The expected role of SAF in decarbonising international civil aviation

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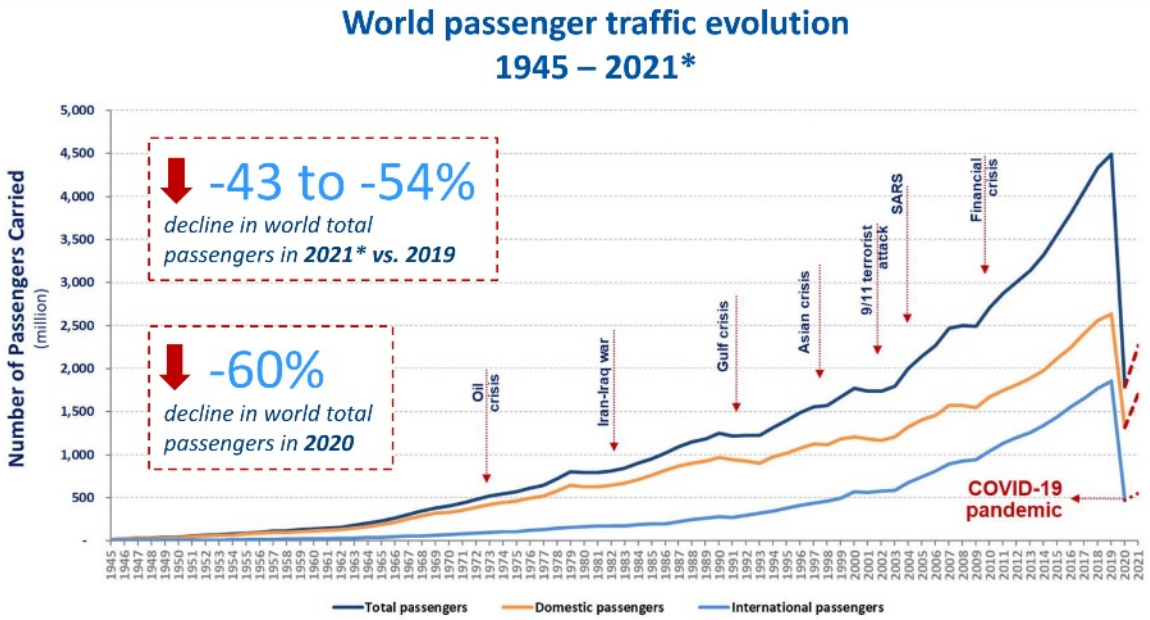
Why we need liquid fuels?

- Before COVID pandemic, international civil aviation was **consuming about 160 megatons (Mt) of fuel**, corresponding to approximately **2.6% of GHG emissions** from fossil fuel combustion.

- The sector **was growing at a significant pace**: before the COVID-19 crisis, ICAO forecasted that by 2050 international aviation **emissions could triple** compared with 2015.



https://www.icao.int/sustainability/Documents/Covid-19/ICAO_coronavirus_Econ_Impact.pdf

