Travel Smart.

TRANSPORT & ENVIRONMENT

Sustainable Aviation Fuels (SAF) Sustainability Guide for Corporate Buyers

October 2023

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List of abbreviations

DAC: Direct Air Capture
ETS: Emissions Trading System
FID: Final Investment Decision
GHG: GreenHouse Gas
ILUC: Indirect Land Use Change
ISCC: International Sustainability and Carbon Certification
LCA: Life-Cycle Analysis
PFAD: Palm Fatty Acid Distillate
PtL: Power-to-Liquid
RED: Renewable Energy Directive
RSB: Roundtable on Sustainable Biofuels
RFNBOs: Renewable Fuels of Non-Biological Origin
SABA: Sustainable Aviation Buyers Alliance
SAF: Sustainable Aviation Fuel(s)
UCO: Used Cooking Oil

Executive Summary

Sustainable Aviation Fuels (SAF) Sustainability Guide for Corporate Buyers

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This guide aims at helping companies to purchase sustainable aviation fuels (SAF) as a way to reduce their ecological footprint. There are many aspects corporate buyers should consider before purchasing SAF.

- **Not all SAF are equally sustainable: companies should avoid purchasing crop-based biofuels at all costs and prioritise e-kerosene over other types of biofuels.**
- **SAF origin matters: imported SAF leads to additional Greenhouse Gas (GHG) emissions due to transportation, and regulations vary from one geographical area to another.**
- **The SAF price premium ranges widely. It is currently at least twice the price of conventional kerosene, but this is likely to decrease over time.**
- **There are several standards to calculate emissions reductions, which complicates analysis and reporting.**
- **Buying SAF does not mean flying on SAF: SAF is not physically available at all airports, which is why most corporate schemes rely on book-and-claim systems.**

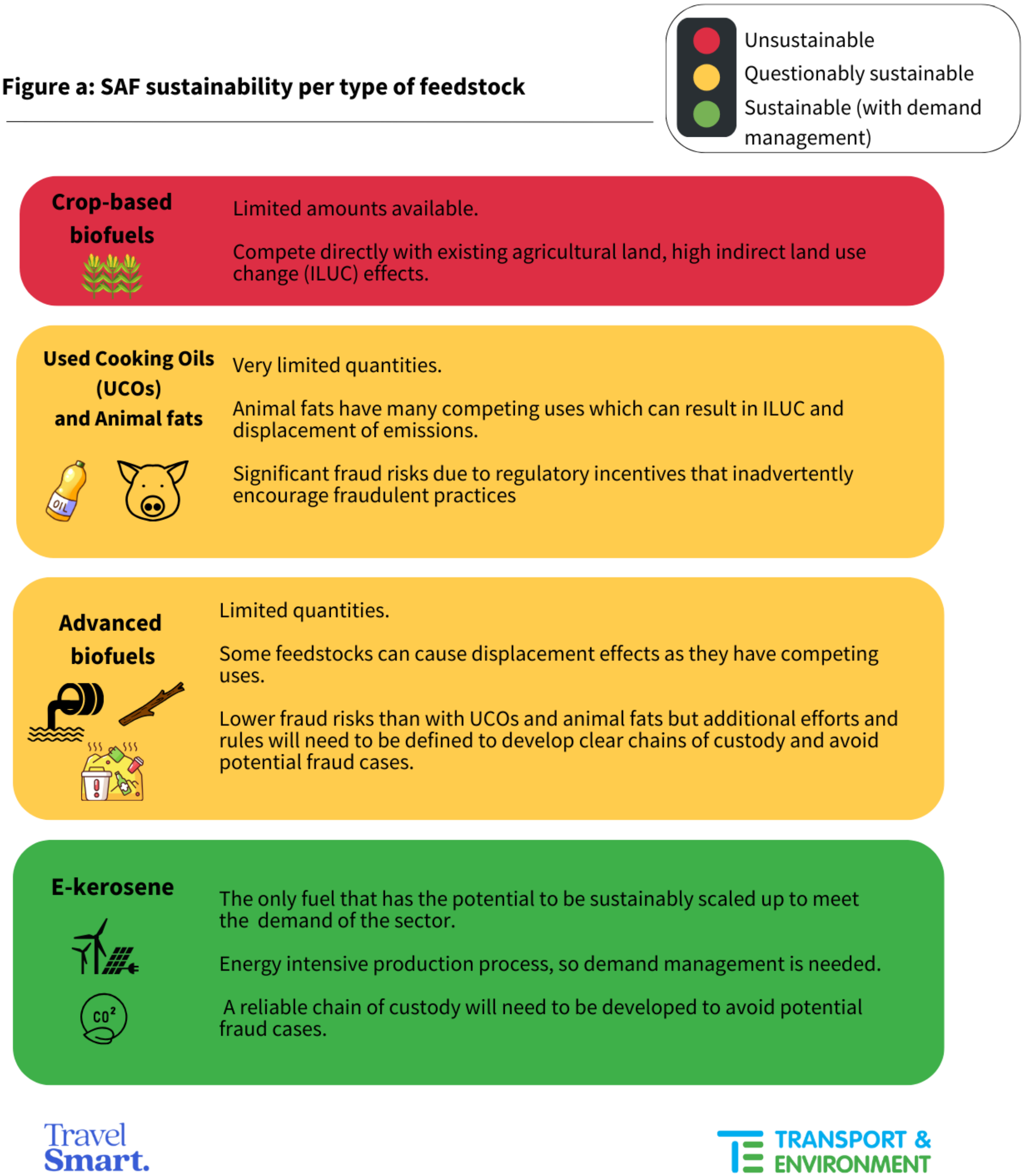
The greatest determinant in the sustainability of SAF is the type of feedstocks used to develop the fuels.

There are two main types of SAF:

1. Biofuels, derived from biomass…
2. … and e-fuels, synthesised from hydrogen combined with a source of carbon.

If produced correctly (with green hydrogen derived from additional renewable electricity and carbon captured from the air), e-kerosene has the potential to be close to CO_2-neutral. On the other hand, the sustainability of biofuels is more questionable because they will only be available in very limited quantities. Crop-based biofuels can be a cure worse than the disease as they compete with food security. Waste-based biofuels (e.g. derived from used cooking oil, animal fats, or forest residues) are more sustainable, but they suffer from limited availability, competing uses in other industries, and fraud risks.

Figure a: SAF sustainability per type of feedstock



Corporate SAF buyers can choose from many dedicated schemes, all of which are sourcing only biofuels at the moment.

More and more corporate SAF schemes are being set up by airlines and/or fuel suppliers as well as travel management platforms or corporate partnerships. However, none of these schemes enables companies to target e-kerosene yet. Even in the case of the few airlines which have signed memorandums of understanding with e-kerosene producers, it is impossible for companies to select the type of SAF they want to support. The current unavailability of e-kerosene on the market should not prevent corporate buyers from exploring bolder options in the near future, such as co-funding an offtake agreement with an e-kerosene start-up in partnership with an airline.

Companies can build momentum for the SAF market to scale up, but they should tread carefully when considering a SAF purchase. T&E recommends the following actions:

Key recommendations

1. Before considering any SAF purchase, **companies should reduce their flying** while making the most of virtual tools and rail travel. In no instance should SAF serve as an excuse to continue frequent flying.

2. **Corporate buyers need to learn about SAF**, in particular its sustainability benefits and its limitations, in order to be able to make informed choices.

3. As a general rule, **crop-based biofuels should be avoided at all costs** (especially relevant for US buyers), and e-fuels should be prioritised over biofuels (as they become available on the market).

4. For residual flights that cannot be avoided, **company travel policies should include a nominal SAF target** (e.g. 50% SAF in 2030 including an e-kerosene sub-target) as well as a commitment to uptake only "best-quality SAF".

5. **Companies should always request as much transparency as possible** from partner airlines or fuel suppliers regarding the feedstocks used to produce the SAF being purchased, as well as a clear price breakdown.

6. **There are alternatives to pre-set corporate SAF schemes**: companies can negotiate on a one-to-one basis with airlines and/or fuel suppliers in order to have more of a say over the type of SAF they want to support, or the share of the SAF premium they want to cover.

7. Communication matters: in order to avoid greenwashing accusations, companies must strive to be **as transparent as possible on their SAF purchases**. And remember, there is no such thing as a "green flight"!

Introduction

Emissions from aviation are a significant contributor to climate change and they are growing faster than for any other mode of transport. CO_2 emissions from flights within Europe have increased 27.5% between 2013 and 2019, while other sectors have reduced emissions[1]. As a result, the climate impact of all flights departing from a European Union (EU) airport have grown from 1.4% of total EU emissions in 1990 to 3.7% today. If unmitigated, global aviation emissions are expected to double or triple by 2050, and in doing so consume up to one-quarter of the global carbon budget under a 1.5 degree scenario[2].

Business travel is one of the biggest drivers of aviation demand. **In 2019, business travel represented approximately 30% of European aviation emissions**[3]. For the critical decade until 2030, the best way to reduce aviation's environmental impact is to fly less, as the timing for scale-up of sustainable fuels and zero-emission aircraft is currently post-2030. Business travellers only make up some 20% of passengers, but many are frequent flyers. The growth of the aviation sector, and in particular that of corporate travel, is not compatible with the needs of the planet. That is why Transport & Environment (T&E) has developed **the Travel Smart Campaign** (see Info Box below). **Cutting corporate travel by half compared to 2019 could save 15% of aviation emissions by 2030**[3]. The Covid-19 pandemic has shown that drastically reducing travel is possible, while still doing good business.

INFO BOX: The Travel Smart Campaign

Travel Smart.

Travel Smart is a global campaign led by Transport & Environment (T&E) to reduce corporate air travel emissions, as the most effective way to significantly reduce aviation's climate impacts in the present decade.

Commitments from the biggest business flyers to **cut corporate travel emissions by -50% or more of pre-Covid levels by 2025 or sooner** can shift the dial on global corporate air travel emissions. Currently, more than 50 companies have set targets to reduce their business travel emissions.

By reducing frequent flying, while making the most of rail journeys and virtual collaboration, companies can innovate purposeful travel and see benefits for both their business and the planet.

