



Camelina Oil seed

Renewable feedstock for biofuels and jet fuel of second generation
and rediscovered oilseed crop with a variety of potential uses

CasusOil ProUG



Overview

Camelina sativa is robust, unpretentious and frugal in relation to climate and soil quality. It is not necessary to fertilize for cultivation of Camelina and it has a high resistance to frost and dryness. Moreover, the plant is also less susceptible to diseases and pests. Shortly: Camelina is ideal for cultivation without using agricultural chemicals. The life cycle assessment of Camelina oil is much better than that of rapeseed oil. An amplified usage of Camelina oil would increase the image of the plant oil, because Camelina can be well combined with organic farming, in contrast to rapeseed. The technical properties of Camelina oil as an energy source can be optimized – although today Camelina oil already exceeds rapeseed oil at least in one quality: it is more liquid (solidification temperature is - 11 to - 18 °C) and therefore it is often mixed with rapeseed oil in winter.

The oil content of Camelina seeds is between 30-45%, whereby a large part of which consists of unsaturated fatty acids (especially omega -3, but also omega - 6 fatty acids). For this reason, Camelina sativa oil is used by leading cosmetics and perfumery manufacturers as well as by producers of organic cosmetics.

Last but not least: Camelina oil as aircraft tanking oil is not new, it was tried out in the 40's and 50's in the Soviet air and space crafts. That's why Camelina was the most important ingredient in the production of jet fuel. Different airlines today also put their focus on Camelina nowadays. The U.S. armed forces order big special financial program for activities with camelina. Since July 2011, Lufthansa is using Camelina as an additional fuel component in aviation.

Key data for Camelina

- Camelina can improve the productivity and value of low-rainfall, non-irrigated wheat farms by replacing summer fallow rotations.
- Camelina oil can be processed into HRJ fuel as a drop-in jet fuel that fits into conventional petroleum infrastructure, to reduce biofuel transportation costs and improving biofuel economics and renewable energy profitability.
- Camelina has potential to be a large-scale and low-cost, sustainable biofuel feedstock for both biodiesel and aviation end markets
- There are opportunities to add value and generate profits at nearly every link in the farm to fuel Camelina supply chain
- With careful planning, consideration of risks, and insight into Camelina market growth rates and forecasts, Camelina presents many possible business opportunities, including opportunities to generate additional farm revenues and create renewable energy jobs.



Some words to company Camelina Sustainable Oil Project (CASUS OIL Project) **CASUS OIL Project**, was established October 2011 as the specific purpose for cultivation in Russia and commercial exploitation of camelina sativa products – oil, press cake and crushed meal in EU on contract basis. 2012 **CASUS OIL Project** founded a joint venture in Russia with just the same aim of cultivating and commercially exploiting camelina sativa products.



Particular qualifications of the project partners: **CASUS OIL Project** – provides know-how in the field of market economy and is able to market camelina sativa products in the respective areas. **CASUS OIL Project** attracts scientific institutions and establishments subject selection and development of new varieties of oilseeds, buyout will apply to renewable energy of future.

The founding members of **CASUS OIL Project** – provide knowledge and the necessary skills for international cooperation (language skills, knowledge of the countries concerned, intercultural skills for dealing with business partners from Eastern Europe, contacts and the ability to create networks).

Russian Partner – provides the technical know-how in the field of primary processing renewable raw materials, particularly oilseeds as local project partner with the necessary contacts to future contract farmers and agro-holdings. It disposes of suitable agricultural areas for the potential cultivation of camelina sativa.

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1. Product description

Utilization of camelina sativa products in Russia and the EU:

- a) Production of jet fuel for aircraft
- b) Production of biodiesel
- c) Production of lubricants
- d) Chemical industry – production of paint and varnish
- e) In smaller amounts in the cosmetics and feed industry (presscake and crushed meal)

Point a) is particularly promising, since for aviation purposes large quantities of products have to be purchased. Apart from that, at the beginning of 2012 a new EU Directive under the EU Emissions Trading System (EU ETS) came into effect, obliging airlines to reduce their greenhouse gas emissions.

Research in the field of renewable raw materials for the production of second generation biofuels is promoted very intensively at the moment, and the possible applications of camelina sativa oil are very versatile.



2. Cultivation methods

Sowing: Casus oil has the know-how about cultivation methods and disposes of the necessary seeds to make it possible to sow twice a year – in winter and in summer. The optimum sowing period in the Middle Volga Region is from 26 April to 10 May for summer camelina and from 25 August to 20 September for winter camelina.

Standard amount of seeds for drilling is 8 million germinable seeds per hectare (6-7-8 kg/ha). Harvest: winter camelina – June; summer camelina – July
Average yield of crops per ha: 2,0 - 2, 5 t with an oilcontent from 35 - 42%

3. Background: environmental policies and market economy

The demand for renewable raw materials in the industry and the energy sector is growing. Directives on the sustainability of renewable raw materials on EU level and in Germany have come into effect (EU-Directive 2008/101/EG, EU-Directive 2009/28/EG and German Directive on the demands for a sustainable production of transport biofuels).

3.1 Sustainable cultivation of camelina sativa in Russia

Russia has the potential to provide areas for agricultural use according to the categorization on sustainable crop production. During the first project phase, camelina sativa is planted as monoculture. The aim of the project is to implement intercropping in the course of the stabilization of JV business activities.

- Intercropping: coproduction of vegetable oil and food products on the same areas.
- Catch cropping: cultivation on areas temporarily out of use (for example during winter time). Camelina sativa can be grown as summer or winter crop.
- Cultivation on areas which are not or not particularly suitable for the production of food (for example areas susceptible to erosion or lesser fertile areas).



The area in the Middle Volga Region, according to the Russian definition, is considered an “agricultural risk area”, since it is susceptible to little precipitation and spring floods. Apart from the fact that the area’s suitability for agriculture is rather low, camelina sativa is a crop plant which can be easily cultivated here. Growing camelina sativa in the Middle Volga Region does not lead to a misuse of agricultural areas. The ecologically sustainable use of agricultural areas is also the aim of the regional and national authorities of the Russian Federation. The reactivation of agricultural use is another aim of the regional and national agricultural authorities of the Russian Federation, which pay attention to a reactivation of areas according to their soil characteristics and suitability for agriculture.

What we can offer you:

Supply of ISCC-EU certified Camelina oil for biofuels or for use in other industries and supply of Camelina press cake for animal feed. On the basis of preliminary agreements and the cultivation by our contract farmers and processing partners.

For the realization of the project opportunities in Russia are very good. Russia has 35 million hectares fallow land, which has to be brought back into the rotation. We are looking for free capital for developing our plans to crop camelina seed in Russia, to produce camelina oil and deliver camelina oil to EU and other markets.

Our company plans to tap this market in Russia and Kasachstan largely, with a vision to bring camelina oil to Europe for using in the production of kerosene in the next 2-3 years.

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The cost of our strategy for developing in the next 3-5 years is 20-30 Mio. Euro. We would be the first company in Europe, which has biggest potential and opportunity to build up camelina market in Russia and Europe.

Resume: We are looking for 50-80 Mio Euro funding or free capital for the development of a global project as production of camelina oil and camelina jet fuel in Russia in the next 10 years.

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Air travel is more biobased: Lufthansa will test Gevo's isobutanol-derived jet fuel

[24 April 2014](#) [Il Bioeconomista](#) [Economy](#), [Europa](#), [Worldbiofuels](#), [Gevo](#), [isobutanol](#), [Jet Fuel](#), [Lufthansa](#)

1 Vote



Air travel is more bio-based. Gevo, Inc., the world's only commercial producer of renewable isobutanol, announced last Tuesday that it has come to an agreement with Lufthansa to evaluate Gevo's renewable jet fuel with the goal of approving Gevo's alcohol-to-jet fuel (ATJ) for commercial aviation use. Lufthansa's testing is being supported through work with the European Commission.

"ATJ, like the Fischer-Tropsch pathway, has the potential to use lignocellulosic waste as feedstock, but promises to do so at less cost than Fischer-Tropsch," said Alexander Zschocke, Lufthansa Group Senior Manager Aviation Biofuels. Lufthansa is a leader in the marketplace for alternative fuels. "By using isobutanol as a renewable raw material for producing jet fuel, the resulting jet fuel has the mixtures of molecules typical of petro-based jet fuel making it directly compatible with engines and infrastructure. Renewable jet embodies the potential of cleaner, greener, and as we scale up, cost competitive drop-in fuels," said Patrick Gruber, Gevo's chief executive officer.

“We greatly appreciate Lufthansa’s and the European Commission’s support of this effort. Through initiatives like this, the commercial airlines are seeking to prove out ATJ and move it towards commercialization. ATJ from Gevo’s isobutanol is a clean burning, homegrown, drop-in jet fuel, and we have a potential route to deliver aviation biofuels at scale and at competitive cost.” Gevo’s patented ATJ fuel is truly a drop-in fuel, designed to be fully compliant with aviation fuel specifications and provide equal performance, including fit-for-purpose properties. Gevo is a leading renewable chemicals and next-generation biofuels company. Gevo’s patent-protected, capital-light business model converts existing ethanol plants into bio-refineries to make isobutanol. This versatile chemical can be directly integrated into existing chemical and fuel products to deliver environmental and economic benefits. Gevo has executed initial commercial-scale production runs at its isobutanol facility in Luverne, Minnesota, constructed in conjunction with ICM, a leading provider of proprietary ethanol process technology.

The airlines are looking with great attention to the use of biofuels. Lufthansa is not the only one. KLM began to test flights using biofuels in 2009. On 23 November 2009, the Dutch company operated the world’s first demonstration flight with passengers on board using biofuel. On this flight, one engine ran on a mix of 50% biofuel made from camelina (huttentut). On 29 June 2011, this was followed by the first commercial flight on biokerosene from Amsterdam to Paris with 171 passengers on board. The biokerosene used on this flight was made from recycled cooking oil supplied by SkyNRG. In September a series of flights were operated on this route.

