ICAO action plan on emissions reduction: Republic of Bulgaria

Kantareva, Mariya, Angelova, Anna, Iliev, Lazar and Efthymiou, Marina (2015) ICAO action plan on emissions reduction: Republic of Bulgaria. Technical Report. ICAO-Civil Aviation Administration Republic of Bulgaria.

ICAO Action Plan on Emissions Reduction

Republic of Bulgaria

June 29, 2015
GENERAL DIRECTORATE OF CIVIL AVIATION ADMINISTRATION
REPUBLIC OF BULGARIA

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INTRODUCTION:

a) The Republic of Bulgaria is a member of Central European Rotation Group[1] (CERG), European Union and of the European Civil Aviation Conference (ECAC) [2]. ECAC is an intergovernmental organisation covering the widest grouping of Member States[1] of any European organisation dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1955.

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

c) The Republic of Bulgaria, 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.

d) The Republic of Bulgaria 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.

e) In that context, it is the intention that all ECAC States submit to ICAO an Action Plan[3]. This is the Action Plan of The Republic of Bulgaria.

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

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

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

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

[1] Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia

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

[3] ICAO Assembly Resolution A38-18 also encourages States to submit an annual reporting on international aviation CO2 emissions. which is a task different in nature and purpose to that of Action Plans, strategic in their nature. For that reason, the reporting to ICAO on international aviation CO2 emissions referred to at paragraph 11 of ICAO Resolution A38/18 is not part of this Action Plan. This information will be provided to ICAO separately, as this is already part of the existing routine provision of data by ECAC States.

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

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

g) 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 Section 1 of this Action Plan, where The Republic of Bulgaria involvement in them is described, as well as that of stakeholders.

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

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

i. 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.

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

Current state of aviation in The Republic of Bulgaria:

Transport plays a major role in the development of every modern society as a means for economic development and a prerequisite for achieving social and regional cohesion. The transport sector in Bulgaria is of an exceptional importance for raising the competitiveness of national economy and for providing services to its citizens. 11.7% of the gross value added in the country and directly employ

Favorable geographic location of Bulgaria, provides opportunities for the development of transit transport along the five Pan-European transport corridors, crossing the country, and favorable conditions for communication between Western and Eastern Europe and the Middle East, Western and Central Asia.

The harmonisation of Bulgaria's legislation with the legislation of the European Communities, and achieving a full compliance, was the main prerequisite for Bulgaria's accession and establishment as a full EU member state. Currently, Bulgaria's regulatory instruments are fully harmonised with the Community legislation.

The Minister of Transport, Information Technology and Communications, assisted by the staff at the Ministry, is in charge of implementing the state policy in the field of transport, and coordinates the process of drafting and implementation of a strategy for development and restructuring of transport. Executive agencies have been established within the Ministry of Transport, Information Technology and Communications, which function as regulatory bodies for the individual transport modes:

The DG CAA is a state budget supported legal entity within the **Ministry of Transport, Information Technology and Communications** , headquarters in Sofia, and a secondary principal of budgetary loans. Directorate General "Civil Aviation Administration" shall constitute of five regional departments - airport administrations as provided for in Article 48a, par.4 of the Civil Aviation Act.The DG CAA performs the functions of a Civil Aviation Administration in accordance with the Civil Aviation Act and the International Conventions and Arrangements, which the Republic of Bulgaria is party to.

Bulgarian Air Traffic Services Authority (BULATSA) performs the functions delegated by the state related to the management of air traffic and providing air navigation services within the serviced civil airspace in compliance with the Civil Aviation Act and the international agreements in the sphere of air navigation ratified by the Republic of Bulgaria. The main line of business of BULATSA is related to air traffic management with the objective to assure safety, efficiency and on-schedule flights within the serviced civil air space.

The market of international passenger services is dominated by air carriers and bus operators.

As a result of a dedicated investment policy carried out over the last several years, Bulgaria's aircraft fleet is being progressively renewed, and the Bulgarian air carriers are progressively increasing their competitiveness, both on the market of chartered flights and of regular destinations.

AIRPORT TRAFFIC (2006-2014)

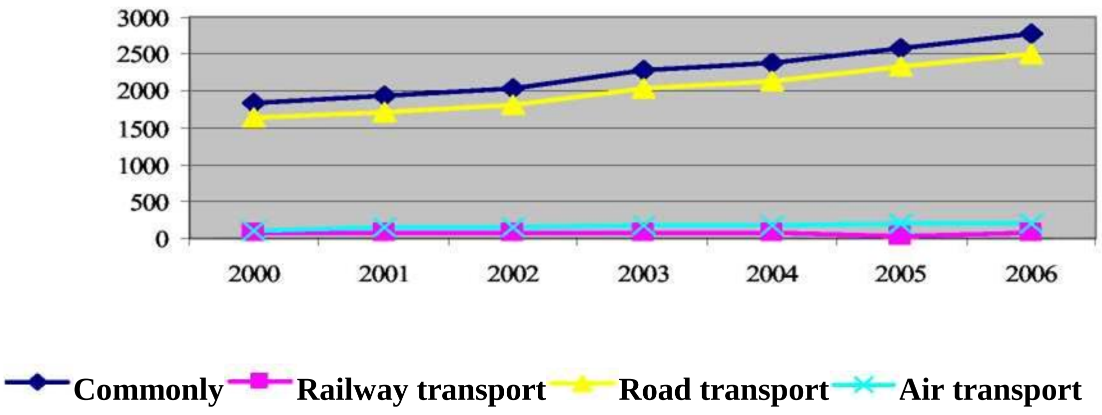
Calendar year	Aircraft Movements Total	Passengers Embarked and Disembarked Total	Freight and Mail (Tonnes) Total
2014	77 418	5 291 590	21 822
2013	75 170	7 363 068	24 978
2012	77 650	7 125 613	27 503
2011	84 787	6 944 834	22 313
2010	81 430	6 388 771	21 478
2009	83 724	6 043 392	18 604
2008	86 392	6 644 971	21 779
2007	84 346	6 262 057	21 519
2006	75 279	5 619 416	18 469
TOTAL	726 196	57 683 712	198 465

7 Year Forecast 2015-2021 MTF15 Results Arr/Dep

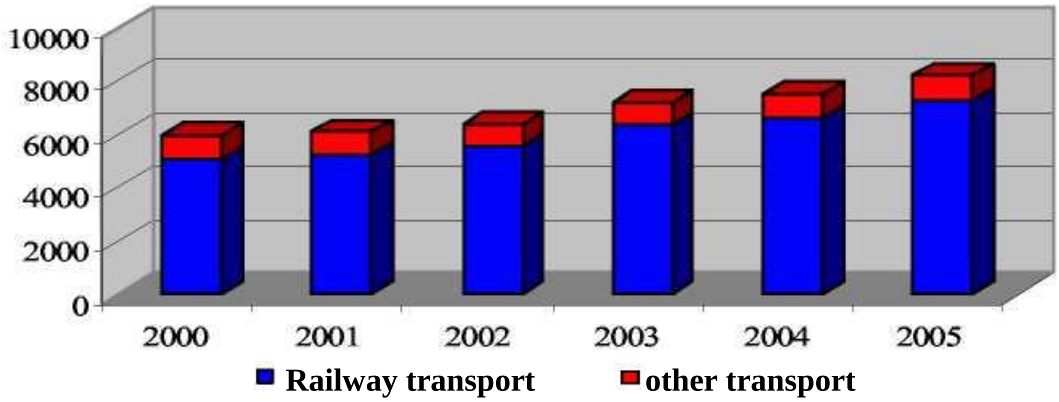
The Republic of Bulgaria

	Growth						
Scenario	2015	2016	2017	2018	2019	2020	2021
1. High Scenario	2.90%	4.90%	7.50%	7.10%	6.60%	6.80%	6.10%
2. Base Scenario	1.10%	2.80%	4.50%	4.90%	4.40%	4.60%	3.90%
3. Low Scenario	-0.60%	0.90%	1.70%	2.90%	2.50%	2.60%	2.00%

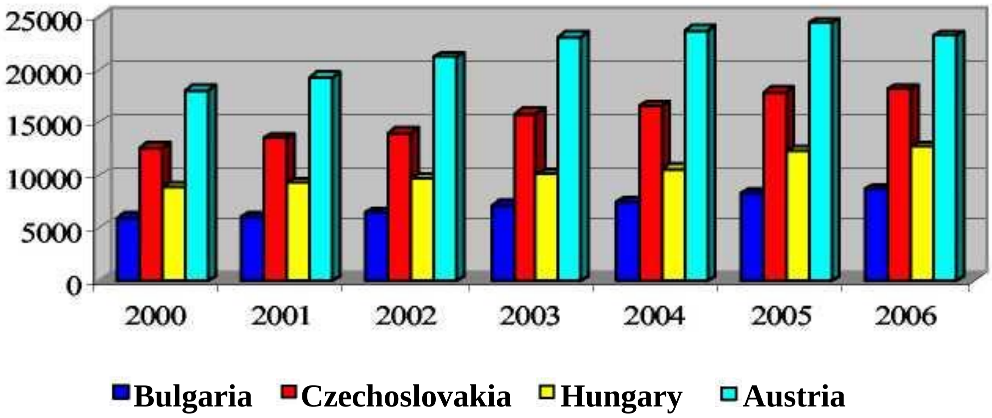
ENERGY CONSUMPTION OF TRANSPORT IN BULGARIA



GREENHOUSE GAS EMISSIONS FROM TRANSPORT IN BULGARIA (1000 t- equivalent CO2)



GREENHOUSE GAS EMISSIONS FROM TRANSPORT (1000 t- equivalent CO2)



