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biofuelwatch

HOW GREEN AND SCALABLE ARE THE AVIATION BIOFUELS THAT UNITED AIRLINES AND OSLO AIRPORT SOURCE FROM WORLD ENERGY?

SUMMARY

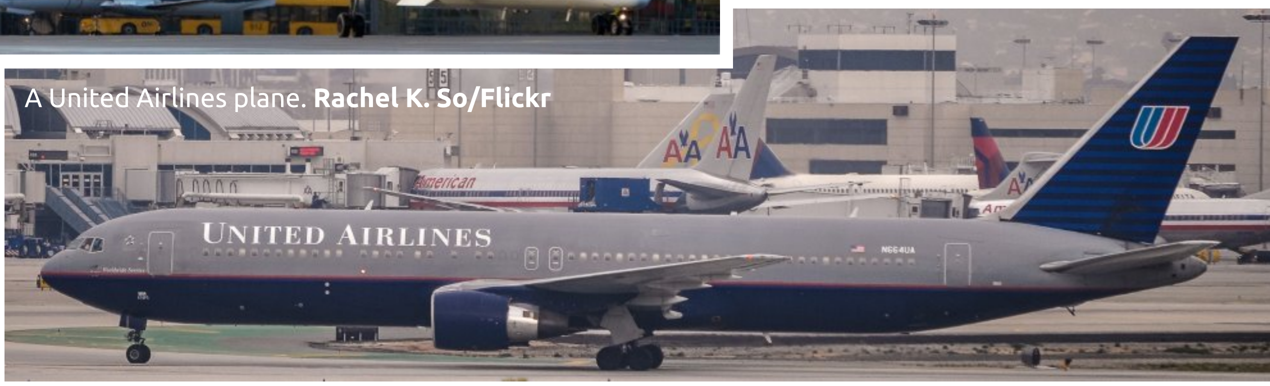
World Energy's refinery in Paramount remains the world's only regular producer of aviation biofuels, although it refuses to disclose the amount of aviation fuels it makes. Its model relies on three feedstocks: two of those are byproducts from industries which themselves are linked to very high greenhouse gas emissions and environmental harm, i.e. the livestock industry and corn ethanol.

All three feedstocks – tallow, used cooking oil/yellow grease, and distillers corn oil – are only available in very limited quantities which cannot increase in response to biofuel demand. Even in the unlikely event that all of those feedstocks worldwide could be turned into aviation biofuels, those would barely replace fossil fuel kerosene for a single week out of a year. Diverting food-grade tallow and distillers corn oil from non-biofuel uses pushes up the demand for palm oil and soya oil respectively as replacements for those displaced uses, contributing further to deforestation and the carbon emissions.

Furthermore, diverting any feedstock from biofuel production for cars and trucks to aviation will push up demand for virgin vegetable oil unless it is compensated for by reduced biofuel use in road transport.

In short, World Energy's aviation biofuel model cannot be scaled up enough to serve any purpose other than greenwashing of airlines and airports. Furthermore, the indirect impacts of its biofuels are such that it cannot be considered 'green' or low-carbon.

Oslo International Airport. **Cato Lien/Flickr**



A United Airlines plane. **Rachel K. So/Flickr**

BACKGROUND

Biofuels have reportedly been used on more than 100,000 flights worldwide according to industry sources, [1] although actual quantities used remain miniscule: according to a 2016 article by Bloomberg New Energy Financ, the refining capacity for aviation biofuels stood at 100 million gallons a year, which was 0.12% of total aviation fuel used that year. [2] Actual production has remained far lower still.

United Airlines, Gulfstream, Singapore Airlines, KLM and South African Airways are amongst those who have gained publicity for blending biofuels with fossil fuel kerosene on some of their flights, and Oslo Airport has been making biofuel blends available to airlines since 2016. All of those listed above have relied on one single refinery: The former AltAir refinery in Paramount, on the outskirts of Los Angeles, which was bought up by the US biofuel company World Energy in March 2018.