The aviation industry, policy-makers and producers of agrarian commodities view agrofuels as the solution to growth of the sector. They plan to use about two million tonnes of bio-kerosene per year by 2020 in Europe, compared to almost none now. This means that about three percent of all the kerosene in Europe could be bio-kerosene by 2020. “Our ambition is to fly with 1 percent of bio-kerosene by 2015,” said Camiel Eurlings, KLM corporate director. “That may seem like nothing at all, but I can tell you that this a big step within the world of the aviation industry.”

Total and Amyris bio-based jet fuel ready for use in commercial aviation

[2 July 2014](#) [II Bioeconomista](#) [Economy](#), [Europa](#), [WorldAmyris](#), [aviation](#), [bioeconomy](#), [Jet Fuel](#), [Total](#)

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in Paris

Total's headquarter

Total, one of the world's leading energy companies, and Amyris, an industrial bioscience company, begin to prepare to market a drop in jet fuel that contains up to 10% blends of renewable farnesane. This new jet fuel blend meets the rigorous performance requirements set for Jet A/A-1 fuel used by the global commercial aviation industry.

“The ability of this renewable jet fuel to meet the criteria in the definitive standard for use in commercial aviation is a significant milestone in the ongoing collaboration between Amyris and Total. It unleashes the potential of our renewable jet fuel for the commercial aviation market”, said Philippe Boisseau, Member of the Executive Committee of Total, President of Marketing & Services and New Energies divisions.

According to the French manager, “the introduction of our green fuel for the commercial aviation industry has the potential to lead to a meaningful reduction of greenhouse gas emissions with strong performance. As one of the world's biggest suppliers of aviation fuel, one of Total's objectives is to make breakthrough jet fuel solutions widely available to its airline customers, supporting their quest to meet high sustainability objectives.”

The revised standard, D7566, developed by ASTM (American Society for Testing and Materials) Committee on Petroleum Products, Liquid Fuels, and Lubricants, now includes the use of renewable farnesane as a blending component in jet fuels for commercial aviation. This latest version of ASTM D7566, Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons, will allow a biomass-based renewable jet fuel, as developed by Amyris and Total, to support the commercial airlines' goal of reducing greenhouse gas emissions.

“Conformance to ASTM D7566 enables us to advance our ongoing discussions with several of the major international airlines seeking to fly commercial flights with renewable fuels capable of reducing emissions and improving performance,” said John Melo, President & Chief Executive Officer of Amyris.

“With our partner Total, we are paving the way for a new era for the aviation industry by providing a drop-in, low carbon jet fuel solution that will support the sustainability and environmental goals set by the industry without compromising performance. Achieving conformance to this standard in record time is a credit to the disruptive potential of our technology and the commitment of the global aviation industry to support innovative solutions,” Melo concluded.

The ASTM standard involved an end-to-end evaluation program to verify and ensure that the renewable jet fuel product is compatible with aircraft and engine components and systems. In collaboration with key stakeholders of the aviation community, Amyris and Total conducted a thorough test program, from the investigation of key fuel properties to evaluation of performance at scale including multiple engine and flight tests. This renewable fuel meets jet fuel strict specifications and bears favorable properties such as low freezing point, high thermostability and high net heat of combustion. The Brazilian fuels regulator, ANP, has indicated it will include this renewable fuel as option among the other alternative aviation fuels already allowed in the national specification.

As part of their ongoing collaboration since 2011, Amyris and Total have also worked to ensure that the fuel be produced sustainably. Earlier this year, the Roundtable on Sustainable Biomaterials (RSB)’s certified Amyris’s first farnesene production facility in Brazil.

Amyris aims at becoming a great player in the bioeconomy. Together with Firmenich and Total

[6 January 2014 Il Bioeconomista Economy, Europa, WorldAmyris, bio-based economy, bioeconomy, biofuels, biorefinery, Firmenich, industrial biotechnology, Jet Fuel, Total](#)

3 Votes



Bill and Melinda Gates: their Foundation supported the start-up of Amyris in 2005

The US biotech company Amyris aims at becoming a great player in the world bioeconomy. Founded in 2003 in the San Francisco Bay Area by a group of scientists at the University of California, Berkeley, Amyris – as anticipated during its prior quarter results call – has begun the production of its first fragrance oil at a specialty contract manufacturing facility. In 2014, building on the successful results of its initial fragrance oil production and based on feedback from its partner, Amyris plans to also produce this fragrance oil at its own Brotas production facility. The Brotas biorefinery currently produces Biofene, Amyris’s brand of farnesene, a renewable hydrocarbon used for a range of applications. Following planned improvements to the Brotas plant in early 2014, Amyris expects to be able to produce both Biofene and a range of other fermentation products, including its fragrance oils, at the plant.

This announcement follows the one of last December, when Amyris announced together with the French oil giant Total the formation of Total Amyris Biosolutions, a 50-50 joint venture that will produce market renewable diesel and jet fuel.

“We have produced our first fragrance oil for our partner Firmenich who will use it in its own formulations as well as supply it to some of its key customers. With the knowledge we have gained from successful scale-up runs, we plan to make modifications to our Brotas plant early next year that will allow us to produce this fragrance oil at our own facility. We believe this will help us increase volumes and lower our production costs, as well give us the flexibility to produce multiple products to maximize the overall efficiency of our Brotas operation,” concluded Melo.

“Amyris has proven it can produce at scale our first collaboration fragrance molecule using its innovative technology. This technology will enable Firmenich to make differentiated perfume creations with unique renewable ingredients. Our clients expect reliability of supply, cost innovation and olfactive differentiation, all of which we think the move to Brotas will help support,” said Boet Brinkgreve, Group Vice president, Ingredients at Firmenich.

Earlier last year, Amyris announced an expansion of its collaboration with Firmenich, with commercialization of its first fragrance molecule targeted for early 2014. The two companies continue to collaborate on additional molecules that Firmenich can market in the flavors and fragrances market. As detailed previously, the parties will share in the economic value derived from the sale of these ingredients.

As already said, last December Amyris and Total announced the formation of Total Amyris Biosolutions, a 50-50 joint venture that now holds exclusive rights and a license under Amyris's intellectual property to produce and market renewable diesel and jet fuel from Amyris's renewable farnesene. Total is Amyris's largest investor, holding approximately 18% of its outstanding common stock, and is deeply committed to the development of next-generation renewable fuels from biomass.

"The joint-venture Total Amyris Biosolutions is a first step towards the commercialization of our renewable diesel and jet fuels. We are in the phase of scaling-up the industrial process and we expect to start commercialization within the next few years, once our joint research and development goals are met," said Philippe Boisseau, President, Marketing & Services and New Energies, and a member of Total's Executive Committee. "As far as commercialization is concerned, the new joint-venture will benefit from the know-how and customer access of Total, which operates in more than 130 countries and is aiming to become a key supplier in renewable fuels," Boisseau added.

"The formation of this joint venture, anticipated by our streamlined collaboration agreement signed in 2012, paves the way for us to initiate our fuels commercialization efforts globally, building on Amyris experience with renewable diesel in Brazil and the growing demand for lower-emission jet fuels worldwide," said John Melo, President & Ceo of Amyris, Inc. "Total has been a strategic partner for Amyris for the last three years and a model of how global companies can leverage our inspired science to deliver sustainable solutions for a growing world," Melo added.

Amyris has developed advanced microbial engineering and screening technologies that modify the way microorganisms process sugars. The company based in California is using this industrial synthetic biology platform to design microbes, primarily yeast, and use them as living factories in established fermentation processes to convert plant-sourced sugars into renewable chemical and transportation fuel products.

This technology may help make it possible for producers to blend renewable hydrocarbons produced from sustainable biomass and organic waste into conventional fuel, in significant proportions. Renewable fuels developed by Total and Amyris may deliver energy density and engine performance comparable to the best petroleum fuels.

Sustainable biofuels from Hawaii for Alaska Airlines

[25 July 2013 II Bioeconomista Economy](#), [WorldAlaska Airlines](#), [bioeconomy](#), [biofuels](#), [Hawaii Bioenergy](#)

2 Votes



Alaska Airlines: flight to Honolulu

Alaska Airlines, a subsidiary of Alaska Air Group, and Hawaii BioEnergy LLC announced yesterday they have signed an agreement for the carrier to purchase sustainable biofuel for its aircraft. Founded in 2006, Hawaii BioEnergy is a consortium of three of Hawaii's largest landowners (Kamehameha Schools, Grove Farm Company Inc., and Maui Land & Pineapple Inc.) and three venture capital companies who plan to use locally grown feedstocks to produce biofuels.

Alaska Airlines is Hawaii BioEnergy's second customer, and the first airline to sign a contract. Hawaiian Electric Co. previously announced it had agreed to purchase 10 million gallons of fuel a year from Hawaii BioEnergy for power generation to the state, pending approval by the Hawaii Public Utilities Commission. Hawaii BioEnergy will ramp up production of the sustainable fuels within five years of regulatory approval, allowing Alaska Airlines to begin procuring sustainable jet fuel for its Hawaii flights possibly as soon as fall 2018.

"We are pleased to be partnering with Hawaii BioEnergy to encourage the production and commercial distribution of sustainable fuels," said Keith Loveless, Alaska Air Group's executive vice president and general counsel. "Beyond the environmental advantages, it improves the fuel supply integrity in the state of Hawaii, which will allow for the further growth of our airline operations throughout the Islands."

"Alaska Airlines shares our goals of environmental responsibility and our commitment to sustainable, local energy production," said Joel Matsunaga, executive vice president and chief

operating officer of Hawaii BioEnergy. “The development and commercialization of local, renewable energy is of critical importance to Hawaii, given the state imports 95 percent of its energy needs. Use of locally grown feedstocks for biofuel production will improve Hawaii’s energy sustainability and security while creating jobs in our communities.”

The feedstock for the biofuel is anticipated to be woody biomass-based and will be consistent with the sustainability criteria established by the Roundtable for Sustainable Biofuels, an international multi-stakeholder initiative concerned with ensuring the sustainability of biomass production and processing.

