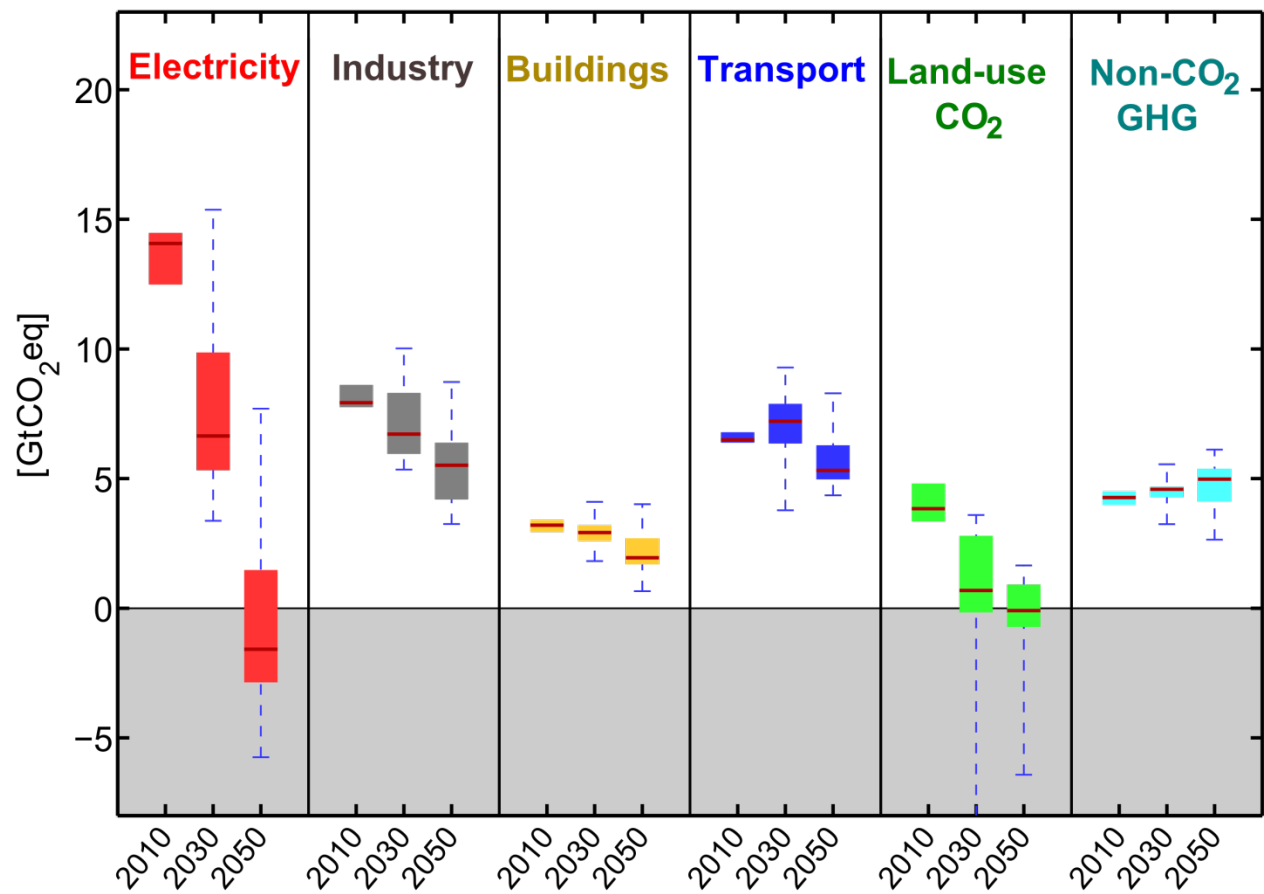
Integrated assessment of climate stabilization strategies



