International Civil Aviation Organization

CAAF/09-WP/18
15/10/09
English only

WORKING PAPER

CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

Rio de Janeiro, Brazil, 16 to 18 November 2009

Agenda Item 4: Production and infrastructure

FRAMEWORK FOR IMPLEMENTATION OF SUSTAINABLE ALTERNATIVE FUELS IN AVIATION

(Presented by the International Air Transport Association)

SUMMARY

This paper describes how the implementation of sustainable alternative fuels can support the aviation industry in achieving its emissions reduction goals. A variety of candidate fuels and feedstock meet the stringent technical, operational and sustainability requirements in aviation; some of them have successfully been flight-tested. Strong efforts in the worldwide development and deployment of alternative fuel production capabilities are now needed to meet aviation's demand. This is only possible with substantial financial support by States to ensure competitive prices and appropriate volumes.

The conference is invited to approve the recommendations in paragraph 6.

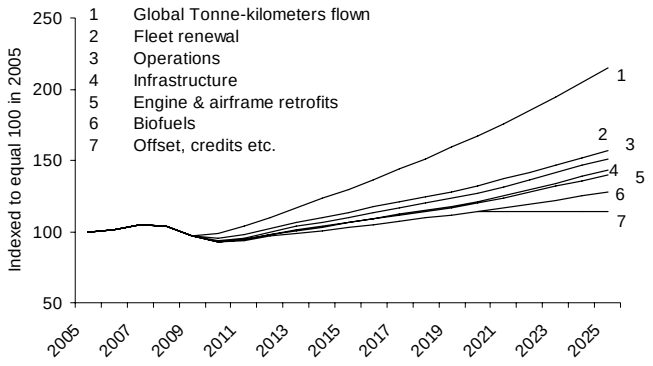
1. INTRODUCTION

1.1 At its Annual General Meeting in June 2009 the International Air Transport Association (IATA) announced the airline industry's commitment to carbon neutral growth from 2020, together with an improvement of fuel efficiency of an average of 1.5% per year up to 2020 and a halving of global aviation emissions by 2050 compared to 2005. IATA's four-pillar strategy, which is supported by ICAO and across the whole aviation industry, defines the pathway to achieve these goals through (1) improved technology, (2) effective operations, (3) efficient infrastructure, and (4) positive economic measures.

1.2 The development and use of sustainable alternative fuels, and in particular of sustainable biofuels, is a major technological innovation needed to support these goals. As shown in Figure 1, fuel efficiency improvements due to better aircraft technology (implemented by both fleet renewal and retrofits to in-service aircraft) and improved operations and infrastructure are not sufficient on their own to compensate for the additional emissions from expected air traffic growth; in addition, an increasing use of low-carbon alternative jet fuels is essential to achieve carbon-neutral growth. While forecasting of aviation fuel use two decades or more ahead is inherently subject to large uncertainties, it is very likely

that the share of alternative fuels in total fuel use will rapidly increase well beyond that shown in Figure 1, once production technologies for alternative fuels have matured.

Figure 1: Forecast of aviation CO_2 emissions and the effect of various reduction measures on the way to carbon neutral growth (Source: IATA 2009)



1.3 This paper gives an outline of necessary conditions and steps towards this very ambitious goal.

2. REQUIREMENTS

2.1 To be usable in aviation, alternative jet fuels need to meet a number of technical and operational requirements accounting for the specific conditions of aviation. For example, they must remain liquid at ambient temperatures at cruise altitude, and their energy content must not be significantly lower than for kerosene to avoid a reduction of aircraft range. These requirements put severe restrictions on the use of many biodiesel and alcohol-type fuels. A very important requirement defines the “drop-in” properties, which ensure that different fuels can be blended with each other and can be used in current aircraft without technical modifications. This avoids having to build up a second distribution infrastructure, which would lead to prohibitive costs.

2.2 Moreover, in order to be acceptable as a sustainable solution, alternative fuels need to meet strict requirements to improve full carbon-lifecycle environmental impact, economic and societal sustainability. Amongst other projects, IATA is participating in the development of sustainability requirements for biofuels through the Roundtable on Sustainable Biofuels, which is establishing principles for sustainability standards to be agreed worldwide and by a wide range of stakeholders.

2.3 Among the candidate feedstock for sustainable biofuels for aviation are jatropha, camelina and algae, which contain oils that can be easily transformed into kerosene-like hydrocarbons through hydrotreatment. Moreover, waste biomass can be used for biomass-to-liquid (Fischer-Tropsch) fuels. The first approach requires production facilities of relatively moderate cost, but relies on a limited choice of feedstock. The second approach allows the use of virtually any kind of biomass as feedstock, but needs very high investments for production plants. A broad variety of specific feedstock and production processes are being tested for viability for industrial application. It is highly likely that several

of these solutions will be retained. As long as all these alternative fuels meet the drop-in requirement, they can be used simultaneously and without restriction.

3. IATA AND AIRLINE ACTIVITIES

3.1 The airline industry is actively engaged in demonstrating the feasibility of using alternative fuels. During the last two years, a number of airlines successfully carried out test flights with different blends of biofuels (see Table 1). Some of the test results even showed a slightly higher energy content and a cleaner combustion of the biofuel blends, compared to kerosene.

