TRACKING AVIATION EFFICIENCY

How is the aviation sector performing in its drive to improve fuel efficiency, in line with its short-term goal?

WAYPOINT 2050

In 2009, the aviation industry agreed an ambitious set of goals for addressing climate change by dealing with its carbon emissions. The first goal is to deliver a global average annual fuel efficiency improvement of 1.5%. In other words, the combined fleet of commercial aviation aircraft would improve its fuel efficiency by an average of 1.5% per year through to 2020, with further goals set to cap net CO_2 emissions from 2020 and to halve them by 2050 (based on 2005 levels).

The aviation sector's short-term goal to improve fleet fuel efficiency by an average of 1.5% per annum from 2009-2020 is on track, with current analysis showing a 2% improvement on a rolling average – an efficiency improvement of 21.4% since 2009.

The full set of goals can be found at: www.enviro.aero

Fuel efficiency performance of commercial aviation

- Airlines have continued to improve their fuel efficiency performance between 2009-2019, securing an average annual improvement of 2% — above the industry goal of 1.5%. The cumulative efficiency improvement between 2009 and 2019 has been 21.4%.
- Since the year 2000, industry fuel efficiency has improved 37.8% and CO_2 tonnes per thousand tonne kilometres performed has improved from 1.84 to 0.84.
- Since 1990, industry fuel efficiency has improved by 54.3%.
- Improved fuel efficiency has been driven by airlines investing over $1 trillion in 15,000 more efficient new-technology aircraft since 2009; and by improving performance through higher load factors and other operational measures.
- High and volatile fuel costs have also made it economical to retire older aircraft at higher rates further contributing favourably to fuel efficiency performance.
- A current production backlog of over 11,650[1] new technology aircraft from the major manufacturers will be entering the global fleet over the next few years, suggesting continuing improvements in fleet efficiency.
- Weight-based load factors improved by nearly six percentage points moving from 64.9% in 2008 to 69.4% in 2019, as airlines continued to make better use of space available on aircraft. Passenger load factors now average 82.4% globally.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Revenue tonne-kilometres performed *(RTK, billions)*	636	610	681	715	740	771	816	866	920	998	1060	1085	-
Commercial aviation CO_2 *(million tonnes)*	667	632	663	682	691	710	733	774	812	860	905	915	-
Fuel efficiency *(CO_2 tonnes per thousand RTK)*	1.05	1.04	0.97	0.95	0.93	0.92	0.90	0.89	0.88	0.86	0.85	0.84	-
Rate of fuel efficiency improvement *(% change over previous period)*		1.1%	6.1%	2.0%	2.1%	1.5%	2.5%	0.5%	1.1%	2.4%	1.0%	1.2%	-
Rolling average fuel efficiency improvement *(compound improvement % per annum 2009-19)*												**2.0%**	-

2008-2017: actual data from ICAO, IEA and IATA (available 22 months after year end)
2018-2019: estimates from ICAO and IATA data

Current rolling fuel efficiency improvement
2%

Fleet fuel efficiency improvement since 1990
54.3%

Fleet fuel efficiency improvement since 2000
37.8%

Passenger load factors now average
82.4%
globally

Historical aviation emissions

Efficiency has been improving since the start of commercial aviation

Year	Total aviation CO_2 *(million tonnes)*	Revenue passenger kms *(millions)*	CO_2 per passenger km *(grams, global average)*	Revenue tonne kms *(billions)*	CO_2 per tonne km *(grams, global average)*	CO_2 split *(CO_2 from international flights)*
1990	453	1,912,086	237	246	1,845	48%
1991	438	1,836,923	239	241	1,818	48%
1992	464	1,949,413	238	255	1,823	49%
1993	469	1,948,313	241	261	1,794	50%
1994	490	2,117,907	231	288	1,698	50%
1995	502	2,270,617	221	310	1,616	51%
1996	524	2,470,642	212	336	1,561	51%
1997	541	2,661,058	203	366	1,478	51%
1998	554	2,775,569	199	379	1,460	52%
1999	571	2,945,897	194	406	1,409	53%
2000	595	3,176,064	187	439	1,356	53%
2001	585	3,084,406	190	423	1,383	53%
2002	591	3,127,670	189	441	1,341	55%
2003	589	3,146,373	187	450	1,308	55%
2004	627	3,613,534	173	514	1,220	56%
2005	650	3,934,896	165	550	1,182	58%
2006	657	4,204,474	156	584	1,126	59%
2007	674	4,538,473	149	621	1,085	59%
2008	667	4,648,512	143	636	1,048	61%
2009	632	4,591,755	138	610	1,036	61%
2010	663	4,959,671	134	681	974	61%
2011	682	5,273,116	129	715	955	62%
2012	691	5,552,591	125	740	935	61%
2013	710	5,869,089	121	771	920	61%
2014	733	6,221,234	118	816	898	61%
2015	774	6,681,606	116	866	893	61%
2016	812	7,176,045	113	920	883	61%
2017	860	7,757,801	111	998	862	60%
2018	905	8,329,776	109	1060	854	-
2019E	915	8,680,283	105	1085	843	-
2020	-	-	-	-	-	-

Source: IATA Economics

28% Industry 2050 goal will reduce aviation CO_2 emissions 28% below 1990 levels

Commentary

The significant 2010 fuel efficiency improvement number was driven by a rebound in traffic and a large jump in weight load factor performance, with improved load factors on both the passenger and cargo side as part of the recovery from the global financial crisis

Key inputs used to assess fuel efficiency performance

- IEA data[2] is used to determine global jet fuel uplift. The IEA data is only available ~18-22 months after the year ends. This is adjusted to remove military and general aviation fuel use, leaving commercial aviation only. Apportionment of jet fuel uplifted to commercial aviation is based on several industry level assessments on the types of aviation activity, sources include:
  - ↳ Scheduled and charter — sourced from the UN IPCC 4th Assessment Report WG 3 and Allocation of International Emissions from Scheduled Air Traffic[3]
  - ↳ General aviation — Boeing and NASA studies Matlock and Alsyne
  - ↳ Military aviation — Estimates based on AERO2K exercise[4]
  - ↳ The above assessments are combined with bottom-up modelling of commercial aviation to take an informed view of the respective share of the fuel used under each category
- ICAO data on historical traffic performance[5]. IATA estimates for other industry related activity is used to scale up ICAO reported traffic data.
- CO_2 emissions for 2019 are based on IATA estimates and incorporate international airline reporting on fuel efficiency performance.

Data and analysis supplied by IATA Economics: www.iata.org

[1] A combination of backlogs 2020-2025 from Cirium Fleet Dashboard.

[2] Data from the International Energy Agency database: www.iea.org

[3] http://bitly.com/1yz3oCO

[4] http://bit.ly/1uhXxhf

[5] http://bit.ly/1DTWJaX