

**CLIMATE ACTION
TAKES FLIGHT**



THE AVIATION SECTOR'S CLIMATE ACTION FRAMEWORK



NOVEMBER 2015
EDITION ONE

The air transport industry is the global network of commercial aircraft operators, airports, air navigation service providers and the manufacturers of aircraft and their components. It is responsible for connecting the global economy, providing millions of jobs and making modern quality of life possible. The Air Transport Action Group (ATAG), based in Geneva, Switzerland, represents the full spectrum of this global business. ATAG brings the industry together to form a strategic perspective on commercial aviation's sustainable development and the role that air transport can play in supporting the sustainability of other sectors of the economy. ATAG's Board of Directors includes: Airports Council International (ACI), Airbus, ATR, Boeing, Bombardier, Civil Air Navigation Services Organisation (CANSO), CFM International, Embraer, GE Aviation, Honeywell Aerospace, International Air Transport Association (IATA), Pratt & Whitney, Rolls-Royce and Safran.

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AIR TRANSPORT IS AN ESSENTIAL CONNECTOR OF THE MODERN WORLD, BRINGING TOGETHER PEOPLE AND BUSINESS. OVER 3.3 BILLION PASSENGERS A YEAR, A THIRD OF WORLD TRADE BY VALUE AND HALF OF ALL INTERNATIONAL TOURISTS TRAVEL BY AIR. WE SUPPORT AROUND 60 MILLION JOBS AND 3.5% OF GLOBAL GDP. BUT WE ALSO PRODUCE AROUND 2% OF THE WORLD'S HUMAN-INDUCED CO₂ EMISSIONS.

AS AIR TRAFFIC GROWS, PARTICULARLY TO POWER THE EMERGING ECONOMIES OF THE WORLD, HOW DO WE BALANCE THAT GROWTH WITH THE OBLIGATION ALL SECTORS FACE TO CONTROL THEIR CLIMATE IMPACTS?

HERE
IS WHAT
AVIATION
IS DOING...



OUR GLOBAL FRAMEWORK

IN 2008, THE AVIATION INDUSTRY PRESENTED THE WORLD'S FIRST GLOBAL TRANSPORT SECTOR CLIMATE ACTION FRAMEWORK, BASED ON A SET OF THREE GLOBAL GOALS, UNDERPINNED BY FOUR PILLARS OF CLIMATE ACTION. THIS PUBLICATION WILL LOOK AT THE PROGRESS BEING MADE WITH THESE EFFORTS.

THE THREE GLOBAL SHORT-, MEDIUM- AND LONG-TERM GOALS:

GOAL 1

PRE-2020 AMBITION

1.5% AVERAGE ANNUAL FUEL EFFICIENCY IMPROVEMENT FROM 2009 TO 2020.

PROGRESS

Goal currently well-exceeded, although figure expected to normalise.

HOW IS INDUSTRY ACHIEVING THIS?

Through the first three pillars: new technology, more efficient operations and better use of infrastructure.

T O I

» See pages 6-9

GOAL 2

IN LINE WITH THE NEXT UNFCCC COMMITMENT PERIOD

STABILISE NET AVIATION CO₂ EMISSIONS AT 2020 LEVELS THROUGH CARBON-NEUTRAL GROWTH.

PROGRESS

Industry is pushing for action at a government level.

HOW IS INDUSTRY ACHIEVING THIS?

Through the four-pillar strategy, including a global market-based measure negotiated at the International Civil Aviation Organization (ICAO)

T O I + M

» See pages 12-13

GOAL 3

ON THE 2°C PATHWAY

REDUCE AVIATION'S NET CO₂ EMISSIONS TO 50% OF WHAT THEY WERE IN 2005, BY 2050.

PROGRESS

Significant research efforts underway.

HOW IS INDUSTRY ACHIEVING THIS?

Two main areas of action: development of sustainable alternative aviation fuels; research into future design concepts by aircraft and engine manufacturers.

T O

» See pages 14-17

THE FOUR PILLARS OF CLIMATE ACTION ARE:

T

TECHNOLOGY AND SUSTAINABLE ALTERNATIVE FUELS

- » In the short-term, see pages 6-7, 14-15
- » In the long-term, see pages 14-17

O

OPERATIONS

- » Page 8

I

INFRASTRUCTURE

- » Page 9

M

MARKET-BASED MEASURES

- » Pages 12

THIS IS A JOINT EFFORT, WITH COLLABORATIVE ACTION TAKING PLACE ACROSS THE AVIATION SECTOR. AIRPORTS, AIRLINES, AIR TRAFFIC MANAGEMENT ORGANISATIONS, THE MANUFACTURERS OF AIRCRAFT AND ENGINES AND PARTNERS ACROSS THE SUPPLY CHAIN ARE WORKING TOGETHER ON ACTION THAT WILL REDUCE AVIATION CO₂ EMISSIONS. MANY OF THEM ARE OUTLINED IN THIS PUBLICATION.

AVIATION'S EMISSIONS PROFILE

Air transport generated 724 million tonnes of CO₂ in 2014. This is around 2% of the 36 billion tonnes of CO₂ generated by human activities every year. Of the total, 65% is from international aviation activity and 35% from domestic.

Historically, international transport emissions from aviation and shipping have not been included in the international climate regime administered by the United Nations Framework Convention on Climate Change (UNFCCC), as these emissions fall outside of the scope of nationally-determined climate action. Instead, these emissions have been dealt with by the International Civil Aviation Organization (ICAO) and shipping's equivalent, the International Maritime Organisation.

BUSINESS AS USUAL?

There is a lot of talk amongst climate change practitioners about not following a 'business as usual' pathway. It should be seen slightly differently in an aviation sense: for aviation, business as usual has always been about improved fuel efficiency. Ever since the first jet aircraft came into service, each generation of aircraft has brought with it advances in technology that have helped cut fuel use (except one – the supersonic Concorde). At the beginning, this was a simple payload issue – the more fuel that was needed for any given mission meant higher weight and fewer passengers, parcels or less distance that could be travelled. Then the concern shifted to cost, as the price of fuel increased. Today, both the price of fuel (around a third of airline operating costs) and the climate impacts have driven advances in aircraft fuel efficiency.

Our "business as usual" focus on efficiency has seen a halving of fuel use per tonne kilometre

travelled since 1990. In other words, your flight today will generate around 50% less CO₂ per kilometre compared to the same flight back in 1990. This progress has not just come about through technological advances – the operational and infrastructure measures that make up our framework also play an important role.

SERVING THE WORLD

Fuel and CO₂ efficiency on an individual flight basis have been making impressive progress. But overall emissions from aviation have continued to rise, as traffic (both passenger and cargo) has grown. Most growth has been taking place in emerging economies, as they recognise the benefits of the connectivity that air travel provides. Trade and tourism are important drivers of economic and social development around the world and as middle-classes continue to grow, their appetite to experience the world also needs to be catered for.

The industry's climate action framework is designed to help balance the two goals – economic growth through connectivity and reducing climate impacts in the long run. Partners within and outside the air transport sector will need to work together to achieve the goals, but the outcome will be worth the effort.

MEETING THE GOALS

The rest of this publication will detail the ways in which the aviation sector is working together to meet the climate goals it has set. This graph outlines how different parts of the climate action framework could deliver the goals. It is a conservative look at the future potential for CO₂ reductions based on concepts described in this publication.

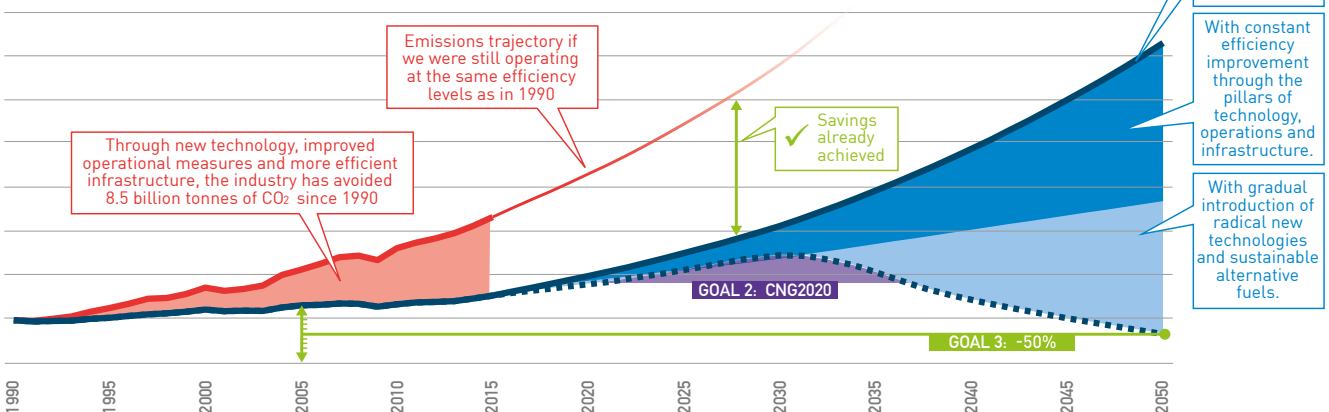
AVIATION CLIMATE SOLUTIONS HIGHLIGHTS 101 INNOVATIVE CLIMATE ACTION SOLUTIONS UNDERWAY ACROSS THE INDUSTRY:

WWW.ENVIRO.AERO/CLIMATESOLUTIONS

FUEL EFFICIENCY AND CO₂ EFFICIENCY GO HAND-IN-HAND FOR AVIATION. FOR EVERY 1 TONNE OF FUEL SAVED, CO₂ EMISSIONS ARE CUT BY AROUND 3.15 TONNES.

