SHAPE

Sustainable Development Pathways reflecting different societal perspectives: Key results from the SHAPE project

Bjoern Soergel[1], **Ariel Hernandez**[2], Sebastian Rauner[1], Elmar Kriegler[1]

for the SHAPE consortium:

[1] Potsdam Institute for Climate Impact Research - PIK
[2] German Institute of Development and Sustainability - IDOS)
…

AXIS | JPI Climate

Linking climate action and sustainable development

Rich and growing body of research:

- SD indicators, targets, trends
- Synergies and trade-offs (particularly between climate and other SDGs)
- Role and limitations of IAMs to inform SDG agenda
- Inter-/transdisciplinary approaches

Research gaps:

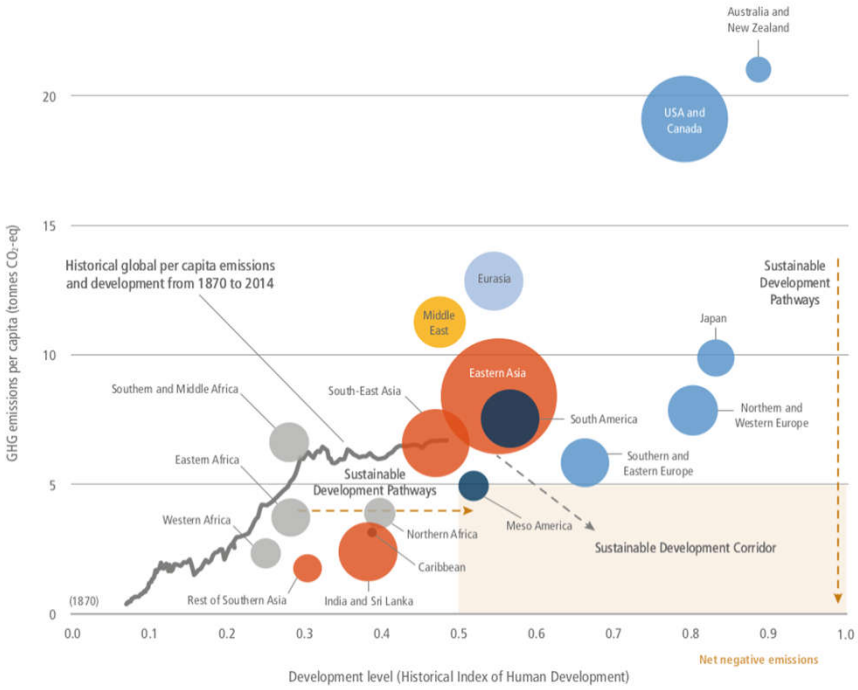
- SD narratives for research
- Holistic sustainable development pathways

SDG 13: Take urgent action to combat climate change and its impacts

Paris Agreement: "...strengthen the global response to the threat of climate change, in the context of **sustainable development** and **efforts to eradicate poverty"**

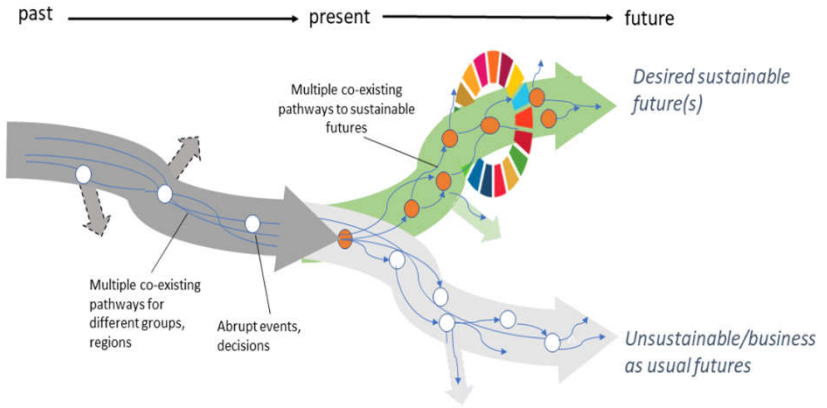
Sustainable development pathways (SDPs)

Sustainable Development Pathways are region-specific



IPCC AR6 WGIII Ch1, Fig. 1.6

Reflecting different perspectives through multiple SDPs



Aguiar et. al (2020); Roy et al (2019); Fazey et al (2016)

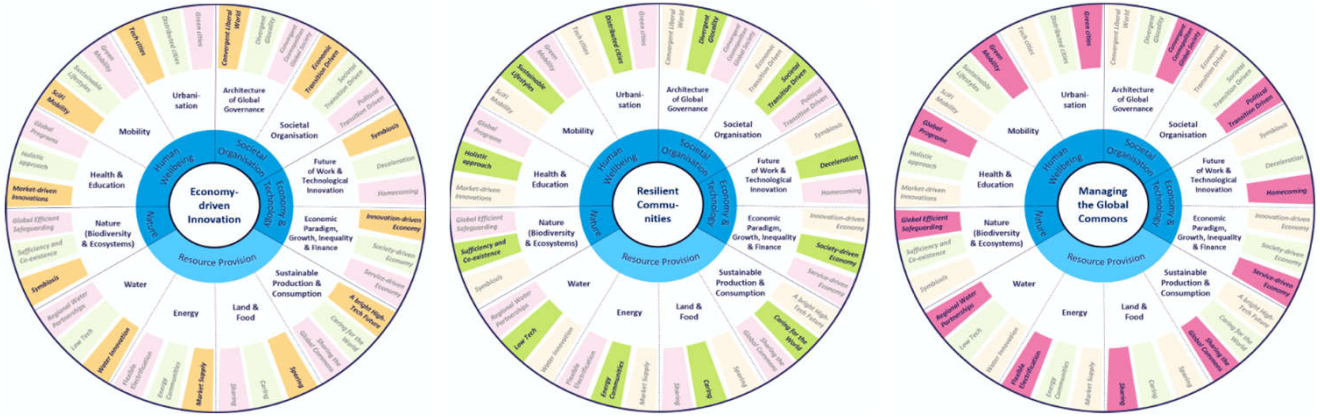
- Holistic coverage of SDG+ space (2030-2050+)
- Combining multiple transformations of human-society-nature systems
- Exploiting synergies and mitigating trade-offs

SHAPE scenario building & co-design process

1. Identify relevant SD **dimensions** (*incl. social sciences!*)
2. Create **alternative SD strategies** for each dimension
3. Align dimensions to overarching **scenario narrative**
4. Translate narratives to **modelling protocol**
5. **Quantify scenarios** using models (IAMs + industrial ecology)
6. **Pathway appraisal** from governance perspective

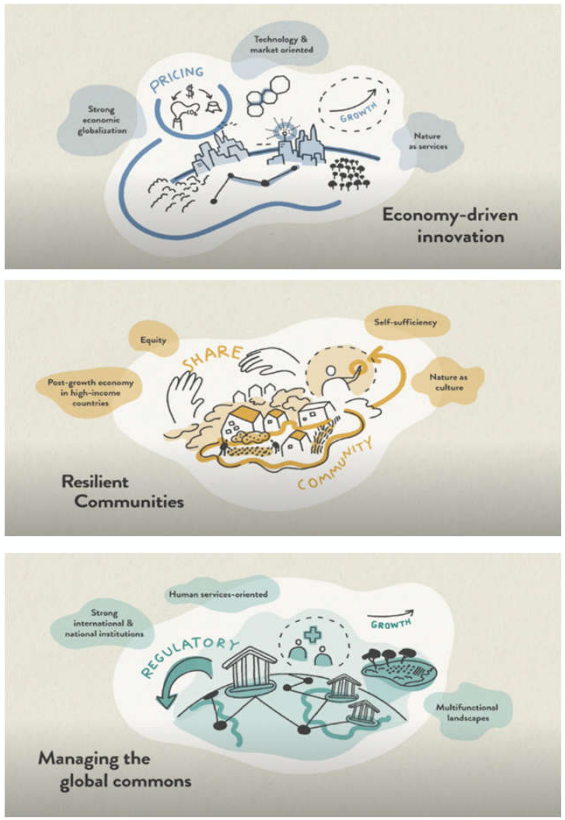
+ continued stakeholder dialogue & co-design over entire process

-> scenarios designed to reflect different (regional, societal, economic) perspectives on how to pursue SD



SHAPE SD narratives

reflecting different perspectives on how to pursue SD



Illustrations by Elsa Wikander / Azote

Economy-driven Innovation (EI)

