The Air Charter Association

The ACA Guide: A Pathway to Sustainability

The Air Charter Association supports Aerospace & Aviation's drive towards sustainability. This is demonstrated through a commitment to raising awareness of increased efficiency, emission reduction and the development of new innovations.

The Air Charter industry is leading the way in efforts to reduce environmental impacts. The introduction of new technology is playing a key role in developing the path to reach 'Net Zero' in the wider aviation industry.

In 2009 the Business Aviation Commitment on Climate Change set the following three targets:

1) Improving fuel efficiency 2% per year from 2010 until 2020
2) Achieving carbon-neutral growth from 2020
3) Reducing CO2 emissions 50% by 2050 relative to 2005

The industry will achieve all these commitments and go further with a commitment to net-zero carbon emissions by 2050.

New aircraft being delivered today produce up to 50% less noise and 15% less emissions than the previous models they replace.

Offsetting schemes are offered by our member companies to travellers when emissions can't be avoided or reduced. This provides a means for travellers to immediately address the environmental impact of flying.

Sustainable aviation fuel (SAF) is a sustainable alternative to conventional jet fuel. While volumes are currently limited, the SAF market is growing. Book and Claim schemes bridge SAF availability gaps – enabling indirect SAF purchasing and emissions reductions, where physical SAF is unavailable at a particular departure airport.

The development and introduction of low-emission electric, hybrid, and zero-emission hydrogen-powered aircraft is an investment focus area for the industry. Smaller aircraft charter operations are anticipated to be first adopters.

THE AIR CHARTER ASSOCIATION SUSTAINABILITY GUIDE

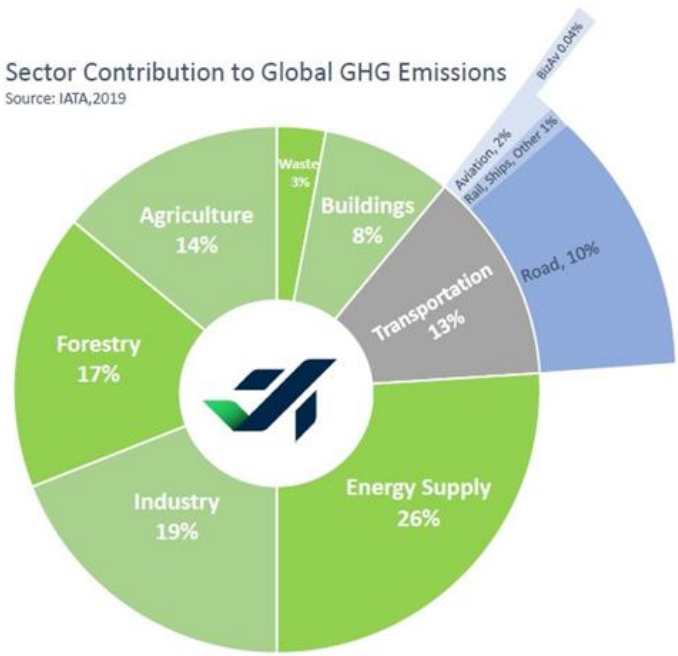
The Air Charter Association's commitment to sustainability

The ACA has a dedicated working group focused on Sustainability and Innovation. As the leading air charter industry association, we are committed to supporting member companies with their efforts to reduce environmental impacts & the introduction of pioneering innovations.

The key objectives of the ACAs Sustainability & Innovation Group are:

- To establish a vetted and trusted emissions offsetting partner for our members and industry, providing solutions for all emissions offsetting, a Sustainable Aviation Fuel programme and a book and claim process for SAF.
- Raise awareness of the initiatives undertaken by members and industry in sustainable and environmental improvements, which have a direct contribution towards a NET Zero pathway.
- Educate, support, train and advise members on sustainability goals and pathways to achievement towards NET Zero.
- Actively engage with regulators, governments, other associations, and industry to support, back and assist in key initiatives in the overall route to NET Zero, within the Air Charter sector.
- Become a carbon neutral association within 2024.

View our progress and the Sustainability Projects we support



Sustainability in Aviation – where are we now?