The energy system transformation

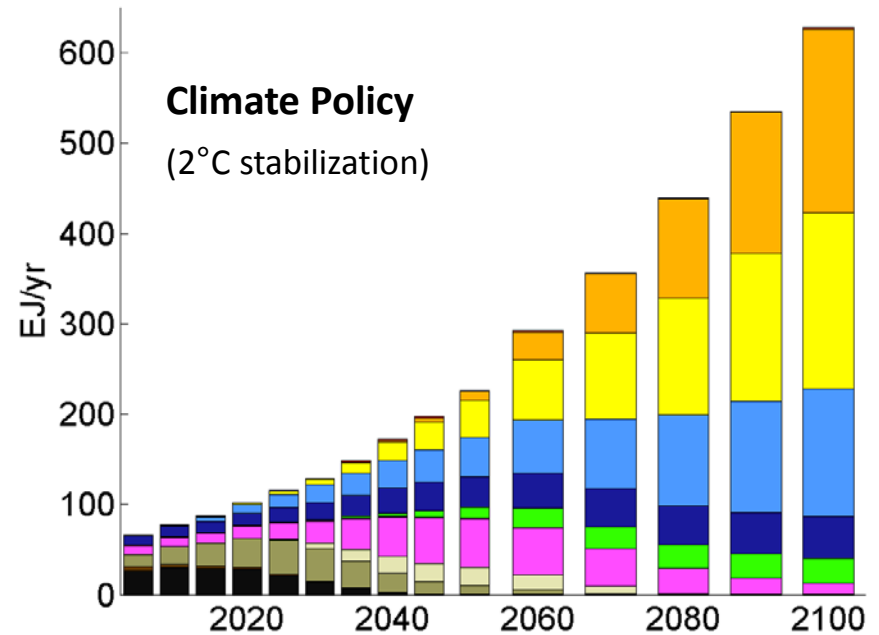
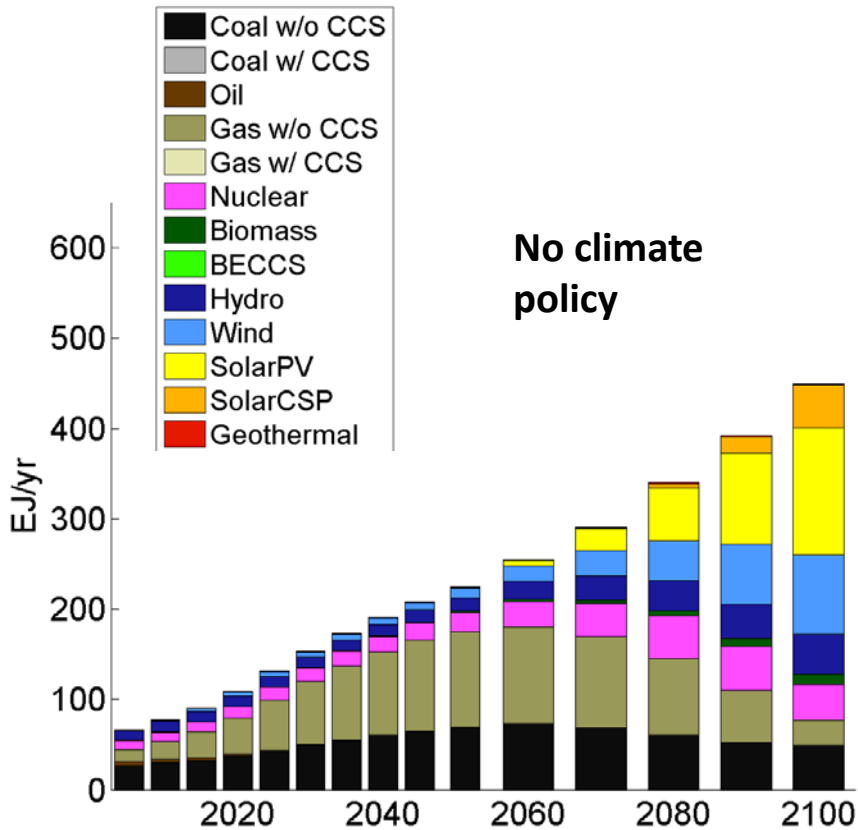


Different contribution of sectors to emission reductions



Based on
Krey et al. (2013)
EMF27 study

Electricity supply

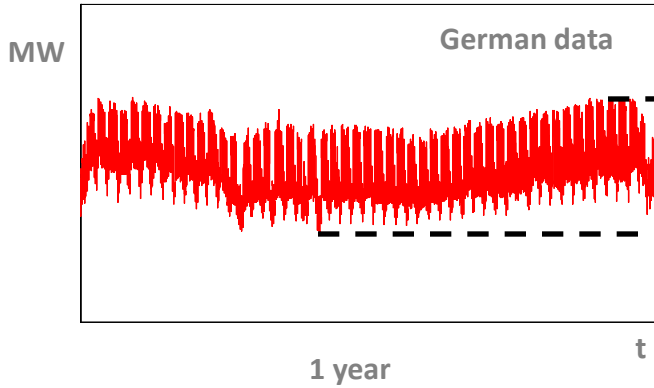


REMIND model, PIK (2013)

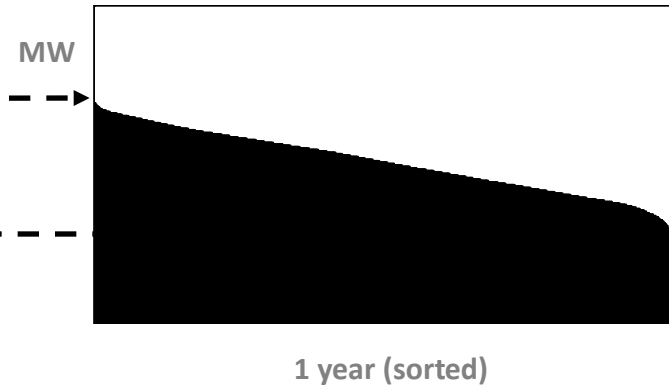


Integration of variable renewable power supply

Load curve (demand)