- Technology, innovation and efficiency
- Continued economic growth
- Pricing (e.g. carbon, biodiversity loss, …) as important policy instrument

Resilient Communities (RC)

- Solidarity, well-being, equitable sharing of resources
- Post-growth (in high-income countries)
- Lifestyle change, low material consumption patterns

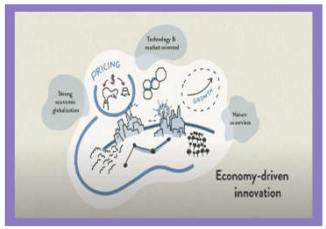
Managing the Global Commons (MC)

- Strong international & national institutions
- Moderate economic growth, orientation towards human services
- Strong regulatory policies

GDP per capita

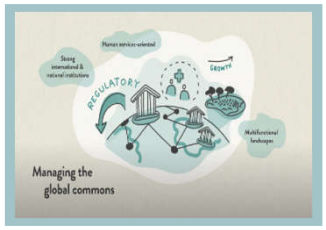
Global

Narrative

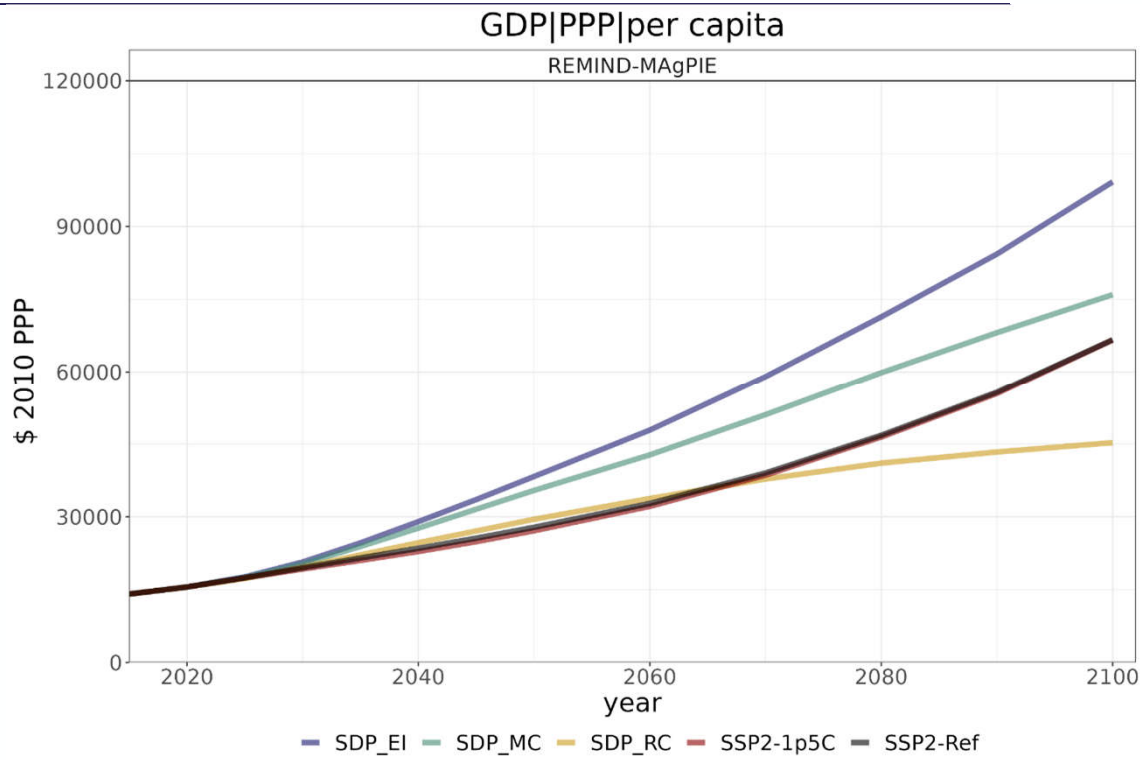


EI: Continued high growth in all regions, medium to strong convergence

RC: Post-growth in Global North, continued growth in Global South, medium to strong convergence

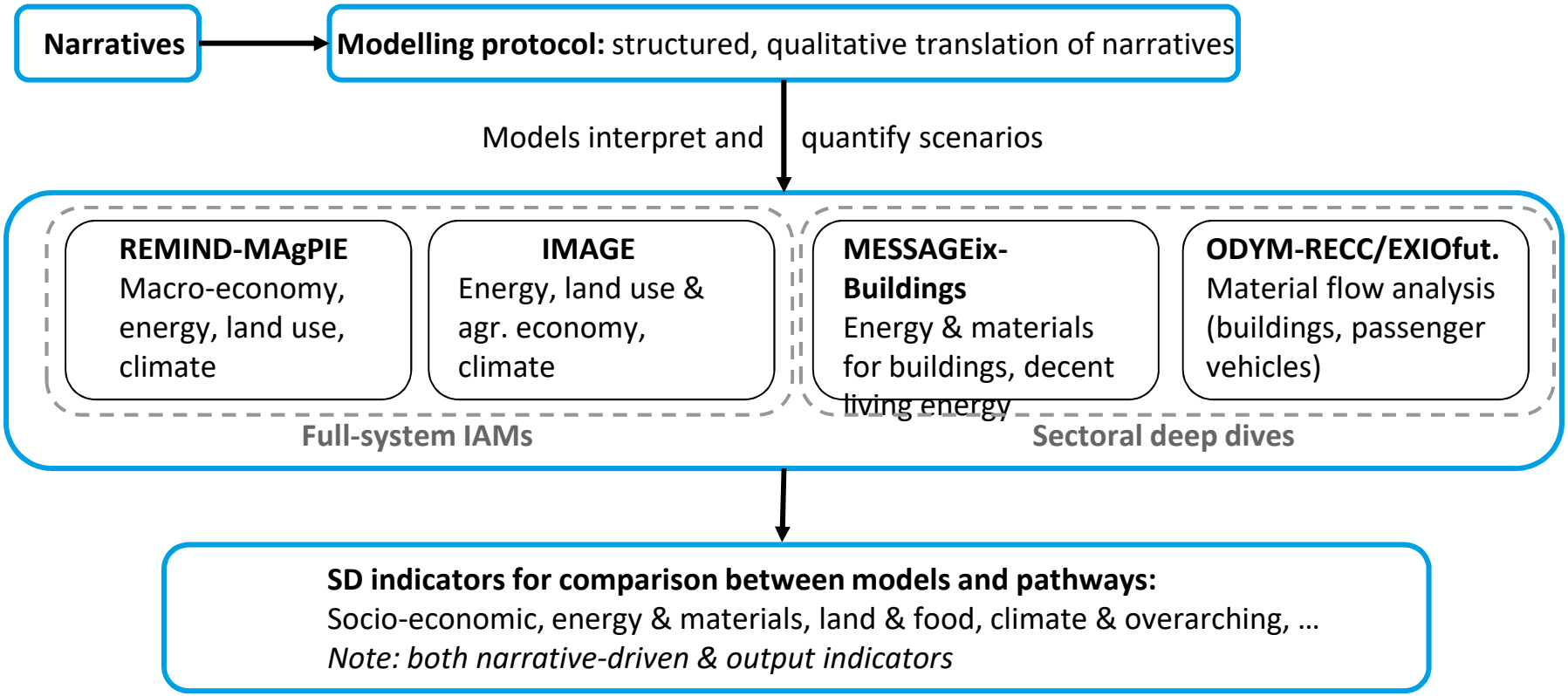


MC: Moderate growth in Global North, high growth in Global South, strong convergence