Aviation is a high-profile, visible industry that attracts significant attention, particularly within business and general aviation where lower passenger numbers make it a higher polluting sector. At present, the aviation industry contributes 2% of all global human-induced CO_2 emissions. Business aviation accounts for 0.04% of this total.

It is important to understand that aviation also has additional non-CO_2 effects on climate change, such as NOx and contrails. When considering these impacts, aviation's overarching GHG responsibility rises 5%. With the industries trajectory of growth anticipated, this figure is also expected to increase.

The aviation industry recognises and the imperative to reduce these emissions. Improvements have already been made, and there are now options to catalyse this change by advancing new technology and innovations. Climate change is a global issue; it is therefore essential that all industries work at a macro level to continue reducing GHG emissions.

What is being done to reduce GHG emissions in the Aviation / Air Charter industries?

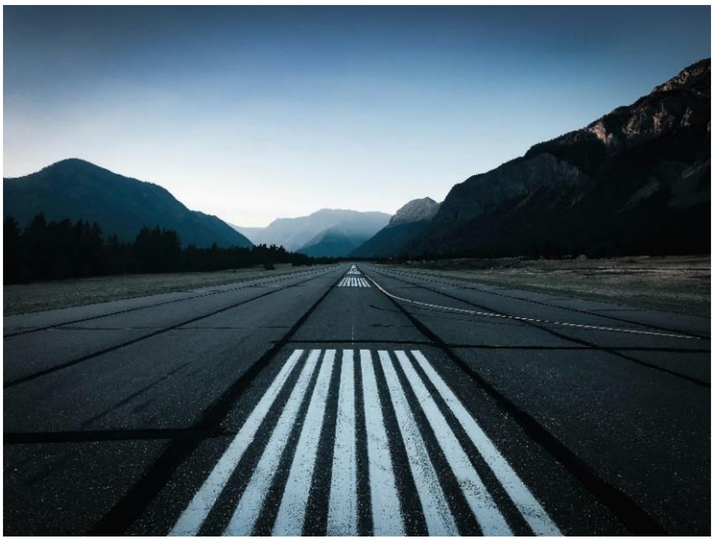
Huge focus and efforts are being placed in sustainable aviation fuels (SAF), emission offsetting schemes and new technological innovations with both electric and hydrogen propulsion. This is in addition to work that continues with aircraft design and increased efficiency in newer aircraft.

Between 2010 and 2016, passenger numbers in the UK alone grew by 27%, while total emissions grew by only around 0.2%.

This is as a result of investment in new aircraft technology, improved air traffic management and airports investing in reduced energy use on airfields.

ICAO Member States, have agreed to concentrate their aviation environmental collaboration on three core areas:

- Climate change and aviation emissions
- Aircraft noise
- Local air quality



Countries are pursuing these objectives through ICAO primarily via their development of new global aviation standards. They have also agreed to aspirational goals for international aviation, and have prioritized ICAO's Environmental Protection resources on:

- Airframe, propulsion, and other aeronautical and technological innovations.
- Optimising flight procedures to reduce fuel burn.
- Increasing the production and deployment of Sustainable Aviation Fuel (SAF) and clean energy.
- Implementing the Carbon Offsetting Reduction Scheme for International Aviation (CORSIA).

What is Sustainable Aviation Fuel (SAF) and how does it reduce carbon emissions?

Sustainable Aviation Fuel describes a fuel produced mainly from biological resources such as cooking oil, waste biomass, waste animal fats and others. Carbon dioxide produced by using SAF is converted into oxygen during photosynthesis. As a result, the consumption of SAF is balanced by the plants during a lifecycle. SAF can provide up to 80% reduction lifecycle CO_2 emissions when blended with the current approved maximum blend ratio of 50% SAF. Using SAF also improves local air quality, refines fuel efficiency, creates more local jobs, and attracts more investment in regions.

One of the greatest benefits of SAF is that existing aircraft can fly on SAF without any modification. Up to 50% SAF can currently be blended with traditional aviation fuel. Manufacturers' engines have started to be tested on 100% unblended SAF and the industry expects to be using 100% SAF in the near future.

