

Biofuels for Aviation

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Executive summary

This brief reviews a range of different targets for emissions reduction in aviation to the year 2050 and estimates the quantity of bio jet fuels required to meet these targets under a number of growth scenarios. Direct emissions from civil aviation currently account for about 3% of total EU greenhouse gas emissions. Biofuels can help lower the EU's carbon footprint by providing a renewable alternative to jet fuel in airliners. Biofuels emit less CO₂ and contain no sulphur compounds.

This analysis shows that in the absence of action, emissions from EU-28 aviation will grow from 151 Mt of CO₂ to 405 Mt in 2050. This represents a 167% increase on 2005 levels. Results indicate that for a 'Hitting the Target' scenario, where emissions are reduced to 50% below 2005 levels, an average annual growth rate in biofuels of approximately 13% is required from 2020. This translates into the production of 85 Mtoe of bio jet fuel in 2050 representing 77% of final energy demand in aviation in 2050. The additional costs for bio jet fuels are between 0.42 €/L and 1.20 €/L. These costs if spread across all domestic and intra-EU-28 flights in 2020 would add between €1.20 and €4.30 to the cost per passenger of a typical 1000 km flight. This is based on achieving the current EU ambition of 2 Mt of bio jet fuel production in 2020.

Aviation is one of the strongest growing transport sectors. Global airline operations consumed approximately 1.5 billion barrels of Jet A-1 fuel producing 705 million metric tonnes (Mt) of CO₂ in 2013, producing just under 2% of the total of man-made CO₂ emissions. In the period up to 2050, worldwide aviation is expected to grow by up to 5% annually. If fuel consumption and CO₂ emissions were to grow at the same rate, CO₂ emissions by worldwide aviation in 2050 would be more than six times their current figure¹.

Europe is home to approximately 3,800 passenger aircraft and over 700 commercial airports (with more than 15,000 passenger movements per year) which supported the free movement of 842 million passengers in 2013 (as reported by Eurostat), an increase of 1.7 % on 2012 levels. CO₂ emissions from aviation in 2012 in Europe were 149 MT

representing 12.9% of total transport emissions. Final energy consumption in aviation 2012 was 49.1 Mtoe or 14% of transport energy usage.

European Policy Context

A number of targets and policy instruments exist that concern biofuels (including bio jet fuels) and Figure 1 presents a graphical overview of medium and long term policy targets for aviation at EU and a global level. The EU's Renewable Energy Directive (RED) sets a binding target of 20% gross energy consumption from renewable sources by 2020 (20% RES). To achieve this, the Directive allocates individual targets to Member States ranging from 10% in Malta to 49% in Sweden. Each Member State is also required to have at least 10% of their transport fuels from renewable sources (10% RES-T) by 2020. It is anticipated that liquid biofuels in road transport will make the largest contribution to the 10% RES-T target owing to the fact that road

¹2 million tons per year: [A performing biofuels supply chain for EU aviation. EC \(2013\)](#)

transport accounts for 72% of transport emissions (EU-28, 2012). In the case of both targets, only biofuels that meet specific sustainability criteria can be included. The denominator for the 20% RES target includes energy use in aviation, while the numerator includes all forms of renewable energy in all forms of transport. Therefore, in principle, bio jet fuel usage can also count towards the 20% RES target.

The Fuel Quality Directive (FQD) sets a 6% target of GHG emission reduction from all energy used in road transport and non-road mobile machinery for 2020 compared with 2010. The FQD target does not apply to aviation fuel, but is expected to be a driver for increased road biofuels, alongside the RED. Under the RED the current GHG savings threshold (one of the sustainability criteria) is 35% for all biofuels, increasing to 50% from 1 January 2017 for existing installations and 60% from 1 January 2018 (for installations that start producing biofuels after 1 January 2017). Equally biofuels cannot be grown in areas converted from land with previously high carbon stock such as wetlands or forests and biofuels cannot be produced from raw materials obtained from land with high biodiversity such as primary forests or highly biodiverse grasslands².

In 2011, the European Commission adopted a White Paper on Transport³ which includes 40 initiatives to build a competitive transport system that will increase mobility, remove major barriers in key areas and fuel growth and employment. The roadmap aims to dramatically reduce Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050. Also there is an ambition of 40% use of sustainable low carbon fuels in aviation.