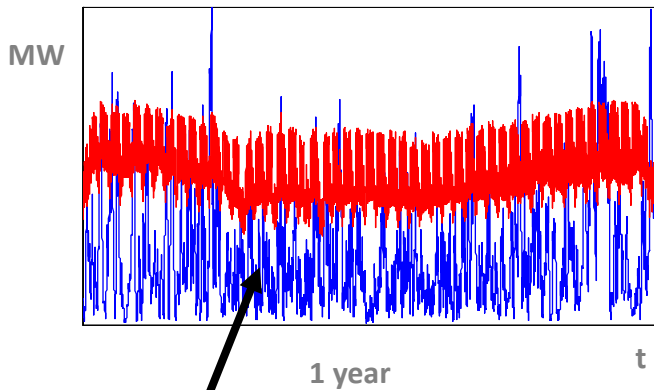


Load Duration Curve



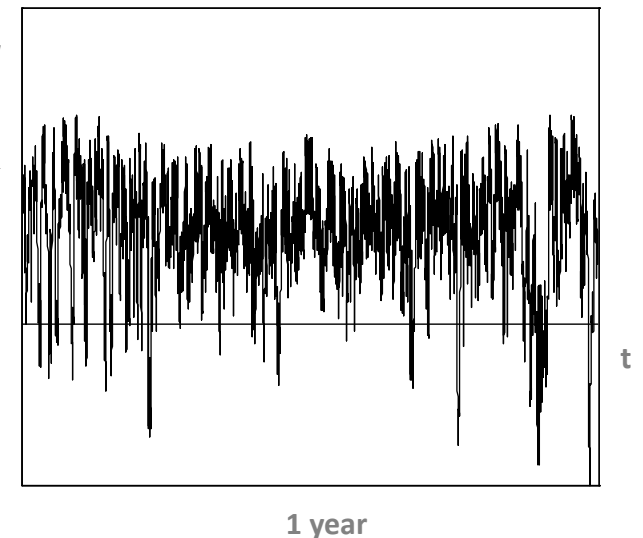
Sorting

Load and renewable supply



Load – renewables

Residual load curve

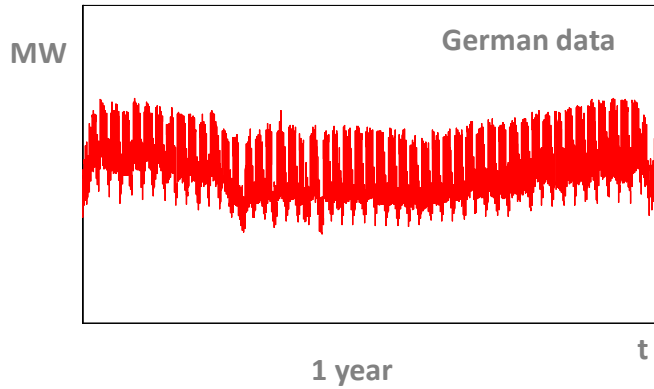


Wind

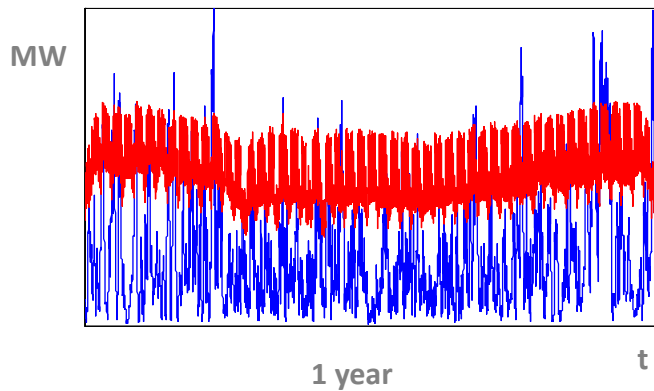


Integration of variable renewable power supply

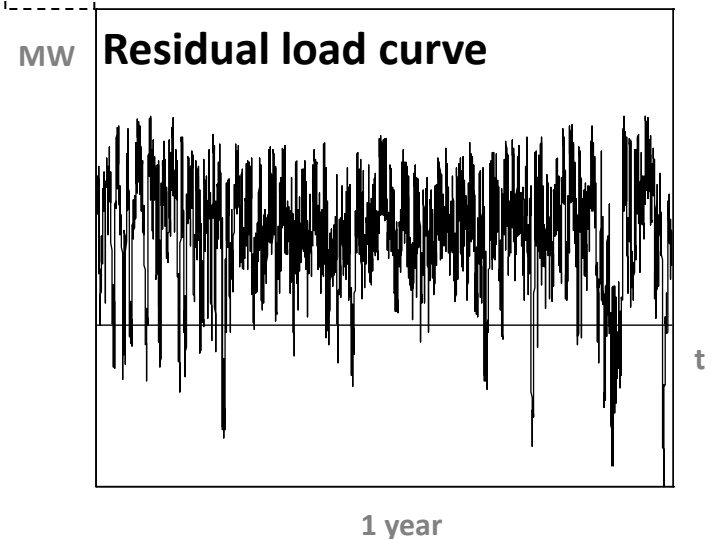
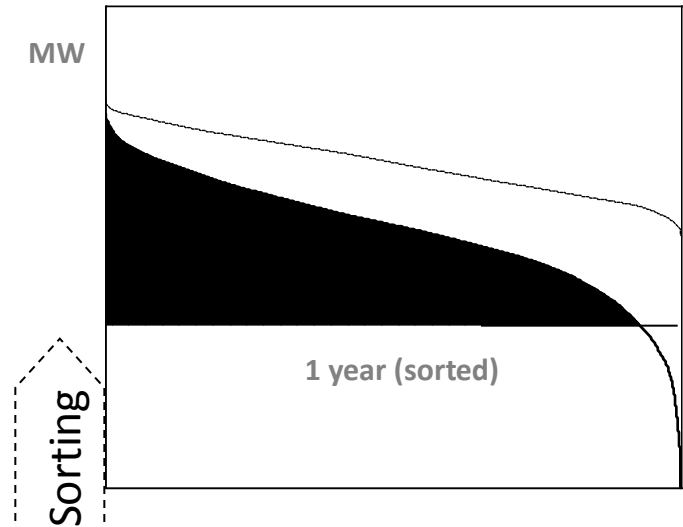
Load curve (demand)



