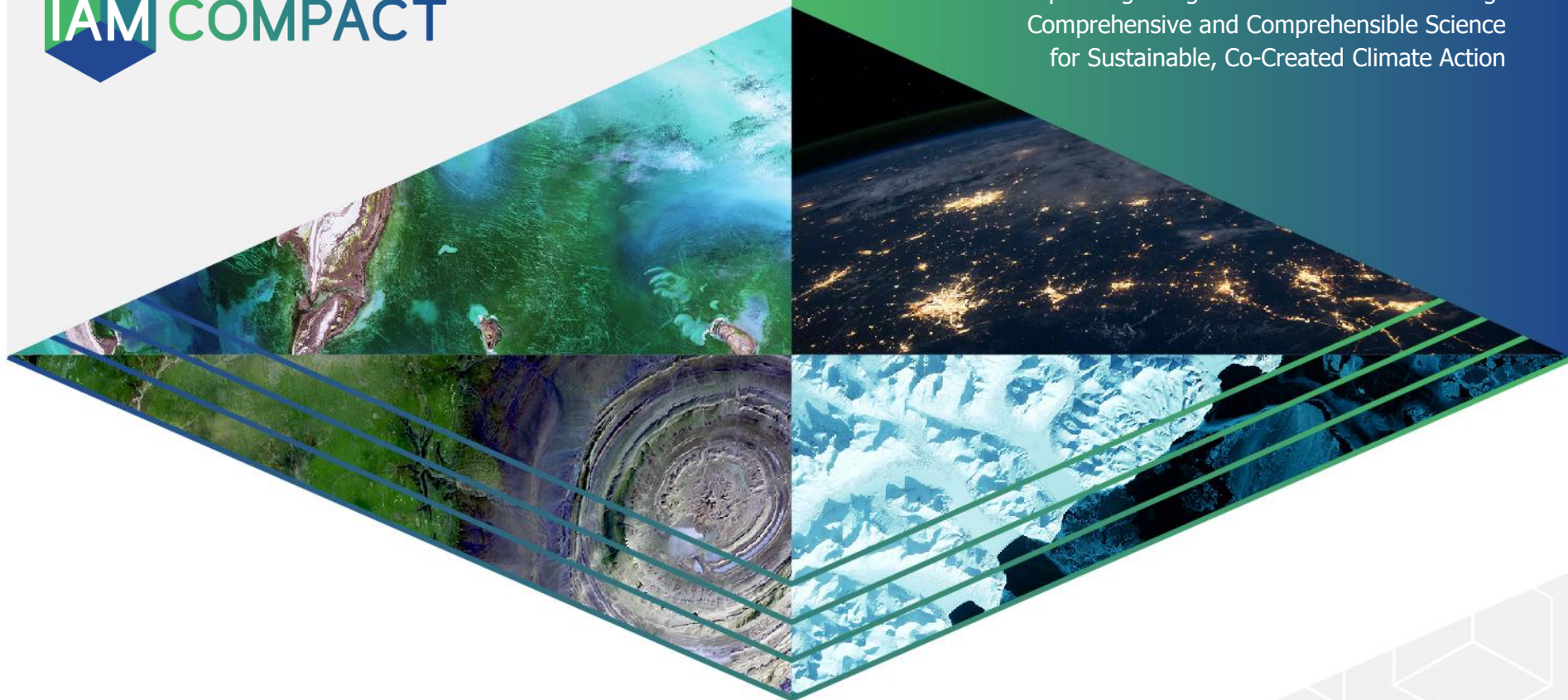




Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action



Responsive science in support of climate policymaking
IAM COMPACT Final Conference, Athens, 29 August 2025

