Note:

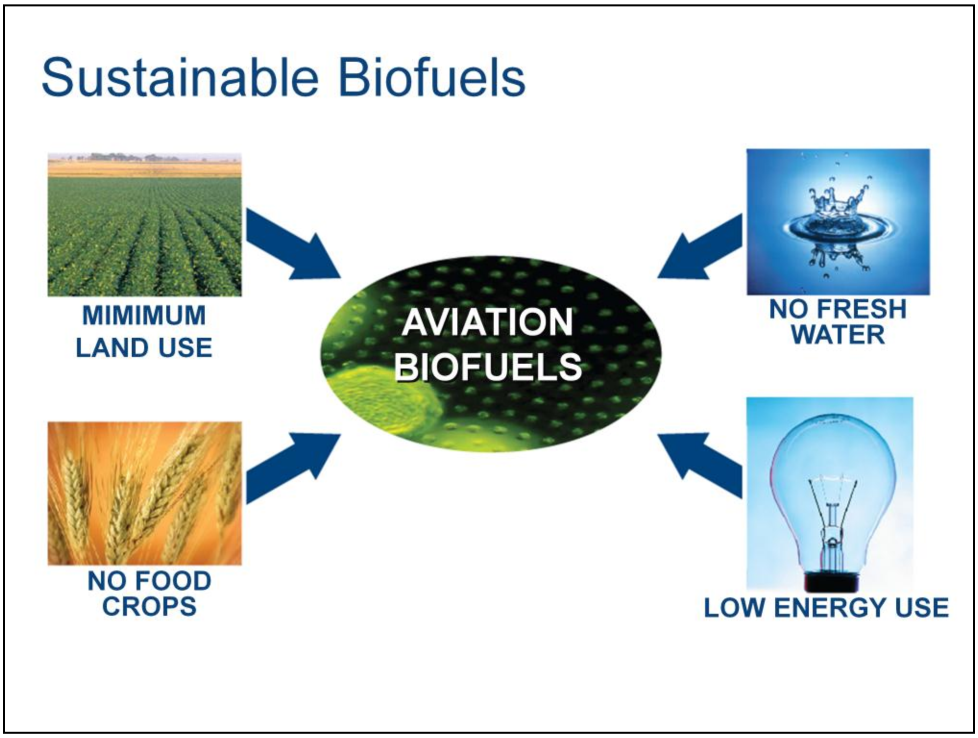
When discussing alternatives to conventional jet fuel, IATA distinguishes between conventional fuel, alternative fuel and biofuel. IATA uses the following distinctions:

Conventional fuel: derived from crude oil, liquid condensates, heavy oil, shale oil, and oil sands.

Alternative fuel: derived from coal, natural gas, and biomass.

Biofuel: derived from biomass.

Sustainable biofuels are supported by IATA because they have been shown over their lifecycle to have the greatest potential to combat climate change. Both alternative fuels and biofuels contribute to energy diversity/independence and typically have cleaner combustion properties than conventional jet fuel resulting in local air quality benefits.



There are scores of different feedstocks that could be used to produce biofuels, but the most appropriate ones will not compete with food, will have a high yield per unit area of growth and will require a minimum of input (water, fertilizer, energy) to grow. Feedstocks that successfully meet these criteria are often called second generation and represent an improvement over first generation crops such as (edible) corn. Examples of feedstocks that appear to meet these criteria are camelina, jatropha, and algae.

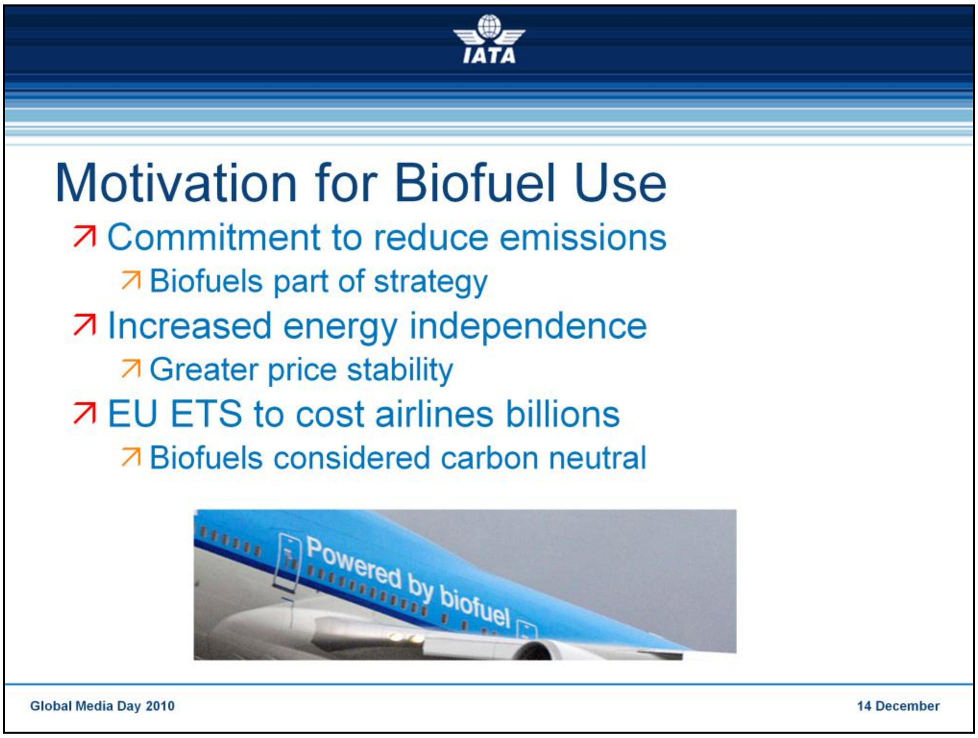
In the absence of regulatory controls and voluntary sustainability standards, the aviation industry, including airlines undertaking early flight tests, developed basic criteria. IATA promotes the development of sustainable biofuels that meet the following criteria:

a) Offer net carbon reductions over their lifecycle

b) Do not compete with fresh water requirements and food production

c) Do not cause deforestation or other environmental impacts such as biodiversity loss

In the meantime, IATA and various other aviation stakeholders have joined the Roundtable of Sustainable Biofuels, which is elaborating a comprehensive voluntary sustainability certification for biofuels for all industrial applications. However, upcoming regulatory schemes in both the EU and USA appear to be gaining importance over voluntary ones. Further details can be found in the IATA 2010 Report on Alternative Fuels, Chapter 5 – Selecting a Sustainable Alternative Fuel.