Currently SAF is 3-4 times more expensive than traditional aviation fuel. As a result, both demand and production are very low, currently representing just 0.1% of the total jet fuel market. However, the cost of SAF is expected to decrease as the demand increases and the production methods become more efficient. The potential demand is likely to depend upon new government regulations which could accelerate the interest in SAF. The UK's Jet Zero Council, a partnership between industry and government, is aiming to mandate the delivery of at least 10% SAF in the UK fuel mix by 2030. Other EU member states are also working towards mandated SAF levels, with Norway and Sweden leading the push, with an aim for 30% by 2030 and a mandate already promulgated or in force.

Another benefit is that in the future the aviation industry can be less affected by a changeable global oil market, making pricing structures more consistent. Currently there are limited refineries throughout the world, but it can be uplifted in most continents. It is argued that airlines should look to buy SAF from locations where there are local refineries, this avoids creating emissions during the transportation of SAF to non-local locations.

Some companies offer a "Book and Claim" program, which sell SAF credits. Book and claim programs give the opportunity to buy SAF for your aircraft without uplifting it directly. The SAF bought is used in another aircraft flying out of an airport that provides SAF which would have otherwise used standard fuel. Therefore, the client who bought the credit can officially consider their flight as using SAF and having reduced emissions as a result.

This scheme helps not only meet the environmental sustainability targets, but also to stimulate investment in the production of SAF.

What is Emissions Offsetting & how does it work?

Emissions offsetting often is just one tool in our toolbox to tackle climate change and should not be considered as a stand-alone action.

Offsetting emissions is a continuous process, starting with measuring your carbon footprint, setting a strategy to decarbonise your organisation, and offsetting residual emissions while you transition to a low-emission operating model.

It is important to note there are big differences in the schemes available. Some purely measure CO_2 whereas others take a more holistic approach and include other greenhouse gas emissions referred to as CO_2e (Carbon Dioxide Equivalent). CO_2e is a standard unit for measuring carbon footprints. The concept is to convert the impact of each different GHG into an amount of CO_2 that would create the same amount of warming. This enables the carbon footprint comprised of lots of different GHG to be expressed as a single number. An estimation is that you need to multiply the CO_2 emissions by 2.5 to 3 times to approximately calculate the CO_2e value.

In simple terms, offsetting one tonne of carbon means there will be one less tonne of carbon dioxide in the atmosphere than there would otherwise have been. To offset your emissions, you purchase the equivalent volume of carbon credits (independently verified emissions reductions) to compensate for, or 'offset', your emissions. The payments you make to purchase these carbon credits pay for emissions reduction projects such as improving technologies or changing awareness and behaviours in a community, which reduce global carbon emissions.

Some projects prevent carbon emissions entering the atmosphere, such as those that replace devices using fossil fuels with cleaner technology (e,g. cleaner cook stoves). These are often known as carbon avoidance projects. Other projects take CO2 out of the atmosphere, such as planting trees to sequester carbon. These are known as removals projects.

Learn more about The ACA recommended Sustainability Scheme

The ACA has partnered with 4AIR to provide our members an exclusive opportunity to address their sustainability initiatives. Whether you operate a fleet, broker-chartered aircraft, or support aircraft operations, 4AIR will help guide you through your journey to a sustainable tomorrow.

As an example look at what The ACA has done to become a Carbon Neutral organisation: The ACA Sustainability Commitment

As a member of The ACA, you receive:

- a free carbon footprint analysis.
- expert support to implement sustainability in your business.
- access to Sustainable Aviation Fuel, both physical uplift and via Book & Claim.
- an exclusive 5% discount on 4AIR voluntary programs.
- regulatory compliance monitoring & reporting.

4 A I R

CLICK AND GET STARTED TODAY

Addressing Aviation Emissions

Market-based measures are essential for aviation when it comes to addressing and mitigating its impact on the climate and beyond, and there are several to which the wider industry must adhere.

European Emissions Trading System (EU ETS)

The world's first and largest system for trading emissions allowances has evolved over the past decades since its implementation by the European Union back in 2005 and is based on an underlying 'cap and trade' concept.

