Feasible 2020 emission windows for staying below 2°C ensuring consistency despite uncertainty

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1. Context
- 2°C limit (UNFCCC, Ref. 1)
- Greenhouse gas budget (Ref. 2)
- Country pledges for 2020 reductions

Poorly quantified relationship between short-term policy and its long-term climate outcome

2. Research question
“What is the window of emissions in 2020 for which technologically and economically feasible emission scenarios exist that limit global temperature increase to below 2°C with a likely (>66%) chance?”

In other words,
“Is there a ‘point of no return’ by 2020 that, if exceeded would foreclose reaching 2°C in the long term?”

3. What is ‘feasible’?

Feasibility is a subjective concept, entirely dependent on what is deemed possible or plausible in the real world.

Feasibility is judged here based on:

a) short-term technological feasibility
b) long-term technological feasibility
c) strong economic penalties
d) very strong economic penalties

4. Methodology
Integrated modelling approach:

a) MESSAGE (Ref. 4,5)
- detailed representation of GHG emitting sectors
- create feasible energy system transformation pathways to stay <2°C in a 2-stage approach

b) MAGICC (Ref. 5,6)
- probabilistic climate model
- computes transient temperature increase ranges over the 21st C.

Twenty-four cases (based on Ref. 7):
- technology portfolio - 6 variations
- energy demand - intermediate, low
- political framework - delayed participation, 1.5°C emission budget

5. Schematic overview

Climate policy
Scientific modelling

6. Results

Feasible 2020 emission windows for staying below 2°C

Intermediate demand
Advanced transportation
Advanced non-CO2 mitigation
Low demand

7. Main conclusions

a) Current pledges (50-55 GtCO2e/yr, Ref. 8)
not on robust path to 2°C
b) 41-47 GtCO2e/yr emission window in 2020
keeps most options open to stay <2°C,
and the possibility to return below 1.5°C by 2100
c) Lowering future energy demand and CCS is paramount
d) Delay in full participation significantly reduces options
e) High 2020 emission imply higher long-term costs

8. Additional results

a) Costs (energy system)
- until 2020: higher costs for lower 2020 levels
- post 2020: ~44 GtCO2e/yr in 2020 minimizes costs over the 21st century

Current pledges (50-55 GtCO2e/yr)
imply higher long-term costs
- 13-21% higher from 2020-2050
- 20-41% higher from 2020-2100

b) Reduction rates

2020 emission window

Earth systems modelling

Energy systems modelling

c) Renewable shares in 2020

9. References & Acknowledgments

References:

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