NAVIGATE

Next generation of advanced integrated assessment modelling to support climate policy making

PIK

Accelerating climate action towards a rapid and just transition: Insights from the NAVIGATE project

Elmar Kriegler (Potsdam Institute for Climate Impact Research)

NAVIGATE Consortium

Science-Policy Event, DG CLIMA Brussels, 10.10.2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

NAVIGATE

Where do we stand with climate action on the EU and international level?

EU Green Deal:

- Headline target for Green Deal in place, 2040 target under discussion (~90%)
- Many instruments are put in place as part of Fit for 55 (ETS, ETS-2, ESR, CBAM, JTF, …)
- Additional regulations being designed (CDR, Net zero industry act, LULUCF regulation, …)
- **Implementation challenges:** multiple crises, finance, public opposition …

➔ **Can the EU master the critical next years until 2030 to put the Green Deal firmly on course?**

Paris Agreement:

- Rule book in place, additional multilateral (G7, JETPs, PPCA, Race to NetZero, Methane pledge …) and non-state actor initiatives (GFANZ, …)
- Implementation lagging behind, 2023 GST largely ineffective so far
- **Implementation challenges:** multiple crises and geopolitical tensions, finance, equity …

➔ **Can the EU provide international leadership?**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

NAVIGATE

How can research in NAVIGATE and ENGAGE support EU climate policy making?

ENGAGE and NAVIGATE analyse mitigation pathways

- for EU, major emitting countries, the world, individual sectors
- providing system-level integrated assessment of mitigation strategies including milestones, benchmarks and targets for policy
- allowing to contextualize policy, socio-economic, technological developments (if-then analysis)
- allowing analysis of mitigation challenges, decarbonization bottlenecks, investments needs, interactions with broader societal objectives, …

➔**Adequate representation of sectors, actors, systems, policies including considerations of equity, institutions, governance, …**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

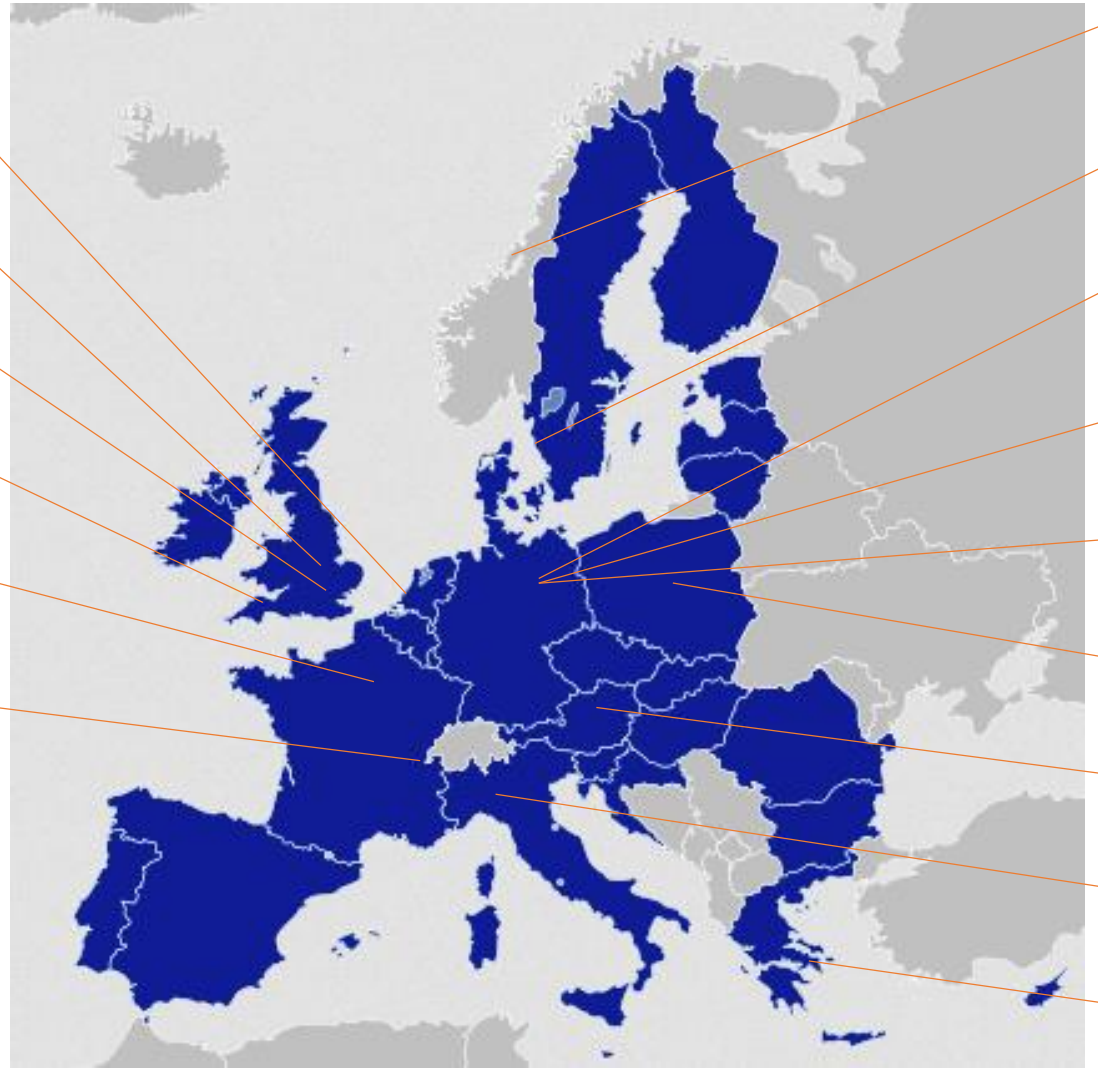
Advancing the next generation of integrated assessment models (09/2019-12/2023)

Horizon 2020

Usability
- Transparency
- Accessibility
- Salience

Transformative systems change
- Economy, technologies, sectors
- Lifestyles, consumption and services

People
- Representing heterogeneity
- Analysing distributional impacts



Rio de Janeiro, Brazil

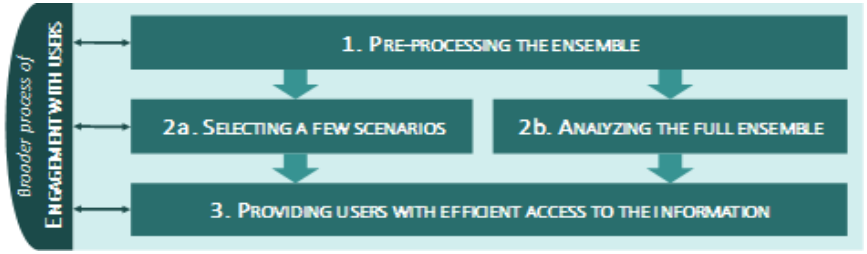
Beijing, China

Picture source: https://commons.wikimedia.org/wiki/File:EU28-2013_European_Union_map.svg