<u>IATA's commitment to reduce emissions</u>

In June 2007 IATA laid out its four-pillar strategy to mitigate greenhouse gas emissions from aviation. Sustainable biofuels are contained in the Technology pillar, the other three pillars being Operations, Infrastructure and Economic measures.

<u>Increased energy independence</u>

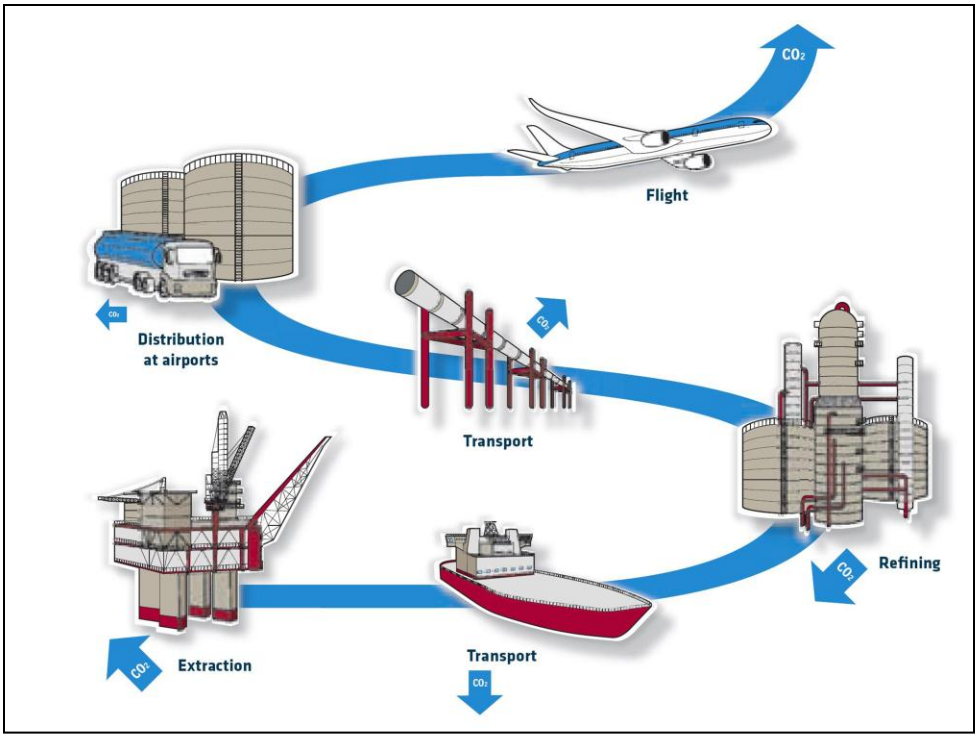
Biofuels offer airlines increased energy independence due to the fact that airlines using biofuels are no longer 100% dependent on petroleum-derived jet fuel. This improves price stability for aviation jet fuels, insulates airlines from geopolitical uncertainties of petroleum supply and protects from projected petroleum shortages in the future (peak oil).

<u>EU ETS Cost</u>

IATA is projecting that in 2012 airlines will be responsible for the purchase of 68.4 million tonnes of carbon emissions allowances in addition to the airlines' free emissions allowance allocation (approximately 180 million tonnes). The number of purchased credits is projected to increase to 133.1 million tonnes in 2020. Assuming an average cost of 15 Euros per tonne of CO2, airlines will be required to purchase approximately 1.03 billion Euros of emissions allowances in 2012. Projecting an increased average cost over the coming years of 30 Euros per tonne of CO2, airlines will be required to purchase approximately 4 billion Euros of emissions allowances in 2020. These costs could rise to over 13 billion Euros in 2020 if carbon prices increase more than anticipated or if the EU reduces the number of free allowances allocated to airlines.

Under the EU ETS, biofuels are considered carbon-neutral. This means that for every

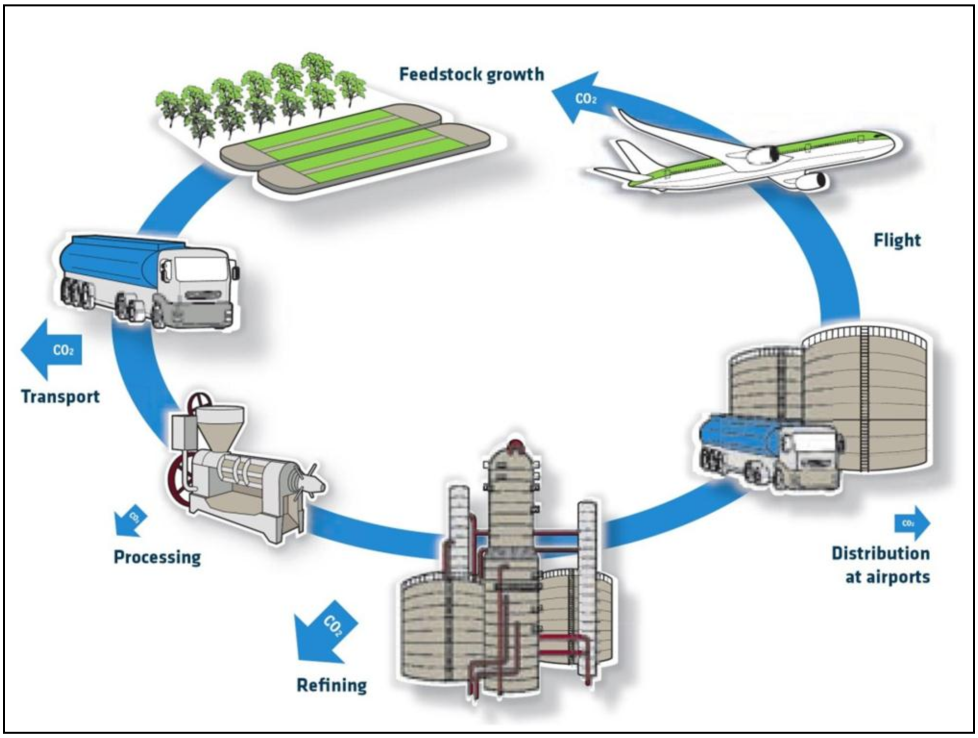
400 liters of biofuels used instead of conventional jet fuel, 1 tonne of CO2 is avoided. As a result, airlines that use large enough volumes of biofuel will not have to purchase additional emissions allowances.