There is a real need to fly less. The International Energy Agency (IEA) highlights the important role that even a limited reduction in flying can achieve, with a 12% reduction in certain flights cutting emissions by as much as 50%[4]. However, **in time, new technologies like zero-emission aircraft and SAF will**

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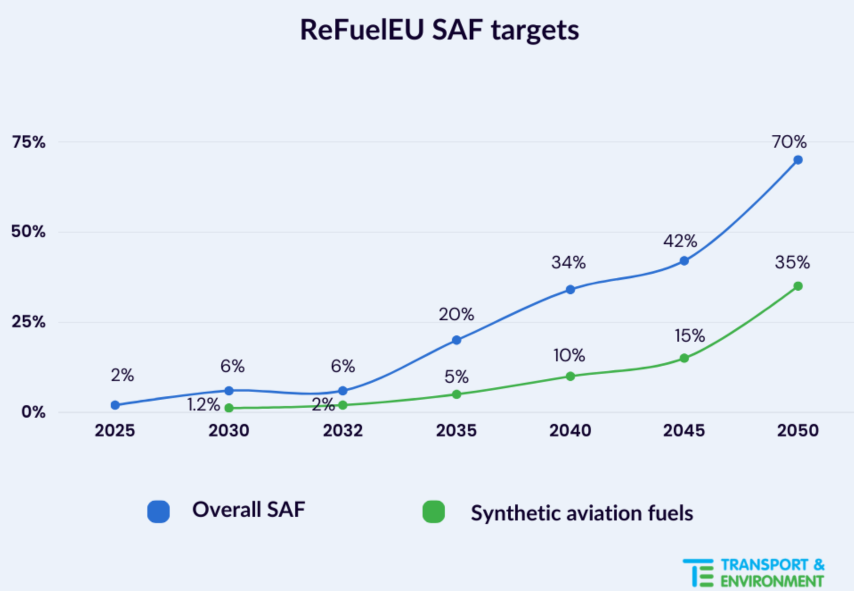
[1] EASA. (2023). *European aviation environmental report 2022*, p. 115.
[2] Carbonbrief (2016). Analysis: Aviation could consume a quarter of 1.5C carbon budget by 2050.
[3] Transport & Environment. (2022). *Roadmap to climate neutral aviation in Europe*.
[4] IEA. (n.d.) *Net Zero by 2050. A Roadmap for the Global Energy Sector*.

also contribute to reducing aviation emissions. Even if they are not yet available at scale to have an impact, SAFs have recently built great momentum, in part because of **ReFuelEU Aviation**.

INFO BOX: ReFuelEU Aviation

ReFuelEU is a European regulation adopted in 2023 which mandates jet fuel suppliers to blend **a growing share of SAF** (defined as biofuels and synthetic aviation fuels) into the fuel they provide to EU airports, starting in 2025 at 2%, growing to 6% in 2030 and then gradually increasing to 70% in 2050. Corporate buyers have an important role to play to bring the actual SAF uptake closer to 100%. ReFuelEU also includes **specific targets for e-kerosene**, **the only type of SAF that can be sustainably scaled up to meet the demand of the aviation sector.** The sub-quota starts at 1.2% in 2030, growing to 5% in 2035 and then gradually increasing to 35% in 2050.



More and more companies express interest in purchasing SAF as a means to reduce their CO_2 emissions. Although alternative fuels have the potential to significantly mitigate the climate impact of aviation, **not all of them are sustainable**. There are many aspects companies should consider before purchasing SAF, including but not limited to: which feedstock(s) is the fuel derived from? Where is it produced? How expensive is it? How is it certified? How will it be accounted for? By providing answers to these questions and by looking into existing buying and investing options, **this guide aims at helping companies to uptake SAF in a truly sustainable manner.**

1. Criteria to consider when purchasing or investing in SAF

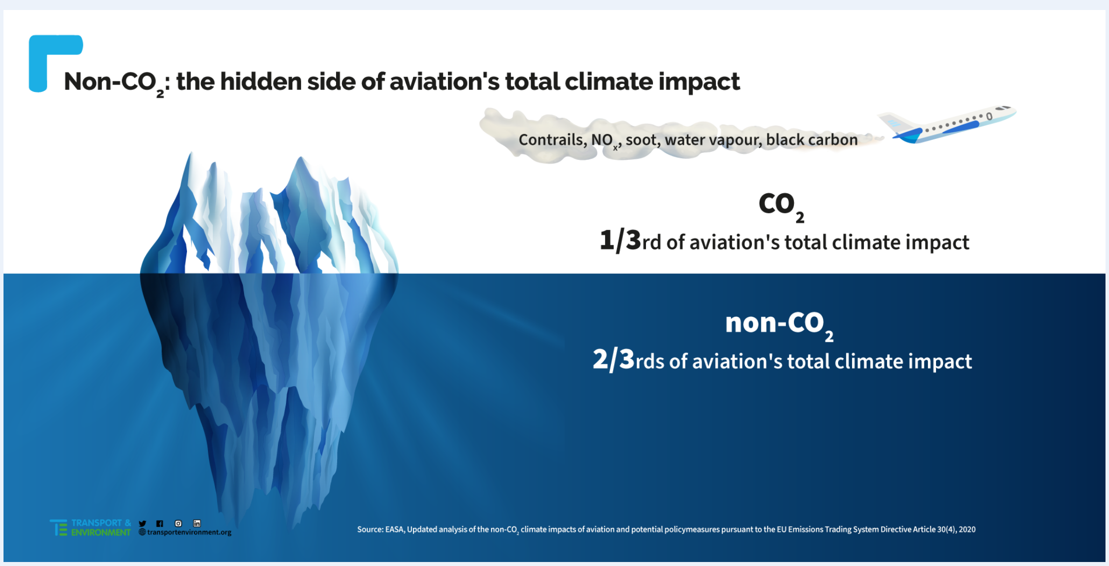
Defining SAF is not an easy task. **Several definitions and terminologies coexist,** depending on the regulatory context, feedstocks and production pathways. Schematically, there are two main types of SAF: (a) **biofuels**, which are derived from biomass, and (b) **synthetic fuels** (also known as Renewable Fuels of Non-Biological Origin (RFNBOs) for aviation or e-kerosene) which are generated by combining hydrogen (H_2) and carbon dioxide (CO_2).

SAF are crucial to bring aviation's CO_2 climate effects close to zero as they can be used within the existing aircraft fleet and fuel supply infrastructure. Flying less can have the greatest impact in the short– to medium- term, and zero-emission aircraft (i.e. hydrogen and/or electric aircraft) may play a significant role in the future on certain routes, but they will struggle to penetrate the long-haul flight segment.

SAF can also play a role in reducing aviation's non-CO_2 effects as they contain less aromatics than fossil fuels, or even no aromatics (see Info Box below).

INFO BOX: SAF and non-CO_2 effects

On top of CO_2, aircraft engines emit other gas (NOx, SO2 and H_2O) and particulate matter (soot). These emissions result in an increase in climate warming through greenhouse gas creation and the formation of persistent contrail cirrus. **The net warming caused by non-CO_2 emissions is estimated to be twice as big as the warming caused by aviation's CO_2 emissions[5].**

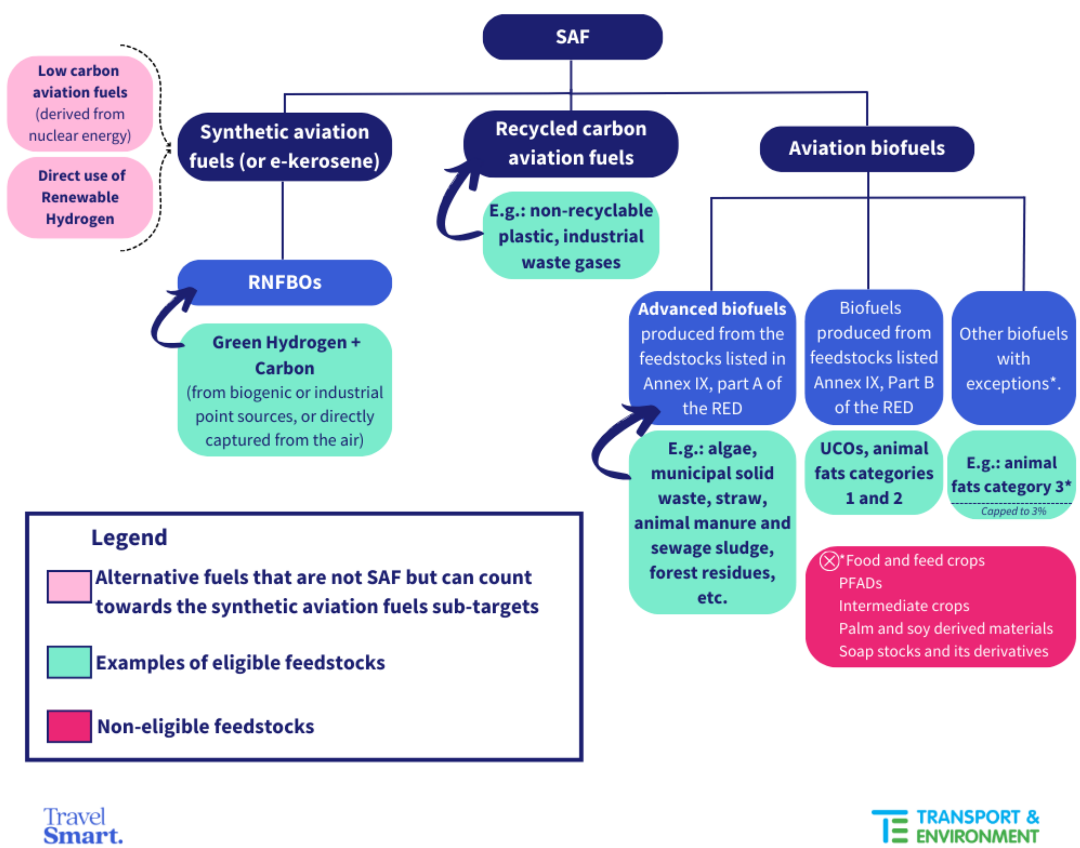


[5] Transport & Environment. (2022). *FAQ: Non-CO2 mitigation measures in ReFuelEU and EU ETS*.

In the air, SAF is likely to reduce the formation of contrails because it contains **less aromatics**, the chemical compounds that are mainly linked to the production of soot, the main "culprit" for contrail formation[6]. On the ground, **SAF can also contribute to improving local air quality**, especially around airports, because of its significantly lower particulate matter (PM) and sulphur emissions compared to fossil fuels.