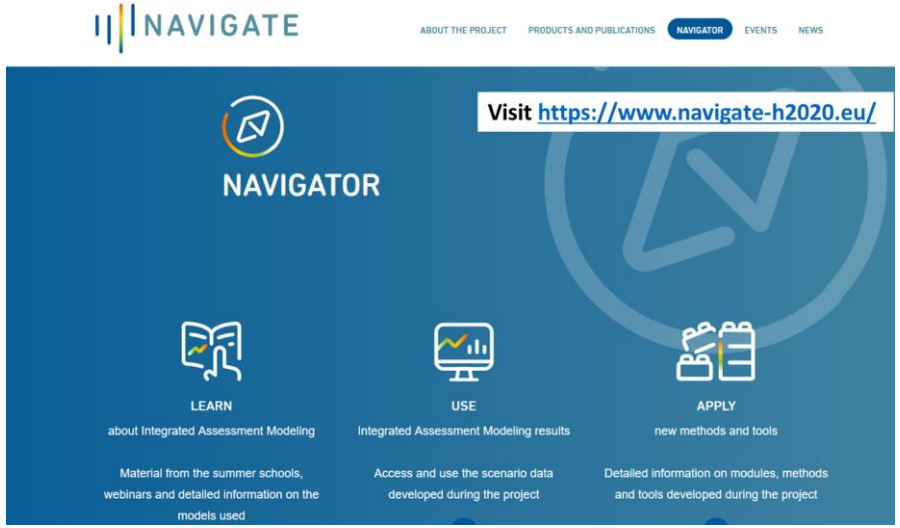
NAVIGATE facilitates user uptake of IAM results

Usability: How to generate insights from large ensembles of climate change mitigation scenarios?

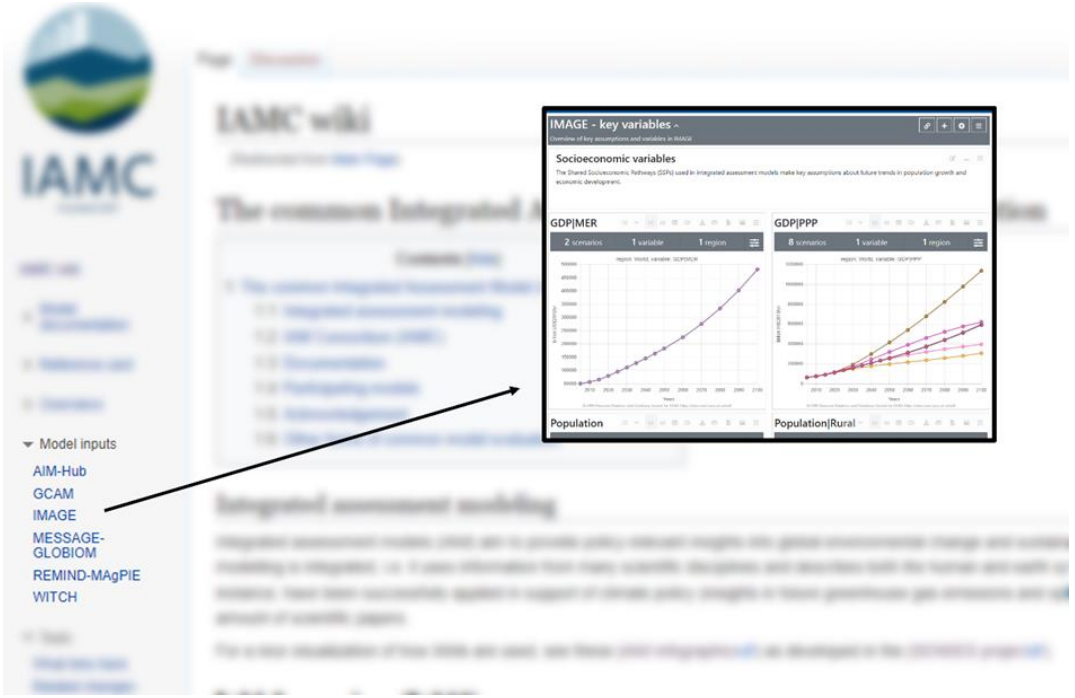
Guivarch et al., 2022, Nat. Clim. Chang. 12, 428–435. https://doi.org/10.1038/s41558-022-01349-x



NAVIGATOR: Collection of tools and data developed by NAVIGATE

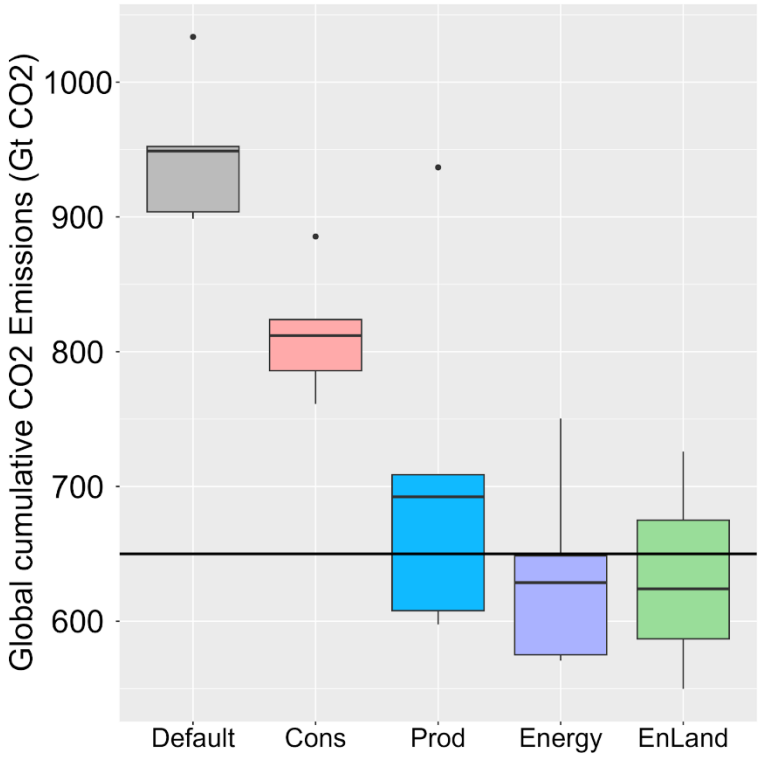


Transparency: IAMC model documentation wiki www.iamcdocumentation.eu



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Closing the gap to 1.5°C mitigation action



Strefler et al., 2023, in preparation

Simultaneous and immediate use of key entry points to deep emissions reductions can accelerate action and close the gap between well below 2°C and 1.5°C (by 2100)

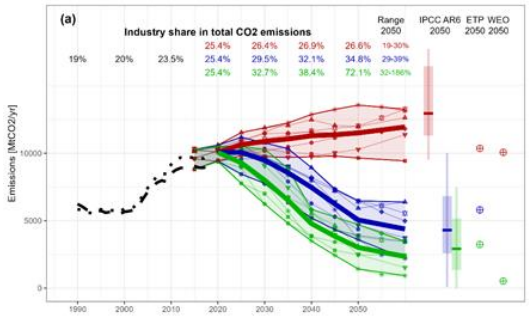
- **Prod:** Decarbonizing electricity, direct and indirect electrification, CCS for industry and CDR, biomass as feedstock
- **Cons:** efficiency improvement, reduced floorspace and transport demand, model shift, building insulation
- **Energy:** Prod+Cons
- **EnLand:** Add advanced land use polices – deep non-CO2 reduction, forest (and peatland) protection, land-based CDR, dietary change

➔ BO Session 1: How to achieve rapid and effective decarbonization across different sectors

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Deep transformations in individual sectors

Industry



➔ Industry table in BO Session 1 (Nico Bauer)

