

Gathering robust evidence on carbon neutrality

Group Work on „Robustness and legitimacy of evidence on emissions gap“

NAVIGATE Stakeholder Workshop

„Robustness and Legitimacy of models for climate policy assessment“

Chris Weber and Elmar Kriegler, 26.05.2020



Definition of carbon neutrality for the purpose of the discussion

Net zero CO₂ emissions of a given entity (world, country, region, company ...)

- based on direct (production-based / Scope 1) emissions
- based on direct and indirect (consumption-based / Scope 1-3) emissions

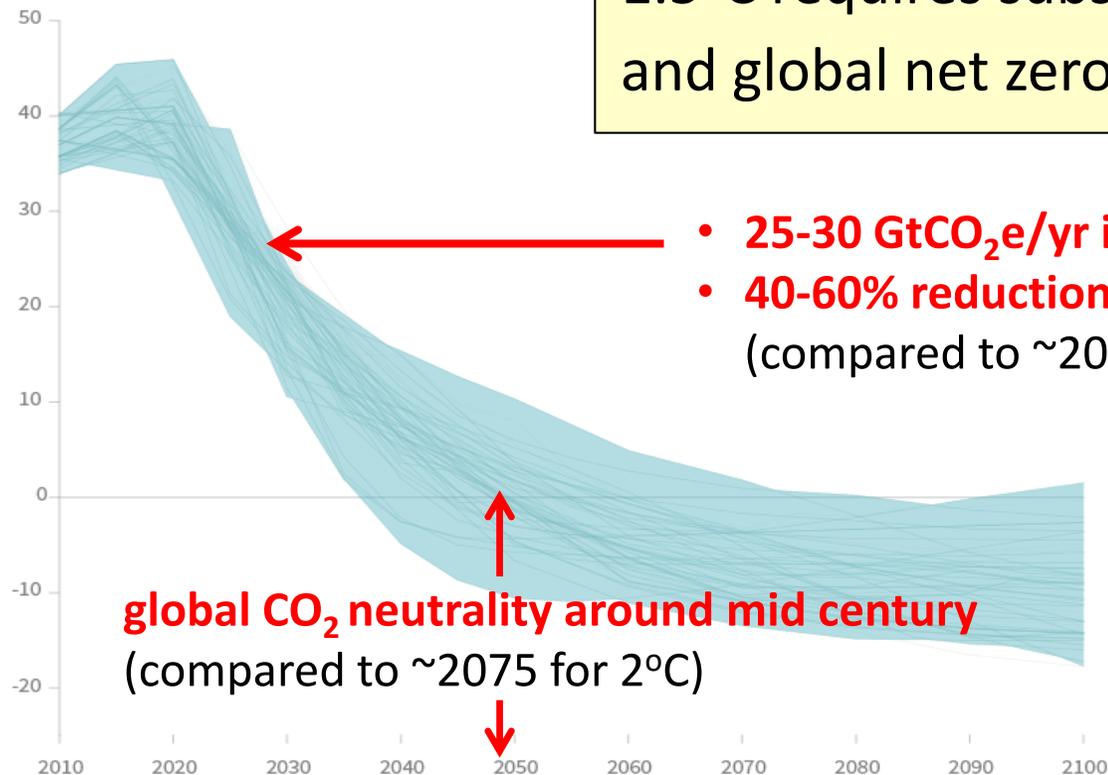
➔ Two different definitions possible. The first one is more common

➔ Carbon neutrality can be a target for different entities across scales (unlike a temperature limit which is only applicable on a global level)



SPM3a | 1.5°C emissions pathway characteristics

Global total net CO₂ emissions
Billion tonnes of CO₂/yr



1.5°C requires substantial emissions reductions until 2030 and global net zero CO₂ emissions by mid century

- 25-30 GtCO₂e/yr in 2030
- 40-60% reductions of CO₂ wrt to 2010 (compared to ~20% for 2°C)

global CO₂ neutrality around mid century (compared to ~2075 for 2°C)

