



NDC ASPECTS

Evolution of global mitigation strategies, global pathways and SDG implications

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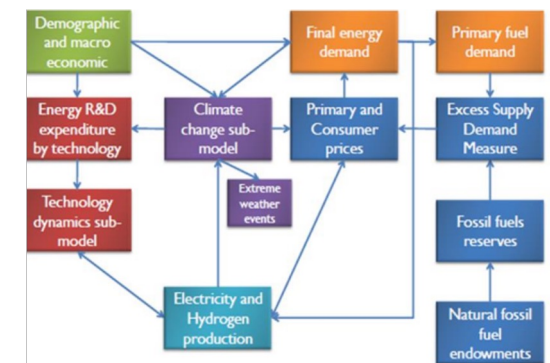
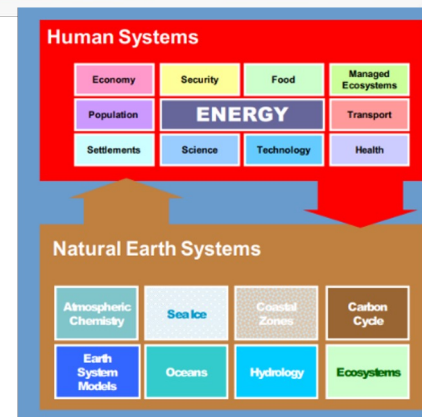
BC3 BASQUE CENTRE FOR
CLIMATE CHANGE
Klima Aldaketa Ikergai

E³Modelling
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Towards new generation of global mitigation pathways

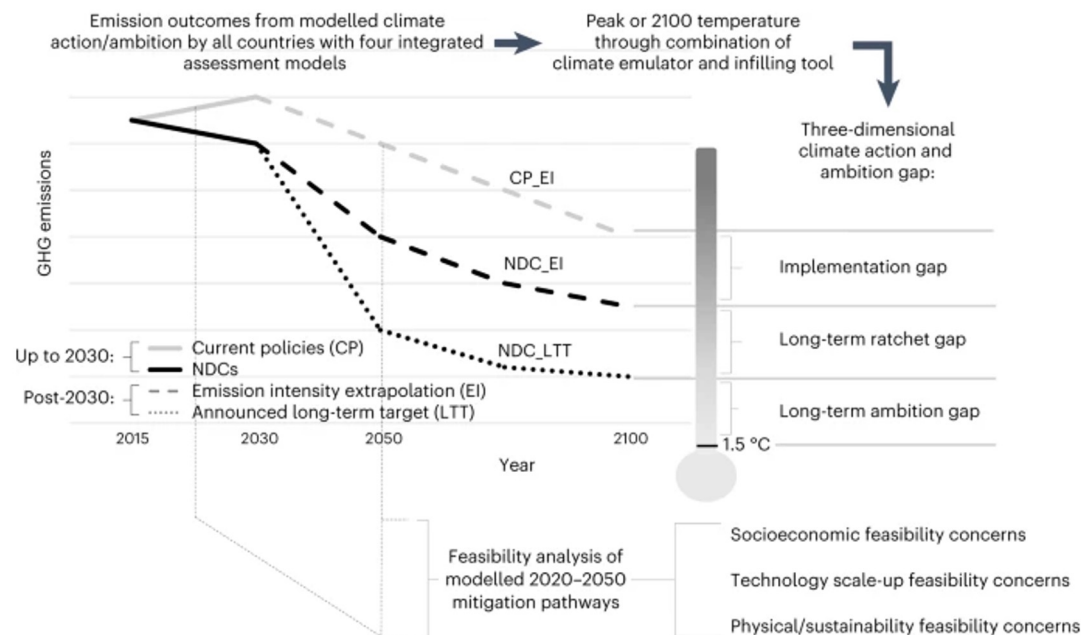
Build new global scenarios based on core information from policies and sectoral/national insights:

- Updated list of climate, energy and SDG-related policies simulated in the models, incl. NDCs and LTTs
- Integrate insights from sectoral and national transformational pathways
- Move beyond idealised 1.5C global cost-optimal pathways, focus more on national targets and pledges
- Use two leading Integrated Assessment Models (GCAM and PROMETHEUS) that consistently capture system linkages