Table 1: Flight tests with sustainable biofuels

Carrier	Aircraft	Engine	Fuel supplier	Date	Biofuel
Virgin Atlantic	B747-400	GE CF6	Imperium Renewables	23 Feb 2008	20% Coconut & Babassu oil (one engine)
Air New Zealand	B747-400	Rolls-Royce RB211	UOP, Terasol	30 Dec 2008	50% Jatropha (one engine)
Continental Airlines	B737-800	GE/Snecma CFM56	UOP, Sapphire	7 Jan 2009	47% Jatropha, 3% Algae (one engine)
Japan Air Lines	B747-300	P&W JT9D	UOP, Sustainable Oils	30 Jan 2009	42% Camelina, 8% Jatropha, 0.5% Algae (one engine)

3.2 IATA and Air France are partners in the SWAFEA study (Sustainable Ways for Alternative Fuels and Energy for Aviation), mandated by the European Commission to get experts' recommendations for its future policy in the matter of aviation alternative fuels. IATA and the US Air Transport Association (ATA) are also involved in the Commercial Aviation Alternative Fuels Initiative (CAAFI), which seeks to enhance energy security and environmental sustainability for aviation through alternative jet fuels. CAAFI is a coalition that focuses the efforts of commercial aviation to engage the emerging alternative fuels industry.

4. WAY FORWARD

4.1 On 1st September 2009 the industry specification standard for jet fuels (ASTM D7566) was opened for a first set of alternative fuels (max. 50% blends of Fischer-Tropsch fuels). It is planned to extend it to further types of alternative fuels, including 100% biofuels. Certification of various types and/or mixtures of alternative fuels will thus be possible in the near future, which is an important pre-condition for building up commercial fuel production.

4.2 To motivate a sufficient number of potential feedstock producers and fuel suppliers to invest in this new product, it is necessary to establish a strong business case for alternative aviation fuels. Substantial barriers to commercialisation on sufficient scale must be overcome. Production costs for aviation sustainable alternative fuels are currently uneconomic without subsidy and further research and development support. Moreover, capital investment costs are very high and, as with other new technologies, are unlikely to be provided by the private sector without government support, including demonstration projects and regulatory certainty. Synergies and competition with other alternative fuel customers, such as the automotive industry, should be considered. In addition, aviation should receive

preferential allocation of feedstocks since other transport industries have alternative energy options (hydrogen, electricity) whereas aviation is restricted, for the foreseeable future, to the use of high-energy combustible liquids.

4.3 A diverse range of feedstocks, produced on a global basis would limit fuel transport costs and logistics for aviation alternative fuels as well as dependence on a few supplying countries, and also to foster economic activities in developing countries. In different regions fuels could be produced from different locally grown feedstock. Some examples would be growing jatropha for use in tropical areas, camelina in the temperate zone, and algae in areas with strong sunlight.

4.4 In order to secure a viable alternative fuels industry and the successful deployment of such fuels to assist the aviation industry to reduce significantly its CO_2 emissions, states are urged to support research and development as well as industrial activities to achieve a change towards sustainable alternative fuels in aviation. In particular financial incentives are needed for investments in new feedstock cultivations and production facilities, as well as favourable tax regimes to allow a competitive fuel price from the beginning, such as the re-investment of auctioned revenues from emissions trading systems. In addition, the potential for generating carbon credits from the alternative aviation fuel projects should also be assessed.

5. CONCLUSION

5.1 The use of sustainable alternative fuels, in particular biofuels, is a promising way of effectively reducing aviation's CO_2 emissions to achieve carbon-neutral growth and other emissions reduction goals.

5.2 Candidate alternative aviation fuels need to meet stringent technical and operational requirements, in particular the "drop-in" requirement. They are acceptable only if they meet carbon lifecycle and other sustainability requirements according to generally accepted criteria.

5.3 There are a variety of candidate fuels meeting these requirements, some of which have been successfully tested in flight as a demonstration for the feasibility of using alternative fuels in aviation. It is very likely that several fuels will be used simultaneously in future operational practice.

5.4 Development of feedstock growth and production facilities is now needed quickly to reach sufficient production quantities. A worldwide spread of production would ease logistics and offer new opportunities for developing countries. Substantial financial support by states is needed for a successful deployment of sustainable alternative fuels for aviation at a competitive price from the beginning.

6. RECOMMENDATION

6.1 The conference is invited to:

a) note the past and ongoing efforts of the aviation sector in developing and deploying sustainable alternative fuels for aviation, and their potential for substantially reducing aviation's CO_2 emissions;

b) recommend that states consider measures to support aviation alternative fuels research and development, investments in new feedstock cultivations and production facilities, as well as favourable tax regimes to stimulate commercialisation and use of sustainable alternative fuels for aviation to accelerate the reduction of aviation CO_2.emissions; and

c) recommend that in its position for UNFCCC COP15 in Copenhagen, ICAO highlights the significant importance of the CO_2 reduction potential from alternative aviation fuels and seeks support from states at COP15 for the development and implementation of these fuels by considering *inter alia* the measures outlined above.

— END —