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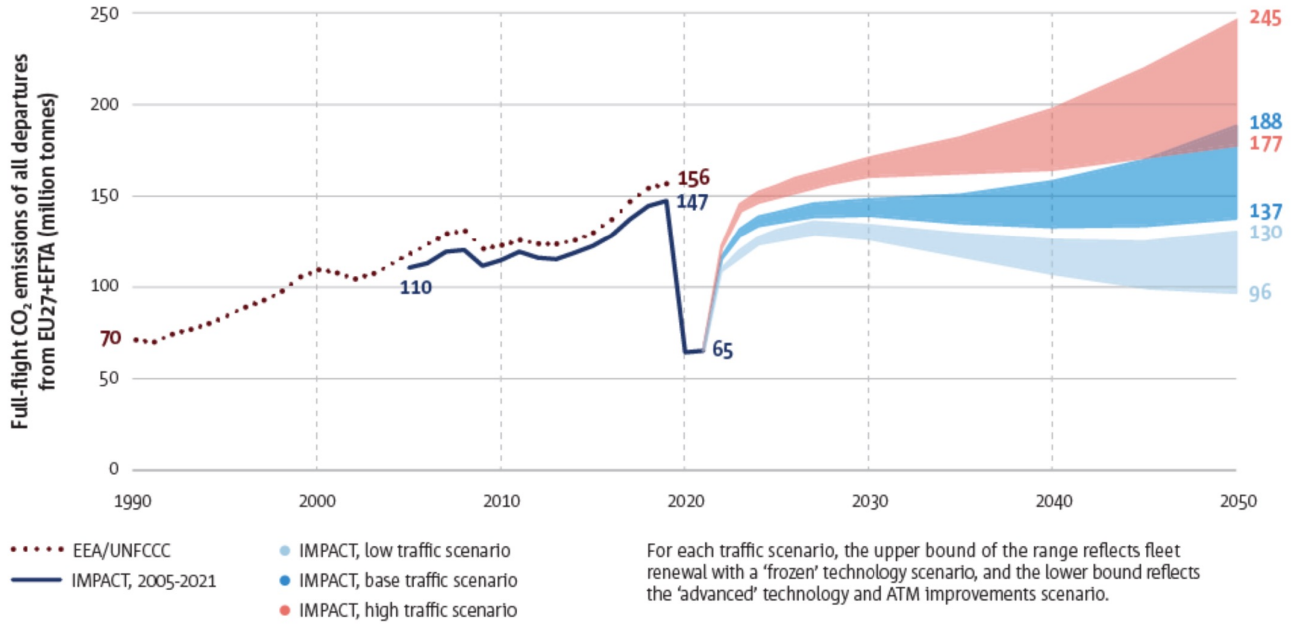
Full-flight CO_2 emissions may grow beyond 2019 levels under the base and high traffic forecast

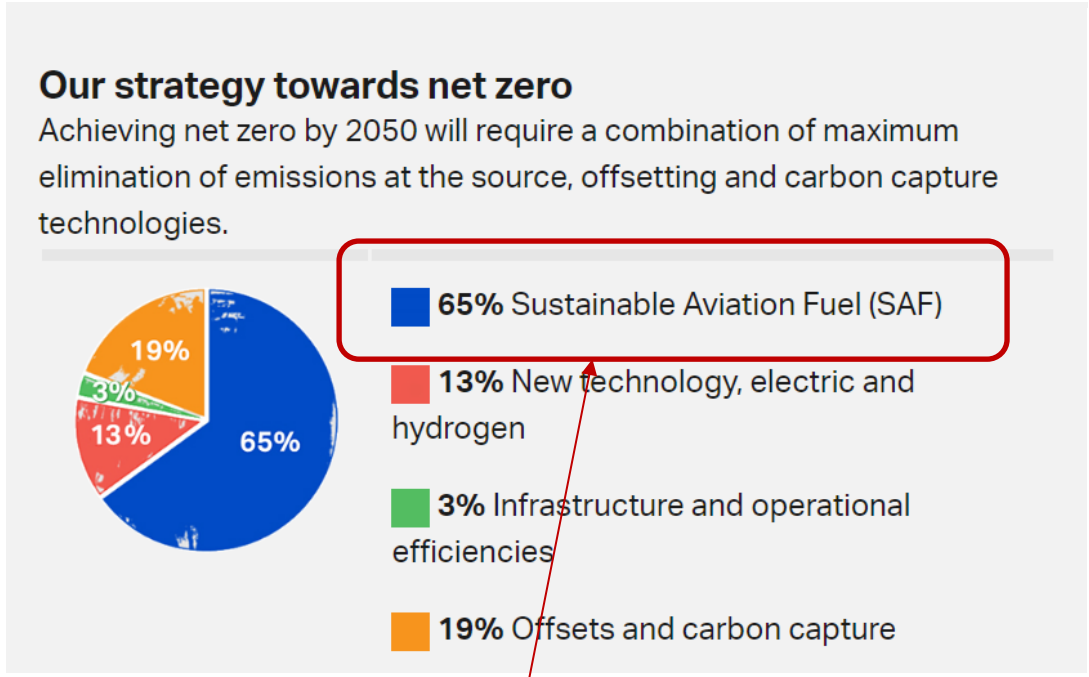


https://www.easa.europa.eu/eco/eaer/topics/overview-aviation-sector/emissions#emissions-grew-steadily-between-2013-and-2019-and-may

