MINISTERUL TRANSPORTURILOR

ROMANIA

ACTION PLAN
on reducing of greenhouse gas emissions
in civil aviation
2011-2020

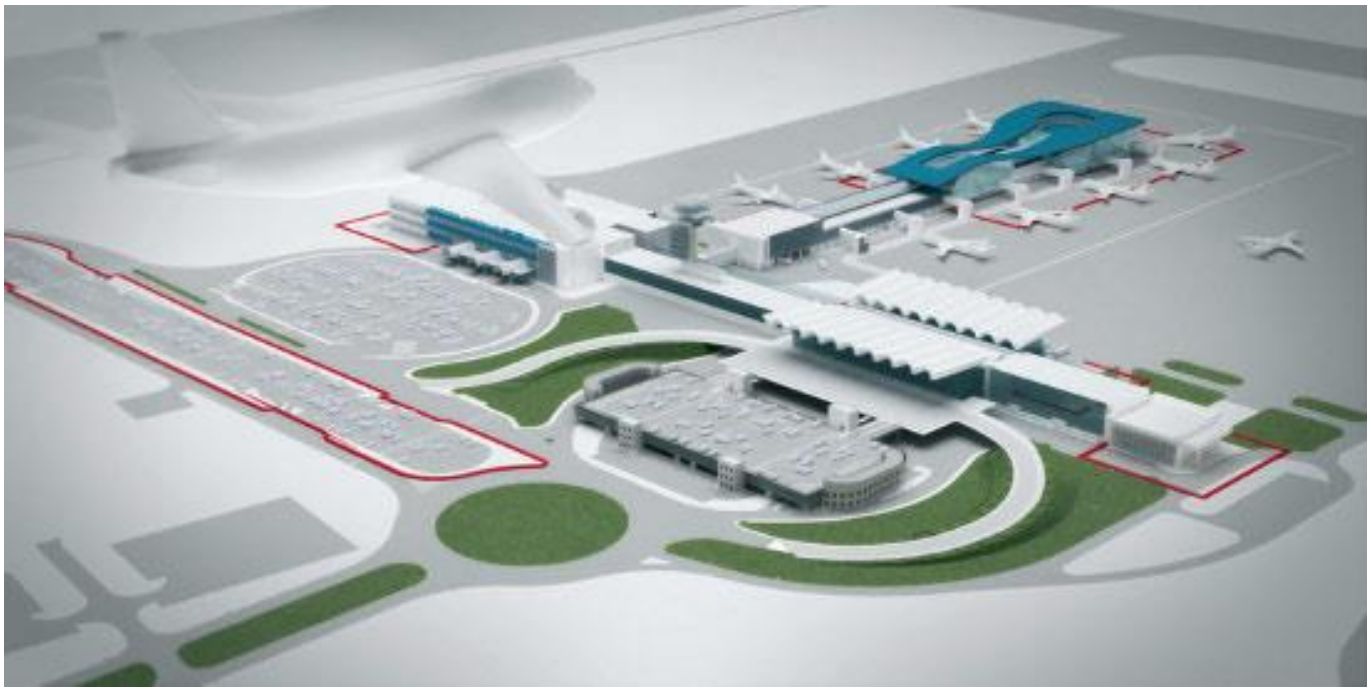


Photo: Henri Coanda New Terminal

Romanian Ministry of Transport

-2017-

Bdul Dinicu Golescu nr. 38, Sector 1, București
Tel.: 021 319.62.09,
Fax: 021 319.61.62;
[dgavc@mt.ro]
www.mt.ro

Second Edition 2016

Acronyms

RCAA - Romanian Civil Aviation Authority
EFA - Environment Fund Administration
NMA - National Meteorological Administration
ATM - Air Traffic Management
EBRD - European Bank for Reconstruction and Development
CER - emission reduction certificates
CNG - Carbon Neutral Growth
EU ETS - European Union scheme for trading emissions of greenhouse gases certificates
GHG - greenhouse gas
NSI - National Statistics Institute
JI - Joint Implementation
MT - Ministry of Transports
ME - Ministry of Environment
NEPA – National Environmental Protection Agency
MECBE - Ministry of Economy, Commerce and Business Society
ICAO - International Civil Aviation Organization
ROMATSA -Romanian Air Traffic Services Administration
RTK - revenue per tonne / kilometre
ECAC-European Civil Aviation Conference