While SAFs truly have the potential to significantly reduce the climate impact of aviation, **they are not a silver bullet**. SAF availability is still low and they are more expensive than (untaxed) fossil jet fuel. Most importantly, talking about "*sustainable* aviation fuels" is often misleading, **as not all SAFs are equally sustainable**, depending on the type of feedstocks used to produce the fuels. Referring to SAF as "alternative fuels" (among which a few are actually sustainable) would be more adequate. To avoid confusion, this guide will keep referring to SAF (as per the ReFuelEU definition, **Figure 1**).

Figure 1: The different types of SAF according to ReFuelEU



[6] Voigt, C., Kleine, J., Sauer, D. et al. (2021). Cleaner burning aviation fuels can reduce contrail cloudiness. *Commun Earth Environ 2, 114.* https://doi.org/10.1038/s43247-021-00174-y

According to **ReFuelEU**, SAF are defined as drop-in aviation fuels that are either **biofuels** produced from feedstocks listed (for the most part) in [Annex IX of the Renewable Energy Directive (RED II)](#)[7], **recycled carbon fuels** (produced from fossil wastes that cannot be prevented, reused, or recycled) or **synthetic fuels** (made from renewable hydrogen and a source of carbon), which comply with the sustainability and greenhouse gas (GHG) emissions reductions criteria [in Article 29 of the RED](#).

For a company willing to purchase "the right type of SAF" only, there are many things to consider, starting with the feedstocks used to produce the fuel, not forgetting its geographical origin, its cost, its certification process and physical availability. The following subsections will dive successively into all these aspects.

1.1. Feedstocks

The greatest determinant in the sustainability of SAF is the type of feedstocks used to develop the fuels (Figure 3 page 14 summarises the section). The actual emissions reductions can vary wildly, from fuel derived from crop-based feedstocks whose emissions can actually be higher than the fossil fuels they seek to replace, to synthetic e-kerosene derived from additional renewable electricity and CO_2 captured from ambient air, which can have close to zero emissions if produced correctly. Many feedstocks can have considerably negative environmental and social impacts (on water, biodiversity, land use and indigenous rights, for example). Consequently, **any company looking to uptake SAF must choose its preferred feedstocks wisely, and ensure sufficient climate, environmental and social safeguards are in place.**

In the EU, ReFuelEU Aviation goes some way towards selecting the right types of SAF: it excludes crop-based biofuels, and other problematic feedstocks such as non-Annex IX intermediate crops, Palm Fatty Acid Distillate (PFAD) and palm- and soy-derived materials[8], and soap stock and its derivatives. However, it leaves the door open to other problematic feedstocks, which will be further discussed in the sections below.

1.1.1. Crop-based biofuels (and other highly problematic feedstocks)

Crop-based biofuels are by far the least sustainable type of SAF. These biofuels can in fact be a cure worse than the disease when the **indirect land use change (ILUC)** effects are taken into consideration, especially for virgin vegetable oils. When existing agricultural land is turned over to biofuel production, agriculture has to expand elsewhere to meet the existing (and growing) demand for crops for food and

[7] Some feedstocks not listed in Annex IX of the RED are allowed for SAF production (e.g. animal fats category 3 or molasses).
[8] This is restricted though to what is currently labelled as a palm and soy derivative as for example palm oil mill effluent (POME) is considered as a waste/residue and placed in Annex IX albeit being a palm oil derivative in reality. For more info please check our 2020 briefing "[RED II and advanced biofuels](#)"

animal feed. This happens at the expense of forests, grasslands, peatlands, wetlands, and other carbon-rich ecosystems, and in turn results in substantial increases in greenhouse gas emissions. Issues relating to impacts on biodiversity, water use, local communities and food prices are also considerable.

Under ReFuelEU, **crop-based biofuels are excluded from the scope of the SAF definition.** However, EU legislation is one of the only legislations (together with the UK and Norway) to have adopted (or be considering) such a strict definition. In the United States (U.S.), crop-based biofuels are even promoted under the "Sustainable Aviation Fuel Grand Challenge" put forward by the Biden administration, whereby they are eligible for tax credits.

ReFuelEU also excludes the use of **Palm Fatty Acid Distillate (PFAD), soapstocks and its derivatives, intermediate crops[9], and all soy- and palm- derived products.** These feedstocks have competing uses in other industries and would therefore have caused displacement emissions. For example, PFAD is a by-product of the palm oil refining process associated with GHG emissions exceeding that of jet kerosene[10]. Since soapstocks are also oily in nature and can be used in livestock feed, they could be replaced with palm oil and their indirect emissions would be similar to PFADs. As for intermediate crops (planted before or after the main crops), they can sometimes include food and feed crops, such as winter corn and soybean from Brazil[11].

1.1.2. Used Cooking Oils (UCOs) and Animal fats

Most of the SAF currently available in Europe is generated from Used Cooking Oils (UCOs) and animal fats. UCOs and animal fats category 1 & 2 (i.e. non-edible fats) are listed in Part B of Annex IX of the RED, which means they are not considered as "advanced biofuels", but they can contribute to the RED transport target (up to 1.7% in energy terms), and are eligible for double-counting[12]. Animal fats category 3 (edible fats with lesser risk posed to human and animal health and thus more uses in other industries than transport) are not eligible for double counting but can contribute to the RED transport targets. Under ReFuelEU, UCO- and animal fat- SAF can contribute to the SAF targets in the same way

[9] …except if these feedstocks are included in the Annex IX of the RED III, which should be the case of intermediate crops that are grown in regions where crops are limited to one harvest (thus indirectly excluding cash crops grown in regions such as Brazil that are later misleadingly labelled as intermediate crops).

[10] Cerulogy. (2017). *Waste not want not. Understanding the greenhouse gas implications of diverting waste and residual materials to biofuel production.*

[11] Intermediate crops can include any crop grown outside the main growing season, for example over winter. In Europe, intermediate crops are usually grown for ecologically beneficial reasons, like increasing soil carbon and reducing erosion. In contrast, outside the EU and particularly in climates with extended growing seasons, intermediate crops are often grown as food and feed cash crops. For example, most Brazilian maize is grown in winter as an intermediate crop.

[12] Double-counting means, for instance, that for category 1 and 2 animal fats two certificates are issued for every gigajoule of energy supplied (and only one in the case of category 3), making it easier for fuel suppliers to meet RED targets.

as advanced biofuels, without any cap. Only the use of animal fats category 3 (and other non-annex IX feedstocks) is capped to 3%.

UCOs and animal fats are considered preferable to crop-based feedstocks as they do not compete (directly) with land for food. However, **there are serious doubts as to the sustainability of these feedstocks,** largely related to their limited availability, competing uses in other industries, and fraud risks. Hence, the fact that they are not capped in the ReFuel EU is quite concerning.

For example, it is estimated that the EU+UK production of UCOs could increase up to 1.7Mt in 2030 (from 1.3Mt today, due to improvements in collection schemes), **which would theoretically cover only 2.9% of projected aviation fuel demand in 2050**[13]. If imports are taken into account, EU+UK supply would increase to 3.1-3.3 Mton/yr in 2030. Even then, the projected UCO supply could only cover up to 50% of the overall transport sector's demand. Similarly, only 0.75 Mt of animal fats biofuels could be sustainably available from 2030 (mainly due to competing uses in other industries), meaning **animal fats could only cover up to 1.4% of the projected aviation fuel demand in 2050**[14]**.**

Competing uses and displacement effects are a major concern when it comes to animal fats in particular. Animal fats are also used as a combustion material for heat and power production and as a raw material by the oleochemicals industry and by the pet food industry. Diverting animal fats from their current uses would result in displacement effects and significant indirect emissions since industries once using animal fats would now have to use less sustainable alternatives to replace these products. In the oleochemicals industry for example, palm oil is considered as the most likely substitute because it is most similar to animal fats and is the cheapest option available.

Finally, UCOs and animal fats are linked to significant **fraud risks.** The double-counting incentive provided by the RED has been signalled as a potential incentive for fraudulent practices, i.e. artificially increasing the volumes of UCO available to the market by mixing it with virgin vegetable oil, or purposefully downgrading animal fats cat 3 to cat 1 or 2. These concerns were backed up by a report of the European Court of Auditors published in 2016 which highlighted loopholes in the existing voluntary certification system[15]. There have also been allegations of fraudulent practices linked to the UCO biodiesel industry in the UK and The Netherlands[16]. As for animal fats, a recent study by T&E highlighted that the amount of biofuels reported to be derived from cat 1 and 2 by Member States is almost twice the amount actually available and reported by the animal fat industry, thus raising concerns that materials from animal fats category 3 could potentially be mislabelled as originating from category 1 and 2 material[9].

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[13] CE Delft. (2020). *Used Cooking Oil (UCO) as biofuel feedstock in the EU.*
[14] Transport & Environment. (2023). *Pigs do fly! Growing demand for animal fats and biofuels to power Europe's transport system raises concerns over climate impacts and potential fraud.*
[15] ECA. (2016). *The EU system for the certification of sustainable biofuels.*
[16] Foot, N. (2020, December 11). New fraud investigation casts doubt over used cooking oil origins. *Euractiv.com.*

1.1.3. Advanced biofuels

Advanced biofuels are produced from wastes and residues such as municipal waste, straw, and forestry residues. Similarly to UCOs and animal fats, these feedstocks are preferable to crop-based biofuels as they are supposed to not compete directly with land for food. In the EU, a list of eligible feedstocks is provided by part A of the Annex IX of the RED. However, these feedstocks are also connected to sustainability concerns. For example, some feedstocks are not real wastes or residues, some have displacement effects as they have competing uses and most of them have a limited availability to be scaled-up[17].