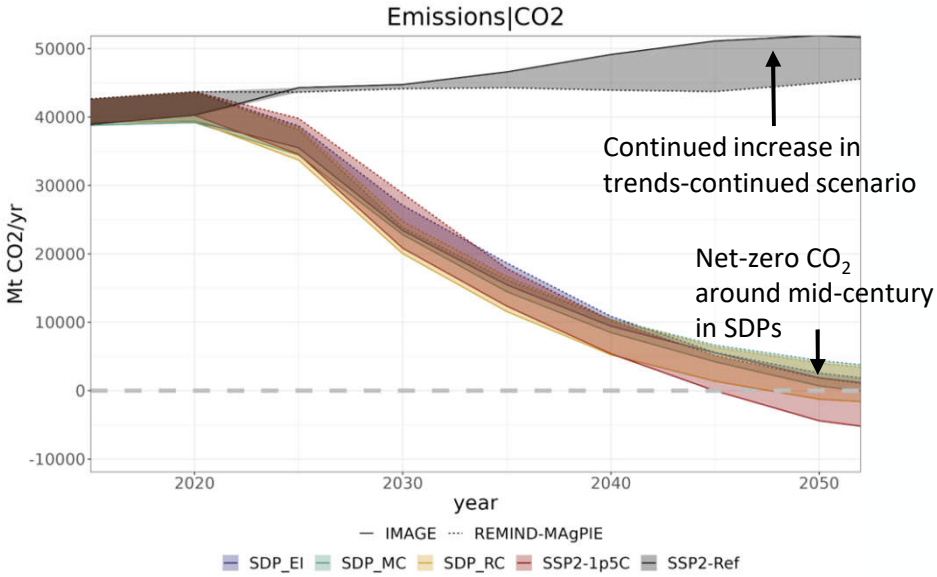
SHAPE models

Translating narratives into quantitative scenarios



SHAPE SDP scenarios
Common features and differences

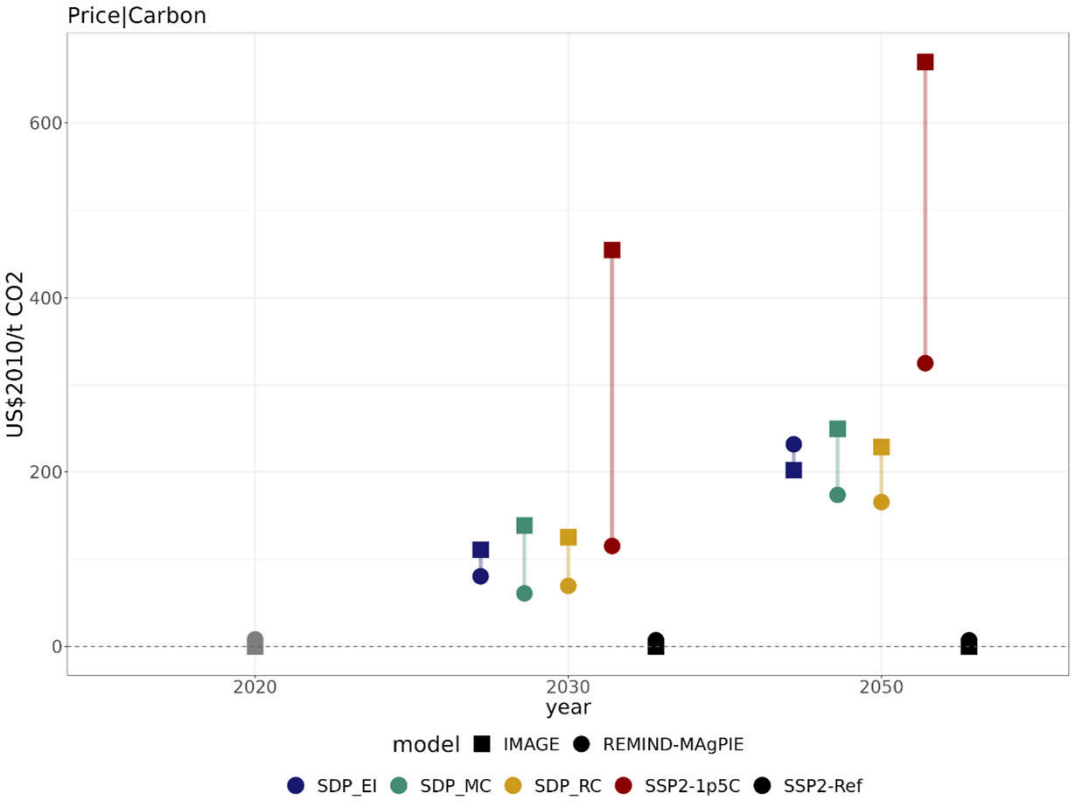
- All SDPs (**EI**, **MC**, **RC**) aim to **meet the SDGs** or **make as much progress as possible** (population, education & demographics are the same)
- All SDPs **require functioning and stable governance**
- **Strategies & policy options differ** between the SDPs (following narratives)
- All SDPs **meet the 1.5°C target** (allowing for small and temporary overshoot).
- Scenarios for comparison:
  - "Trends-continued": **SSP2-Ref**
  - "climate-only": **SSP2-1p5C**



Note: All results are "pre-final". Minor changes during scientific review are possible.

Climate mitigation effort

Required carbon prices for 1.5°C target



- Meeting the **1.5°C target** requires **substantial carbon prices** already by 2030, further increase until 2050
- SDPs **reduce required carbon prices**, through different strategies
  - Demand-side shifts (**RC**)
  - Technology & innovation (**EI**)
  - Mix of both (**MC**)
- **Global equity:** SDP scenarios include energy access compatible with decent living standards in Global South (SDG 7)

Inequality & Poverty

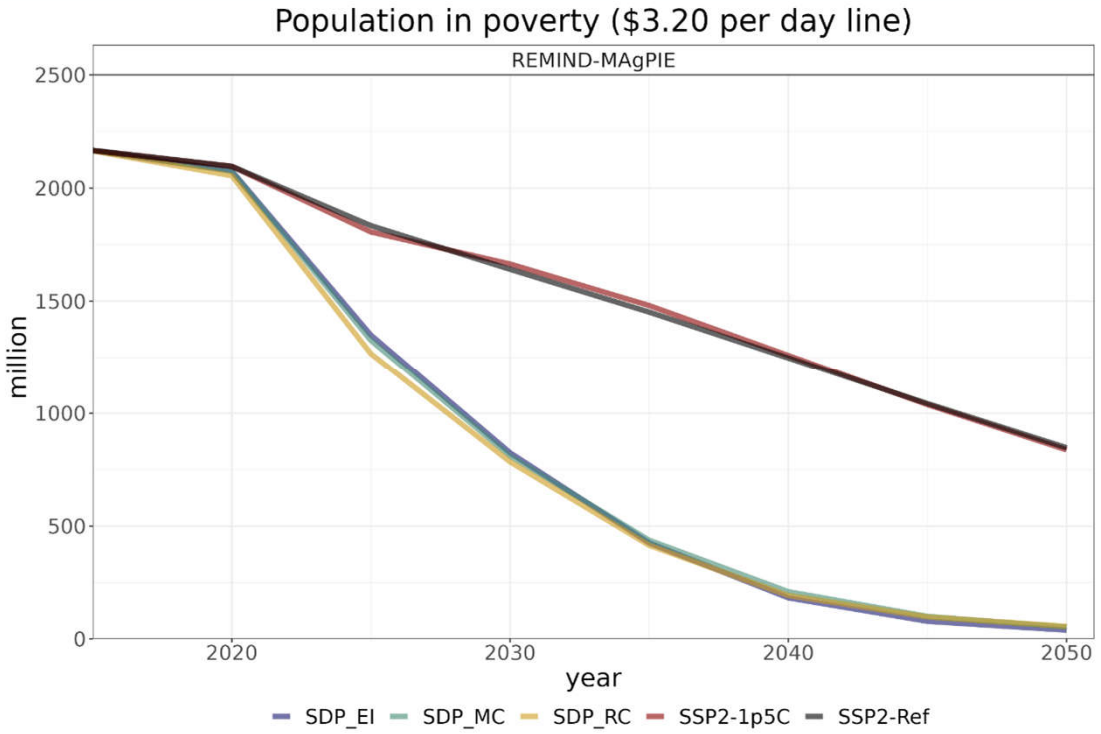
Narrative:

- All SDP scenarios **reduce inequality rapidly** (much faster than reference scenario).
- Within SDPs, **RC** reduces inequality fastest, **EI** slowest