Load and renewable supply



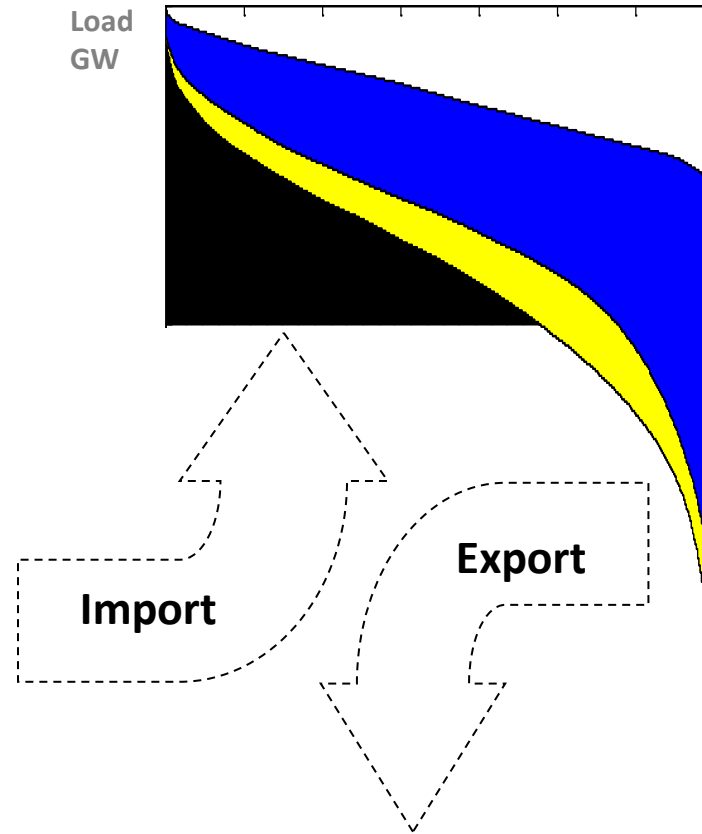
Residual Load Duration Curve



Integration of variable renewable power supply

Flexibility options

- Transmission grid
- Storage
- Demand side management

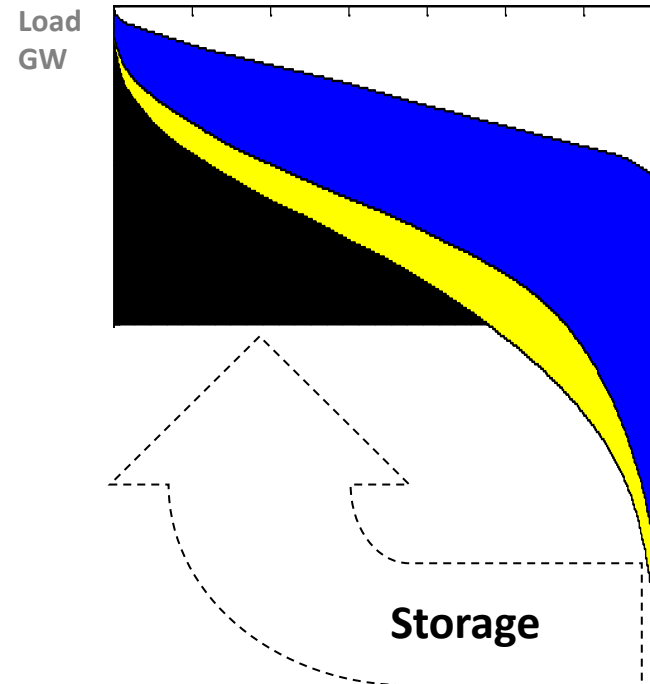


Ueckerdt et al. (2014)

