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IRELAND'S ACTION PLAN ON AVIATION EMISSIONS REDUCTION-

Contents

[.]

General approach

Ireland is a member of the European Union and of the European Civil Aviation Conference (ECAC). ECAC is an intergovernmental organisation covering the widest grouping of Member States[1] of any European organisation dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1955.

ECAC States share the view that environmental concerns represent a potential constraint on the future development of the international aviation sector, and together they fully support ICAO's on-going efforts to address the full range of these concerns, including the key strategic challenge posed by climate change, for the sustainable development of international air transport.

Ireland, like all of ECAC's forty-four States, is fully committed to and involved in the fight against climate change, and works towards a resource-efficient, competitive and sustainable multimodal transport system.

Ireland recognises the value of each State preparing and submitting to ICAO a State Action Plan on emissions reductions, as an important step towards the achievement of the global collective goals agreed at the 37th Session of the ICAO Assembly in 2010.

In that context, it is the intention that all ECAC States submit to ICAO an Action Plan[2], regardless of whether or not the 1% de mimimis threshold is met, thus going beyond the agreement of ICAO Assembly Resolution A/37-19. This is the Action Plan of IRELAND.

Ireland shares the view of all ECAC States that a comprehensive approach to reducing aviation emissions is necessary, and that this should include:

    i.   emission reductions at source, including European support to CAEP work

    ii.   research and development on emission reductions technologies, including public-private partnerships

    iii.   the development and deployment of low-carbon sustainable alternative fuels, including research and operational initiatives undertaken jointly with stakeholders

    iv.   the optimisation and improvement of Air Traffic Management, and infrastructure use within Europe, in particular through the Single European Sky ATM Research (SESAR), and also beyond European borders, through the Atlantic Initiative for the Reduction of Emissions (AIRE) in cooperation with the US FAA.

    v.   Market-based measures, such as open emission trading schemes (ETS), which allow the sector to continue to grow in a sustainable and efficient manner, recognising that the measures at (i) to (iv) above cannot, even in aggregate, deliver in time the emissions reductions necessary to meet the global goals. This growth becomes possible through the purchase under an ETS of CO_2 allowances from other sectors of the economy, where abatement costs are lower than within the aviation sector.

In Europe, many of the actions which are undertaken within the framework of this comprehensive approach are in practice taken at a supra-national level, most of them led by the EU. They are reported

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[1] Albania, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, and the United Kingdom

[2] ICAO Assembly Resolution A37-19 also encourages States to submit an annual report on international aviation CO2 emissions. This is considered by Europe an important task, but one which is different in nature and purpose to the Action Plans, which are strategic in their nature. For that reason, the reporting to ICAO of international aviation CO2 emissions referred to at paragraph 9 of ICAO Resolution A37/19 is not part of this Action Plan, nor of those submitted by other Member States of ECAC. This information will be provided to ICAO separately.

in Section 2 of this Action Plan, where Irish involvement in them is described, as well as that of stakeholders.

In Ireland, a number of actions are undertaken at the national level, including by stakeholders, in addition to those of a supra-national nature. These national actions are reported in Section 2 of this Plan.

In relation to actions which are taken at a supranational level, it is important to note that:

The extent of participation will vary from one State and another, reflecting the priorities and circumstances of each State (economic situation, size of its aviation market, historical and institutional context, such as EU/ non EU). The ECAC States are thus involved to different degrees and on different timelines in the delivery of these common actions. When an additional State joins a collective action, including at a later stage, this broadens the effect of the measure, thus increasing the European contribution to meeting the global goals.

Nonetheless, acting together, the ECAC States have undertaken to reduce the region's emissions through a comprehensive approach which uses each of the pillars of that approach. Some of the component measures, although implemented by some but not all of ECAC's 44 States, nonetheless yield emission reduction benefits across the whole of the region (thus for example research, ETS).

Current State of aviation in Ireland

The Irish aviation and aerospace industry operates within a legislative and regulatory framework established at national, EU and international level. A number of oversight processes exist with the legal system as the overriding entity, including;

- State Obligations under International Conventions and European legislation,
- Safety Regulation,
- Economic Regulation,
- Company, Financial and Other regulation, and
- Industry Incentives and the Tax System.

The components of the aviation and aerospace industry include:

- Airlines and General Aviation,
- Airports and Air Traffic Management infrastructure,
- Maintenance, Repair and Overhaul,
- Leasing and International trade,
- Banking and Legal Services,
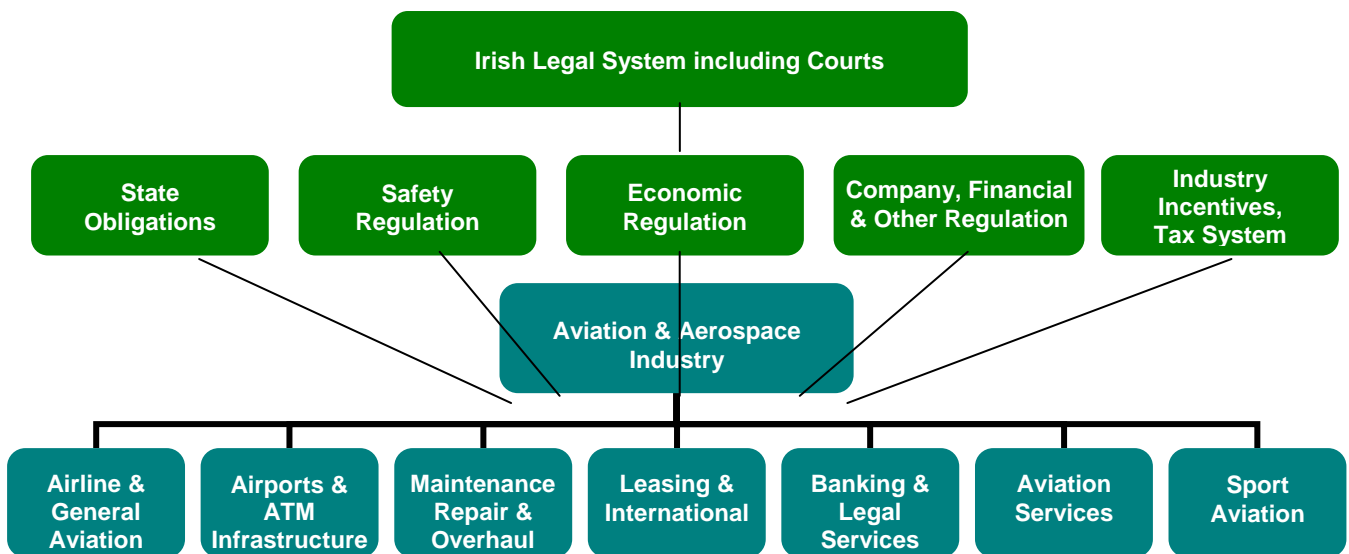- Aviation Services, and
- Sports aviation

Figure 1: Irish Aviation Industry Framework

In terms of aviation activity, the following sections provide an overview in respect of:

- Provision of air traffic control services
- Passenger and freight numbers
- Main air routes
- Aircraft registrations
- Main air carriers and fleet characteristics, and
- Employment.