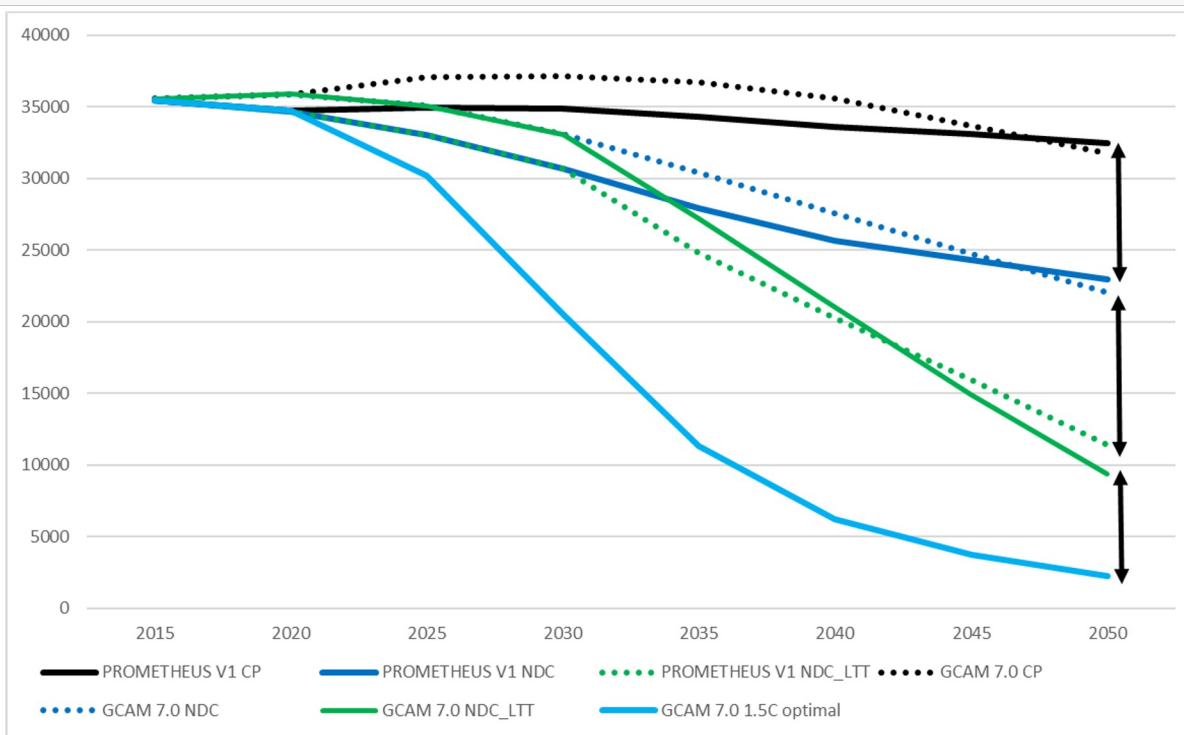
Scenario design

CP	The scenario is based on the current portfolio of climate policies and credible policy targets until 2030 Same CO2 intensity rates are imposed by region after 2030.
NDC	Stated 2030 emission targets captured in NDCs submitted or announced by June 2022 NDCs are applied on top of CP scenario. The same EI method is applied for post-2030 action as in CP.
NDC_LTT	For regions that expressed an LTT for 2050 or later (in law, policy documents or only announced), emission constraints linearly decline from 2030 to the long-term target. For regions without LTTs, post-2030 emissions follow the NDC scenario.



Taken from Van De Ven et al, Nature Climate Change, 2023

Global emission projections from PROMETHEUS and GCAM

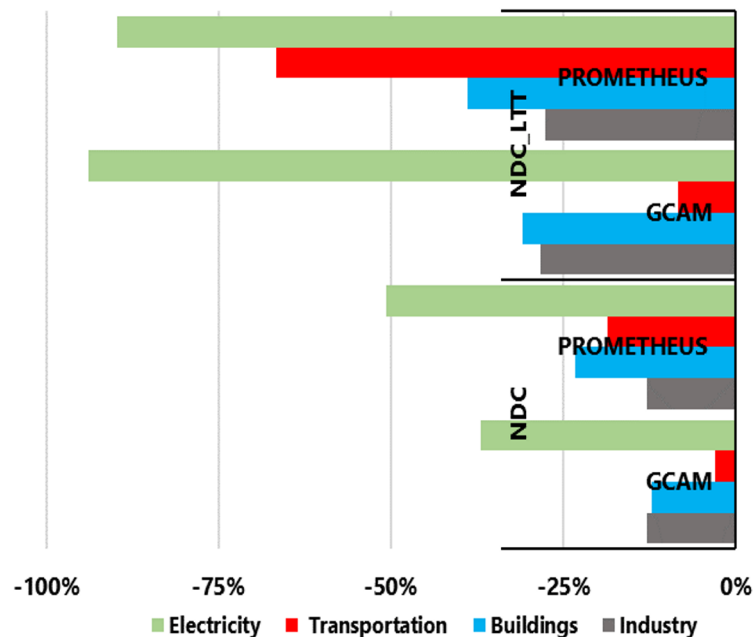


Implementation gap (about
1/3 of the effort to net-zero)

Long-term ratchet gap
(about 40% of the effort)

Long-term ambition gap
(about 25% of the effort)

Emissions by sector



The NDC scenario would result in reduced emissions in all sectors, with largest impacts on the electricity and buildings sectors

