

# 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“

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## Definition of carbon neutrality for the purpose of the discussion

Net zero CO<sub>2</sub> 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

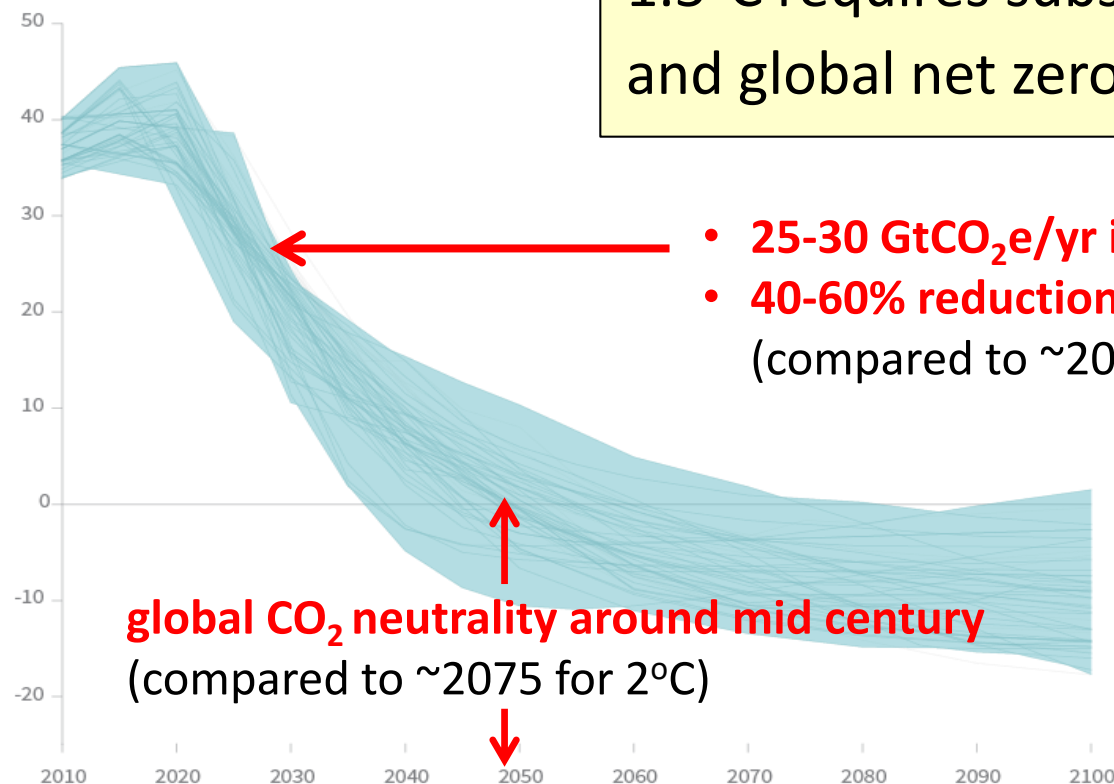
➔ Carbon neutrality can be a target for different entities across scales  
(unlike a temperature limit which is only applicable on a global level)



# SPM3a | 1.5°C emissions pathway characteristics

Global total net CO<sub>2</sub> emissions

Billion tonnes of CO<sub>2</sub>/yr



1.5°C requires substantial emissions reductions until 2030 and global net zero CO<sub>2</sub> emissions by mid century

- 25-30 GtCO<sub>2</sub>e/yr in 2030
- 40-60% reductions of CO<sub>2</sub> wrt to 2010 (compared to ~20% for 2°C)