Air Traffic Control Service Provision

Air navigation services are provided by the Irish Aviation Authority on behalf of the State in accordance with international standards laid down by the International Civil Aviation Organisation (ICAO), Eurocontrol and others. Three core services are provided:

1. terminal services at airports;
2. en route services (the most significant of which relates to Ireland's position as the gateway between Europe and North America); and
3. High Frequency (HF) Communications in the Shanwick Flight Information Region or North Atlantic airspace is assigned by ICAO to Ireland and the UK.
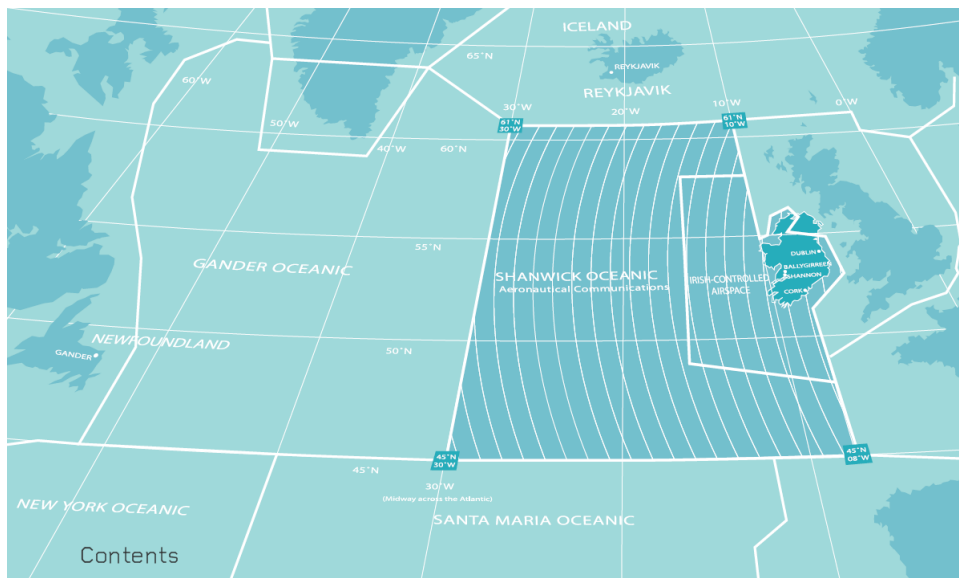
Figure 2: Irish Air Traffic Controlled Airspace

Ireland's ATC controlled airspace comprises almost 500,000 square kilometres. This airspace lies at the interface between Europe and North America and up to 90% of all aircraft transiting between Europe and North America fly through parts of this area. These are flights that do not land at Irish airports. It is unique en route airspace in the sense that it connects North Atlantic traffic flows (which operate in a non-radar environment) with the European air traffic management (ATM) network (which is a radar environment).

Passenger and Freight Numbers

Airports

Ireland's airport infrastructure consists mainly of three State-owned airports (Dublin, Cork and Shannon) and six designated regional airports (details below). Dublin Airport is Ireland's largest airport with a total of 18.4m passengers in 2010, of which 97% was scheduled traffic and the remainder was non-scheduled (charter) traffic. It accounts for approximately 83% of total State airport traffic. Dublin Airport managed an average of 50,000 passengers per day during 2010 and close to 450 aircrafts movements. Cork is the second largest State Airport, following by Shannon Airport. These three airports are managed by the Dublin Airport Authority plc (DAA), an airport management company.
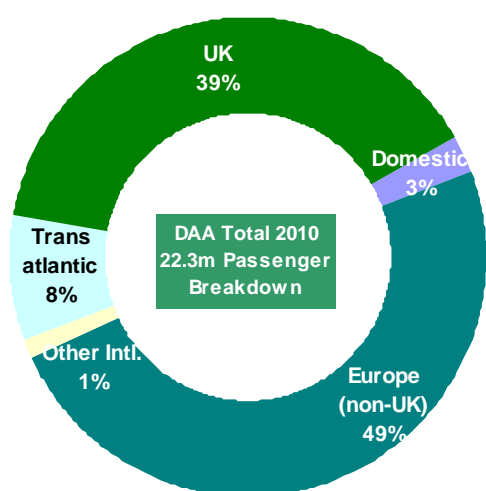
Figure 3: Airport 2010 Passenger Breakdown Percentage Share

DAA Total 2010 – Traffic Breakdown		
Traffic Breakdown	Total Passenger	Total Aircraft Movements
Domestic	572,096	46,564
Europe (non-UK)	10,927,001	84,795
Other International	273,016	3,057
Transatlantic	1,840,245	13,649
UK	8,705,496	88,010
Total Traffic 2010	22,317,854	236,075
Total Traffic 2009	25,720,050	264,494
% Growth 2010 v 09	-13.2%	-10.7%

Table 1: DAA Total 2010 Passenger Breakdown

State Airports Passenger Numbers (Millions) 2003 – 2010								
	2003	2004	2005	2006	2007	2008	2009	2010	% Growth 2010 v 2008
Dublin	15.9	17.1	18.5	21.3	23.3	23.5	20.5	18.4	-21.6%
Cork	2.2	2.3	2.7	3.0	3.2	3.3	2.8	2.4	-25.6%
Shannon	2.4	2.4	3.3	3.7	3.5	3.0	2.4	1.5	-50.6%
Total	20.4	21.8	24.5	27.9	30.0	29.7	25.7	22.3	-24.9%

Table 2: State Airport Passengers Numbers: 2003 - 2010

State Airports Passenger Numbers: 2003 - 2010

Year	Dublin	Cork	Shannon
2003	15.9	2.2	2.4
2004	17.1	2.3	2.4
2005	18.5	2.7	3.3
2006	21.3	3.0	3.7
2007	23.3	3.2	3.5
2008	23.5	3.3	3.0
2009	20.5	2.8	2.4
2010	18.4	2.4	1.5

Figure 4: State Airport Passengers Numbers: 2003 - 2010

Regional Airports

There are a total of six designated regional airports; Donegal Airport, Galway Airport, Ireland West Airport Knock, Kerry Airport, Sligo Airport, and Waterford South East Regional Airport.