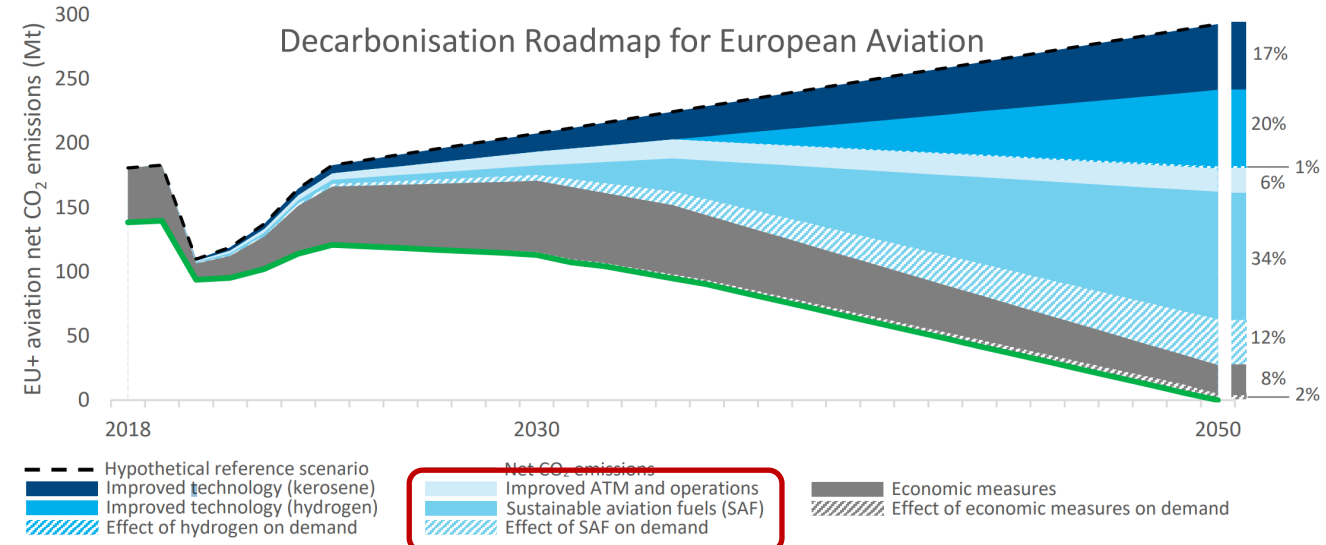
Why we need liquid fuels?

- Due to some peculiar characteristics of the aviation sector, **the penetration of disruptive technologies** (e.g. electrification) is expected to **occur at a different pace than in other sectors** (e.g. road).
- **Alternative** to fossil kerosene should ideally **be able to supply exisiting infrastructures and engines** (**drop-in** fuels).
- This is the reason why **liquid alternative fuels could be an effective short-medium term mean** for deacarbonising international aviation.

Which is the expected role of SAF?



