How will flights be decarbonised?

Aviation and Climate: Part II – Airlines and Aircraft

November 2022

The aviation sector has committed to net zero carbon emissions by 2050

The aviation sector is acutely aware of the need to decarbonise and there is a global effort underway to do so.

Aviation is critical to the world economy supporting $3.5 trillion (4.1%) of the world's gross domestic product[1].

With around 80% of its emissions produced by flights of over 1,500 km[2] (for which there are currently no practical alternatives) much of that global effort is focused on developing new technology which will enable decarbonisiation.

The aviation sector has long been committed to change.

In 2008, industry leaders from across the globe signed a Commitment to Action on Climate Change[3] committing to a pathway of carbon-neutral growth and aspiring to a carbon-free future.

The Commitment was signed by 13 of aviation's largest global businesses and organisations (including Airbus, Boeing, the Airports Council International (ACI) and the International Air Transport Association (IATA).

In October 2021, the industry strengthened its climate action approach with Fly Net Zero – a formal commitment to achieving net-zero carbon emissions by 2050[4]. This brought international air transport in line with the objectives of the Paris Agreement to limit global warming to 1.5°C.

Fly Net Zero is signed by organisations representing nearly 2,000 airports, 290 airlines and the world's largest aircraft manufacturers.

The International Civil Aviation Organization (ICAO) is a United Nations agency that brings together the governments of 193 countries, including New Zealand. All members supported the adoption of Fly Net Zero at the 41st ICAO Assembly in October 2022.

That historic agreement ensures those governments will adopt policies that are aligned to and are supportive of the sector's efforts to get to net zero carbon emissions by 2050.

There is wide agreement that reaching this goal will be challenging but aviation has a history of achieving what was thought to be impossible – including flying itself.

FLY NET ZERO

Signed by 16 of the world's most influential aviation organisations including:

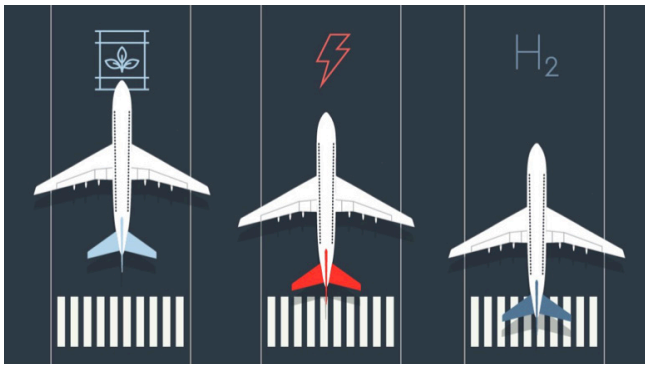
- ACI - Airports Council International representing 1,950 airports in 185 countries.
- IATA - International Air Transport Association representing 290 airlines or 83% of the world's air traffic.
- CANSO - Civil Air Navigation Services Organisation representing 90% of the world's air traffic.
- ICCAIA - International Coordinating Council of Aerospace Industries Associations.
- GAMA - General Aviation Manufacturers Association.
- International Business Aviation Council.

[1] Aviation Benefits Beyond Borders - https://aviationbenefits.org/economic-growth/#:~:text=The%20aviation%20industry%20supports%20%243.5,17th%20in%20size%20by%20GDP
[2] Aviation Benefits Beyond Borders - aviationbenefits.org/media/167159/fact-sheet_2_aviation-and-climate-change.pdf
[3] Air Transport Action Group - www.atag.org/our-activities/climate-change.html
[4] Aviation Benefits Beyond Borders - www.aviationbenefits.org/media/167501/atag-net-zero-2050-declaration.pdf

Aviation has a multi-pronged plan to reach net zero emissions by 2050

Successfully realising the aspirations laid out by Fly Net Zero will require a coordinated and combined effort from the entire aviation industry (airlines, airports, air navigation service providers and aircraft manufacturers).

The industry strategy is to eliminate a maximum of emissions at the source before using approved offsetting and carbon capture technology.



There are four key components to the emissions reduction strategy.

Sustainable Aviation Fuels (SAFs) - with lower carbon emissions.

New technologies - Investment in new aircraft technology including new aerodynamic and alternative propulsion solutions (electric or green hydrogen).

Infrastructure/operations - Continued improvements in operational efficiencies with a particular focus on improved air traffic management.

Offsetting/carbon capture - Where the above is not possible, the use of approved offsets including carbon capture and storage technology.

Aviation emissions per passenger kilometre have halved since 1990

The cost of aviation fuel has provided a financial incentive to airlines to improve their efficiency (thereby reducing carbon emissions) for decades.

Aircraft in service today are 80% more fuel efficient per seat kilometre than those of the 1960s.[5]

Climate change provides an even greater impetus to decarbonise and since 1990 the industry has reduced emissions per passenger kilometre by 50%.

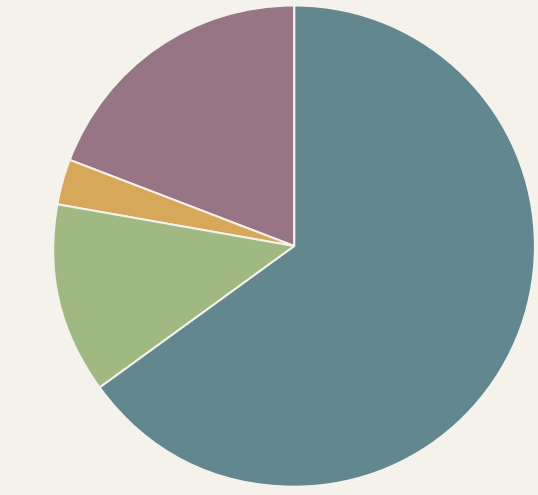
This has been achieved through optimising the aerodynamics of existing aircraft (such as introducing winglets and using advanced materials) and the introduction of the next generation of engines.