Alaska Airlines has reduced its carbon footprint intensity by 30 percent (measured by revenue passenger miles) since 2004. In 2011, Alaska Airlines and Horizon Air were the first domestic airlines to fly multiple passenger flights powered by a biofuel blend.

Audi partners with Global Bioenergies on drop-in biofuel

[24 January 2014](#) [Il Bioeconomista](#) [Economy](#), [EuropaAudi](#), [bioeconomy](#), [biofuels](#), [Global Bioenergies](#), [renewable resources](#)

1 Vote



Headquarter of Audi in Ingolstadt (Germany)

Global Bioenergies, a French company that is developing a process to convert renewable resources into hydrocarbons through fermentation, announces the signature of a collaboration with the German car-manufacturer Audi on the development of isobutene-derived isooctane, a high performance biofuel for gasoline engines.

Global Bioenergies, a NYSE Alternext Paris listed company, is a pioneer in the development of processes for the direct and cost-efficient transformation of renewable resources into light olefins, the key building blocks of the petrochemical industry. Its most advanced program consists in the production of bio-isobutene, a molecule with multiple applications, one of which allows its transformation into isooctane, the gold standard for gasoline engines (octane number 100). As a 100% drop-in fuel, it can be used in any blending ratio with all standard fuels for gasoline motors. It does not present the drawbacks associated with alcohol-based biofuels such as ethanol or isobutanol which lead to limited blending ratios and lower mileage per liter.

Audi, the world's second-biggest maker of luxury cars (the first is another German company: BMW), is a frontrunner at implementing sustainable solutions for all aspects directly linked to its products. Three parameters are key to Audi in pushing forward the development of new biofuels: the quality of the fuel to ensure optimal compatibility with its engines, the environmental footprint in particular regarding CO₂ emissions and the requirement to use feedstock not in competition with eatable resources.

Thomas Buhl, Head of Business Development at Global Bioenergies comments: "We had recently announced the start of our pre-commercial pilot phase at the Fraunhofer CBP in Leuna allowing obtaining high-purity isobutene which can be used for different applications. One crucial point of our collaboration with Audi will consist in supplying them with isooctane

derived from our isobutene to be produced at that pilot. Furthermore, the collaboration with Audi will enable us to emphasize even more the usage of sustainable feedstock.”

During the two-year collaboration, this agreement also foresees the possibility for Audi to acquire shares of Global Bioenergies corresponding to less than 2% of its capital.

KLM: first flight on biofuels to New York City

[11 March 2013](#) | [Bioeconomista](#) | [Economy](#), [Europa](#), [Worldbiofuels](#), [flight](#), [Klm](#)

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After a series of flights between Schiphol and Paris, Dutch airlines KLM operated its first transatlantic flight on used cooking oil to New York City. The company announced late last week that Thursday’s Flight KL642 flight from John F. Kennedy Airport to Schiphol was made using biofuel, and confirmed the weekly flight will now continue to use the biofuel. The flight between Amsterdam and New York is scheduled to fly every Thursday in the coming 25 weeks.

The Dutch company began to test flights using biofuels in 2009. KLM started with 200 flights between Amsterdam and Paris. Last year, KLM operated its first intercontinental flight on used cooking oil to Rio de Janeiro. On 23 November 2009, KLM operated the world’s first demonstration flight with passengers on board using biofuel. On this flight, one engine ran on a mix of 50% biofuel made from camelina (huttentut). On 29 June 2011, this was followed by the first commercial flight on biokerosene from Amsterdam to Paris with 171 passengers on board. The biokerosene used on this flight was made from recycled cooking oil supplied by SkyNRG. In September a series of flights were operated on this route. With these flights KLM is demonstrating more sustainable operations really are possible.

The aviation industry, policy-makers and producers of agrarian commodities view agrofuels as the solution to growth of the sector. They plan to use about two million tonnes of biokerosene per year by 2020 in Europe, compared to almost none now. This means that about

three percent of all the kerosene in Europe could be bio-kerosene by 2020.

“Our ambition is to fly with 1 percent of bio-kerosene by 2015,” said Camiel Eurlings, KLM corporate director. “That may seem like nothing at all, but I can tell you that this a big step within the world of the aviation industry.”

KLM – says a company’s note – believes flying should be made more sustainable. Despite the economic challenges, KLM is striving on all fronts to reduce its impact on the climate. CO2 reduction and – efficiency are key in this regard. Thanks to fleet renewal and a dynamic fuel-reduction programme, KLM has gained a place among the industry leaders. The aim of the air transport industry (IATA) is to reduce CO2 emissions by 50% in 2050. KLM already strives for a 20% CO2 reduction per ton/kilometer as per 2020 (compared to 2009). KLM believes that only a sustainable alternative to fossil-fuel kerosene can bring a drastic reduction in emission in the medium term. Innovation is key in this regard.

KLM’s approach is distinctive in that a company – SkyEnergy (SyNRG) – has been specially established to give the production and availability of biofuels a real impulse. SkyNRG is a joint venture of KLM Royal Dutch Airlines, North Sea Group and Spring Associates. SkyNRG’s mission is to help create a sustainable future for aviation through actively developing a sustainable production chain for alternative aviation fuels. Today the market for these fuels is just emerging; SkyNRG is taking the first steps to make this a reality. A breakthrough can only be achieved by combining essential expertise and experience in the fields of regulations, effective sustainability criteria, product knowledge and air transport.

The World Wide Fund for Nature in the Netherlands (WWF Netherlands) sees the establishment of SkyNRG as a ground-breaking development. The sustainability of alternative aviation fuels depends on many factors and has to be assessed on a case-by-case basis. To ensure it makes the right decisions now and in the future, SkyNRG is advised by an independent Sustainability Board, consisting of the Dutch chapter of the World Wide Fund for Nature (WWF Netherlands), Solidaridad and the Copernicus Institute of the University of Utrecht.

Link: <http://www.bloomberg.com/news/2014-10-30/italy-to-require-advanced-biofuels-in-gasoline-and-diesel.html>

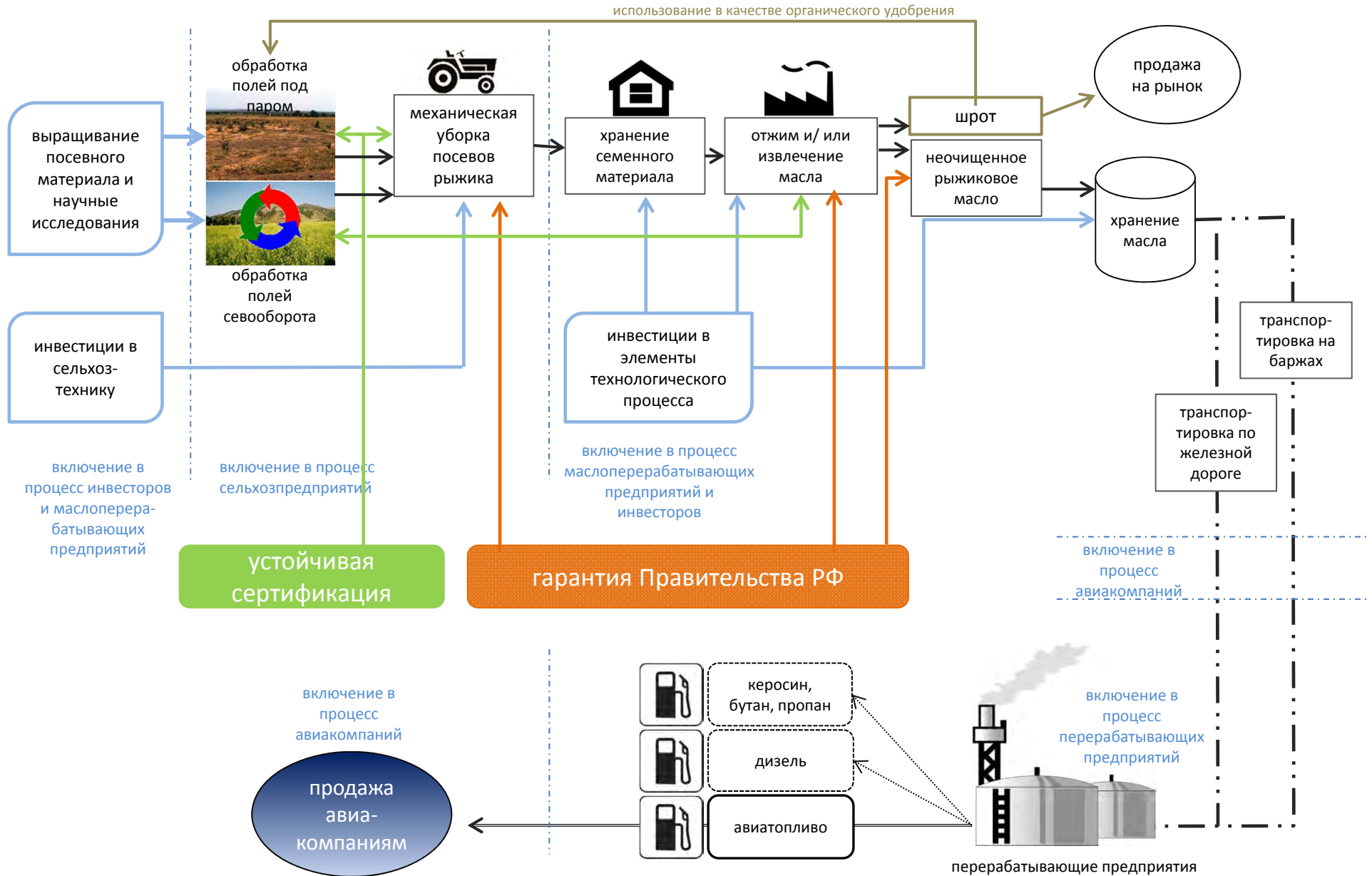
Italy became the first member of the European Union to mandate the use of advanced biofuels.

According to the new legislation, starting in January 2018 gasoline and diesel shall contain at least 1.2 percent advanced biofuel. By 2020 that number will increase to 1.6 percent, and by 2022 it will reach a minimum of 2 percent biofuel.