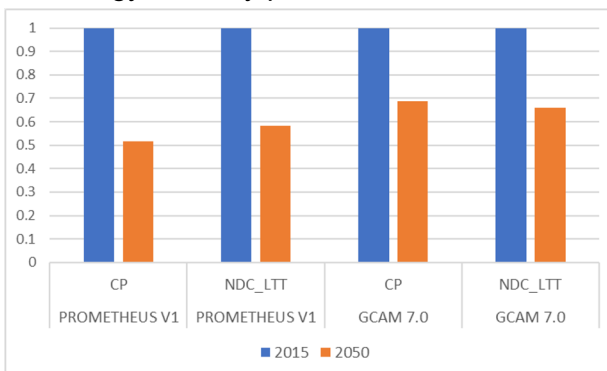
The LTT targets (compared to CP) would lead to:

- Around 25% reduction of industrial emissions in both models (a sector requiring strong innovation and international collaboration for mitigation)
- 25%-35% reduction of buildings-related emissions
- Very large reductions of electricity emissions, more than 90% from CP levels (with GCAM even going net-negative via the emergence of BECCS)
- Large model differences in transport (from 10% in GCAM to 65% in PROMETHEUS)

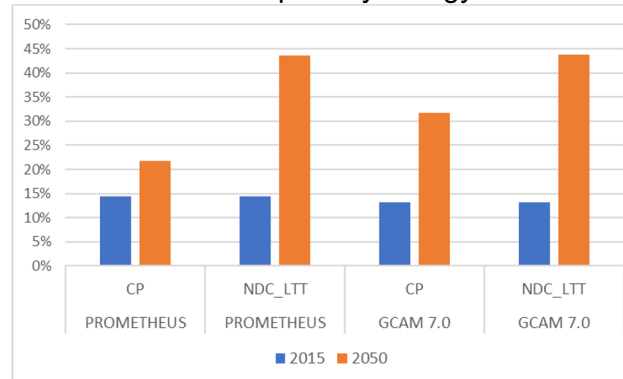
Broadly consistent trends, but PROMETHEUS puts more focus on demand-side solutions, while GCAM depends more on supply-side transformation