This slide should be compared with the following slide to contrast the overall carbon emissions of conventional jet fuel with those of biofuel.

Conventional jet fuel is derived from petroleum. This graphic shows how this conventional pathway results in a net increase in atmospheric carbon. Carbon is extracted from underground in the form of petroleum, then transported, processed, and burned in flight, producing CO2. The well from which this carbon originated does not reabsorb the carbon emissions, and therefore net carbon concentrations in the atmosphere continually increase under this scenario.

Over the course of the fuel’s lifecycle, each kg of fuel burned results in approximately 3.15 kg of CO2 being released into the atmosphere. Compare this with the following slide demonstrating the lifecycle of biofuels.



A biofuel lifecycle analysis demonstrates a reduction in CO2 emissions relative to conventional jet fuel from petroleum. As the biomass grows, it absorbs carbon from the atmosphere. This biomass is harvested, processed into fuel, and burned in flight, where the carbon is re-released as CO2.

Since the carbon in the biofuel originated in the atmosphere (rather than underground as in petroleum), there is no net carbon added to the atmosphere. This is a closed loop that even over many years will not result in increasing carbon concentrations in the atmosphere. If not for the emissions associated with fuel processing and transportation (still presumably powered by fossil fuels), there would be no net CO2 emissions from biofuels over this lifecycle. However, because of the processing and transportation steps, there are still a small amount of net carbon emissions.

The amount of CO2 released during the combustion of biofuels is similar to the amount released during the combustion of conventional jet fuel. It is only through looking at the whole lifecycle of the biofuel that we see a relative reduction in emissions. Certain aviation biofuels are expected to reduce net CO2 emissions by more than 80% relative to conventional jet fuel.

IATA

Aviation Biofuel Types

	Energy Source	Process	Certification
Fischer-Tropsch (FT) Biomass-to-Liquid (BTL)	Energy crops, forestry residues, municipal waste	Gasification/ Fischer-Tropsch	Attained 2009
Hydroprocessed Renewable Jet (HRJ)	Conventional oil crops, camelina, jatropha, halophytes, algae	Hydrogen treatment	1st Quarter 2011

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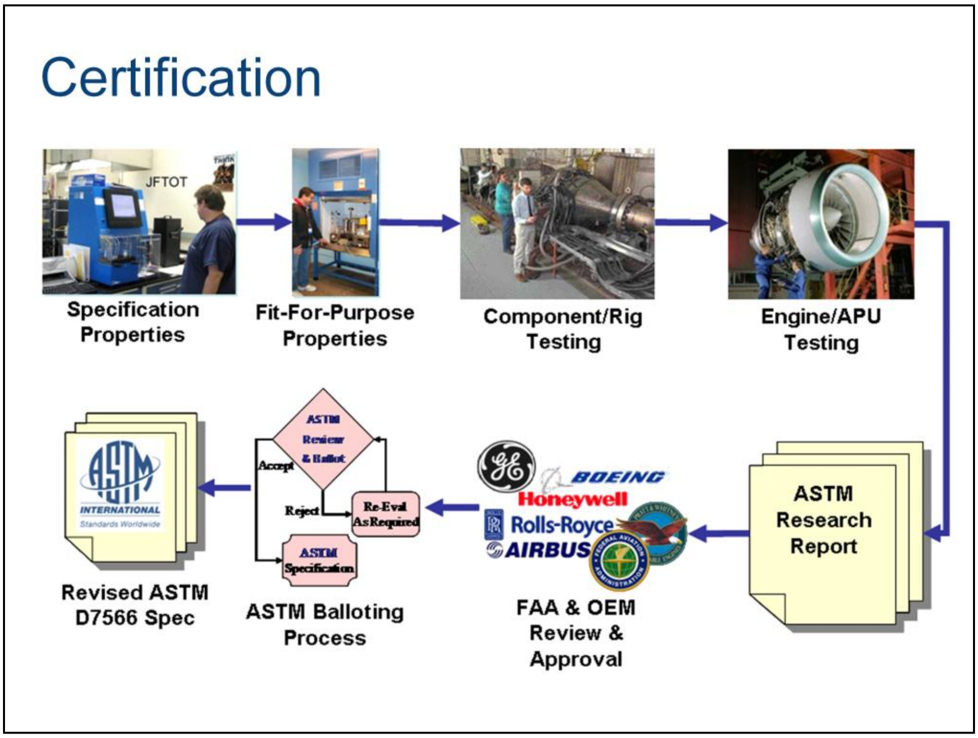
A FT fuel is produced from a feedstock through gasification followed by a FT synthesis process. The feedstocks for the gasification route include coal, natural gas, or biomass; these processes are also commonly called coal to liquid (CTL), gas to liquid (GTL) and biomass to liquid (BTL). BTL is a biofuel, but CTL and GTL are not. The carbon monoxide and hydrogen produced in the gasification process are combined to form a mixture of products in the FT synthesis process. These products are either polymerized or further processed by reacting with catalyst and hydrogen; these processes are collectively known as hydroprocessing. The final step is fractionation to extract a cut with suitable properties to be used in turbine engines.

HRJ fuel is produced by refining the oils (triglycerides and fatty acids) naturally present in plant seeds and waste animal fats. HRJ production first requires the removal of oxygen by reaction with hydrogen ("deoxygenation"). In a second step, the resulting hydrocarbon is further cracked using high temperatures to reduce the carbon number into the jet range and achieve key jet fuel properties such as freeze and flash points.