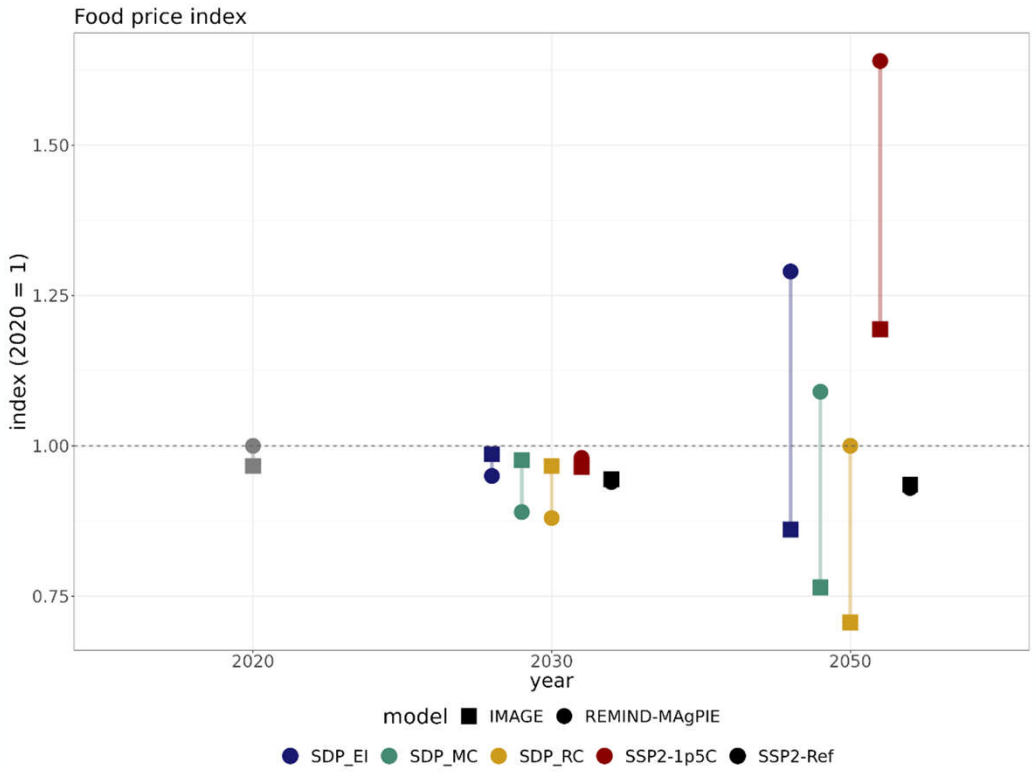
Outcome indicator:
Population in poverty (**$ 3.20/day)**
-> all SDPs **eradicate poverty** by 2050

Model takes into account:

- Effect of **climate policy** on **energy and food prices**
- **Redistribution** of carbon pricing revenues



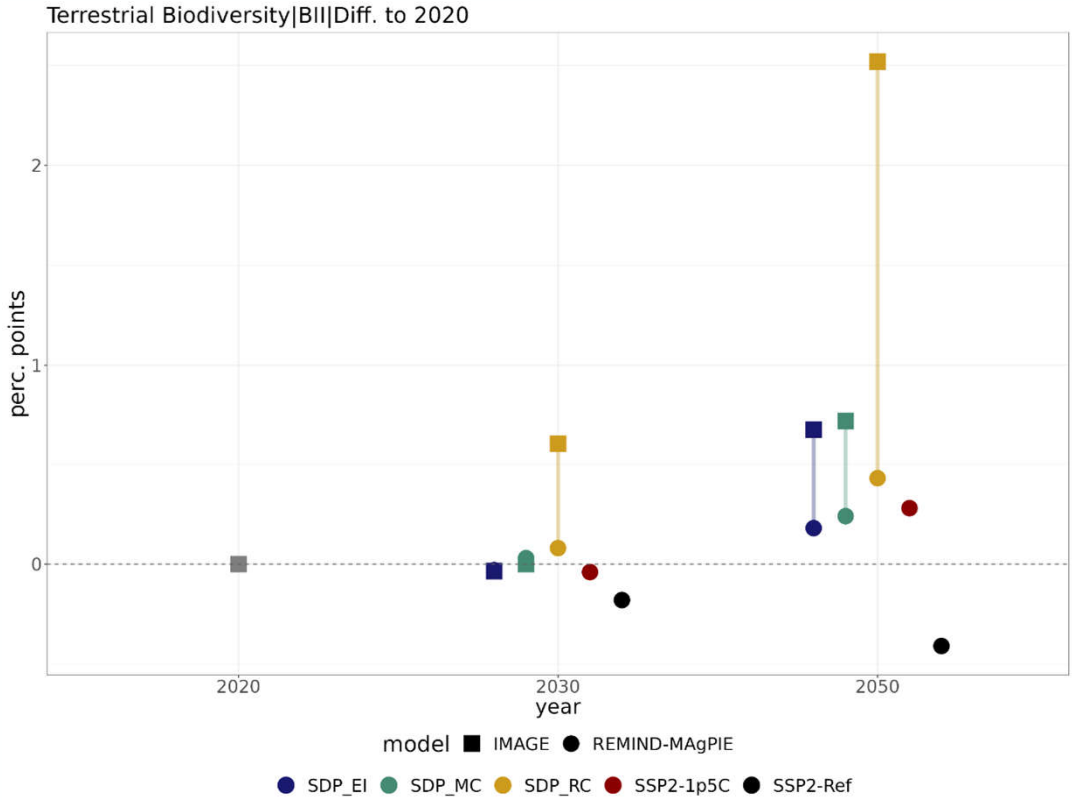
Food security



- ***"Climate-only"*** scenario: increased food prices (pricing of agr. emissions & land competition)
  -> trade-off climate vs. food security
- **SDPs scenarios:** Additional SD interventions **reduce/avoid food price increase**
- **RC:** Strongest **dietary change** and food waste reduction lead to lower food prices
  -> synergy with food security

Biosphere integrity

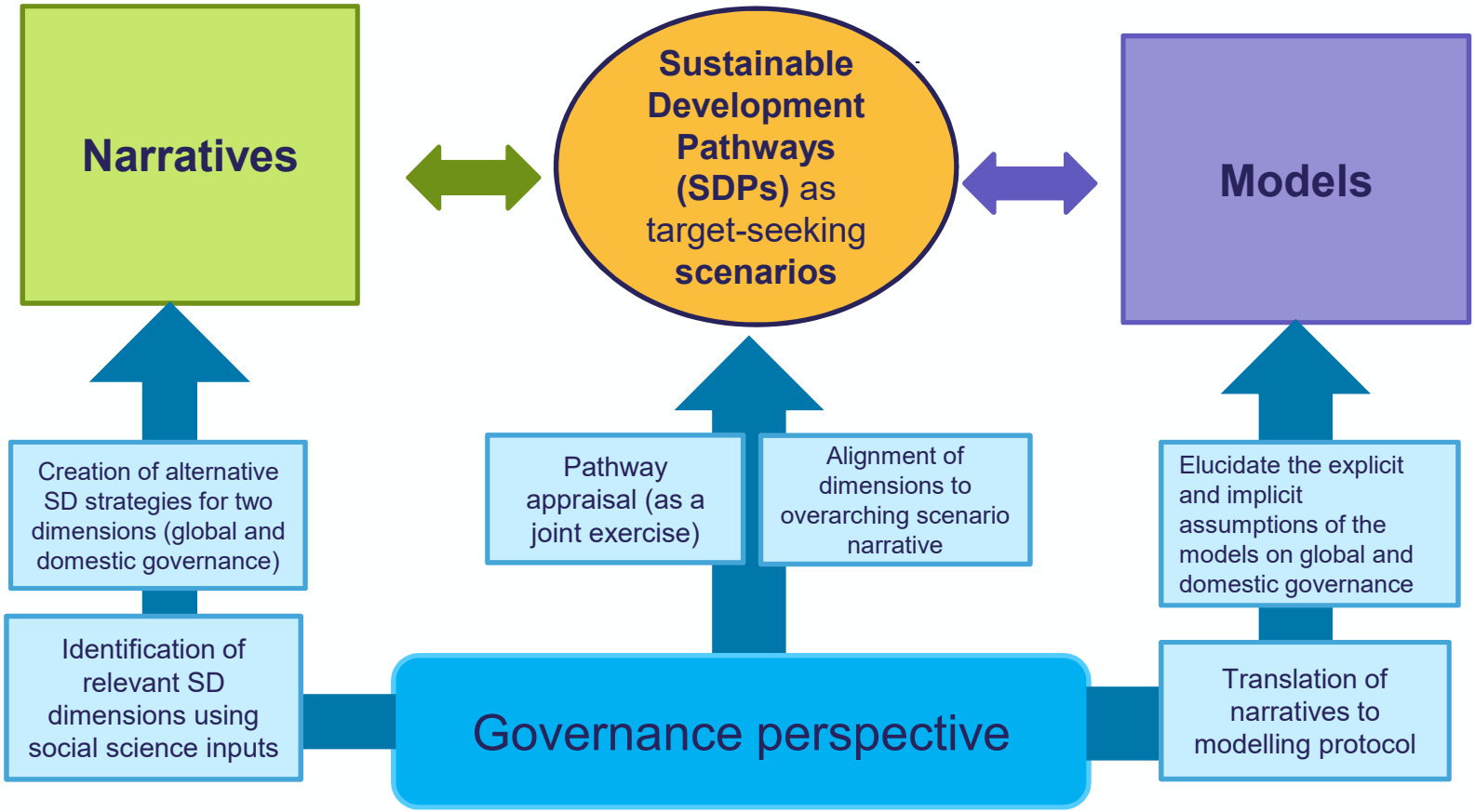
Biodiversity Intactness Index



- **All SDPs stop and reverse biodiversity loss**
- Improvements limited in **EI** and **MC** scenario; stronger in **RC** (**plantation afforestation vs. natural regrowth**)

Note: BII = 100% means fully intact biosphere, BII = 0% no biodiversity at all. Modest changes in BII correspond to relatively large effects.

