NATIONAL ACTION PLAN ON CO₂ EMISSIONS REDUCTION
THE SLOVAK REPUBLIC

July 2016

Ministry of Transport, Construction and Regional Development of the Slovak Republic
General Directorate of Civil Aviation
Content

Content............................................................................................................................................2
Article 1 Introduction....................................................................................................................................3
Article 2 Current state of aviation in the Slovak Republic ..................................................................5
  2.1. Historical development of international aviation ................................................................. 5
  2.2. Structure of civil aviation sector ............................................................................................ 6
  2.3. Specific geographical or other characteristics that influence the development of international aviation .......................................................................................................................... 8
  2.4. Education, including scientific and technical research institutions focusing on aviation-related issues .......................................................................................................................... 10
  2.5. Effects of past efforts to bring about changes in the international aviation sector of the Slovak Republic .................................................................................................................. 11
Article 3 Supra-national actions, including those led by the EU .................................................... 12
  3.1. ECAC Baseline Scenario ........................................................................................................ 12
  3.2. Actions taken at the Supranational Level .............................................................................. 16
Article 4 National Actions in the Slovak Republic ........................................................................ 41
  4.1. Implemented measures ........................................................................................................ 41
Article 5 Conclusion .......................................................................................................................... 43
Article 1
Introduction

1.1. The Slovak Republic is a member of the International Civil Aviation Organization (ICAO), of the European Union\(^1\) (EU), of the Organization for Economic Co-operation and Development\(^2\) (OECD), of the European Organisation for the Safety of Air Navigation (EUROCONTROL) and of the European Civil Aviation Conference (ECAC). ECAC is an intergovernmental organization covering the widest grouping of Member States\(^3\) of any European organization dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1955.

1.2. 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 ongoing 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.

1.3. The Slovak Republic, 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.

1.4. The Slovak Republic recognises the value of each State preparing and submitting to ICAO an updated State Action Plan for emissions reductions, as an important step towards the achievement of the global collective goals agreed at the 38th Session of the ICAO Assembly in 2013.

1.5. In that context, it is the intention that all ECAC States submit to ICAO an Action Plan. This is the Action Plan of the Slovak Republic.

1.6. The Slovak Republic shares the view of all ECAC States that a comprehensive approach to reducing aviation emissions is necessary, and that this should include:

- 1.6.1. emission reductions at source, including European support to CAEP work
- 1.6.2. research and development on emission reductions technologies, including public-private partnerships

---

\(^1\) Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, United Kingdom

\(^2\) Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

\(^3\) 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, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, and the United Kingdom
1.6.3. the development and deployment of low-carbon sustainable alternative fuels, including research and operational initiatives undertaken jointly with stakeholders.

1.6.4. the optimization 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.

1.6.5. Market-based measures, which allow the sector to continue to grow in a sustainable and efficient manner, recognizing that the measures at (1.6.1.) to (1.6.4.) above cannot, even in aggregate, deliver in time the emissions reductions necessary to meet the global goals. This growth becomes possible through the purchase of carbon units that foster emission reductions in other sectors of the economy, where abatement costs are lower than within the aviation sector.

1.7. 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 European Union. They are reported in Article 3 of this Action Plan, where the Slovak Republic involvement in them is described, as well as that of stakeholders.

1.8. In the Slovak Republic 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 Article 4 of this Plan.

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

1.9.1. 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.

1.9.2. 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).
Article 2
Current state of aviation in the Slovak Republic

2.1. Historical development of international aviation

The Slovak Republic was founded on 1 January 1993. Its foundation and resulting establishment of the Slovak aviation sector represented a considerable change in the existing managerial, economic and logistic relations. Shortly after the declaration of independence the Slovak Republic became a member of the international organizations ICAO and ECAC.

After the foundation of the Slovak Republic, the contributory organization Air Navigation Services of the Slovak Republic (Riadenie letovej prevádzky Slovenskej republiky) was established with the aim to achieve the required capacity of airspace, its effective configuration and accessibility through the CFMU (Central Flow Management Unit) programme and EATCHIP (European Air Traffic Control Harmonization and Integration Programme).

Since 1 January 2000 the contributory organization Air Navigation Services of the Slovak Republic was transformed to the state enterprise Letové prevádzkové služby Slovenskej republiky (Air Navigation Services). In October 1999 one of at that time most advanced systems for provision of air traffic services EUROCAT E2000 was launched. This system enabled to increase the capacity of the Slovak Republic airspace from 78 to 120 flights per hour.

A part of the historical development of the Slovak aviation sector was the establishment of the Civil Aviation Authority of the Slovak Republic (CAA SR). The activities of CAA SR were then specified by the Resolution of the Minister of Transport, Posts and Telecommunications that entered into force on 1 July 1998.

Since September 2013 the Ministry of Transport, Construction and Regional Development of the Slovak Republic (MoT) started the preparation of the merger of its five regulatory offices and authorities (Telecommunications Office, Postal Regulatory Office, Railway Regulatory Authority, CAA SR and State Navigation Administration). Since 1 January 2014 those authorities and offices were merged into the Regulatory Authority for Electronic Communications and Postal Services and the Transport Authority according to the Act No. 402/2013 Coll. and on amendments to Certain Acts.

Slovak civil aviation infrastructure consists of 27 domestic and international airports. 8 of them are international (Airport Bratislava, Airport Košice, Airport Piešťany, Airport Sliač, Airport Poprad – Tatry, Airport Žilina, Airport Nitra and Airport Prievidza). 6 of the international airports (Airport Bratislava, Airport Košice, Airport Piešťany, Airport Sliač, Airport Poprad – Tatry, Airport Žilina) reported to the Slovak Airport Administration until the end of year 2004. In 2005 these 6 airports were transformed to joint stock companies.
2.2. Structure of civil aviation sector

2.2.1. Ministry of Transport, Construction and Regional Development of the Slovak Republic

Civil Aviation in the Slovak Republic is in the responsibility of the Ministry of Transport, Construction and Regional Development of the Slovak Republic (MoT). The regulatory entity under the structure of the MoT in civil aviation is the Directorate General of Civil Aviation. It is (among other functions in civil aviation) responsible for:

- state transport policy in civil aviation;
- representing state in international civil aviation organizations;
- monitoring of state supervision in civil aviation;
- legislation and regulatory process;
- designation of air navigation services providers.

The MoT acts as an economic and market regulator in the civil aviation. In general the MoT is responsible for preparation, transposition and implementation of legal rules.

2.2.2. The Ministry of Interior of the Slovak Republic

The Ministry of Interior of the Slovak Republic is responsible for regulation of state aircraft other than military aircraft.

2.2.3. Transport Authority

Transport Authority (NSAT) was established by the act No 402/2013 Coll. on Regulatory Authority for Electronic Communications and Postal Services and on Transport Authority and on amendments to certain acts and came into force on 1 January 2014. NSAT is a state administrative body with nationwide competence in the area of railways and other guided transport, civil aviation and inland waterway transport.

Civil Aviation Division of the NSAT ensures the performance of the state administration and state supervision in civil aviation as well as other tasks arising from the Act. 143/1998 Coll. of 2 April 1998 on Civil Aviation (Aviation Act) and on amendments to certain acts, as amended, generally binding regulations, legally binding acts of the European Union and international treaties by which the Slovak Republic is bound.

Civil Aviation Division performs the function of national supervisory body in the field of certification and preservation of airworthiness and environmental certification of aircraft, certification of design and production, operation of aircraft, professional competence of personnel, training facilities providing air navigation services, airport operations and aviation ground equipment and civil aviation security.

2.2.4. Letové prevádzkové služby Slovenskej republiky, štátny podnik - Air Navigation Services Provider

Letové prevádzkové služby Slovenskej republiky, štátny podnik (LPS SR), a state enterprise, has been entrusted for provision of air navigation services under the
Slovak laws since January 1993. LPS SR, state enterprise, is acting as a commercial entity.

The mission of LPS SR is in the following domains:
- Air navigation services,
- Aeronautical Telecommunication Services,
- ATS Infrastructure Operation, Maintenance and Development,
- Aeronautical Information Management, including Aeronautical Information Services,
- Air Traffic Services Safety and Quality,
- Aeronautical search and rescue coordination,
- Administrative and finance.

2.2.5. Airports

The main international airports in the Slovak Republic are:
- Airport Bratislava – Letisko M. R. Štefánika (www.bts.aero);
- Airport Košice (www.airportkosice.sk);
- Airport Piešťany (www.airport-piestany.sk);
- Airport Sliač (www.airportsliač.sk);
- Airport Poprad - Tatry (www.airport-poprad.sk);
- Airport Žilina (www.letisko.sk).

All of these international airports are for public use and all are joint stock companies. Ownership differs on individual airports and stakeholders are usually municipalities, regional governments and MoT.