Lifestyle changes towards net zero

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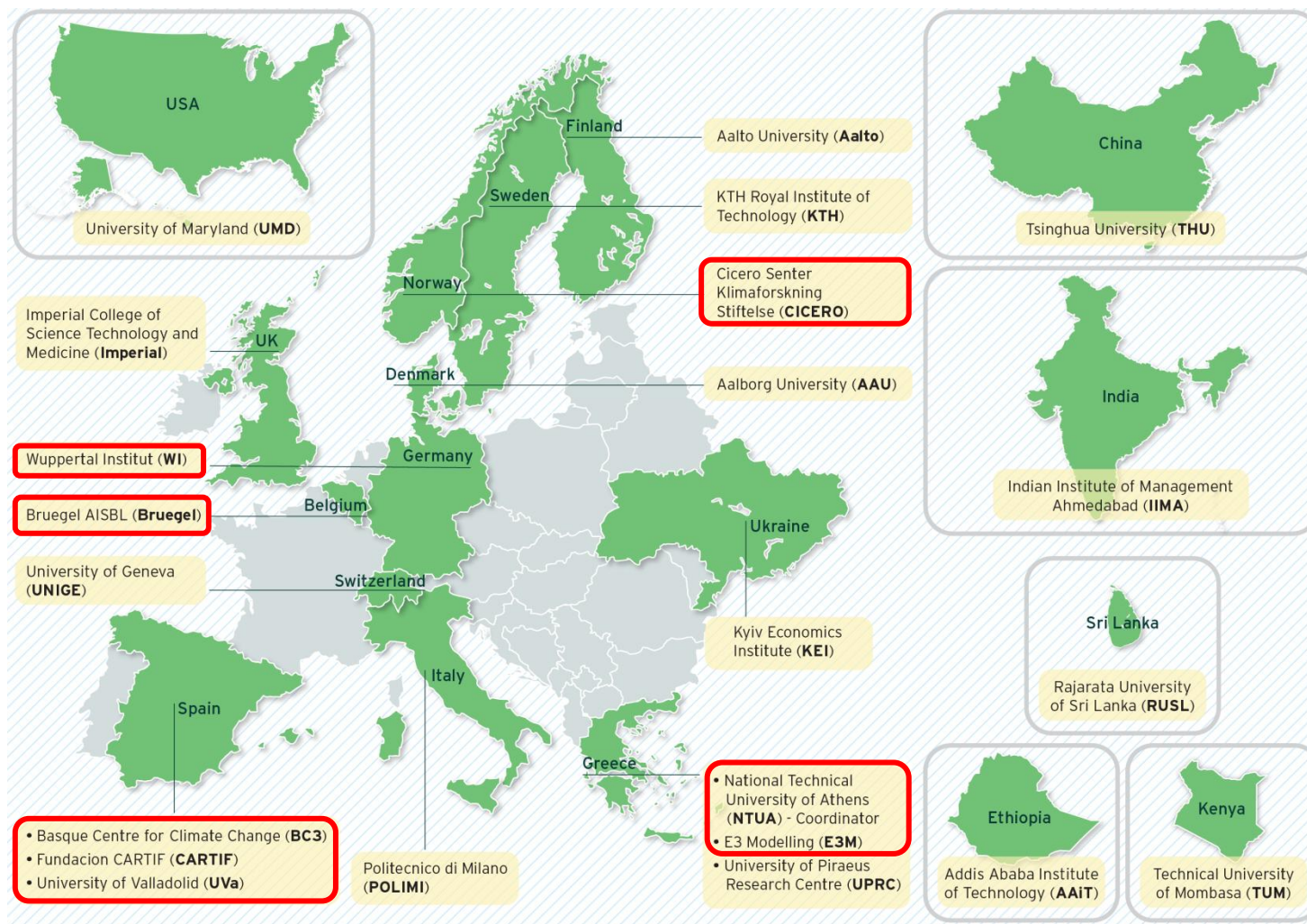
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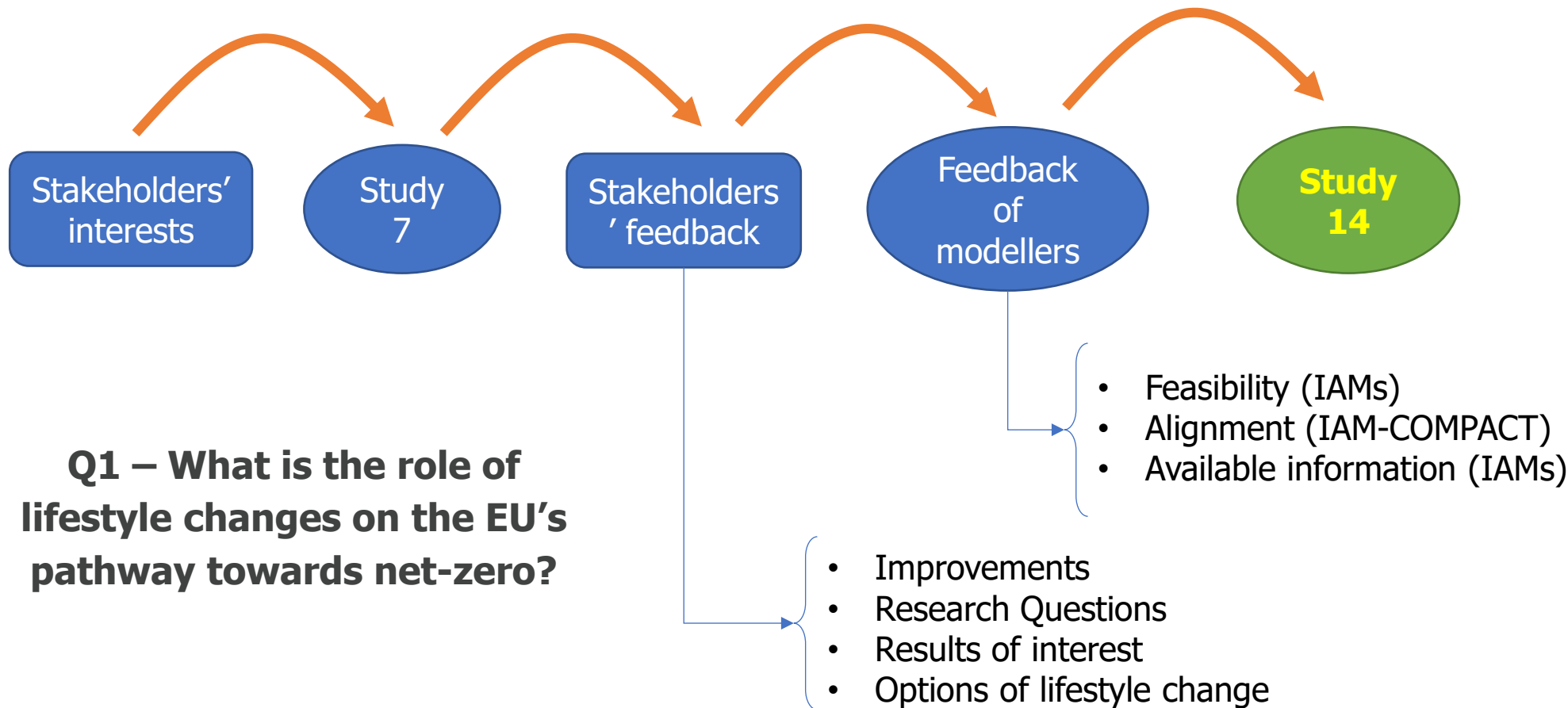
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Lifestyle change refers to broad, long-term, and sustainable adjustments in people's way of living (definition adopted from "sustainable lifestyle", UNED 2016)