Regional Airports Passenger Numbers ('000) 2003 – 2010								
	2003	2004	2005	2006	2007	2008	2009	2010	% Growth 2010 v 2008
Ireland West Knock	247.7	373.0	530.1	621.2	555.9	629.0	607.0	589.2	-6.3%
Kerry	286.4	376.2	385.0	393.0	387.9	419.1	371.8	387.2	-7.6%
Galway	137.2	230.1	252.6	243.9	309.3	266.6	194.4	154.6	-42.0%
Waterford	19.3	58.9	78.9	84.6	119.8	146.5	112.4	106.0	-27.7%
Donegal	38.4	42.7	47.8	56.7	61.4	65.5	50.8	46.8	-28.6%
Sligo	31.1	41.1	39.5	34.3	37.1	33.1	26.1	21.7	-34.4%

Table 3: Regional Airport Passengers Numbers: 2003 - 2010

Total Cargo Movements		Dublin	Cork	Shannon	DAA Total
	2009	4,815	1,272	2,681	8,768
	2010	4,192	1,205	2,317	7,714
	2010 v 2009	-12.9%	-5.3%	-13.6%	-12.0%

Table 4: Total Cargo Movements: 2009 – 2010

Main Air Routes

In terms of country pairs and daily air routes, the UK is by far the biggest market for passengers departing Irish airports, with an average of 138.3 flights departing from Ireland to UK airports on a daily basis during 2010. Domestic flights within Ireland were next with an average of 40.8 departure flights per day in 2010. France is next on 21.1, followed by Spain, North America, Germany, Italy, Poland Netherlands, and the Canary Islands.

Ireland Top 10 Departure Destinations by Country Average Number of Daily Flights in 2010		
Airport Pair	**Average Number of Flights per Day in 2010**	**Change V 2009**
1. United Kingdom	138.3	-7.3%
2. Ireland (Domestic flights)	40.8	-16.9%
3. France	21.1	-17.4%
4. Spain	18.5	-13.3%
5. North America	18.4	-5.2%
6. Germany	15.3	-15.6%
7. Italy	9.0	-19.3%
8. Poland	8.2	-11.3%
9. Netherlands	7.1	-4.4%
10. Canary Islands	5.8	-2.2%

Table 5: Ireland Top 10 Departure Destinations by Country (Average number of daily flights in 2010)

Irish Aircraft Registrations

The growth in aviation activity in the last 10 to 15 years has changed the position in Ireland from one where a few organisations dominated the relatively straightforward aviation sector to one where there are a sizeable number of influential players – large, medium and small – in a highly complex sector. By the end of 2010, there were a total of 1,241 aircraft on the Irish Register, up from 616 in the year 2000.

Table 6: Irish Registered Fleet, End 2010

| Category	Sub-Category	No# aircraft at end 2010
Irish Registered Fleet, End 2010		
Large Fixed Wing Aircraft	**Large Public Transport with MTOW > 13,000kgs (e.g. Airbus A330, A320, Boeing 737-800, etc)**	624
	Large Jet Aircraft with MTOW < 13,000kgs (e.g. Learjet, Cessna Citation 550, etc)	7
	Large Fixed Wing Aircraft	*631*
General Aviation (GA) and Light Aircraft	**Amphibian**	1
	Balloon	12
	Glider	22
	Gyrocopter	16
	Homebuild	33
	Light Aircraft (MTOW < 5700kgs)	284
	Microlight	152
	Total GA and Light Aircraft	*520*
Rotorcraft	**Helicopter (MTOW > 5700kgs)**	6
	Helicopter (MTOW < 5700kgs)	84
	Total Rotorcraft	*90*
Total All Aircraft Types		**1241**

Main Irish Air Carriers and Fleet Characteristics

Irish carriers have grown rapidly over the past decade and the major carriers are now a significant presence on the international and European markets. Of the 407 Large Public Transport aircraft operated by Irish air carriers (end of 2010), the five main air carriers (Ryanair, Aer Lingus, Air Contractors, CityJet and Aer Arann) account for over 90% of the registered fleet with a total of 367 aircraft. These carriers have increased their combined fleet by nearly threefold since 2000.

In terms of Air Operator Certificates (AOC) on the Irish Register, Ryanair is by far the largest Irish carrier. The Ryanair fleet of Boeing 737 aircraft totalled 254 by the end of 2010.

The second largest fleet is operated by Aer Lingus, with 44; a mixture of Airbus A320 (narrow body short-haul operations) and A330 (twin-aisle wide-body aircraft for long-haul operations).

Figure 6: Main Irish Air Carriers Fleet Growth (end 2010)

AOC: Large Aircraft Number 1993-2010
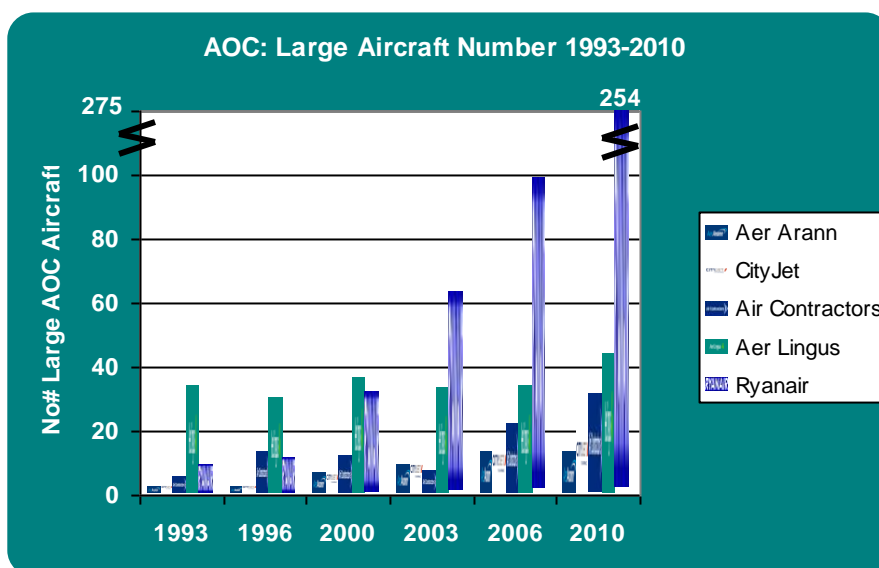
Freight activities supporting the many multi-national manufacturing firms and distributors have also expanded and services such as those provided by Air Contractors; the third largest AOC holder, had 31 aircraft on the Irish Register at the end of 2010. Air Contractors operate a full range of dedicated freighter aircraft.