The 2013 Directive on the deployment of alternative fuels infrastructure⁴ acknowledges the fact that aviation can rely only on alternative *liquid* fuels of drop-in type (and for the time being, biofuel remain the main alternative). This contrasts with other transport modes which can rely on electricity, LNG, hydrogen. The Trans-European Network for Transport (TEN-T) guidelines recognise that alternative fuels serve, at least partly, as a substitute for fossil oil sources in the energy supply

² ec.europa.eu/energy/node/73

³ [Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system. EC 2011](#)

⁴ [Directive \(2014\)/94/EU of the European parliament and of the council on the deployment of alternative fuels infrastructure. EC \(2014\)](#)

to transport, contribute to its decarbonisation and enhance the environmental performance of the transport sector. In its 2014 Communication⁵, the European Commission proposed a policy framework for climate and energy covering the period from 2020 to 2030, in which the goals for transport echo those from the 2011 White Paper on Transport but without specifying the role of biofuels, i.e. leaving it free for Member States to opt for other alternatives such as electric cars, etc.

The Biofuel FlightPath Initiative⁶ was introduced in June 2011. The European Commission with Airbus, Air-France-KLM, British Airways, Lufthansa and biofuel producers Chemtex Italia, Neste Oil, Biomass Technology Group, UOP and Swedish Biofuels are targeting 2 Mt annual production of fuel derived from renewable sources by 2020. This equates to approximately 1% of the total world jet fuel consumption in 2020 or 4% of EU jet fuel consumption. To put this in context, in 2013 approximately 13.1 Mt of biofuels were consumed in *all forms of transport* in Europe. Alternative jet fuels are currently produced in small quantities compared to both jet kerosene and to corn ethanol. While there are no specific figures for Europe in terms of volumes consumed, over 200 flights were operated globally in 2014 using alternative jet fuel and in the last decade over 1600 commercial flights have occurred by 21 different airlines. In 2011, Lufthansa became the first airline worldwide to use a biofuel mix in scheduled daily operations when it conducted a six-month test run with an Airbus A321 on the Frankfurt-Hamburg route totalling over 1188 flights involving 800 tons of bio jet fuel.

Ambition to 2050

There are a number of Global and European targets for emissions reduction and alternative fuel use in aviation. The goals pursued by the Advisory Council for Aviation Research and Innovation in Europe (ACARE) in terms of GHG emissions are a 50% reduction in CO₂ per passenger kilometre by 2020 (relative to 2000 levels) and a 75% reduction by 2050⁷. These targets are therefore independent of traffic growth.

At a global level, the International Air Transport Association (IATA) has also set ambitious targets to

⁵ ec.europa.eu/clima/policies/2030/index_en.htm

⁶ <http://ec.europa.eu/energy/en/topics/biofuels/biofuels-aviation>

⁷ [Flightpath 2050 Europe's Vision for Aviation Report of the High-Level Group on Aviation Research. EC 2011](#)

curb fuel consumption and mitigate emissions from aviation in its Carbon Neutral Growth initiative, according to which the aviation industry has committed to an average improvement in fuel efficiency of 1.5% per year from 2010 to 2020 and a cap on aviation CO₂ emissions from 2020 (carbon-neutral growth). By 2050, the ambition is to reduce CO₂ emissions from aviation by 50% relative to 2005 levels.

In 2013, at the 38th Session of the International Civil Aviation Organization (ICAO) Assembly, member reaffirmed ambition for collective global aspirational goals for the international aviation sector to improve annual fuel efficiency by 2%, and

to limit CO₂ emissions at 2020 levels. The Assembly also defined a range of measures designed to help achieve these goals. This includes: technology improvements, operational changes, alternative fuels such as bio jet fuels, and market-based measures. However it was recognized that the aspirational goal of 2% annual fuel efficiency improvement is unlikely to deliver the level of reduction necessary to stabilize, and then reduce, aviation’s absolute emissions contribution to climate change, and that more ambitious goals will need to be considered to deliver a sustainable path for aviation. To date, no long term binding targets exist.

