

The airline industry faces several challenges over the next few years, including price volatility in petroleum markets, expensive jet fuel, economic recession, petrol supply shocks, and the imminent arrival of carbon-based tax penalties and expenses – biofuels present a potential solution

Algae-powered plane takes flight

Based on the findings from a recent study *Algae 2020*, there are three key challenges facing commercial and aviation industries in the next few years.

The first comes from petroleum-based jet fuel also known as JP8. As airline industries prepare for increasing growth from emerging market nations, they are also facing decreasing supplies of cheap oil and affordable jet fuel from petroleum. Most airline companies are riddled with the challenge of mitigating rising demands for air routes in emerging markets at a time when petrol supplies are limited, pricey, and volatile.

The second relates to the arrival of carbon emissions penalties for aviation. Most airlines are already operating on tight profit margins and these margins get even tighter with rising petrol and JP8 fuel prices.

To add insult to injury, the coming carbon penalties for airfare – designed to reduce pollution – will also contribute to reduced profitability for airlines. This is a threat and a challenge for airlines. While politicians and governments try to mitigate the threat of carbon emissions, airlines are also trying to mitigate between rising costs and long-term growth related



World's first commercial algae flight test. Pictured are representatives from Continental, UOP, Boeing and CFM/GE

to carbon emissions. It is a catch-22 and a difficult challenge over the long term.

The third key challenge is a sustainable supply of biomass-based aviation fuels. The US defense aviation industry, which includes DARPA, the Air Force Office of Scientific Research, NREL, and the Navy, is concerned another petroleum supply shock could weaken military aviation, and the US economy. Most defense hawks agree the market is nearing the end of

cheap oil, and are looking for alternatives to petroleum-based JP8 jet fuels.

These challenges add up to another catch-22 for defense companies, and a major threat to national security for many nations.

It is no surprise that Ronald Reagan's former Secretary of State George Shultz, and the former director of the CIA James Woolsey have been adamantly promoting biofuels for aviation for reasons of national security and energy independence.

Several other national governments (and defense entities) around the globe are also exploring alternative fuel sources and biofuels as a way to supplement or replace petroleum based jet fuels in a world of increasing fuel supply demands challenged by the decreasing long-term availability of petroleum supplies.

Jet fuel alternatives

Several solutions are now being explored to increase

the supply of non-petroleum based jet fuels. For both commercial and defense aviation groups, the prospects of jet fuel from biomass represents one of the first signs of relief in today's challenging environment.

More importantly, biomass-based jet fuels represent a long term solution for both groups to achieve reliable supplies of economically sustainable fuels.

The commercial aviation industries have already performed a handful of test flights with biofuels. These include Virgin Airways, along with Imperium Renewables, GE and Boeing, in the first major biofuels test flight using a mixture of palm oil and babasu. This was followed by a recent test flight by New Zealand air with a mix of jatropha.

2009 and beyond

In order for biofuels to be viable solutions for aviation, they must meet three key sustainability criteria. First, governments will require the fuels to be environmentally sustainable. Already, airlines are now preaching the mantra of sustainably grown fuels from sources such as jatropha and algae. Meeting these environmental sustainability criteria is a necessity for regulatory compliance.

Second, economically sustainable and affordable fuel for aviation will be critical to the survival of the commercial aviation industry. Commercial airlines cannot afford to pay carbon tax penalties, increase their routes, and pay higher petrol JP8 prices all at once.

In the next few years, the economic viability of using jatropha, algae, and other forms of lower-cost, commercially viable and economically sustainable biofuels will be essential.

Third, sustainable supply of fuel is critical to both commercial and defense

Biofuel aviation tests

FLIGHT	DATE	FEEDSTOCK BLEND	COMPANIES
Japan Air	January 2009	B50 - 50% Jet-A Kerosene, 42% camelina, 8% jatropha, 1% algae biofuels blend	JAL, Pratt & Whitney, Boeing, Sustainable Oils
Continental	January 2009	B50 - 50% JP8, 50% blend algae and Jatropha blend	Continental, UOP, Boeing, CFM Engines, Sapphire Energy
New Zealand	December 2008	B50 - 50% Jatropha fuel, 50% JP8 blend	NZ Air, Boeing, Rolls Royce, UOP
Virgin Air	February 2008	B20 - Blend of Babasu and Palm Oil fuels blend	Virgin, Boeing, GE, Imperium Renewables

aviation. Defense aviation concerns can not afford to wait on seasonal crops to produce a steady supply of reliable biofuels.

In the warmer climates, jatropha has the potential to meet all three sustainability criteria: environmental, economic and steady (non-seasonal) supply as the industry matures. But it does not offer much consolation to the US, European and north Asian defense initiatives.

Alternatively, algae can be grown in these climates, and can meet each of the three sustainability criteria. For these reasons, the defense and commercial aviation industries in these northern climates are aggressively pursuing algae as most viable biofuels solution (among biomass alternatives).

Algae aviation

Among potential fuel producers, Solazyme and Sapphire energy have been the first in the group to produce fuels that meet aviation JP8 standards.

The US defense industry is the world leader in algae aviation fuels, and already has several projects for algae aviation in the works, including two contracts

“In the US and Europe, algae biofuels have the potential to meet all three sustainability criteria: environmental, economic and steady (non-seasonal) supply as the industry matures”

for development of algae aviation fuels from two groups of companies. One is lead by General Atomics, and the other by SAIC, and each group includes several other technology related organisations, universities, and research labs in the algae biofuels.

The world's first commercial aviation algae test flight occurred in Houston, Texas, in January, 2009.

Members of the National Algae Association and Sustainable Aviation Fuel Users Group produced a successful demonstration of the technical viability of algae-based biofuels flight, using a mixture of algae, jatropha and JP8.

This included Sapphire Energy, GE, Continental

Airlines, UOP and Boeing. All groups acknowledged the three sustainability criteria, and the imminent arrival of carbon emissions taxes, helped to accelerate the arrival of this event, and anticipate more to come.

Considering the recent reminder of the arrival of \$150 (€111) per barrel petroleum in 2008, the likelihood of a return to higher oil prices over the mid-long term, and the potential of future petrol supply shocks, the world's first commercial algae test flight arrived right on time. ●

For more information

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