AVIATION SUPPORTS AROUND 60 MILLION JOBS AND \$2.5 TRILLION IN GLOBAL GDP.

AVIATION CO₂





T NEW TECHNOLOGY

AVIATION IS A TECHNOLOGY-DRIVEN BUSINESS. AND TECHNOLOGY CAN PROVIDE THE BIGGEST IMPROVEMENTS IN FUEL EFFICIENCY. SINCE THE START OF JET TRAVEL, EACH GENERATION OF AIRCRAFT HAS CUT FUEL USE AND CONSEQUENTLY CO₂ EMISSIONS. IT IS THESE STEP-CHANGES THAT BRING ABOUT LARGE EFFICIENCY SHIFTS ACROSS THE GLOBAL AIRLINER FLEET.

Each new generation of aircraft brings around 15-20% savings in fuel and CO₂ compared with the aircraft it replaces. Once new models of plane enter service, it takes a few years for them to start having an impact on the global fleet fuel efficiency, as they are delivered and start flying. But when there is a critical mass, they can have a profound impact on the carbon footprint of the sector. For example, after years of financial difficulty, airlines in the United States have recently replaced a lot of older aircraft with brand new, fuel efficient planes. This is one of the reasons why absolute emissions from US airlines dropped by 8% between 2000 and 2014, while traffic rose by 20%.

Globally, over 9,500 new aircraft have been delivered since 2009 at a cost of \$1 trillion. This is a significant investment in a new fleet. Whilst 44% of these aircraft are to cope with growth in traffic, mainly in emerging economies, the rest will replace older less efficient aircraft being retired from the fleet.

RESEARCHING THE FUTURE

Manufacturers of aircraft and engines spend \$15 billion a year on research to produce more efficient aircraft. It is this investment which is already supporting a wave of new-generation technology entering the fleet. Each of the world's leading manufacturers has new model aircraft either entering service, or that will do so in the next five years, as illustrated below.

Governments, civil society and industry are working at ICAO on a new CO₂ standard for aircraft – much like CO₂ performance ratings for cars, except significantly more complex. This will apply to aircraft certified after 2020. But already, manufacturers are designing – and competing – on the most energy-efficient products they can make, whilst maintaining the industry's well-known safety levels.



ATR 72-600

ENTRY INTO SERVICE 2013

Reduces emissions by 12% compared to the previous models through the use of lightweight cabin materials and improved navigation technology.



Embraer E2

ENTRY INTO SERVICE 2018

By utilising aerodynamic wing designs and the new Pratt & Whitney PurePower engine, the E2 series will reduce emissions by 16%-24% per seat.



Bombardier C Series

ENTRY INTO SERVICE 2016

20% increase in fuel efficiency through the next generation Pratt & Whitney PurePower engine, composite materials and improved navigation technology.



Airbus A320neo

ENTRY INTO SERVICE 2014

20% less CO₂ compared to the current A320 through the introduction of next generation engines (CFM LEAP and Pratt & Whitney PurePower) and sharklet wingtip devices.



Boeing 737MAX

ENTRY INTO SERVICE 2017

20% less CO₂ than the traditional 737. This is achieved through the use of CFM LEAP engines, lighter weight construction materials and an advanced technology winglet.



Airbus A330neo

ENTRY INTO SERVICE 2018

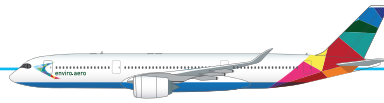
14% less CO₂ than the aircraft it replaces through an increased wingspan and winglets, as well as the next generation Rolls-Royce Trent 7000 engine.



Boeing 787

ENTRY INTO SERVICE 2011

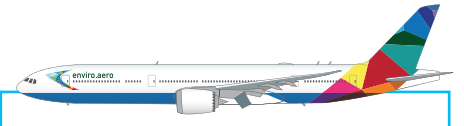
20 -25% more fuel efficient than aircraft it replaces. These gains are made through manufacturing single piece barrel sections of the fuselage, innovative wing design and use of next generation GE and Rolls-Royce engines.



Airbus A350WXB

ENTRY INTO SERVICE 2015

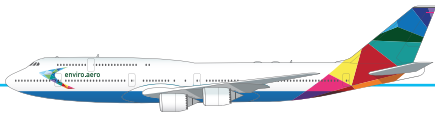
25% less CO₂ than the aircraft it replaces and utilises innovative technology such as morphing wings, a carbon-fibre reinforced plastic fuselage and the Rolls-Royce Trent XWB engine.



Boeing 777X

ENTRY INTO SERVICE 2020

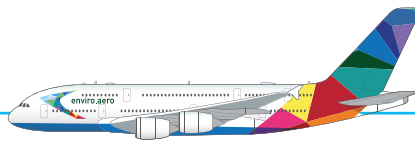
Will reduce CO₂ emissions by 20% compared to the original model through using longer wings made from composite materials and the new GE9X engine.



Boeing 747-8

ENTRY INTO SERVICE 2012

The updated 'jumbo jet' is built with new wings based on 787 technology and fuel efficient engines to produce a CO₂ emissions saving of 16% compared to its predecessor.



Airbus A380

ENTRY INTO SERVICE 2007

The large size of the A380 allows for more passengers to be flown in one aircraft, reducing overall fuel use and lower weight, improved aerodynamics and new generation engines has brought down fuel burn.

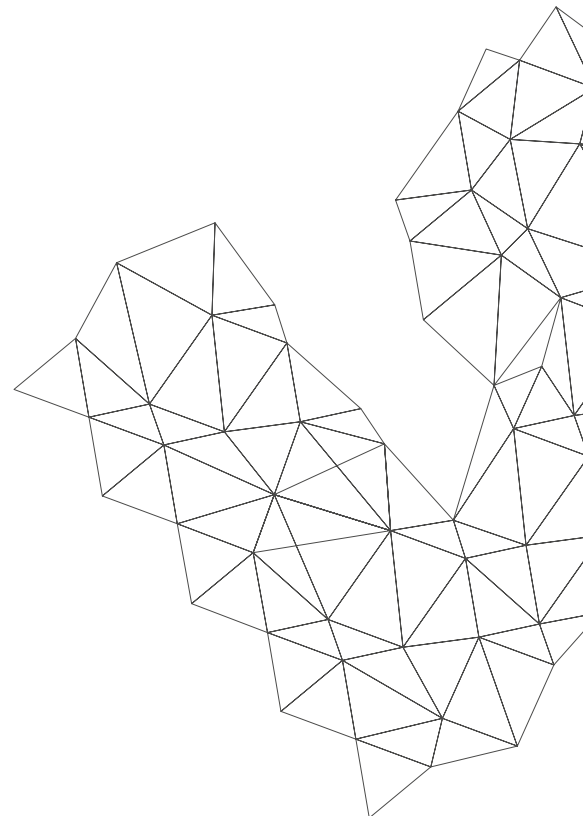
IN ADDITION TO FOCUSING ON REDUCING GLOBAL CO₂ EMISSIONS WHEN AIRCRAFT ENTER SERVICE, EFFORTS ARE MADE TO MITIGATE THE IMPACT OF AIRCRAFT NOISE ON POPULATIONS OR ON LOCAL AIR QUALITY, WHILE MAINTAINING THE HIGHEST DEGREE OF SAFETY. THIS BALANCE IS IMPERATIVE FOR THE AVIATION SECTOR.