In capping the volume of GHG emissions that can be emitted from participants who are obligated to monitor, report, and verify their emissions under the scheme, over time the intended emissions decrease is a consequential result of the intentional 'cap' being reduced.

- Under the European Emissions Trading System (EU ETS); tradeable European Union Allowances (EUA)/climate credits are allocated to participants of the scheme. One allowance enables the emitter to emit 1 ton of CO_2 or its equivalent.
- It is a mandatory requirement for all airlines operating intra-EU flights to surrender their allowances against the emissions emitted.
- Participants who are anticipated to emit more than their allowance allocation can either take additional measures in reducing their CO2 emissions or choose to purchase additional allowances.

NOTE: A climate credit/carbon credit is a mandatory scheme-wide instrument used in EU-ETS, whereas a carbon offset is generally transacted in the voluntary carbon market through carbon avoidance, reduction, or removal projects. There are distinct synergies between the two however, they serve different purposes. Depending on the project, some voluntary carbon offsets may or may not yield carbon credits.

The EU ETS is mandatory for all complying operators and penalties can be strictly imposed for those who do not comply with the regulations.

CORSIA

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a global CO_2 emissions reduction scheme for international flights, and in 2016 was implemented by the International Civil Aviation Organization (ICAO). This global scheme aims to stabilize carbon emissions produced by the aviation industry.

While the sector is committed to technological innovation in aid of providing a long-term solution for the mitigation of GHG emissions, CORSIA intends to support the industry in achieving its climate targets through effective emissions reduction initiatives in the short to medium-term.

MAPPING CORSIA – THREE PHASES OF IMPLEMENTATION

CORSIA is considered a relatively new scheme intended to scale up the industry's decarbonisation efforts and is being implemented in three phases. Each phase is divided into three-year compliance periods and the CORSIA shall be reviewed by the ICAO in such increments.

BASELINE PERIOD 2019: Aircraft operators are required to monitor, report, and verify their CO_2 emissions data for all international flights (i.e. between two ICAO states) if total annual emissions exceed 10,000 tCO_2. Exclusions of this scheme apply to the following categories of flight(s): humanitarian, medical, firefighting, and flights from state aircraft. A large proportion of business aviation activities serve such flights.

PILOT PHASE (VOLUNTARY)

2021-2023: CORSIA only applies to states who have volunteered to participate in the pilot phase. For international flights between non-participating states, these flights will be exempt from the CORSIA. All qualifying aircraft operators of the scheme will be subject to the offsetting requirements.

FIRST PHASE (VOLUNTARY)

2024-2026: Similarly, to the pilot phase of the CORSIA, all qualifying aircraft operators of the scheme will be subject to offsetting requirements.

SECOND PHASE (MANDATORY)

2027-2035: As of 2027, CORSIA offsetting requirements will become mandatory for all aircraft operators flying routes between most 193 ICAO member states. Subsequently, most of the business aviation's international flying will fall within the remit of the CORSIA requirements.

Source: ICAO CORSIA Brochure

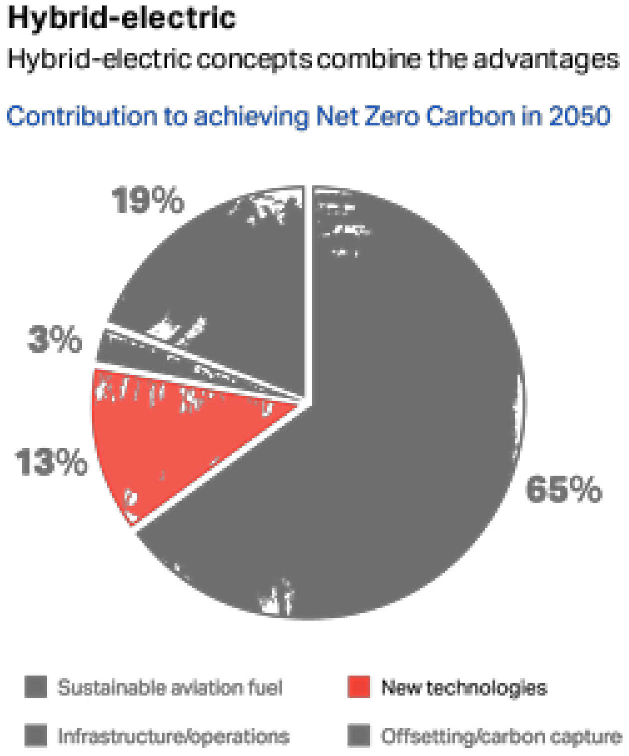
What are the sustainable new technologies & innovations?