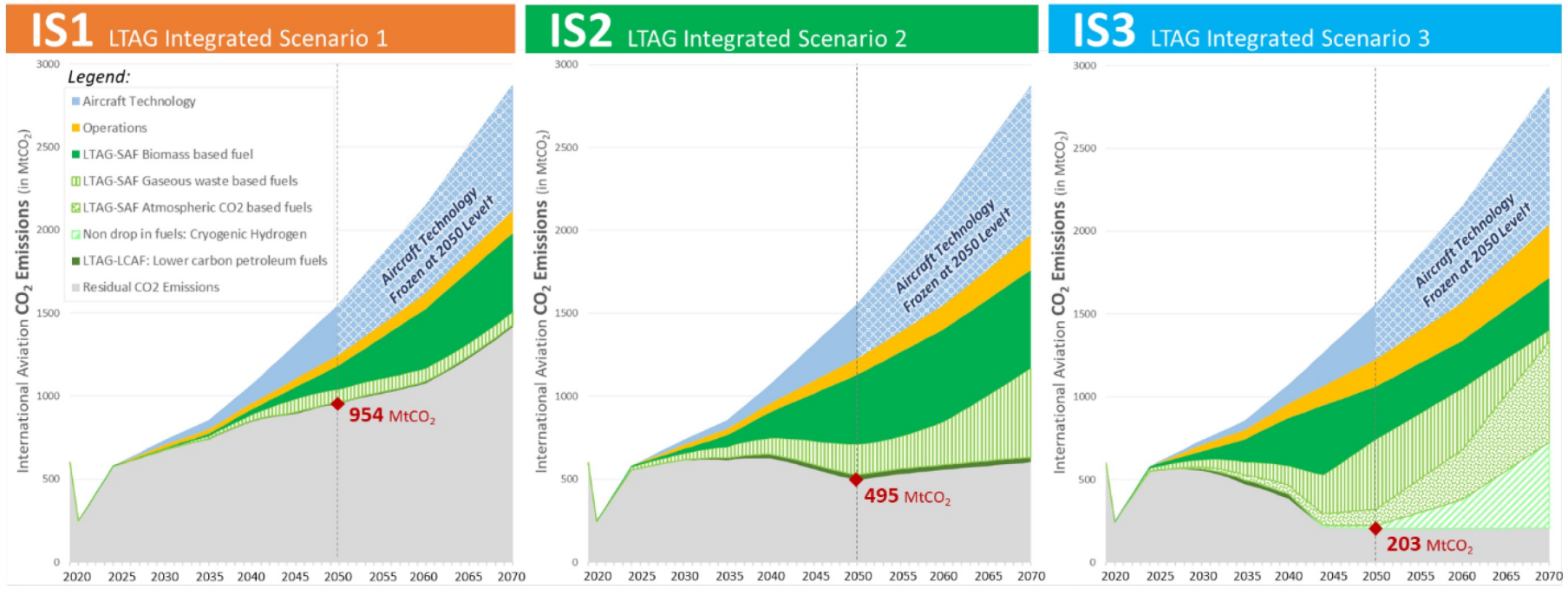
IATA.
https://www.iata.org/en/programs/environment/flynetzero/



Results are presented for all flights within and departing from the EU region[2]. Improving aircraft and engine technology, ATM and aircraft operations, SAF and economic measures all hold decarbonisation potential. Modelled for 2030 and 2050, the impacts are linearly interpolated. The base year for this study is 2018.

Destination2050.
https://www.destination2050.eu/wp-content/uploads/2021/02/Destination2050_ExecutiveSummary.pdf

The ICAO LTAG feasibility study



† Caution required with the interpretation of absolute CO_2 emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO_2 emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO_2 emissions from international aviation associated with LTAG Integrated Scenarios

- The 41st **ICAO Assembly adopted** a long-term global aspirational goal (**LTAG**) for international aviation of **net-zero carbon emissions by 2050**.
- **3** main **integrated scenario** with **increasing aspiration** and **decreasing readiness** and **attainability**