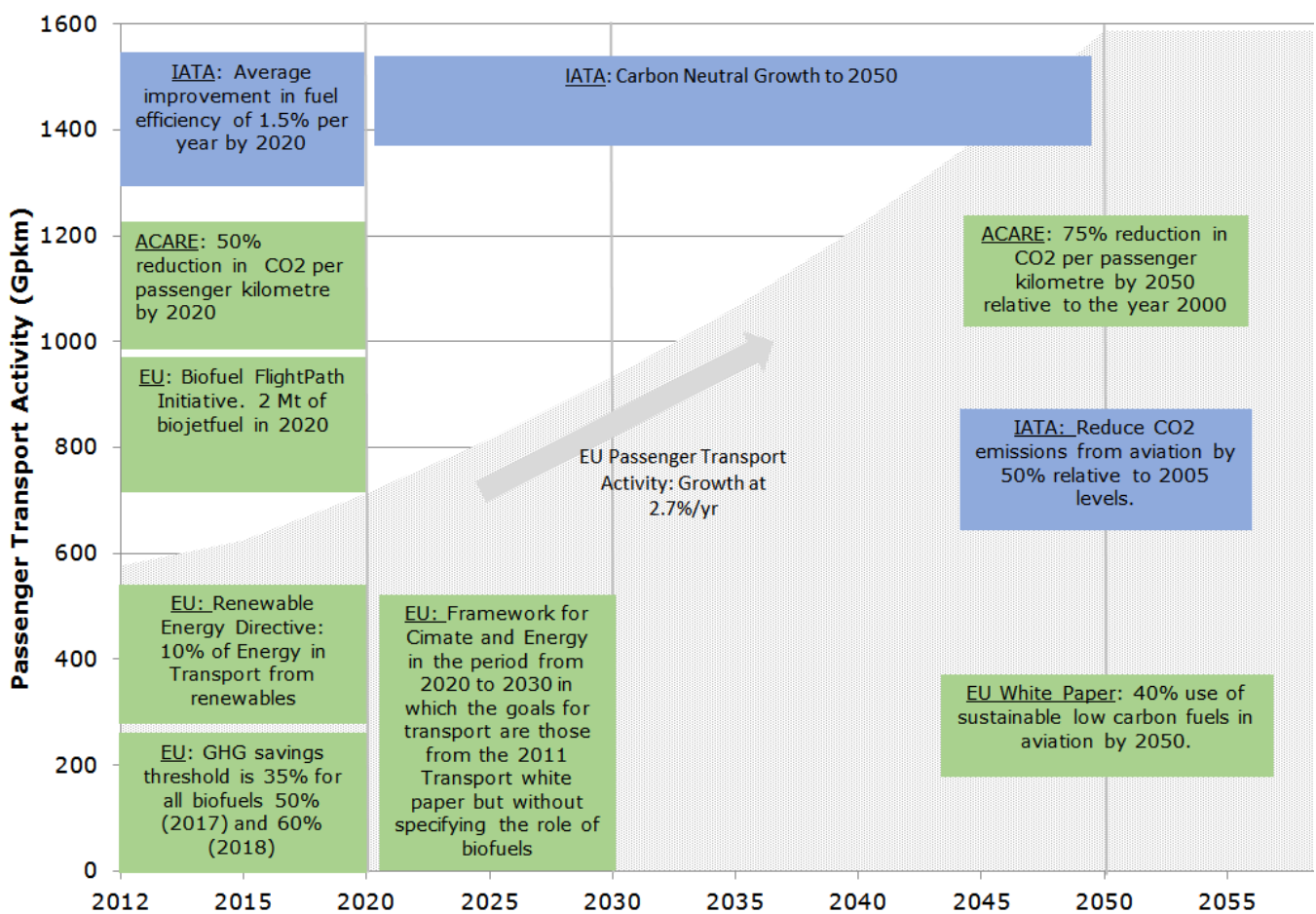


Figure 1: EU (green) and Global (blue) Policy Landscape to 2050

Long Term Passenger Forecasts

A primary driver for emissions in aviation is passenger activity. This section briefly reviews passenger forecast figures to 2050.

World passenger traffic, expressed in terms of revenue passenger kilometres (RPK) on total

scheduled services, increased by 5.2% in 2013 compared to 2012, according to ICAO preliminary figures. This represents the fourth consecutive year of positive growth for the air transport industry since 2009 and corresponds to a slightly higher increase than in 2012.