2.2.6. Accident and Incident Investigation Body

Technical investigation following accidents and incidents is carried out by Accident and Incident Investigation Board (AAIIB) as an independent part of MoT. This Board performs its functions in compliance with Council Directive 94/56/EC which is transposed into national legislation.

The AAIIB conducts investigations of civil aircraft accidents and serious incidents; upon its decision in specific cases AAIIB also conducts investigations for incidents. In some cases, AAIIB may delegate investigation of incidents and serious occurrences to another body, but remains responsible of it.

The NSAT in co-operation with AAIIB performs the collection, evaluation, process and storing of all information related to accidents, incidents and occurrences, as well as making this information available to the other EU States according to Directive 2003/42/EC, EC Regulation 1321/2007 and EC Regulation 1330/2007. These data and processes are used for safety and investigation purposes.

In case of civil-military accidents/incidents both civil and military investigation authorities have to cooperate.
2.3. Specific geographical or other characteristics that influence the development of international aviation

The Slovak Republic is a landlocked central European country. Thanks to its advantageous geographic position it is important for the international air navigation. It closely cooperates with the bodies of the European Union (on the level of Working Parties of the Council and various committees of the Commissions), the European office of ICAO, EASA EUROCONTROL, and ECAC. Air navigation services and provided infrastructure are continuously modernised so that civil aviation can be operated on a safe and economically effective basis.

The Airport Bratislava is the biggest international airport in the Slovak Republic. It is situated near the large international airport in Austria (Vienna Airport 50 km), Hungary (nearest of which is Györ Airport 65 km) and Czech Republic (nearest of which is Airport Brno 130 km).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of aviation enterprises</td>
<td>12</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Employment in aviation enterprises</td>
<td>1128</td>
<td>1087</td>
<td>421</td>
<td>311</td>
<td>353</td>
<td>318</td>
</tr>
<tr>
<td>Airport enterprises</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Employment in airport enterprises</td>
<td>1054</td>
<td>1004</td>
<td>950</td>
<td>950</td>
<td>926</td>
<td>848</td>
</tr>
</tbody>
</table>

2.3.1. Statistical Data of the Slovak International Airports
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Total number of passengers (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Airport BRATISLAVA</td>
<td>2218.592</td>
</tr>
<tr>
<td>Airport KOŠICE</td>
<td>590.919</td>
</tr>
<tr>
<td>Airport POPRAD - TATRY</td>
<td>58.154</td>
</tr>
<tr>
<td>Airport PIEŠŤANY</td>
<td>3.285</td>
</tr>
<tr>
<td>Airport SLIAČ</td>
<td>4.559</td>
</tr>
<tr>
<td>Airport ŽILINA</td>
<td>12.294</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2887.803</td>
</tr>
</tbody>
</table>

Figure 2.3.1.1. Airport operating outputs – passengers

* Airport Sliač under reconstruction

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Cargo [tons]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Airport BRATISLAVA</td>
<td>6960.649</td>
</tr>
<tr>
<td>Airport KOŠICE</td>
<td>457.037</td>
</tr>
<tr>
<td>Airport POPRAD - TATRY</td>
<td>96.412</td>
</tr>
<tr>
<td>Airport PIEŠŤANY</td>
<td>0.965</td>
</tr>
<tr>
<td>Airport SLIAČ</td>
<td>63.485</td>
</tr>
<tr>
<td>Airport ŽILINA</td>
<td>1.685</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7580.233</td>
</tr>
</tbody>
</table>

Figure 2.3.1.2. Airport operating outputs – cargo

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Mail [tons]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Airport BRATISLAVA</td>
<td>93.756</td>
</tr>
</tbody>
</table>

Figure 2.3.1.3. Airport operating outputs – mail
2.4. Education, including scientific and technical research institutions focusing on aviation-related issues

2.4.1. University of Žilina

The Air Transport Department at the University of Žilina (ATD) is a centre for education, research, and training in civil aviation. ATD provides accredited study programmes in a three-tier course structure of university education – Bc., Ing (equivalent to MSc.) and doctorate degrees. On a commercial basis, the ATD also provides initial Air Traffic Controller training and aircraft pilot training up to the CPL/IR/MEP (A) level and theory up to the frozen ATPL level.

ATD is also the base of the National Civil Aviation Security Training Centre of the Slovak Republic. The Centre runs basic aviation security courses in line with the EU regulations for all categories of personnel in aviation. Courses are designed to enhance personnel's academic knowledge and technical skills in handling a variety of potentially critical situations. These courses are certified by the CAA of the Slovak Republic.

The core areas of research and consulting activities of the ATD include:

- Airport capacity and operational assessments
- Civil aviation security
- Meteorology and weather hazards
- Airline operations and economics
- Human Factors
- Safety of general aviation
- Air Traffic Management

2.4.2. Technical university of Košice

Starting with the Academic year of 2005/2006, the Faculty of Aeronautics has adopted a three-level system of education within the accredited 3-year bachelor degree programs (Level I), subsequently followed by a 2-year Master degree study (Level II) and a 3 to 5-year Doctoral degree study program (Level III).

In accordance with the basic mission of the Faculty of Aeronautics - to provide, organize and ensure higher level education, life-time education as well as facilitate creative academic research in the fields of aeronautics, aviation equipment, aerospace and related issues - the accredited study programs are focused on the areas such as air traffic control and management (with pilots and ATC-staff included), aviation mechanical engineering, electrical engineering and avionics, aircraft design, aviation equipment repair and operations.

Academic departments:

- Aerodynamics and Simulations
- Air Traffic Management
- Flight Training
- Aviation Technical Studies
- Aviation Engineering
• Avionics

2.4.3. The Transport Research Institute

The Transport Research Institute (TRI), in its 50-year history, has fulfilled important national economic assignments related to national transport policy making and implementation. Wide know-how integrates the TRI activities into the scientific and research basis of the Slovak Republic, which is one of the most important priorities of the TRI’s long-term strategy.

TRI scientific and research activities cover all modes of transport, in particular, in the field of engineering and technology, operation, economy, legislation, management and organization, informatics and automation, ecology, power system, transport infrastructure safety and quality, transport services and tourism management transport policy, certification and testing in transport.

2.4.4. Aircraft Repair Company Trenčín JSC

Aircraft Repair Company Trenčín JSC is a well-established aircraft repair and manufacturing company, the only one of its kind in Slovakia not only with regard to the number of repaired military and civil aircraft and other aviation equipment but also in terms of types and versions of repaired and upgraded aircraft and helicopters. Company, headquartered in Trenčín, has risen from the historical basis of one of Slovak Republic's oldest repair companies with almost 60 years of tradition and possession of extensive know-how about repairs of aircraft, airport ground vehicles and equipment, and air defense equipment. As of 1 January 1993 the official founder is the Ministry of Defense of the Slovak Republic. The former state-run company has been transformed as of 1 February 2006 into a joint-stock company with 100% state ownership. The government is currently looking for a strategic partner.

2.5. Effects of past efforts to bring about changes in the international aviation sector of the Slovak Republic

Since the foundation of the Slovak Republic in 1993 the international aviation in the country has made a noticeable progress. The Slovak Republic gradually became a member of several international civil aviation organisations: ICAO, ECAC, EASA and EUROCONTROL.

An important step in the development of civil aviation of our country was the accession of the Slovak Republic to the European Union in 2004. Since then we have actively participated in making transport policy in the area of aviation.

The legislation of the Slovak Republic in the area of civil aviation is sufficiently open and liberal and supports carriers and airports in providing safe and quality services on the air transport market.
3.1. ECAC Baseline Scenario

The baseline scenario of ECAC States presents the following sets of data (in 2010) and forecast (in 2020 and 2035), which were provided by EUROCONTROL:

- European air traffic (includes all international and national passenger flight departures from ECAC airports, in number of flights, and RPK calculated purely from passenger numbers, which are based on EUROSTAT figures. Belly freight and dedicated cargo flights are not included),
- its associated aggregated fuel consumption (in million tonnes)
- its associated emissions (in million tonnes of CO₂), and
- average fuel efficiency (in kg/10RPK).

The sets of forecasts correspond to projected traffic volumes and emissions, in a scenario of “regulated growth”.

3.1.1. Scenario “Regulated Growth”, Most-likely/Baseline scenario

As in all 20-year forecasts produced by EUROCONTROL, various scenarios are built with a specific storyline and a mix of characteristics. The aim is to improve the understanding of factors that will influence future traffic growth and the risks that lie ahead. In the 20-year forecast published in 2013 by EUROCONTROL, the scenario called ‘Regulated Growth’ was constructed as the ‘most-likely’ or ‘baseline’ scenario, most closely following the current trends. It considers a moderate economic growth, with regulation reconciling the environmental, social and economic demands.
The figure above presents a summary of the social, economic and air traffic-related characteristics of the different scenarios developed by EUROCONTROL for the purposes of EUROCONTROL 20-year forecast of IFR movements.\footnote{The characteristics of the different scenarios can be found in Task 4: European Air Traffic in 2035, Challenges of Growth 2013, EUROCONTROL, June 2013 available at ECAC website}

### 3.1.2. ECAC baseline scenario

The ECAC baseline scenario presented in the following tables was generated by EUROCONTROL for all ECAC States including the Canary Islands. Over-flights of the ECAC area have not been included.