Agriculture and land use

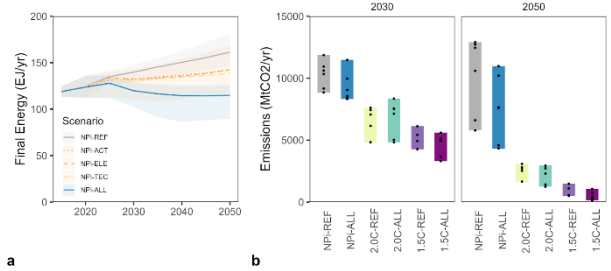
Non-CO_2 emission reduction potentials

➔ Road transport table in BO Session 1 (Gunnar Luderer)

Road transport

International shipping and aviation

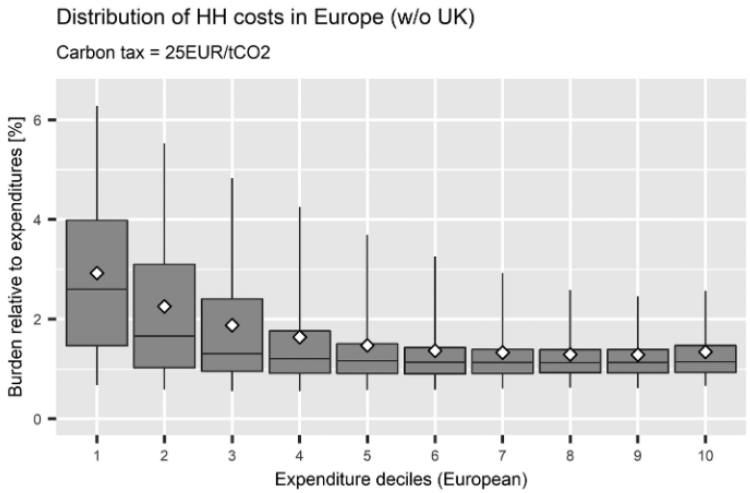
Buildings



➔ Buildings table in BO session 1 (Alessio Mastrucci)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Distributional implications of climate change



Mitigation policies tend to be regressive in many regions

- **Example:** 25$/tCO2 in Europe ➔ 3% expenditure increase for lowest decile, 1.5% for highest

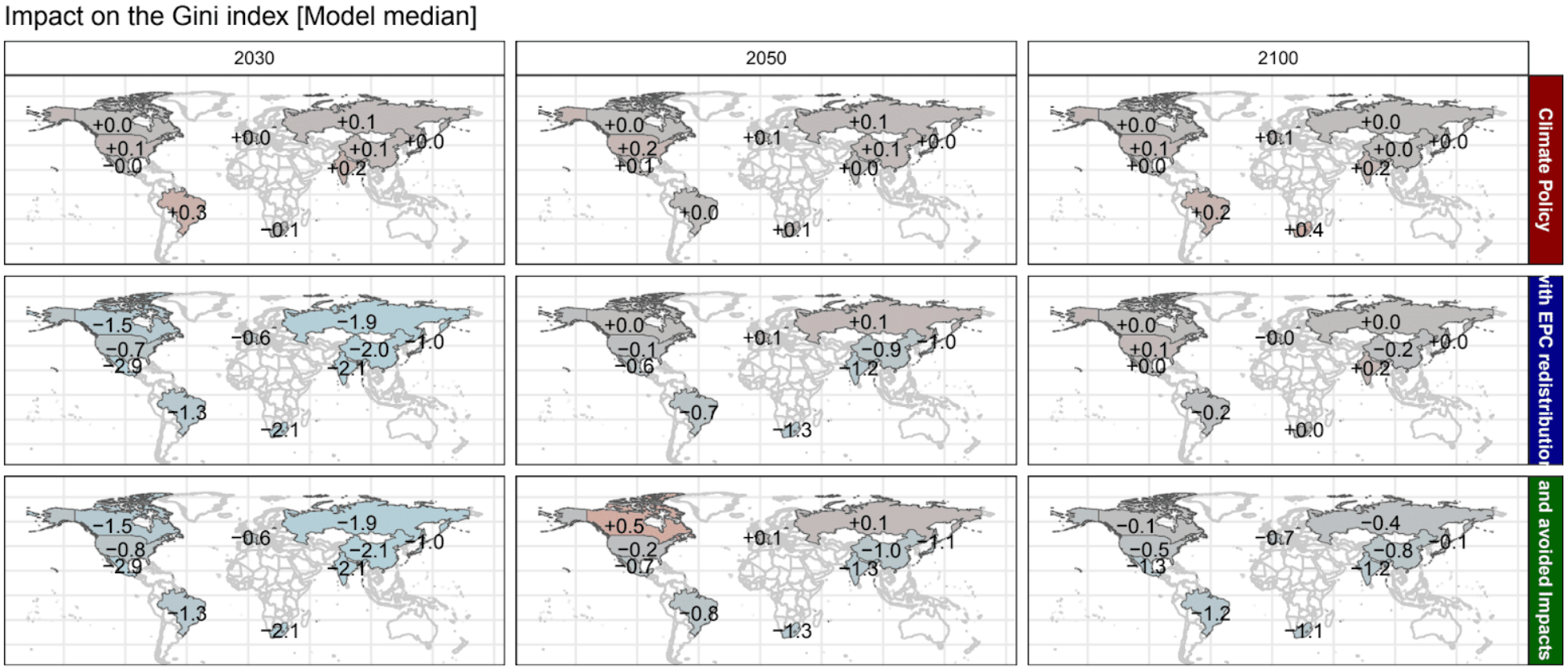
Feindt et al., 2021, Energy Economics 103: 105550

Climate change impacts affect the poor disproportionally

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Mitigation pathways benefit the poor

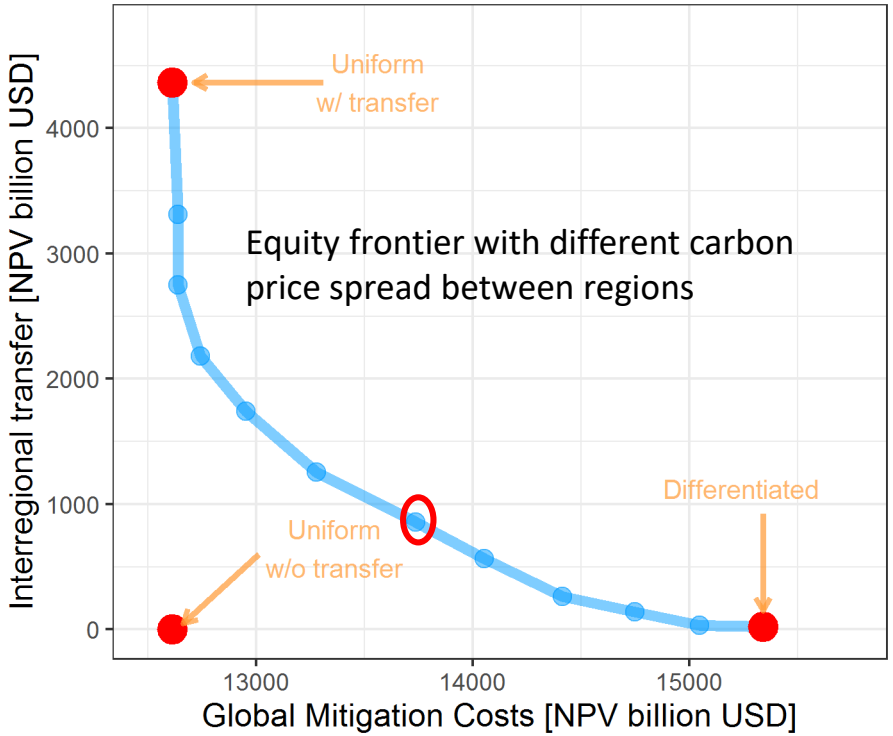
Inequality consistently reduced in 1.5°-2°C mitigation pathways from a combination of redistributive policies using carbon pricing revenues and avoided increase in inequality from climate damages.