BUILDING THE AIRCRAFT DIFFERENTLY

Aerodynamics and engine efficiencies, new manufacturing techniques and materials are showing major benefits. Long ago, the advent of lightweight alloys allowed aeronautical engineers to design strong and relatively light structures. The recent use of composite materials such as carbon-fibre reinforced plastic for the construction of large parts of aircraft fuselages and wing structures has delivered further weight reductions and also cut down on the number of rivets that need to be used, making the aircraft even more aerodynamic.

The recent surge in additive layer manufacturing, otherwise known as 3D printing, has also been taken up by the aviation industry, creating aircraft parts that are perfectly shaped to meet their task, not shaped by what is possible in the manufacturing process. This too is saving weight onboard aircraft. It also helps reduce the environmental footprint of manufacturing through less energy consumption and improved waste management.

Computational fluid dynamic modelling is shaping a whole new generation of even more aerodynamic wings. Whilst they may look similar to previous wings, these are carefully produced to be as aerodynamic as current materials and production processes allow and many are made out of carbon fibre composites.



0 MORE EFFICIENT OPERATIONS

ONCE AIRCRAFT ARE IN SERVICE, THERE ARE A RANGE OF THINGS THAT CAN BE DONE TO REDUCE THE EMISSIONS FROM THEIR OPERATION. A LOT OF THIS HAS TO DO WITH CUTTING THE WEIGHT CARRIED ON BOARD: MORE WEIGHT MEANS MORE FUEL USED. BUT IT CAN ALSO MEAN FLYING EACH FLIGHT MORE EFFICIENTLY, AND EVEN USING ELECTRICITY INSTEAD OF JET FUEL WHEN ON THE GROUND.

There are around 27,000 aircraft already in service worldwide. Whilst a number of those are latest technology aircraft, many older planes can have efficiency measures undertaken to improve fuel use and CO₂ reduction, before they are eventually replaced with new models.



GOING ON A DIET

Reducing weight on board is a major part of any airline's operational efficiency measures. New technology and materials can mean cabin furnishing components and equipment are lighter weight. Airlines conduct weight audits whereby they remove all loose equipment from an aircraft and determine which items are safety critical, which are service necessary and which can either be left off the aircraft or replaced with lighter alternatives.



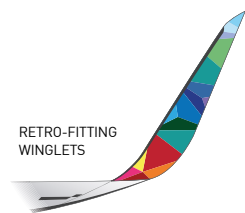
New equipment takes many forms:

- State-of-the-art materials are being used to build lighter food service carts and in one airline's case this has cut CO₂ emissions by 28,000 tonnes each year.
- Installing stronger but thinner seats enabled one airline to increase the number of passengers on board (making better use of each aircraft), whilst also reducing CO₂ across its fleet by 21,000 tonnes.
- Purchasing cargo and passenger baggage containers made from Kevlar and other new materials has cut weight by one third and, in the case of one airline, decreased its CO₂ emissions by 3,200 tonnes in 2014.
- Many airlines have now replaced their paper-based flight manuals, which can weigh up to 20 kilograms, with tablet computers weighing only half a kilogram. One airline was able to save 3,500 tonnes of CO₂ annually using this system.



THOSE THINGS ON THE WINGS

Most newer aircraft and many retro-fitted aircraft now utilise winglet technology. These additional devices fitted to the tips of aircraft wings significantly reduce drag, and therefore fuel consumption, and have resulted in the avoidance of over 56 million tonnes of CO₂ worldwide since the year 2000.



FLYING IN NEW WAYS

Through improved navigation technology, aircraft are now able to fly more flexible, efficient routes rather than sticking to pre-determined routes. This allows pilots to plan a route based on the optimum flightpath, adapting especially to the wind conditions at cruising level. These Free Route Airspace systems have been trialed in Europe and Australia.

In previous years, an aircraft's climb and descent were carried out in a staggered, stepped manner, which required additional engine power to move through each phase. Through smoother continuous climb and descent, aircraft at many airports can save fuel and CO₂ emissions.



By taking into account real-time changes in the weather patterns using new navigation technology, pilots can replace pre-set flight plans with flexible navigation that allows the aircraft to better anticipate avoidance of obstructive weather conditions, saving on fuel and CO₂. One airline has been able to save an average of 1.3 tonnes of CO₂ per flight on which this has been used.

To cut down on the use of jet fuel whilst the aircraft is on the ground, many airlines are using only one engine during the taxiing phase.



By sharing information between pilots, airport staff and navigation services more efficiently, fuel and CO₂ can be saved through reducing the time spent by aircraft in the sky, increasing slot adherence and cutting down on taxiing time through a process known as collaborative decision-making.

MEETING GOAL ONE: 1.5% IMPROVEMENT IN FUEL EFFICIENCY PER ANNUM

I BETTER INFRASTRUCTURE

INFRASTRUCTURE IS THE THIRD MAIN PILLAR OF AVIATION'S CLIMATE ACTION. IT REPRESENTS AN IDEAL OPPORTUNITY FOR SIGNIFICANT FUEL EFFICIENCY IMPROVEMENTS, COUPLED WITH CAPACITY ENHANCEMENTS, MAINLY RELATED TO CHANGES IN AIR TRAFFIC MANAGEMENT. WHILST MANY AIR NAVIGATION SERVICE PROVIDERS HAVE BEEN TAKING IMPRESSIVELY PROACTIVE ACTION TO CUT EMISSIONS ON AN INDIVIDUAL AND REGIONAL BASIS, MANY OF THE POTENTIAL GAINS REQUIRE GOVERNMENT ACTION. AIRPORTS HAVE BEEN TAKING ACTION TOO, MUCH OF IT TO REDUCE ENERGY CONSUMPTION AND FOSSIL FUEL USE IN THEIR BUILDINGS OR FOR THEIR OPERATIONAL ACTIVITIES, BUT THERE ARE ALSO WAYS THEY CAN HELP REDUCE JET FUEL USE.

The biggest gains are coming through development of the air traffic system away from a strict 'control' model to a 'management' concept that gives greater autonomy to individual flights without compromising safety. There are a number of concepts and techniques that enable air traffic management to reduce aviation CO₂ emissions. Many are already being implemented, but there is also a more systematic need to introduce new technology and techniques in many parts of the world, not to mention changing the institutional environment for many air traffic management organisations.

IN THE AIR

By using a range of navigation technologies and procedures collectively called 'performance based navigation', aircraft can plan the optimum route available without having to be 'controlled' from one area to the next, taking into consideration weather, restricted airspace and safety concerns. This increase in route efficiency cuts down on fuel use and CO₂ emissions.

Taking advantage of new technology to track aircraft more closely can help significantly increase efficiency and capacity. Traditionally, air traffic controllers have used ground-based radar to track and control flights. Now, more efficient satellite-based technology is being used which allows the surveillance of aircraft in remote areas and oceans that were previously not covered by radar.

The Single European Sky ATM Research and NextGen projects are impressive collaborative efforts that will lead to significant emissions reductions. However, whilst much of this work is underway at air traffic management providers around the world, more systematic airspace changes need to be implemented which could help reduce aviation emissions even further.

Full efficiency, including global implementation of the ICAO Global Air Navigation Plan and the aviation system block upgrades (ASBU) methodology that States have agreed to apply, will lead to much more efficient operations and greater capacity of the system. ASBUs allow States to modernise their airspace at their own pace with support from ICAO and international organisations.

There is also a balancing act which needs to be considered. New technologies and procedures can bring about significant CO₂ reductions, but in some circumstances can also increase

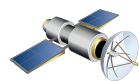
impacts elsewhere. For example, much more accurate and efficient landing techniques can sometimes lead to more concentration of noise over certain areas. Although the number of people impacted overall is significantly reduced, more noise may be imposed on specific areas and groups of people.

ON THE GROUND

Airports are active promoters of climate-friendly practices. The Airport Carbon Accreditation programme, initially developed in Europe but now available to airports worldwide, is a systematic approach to measuring, reducing and eventually offsetting CO₂ emissions from airport-related activity. Over 128 airports are now taking part in the programme, covering 28% of global air traffic and the actions logged by the programme saved an estimated 212,460 tonnes of CO₂ in the year following May 2014.

The design of airport terminals has a significant impact on the level of CO₂ produced at airports. Some airports have designed their layouts so as to cut down on taxiing time and some save energy through the use of LED lighting (both in terminal buildings and on the airfield) and carefully placed windows, which take advantage of natural light.

Most jet aircraft contain a small generator used to power systems (for cleaning and air conditioning) when the aircraft is on the ground. Many airports now offer fixed electrical ground power and pre-conditioned air, plugged into the aircraft at the gate. Some even makes its use mandatory. The power from these ground sources comes either directly from the grid or even from solar power and cuts CO₂ by 100,000 tonnes per year at one major hub airport.



