The global decarbonization challenge and aviation within it: where are we now, where are we going?

What should aviation’s fair share of these emissions reductions be and how does this compare to ATAG’s 2050 aspirational target?

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Dr. Martin Cames
Background and challenge

- IPCC: international transport, including aviation needs to contribute appropriately to global GHG mitigation efforts
- Civil aviation contributes 2.1% of global CO\textsubscript{2} emissions
- Emissions were and are constantly growing by 3-5%/year
- Aviation’s non-CO\textsubscript{2} GHG impacts are largely neglected
- So far aviation’s emissions are hardly regulated
- Challenge: develop a mitigation target compatible with the staying well below 2.0°C objective of the Paris Agreement
CO₂ emissions from international bunkers

Sources: IEA 2019, IMO 2009, IMO 2014
Projected CO₂ emissions from international aviation

Projected emissions from international aviation and the EU target path

Projected change in global mean surface air temperature

<table>
<thead>
<tr>
<th>RCP</th>
<th>2046-2065 Mean</th>
<th>Likely range</th>
<th>2081-2100 Mean</th>
<th>Likely range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>1.6</td>
<td>1.0 to 2.2</td>
<td>1.6</td>
<td>0.9 to 2.3</td>
</tr>
<tr>
<td>4.5</td>
<td>2.0</td>
<td>1.5 to 2.6</td>
<td>2.4</td>
<td>1.7 to 3.2</td>
</tr>
<tr>
<td>6.0</td>
<td>1.9</td>
<td>1.4 to 2.4</td>
<td>2.8</td>
<td>2.0 to 3.7</td>
</tr>
<tr>
<td>8.5</td>
<td>2.6</td>
<td>2.0 to 3.2</td>
<td>4.3</td>
<td>3.2 to 5.4</td>
</tr>
</tbody>
</table>

Sources: Wikipedia - Representative Concentration Pathway, IPCC 2013, p. 23, authors’ own calculations
International aviation’s share of global GHG emissions under the RCP 2.6 pathway (chance of meeting 2°C are 66%)

Sources: ICAO 2013, Lee & Owen 2016, van Vuuren, D. P. et al. 2011
Bottom-up approach

- Reduction potential within aviation
  - Aircraft Efficiency: 0.5 to 2.6, average 1.3%/a
  - Operational efficiency: on average <1%/a
  - Sustainable Alternative Fuels (biofuels, e-fuels)
  - Demand reduction: -x%/a?

- Reduction potential beyond aviation: Offsets
  - Credits from mitigation projects
  - Allowances from ETSs
  - Credits from negative emissions
Potential GHG mitigation targets

- Reduction potential within and beyond aviation (bottom-up)
- Constant share of RCP 4.5 and RCP 2.6 CO₂ emissions
- EU (2009): -80 to -95 % by 2050 compared to 1990
- Remaining budget approach: 66% likelihood staying below
  - < 2.0°C (2015): 11.6 Gt from 2021 (IPCC 5AR)
  - < 1.5°C (2018): 8.0 Gt from 2021 (Miller et al. 2017)
  - < 2.0°C (2018): 22.0 Gt from 2021 (Miller et al. 2017)
- CORSIA: carbon neutral growth (CNG 2020), 2021-2035
- ATAG: CNG2020 + -50% compared to 2005, 2030-2050
Potential CO₂ emission targets for international aviation

Carbon budget and potential CO₂ emission targets for international aviation

## Aggregated CO₂ emissions 2021 to 2050 and deviation from 2°C pathway

<table>
<thead>
<tr>
<th>Source</th>
<th>Gt CO₂ 2021-50</th>
<th>Deviation from RCP 2.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee &amp; Owen 2016: S2 low tech/ops</td>
<td>41,4</td>
<td>213%</td>
</tr>
<tr>
<td>Lee &amp; Owen 2016: S9 advanced tech/ops</td>
<td>35,3</td>
<td>167%</td>
</tr>
<tr>
<td>CORSIA post 2035 option 1</td>
<td>26,2</td>
<td>99%</td>
</tr>
<tr>
<td>Constant share of global CO₂ emissions (RCP 4.5)</td>
<td>22,8</td>
<td>73%</td>
</tr>
<tr>
<td>Carbon neutral growth 2020</td>
<td>20,9</td>
<td>58%</td>
</tr>
<tr>
<td>CORSIA post 2035 option 2</td>
<td>18,1</td>
<td>37%</td>
</tr>
<tr>
<td>ATAG</td>
<td>17,0</td>
<td>29%</td>
</tr>
<tr>
<td>Budget approach &lt; 2.0°C (2018)</td>
<td>14,3</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Constant share of global CO₂ emissions (RCP 2.6)</strong></td>
<td><strong>13,2</strong></td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td>EU target path (min)</td>
<td>12,7</td>
<td>-4%</td>
</tr>
<tr>
<td>EU target path (max)</td>
<td>11,8</td>
<td>-10%</td>
</tr>
<tr>
<td>Budget approach &lt; 2.0°C (2015)</td>
<td>11,5</td>
<td>-13%</td>
</tr>
<tr>
<td>Budget approach &lt; 1.5°C (2018)</td>
<td>6,2</td>
<td>-53%</td>
</tr>
</tbody>
</table>

Sources: Authors’ own calculations
Conclusions

• Single year targets need to translated into an emission trajectory
• Efforts to reduce GHG emissions fall so far short of the global mitigation requirements
• Targets are not necessarily a sectoral cap but determine the contribution to global mitigation efforts

• Achieving these targets may require
  • Policies to incentivise technical and operational measures within the sector
  • Offsetting of emissions in other sectors
  • Behavioural change to reduce transport demand

• A GHG reduction target indicates that emissions cannot grow unlimited and will provide clear signals for investments decisions
Conclusions (continued)

• Even though aviation is not mentioned in the Paris Agreement it is implicitly included through Art. 4.1 (balance between anthropogenic emissions and removals)

• Contribution of aviation to global GHG mitigation efforts needs to be taken into account at the Global Stocktake of the UNFCCC (Art. 14.1 PA)

• Non-CO₂ GHG impacts must not be ignored

• Delaying action is not an option
  • Requires other sectors to reduce more
  • Requires steeper emission reduction in the future

• To contribute a fair share to global efforts for staying below 2.0/1.5°C aviation needs to increase ambition significantly
Thank you for your attention!

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