Major energy transition options

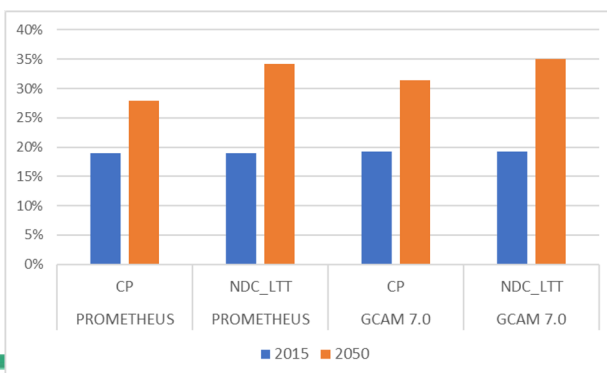
Energy intensity per GDP



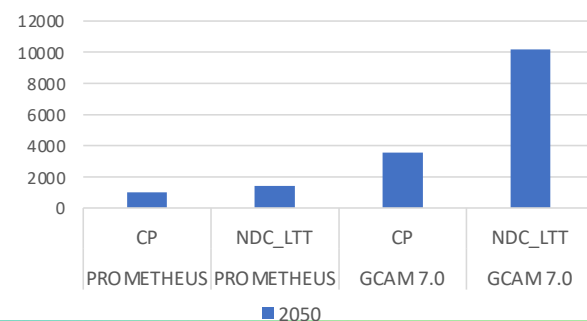
Share of RES in primary energy



Share of electricity in final energy

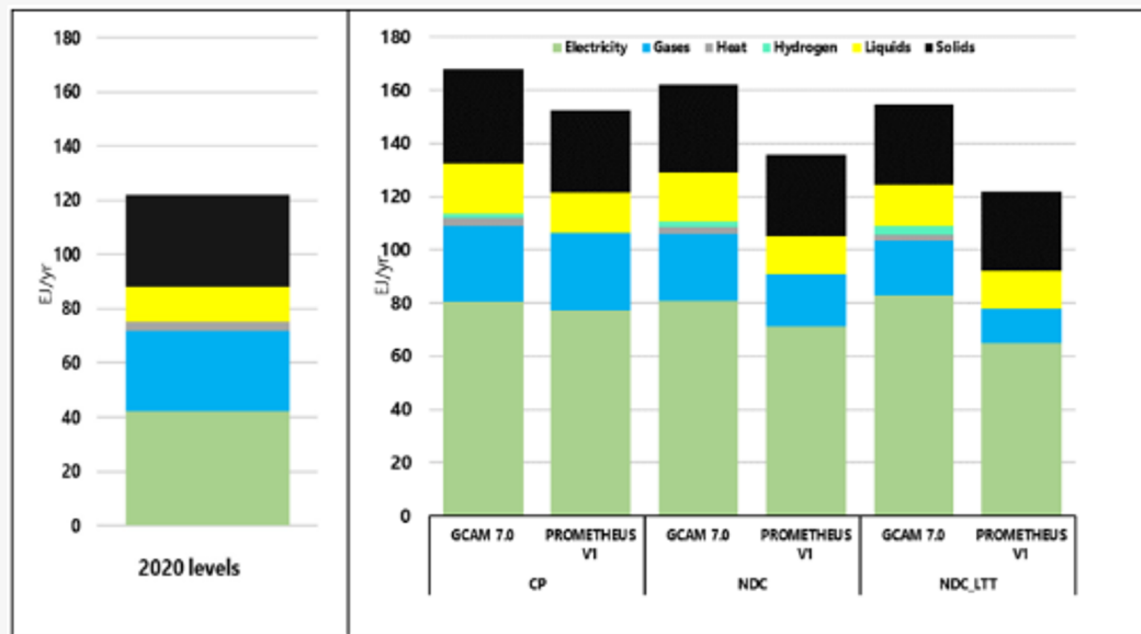


Carbon capture



- 1) Energy Efficiency (reduction of energy intensity by 45-55% in NDC LTT over 2015-2050)
- 2) Renewable energy share in PE (increasing from the current 14% to about 40% in both models in 2050)
- 3) Electrification (elec share in final energy increases to about 35% in 2050 in LTT in both models)
- 4) Low-carbon fuels (biofuels, hydrogen) and uptake of CCS, up to 4-10 GtCO₂ annually in 2050 in the LTT scenario

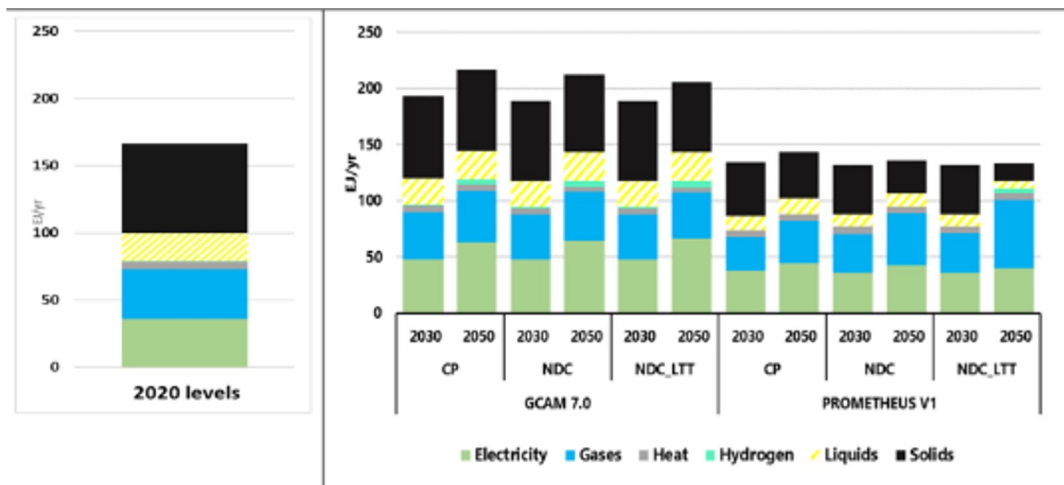
Transformation in buildings



Key transformation options:

- 1) Energy efficiency but without hampering standards of living (deep renovation in Global North, more efficient uses in Global South)– more important option in PROMETHEUS than GCAM
- 1) Electrification of end-uses with electricity increasing to more than 55% in 2050
- 1) Some fossil fuels remain esp. in developing countries to support households' energy needs
- 1) Very limited use of H2

Transformation in industry

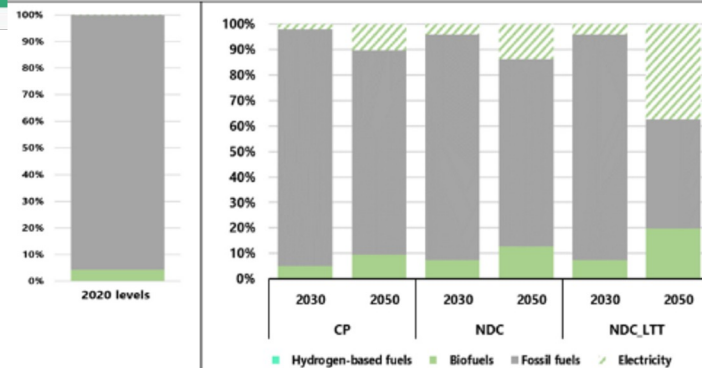


Key transformation options:

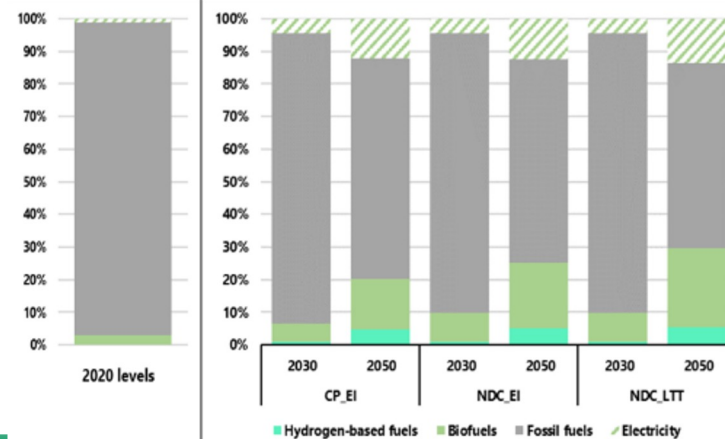
- 1) Electrification of industrial processes esp. those requiring low or medium temperature
- 1) Improved energy efficiency combined with circular economy to reduce the needs and production of materials – mostly used in PROMETHEUS
- 1) Fossil fuel use remains by 2050 even in LTT scenario
- 1) CCS emerges to reduce unabated emissions from the sector in LTT case
- 1) H2 uptakes in specific segments (e.g. steelmaking, chemicals) in LTT