➔ BO Session 2: Just transition and economic growth: An income and employment perspective on the EU and global level

Emmerling et al., 2023, in preparation

Global collective action: Efficiency-equity-sovereignty trade-off



Source: Bauer et al. 2020, Nature 588: 261-269

Equitable effort sharing can be achieved by a combination of limited international financial transfers and moderate spread of domestic mitigation action.

- For instance, reducing carbon price spread by 75% (from a factor 100) lessens global inefficiency by 56%, and requires only around 20% of transfers needed under a globally uniform carbon price.
- Strong deviations from uniform carbon pricing distort markets and put other sustainability goals at risk

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

NAVIGATE

Visit https://www.navigate-h2020.eu/

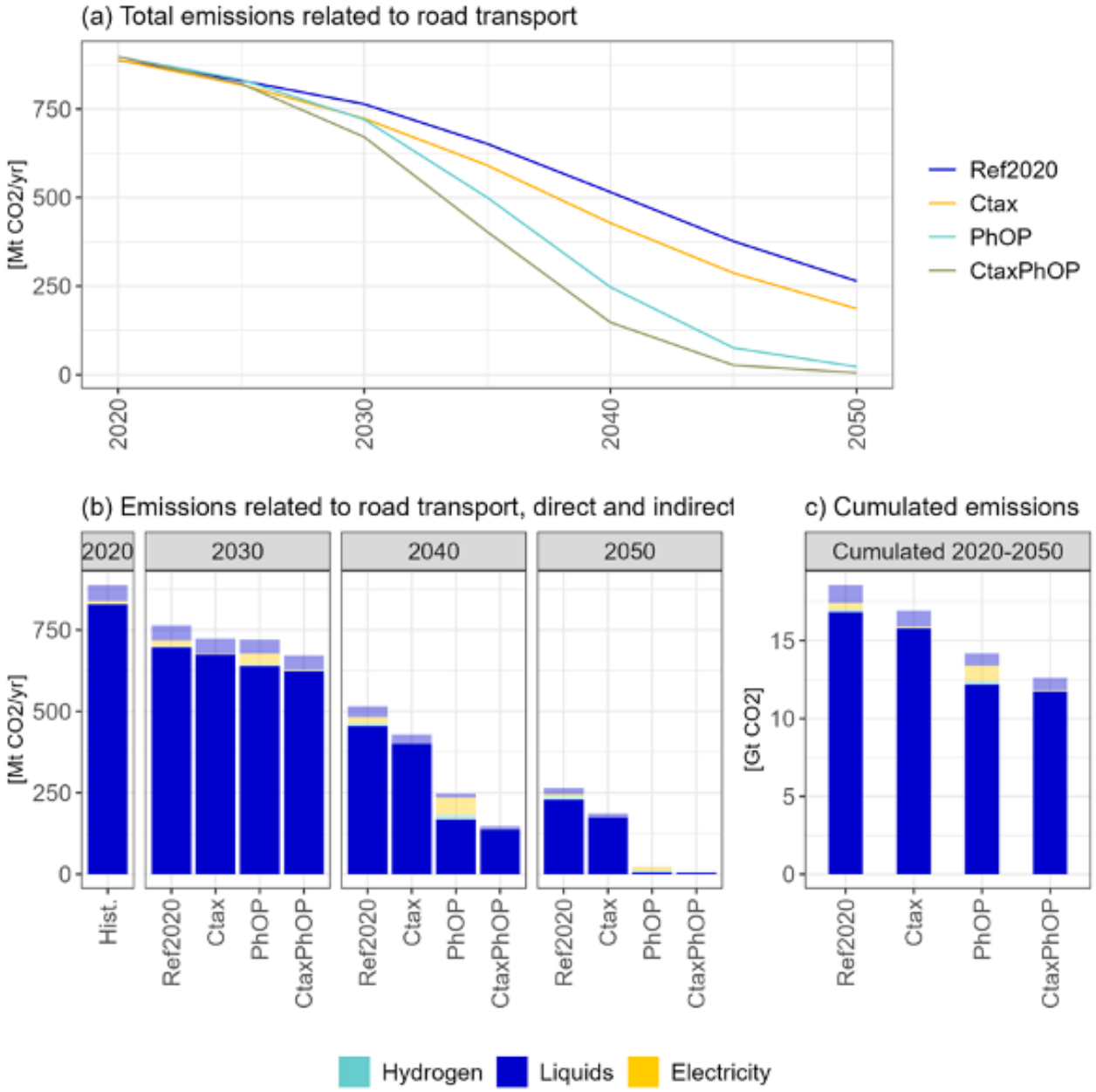
Presentation of insights from the NAVIGATE project at today's meeting	
9:50-11:00 Room 402+416	**How to achieve rapid and effective decarbonisation across different sectors?**
	• Entry points to close the gap to 1.5°C pathways • Decarbonising the production side • Decarbonising the demand side • Round table discussions on sectoral deep dives: Industry, Transport, Buildings
11:20-12:30 Room 374	**Just transition and economic growth: An income and employment perspective on the EU and global level**
	• Distributional implications of climate policies and impacts and the effect of redistribution • Economic growth and employment effects of carbon price revenue recycling

https://www.navigate-h2020.eu/navigate-synthesis-report/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

NAVIGATE

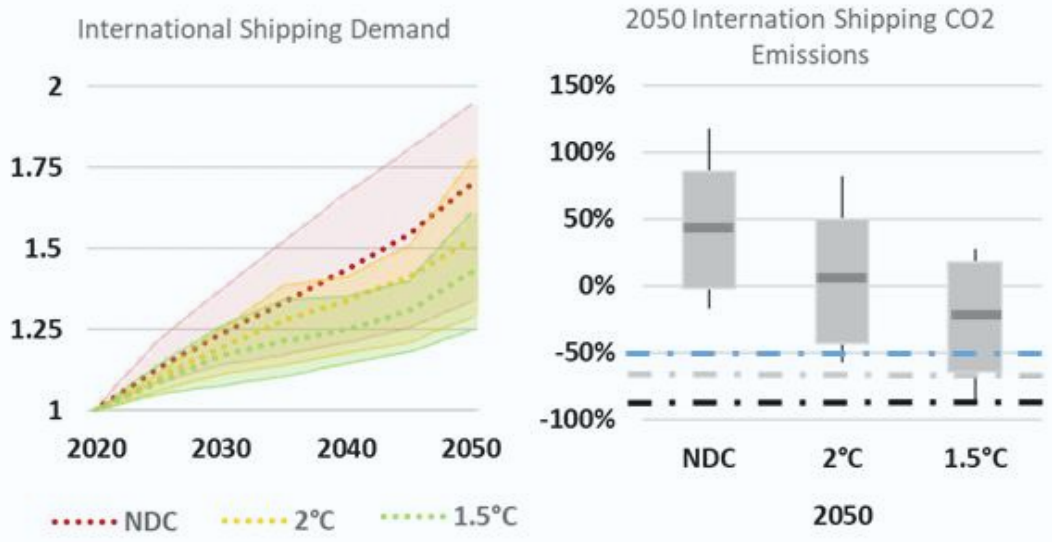
EU road transport scenarios for different policy mixes