The baseline scenario, which is presented in the following tables, does not include business and dedicated cargo traffic. It covers only commercial passenger flight movements for the area of scope outlined in the previous paragraph, using data for airport pairs, which allows for the generation of fuel efficiency data (in kg/RPK). Historical fuel burn (2010) and emission calculations are based on the actual flight plans from the PRISME data warehouse, including the actual flight distance and the cruise altitude by airport pair. Future year fuel burn and emissions (2020, 2035) are modelled based on actual flight distances and cruise altitudes by airport pair in 2014.
Taxi times are not included. The baseline is presented along a scenario of engine-technology freeze, as of 2014, so aircraft not in service at that date are modelled with the fuel efficiency of comparable-role in-service aircraft (but with their own seating capacities).

The future fleet has been generated using the Aircraft Assignment Tool (AAT) developed collaboratively by EUROCONTROL, the European Aviation Safety Agency and the European Commission. The retirement process of the Aircraft Assignment Tool is performed year by year, allowing the determination of the amount of new aircraft required each year. This way, the entry into service year (EISY) can be derived for the replacement aircraft. The Growth and Replacement (G&R) Database used is largely based on the Flightglobal Fleet Forecast - Deliveries by Region 2014 to 2033. This forecast provides the number of deliveries for each type in each of the future years, which are re-scaled to match the EUROCONTROL forecast.

The data and forecasts for Europe show two distinct phases, of rapid improvement followed by continuing, but much slower improvement after 2020. The optimism behind the forecast for the first decade is partly driven by statistics: in the 4 years 2010-2014, the average annual improvement in fuel efficiency for domestic and international flights was around 2%. [Source: EUROCONTROL] so this is already achieved. Underlying reasons for this include gains through improvements in load factors (e.g. more than 3% in total between 2010 and 2014), and use of slimmer seats allowing more seats on the same aircraft. However, neither of these can be projected indefinitely into the future as a continuing benefit, since they will hit diminishing returns. In their place we have technology transitions to A320neo, B737max, C-series, B787 and A350 for example, especially over the next 5 years or so. Here this affects seat capacity, but in addition, as we exit from the long economic downturn, we see an acceleration of retirement of old, fuel-inefficient aircraft, as airline finances improve, and new models become available. After that, Europe believes that the rate of improvement would be much slower, and this is reflected in the ‘technology freeze’ scenario, which is presented here.

**Figure 3.1.2.1.** Total fuel burn for passenger domestic and international flights (ECAC)

<table>
<thead>
<tr>
<th>Year</th>
<th>Traffic (millions of departing flights)</th>
<th>Total Fuel burn (in million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>7,12</td>
<td>40,34</td>
</tr>
<tr>
<td>2020</td>
<td>8,48</td>
<td>48,33</td>
</tr>
<tr>
<td>2035</td>
<td>11,51</td>
<td>73,10</td>
</tr>
</tbody>
</table>

**Figure 3.1.2.2.** CO₂ emissions forecast

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ emissions (in million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>127,47</td>
</tr>
<tr>
<td>2020</td>
<td>152,72</td>
</tr>
<tr>
<td>2035</td>
<td>231,00</td>
</tr>
</tbody>
</table>
Figure 3.1.2.3. Traffic in RPK (domestic and international departing flights from ECAC airports, PAX only, no freight and dedicated cargo flights)

<table>
<thead>
<tr>
<th>Year</th>
<th>Traffic (in billion RPK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1 329,6</td>
</tr>
<tr>
<td>2020</td>
<td>1 958,7</td>
</tr>
<tr>
<td>2035</td>
<td>3 128,2</td>
</tr>
</tbody>
</table>

Figure 3.1.2.4. Fuel efficiency (kg/10RPK)

<table>
<thead>
<tr>
<th>Year</th>
<th>Fuel efficiency (in kg/10 RPK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0,3034</td>
</tr>
<tr>
<td>2020</td>
<td>0,2468</td>
</tr>
<tr>
<td>2035</td>
<td>0,2337</td>
</tr>
</tbody>
</table>

Figure 3.1.2.5. Average annual fuel efficiency improvement

<table>
<thead>
<tr>
<th>Period</th>
<th>Fuel efficiency improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020 - 2010</td>
<td>-2,05%</td>
</tr>
<tr>
<td>2035 - 2020</td>
<td>-0,36%</td>
</tr>
<tr>
<td>2035 - 2010</td>
<td>-1,04%</td>
</tr>
</tbody>
</table>

In order to further improve fuel efficiency and to reduce future air traffic emissions beyond the projections in the baseline scenario, ECAC States have taken further action. Supranational measures in order to achieve such additional improvement will be described in the following sections.

It should be noted, however, that a quantification of the effects of many measures is difficult. As a consequence, no aggregated quantification of potential effects of the supranational measures can be presented in this action plan.
3.2. Actions taken at the Supranational Level

3.2.1. Aircraft – related technology development

3.2.1.1. Aircraft emissions standards (Europe's contribution to the development of the aeroplane CO$_2$ standard in CAEP)

European Member States fully supported the work achieved in ICAO’s Committee on Aviation Environmental Protection (CAEP), which resulted in an agreement on the new aeroplane CO$_2$ Standard at CAEP/10 meeting in February 2016, applicable to new aeroplane type designs from 2020 and to aeroplane type designs that are already in-production in 2023. Europe significantly contributed to this task, notably through the European Aviation Safety Agency (EASA) which co-led the CO$_2$ Task Group within CAEP’s Working Group 3, and which provided extensive technical and analytical support.

The assessment of the benefits provided by this measure in terms of reduction in European emissions is not provided in this action plan. Nonetheless, elements of assessment of the overall contribution of the CO$_2$ standard towards the global aspirational goals are available in CAEP.

3.2.1.2. 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 7$^{\text{th}}$ Framework Programme (FP7) and continued within the Horizon 2020 Framework Programme. Set up as a Public Private Partnership between the European Commission and the European aeronautical industry, Clean Sky pulls together the research and technology resources of the European Union in a coherent programme, and contribute significantly to the ‘greening’ of aviation.

The first Clean Sky programme (Clean Sky 1 - 2011-2017) has a budget of € 1,6 billion, equally shared between the European Commission and the aeronautics industry. It aims to develop environmental friendly technologies impacting all flying-segments of commercial aviation. The objectives are to reduce CO$_2$ aircraft emissions by 20-40%, NO$_x$ by around 60% and noise by up to 10dB compared to year 2000 aircraft.
What has the current JTI achieved so far?

It is estimated that Clean Sky resulted in a reduction of aviation CO\textsubscript{2} emissions by more than 20\% with respect to baseline levels (in 2000), which represents an aggregate reduction of 2 to 3 billion tonnes of CO\textsubscript{2} over the next 35 years.

This was followed up by a second programme (Clean Sky 2 – 2014-2024) with the objective to reduce aircraft emissions and noise by 20 to 30\% with respect to the latest technologies entering into service in 2014. The current budget for the programme is approximately €4 billion.

The two Interim Evaluations of Clean Sky in 2011 and 2013 acknowledged that the programme is successfully stimulating developments towards environmental targets. These preliminary assessments confirm the capability of achieving the overall targets at completion of the programme.

Main remaining areas for RTD efforts under Clean Sky 2 are:

- **Large Passenger Aircraft**: demonstration of best technologies to achieve the environmental goals while fulfilling future market needs and improving the competitiveness of future products.
- **Regional Aircraft**: demonstrating and validating key technologies that will enable a 90-seat class turboprop aircraft to deliver breakthrough economic and environmental performance and superior passenger experience.
- **Fast Rotorcraft**: demonstrating new rotorcraft concepts (tilt-rotor and FastCraft compound helicopter) technologies to deliver superior vehicle versatility and performance.
- **Airframe**: demonstrating the benefits of advanced and innovative airframe structures (like a more efficient wing with natural laminar flow, optimised control surfaces, control systems and embedded systems, highly integrated in metallic and advanced composites structures). In addition, novel engine integration strategies and investigate innovative fuselage structures will be tested.
- **Engines**: validating advanced and more radical engine architectures.
- **Systems**: demonstrating the advantages of applying new technologies in major areas such as power management, cockpit, wing, landing gear, to address the needs of future generation aircraft in terms of maturation, demonstration and Innovation.
- **Small Air Transport**: demonstrating the advantages of applying key technologies on small aircraft demonstrators and to revitalise an important segment of the aeronautics sector that can bring key new mobility solutions.
- **Eco-Design**: coordinating research geared towards high eco-compliance in air vehicles over their product life and heightening the stewardship in intelligent Re-use, Recycling and advanced services.