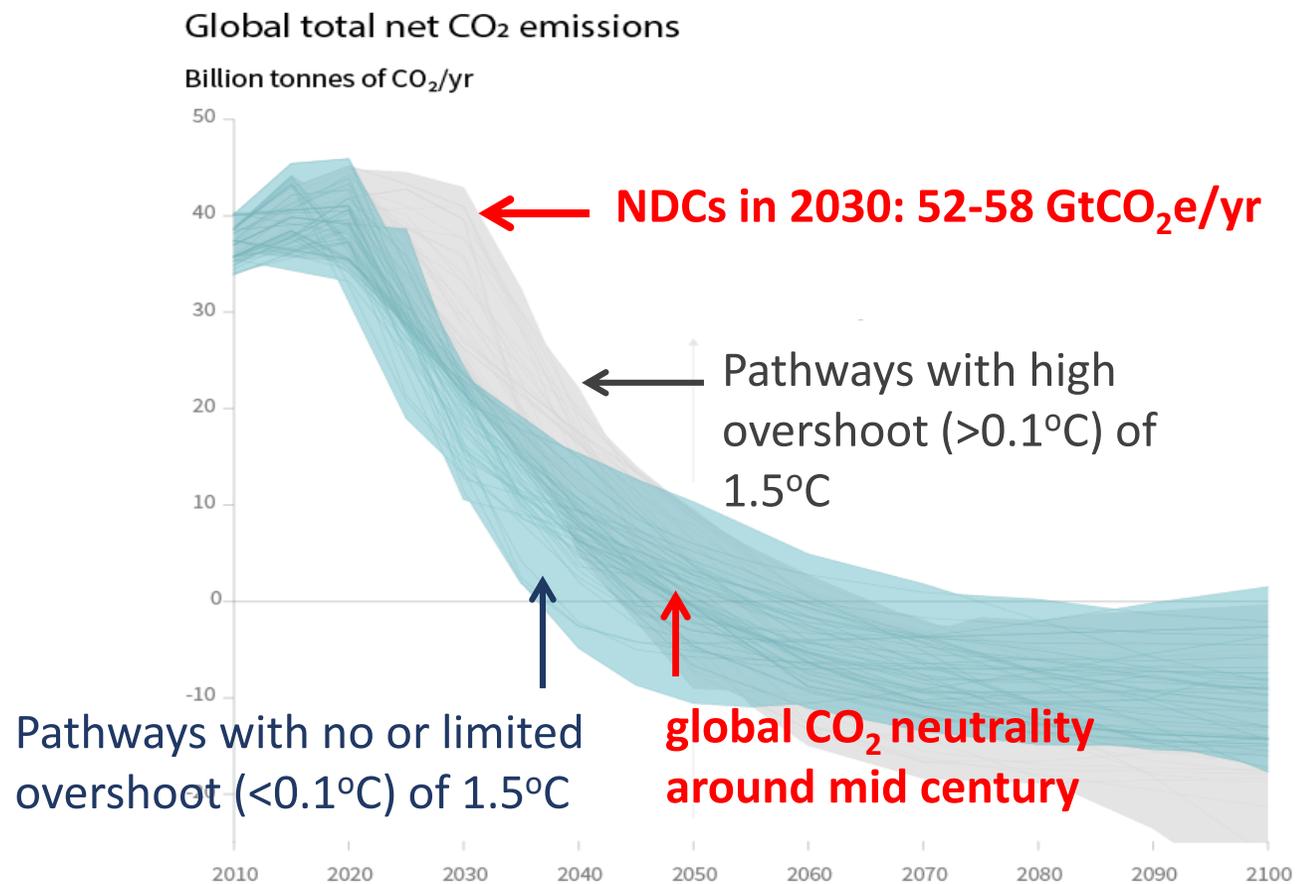
Pathways with no or limited overshoot (<0.1°C) of 1.5°C

