
ACHIEVABILITY OF THE PARIS AGREEMENTS' TARGETS IN THE EU - IMPLICATIONS FROM A COMBINED BOTTOM-UP MODELLING AND BUDGET APPROACH*

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Introduction

■ Paris agreement:

- limit global warming to “well below 2°C” and
- “pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels”
- reach net-zero emissions in the second half of the century

■ Global carbon budget between 2017-2100:

- 2°C limit: between 940 and 390 GtCO₂ (medium estimate **760 GtCO₂**)
- 1.5°C limit: 167 and -48 GtCO₂ (medium estimate **59 GtCO₂**)

■ Overarching question:

- What kind of transformation is necessary to stay within those budgets?

Different approaches to determine transformation pathways from a modelling perspective

■ **Climate Models**

- lack a sufficient level of detail of the energy and non-energy systems but provide insight on the impacts of emissions

■ **Integrated Assessment Models (IAMs)**

- include a certain level of detail of the energy and non-energy systems while still able to model the impacts of emissions

■ **Techno-economic bottom-up models or macroeconomic models**

- applied to analyze transformation pathways but lack the information to make projections on the associated climate impact

Approach: Compare decarbonization ambitions of global and national 2°C scenarios

- **Focus on Europe**
- **Global and European mitigation scenarios**
- **National mitigation scenarios** with a GHG reduction of 80 – 100 %

- **Looking from a carbon budget perspective:**
 - are the **national mitigation scenarios** in line with CO₂-emission projections of the **global and European scenarios**?

- **Burden sharing:** do the selected scenarios have the potential to reach a **fair share carbon budget**
 - calculations provided by Gignac and Matthews (2015)
 - budget approach applies contraction & convergence framework for allocation of emission allowances by Meyer (2000)

Methods: selection of national decarbonisation scenarios

■ Selection criteria

- level of ambition compatible with the 2°C target or 80-100% GHG reduction by 2050
- four european biggest emitters that together cover about 50% of GHG emissions

■ Scenario selection: national mitigation scenarios :

- Italy: 83 %, Deep Decarbonisation Pathways Project (SDSN/IDDRI 2015)
- France: 83 %, Scenario négaWatt, (négaWatt 2014)
- Germany: 95 %, Climate Protection Scenario KS 95 (BMUB 2015)
- UK: 100%, Zero-Carbon Britain 2030 (CAT 2013)

- Country's figures are applied to construct rough estimates for reduction pathways for the EU as a whole

Methods: Scenario selection from AR5 Scenario Database

- Selection criteria:

- likelihood of at least 2/3 to meet the 2°C target or 1/2 to meet the 1.5°C target

