

The Supply Chain

Policy alternatives for the promotion of SAF and their implications

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Flightpath Conference “RED II and CORSIA: Will they
make the EU fly on biojet the next decade?”

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Background to study

Commissioned by DG MOVE as independent analysis of policy alternatives

Task:

- Identify policy alternatives for promotion of sustainable aviation fuel
- Assess and quantify implications of these policies

Study results discussed with various experts, including Flightpath Core Team

However, opinions expressed are solely that of the author

Basic assumptions:

- For commercial aviation there will be no relevant technical alternatives to kerosene until way beyond 2050
- Oil prices will not rise to miraculously make alternative kerosene cost competitive with fossil kerosene

Quantifying the problem

Current European consumption of aviation kerosene: 54 million tonnes¹

Not expected to change much in coming decades

- Expected annual growth rate: 1 to 2%
- Will be largely offset by efficiency improvements of similar magnitude

Required volumes to reach emissions targets using SAF

- No CO₂ growth from 2020 onwards (current ICAO commitment):
No SAF required
- 50% reduction of CO₂ emissions by 2050 (IATA goal):
 - *50% SAF with GHG reduction factor of 100%*
 - *77% SAF with GHG reduction factor of 65%*
- 100 % reduction of CO₂ emissions by 2050 (corresponding to Paris agreement):
 - *100% SAF with GHG reduction factor of 100%*

Non-Mandate Policy Alternatives

	Support to SAF	Remarks
Cap-and-Trade Systems (ETS / CORSIA)	Not effective at current CO2 prices (equates to 80 EUR/tonne CO2)	Concept designed to find low-cost solutions, not to support SAF
Modulation of Air Traffic Charges	European ATC charges are some 10 billion EUR annually, hence potentially significant support possible	Currently only possible for states, not EU International reactions possible
Green tickets	<ul style="list-style-type: none">• Covers only part of price difference due to refining economics• However, in combination with voluntary airline activity is mainstay of current limited SAF production	<ul style="list-style-type: none">• Voluntary scheme leaves choice of feedstock to airlines• Issue of allocation to road / air• Political risk if used at large scale

Mandates

Scenario	Volume	Production	Feedstock	Effect on airline competitiveness
Low percentage (calculations for 1% scenario)	540,000 tonnes of SAF	Co-processing of vegetable oil in fossil refineries; existing HEFA plants	Ca. 630,000 tonnes of vegetable oil; if advanced biomass required, same amount of UCO	As low as 250 (co-processing of palm oil) to 500 mio. EUR of extra cost Higher depending on feedstock
High percentage (calculations for 50% scenario)	27 mio tonnes of SAF	New production capacity required	More than twice as much again as currently needed for road bio fuels; sources and availability doubtful	Estimated 50 bio. EUR of extra cost; ruinous effect on airline competitiveness

Details on 1% scenario – production side

Most economically efficient approach: Co-processing of vegetable oil in fossil refineries

- Technically approved for aviation use in 2018
- Lowest cost approach, can essentially use unchanged infrastructure
- Limited to 5% of feedstock

Currently legal uncertainty about allocation to products

- To be regulated by delegated act of the commission in accordance with Article 32 of RED II
- To be adopted by 31 December 2021

Can potentially provide large volumes, as total European processing of crude oil is some 600 million tonnes per year

If regulation makes co-processing unattractive, alternative is HEFA kerosene

- Several existing HEFA plants (by Neste, Total, ENI)
- Total annual capacity is several million tonnes
- Currently serving road market, but easily partially repurposed
- Would leave higher share of road market to biodiesel, where there is currently overcapacity

Details on 1% scenario - feedstock side

Both co-processing and HEFA require oil-type feedstock

- Co-processing in a refinery essentially limited to virgin vegetable oils
- HEFA process more flexible, can process waste driven vegetable oil, fats and oil-based residues
- Neste using Annex IX material at large-scale, other European HEFA refineries focused on virgin vegetable oil

Vegetable oil requirement to produce 540,000 tonnes of bio kerosene: Some 630,000 tonnes

- If feedstock decision is unrestricted and solely price-based, feedstock will be palm oil
- If feedstock is limited to advanced bio mass, and otherwise price-based, feedstock will be double counting UCO

Details on 50% scenario – feedstock side

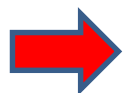
SAF required for 50% bio kerosene quota: **27 million tonnes**

For reference

European biodiesel production 2016: 11.6 million tonnes

European fuel ethanol production 2016: 3.7 million tonnes

Total road biofuels 2016 by weight: **15.3 million tonnes**



50% bio kerosene quota would triple EU biomass requirements

- Under RED II, feedstock from oils, sugar and starch limited to little more than 2019 volumes
- Waste and residue availability way below what is needed for tripling production
- Other sources of feedstock required, but not clear where they are to come from

Details on 50% scenario – production side

European kerosene production: 40 million tonnes (remainder is imported)

Scope for Co-processing: 5% of 40 million = 2 million tonnes

HEFA capacity currently used for road fuels: Some 2 million tonnes

50% bio kerosene quota would require some 20 to 25 million tonnes of new production capacity

Would have to be various production processes

However, different production processes require different feedstocks, and feedstock is not clear

The need to encourage creativity

- Non-mandate policies can help, but are limited in effect
- Low level blend mandates (a few %)
 - would have little effect
 - could establish dominance of vegetable oil based production pathways
 - could have undesirable effects with regard to feedstocks
- High level blend mandates (e.g. 50%)
 - would destroy European aviation competitiveness
 - would create a situation we are not prepared for

At the same time, 50% SAF use in 2050 will probably be not nearly enough.

To find a viable solution, creativity is required, which cannot be legislated.

Proposal: Give blend mandates as a prize, for the first producer meeting an agreed set of conditions which is impossible to meet now