

Sustainable Aviation Fuels in the One Earth Climate Model's 1.5° C scenario: Where does the (sustainable) carbon come from?

MSc Maartje Feenstra & A/Prof dr. Sven Teske, Institute for Sustainable Futures, UTS, Sydney

Aviation is one of the transport sectors with a strong predicted growth till 2050. With 936 Mt of CO₂ in 2019, it represents around 2-3% of global emissions, which makes it an important sector for CO₂ emission reduction strategies. [1] With the strict requirements for energy density and other properties, only sustainable aviation fuels (SAF) are expected as a sustainable solution for the energy source of the plane.

Multiple 1.5 °C scenario describe the role that sustainable aviation fuels (SAFs) play in the net-zero pathways for the aviation sector. However, there is no exploration if there will be **enough** and **timely available sustainable carbon feedstock**. This is a considerable knowledge gap as complications in feedstock availability would hinder the development of a sustainable aviation sector!

Thus, this deep dive in the 1.5° C One Earth Climate Model answers the following main research question: **“Where does the (sustainable) carbon for the aviation sector come from?”**.

Sub question for answering the main research question are:

- 1.) How much sustainable bio and synthetic carbon is available, considering both timing and scale?
- 2.) What is the best division between bio- and synthetic produced SAF up to 2050 for the aviation sector?
- 3.) What are the implications for land and water use, as a consequence of the division?

The result will be a realistic (in timing and scale) mapping of the sustainable feedstock flows, optimized divisions between bio, waste and synthetic sources, maximum achievable CO₂ reductions, resulting land-use and water impacts, necessary cross-sector development steps and implications for other sectors evaluated in the framework of the One Earth Climate Model's 1.5 °C scenario up to 2050.

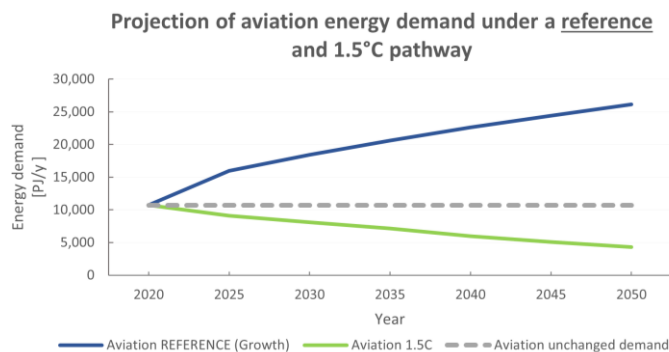


FIGURE 1: ONE EARTH CLIMATE MODEL'S PROJECTION OF AVIATION ENERGY DEMAND UNDER THREE DIFFERENT ASSUMPTIONS: GROWTH, UNCHANGED AND DECREASE, SOURCE: [1¹]

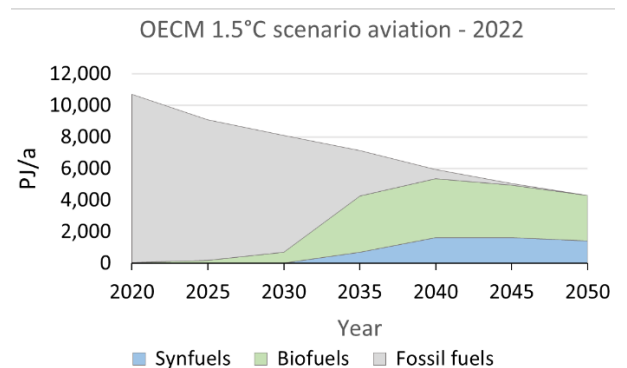


FIGURE 2: OECM'S FUEL SPLIT IN 1.5 °C AVIATION SCENARIO, SOURCE: [1]

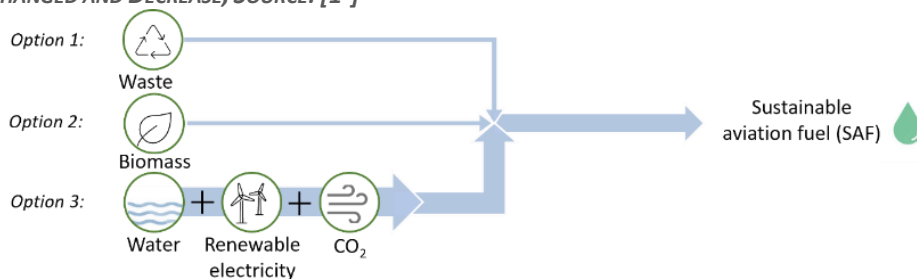


FIGURE 3: SUSTAINABLE FEEDSTOCKS FOR SAF: WASTE, BIOMASS OR SYNTHETIC SOURCES

¹ Teske, S. (2022). Achieving the Paris Climate Agreement Goals - Part 2: Science-based Target setting for the finance industry. <https://link.springer.com/book/10.1007/978-3-030-99177-7>