https://www.icao.int/environmental-protection/Pages/LTAG.aspx

The ICAO LTAG feasibility study

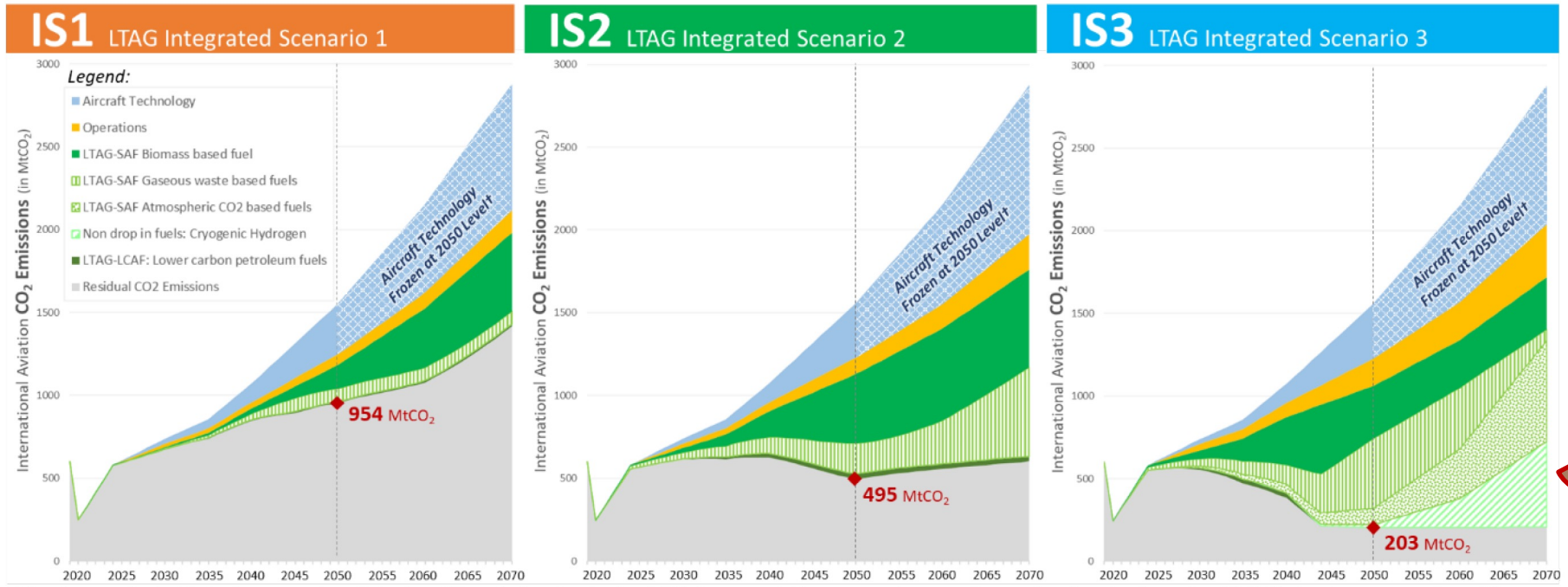


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Figure 1. CO_2 emissions from international aviation associated with LTAG Integrated Scenarios

From LTAG it is clear the **crucial role of SAF**

https://www.icao.int/environmental-protection/Pages/LTAG.aspx

Cost per tonne of CO2 saved

For creating the fuel scenarios, the cost per tonne of abated CO2 has been established, in LTAG.

Category	Fuel Name	Abbreviation
LTAG-SAF	Biomass	LTAG-SAF-FTG
	Solid/liquid	
	Gaseous waste CO2	LTAG-SAF-CO2
	Atmospheric CO2	LTAG-SAF-DAC
LTAG-LCAF	Lower carbon petroleum fuels	LTAG-LCAF

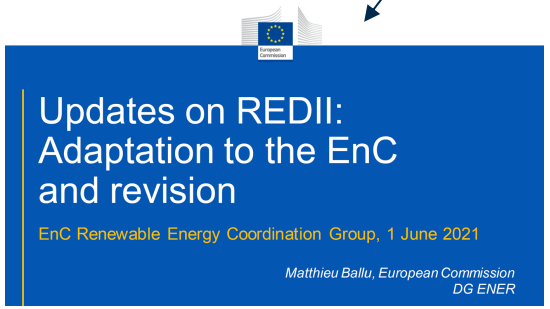
Fuel Order per Scenario with Selection Criteria					
F1*	**MSP** [$/L]	**F2^**	**Marginal Abatement Cost** [$/kg $CO2e_{red}$]	**F3**	**Lifecycle** [gCO2e/MJ]
LTAG-**LCAF**	**0.52**	LTAG-**SAF-FTG**	**<1**	LTAG-**SAF-DAC**	**8-13**
LTAG-**SAF-FTG**	**0.7-2**	LTAG-**LCAF**	**1-2**	LTAG-**SAF-CO2**	**13-16**
LTAG-**SAF-CO2**	**~2.5**	LTAG-**SAF-CO2**	**4.3**	LTAG-**SAF-FTG**	**21-24**
LTAG-**SAF-DAC**	**N/A**	LTAG-**SAF-DAC**	**N/A**	LTAG-**LCAF**	**80.1**

