European Aviation Environmental Report 2016

European Environment Agency

EASA European Aviation Safety Agency

EUROCONTROL

"By providing valuable information on the environmental performance of the European aviation sector, this report will help focus the efforts of current and future pioneers to spur innovation and address the environmental challenges that the sector faces."

Bertrand Piccard
Initiator, Chairman
and Pilot of Solar Impulse

A HISTORICALLY FAST GROWING SECTOR

Alongside the growth of air traffic, the CO_2 and NO_x emissions from European aviation have almost doubled between 1990 and 2014. During the past ten years, the economic downturn and measures such as technological improvements, fleet renewal and improved air traffic management efficiency have helped limit the growth in emissions. For the same reasons, aircraft noise exposure in 2014 remains similar to its 2005 level.

2005-2014

TRAFFIC

Number of flights	- 0.5%
Mean distance per flight	+ 12%
Mean seats per flight	+ 19%
Mean share of seats filled (load factor)	+ 9%
Number of passengers	+ 25%
Number of city pairs served most weeks	+ 29%
Passenger kilometres flown	**+ 32%**

ENVIRONMENT

Fuel burn per passenger kilometre flown	- 19%
Average noise energy per operation	- 12%
Total full-flight CO_2 emissions	**+ 5%**
Total full-flight NO_x emissions	**+ 13%**
Population exposed to $L_{den} \geq 55$ dB noise level*	**- 2%**

* L_{den}: equivalent sound pressure level averaged over a day, evening and night time period.

EUROPEAN AVIATION WILL CONTINUE TO GROW

As aviation grows, albeit at a lower rate than in the past, its environmental impact is forecast to increase over the next twenty years. Future aircraft technology and air traffic management improvements may help stabilise aircraft noise exposure by 2035. However, it will be insufficient to prevent an overall increase of emissions and subsequent impact on local air quality and climate change.

2005-2035*

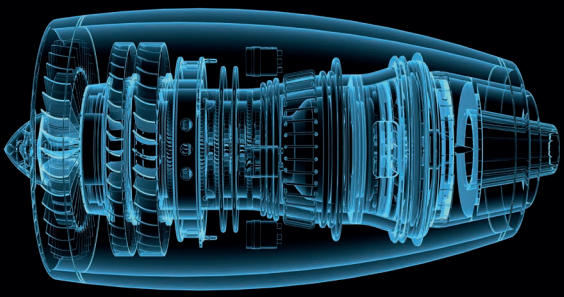
TRAFFIC

Number of flights	+ 44%
Number of passengers	+ 120%
Passenger kilometres flown	**+ 158%**

ENVIRONMENT

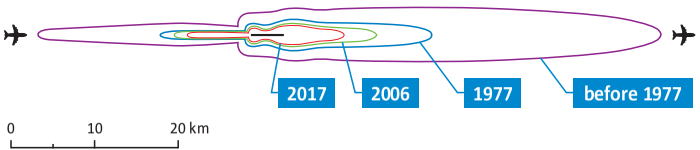
Fuel burn per passenger kilometre flown	- 43%
Average noise energy per operation	- 22%
Total full-flight CO_2 emissions	**+ 53%**
Total full-flight NO_x emissions	**+ 61%**
Population exposed to $L_{den} \geq 55$ dB noise level	**+ 12%**

* Estimation of change in performance indicators under a most likely traffic forecast and low technology improvement rate (for details see www.easa.europa.eu/eaer)



