#H2OffThePress

Sustainable Aviation Fuel (SAF)

Decarbonising the aviation industry

What is SAF and how can green hydrogen play a role in in decarbonisation of aviation?

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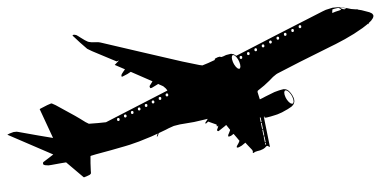
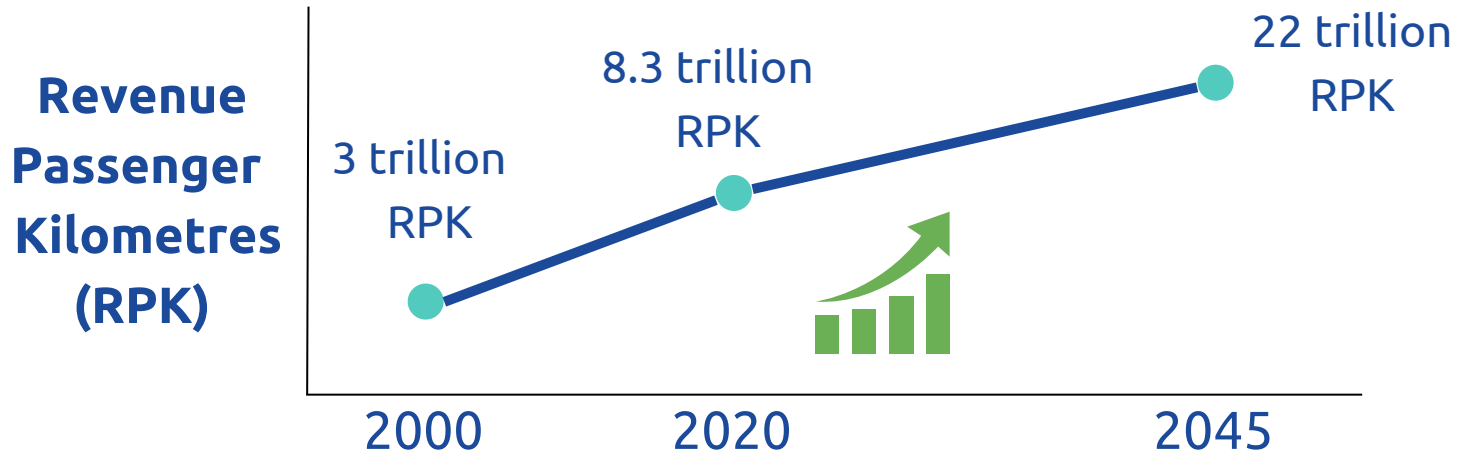
Aviation industry in a nutshell



→ Aviation is one of the fastest growing industries over the past 20 years (*CAGR≈ 5%*) and is to continue its steep ascent ...



4.1% p.a growth expected until 2045 via

Population growth *Globalisation* Rising income

→ ... and has a huge impact in our economies

Economic

Global Trade

Tourism

Employment

Social

Connectivity

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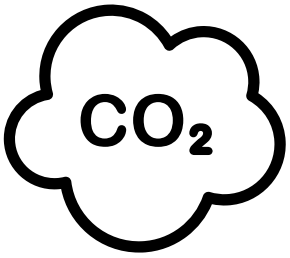
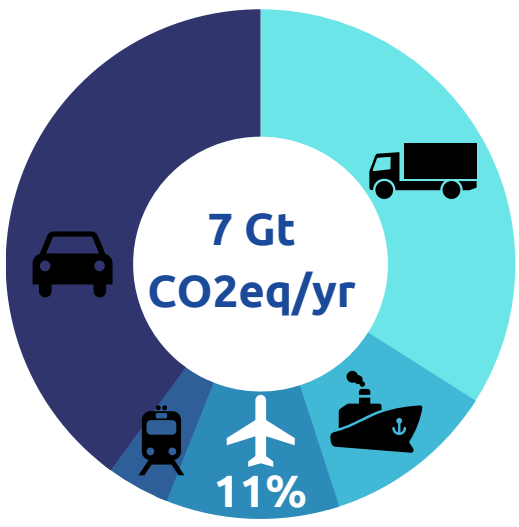
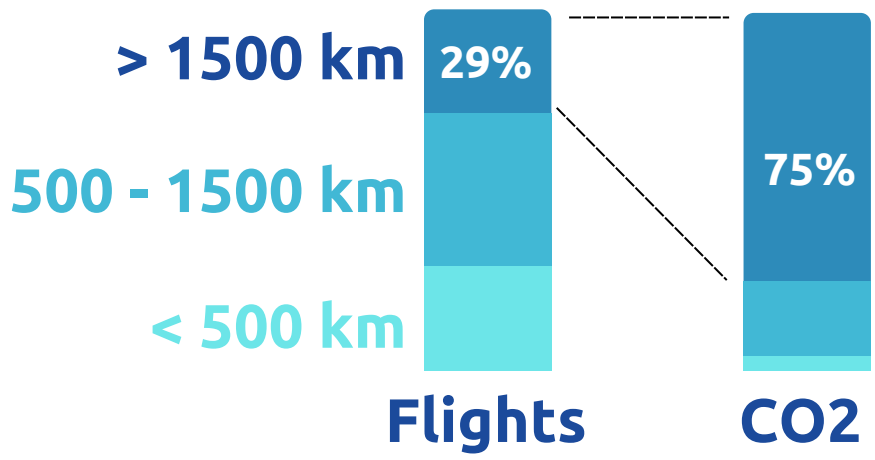
A hard-to-abate industry 100% reliant on fossil fuel