INFO BOX: Examples of problematic feedstocks from annex IX part A of the RED[18]

- *Crude tall oil, crude glycerine* because of competing and higher value uses. For example, crude tall oil is a by-product of the pulp & paper industry, already used to produce paints, detergents, etc. Its use for biofuels would lead to these industries being forced to revert to fossil or virgin vegetable oils as feedstocks, consequently leading to higher emissions in these sectors.
- *Cellulosic energy crops* (grassy energy crops such as miscanthus, switchgrass, giant cane, sorghum and hemp grown as main crops) and *woody energy crops* (willow, poplar or eucalyptus, depending on geography) should only be eligible if evidence is provided that these are grown on abandoned or marginal land.
- *Palm oil mill effluent, empty palm fruit bunches and bagasse,* because of the risk of import dependence and the need for the countries of origin to decarbonise their own economy.
- *Wastes and residues from forestry*, such as bark, branches, pre-commercial thinnings, leaves, needles and tree tops, because of competing and higher value uses as energy or soil carbon.

While they have a role to play in reducing the exclusive reliance of the aviation sector on fossil fuels, **there will never be nearly enough advanced biofuels to meet the sector's demand**. T&E's forecast suggests an EU27 advanced biofuel supply of 1.3Mtoe in 2030 and 5.8Mtoe in 2050, which amounts to respectively 54% and 31% of the biofuel uptake mandated by ReFuelEU (in a high traffic scenario)[19].

1.1.4. E-kerosene

[17] Transport & Environment. (2021). *A clean shift for EU transport fuels? T&E recommendations for the RED review.*
[18] Transport & Environment. (2020). *RED II and advanced biofuels. Recommendations about Annex IX of the Renewable Energy Directive and its implementation at national level.*
[19] Transport & Environment. (2022). *Roadmap to climate neutral aviation in Europe*. ReFuelEU mandates a minimum biofuel uptake of 4.8% of the aviation sector's energy demand in 2030, which amounts to a biofuel uptake of 2.4 Mtoe in a high traffic scenario (no demand management, FF55 compromise, no ETD) in which the final energy demand of the sector is estimated at 50 Mtoe, according to T&E calculations.

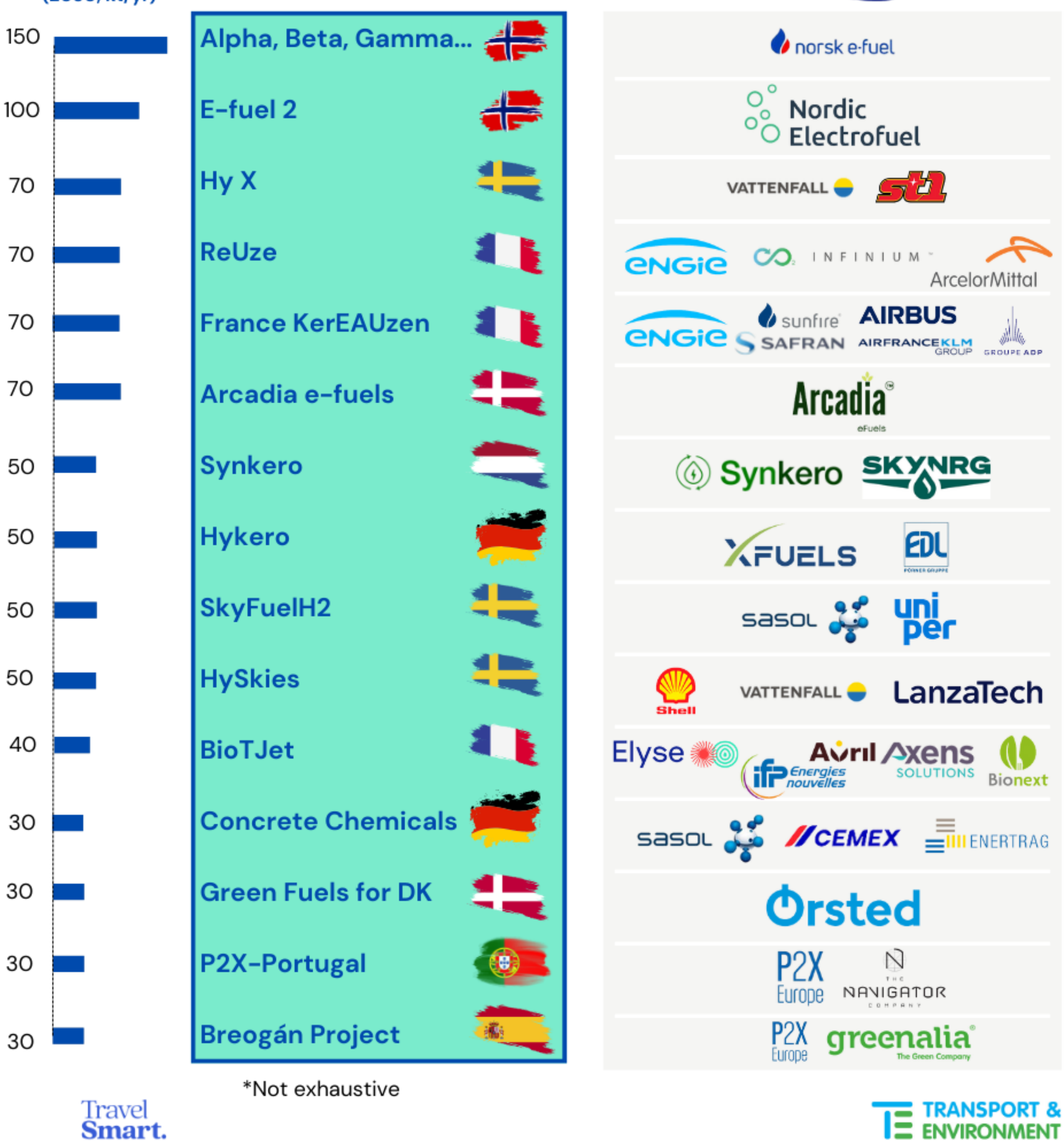
E-kerosene (also called synthetic kerosene or Power-to-Liquid (PtL) fuel) is produced by combining H_2 and CO_2. If hydrogen is produced using additional renewable electricity (so-called “green hydrogen”), and carbon dioxide captured from ambient air (through a process known as direct air capture (DAC)), **e-kerosene can have near zero GHG emissions.**

Because its primary feedstock is renewable electricity, it is a more viable option to decarbonise aviation than crop-based and advanced biofuel. However, producing e-kerosene is **a very energy intensive process**, which is why it can only be scaled up to meet the fuel demands of the aviation sector **in scenarios where aviation demand is managed** (through reductions in corporate travel and capping leisure travel)[14]. The production of e-kerosene also requires a significant amount of water, because hydrogen is produced through electrolysis. However, e-kerosene has a water footprint 100 to 1000 times lower than biomass-derived aviation fuels.[20]

Although e-kerosene is not yet available on the market, **more and more companies are looking to set up production facilities** (**Figure 2**). ReFuelEU has ensured a minimum level of demand for e-kerosene in the EU by setting up dedicated quotas, but the investment needs of the sector are colossal. None of the projects announced in the EU has reached a final investment decision. E-kerosene producers struggle to secure investments as they suffer from the first mover disadvantage, and from a lack of commitment from airlines to offtake their product. Corporate offtakers have an important role to play in that regard: by partnering with innovative e-kerosene start-ups, they can help reassure investors and actively contribute to the scale up of the market.

[20] Rojas-Michaga, Maria Fernanda, et al. "Sustainable aviation fuel (SAF) production through power-to-liquid (PtL): A combined techno-economic and life cycle assessment." *Energy Conversion and Management* 292 (2023): 117427. https://doi.org/10.1016/j.enconman.2023.117427

Figure 2: Major e-kerosene projects in the EU*



[21]

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[21] The unit on figure 2 was changed from Mt to kt on 03 November 2023. This was an unintentional error.

Figure 3: SAF sustainability per type of feedstock

Type	Availability	Competing uses	Fraud risks
Crop-based biofuels	Limited. Crops could be much better used in increasing global food security.	Compete directly with existing agricultural land. High indirect land use change (ILUC) effects.	Some crop-based biofuels can be passed as waste-based biofuels.
Used Cooking Oils (UCOs) and Animal fats	Very limited. The EU+UK production of UCOs and animal fats could only cover 2.9% and 1.4% of projected aviation fuel demand in 2050, respectively.	Animal fats have many competing uses (e.g. cosmetics, pet food) which can result in ILUC and displacement emissions.	Significant fraud risks due to regulatory incentives that inadvertently encourage fraudulent practices, i.e. artificially increasing the volumes of UCO available to the market by mixing it with virgin vegetable oil, or purposefully downgrading animal fats cat. 3 to cat. 1 or 2.
Advanced biofuels	Limited. Maximum supply of 1.3Mtoe in 2030 and 5.8 Mtoe in 2050, i.e. respectively 54% and 31% of the biofuel uptake mandated by ReFuelEU (in a high traffic scenario).	Some feedstocks listed in Annex IX, Part A can cause displacement effects as they have competing uses (e.g. crude tall oil, crude glycerine, pre-commercial thinnings, pulp wood and trees stumps etc).	Lower fraud risks than with UCOs and animal fats but additional efforts and rules will need to be defined to develop clear chains of custody and avoid potential fraud cases.
E-kerosene	Because its primary feedstock is renewable electricity, it is the only fuel that has the potential to be scaled up to meet the demand of the sector. If it is produced from additional renewable electricity and CO_2 captured in the air, it can be close to CO_2 neutral.	Producing e-kerosene is a highly energy intensive process which will compete with renewable electricity needed to achieve the decarbonization of other sectors. That is why demand management is needed.	A reliable chain of custody will need to be developed to avoid potential fraud cases (e.g. regarding additionality, geographical and temporal correlation requirements).

Unsustainable
Questionably sustainable
Sustainable (with demand management)

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1.2. Origin

The geographical production of SAF plays a key role for its efficient use. Purchasing locally produced SAF instead of importing it can offer several benefits for businesses and competitive advantage.

Locally produced SAF can reduce the carbon footprint by avoiding long-distance transportation of feedstocks and fuels.[22] When SAF is produced locally, it eliminates the emissions associated with long-distance transportation, such as shipping or air freight, and its distribution.

Cost-savings from purchasing local SAF are significant when compared to importing it, making the overall supply chain more cost-effective. Shipping, customs duties, and handling fees increase transportation costs. Besides, locally produced SAF can benefit from regional incentives and market demand that can lower the production costs and increase profitability.[23]

Regulations and standards regarding SAF sustainability vary from one region to another. Given that the EU has adopted more stringent sustainability criteria than the rest of the world, it is easier to check that the SAF purchased complies with EU standards if it is produced in Europe.