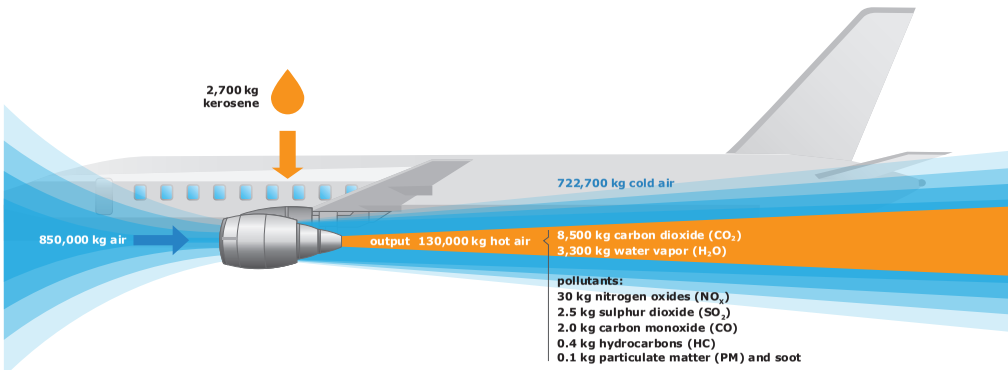
QUIETER & CLEANER AIRCRAFT

Increasingly stringent standards and continuous improvements in technology and design have led to reductions in noise and NO_X emissions of aircraft and engine type designs. New standards to limit CO_2 and particulate matter emissions are currently being developed. European research programmes are supporting progress towards future environmental goals.



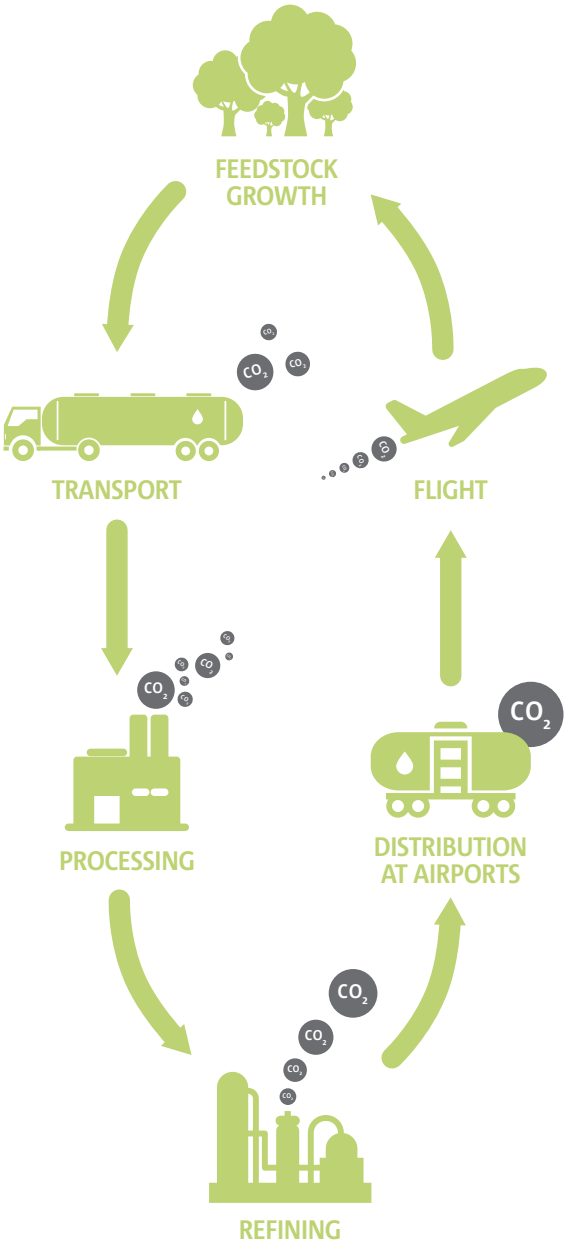
80 dB noise contour of one landing and take-off for aircraft that just meet the various noise limits agreed over time