BULGARIA CO_2 emissions from transport (% of total fuel combustions)	
2005-2009	17,4%
2010-2014	16 %

AIR CARRIERS

List of the air carriers with a valid Operating Licence of Community air carrier

-	Name of Air Carrier	Address of Air Carrier	Permited to carry	Category
1	BULGARIA AIR Jsc.	Sofia Airport, Sofia 1540, Republic of Bulgaria	Passengers, Cargo, Mail	Category A
2	AIR VIA Ltd.	4bl.Rila, vh.A, app.5, 6600 Kardjali, Bulgaria	Passengers, Cargo, Mail	Category A
3	BH AIR Ltd.	7 Dyakon Ignatii Str., Sofia 1000, Bulgaria	Passengers, Cargo, Mail	Category A
4	BULGARIAN AIR CHARTER Ltd.	35 Pavel Krasov Str., Gorubliane, 1138 Sofia, Bulgaria	Passengers, Cargo, Mail	Category A
5	CARGO AIR Ltd.	17 Angelov vrah Str., Obshtina Ovcha	Cargo, Mail	Category A

		Kupel, Sofia 1618, Bulgaria		
6	**HELI AIR SERVICES Jsc.**	**Sofia Airport - North, 1540 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category A**
7	**AVIOSTART Ltd.**	**13 Tsvetna gradina Str., 1421 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category B**
8	**AVIO DELTA Ltd.**	**off.10, fl.7, Jessika Office Centre, 229, Botevgradsko shosse Blvd, 1517, Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category B**
9	**VICTORIA AIR Ltd.**	**8, Maria Luisa Blvd, 4000 Plovdiv, Republic of Bulgaria**	**Passengers**	**Category B**
10	**ALK Jsc.**	**2A 'Acad.Nikola Obreshkov' Str., 1113 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category A**
11	**JET OPS EUROPE Ltd.**	**app.2, 14 'Karnigradska' Str., 1000 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category B**
12	**AIR VOLTA Ltd.**	**3A 'Nikolay Haytov' Str., 1113 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category A**
13	**AVB 2012 Ltd.**	**14 'Iskar' Str., 1000 Sofia, Republic of Bulgaria**	**Passengers**	**Category A**
14	**BRIGHT FLIGHT Ltd.**	**16A jk. Bokar, Bulgaria Blvd., 1404 Sofia, Republic of Bulgaria**	**Passengers, Cargo, Mail**	**Category A**
15	**ROSE AIR Ltd.**	**330 Building; fl.6, Deliyska Vodenitsa Str., 1582 Sofia, Republic of Bulgaria**	**Cargo, Mail**	**Category A**

Operating licences of air carriers, entered in p.1, 2, 3, 4, 5 and 6 *have been granted in accordance with Regulation (EEC) № 2407/92*

Operating licences of air carriers, entered in p.7, 8, 9, 10, 11, 12, 13, 14 and 15 *have been granted in accordance with Regulation (EC) № 1008/2008*

Category A: *operating licences without the restriction of Article 5(3) of Regulation 1008/08/EC*

Category B: *operating licences with the restriction of Article 5(3) of Regulation 1008/08/EC*

BULGARIAN INTERNATIONAL AIRPORTS

The airport infrastructure in Bulgaria is well developed, but its capacity has been quickly exhausted over the last several years. This implies the need for initiating measures to develop a concept project for the expansion of the Sofia Airport and support for the concessionaire, “Fraport Twin Star Airport Management”, for the urgent construction of new passenger terminals at the Varna and Burgas airports. The level of services offered to passengers is progressively improving.

Sofia Airport is a slot coordinated airport. The slots are coordinated under EU Regulation 95/93. Runway movements are coordinated according to the capacities calculated by ATC - 8 movements per 20 minutes and 22 movements per hour.

In the beginning of 2012 the airport operator established cost-based rates of airport charges for Sofia Airport related to the implementation of Directive 2009/12/EC of March 2011 on airport charges in the national legislation. A separate "noise/ecological" charge was fixed, intended also to cover activities on reduction of carbon dioxide.

INTERNATIONAL AIRPORT IN BULGARIA

There are 5 /five/ international airports in Bulgaria:

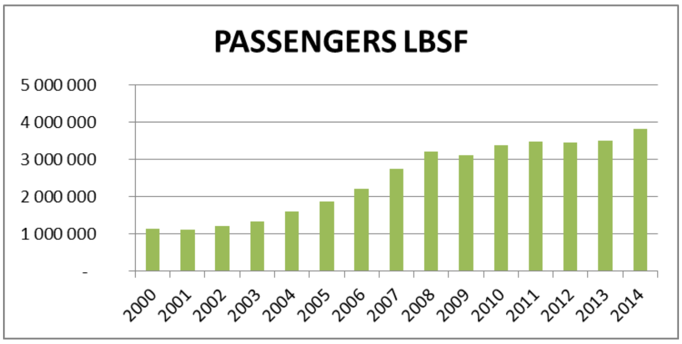
- ***Sofia Airport***
- ***Varna Airport***
- ***Bourgas Airport***
- ***Plovdiv Airport***
- ***Gorna Oriahovitza Airport***

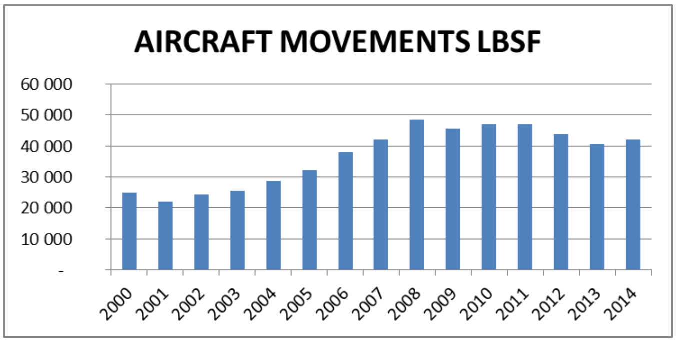
SOFIA AIRPORT /LBSF/

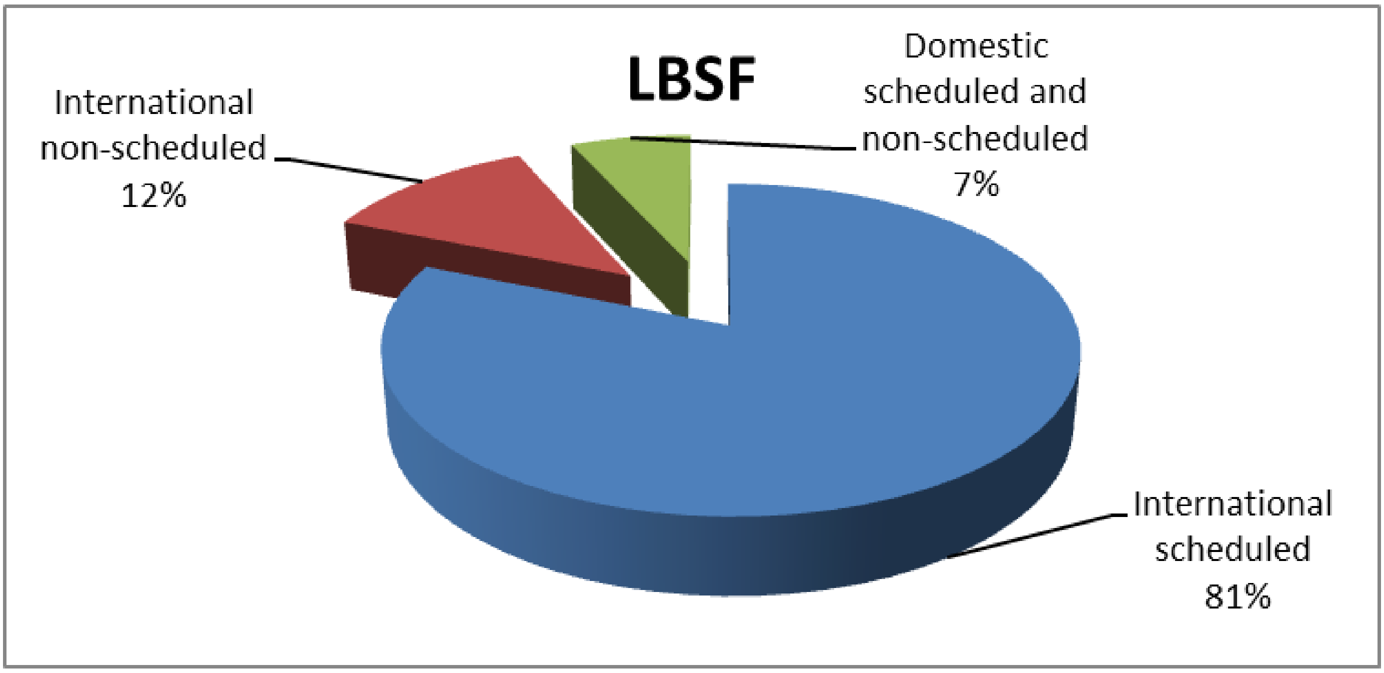
RUNWAY:

Length	**2800 m**
Width	**45 m + 2 x 7,5 m**
Durability by ICAO	**PCN 41 F/ B / X / T**
Aprons stands	**41**
Taxiways	**7**

