



What is SAF?

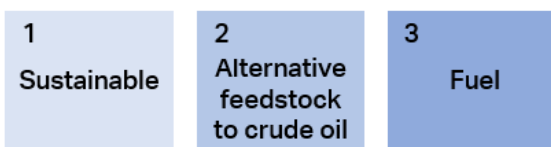
Sustainable aviation fuel (SAF) is the main term used by the aviation industry to describe a non-conventional (fossil derived) aviation fuel. SAF is the preferred IATA term for this type of fuel although when other terms such as sustainable alternative fuel, sustainable alternative jet fuel, renewable jet fuel or biojet fuel are used, in general, the same intent is meant.

'Biofuels' typically refers to fuels produced from biological resources (plant or animal material). However, current technology allows fuel to be produced from other alternative sources, including non-biological resources; thus, the term is adjusted to highlight the sustainable nature of these fuels.

The chemical and physical characteristics of SAF are almost identical to those of conventional jet fuel and they can be safely mixed with the latter to varying degrees, use the same supply infrastructure and do not require the adaptation of aircraft or engines. Fuels with these properties are called "drop-in fuels" (i.e. fuels that can be automatically incorporated into existing airport fueling systems).

Moreover, to validly use the term "sustainable" they must meet sustainability criteria such as lifecycle carbon emissions reduction, limited fresh-water requirements, no competition with needed food production (like first generation biofuels) and no deforestation.

Sustainable aviation fuel consists of three key elements:



1. Sustainability in this context is defined as something that can be continually and repeatedly resourced in a manner consistent with economic, social and environmental aims, and conserves

an ecological balance by avoiding depletion of natural resources.

2. It is a fuel for **aviation with an alternative feedstock (raw material from which fuels are produced) to crude oil**. In this case non-conventional or advanced fuels and includes any materials or substances that can be used as fuels, other than conventional, fossil-sources (such as oil, coal, and natural gas). It is also processed to jet fuel in an alternative manner. Feedstocks for SAF are varied; ranging from cooking oil, plant oils, municipal waste, waste gases, and agricultural residues – to name a few.

3. Fuel means jet fuel that meets the technical and certification requirements for use in commercial aircraft.

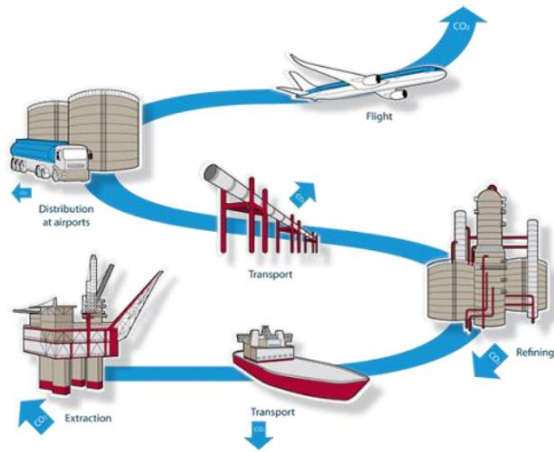
The International Civil Aviation Organization (ICAO), a United Nations specialised agency, in some cases uses 'Alternative Fuels' as its terminology, and it is defined as 'any fuel that has the potential to generate lower carbon emissions than conventional kerosene on a life cycle basis'. ICAO also uses the term 'sustainable aviation fuel'.

1. Sustainable Aviation Fuel – Providing Environmental Benefits

Relative to fossil fuels, sustainably produced, unconventional, jet fuel results in a reduction in carbon dioxide (CO₂) emissions across its life cycle. Carbon dioxide absorbed by plants during the growth of biomass is roughly equivalent to the amount of carbon dioxide produced when the fuel is burned in a combustion engine, which is simply returned to the atmosphere. This would allow the SAF to be approximately carbon-neutral over its life cycle. However, there are emissions produced during the production of SAF, from the equipment needed to grow the crop, transport the raw goods, refine the fuel and so on. When these elements are accounted for,

the use of sustainable aviation fuel has been shown to provide significant reductions in overall CO₂ lifecycle emissions compared to fossil fuels, up to **80% in some cases**. Furthermore, SAF contains fewer impurities (such as sulphur), which enables an even greater reduction in sulphur dioxide and particulate matter emissions than present technology has achieved.