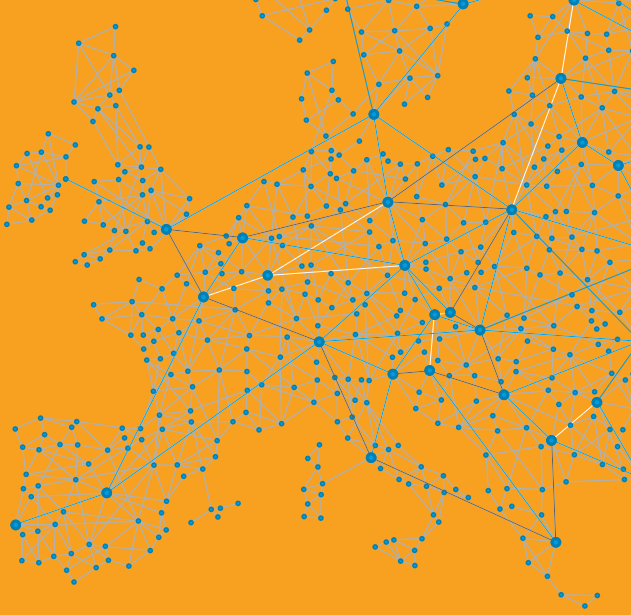
Emissions from a typical two-engine jet aircraft during 1-hour flight with 150 passengers



INNOVATIVE-GREENER-CLEANER FUELS

The uptake of sustainable alternative fuels by aviation is expected to play a role in reducing the sector's greenhouse gas emissions in the coming decades. In the next few years regular production of aviation alternative fuels in Europe is projected to be very limited, and the European Advanced Biofuels Flightpath target for 2020 is unlikely to be achieved. Future aircraft CO_2 emissions may be up to 80% carbon neutral, but will depend highly on the source of biomass and the production process.

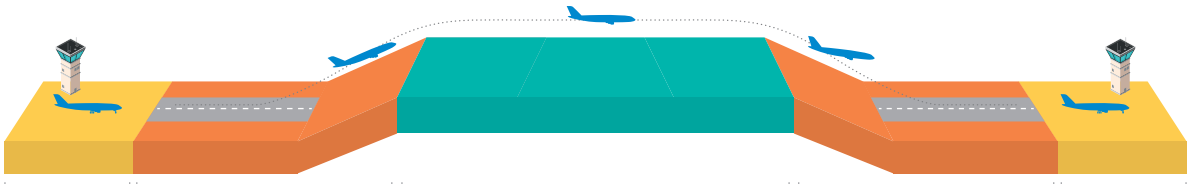

FEEDSTOCK GROWTH
TRANSPORT
FLIGHT
PROCESSING
DISTRIBUTION AT AIRPORTS
REFINING
CO2



ATM CAPACITY, ENVIRONMENT & EFFICIENCY

Operational improvements delivered by the EU Single European Sky framework and its Air Traffic Management (ATM) Research programme will contribute to the agreed goals of reduced delays both on the ground and in the air, and a reduction in fuel consumption per flight by 10%.

Excess CO_2 emissions caused by taxi, climb, descent and en route flight inefficiencies have decreased by 7% between 2012-2014 due to improved Air Navigation Services



AIRPORT NOISE & EMISSIONS MITIGATION

A framework of regulatory and industry initiatives at EU, national and local level have been put in place to reduce the environmental impacts from airport activities. In the absence of continuing mitigation efforts, 20 major European airports could face significant congestion and related environmental impacts by 2035.

92 European **airports** participate in the Airport Carbon Accreditation programme covering 64% of passengers in Europe

A **Balanced Approach** is used to manage aircraft noise at European airports through noise reduction at the source, land-use planning, noise abatement procedures and operating restrictions

80% of **passengers** in Europe travel via airports that are certified against an environmental management scheme

MARKET MEASURES

Measures based on market incentives are part of Europe's comprehensive approach to reduce aviation's noise and emissions. Technological and operational measures alone are not considered sufficient to tackle the growing environmental challenges of the aviation sector.

More than 100 European airports have deployed local noise and emissions charging schemes. Aviation has also been included in the EU Emissions Trading System (ETS) resulting in a CO_2 reduction of 65 million tonnes between 2013 and 2016.