Transport sector transformation

PROMETHEUS



GCAM



Key transformation options:

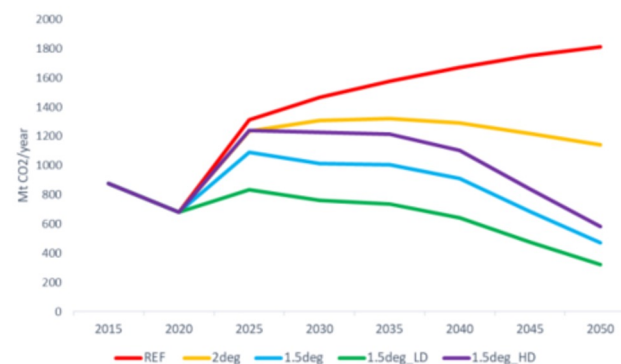
- 1) Electrification of road transport is the major trend with electricity's share rapidly increasing by 2050 esp. in the NDC-LTT scenario
- 2) Both models agree that biofuels will play an increasingly important role in the transport sector accounting for 20-25% of sectoral energy consumption in 2050
- 3) PROMETHEUS opts more for electrification while GCAM also uses hydrogen to decarbonize transport

The role of international aviation under Paris compatible scenarios

International aviation activity



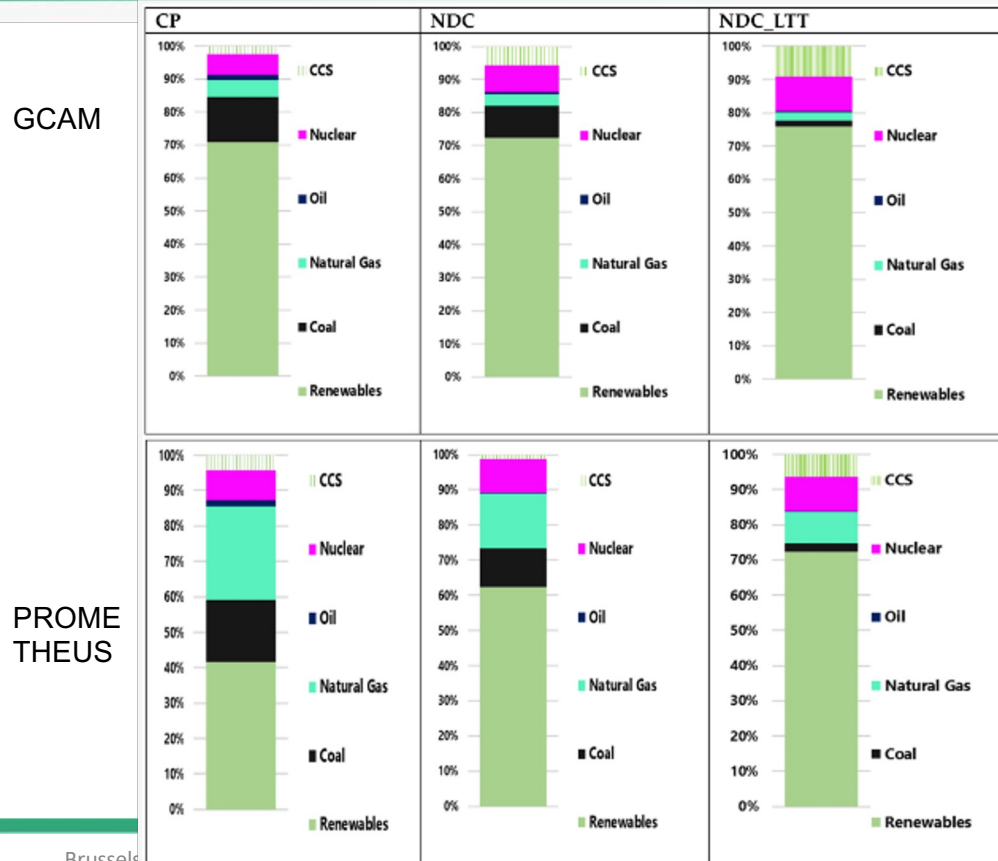
Aviation CO2 emissions



Fuel mix used in international aviation



Transformation in the electricity sector



Both models show that renewable energy will become the backbone of future's energy systems

The share of RES increases to more than 60% in the NDC scenario and even more than 70%-75% in NDC_LTT in 2050

Nuclear and CCS -both fossil-based and BECCS - contribute around 20% in LTT scenario in 2050,