With this move, the country takes one step ahead of the EU in general, which has decided that by the year 2020 only 7% of its biofuel currently being blended will be from sources considered food (such as corn and wheat), the rest being from feedstocks considered inedible (such as Miscanthus) or from residues.

Food-based feedstocks have been blamed for the increase of food prices, and to that end other sources are being identified, especially cellulose.

Управляющая компания по производству рыжика и биотоплива



11/11/2014 14:44:01

<http://ilbioeconomista.com/2014/11/13/norwegian-carried-out-its-first-ever-flight-with-biofuel/>

SAS and Norwegian operate their first commercial flights on SkyNRG Nordic's bio jet fuel. Today, SAS flies on bio jet fuel from Trondheim to Oslo and Norwegian from Bergen to Oslo. The bio-flights in Norway are done in close cooperation with ZERO and Avinor and are on the occasion of the annual ZERO Emissions Conference.

SkyNRG Nordic, the partnership between SkyNRG and Statoil Fuel & Retail Aviation, has the mission to make the Nordic region the first in the world where all flights are operated on biofuel. Both flights highlight the increased cooperation in the area of bio jet fuel in the Nordic and the willingness to move towards substantial volumes in the coming years.

To catalyze the development of bio jet fuel in the Nordics, SkyNRG established the Fly Green Fund. This fund is set up for corporates in the Nordic that wish to fly more sustainable by operating a part of their staff travel on bio jet fuel. Similar to the KLM Corporate Biofuel Programme, that was co-developed by SkyNRG in 2012, the aim of the Fly Green Fund is to create scale, bridge the current premium for bio jet fuel and to enable investments in the development of sustainable bio jet fuel production from forestry residues and waste in the Nordics.

'These flights can be considered as a warm up for our big plans next year in the Nordic market. With help from our partners and corporate clients, we believe that we can get to substantial volumes in the next two years,' says Dirk Kronemeijer, CEO SkyNRG.

Thorbjörn Larsson, Vice President at Statoil Fuel & Retail Aviation states: 'Another important step on the journey towards greener aviation. Biofuels for aviation are available here and now and I am proud that Statoil Aviation, together with SkyNRG Nordic, are the leading fuel suppliers of biofuels in the Nordic.'

'The Nordic countries are well suited to drive this development, but it requires the involvement of everyone in the entire value chain from raw material supplier, manufacturers, to the passenger. With our innovative co-funding model, The Fly Green Fund, we will involve the end customer in a meaningful and critical way,' says Maria Fiskerud Nordic director SkyNRG.

'That the major airlines in the Nordics are starting to fly on bio jet fuel sends an important signal to the international aviation community. Bio jet fuel exists and the more the product is used, the easier it becomes to increase the volume of production and to realize a competitive price,' says Peter Landmark CEO Karlstad Airport. 'After organizing the first bio jet fuel flights in Sweden with SkyNRG Nordic, we will step up our effort by providing bio jet fuel on a continued basis in 2015.'

Inhalt bereitgestellt von

UmweltCO2-Emissionen in der Luftfahrt steigen ungebremst weiter

Montag, 10.11.2014, 08:42

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dpa/Julian Stratenschulte Der Luftverkehr wächst und wächst - und macht die Bemühungen um eine Reduzierung der CO2-Emissionen zunichte. Die Luftfahrt ist nach Ansicht von Klimaschützern noch weit von einer nachhaltigen Reduzierung der für die globale Erwärmung verantwortlichen Treibhausgase entfernt. Das geht aus dem neuen Klima-Index der Organisation Atmosfair hervor.

Demnach haben die Fluggesellschaften weltweit ihre CO2-Emissionen pro Passagier und Kilometer um 1,3 Prozent gesenkt. Da die Branche aber zeitgleich um 4,8 Prozent zulegte, stiegen die Emissionen insgesamt um 3,5 Prozent. Die Senkung der Emissionen pro Kilometer ist laut Atmosfair vor allem auf den Ersatz älterer Modelle, die Nachrüstung mit aerodynamischen Flügelspitzen („Winglets“) und die bessere Auslastung zurückzuführen.

„Es ist zu befürchten, dass sich der Anstieg der Emissionen auch in den nächsten Jahrzehnten wie bisher fortsetzt“, mahnt Atmosfair- Geschäftsführer Dietrich Brockhagen. Für die anstehende Klimakonferenz in Peru sei ein stärkeres Engagement aller Beteiligten gefragt. Nur so könne das für 2020 anstehende Klimaschutzprogramm für den Weltluftverkehr wirksam an den Start gebracht werden. Brockhagen: „Die Klimakonferenz in Peru braucht mehr Entschlossenheit“.

Unter den 193 weltgrößten Fluggesellschaften ist der deutsche Ferienflieger Tuifly erneut die klimafreundlichste Charterairline. Auch die kleine Regionalfluglinie Tunisair Express verteidigte ihren Spitzenplatz: Dank guter Bestuhlung ihrer hervorragend ausgelasteten Turboprop-Maschinen erreichte sie 84,6 von 100 möglichen Effizienzpunkten (Vorjahr: 83,8). Tuifly kam in der Gesamtwertung mit 83,3 Punkten (Vorjahr: 83,7) auf Rang zwei und führt damit vor der [türkischen](#) SunExpress (80,5) und der britischen Monarch Airlines (80,5) erneut das

Gesamtranking aller Charterfluggesellschaften an.

Die besten Werte in dem Index erreichen Airlines, die moderne und auch für die beflogenen Strecken geeignete Flugzeuge einsetzen, die viele Passagiere darin unterbringen und auch in Kabine und Frachtraum stets voll ausgelastet fliegen. Der deutsche Ferienflieger Condor sank daher trotz effizienter Flugzeuge vor allem wegen einer nur durchschnittlichen Auslastung gegenüber dem Vorjahr von Platz sechs auf Rang 22 in der Gesamtwertung. Auch Air Berlin rutschte aus dem gleichen Grund von Platz zwölf auf den 17. Platz.

Die Lufthansa sackte im Mittelfeld trotz einer leichten Verbesserung ihrer Klimaeffizienz auf Platz 72 (Vorjahr: 67) - hinter der iranischen Aseman Airlines und vor der Royal Air Maroc. Neben einer „leicht unterdurchschnittlichen Bestuhlung“ begründet die Klimaschutzorganisation das mit dem noch immer häufigen Einsatz älterer Flugzeugmodelle. „Die Lufthansa hat es durch ihre Zubringerflüge zudem schwieriger als etwa Chartergesellschaften“, so Brockhagen.

Die russische Zentralbank ändert im Kampf gegen den Verfall des Rubel die Strategie und gibt den Wechselkurs frei. Notenbankchefin Elwira Nabiullina kündigte an, dass ihre Institution bei Bedarf „jederzeit und in ausreichendem Umfang“ mit Interventionen am Devisenmarkt reagieren werde.

Dies gelte insbesondere, wenn aufgrund von spekulativen Kursbewegungen Gefahr für die Finanzstabilität drohe, sagte Nabiullina am Montag. Mit der Freigabe des Rubels droht der russischen Währung ein erneuter Kurssturz. Dieser würde die Kaufkraft der Verbraucher im Land massiv beschneiden und die Inflation anheizen – wenn die Notenbank nicht gegensteuert.

Ab 2015 wird der Rubel frei konvertierbar sein

Der Kurswechsel in Moskau kommt überraschend, da die Notenbanker erst am Mittwoch die Begrenzung der Rubel-Käufe auf maximal 350 Millionen Dollar pro Tag angekündigt hatten. Das war nur noch ein Bruchteil dessen, was die Zentralbank in den vergangenen Wochen in die Hand genommen hatte, um die anhaltende Talfahrt des Rubel abzubremsen. Sie intervenierte immer dann automatisch, wenn der Kurs eines Währungskorbs aus Euro und Dollar eine bestimmte Spanne zum Rubel überschritt. Ab 2015 werde die Währung nun frei konvertierbar sein, betonte die Zentralbank. Die nun angekündigten Stützungskäufe könnten weit größere Summen erfordern.

Putin: Keine fundamentalen Gründe für den Kursrutsch

Der russische Präsident Wladimir Putin hatte die aktuelle Schwäche der russischen Währung am Montag vor allem auf Spekulationen gegen den Rubel zurückgeführt. Fundamentale Gründe für den Kursrutsch der jüngsten Zeit sehe er keine, sagte Putin am Rande des [Asien-Pazifik-Gipfels \(Apec\)](#) in Peking.

