

# [OPINION] Take-off for Aviation Biofuels: When, How, and Why?

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One striking image for all of us in 2016 has been the graceful lines of the Solar Impulse as it shuttled around the globe in a remarkable demonstration of the potential of solar energy for powered flight.

But if we reflect upon the wingspan, the minuscule payload, the multi-month journey, the speed and the discomfort involved, we might sympathize with Boeing executive Julie Felgar when she stated at ABLC this year, “We’re all excited about solar. I’m excited about solar, but as a commercial reality we are decades and decades away.”

By the 21<sup>st</sup> Century, we’ll have many more technological options for limiting and adapting to climate change, but in there here and now, when it comes to aviation, representing 5 percent of the world’s greenhouse gas emissions, for now we have two strategies and two alone. Fuel efficiency and renewable fuels.

There are limits on fuel efficiency because of the 30-40 year replacement cycle for jets, and the 10-20 year development cycle. Designs only on a drawing board today will be not deployed until the 2020s or 2030s, and jets we have in service today will be still flying, somewhere, in the 2050s.

So it is not a shock to observers that airlines such as Virgin, United Airlines, British Airways and Cathay Pacific have been investing in renewable fuel companies. The US government has made substantial investments in search of sustainable military jet fuels, also. Other airlines are expected to follow suit, and more than 30 of them have joined R&D consortia, conducted flight certification tests and in other ways contributed towards the deployment of these fuels.

Were price to be no object, renewable fuels delivering up to 7% more fuel efficiency and reductions of up to 100% in greenhouse gas emissions would be in widespread production and use. True, the costs have come down fast. The US Navy purchased a small batch of renewable fuel in 2012 and paid \$25 per gallon. When they went to full-scale in 2016, the price had dropped to \$2.05 per gallon.

\$2.05 per gallon?! That's roughly a dollar less a gallon than airlines were paying for conventional petroleum-based fuels just 3 years ago. But in the meantime, OPEC has been cranking up an offensive against unconventional fuels of all sorts, flooding the market with cheap petroleum and driving down the price. They want the fuels — all of them — to go away. And with a spot price of aviation fuels less than \$1.50 per gallon, renewables have been having a tough time competing head to head on price.

A little about the raw materials. In general, renewable airline fuels use inedible waste oils (such as used cooking oil), carbon monoxide waste gases, municipal solid waste, and waste or low-value woody biomass. Not only are these odious materials we all want less of — they are low-cost. Sometimes they even come at negative cost. Municipalities will pay producers to use their garbage, to avoid building more landfills. Producers can use more than 100 different types of sugars, fats, oils or greases derived from virtually any type of plant, or municipal, agricultural, animal or industrial waste. Airlines stay away from anything that could be used in food production, and everyone focuses on residues because they cost less and help the environment more.

What about the technologies? Typically, they either are fermentation-based — a high-tech version of the approach used to make homecrafted beer — or they are gasification-based. In the latter, we cook the biomass until it turns into a gas, then use special catalysts to make fuel out of the soup of molecules as the gas cools down.

Why are the costs comparatively high? First of all, biorefineries are small compared to massive oil refineries, so there are different economies of scale. Most importantly, feedstock has to be aggregated and prepped, sometimes grown — and the handling costs can be high compared to petroleum. And financing costs are high, because of the risks associated with new technology. When interest rates are just 2%, failure rates have to be near zero for lenders to make money from loans. So renewable fuels face net borrowing and equity costs that are higher than consumer credit cards.

However, there's been help from governments around the world — recognizing that society benefits from breakthroughs on emission reductions, but no one will invest until some of that benefit is internalized for the project developer, instead of remaining an external benefit. Although renewable fuel incentives are a fraction of those offered to other renewables, they are there. In some exotic cases, renewable fuels can for a short period of time gain up to \$2.80 per gallon in carbon advantage. Not every market offers this, and it's a temporary measure, but helpful.

The market expects to have dozens of biorefineries producing renewable jet fuel by the mid-2020s, and the airline industry projects that 5% of all fuels in 2030 will be renewable. That's 3.5 billion gallons per year. Think of 100 million drivers in the US each getting 35 tankfuls of fuel each. So it's a lot.

What are the factors that might hold back aviation biofuels from hitting those targets? Regulatory uncertainty caused by change of governments that might throw fuel developers under the bus with each change of regime. Or, possibly soaring feedstocks cost, or the absence of help in overcoming the high cost of capital.

Factors that might accelerate a speedier positive result? More direct investment from airlines, aimed at building capacity faster. Or longer-term policy commitments, or long-term hedges that can smooth out any impact from the continuing roller coaster in commodity prices.

The Bottom Line? We can expect aviation biofuels to deliver roughly 70% emission reduction compared to conventional fuels each time they are used. Those are powerful results for an industry that, aside from buying new and expensive fleets, will struggle to hit ambitious carbon-reducing targets. So, governments, airlines, and technology developers have formed groups around the world, like the Sustainable Aviation Fuels Users Group and CAAFI – aimed at delivering renewables as fast as possible to the market.

“Fly the Friendly Skies” says the old United slogan. Now, United and others are aiming for the Bio-Friendly Skies.

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