CityJet is the next largest Irish AOC holder, with 24 aircraft (Avro RJ85) on the Irish Register. CityJet is a regional carrier and is a subsidiary of one of the largest airlines in the world, the Air France KLM Group. (CityJet also operates 15 Fokker 50 aircraft, which are not on the Irish Register, as a result of its acquisition of Belgium carrier VLM Airlines in 2008).

Aer Arann is the fifth largest AOC holder (operating a fleet of 12 ATR aircraft. In late August 2010, Aer Arann entered Examinership but successful secured investment from the Stobart Group in October. To maximise opportunities within the domestic and regional markets, Aer Lingus and Arann are working closely together in a franchise arrangement known as Aer Lingus Regional.

Aviation and employment

Aviation is central to all major forms of economic activity in Ireland. Over 23 million passengers used Ireland's airports in 2010 and approximately 120 million used its air traffic services. As an island nation which focuses on exports, accessibility to major overseas markets is central to the overall success of the country, as well as inward tourism. The vulnerability of the Irish economy to interruptions to air services was clearly demonstrated in 2010 by the volcanic ash crises and severe weather episodes. It is estimated that approximately 20,000 people are **directly** employed in the various strands of the Irish aviation industry.

Aerospace sector	Estimated Employees
Airlines	13,200
Maintenance and Repair Organisations (MROs) and other Aerospace	4,000
State Airports	2,600
Financial (Leasing, aircraft management)	1,000
Air Traffic Management and Safety Regulation	700
Regional Airports	330
Total Estimated Direct Employees	**+20,000**

The aviation industry however indirectly supports many more employment opportunities given the export orientation of Ireland's economy. Out of a total workforce of approximately 1.8 million people, a very sizeable proportion, if not a majority, is supported to varying degrees by aviation activity to and from Ireland.

1. SUPRA-NATIONAL ACTIONS, INCLUDING THOSE LED BY THE EU

AIRCRAFT RELATED TECHNOLOGY DEVELOPMENT

Aircraft emissions standards

European states fully support the ongoing work in ICAO's Committee on Aviation Environmental Protection (CAEP) to develop an aircraft CO_2 standard. Assembly Resolution A37-19 requests the Council to develop a global CO_2 standard for aircraft aiming for 2013. It is recognised that this is an ambitious timeframe for the development of a completely new ICAO standard. Europe is contributing to this task notably through the European Aviation Safety Agency providing the co-rapporteurship of the CO_2 task group within CAEP's Working Group 3.

In the event that a standard, comprising certification requirement and regulatory level, is adopted in 2013, it is likely to have an applicability date set some years in the future. The contribution that such a standard will make towards the global aspirational goals will of course depend on the regulatory level that is set, but it seems unlikely that an aircraft CO_2 standard could have any significant effect on the fuel efficiency of the global in-service fleet until well after 2020.

Research and development

Clean Sky is an EU **Joint Technology Initiative** (JTI) that aims to develop and mature breakthrough "clean technologies" for air transport. By accelerating their deployment, the JTI will contribute to Europe's strategic environmental and social priorities, and simultaneously promote competitiveness and sustainable economic growth.

Joint Technology Initiatives are specific large scale EU research projects created by the European Commission within the 7th Framework Programme (FP7) in order to allow the achievement of ambitious and complex research goals. Set up as a Public Private Partnership between the European Commission and the European aeronautical industry, Clean Sky will pull together the research and technology resources of the European Union in a coherent, 7-year, €1.6bn programme, and contribute significantly to the 'greening' of aviation.

The Clean Sky goal is to identify, develop and validate the key technologies necessary to achieve major steps towards the Advisory Council for Aeronautics Research in Europe (ACARE) environmental goals for 2020 when compared to 2000 levels:

- Fuel consumption and carbon dioxide (CO_2) emissions reduced by 50%

- Nitrous oxides (NO_X) emissions reduced by 80%

- Perceived external noise reduction of 50%

- Improved environmental impact of the lifecycle of aircraft and related products.

Three complementary instruments are used by Clean Sky in meeting these goals:

Technologies.

These are selected, developed and monitored in terms of maturity, or "technology readiness level" (TRL). A detailed list of more than one hundred key technologies has been set. The technologies developed by Clean Sky will cover all major segments of commercial aircraft.

Concept Aircraft.

These are design studies dedicated to integrating technologies into a viable conceptual configuration, and assessing their potential and relevance. They cover a broad range of aircraft: business jets, regional and large commercial aircraft, as well as rotorcraft. They have been grouped and categorised in order to represent the major future aircraft families. Clean Sky's environmental results will be measured and reported upon principally by Concept Aircraft.

Demonstration Programmes.

Some technologies can be assessed during their development phase, but many key technologies need to be validated at an integrated vehicle or system level via dedicated demonstrators. These demonstrators pull together several technologies at a larger "system" or aircraft level. Airframe, Engine and Systems technologies are monitored through in-flight or large scale ground demonstrations. The aim is to validate the feasibility of these technologies in relevant (in-flight or operating) conditions. Their performance can then be predicted in areas such as mechanical or in-flight behaviour. This in turn will help determine the true potential of the technologies and enable a realistic environmental assessment. Demonstrations enable technologies to reach a higher level of maturity (or TRL: technology readiness level), which is the "raison d'être" of Clean Sky.

The environmental objectives of the programme are determined by evaluating the performance of concept aircraft in the global air transport system (when compared to 2000 level technology and to a "business as usual" evolution of technology). The ranges of environmental improvements result from the sum of technologies which are expected to reach TRL5-6 within the programme timeframe. While not all of these technologies will be developed directly through the Clean Sky programme, it is neither feasible nor relevant at this stage to isolate the benefits derived purely from Clean Sky technologies, as Clean Sky will achieve a significant synergy effect in European Aeronautics Research by maturing closely linked technologies to a materially higher TRL through demonstration and integration.

Clean Sky activities are performed within six "**Integrated Technology Demonstrators**" (ITDs) and a "**Technology Evaluator**".