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

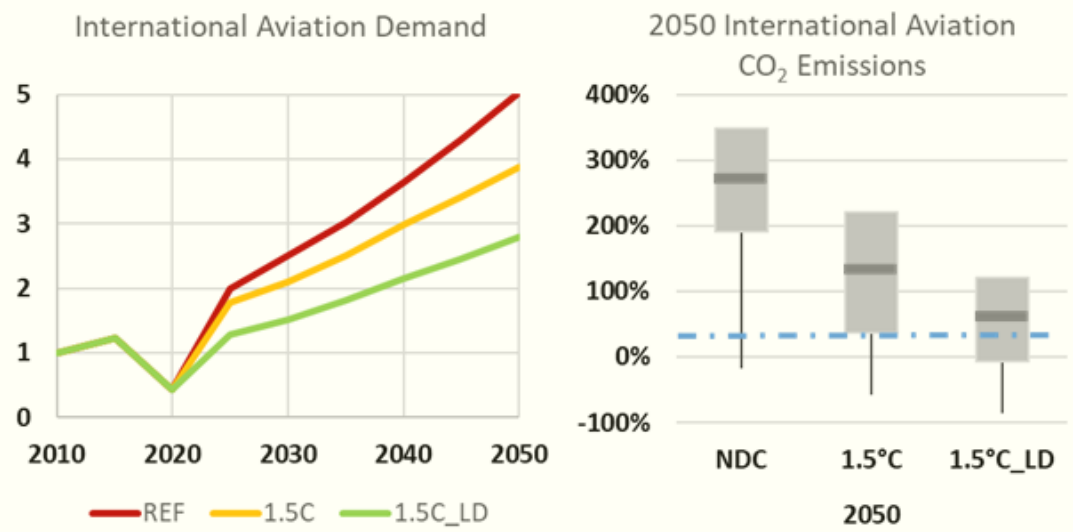
Rottoli et al., 2023, submitted.

International shipping and aviation in 1.5°C pathways



Declining (1.5°C) to stabilizing (2°C) CO_2 emissions by 2050

- Reductions by fuel switching and (less) efficiency improvements
- Biofuels and alcohols most promising in short-term, ammonia and synthetic fuels essential towards 2050
- IMO 2018 emission reduction target for sector (-50% by 2050) remains on the ambitious side of 1.5°C scenarios



International aviation harder to decarbonize than shipping

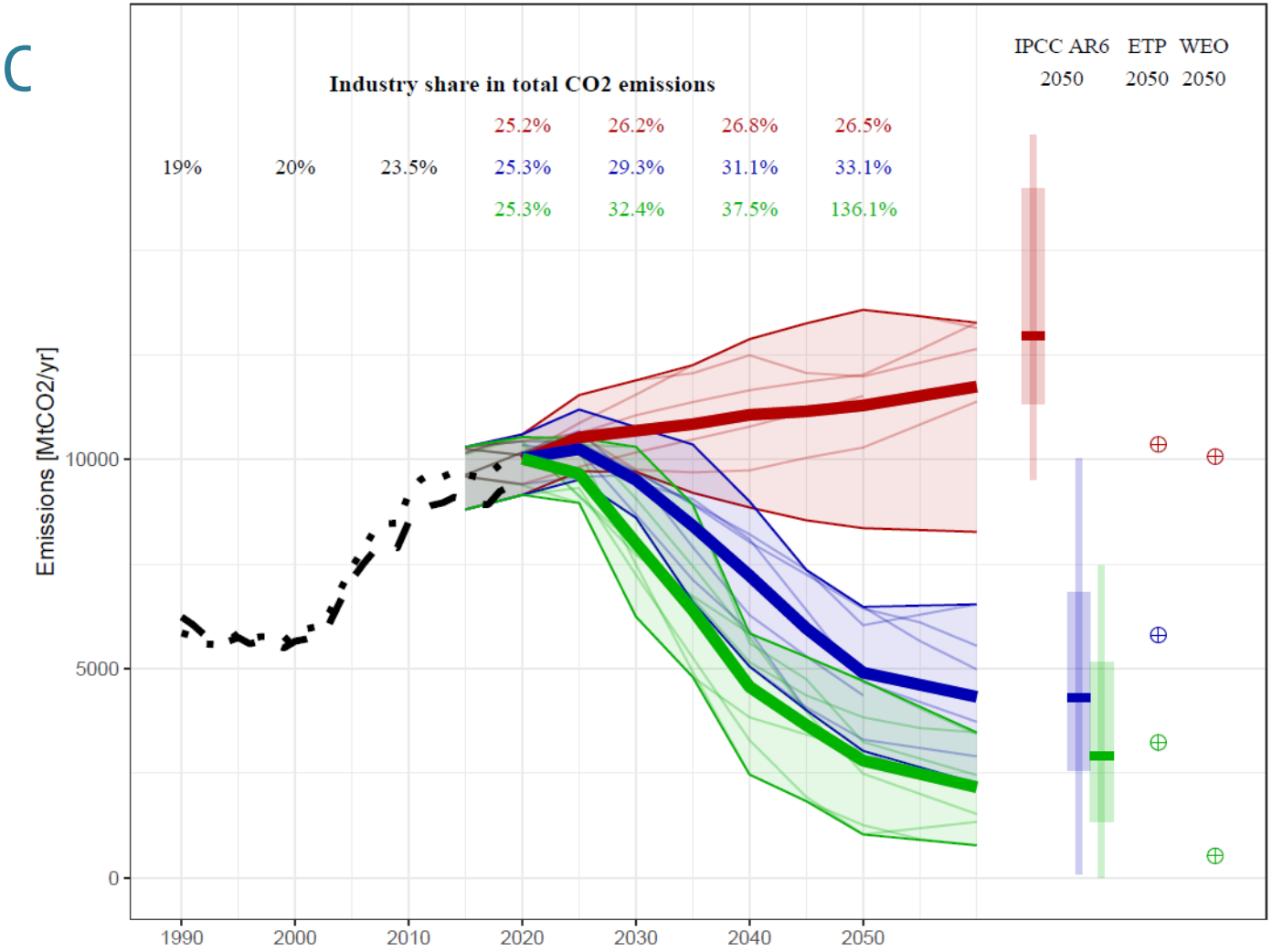
- Emissions increase until 2050 even in 1.5°C scenarios
- Large increase in aviation demand
- Limited efficiency improvements and fuel substitution
- Biokerosene limit by biomass availability, e-fuels slow

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Dessens et al., 2023, in preparation

Deep decarbonization c industry

- To limit warming to 1.5°C by 2100, rapid and deep industry sector decarbonization is required, particularly in developed countries, leading to a reduction of global industry sector CO2 emissions to around 3 GtCO2 by 2050 (about 2 GtCO2 lower than in the well below 2°C scenario).
- For the EU, models with the largest industry decarbonization potential project CO2 emissions reductions of 73 to 82% by 2040 and 83 to 95% by 2050 relative to 2020.