OPEN FOR BUSINESS: 24 hours



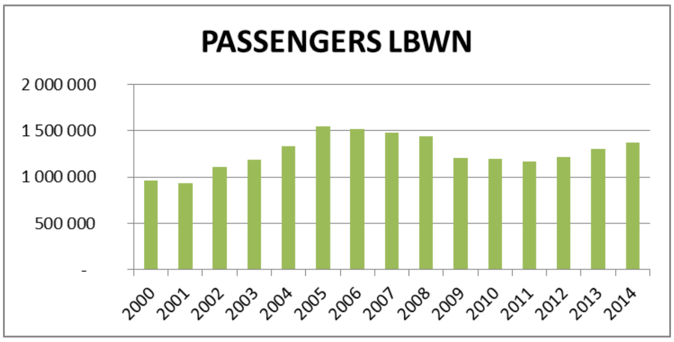


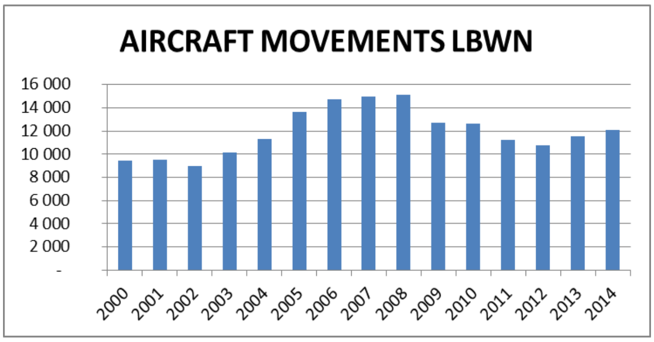


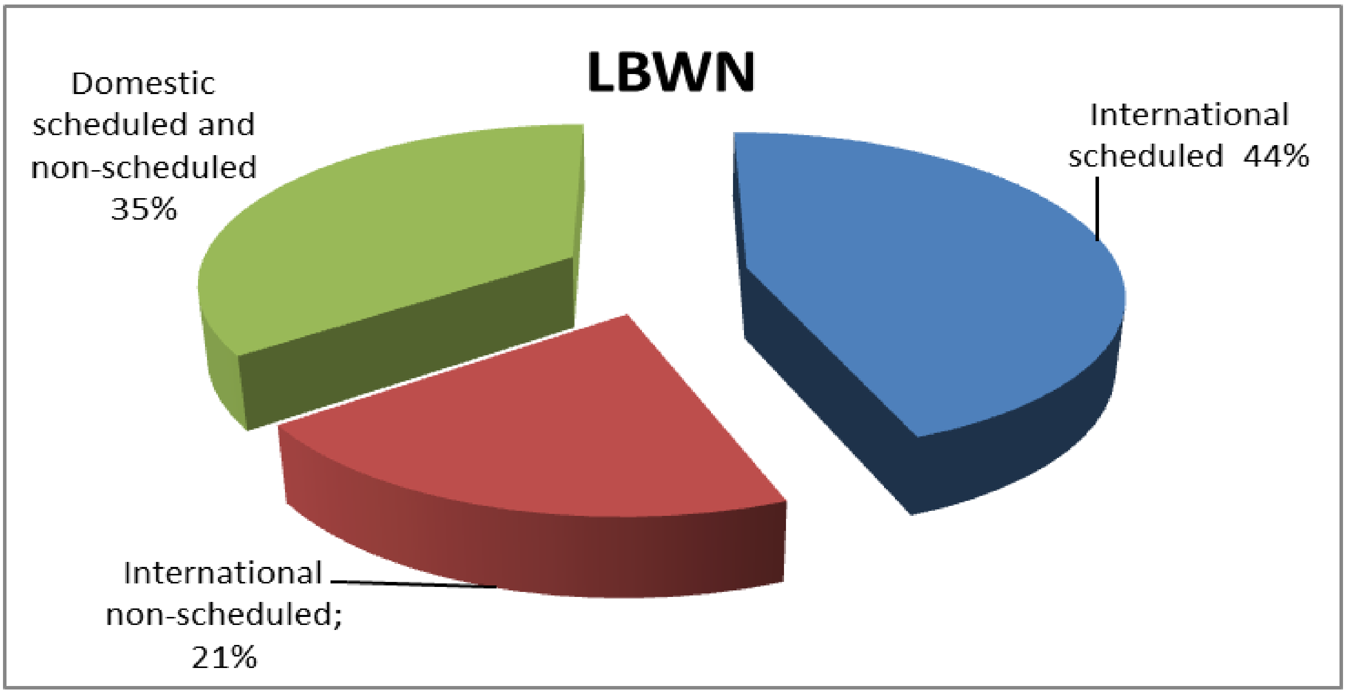
VARNA AIRPORT /LBWN/

RUNWAY	
Length	**2500 m**
Width	**45 m + 2 x 5 m**
Durability by ICAO	**PCN 60 F/ B / X / T**
Aprons stands	**24**
Taxiways	**5**

OPEN FOR BUSINESS: 24 hours





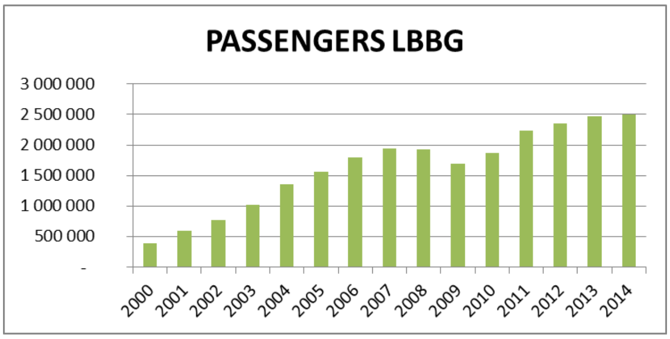


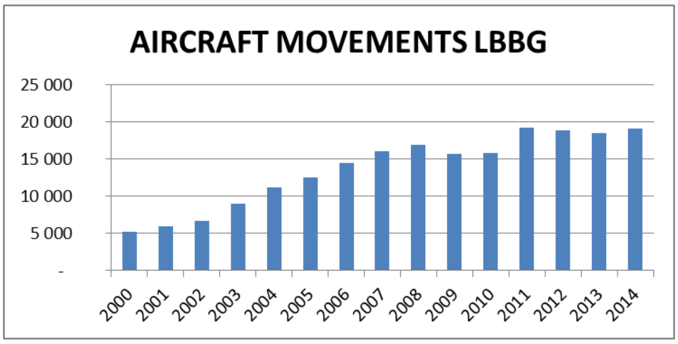
BURGAS AIRPORT /LBBG/

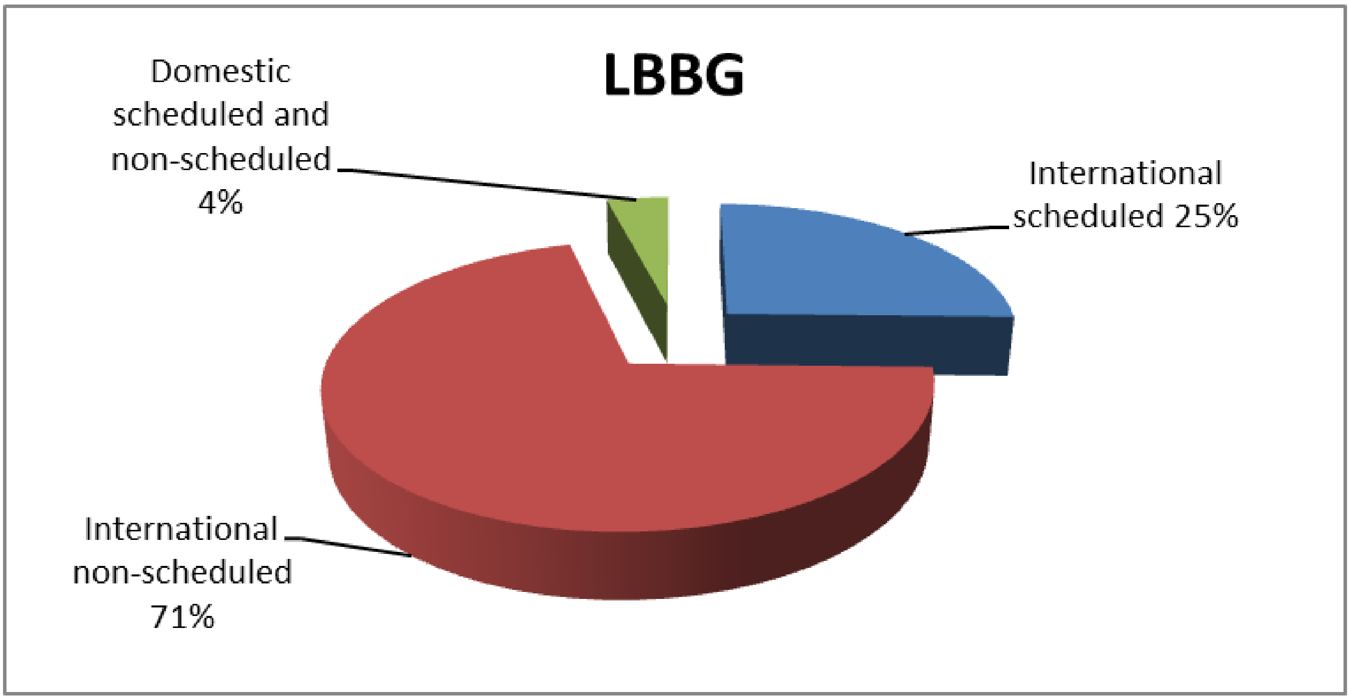
RUNWAY:

Length	**3200 m**
Width	**45 m + 2 x 7,5 m**
Durability by ICAO	**PCN 60 F/ B / X / T**
Aprons stands	**20**
Taxiways	**6**

OPEN FOR BUSINESS: 24 hours







IMPROVED AIR TRAFFIC MANAGEMENT AND INFRASTRUCTURE USE IMPLEMENTATION OF DANUBE FUNCTIONAL AIRSPACE BLOCK (DANUBE FAB)

DANUBE FAB is being developed and is under implementation in accordance with EU legislation between Republic of Bulgaria and Romania.