- **Global mitigation scenarios (EU data) (projects AME, AMPERE and LIMITS)**

- **data for CO₂-emissions 2005-2100**

- GCAM
- GCAM 2.0
- REMIND
- MERGE-ETL
- WITCH
- IMAGE
- IMAGE 2.4
- POLES
- TIAM-ECN
- DNE21*

- **European mitigation scenarios (project AMPERE)**

- **data for CO₂-emissions 2005-2050**

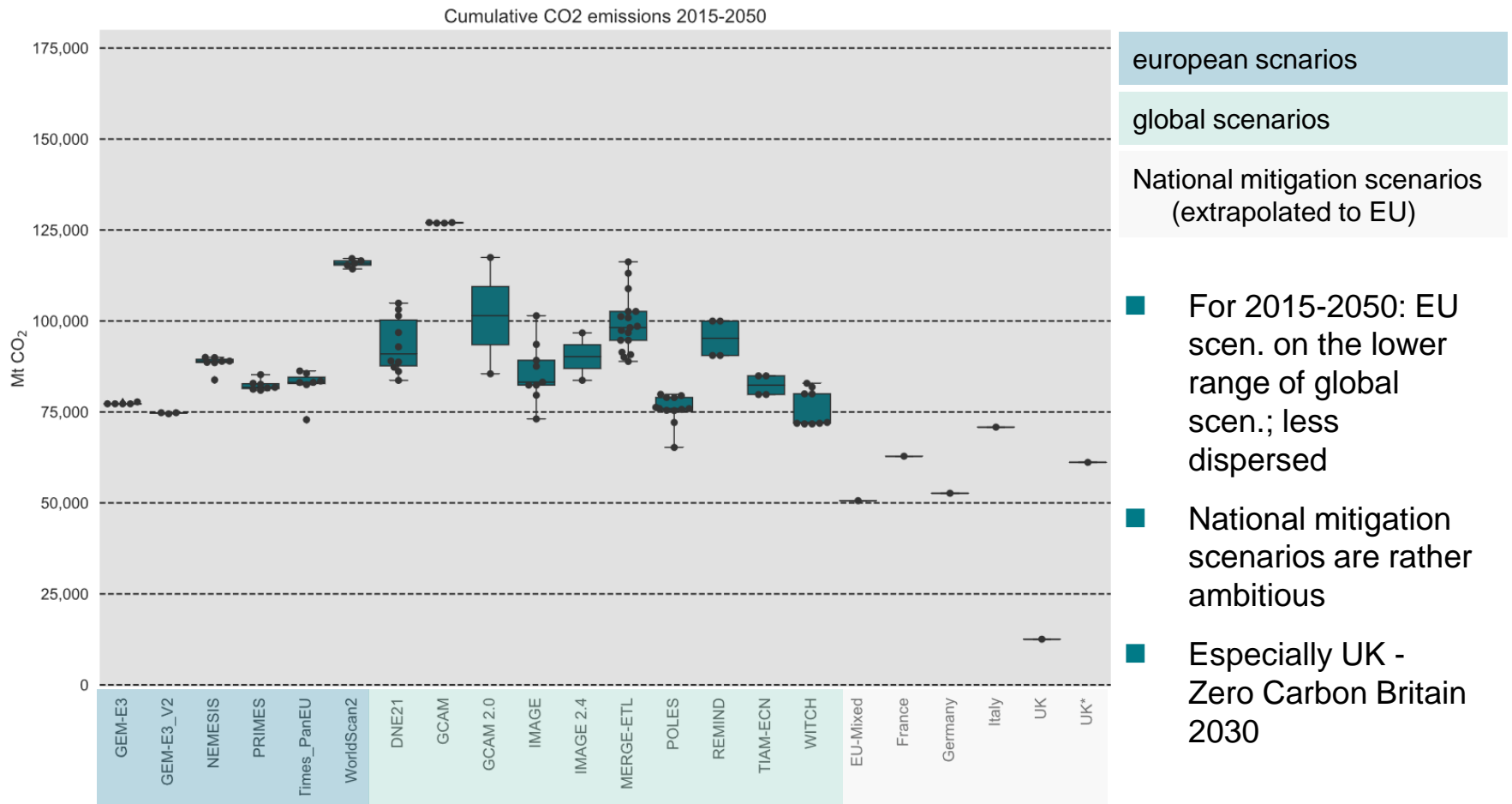
- WorldScan2
- GEM-E3
- GEM-E3 V2
- NEMESIS
- PRIMES
- Times_PanEU