The three vehicle-based ITDs will develop, deliver and integrate technologies into concrete aircraft configurations. The two "transversal" ITDs are focused on propulsion and systems, and will deliver technologies, which will be integrated in various aircraft configurations by the vehicle ITDs. A further ITD will focus specifically on the life cycle assessment and 'eco-design' philosophy.

Smart Fixed Wing Aircraft (SFWA) – co-led by Airbus and SAAB - will deliver innovative wing technologies together with new aircraft configurations, covering large aircraft and business jets. Key enabling technologies from the transversal ITDs, for instance Contra Rotating Open Rotor, will be integrated into the demonstration programmes and concept aircraft.

Green Regional Aircraft (GRA) – co-led by Alenia and EADS CASA - will develop new technologies for the reduction of noise and emissions, in particular advanced low-weight & high performance structures, incorporation of all-electric systems, bleed-less engine architecture, low noise/high efficiency aerodynamics, and finally environmentally optimised mission and trajectory management.

Green Rotorcraft (GRC) – co-led by Agusta Westland and Eurocopter - will deliver innovative rotor blade technologies for reduction in rotor noise and power consumption, technologies for lower airframe drag, environmentally friendly flight paths, the integration of diesel engine technology, and advanced electrical systems for elimination of hydraulic fluids and for improved fuel consumption.

Sustainable and Green Engines (SAGE) - co-led by Rolls-Royce and Safran - will design and build five engine demonstrators to integrate technologies for low fuel consumption, whilst reducing noise levels and nitrous oxides. The 'Open Rotor' is the target of two demonstrators. The others address geared turbofan technology, low pressure stages of a three-shaft engine and a new turboshaft engine for helicopters.

Systems for Green Operations (SGO) - co-led by Liebherr and Thales - will focus on all electrical aircraft equipment and system architectures, thermal management, capabilities for environmentally-friendly trajectories and missions, and improved ground operations to give any aircraft the capability to fully exploit the benefits of the "Single European Sky".

Eco-Design - co-led by Dassault and Fraunhofer Gesellschaft - will support the ITDs with environmental impact analysis of the product life-cycle. Eco-Design will focus on environmentally-friendly design and production, withdrawal, and recycling of aircraft, by optimal use of raw materials and energies, thus improving the environmental impact of the entire aircraft life-cycle.

Complementing these six ITDs, the **Technology Evaluator (TE)** is a dedicated evaluation platform cross-positioned within the Clean Sky project structure. The TE is co-led by DLR and Thales, and includes the major European aeronautical research organisations. It will assess the environmental impact of the technologies developed by the ITDs and integrated into the Concept Aircraft. By doing this, the TE will enable Clean Sky to measure and report the level of success in achieving the environmental objectives, and in contributing towards the ACARE environmental goals. Besides a mission level analysis (aircraft level), the positive impact of the Clean Sky technologies will be shown at a relevant hub airport environment and across the global air transport system.

The first assessment by the Technology Evaluator on the way to meeting Clean Sky's environmental objectives is planned for the end of 2011. The ranges of potential performance improvement (reduction in CO_2, NO_X and Noise) will be narrowed or evolved during the life of the programme based on the results from the key technologies developed and validated through the demonstrations performed.

Clean Sky is a 'living' programme: each year, Annual Implementation Plans are produced and agreed, and research priorities are (re-)calibrated based on results achieved. The best approach to progressing the technologies is pursued. The Clean Sky JU uses regular Calls for Proposals to engage with the wider aeronautical industry, research organisations and universities in order to bring the best talent on board and enable broad collaborative participation. A very significant share of the Clean Sky research programme is already being taken on by Europe's aerospace related SMEs, and by September 2011 nine Calls for Proposals will have been completed, demonstrating the JU's commitment to involving all competent organisations in the European aeronautics research arena. In June 2011, a major and exciting milestone was reached with the 400th partner joining the Clean Sky programme.

ALTERNATIVE FUELS

European Advanced Biofuels Flightpath

In February 2009, the European Commission's Directorate General for Energy and Transport initiated the SWAFEA (Sustainable Ways for Alternative Fuels and Energy for Aviation) study to investigate the feasibility and the impact of the use of alternative fuels in aviation. The goal was to provide the European Commission with information and decision elements to support its future air transport policy, in the framework of the European commitment to promote renewable energy for the mitigation of climate change, security of supply and also to contribute to Europe's competitiveness and economic growth.

The study team involved 20 European and international organisations, representing all players in alternative aviation fuels: aircraft and engine manufacturing, air transport, oil industry, research and consulting organisations covering a large spectrum of expertise in the fields of fuel, combustion, environment as well as agriculture.

The SWAFEA final report was published in July 2011[3]. It provides a comprehensive analysis on the prospects for alternative fuels in aviation, including an integrated analysis of technical feasibility, environmental sustainability (based on the sustainability criteria of the EU Directive on renewable energy[4]) and economic aspects. It includes a number of recommendations on the steps that should be taken to promote the take-up of sustainable biofuels for aviation in Europe.

In March 2011, the European Commission published a White Paper on transport[5]. In the context of an overall goal of achieving a reduction of at least 60% in greenhouse gas emissions from transport by 2050 with respect to 1990, the White Paper established a goal of low-carbon sustainable fuels in aviation reaching 40% by 2050.

[3] http://www.swafea.eu/LinkClick.aspx?fileticket=llISmYPFNxY%3D&tabid=38
[4] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
[5] Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final

As a first step towards delivering this goal, in June the European Commission, in close coordination with Airbus, leading European airlines (Lufthansa, Air France/KLM, & British Airways) and key European biofuel producers (Choren Industries, Neste Oil, Biomass Technology Group and UOP), launched the European Advanced Biofuels Flightpath. This industry-wide initiative aims to speed up the commercialisation of aviation biofuels in Europe, with the objective of achieving the commercialisation of sustainably produced paraffinic biofuels in the aviation sector by reaching a 2 million tons consumption by 2020.

This initiative is a shared and voluntary commitment by its members to support and promote the production, storage and distribution of sustainably produced drop-in biofuels for use in aviation. It also targets establishing appropriate financial mechanisms to support the construction of industrial "first of a kind" advanced biofuel production plants. The Biofuels Flight path is explained in a technical paper, which sets out in more detail the challenges and required actions[6].