Люфтганза. Авиационное биотопливо

Наш путь в небо с использованием экологически чистой энергии

Биотопливо в авиации – инициатива Люфтганзы

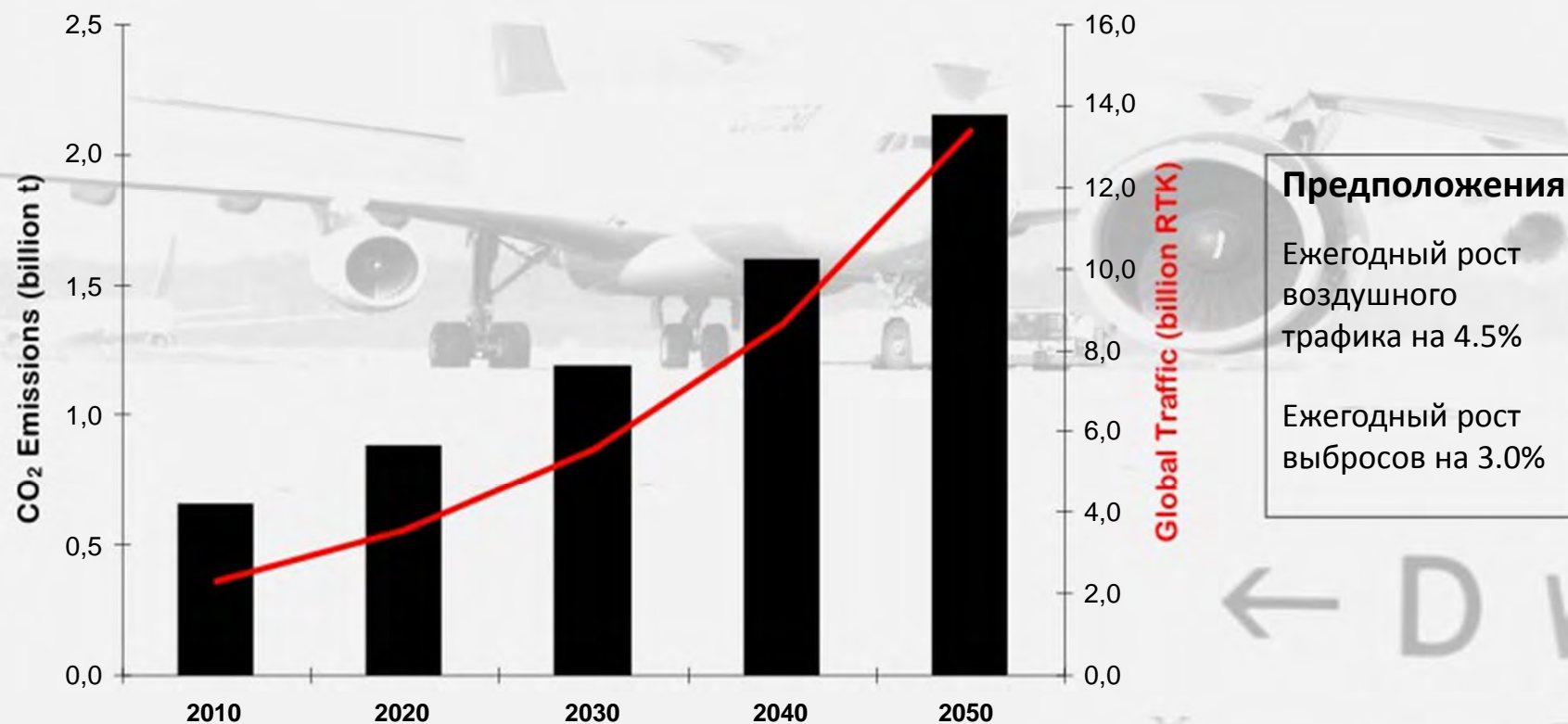
Гамбург, 15 апреля 2011



Jet A-1: Топливо для использования в мировой гражданской авиации

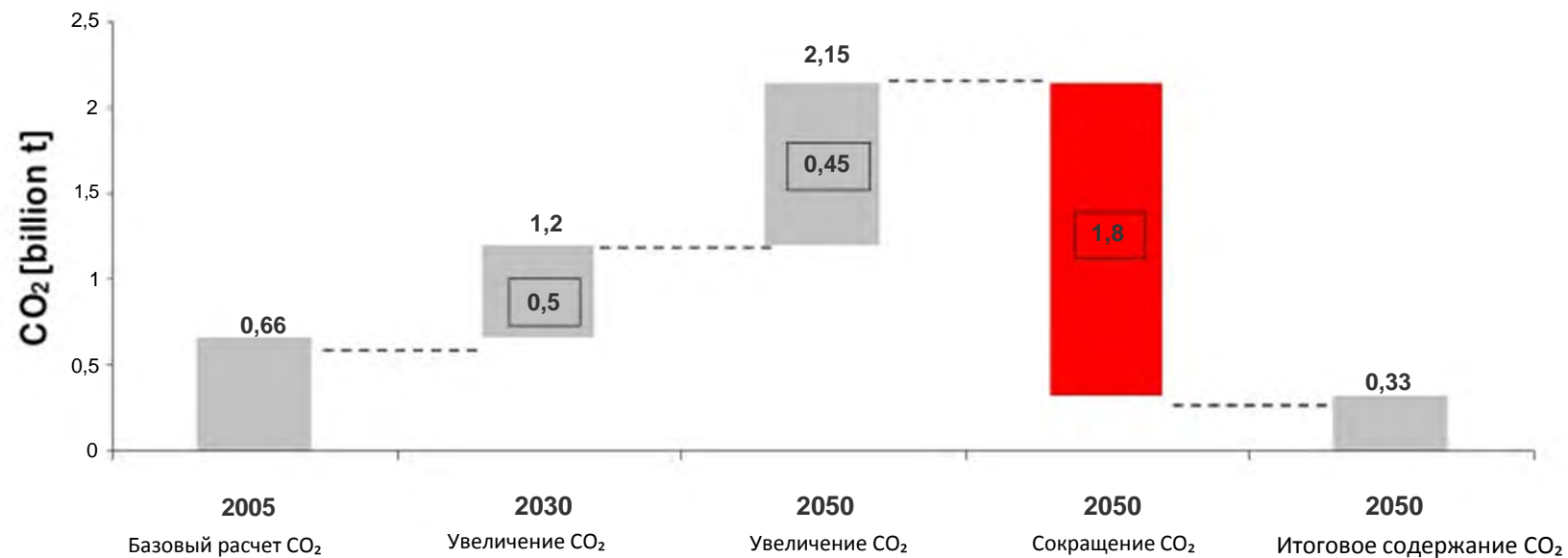
Обозначение	Jet A-1 (керосин - согласно норме ASTM D1655)
Допуск к использованию	1960 для турбореактивных двигателей
Группа продуктов	средний дистиллят сырого масла, похоже на автомобильный дизель
Сжигание	3,15 тонн CO ₂ на тонну Jet A-1
Длина углеродной цепочки	C9 - C13
Температура замерзания	- 47°C
Доля на мировом рынке	ок. 5% от количества мировой добычи сырой нефти
Расход компанией Люфтганза в 2010г.	11,2 млн м ³ (= 1.000 топливозаправщиков в день)

Выбросы CO₂ в авиации будут увеличиваться



Source: Booz & Company, WEF, Davos 2011

Необходимо ежегодное сокращение уровня CO₂ на 1,8 млрд тонн



Source: Booz & Company, WEF, Davos 2011

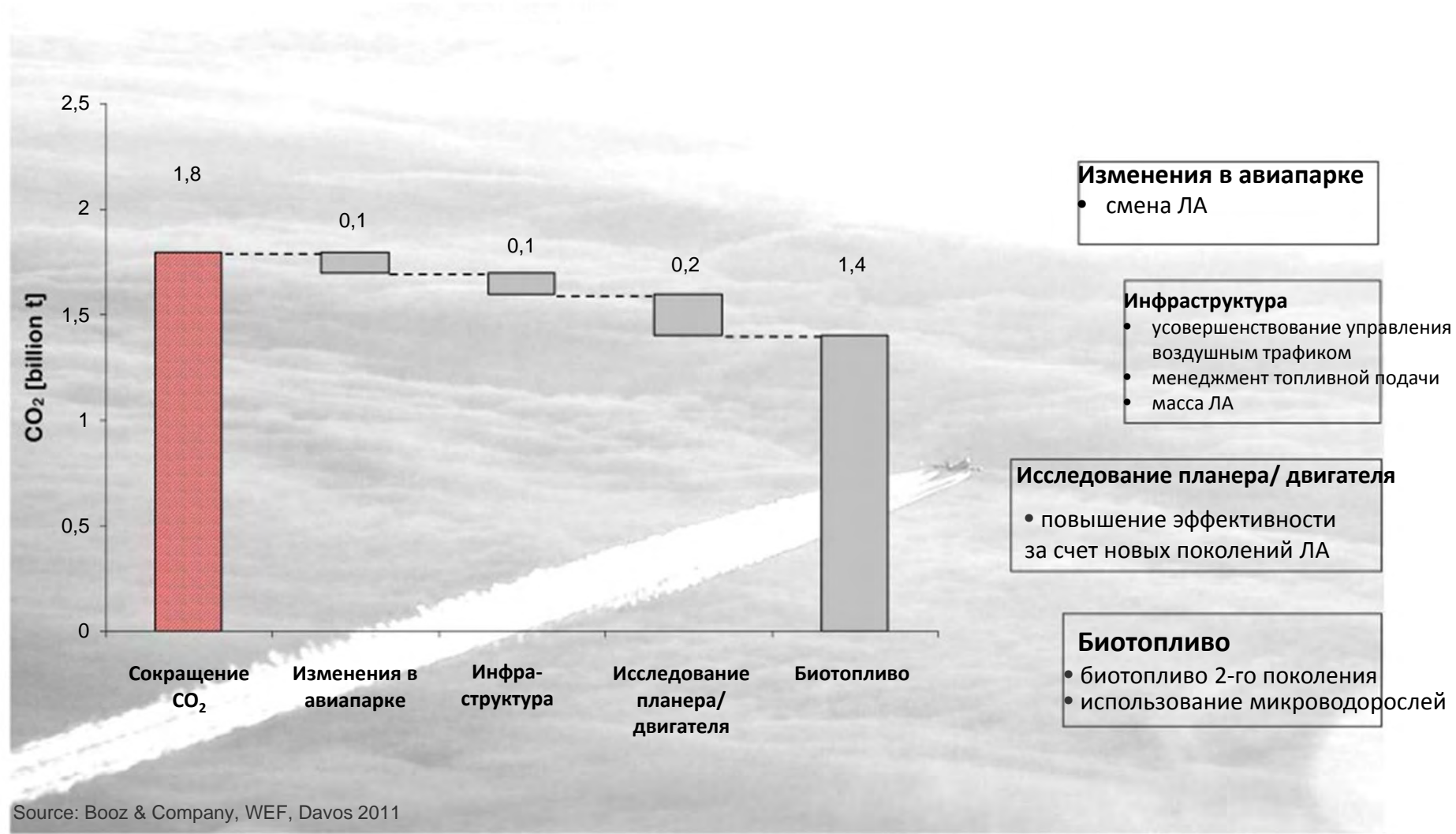


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Lufthansa

Как сократить разрыв



Изменения в авиапарке

- смена ЛА

Инфраструктура

- усовершенствование управления воздушным трафиком
- менеджмент топливной подачи
- масса ЛА