Within the EU, aviation traffic is expected to grow at an average rate of 3% annually until 2050, pointing to a fuel consumption growth of 2% annually, and hence a more than doubling of CO₂ emissions by 2050⁸.

The International Civil Aviation Organization estimates that, global passenger traffic is expected to grow from 5 billion to more than 13 billion RPK over the period 2010-2030, i.e. an average annual growth rate of 4.9%. Examining the specific figures for Europe suggests annual growth rates of approximately 2.7% to the year 2040.

In the report 'EU trends in energy and transport to 2050'⁹ air transport is projected to be the highest growing of all passenger transport modes, increasing by 133% between 2010 and 2050 (2.1% p.a.), mainly due to the large increase of international trips (e.g. to emerging economies in Asia). Higher potential for air traffic growth (3.1% p.a. for 2010-2050), including for international holiday trips, is expected in the EU-12 Member States due to their less mature markets and projected faster growing GDP per capita. Aviation activity in EU-15 is expected to increase at a lower rate compared to EU-12 due to weaker growth of GDP per capita and the available capacity at the airports.

Technical Improvements

Technological improvements will play an important role in emissions reduction from aviation to 2050. The ICAO Committee on Aviation Environmental Protection (CAEP) projects future environmental trends in aviation that include GHG emissions. The CAEP uses the latest input data and related assumptions to investigate improvements in trends related to global climate, particularly fuel burn and CO₂ emissions trends. Results¹⁰ are presented for global full-flight fuel burn for international aviation from 2005 to 2040, and extrapolated to the year 2050. Under the scenarios investigated technological improvements to 2050 range from 0.57% p.a. (from 2015-2050) for a moderate technology improvement scenario to 1.5% p.a. (2010-2050) under an optimistic improvement scenario.

⁸ ec.europa.eu/.../20130911_a_performing_biofuels_supply_chain.pdf

⁹ [EU energy, transport and ghg emissions trends to 2050 reference scenario \(2013\). EC \(2013\)](#)

¹⁰ [\(2013\) Environment Report. ICAO \(2014\)](#)

Air Traffic Management

As the technological pillar of Europe's ambitious *Single European Sky Initiative*¹¹, *SESAR*¹² is the mechanism that coordinates and concentrates all EU research and development activities in Air Traffic Management (ATM). The European ATM Master¹³ Plan is the agreed roadmap driving the modernisation of the Air Traffic Management system and connecting SESAR research and development with deployment. The roadmap includes a target of a 2.8% reduction in environmental impact per flight by 2020.

The modernization of the European ATM systems is discussed in the document 'A Blueprint for the Single European Sky'¹⁴ and is expected to deliver a 300 kg fuel saving per flight, resulting in €6 billion of cost savings, and 12 Mt reduction in CO₂ emissions for 20 million flights annually.

According to a review by the IPCC¹⁵, improvements in air traffic management and other operational procedures could reduce aviation fuel burn by between 8% and 18%. It reports that the large majority (6% to 12%) of these reductions comes from ATM improvements, which are anticipated to be fully implemented in the next 20 years. All engine emissions will be reduced as a consequence.

CANSO, the Civil Air Navigation Services Organisation, state in their report "ATM Global Environment Efficiency Goals for 2050" that 100% ATM efficiency is not achievable as some efficiency is reserved for the interdependencies such as safety, capacity, weather and noise. They estimate the Global ATM system is already between 92% and 94% fuel efficient. CANSO has set the ATM industry the aspirational goal of recovering all of the remaining recoverable inefficiency by 2050, resulting in a Global ATM system which is between 95% and 98% efficient at that time.