Integration of variable renewable power supply

Flexibility options

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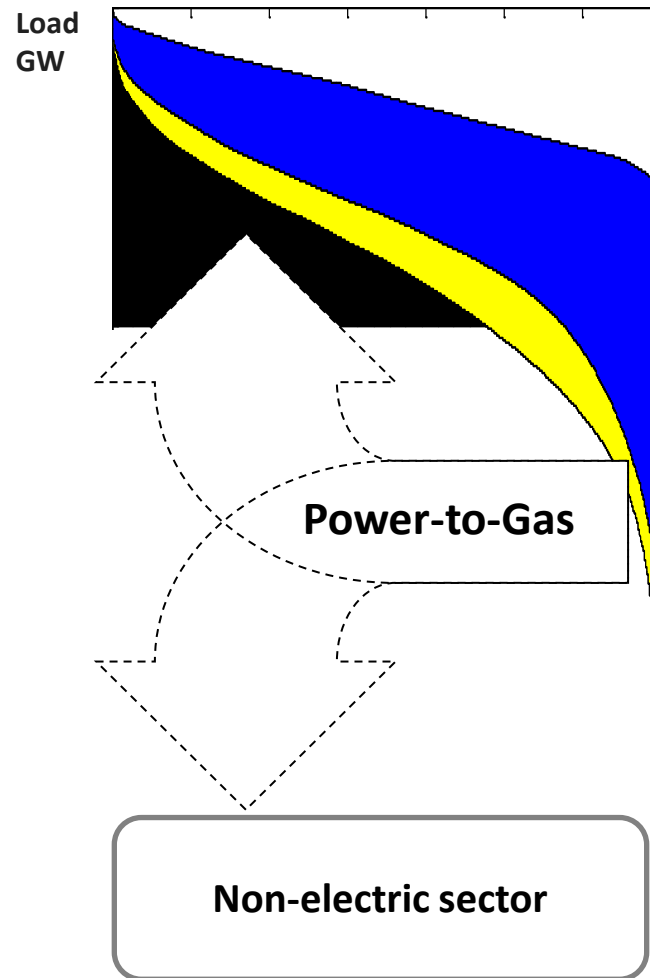


Ueckerdt et al. (2014)

Integration of variable renewable power supply

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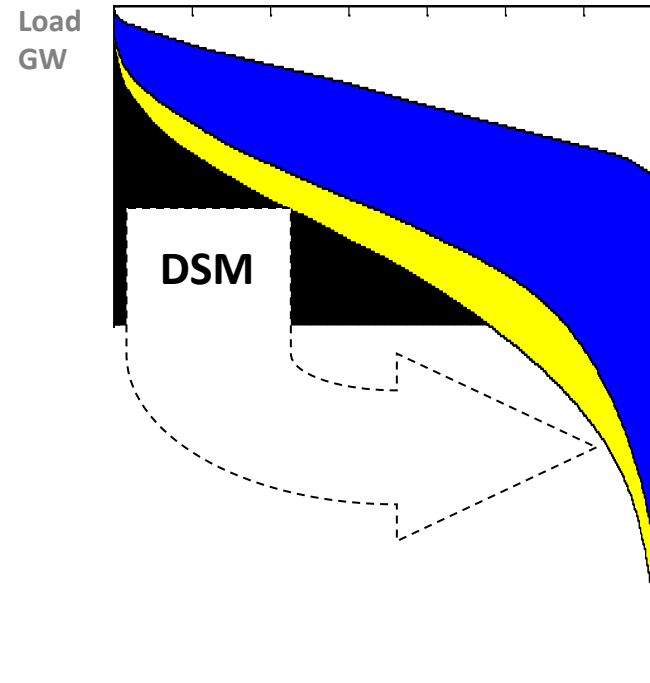


Ueckerdt et al. (2014)

