14/11/2023

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Degrowth in IAMs: an example with MESSAGEix-Australia

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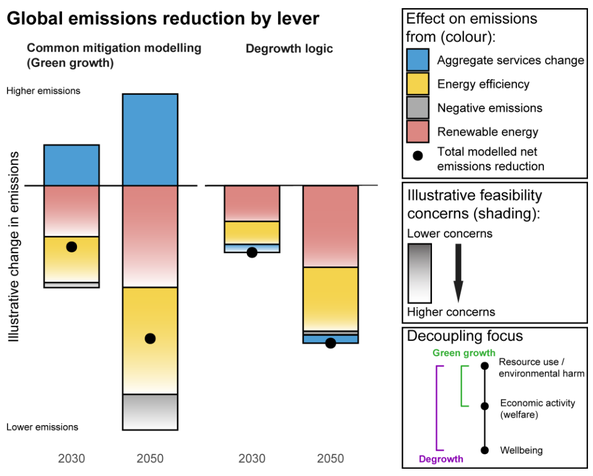
Why model degrowth?

A question of justice:

- Faster emissions reduction in rich countries.
- Intra- and intergenerational justice.

A question of feasibility:

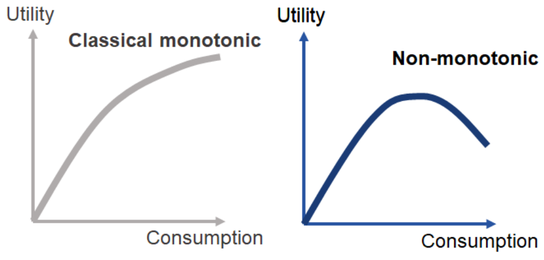
- Reducing 'decoupling' rates?
- Reducing upscaling necessary for (a) renewables, (b) CDR.



The utility function

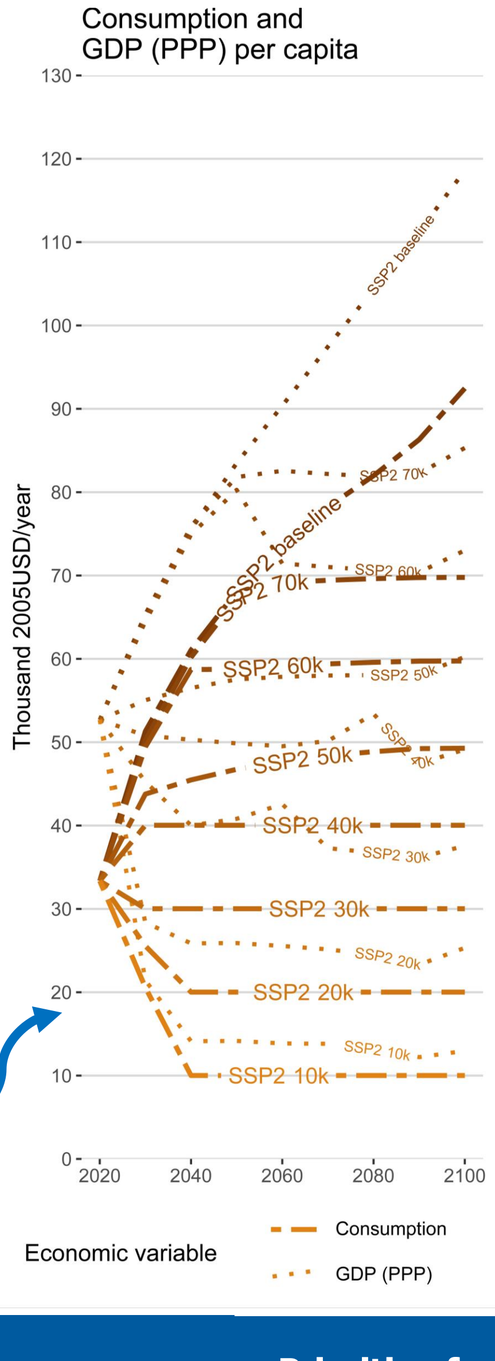
Changing to a non-monotonic utility function allows for:

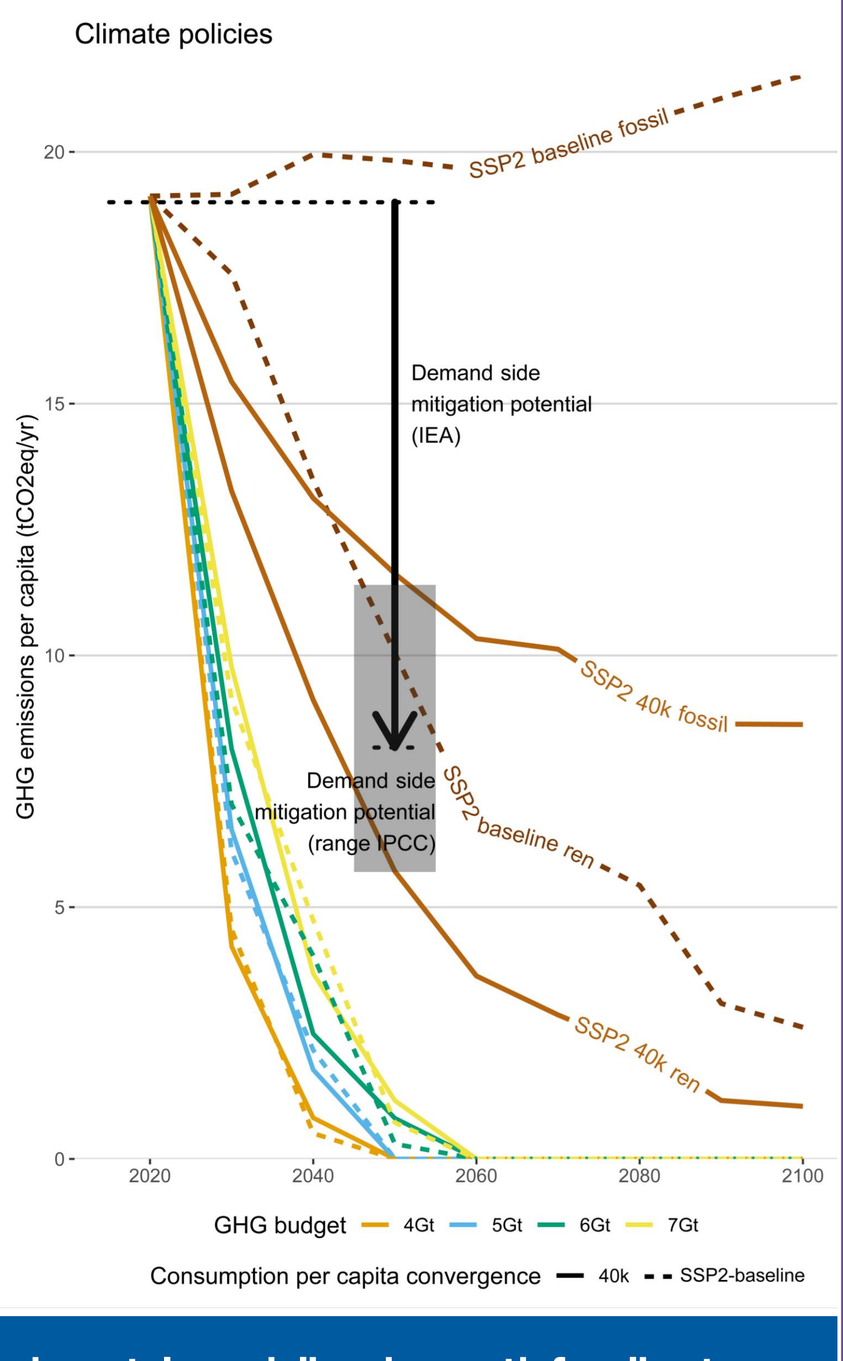
- Flexibly setting the point of convergence
- Endogenizing GDP and investments