1. Scope & RQ	From stakeholders' engagement to study design
2. Methods	Model intercomparison, literature review & system dynamics
3. Results	Impacts of a lifestyle change in the Europe-27 region
4. Conclusions	Policy recommendations & further work







Q2 – What are the emissions, land use and cost implications of changes in households towards a more sustainable lifestyle (mobility, housing and diets)?



Geographical scope: EU-27 region.

Temporal scope: Simulations go from 2015 (mobility and housing)/2020 (for diets) to 2050. The lifestyle changes are introduced starting from 2025.

Participant models: PROMETHEUS, GCAM and WILIAM.

Subject of study: households (household consumption).

Reference scenarios:

- No-Policies: continuation of historical trends from 2015 without climate policy.
- NDC-LTT: application of climate policy to meet the national determined contributions by 2030, and additional long-term targets by 2050, aiming to avoid the 2°C stated by the Paris Agreement.

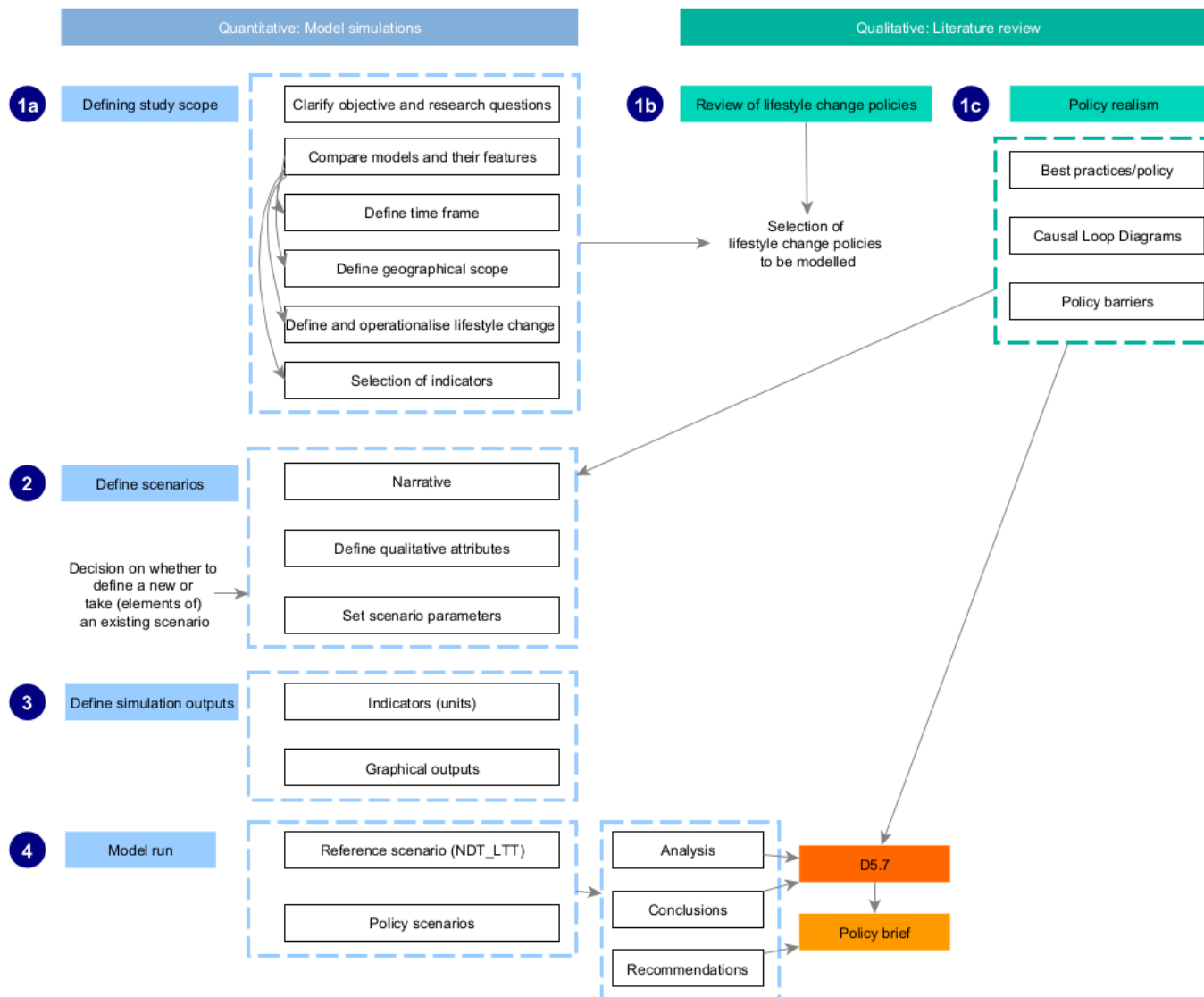
Policy scenarios:

- Moderate lifestyle change: modest change in lifestyles that largely reflects the past observed in the real world ("best-in-class"). This scenario was parametrized to be 50% of the change assumed under the high change scenario.
- High lifestyle change: more radical yet unprecedented lifestyle change.

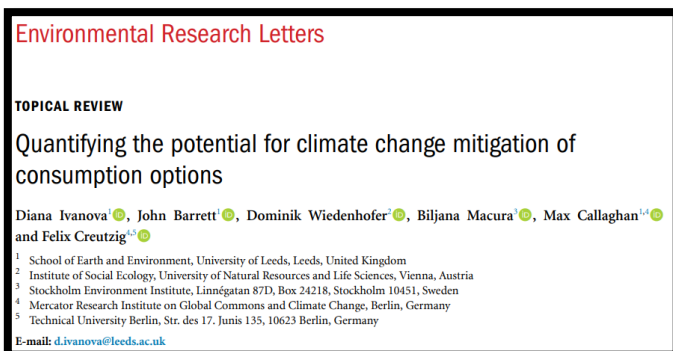
Impacts: emissions, land use changes, households expenditures.