- **assumption for CO₂-emission projections 2015-2100:**

- linear decrease of CO₂-emissions from year 2050 to zero at the year 2070

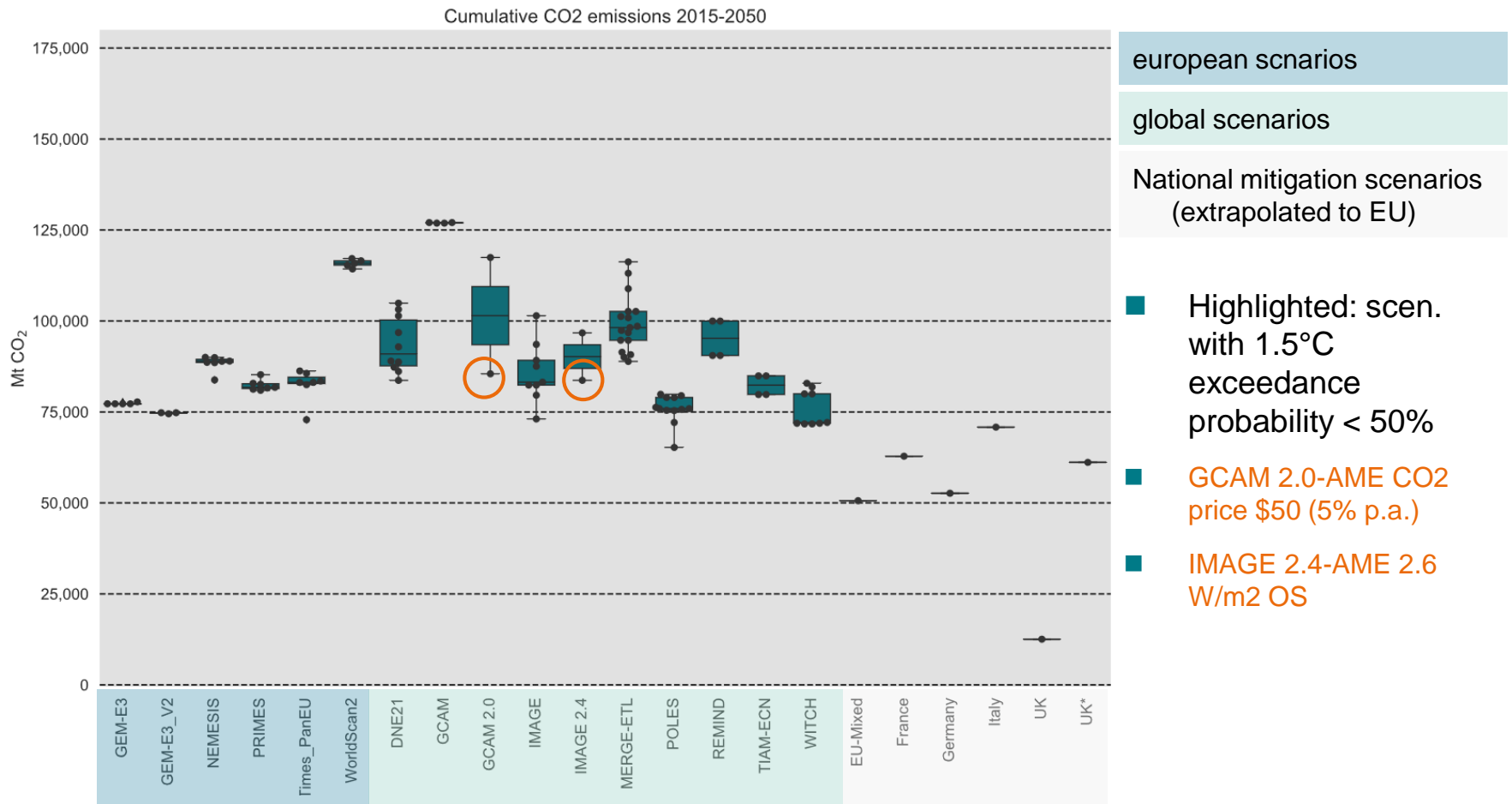
* data availability for DNE21 until year 2050: same underlying assumption for projections until 2100 as for european mitigation scenarios

Results: comparison of cumulative CO₂-emissions from european + global + national 2°C scenarios 2015-2050 for the EU