Integration of variable renewable power supply

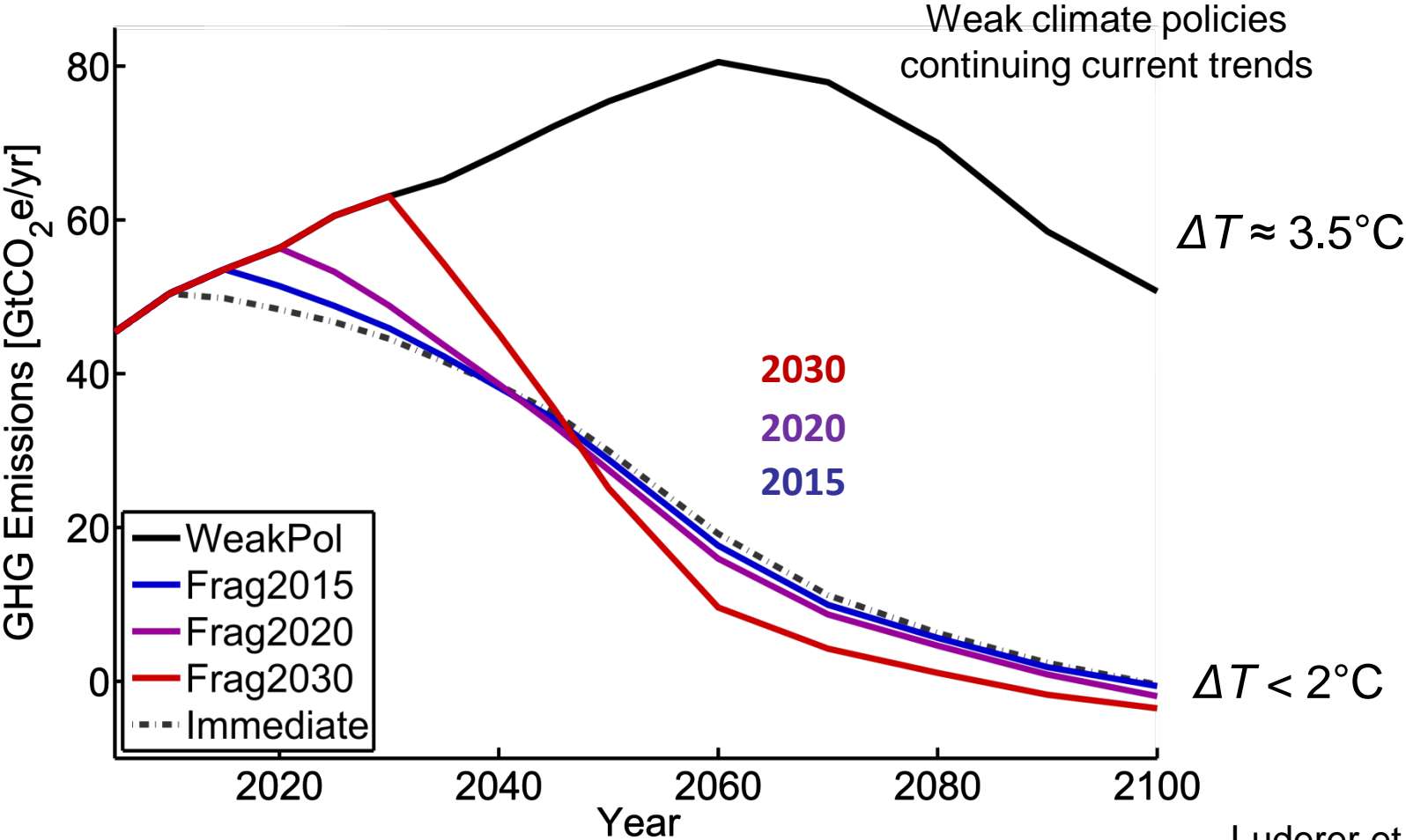
Flexibility options

- Transmission grid
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- **Demand side management**



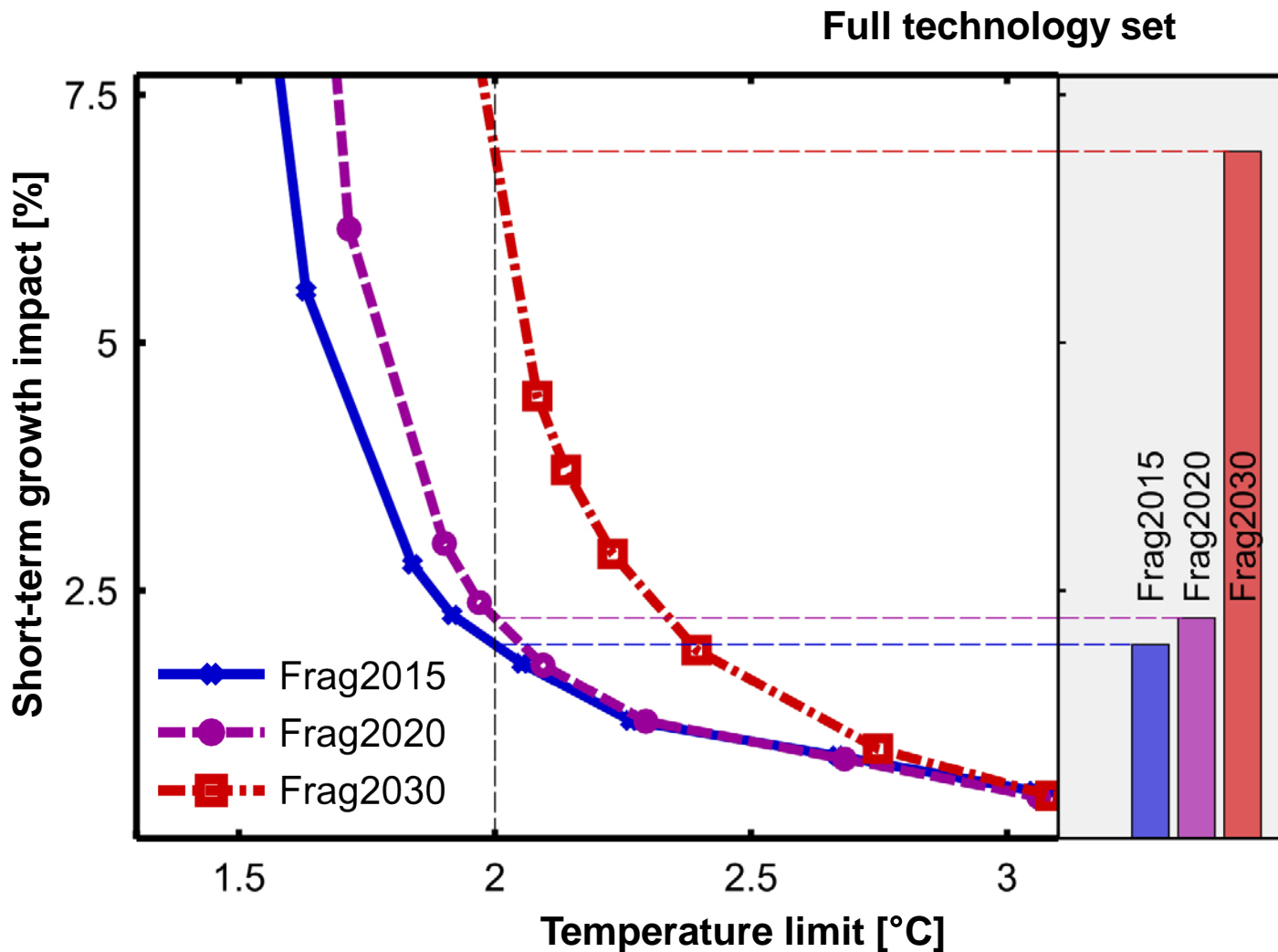
Ueckerdt et al. (2014)