What are the cost implications (emissions, economic, land use, materials, energy) of lifestyle changes in mobility, housing and diets?
What is the role of lifestyle changes on the EU's pathway towards net-zero?



Literature review



Selection of lifestyle changes

They ranked 43 effective consumption options according to their mitigation potential measured in tons of CO₂eq/capita/yr. List included in the IPCC-WGIII for the 6th assessment report.

List of lifestyle changes modelled in the study

Mobility	• Change in mobility demand (number of person-km travelled/yr) • Change in transport mode (% shares of NMT, trains, road (buses+LDV), domestic aviation, international aviation) • Change in vehicle occupancy (number of people per vehicle)
Housing	• Change in residential floorspace per person (squaremeters/person) • Change in the use of domestic energy for space heating/cooling, hotwater, cooking and other domestic energy end-uses (% end use energy by type of domestic use)
Diets	• Change towards a more plant-based and less meat-based diet (gr/day) • Change in the generation of food waste (kg/yr)



Literature review



Quantification of mobility & housing

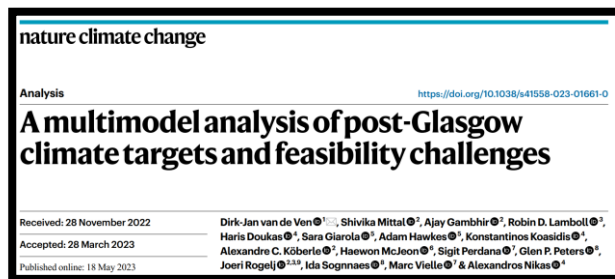
This project worked with experts and surveys to put values in mobility behaviour by 2050 in Europe-27.



THE LANCET

Quantification of diet

We assume that EU-27's population has made a shift towards a diet with low levels of animal-source foods in line with the flexitarian diet recommended by the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems.



Quantification of reference scenarios

The authors use four IAMs to assess CO₂ emission trajectories in the near- (2030) and long-term (2050) on the basis of national policies and pledges. The feasibility of national long-term pledges towards net-zero was also considered.



Passenger transport assumes 58% – 63% of the mitigation potential of this lifestyle change.

Housing assumes 25%.

Diet change assumes 12% – 17%.

In terms of emissions, PROMETHEUS show lower reductions than WILIAM and GCAM.

Reduction of CO₂ equivalent emissions (CO₂, CH₄, N₂O) from 2025 to 2050 for mobility, housing and diet change.

	WILIAM	GCAM
	No-policies	
Moderate change	-15,57%	-19,67%
High change	-22,09%	-25,71%
	NDC-LTT	
Moderate change	-10,97%	-17,29%
High change	-17,21%	-22,80%

Reduction of CO₂ emissions from 2025 to 2050 for mobility and housing.

	WILIAM	GCAM	PROMETHEUS
	No-policies		
Moderate change	-19,39%	-19,49%	-7,51%
High change	-23,22%	-25,30%	-11,68%
	NDC-LTT		
Moderate change	-12,08%	-19,01%	-4,80%
High change	-17,20%	-24,62%	-7,56%

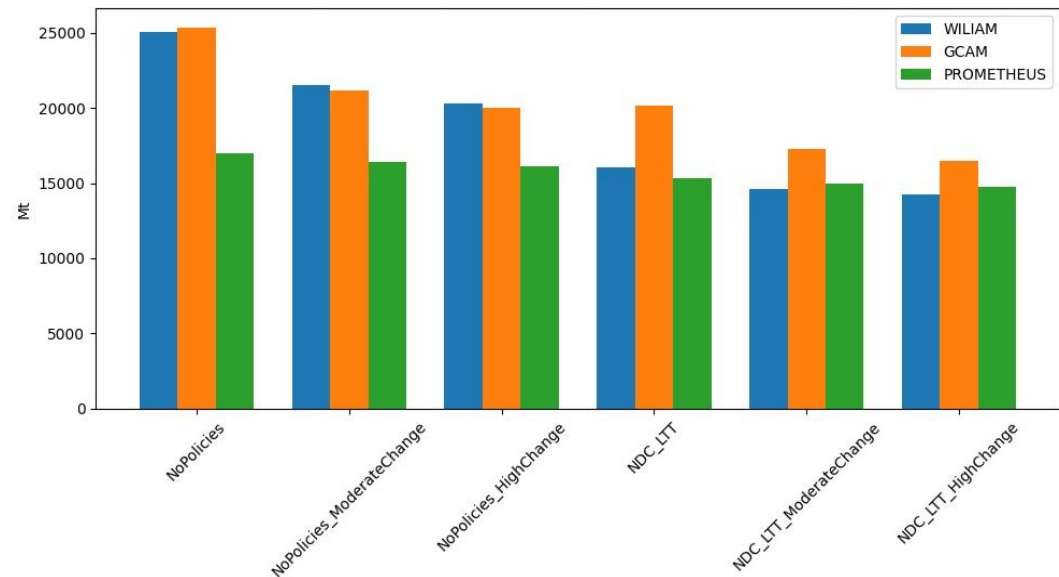
Agreement: the three IAMs show a similar decreasing trend.