Scenarios covering high to (very) low growth

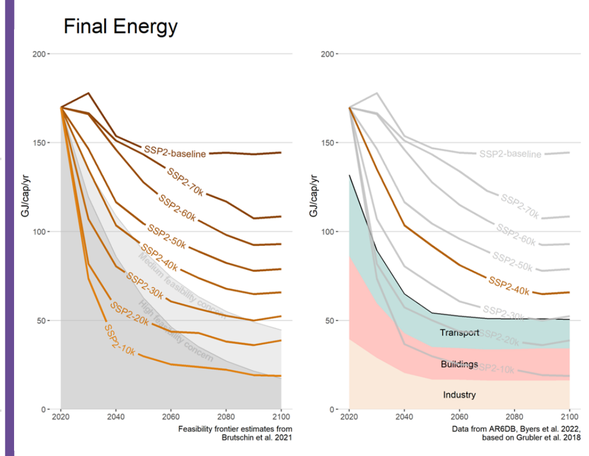
Our structured scenario ensemble (n=51) is based on SSP2, with additional scenarios having utility peaking at 10-70k USD/cap/year. GDP growth in this ensemble goes from **continuing historical growth trends** (+3%/year) to **rapid reductions** (-5%/year). This is combined with 7 climate policies: "Keep fossil fuels", "Expand renewables", and "GHG budget" (five different budgets, 3-7GtCO2).



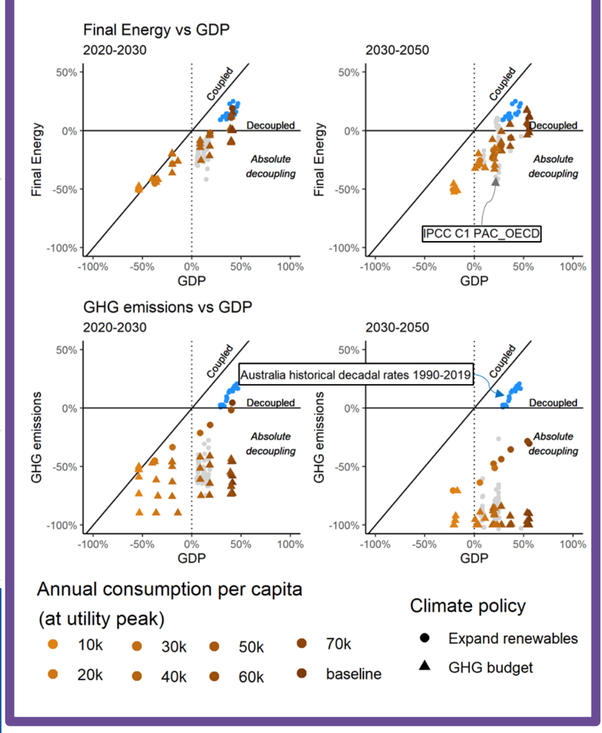


Medium feasibility concerns, while decoupling remains necessary

Final Energy per capita **declines** in the **40k** scenario are about **as fast** as **OECD declines in LED**.



A wide range of different **decoupling** dynamics is observed. Absolute GHG decoupling happens in all cases. For final energy, decoupling in degrowth scenarios is reduced, but is the same for 2030-2050.



What is new?

- Exploring meeting a wide range of mitigation targets
- Identifying the energy supply system benefits
- Linking to poverty and justice
- Highlighting effects on decoupling and feasibility