The policy challenge



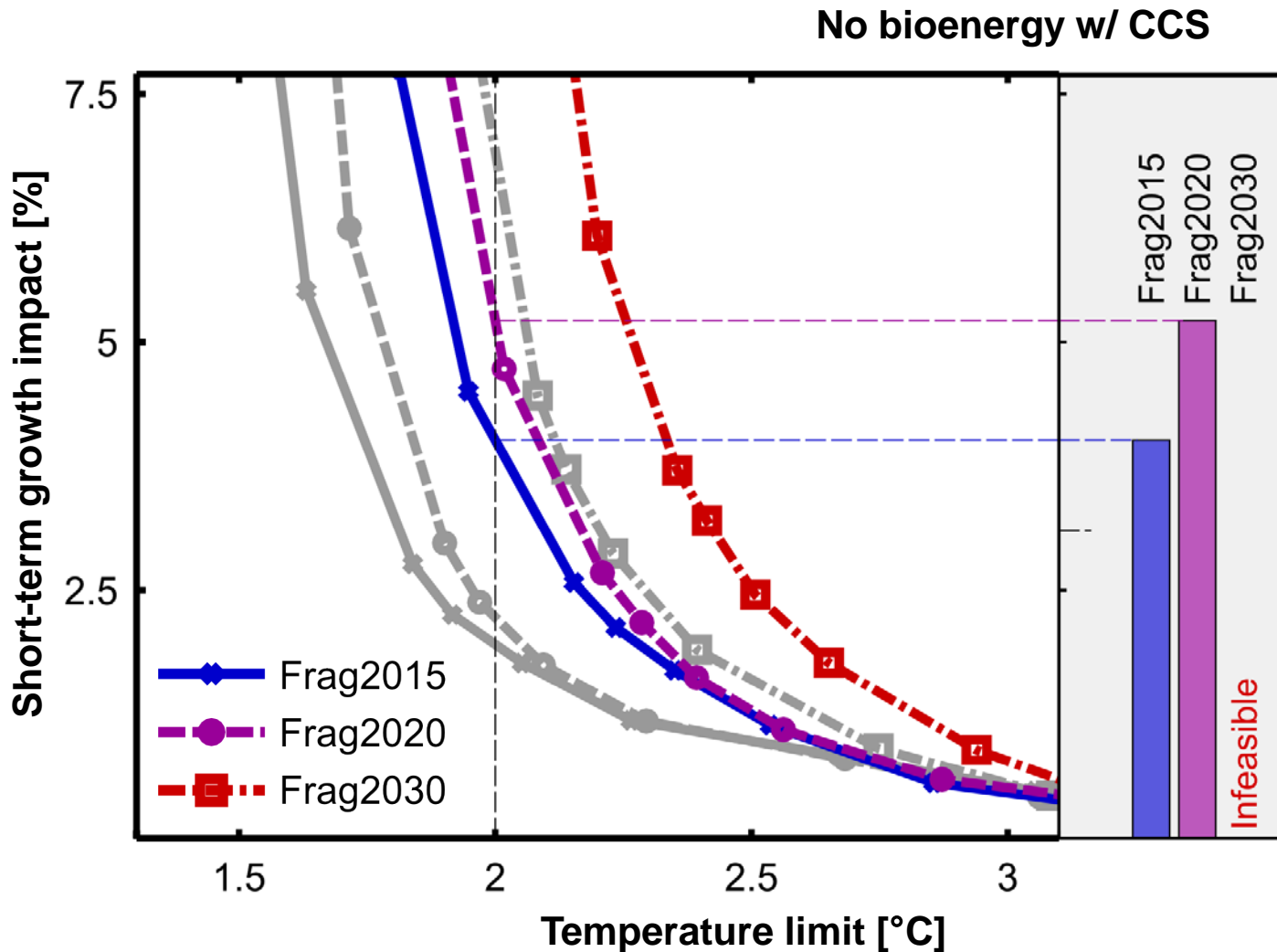
Luderer et al. (2013)

What if a global climate deal is delayed further?