Disagreement: WILIAM and GCAM achieve around 19,6%, resp. 23,7% under assumptions of moderate change and 26%, resp. 30% of high lifestyle change. PROMOTHEUS shows much lower (factor 3-4) reductions.

Simulation results transport (CO₂ emissions reduction between 2025 and 2050).

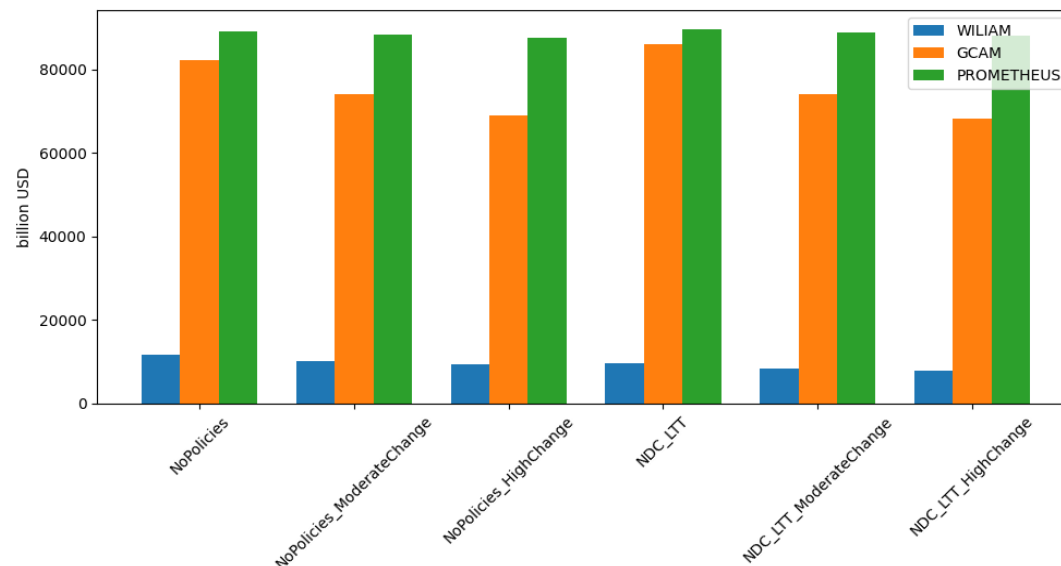
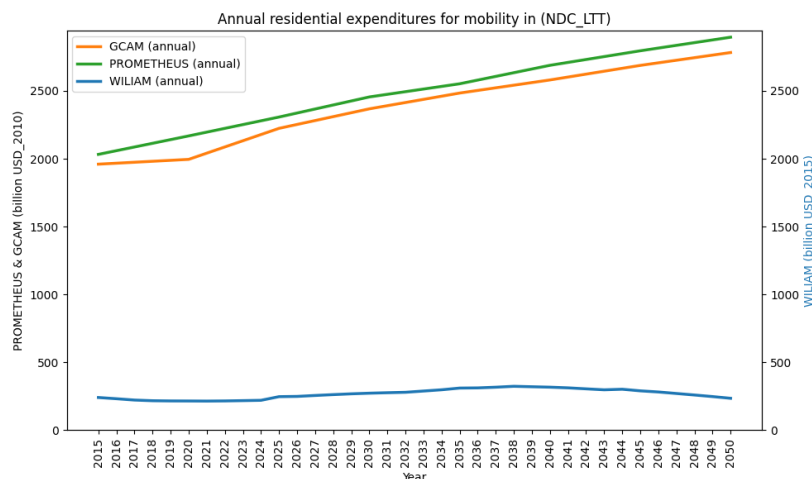
	WILIAM	GCAM	PROMETHEUS
No-policies			
Moderate change	-19,60%	-23,74%	-5,41%
High change	-26,17%	-30,25%	-8,52%
NDC-LTT			
Moderate change	-15,18%	-22,95%	-4,69%
High change	-19,02%	-28,84%	-7,36%

EU-27 carbon budget released in passenger transport (cumulative CO₂ emission in Mt over the period 2015-2050).