16% of the global GHG emissions comes from the transport industry, with **aviation accounting for 11% of it**

75% of EU aviation emissions come from **medium to long haul flights (>1500 km)**, for which no practical alternative modes of transport exist

→ Therefore, decarbonising aviation is a must, and will need to involve **adopting low-carbon fuels** such as **Sustainable Aviation Fuel (SAF)**

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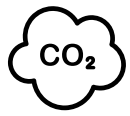
How to produce SAF? Where does Green H2 come in?

SAF is produced from *sustainable feedstocks* and possess a **70% emission reduction** when compared to traditional fuels

→ SAF can be broadly divided in **two categories**, based on their feedstocks

	 **Biological origin**	 **Synthetic**
Feedstock	Waste fats, oils , sustainable wastes and non food crops	**CO2** + **Green H2**
SAF type	**HEFA**, **FT-SPK** and **AtJ***	**e-kerosene**
Development stage	Mostly commercially available	Pilot stage
	• Availability of feedstock • Strain on land availability for feed crops	• (Current) price of Green H2 • CO2 capture

→ With expected sharp cost of green H2, **e-kerosene** is expected to gain a significant market share of aviation fuel globally

? Paradoxically, this low-carbon fuel needs **CO2** as a feedstock. Hence the question: **what can be considered as 'green' CO2?**

**Hydroprocessed Esters & Fatty Acids (HEFA), Gasification/Fischer-Tropsch (FT-SPK) and Alcohol to Jet (AtJ)*

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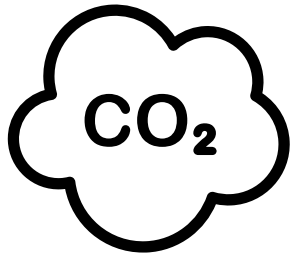
The 'green' CO2 bottleneck



There are four ways of sourcing CO2, but each comes with its own challenges

Point source *from industries such as cement,*

Point source *from combustion of fuels for electricity generation,*

Direct air capture (DAC) *extracts CO2 from the atmosphere,*
but the method today is complex and very expensive

Biogenic CO2 capture from the combustion, decomposition, or processing of *biologically based materials,*
but market volumes do not meet total demand forecast

For Europe, eligible CO2 for SAF production (i.e. green CO2) is:

→ Hence current market announcements of SAF projects using **industrial CO2** as feedstock ...

→ ... but emphasis should be put on **DAC** to prepare for 2041+

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All considered, is there a current market for SAF?

Currently, SAF is 2 to 9 times **more expensive** than conventional fuels and hence is only **0.1% of the market**

But major players are already announcing/making significant investment in SAF despite this green premium

Big energy players with production

and major airlines joining in

With,

- **300 million litres per annum in production**
- **57 airports distributing SAF**
- **$25 billion in offtake agreements**

There is a solid foundation for SAF for further market penetration

With the expected SAF demand rising from *8 to 449 billion litres by 2050 inorder to reach IATA targets,*

SAF is set to be a major offtake market for Green H2

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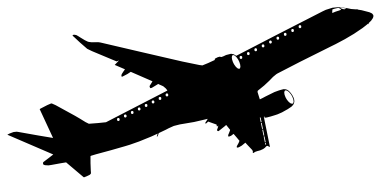
SAF will dominate the decarbonisation pathway



According to International Air Transport Association (**IATA**), SAF holds the key to decarbonisation by 2050

65% — *Use of SAF* to replace fossil fuels as a low carbon alternate

13% — Innovative propulsion technologies such as *hybrid electric airplanes and hydrogen combustion*

3% — Improved *operational and infrastructure solutions*

19% — Carbon offset options such as *CCUS, Direct air capture and natural climate solutions*

Beyond SAF and other technological innovation, reaching net zero targets also comes with **behavioural changes** and the use of other forms of transport for short distances

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