Moreover, the SAF supply chain can become more resilient, stable and less exposed to geopolitical disruptions, trade restrictions or unanticipated circumstances by being less dependent on imported goods.

INFO BOX: Different regulations in different geographies

SAF regulations and standards vary across different countries. **In the U.S.**, the **California Low Carbon Fuel Standard (CA-LCFS),** designed to reduce greenhouse gas (GHG) emissions in the transportation sector, recognized SAF as an eligible fuel to generate carbon credits in 2019. Through a life cycle assessment, it calculates the emissions saved when compared to traditional jet fuel. These emission credits serve as an incentive for SAF production, as they can be sold to other obligated parties under the CA-LCFS. **The Inflation Reduction Act of 2022 (IRA)** outlines a two-phase strategy to encourage the production of SAF. The first phase, 2023-2024, includes the **SAF Blender's Tax Credit (BTC)**. Effective from January 2023, incentives SAF production by making SAF producers qualify for a $1.25 per gallon credit for each gallon of SAF sold in a qualified fuel mixture, demonstrating a life cycle greenhouse gas (GHG) reduction of at least 50% compared to conventional jet fuel. The stand-alone SAF tax credit rises by one cent for each percentage point by

[22]International council on clean transportation (ICCT), (2021). *Estimating sustainable aviation fuel feedstock availability to meet growing European Union demand.*
[23] Clean Skies for Tomorrow (2020). *Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation*.

which the life cycle GHG emissions reduction surpasses 50%, reaching up to $1.75 per gallon for a 100% reduction.[24] The second phase, 2025-2027, the tax credit is strengthened, allowing renewable fuels, including SAF, to qualify for the **clean fuel production credit (CFPC)**.[25] Under the Biden administration, the U.S. announced a target to to increase the production of SAF to **at least 3 billion gallons per year by 2030**; including measures such as establishing tax credit to cut costs and boost domestic production of SAF, funding SAF projects, and actively collaborating with international partners to scale up SAF[26]. While the EU policy is targeted at promoting advanced biofuels and e-kerosene through a comprehensive framework, **the U.S. are betting on short-term subsidies incentivizing all types of SAF instinctively**, including crop-based biofuels.[27]

In the UK, the government is expected to introduce a SAF mandate equivalent to at least 10% (around 1.5 billion litres) of jet fuel to be made from sustainable sources by 2030. The mandate will operate as a GHG emission reduction scheme with tradable certificates. The mandate will apply to jet fuel suppliers and will begin in 2025. Eligible fuels include biofuels from waste, recycled carbon fuels using unrecyclable plastic and waste industrial gases, and power-to-liquid (PtL) fuels. SAF must adhere to rigorous sustainability standards, ensuring a minimum of 50% reduction in GHG emissions compared to traditional jet fuel.[28]

1.3. Price

The price of SAF can vary widely based on several factors, including feedstock availability, production technology, government incentives, and market demand. In most SAF transactions, **corporate buyers only pay the SAF price premium (or a share of it)**, while airlines pay for the conventional jet fuel cost equivalent (and possibly part of the premium as well). The SAF price premium is the cost of SAF (including feedstock price, production and logistics costs, and sustainability certification) less the price of conventional kerosene and any government subsidy.[29] Instead of receiving a predetermined cost, **it is important that companies always request a clear price breakdown of SAF compared to conventional jet fuel from their transaction partner.**

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[24] National Business Aviation Association (NBAA). January/February 2023. *What Will the SAF Blenders Credit Mean for Operators?*
[25] Stillwater Associates. (April 13, 2023). *SAF in the IRA Era – How do the incentives stack up?*
[26] IATA. *Fact Sheet: EU and US policy approaches to advance SAF production.*
[27] Rutherford, D. (August 11, 2022). *Sustainable aviation fuels: what does real leadership look like?*
[28] Gov.UK. (July 2021, last update March 2023). *Mandating the use of SAF in the UK.*
[29] Deloitte. (2021). *Pioneering early SAF transactions*; Deloitte indicates that it paid an average of $130 per metric ton of CO2e avoided (with a “well-to-wake” methodology), and this cost ranged by more than $90 per metric ton avoided.

Regarding metrics, the SAF premium is usually communicated per gallon or litre throughout the transaction process, but the **price per metric ton of CO_2 avoided** offers a more meaningful metric from a sustainability perspective.

Despite SAF being a key factor to cut aviation emissions, **its price is significantly higher than standard jet fuel,** especially e-kerosene. This can be due to factors such as limited production capacity, higher production costs, and economies of scale. The price of fossil-based jet fuel was approximately €600 per tonne in 2021, while SAF prices could range from 1.5 to 6 times higher, depending on the regions and technological pathways considered.[30] During 2022, **the average SAF price estimate was around €2,300/t** (with significant differences across regions), which was around **2.5 times higher than the price of conventional jet fuel**[31].

As technology advances and production scales up, the cost of SAF is expected to decrease. The US Energy Information Administration projects e-kerosene prices are likely to decrease as the market gets mature and technology improves. E-kerosene production costs will also drop substantially as renewable electricity becomes cheaper. For example, DENA (the German Energy Agency) estimates the domestic costs of DAC-e-kerosene in the EU will decline from 125 €/MWh in 2030 to 70 €/MWh in 2050. Additional economic incentives from market-based measures, like the EU Emissions Trading System (EU ETS) and potential tax credits will also help in reducing the price gap relative to fossil-based jet fuels. Unlike the EU ETS, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) does not provide economic incentives for SAF usage. It gives airlines the possibility to reduce their offsetting requirements through voluntary uptake of SAF, but this is not effective because cheap offsets are widely available instead therefore providing no economic incentive to use SAF[32].

Increased demand for SAF can boost the improvement of production processes and reduce costs progressively. In parallel to mandates and regulations, businesses have the opportunity to contribute to the scale up of SAF by being pioneers in its use for their work-related flights, when necessary.

1.4. Flight emission calculation methods

Airlines and fuel suppliers schemes or independent platforms through which companies can purchase SAF typically offer companies to use a flight emission calculator before determining a percentage they want to reduce by purchasing SAF, most of them relying on the ICAO methodology. Methodologies for calculating CO_2 emissions and determining the quantity of SAF to compensate for these emissions might vary between airlines and platforms depending on the variables taken into account, such as the type of SAF, fare class, load, route, aircraft model, among others.

[30] EASA. E*UROPEAN AVIATION ENVIRONMENTAL REPORT* (2022). 230217_EASA EAER 2022.pdf (europa.eu) p.82
[31] IATA. (2023). *Chart of the Week. Sustainable aviation fuel output increases, but volumes still low.*
[32] T&E. (2022). Pay €2 to greenwash a flight to New York with UN aviation scheme.

Currently, most greenhouse gas calculation methodologies only address CO_2 emissions. However, non-CO_2 effects have a substantial impact on the climate, at least as important as CO_2 emissions, and are usually estimated by the use of a multiplier applied to CO_2.

Non-CO_2 emissions are referenced in the Greenhouse Gas (GHG) Protocol and UK BEIS calculation factors, but their reporting is left optional. Currently, various calculation methods, such as UK BEIS, ICAO, US EPA, France ADEME, GRI, or GHG Protocol, are available. However, **companies should use a methodology that applies a Radiative Forcing Index factor of at least 1.7 to CO_2 emissions, such as the UK BEIS conversion factors** for company reporting of greenhouse gas emissions.[33]

1.5 Calculating and reporting emissions reductions

Businesses have the opportunity to reduce their Scope 3 emissions by using SAF for their corporate air travel. When airlines burn traditional jet fuel, it generates emissions categorised as their direct operational emissions, known as Scope 1 emissions[34]. However, for airline passengers and air freight customers, these emissions are classified as Scope 3 emissions, representing indirect supply chain emissions. The GHG Protocol assigns responsibility for these emissions to multiple parties, encompassing both Scope 1 and Scope 3 emissions within the same supply chain.

To illustrate this further, when airlines make the switch from conventional jet fuel to SAF in their aircraft, they can claim the emissions reductions linked to this transition as part of their Scope 1 disclosure. Similarly, customers can incorporate these reductions into their Scope 3 disclosure.

The reduction in emissions resulting from SAF is determined through a comprehensive life cycle assessment (LCA). This assessment computes emissions at every stage of the SAF supply chain, ranging from feedstock production to the combustion of fuel in an aircraft, and then compares this to the equivalent lifecycle of conventional jet fuel. It's essential to note that emissions reductions from SAF are not realised at the moment of fuel combustion but occur due to the replacement of new carbon (fossil fuels) with recycled carbon. Therefore, a comprehensive life cycle analysis is necessary to quantify the emissions reduction benefits of SAF.

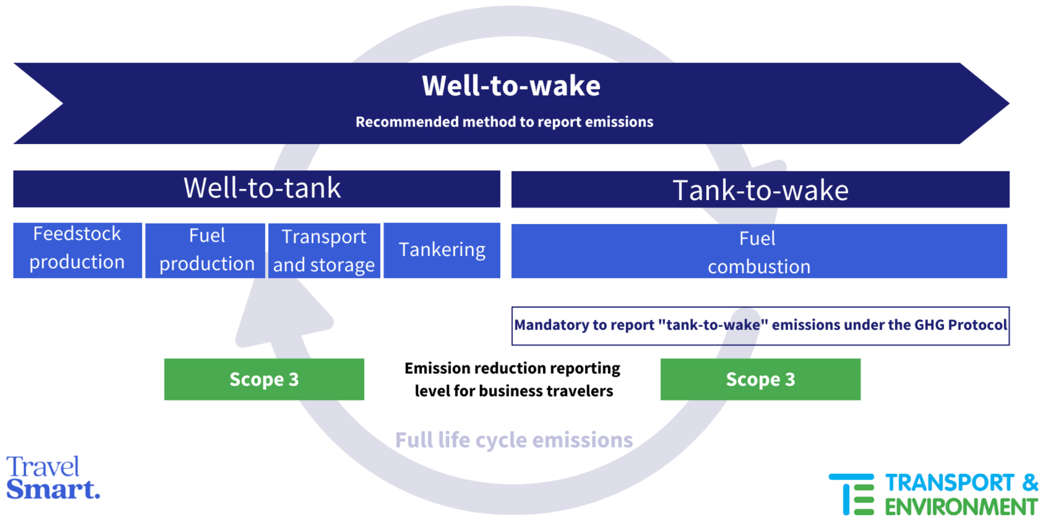
There are two main methods to calculate emission reductions from SAF: **"well-to-wake"** and **"tank-to-wake."** The "well-to-wake" method encompasses emissions from feedstock production to

[33] UK Department for Business, Energy & Industrial Strategy, now succeeded by the UK Department for Energy Security & Net Zero.