Agreement: the three IAMs show a decreasing trend. Similar percentages between WILIAM and GCAM, PROMETHEUS shows lower reductions.

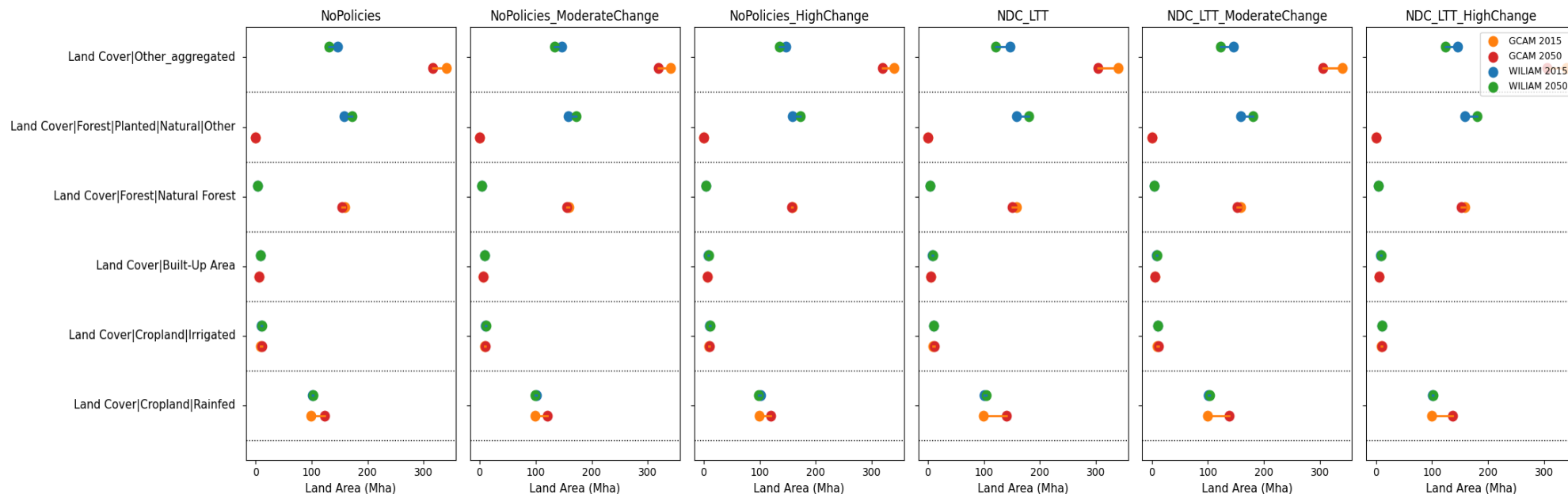
Disagreement:
historical data
requires further
harmonisation.