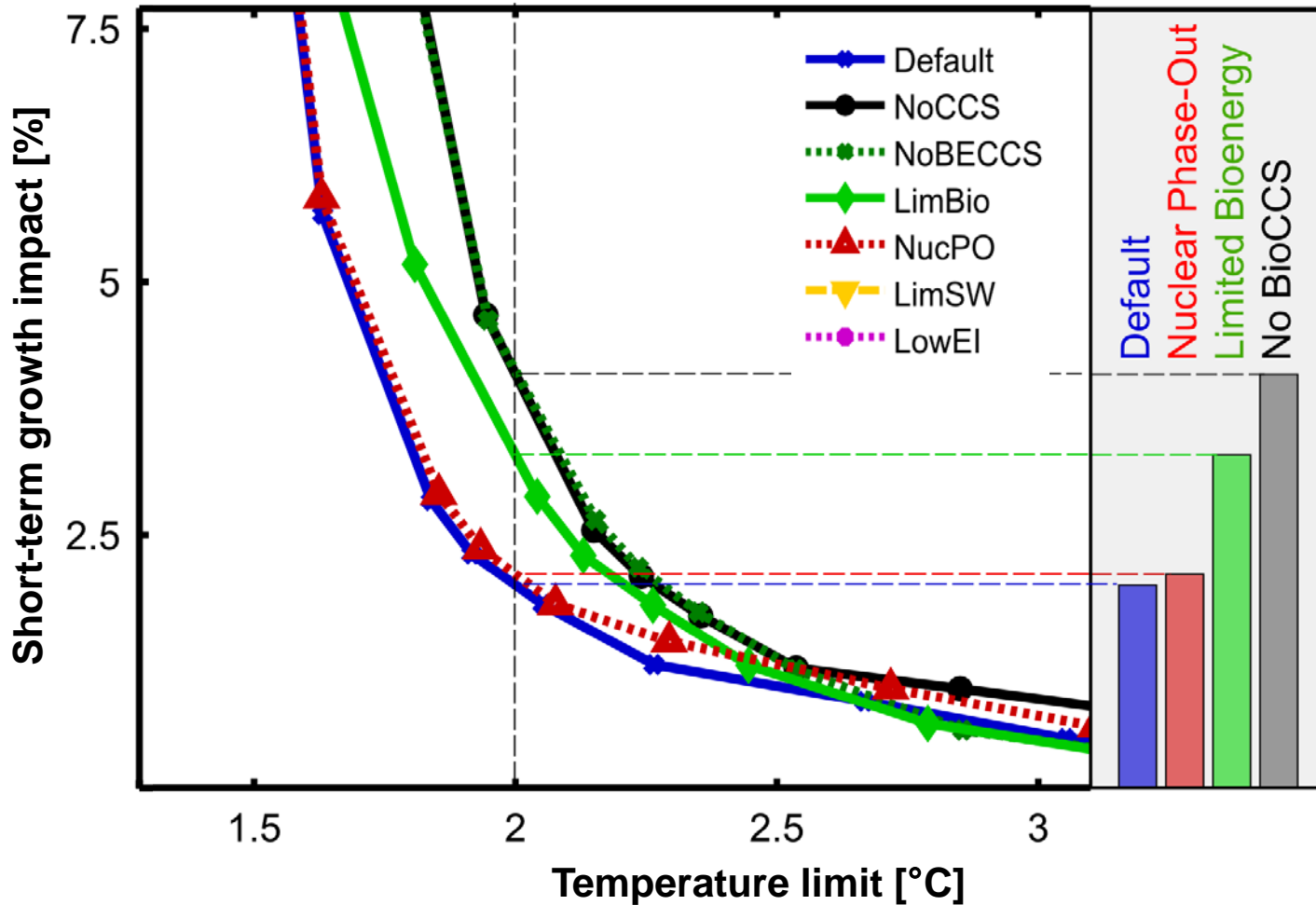
Luderer et al. (2013)

Further delay closes the door for 2°C target



Luderer et al. (2013)

The role of technologies



Luderer et al. (2013)

Important challenges for policy and research

- How to reconcile sustainable bioenergy and food production?
- Technology, geology and societal acceptance of carbon capture and storage
- Integration of variable renewable energy into power systems
- Energy efficiency and demand side policy options
- Low-carbon transport systems for a globalized world
- How to achieve and incentivize international cooperation?

Thank you!

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