Cost of Bio jet fuels

Alternative jet fuels are currently produced batch-wise in small quantities as the demand is not yet sufficient to justify continuous production. This makes an analysis of costs challenging and the

¹¹ eurocontrol.int/dossiers/single-european-sky

¹² <http://www.sesarju.eu/>

¹³ [The Roadmap for Sustainable Air Traffic Management Updated with SESAR's first developments European Union European ATM Master Plan. SESAR \(2013\)](#)

¹⁴ [A Blueprint for the Single European Sky. IATA, ATA, ERA \(2013\)](#)

¹⁵ [Special report aviation and the global atmosphere. IPCC \(1999\)](#)

costs reviewed vary significantly. As of February 2015, the price of conventional Jet Fuel is 621 \$/tonne¹⁶ (0.48 \$/L) and in 2012 fuel costs accounted for approximately 30% of operating costs for airlines¹⁷

From 2007 to 2012, the United States military purchased 1.9 million gallons of jet fuel through its procurement agency DLA Energy (Defence Logistics Agency), which provides data regarding the actual purchase prices of biofuels. These prices are detailed in "IATA 2014 Report on Alternative Fuels" and vary from 0.99 \$/L for Fischer-Tropsch (FT) jet fuel from natural gas or coal to 10.99 \$/L for hydro-processed renewable jet / hydroprocessed esters and fatty acids (HEFA) from camelina, algal oil, used cooking oil and tallow and 15.59 \$/L for fuel from alcohols. For commercial aviation, there is limited data available on costs of alternative fuel purchase agreements. In April 2014 however, British Airways committed to purchasing 50,000 tonnes of bio jet fuel per annum at market competitive prices, produced from post-recycled waste, normally destined for landfill or incineration¹⁸.

In a recent US study of the ambition of the FAA's goal of one billion gallons of renewable jet fuel each year from 2018, Winchester et al¹⁹ used an economy-wide model of the US aviation industry. They found that if soybean oil is used as a feedstock for meeting the FAA aviation biofuel goal in 2020, it would require an implicit subsidy from airlines to biofuel producers of 0.71 \$/L of renewable jet fuel. If the aviation goal can be met by fuel from oilseed rotation crops grown on otherwise fallow land, the implicit subsidy is 0.09 \$/L of renewable jet fuel.

Pearlson²⁰ reviews HEFA fuel production, and estimates the gate price of fuel for several plant sizes and operating conditions. The gate price was found to range between 1.00 \$/L for a 378 MML p.a. HEFA facility, and 1.16 \$/L for a smaller 116 MML p.a. facility.

Seber et al²¹ present an environmental and economic assessment of producing hydroprocessed jet and diesel fuel from waste oils and tallow. They calculate the production costs for these fuels using a discounted cash flow rate of return model. The minimum selling price was estimated to be 0.88 \$/L - 1.06 \$/L for yellow grease-derived HEFA, and 1.05 \$/L - 1.25 \$/L for tallow-derived HEFA fuel.

The EU report on 'A performing biofuels supply chain for EU aviation' investigates the costs of bio jet fuels for a target of 2 Mt per year by 2020. To achieve this target, construction of the plants has to start soon. The deployment of the bio jet fuels is foreseen in two steps; first the starting of operation of 'first of its kind' dedicated plants by 2015, and then a steady increase in supply chains to bring more bio jet fuel to the market.

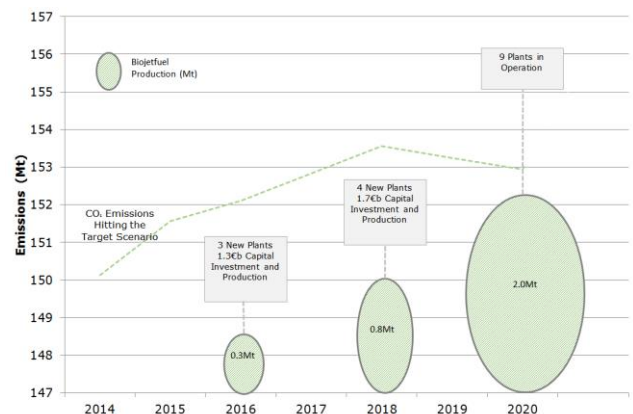


Figure 2: Projected biojet fuel production to 2020 and estimated associated EU aviation CO₂ emissions pathway

According to the document, sustainable bio jet kerosene currently comes at significant additional costs for airlines. In addition to the estimated 3 billion euros investment in technologies and production facilities to enable a constant production flow of bio kerosene, mechanisms are also needed to address the cost increase, which is currently attached to bio kerosene. This cost increase, currently calculated at €3 billion for 2 million tonnes (ca. 1.20 €/L), reduces the potential market uptake.