SATELLITE-BASED NAVIGATION SYSTEMS ALLOW FLIGHTS TO OPERATE IN BEST CONDITIONS

AIR NAVIGATION SERVICE PROVIDERS CAN IMPLEMENT SYSTEMATIC AND TACTICAL IMPROVEMENTS



AIRPORT OPERATORS WORK WITH AIR TRAFFIC MANAGEMENT AND AIRLINES THROUGH COLLABORATIVE DECISION MAKING



MEETING GOAL ONE: 1.5% IMPROVEMENT IN FUEL EFFICIENCY PER ANNUM

CLIMATE ACTION AROUND THE WORLD

THIS MAP ILLUSTRATES A SELECTION OF CLIMATE ACTIONS ALREADY UNDERWAY AROUND THE WORLD. TOGETHER, THEY REPRESENT BILLIONS OF DOLLARS OF INVESTMENT AND MILLIONS OF TONNES OF CO₂ AVOIDED SINCE 2009. THIS MAP COMES FROM THE ATAG PUBLICATION *AVIATION CLIMATE SOLUTIONS*, A COMPENDIUM OF 101 CASE STUDIES OF SMALL AND LARGE ACTIONS BEING UNDERTAKEN BY OVER 400 PARTNERS ACROSS THE AVIATION SECTOR.

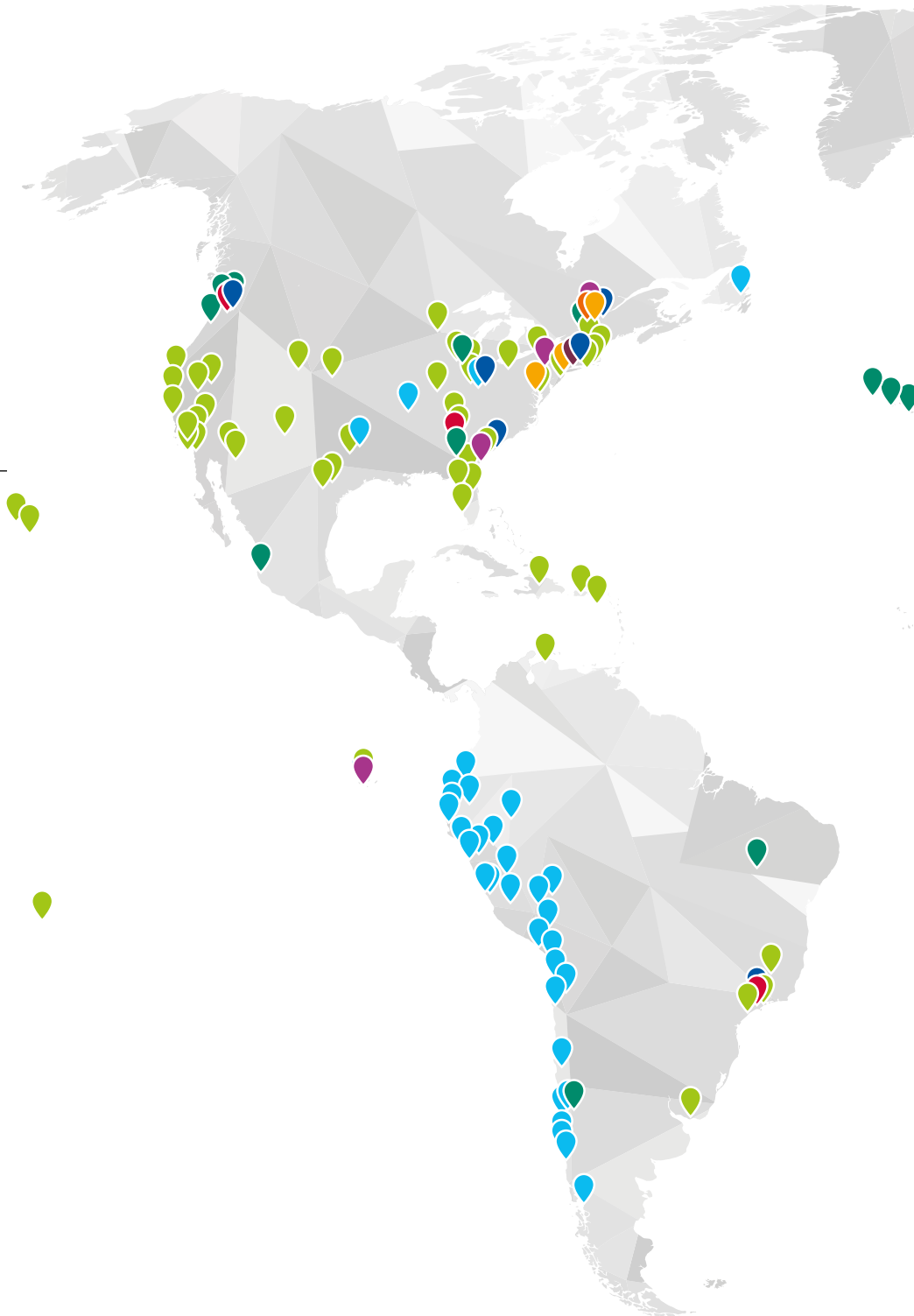
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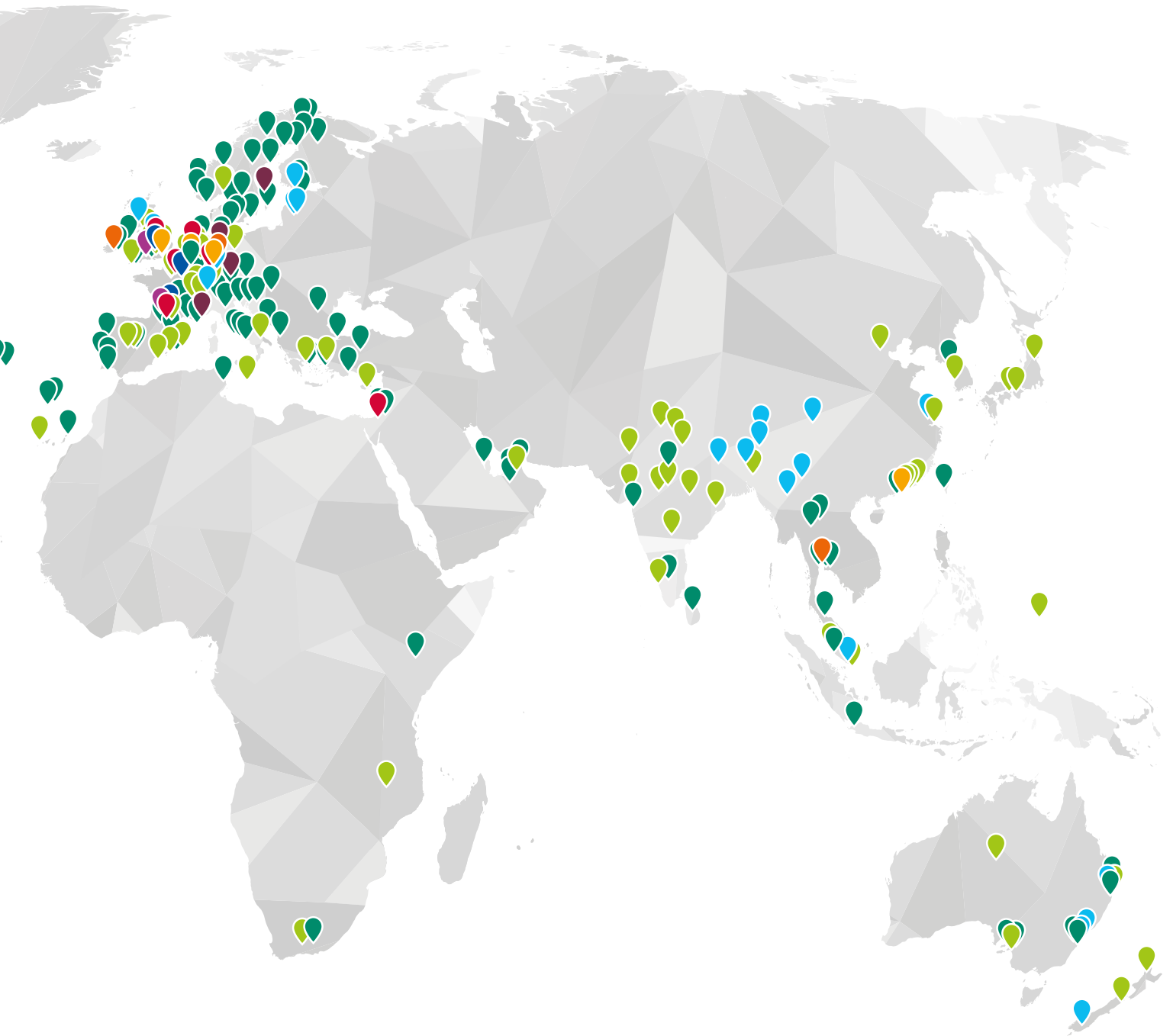
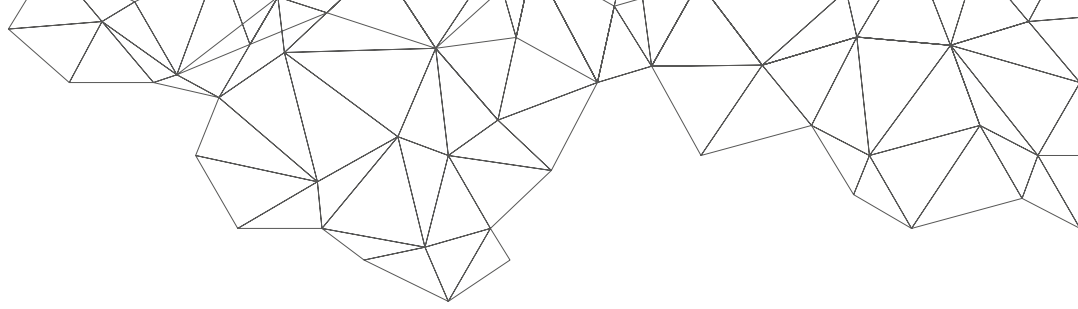
OVER 100 AIRPORTS WORLDWIDE HAVE INSTALLED PHOTOVOLTAIC POWER GENERATION PLANTS, CONTRIBUTING OVER 400 MEGAWATTS OF CAPACITY GLOBALLY. AIRPORTS OF ALL SHAPES AND SIZES ARE INVESTING IN THE TECHNOLOGY: FROM LARGE INTERNATIONAL HUBS TO SMALL ISLAND AIRFIELDS, THE LARGE FLAT SURFACES ON TERMINAL ROOFS AND ALONGSIDE RUNWAYS MAKE AIRPORTS THE PERFECT PLACE FOR SOLAR PANELS.