...with only small residual fossil use in developing countries without LTT targets in PROMETHEUS

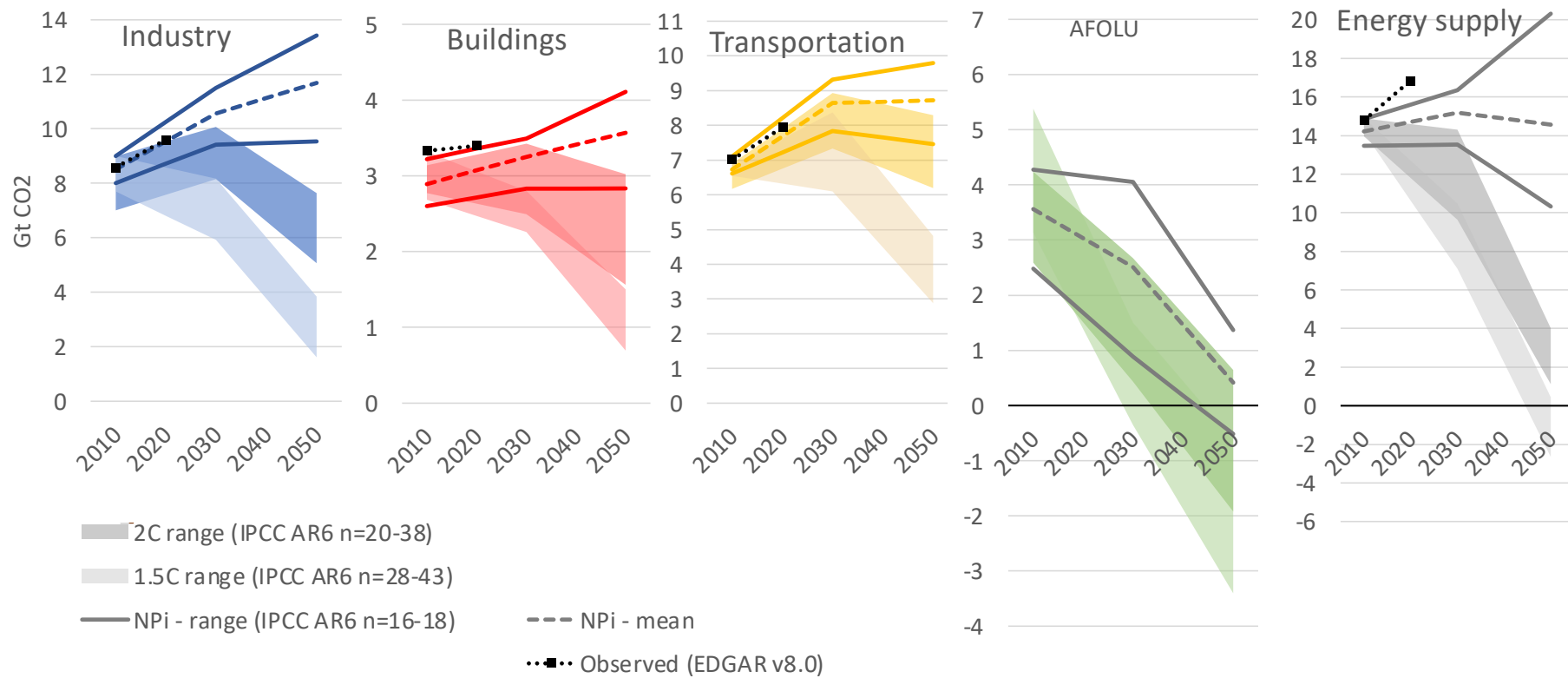
Conclusions

- Climate policies should become more ambitious globally if we want to keep Paris agreement within reach
- NDCs and LTTs can drive the transformation of sectoral, national and global systems towards a low-emission paradigm based on renewable energy uptake, energy efficiency and electrification of end-uses
- Both the implementation and the ambition gaps should close early to allow meeting the Paris goals and limit temperature overshoot
- but this raises financial challenges and feasibility concerns
- and has also impacts for achieving the SDGs