Governance perspectives in the SHAPE process



Governance assumptions in SHAPE narratives and scenarios

Economy-driven innovation (EI):	Resilient communities (RC):	Managing the global commons (MC):
Domestic governance • **Market** actors drive transformation; • **State as regulator**: fast-paced and "lean" policy cycle, minimal intervention ***Global Governance*** • **Convergent liberal world:** strong economic globalization, technology-driven centers of power in a polycentric world	***Domestic governance*** • **Networks** (civil society, private sector, government) drive transformation; • **State as partner**: strong role for local or subnational actors, strong collaboration between state and non-state actors. ***Global Governance*** • **Divergent glocality:** Strong social and weak economic globalization, diverse values and norms drive transnational cooperation in a polycentric and non-state centered world	***Domestic governance*** • **Governments** drive transformation; • **State as leader**: top-down or vertical approach in policy development and implementation ***Global Governance*** • **Convergent cosmopolitan global society:** A polycentric order with weak economic and strong globalization, strong global institutions and norm/value driving convergence, preference for regional cooperation

Social science in the modeling protocol

Initiation of discussions on the model resolvability and improved scientific representation of sociopolitical factors in IAMs

- → Panel at the Scenarios Forum in June 2022
- → Workshop „*State of the science of political futures*" at IDOS in October 2022
- → Exercise at the Managing Global Governance (MGG Academy) 2022

ARCHITECTURE OF GLOBAL GOVERNANCE & SOCIETY AND GOVERNANCE				
Policy instrument	Economic (pricing, subsidies, etc.)	Price-based plus behavioral (e.g., demand for more efficient products)	Mix of regulatory instruments (standards, labels, etc.) and economic	Regional, in line with NDCs
Regionally different social and policy innovation deployment (E.g., uptake of carbon pricing across countries)	Regional	Regional	Global	Global
Level of technological innovation	High	Medium	High	Medium
Regionally different technological deployment	Global	Regional	Global	Global
Trade Flows	Globalized	Regionalized	Globalized	Globalized

Open questions from the governance perspective

- How do we deal with **exogenous factors** such as pandemics, conflicts, war, geopolitical tensions?
- How do we deal with the **high level of uncertainty** related to SDG interactions and the effects and implementation of climate protection and sustainability interventions?
- To what extent do the narratives, scenarios and models provide a sufficient **basis to justify policymaking**?
- To what extent do scenarios assume that they can identify policies that go **beyond political ideologies**? If yes, is this assumption rectified? (e.g., liberal, socio-democratic, conservative preferences in global trade or energy security)?
- Can the SHAPE narratives, scenarios and models **inform the reformulation of the SDGs in 2030**? (e.g., beyond growth, beyond modern scientism)

Key insights from SHAPE

- The SHAPE SDPs explore **pathways towards climate targets and SDGs** (*current trends: not on track for either*).
- Narratives: based on **co-design process**, representing **different perspectives on SD**.
- The SHAPE SDPs **facilitate reaching the 1.5°C target**, and **avoid trade-offs** of "climate-only" pathways.
- **Underlying strategies very different**:
  - RC: post-growth & low demand
  - EI: fast technological development
  - MC: targeted regulation
- Multi-model approach: **robust assessment of strategies**, synergies and trade-offs, bottlenecks
- **Governance dimension**: Pathway appraisal of policy assumptions and policy mixes
- ***Goal: inform SDG & Paris implementation, also for SD post-2030***

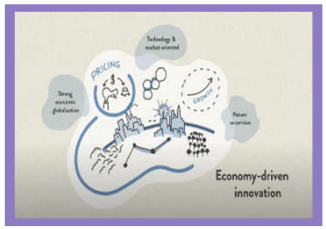
Acknowledgements

The project SHAPE is part of AXIS, an ERA-NET initiated by JPI Climate, and funded by FORMAS (SE), BMBWF/FFG (AT), DLR/BMBF (DE, Grant No. 01LS1907A-B-C), NWO (NL) and RCN (NO) with co-funding by the European Union (Grant No. 776608).

GDP per capita

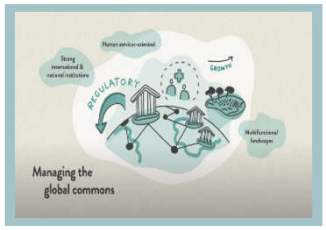
Regional

Narrative

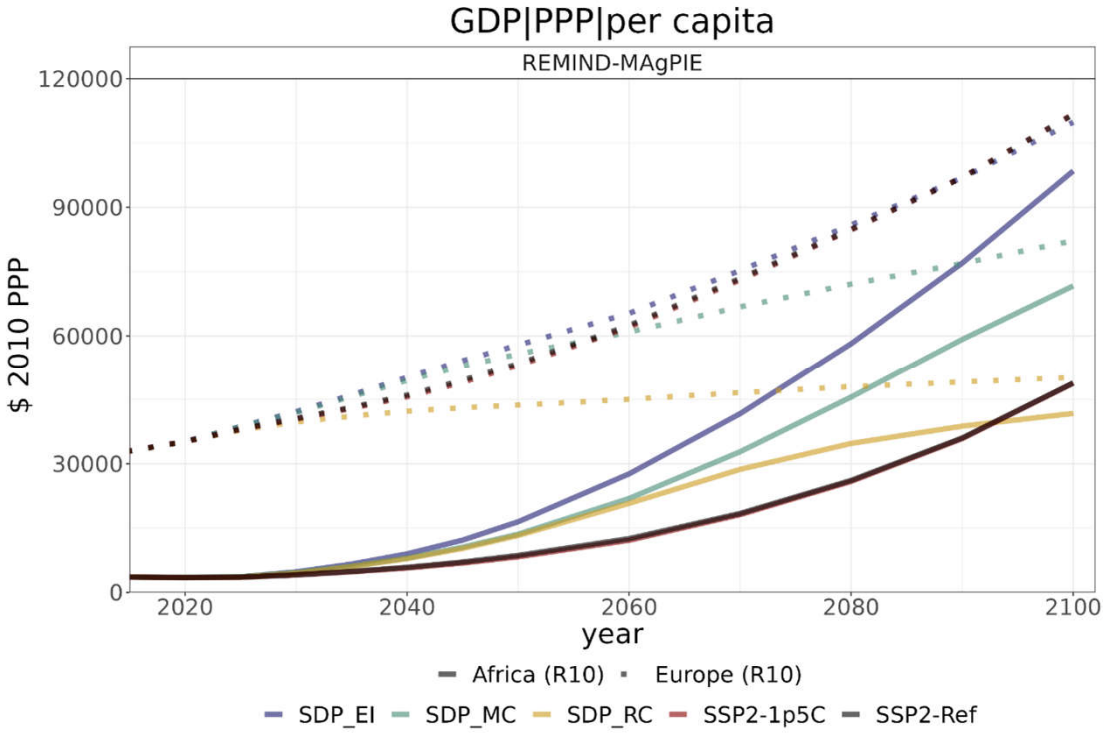


EI: Continued high growth in all regions, medium to strong convergence

RC: Post-growth in Global North, continued growth in Global South, medium to strong convergence

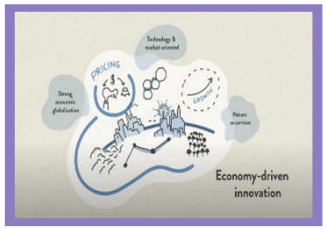


MC: Moderate growth in Global North, high growth in Global South, strong convergence