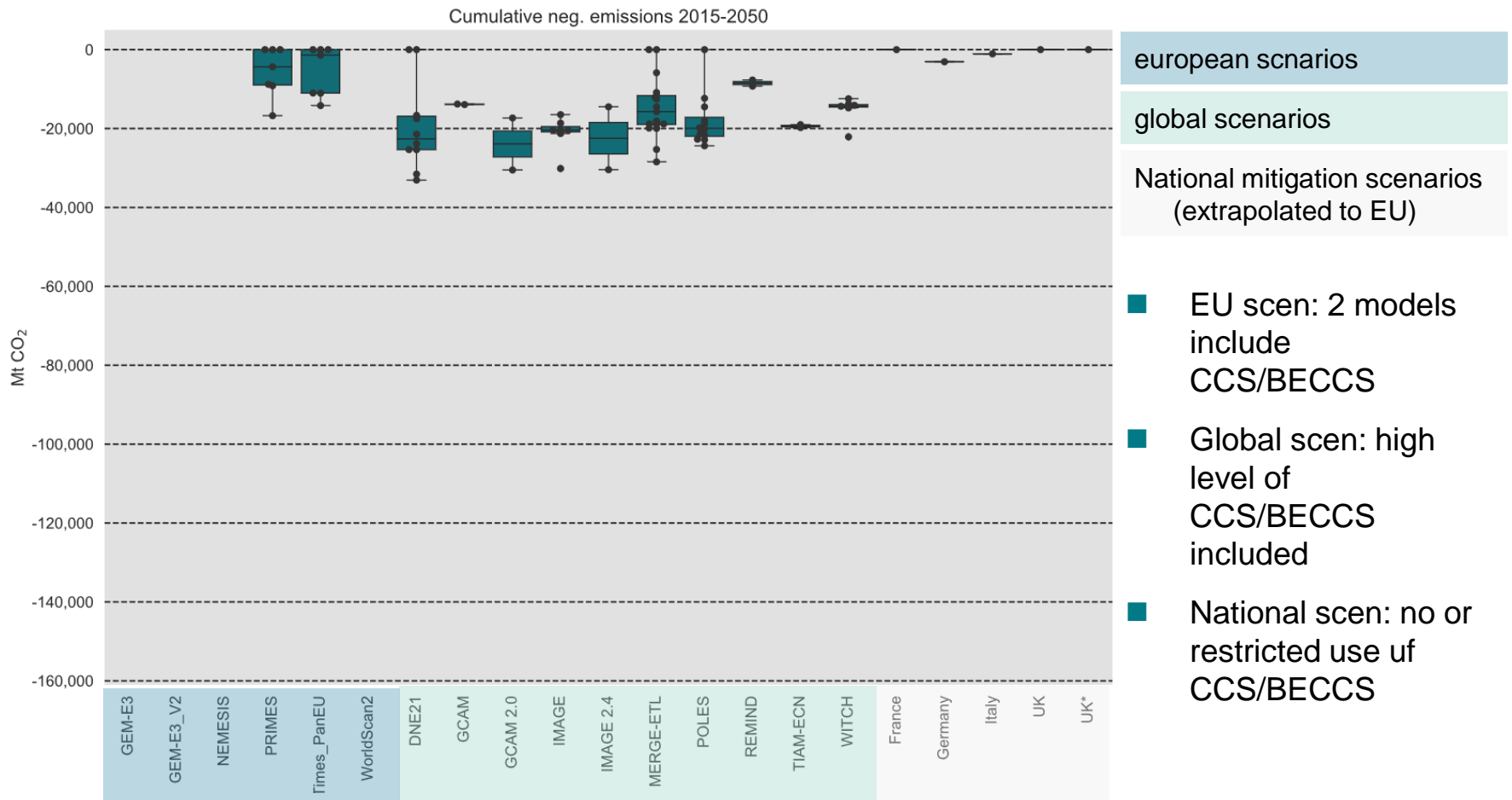
UK*: available data from „Zero Carbon Britain 2030“ extended to 2050