Aviation's impact on climate change has become a major driving force for the development of new technologies, with a zero-emissions goal.

The main development areas that are currently being focused on are:

- Innovations in engine and aircraft design to significantly increase efficiency and reduce fuel burn.
- Efficiencies in air traffic management reducing flight times and hence emissions produced.
- Hybrid Electric, and Electric eVTOL and eCTOL powered aircraft.
- Hydrogen power.

All these new developments take significant resource and time to bring to reality and then need to be trialled and tested to very high levels, to comply with strict aviation safety regulations. The pace of their development has been increasing in recent years and several of these are already in the trial and testing phase.



Source: IATA Net zero 2050: new aircraft

Dassault Falcon 10X, NeXus flight deck

Efficiencies and improvements in Technology

Data from the IATA shows an historic trend of technological improvement, with each new generation of planes having reduced emissions of 15-20%. Over the past 50 years it is estimated that overall fuel efficiency has increased by 80%. These advances have primarily been achieved through improved aerodynamics, engine efficiency and reduced weight. The use of composites in the latest generation of aircraft, instead of aluminium has helped to significantly reduce weight.

Another factor which helps to reduce aviation emissions is the improved operational efficiency of Air Traffic Control (ATC). The Intergovernmental Panel on Climate Change (IPCC) stated in their 1999 report 'Aviation and the Global Atmosphere' that improvements in air traffic management (ATM) and other operational procedures could reduce aviation fuel burn by between 8 and 18%.

The large majority (6 to 12%) of these reductions comes from ATM improvements which it is anticipated will be fully implemented in the next 20 years. Today we see many examples of these operational efficiencies being implemented by regulatory agencies. In 2021 the FAA unveiled a new software as part of their Rolling to the Runway initiative which aims to reduce taxi time and fuel burn. With full implementation of the initiative the FAA anticipates savings of more than 7 million gallons of fuel every year and the elimination of more than 75,000 tons of CO_2 emissions annually.

Electric Aircraft & Hybrid-Electric Aircraft

Electric and hybrid-electric aircraft rely at least partially on electric propulsion. While public attention often focuses on eVTOL aircraft (electric vertical take-off and landing aircraft), which have a similar architecture and operational profile to conventional helicopters, eCTOL (electric conventional take-off and landing) as well as hybrid electric aircraft technology is developing rapidly and there are already examples employed in day-to-day operation.

eVTOL Technology

A significant number of ventures are in the process of developing eVTOL platforms, which operate a fully electric propulsion technology, aiming to disrupt short-haul travel. While these aircraft are expected to come into operation from 2024 onwards, pending their type certification with relevant national authorities, their utilisation will be dependent on hourly operating costs, OEMs' manufacturing capacity as well as a relevant support ecosystem being deployed in a timely manner.

In earlier stages of operation, and dependent on platform, eVTOL aircraft will be able to operate short intracity 'hops', to longer intercity journeys of up to approximately 250km. With advancing battery technology their ratio of energy density to weight is likely to increase over time, though for this initial range can also be expected to increase. National aviation authorities may also take a different perspective to currently restricting factors, such as battery reserves and maximum take-off and landing weight, as their confidence in this new technology matures, potentially leading to increased aircraft ranges.