The final biofuel produced from these two processes is essentially identical, and is sometimes collectively referred to as synthetic paraffinic kerosene (SPK). This name alludes to the fact that this is a synthetic (man-made) fuel consisting primarily of straight-chain molecules (much like paraffin waxes), and with similar properties to kerosene (jet fuel).

Generally speaking, FT production plants are expensive to build but use cheap feedstocks such as agricultural residues and wood chips. HRJ plants are relatively inexpensive to build but require costly plant and vegetable oils to feed the process. The final cost of each fuel (taking into account amortized costs for the construction of the facility and feedstock costs) is similar, currently in the range of $0.80-$2.00 per liter. See Chapter 3 of IATA 2010 Report on Alternative Fuels for more on costs.

The net emissions reduction of each biofuel is dependent on many factors, including the specific source of biomass, the use of co-products, and land use factors. However, according to recent studies, it appears some FT fuels may have a greater overall emissions reduction than HRJ. This is highly dependent on the aforementioned factors, and one should be cautious not to generalize. A comparison of net emissions from different types of biofuel can be found in Section 5.6.3 of the IATA 2010 Report on Alternative Fuels.



Aircraft operators are required to use only standard fuels with very specific properties. These properties are defined in fuel specifications such as ASTM D1655 (Standard Specification for Aviation Turbine Fuels). The specifications cover the following properties: composition (aromatics, sulfur), volatility, fluidity (cold weather, etc.), combustion properties, corrosion, thermal stability, contaminants and additives.

If an aircraft operator uses fuel that does not meet specification, it may have its aircraft operator's certificate (AOC) revoked. Until recently only fuels derived from fossil sources were specifically included in ASTM D1655.

ASTM International has developed a new specification, ASTM D7566 ("Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons"), in which biofuels produced to this standard using the Fischer-Tropsch process and blended to a maximum of 50% with conventional jet fuel are considered functionally equivalent to conventional jet fuel. Therefore, biofuel meeting this specification can be used by aircraft operators without fear of losing their AOC.

In late 2010/early 2011 a new type of aviation biofuel produced by hydroprocessing (treating with hydrogen) plant oils will be approved by ASTM International and will be included in the ASTM D7566 specification. This new fuel is commonly called hydroprocessed renewable jet fuel, or just HRJ.

The main result of the certification of aviation biofuels such as FT and HRJ is that airlines can substitute these fuels for conventional jet fuel up to 50% (the limit specified in ASTM D7566), thus reducing emissions while still respecting fuel regulations. The legal/regulatory barrier to biofuel use has thus been removed.

IATA

Historical Biofuel Flights

Carrier	Aircraft	Partners	Date	Biofuel	Blend
Virgin atlantic	B747-400	Boeing, GE Aviation	23 Feb 2008	Coconut & Babassu FAME	20% one engine
AIR NEW ZEALAND	B747-400	Boeing, Rolls-Royce	30 Dec 2008	Jatropha HRJ	50% one engine
Continental Airlines	B737-800	Boeing, GE Aviation, CFM, Honeywell UOP	7 Jan 2009	Algae and Jatropha HRJ	50% one engine
JAL	B747-300	Boeing, Pratt & Whitney, Honeywell UOP	30 Jan 2009	Camelina, Jatropha, and Algae HRJ	50% one engine
KLM	B747-400	GE, Honeywell UOP	23 Nov 2009	Camelina HRJ	50% one engine
TAM AIRLINES	A320	Airbus, CFM	22 Nov 2010	Jatropha HRJ	50% one engine

…and more being planned!

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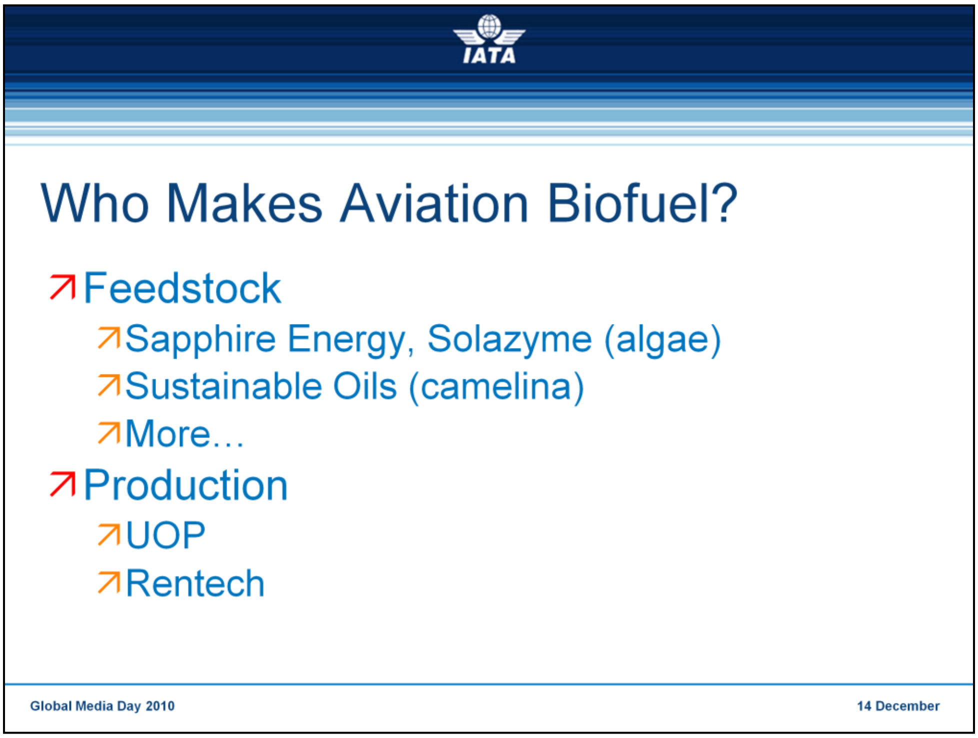
As a safety precaution, all flights were performed by supplying one engine with an alternative fuel blend from a separate tank. The duration of the test flights was typically around two hours. The test programs consisted of the typical phases of a normal flight as well as a number of simulated incidents. No adverse effects were observed during the flights or the post-flight inspections of the engines and the fuel system (nozzles, fuel management unit, fuel pump and fuel filters).

