What is the best use of “waste”, hydrogen and carbon?

Should it be turned into Jet Fuel?

July 2025, Matt Finch

While the theory behind Sustainable Aviation Fuels (SAF) - using non-fossil feedstocks to displace fossil kerosene - is environmentally sound, the reality is not. There’s a disconnect between the push for SAF and broader environmental goals. The core issue is **feedstock scarcity**: all feedstocks are either already used for more environmentally beneficial purposes or are limited in supply. Using them to create jet fuel may actually increase emissions overall.

Environmental tradeoffs:

As crop-grown biofuels are excluded from the UK’s SAF mandate, alternative jet fuel types which qualify in the UK fall into two categories: waste-based (e.g. using food waste, or used cooking oil) and e-kerosene (using hydrogen and captured carbon). Almost all potential jet fuel feedstocks can be used to create products that displace fossil fuels being burnt elsewhere in the system (eg biomethane from biogenic waste directly displaces fossil gas in the gas grid). So, as long as the alternative fossil-derived product is needed, diverting an individual feedstock to jet fuel use could paradoxically increase total emissions. In the SAF debate thus far, the question of what the feedstocks could alternatively be used for is not usually considered. For instance:

- Biogenic waste supports soil health and food production.
- Waste oils and fats (which in the UK is predominantly used cooking oil) have been converted into biodiesel for road transport for years.
- Hydrogen is vital for power decarbonisation and some industrial processes.
- Captured carbon can be sequestered underground, thus locking the carbon away.

Therefore, several key areas should be considered in any economy-wide assessment of whether scarce feedstocks should be diverted to SAF production. These are: whether there is a current use of the feedstock, and whether diverting it to use for jet fuel would be the best environmental use at present; whether that analysis will change in the future as other sectors decarbonise and no longer need the feedstock; and how much of the feedstock is currently available and is there enough to scale up SAF productions?

Using this framework, there is not a single proposed SAF feedstock for which the answer is positive to all three questions above. The missing question in the SAF debate therefore is:

Is jet fuel the best use of a finite feedstock in a climate-constrained world?

Below is a critical assessment and overview of the major feedstocks that have been proposed and utilised thus far in the UK:

Q1: In most cases, feedstocks could be used in a variety of environmentally beneficial ways. Is jet fuel the best environmental use for the feedstock today?

- ✘ Absolutely not
- ? It's not clear
- ✔ Absolutely!

Q2: The future world will look very different to today. Will jet fuel be the best use of the feedstock in a net zero (2050) world?

- ✘ Absolutely not
- ? It's not clear
- ✔ Absolutely!

Q3: Pragmatically, current and proposed SAF feedstocks are utilised in a variety of ways: some poorly, and some well. To what level are UK levels of the feedstock currently utilised for something environmentally or socially beneficial?

- ✘ Overused or fully utilised: UK-produced feedstock is fully utilised already, and in some cases the UK may even import feedstock from other countries.
- ✔ Underused: feedstock is currently disposed of poorly and therefore some is available for jet fuel.

Feedstock (e-kerosene)	Q1	Q2	Q3	Description
Captured Carbon (for e-kerosene)	✘	✘	✘	Captured Carbon can either be utilised or permanently sequestered under the ground, however it is always more energy-efficient to sequester captured carbon rather than use it as an e-kerosene feedstock. The UK aims to sequester 23 Mt CO_2 annually by 2035, so it is unclear how much, if any, will be available for jet fuel.
Hydrogen / renewable electricity (for e-kerosene)	✘	✔	✘	Green Hydrogen needs electricity to be produced, and environmentally, that electricity would have greater climate benefit decarbonising the power grid or being used directly in electric vehicles and heat pumps than in jet fuel production. Indeed, until green hydrogen is abundant, using it for jet fuel is one of the least efficient ways to cut emissions. Additionally, academic research suggests that hydrogen is better used in hydrogen planes rather than as a SAF feedstock.

Feedstock (waste)	Q1	Q2	Q3	Description
Agricultural, garden and food waste	✘	?	✔	Agricultural, food and garden (aka biogenic) waste is used to aid soil health and in anaerobic digestion (AD) plants to make biomethane (that displaces fossil gas), and digestate (that displaces grey-hydrogen-derived synthetic fertilisers). AD is supported through the Green Gas Support Scheme. As fossil gas use declines, jet fuel production may become a good use of biogenic waste. This won't happen for at least 15 years though.
Cover crops	✘	?	✘	Cover crops are used to build and maintain soil health. Harvesting them for jet fuel would result in less healthy soil, and therefore less food produced.
Non-biogenic waste in MSW	✘	✘	✔	Non-biogenic municipal solid waste (MSW) is predominantly plastics, which can be chemically recycled back into usable plastic. Currently, plastic waste is diverted to either energy-from-waste (EfW) plants (41%), which generate electricity, or landfill (22%). It is not clear if EfW is a better use than jet fuel, but environmentally recycling is always better than both. Landfill is generally seen as a poor use of waste though.
Recycled Carbon Fuels	?	✘	✔	Recycled Carbon Fuels (RCFs) are fuels derived from waste plastic or industrial off gases. As above, plastic waste can be mechanically or chemically recycled. Figures for off-gases are hard to reliably get hold of, as the gases are varied and distributed.
Sewage	✘	?	✘	Sewage sludge is already predominantly used as agricultural fertiliser in the UK, with 87% of it applied to land to improve soil health.
Waste oils and fats	✘	✔	✘	Waste oils and fats are used to produce HEFA fuels, which is what current SAF invariably is. In the UK, this is almost certainly imported used cooking oil (UCO): 90% of SAF uplifted in the UK in 2024 came from Chinese UCO. UCO has been turned into biodiesel for years, and any that is used for jet fuel means that more fossil diesel is burnt. Using UCO for biodiesel yields greater overall emissions reductions than using it for jet fuel, suggesting that as long as diesel is burnt in the UK, UCO should be prioritised for biodiesel over SAF.
Waste tyres	?	✘	✔	Waste Tyres are either retreaded (14%), used in sports and play surfaces (17%), incinerated in cement kilns (6%), or exported (63%). Around 50 million used tyres are produced annually (approximately 700,000 tonnes). Environmentally, the best uses are always to reuse and recycle them. Pyrolysis produces tyre pyrolysis oil (TPO) that can be used for fuels or chemicals, though its optimal environmental role is unclear. In a net-zero future, the most sustainable path would be full material recovery: reprocessing tyres into high-quality rubber and steel that can be used to create new tyres, as done by companies like Genan.
Woody residues	?	?	✘	Woody residues are currently used for panel boards, animal bedding and electricity production. Bioenergy with carbon capture and storage (BECCS) is expected to play a role in the UKs future net zero power mix. It is unclear how much, if any, would be available for jet fuel.