Исследование планера/ двигателя

- повышение эффективности за счет новых поколений ЛА

Биотопливо

- биотопливо 2-го поколения
- использование микроводорослей

Авиационное биотопливо: Экологически чистая альтернатива керосину Jet A-1

- **Обзор**

- биосинтетическое топливо из биомассы или отходов (бытовые или производственные отходы)
- полная совместимость с Jet A-1
- совместное хранение и смесь с Jet A-1
- отсутствие необходимости конструктивных изменений в двигателях
- совместное использование существующей логистической инфраструктуры
- допускается или признается допустимым смешивание с Jet A-1 до 50% доли от общего объема



Авиационное биотопливо: Экологически чистая альтернатива керосину Jet A-1

- **Преимущества**

- Улучшенный баланс углерода за счет углеродной связи биомассы путем фотосинтеза
- Топливо без содержания серы и запахов, слабое соединение частиц технического углерода
- Использование при производстве биотоплива различных сырьевых материалов и двух способов переработки



- **Недостатки**

- Доступность
- Цена

Способы производства биосинтетического керосина

- **1. Керосин на основе жидкой биомассы (BtL-FT-керосин)**

Сырье

- Древесина, древесные отходы, солома
- Бытовые и производственные отходы

Процесс производства

- Многоступенчатое превращение в синтез-газ

Очистка

- Мокрая очистка газов и синтез по методу Фишера-Тропша (синтез углеводорода на базе окиси углерода и водорода)

Продукт

- BtL-FT-керосин



Способы производства биосинтетического керосина

- **2. Керосин на основе гидроочищенных растительных масел (HVO-керосин)**

Сырье

- Пальмовое, соевое, рапсовое масло
- Масло ятрофы, масло рыжика
- Масло из сухой водораслевой массы

Процесс производства

- Отжим, гидрирование

Очистка

- Дестилляция

Продукт

- HVO-керосин или гидроочищенное возобновляемое топливо (HRJ)



Авиационное биотопливо – сравнительная характеристика с Jet A-1

Свойство топлива	Jet A-1	BtL-FT	HVO
Стандарт	ASTM D1655	ASTM D7566 ASTM D1655	ASTM D7566 Annex 1 ASTM D1655
Допуск к использованию	1960	2009	2011
Температура замерзания	- 47° C	- 47° C - - 69° C	> - 47° C
Плотность	0,78 - 0,82	0,72 - 0,75	0,72 - 0,75
Энергосодержание	100%	104%	104%
В смеси с Jet A-1	-	≤ 50%	≤ 50%



Цели охраны окружающей среды 2010 – 2020 – 2050 (ИАТА)

2010

1.5 %
эффективно
используемого
топлива ежегодно
работает в
направлении
нейтрального
выброса CO₂

2020

Нейтральный
рост CO₂ с 2020
года

Реализация
глобального
отраслевого
подхода

2050

Снижение чистых
выбросов CO₂
на 50% по
сравнению с
уровнем
2005 года

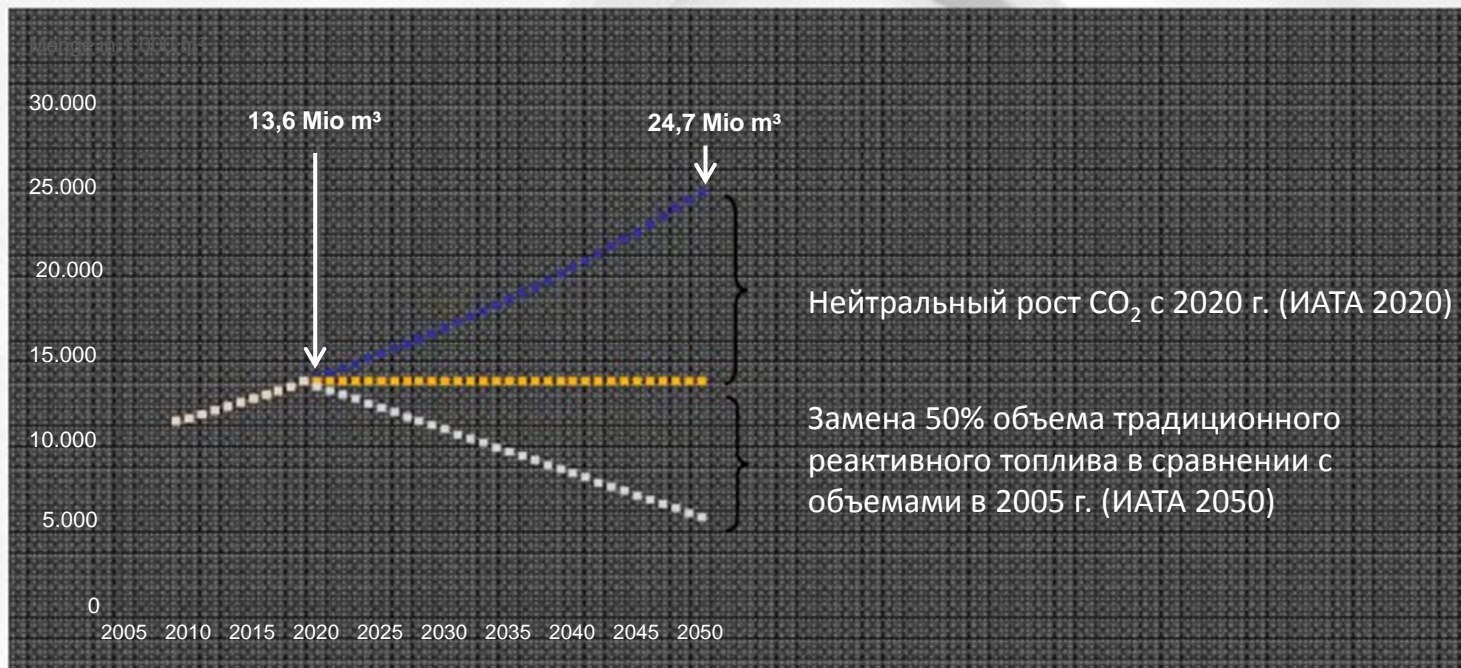


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Lufthansa

Реализация целей ИАТА в группе компаний Люфтганза



Количество в 2020 г.: 530 000 m³ биосинтетического топлива (до 4% от общего количества)

Количество в 2025 г. : 3 200 000 m³ биосинтетического топлива (до 18% от общего количества)



Люфтганза – перспективы на 2020 / 2025 гг.

Сырьевая база является решающим фактором!

Территориальная конкуренция в Германии и ЕС ведет к переориентации на Восточную Европу, где представляется возможным и выращивание рыжика, и развитие лесопромышленности.

Шансы и риски для развивающихся стран!

Возможно выращивание ятрофы, моринги и развитие устойчивого производства пальмового масла.



Люфтганза – перспективы на 2020 / 2025 гг.

- Избежание расширения пустынных площадей
 - Избежание переселения сельского населения в города
 - Избежание подсечно-огневого земледелия
 - Занятость населения за счет развития местного производства
 - Биологическое разнообразие и устойчивое развитие сельского хозяйства
-
- Конкуренция с пищевой промышленностью!
 - Косвенные изменения в землепользовании!



Потребность компании Люфтганза в сельхозплощадах под биомассу в 2025г.