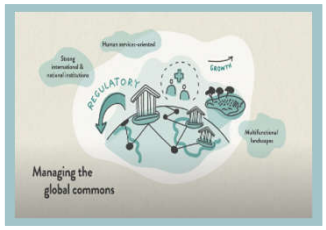
Energy consumption per capita

Narrative

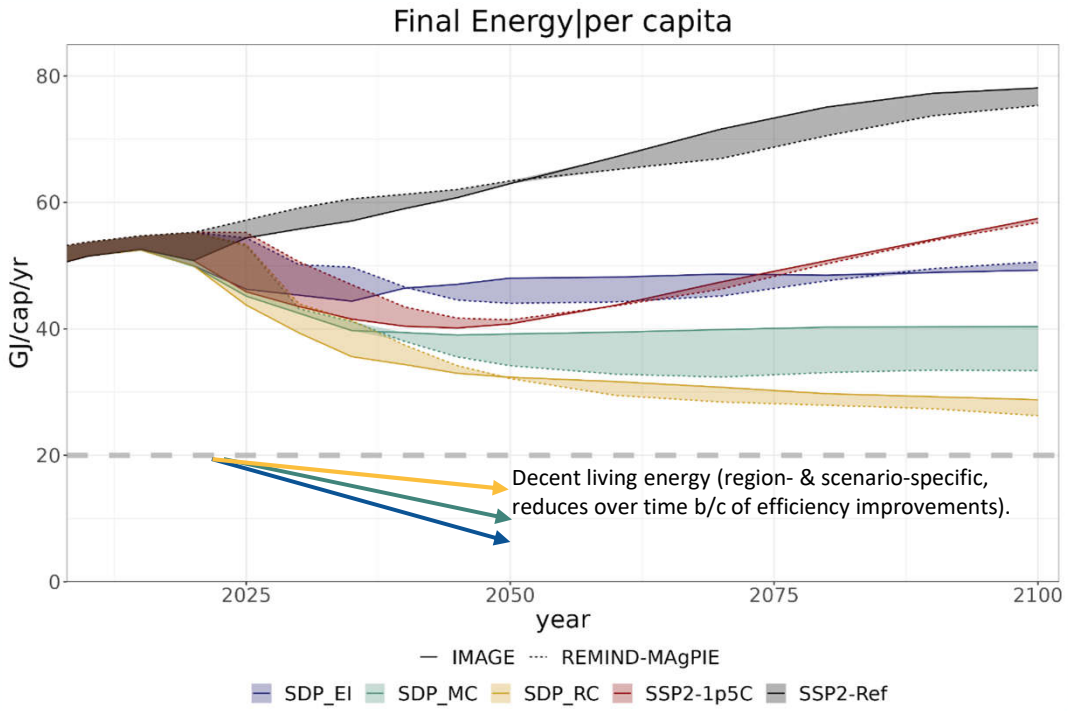


EI: high demand for energy services, very high efficiency

RC: low demand for energy services through behavioural change, moderate efficiency



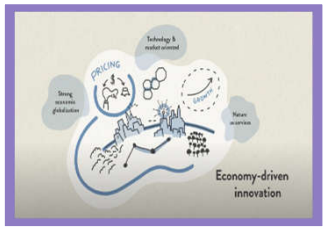
MC: medium demand for energy services, high efficiency



In all SDPs, energy use converges between Global North and Global South, enabling decent living standards.

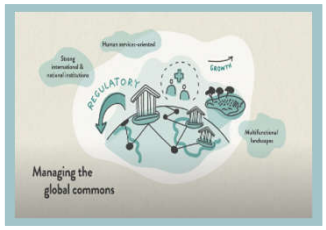
Example driver: Floor space per capita

Narrative

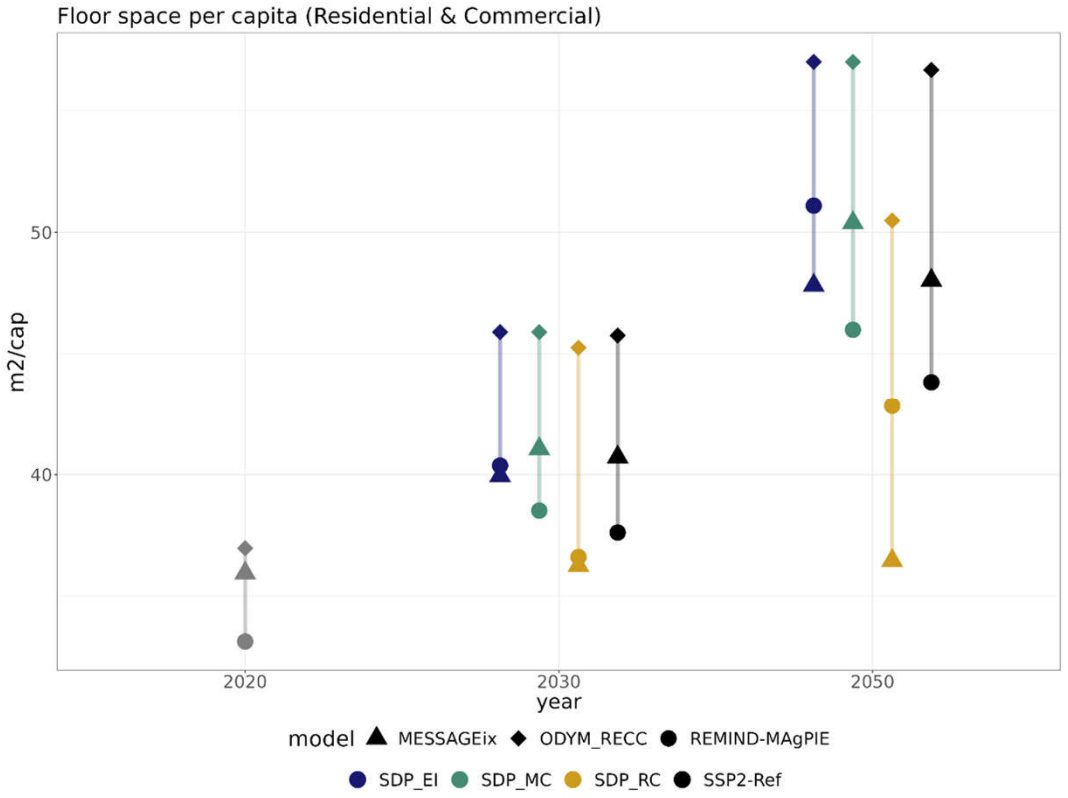


EI: high demand for energy services, very high efficiency

RC: low demand for energy services through behavioural change, moderate efficiency

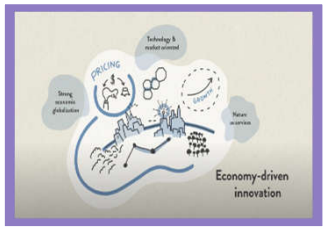


MC: medium demand for energy services, high efficiency



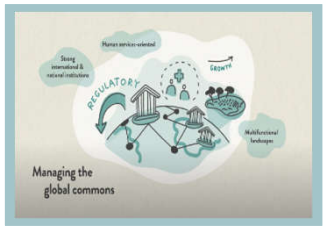
Material consumption
(Example Steel production)

Narrative



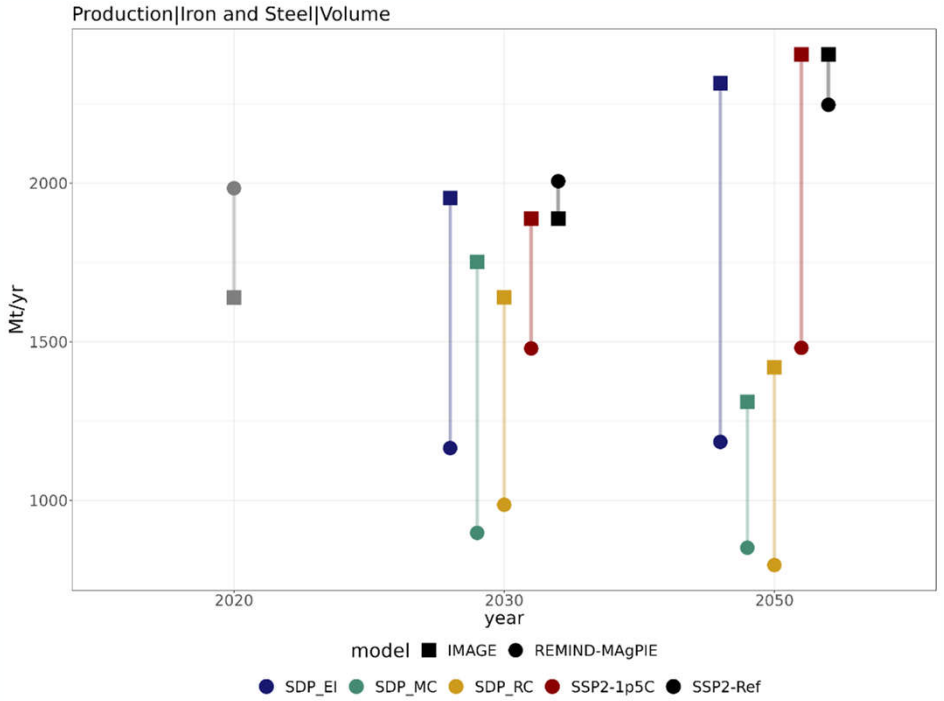
EI: high material demand, med-high recycling rates