In addition, the Technology Evaluator will continue and be upgraded to assess technological progress routinely and evaluate the performance potential of Clean Sky 2 technologies at both vehicle and aggregate levels (airports and air traffic systems).
More details on Clean Sky can be found at the following link:
http://www.cleansky.eu/

3.2.2. Alternative Fuels

3.2.2.1. European Advanced Biofuels Flightpath

Within the European Union, Directive 2009/28/EC on the promotion of the use of energy from renewable sources (“the Renewable Energy Directive” – RED) established mandatory targets to be achieved by 2020 for a 20% overall share of renewable energy in the EU and a 10% share for renewable energy in the transport sector. Furthermore, sustainability criteria for biofuels to be counted towards that target were established.\(^5\)

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 SWAFEA final report was published in July 2011\(^6\). 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\(^7\)) 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\(^8\). 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.

<table>
<thead>
<tr>
<th>ACARE Roadmap targets regarding share alternative sustainable fuels: Aviation to use:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- at minimum <strong>2%</strong> sustainable alternative fuels in <strong>2020</strong>;</td>
</tr>
<tr>
<td>- at minimum <strong>25%</strong> sustainable alternative fuels in <strong>2035</strong>;</td>
</tr>
<tr>
<td>- at minimum <strong>40%</strong> sustainable alternative fuels in <strong>2050</strong>;</td>
</tr>
</tbody>
</table>

Source: ACARE Strategic Research and Innovation Agenda, Volume 2

As a first step towards delivering this goal, in June 2011 the European Commission, in close coordination with Airbus, leading European airlines (Lufthansa, Air

---


\(^8\) Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM (2011) 144 final
France/KLM, & British Airways) and key European biofuel producers (Choren Industries, Neste Oil, Biomass Technology Group and UOP), launched the European Advanced Biofuels Flight-path. 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 tonnes 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.

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 2nd Generation biofuel projects;
6. Accelerate targeted research and innovation for advanced biofuel technologies, and especially algae.
7. 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.

<table>
<thead>
<tr>
<th>Time horizons (Base year - 2011)</th>
<th>Action</th>
<th>Aim/Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term (next 0-3 years)</td>
<td>Announcement of action at International Paris Air Show</td>
<td>To mobilise all stakeholders including Member States.</td>
</tr>
<tr>
<td></td>
<td>High-level workshop with financial institutions to address funding mechanisms.</td>
<td>To agree on a &quot;Biofuel in Aviation Fund&quot;.</td>
</tr>
</tbody>
</table>

When the Flight-path 2020 initiative began in 2010, only one production pathway was approved for aviation use; no renewable kerosene had actually been produced except at very small scale, and only a handful of test and demonstration flights had been conducted using it. Since then, worldwide technical and operational progress of the
industry has been remarkable. Four different pathways for the production of renewable kerosene are now approved and several more are expected to be certified. A significant number of flights using renewable kerosene have been conducted, most of them revenue flights carrying passengers. Production has been demonstrated at demonstration and even industrial scale for some of the pathways. Use of renewable kerosene within an airport hydrant system was demonstrated in Oslo in 2015.

**Performed flights using bio-kerosene**

IATA: 2000 flights worldwide using bio-kerosene blends performed by 22 airlines between June 2011 and December 2015


**Production (EU)**

**Neste** (Finland): by batches
- Frankfurt-Hamburg (6 months) 1189 flights operated by Lufthansa: 800 tonnes of bio-kerosene
- Itaka: €10m EU funding (2012-2015): > 1000 tonnes

**Biorefly**: €13,7m EU funding: 2000 tonnes per year – second generation (2015) – BioChemtex (Italy)

**BSFJ Swedish Biofuels**: €27,8m EU funding (2014-2019)

3.2.2.2. Research and Development projects on alternative fuels in aviation

In the time frame 2011-2016, 3 projects have been funded by the FP7 Research and Innovation program of the EU.

**ITAKA**: €10m EU funding (2012-2015) with the aim of assessing the potential of a specific crop (camelina) for providing jet fuel. The project aims entail the testing of the whole chain from field to fly, assessing the potential beyond the data gathered in lab experiments, gathering experiences on related certification, distribution and on economical aspects. As feedstock, ITAKA targets European camelina oil and used cooking oil, in order to meet a minimum of 60% GHG emissions savings compared to the fossil fuel jetA1.

**SOLAR-JET**: this project has demonstrated the possibility of producing jet-fuel from CO₂ and water. This was done by coupling a two-step solar thermochemical cycle based on non-stoichiometric ceria redox reactions with the Fischer-Tropsch process. This successful demonstration is further complemented by assessments of the chemical suitability of the solar kerosene, identification of technological gaps, and determination of the technological and economical potentials.
**Core-JetFuel**: €1,2m EU funding (2013-2017) this action evaluates the research and innovation “landscape” in order to develop and implement a strategy for sharing information, for coordinating initiatives, projects and results and to identify needs in research, standardisation, innovation/deployment, and policy measures at European level. Bottlenecks of research and innovation will be identified and, where appropriate, recommendations for the European Commission will be elaborated with respect to re-orientation and re-definition of priorities in the funding strategy. The consortium covers the entire alternative fuel production chain in four domains: Feedstock and sustainability; conversion technologies and radical concepts; technical compatibility, certification and deployment; policies, incentives and regulation. CORE-JetFuel ensures cooperation with other European, international and national initiatives and with the key stakeholders in the field. The expected benefits are enhanced knowledge of decision makers, support for maintaining coherent research policies and the promotion of a better understanding of future investments in aviation fuel research and innovation.

**In 2015, the European Commission launched projects under the Horizon 2020 research programme with capacities of the order of several 1000 tonnes per year.**

3.2.3. Improved Air Traffic Management and Infrastructure Use

3.2.3.1. The EU's Single European Sky Initiative and SESAR

The European Union's Single European Sky (SES) policy aims to reform Air Traffic Management (ATM) in Europe in order to enhance its performance in terms of its capacity to manage larger volume of flights in a safer, more cost-efficient and environmental friendly manner.

The SES aims at achieving 4 high level performance objectives (referred to 2005 context):

- Triple capacity of ATM systems
- Reduce ATM costs by 50%
- Increase safety by a factor of 10
- **Reduce the environmental impact by 10% per flight**

SESAR, the technological pillar of the Single European Sky, contributes to the Single Sky's performance targets by defining, developing, validating and deploying innovative technological and operational solutions for managing air traffic in a more efficient manner.

SESAR contribution to the SES high-level goals set by the Commission are continuously reviewed by the SESAR JU and kept up to date in the ATM Master Plan.

The estimated potential fuel emission savings per flight segment is depicted below:
SESAR’s contribution to the SES performance objectives is now targeting for 2016, as compared to 2005 performance:

1) 27% increase in airspace capacity and 14% increase in airport capacity;
2) Associated improvement in safety, i.e. in an absolute term, 40% of reduction in accident risk per flight hour.
3) 2.8% reduction per flight in gate to gate greenhouse gas emissions;
4) 6% reduction in cost per flight.

The projection of SESAR target fuel efficiency beyond 2016 (Step 110) is depicted in the following graph:

---

10 Step 1, “Time-based Operations” is the building block for the implementation of the SESAR Concept and is focused on flight efficiency, predictability and the environment. The goal is a synchronised and predictable European ATM system, where partners are aware of the business and operational situations and collaborate to optimise the network. In this first Step, time prioritisation for arrivals at airports is initiated together with wider use of datalink and the deployment of initial trajectory-based operations through the use of airborne trajectories by the ground systems and a controlled time of arrival to sequence traffic and manage queues.

Step 2, “Trajectory-based Operations” is focused on flight efficiency, predictability, environment and capacity, which becomes an important target. The goal is a trajectory-based ATM system where partners optimise “business and mission trajectories” through common 4D trajectory information and users define priorities in the network. “Trajectory-based Operations” initiates 4D-based business/mission trajectory management using System Wide Information Management (SWIM) and air/ground trajectory exchange to enable tactical planning and conflict-free route segments.

Step 3, “Performance-based Operations” will achieve the high performance required to satisfy the SESAR target concept. The goal is the implementation of a European high-performance, integrated, network-centric, collaborative and seamless air/ground ATM system. “Performance-based Operations” is realised through the achievement of SWIM and collaboratively planned network operations with User Driven Prioritisation Processes (UDPP).
It is expected that there will be an ongoing performance contribution from non-R&D initiatives through the Step 1 and Step 2 developments, e.g. from improvements related to FABs and Network Management: the intermediate allocation to Step 1 development has been set at -4%, with the ultimate capability enhancement (Step 3) being -10%. 30% of Step 1 target will be provided through non-R&D improvements (-1.2% out of -4%) and therefore -2.8% will come from SESAR improvements. Step 2 target is still under discussion in the range of 4.5% to 6%.

