

# Aviation aiming for carbon neutrality

Technology solves most of the problems it creates, it is said. The aviation industry is one of the sectors which have achieved the most in terms of emission reductions in recent decades. A modern jet is about 80 percent more fuel efficient than an aircraft delivered in 1960. Aircraft and engine manufacturers envisage carbon neutral growth from as early as 2020, and a 50 percent reduction in carbon emissions by 2050 compared to 2005 levels. The long-term goal is carbon neutrality.

Carbon neutral growth means that net CO<sub>2</sub> emissions from aviation will peak in 2020, stabilize and then decline, while accommodating increased air transport demand.

To achieve these goals, a multi-faceted approach involving all aviation stakeholders is necessary.

## Aircraft and engine design

The industry is committed to an average 1.5 percent efficiency increase per year. Boeing targets improving fuel efficiency of each new generation of commercial airplane by 15 percent compared to the airplanes they replace.

A contemporary example is the introduction of the Boeing 787-8 Dreamliner in 2011. This all-new aircraft is primarily built using composite materials which are stronger but lighter compared to conventional aircraft materials such as aluminum structures. Combined with a new generation of engines and smarter overall design, the result is an emissions reduction of approximately 20 percent compared to the most modern jets of comparable size in production today, such as the Airbus A330 or Boeing 767. Norwegian will introduce the Dreamliner into its fleet in 2012.

## Sustainable Biofuels

The most effective short-term alternative is biofuel. Biofuel is different from conventional jet fuel in terms of origin. Biofuel is derived from organic sources such as plants and algae, and has a substantially lower carbon emission throughout its lifecycle. Biofuels derived from biomass such as algae, jatropha and camelina have been shown to reduce the carbon footprint of aviation fuel by up to 80 percent.

Sustainable aviation biofuel does not displace food crops, does not require deforestation, but must meet or exceed jet fuel standards. The aforementioned biomasses meet these criteria.

Tests flights have clearly demonstrated that the use of biofuel from these sources as “drop-in” fuels is safe and technically sound. Biofuels can be blended with existing jet fuel in increasing quantities as they become available.

Commercial jets including the 747 jumbo have been powered during tests by bio fuels derived from coconut oil, babassu, jatropha, algae, camelina and sugar cane since 2008.

## Improved operational practices

Airlines can reduce their emissions by implementing more efficient flight procedures, weight reductions and other measures. To learn more about what Norwegian does, please see the chapter “Reducing Emissions”.

## More efficient infrastructure

Full implementation of more efficient air traffic management and airport infrastructure could provide substantial emissions reductions through implementation of measures such as the Single European Sky and the Next Generation Air Traffic Management system in the United States. These measures will allow more streamlined air traffic flows, enabling aircraft to fly the shortest, most efficient routes to their destinations.

## Alternative propulsion

Advanced technologies for generating and harnessing energy are creating new possibilities for airplane design and propulsion, from fuel cells and solar cells to innovative energy-harvesting methods. Energy harvesting is the collection of otherwise unused ambient energy to perform useful functions without emissions. Newer wristwatches powered by kinetic motion are examples of energy harvesting.

Boeing's Fuel Cell Demonstrator Airplane achieved the first manned straight-level flight powered solely by a hydrogen fuel cell in 2008, the only emissions being heat and water. Technologically commercial hydrogen-propelled aircraft can be marketed from as early as 2030, but commercialization depends on the price of hydrogen as an alternative - and not least the political will to introduce "the hydrogen society".

NASA conducted flights with solar-powered unmanned aircraft in the late 90's. In 2010 the Swiss consortium SolarImpulse performed a 48 hour flight solely using solar power, including night-time flying which is considered a technological breakthrough. SolarImpulse is planning a manned round-the world solar-powered flight.

While commercial flights powered by alternative propulsion are still a distant vision, successful test flights help pave the way for further research and development, speeding up the process. All that is impossible remains to be achieved.