[34] If owned by companies, private jets can be linked to their Scope 1 emissions. As organisations strive to meet sustainability goals, there is a pressing need to address the environmental implications of private jet usage comprehensively, encompassing not only fuel choices but also the overall sustainability practices surrounding this mode of transportation.

exhaust emissions from the aircraft. This method includes both upstream supply chain emissions and direct emissions within the SAF lifecycle. On the other hand, the "tank-to-wake" method considers only emissions from fuel combustion and omits upstream emissions from feedstock production and SAF distribution. Currently, it is only mandatory to report "tank-to-wake" emissions under the GHG Protocol. Still, **revised guidance from the Science Based Targets initiative (SBTi) for the aviation sector recommends adopting the more comprehensive "well-to-wake" calculation methodology**.[35]

Figure 4: Well-to-wake method



As there is not yet standardisation, companies who wish to report reduced emissions should use a **"well-to-wake" method** to strive for a more complete emission reduction framework. Looking ahead, standardised emissions calculations would be advantageous in establishing a consistent and reliable approach for Scope 3 buyers.

In accordance with emerging best practice and guidance, companies should transparently report their emissions both with and without the application of SAF reductions.[36]

1.6. Certification

SAF are certified by **voluntary sustainability certification schemes** in accordance with standards established at the global and EU levels under the CORSIA framework and the Renewable Energy Directive (RED).

[35] Deloitte. (2021). *Pioneering early SAF transactions.*
[36] BCG. (2022). *Expanding Our Reach, Enhancing Our Impact.* pg. 86

In the EU, the European Commission formally recognizes 15 schemes for the production of sustainable fuels and gases, from which three schemes stand out for being the most used by aviation stakeholders: the **International Sustainability and Carbon Certification** (ISCC EU), the **Roundtable on Sustainable Biofuels** (RSB EU RED), and **REDCert**[37]. While REDCert is limited to the same land-use and GHG standards as the RED, ISCC and RSB aim to address sustainability issues of biofuels more comprehensively at environmental, social and economic levels.

It should be noted that **these certification schemes have often come under fire in the past few years**. Back in 2016, the European Court of Auditors (ECA) itself said in a report that the EU's certification system for the sustainability of biofuels was "not fully reliable" and that it "did not adequately cover some important aspects necessary to ensure the sustainability of biofuels"[38]. The ECA pointed to *inter alia* the weak verification of the origin of waste or residues used for the production of biofuels and to a general lack of adequate supervision of voluntary schemes by the European Commission. More recently, **a rapid surge in biofuels exports from China has led biofuels prices in the EU to collapse and has raised suspicions that palm oil is being passed off as a waste material.** In response, the ISCC has increased unannounced "integrity audits" but it remains questionable whether the approach of the ISCC and other certification schemes is sufficient to ensure the sustainability of SAF purchased.[39]

1.7. Physical availability and Book-and-Claim systems

Corporates should be mindful of the fact that **SAF are not yet available at all airports**, mainly because they are produced only in a limited number of locations (**Figure 5**). Moreover, transporting SAF to a specific airport is not always possible and can lead to higher lifecycle emissions. In the EU, to comply with ReFuelEU, SAF will eventually have to be available at all airports[40], but until 2034 fuel producers have the possibility to supply aviation fuel containing higher shares of SAF in certain airports to compensate for lower shares or the absence of SAF in other airports.

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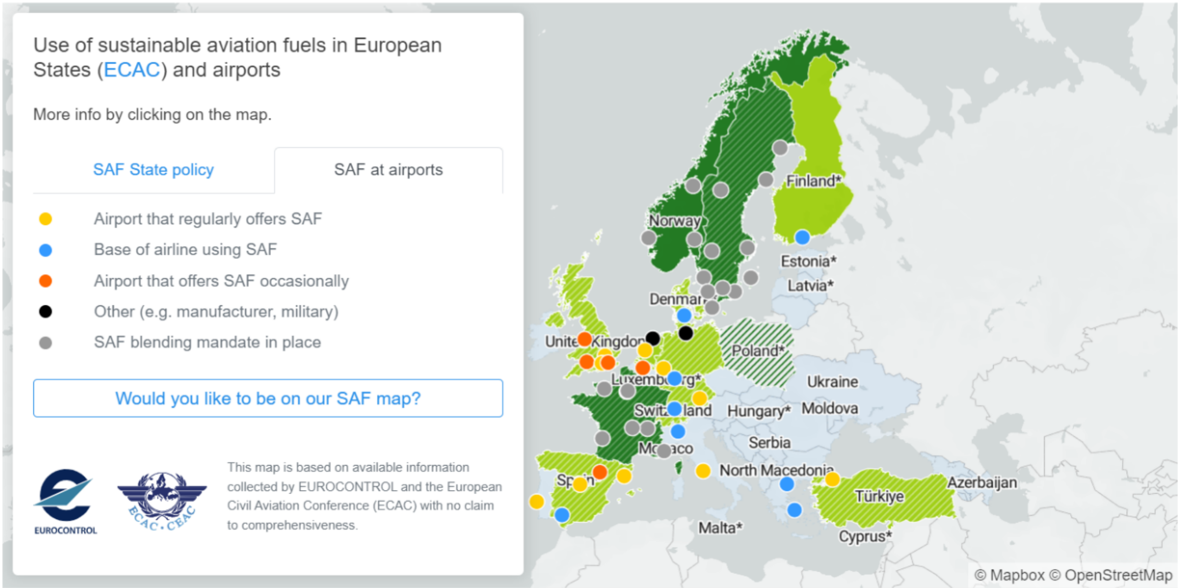
[37] European Commission. Voluntary schemes. *Energy.ec.europa.eu.*

[38] ECA. (2016). *The EU system for the certification of sustainable biofuels*.

[39] Goulding Carroll, S. (2023, July 7). *EU industry demands answers as 'fraudulent' Chinese biofuels continue to flow.* *Euractiv.com.*

[40] Only airports where annual passenger traffic is higher than 800.000 passengers or where the freight traffic is higher than 100.000 tons are included in the scope of the regulation. Airports located in outermost regions are also excluded.

Figure 5: Availability of SAF at European airports



Source: Eurocontrol

As a result, most airlines or fuel producers already offering corporates the possibility to purchase SAF actually offer the purchase **not of *physical* SAF but of *the environmental attribute* of SAF through a Scope 3 credit.**

This can be done through so-called **book and claim systems.** Such systems are already used for renewable electricity: electricity providers can enter or "book" the electricity they have produced in their systems and customers can "claim" the green energy they have bought. Consumers will then receive a certificate stating the amount of renewable electricity they paid for. For SAF, this means that **the fuel does not go into the specific aircraft of the corporate customer purchasing SAF.** Instead, it goes into the fuel system at an airport close to the SAF production facility.

While several book and claim systems for SAF are currently being developed on a voluntary basis by the private sector, such as Avelia (a book-and-claim platform launched by Shell and Accenture)[41] or the SAF certificates developed by the Sustainable Aviation Buyers Alliance (SABA), **there is no official globally accepted reporting system for SAF.** Several methodologies have been developed, for example the *RSB Book & Claim Manual*. In the EU, the European Commission will have to assess the feasibility of a harmonised book and claim system by July 2024.

[41] https://aveliasolutions.com/

While book-and-claim systems can help overcome logistical difficulties and allow for offtakers distant from the locations of production, the risks of **double counting**[42] and fraud should not be overlooked. It is also important to ensure these systems lead to *additional* SAF demand and GHG emission reductions compared to what would have happened in the absence of such mechanisms, i.e. mandated by law.

2. Offtaking options

Given the increasing recognition of SAF's significant role in mitigating aviation's environmental impact, the corporate world is actively exploring diverse purchasing avenues for SAF. Various fuel suppliers and retailers, airlines, and corporates have initiated programs to enable business travellers to finance SAF (**Figure 5**).

2. 1. Airlines' schemes

More and more **airlines** have launched programs to allow their corporate customers to contribute to paying the SAF premium. These programmes can take the form of voluntary **"green fares"** or opt-in options, whereby corporates are offered the option to "purchase" SAF during the booking process. Airlines then commit to complete the purchase within a certain amount of time. For example, **Lufthansa launched "Business Green Fares" in 2023.** It should be noted that only 20% of the fares are used to reduce emissions by purchasing SAF, while the remaining 80% of flight emissions are offset by funding climate protection projects, the effectiveness of which is highly questionable[43].

Airlines can also have partnerships with **stand-alone digital CO_2 compensation platforms** accessible independently of the booking process (e.g. Compensaid by Lufthansa), or **funds** to which corporates can choose to make a voluntary contribution (e.g. the Eco-Skies Alliance SAF programme developed by United Airlines). In most cases, companies are offered the option to calculate their CO_2 emissions and choose a percentage they wish to compensate for. Scope 3 credits are only offered when the schemes are specifically designed for corporates.

Figure 6 tries to provide more clarity into the type of SAF airlines purchase (or are considering purchasing), on the basis of Memoranda of Understanding (MoUs) and offtake agreements they have signed. **Most airlines have only signed offtake agreements with biofuels producers.** Only a handful

[42] Double counting refers to the risk for emissions reductions to be counted more than once towards a climate change mitigation effort.

[43] The systems used to measure offsetting's impact are flawed. 'Avoided' deforestation schemes are based on hypothetical predictions of how much deforestation would happen if the project did not exist with comparable nearby regions used as a reference. The projects are only set to last a short period of time, meaning that the carbon savings from forest preservation are not guaranteed over the longer term, while CO2 emissions released by jets stay in the atmosphere for hundreds of years. Even the industry is starting to recognise the uselessness of offsetting, with some airlines moving away from it, and some executives calling it "a fraud".

of airlines with corporate SAF schemes stand out for having signed offtake agreements or MoUs with e-kerosene producers (namely Lufthansa Cargo with Atmosfair, United Airlines with Dimensional Energy, and Virgin Atlantic with Air Company). However, the schemes of these airlines don't allow companies to select the type of SAF they want to contribute to purchasing.