Рапс 68.403 км²

Бавария 70.551 км²

Ятрофа 48.023 км²

Ниж. Саксония 47.624 км²

Пальмовое масло 13.680 км²

Тюрингия 16.172 км²

Водоросли 30% 1.387 км²

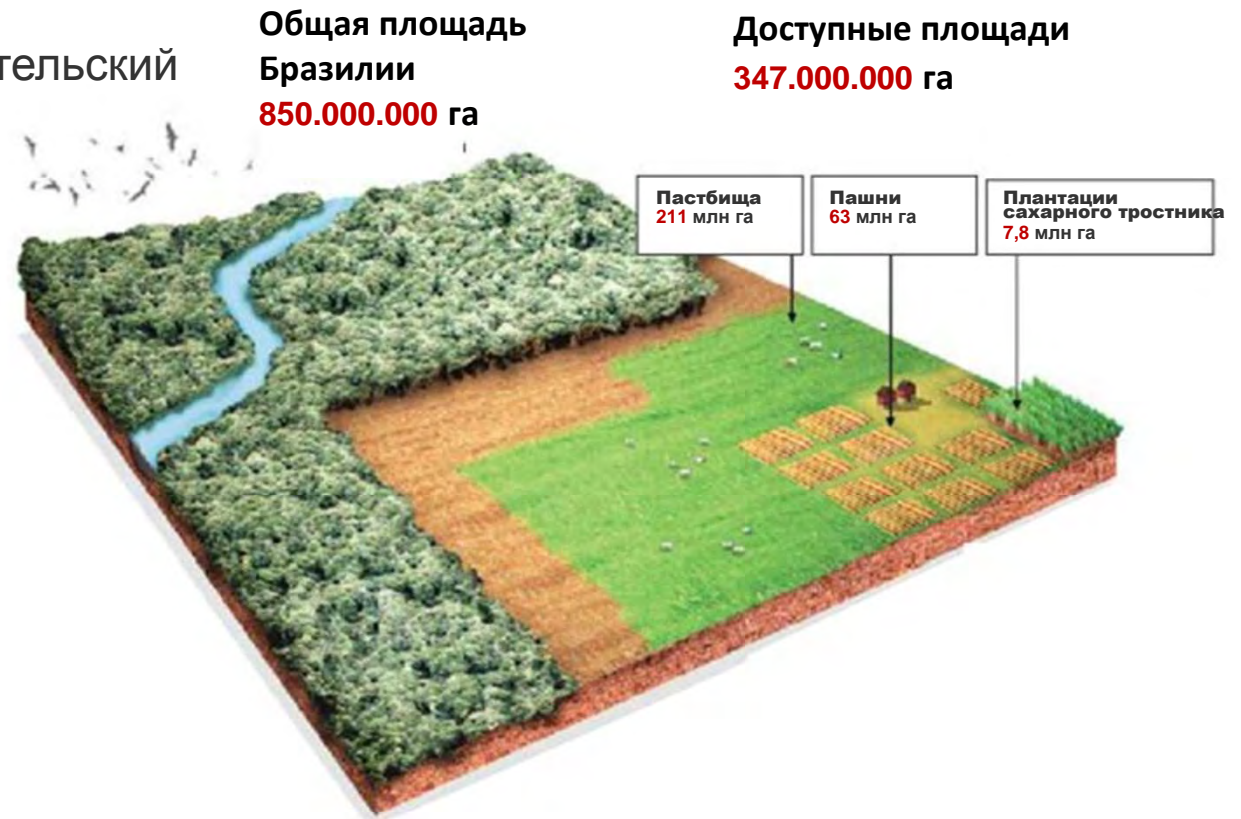
Берлин и Бремен 1.310 км²

Водоросли 70% 625 км²

Гамбург 750 км²

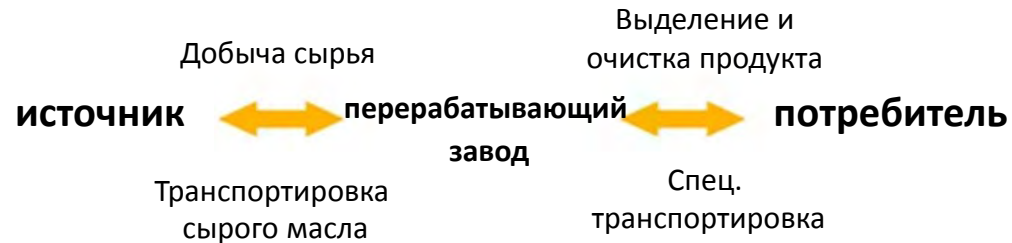
Бразилия в качестве примера страны для последующего выращивания энергокультур

- Доступность сельхозплощадей
- Сторонник устойчивости
- Высокий научно-исследовательский потенциал

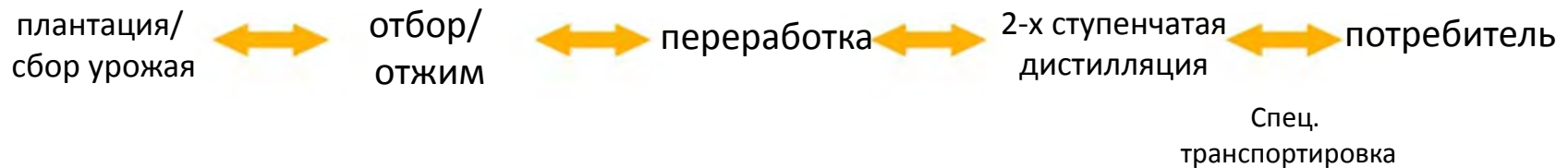


Сравнение керосина Jet A-1 с биотопливом по уровню сложности

- ископаемое топливо



- биотопливо



- Высокий уровень сложности
- Несколько шагов от этапа выращивания до потребителя
- Некоторые сдерживающие факторы
- Более высокая степень сезонного влияния

Партнеры компании Люфтганза по биотопливной инициативе

Университеты и научные учреждения

Проф. д-р Кальтшмит

Технический университет Гамбурга – Гарбург

Проф. д-р Гольник

Технический университет Гамбурга – Гарбург

Проф. д-р Хорнунг

Технический университет Мюнхена/
Высшая школа авиационного строительства

Проф. д-р Бэкер

Университет Штуттгарта - Хоэнхайм

Проф. д-р Айгнер

Университет Штуттгарта/ Германский центр
авиации и космонавтики – Институт техники
сжигания

Проф. д-р Вильнер

Высшая школа прикладных наук, Гамбург

Проф. д-р Шальтеггер

Университет Лейфана в Люнебурге

Проф. д-р Пульц

Высшая школа Лаузитц в Зенфтенберге

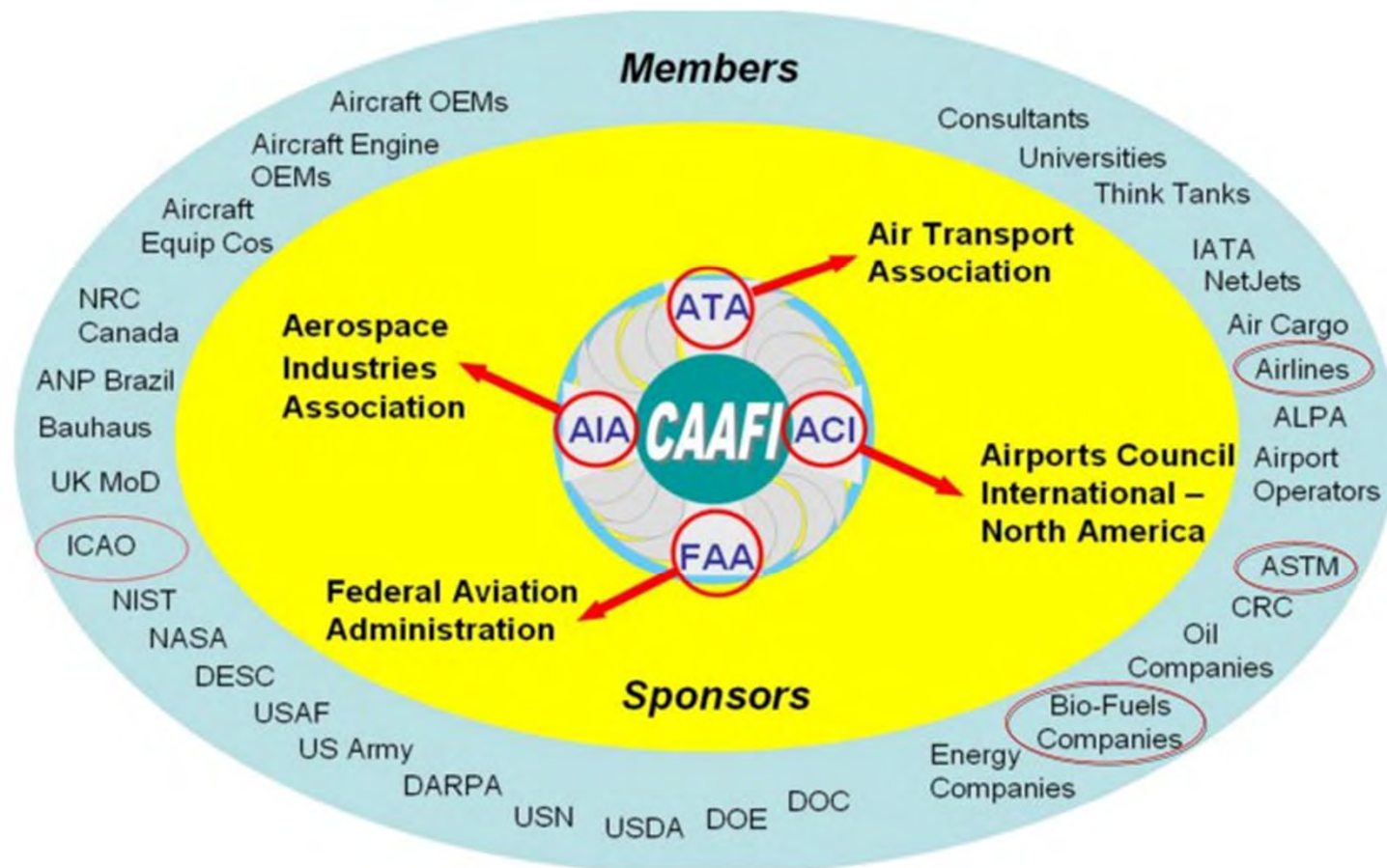
Д-р Хенкес / Д-р Бройер

Германское общество международного
сотрудничества, Эшборн



Коммерческая инициатива по использованию альтернативного авиатоплива (CAAFI)

Структура членства



От теории к практике: Длительные биотопливные испытания компании Люфтганза

- Исследовательский проект „burn FAIR“:
Использование биотоплива на регулярных маршрутах
- 4-х дневные рабочие циклы A321 по маршруту
Гамбург – Франкфурт/ Майн – Гамбург
на протяжении 6 месяцев
- Заправка самолета только в Гамбурге
Двигатель работает на смеси из авиакеросина Jet A-1
и гидроочищенного возобновляемого топлива
при соотношении 50-50
- Исследовательский проект при участии
12 университетов и партнеров-производителей
при поддержке BMW



Предложения Люфтганзы

- **Создание национальных коопераций в научной, политической и предпринимательской сферах для определения совместных целей**
- **Общий уровень деятельности "CAAFI - Германия"**
- **Создание кластеров с целью повышения эффективности процесса добычи и переработки сырья**
- **Концентрация на перспективных проектах**
- **Усилить развитие биотехнологий в Германии – меньше импорта**
- **Стартовое финансирование вместо долгосрочных субсидий на новые технологии**
- **Обеспечение долгосрочной сырьевой базы для лучшей мобильности**
- **Разработка кросс-секторальной топливной стратегии**

Начало – это уже половина пути к успеху.