TABLE OF CONTENTS

CHAPTER1. INTRODUCTION

With an area of 238,400 square kilometres, Romania is the twelfth largest country in Europe. Located in Southeastern Europe, bordering on the Black Sea, the country is halfway between the equator and the North Pole and equidistant from the westernmost part of Europe—the Atlantic Coast—and the most easterly—the Ural Mountains. Romania has 3,195 kilometres of border. Republic of Moldova lies to the east; Bulgaria lies to the south, Serbia and Hungary to the west and Ukraine to the North. In the southeast, 245 kilometres of sea coastline provide an important outlet to the Mediterranean Sea and the Atlantic Ocean.

Romania became a member State of International Civil Aviation Organization (ICAO) in 1965, European Civil Aviation Conference (ECAC) member in 1991, EUROCONTROL member in 1996 and since 2007 Romania is a European Union Member State.

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 established in 1955.

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

Romania, 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.

Romania recognises the value of each State preparing and submitting to ICAO a State Action Plan on emissions reductions, as an important step towards the achievement of the global collective goals agreed at the 39th Session of the ICAO Assembly in 2016.

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

i. mission on reductions at source, including European support to Committee on Aviation Environmental Protection (CAEP) work;

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

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

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

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

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

In Romania, 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 Chapter 4 of this Plan.

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 to 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 Member 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 Member 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.

CHAPTER 2. CURRENT STATE OF AVIATION IN ROMANIA

2.1. Competent authorities and national legislation for civil aviation and environmental protection

Ministry of Transportation, hereinafter referred to MT, is the central public authority responsible for the development, regulation and implementation of transport strategies and policies in Romania. In accordance with the Civil Aviation Law, it represents the Government in specific international and European organizations, in the field of civil aviation.

The Romanian Civil Aviation Authority, hereinafter referred to RCAA, is an autonomous national public interest body under the authority of MT, technical body with competences in the field of flight safety supervision.

The Ministry of Environment, hereinafter referred to as ME, is the central public authority developing environmental policy at national level and coordinating activities to integrate environmental protection requirements into other sector policies, in accordance with the European and international requirements and standards, according to the Government Decision no. 19/2007 on the organization and functioning of the Ministry of Environment.

National Environmental Protection Agency, hereinafter referred to as NEPA, is a public institution under the authority of the Ministry of Environment, with responsibility for implementing policies and legislation on environmental protection, according to Government Decision no. 1000/2012 on the reorganization and functioning of the National Environmental Protection Agency and public institutions subordinated to it, as amended, respectively that on climate change. According to Government Decision no. 780/2006 regarding the scheme of trading of greenhouse gases emissions certificates, as amended and supplemented, ANPM was designated as the competent authority for implementation of Directive 2008/101/EC (which includes aviation activities in the greenhouse gas emission trading scheme) in addition to other responsibilities regarding the verification and approval of plans for monitoring and reporting emissions of greenhouse gases.

2.2. International law applicable for environmental protection

Annex number one to the National action plan presents the legal acts representing the basis for implementing in Romania of the measures to reduce emissions of greenhouse gases.

2.3. Airlines and airports in Romania

The list of Romanian airlines and airports is posted on the website of RCAA, respectively http://www.caa.ro/.

2.4. Statistics

Table.1. **List of Greenhouse gas emissions in Romania and Europe (Million tonnes of CO2 equivalents)**

