report[2018]

climate
protection

Aviation moves.

For some years now, aviation has been working hard – and successfully – to reduce the specific energy consumption of its aircraft. In 2017, German aircrafts used an average of 3.58 litres of kerosene per 100 passenger kilometers. Furthermore, the aviation industry promotes the development and production of sustainable fuels as well as new engines to achieve the future goal of carbon neutrality. In addition, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) was agreed on international level – starting in 2020. By introducing CORSIA, aviation is the first industrial sector that initiates its own climate protection system.

In this report, the German Aviation Association (BDL) presents the key indicators of the improvements achieved in energy efficiency and climate protection.

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Increase in energy efficiency since 1990 (BDL passenger airlines)	**+43 %**
Average kerosene consumption per passenger per 100 km in 2017 (BDL passenger airlines)	**3.58 litres**
Domestic air traffic as a percentage of German CO_2 emissions in 2015	**0.3 %**
Global air traffic as a percentage of global CO_2 emissions in 2015	**2.69 %**
Average passenger load factor for aviation in Germany in 2017	**82.1 %**
Value of planned investments in 242 new fuel-efficient aircraft (BDL airlines)	**€ 39 bn.**

BDL
Bundesverband der Deutschen
Luftverkehrswirtschaft

Aviation's international climate protection strategy

In 2009, airlines, aircraft manufacturers, air navigation service providers and airports worldwide agreed a climate protection plan: to increase fuel efficiency by approximately 1.5 percent per year; to achieve carbon-neutral growth in air travel by 2020; and to halve net CO_2 emissions by 2050 compared to 2005 levels. These goals will be achieved by implementing the following measures:

① Already today: increase efficiency – reduce CO_2 increase

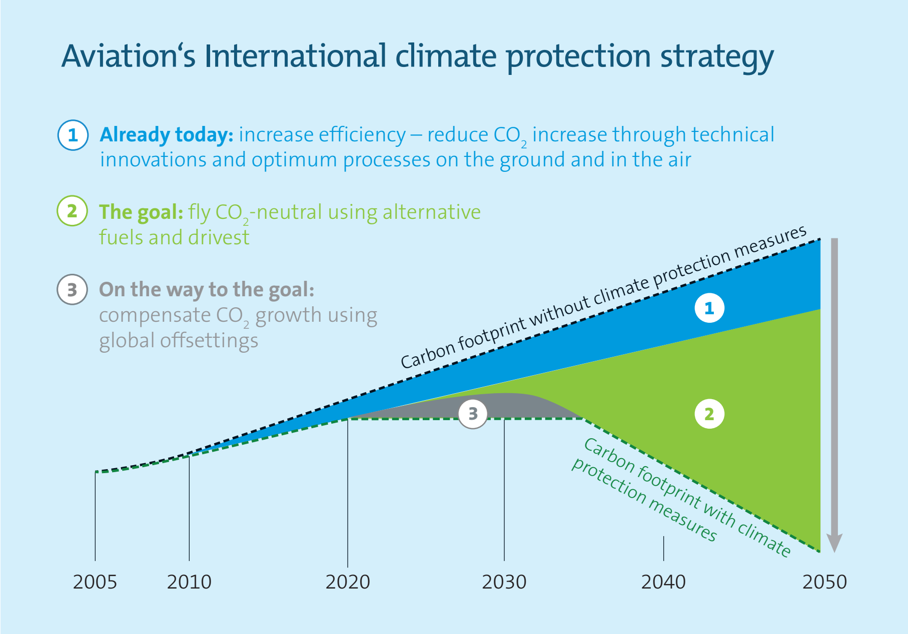
Reducing the specific energy requirements of aircraft will cut fuel consumption and, in turn, CO_2 emissions. The measures designed to achieve this improvement include technical innovations by aircraft and engine manufacturers, optimally coordinated operational processes on the ground and in the air, and implementation of the Single European Sky.

② The goal: fly carbon-neutral

In order to be able to fly CO_2-neutral in the long term, we need to see the development of new airplanes, alternative fuels and drives, combined with the political support to make their use commercially viable.

③ On the way to the goal: compensate carbon growth

As global air traffic continues to grow by about five percent per year, the reduction in specific fuel consumption is not enough to stop the increase in CO_2 emissions. Therefore, at the UN level, the international CO_2 offsetting system CORSIA was adopted by the Civil Aviation Organization ICAO. As part of CORSIA, growth-related CO_2 emissions of international flights will be compensated by financing carbon offset projects from 2021 onwards.