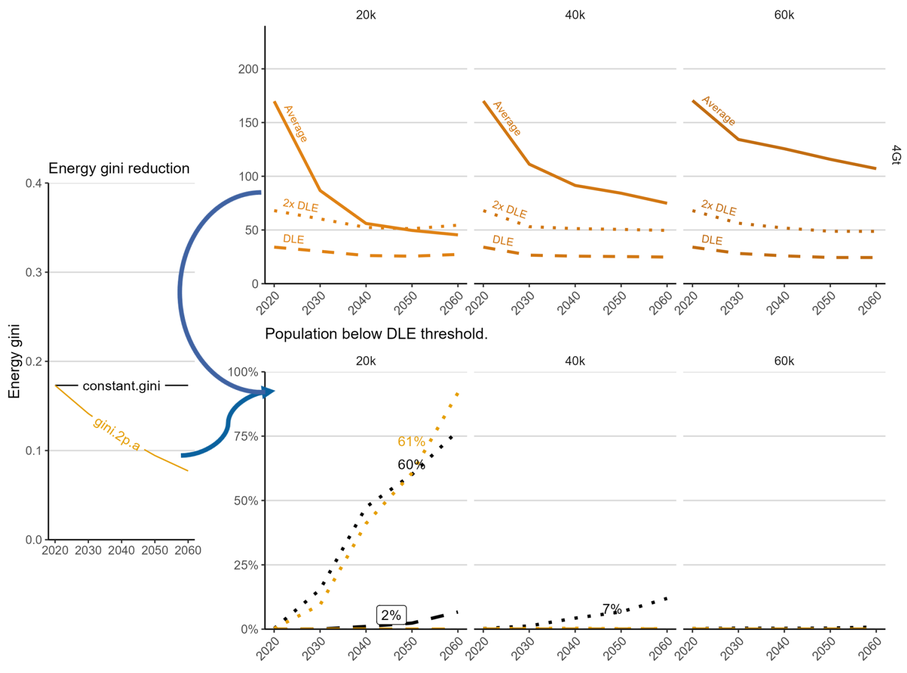
Priorities for adequately modeling degrowth for climate mitigation pathways:

- Sectoral detail: (A) inequality and needs-based accounting (just downscaling), (B) dynamics of energy demand reductions (feasibility)
- International economics: political economy, international relations, and e.g., input-output modeling.

Justice: no need to become poor

By scaling final energy with the final-to-useful energy ratio, we project the energy needed for Decent Living Standards (DLE) in the future.

For the 40k scenario, to ensure nobody falls below 2x DLE in Australia, both **continued energy efficiency** and **inequality reduction** are important.



- Paper 1: Li, Mengyu, et al. "Integrated assessment modelling of degrowth scenarios for Australia." Economic Systems Research (2023): 1-31. https://doi.org/10.1080/09535314.2023.2245544
- Paper 2: Kikstra, Jarmo S., et al. "Downscaling Down Under: Towards degrowth in integrated assessment models." Economic Systems Research (in review). http://dx.doi.org/10.13140/RG.2.2.20355.68647

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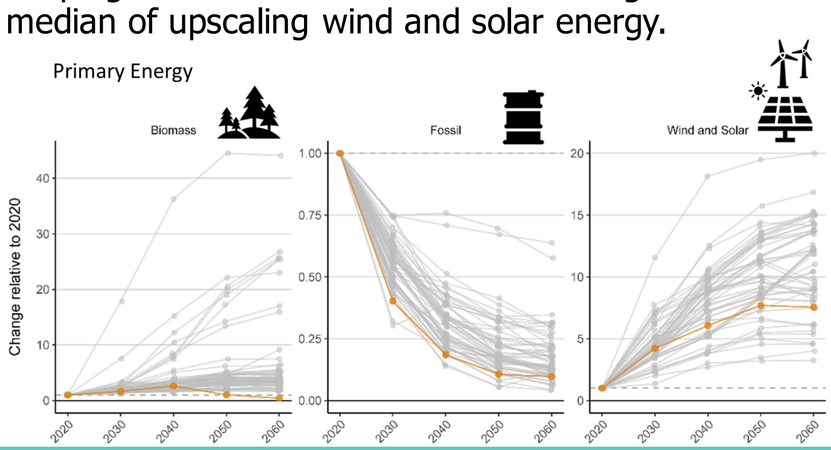
Supply-side benefits of degrowth?

Comparing to the **IPCC AR6 Scenario Database** (category C1, 1.5 with no or low overshoot), the MESSAGEix-Australia run (4Gt, 40k) shows a faster reduction of fossil fuels than 95% of the IPCC scenarios show for the Pacific OECD region, all while keeping biomass to a minimum and being below the median of upscaling wind and solar energy.



Comparing the **SSP2-baseline growth vs the 40k scenario** ("Stopping GDP growth"), both for a 4GtCO2 budget, we find that while wind and solar growth until 2030 still needs to be fast (5.6x vs 4.2x), the mid-century upscaling need is reduced by about 40%.