	1990	1995	2000	2005	2010	2014	Share in EU-28*
EU-28	**5 735.1**	**5 399.3**	**5 283.8**	**5 347.0**	**4 914.4**	**4 419.2**	**100.00%**
Belgium	149.2	156.9	153.9	148.4	137.5	117.9	2.67%
Bulgaria	104.8	74.4	58.5	63.2	60.3	55.4	1.25%
Czech Republic	199.8	158.7	151.5	149.7	141.1	126.8	2.87%
Denmark	72.4	80.4	73.4	69.3	66.0	53.9	1.22%
Germany	1 258.2	1 133.4	1 060.3	1 012.8	963.6	969.1	21.93%
Estonia	40.1	20.0	17.1	18.4	20.0	21.2	0.48%
Ireland	57.2	61.0	71.2	72.9	64.6	60.6	1.37%
Greece	107.3	113.4	130.2	138.4	120.8	104.3	2.36%
Spain	291.6	333.0	395.3	450.5	373.6	342.7	7.75%
France	556.8	557.7	568.8	570.6	530.7	475.4	10.76%
Croatia	35.2	24.6	27.1	31.3	29.2	24.8	0.56%
Italy	526.1	539.2	562.6	588.1	517.9	428.0	9.69%
Cyprus	6.4	7.9	9.2	10.2	10.4	9.2	0.21%
Latvia	26.4	12.9	10.5	11.6	12.6	11.6	0.26%
Lithuania	47.5	21.7	18.8	22.4	20.2	19.2	0.44%
Luxembourg	13.3	10.7	10.7	14.4	13.5	12.0	0.27%
Hungary	94.6	76.2	74.2	76.7	66.2	57.7	1.31%
Malta	2.2	2.8	3.0	3.2	3.4	3.3	0.08%
Netherlands	226.8	239.8	230.2	225.5	224.1	198.0	4.48%
Austria	79.7	81.2	82.1	94.8	87.0	78.3	1.77%
Poland	473.5	446.0	393.0	397.9	407.7	382.0	8.64%
Portugal	62.1	73.0	86.0	90.5	73.1	67.6	1.53%
Romania	252.7	183.4	140.9	147.0	117.5	110.4	2.50%
Slovenia	18.7	18.8	19.2	20.6	19.7	16.7	0.38%
Slovakia	74.8	54.8	50.0	51.6	46.7	40.8	0.92%
Finland	72.4	72.8	71.1	70.9	77.6	61.1	1.38%
Sweden	73.3	75.5	70.8	68.9	67.1	56.7	1.28%
United Kingdom	812.2	769.0	744.0	727.3	642.1	556.7	12.60%

*Share in EU-28 total in year 2014

Source of information: Eurostat statistic

In the table above are shown the total greenhouse gas emissions from European countries (including international aviation and indirect CO2, excluding LULUCF), between 1990 – 2014.

*Table 2.**Greenhouse gas emissions in Romania and neighbouring countries (Million tonnes)***

Country	1990	1995	2000	2005	2010	2014
Romania	252,7	183,4	140,9	147	117,5	110,4
Hungary	94,6	76,2	74,2	76,7	66,2	57,7
Bulgaria	104,8	74,4	58,5	63,2	60,3	55,4