Figure 1: Carbon Lifecycle Diagram Fossil Fuel



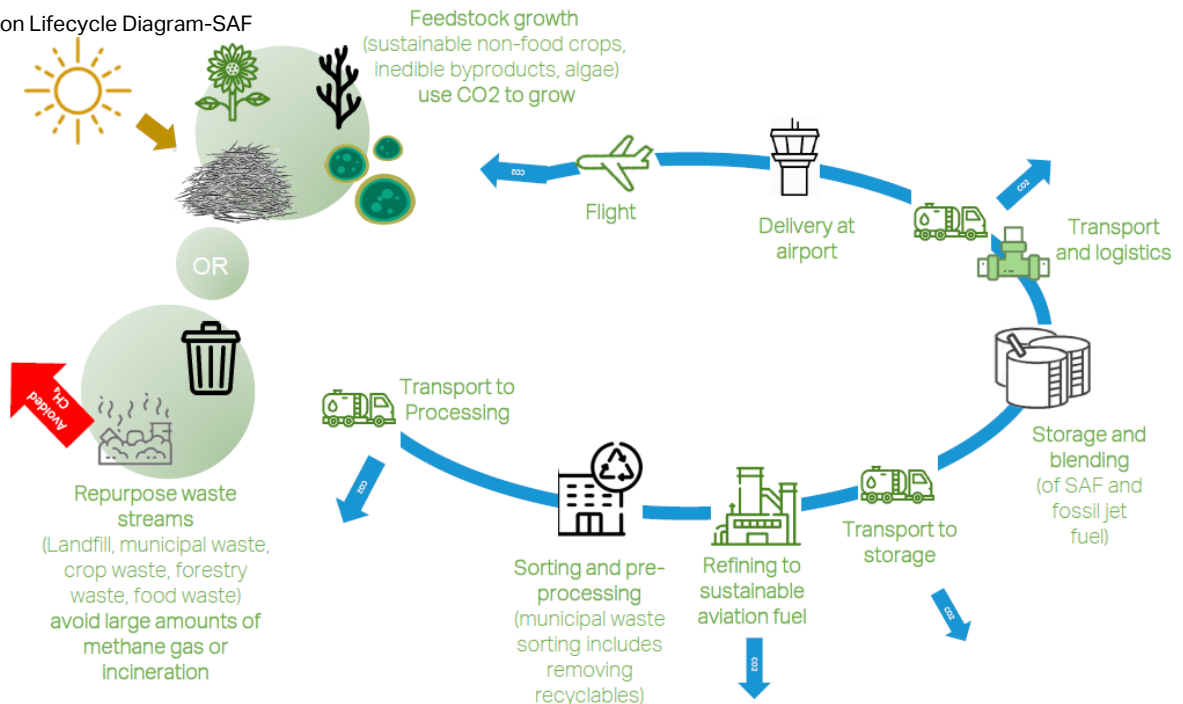
In the case of SAF produced from municipal waste, the environmental gains are derived both from avoiding petroleum use and from the fact that the waste would be otherwise left to decompose in landfill sites, producing no further benefits and dangerous greenhouse gases like

methane, rather than being used to power a commercial flight, which would otherwise be powered by unsustainable, fossil-based fuel.

2. Providing Diversified Supply

The airline industry's reliance on fossil fuels means that it is affected by a range of fluctuations, such as the changing price of crude oil and problems with supply and demand. SAF is an attractive alternative as its production is not limited to locations where fossil fuels can be drilled, enabling a more diverse geographic supply and a degree of energy security for states and airlines. In theory, a range of SAF feedstocks can be grown or collected in differing conditions around the world, depending on the natural environment, wherever the aviation industry needs it. As is the case with the petroleum industry, there will likely be major producers of SAF feedstock (which will be transported to where it needs to be used), and it is also likely that local smaller scale supply chains will be established.

Figure 2: Carbon Lifecycle Diagram-SAF





3. Providing Economic and Social Benefits

Fuel is typically the single largest operating cost for the airline industry. The fluctuating price of crude oil also makes it very difficult to plan and budget for operating expenses long-term. SAF may offer a solution to this problem since its production can be spread worldwide, and across a number of different feedstocks, thereby reducing airlines' exposure to the fuel cost volatility that comes with having a single energy source. SAF can also provide economic benefits to parts of the world that have large amounts of marginal or unviable land for food crops, but are suitable for growing SAF crops, or which have other sources of feedstock such as municipal waste. Many of these countries are developing nations that could benefit greatly from a new industry such as sustainable aviation fuel production without negatively impacting their local food production ability. On a social level, SAF could stimulate job growth, but also encourage improved waste management strategies as it is not uncommon for waste to be an environmental problem in developing countries. Implementing SAF could provide a mutually beneficial strategy to process waste, while simultaneously reducing CO2 emissions in aviation.