The principal focus during the development of the DANUBE FAB has been to re-design airspace, taking due account of operational improvements and ensuring optimisation is achieved. The DANUBE FAB fixed route network is included in and compliant with the European ATS Route Network Version-7 (ARN v.7) and has been developed to easily ensure further integration into the future European Route Network Improvement Plan ARN V8.

In terms of horizontal flight efficiency, the proposed route network is in line with the Network Manager plans and is expected to deliver substantial benefits to airspace users. The introduction of the new ATS routes enables airspace users to flight-plan shorter flights. This is expected to result in reduced track miles for the transition of aircraft through the Danube FAB airspace.

As detailed in the DANUBE FAB Cost Benefit Analysis, by 2015 each flight is expected to save more than 0.5 minutes of flying time, increasing to beyond a minute per flight in 2020 following the introduction of free routes. The gain in flight efficiency in terms of reduced track miles is directly linked to an equivalent gain in reduced environmental impact as a result of reduced fuel burn and hence CO_2 emission.

A dedicated DANUBE FAB Environmental Impact Assessment Study was performed by EUROCONTROL to analyse this environmental impact. The study was carried out using the System for traffic Assignment and Analysis at a Macroscopic level (SAAM) fast-time simulation tool. This incorporates the EUROCONTROL Advanced Emissions Model (AEM) which allows fuel and emissions to be calculated for each trajectory processed. AEM has been endorsed by ICAO following extensive stress testing by its Committee on Aviation Environmental Protection (CAEP).

The assessment was limited to changes in fuel use and the greenhouse gas Carbon Dioxide (CO_2) in the Danube FAB airspace above FL095. It took place between October and December 2011. The following scenarios were simulated:

Route Network (RN)		
Traffic scenario years	**Base case (withOUT FAB)**	**Future case (with FAB)**
2015	**(A2)** Bulgaria and Romania RN (APR 2009)	**(B2)** Danube FAB RN (2015)
2020	**(A3)** Bulgaria and Romania RN (APR 2009)	**(B3)** Danube FAB Free Route Airspace (2020)
2030	**(A4)** Bulgaria and Romania RN (APR 2009)	**(B4)** Danube FAB Free Route Airspace (2020)

DANUBE FAB environmental assessment scenarios

The study determined annual fuel and emissions savings as shown in the table below:

	2015	**2020**	**2030**
Fuel savings (tonnes)	22000	45000	80000
CO2 savings (tonnes)	70000	143000	255000
NOx savings (kg)	280000	550000	960000

DANUBE FAB environmental impact

Danube FAB can be considered to contribute to the global need to conserve increasingly scare oil stocks by reducing aviation fuel use by around 80K tonnes per annum by 2050.

SUPRA-NATIONAL MEASURES, INCLUDING THOSE LED BY THE EUROPEAN UNION

EUROPEAN BASELINE SCENARIO ***< section to be updated…>***

European Baseline Scenario

	CO2 emissions, tons	Traffic in RTK**	Fuel consumption, in tons	Fuel efficiency
2010				
2020				
2030? Or 2035? Or 2050?*				

* should the forecasts be for 2030, 2035 or 2050? (only 2 non-EU ECAC States provide forecasts for 2050 and 1 for 2025)

** Level of accuracy (scope covered as compared to ECAC Scope) estimated on the
basis of share of international traffic covered (see Decision 3 of ACCAPEG6/SD)

ACTIONS TAKEN AT THE SUPRANATIONAL LEVEL

1. AIRCRAFT RELATED TECHNOLOGY DEVELOPMENT

1.1. Aircraft emissions standards [Europe's contribution to the development of the CO_2 standard in CAEP

European Member States fully support the ongoing work in ICAO's Committee on Aviation Environmental Protection (CAEP), and welcomed the agreement of certification requirements for a global aeroplane CO2 Standard at CAEP/9 in 2013. Assembly Resolution A38-18 requests the Council to develop a global CO_2 standard for aircraft aiming to finalize analyses by late 2015 and adoption by the Council in 2016. Europe continues to make a significant contribution to this task notably through the European Aviation Safety Agency (EASA) which co-leads the CO_2 Task Group within CAEP's Working Group 3, and which provides extensive technical and analytical support.

In the event that a standard, comprising of certification requirements and regulatory level, is adopted in 2016, it is expected to have an applicability date set at 2020 or beyond. In addition to being applicable to new aeroplane types, CAEP is discussing potential applicability options for in-production types. The contribution that such a standard will make towards the global aspirational goals will of course depend on the final applicability requirements and associated regulatory level that is set.

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 7th Framework Programme (FP7) and continued within the Horizon 2020 Framework Programme in order to allow the achievement of ambitious and complex research goals. Set up as a Public Private Partnership between the European Commission and the European aeronautical industry, Clean Sky pulls together the research and technology resources of the European Union in a coherent programme, and contribute significantly to the 'greening' of aviation.

Clean Sky 1 (2011 to 2017)

Budget: €1.6 billion

CO2 emissions reduction: -20% to -40% (programme objective)

Fuel burn CO2 target 2020 (2000 baseline):

-50% per pax.km or tonne.km

The first Clean Sky programme was set up in 2011 for a period up to 31 December 2017, with a budget of € 1.6 billion, equally shared between the European Commission and the aeronautics industry, and the aim to develop environmental friendly technologies impacting all flying segments of commercial aviation. Clean Sky objectives for the whole programme at aircraft level are to reduce CO2 aircraft emission between 20-40%, NOx by around 60% and noise by up to 10dB compared to year 2000 aircraft.

Clean Sky 2 (2014-2024)

Budget: €4 billion

Fuel burn CO2 target 2025 (baseline: state of the art 2014): -20%

Fuel burn CO2 target 2035 (baseline: state of the art 2014): -30%

A new programme – **Clean Sky 2** – was set up in 2014 for a period up to 31 December 2024 in order to make further advancements towards more ambitious environmental targets and to secure the competitiveness of the European aeronautical industry in the face of growing competition. The new Clean Sky 2 Joint Technology Initiative objectives are to increase the aircraft fuel efficiency and 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 with more than € 2 billion industrial commitment matched by a similar contribution from the Horizon 2020 transport budget.

It is estimated that the technology developments already made or in progress could reduce aviation CO_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_2 over the next 35 years**.

Technologies, Concept Aircraft and Demonstration Programmes form the three complementary instruments used by Clean Sky in meeting its goals:

- **Technologies** are selected, developed and monitored in terms of maturity or 'Technology Readiness Level' (TRL). A detailed list of more than one hundred key technologies has been set. The technologies developed by Clean Sky will cover all major segments of commercial and general aviation aircraft. The technologies are developed in Clean Sky by each Integrated Technology Demonstrators (ITD), and subject to TRL roadmaps. Some technologies may not directly provide an environmental outcome, being 'enabling technologies' without which the global achievements would not be feasible.
- **Concept Aircraft** are design studies dedicated to integrating technologies into a viable conceptual configuration. They cover a broad range of aircraft: business jets, regional and large commercial aircraft, as well as rotorcraft. They are categorized in order to represent the major future aircraft families. Clean Sky environmental results will be measured and reported mainly by comparing Concept Aircraft to existing aircraft and aircraft incorporating 'business as usual' technology in the world fleet.
- **Demonstration Programmes** include physical demonstrators that integrate several technologies at a larger 'system' or aircraft level, and validate their feasibility in operating conditions. This helps determine the true potential of the technologies and

enables a realistic environmental assessment. Demonstrations in a relevant operating environment enable technologies to reach the maturity level of 6, according to the scale of levels of technology maturity developed by NASA in 1995 and called Technology Readiness Level (TRL).

In the Clean Sky programme 12 industry leaders, 74 associated members and more than 400 partners are working together in a number of technology domains to address the common environmental objectives and to demonstrate and validate the required technology breakthroughs in a commonly defined programme. All those technology domains have been integrated into 6 Integrated Technology Demonstrators (ITD) that cover the broad range of R&D work and able to deliver together more environmental friendly aircraft manufacturing and operations:

- **Smart Fixed Wing Aircraft** – delivers active wing technologies together with new aircraft configurations, covering large aircraft and business jets. Key enabling technologies from the transversal ITDs, for instance Contra Rotating Open Rotor, are being integrated into the demonstration programmes and concept aircraft.
- **Green Regional Aircraft**– develops new technologies for the reduction of noise and emissions, in particular advanced low-weight & high performance structures, incorporation of all-electric systems, bleed-less engine architecture, low noise/high efficiency aerodynamics, and finally environmentally optimised mission and trajectory management.
- **Green Rotorcraft** - – delivers innovative rotor blade technologies for reduction in rotor noise and power consumption, technologies for lower airframe drag, environmentally friendly flight paths, the integration of diesel engine technology, and advanced electrical systems for elimination of hydraulic fluids and for improved fuel consumption.
- **Sustainable and Green Engines** - designs and builds five engine demonstrators to integrate technologies for low fuel consumption, whilst reducing noise levels and nitrous oxides. The ‘Open Rotor’ is the target of two demonstrators. The others address geared turbofan technology, low pressure stages of a threeshaft engine and a new turboshaft engine for helicopters.
- **Systems for Green Operations** - focuses on all electrical aircraft equipment and system architectures, thermal management, capabilities for environmentally-friendly trajectories and missions, and improved ground operations to give any aircraft the capability to fully exploit the benefits of the “Single European Sky”.
- **Eco-Design** - supports the ITDs with environmental impact analysis of the product life-cycle. Eco- Design focuses on environmentally-friendly design and production, withdrawal, and recycling of aircraft, by optimal use of raw materials and energies, thus improving the environmental impact of the entire aircraft life-cycle.