(корейская мудрость)



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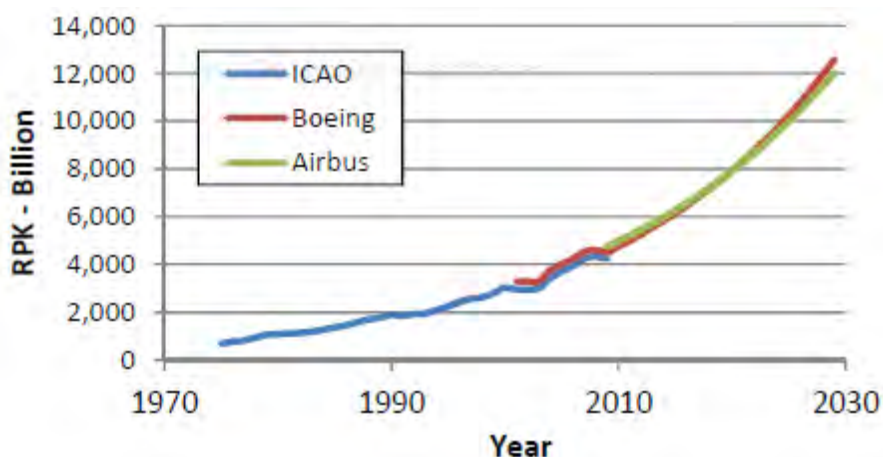
Ресурсы, шансы и реальные

В настоящее время в Европе и во всем мире ведутся активные поиски источников получения биотоплива, в том числе авиатоплива, а также развивается тенденция увеличения его доли в составе минерального топлива (50%-50%). Решение Европейского Союза по поводу введения дополнительных требований и норм к выбросу парниковых газов над европейским пространством было перенесено на более поздний срок. В связи с этим ведущие авиастроительные компании уже сейчас усовершенствуют разработки самолетов новых поколений. Так, например, Аэробус Airbus обещает, что A330-neo станет расходовать на 14% меньше топлива в расчете на одного пассажира, чем аналоги. Кроме того максимальная дальность полета A330-neo увеличится на 400 миль.

Одновременно с этим мировое потребление биотоплива ежегодно растет в среднем на 1,5% и уже составляет порядка 10%.

Международная ассоциация воздушного транспорта (ИАТА) прогнозирует ежегодный рост коммерческой авиации на 5% вплоть до 2030 года. А так же повышение топливной эффективности примерно на 3%. **Следствием этого является увеличение расхода топлива и увеличение выбросов!**

Рост воздушного движения измеряется в коммерческих пассажир-километрах (РПК) и используется двумя ведущими мировыми производителями самолетов, Airbus и Boeing, для прогнозирования дальнейшего развития. В данной связи они предсказывают рост с 2010 до 2030 года до 4,8% и 5,1% (Airbus, 2011; Boeing, 2011). Единицей измерения в данном случае является увеличение пассажир-километров. Но чем больше пассажир-километров, тем выше расход топлива.



Авиакомпании должны действовать в рамках поставленных целей и взятых обязательств за счет добровольных сбережений, прописанных в инициативе ИАТА «Flightpath», чтобы предоставить общественности промежуточные результаты на пути достижения глобальной цели.

ИАТА обязалась достичь нейтрального роста углерода к 2020 году и сокращения CO₂ к 2050 году на 50%. Важным шагом было создание системы европейского союза по торговле выбросами (СТВ ЕС), хотя это оспаривается различными авиакомпаниями, особенно американскими и китайскими.

Поэтому основными целями коммерческой авиации являются: 1) поиск надежных альтернативных видов топлива, 2) снижение затрат и стабильность цен на топливо, 3) минимизация климатических воздействий и 4) улучшение топливной логистики.

Использованию биокеросина в коммерческой авиации это ответ на вызовы со стороны организаций по защите окружающей среды и правительственных обязательств, зафиксированных в Кийотском протоколе и Законе о возобновляемых источниках энергии.

Таким образом, почти все крупные коммерческие авиакомпании, а также некоторые военные секторы (США), активно участвовали в тестировании и разработке биокеросина. Учитывая высокое качество смесового топлива, применяемого в авиации, конверсионные технологии производства керосина из биомассы весьма ограничены, но не являются главным препятствием.

Тем не менее на сегодня существует ряд технологий, которые дают высокие результаты. К числу наиболее реальных и востребованных сырьевых источников для керосина относится рыжик посевной (camelina, lat.)

Рыжиковое масло содержит длинные цепочки углеводов, которые наиболее пригодны для авиационного топлива. На первом этапе в процессе гидрирования из рыжикового масла удаляется кислород, который снижает стабильность топлива и эффективность процесса его сгорания в реактивных двигателях. Продуктами гидрирования, дистилляции и сепарирования являются биокеросин и (в меньшем количестве) другие продукты, в частности, биодизель.

Биокеросин уже доказал свою пригодность в качестве готовой замены традиционного авиационного топлива при использовании его в смеси в пропорции 50-50 с обычным или синтезированным авиакеросином. В чистом виде биокеросин, полученный методом гидрирования растительных жиров, не отвечает стандартам ASTM и не может заменить традиционное топливо, поскольку некоторые его свойства при низких температурах не соответствуют предъявляемым требованиям. Смесь биокеросина с обычным топливом в соотношении 50-50 отвечает всем требованиям, предъявляемым к авиатопливам, а также способствует снижению выбросов парниковых газов в авиации. Компанией Боинг и вооруженными силами США было проведено множество тестовых полетов с использованием смеси 50-50 традиционного керосина и топлива из рыжика, которые доказали, что такая смесь является полноценной заменой традиционному топливу и не требует никаких изменений в авиатехнике. **Тем самым были подтверждены возможность использования рыжика для биотопливного производства и потенциал сокращения выбросов парниковых газов до 65%.**

Тем не менее, практически все авиакомпании, стоят перед одной и той же проблемой: отсутствие устойчивого сырья в достаточном количестве и высокие затраты на производство биокеросина в независимости от технологий. Самая большая сложность при этом – снижение производственных затрат, которые пока что больше чем в два раза выше затрат на производство традиционного авиакеросина.

Авиатопливо: спрос и ценовая политика:

- Согласно прогнозам, спрос на авиакеросин будет ежегодно расти на 1,5%
- Азиатско-тихоокеанский регион станет лидером в росте спроса (3,2% с 2010 по 2030г.)
- Среднегодовой темп роста в Индии составит до 2030г. 4-4,5%
- Средняя цена на авиакеросин в 2000-2008гг. составила \$62,3/баррель
- Самая высокая цена была установлена в июле 2008 – \$167/баррель
- Авиационное биотопливо могло бы стоить к 2030г. \$80/баррель (при приведенных затратах \$250-сегодня: 230/барр).

В настоящее время инструментом сертификации устойчивого авиакеросина (SAF – устойчивое авиатопливо) является ASTM D7566 и стандартизированные и сертифицированные по стандартам ASTM две технологии производства

- 1) По технологии Фишера-Тропша (FT) производится гидросинтетический парафиновый керосин (SPK).
- 2) Технология гидрирования эфирных масел и жирных кислот (HEFA) лежит в основе производства гидрированного возобновляемого авиатоплива (HRJ), который также известен под названием биосинтетический парафиновый керосин (Bio-SPK).

При этом ни SPK-, ни BioSPK-керосин не могут использоваться в чистом виде – только в составе так называемой топливной смеси с максимальной долей в 50%.

Проведенные тесты авиобензина и экспериментальные полеты

1.2.1 Testing (demo) flights

Table 1.1. Testing (demo) flights conducted since 2008 [10].

Carrier	Aircraft	Partners	Date	Biofuel	Blend
	B747-400	Boeing, GE Aviation	23 Feb 2008	Coconut & Babassu	20% one engine
	A380	Airbus, Rolls-Royce, Shell	1 Feb 2008	Gas to Liquid (not biofuel)	50% one engine
	B747-400	Boeing, Rolls-Royce	30 Dec 2008	Jatropha	50% one engine
	B737-800	Boeing, GE Aviation, CFM, Honeywell UOP	7 Jan 2009	Algae and Jatropha	50% one engine
	B747-300	Boeing, Pratt & Whitney, Honeywell UOP	30 Jan 2009	Camelina, Jatropha, Algae blend	50% one engine
	A340-600	Airbus, Shell	12 Oct 2009	Gas to Liquid (not biofuel)	50% four engines
	B747-400	GE, Honeywell	23 Nov 2009	Camelina	50% one engine
	A319	Rentech	30 Apr 2010	Gas to Liquid (not biofuel)	40% two engines
	A320	Airbus, CFM	23 Nov 2010	Jatropha	50%
	A320	CFM, Safran, EADS, Airbus, Honeywell	1 Apr 2011	Jatropha	27%
	G450	Rolls-Royce, Gulfstream	18 Jun 2011	Camelina	50% one engine
	B747-8F	GE, Honeywell	20 Jun 2011	Camelina	15% four engines
	B747-400	Boeing, PetroChina, Pratt & Whitney, Honeywell UOP	28 Oct 2011	Jatropha	50% one engine
	300 ER	Boeing	24 Jan 2012	Recycled Vegetable Cooking Oil	TBC
	787 Dreamliner	Boeing	17 Apr 2012	Used Cooking Oil	TBC
	E190	Embraer, Amyris, GE Aviation	19 Jun 2012	Sugarcane	TBC

Table 1.3. Stakeholders that provided information.

Stakeholder	Technology	Location
Neste Oil [12]	HEFA	Finland
Ineos [13]	ATJ	US/Norway
BTG [14]	Pyrolysis	The Netherlands
Solena [15]	FT	US

Кроме того, следует отметить, что на сегодняшний день существуют только две компании, имеющие в распоряжении технологии для производства синтетического авиакеросина - это Neste ойл с технологией NexBTL, Финляндия и Honeywell/UOP, США. Neste ойл в состоянии перерабатывать неограниченные количества рыжикового масла на трех заводах, где установлена технология, в частности в Роттердаме и Сингапуре (2x 1 млн тонн биотоплива) и в Порвоо. Neste ойл ввела в действие три завода в США и один в Северной Италии.

С другой стороны, практически все нефтяные концерны мира и крупные научно-исследовательские учреждения во многих странах мира тратят миллиарды бюджета на развитие и совершенствование технологий для производства биотоплива и авиатоплива. При этом в процессе задействованы ведущие страны и материки, новейшие технологии и крупнейшие авиакомпании. Тема «Биотопливо в авиации» становится главной в мировом сообществе XXI-го века. Мировые авиакомпании занимаются разработкой не только новых авиаконструкций, но и возобновляемой альтернативы минеральному топливу.

Компания „Camelina sustainable oil project ltd”, Germany обладает не только инсайдерской информацией по ситуации в этом спектре в Германии и Европе, но и имеет прочные контакты с рядом исследовательских бюро заинтересованных в тестах рыжикового масла и технологическому сотрудничеству.