INTERNATIONAL

ICAO · OACI · ИКАО
国际民航组织 · منظمة الطيران المدني الدولي

CORSIA
CARBON OFFSETTING AND REDUCTION SCHEME FOR INTERNATIONAL AVIATION

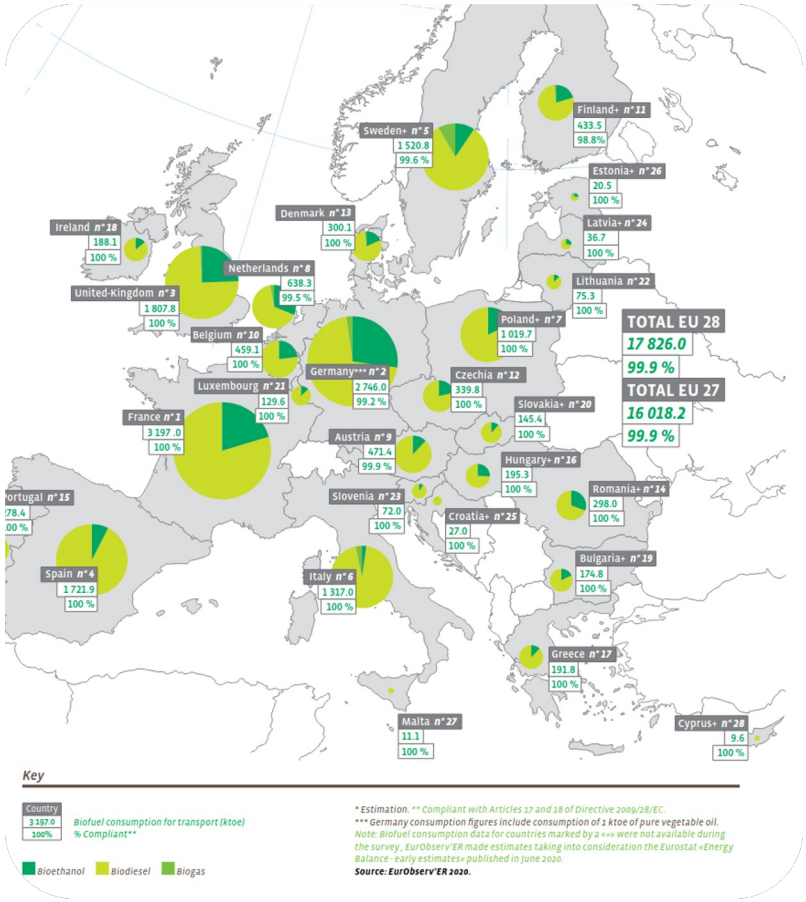
EUROPEAN



Emission Trading System (EU ETS)

Expected volumes and production capacity

- **At European level** we are discussing **mandates for SAF.**
- **Under the proposal of a target of 5%,** the **volume of SAF** would be around **3.0 Mtoe/y.**
  - To put such figure into context, **this** would represent the **17.5% of the current EU27 biofuel consumption in** the whole **transport sector.**



Sustainability criteria for SAF

Other principles are considered during the certification process:

RSB

https://rsb.org/rsb-corsia-certification/

FIGURE 1: ISCC Sustainability Principles

https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg188-191.pdf

The feedstock availability issue

- Given the **expected contribution** of **SAF** to sector decarbonisation, it is clear the need of **ensuring sustainable feedstock avaialbility**.