The SESAR concept of operations is defined in the European ATM Master Plan and translated into SESAR solutions that are developed, validated and demonstrated by the SESAR Joint Undertaking and then pushed towards deployment through the SESAR deployment framework established by the Commission.

SESAR Research Projects (environmental focus)

Within the SESAR R&D activities, environmental aspects have mainly been addressed under two types of projects: Environmental research projects which are considered as a transversal activity and therefore primarily contribute to the validation of the SESAR solutions and SESAR demonstration projects, which are pre-implementation activities. Environment aspects, in particular fuel efficiency, are also a core objective of approximately 80% of SESAR’s primary projects.

Environmental Research Projects:

Four Environmental research projects are now completed:

- Project 16.03.01 dealing with Development of the Environment validation framework (Models and Tools);
- Project 16.03.02 dealing with the Development of environmental metrics;
- Project 16.03.03 dealing with the Development of a framework to establish interdependencies and trade-off with other performance areas;
- Project 16.03.07 dealing with Future regulatory scenarios and risks.
In the context of Project 16.03.01 the IMPACT tool was developed providing SESAR primary projects with the means to conduct fuel efficiency, aircraft emissions and noise assessments at the same time, from a web based platform, using the same aircraft performance assumptions. IMPACT successfully passed the CAEP MDG V&V process (Modelling and Database Group Verification and Validation process). Project 16.06.03 has also ensured the continuous development/maintenance of other tools covering aircraft GHG assessment (AEM), and local air quality issues (Open-ALAQS). It should be noted that these tools have been developed for covering the research and the future deployment phase of SESAR.

In the context of Project 16.03.02 a set of metrics for assessing GHG emissions, noise and airport local air quality has been documented. The metrics identified by Project 16.03.02 and not subject of specific IPRs will be gradually implemented into IMPACT.

Project 16.03.03 has produced a comprehensive analysis on the issues related to environmental interdependencies and trade-offs.

Project 16.03.07 has conducted a review of current environmental regulatory measures as applicable to ATM and SESAR deployment, and another report presenting an analysis of environmental regulatory and physical risk scenarios in the form of user guidance. It identifies both those Operation Focus Areas (OFA) and Key Performance Areas which are most affected by these risks and those OFAs which can contribute to mitigating them. It also provides a gap analysis identifying knowledge gaps or uncertainties which require further monitoring, research or analysis.

The only Environmental Research project that is still on-going in the current SESAR project is the SESAR Environment support and coordination project which ensures the coordination and facilitation of all the Environmental research projects activities while supporting the SESAR/AIRE/DEMO projects in the application of the material produced by the research projects. In particular, this project delivered an Environment Impact Assessment methodology providing guidance on how to conduct an assessment, which metrics to use and do and don’ts for each type of validation exercise with specific emphasis on flight trials.

New environmental research projects will be defined in the scope of SESAR 2020 work programme to meet the SESAR environmental targets in accordance to the ATM Master Plan.

Other Research Projects which contribute to SESAR's environmental target:

A large number of SESAR research concepts and projects from exploratory research to preindustrial phase can bring environmental benefits. Full 4D trajectory taking due account of meteorological conditions, integrated departure, surface and arrival manager, airport optimised green taxiing trajectories, combined xLS RNAV operations in particular should bring significant reduction in fuel consumption. Also to be further investigated the potential for remote control towers to contribute positively to the aviation environmental footprint.

Remotely Piloted Aircraft (RPAS) systems integration in control airspace will be an important area of SESAR 2020 work programme and although the safety aspects are considered to be the most challenging ones and will therefore mobilise most of research effort, the environmental aspects of these new operations operating from and
to non-airport locations would also deserve specific attention in terms of emissions, noise and potentially visual annoyance.

**SESAR demonstration projects:**

In addition to its core activities, the SESAR JU co-fines projects where ATM stakeholders work collaboratively to perform integrated flight trials and demonstrations validating solutions for the reduction of CO₂ emissions for surface, terminal and oceanic operations to substantially accelerate the pace of change. Since 2009, the SJU has co-financed a total 33 “green” projects in collaboration with global partners, under the Atlantic Interoperability Initiative to Reduce Emissions (AIRE), demonstrating solutions on commercial flights.

A total of 15767 flight trials were conducted under the AIRE initiative involving more than 100 stakeholders, demonstrating savings ranging from 20 to 1000kg fuel per flight (or 63 to 3150 kg of CO₂), and improvements to day-to-day operations. Other 9 demonstration projects took place from 2012 to 2014 focusing also on environment and during 2015 and 2016 the SESAR JU is co-financing 15 additional large-scale demonstrations projects more ambitious in geographic scale and technology. More information can be found at [http://www.sesarju.eu](http://www.sesarju.eu)

**AIRE – Achieving environmental benefits in real operations**

AIRE was designed specifically to improve energy efficiency and lower engine emissions and aircraft noise in cooperation with the US FAA, using existing technologies by the European Commission in 2007. SESAR JU has been managing the programme from an European perspective since 2008. 3 AIRE demonstration campaigns took place between 2009 and 2014.

A key feature leading to the success of AIRE is that it focused strongly on operational and procedural techniques rather than new technologies. AIRE trials have almost entirely used technology which is already in place, but until the relevant AIRE project came along, air traffic controllers and other users hadn’t necessarily thought deeply about how to make the best use operationally of that technology. In New York and St Maria oceanic airspace lateral [separation] optimisation is given for any flight that requests it because of the AIRE initiative and the specific good cooperation between NAV Portugal and FAA.

Specific trials have been carried for the following improvement areas/solutions as part of the AIRE initiative:

- a. Use of GDL/DMAN systems (pre departure sequencing system / Departure Manager) in Amsterdam, Paris and Zurich;
- b. Issue of Target-Off Block time (TOBT), calculation of variable taxi out time and issue of Target-Start-up Arrival Time (TSAT) in Vienna;
- c. Continuous Descent Operations (CDOs or CDAs) in Amsterdam, Brussels, Cologne, Madrid, New York, Paris, Prague, Pointe a Pitre, Toulouse, and Zurich;
- d. CDOs in Stockholm, Gothenburg, Riga, La Palma; Budapest and Palma de Majorca airports using RNP-AR procedures;
- e. lateral and vertical flight profile changes in the NAT taking benefit of the
The implementation of Automatic Dependent Surveillance-Broadcast (ADS-B) surveillance in the North Atlantic;

f. Calculation of Estimated Times of Arrival (ETA) allowing time based operations in Amsterdam;

g. Precision Area Navigation - Global Navigation Satellite System (PRNAV GNSS) Approaches in Sweden;

h. Free route in Lisbon and Casablanca, over Germany, Belgium, Luxembourg, Netherlands in the EURO-SAM corridor, France, and Italy;

i. Global information sharing and exchange of actual position and updated meteorological data between the ATM system and Airline AOCs for the vertical and lateral optimisation of oceanic flights using a new interface;

The AIRE 1 campaign (2008-2009) has demonstrated, with 1152 trials performed, that significant savings can already be achieved using existing technology. CO₂ savings per flight ranged from 90kg to 1250kg and the accumulated savings during trials were equivalent to 400 tonnes of CO₂. This first set of trials represented not only substantial improvements for the greening of air transport, but high motivation and commitment of the teams involved creating momentum to continue to make progress on reducing aviation emissions.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Location</th>
<th>Trials performed</th>
<th>CO₂ benefit/flight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>Paris, France</td>
<td>353</td>
<td>190-1200 kg</td>
</tr>
<tr>
<td>Terminal</td>
<td>Paris, France</td>
<td>82</td>
<td>100-1250 kg</td>
</tr>
<tr>
<td></td>
<td>Stockholm, Sweden</td>
<td>11</td>
<td>450-950 kg</td>
</tr>
<tr>
<td></td>
<td>Madrid, Spain</td>
<td>620</td>
<td>250-800 kg</td>
</tr>
<tr>
<td>Oceanic</td>
<td>Santa Maria, Portugal</td>
<td>48</td>
<td>90-650 kg</td>
</tr>
<tr>
<td></td>
<td>Reykjavik, Iceland</td>
<td>48</td>
<td>250-1050 kg</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1152</td>
<td></td>
</tr>
</tbody>
</table>

The AIRE 2 campaign (2010-2011) showed a doubling in demand for projects and a high transition rate from R&D to day-to-day operations. 18 projects involving 40 airlines, airports, ANSPs and industry partners were conducted in which surface, terminal, oceanic and gate-to-gate operations were tackled. 9416 flight trials took place. The next table summarises AIRE 2 projects operational aims and results.