Timing of net zero CO₂
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios

Pathways limiting global warming to 1.5°C with no or low overshoot

SPM3a

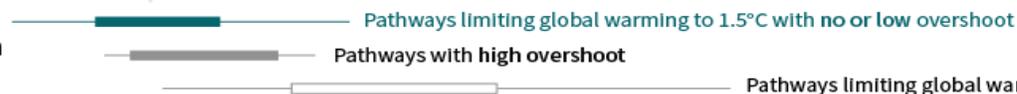
Robustness of timing of carbon neutrality



Timing of carbon neutrality

- fairly robust against near term policy assumptions if temporary overshoot is allowed
- earlier in delay scenarios if peak warming limit is imposed.
- more robust than carbon budget estimates
(+/- 200 GtCO₂ → +/- 10 years)

Timing of net zero CO₂
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios



Pathways limiting global warming below 2°C
(Not shown above)

Evidence on carbon neutrality in national pathway modelling

Results from COMMIT

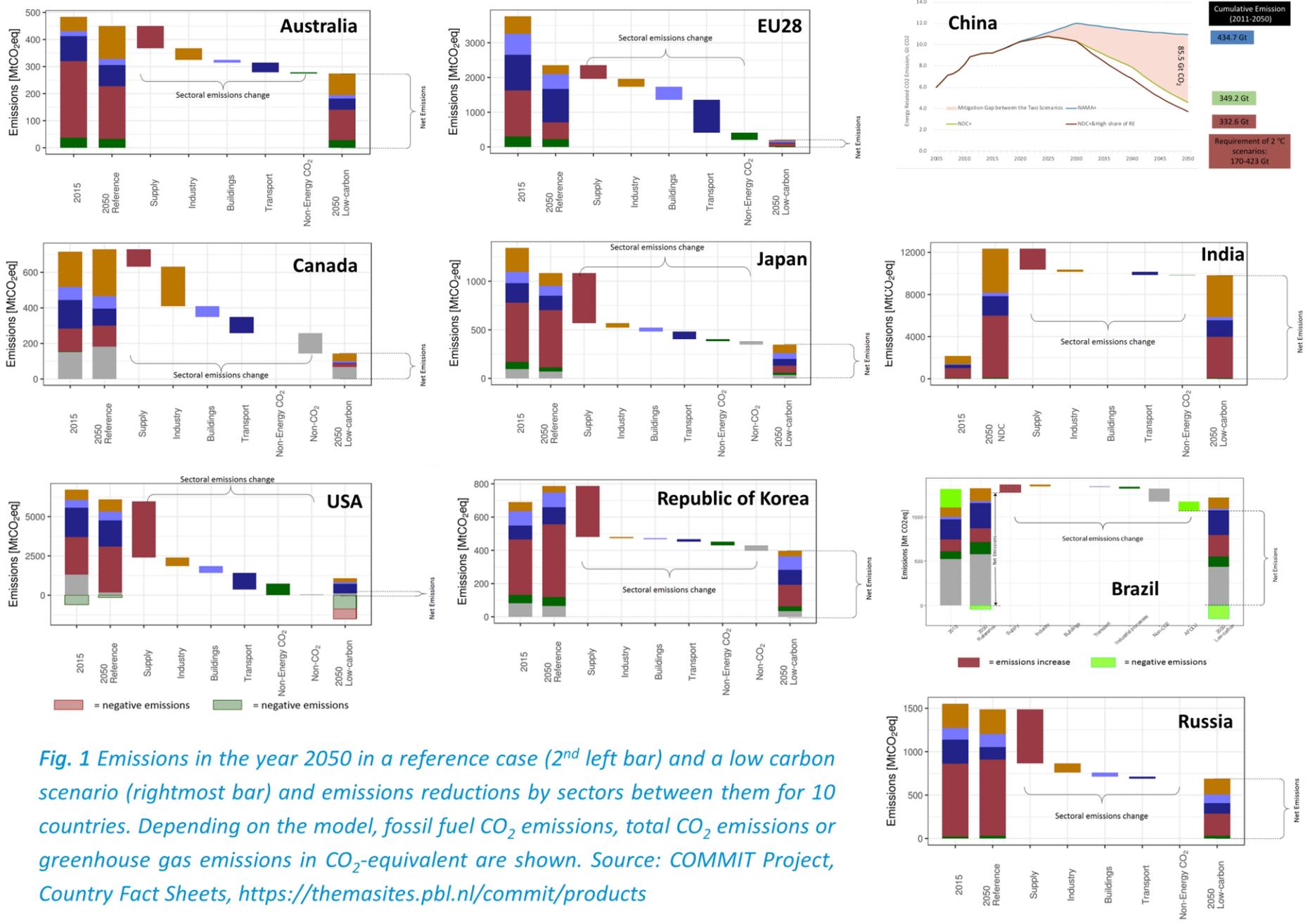


Fig. 1 Emissions in the year 2050 in a reference case (2nd left bar) and a low carbon scenario (rightmost bar) and emissions reductions by sectors between them for 10 countries. Depending on the model, fossil fuel CO₂ emissions, total CO₂ emissions or greenhouse gas emissions in CO₂-equivalent are shown. Source: COMMIT Project, Country Fact Sheets, <https://themasites.pbl.nl/commit/products>

„Net zero targets“ for non-state actors

- Carbon neutrality commitments have long been common for non-state actors (companies, cities/subnationals, etc)
 - Often ‚carbon neutral‘ includes offsets/compensation
- Carbon neutral -> „net zero“ since SR1.5
- Several commitment campaigns building support for such targets, e.g.
 - Science Based Targets Initiative (companies)
 - Net Zero Asset Owner Alliance (investors)
- Key piece for COP26
- IAMs and resulting scenarios/studies are key inputs for such initiatives



„Net zero“ for non-state actors have similar issues as for countries

- **Gases:** Carbon vs. GHGs + accounting for non-CO2 (GWP vs. Dynamic accounting)
- **Timing:** long term + interim ‚pathway‘ targets
- **Offsetting:** allowable and to what extent?
- **Equity:** who must move at what rate?
- **Tech dependency:** CDR, CCS dependency implied in different pathways
- **Influence/Scope:** direct vs. Value chain/consumption based accounting



Desired output of the group work

Aim: Enable participants to share experiences and reflect on good-practice examples, expectations, and remaining challenges for robustness and legitimacy of models for climate policy assessment.