It has recently been announced that Lufthansa will be operating commercial flights using biofuels between Hamburg and Frankfurt on an Airbus A321 in 2011. The fuel will be a FT biomass to liquid (BTL) produced by Neste Oil, a Finnish company. This fuel has been certified by the ISCC (International Sustainability and Carbon Certification), a strict sustainability criteria recognized by German Authorities.

Other airlines planning biofuel flights are Jet Blue, Interjet, Azul and Porter. For further information on these flights and the flights listed in the table above, see http://www.enviro.aero/Biofuels.aspx

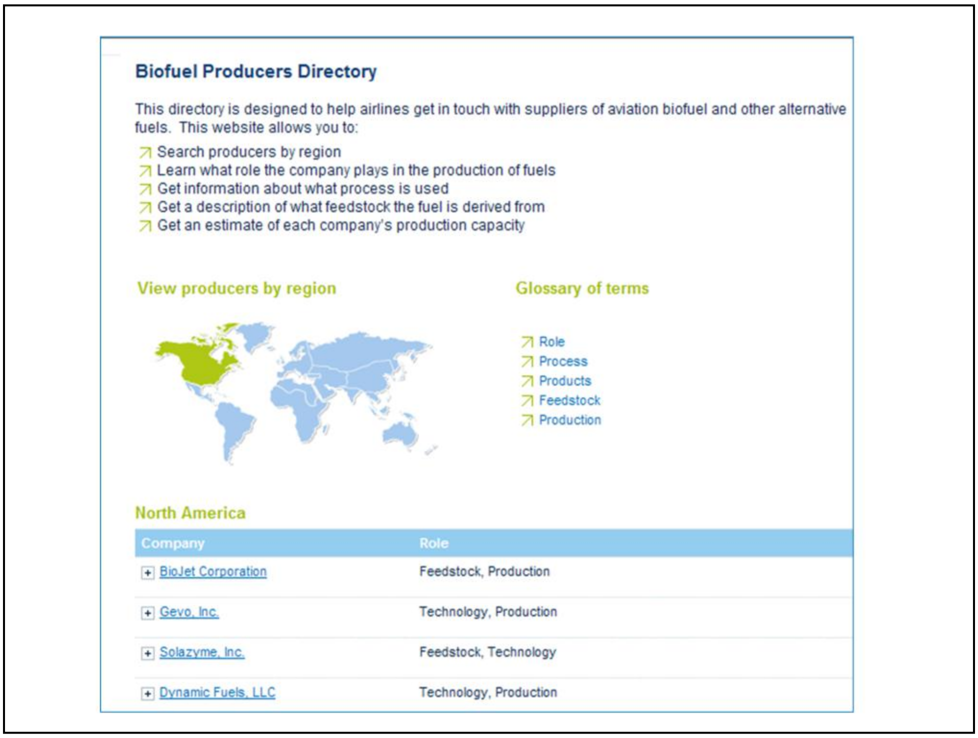


Since there have only been a handful of biofuel flights, the number of companies involved in the production of the biofuels has remained relatively small. Some of these companies are listed on the slides above. IATA has recently begun an initiative to collect data and contact information of companies working in the biofuel value chain, which can be found online (public site) at http://www.iata.org/whatwedo/aircraft_operations/fuel/biofuel-directory/Pages/index.aspx

The IATA Biofuel Producers Directory was launched in November 2010 with the goal of facilitating airlines' access to producers of biofuel. This will be useful tool for airlines looking to make a first contact with aviation biofuel producers.

This website allows the user to:

- •Search producers by region
- •Learn what role the company plays in the production of fuels
- •Get information about what process is used
- •Get a description of what feedstock the fuel is derived from
- •Get an estimate of each company's production capacity



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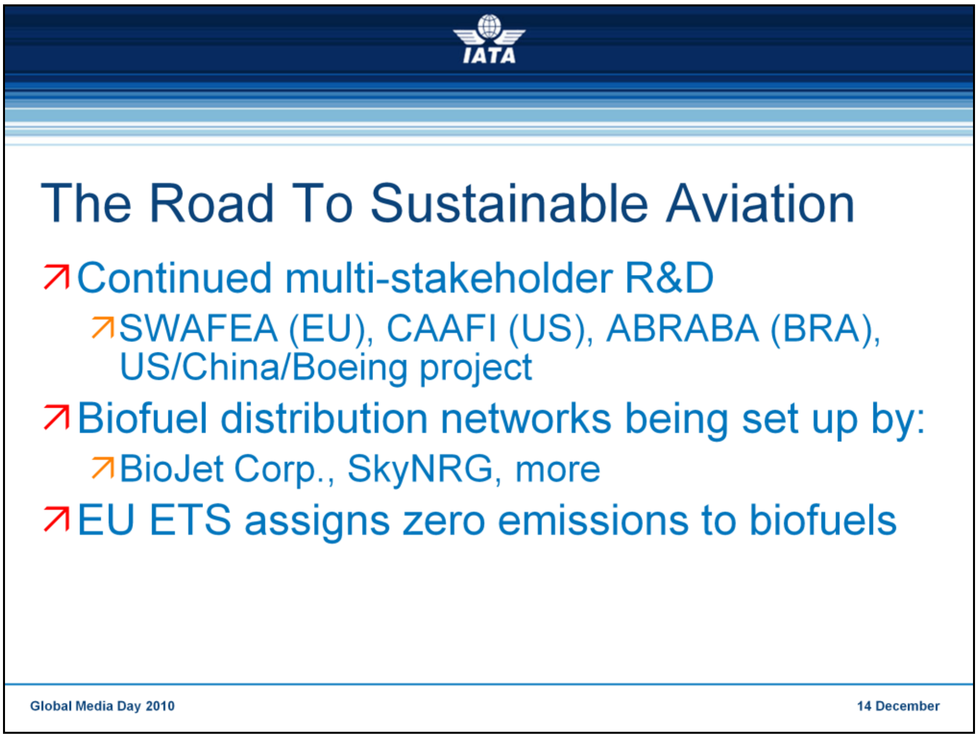


SWAFEA (EU) was created to provide the EC with support in policy decisions relating to alternative aviation fuels. This covers the following: analysis of technical aspects related to the fuel suitability, Lifecycle Assessment (LCA) and analysis of environmental and societal impacts of fuel production and assessment of economic viability of alternative fuels implementation strategies.