One of the biggest challenges the eVTOL OEMs face is an uncertainty in rules and regulations for certification and operations, with these not being fully determined at this stage. Therefore, some degree of design and operations planning are currently taking place amidst uncertainty over final rules and regulations. However, most OEMs work closely with their national authorities, to design aircraft and their operations, in conjunction with rules that will eventually be agreed upon.

eVTOL Prosperity I Credit: Autoflight

eCTOL Technology

Fewer OEMs are focused on eCTOL (conventional take-off and landing) aircraft equipped with a fully electric propulsion, yet this technology is already used in day-to-day operations, predominantly in-flight training environments with platforms such as the Pipistrel Velis Electro, which is the first electric aircraft type certified by EASA.

Although it is unlikely that fully electric aircraft will be operated for long-range flights due to the weight constraints of current battery technology, certain OEMs are focused on designing passenger eCTOL aircraft with an initial range of up to 450km, which can eventually replace conventionally fuelled short-haul aircraft and therefore provide a zero operating emissions option for shorter, regional flights.

The main advantage of such eCTOL architecture in comparison to eVTOL platforms, is the relatively smaller power requirement for take-off and landing phases, which is significant during hovering phases at take-off and landing in VTOL operations. The operational profile of a CTOL platform will therefore allow for an increased range with similar battery energy density, however, requires a conventional runway to take off from.

Hybrid-electric Technology

Hybrid-electric aircraft, similarly, to hybrid cars, combine two sources of power, typically Jet A-1 fuel, or hydrogen fuel cells, in conjunction with an electric battery. By using partial electric power, the fuel burn of an aircraft can be reduced therefore, limiting its environmental operating impact. In the short term this has a great potential to further reduce emissions, however, it is important to note, that a hybrid technology that combines electric propulsion with a conventional Jet A-1 fuel engine, can only be a means to reduce emissions and it is only when this Jet A-1 is replaced with hydrogen fuel will this technology have the potential to provide a long-term pathway to a zero-emissions solution.

eAircraft Ecosystem

While the support requirements for eAircraft platforms will vary, all aircraft powered by electric propulsion will require a certain degree of ground support that differs from the one currently in place. Stakeholders will therefore need to invest into existing airports, heliports or dedicated vertiports to provide relevant ground support infrastructure.

Charging infrastructure requirements, similarly to that of electric cars, may vary for different aircraft platforms and jurisdictions. Charging facilities may also offer different charging speeds. For aircraft used in commercial, high frequency operations, it is imperative for battery charging to be carried out simultaneously with conventional fuelling for hybrid aircraft and to be completed as quickly as possible for fully electric aircraft. For this to be the case however, any charging facility will require a strong grid connection which can be significantly more costly than the charging device itself, as well as a cooling mechanism for the batteries not to overheat during charging.

Additionally, with a shifting ecosystem, ground handling, maintenance as well as crew training requirements are subject to change; stakeholders will need to work alongside OEMs to build and invest into an ecosystem suitable for these new technologies.

Hydrogen

Hydrogen (H_2) is the most abundant element in the universe and one of the most promising zero-emissions technologies aviation strives to adopt in the future due to its efficient and effective characteristics. The utilisation of this potential energy source is a long-term solution that could radically catalyse decarbonisation in what is considered a hard-to-abate sector.

Green Hydrogen is produced through a process called electrolysis. During this process water molecules (H_2O) are broken down into hydrogen (H_2) and oxygen (O). The lifecycle of this production must use renewable energy in order for this technology to avoid creating carbon dioxide (CO_2) as a by-product.

Effective renewable sources can include wind, solar and hydroelectricity and, subject to their geographical placing, performance capabilities can be both harnessed and leveraged. Where Hydrogen is produced using fossil fuel elements it is referred to as Blue, Grey, or Black Hydrogen.

Research continues on the use of both Gaseous Hydrogen and Liquid Hydrogen as fuels. Hydrogen in liquid form has high energy density (2.5 times more energy/Kg than Jet A-1), inexhaustibility, cleanliness, convenience and independence from foreign control, all attributes which make it a promising alternative fuel.

Hydrogen gas is liquified by cooling it to and storing at -253°C, this does create storage challenges. In addition, although liquid hydrogen has a higher energy output per Kg it has a lower volumetric density compared to Jet A-1 fuel, which means although less overall fuel is needed the space needed to contain the fuel is estimated to be 4 times larger. Subsequently, storage tank and airframe designs require adapting to support the increased volumes to achieve the same range.