<table>
<thead>
<tr>
<th>Project name</th>
<th>Location</th>
<th>Operation</th>
<th>Objective</th>
<th>CO₂ and Noise benefits per flight (kg)</th>
<th>Nb of flights</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDM at Vienna Airport</td>
<td>Austria</td>
<td>CDM notably pre-departure sequence</td>
<td>CO₂ &amp; Ground Operational efficiency</td>
<td>54</td>
<td>208</td>
</tr>
<tr>
<td>Greener airport operations under adverse conditions</td>
<td>Country</td>
<td>Description</td>
<td>CO₂ &amp; Ground Operational efficiency</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>---------</td>
<td>-------------</td>
<td>------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Belgium</td>
<td>CDO in a complex radar vectoring environment</td>
<td>Noise &amp; CO₂ 160-315; -2dB (between 10 to 25 Nm from touchdown)</td>
<td>3094</td>
<td></td>
</tr>
<tr>
<td>DoWo - Down Wind Optimisation</td>
<td>France</td>
<td>Green STAR &amp; Green IA in busy TMA</td>
<td>CO₂ 158-315</td>
<td>219</td>
<td></td>
</tr>
<tr>
<td>REACT-CR</td>
<td>Czech republic</td>
<td>CDO</td>
<td>CO₂ 205-302</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td>Flight Trials for less CO₂ emission during transition from en-route to final approach</td>
<td>Germany</td>
<td>Arrival vertical profile optimisation in high density traffic</td>
<td>CO₂ 110-650</td>
<td>362</td>
<td></td>
</tr>
<tr>
<td>RETA-CDA2</td>
<td>Spain</td>
<td>CDO from ToD</td>
<td>CO₂ 250-800</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>DORIS</td>
<td>Spain</td>
<td>Oceanic: Flight optimisation with ATC coordination &amp; Data link (ACARS, FANS CPDLC)</td>
<td>CO₂ 3134</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>ONATAP</td>
<td>Portugal</td>
<td>Free and Direct Routes</td>
<td>CO₂ 526</td>
<td>999</td>
<td></td>
</tr>
<tr>
<td>ENGAGE</td>
<td>UK</td>
<td>Optimisation of cruise altitude and/or Mach number</td>
<td>CO₂ 1310</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>RlongSM (Reduced longitudinal Separation Minima)</td>
<td>UK</td>
<td>Optimisation of cruise altitude profiles</td>
<td>CO₂ 441</td>
<td>533</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>Country</td>
<td>Description</td>
<td>CO₂ &amp; noise</td>
<td>CO₂</td>
<td>Noise</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>-------</td>
</tr>
<tr>
<td>Gate to gate Green Shuttle</td>
<td>France</td>
<td>Optimisation of cruise altitude profile &amp; CDO from ToD</td>
<td></td>
<td>788</td>
<td>221</td>
</tr>
<tr>
<td>Transatlantic green flight PPTP</td>
<td>France</td>
<td>Optimisation of oceanic trajectory (vertical and lateral) &amp; approach</td>
<td></td>
<td>2090+1050</td>
<td>93</td>
</tr>
<tr>
<td>Greener Wave</td>
<td>Switzerland</td>
<td>Optimisation of holding time through 4D slot allocation</td>
<td></td>
<td>504</td>
<td>1700</td>
</tr>
<tr>
<td>VINGA</td>
<td>Sweden</td>
<td>CDO from ToD with RNP STAR and RNP AR.</td>
<td>70-285; negligible change to noise contours</td>
<td>220</td>
<td>25</td>
</tr>
<tr>
<td>AIRE Green Connections</td>
<td>Sweden</td>
<td>Optimised arrivals and approaches based on RNP AR &amp; Data link. 4D trajectory exercise</td>
<td></td>
<td>220</td>
<td>25</td>
</tr>
<tr>
<td>Trajectory based night time</td>
<td>The Netherlands</td>
<td>CDO with pre-planning</td>
<td></td>
<td>TBC</td>
<td>124</td>
</tr>
<tr>
<td>A380 Transatlantic Green Flights</td>
<td>France</td>
<td>Optimisation of taxiing and cruise altitude profile</td>
<td></td>
<td>1200+1900</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>9416</td>
</tr>
</tbody>
</table>

CDOs were demonstrated in busy and complex TMAs although some operational measures to maintain safety, efficiency and capacity at an acceptable level had to developed.

The AIRE 3 campaign comprised 9 projects (2012-2014) and 5199 trials summarised in the next table.
<table>
<thead>
<tr>
<th>Project name</th>
<th>Location</th>
<th>Operation</th>
<th>Number of Trials</th>
<th>Benefits per flight</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMBER</td>
<td>Riga International Airport</td>
<td>turboprop aircraft to fly tailored Required Navigation Performance – Authorisation Required (RNP-AR) approaches together with Continuous Descent Operations (CDO),</td>
<td>124</td>
<td>230 kg reduction in CO₂ emissions per approach; A reduction in noise impact of 0.6 decibels (dBA)</td>
</tr>
<tr>
<td>CANARIAS</td>
<td>La Palma and Lanzarote airports</td>
<td>CCDs and CDOs</td>
<td>8</td>
<td>Area Navigation-Standard Terminal Arrival Route (RNAV STAR) and RNP-AR approaches 34-38 NM and 292-313 kg of fuel for La Palma and 14 NM and 100 kg of fuel for Lanzarote saved.</td>
</tr>
<tr>
<td>OPTA-IN</td>
<td>Palma de Mallorca Airport</td>
<td>CDOs</td>
<td>101</td>
<td>Potential reduction of 7-12% in fuel burn and related CO₂ emissions</td>
</tr>
<tr>
<td>REACT plus</td>
<td>Budapest Airport</td>
<td>CDOs and CCOs</td>
<td>4113</td>
<td>102 kg of fuel conserved during each CDO</td>
</tr>
<tr>
<td>ENGAGE Phase II</td>
<td>North Atlantic – between Canada &amp; Europe</td>
<td>Optimisation of cruise altitude and/or Mach number</td>
<td>210</td>
<td>200-400 litres of fuel savings; An average of 1-2% of fuel conserved</td>
</tr>
<tr>
<td>SATISFIED</td>
<td>EUR-SAM Oceanic corridor</td>
<td>Free routing</td>
<td>165</td>
<td>1578 kg in CO₂ emissions</td>
</tr>
<tr>
<td>SMART</td>
<td>Lisbon flight information region (FIR), Oceanic: Flight optimisation</td>
<td>250</td>
<td>3134 kg CO₂ per flight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New York Oceanic and Santa Maria FIR</td>
<td>WE-FREE</td>
<td>MAGGO*</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------</td>
<td>---------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Parter airports</td>
<td>Paris CDG, Venice, Verona, Milano Linate, Pisa, Bologna, Torino, Genoa airports</td>
<td>free routing</td>
<td>Santa Maria FIR and TMA</td>
<td>Several enablers</td>
</tr>
<tr>
<td>CDG-Roma Fiumicino</td>
<td>693 Kg of CO2 for CDG-Milano Linate</td>
<td>128</td>
<td>100*</td>
<td></td>
</tr>
</tbody>
</table>

*The MAGGO project couldn’t be concluded

**SESAR solutions and Common Projects for deployment**

SESAR Solutions are operational and technological improvements that aim to contribute to the modernisation of the European and global ATM system. These solutions are systematically validated in real operational environments, which allow demonstrating clear business benefits for the ATM sector when they are deployed including the **reduction by up to 500 kg of fuel burned per flight by 2035 which corresponds to up to 1,6 tonnes of CO2 emissions per flight, split across operating environments.**

By end of 2015 twenty-five SESAR Solutions were validated targeting the full range of ATM operational environments including airports. These solutions are made public on the SESAR JU website in a datapack form including all necessary technical documents to allow implementation. One such solution is the integration of pre-departure management within departure management (DMAN) at Paris Charles de Gaulle, resulting in a 10% reduction of taxi time, 4 000-tonne fuel savings annually and a 10% increase of Calculated Take Off Time (CTOT) adherence and the Implementation. Another solution is Time Based Separation at London Heathrow, allowing up to five more aircraft per hour to land in strong wind conditions and thus reduces holding times by up to 10 minutes, and fuel consumption by 10% per flight. By the end of SESAR1 fifty-seven solutions will be produced.

The deployment of the SESAR solutions which are expected to bring the most benefits, sufficiently mature and which require a synchronised deployment is mandated by the Commission through legally binding instruments called Common Projects.

The first Common Projects identify six ATM functionalities, namely Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas; Airport Integration and Throughput; Flexible Airspace Management and Free Route; Network Collaborative Management; Initial System Wide Information Management; and Initial Trajectory Information Sharing. The deployment of those six ATM functionalities should be made mandatory.

- The Extended Arrival Management and Performance Based Navigation in the High Density Terminal Manoeuvring Areas functionality is expected to improve the precision of approach trajectory as well as facilitate traffic
sequencing at an earlier stage, thus allowing reducing fuel consumption and environmental impact in descent/arrival phases.

- The Airport Integration and Throughput functionality is expected to improve runway safety and throughput, ensuring benefits in terms of fuel consumption and delay reduction as well as airport capacity.