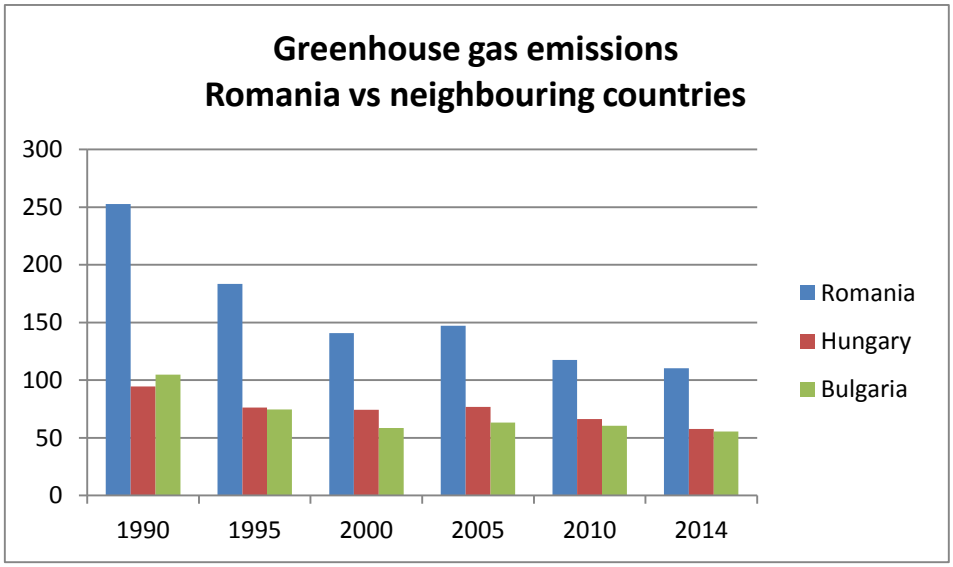


Figure.1. *Source: Eurostat statistics*

From the figure above we can see that, the greenhouse gas emissions in Romania has decreased, from 1990 compare to 2014 since actions have been taken at national level for reducing of greenhouse gases emissions.

An analysis of CO_2 emissions for most important Romanian air carriers is presented in the table 3:

*Table.3.**CO_2 emissions for most important air carriers (tonnes)***

AIRLINE	2012	2013	2014	2015
BLUE AIR	208971	186292	192816	269194
TAROM	260886	267022	288705	295621
CARPATAIR	38029	19536	8820	5339

Source: ANPM

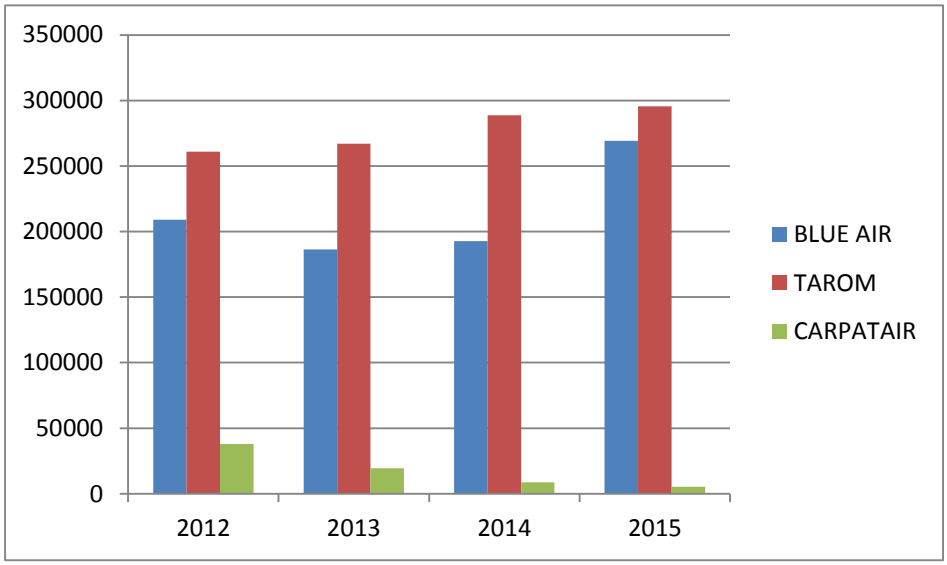


Figure 2 Co_2 emissions for the most important airline carriers

An analysis of the most important Romanian air carrier - TAROM - shows how the fuel consumption has evolved in the period 2009-2015:

Table.4. ***Fuel consumption on Tarom fleet***

	2009	2010	2011	2012	2013	2014	2015
Fuel Consumption on Tarom fleet(tonnes)							
A310	796,29	3.709,01	6.086,38	5.196,23	5.832,36	12.936,77	21.137,25
A318	24.972,15	26.093,65	26.714,20	24.216,08	24.139,69	27.111,67	29.419,72
B737 (300+700)	47.407,75	52.891,28	50.206,09	55.313,44	54.751,03	55.635,93	56.865,34
B738	17.988,56	18.126,52	11.595,82	5.190,73	7.075,18	7.215,24	716,83
ATR42	7.719,10	7.628,91	7.844,36	8.653,18	8.134,34	7.849,09	7.345,75
ATR72	1.558,42	3.065,09	2.792,98	2.465,49	2.679,01	2.652,33	2.596,79
Total	**100.442,28**	**111.514,45**	**105.239,81**	**101.035,16**	**102.611,61**	**113.401,02**	**118.081,68**