NEW PROCEDURES THAT TAKE ADVANTAGE OF PERFORMANCE BASED NAVIGATION, BETTER SPEED CONTROL AND PARALLEL RUNWAY OPERATIONS HAVE TAKEN KILOMETRES OFF EVERY DEPARTURE AND ARRIVAL PATH REDUCING CO₂ BY THOUSANDS OF TONNES.

WHICH CATEGORY OF CLIMATE ACTION?

-  COLLABORATION
-  INNOVATION
-  ALTERNATIVE ENERGY
-  EFFICIENCY IN THE AIR
-  EFFICIENCY ON THE GROUND
-  PEOPLE
-  BUILDING AND CONSTRUCTION
-  STEP-CHANGE TECHNOLOGY
-  CARBON MANAGEMENT







M CARBON-NEUTRAL GROWTH

ONCE THE FIRST THREE PILLARS HAVE BEEN MAXIMISED, A MARKET-BASED MEASURE (MBM) CAN HELP BRING DOWN AVIATION EMISSIONS TO MEET THE 2020 GOAL. THE AVIATION INDUSTRY HAS TAKEN THE UNUSUAL STEP OF ASKING FOR A GLOBAL MARKET-BASED MEASURE TO BE DEVELOPED THROUGH THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), A PROCESS THAT IS NOW WELL UNDERWAY. THIS MBM WILL BE USED, ALONG WITH THE OTHER PILLARS OF ACTION, TO MEET THE INDUSTRY-WIDE GOAL TARGET OF CARBON-NEUTRAL GROWTH FROM 2020.

Aviation is a global sector that relies on global standards and solutions for so many issues. Safety and security need to be defined at an international level to ensure applicability worldwide. On environmental issues, too, the industry needs a standard approach. Air traffic management systems must be compatible with aircraft that could fly across 20 or 30 different pieces of airspace in a single day. The same can be said for development of a market-based measure (MBM) for the sector.

AVOIDING A PATCHWORK

To avoid a potential patchwork of different measures popping up in countries and regions around the world, the aviation industry took a pragmatic decision to push for the development of one global MBM, to be designed under the direction of States meeting at ICAO. A single global scheme will help ensure environmental integrity by covering virtually all commercial aviation emissions. It will also avoid market distortion which could be caused if some airlines need to pay for emissions and some are exempt, depending on whether they are registered in a developing or developed nation: all routes and airlines should be covered.

The industry has, therefore, called for one global scheme for international flights, to come into force from 2020. Governments, civil society and the industry are currently working under the auspices of ICAO to design the framework for such a scheme, which will be presented to the next ICAO Assembly in September 2016. This would leave four years for operationalisation before the MBM comes into force in 2020, coincidentally in line with the next global UNFCCC climate agreement.

The process is well underway with two major streams of work ongoing:

- Policy – through a working group of the ICAO Council called the Environment Advisory Group;
- Technical – through a task force convened under the ICAO Committee on Aviation Environmental Protection, the Global Market Based Measure Technical Task Force.

AN IMPORTANT PART OF ANY SCHEME

The industry has set out some criteria it considers important in any MBM:

- It should maximise environmental integrity (to ensure that all airlines face the same environmental stringency).
- It should be cost-efficient (both to the industry and to governments).
- It should not be used to raise general revenues or suppress the demand for air travel (which would breach the Chicago Convention and not meet the needs of developing nations for aviation connectivity to power economic growth).
- It must minimise competitive distortion (in aviation, this is not a simple task, as competition does not just occur between airlines flying the same city-pair route).
- It should be easy to implement and administer (both for airlines to comply with and for government agencies to verify).

ICAO has in the past studied three potential MBM options:

1. A global levy or tax – a simple solution, but studies have found any such levy would need to be very large to suppress demand enough for any environmental outcome, causing disproportionate impacts on small island and developing states;
2. A global emissions trading scheme – which fulfils environmental integrity, but is not simple enough to operate in 191 ICAO member states by 2020; and
3. A simple carbon offsetting mechanism – whereby the growth in emissions is offset using qualifying offsets purchased on an open market, but with quality criteria applied to ensure environmental integrity.

The aviation industry has a stated preference for carbon offsetting as the mechanism, as this would be easiest to implement, most cost-efficient and, importantly, the fastest to establish given the 2020 deadline.

THE GLOBAL AVIATION MARKET-BASED MEASURE WILL APPLY FROM 2020 AND WILL CAP EMISSIONS GROWTH FROM AVIATION (MEETING GOAL TWO – CARBON-NEUTRAL GROWTH).

POLITICAL CHALLENGES

Given the difficulty in reaching multilateral consensus at the UN climate talks, particularly over issues concerning differentiated responsibility for climate action between developed and developing countries, the industry has been very encouraged by the positive approach taken by parties around the ICAO table. There is a general understanding that, for aviation at least, a global approach is needed.

However, reconciling the needs of emerging markets which see aviation as a catalyst for economic and social growth, with the need for comprehensive and effective climate action that preserves the Chicago Convention's principle of non-discrimination has been a challenging part of the talks. All parties are working to find a suitable solution and the industry is confident of success.

A key issue under consideration by the technical working groups is the eligibility criteria to be applied to the use of offsets and/or allowances under any offset mechanism. It is recognised as critical to the environmental integrity of the MBM, that any offsets eligible for use must meet essential quality criteria. This includes that they represent real, additional, verifiable and permanent emissions reductions that avoid leakage. Discussions regarding emissions unit eligibility criteria have been largely focused on: ensuring the long-term cost-effectiveness and flexibility under the MBM by providing access to the broadest possible pool of emissions units that meet the environmental integrity