RC: low material demand, med recycling rates



MC: medium material demand, high recycling rates

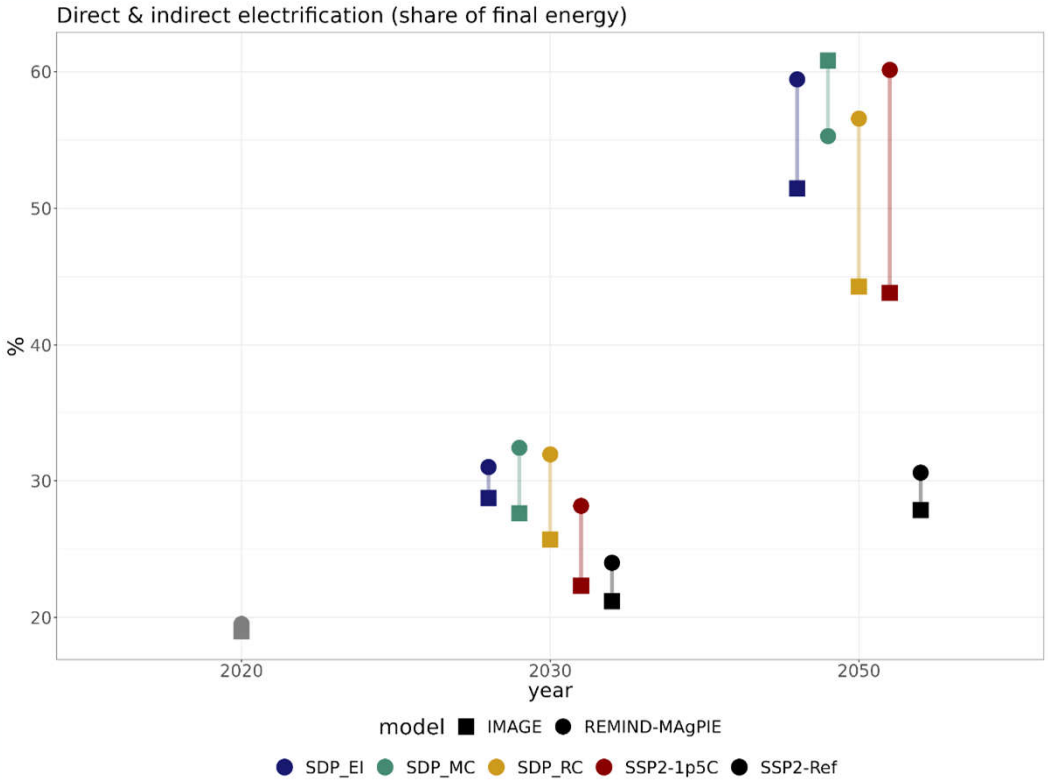
\+ Response to climate policy (REMIND)



Material demands are informed by material flow modelling with ODYM-RECC.

Transition to modern energy

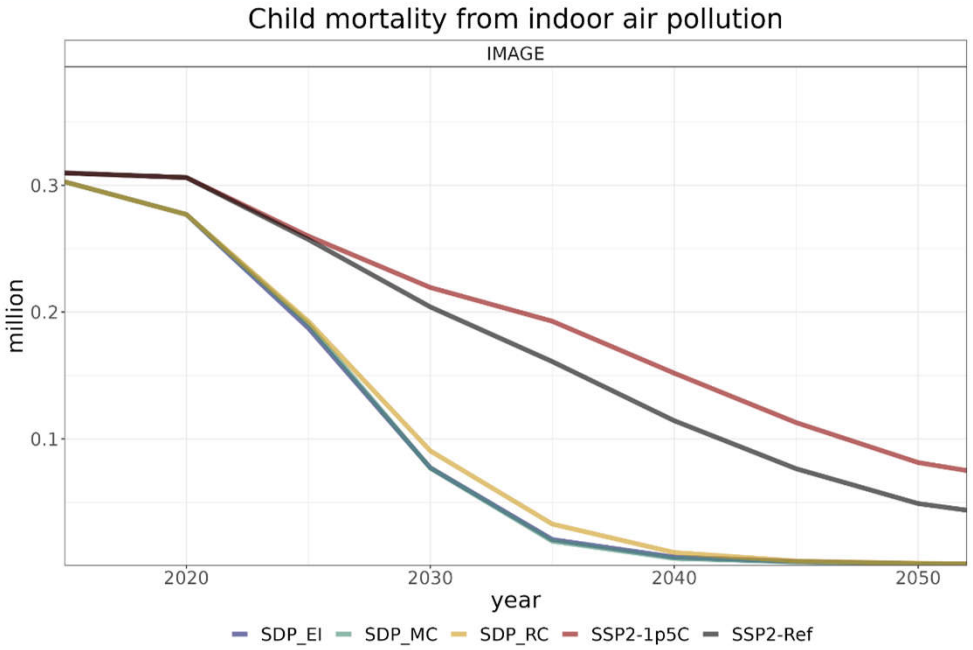
Electrification share



- All 1.5°C - compatible scenarios feature rapid electrification - SDPs further enhance electrification rate
- Stringent regulation (MC) and technological development (EI) lead to highest electrification rates
- Lower energy demand and lower technological development slow down electrification push slightly (RC)

Transition to modern energy

Air pollution health effects

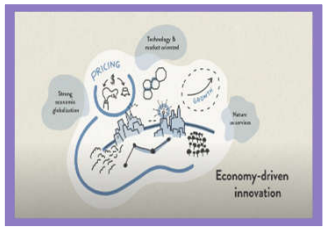


- Interactions between climate policy and air pollution health effects:
  - *Synergy:* Ambient air pollution reduced (e.g. less coal power plants)
  - *Trade-off (figure):* Slower reduction of indoor air pollution (price of modern cooking fuels increases, i.e. slower uptake)
- SDPs accelerate uptake of modern cooking fuels, avoid indoor air pollution trade-off