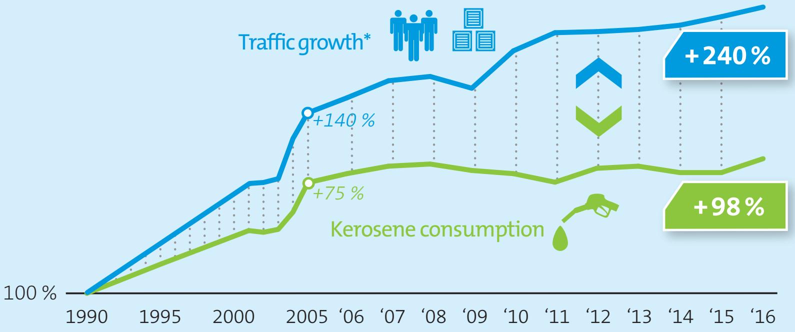


Climate protection in figures

Air transport is becoming increasingly eco-efficient thanks to the aviation industry's success in decoupling air traffic growth from growth in fuel consumption and CO_2 emissions.

While air traffic in Germany has more than tripled since 1990, kerosene consumption has risen by just 98 percent during the same period. This decoupling of kerosene consumption from traffic growth has been achieved primarily by measures to increase energy efficiency.

Decoupling kerosene consumption from traffic growth



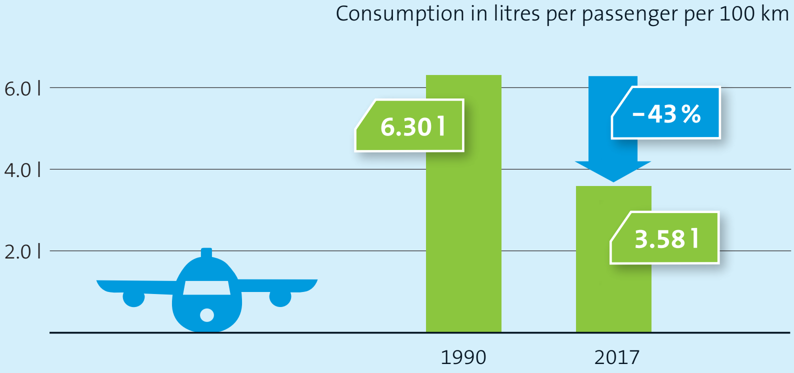
*Traffic growth and kerosene consumption refer to the total traffic volume of all departures from airports in Germany.

Source: BDL based on data from destatis and the German Federal Environment Agency (UBA)

A new record of efficiency in passenger traffic

Since 1990, German airlines have reduced fuel consumption per passenger by 43 percent. In 1990, the average consumption of an aircraft was 6.3 litres per person and per 100 kilometres. Last year, the German fleet used an average of only 3.58 litres on the same route, which is a new efficiency record.

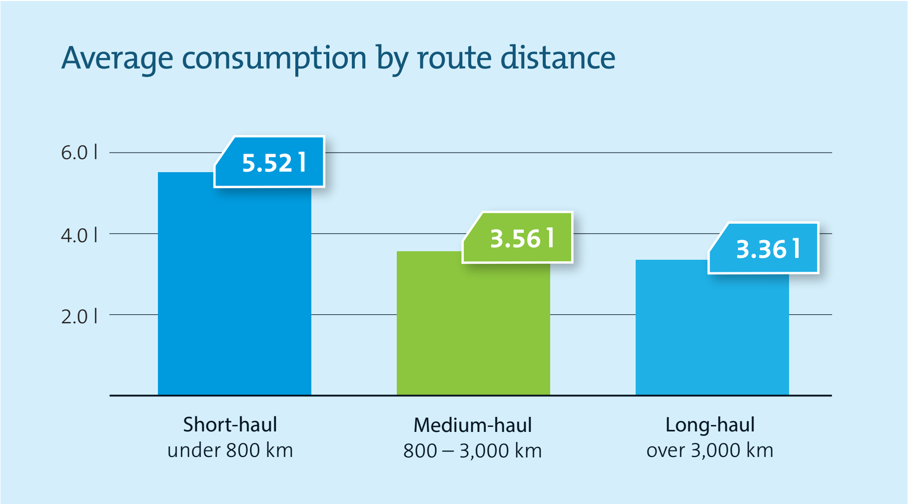
Average consumption of German fleet: 3.58 litres*



*This statistic takes into account all BDL passenger airlines and their subsidiaries.
Source: BDL based on company data