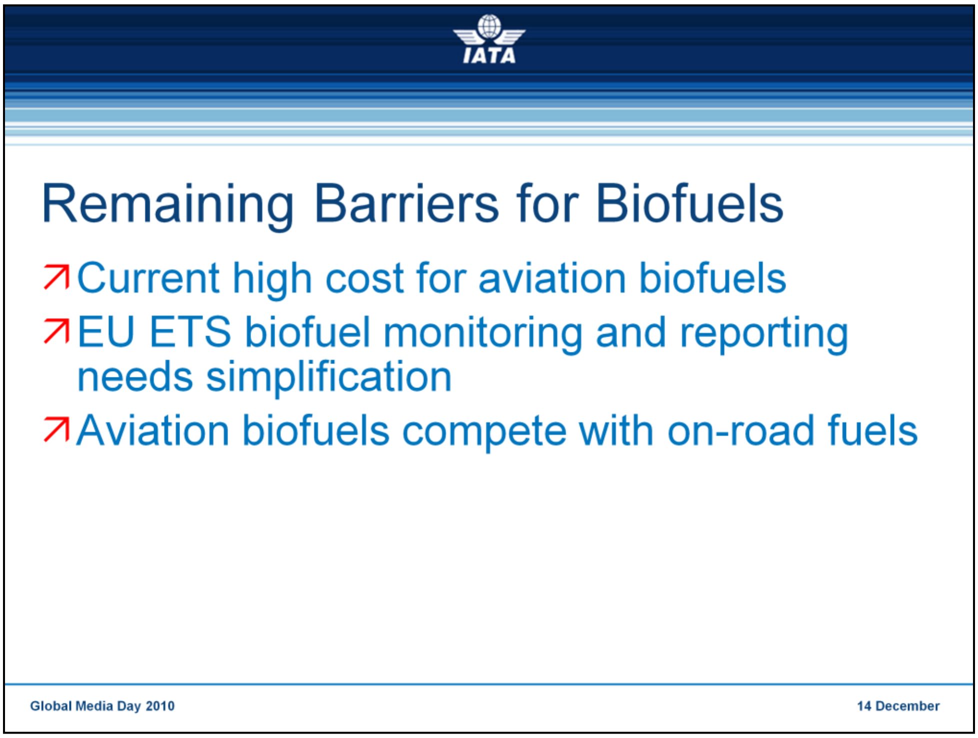
CAAFI (USA) evaluates alternative jet fuels in teams focused in four areas: fuel certification and qualification, environment, business and economics and research and development. Key accomplishments include the following: approval by ASTM International of synthesized hydrocarbon jet fuels (D7566 specification), initial pre-purchase agreements announced by 15 airlines with two alternative-fuel suppliers formation of a strategic alliance between airlines (via ATA) and the Defense Logistics Agency (DLA), creating a single market for alternative jet fuel, over 50 energy suppliers engaged in development and deployment discussions, made aviation a priority with respect to biofuel deployment by U.S. government and signing of Farm to Fly resolution between ATA, Boeing and USDA to accelerate commercial availability of sustainable aviation biofuels in the United States.

ABRABA (Brazil) was created to promote public and private initiatives seeking development of sustainable aviation biofuels. Some key goals include the following: support the implementation of the legal framework for biokerosene production and criteria for biokerosene certification in Brazil, support sustainable multi-feedstock programs and new technology routes for competitive processing of biokerosene, recommend agricultural programs for the selected alternatives to meet the sustainable feedstock demand of IATA by 2050, develop adequate financing mechanisms for every step of the value chain, and propose adequate tax incentives for the development, certification and commercialization of alternative aviation fuels in Brazil, similar to existing biodiesel incentives.

US/China/Boeing project: agreements signed between Chinese and US governments to promote the commercialization and use of aviation biofuels (see IATA 2010 Report on Alternative Fuels Section 6.2.2 for more details)

For more on BioJet and SkyNRG, see Sections 6.4 and 6.4 of aforementioned Report.

For more on EU ETS see Chapter 4 of aforementioned Report.



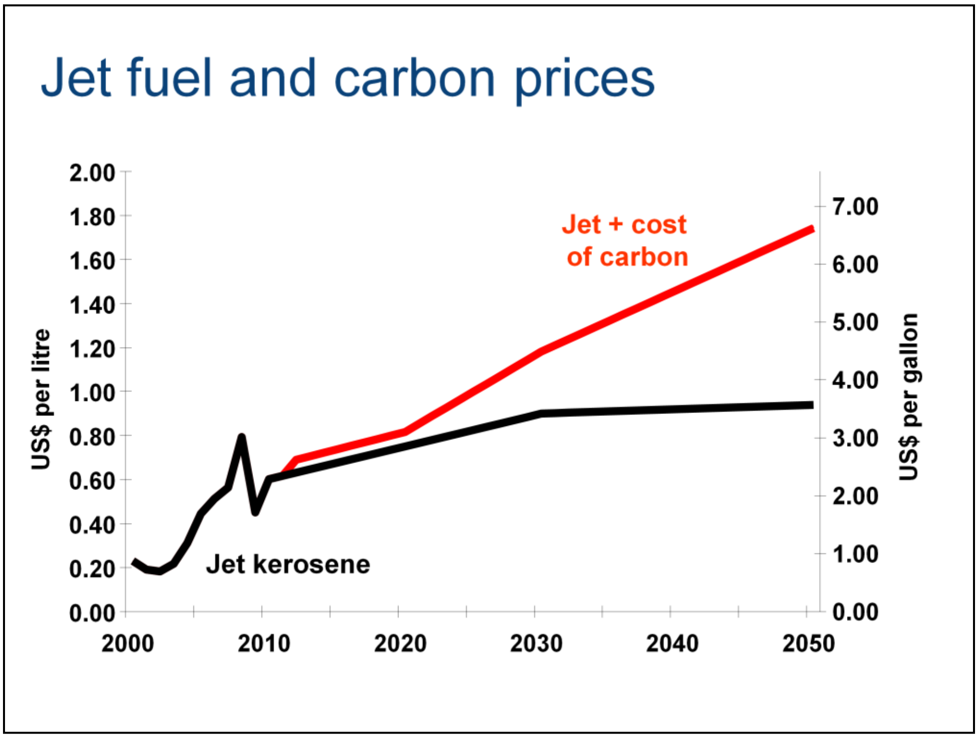
Difficulties of the EU ETS with respect to biofuel:

Under current EU ETS guidelines, airlines are required to report the fraction of biofuel (if any) that is used on each individual flight in order to take advantage of biofuels' zero emissions factor. This implies a level of isolation of the biofuel is incompatible with existing airport fueling infrastructure, where all jet fuel (regardless of origin) is intermingled at the airport holding tanks and distributed through a single subterranean network of pipes. Therefore, under current guidelines, in order to ensure that the airline that purchased the biofuels gets credit the airline must keep the biofuels in a separate holding tank at the airport until ready for use, and then transfer it into the aircraft using a fueling vehicle. The adds unnecessary costs to the airline. A better alternative would be the assignment of credits (such as the RINs used in the US Renewable Fuel Standard) for each kg of biofuel purchased by the airline. Under this scheme the biofuel would be blended with the remaining jet fuel at the airport, where it would gradually be distributed throughout the airport's system. This is the same concept as "green electricity".

Competition with on-road fuels

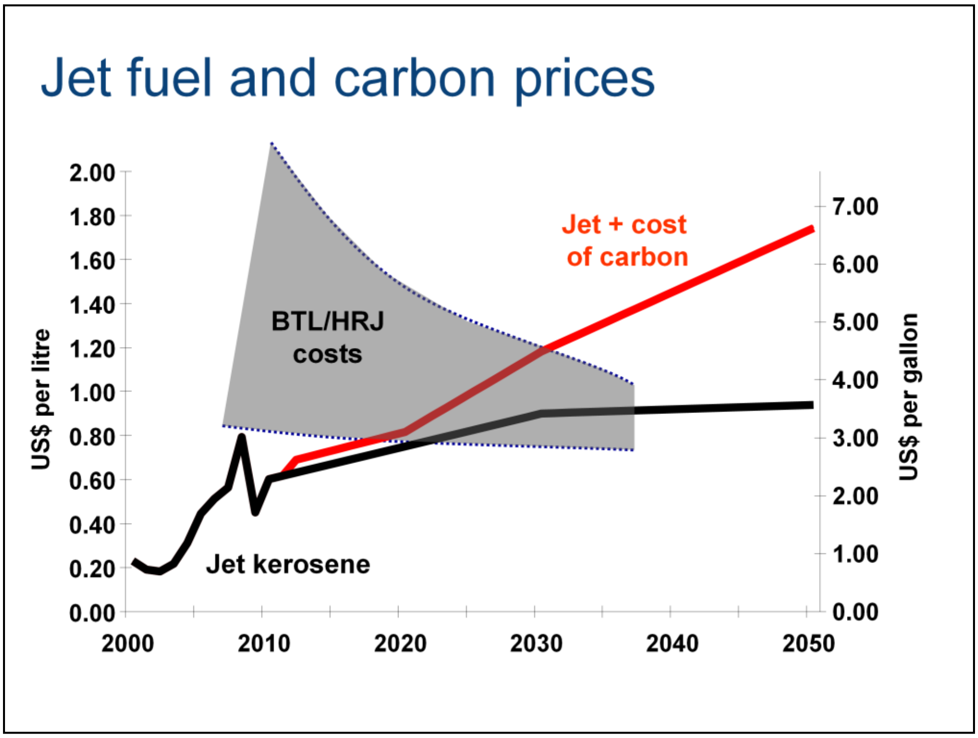
Other biofuels such as biodiesel use the same feedstocks as aviation biofuels. However, the market for the on-road fuels is larger than for aviation and on-road fuels require less processing (lower production costs). Therefore there is little motivation for biofuel producers to enter the aviation biofuel market while on-road fuels will result in larger profits.

See next slide for high costs.



Source: Jet kerosene price based on 25% markup over IEA's crude oil forecast in Energy Technology perspectives 2010. Carbon price taken from UK DECC 2010 central case forecast for traded carbon price. All are in constant (inflation adjusted) US dollars.

This graph shows that current BTL (biomass to liquid) and HRJ (hydroprocessed renewable jet from vegetable oils) prices are in the range of \$0.80-\$2.00/L, a factor of 2-3 times the price of conventional jet fuel. Over the coming years aviation biofuels are expected to follow the same trend as other new technologies (solar panels, wind turbines, etc.), namely that prices come down as efficiency improves and experience is gained with the new technology. Price parity is currently projected sometime after 2020.