For the year 2020, analysis done by the IEA²² assumes a cost range for FT jet fuel from 1,500 €/t - 1,800 €/t [i.e. 1.20 €/L - 1.45 €/L] and for HEFA

¹⁶ <http://www.iata.org/publications/economics/fuel-monitor/Pages/index.aspx>

¹⁷ <http://airlines.iata.org/reports/special-report-fuel-slick-oil>

¹⁸ britishairways.com/en-gb/bamediacentre/newsarticles?articleID=20140416080250&articleType=LatestNews#.VNuHU_nGrwt

¹⁹ Economic and emissions impacts of renewable fuel goals for aviation in the US. Winchester N. et al. (2013)

²⁰ A techno-economic review of hydroprocessed renewable esters and fatty acids for jet fuel production. Pearlson, M. et al. (2013)

²¹ Environmental and economic assessment of producing hydroprocessed jet and diesel fuel from waste oils and tallow. Seber, G. et al. (2014)

²² The potential and role of biofuels in commercial air transport-biojetfuel. IEA Bioenergy (2012)

jet fuel from 1,200 €/t – 1,300 €/t [0.96-1.05 €/L]. This analysis is based on production costs of HEFA (based on palm oil) and FT biofuel (based on forest wood).

A comparison of current and future projected kerosene prices from the EIA²³ to IEA projected bio jet fuel prices in 2020 is given in Figure 3. Given the EIA projected price of jet fuel in 2020 [0.54 €/L], this leads to cost increase of between 0.42 €/L and 0.91 €/L compared to IEA estimates, while the previously mentioned EU analysis suggest a higher additional cost of 1.20 €/L. These costs if spread across all domestic and intra-EU-28 flights in 2020 would add between 1.20€ and 4.30€ to the cost of a typical 1000 km flight per passenger, for 2 Mt of bio jet fuel production in 2020 i.e. 4% of the estimated EU 28 jet fuel volume.

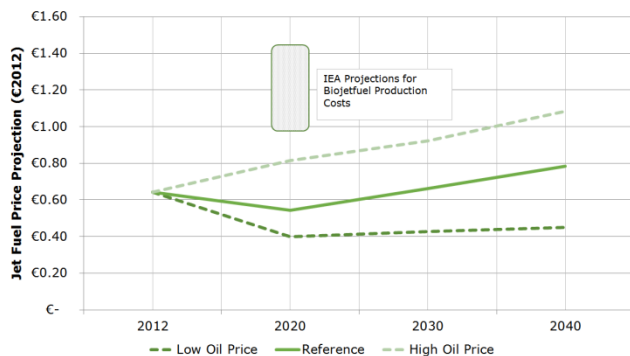


Figure 3: EIA price projections per litre for jet fuel in the United States to 2040 from the 2014 Annual Energy Outlook compared to projected IEA bio jet fuel costs in 2020 (€1 to \$0.85)

Feedstocks

A major concern with bio jet fuel is with the limitations of feedstock quantity and quality, since only a limited number of feedstocks meet the requirements to produce the strict physical and chemical characteristics of jet fuel. Feedstock supply is further compounded by the fact that there are competing uses for biomass e.g. heat, electricity and chemicals. Each crop has benefits and drawbacks in terms of costs, availability, yields, etc. Increasingly wastes have been considered a viable feedstock option as stated above. In the GreenSky London partnership, British Airways and biofuel producer Solena have announced plans to build a plant that will process 575,000t of post-recycled municipal waste into 120,000t of liquid fuel

(50,000t bio jet fuel) using plasma gasification followed by the FT process from 2017 onwards.

Algal oils could potentially replace vegetable oils in the biofuels process but these will not be commercially available within the next 5-8 years. Due to very high infrastructure cost for industrial algal cultivation it is unclear when competitiveness vs. conventional plant oil or other advanced biofuels cost will be achieved. However, due to the fact that in principle there are no issues related to land use, algal oils have attracted significant interest from the aviation sector. Deltares²⁴ (2011) concludes that producing bio jet fuel from algae grown in the Netherlands currently costs approximately 28 €/L, which is approximately 60 times higher than the cost of conventional jet fuel.

Scenario Analysis

We use simple scenario analysis to compare the future quantity of bio jet fuels required in European aviation under three levels of ambition to 2050.