Decisive: distance and load factor

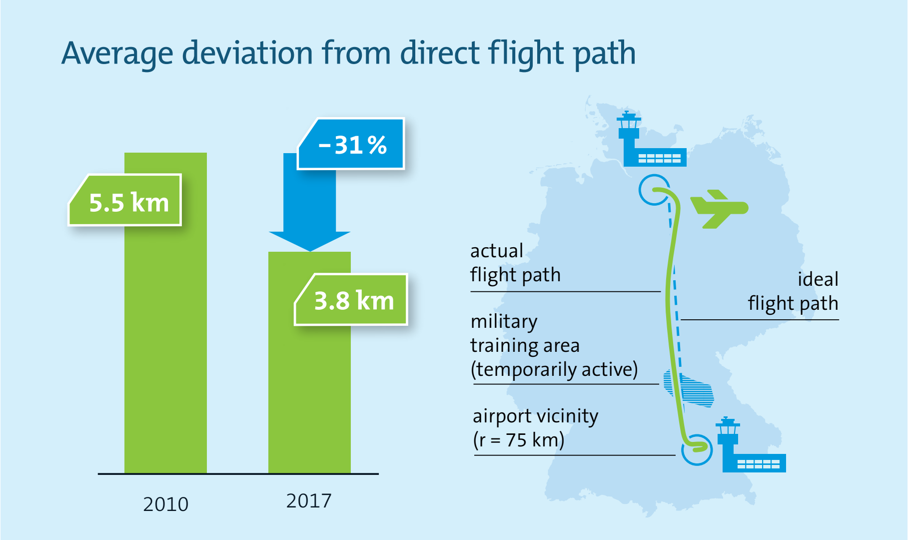
The consumption per passenger for air traffic depends on, among other things, the passenger load factor and distance flown. Charter flights use, on average, less kerosene per person because long-term planning and booking generally mean a higher passenger load factor than scheduled flights.



Source: BDL based on company data for 2017

German air traffic control contributes to climate protection

In recent years, German air traffic control (DFS) has successfully improved routing efficiency, enabling a 31 percent reduction in the average deviation from an aircraft's ideal flight path in Germany – down from 5.5 km to 3.8 km in 2017. If the kilometres saved in this way on all flights were added together, it would be equivalent to an aircraft flying 136 times around the globe. Ensuring optimal routings has reduced CO_2 emissions by some 69,000 tonnes in 2017 alone.

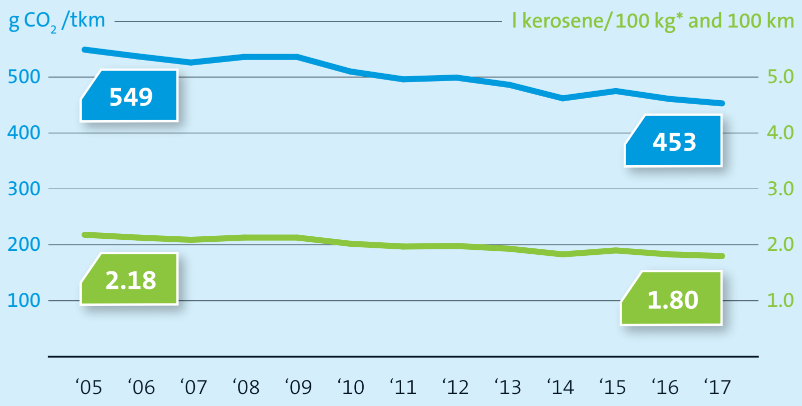


Source: DFS Deutsche Flugsicherung GmbH

Freight up – consumption down

German cargo aircraft are also more efficient than ever: expressed in terms of passengers, the Lufthansa Cargo fleet only uses 1.80 litres per 100 kilometres. That is almost half the consumption of passenger aircraft. This is due to the fact that a freighter does not have to be fitted with seats and can utilise the available space more efficiently.