In addition, the **Technology Evaluator** programme, co-led by DLR and Thales, is a set of numerical models predicting the local and global environmental impact of developed technologies and allows independent analysis of the projects Part of the Clean Sky programme is performed by partners selected through open calls for proposals addressing specific tasks which fit into the overall technical Work Programme and time schedule.

By 2014 most down-selections of key technologies have been completed for integration in demonstrators that will enter the phase of detailed design, manufacturing and testing. Several demonstrators have passed the design phase and have started testing successfully. An Advanced Lip Extended Acoustic Panel, the technology to reduce the Fan noise of large turbofan engine was flown and validated in operational conditions in 2010 with an Airbus A380-800 aircraft. A flight test with Falcon F7X, which validated the technology to visualize laminar flow structure in flight by an infrared camera, was already performed in 2010. Two flight tests started in the last quarter of 2014, namely in the Sustainable and Green Engines ITD with SAGE 3 flight testing on Advanced Low Pressure System (ALPS) configuration and the flight tests of an experimental Liquid Skin Heat Exchanger (LSHX) in the System for Green Operations ITD.

The two Interim Evaluations of Clean Sky in 2011 and 2013 acknowledged that the programme is successfully stimulating developments towards environmental targets and that it was highly successful in attracting a high level and wide participation from all EU key industries and a large number of SMEs. The preliminary assessments of the environmental benefits confirm the capability of achieving the overall targets at completion of the programme.

Clean Sky: First Assessment (2011)

The first assessment of the Technology Evaluator performed in 2011 demonstrated that short/medium range aircraft equipped with open rotor engines and laminar-flow wing technology could deliver up to **30% better fuel efficiency and related CO2 emissions** and important reductions in noise nuisance are foreseen.

Clean Sky: Second Assessment (2012)

The second assessment performed in 2012 showed similar results and demonstrated that **CO2 emission reduction is in the range of 20 to 30% depending on the type of aircrafts**. Reduction in NOx emissions is up to 70% and in noise footprint up to 68% depending on the concept aircraft.

Based on this success, the Clean Sky 2 programme builds upon contents and achievements of the Clean Sky programme and makes further advancements towards more ambitious environmental targets.

In terms of programme structure, Clean Sky 2 continues to use the Integrated Technology Demonstrators (ITDs) mechanism but also involves demonstrations and simulations of several systems jointly at the full vehicle level through Innovative Aircraft Demonstrator Platforms (IADPs). A number of key areas are coordinated across the ITDs and IADPs through Transverse Activities (TA) where additional benefit can be brought to the Programme through increased coherence, common tools and methods, and shared know-how in areas of common interest. As in Clean Sky, a dedicated monitoring function - the Technology Evaluator (TE) - is incorporated in Clean Sky 2.

- **Large Passenger Aircraft IADP** –-TRL demonstration of the best technologies to accomplish the combined key ACARE goals with respect to the environment, fulfilling future market needs and improving the competitiveness of future products.
- **Regional Aircraft IADP** –focuses on 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 IADP** –consists of two separate demonstrators, the NextGenCTR tilt-rotor and the FastCraft compound helicopter. These two fast rotorcraft concepts aim to deliver superior vehicle versatility and performance.
- **Airframe ITD** –demonstrates, as one of the key contributors to the different IADPs flight demonstrators, 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. It will also test novel engine integration strategies and investigate innovative fuselage structures.
- **Engines ITD** –focuses on activities to validate advanced and more radical engine architectures.
- **Systems ITD** –develops and builds highly integrated, high TRL demonstrators 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 TA** –aims at developing, validating and integrating key technologies on small aircraft demonstrators up to TRL6 and to revitalise an important segment of the aeronautics sector that can bring key new mobility solutions.
- **Eco-Design TA** – 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).

2. ALTERNATIVE FUELS

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.[4]

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[5]. 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[6]) 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[7]. 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**.

ACARE Roadmap targets to share alternative sustainable fuels:

2% in 2020

25% in 2035

at least 40% by 2050

As a first step towards delivering this goal, in June 2011 the European Commission, in close coordination with Airbus, leading European airlines (Lufthansa, Air France/KLM, & British Airways) and key European biofuel producers (Choren Industries, Neste Oil, Biomass Technology Group and UOP), launched the **European Advanced Biofuels Flightpath**. This industry-wide initiative aims to speed up the commercialisation of aviation biofuels in Europe, with **the objective of achieving the commercialisation of sustainably produced paraffinic biofuels in the aviation sector by reaching a 2 million tons consumption by 2020**.

[4] Directive 2009/28/EC of the European Parliament and of the Council of 23/04/2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Article 17 Sustainability criteria for biofuels and bioliquids, at pp. EU Official Journal L140/36-L140/38.

[5] http://www.swafea.eu/LinkClick.aspx?fileticket=llISmYPFNxY%3D&tabid=38

[6] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[7] Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final

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[8].

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 cerosin by certified sustainable biofuels.

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

Time horizons (Base year - 2011)	Action	Aim/Result
Short-term (next 0-3 years)	Announcement of action at International Paris Air Show	To mobilise all stakeholders including Member States.
	High level workshop with financial institutions to address funding mechanisms.	To agree on a "Biofuel in Aviation Fund".
	> 1,000 tons of Fisher-Tropsch biofuel become available.	Verification of Fisher-Tropsch product quality. Significant volumes of synthetic biofuel become available for flight testing.
	Production of aviation class biofuels in the hydrotreated vegetable oil (HVO) plants from sustainable feedstock	Regular testing and eventually few regular flights with HVO biofuels from sustainable feedstock.
	Secure public and private	To provide the financial means for

[8] http://ec.europa.eu/energy/technology/initiatives/doc/20110622_biofuels_flight_path_technical_paper.pdf

	financial and legislative mechanisms for industrial second generation biofuel plants.	investing in first of a kind plants and to permit use of aviation biofuel at economically acceptable conditions.
	Biofuel purchase agreement signed between aviation sector and biofuel producers.	To ensure a market for aviation biofuel production and facilitate investment in industrial 2G plants.
	Start construction of the first series of 2G plants.	Plants are operational by 2015-16.
	Identification of refineries & blenders which will take part in the first phase of the action.	Mobilise fuel suppliers and logistics along the supply chain.
Mid-term (4-7 years)	2000 tons of algal oils are becoming available.	First quantities of algal oils are used to produce aviation fuels.
	Supply of 1.0 M tons of hydrotreated sustainable oils and 0.2 tons of synthetic aviation biofuels in the aviation market.	1.2 M tons of biofuels are blended with kerosene.
	Start construction of the second series of 2G plants including algal biofuels and pyrolytic oils from residues.	Operational by 2020.
Long-term (up to 2020)	Supply of an additional 0.8 M tons of aviation biofuels based on synthetic biofuels, pyrolytic oils and algal biofuels.	2.0 M tons of biofuels are blended with kerosene.
	Further supply of biofuels for aviation, biofuels are used in most EU airports.	Commercialisation of aviation biofuels is achieved.

When the Flightpath 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. During the four years since then, worldwide technical and operational progress of the industry has been remarkable. Three different pathways for the production of renewable kerosene are now approved and several more are expected to be certified. More than 1,600 flights using renewable kerosene have been conducted, most of them revenue flights carrying passengers.

Flights

IATA: 1600 flights worldwide using bio-kerosene blends

Lufthansa: 1189 flights Frankfurt-Hamburg using 800 tons of bio-kerosene

KLM: 18 flights Amsterdam-Aruba-Bonaire using 200 tons of bio-kerosene

Production (EU)

Neste (Finland): by batches

- Frankfurt-Hamburg (6 months) 1189 flights operated by Lufthansa: 800 tons of bio-kerosene

- Itaka: €10m EU funding (2012-2015): > 1 000 tons

Biorefly: €13.7m EU funding: 2000 tons per year – second generation (2015) – BioChemtex (Italy)

BSFJ Swedish Biofuels: €27.8m EU funding (2014-2019)

Production has been demonstrated at demonstration and even industrial scale for some of the pathways. Use of renewable kerosene within an airport hydrant system will be demonstrated in Oslo in 2015.

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 nonstoichiometric 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 is launching projects under the Horizon 2020 research programme with capacities of the order of several 1000 tons per year.

3. IMPROVED AIR TRAFFIC MANAGEMENT AND INFRASTRUCTURE USE

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

SESAR Project

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.