The following questions shall be addressed for the case of carbon neutrality:

- What defines robust models, modeling results, and climate policy recommendations?
- By what means can this robustness be assessed, ensured, documented, and communicated?
- What do models need in order to be legitimate tools to inform climate policy?

Need to **produce a short summary of the discussion** to be shared with participants by tomorrow (e.g. some visuals with 1/2-2 page summary)



What do models need in order to be legitimate tools for exploring carbon neutral futures and pathways towards them?

- **Granularity:** Necessary region, sector and technology detail to capture carbon neutral systems at the scale of interest
- **Systems and policy dynamics:** Sufficiently accurate description of the interaction between systems and policy pathways towards carbon neutrality
- **Transparency and validity:** Publicly available and expert reviewed model documentation (high level and detailed), track record of applications
- **Uncertainty quantification:** Ability to explore parameter and scenario sensitivities of pathways towards carbon neutrality



What scenario designs are needed to produce robust insights on pathways to carbon neutrality?

What are key variations in socio-economic, policy and technology assumptions?

- Socioeconomic pathways/inputs (inc transformative ones)
- Policy coverage, effectiveness, timing and heterogeneity
- Technology parameters and limits
- Alternative management practices
 - Energy: energy efficiency/conservation; deep electrification and sector coupling; biofuels
 - Industry and buildings: CCU; carbon storage in materials and buildings
 - Land: plantation vs. sustainable forestry; agricultural practices; SOC enhancement

What studies and assessment approaches are needed to produce robust insights on carbon neutral futures and pathways towards them?

- **Interdisciplinarity:** How to assess the interplay between institutional, economic, and technological change (incl political economy considerations)?
- **Model comparison and diagnostics:** How to assess robust and sensitive features of model results individually and across models?
- **Communication of results:** How can insights from the assessment, including on robustness, be communicated convincingly and accurately to stakeholders?



Looking forward to productive group work!