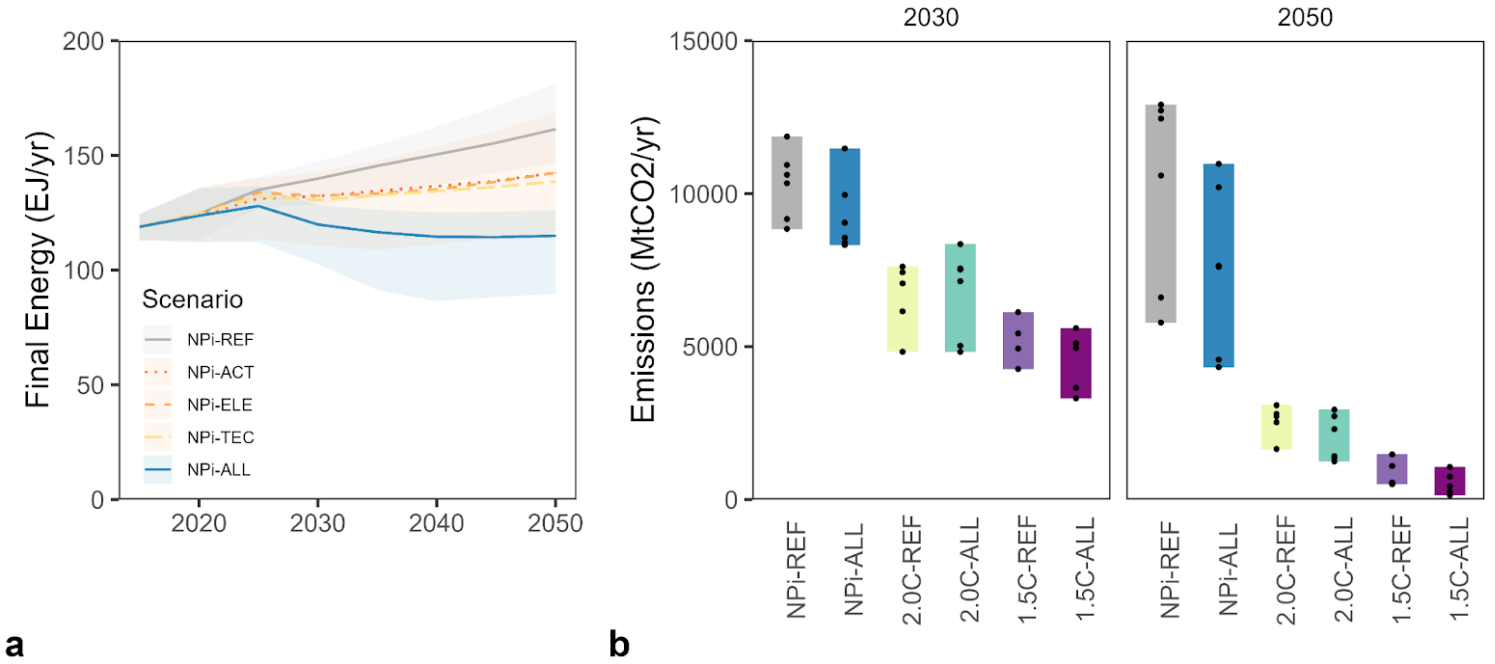


Bauer et al., 2023, in preparation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Deep demand-side reductions in buildings

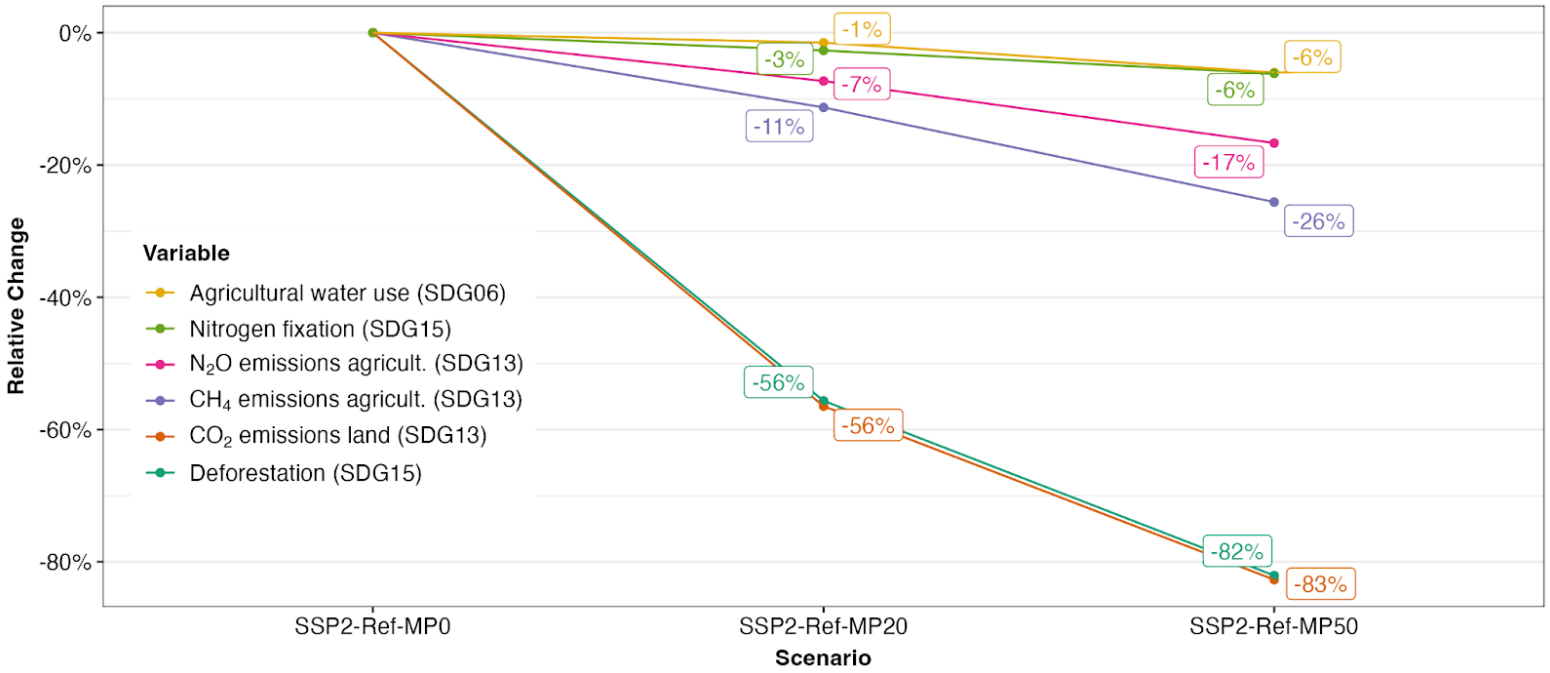
Combining stringent decarbonisation of energy supply with building sector policies including activity reduction, electrification and fuel shifts, and energy efficiency improvements can reduce total CO2 emissions in the global and European building sectors by up to 95% in 2050 compared to a reference scenario without stringent decarbonisation and building sector policies. The building sector policies are critical to fully capitalize on the decarbonisation of energy supply in the sector.