1980
1st European airport noise charging scheme

1997
1st European airport emissions charging scheme

2009
EU Directive on airport charges

2010
Aviation included within EU ETS

2013
ETS scope reduced to intra-EU flights only (until 2016)

2015
Noise and emissions charging schemes at 100+ airports

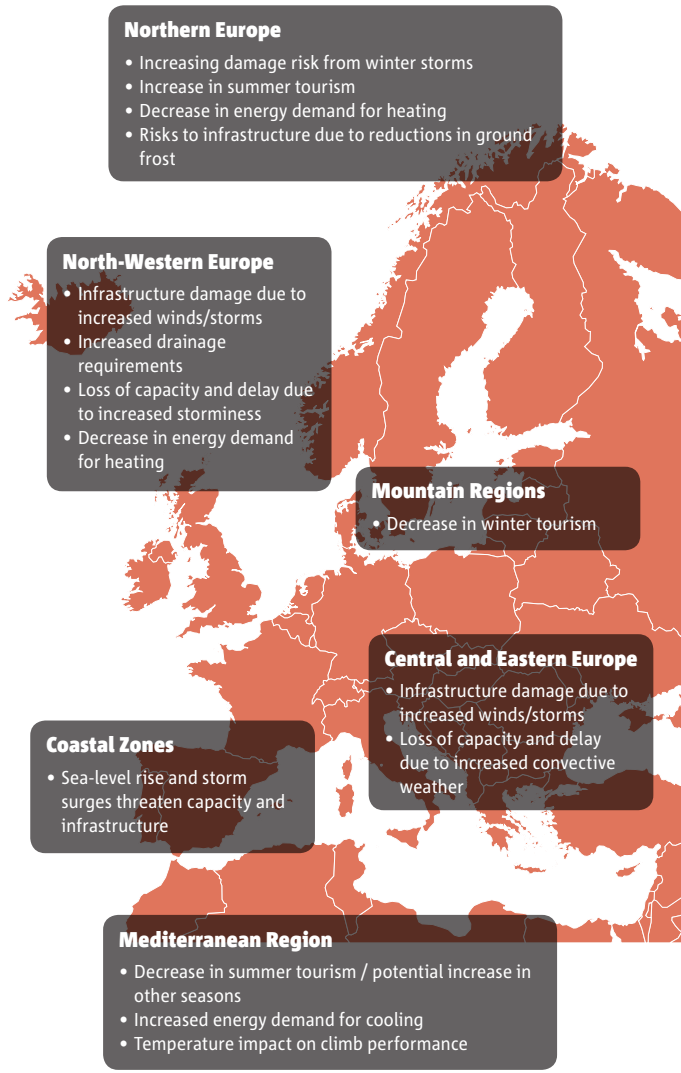
2016
Reduction of 65 million tonnes CO_2 from aviation in the ETS since 2013

Charging Schemes

Trading Schemes

ADAPTING AVIATION TO A CHANGING CLIMATE

Climate change impacts include more frequent and more adverse weather disruption, as well as sea-level rise. The aviation sector needs to prepare for and develop resilience to these future potential impacts. Pre-emptive action is likely to be cost-effective. Action is already being taken at European, national and organisational levels.


Northern Europe
• Increasing damage risk from winter storms
• Increase in summer tourism
• Decrease in energy demand for heating
• Risks to infrastructure due to reductions in ground frost
North-Western Europe
• Infrastructure damage due to increased winds/storms
• Increased drainage requirements
• Loss of capacity and delay due to increased storminess
• Decrease in energy demand for heating
Mountain Regions
• Decrease in winter tourism
Central and Eastern Europe
• Infrastructure damage due to increased winds/storms
• Loss of capacity and delay due to increased convective weather
Coastal Zones
• Sea-level rise and storm surges threaten capacity and infrastructure
Mediterranean Region
• Decrease in summer tourism / potential increase in other seasons
• Increased energy demand for cooling
• Temperature impact on climb performance

The environmental challenges for the aviation sector are expected to increase, and so future growth in the European aviation sector will be inextricably linked to its environmental sustainability.

A comprehensive and effective package of measures is required to address this challenge. The foundation of such an approach requires published, reliable and objective information, accessible to all. This is the core objective of the European Aviation Environmental Report.

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