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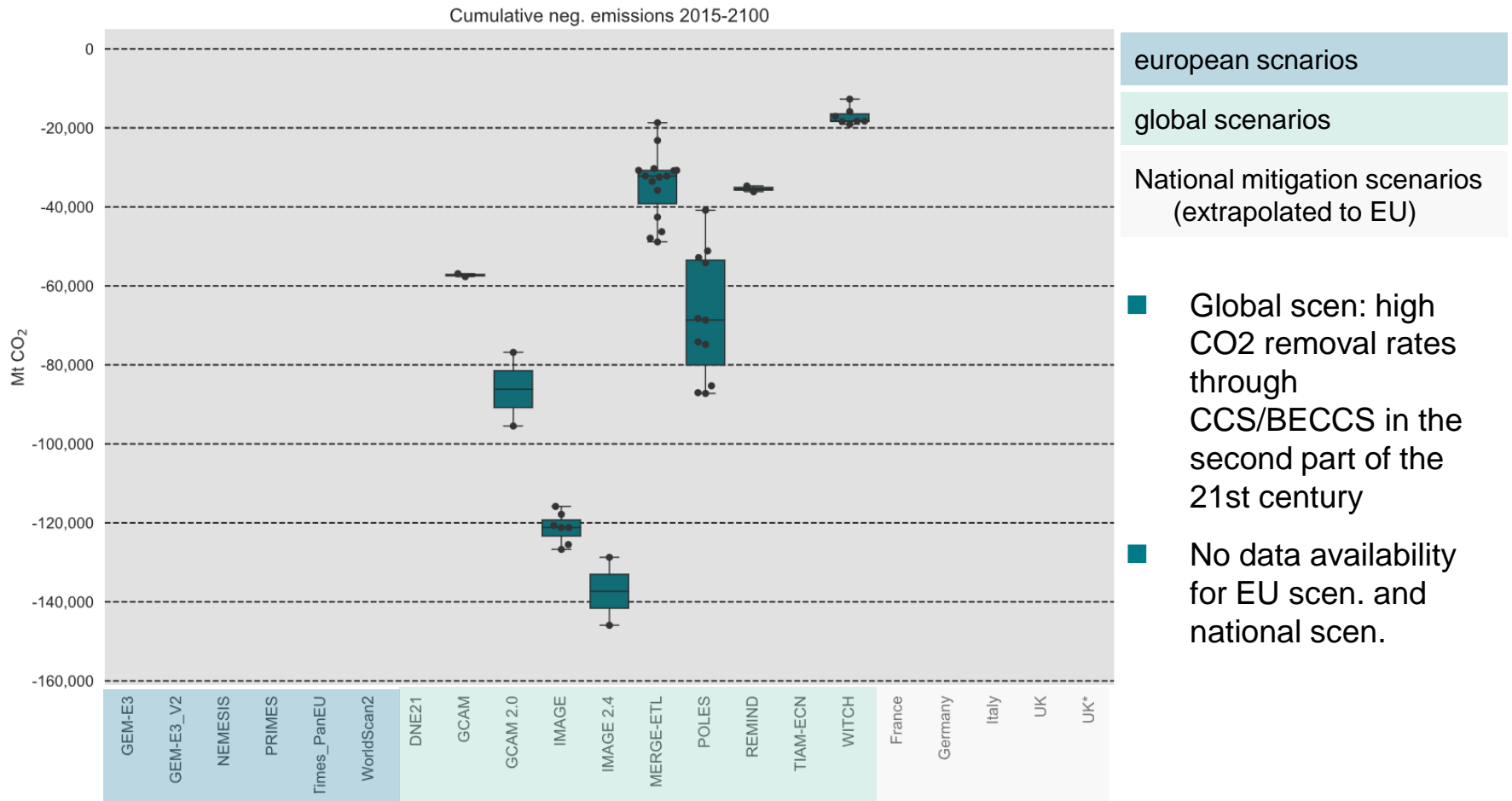
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Results: comparison of cumulative neg. CO₂-emissions from CCS/BECCS of european + global + national 2°C scenarios 2015-2050 for the EU