Food demand

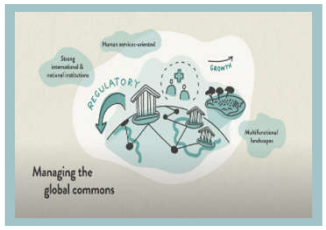
Calorie supply per capita

Narrative

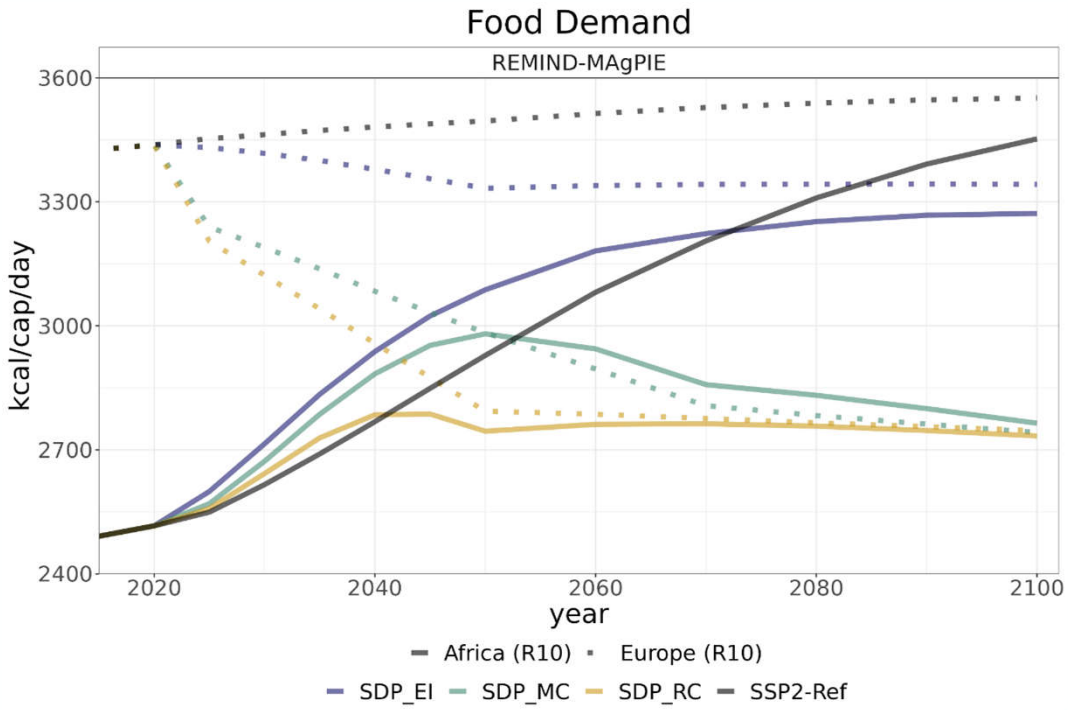


Adequate calorie intake & modest reduction of food waste. Increase in animal-free meat & milk alternatives.

Rapid transition to healthy calorie intake and nutrition (EAT-Lancet diet). Very low levels of food waste.

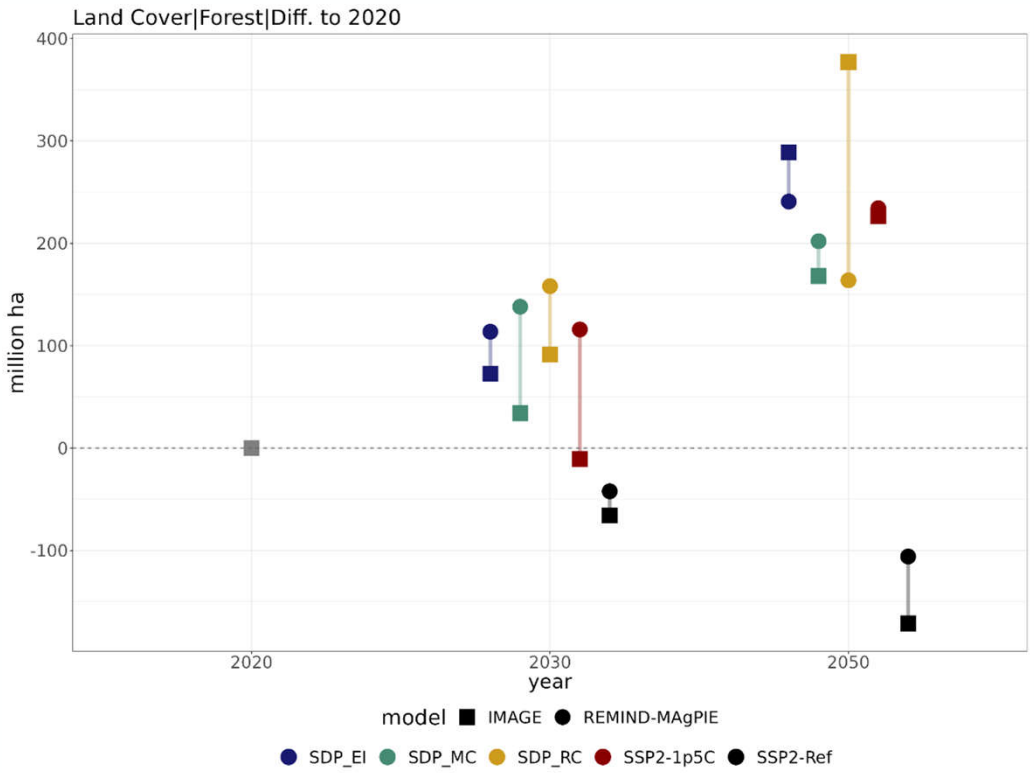


Gradual transition to healthy calorie intake and nutrition (EAT-Lancet diet). Low levels of food waste.



Land use change

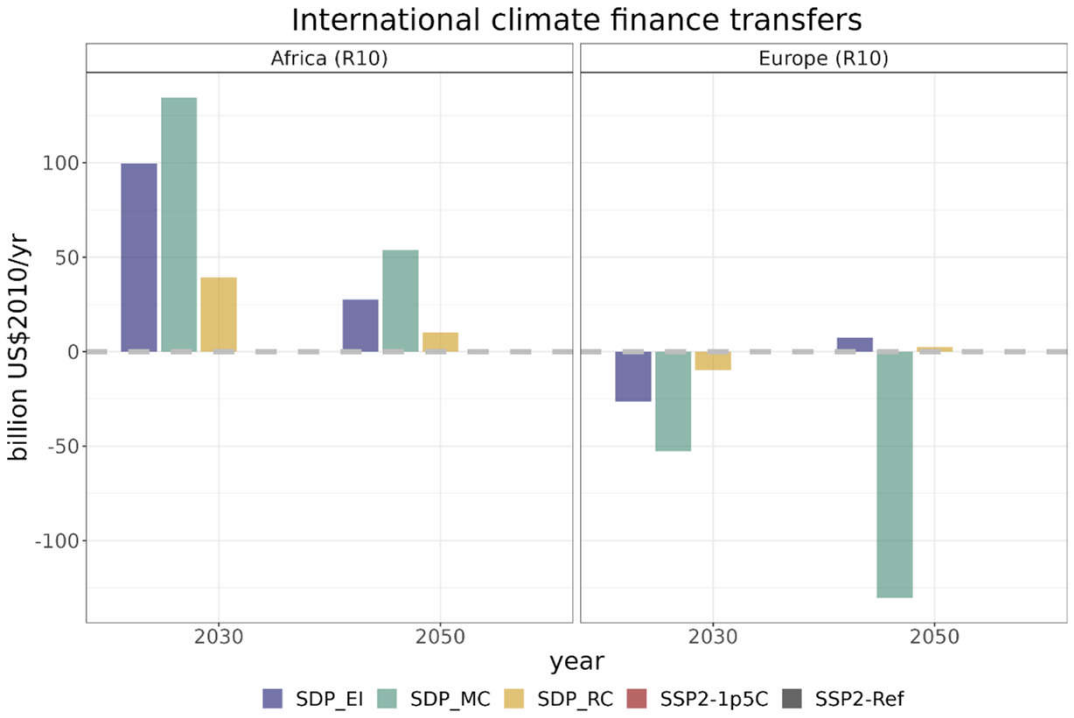
Example: Forest Area



- All 1.5°C - compatible scenarios stop deforestation and increase forest area
- SDPs with comparable forest area increase - but with different underlying strategies:
  - increased land productivity, afforestation projects **(EI)**
  - dietary change and increased land protection **(RC)**
  - a mix of the measures above, but with a lower level of ambition **(MC)**

Intern. Collaboration

Burden sharing



- Importance of international collaboration varies across narratives.
- Reflected through international climate finance (ex-post calculation from REMIND-MAgPIE scenarios)
  - International redistribution of part of carbon pricing revenues (all SDPs, **MC** highest, **RC** lowest)
  - Equalization of policy cost relative to GDP (**MC**)

Key insights from SHAPE

- The SHAPE SDPs explore pathways towards climate targets and SDGs (*current trends: not on track for either*).
- Narratives: based on co-design process, representing different perspectives on SD.
- The SHAPE SDPs facilitate reaching the 1.5°C target, and avoid trade-offs of "climate-only" pathways.
- Underlying strategies: RC: post-growth & low demand, EI: fast technological development, MC: targeted regulation
- Multi-model approach: robust assessment of strategies, synergies and trade-offs, bottlenecks
- Different pathways lead to specific strengths, but also challenges, e.g.
    - ***EI:*** worst biodiversity outcomes of SDP scenarios (plantation afforestation)
    - ***MC:*** challenge for international policy: highest international climate finance
    - ***RC:*** residual energy poverty despite rapid inequality reduction (lowest per-capita demands)
- Governance dimension: Pathway appraisal of policy assumptions and policy mixes
- *Goal: inform SDG & Paris implementation, also for SD post-2030*