The following tables are meant to provide an overview of existing corporate SAF schemes, in an effort to centralise the information available on the matter, it does not constitute an endorsement by Transport & Environment.

Figure 6.1. Corporate SAF schemes by airlines

	Program name	Companies involved	Brief description	Type of SAF sourced	Supplied by
COMMERCIAL AIRLINES	*Business Green fares*	Lufthansa, Austrian, SWISS, brussels airlines	20% of flight-related CO2 emissions are reduced by the use of SAF and the remaining 80% are offset by an equivalent contribution to climate protection projects.	Biofuels generated from oils, UCOs & fats.	Shell, OMV, H·C·S GROUP, VARO
	Corporate Sustainable Aviation Fuel Program	AIRFRANCE, KLM	Members of the program determine an annual contribution they wish to make. Contributions are invested in the sourcing and consumption of SAF.	Biofuels generated from oils & fats, waste wood, corn stover, cotton gin waste, straw, forest waste, dedicated energy crops...	DG FUELS, TotalEnergies, NESTE
		IBERIA	Corporates can choose the proportion of their emissions they want to reduce by purchasing SAF or combining the use of SAF with Iberia's offset program.	Biofuels generated from agri-food waste such as UCOs.	REPSOL
	Corporate SAF program for business travel	virgin atlantic	Enables customers to contribute to the cost of SAF.	Biofuels generated from oils & fats, corn, sugar, lignocellulose; e-kerosene.	gevo, AIR COMPANY, NESTE
	Eco-Skies Alliance SAF program	United Airlines	Companies' contributions are collected in a designated SAF account. At the end of the year, contributions are totaled and used for the future purchase and use of SAF and/or SAF-blended products.	Biofuels generated from waste fats, oils & greases; advanced biofuels made from MSW; e-kerosene.	NESTE, Fulcrum BioEnergy, Dimensional Energy

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Source: Public information

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2.2. SAF producers' schemes

Alternatively, companies can purchase SAF **directly from producers and retailers.** Typically, programme members commit to pay for an annual SAF volume based on their targets. The SAF is then produced and delivered to a nearby airport and corporates receive Scope 3 credits, using a book &

claim system, meaning that corporates cannot know exactly at what airport the SAF they purchased was delivered to.

There are only two producers' schemes we know of: Neste's "My SAF for business", and Sky NRG's "Board Now" program. Similarly to airlines', at the moment, these producers' schemes only enable the offtake of biofuels made from waste fats. Sky NRG aims to develop a commercial plant for the production of e-fuel in the Port of Amsterdam by 2027.

Figure 6.2. Corporate SAF schemes by fuel producers

	Program name	Companies involved	Brief description	Type of SAF sourced
FUEL PRODUCERS	*My SAF for business*	NESTE	Programme customers determine and share their carbon footprint and reduction targets with Neste. After establishing how much SAF is needed, Neste delivers SAF to the airlines companies fly with.	Biofuels generated from oils & fats
	Board Now	SKYNRG	Program customers set their targets and commit to pay for a corresponding volume of SAF. Sky NRG produces the SAF in one of its production facility and delivers it to a nearby airport (via Book and Claim)	Biofuels generated from waste oils & fats

Source: Public information

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2.3. Joint procurement

An alternative way for companies to purchase SAF is to undertake **joint procurement**. By aggregating demand, companies can increase their market power and potentially reduce the SAF premium. For example, in April 2023, several companies (including Bank of America, Boom Supersonic, Boston Consulting Group, JPMorgan Chase & Co., Meta and clean energy nonprofit RMI) joined together through **the Sustainable Aviation Buyers Alliance (SABA)** to purchase SAF certificates linked to 850,000 gallons of bio-SAF procured by World Energy, to be used to fuel Jet Blue flights in 2023[44]. SABA aims to launch a second competitive procurement process open to all airlines and fuel providers to

[44] Sustainable aviation buyers alliance announces aviation decarbonization first, with collective purchase of sustainable aviation fuel certificates. (2023, April 4). *Flysaba.org.*

procure SAF certificates across a five-year timeframe. The objective is to increase its annual collective demand by more than 10 times compared to this first process[45].

Figure 6.3. Corporate SAF schemes by corporate buyers: the SABA

	Program name	Companies involved	Brief description	Type of SAF sourced
CORPORATE ALLIANCE	SABA SUSTAINABLE AVIATION BUYERS ALLIANCE	Environmental Defense Fund, RMI, Bank of America, Meta, BCG, Microsoft, Boeing, Deloitte., McKinsey & Company, Netflix, salesforce, JPMorgan Chase & Co.	Enables joint SAF purchase through its SAF certificate system (i.e. joint procurement of 850,000 gallons of SAF in April 2023). The alliance also helps its members navigate the technical aspects of SAF and the SAF market, aviation emissions accounting, and the SAF policy-making landscape. Also building a book-and-claim registry system and developing a sustainability framework.	The 850,000 gallons of SAFs jointly procured by SABA in April 2023 will be supplied by world energy which produces biofuels generated from waste oils and fats.

Source: Public information

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2.4. Travel management companies and dedicated platforms

Some business travel management companies offer corporate customers the possibility to invest in SAF through dedicated programmes, like the American Express Global Business Travel (Amex GBT), through the Avelia platform in partnership with Shell and Accenture, or Travel Places UK, which works in partnership with British Airways offering clients to purchase bio-SAF provided through the airline's partnership with Phillips 66 Limited. Goodwings, a sustainable business travel management platform, offers to systematically use booking revenues to purchase biofuels. Companies can also turn to dedicated platforms like Compensaid, Avikor, or the Fly Green Fund (non-profit).

[45] Timeline unknown.

Figure 6.4. Other corporate SAF schemes (business travel management and emission compensation platforms)

	Program name	Companies involved	Brief description	Type of SAF sourced
TRAVEL MANAGEMENT PLATFORMS		Goodwings	Sustainability-focused travel management platform, which uses booking revenues to purchase biofuel on behalf of customers, removing any remaining emissions with removal offsets.	Biofuels generated from UCOs and waste animal fats, supplied by SQUAKE produced by NESTE
		TRAVEL PLACES, BRITISH AIRWAYS	Working in partnership with British Airways, Travel Places UK is offering its clients the possibility to purchase a percentage of SAF	Biofuels generated from UCOs, provided by PHILLIPS 66
DEDICATED PLATFORMS	*Compensaid Corporate Program*	compensaid, Lufthansa, SWISS, Eurowings, AIRGO	Digital CO2 compensation platform offering corporate customers the possibility to use SAF for their air travel and/or to sponsor certified climate protection projects to compensate for their individual emissions. Compensaid guarantees that the purchased SAF is put into circulation within the next six months.	Biofuels generated from oils, UCOs & fats, supplied to the Lufthansa Group, which has signed MoUs with Shell, OMV, VARO, H-C-S GROUP
	Avikor	Avikor, exolum, vueling	Avikor offers companies travelling from BCN or MAD airports the possibility to reduce the emissions of their flight thanks to the use of SAF. Avikor calculates the litres of SAF needed to reduce or eliminate the emissions caused by the flights and it introduces this fuel into the fuelling system of the airport. The customer pays the difference in price between the two fuel types. Avikor sends to the airport the amount of SAF acquired for the flights each day, and the customers receive a message informing them that the SAF they have purchased has been dispatched to the airport before their flight takes off. Airline partner Vueling has committed to matching the contributions of its customers using the scheme.	Exolum distributes SAF made from waste oils and fats produced by REPSOL, CEPSA, air bp
	Fly Green Fund	KSDarprt. Karlstad Airport, NISA, svenska regionala flygplatser, Swedavia Airports, SKYNRG	Non-profit organisation offering companies to calculate their flights carbon footprint through a carbon calculator, then choose the level they want to compensate, and pay to buy SAF that will be delivered to Swedish airports, or support development of local supply chain projects based on local feedstocks. 75% of the Fund's corporate and private customer's contributions are used to pay the additional cost for bio jet fuel. 25% of the funds are used to support supply chain projects, market development, knowledge sharing and research of local production.	Most of the SAF delivered to date comes from California, USA and is made of UCO. The Fund has committed to uptake PFAD-free SAF. world energy produces the fuel, SKYNRG distributes it.
	SKYFINITY	VÆRIDION, INSEAD, launchpad, STATION F, AeroDelft	Non-profit and Public Benefit Organisation (PBO/ANBI) which invests contributions from companies into sustainable aviation start-ups, including (but not limited to) advanced biofuels and e-kerosene start-ups.	
HYBRID	Avelia	Shell, accenture, American Express GLOBAL BUSINESS TRAVEL	Platform based on a "blockchain-powered" book-and-claim system, offering around 1 million gallons of SAF.	Biofuels generated from UCOs and waste animal fats. Supplied by: Shell

Source: Public information

2.5. Ad-hoc partnerships

Corporate buyers can also opt for bilateral transactions with airlines or multilateral agreements with airlines and fuel suppliers negotiated on an ad-hoc basis. For example, in 2021, Deloitte negotiated an agreement with Delta to purchase SAF produced by Neste[46]. Similarly, in August 2023, Microsoft agreed to co-fund 14,700 tonnes of IAG's SAF purchasing from Phillips 66 Limited's Humber refinery[47]. The company has also signed a book-and-claim 10-year SAF deal with World Energy[48].

While it may be simpler to rely on corporate SAF schemes such as those listed in the previous sections of this guide, these schemes can lack transparency on the details of the SAF purchased, and could carry reputational risks for the buyer. On the other hand, **ad-hoc transactions can give companies more leeway to select what airlines and/or suppliers they wish to engage with and to be more selective when it comes to the type of SAF they want to support.** These one-to-one negotiations may also make it easier for companies to request a clear SAF price breakdown.

After careful in-depth research, **companies can sign partnerships with new players** (like some of the innovative start-ups highlighted in Figure 2), thus helping them to achieve FID. For example, in July 2022, **Microsoft signed an MoU with Twelve**, a U.S. based e-kerosene start-up, and Alaska Air Group, to advance production and use of e-kerosene[49]. The agreement includes plans to work toward the first demonstration flight in the U.S. using e-kerosene, as well as a commitment from Microsoft to use e-kerosene produced by Twelve to power its business travel flights on Alaska.