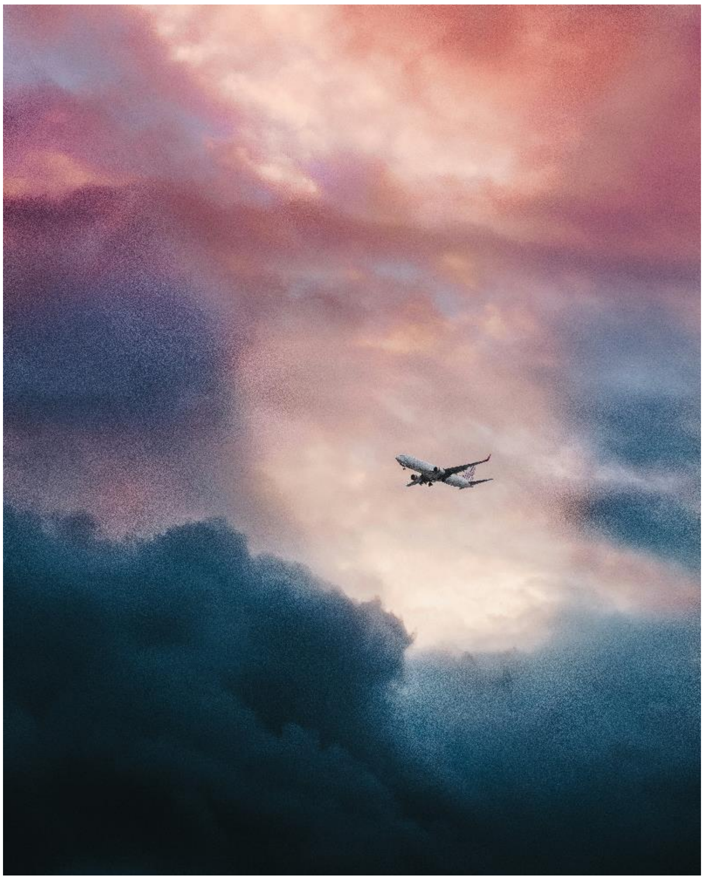
Another useful feature of hydrogen is that it can be used as a fuel cell for electrical power. Electrical fuel cells could be suitable for short-range aircraft while hydrogen combustion would be suitable for long-range and higher payloads. Hydrogen fuel-cells are already common devices found in cars, buses, and aircraft servicing vehicles.

While retrofitting other evolving technologies require little to no changes to existing modular designs, hydrogen propulsion requires completely new aircraft designs and certification. Not forgetting that airport infrastructures will also need to be similarly redesigned.

For the air charter industry, the hydrogen ecosystem is poised to significantly reshape short haul and long-haul travel. Short range flights could advocate liquid hydrogen's fuel cell technology, while longer range aircraft could directly burn hydrogen in gas turbine engines. The evolution of this developing technology could also act as a foundational pathway for synthetic fuels.

Research and testing are already underway, but such disruptive innovation will require time to refine and further development over the course of the next decade will be essential if we can anticipate this technology reaching service by around 2035. Such innovations will require abundant commitment and investment to turn what is an ambitious, but achievable vision, into an industry reality.

All these innovations will provide truly sustainable options for the aviation industry. It is inevitable due to the initial size and range limitations of these new technologies, that the business aviation and wider air charter sector will be the first adopters and will be heavily involved in their further development.



Find out More:

Set up your own Sustainability Scheme:
The ACA Member Sustainability Scheme

What are the ACA doing ourselves?
The ACA Sustainability Commitment

View our members Communications Guide:
The ACA Sustainability Communications Guide

Useful Industry Reference Links:

IATA Fly Net Zero

ICAO carbon compensation calculator

IATA SAF Fact Sheet

ICAO SAF Airport Availability Map

IATA Hydrogen Fact Sheet

Eurocontrol – Sustainability Data

4AIR Sustainable Fuels (SAF) Location Map

Sustainable Aviation

EBAA S.T.A.R.S programme

Climbing Fast International Initiative

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