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 ½ 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

For 2015-2050: EU scen. on the lower range of global scen.; less dispersed

National mitigation scenarios are rather ambitious

Especially UK - Zero Carbon Britain 2030

UK*: available data from “Zero Carbon Britain 2030” extended to 2050
Results: comparison of cumulative CO2-emissions from european + global + national 2°C scenarios 2015-2050 for the EU

- European scenarios
- Global scenarios
- National mitigation scenarios (extrapolated to EU)

- Highlighted: scen. with 1.5°C exceedance probability < 50%
- GCAM 2.0-AME CO2 price $50 (5% p.a.)
- IMAGE 2.4-AME 2.6 W/m2 OS

UK*: available data from “Zero Carbon Britain 2030” extended to 2050
Results: comparison of cumulative neg. CO2-emissions from CCS/BECCS of European + global + National 2°C scenarios 2015-2050 for the EU

EU scen: 2 models include CCS/BECCS
Global scen: high level of CCS/BECCS included
National scen: no or restricted use of CCS/BECCS

UK*: available data from "Zero Carbon Britain 2030" extended to 2050
Results: comparison of cumulative neg. CO2-emissions from CCS/BECCS of global (+European + national 2°C scenarios) 2015-2100 for the EU

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

- Global scen: high CO2 removal rates through CCS/BECCS in the second part of the 21st century
- No data availability for EU scen. and national scen.
Results: comparison of cumulative CO2-emissions from European + Global + National 2°C scenarios 2015-2100 for the EU

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

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*“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)
References

- Wachsmuth, J. and Duscha, V. (2017): Achievability of the Paris agreements’ targets in the EU - Comparison of Energy and emission intensities in international and national mitigation scenarios