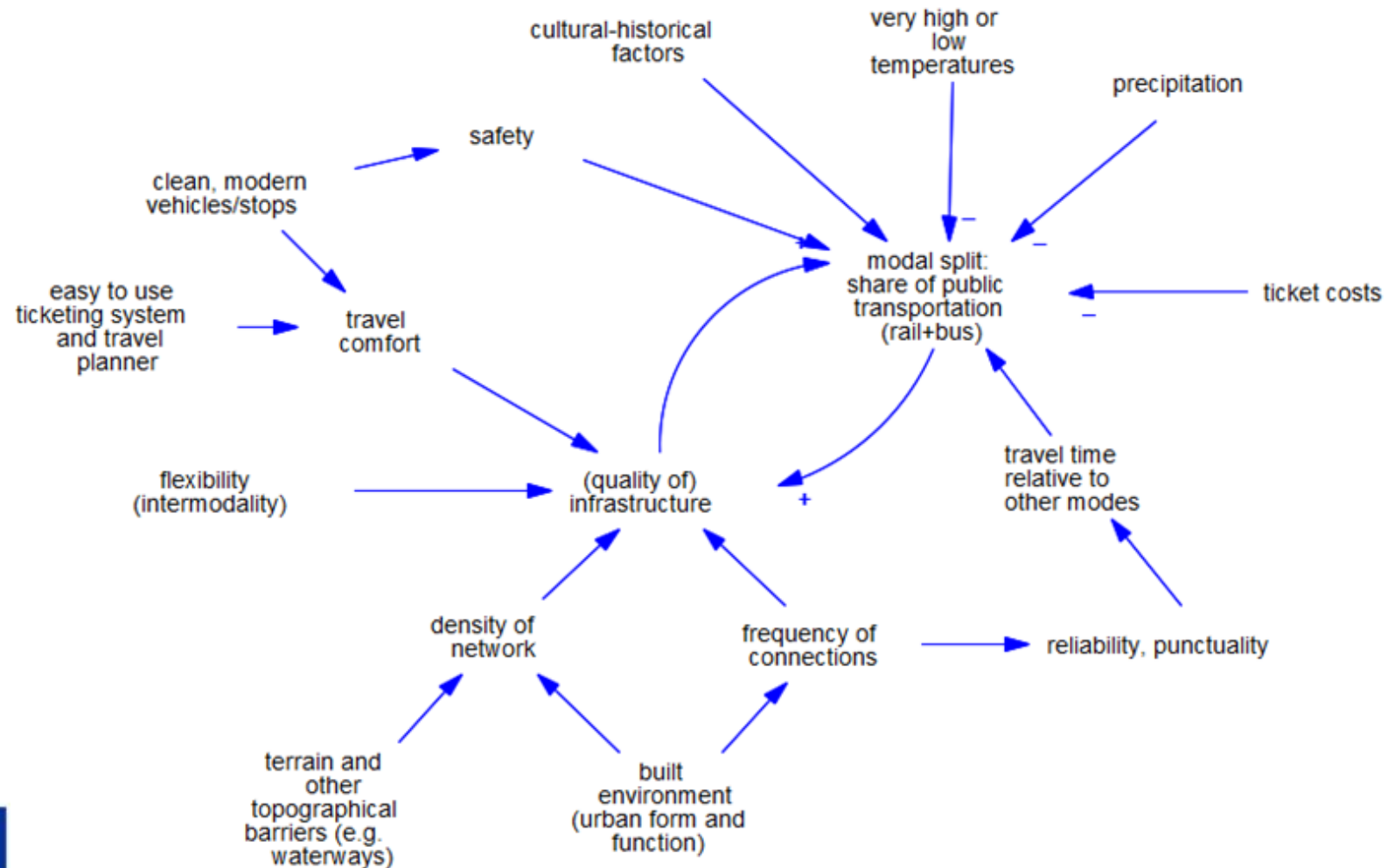
	WILIAM	GCAM	PROMETHEUS
	No-policies		
Moderate change	-13,26%	-10,14%	-0,94%
High change	-20,55%	-16,06%	-1,73%
	NDC-LTT		
Moderate change	-13,47%	-13,85%	-0,95%
High change	-19,01%	-20,64%	-1,86%



Disagreement: GCAM and WILIAM agree in the historical data of built-up and cropland, while they disagree in the value of forest (2015).



Causal loop diagram "Modal split: share of public transportation (rail + bus).



Mobility



- High mitigation potential assuming a very moderate decrease in people's mobility.
- Passenger transport policies can be considered the "low-hanging fruits" among the decarbonisation-of-households policies.
- Further emissions savings could be harnessed if it is combined with an electrification process.

Housing



- The building sector bears a big energy and GHG saving potential without having to significantly reduce the current per capita floor space in the EU or compromising on comfort.
- Emission savings would be even higher if it is combined with technical measures.
- Governments rely very heavily on people's personal choices and conscientiousness to harness the full emission saving potential.

Diet



- Dietary changes achieve significant reductions of AFOLU emissions (up to ~30%). However, its related reduction is more modest (12-17%).
- Additional beneficial effects on human health and other planetary boundaries besides the climate.
- Politicians have few levers to influence people's dietary choices besides education and awareness raising, and pricing policies that disincentivise.





Thank you!

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