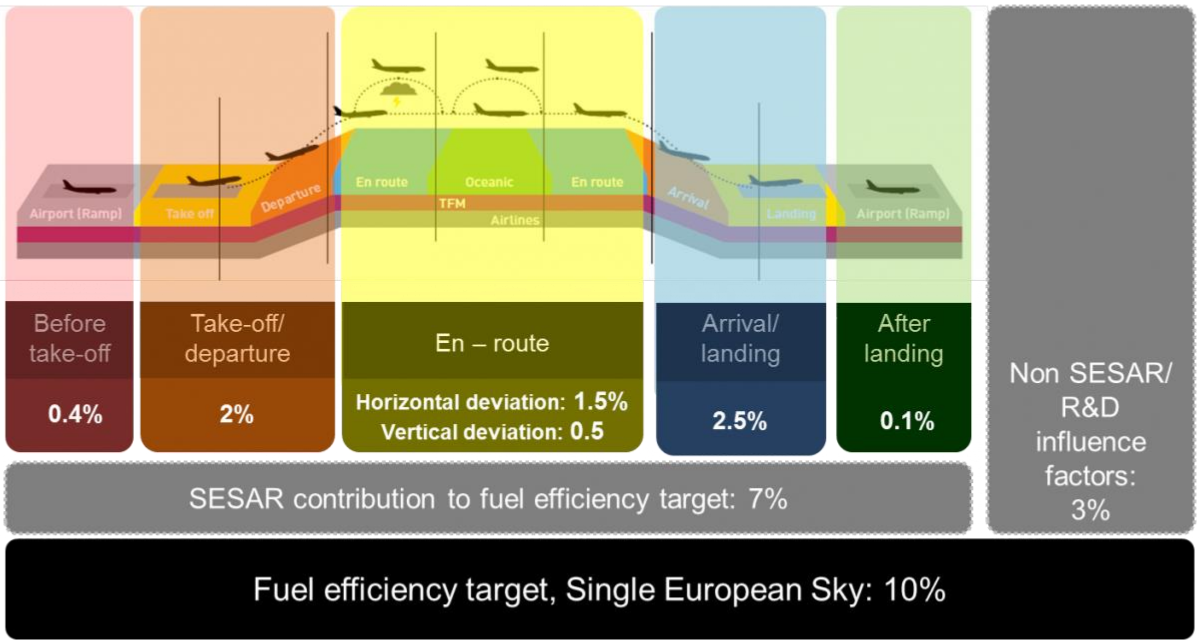
The SES aims at achieving 4 high level performance objectives (referred to 2005 context):

- **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 1[9]) is depicted in the following graph:

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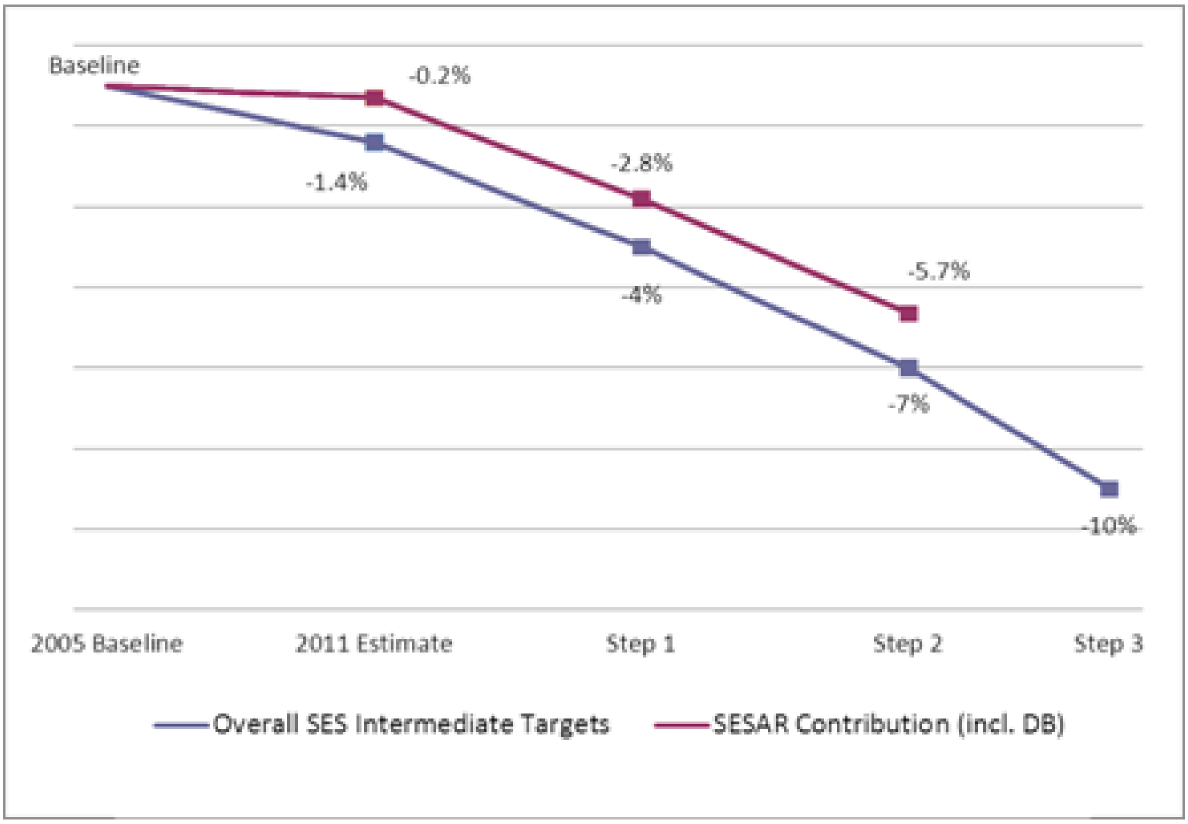
[9] Step 1, "Time-based Operations" is the building block for the implementation of the SESAR Concept and is focused on flight efficiency, predictability and the environment. The goal is a synchronised and predictable European ATM system, where partners are aware of the business and operational situations 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



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.

achievement of SWIM and collaboratively planned network operations with User Driven Prioritisation Processes (UDPP).

Environmental Research Projects:

4 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 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 16.03.02 a set of metrics for assessing GHG emissions, noise and airport local air quality has been documented. The metrics identified by 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 ongoing 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:

AIRE

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

Under this initiative ATM stakeholders work collaboratively to perform integrated flight trials and demonstrations validating solutions for the reduction of CO2 emissions for surface, terminal and oceanic operations to substantially accelerate the pace of change.

3 AIRE demonstration campaigns took place between 2007 and 2014.

The **AIRE 1** campaign (2008-2009), has demonstrated, with 1,152 trials performed, that significant savings can already be achieved using existing technology. **CO_2 savings per flight ranged from 90kg to 1250kg and the accumulated savings during trials were equivalent to 400 tons of CO_2**. Another positive aspect of such pre implementation demonstrations is the human dimension. Indeed the demonstration flight strategy established in AIRE is to produce constant step-based improvements, to be implemented by each partner in order to contribute to reaching the common objective. Hence the AIRE projects boost crew and controller's motivation to pioneer new ways of working together focusing on environmental aspects, and enables cooperative decision making towards a common goal.

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. 9416 flight trials took place. Table 2 summarises AIRE 2 projects operational aims and results.

Table 2: Summary of AIRE 2 projects

Project	Location	Operation	Objective	CO2 and Noise benefits per flight (kg)	Nb of flights
CDM at Vienna Airport	Austria	CDM notably pre-departure sequence	CO2 & Ground Operational efficiency	54	208

Greener airport operations <u>under adverse conditions</u>	France	CDM notably pre-departure sequence	CO_2 & Ground Operational efficiency	79	1800
B3	Belgium	CDO in a complex radar vectoring environment	Noise & CO_2	160-315; -2dB (between 10 to 25 Nm from touchdown)	3094
DoWo - Down Wind Optimisation	France	Green STAR & Green IA in busy TMA	CO_2	158-315	219
REACT-CR	Czech republic	CDO	CO_2	205-302	204
Flight Trials for less CO_2 emission during transition from en-route to final approach	Germany	Arrival vertical profile optimisation in high density traffic	CO_2	110-650	362
RETA-CDA2	Spain	CDO from ToD	CO_2	250-800	210
DORIS	Spain	Oceanic : Flight optimisation with ATC coordination & Data link (ACARS, FANS CPDLC)	CO_2	3134	110
ONATAP	Portugal	Free and Direct Routes	CO_2	526	999
ENGAGE	UK	Optimisation of cruise altitude and/or Mach number	CO_2	1310	23
RlongSM (Reduced longitudinal Separation Minima)	UK	Optimisation of cruise altitude profiles	CO_2	441	533
Gate to gate Green Shuttle	France	Optimisation of cruise altitude profile & CDO from ToD	CO_2	788	221

Transatlantic green flight PPTP	France	Optimisation of oceanic trajectory (vertical and lateral) & approach	CO2	2090+1050	93
Greener Wave	Switzerland	Optimisation of holding time through 4D slot allocation	CO2	504	1700
VINGA	Sweden	CDO from ToD with RNP STAR and RNP AR.	CO2 & noise	70-285; negligeable change to noise contours	189
AIRE Green Connections	Sweden	Optimised arrivals and approaches based on RNP AR & Data link. 4D trajectory exercise	CO2 & noise	220	25
Trajectory based night time	The Netherlands	CDO with pre-planning	CO2 + noise	TBC	124
A380 Transatlantic Green Flights	France	Optimisation of taxiing and cruise altitude profile	CO2	1200+1900	19
				Total	9416

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 (2012-2014)

Table 3 below summarises the nine projects of the third AIRE campaign. Seven of them are completed. A detailed analysis of the results is on-going.