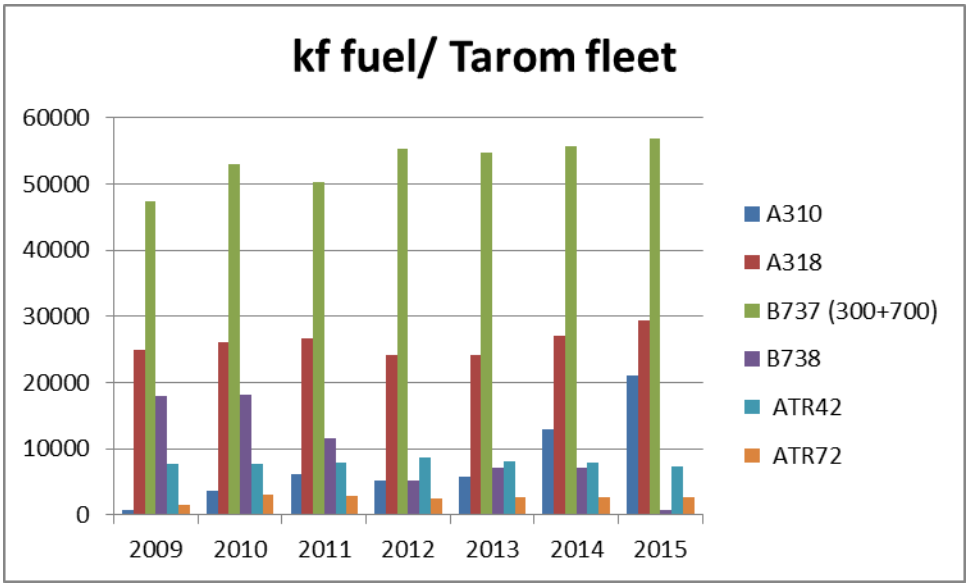


Figure.3: Fuel consumption, 2009-2015 TAROM *Source: Tarom S.A*

Table.5. ***Fuel efficiency indicator for major Romanian air carriers***

Efficiency indicator for major romanian air carriers			
Years	100X(TONE –KM)	Fuel quantity (litters)	Fuel Efficiency indicator
2011	546.088.917	203.506.000	0.372
2012	490.119.064	182.719.000	0.372
2013	484.088.685	168.200.000	0.347
2014	502.596.946	180.769.000	0.359
2015	609.964.746	210.616,040	0.345
2016	803.241.425	264.614.850	0,329