Mastrucci et al., 2023, in preparation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

New option for reducing livestock emissions



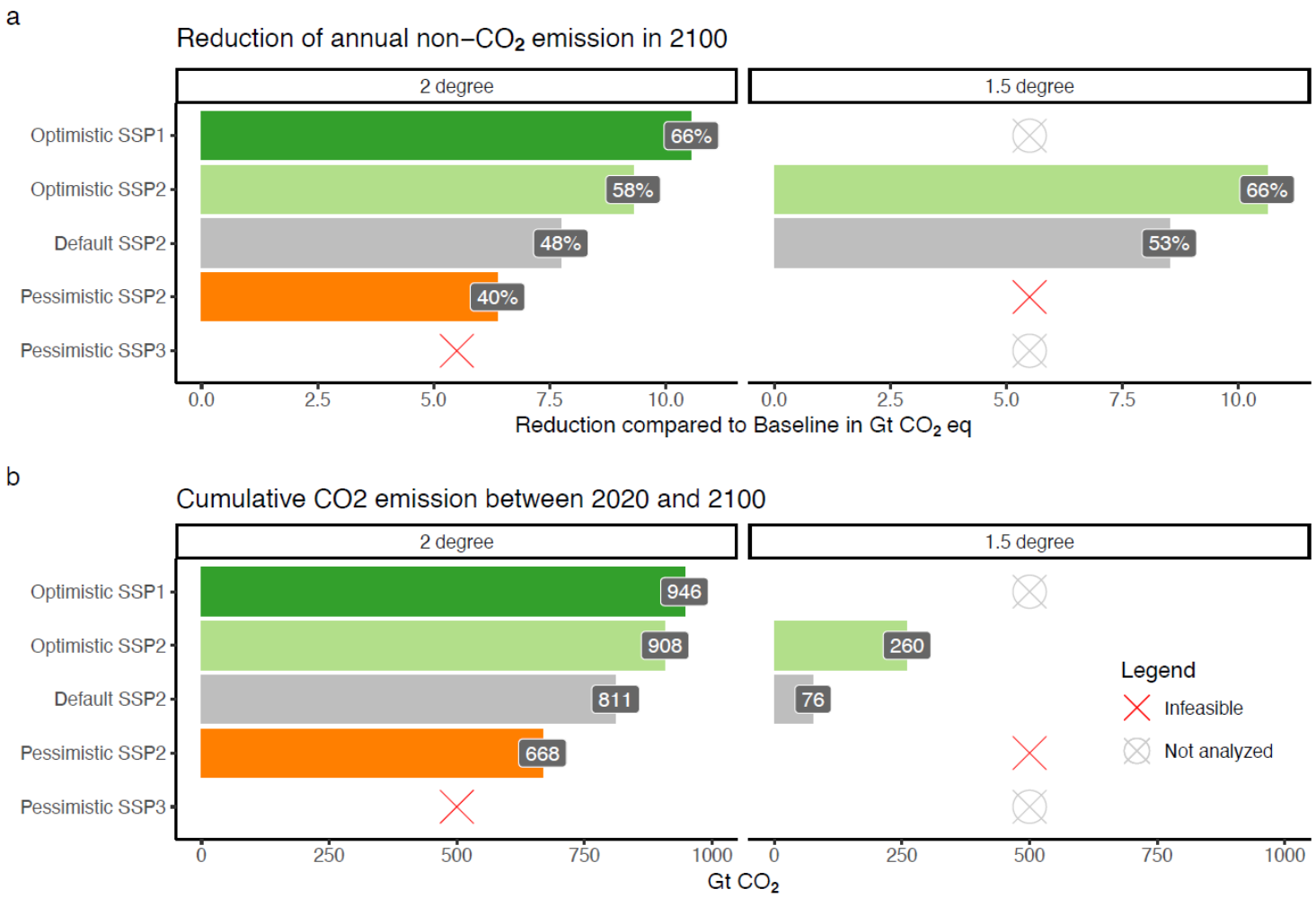
Humpenöder et al. (2022) Nature 605, 90–96.
doi: 10.1038/s41586-022-04629-w

Substituting ruminant meat with microbial protein

- Substituting 20% of per capita consumption by 2050 halves global deforestation and land use CO2 emissions.
- Also lowers CH4 emissions from ruminants and reduces N2O emissions from fertilizers.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

The key role of Non-CO_2 mitigation potentials for 1.5-2°C mitigation pathways



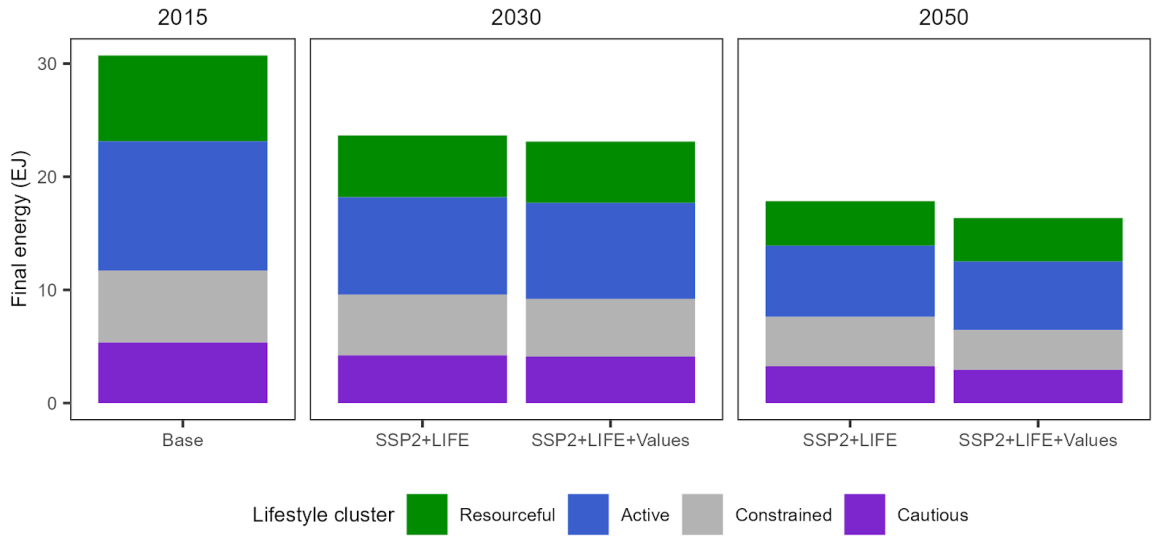
Harmsen et al., 2023, Nat Commun 14, 2949.
https://doi.org/10.1038/s41467-023-38577-4