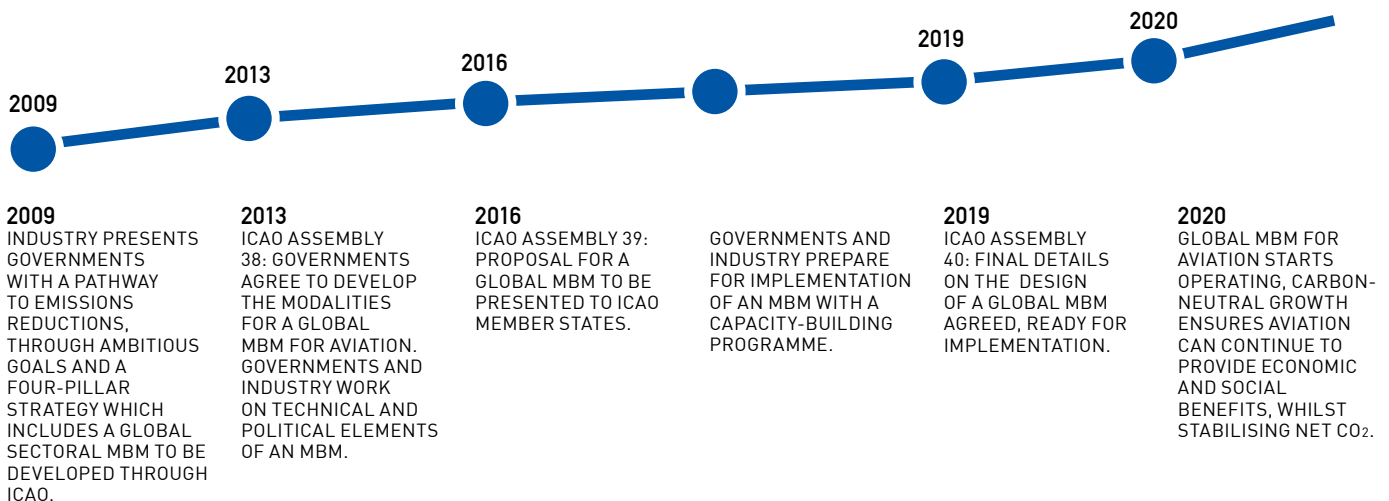
standards, how to assess the eligibility of emissions units from existing national and international programs and standards, such as the Verified Carbon Standard (VCS), the Gold Standard and the Clean Development Mechanism (CDM); the inclusion of emissions units from land use, land use change and forestry activities and sourcing from the broadest range of countries; and ensuring the traceability of emissions units through registry systems.

NEXT STEPS

The creation of a viable, global, MBM for aviation is a formidable challenge, but this is the first time such an endeavour has been attempted. ICAO is well placed and well advanced in its efforts to adopt a global MBM and has established a timetable and work programme to develop its approach. A successful outcome will position aviation as a climate change leader – demonstrating to the global community that a complementary approach to traditional climate change negotiations is possible and desirable. Current negotiations will also provide a valuable precedent for the technical aspects of climate agreements generally and across other industries. The industry is committed to delivering on these ambitious targets and is advanced in efforts to reduce the impact of its greenhouse gas emissions.

THE GLOBAL AVIATION MARKET-BASED MEASURE WILL APPLY FROM 2020 AND WILL CAP EMISSIONS GROWTH FROM AVIATION (MEETING GOAL TWO – CARBON-NEUTRAL GROWTH).

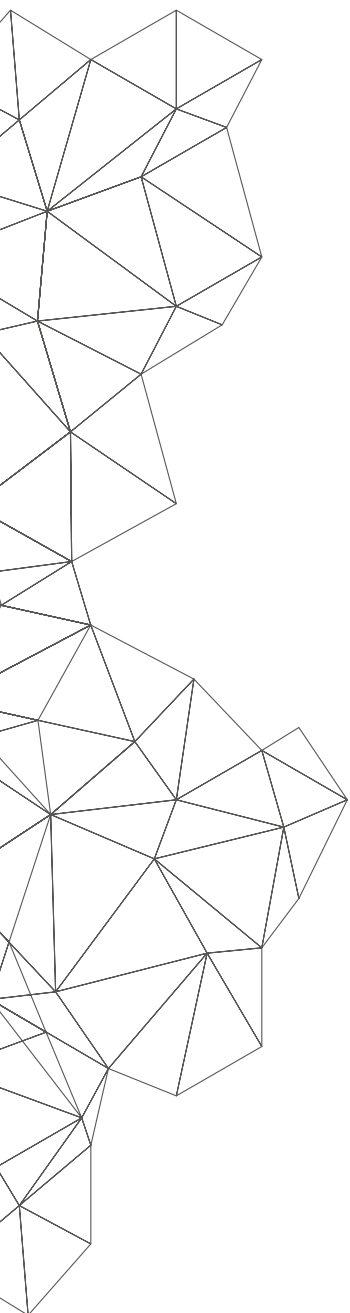
ICAO HAS PRODUCED FORECASTS OF THE POTENTIAL COSTS OF THE MBM ON AIRLINES. IN THE YEAR 2030, FOR EXAMPLE, THE FORECAST SUGGESTS IT MAY COST \$5.6 BILLION TO PURCHASE THE OFFSETS NECESSARY. THIS WOULD BE A FRACTION OF FUEL COSTS FOR THE SECTOR.





T SUSTAINABLE ALTERNATIVE FUELS

UNTIL VERY RECENTLY, THE ONLY SOURCE OF ENERGY FOR AVIATION HAS BEEN TRADITIONAL JET FUEL. IT IS PERFECT FOR AIRCRAFT, WITH HIGH ENERGY DENSITY AND A LOW FREEZE POINT. IT HAS SERVED US VERY WELL SINCE WE FIRST STARTED FLYING JETS, BUT WE NEED TO DIVERSIFY OUR ENERGY SUPPLY AND MOVE AWAY FROM FOSSIL SOURCES. THE TRANSITION HAS ALREADY BEGUN.



Since the first jet aircraft flew on an alternative fuel demonstration flight in 2008, the aviation industry's development of alternative fuels has progressed at an astonishing rate. Despite the high-technology focus of the sector, the industry is often very cautious about the introduction of new concepts – safety remains the highest priority.

DROP-IN

Practically speaking, aviation needed to find a fuel that could operate in existing aircraft engines without modifications. The global and integrated nature of the commercial aviation system means that airlines must be able to use the same fuel and equipment everywhere. A short-haul aircraft can fly into as many as seven airports in as many countries in a single day, so needs access to the same fuel wherever it lands. By ensuring the new product can 'drop-in' to the existing fuel supply chain also means that there does not need to be a hard transition point – as new supplies come on stream, they can be blended with traditional fuel in increasing quantities. It also means that alternative aviation fuel can be used in high blend percentages (whilst there is currently a technical blend limit, up to 100% is likely to be possible in the future) – there is not the same low blend limit as has been the case with many biofuels for cars.

SUSTAINABILITY

Also vital to the industry was to learn from mistakes made in previous efforts to shift to biofuel in automobiles. Aviations wants to avoid issues of land and water use, the impact on food supplies and the broader sustainability questions raised with some crop-based sources of biofuel feedstock. Sustainability is at the heart of aviation's efforts to develop alternative fuels. Although the CO₂ benefits vary according to feedstock, transport and processing needs, studies have shown that some of the options explored for aviation have a lifecycle CO₂ reduction of up to 80% compared with traditional jet fuel.

VARIETY

There are now three production 'pathways' certified for use to supply air transport and a further three are working through the certification process. Four more are in the early stages of testing. Whilst the process is length, this confirms the rigorous and safety-oriented nature of the aviation industry. It also points to the variety of both the different sources of feedstock and the production methods being researched. Sources include some non-edible crops, waste and by-products, agricultural and forestry residues and even waste gases and algae.

Aviation also has an advantage as it can use locally-appropriate feedstocks instead of shipping the fuel all over the world, as is done now. Once the technology exists, small production facilities can be established close to both feedstock and airports, allowing airlines to pick up locally-produced fuel and create economic opportunities in communities around the world.

ON THE VERGE OF A BREAKTHROUGH

So far, over 2,000 commercial flights by over 20 airlines have taken place using alternative aviation fuel from renewable sources. The cost of the fuel is still high, mainly due to the small batches of fuel currently being produced. To bridge the gap between small-scale production and commercialisation, several airlines have taken a bold approach and signed forward purchase agreements for up to 340 million litres of fuel per year with alternative fuel suppliers, over periods as long as ten years. This raises confidence in the product and provides the investment community with certainty to fund the construction of commercial-scale production facilities, it is expected that more airlines will enter into such agreements in the coming years.



THE LONG-TERM VIEW

To meet the aviation industry's longer term goal of a 50% reduction in CO₂ by 2050 (relative to a 2005 baseline) we know that sustainable alternative fuel must play a significant role. Considerable efforts are underway to advance deployment, but the challenges should not be underestimated. The conventional petroleum industry has enjoyed nearly 100 years of experience and development to optimise extraction and refining techniques. Further, the fossil industry has been well supported by government subsidies for many years – cheaper energy has been one of the great enablers to advance standards of living and economic welfare.

Aviation is a somewhat unique industry given its inflexible dependence on liquid fuels over the medium term. Aircraft are designed to be long-life assets. Many are utilised for up to 30 years and while some substitution may occur later this century for short-haul flights, it is probable that aviation will still be powered by liquid fuel for many decades.