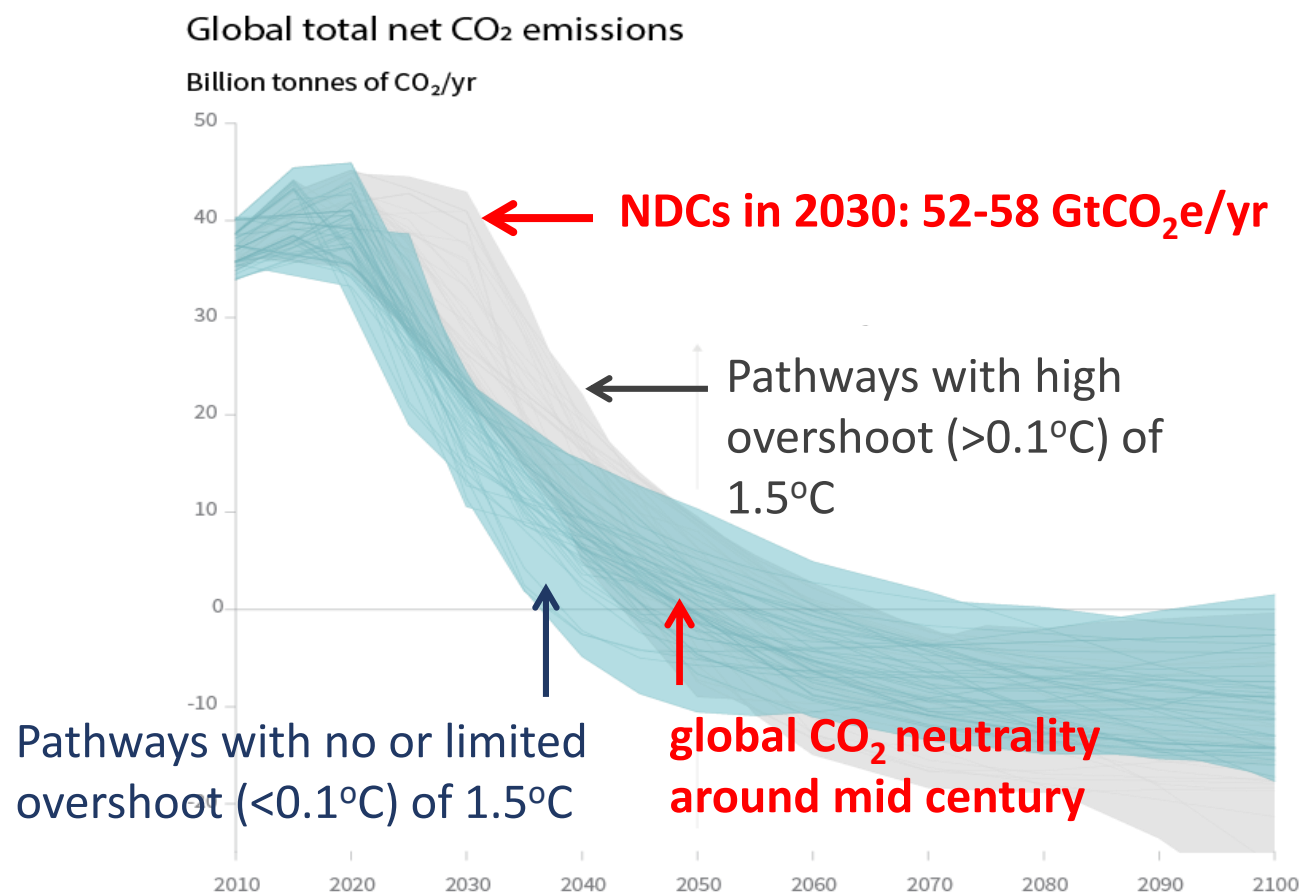
**global CO<sub>2</sub> neutrality around mid century**  
(compared to ~2075 for 2°C)

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

Timing of net zero CO<sub>2</sub>  
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 GtCO<sub>2</sub> → +/- 10 years)