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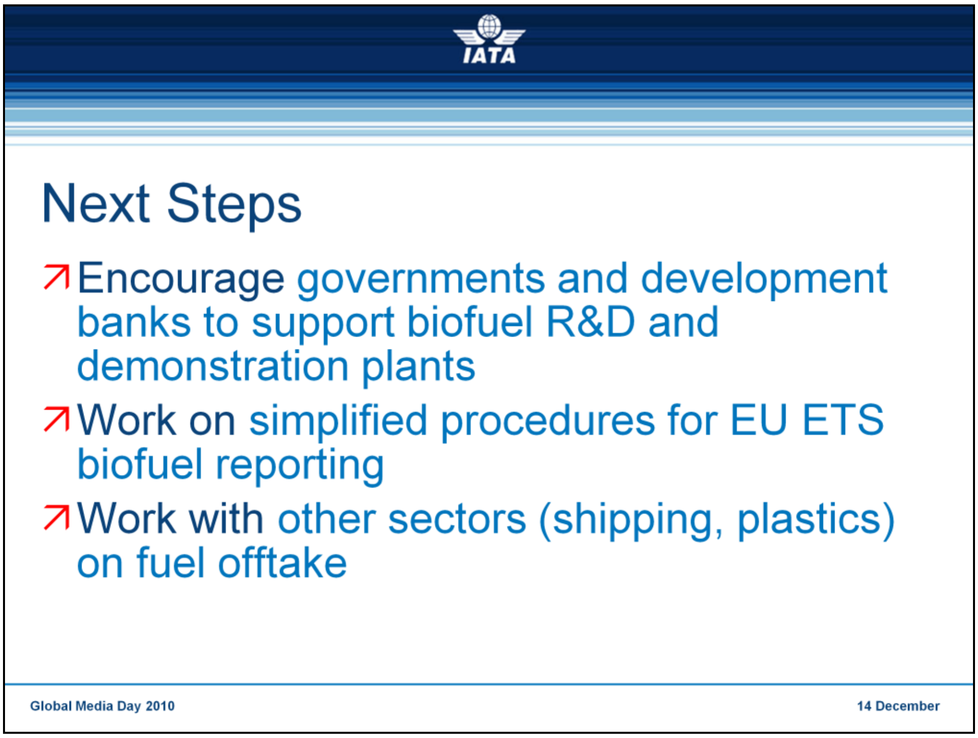
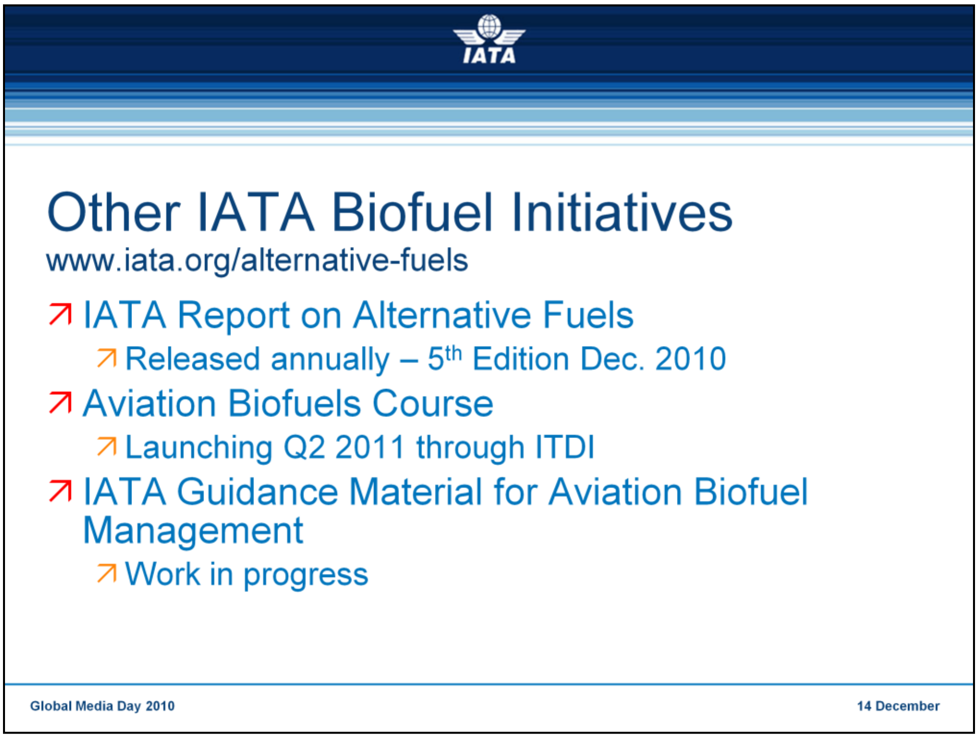


It is difficult to get the new aviation biofuels industry off the ground by simply relying on the forces of the free market. Currently, the costs associated with aviation biofuels are too high for significant development to happen on its own. IATA encourages government support (through tax incentives, loan guarantees, etc.) of research and development into new aviation biofuels, developing advanced sources of biomass, and supporting the construction of demonstration plants. This will help to encourage investment and build a solid and sustainable foundation for the aviation biofuel industry of the future.

As discussed in slide 10 (Remaining Barriers for Biofuels), the EU ETS reporting procedures must be improved. IATA is working towards a “book-and-claim” system in which airlines provide verifiable evidence of purchased biofuels (which are then distributed to multiple aircraft), rather than ensure specific flights are “biofuel flights”.

FT and HRJ production plants do not only produce a substitute for jet fuel. They also produce replacements for diesel, naphtha, natural gas, and more. It is therefore recommended that agreements be reached with other sectors that may have a use for these products to purchase the remaining fuels produced. This will help to ensure the viability of biofuel production plants that produce some fraction of aviation biofuel.



IATA releases an annual Report on Alternative Fuel. The IATA Report on Alternative Fuels describes recent developments in alternative aviation fuels. Updated annually, this report includes:

•Innovations in alternative aviation fuels; Fuel properties; Certification and flight trials; Greenhouse gas emissions and sustainability; Production capability, capacity and efficiency; Biofuel economics and their impact on Emissions Trading Schemes (ETS)

In April 2011, IATA is launching a new biofuels course through the IATA Training and Development Institute. The course is intended to offer the following benefits to the students:

•Understand the differences between biofuel, alternative fuel, and conventional jet fuel

•Gain insight into the technical requirements of biofuel

•Gain an understanding of biofuel lifecycle (emission and re-absorption of CO2), environmental impact, and the importance of selecting a sustainable fuel

•Learn about commercial airlines' experiences using biofuel in flights

•Learn about evolving biofuel regulations in the EU and US, including carbon trading, renewable fuel mandates and minimum sustainability criteria

•Understand how to estimate costs associated with adopting biofuels

•Discuss strategies for biofuel ground handling and accounting

Finally, IATA is creating a new guidance material for airlines on the topic of aviation biofuel management. This is a work in progress, but covers the following topics:

•Alternative Fuel Specifications

•Blending, Chain of Custody, Certification

•Sustainability and Environmental Regulations

•Purchasing Alternative Fuels

•Handling Alternative Fuels

•Monitoring, Reporting and Verifying Alternative Fuel Use