Table 3: AIRE III projects

Project name	**Objectives**	**Expected results**	**Location**
CANARIAS	Reduction of track miles, fuel consumption (and therefore CO_2) through optimised vertical and horizontal paths compared with existing arrival procedures.	Reduction of: • 90-180 kg of fuel burn per flight. • 285-570 kg of CO_2 emissions per flight.	La Palma Lanzarote
AMBER	Design, validation	Reduction of:	Riga Airport

	and test RNAV STARS and RNP-AR arrivals, in order to reduce CO_2 emissions and noise in the airport's vicinity.	• 70-120 kg of fuel burn per flight. • 220-380 CO_2 emissions per flight.	
REACT-PLUS	Introduction of more efficient flight profiles by identifying and implementing Continuous Descent Approaches (CDA) and Continuous Climb Departures (CCD).	Reduction of: • 70-120 kg of fuel burn per flight. • 220-380 CO_2 emissions per flight.	Budapest Airport
OPTA-IN	Achieve optimised descent procedures (with current systems) using the OPTA speed control concept and an ad-hoc air traffic control tool.	Reduction of: • 22-30% of fuel burn per flight. • 126-228 CO_2 per flight.	Palma de Mallorca Airport
SMART	Optimisation of oceanic flights by seeking the most economical route under actual meteorological conditions. It involves integration of various flight plans, position and meteorological dtas between the ATM system and Airline Operations Centre.	Reduction of: • 2% fuel burn per flight. • 2% CO_2 emissions per flight.	Lisbon FIR Santa Maria FIR New York Oceanic
SATISFIED	Trial and assess the feasibility of implementing flexible optimised oceanic routes.	Reduction of CO_2 emissions per flight.	EUR-SAM corridor
ENGAGE PHASE II	Expands on the work of ENGAGE (AIRE II) and aims at demonstrating safety	Reduction of: • 416 kg of fuel per flight.	North Atlantic

	and viability of progressive step climb or continuous alititude change.	• 1310 kg of CO_2 emissions per flight.	
WE FREE	Flight trials for free route optimisation during weekends using flights between Paris CDG and airports in Italian cities.	Reduction of CO_2 emissions per flight.	France Switzerland Italy
MAGGO	Foster quick implementation of enhancements in the Area Control Centres (ACC) and Tower (TWR) communications and surveillance.	Fuel savings of O.5% per flight.	Santa Maria FIR Santa Maria TMA

Everyone sees the "AIRE way of working together" as an absolute win-win to implement change before the implementation of SESAR solutions.

SESAR next programme (SESAR 2020) includes very large scale demonstrations which should include more environmental flight demonstrations and go one step further demonstrating the environmental benefits of the new SESAR solutions.

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. 17 solutions have already been identified in the key areas of the ATM Master Plan. SESAR Solutions according to a study conducted by the SJU will **help saving 50 million tons of CO_2 emissions.** However to fully achieve SESAR benefits the SESAR solutions must be deployed in a synchronised and timely manner.

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.

1. 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.**
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.

The fuel efficiency expected benefits from the deployment of these solutions is **66% reduction of fuel burn resulting in EUR 0.8 billion (6%) CO_2 credit savings.**

4. ECONOMIC/MARKET-BASED MEASURES

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 600 commercial and non-commercial aircraft operators that have flown between airports in the European Economic Area (EEA)[10]**.**

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

[10] Estimate from Eurocontrol, to be updated following reporting of 2013 and 2014 emissions by 31 March 2015.

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, following more than a decade of inaction with respect to the introduction of a global market based measure aiming at reducing the impact of aviation on climate change on the level of the International Civil Aviation Organization (ICAO), legislation to include aviation in the EU ETS was adopted in 2008 by the European Parliament and the Council[11]**.** The 2006 proposal to include aviation in the EU ETS was accompanied by detailed impact assessment[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. This is an important step and follows years of pressure from the EU for advancing global action. 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[13]. The temporary limitation applies for 2013-2016, following on from the April 2013 'stop the clock' Decision[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.

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[11] Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0101

[12] http://ec.europa.eu/clima/policies/transport/aviation/documentation_en.htm

[13] Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in view of the implementation by 2020 of an international agreement applying a single global market-based measure to international aviation emissions http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32014R0421

[14] Decision No. 377/2013/EU derogating temporarily from Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32013D0377:EN:NOT

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) N°600/2012[15] and 601/2012.[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 *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 CO2 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 CO_2 emissions reductions in other sectors of the economy.

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

[15] Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R0600&from=EN

[16] Regulation (EU) No 601/2012 of the European Parliament and of the Council of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32012R0601

from aviation activities carried out between aerodromes located in the EEA amounted to 54.9 million tonnes of CO2 in 2014. This means that the EU ETS will contribute to achieve around 16 million tonnes of emission reductions annually, or almost 65 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 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 biofuels, 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 biofuels[17].

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 change[18]. 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 CO_2 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.

5. EU INITIATIVES IN THIRD COUNTRIES

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 CO_2 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 2010 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:

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

[16] For further information, see http://ec.europa.eu/clima/news/articles/news_2014102801_en.htm

Africa: Burkina Faso, Kenya and Economic Community of Central African States (ECCAS) Member States: Angola, Burundi, Cameroon, Central African Republic, Chad, Republic of Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon, Sao Tome and Principe.

Caribbean: Dominican Republic and Trinidad and Tobago.

6. SUPPORT TO VOLUNTARY ACTIONS: ACI AIRPORT CARBON ACCREDITATION

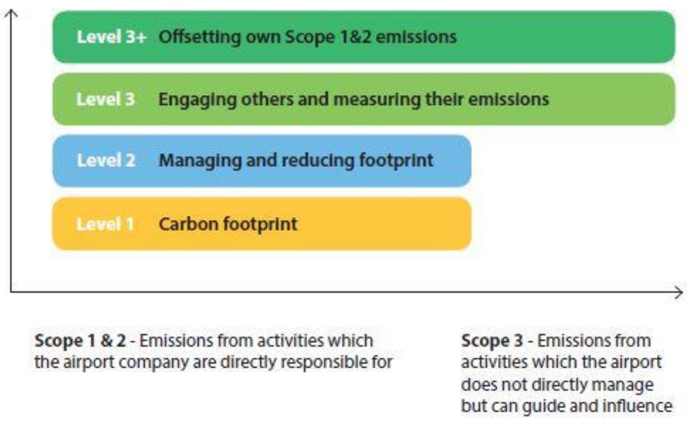
Airport Carbon Accreditation is a certification programme for carbon management at airports, based on carbon mapping and management standard specifically designed for the airport industry. It was launched in 2009 by ACI EUROPE, the trade association for European airports.

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.

Now covering ACI member airports in three ACI regions, Europe, Asia-Pacific, Africa, it is poised to move to Latin America and North America in the coming years. The number of airports participating in the programme has grown from 17 in Year 1 (2009-2010) to 102 at the end of Year 5 – an increase of 85 airports or 500% in participation. Airport participation in the programme now covers 23.2% of world 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".



Levels of certification (ACA Annual Report 2013-2014)

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 2014, 5 years after the launch of the programme, 85 European airports were accredited, representing 62.8% of European 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.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Total aggregate scope 1 & 2 reduction (tCO2)	51 657	54 565	48 676	140 009	129 937
Total aggregate scope 3 reduction (tCO2)	359 733	675 124	365 528	30 155	223 905

Variable	Year 4		Year 5	
	Emissions	Number of airports	Emissions	Number of airports
Aggregate carbon footprint for 'year 0'[19] for emissions under airports' direct control (all airports)	2 553 869 tonnes CO2	75	2 044 683 tonnes CO2	85
Carbon footprint per passenger	2.75 kg CO2		2.01 kgCO2	
Aggregate reduction in emissions from sources under airports' direct control (Level 2 and above)[20]	158 544 tonnes CO2	43	87 449 tonnes CO2	56

19 '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.

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

Carbon footprint reduction per passenger	0.22 kg CO_2		0.11 kg CO_2	
Total carbon footprint for 'year 0' for emissions sources which an airport may guide or influence (level 3 and above) [21]	12 176 083 tonnes CO_2	26	6 643 266 tonnes CO_2[22]	31
Aggregate reductions from emissions sources which an airport may guide or influence	30 155 tonnes CO_2		223,905 tonnes CO_2	
Total emissions offset (Level 3+)	66 724 tonnes CO_2	15	181 496 tonnes CO_2	16

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.

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.

SECTION 2 – NATIONAL ACTIONS IN BULGARIA

The International Civil Aviation Organization (ICAO) recognizes the critical importance of providing continuous leadership to international civil aviation in limiting or reducing its CO_2 emissions that contribute to global climate changes.

ICAO is taking decisive action in the assessment of international aviation sector's CO_2 emissions. Resolution A37-19: „Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change" was adopted on 11-13.07.2011.

To pursue the Resolution, ICAO is requesting that each of its member States develop and submit an Action Plan in order to track, consolidate and report on the efforts of all aviation stakeholders in reducing their carbon footprint. The ICAO Resolution is focused on the reduction of aircraft fuel-burn.

However, it is recommended that each State may involve a range of aviation players, including airports.

According to forecasts, transport of passengers by air will exceed the 2008 level as early as 2011, while the rest of the transport modes will be able to catch up not earlier than 2013. The higher growth rates of air transport will be preserved and by 2020 (measured by pass-km) it

21 These emissions sources are those detailed in the guidance document, plus any other sources that an airport may wish to include.

will increase by about 35 – 36%, compared to 2008. As a result of this increase, the relative share of air transport in overall passenger transport volumes will increase from 21% in 2008 to 30% in 2020.

The expectations, as discussed herein, of a higher growth rate or air transport are relevant not only for Bulgarian air carriers but also for all European airline companies. These forecasts, combined with the already mentioned expectations of world financial institutions for a higher economic growth rate after 2015, which will have a positive impact on tourism, provide a sufficient ground for forecasts that the passenger flows through Bulgaria's international airports will substantially increase.

Basket of Measures Reducing Aviation Emissions of Air carriers

The measures implemented in the following areas of operator`s activity are considered to be substantial for ensuring the reduction or limitation of CO2 emission:

Participation in emission trading scheme.