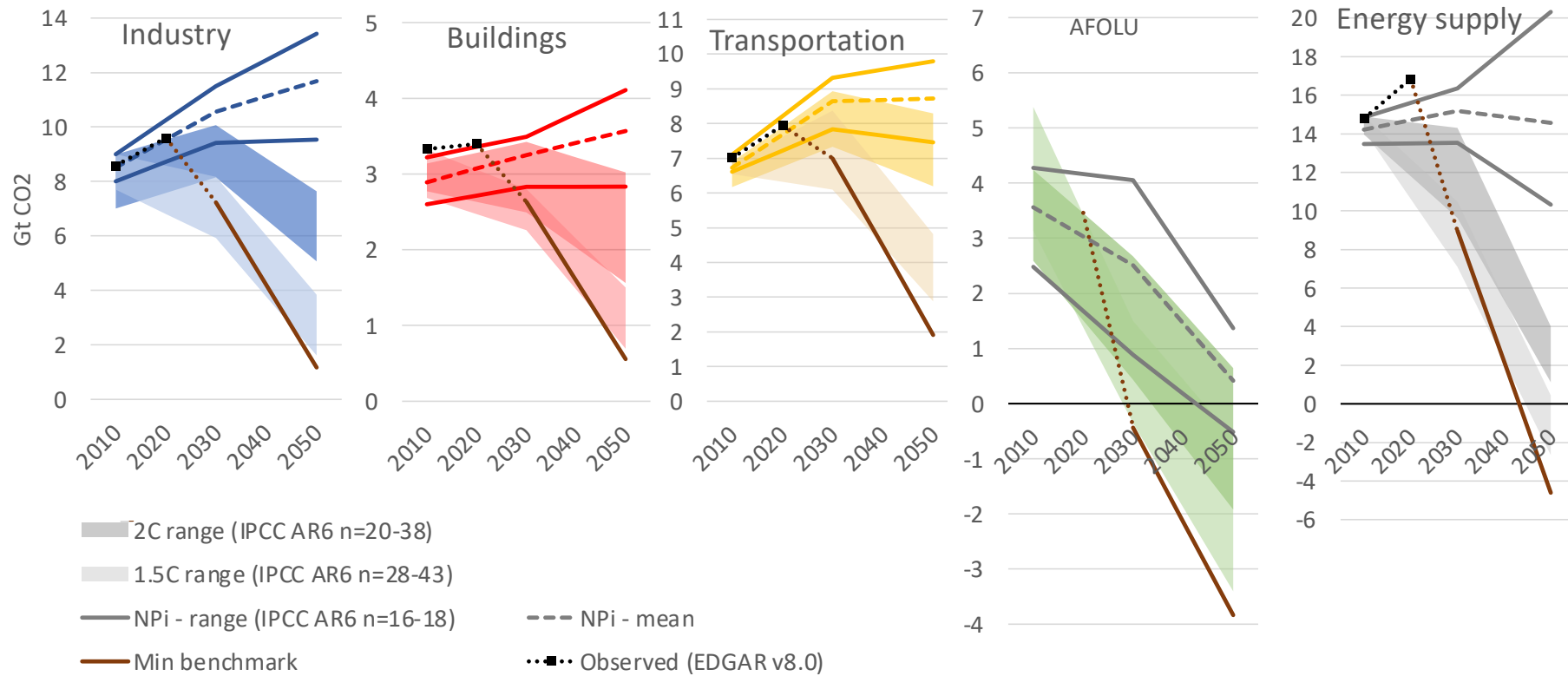
Optimising sectoral efforts over SDGs: introduction

- An widely debated issue in climate policy is on the question of how much each sector mitigates, how do we divide the pie?
- Traditionally, IAMs divide the pie based on a least-cost approach, but impacts go much beyond costs alone
- We present an exercise combining GCAM with optimal portfolio theory, allocating sectoral efforts based on their impact to 5 global SDGs by 2050:
 - SDG 2 on Hunger: % change of food basket Bill
 - SDG 3 on Health: # Premature mortalities due to air pollution
 - SDG 6 on Water: Physical water scarcity index
 - SDG 8 on Economy: % impact on GDP
 - SDG 15 on Land: Proportion of natural land (biodiversity indicator)