The first scenario is 'No Action' and this provides a counterfactual to the other scenarios. Growth in passenger activity to 2050 is assumed to be 2.7% p.a. with no annual fuel efficiency improvements or ATM improvements.

The second scenario is 'Hitting the Target' and assumes that EU emissions from aviation in 2050 will be 50% of the 2005 reference level thus applying the IATA global goal at EU level. Growth in passenger activity to 2050 is again assumed to be 2.7% p.a., which is consistent with ICAO estimates. Annual fuel efficiency improvements due to technology and operational improvement are set at 1.5% p.a. to 2020 and improvements due to ATM are assumed to be 0.2% p.a. Note that these combined assumptions are more optimistic than the IATA self-commitment. It is here assumed that the Biofuel Flightpath Initiative delivers 2 Mt of biofuel production in Europe in 2020. An output of this scenario is the growth in annual biofuel production from 2020 to 2050 required to meet the emissions target.

²⁴ [Algae as a source of fuel for the Dutch aviation sector. Deltares 2011](#)

²³ [Annual Energy Outlook \(2014\). EIA \(2014\)](#)

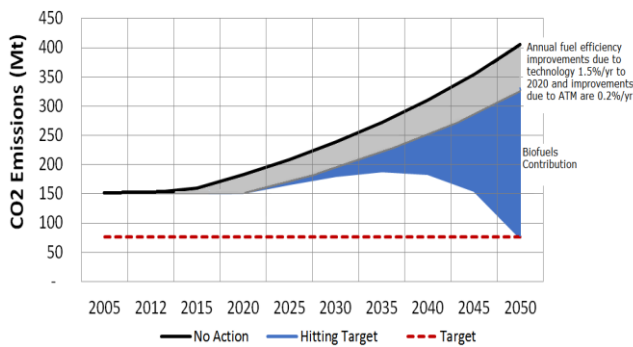


Figure 4: Schematic of the 'Hitting the target' scenario with contributions from efficiency, ATM and biofuels outlined

The scenario assumes growth in passenger activity of 2.1 p.a. (aligned with EU estimations) with annual fuel efficiency improvements due to technology to 2020 at 0.75% p.a. and improvement due to ATM at 0.1% p.a. It is assumed that *Biofuel Flightpath Initiative* delivers 2 Mt of Biofuel production in 2020 with a growth of 5% p.a. thereafter. However it does not assume that 2050 EU emissions from aviation will meet the IATA 50% reduction target.

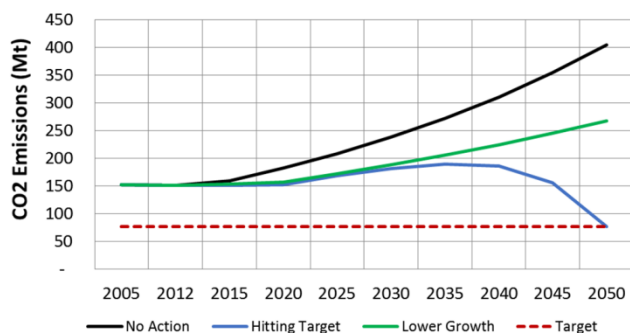


Figure 5: EU CO₂ Emissions from Aviation under 3 investigated scenarios

Results of the analysis are as follows: In the absence of any action or improvements in fuel efficiency or ATM, CO₂ emissions will grow to 405 Mt (compared to 152 Mt in 2005). Results indicate that for the 'Hitting the Target' scenario, an annual growth in biofuels of 13.1% is required from 2020 to meet the IATA emission reduction target. This translates into the production of 83 Mt of biofuels in 2050 representing approximately 77% of final energy demand in aviation in 2050. This clearly requires strong growth in biofuel production (as shown in Figure 6) particularly in the period post 2040 where production will almost have to triple in ten years. If biofuels are withdrawn as a mitigation

option (but ATM and fuel efficiency improvements are allowed) then the resulting CO₂ emissions in 2050 are 334 Mt, breaching the IATA 50% reduction target of 75 Mt by approximately 258 Mt (shown in Figure 5).

A final sensitivity was done on this scenario where annual fuel efficiency improvements due to technology are set at 1.5% p.a. to 2050. This reduces the amount of biofuels required to meet the target from 83 Mt to 43.6 Mt or 64% of energy.