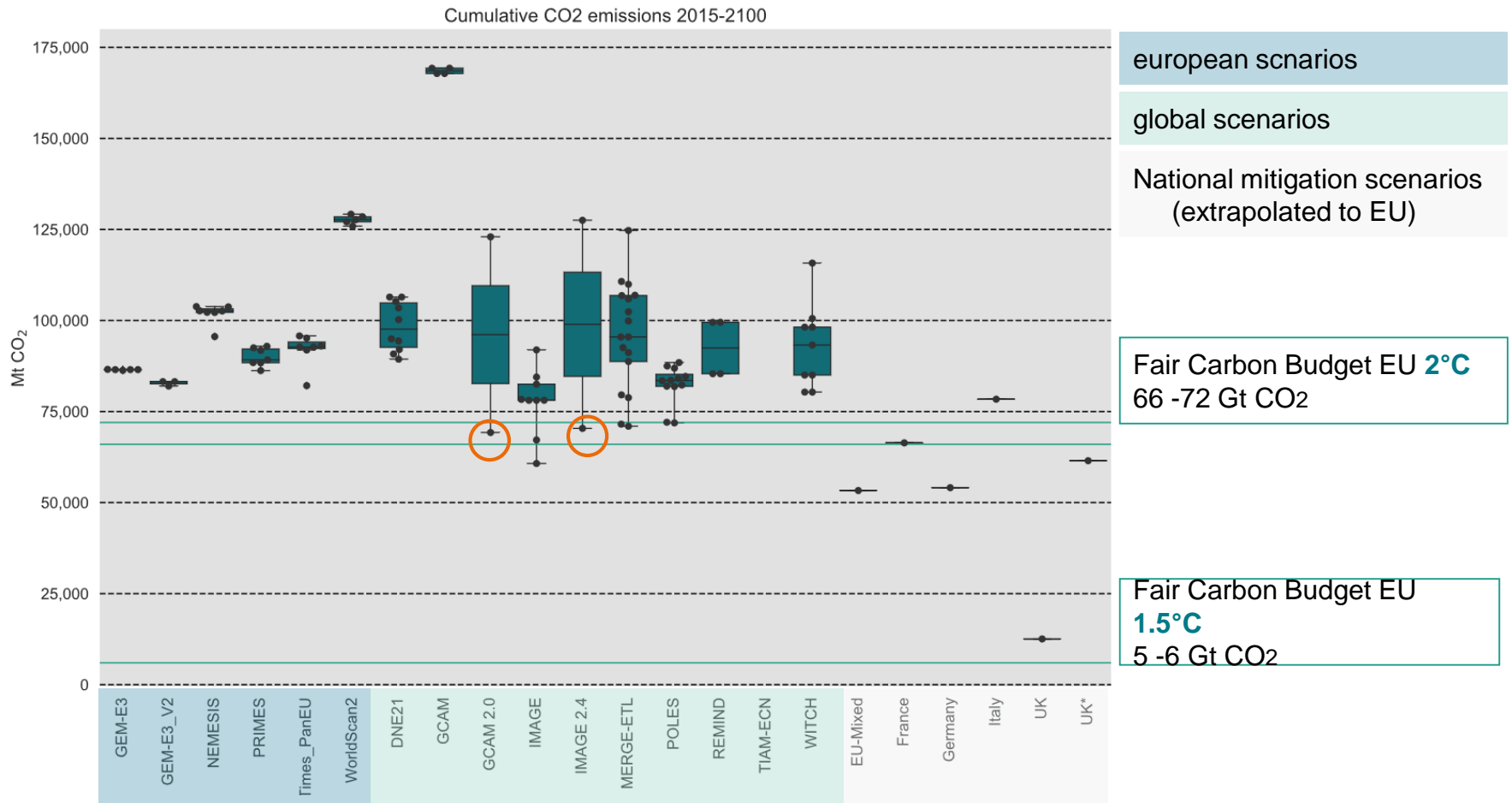
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Conclusions:

- **National mitigation scenarios** are more ambitious than the most ambitious global scenarios or european scenarios in the first half of the 21st century.
- **Global and european scenarios** include a high level of negative emissions through **CCS/BECCS** while national mitigation scenarios have no specific focus or only very restricted use.
- The **fair carbon budget** calculated for the 2°C EU target is achieved by some ambitious global scenarios but national mitigation scenarios even are below the EU benchmark
- **National mitigation scenarios** achieve emission reduction by ambitious reductions of **sectoral energy intensities** (Wachsmuth, Duscha 2017)*
- **Outlook:**
 - Next to information on target points, **transformation pathways** and **reduction speed** should be taken into account
 - Further development and analyses of **non-linear reduction pathways** and determine their effects on the EU's carbon budget

*"Achievability of the Paris Agreements' targets in the EU – Comparison of Energy and Emission Intensities in International and National Mitigation Scenarios" by Jacob Wachsmuth and Vicki Duscha (Fraunhofer ISI)

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