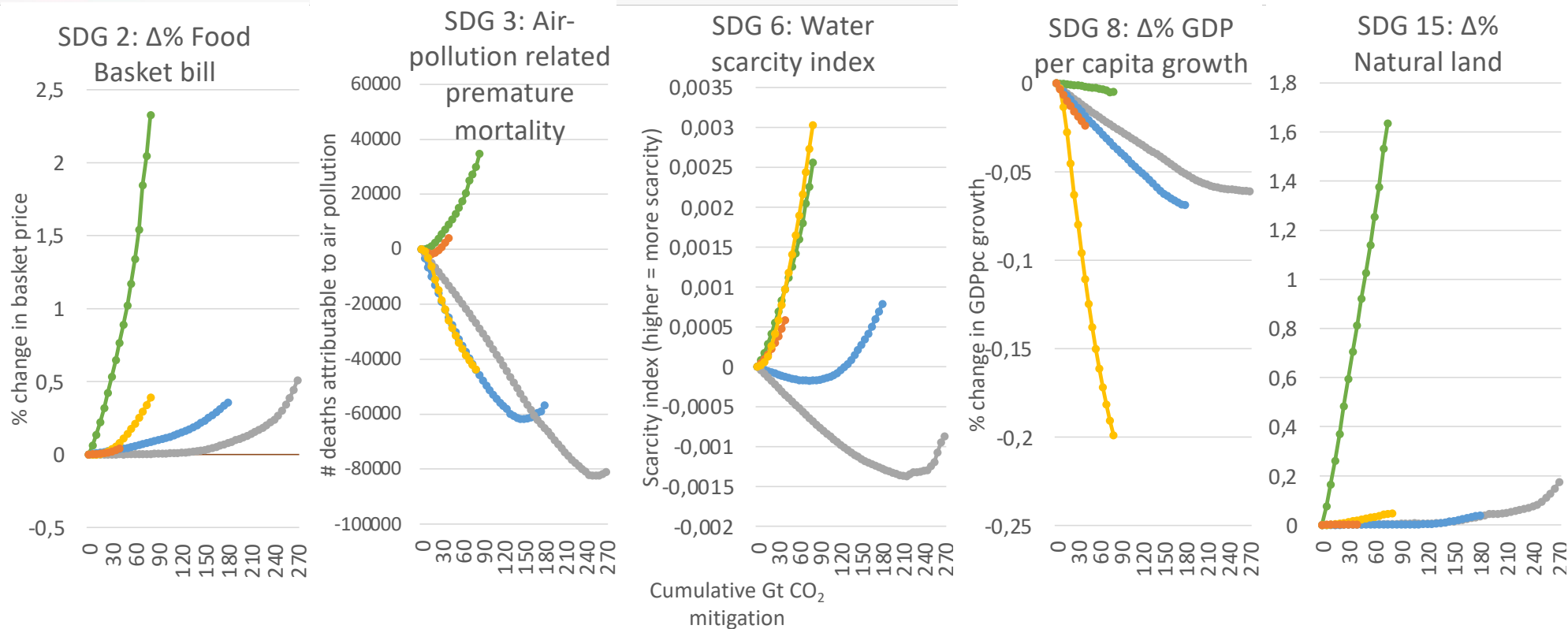
Benchmarking sectoral potentials



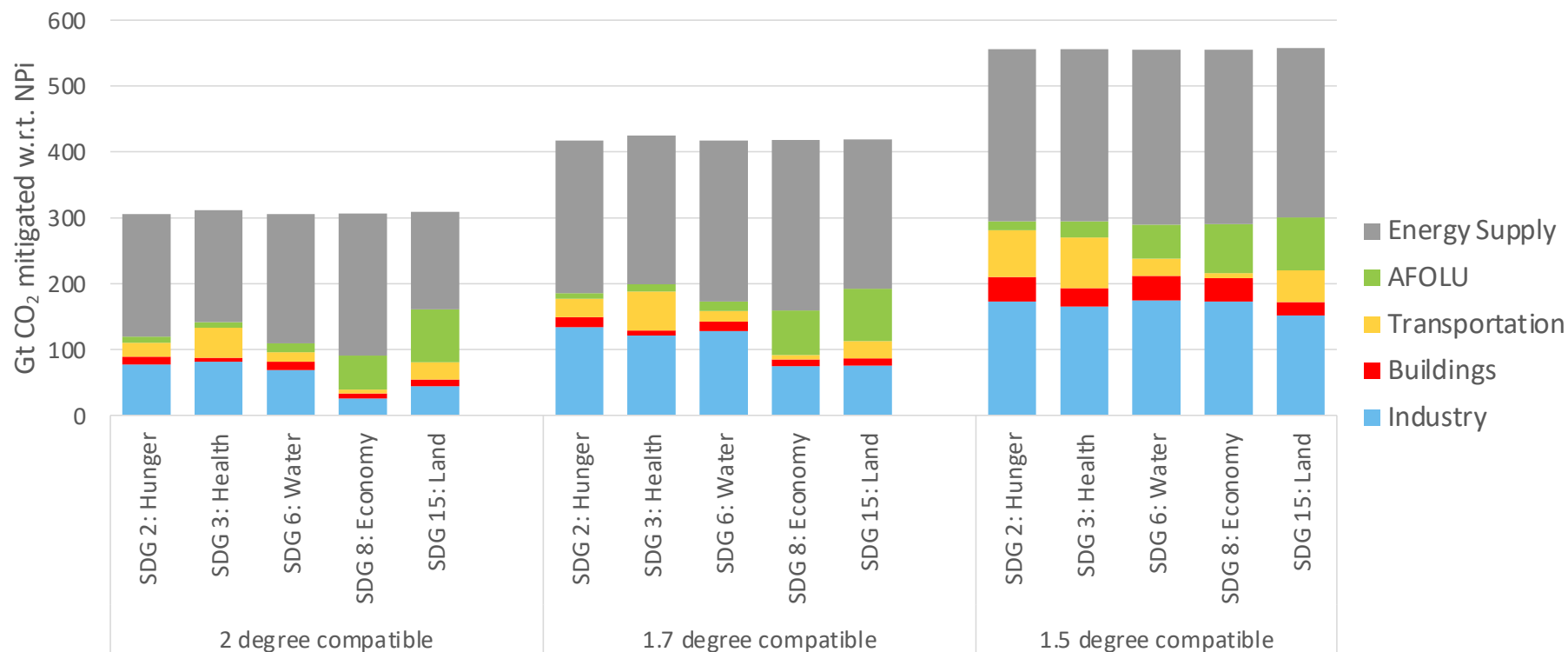
Benchmarking sectoral potentials



Incremental SDG impacts for sectoral mitigation



SDG-Optimal allocation of Paris-compatible mitigation budgets





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Thank you for the attention !

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