- The Flexible Airspace Management and Free Route functionality is expected to enable a more efficient use of airspace, thus providing significant benefits linked to fuel consumption and delay reduction.

- The Network Collaborative Management functionality is expected to improve the quality and the timeliness of the network information shared by all ATM stakeholders, thus ensuring significant benefits in terms of Air Navigation Services productivity gains and delay cost savings.

- The Initial System Wide Information Management functionality, consisting of a set of services that are delivered and consumed through an internet protocol-based network by System Wide Information Management (SWIM) enabled systems, is expected to bring significant benefits in terms of ANS productivity.

- The Initial Trajectory Information Sharing functionality with enhanced flight data processing performances is expected to improve predictability of aircraft trajectory for the benefit of airspace users, the network manager and ANS providers, implying less tactical interventions and improved de-confliction situation. This is expected to have a positive impact on ANS productivity, fuel saving and delay variability.

### SESAR 2020 programme

SESAR next programme (SESAR 2020) includes in addition to exploratory and industrial research, very large scale demonstrations which should include more environmental flight demonstrations and goes one step further demonstrating the environmental benefits of the new SESAR solutions.

### 3.2.4. Economic/Market-Based Measures

#### 3.2.4.1. The EU Emissions Trading System

The EU Emissions Trading System (EU ETS) is the cornerstone of the European Union's policy to tackle climate change, and a key tool for reducing greenhouse gas emissions cost-effectively, including from the aviation sector. It operates in 31 countries: the 28 EU Member States, Iceland, Liechtenstein and Norway. The EU ETS is the first and so far the biggest international system capping greenhouse gas emissions; it currently covers half of the EU's CO₂ emissions, encompassing those from around 12 000 power stations and industrial plants in 31 countries, and, under its current scope, around 640 commercial and non-commercial aircraft operators that have flown between airports in the European Economic Area (EEA).

The EU ETS began operation in 2005; a series of important changes to the way it works took effect in 2013, strengthening the system. 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, other installations and aircraft operators in the system. Within this cap, companies can sell to or buy emission allowances from one another. The limit on allowances available provides certainty that the environmental objective is achieved and gives allowances a market value.

By the 30th April each year, companies, including aircraft operators, have to surrender allowances to cover their emissions from the previous calendar year. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or 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 reduces over time so that total emissions fall.

As regards aviation, legislation to include aviation in the EU ETS was adopted in 2008 by the European Parliament and the Council\(^\text{11}\). The 2006 proposal to include aviation in the EU ETS was accompanied by detailed impact assessment\(^\text{12}\). After careful analysis of the different options, it was concluded that this was the most cost-efficient and environmentally effective option for addressing aviation emissions.

In October 2013, the Assembly of the International Civil Aviation Organization (ICAO) decided to develop a global market-based mechanism (MBM) for international aviation emissions. The global MBM design is to be decided at the next ICAO Assembly in 2016, including the mechanisms for the implementation of the scheme from 2020. In order to sustain momentum towards the establishment of the global MBM, the European Parliament and Council have decided to temporarily limit the scope of the aviation activities covered by the EU ETS, to intra-European flights\(^\text{13}\). The temporary limitation applies for 2013-2016, following on from the April 2013 'stop the clock' Decision\(^\text{14}\) adopted to promote progress on global action at the 2013 ICAO Assembly.

The legislation requires the European Commission to report to the European Parliament and Council regularly on the progress of ICAO discussions as well as of its efforts to promote the international acceptance of market-based mechanisms among third countries. Following the 2016 ICAO Assembly, the Commission shall report to the European Parliament and to the Council on actions to implement an international agreement on a global market-based measure from 2020, that will reduce greenhouse gas emissions from aviation in a non-discriminatory manner. In its report, the Commission shall consider, and, if appropriate, include proposals on the appropriate scope for coverage of aviation within the EU ETS from 2017 onwards.


\(^{12}\) http://ec.europa.eu/clima/policies/transport/aviation/documentation_en.htm


Between 2013 and 2016, the EU ETS only covers emissions from flights between airports which are both in the EEA. Some flight routes within the EEA are also exempted, notably flights involving outermost regions.

The complete, consistent, transparent and accurate monitoring, reporting and verification of greenhouse gas emissions remain fundamental for the effective operation of the EU ETS. Aviation operators, verifiers and competent authorities have already gained experience with monitoring and reporting during the first aviation trading period; detailed rules are prescribed by Regulations (EU) No 600/2012\(^\text{15}\) and 601/2012\(^\text{16}\).

The EU legislation establishes exemptions and simplifications to avoid excessive administrative burden for the smallest aircraft operators. Since the EU ETS for aviation took effect in 2012 a \textit{de minimis} exemption for commercial operators – with either fewer than 243 flights per period for three consecutive four-month periods or flights with total annual emissions lower than 10 000 tonnes CO\(_2\) per year – applies, which means that many aircraft operators from developing countries are exempted from the EU ETS. Indeed, over 90 States have no commercial aircraft operators included in the scope of the EU ETS. From 2013 also flights by non-commercial aircraft operators with total annual emissions lower than 1 000 tonnes CO\(_2\) per year are excluded from the EU ETS up to 2020. A further administrative simplification applies to small aircraft operators emitting less than 25 000 tonnes of CO\(_2\) per year, who can choose to use the small emitter’s tool rather than independent verification of their emissions. In addition, small emitter aircraft operators can use the simplified reporting procedures under the existing legislation.

The EU legislation foresees that, where a third country takes measures 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 ETS. 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 the EU legislation regarding aviation under the EU ETS are necessary.

**Impact on fuel consumption and/or CO\(_2\) emissions**

The environmental outcome of an emissions trading system is determined by the emissions cap. Aircraft operators are able to use allowances from outside the aviation sector to cover their emissions. The absolute level of CO\(_2\) emissions from the aviation sector itself can exceed the number of allowances allocated to it, as the increase is

---


offset by CO₂ emissions reductions in other sectors of the economy covered by the EU ETS.

Over 2013-16, with the inclusion of only intra-European flights in the EU ETS, the total amount of annual allowances to be issued will be around 39 million. Verified CO₂ emissions from aviation activities carried out between aerodromes located in the EEA amounted to 56.9 million tonnes of CO₂ in 2015. This means that the EU ETS will contribute to achieve more than 17 million tonnes of emission reductions annually, or around 68 million over 2013-2016, partly within the sector (airlines reduce their emissions to avoid paying for additional units) or in other sectors (airlines purchase units from other ETS sectors, which would have to reduce their emissions consistently). While some reductions are likely to be within the aviation sector, encouraged by the EU ETS's economic incentive for limiting emissions or use of aviation biofuels¹⁷, the majority of reductions are expected to occur in other sectors.

Putting a price on greenhouse gas emissions is important to harness market forces and achieve cost-effective emission reductions. In parallel to providing a carbon price which incentivises emission reductions, the EU ETS also supports the reduction of greenhouse gas emissions through €2.1 billion funding for the deployment of innovative renewables and carbon capture and storage. This funding has been raised from the sale of 300 million emission allowances from the New Entrants' Reserve of the third phase of the EU ETS. This includes over €900 million for supporting bioenergy projects, including advanced biofuels¹⁸.

In addition, through Member States' use of EU ETS auction revenue in 2013, over €3 billion has been reported by them as being used to address climate change¹⁹. The purposes for which revenues from allowances should be used encompass mitigation of greenhouse gas emissions and adaptation to the inevitable impacts of climate change in the EU and third countries, to reduce emissions through low-emission transport, to fund research and development, including in particular in the fields of aeronautics and air transport, to fund contributions to the Global Energy Efficiency and Renewable Energy Fund, and measures to avoid deforestation.

In terms of contribution towards the ICAO global goals, the States implementing the EU ETS will together deliver, in “net” terms, a reduction of at least 5% below 2005 levels of aviation CO₂ emissions for the scope that is covered. Other emissions reduction measures taken, either at supra-national level in Europe or by any of the 31 individual states implementing the EU ETS, will also contribute towards the ICAO global goals. Such measures are likely to moderate the anticipated growth in aviation emissions.