- **Incresing** the **potential feedstock pool** is a strategy to **limit** risks of feedstock **shortage** and/or **potential competition** with **other sectors** (e.g. maritime)

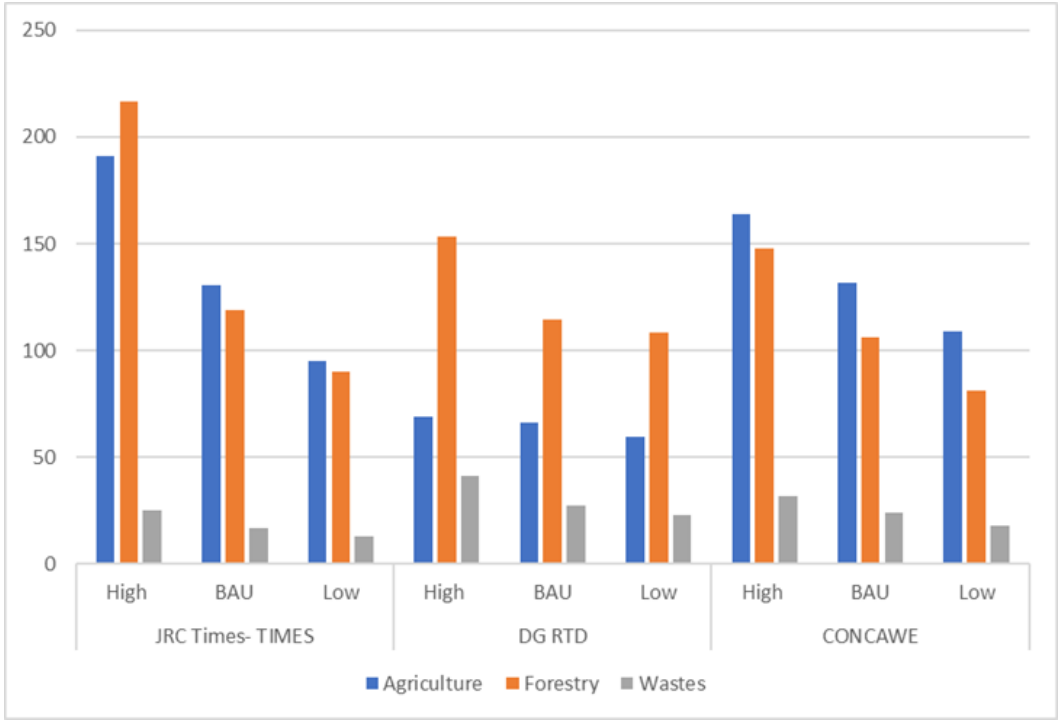
The feedstock availability issue

- The **analysis confirmed**, even under very conservative assumptions, that **feedstock availability may not be the major barrier in the short term**.

- Other **issues** such as the feedstock **costs**, the **price volatilities**, the existing logistical infrastructures, etc. are **relevant aspects**, contributing to the puzzle.

- Whilst feedstock is present across European regions **a critical element** which requires detailed analysis at the implementation, value chain level is the **effectiveness of its sustainable mobilisation alongside** the **synergies** and **trade offs that may arise**.

Feedstock potentials from the three selected studies for 2030.



Prussi, M., Panoutsou, C., & Chiaramonti, D. (2022). Assessment of the Feedstock Availability for Covering EU Alternative Fuels Demand. Applied Sciences, 12(2), 740.

Conclusions

- **Aviation** is **expected** to **recover from** COVID-19 **pandemic**, continuing increasing its growth, **with** a **significant associated environmental impact**.
- **Aviation** is **expected** to **rely on liquid fuels in the short-medium term**, especially for the long-haul flights.
- **Sustainable Aviation Fuels** are considered an **effective tool** for the sector decarbonisation strategy.
- Sustainable aviation fuels (**SAFs**) as defined in CORSIA **can reduce life-cycle GHG emissions by over 90%**.
- **A potential issue related to feedstock availability exist, even if analyses confirm that this may not be the major barrier in the short term.**
- **Feedstock costs, the price volatilities, competition with other sectors, etc. are other relevant aspects.**
- **Increasing the uptake of SAF will also require significant investments, in terms of production capacity, expecially for new technolgies entering the market.**

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