SUPPLY AND DEMAND EVOLUTION

It is difficult to make a reliable forecast of sustainable alternative fuel production in the mid-to-long term, because the pace of deployment strongly depends on political choices, project economics and clean energy progress in other sectors. Effective policies in the near-term will positively influence the longer-term achievement potential for sustainable alternative fuel.

Further study will be needed to determine the exact quantities of alternative fuel needed to reach the industry's 2050 goal, but initial research suggests that adequate global feedstock (or biomass potential) can be made available to supply all of aviation's energy needs without impacting the future food and water supply of a growing population. Whether or not this potential is converted into a liquid aviation fuel will depend on economics and policy decisions.

THE POLICY ENABLERS

There is not one 'silver bullet' perfect policy. Different economies, geographies and government priorities will dictate a different application of instruments. Often combining policy initiatives will achieve more than a single policy application. Additionally, it is vitally important for policy makers to understand how policy tools impact project cost-benefit scenarios.

The aviation industry believes some of the most important policy requirements to enable sustainable alternative fuel production and deployment include:

- At least a level playing field for alternative fuel use between the air and road sector – currently, policy measures in a number of regions are more heavily focused on road use. Personal vehicles should be looking towards other energy sources such as electricity.
- Research aimed to lower feedstock costs and new production processes – aviation is keen to access as many sources of alternative fuel as possible, as long as sustainability criteria are maintained.
- De-risk public and private investment in production – production grants have been effective and guaranteeing the building of production facilities can help start putting bioenergy on a similar footing to fossil fuel.
- Incentivise airlines to use alternative fuels from an early stage to help boost the market and catalyse investment.
- Support robust sustainability criteria and international efforts to harmonise these – a global industry needs global standards and aviation is focused on ensuring sustainability of supply as much as cost.
- Foster local opportunities (localised scoping studies and roadmaps are effective) – there may be local sustainable alternative energy industries that could be fostered, providing economic benefits and bringing the green economy to parts of the world not currently included.



T RADICAL NEW TECHNOLOGY

EVERY YEAR, AIRCRAFT AND ENGINE MANUFACTURERS SPEND UPWARDS OF \$15 BILLION ON EFFICIENCY RESEARCH AND DEVELOPMENT. SOME OF IT FOCUSES ON IMPROVEMENTS TO EXISTING MODELS, A LOT IS DEDICATED TO THE NEXT SERIES OF AIRCRAFT ENTERING SERVICE IN 5-10 YEARS, AND SOME LOOKS MUCH FURTHER OUT, TO FUTURE GENERATIONS.

THE ACCELERATION OF PRODUCT CYCLES AND INNOVATION SPEED IN AVIATION IS IMPORTANT TO ENABLE SUFFICIENT MARKET PENETRATIONS OF CLIMATE-FRIENDLY TECHNOLOGIES UNTIL 2050.

Cooperative research into the next concepts of air transport continue, with the Clean Sky project in Europe and NASA's work in the field in the United States. Academic institutions around the world are engaged in collaborative efforts to determine how aircraft will fly in 20 or 30 years' time; and what impact that technology will have on the industry's ability to meet the 2050 goal to halve CO₂ emissions (against a 2005 baseline).

The Advisory Council for Aeronautics Research in Europe (ACARE) has set goals for the aviation sector in the region, including the following climate goals which, if delivered, will help towards meeting the overall industry 2050 goals:

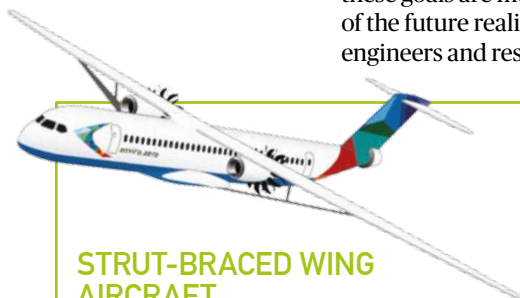
1. In 2050 technologies and procedures available allow a 75% reduction in CO₂ emissions per passenger kilometre and a 90% reduction in NO_x emissions. Perceived noise emission of flying aircraft reduced by 65%. These are relative to the capabilities of typical new aircraft in 2000.
2. Aircraft movements are emission-free when taxiing.
3. Air vehicles are designed and manufactured to be recyclable.

Research is being undertaken to ensure that these goals are met. So what could the aircraft of the future realistically look like? Aeronautical engineers and researchers are constantly

developing new technologies and concepts for more efficient components of aircraft, or entirely new models. New forms of propulsion (such as hydrogen or 'scram-jet' concepts) are distant possibilities, although significant feasibility questions remain.

In early 2015, the International Air Transport Association (IATA) and German Aerospace Center DLR gathered experts in the field from research institutions and the industry to look at which long-term concepts could potentially enter service. They determined that these three examples of aircraft concepts are: technically feasible; would deliver significant emissions savings compared with current aircraft; and identified the barriers that will need to be overcome to make them a reality. These are not aircraft proposals, but concepts that need further development, or which have technologies that could make their way into future aircraft.

In order that these concepts, or parts of these concepts, are able to be realised, funding of research into radical new technologies is vital. Joint industry / public funding research initiatives such as the European Union's CleanSky programme are an ideal model.



STRUT-BRACED WING AIRCRAFT

ENTRY IN INTO SERVICE

2030+

SEATS

~150

RANGE

3,500 nautical miles

*(London - Chicago)
(Los Angeles - Bogota)
(Singapore - Dubai)*

ESTIMATE FOR DEMAND

6,000 aircraft

A wing support strut (or truss) allows larger wing spans without increases in structural weight. By increasing the wing span, the lift is increased and the engine performance requirements can be reduced. The high wings allow for bigger engine sizes, including open rotor engines and the aircraft will likely incorporate other radical innovation such as fuel cell technology.

BARRIERS TO OVERCOME

- The new aircraft will be able to use open rotor engines (already being researched and developed). These are more fuel efficient than regular 'closed' engines, however they operate at slower speeds and at present are noisier than traditional jet engines.
- The slower speed will mean lower productivity of the aircraft.
- The larger wings will need to be foldable to fit airport space constraints (a concept used in some military aircraft and also on the new Boeing 777X), their operational reliability will be key.

HOW TO ACCELERATE PROGRESS

- Expand efforts in network and air traffic management research, focus on increasing spectrums of aircraft with different operational characteristics (e.g. speed, separation, size).
- Reduce noise emissions by unducted fans / open rotors through increasing research and development efforts.

POTENTIAL FOR CO₂ SAVINGS

(PER TONNE KILOMETRE)

Up to 29% (early versions)
Up to 54% (post-2040 versions)



Run completely on battery power, this aircraft would have a fast turnaround time at airports (used batteries would be swapped out for fresh ones) and be suitable for up to 1,000 nautical mile missions around 2035-40, with a later increase in battery performance and thus aircraft range.

ALL-ELECTRIC AIRCRAFT

ENTRY IN INTO SERVICE

2035+

SEATS

~200

RANGE

1,000 nautical miles (second phase)

*(London – Riga)
(Los Angeles – Seattle)
(Singapore – Bangkok)*

ESTIMATE FOR DEMAND

Up to 6,000 aircraft

BARRIERS TO OVERCOME

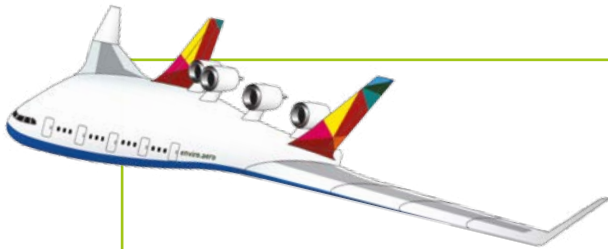
- Higher battery performance — aircraft need high-density batteries.
- Weight of batteries vs aircraft payload performance.
- Reliable renewable electricity supply at airports.
- Reduction of overall CO₂ emissions from battery production.
- Safety (reliability of batteries operating in aircraft conditions).
- Standardisation of batteries for aircraft compatibility.

HOW TO ACCELERATE PROGRESS

- Focus research and development on high performance batteries with high energy density.
- Support battery technologies and battery production technologies, which have low production emissions.
- Support the development of strategies for building up worldwide battery supply networks and airport infrastructure.

POTENTIAL FOR CO₂ SAVINGS (PER TONNE KILOMETRE)

Up to 100%, depending on electricity source.



Essentially a large wing, which houses a payload (cargo and passenger) area within its centre section. The design has been mainly driven by aerodynamic performance optimisation. New engine integration concepts allow for a reduction in noise emissions and fuel consumption.