As of December 2018, the Paramount refinery remains the only plant in the world to regularly produce biofuels for aircraft. It has had a capacity of around 117,000 tonnes of biofuels a year, but World Energy is investing $350 million to expand it to half a million tonnes of fuel annually. [3] The company has refused to disclose how much of the biofuel it makes is jet fuel, and how much is 'renewable diesel' for cars and trucks. [4]

The underlying technology used by World Energy is called Hydrotreating, producing a fuel called HVO (Hydrotreated Vegetable Oil). In short, the process involves reacting vegetable oils or animal fats with hydrogen under conditions of high temperatures and pressure, using a chemical catalyst. It is a mature technology developed for oil refineries. Upgrading the HVO to jet fuel [5] requires one extra step, [6] to ensure that the fuel will not freeze at the extremely low temperatures in the stratosphere. HVO fuels are so far mainly used for cars and trucks. According to a report published by the Danish Energy Agency, the sales prices of HVO diesel was still more than double that of fossil fuel diesel – and greater than that of regular biodiesel. The report estimates one litre of HVO jet fuel to cost an additional 25% more than one litre of HVO diesel. [7]

Most HVO producers worldwide rely, at least in part, on palm oil, including a fraction of crude palm oil which some in the industry controversially claim to be a residue. [8] Airlines have, so far, been reluctant to fly with palm oil-derived fuel, presumably because of widely acknowledged environmental and human rights abuses associated with palm oil, which would undermine their attempts to portray a 'green' image. World Energy on the other hand relies almost entirely on tallow, a byproduct from slaughterhouses. Although the company refined carinata/wild mustard oil for one long-distance flight by United Airlines, it has no plans to use that regularly in future. [9]

So, are World Energy's aviation biofuels genuinely low-carbon and sustainable? And could this model be expanded?

An airline CEO shows off their first flight using 50% biofuels. **Jetstar Airways/Flickr**

TALLOW: PROBLEMS OF SCALE AND INDIRECT GREENHOUSE GAS EMISSIONS

Every year, slaughterhouses worldwide produce just under 7 million tonnes of tallow as a byproduct. [10] Based on figures used by the Danish Energy Agency, refining all of that tallow would yield just over 5 million tonnes a year of jet fuel. [11] This is equivalent to 1.7% of global aviation fuel burned in 2016. [12] If governments were serious about achieving the Paris Climate Agreement goal to keep global warming to 1.5 degrees, they would be working to drastically reduce meat and dairy consumption, and this would shrink the global availability of tallow too.

Long before biofuel targets and incentives were put in place for road transport, tallow was already fully used in other sectors. Those other uses differ according to the type of tallow. The EU distinguishes between three categories of tallow: Category 1 and 2 tallow cannot be used for food or livestock feed. In the past, they were mainly burned to supply heat and power for meat processing. Today, tallow of this type is turned into biodiesel for road transport, and a far lower proportion is burned for fuel. The latter has mostly been replaced by fossil fuels, mainly fuel oil. Using more such tallow for aviation biofuels is likely to accelerate this trend.

Moreover, if aviation biofuels use is additional to biofuel use for road transport, tallow and Used Cooking Oil diverted from the latter will have to be replaced with virgin vegetable oils such as palm, soybean or rapeseed oil. Category 3 tallow, which is not classified as a 'waste or residue' by EU biofuels legislation, is mainly used (in this order in the EU) for animal feed, oleochemicals (e.g. soap), biodiesel, pet food and food. [13] If this type of tallow is diverted to biofuels, it is expected to be primarily replaced with palm oil, which has a similar profile of fatty acids. [14]

The indirect impacts of diverting different types of tallow to biofuels have been understood since 2008, when the UK government published a report on the topic. [15] More recently, they have been detailed in a report about the greenhouse gas impacts of using different residues and wastes for EU biofuels, published by Cerulogy and the International Council on Clean Transportation. [16]

In the US, tallow is not categorised so there is no way of knowing how much the feedstock for the Paramount refinery is food- and feed-grade tallow.


A concentrated cattle feedling lot.
USA Department of Agriculture/Flickr

Once the Paramount refinery is expanded, it will have to use other types of feedstock, too, with its former owners having referred to Used Cooking Oil and distillers corn oil.