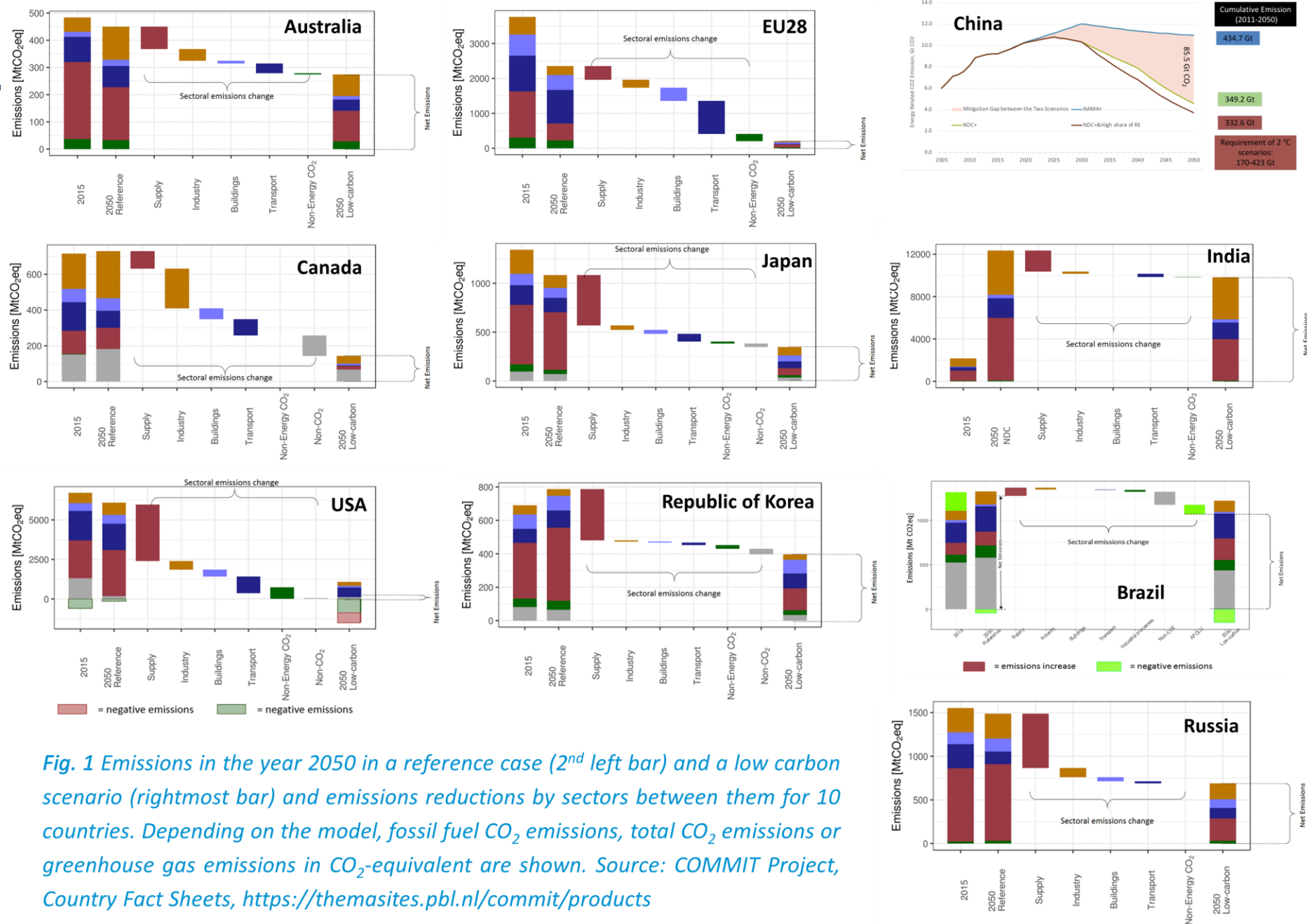
Timing of net zero CO<sub>2</sub>  
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios

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

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 (2<sup>nd</sup> 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 CO<sub>2</sub> emissions, total CO<sub>2</sub> emissions or greenhouse gas emissions in CO<sub>2</sub>-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!