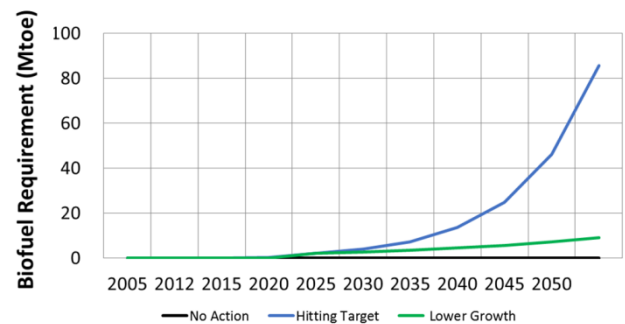


Figure 6: Biofuel Requirement under 3 investigated scenarios

In the *Lower Growth* scenario CO₂ emissions in 2050 grow to 267 Mt therefore breaching the IATA 50% reduction target by 191 Mt. Biofuel production is assumed to grow by 5% p.a. and this leads to a contribution of 8.8 Mt of biofuels in 2050 or 9% of energy in aviation. In the absence of any contribution for biofuels for this scenario CO₂ emissions would grow to 294 Mt.

Conclusion

It is widely acknowledged that (in the absence of fuel switching) improved efficiency through technological progress, combined with better air traffic management will not be sufficient to reach the IATA 2050 target. Aviation biofuels will have an important role to play. The main obstacle to the widespread uptake of biofuels is not due to technical constraints but more so economic in nature. For large scale deployment of biofuels, as detailed in the 'Hitting the Target' scenario, it will be imperative that significant volumes of bio jet fuel are produced and utilised. Increasing the volume and the availability invariably decreases price but will not happen without sufficient support mechanisms.

For further reading or information, please visit www.insightenergy.org

Appendix

EC-supported biofuel aviation initiatives from the report 'Biofuels for aviation' from ECOFYS

EU Advanced Biofuels Flight path Initiative: In 2011, the EC, in coordination with Airbus, leading European airlines and key European biofuel producers, launched an industry wide initiative to speed up the commercialisation of aviation biofuels in Europe. The "European Advanced Biofuels Flight path" initiative is a roadmap to achieve an annual production of two million tonnes of sustainably produced biofuel for aviation by 2020.

Initiative Towards sustainable Kerosene for Aviation (ITAKA): ITAKA is a collaborative project between aircraft manufactures, airlines, fuel suppliers and others. It specifically aims to make a contribution to the fulfilment of some of the short-term (2015) EU Flight Path objectives. ITAKA will address challenges in two main areas: 1. Development of commercial scale production and study implications of large-scale use, and 2. Research on sustainability, economic competitiveness and technology readiness.

Aviation Initiative Renewable Energy in Germany (aireg): Aireg was founded in 2011, and comprises airlines, airports, research organisations and companies in the aviation and feedstock industries. Aireg's target is for biofuels to make up 10% of the jet fuel consumed in Germany by 2025.

Biokerosene Agreement (Green Deal) in the Netherlands: In November 2013, the Dutch Ministries of Infrastructure and Environment and Economic Affairs, KLM, Schiphol Group, SkyNRG, Neste Oil and the Port of Rotterdam signed a declaration of intent to promote the large-scale deployment of biojet fuel in the Netherlands.

Bioqueroseno: The "Spanish Initiative for the Production and Consumption of Biokerosene for Aviation" was formed in 2011 with the signing of an agreement between the Ministry of Industry, Energy, and Tourism, the Ministry of Public Works, the Ministry of Agriculture, Food, and Environmental Affairs, Services and Studies for Air Navigation and Aeronautical Safety (SENASA) and several companies related to the production of raw materials, refining technologies, aeronautical logistics and sustainability processes. This initiative is structured as a platform to exchange information, identifying needs as well as connecting the public and private sector

NISA: The Nordic Initiative for Sustainable aviation comprises stakeholders from the public and private sector of Norway, Finland, Sweden, Denmark and Iceland, covering airlines and their associations as well as authorities, airports and international manufactures (Airbus, Boeing). NISA was founded in November 2013 and is endorsed by IATA.