FUEL FROM USED COOKING OIL – A DROP IN THE (JET FUEL) OCEAN

Used cooking oil (UCU) – called yellow grease in the USA – is mainly used for biofuels with some going to heat and power and some to animal feed supplements. It may be the least controversial of all biofuel feedstocks, but very little is available. In the US, UCO collection from restaurants and hotels *"is a well-established and highly competitive industry, thus it is unlikely that collection rates will improve"*, according to another report by the International Council on Clean Transportation. [17] Processing all UCO collected across the US to HVO jet fuel would meet just 0.16% of US aviation fuel use at 2017 levels. [18] In the EU, a 2016 industry report estimated that UCO collections could realistically be increased from 50,000 to 200,000 tonnes a year by 2030. [19] If all of this UCO was converted to HVO jet fuel, it would be equivalent to 0.26% of EU aviation fuel use in 2016. [20]

DISTILLERS CORN OIL: TINY AMOUNTS, LINKED TO INDIRECT LAND USE CHANGE

Distillers corn oil (DCO) is extracted from the corn mash left over after corn, or maize, fermentation to ethanol. The USA is by far the largest corn ethanol refiner in the world – producing more of it in a fortnight than the EU does in a year. [21] DCO is extracted from at least 70% of corn mash in ethanol refineries, with the remaining mash processed and fed to livestock. [22] There is little prospect of DCO production increasing in coming years. Even though the USA is the world leader in DCO production, it still would meet even less of its own aviation fuel demand than Used Cooking Oil.

Unlike corn oil that is extracted before ethanol fermentation, DCO is not suitable for food. Nonetheless, diverting it to aviation biofuels would result in indirect land use change and the greenhouse gas emissions caused by that. This is due to the fact that all DCO is already used either as an animal feed supplement or for biofuels, so far mainly for biodiesel. If aviation biofuels were expanded without reductions in biodiesel use for cars and trucks, then US biodiesel refiners would almost certainly switch to virgin soy oil. Similarly, soybean oil is the most likely replacement of DCO in animal feed, with rapeseed and sunflower oil as possible alternatives. Using DCO for aviation fuel will thus push up demand for virgin vegetable oils, especially soya which is associated with high levels of pesticide use and, like all oil crops, land use.

Although DCO would most likely be replaced with US-grown soya, global vegetable oil markets and prices are closely interlinked, and in South America, an estimated 480,000 hectares of tropical and subtropical forests a year are cleared for soya. [23] Scientists showed as long ago as 2008 that corn ethanol, from which DCO is derived, results in around twice as many greenhouse gas emissions than the petrol it replaces. That is largely due to indirect land use change. [24] US corn production for ethanol is also linked to the destruction of biodiverse grasslands, soil depletion and the pollution of freshwater and marine ecosystems. [25]

A hybrid corn research field.
Lindsay Eyink/Wikimedia Commons

CONCLUSION

World Energy's refinery in Paramount, California, is currently the only refinery in the world that regularly produces biofuels for aviation. It is a medium-sized biofuel refinery which produces both Hydrotreated Vegetable Oil (HVO) for road transport, and HVO upgraded to jet fuel – in undisclosed proportions. World Energy has so far relied on tallow, a byproduct from the slaughterhouses, i.e. from the industrial livestock industry, which in turn is a major contributor to greenhouse gas emissions worldwide. The availability of tallow worldwide is limited and inelastic, i.e. it will only increase meat consumption goes up. World Energy is investing in expanding its refinery and has made it clear that it will need to look for different feedstocks, presumably because the company is already sourcing as much tallow as it can procure. The two main feedstocks which World Energy intends to use in future are Distillers Corn Oil (DCO), a byproduct of corn ethanol production, and Used Cooking Oil (DCO). Low-quality tallow and UCO are currently mainly used for regular biodiesel made for cars and trucks. If aviation biofuel capacity is additional to the existing biofuel market for road transport, then diverting those feedstocks from regular biodiesel to HVO jet will result in significant indirect land use change. Indirect impacts are more serious for high-quality tallow and DCO. The former is widely used, including for soap, animal feed and food and is expected to be mainly replaced with palm oil, whereas DCO is likely to be replaced with soya oil.

Regardless of those controversies, none of the feedstocks which World Energy uses to make jet fuel are available in large enough quantities to replace more than a minute fraction of global aviation fuel consumption. The company's model is thus not scalable.

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