BARRIERS TO OVERCOME (AND ESTIMATED TIMEFRAME, BASED ON CURRENT ADVANCEMENT)

- Uncertainties within the design process especially in respect to aerodynamics, flight mechanics, and trade-offs between structural weight and the integration of the pressurised cabin.
- Development of a blended wing family concept will be very expensive for the manufacturer, given the high level of innovation required for all systems and structures and the lack of ability to easily grow or shrink the fuselage for different models.
- Passenger acceptance of not being close to windows.
- Safety — can the concept meet today's rigorous passenger evacuation standards?
- Airport compatibility (will airport terminals and runways need to be altered to enable operations of this wider aircraft?).
- Major difference of the structure compared to today's 'tube-and-wing' models means a high complexity in both the structure itself and the manufacturing of such a machine.
- Development of new loading concepts for passengers and freight.
- Service and maintenance procedures will need to be re-thought due to completely different design.

HOW TO ACCELERATE PROGRESS

Focus research and development on finding early-stage solution concepts for the above barriers and on strengthening overall design capabilities able to handle the radically new configuration.

Strengthen concepts and strategies for the production, assembly, supply, and logistics of large and complex structural components.

POTENTIAL FOR CO₂ SAVINGS (PER TONNE KILOMETRE)

Up 50%

BLENDED WING BODY AIRCRAFT

ENTRY IN INTO SERVICE

2040+

SEATS

~500

RANGE

7,500 nautical miles

*(London – Bali)
(Los Angeles – Bangkok)
(Singapore – Vancouver)*

ESTIMATE FOR DEMAND

1,000 aircraft



WE NEED GOVERNMENTS TO STEP UP

THIS PUBLICATION HAS SHOWN THAT THE AVIATION INDUSTRY IS ALREADY TAKING IMPRESSIVE CLIMATE ACTION. IT HAS AVOIDED 8.5 BILLION TONNES OF CO₂ EMISSIONS SINCE 1990 AND HALVED FUEL USE PER TONNE KILOMETRE. IT HAS DEVELOPED AND LAUNCHED 12 NEW FUEL-EFFICIENT AIRCRAFT TYPES AND THEIR ENGINES IN THE LAST DECADE. AIRLINES HAVE SPENT A TRILLION DOLLARS BUYING THEM SINCE 2009. AIR TRAFFIC MANAGEMENT PROVIDERS AND AIRPORTS HAVE ENGAGED IN IMPRESSIVE COLLABORATIVE ACTION. AND THE INDUSTRY HAS ALSO SET AMBITIOUS GOALS FOR CONTINUING THIS WORK IN THE LONG-TERM.

But, as a heavily-regulated sector, there is only so much the industry can do by itself. To accelerate action even further, a supportive environment from policymakers is needed. Through the following key areas, the sector can ensure that the potential to halve aviation emissions by 2050, based on 2005 levels, can be achieved. Importantly, many of these policy responses will also reap benefits under the sustainable development agenda, ensuring that access to mobility is available to as many citizens as possible, but with as little environmental impact as possible.

Each of these suggestions adopts the concepts of 'smart regulation' which solves real, not imagined problems, takes advantage of broad consultation – including with industry and civil society, rigorously weighs costs and benefits with a keen awareness to avoid unintended consequences and respects global standards where they exist.

AIR TRAFFIC MANAGEMENT INVESTMENT, REFORM AND MODERNISATION

MANY AIR TRAFFIC SERVICE PROVIDERS ARE CONSTRAINED BY GOVERNANCE ARRANGEMENTS FROM REFORMING THE WAY IN WHICH THEY ARE STRUCTURED AND OPERATE. IN ORDER TO REALISE THE GREAT EFFICIENCIES POSSIBLE IN STREAMLINING AIR TRAFFIC SYSTEMS, A NEW WAY OF THINKING NEEDS TO BE PURSUED.

- Incentivise air navigation service providers to apply international best practice in: operational efficiencies; collaborative decision-making; employee engagement for efficiency improvements; and by working across borders to harmonise ATM systems and procedures.
- Allow flexible use of military airspace by civil flights — and encourage close cooperation between civil and military controllers to ensure greater collaboration and more efficient procedures.
- Ideally, separate the air navigation service provider from the regulatory function so that proper performance-based oversight can be provided.
- Make the needed, early, investment in new air traffic management technologies (such as PBN and ADS-B).
- Ensure ICAO Aviation System Block Upgrades methodology is applied for ATM modernisation planning in all States.
- Land-use planning and proper zoning of activities surrounding airports is a vital (and often missed) environmental imperative. Industry gets blamed for impacts resulting from poor planning by local and national authorities. New navigation technologies that result in significant emissions reductions could be hampered by uncoordinated land-use planning.

SUPPORT FOR RESEARCH AND DEVELOPMENT: NEW TECHNOLOGY AND OPERATIONS

ADVANCED RESEARCH CAN HELP BRING ABOUT NEW TECHNOLOGIES, MATERIALS, OPERATIONAL PRACTICES AND INFRASTRUCTURE OPPORTUNITIES, IF SUPPORTED BY GOVERNMENT DIRECTION.

- Provide national curriculum promotion of science, technology, engineering and maths education for all students.
- Foster air transport technology and operations research at universities and specialised aerospace institutions.
- Encourage and support collaborative research programmes between government, academia and industry which have been proven to deliver significant results.
- Ensure that current research funding is maintained or increased — this will help technology providers reach targets and help deliver the long-term vision of significant emissions reductions.

DESIGNING AND IMPLEMENTING A GLOBAL MARKET-BASED MEASURE AT ICAO

GOVERNMENTS NEED TO SUPPORT THE WORK BEING UNDERTAKEN AT ICAO ON DEVELOPING AND THEN IMPLEMENTING A GLOBAL MBM FOR AVIATION. THIS WORK IS ONGOING NOW AND NEEDS TO BE DELIVERED BY THE 2016 ICAO ASSEMBLY.

- Support the work currently underway at ICAO to develop the global market-based measure for aviation emissions.
- Provide constructive input, recognising the unique global nature of aviation and the need to limit market distortion.
- At the ICAO Assembly in September 2016, support the MBM and endorse the CO₂ Standard proposal.
- Help industry and ICAO with implementation of the MBM between 2016 and 2020, to ensure it is in place globally from 2020.

IMPROVED INTERMODAL TRANSPORT PLANNING

TRANSPORT IS A SYSTEM AND WHILST AVIATION IS A UNIQUE GLOBAL MODE OF TRANSPORT, THE SYSTEM AS A WHOLE MUST BE PLANNED AND DESIGNED FOR MAXIMUM EFFICIENCY. HIGH-SPEED RAIL CAN PLAY A POSITIVE ROLE IN SOME CITY-PAIR ROUTES, ALTHOUGH AVIATION WILL ALWAYS BE NEEDED FOR LONGER JOURNEYS OR TO CONNECT LESS DENSE URBAN CENTRES.

- Transport networks should be planned as intermodal exchanges, with rail and air connecting seamlessly with urban buses, watercraft and bike and walking opportunities.
- Intermodal rail/air freight planning can ease road congestion when connecting major freight hubs and reduce the overall end to end freight transportation environmental impact.
- Just as important, establishing 24-hour customs clearance options and implementing e-processes (such as the industry-standard e-airwaybill) could speed up the freight delivery and collection process, reducing truck emissions.
- Common ticketing encourages use of intermodal systems.

SUSTAINABLE ALTERNATIVE AVIATIONS FUEL

A KEY COMPONENT OF FUTURE AVIATION SUSTAINABILITY WILL BE THE USE OF ALTERNATIVE AVIATION FUELS. WHILST AIR TRANSPORT IS NOT LOOKING FOR SUBSIDIES, THERE ARE SOME REASONABLE POLICY INCENTIVES THAT CAN HELP INCENTIVISE AND ACTIVATE THE SUSTAINABLE ALTERNATIVE AVIATION FUEL SECTOR.

- Foster research into new feedstock sources and refining processes to ensure greater efficiencies and a wider variety of feedstock options.
- De-risk public and private investment in sustainable alternative aviation fuel through construction loans for new plants or other incentives.
- Provide policy incentives for airlines to use alternative fuels from an early stage.
- Encourage stakeholders to commit to robust international sustainability criteria: a global sector like aviation needs to be able to rely on the same set of standards everywhere.
- Understand local green growth opportunities as aviation can pick up alternative fuel grown and processed close to each airport — every country and region has a different fuel source that could spark a new economic opportunity.
- Establish coalitions encompassing all parts of the supply chain.



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