The ultimate goal for New Zealand is to use zero or low carbon planes on all domestic and trans-Tasman flights. In the long term, there is hope that such aircraft will be able to service long-haul routes too and overtake the use of SAFs.

However at this stage the industry estimates SAFs will be necessary to remove up to 65% of emissions to reach the net zero 2050 goal.

As a result, the sector invests heavily in research and development. For example, Airbus spends around €2.75 billion Euros per year on researching new innovations.

Initial contribution to achieving Net Zero Carbon in 2050



[5] BARNZ - barnz.org.nz/2019/05/10/how-new-zealands-airline-industry-promotes-sustainable-air-travel

Sustainable Aviation Fuels cut emissions by up to 80%

Increasing the use and production of SAFs is one of the cornerstones of the strategy to decarbonise aviation.

There are two types of SAFs – biofuels and electro fuels (e-fuels).

Rather than being made from fossil fuels, biofuels are usually produced from biological sources such as plant matter, waste streams or used cooking oil.

Chemically, SAFs are almost identical to traditional jet fuel and meet its rigid specifications. They've been dubbed 'drop-in' because of their ability to fuel existing aircraft types and be transported, stored and delivered using existing infrastructure.

Current SAFs can reduce CO_2 emissions by up to 80% over their lifecycle compared with fossil fuels and research is underway into fuels that could even have a negative emissions lifecycle - meaning they absorb more CO_2 than they emit.

Norway, a country that shares many geographic characteristics with New Zealand, has adopted a target of having biofuel make up 30% of aviation fuel consumption by 2030.

The implementation of a mandated target for the use of SAFs by airlines is included in New Zealand's Emissions Reduction Plan (ERP).

Increasing the production and availability of SAFs will increase their uptake.

While the industry purchased all 100-million litres of SAF available in 2021, the supply remains limited and the price is currently higher than conventional jet fuel.

Critically, the 193 countries of ICAO have agreed to look at ways to accelerate this and doing so underpins the approach to decarbonising transport outlined in New Zealand's ERP[6] .

SAF's critical numbers*

450,000+
flights have used SAF

100 million+
litres of SAF produced in 2021

50+
airlines have used SAF

$17 billion
USD of SAF on order

*as at October 2022

Aviation is ready to stabilise international aviation emissions

Aviation is the first sector in the world to create its own offsetting scheme which will be necessary to 'remove' emissions while clean technology is developed.

ICAO has led the development of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Its creation is significant. Airlines in countries that adopt CORISA will be required to offset international flight emissions through the scheme. This provides a consistent rulebook to the industry and ensures offsets are credible.The scheme will stabilise the emissions of international aviation at 85% of 2019 levels.

As at October 2022[7] , 115 countries (including New Zealand) have committed to participating in CORSIA from 1 January 2023.

In addition, many companies (including Airbus) are looking at options to directly capture carbon from the air.

Direct Air Carbon Caputure (DACC) is a comparatively new concept. It differs from other carbon capture

[6] Ministry of Environment - environment.govt.nz/assets/Emissions-reduction-plan-chapter-10-transport.pdf
[7] International Civil Aviation Organization - www.icao.int/environmental-protection/CORSIA/Documents/CORSIA%20States%20for%20Chapter%203%20State%20Pairs_3Ed_web.pdf

methods, because it captures CO_2 from the air around us, rather than at source (like industrial flues).

The captured carbon dioxide can then be stored or used as raw material.

Powered by renewable energy, it is predicted that there will be dozens of DACC facilities around the world by 2030[8].

A DACC facility being built in Texas is expected to capture one million tonnes of CO_2 every year – the equivalent absorption capacity of 40 million trees.

The new generations of aircraft technology

For the sector to achieve its ambitious objectives it will be necessary to develop, manufacture and install different aircraft and ground support infrastructure.

Electric and green hydrogen aircraft look set to play an important role in decarbonising domestic aviation in New Zealand and there has been significant progress in the development of both.

Heart Aerospace is in the final stages of developing a 30-seat electric aircraft (the ES-30) which is expected to be available for service before 2030.

Sounds Air is committed to operating the ES-30 in New Zealand as soon as it's available. Electric Air is already operating a small two-seater electric aircraft.

Air New Zealand has announced it's replacing its Q300 domestic fleet with a more sustainable aircraft. It is aiming to have its first zero emissions aircraft take flight in New Zealand by 2026.

Green hydrogen aircraft are already being trialled and Airbus has committed to bringing zero-emission hydrogen planes to market by 2035.

The arrival of these aircraft disrupts conventional methods of planning for and providing ground services at airports.

Efficient operations and infrastructure

Increasing the efficiency of operations and existing infrastructure will also help aviation reach its net zero goal.

Airports have a key role to play here, they:

- Will need to provide and develop airfield infrastructure (runways and taxiways) that allow new and next-generation aircraft types to operate efficiently;
- Should prepare to deliver new infrastructure to support either battery electric or green hydrogen-powered aircraft types;
- Must ensure they have access to resilient supplies of renewable energy sources;
- Must ensure their ground operations are designed, delivered and maintained in ways that continue to remove emissions.

Future-focused airports are also looking at ways they can generate renewable energy onsite with Hawkes Bay, Gisborne, Nelson and Christchurch Airports all committing to developing solar farms.

[8] Airbus - https://www.airbus.com/en/newsroom/stories/2022-07-direct-air-carbon-capture-and-storage-for-aviation-explained