<table>
<thead>
<tr>
<th>Estimated emissions reductions resulting from the EU-ETS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>2013-2016</td>
</tr>
</tbody>
</table>

¹⁷ The actual amount of CO₂ emissions savings from biofuels reported under the EU ETS from 2012 to 2014 was 2 tonnes

¹⁸ For further information, see http://ec.europa.eu/clima/policies/lowcarbon/ner300/index_en.htm

¹⁹ For further information, see http://ec.europa.eu/clima/news/articles/news_2014102801_en.htm
The table presents projected benefits of the EU-ETS based on the current scope (intra-European flights).
3.2.5. EU Initiatives in Third Countries

3.2.5.1. Multilateral projects
At the end of 2013 the European Commission launched a project of a total budget of €6,5 million under the name "Capacity building for CO2 mitigation from international aviation". The 42-month project, implemented by the ICAO, boosts less developed countries’ ability to track, manage and reduce their aviation emissions. In line with the call from the 2013 ICAO Assembly, beneficiary countries will submit meaningful State action plans for reducing aviation emissions, and also receive assistance for establishing emissions inventories and piloting new ways of reducing fuel consumption. Through the wide range of activities in these countries, the project contributes to international, regional and national efforts to address growing emissions from international aviation. The beneficiary countries are the following:


**Caribbean**: Dominican Republic and Trinidad and Tobago.

3.2.6. Support to Voluntary Actions: ACI 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.

The underlying aim of the programme is to encourage and enable airports to implement best practice carbon and energy management processes and to gain public recognition of their achievements. It requires airports to measure their CO2 emissions in accordance with the World Resources Institute and World Business Council for Sustainable Development GHG Protocol and to get their emissions inventory assured by an independent third party.

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.

In 2014 the programme reached global status with the extension of the programme to the ACI North American and Latin American & Caribbean regions, participation has increased to 125 airports, in over 40 countries across the world – an increase of 23% from the previous year, growing from 17 airports in Year 1 (2009-2010). These airports welcome 1,7 billion passengers a year, or 27,5% of the global air passenger traffic.

*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”.

37
Levels of certification (ACA Annual Report 2014-2015)

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 Europe, participation in the programme has increased from 17 airports to 92 in 2015, an increase of 75 airports or 441% since May 2010. 92 airports mapped their carbon footprints, 71 of them actively reduced their CO₂ emissions, 36 reduced their CO₂ emissions and engaged others to do so, and 20 became carbon neutral. European airports participating in the programme now represent 63.9% of European air passenger traffic.

**Anticipated benefits:**

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

**Emissions reduction highlights**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total aggregate scope 1 &amp; 2 reduction (tCO₂)</td>
<td>51 657</td>
<td>54 565</td>
<td>48 676</td>
<td>140 009</td>
<td>129 937</td>
<td>168 779</td>
</tr>
<tr>
<td>Total aggregate scope 3 reduction (tCO₂)</td>
<td>359 733</td>
<td>675 124</td>
<td>365 528</td>
<td>30 155</td>
<td>223 905</td>
<td>550 884</td>
</tr>
</tbody>
</table>
Emissions performance summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emissions</td>
<td>Number of airports</td>
</tr>
<tr>
<td>Aggregate carbon footprint for ‘year 0’ (^{20}) for emissions under airports’ direct control (all airports)</td>
<td>2 044 683 tonnes CO₂</td>
<td>85</td>
</tr>
<tr>
<td>Carbon footprint per passenger</td>
<td>2.01 kg CO₂</td>
<td>1.89 kg CO₂</td>
</tr>
<tr>
<td>Aggregate reduction in emissions from sources under airports’ direct control (Level 2 and above) (^{21})</td>
<td>87 449 tonnes CO₂</td>
<td>56</td>
</tr>
<tr>
<td>Carbon footprint reduction per passenger</td>
<td>0.11 kg CO₂</td>
<td>0.15 kg CO₂</td>
</tr>
<tr>
<td>Total carbon footprint for ‘year 0’ for emissions sources which an airport may guide or influence (level 3 and above) (^{22})</td>
<td>12 777 994 tonnes CO₂</td>
<td>31</td>
</tr>
<tr>
<td>Aggregate reductions from emissions sources which an airport may guide or influence</td>
<td>223 905 tonnes CO₂</td>
<td></td>
</tr>
<tr>
<td>Total emissions offset (Level 3+)</td>
<td>181 496 tonnes CO₂</td>
<td>16</td>
</tr>
</tbody>
</table>

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

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.

\(^{20}\) ‘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.

\(^{21}\) This figure includes increases in emissions at airports that have used a relative emissions benchmark in order to demonstrate a reduction.

\(^{22}\) These emissions sources are those detailed in the guidance document, plus any other sources that an airport may wish to include.
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.
Article 4
National Actions in the Slovak Republic

The Slovak Republic as a member state of the European Union takes various actions to meet the climate change goals.

Although the impact of the climate change is contrasting in different regions of the world, its socio-economic and environmental impact always needs an active solution. Necessary political measures have to stem from detailed analysis of the current greenhouse gas emissions in every sector, including aviation sector, emission projections and impact assessment of adopted or planned policy measures.

4.1. Implemented measures

4.1.1. The EU Emissions Trading System (EU ETS)

Since the beginning of the year 2012 emissions from all flights from, to and within the European Economic Area – the 28 European Union Member States, plus Iceland, Liechtenstein and Norway – are included in the EU ETS.

More information are described in Article 3, point 3.2.4.1.

4.1.2. Measures in the area of Air Navigation Services and Flight Routes Design

4.1.2.1. Seven air navigation service providers, associated in the project FAB CE (Functional Airspace Block Central Europe), developed a CBA (Cost Benefit Analysis) foreseeing that by means of optimizing air routes up to 2 million km per year should be saved after 2017, which in addition to savings in direct operating cost of airliners shall contribute to the reduction of negative impacts of aviation on air quality in the volume of up to 22,000 tons of CO2 that would be produced by burning fuel required to carry out flights over the contemporary air routes. Preliminary analyzes and simulations that were carried out in this area confirmed the justness of the introduction of FRA (Free Route Airspace). The Free Route Airspace is a crucial concept in terms of coping with progress and growth of the amount of air traffic. It is associated with a reduction of the total distance flown, which results in savings on air operator’s side. Another considerable aspect is the impact on the environment by reducing CO2 emissions while maintaining preset security levels and streamlining the use of airspace. Principally this concept leads to a greater degree of consensus between a planned route and an actual flight, and thus the allowing an air operator to plan the amount of fuel required more precisely.

4.1.2.2. By implementing the CDO / CCO (Continuous Descent/Climb Operations) techniques a positive impact on the environment in terms of emissions reductions shall be achieved without affecting the safety and capacity, as these techniques lead to fuel savings, reduction of exhaust gases and noise exposure limitation.

Air traffic controllers while on duty contribute to the fluidity of air operations and by means of their active coordination help to reduce both the total distance flown and the flight time, leading to fuel savings and thus reducing CO2 emissions.

4.1.2.3. The optimization of design of standard ATS routes and airspace structure based on coordination agreements and airspace user requirements leads to more efficient use of lower
airspace, which through means of direct routes and minimizations of active areas circumvention also contributes to achieving the objectives set.

4.1.2.4. By implementing RNP (required navigation performance) approaches (using satellite navigation) a vertical guidance during the most critical phases of flight is provided, which is seeking to both increase safety on final approach and impact the environment positively by reducing CO₂ emissions, improving fuel economy and at last but not least by limiting noise exposure of areas in airports vicinity. In the year 2015 required navigation performance approaches were implemented at Bratislava Airport and Košice Airport and the implementation is expected to continue in years 2016-2017 at Poprad – Tatry Airport, Žilina Airport and Piešťany Airport.

4.1.2.5. Similarly implementation of RNAV (area navigation) standard instrument departures and arrivals and related flights trajectory optimization in TMA (terminal control area) also contributes to reducing CO₂ emissions. The implementation in all civil airports TMAs is expected to be effective by the end of 2020.

4.1.3. The operational measures at Bratislava Airport

4.1.3.1. The structure of vehicle and technical fleet of maintenance machines serving the aircraft ground handling at Bratislava Airport takes the utmost to account the environmental impact and where feasible, fossil-fuel-powered ground vehicles are being gradually replaced with electric ones. All belt loaders at Bratislava Airport are currently powered by electricity.

4.1.3.2. All aircraft are pushed back from the gate with their engines running on idle thrust until an aircraft leaves a stand and initiates taxi. This step causes significant reduction of a time spent with engines running full and thereby the amount of gases and combustion products emitted into the atmosphere is diminished.

4.1.3.3. Taking into consideration operational and technological conditions of the airport Bratislava new declared distances for take-offs from the crossroads of the taxiways with runways (TORA, TODA and ASDA) have been issued in order to allow carry out take-offs using a shorter range than a full length of runway. This change shall reduce the time of an aircraft taxiing before the take-off as well the take-off itself thus contributing to the reduction of the emissions and noise impact on the environment.

4.1.3.4. During the construction of the new terminal at the Bratislava Airport the project of the construction covered the assembly of a complex waste disposal management, making it possible to sort all waste from aircraft and the airport itself with the aim to reduce the amount of the communal waste which is further processed and disposed of by the specialized companies.

4.1.3.5. Bratislava Airport has got a new-built de/anti-icing stand which has also been built with the positive approach to environmental impact. It has been built with a tank collecting waste liquids of the de/anti-icing process of the aircraft. These waste liquids are then transferred to waste treatment plant at Slovnaft refinery.
Article 5
Conclusion

This Action Plan was finalized on July 2016, and shall be considered as subject to update after that date.