More specifically, the initiative focuses on the following:

1. Facilitate the development of standards for drop-in biofuels and their certification for use in commercial aircraft;

2. Work together with the full supply chain to further develop worldwide accepted sustainability certification frameworks

3. Agree on biofuel take-off arrangements over a defined period of time and at a reasonable cost;

4. Promote appropriate public and private actions to ensure the market uptake of paraffinic biofuels by the aviation sector;

5. Establish financing structures to facilitate the realisation of 2G biofuel projects;

6. Accelerate targeted research and innovation for advanced biofuel technologies, and especially algae.

Take concrete actions to inform the European citizen of the benefits of replacing kerosene by certified sustainable biofuels.

The following "Flight Path" provides an overview about the objectives, tasks, and milestones of the initiative.

Time horizons	Action	Aim/Result
Short-term (next 0-3 years)	Announcement of action at International Paris Air Show	To mobilise all stakeholders including Member States.
	High level workshop with financial institutions to address funding mechanisms.	To agree on a "Biofuel in Aviation Fund".
	> 1,000 tons of Fisher-Tropsch biofuel become available.	Verification of Fisher-Tropsch product quality. Significant volumes of synthetic biofuel become available for flight testing.
	Production of aviation class biofuels in the hydrotreated vegetable oil (HVO) plants from sustainable feedstock	Regular testing and eventually few regular flights with HVO biofuels from sustainable feedstock.
	Secure public and private financial and legislative mechanisms for industrial second generation biofuel plants.	To provide the financial means for investing in first of a kind plants and to permit use of aviation biofuel at economically acceptable conditions.
	Biofuel purchase agreement signed between aviation sector and biofuel producers.	To ensure a market for aviation biofuel production and facilitate investment in

		industrial 2G plants.
	Start construction of the first series of 2G plants.	Plants are operational by 2015-16.
	Identification of refineries & blenders which will take part in the first phase of the action.	Mobilise fuel suppliers and logistics along the supply chain.
Mid-term (4-7 years)	2000 tons of algal oils are becoming available.	First quantities of algal oils are used to produce aviation fuels.
	Supply of 1.0 M tons of hydrotreated sustainable oils and 0.2 tons of synthetic aviation biofuels in the aviation market.	1.2 M tons of biofuels are blended with kerosene.
	Start construction of the second series of 2G plants including algal biofuels and pyrolytic oils from residues.	Operational by 2020.
Long-term (up to 2020)	Supply of an additional 0.8 M tons of aviation biofuels based on synthetic biofuels, pyrolytic oils and algal biofuels.	2.0 M tons of biofuels are blended with kerosene.
	Further supply of biofuels for aviation, biofuels are used in most EU airports.	Commercialisation of aviation biofuels is achieved.

IMPROVED AIR TRAFFIC MANAGEMENT AND INFRASTRUCTURE USE

The EU's Single European Sky initiative and SESAR

The EU's Single European Sky initiative was originally launched by the European Commission in 1999. Its fundamental aim is to reform the architecture of European air traffic control to meet future capacity and safety needs. Its main principles are to reduce fragmentation in European air traffic management, between states, between civil and military, and between systems; to introduce new technology; and to establish a new regulatory framework built on closer synergy between the EU and Eurocontrol.

The first package of EU Single European Sky legislation was adopted by the Council and European Parliament in 2004. This was followed in 2009 by the Single European Sky II package of measures, which comprises five main pillars: performance, safety, technology, airport capacity and the human factor. The aim is to improve the performance of air navigation services by reducing the cost of flights, while improving the capacity and better preserving the environment, all having regard to the overriding safety objectives.

Reducing fragmentation in European air traffic management is expected to result in significant efficiency and environmental improvements. A core starting point is the reduction of the current surplus length of flights in Europe, estimated on average to be almost 50 km. The defragmentation of European airspace with new possibilities for more direct routing, and efforts to define a true pan European network of routes and to implement flexible use of airspace are expected to result in emission reductions of 2% per year.

SESAR

SESAR (Single European Sky ATM Research) is the technological component of the Single European Sky (SES). It is a €2.1bn Joint Undertaking, funded equally by the EU, Eurocontrol and industry (€700m EU, €700m Eurocontrol, €700m industry). Fifteen companies are members of the SESAR JU: AENA, Airbus, Alenia Aeronautica, the DFS, the DSNA, ENAV, Frequentis, Honeywell, INDRA, NATMIG, NATS (En Route) Limited, NORACON, SEAC, SELEX Sistemi Integrati and Thales. The SESAR SJU includes an additional thirteen associate partners including non-European companies with different profiles and expertise.

SESAR aims to help create a "paradigm shift" by putting performance-based operations at the core of air traffic management's objectives, and will be supported by state-of-the-art and innovative technology capable of ensuring the safety, sustainability and fluidity of air transport worldwide over the next 30 years. It is composed of three phases:

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- The Definition phase (2004-2008) delivered the ATM master plan defining the content, the development and deployment plans of the next generation of ATM systems. This definition phase was led by Eurocontrol, and co-funded by the European Commission under the Trans European Network-Transport programme and executed by a large consortium of all air transport stakeholders.

- The Development phase (2008-2013) will produce the required new generation of technological systems, components and operational procedures as defined in the SESAR ATM Master Plan and Work Programme.

- The Deployment phase (2014-2020) will see the large scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components guaranteeing high performance air transport activities in Europe.

Implementation of SESAR in general will facilitate the following:

- Moving from airspace to trajectory based operations, so that each aircraft achieves its agreed route and time of arrival and air and ground systems share a common system view.

- Collaborative planning so that all parties involved in flight management from departure gate to arrival gate can strategically and tactically plan their business activities based on the performance the system will deliver.

- An information rich ATM environment where partners share information through system wide information management.

- A globally agreed 4D trajectory definition and exchange format at the core of the ATM system where time is the 4th dimension providing a synchronised "time" reference for all partners.

- Airspace users and aircraft fully integrated as essential constituents and nodes of the ATM system.

- Dynamic airspace management and integrated co-ordination between civil and military authorities optimising the available airspace.

- Network planning focused on the arrival time as opposed to today's departure based system with Airport airside and turn-around fully integrated into ATM.

- New Communication, Navigation & Surveillance (CNS) technologies providing for more accurate airborne navigation and spacing between aircraft to maximise airspace and airport efficiency, improve communication and surveillance.

- Central role for the human widely supported by automation and advanced tools ensuring safe working without undue pressure.

Within the SESAR programme most of the almost 300 projects include environmental aspects of aviation. They concern aircraft noise management and mitigation, aircraft fuel use and emissions management etc. throughout all of SESAR's 16 work packages. The Joint Undertaking's role is to establish environmental sustainability as an integral aspect of broader ATM development and operating processes.