17 percent reduction in cargo fleet consumption

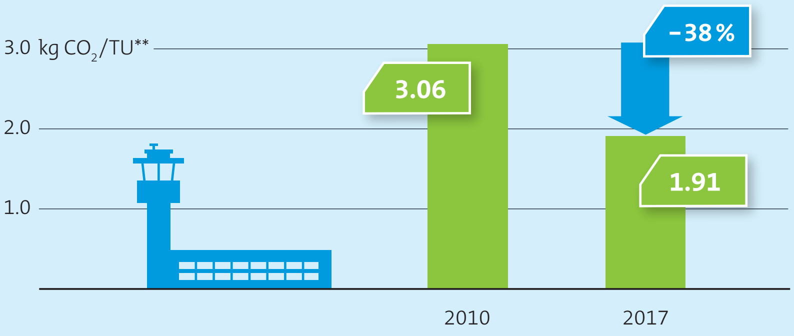


*100 kg ≙ 1 passenger incl. luggage
Source: Lufthansa Cargo

Carbon footprint at German airports

Between 2010 and 2017, German airports successfully reduced their specific CO_2 emissions by 38 percent, down to 1.91 kg of CO_2 per transport unit. Factors that contributed to this reduction include the optimisation of ground operations, the use of innovative technologies to run buildings and installations, such as modern heating controls, and the use of alternative vehicle propulsion systems, such as electric vehicles.

Specific CO_2 emissions of German airports

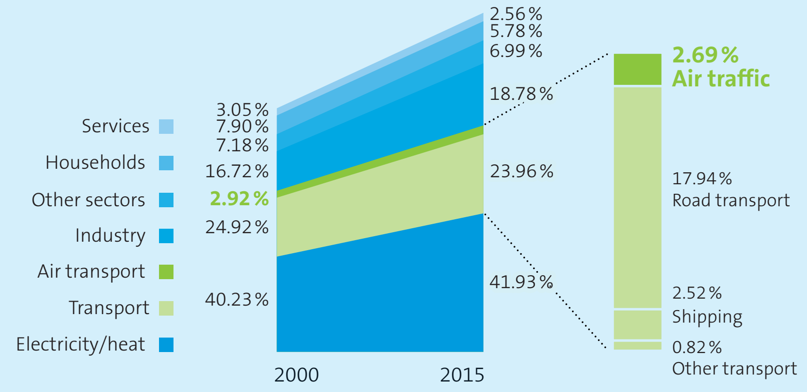


**1 TU ≙ 1 transport unit ≙ 1 passenger incl. luggage or 100 kg cargo; figures refer to Scope 1 (direct emissions from airports' own facilities) and Scope 2 (indirect emissions from purchased energy); Source: German Airports Association (ADV)

Global aviation accounts for 2.69 percent of CO_2 emissions

For years now, aviation has been improving its energy efficiency and carbon footprint around the world. Despite high growth rates, aviation accounted for 2.69 percent of global CO_2 emissions in 2015. By comparison, the share was 2.92 percent in 2000. This is due to increasingly efficient flights ensuring that the absolute CO_2 emissions in the aviation sector grow at a lower rate than emissions from other sectors.

Trend in global CO_2 emissions*



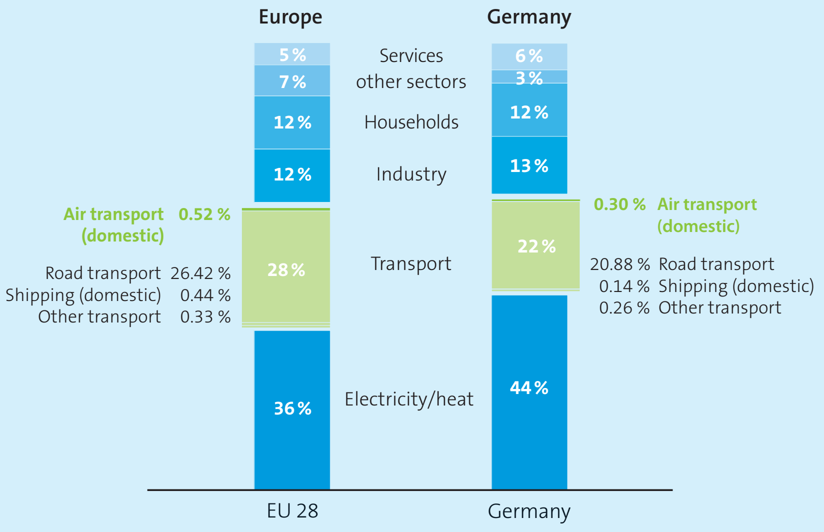
*Measured against CO_2 emissions from burning fossil fuels

Source: International Energy Agency (IEA) 2018, data for 2015

Intra-European aviation: share of CO_2 emissions remains low

In 2015, intra-European flights accounted for 0.52 percent of total CO_2 emissions in the EU, while in Germany the share of CO_2 emissions from domestic flights was 0.3 percent of total German emissions.