When negotiating with more conventional SAF producers, corporate buyers should bear in mind that **multi-year contracts can allow them to specify checkpoints in what to build towards** - in terms of water and energy requirements, or technological transition, in order to help the market scale up in the right direction. Firm commitments from corporate buyers can partly compensate for airlines' lack of willingness to sign multiple-year contracts.

There are a few principles which should guide companies when negotiating such contracts: including transparency, traceability, no double-counting, no ILUC, no palm oil, optimisation of energy and water impacts (location). A key principle to bear in mind is **additionality,** i.e. making sure that one's contribution brings additional climate benefits as compared to what would have happened without such a contribution. In other words, companies should try to ensure that the SAF they are purchasing

[46] Delta and Deloitte commit to reducing carbon emissions via sustainable fuel agreement. (2021, February 26). *News.delta.com.*
[47] IAG signs agreement with Microsoft for the large-scale global purchase of Sustainable Aviation Fuel (SAF). (2023, August 14). *Iairgroup.com.*
[48] Harrington, T. (2023, October 9). Microsoft and World Energy sign landmark 10-year book-and claim SAF deal. *Greenairnews.com.*
[49] Alaska Airlines, Microsoft and Twelve partner to advance new form of sustainable aviation fuel. (2022, July 14). *News.alaskaair.com.*

wouldn't have already been supplied to comply with legal mandates, or purchased by airlines as part of their efforts to achieve the SAF targets they have set themselves.

3. Conclusions and best practices

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Checklist: DO's & DON'Ts

What should companies consider when choosing SAF for their business flights?

DO ✓

- ✓ Implement purposeful travel: is that meeting worth the flight?
- ✓ Consider SAF, if taking the flight is really necessary.
- ✓ Inform yourself about SAF, its environmental benefits and its limitations.
- ✓ Pave the way and lead by example: set a comprehensive SAF policy in your company, including a realistic SAF target (e.g. uptaking 2% SAF on every flights by 2025), and a commitment to strive to uptake only the best quality SAF.
- ✓ Set your conditions when considering different purchasing options: prioritize ad hoc off-take agreements with airlines and/or fuel suppliers over pre-existing schemes, which will give you more leeway to pick the type of SAF you want to support and more negotiating power over SAF price.
- ✓ Be a pioneer: consider investing in new players like e-kerosene start-ups to foster the scale-up of the market.

DON'T ✗

- ✗ Justify a high frequency of business flights with SAF purchase/investment.
- ✗ Be fooled by greenwashing offers. Inform yourself to take the right decisions and request maximum transparency from airlines and suppliers with whom you engage to purchase SAF (about feedstocks, price, physical uptake, etc.).
- ✗ Expose your company to reputational risks and erode trust among consumers and investors: Be clear on the way you communicate about SAF, be transparent about what type of SAF you are investing in.
- ✗ Choose crop-based biofuels (especially if purchasing from US providers), in spite of their negative climate, environmental, and social impacts.
- ✗ Wait for others to contribute to the scale-up of SAFs: take action now.

Sustainable Aviation Fuels (SAF) represent a promising avenue to address mounting concerns over climate change and emissions in the aviation sector, especially with the ReFuel EU initiative acting as a driving force behind their rising availability. However, their effectiveness and sustainability are influenced by several factors. For the successful integration and maximisation of SAF's potential, corporations need to consider key aspects and promote best practices:

Selective SAF adoption and clear communication: Businesses must be discerning when choosing SAF. Only those that genuinely reduce emissions along the production and distribution process, can maintain high environmental and social integrity. Companies should request maximum transparency from airlines and suppliers with whom they engage to purchase SAF and make information on their SAF choices as transparent as possible.

Feedstock scrutiny: The sustainability of SAF is closely tied to the type of feedstock from which it's derived. Excluding crop-based biofuels that compete with agricultural land, corporations should be pioneers in choosing feedstocks with established climate, environmental, and social safeguards. Negotiating directly with airlines and/or fuel suppliers can give companies more freedom to decide over the type of SAF they want to support.

E-fuels emphasis: E-fuels, such as e-kerosene, should be given priority as it becomes available, as a part of the broader SAF adoption and investment strategy due to their potential environmental advantages.

Include a nominal SAF target in the company's travel policy: Companies should show clear commitments and plans by setting science-based SAF targets in line with their own emission reduction goals. The Travel Smart campaign recommends reducing business air travel emissions by 50% of 2019 levels by 2025 or sooner. For companies finding the prospect of procuring SAF challenging, the advice is to start small and scale progressively. Consider starting with a modest percentage, such as 10% of total aviation fuel consumption, ensuring its feasibility and aligning with the company's operations and capacity. Then, set mid-term targets to steadily increase SAF uptake over the next decade, aiming for 50% SAF usage by 2030. Finally, companies should establish a long-term commitment to reach 100% SAF by 2050 or earlier, aligning with global climate goals.

Local production and consumption: Supporting local SAF production rather than relying on imports can be beneficial for both economic reasons and reducing transportation emissions. This can lead to cost savings, increase in reliability of supply and compliance with regulations, and further reduce global emissions.

Driving down costs: Given the higher cost of SAF compared to standard jet fuel, businesses can play a pioneering role by integrating SAF into their operational expenses, thereby increasing demand and potentially driving down costs over time.

Certification and standards adherence: To ensure credibility, businesses should engage with SAFs that are certified under recognized voluntary sustainability certification schemes. The most widely used are ISCC EU, RSB EU RED, and REDCert. Companies purchasing SAF should familiarise themselves with certification schemes and define their own sustainability criteria according to the company's priorities to gain greater credibility and raise sustainability standards.

Awareness of Book and Claim systems: Recognizing that SAF aren't universally available at all airports, businesses should be aware that they may be purchasing the environmental attributes of SAF rather than the physical fuel. Until a universally accepted system with sufficient safeguards (e.g. regarding double counting and additionality) is in place, businesses should approach such purchases with due diligence and transparency, identifying areas for improvement, and seeking input and support from key stakeholders.

To conclude, while SAF is a beacon of hope in the effort to curb air travel emissions from business flying, their effective integration requires nuanced strategies and informed decisions that can enhance the credibility of corporate choices while reducing risks to reputation.

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GLOSSARY

Additionality: the Greenhouse Gas Protocol defines additionality as a criterion for assessing whether a project has resulted in greenhouse gas emission reductions or removals in addition to what would have occurred in the project's absence.

Advanced biofuels: according to the RED, liquid or gaseous biofuels made from materials listed in Part A of the Annex IX of the RED.

Aviation biofuels: according to ReFuelEU, aviation fuels that are either: (a) advanced biofuels as defined above, (b) biofuels produced from used cooking oils or animal fats (category 1 and 2), or (c) other biofuels, with the exception of biofuels produced from 'food and feed crops'.

Biogenic carbon: carbon sourced from biogenic carbon derives from the combustion of biofuels for the purpose of generating electricity.

Book-and-Claim: chain-of-custody model in which the administrative record flow does not necessarily connect to the physical flow of material or product throughout the supply chain (Source: ISO 22095:2020).

Direct Air Capture: technology allowing the capture of carbon dioxide from the atmosphere.

Double Counting: risk for emissions reductions to be counted more than once towards a climate change mitigation effort.

Hydroprocessed Esters and Fatty Acids (HEFA): SAF production pathway, for which potential feedstocks include waste and residue fats (e.g., vegetable oil, used cooking oil, animal fats) and purposely grown plants (e.g., jatropha, camelina). Feedstock is converted using hydrogen to remove oxygen and produce hydrocarbon fuel components. (Source: EASA).

E-fuels: fuels in gas or liquid form that are produced from electricity. E-methane, e-kerosene and e-methanol are different types of e-fuels.

E-kerosene: jet fuel produced by combining H_2 and CO_2. If hydrogen is produced using additional renewable electricity (so-called "green hydrogen"), and carbon dioxide is captured from ambient air (through a process known as direct air capture (DAC)), e-kerosene can have near zero GHG emissions.

Electrolysis: the process of using electricity to decompose water into oxygen and hydrogen gas. It is needed to produce green hydrogen, the primary feedstock of e-kerosene.

Fischer-Tropsch: a collection of reactions that converts a mixture of carbon monoxide and hydrogen into liquid hydrocarbons in the presence of catalysts, involved in the production of e-kerosene.

Low Carbon Aviation Fuels: according to ReFuelEU, synthetic low-carbon aviation fuels or low-carbon hydrogen for aviation:

- **Synthetic low carbon aviation fuels** means "aviation fuels that are of non-biological origin, the energy content of which is derived from *non-fossil* low-carbon hydrogen[50], which meet lifecycle emissions savings threshold of 70% and the methodologies for assessing such lifecycle emissions savings pursuant to relevant Union legislation";
- **Low-carbon hydrogen for aviation** means hydrogen for use in aircraft the energy content of which is derived from non-fossil non-renewable sources, which meets a lifecycle emissions savings threshold of 70 % and the methodologies for assessing such lifecycle emissions savings pursuant to relevant Union law.

Point Source CO_2: CO_2 sourced from industrial sites.

Power-to-Liquid (PtL): SAF production pathway used to produce e-kerosene. Water and electricity are used in an electrolyser to produce hydrogen, which is subsequently synthesised with CO_2 into syngas. The resulting syngas is then further processed into fuel by the Fischer-Tropsch reactor or alternatively by methanol synthesis.

Recycled carbon aviation fuels: according to the RED, liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC, or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations;

Renewable Fuels of Non-Biological Origin (RFNBO): according to the RED, liquid or gaseous fuels which are used in the transport sector other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass.

Sustainable Aviation Fuels (SAF): according to ReFuelEU, SAF means aviation fuels that are either: (a) synthetic aviation fuels, (b) aviation biofuels, or (c) recycled carbon aviation fuels.

Synthetic aviation fuels: according to ReFuelEU, aviation fuels that are renewable fuels of non-biological origin (RFNBO) (see definition above).

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[50] NB: the "non-fossil" mention excludes fuels derived from blue hydrogen (produced mainly from natural gas) and limits the scope of low-carbon fuels to fuels derived from nuclear energy.