SESAR aims at reducing the environmental impact per flight by 10% without compromising on safety but with clear capacity and cost efficiency targets in mind. More specifically, in addressing environmental issues, SESAR will:

1. Achieve emission improvements through the optimisation of air traffic management services. The SESAR target for 2020 is to enable 10% fuel savings per flight as a result of ATM improvements alone, leading to a 10% reduction of CO_2 emissions per flight;

2. Improve the management of noise emissions and their impacts through better flight paths, or optimised climb and descent solutions;

3. Improve the role of ATM in enforcing local environmental rules by ensuring that flight operations fully comply with aircraft type restrictions, night movement bans, noise routes, noise quotas, etc.;

4. Improve the role of ATM in developing environmental rules by assessing the ecological impact of ATM constraints, and, following this assessment, adopting the best alternative solutions from a European sustainability perspective.

5. Accompany the development of new procedures and targets with an effective regulatory framework in close cooperation with the European Commission;

6. Implement more effective two-way community relations and communications capabilities at local and regional levels including a commonly agreed environmental strategy and vision.

By 2012 SESAR is expected to deliver fuel burn reductions of approximately 2% (compared with a baseline 2010), to demonstrate environmental benefits on city pairs connecting 8 European airports, and to have airspace users signing up to the SESAR business case (including the environment case) for time-based operations.

Operational improvements: AIRE

The Atlantic Interoperability Initiative to Reduce Emissions (AIRE) is a programme designed to improve energy efficiency and lower engine emissions and aircraft noise in cooperation with the US FAA. The SESAR JU is responsible for its management from a European perspective.

Under this initiative ATM stakeholders work collaboratively to perform integrated flight trials and demonstrations validating solutions for the reduction of CO_2 emissions for surface, terminal and oceanic operations to substantially accelerate the pace of change.

AIRE has demonstrated in 2009, with 1,152 trials performed, that significant savings can be achieved using existing technology. CO_2 savings per flight ranged from 90kg to 1250kg and the accumulated savings during trials were equivalent to 400 tons of CO_2. Another positive aspect is the human dimension - the AIRE projects boost crew and controller motivation to pioneer new ways of working together focusing on environmental aspects, and enabled cooperative decision-making towards a common goal.

The strategy is to produce constant step-based improvements, to be implemented by each partner in order to contribute to reaching the common objective. In 2010 demand for projects has more than doubled and a high transition rate from R&D to day-to-day operations, estimated at 80%, from AIRE 2009 projects was observed (expected to further increase with time). Everyone sees the "AIRE way of working together" as an absolute win-win to implement change before the implementation of more technology intensive ATM advancements expected for the period 2013 onward. A concrete example of the progress achieved is that, due to AIRE, both FAA and NAV Portugal offer lateral optimisation over the transatlantic routes to any user upon request. In July 2010, the SESAR JU launched a new call for tender and had an excellent response - 18 projects were selected involving 40 airlines, airport, air navigation service providers and industry partners. More than 5,000 trials are expected to take place.

ECONOMIC / MARKET-BASED MEASURES

The EU Emissions Trading System

The EU Emissions Trading System (EU ETS) is a cornerstone of the European Union's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. Being the first and biggest international scheme for the trading of greenhouse gas emission allowances, the EU ETS currently covers some 11,000 power stations and industrial plants in 30 countries.

Launched in 2005, the EU ETS works on the "cap and trade" principle. This means there is a "cap", or limit, on the total amount of certain greenhouse gases that can be emitted by the factories, power plants and other installations in the system. Within this cap, companies receive emission allowances which they can sell to or buy from one another as needed. The limit on the total number of allowances available provides certainty that the environmental objective is achieved and ensures that the allowances have a market value.

At the end of each year each company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or else sell them to another company that is short of allowances. The flexibility that trading brings ensures that emissions are cut where it costs least to do so. The number of allowances is reduced over time so that total emissions fall.

The EU ETS now operates in 30 countries (the 27 EU Member States plus Iceland, Liechtenstein and Norway). It currently covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. Between them, the installations currently in the scheme account for almost half of the EU's CO_2 emissions and 40% of its total greenhouse gas emissions.

The EU ETS will be further expanded to the petrochemicals, ammonia and aluminium industries and to additional gases (PFCs and N_2O) in 2013, when the third trading period starts. At the same time a series of important changes to the way the EU ETS works will take effect in order to strengthen the system.

The legislation to include aviation in the EU ETS was adopted in November 2008, and entered into force as Directive 2008/101/EC of the European Parliament and of the Council on 2 February 2009. The proposal to include aviation in the EU ETS, made by the European Commission in December 2006, was accompanied by a detailed impact assessment.

Under the EU ETS, the emissions cap is increased to accommodate the inclusion of aviation. This addition to the cap establishes the total quantity of allowances to be allocated to aircraft operators. This quantity is defined as a percentage of historical aviation emissions, which is defined as the mean average of the annual emissions in the calendar years 2004, 2005 and 2006 from aircraft performing an aviation activity falling within the scope of the legislation. In July 2011, it was decided that the historical aviation emissions are set at 221,420,279 tonnes of CO_2.

The additional cap to be added to the EU ETS in 2012, the first year of operation for aviation, will be set at 97% of the historical aviation emissions. For the period from 2013 to 2020 inclusive the additional cap will be set at 95% of the historical aviation emissions.

Aircraft operators flying to and from airports in 30 European states from 2012 will be required to surrender allowances in respect of their CO_2 emissions on an annual basis. The large majority of allowances will be allocated to individual aircraft operators free of charge, based on their respective aviation output (rather than emissions) in 2010, thus rewarding operators that have already invested in cleaner aircraft. In 2012, 85% of the total quantity of the additional allowances (or "cap") will be allocated free of charge according to this benchmarking methodology, while in the 2013-2020 trading period 82% of the additional allowances will be allocated free of charge in this way. In the 2013-2020 trading period, an additional 3% of the total additional allowances for aviation will be set aside for allocation free of charge via the special reserve, to new entrants and fast-growing airlines. The remaining 15% of allowances will be allocated each year by auction.

Aircraft operators that choose to emit more than their free allocation of allowances will be able to source allowances from other participants in the ETS (including those outside the aviation sector), from intermediaries who trade allowances, from Member States via auctions, or they can use specific quantities of international credits from emissions reduction projects in third countries (e.g. CDM credits and ERUs).

The system also includes a de minimis provision under which commercial aircraft operators with a low level of aviation activity in Europe are excluded from its scope. This is likely to mean that many aircraft operators from developing countries will be unaffected by the scheme and, indeed, over 90 ICAO states have no commercial aircraft operators included in the scope of the EU ETS.