- Improvement of equipment of the airplane.
- Increasing of capabilities of the aircraft for the carriage of **passengers and cargo**.
- Maintenance planning – in order to limit ferry flights (non – commercial flights) due to technical reasons
- Implication of components directly related to fuel consumption (such as fuel pumps, fuel filters, etc.
- Strict observance of manufacturers' specifications.
- Thorough input inspection.
- Quality audits of external component suppliers.
- Quality audits of fuel suppliers
- Aircraft regular external washing – in order to decrease air resistance during flight.
- Flight planning and performance
- Strict and accurate observance Fuel policy
- Flight Performance using optimum altitude and speed when possible, and optimum flight path, for ensuring economical fuel consumption.
- Fuel inspection prior refueling:
- Supporting documentation:
- Visual check for fuel purity
- Use of airport infrastructure.

Basket of Measures Reducing Aviation Emissions at Airports

The ICAO Resolution is focused on the reduction of aircraft fuel-burn. However, it is recommended that each State may involve a range of aviation players, including airports. The objective of this program is to encourage as many European airports as possible to engage in comprehensive CO2 management and achieve carbon-neutral operation as:

- operation of aircraft on the ground (engine runups and test runs, operation of Auxiliary Power Units),
- operation of buildings and ground handling vehicles,
- supply of aircrafts with ground power supply,
- travel to and from the airport by passengers and employees, and business trips.

To help airport members "Airports Council International Europe" (ACI Europe) has compiled a briefing document with information and suggested areas that States might chose to include in their AIRPORTS ACTION

PLANS on AVIATION CO2 EMISSIONS.

We support the expansion of our Airports with the aspiration to maintain environmental standards.

We invest in environmental impact reduction measures.

Varna and Burgas Airports traffic forecast was prepared in 2011 by Lufthansa Consulting for the period 2011-2035. The average growth rates of passenger traffic are presently forecasted with approximately 3.7-4.0% per annum.
Comparing the forecasted Air Traffic Movements (ATM) will show the same tendency as the passenger volumes. In the long term view the ATM's will increase with an average growth rate of 3.5 % between 2011 and 2035.

ACI EUROPE has made a commitment through its resolution on climate change agreed on 18th June 2008 to assist member airports to assess and reduce their carbon footprint.

Reducing Aviation Emissions at Airports

1. Improving Air Trafic Management:

- On our two airports there is a tradition to hold working meetings with the airlines and Air Traffic Control to discuss ways to optimize traffic in nearby space, without safety compromising. Working with stakeholders to improve Landing and Take-off (LTO) efficiencies with applicable procedures. Improve the efficiency of air navigation lead to fuel efficient and to reduce aviation emissions over regions of our airports. More efficient ATM planing in airfield operations at airport.
- More efficient ATM planing in airpron operations (departure,approach to stands and arrivals).
- More efficient use and planing of airport capacities.
- Use of best practices in Air Trafic Mamagement from other airports.
- We are also working continuously on reducing taxiing and waiting times for aircraft. The procedure involves better coordination of the ground-based processes.

Infrastructure efficiency:

- Decision for improving of the aircraft taxiways, terminal and runway configuration to optimize the taxiing distance and capacity, and to reduce ground and terminal area congestion. Projects for that is parts of "AIRPORTS MASTER PLAN 2012-2031" of Varna and Burgas Airports.
- Arrival management that provides stands for aircraft, as far as possible, immediately after landing.
- Departure management including holding aircraft at the stand (with APU switched off) until departure slot is ready. Such practices can also encompass slot management, virtual queuing, delayed pushback and Collaborative Making.

3. Operational efficiency:

Infrastructure efficiency:

- Decision for improving of the aircraft taxiways, terminal and runway configuration to optimize the taxiing distance and capacity, and to reduce ground and terminal area congestion. Projects for that is parts of "AIRPORTS MASTER PLAN 2012-2031" of Varna and Burgas Airports.

- Arrival management that provides stands for aircraft, as far as possible, immediately after landing.
- Departure management including holding aircraft at the stand (with APU switched off) until departure slot is ready. Such practices can also encompass slot management, virtual queuing, delayed pushback and Collaborative Making.
- APU during the stay of the aircraft on the apron.
- Future implementation of fixed electrical ground power (FEGP) supply to aircraft near terminal gates, allowing auxiliary power unit (APU) switch-off. This measure shall be discussed in the next update of the Master plans of both airports in 2016. Switching off the APUs could significantly reduce emissions of CO2 and other air pollutants.
- The Ground Support Equipment (GSE) fleet is gradually being converted to run on energy-efficient power units. Already 8 % of the
- GSE vehicles operating at both airports run on electricity and this includes a large number of energy-intensive special vehicles. This process will continue.
- Modernization of fleet vehicles and use of alternative fuels for buses, cars and other air and land side vehicles, including compressed natural gas (CNG), hydrogen, electric, compressed air and hybrid vehicles.
- Providing the infrastructure for alternative fuels for airport and tenant vehicles.
- Implementation of a no-idling policy.
- Driver education on fuel conserving driving techniques.
- The apron transport flows will analyze with a view to potential optimization.
- New methods for runway deicing are being introduced at both airports in 2012 as part of the environmental program and waste management program. New measures and systems are being developed for the roll-out of a future-oriented waste strategy geared to conserving resources. This system will avoid large amounts of waste over the long term and improve the recycling of valuable materials.
- We are also implementing measures for separating and treating deicing agents at our airports in Varna and Burgas, Bulgaria. In addition to setting up special deicing areas and development of technical systems, building modifications are also being implemented, such as the construction of a runway drainage system in Varna.

Enhancing weather forecasting services

Airport Collaborative Decision Making (A-CDM) is the foundation stone of the Single European Sky ATM Research (SESAR) project and a key enabler to the realisation of the ATM Master plan bringing cost, capacity, safety and environmental benefits to airline customers both during normal operations and especially through times of adverse meteorological conditions. It all depends upon partnership –the partnership involves airport operators, aircraft operators, ground handlers, air traffic control and meteorological services working together more efficiently and transparently and sharing information in real time.

Information sharing is the first and most essential element of A-CDM as it creates the foundation by creating a common situational awareness. This dramatically reduces the controller workload, thereby allowing for greater operational efficiency. Furthermore, the reduction of taxi and flight times based on sharing of meteorological information will lead to a significant decrease in emissions and noise. This environmental benefit comes alongside the operational efficiency gains, bringing added-value even for the airport's surrounding communities.

In view of A-CDM identifying and developing of national A-CDM platform based on a good forecasting of weather conditions for the main airports in Bulgaria will bring benefits in enhanced predictability, reduced delay, more flexibility, better use of resources and significant environmental benefits. Finally the improved information sharing and flight predictability in connection with enhancing weather forecasting services will be beneficial for the whole air transport network.

Introducing Collaborative Environmental Management (CEM) in Bulgaria.

This is one of the key SESAR enablers and although primarily focused on the airport (local) environmental partnership, will also have the climate change (CO_2) measures within its scope. This commonly agreed on European level strategic management process will allow us to prioritise and meet environmental challenges caused by the environmental impacts of aircraft operations, involving the key stakeholders.

Year	Fuel Burn (billions of litres)	RTK (in thousands)	Fuel (in litres) per RTK (efficiency)
2010	0,46	110 259.60	4,1267

Future year	Projected Fuel (in litres) per RTK (efficiency) Identical to Efficiency in the Base Year
2011	4,13
2012	4,13
2013	4,13
2014	4,13
2015	4,13
2016	4,13
2017	4,13
2018	4,13
2019	4,13
2020	4,13

Forecasted traffic growth rate (RTK)	3,5%

Future year	Projected RTK (‘000)
2011	114 118.69
2012	118 112.79
2013	122 246.79
2014	126 525.43
2015	130 953.82
2016	135 537.20
2017	140 281.00
2018	145 190.84
2019	150 272.52
2020	155 532.06

Future Year	Projected Fuel Burn (in billions of litres) Calculated Automatically
2011	470 937.58
2012	487 420.39
2013	504 480.10
2014	522 136.91
2015	540 411.70
2016	559 326.11
2017	578 902.52
2018	599 164.11
2019	620 134.86
2020	641 839.58

CONCLUSION

According to the strategic vision for the development of the country, as defined in the National Strategic Reference Framework, Bulgaria is facing the challenge to achieve a sustainable genuine convergence through high economic growth rates based on investments, a substantial increase of productivity and improvement of competitiveness. In order to negotiate the risks, which may compromise the efforts to maintain a high and stable economic growth, the economic policy must be focused on improving the quality of the physical infrastructure (by enhancing connectivity and accessibility), on investing in human capital and raising the standards of education and healthcare in order to maintain the quality of the work force, and remove the inefficiency in the performance of the administration and the market in order to provide incentives for entrepreneurship and investments and support a balanced territorial development.Achieving this vision implies that Bulgaria must achieve two strategic objectives in the mediumterm:

- To achieve and maintain a high economic growth rate by a dynamic economy in compliance with the principles of sustainable development
- To improve the quality of the human factor and reach employment, income and social integration levels, which would assure a high living standard.
- Modernising the transport system is a prerequisite for its successful integration within the European transport system.

Bulgaria's transport sector must support the economic and social development of the country by:

- **Providing efficient (with maximum benefits), effective and sustainable (with minimum external influences) transport**
- **Supporting a balanced regional development**
- **Assisting in Bulgaria's integration in the European structures, taking into account its crossroad location and its transit potential.**

The following **vision** for the development of the transport sector has been derived on the basis of the principles mentioned above:

By 2020, Bulgaria should have a modern, safe and reliable transport system in order to satisfy the demand for high-quality transport services and to provide better opportunities for its citizens and business.