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

System-wide change: Example lifestyle change

Many entry points for enabling low-carbon lifestyle change

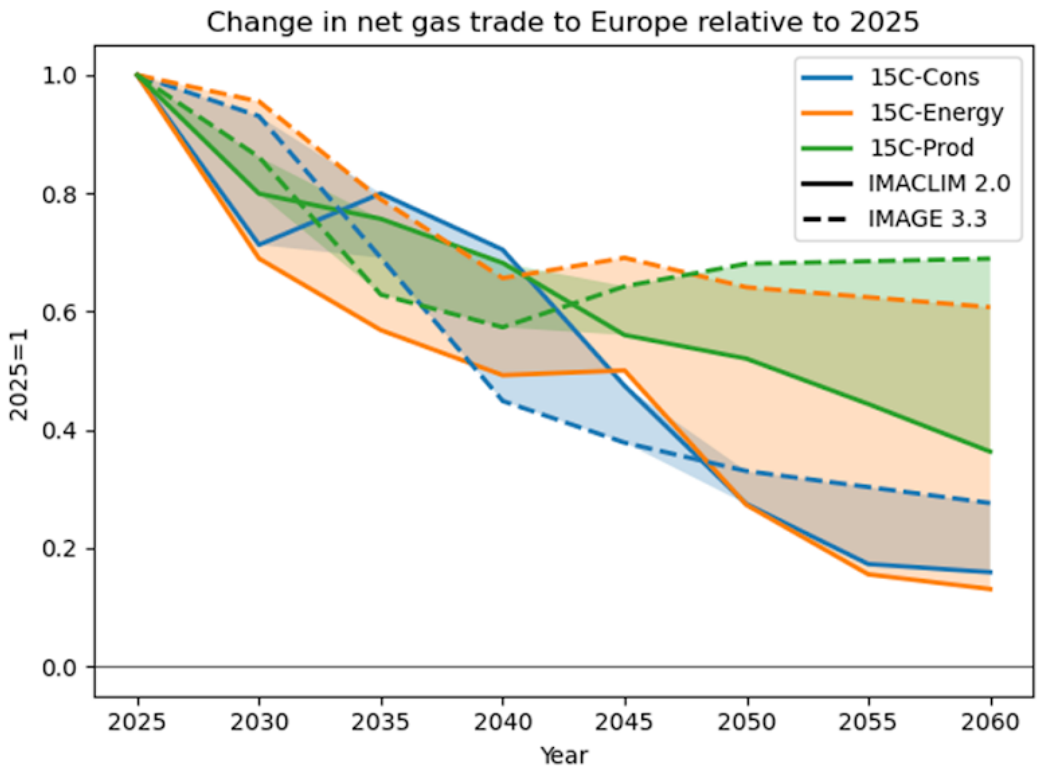
- Lifestyle change can act as an amplifier for technology- and policy-driven transformations.
- Lifestyle change needs to be enabled by targeted policy and infrastructure measures that widen access, skills, capabilities and opportunities for engaging with climate action.
- Lifestyle groups with lower inherent propensities towards low-carbon lifestyles should not be ‘left behind’ by mitigation policies.

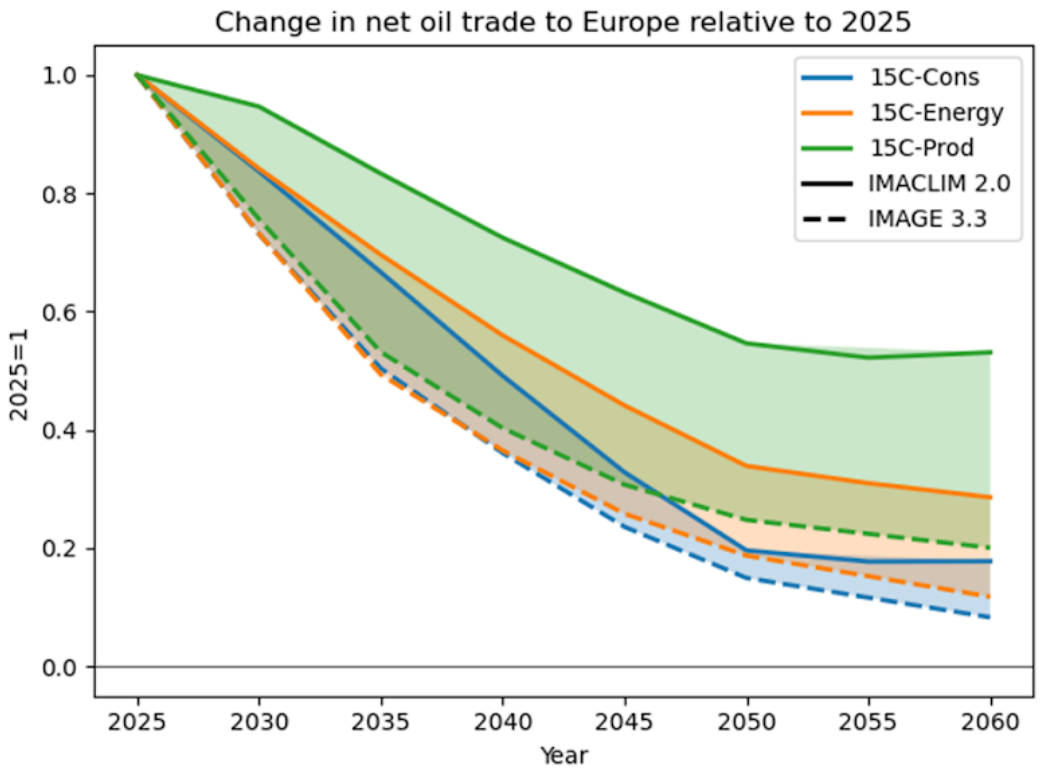


- Pettifor et al. (2023) Global Environmental Change 82: 102739. DOI: https://doi.org/10.1016/j.gloenvcha.2023.102739
- Pettifor et al. (2023). Environmental Research Letters.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 821124.

Synergy between EU mitigation and energy security

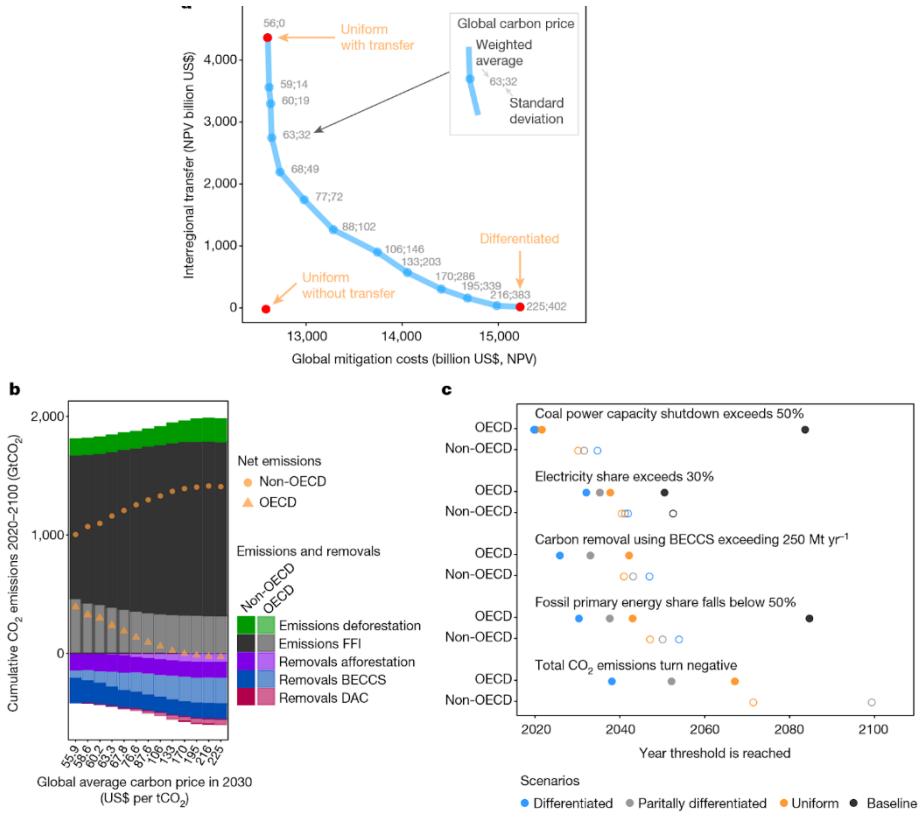




Van Ruijven et al., 2023, in preparation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.

Equity-Efficiency-Sovereignty trade-off



Source: Bauer et al. 2020, Nature 588: 261-269

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 821124.