The EU legislation foresees that, where a third country takes measures of its own to reduce the climate change impact of flights departing from its airports, the EU will consider options available in order to provide for optimal interaction between the EU scheme and that country's measures. In such a case, flights arriving from the third country could be excluded from the scope of the EU scheme. The EU therefore encourages other countries to adopt measures of their own and is ready to engage in bilateral discussions with any country that has done so.

The legislation also makes it clear that if there is agreement on global measures, the EU shall consider whether amendments to this Directive as it applies to aircraft operators are necessary.

Anticipated change in fuel consumption and/or CO_2 emissions

The environmental outcome of an emissions trading system is pre-determined through the setting of an emissions cap. In the case of the EU ETS, an addition to the overall cap is established for aviation emissions. However, aircraft operators are also able to use allowances allocated to other sectors to cover their emissions. It is therefore possible (indeed highly likely given traffic growth forecasts) that the absolute level of CO_2 emissions from aviation will exceed the number of allowances allocated to aviation. However, any aviation emissions will necessarily be offset by CO_2 emissions reductions elsewhere, either in other sectors within the EU that are subject to the EU ETS, or through emissions reduction projects in third countries. The "net" aviation emissions will however be the same as the number of allowances allocated to aviation under the EU ETS.

In terms of contribution towards the ICAO global goals, the states implementing the EU ETS will together deliver, in "net" terms, a 3% reduction below the 2005 level of aviation CO_2 emissions in 2012, and a 5% reduction below the 2005 level of aviation CO_2 emissions in the period 2013-2020.

Other emissions reduction measures taken, either at supra-national level in Europe or, by any of the 30 individual states implementing the EU ETS, will of course make their own contribution towards the ICAO global goals. Such measures are likely to moderate the anticipated growth in aviation emissions in Europe and therefore reduce the extent to which the absolute level of CO_2 emissions from aviation will exceed the number of allowances allocated to aviation. However, assuming that absolute aviation emissions will nonetheless in future exceed the additional aviation cap, the aggregate contribution towards the global goals is likely to remain that which is determined by the EU ETS cap.

Expected co-benefits

The EU ETS covers both international and domestic aviation and does not distinguish between them. It is not therefore possible to identify how the "net" emissions reductions it delivers are apportioned between international and domestic aviation.

SUPPORT TO VOLUNTARY ACTIONS: ACI AIRPORT CARBON ACCREDITATION

Airport Carbon Accreditation is a certification programme for carbon management at airports, based on carbon mapping and management standard specifically designed for the airport industry. It was launched in 2009 by ACI EUROPE, the trade association for European airports.

This industry-driven initiative was officially endorsed by Eurocontrol and the European Civil Aviation Conference (ECAC). It is also officially supported by the United Nations Environmental Programme (UNEP). The programme is overseen by an independent Advisory Board. ACI EUROPE is looking at expanding the geographical scope of the programme through the other ACI regions. Discussions are currently under way with ACI Asia Pacific for a possible extension of the programme to the Asia Pacific region.

Airport Carbon Accreditation is a four-step programme, from carbon mapping to carbon neutrality. The four steps of certification are: Level 1 "Mapping", Level 2 "Reduction", Level 3 "Optimisation", and Level 3+ "Carbon Neutrality". One of its essential requirements is the verification by external and independent auditors of the data provided by airports. Aggregated data are included in the *Airport Carbon Accreditation* Annual Report thus ensuring transparent and accurate carbon reporting. At level 2 of the programme and above (Reduction, Optimisation and Carbon Neutrality), airport operators are required to demonstrate CO2 reduction associated with the activities they control.

In June 2011, 2 years after the launch of the programme, 43 airports were accredited, representing 43% of European passenger traffic. ACI/Europe's objective for the end of the 3rd year of the programme's operation is to cover airports representing 50% of European passenger traffic. Programme's implementation is twofold: on top of recruiting new participants, individual airports should progress along the 4 levels of the programme.

Anticipated benefits:

The Administrator of the programme has been collecting CO2 data from participating airports over the past two years. This has allowed the absolute CO2 reduction from the participation in the programme to be quantified.

	2009-2010	2010-2011
Total aggregate scope 1 & 2 reduction (tCO2)	51,657	54,565
Total aggregate scope 3 reduction (tCO2)	359,733	675,124

Variable	Year 1		Year 2	
	Emissions	Number of airports	Emissions	Number of airports
Aggregate carbon footprint for 'year 0'[7] for emissions under airports' direct control (all airports)	803,050 tonnes CO2	17	2,275,469 tonnes CO2	43
Carbon footprint per passenger	2.6 kg CO2		3.73 kgCO2	
Aggregate reduction in emissions from sources under airports' direct control (Level 2 and above)[8]	51,657 tonnes CO2	9	51,819 tonnes CO2	19
Carbon footprint reduction per passenger	0.351 kg CO2		0.11 kg CO2	
Total carbon footprint for 'year 0' for emissions sources which an airport may guide or influence (level 3 and above)	2,397,622 tonnes CO2	6	6,643,266 tonnes CO2[9]	13
Aggregate reductions from emissions sources which an airport may guide or influence	359,733 tonnes CO2		675,124 tonnes CO2	
Total emissions offset (Level 3+)	13,129 tonnes CO2	4	85,602 tonnes CO2	8

Its main immediate environmental co-benefit is the improvement of local air quality.

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7 'Year 0' refers to the 12 month period for which an individual airport's carbon footprint refers to, which according to the Airport Carbon Accreditation requirements must have been within 12 months of the application date.

8   This figure includes increases in emissions at airports that have used a relative emissions benchmark in order to demonstrate a reduction.

Costs for design, development and implementation of *Airport Carbon Accreditation* have been borne by ACI EUROPE. *Airport Carbon Accreditation* is a non-for-profit initiative, with participation fees set at a level aimed at allowing for the recovery of the aforementioned costs.

The scope of *Airport Carbon Accreditation,* i.e. emissions that an airport operator can control, guide and influence, implies that aircraft emissions in the LTO cycle are also covered. Thus, airlines can benefit from the gains made by more efficient airport operations to see a decrease in their emissions during the LTO cycle. This is coherent with the objectives pursued with the inclusion of aviation in the EU ETS as of 1 January 2012 (Directive 2008/101/EC) and can support the efforts of airlines to reduce these emissions.

2. NATIONAL ACTIONS IN IRELAND

To be added…………