CO_2 emissions* in Europe and Germany in 2015



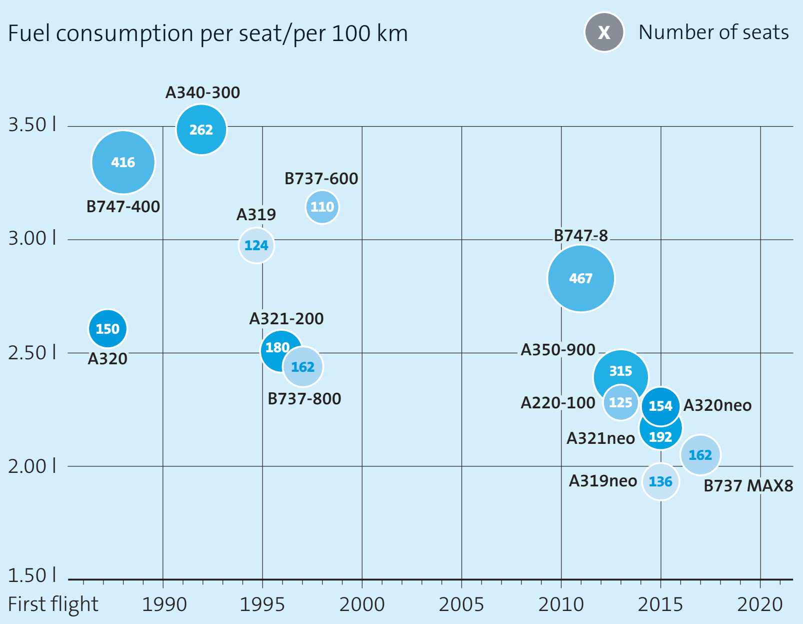
Measured by CO_2 emissions from the combustion of fossil fuels
Source: International Energy Agency (IEA) 2018, data for 2015

€ 39 billion investment to reduce carbon footprint

Reducing the fuel consumption of an aircraft, and thus its carbon footprint, requires a multifaceted approach. Key factors are propulsion systems, aerodynamics and weight. Technical innovations mean that fuel consumption is reduced by up to 25 percent with each new generation of aircraft. While the most effective action is investment in new aircraft, this presupposes that airlines have sufficient resources.

Unilateral approaches, however, such as Germany's air travel tax, create an unlevel playing field and distort competition to the detriment of German airlines – which reduces the ability to invest and undermines innovation for more climate protection. In spite of this, German airlines are continually investing in new aircraft; currently in 242 more fuel-efficient planes at a list price of € 39 billion in total. It is an effective combination of economy and ecology, given that fuel costs account for up to 30 percent of an airline's overall operating costs. Investment could be higher still if only the legislators would act to mitigate the competition-distorting effects of unilateral burden.

Fuel consumption of selected aircraft



Source: BDL based on manufacturer's specifications, Status as of August 2018

Conversion factors

Emissions

1 kg kerosene emits 3.15 kg CO_2

4 litres per passenger per 100 km is equivalent to approx. 100 grams of CO_2 per passenger per kilometre

0.2 litres per tonne/per km is equivalent to approx. 500 grams of CO_2 per tkm

Energy density

1 kg kerosene ≙ 42.8 MJ (megajoules)
1 MJ ≙ 0.023 kg kerosene

1 l kerosene ≙ 34.24 MJ
1 MJ ≙ 0.029 l kerosene

1 kg kerosene ≙ 11.9 kWh
1 kWh ≙ 0.084 kg kerosene

Mass density

1 l kerosene = 0.8 kg kerosene
1 kg kerosene = 1.25 l kerosene

Volume

1 l = 0.264 US gal lqd (US gallon)
1 US gal. lqd. = 3.785 l

1 l = 0.00629 bl (barrel)
1 bl = 159 l

Freight and passengers

1 passenger incl. luggage is equivalent to 100 kg ≙ 1 TU (transport unit)

1 tonne of cargo is equivalent to ten passengers incl. luggage ≙ 10 TU (transport unit)

Distance

1 m = 3.28 ft (feet)
1 ft = 0.3048 m

1 km = 0.62 mi (miles)
1 mi = 1.61 km

1 km = 0.54 NM (nautical mile)
1 NM = 1.852 km
1 NM = 1 sm (sea mile)

Speed

100 km/h = 54 kn (knots)
1 kn = 1 NM/h = 1.852 km/h

Other

Megajoule:
1 MJ = 1,000,000 J = 10^6 J

Petajoule:
1 PJ = 1,000,000,000,000,000 J = 10^{15} J

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