Source: Romanian Environmental report 2011-2015

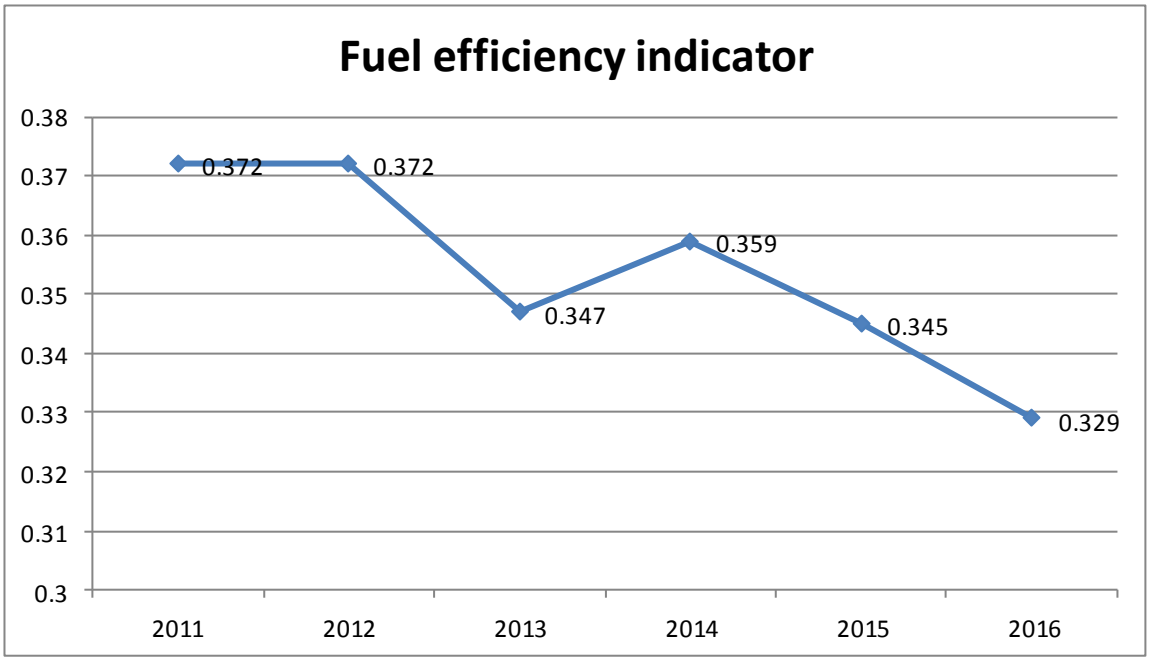


Figure.no.4 *Sourse: Romanian Environmental report 2011-2015*

Table. 6. ***Air traffic statistics in FIR Bucharest -2005-2015***

Romanian Air Trafic 2005-2015											
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
No. of flights	410.449	415.721	431.966	443.918	431.800	466.587	483.982	484.210	509.048	594.264	631.068

Source: ROMATSA

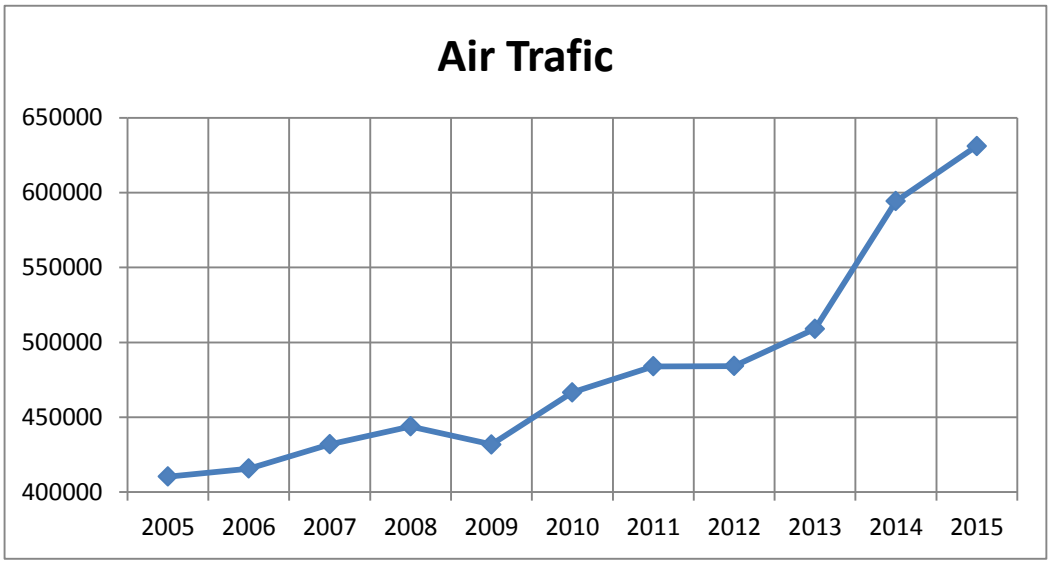


Figure .5 Annual Air Traffic *Source: ROMATSA*

Air traffic in national airspace has increased by more than 53% over 2005 due to the emergence of low-cost airlines and the increase in operating frequencies of national air operators.

*Table .7.**Passengers Traffic on Romanian airports 2006-2016***

Aeroport	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Otopeni	3.513.408	5.247.401	5.064.230	4.483.661	4.917.952	5.049.443	7.090.977	7.643.467	8.317.168	9.282.975	10.983.063
Baneasa	676.746	968.134	1.724.732	1.974.337	2.118.150	2.398.911	427.272	6.036	4.690	4.579	7.172
Constanta	71.213	48.740	68.858	77.453	78.770	81.336	91.288	68.153	162.808	85.323	108.441
Timisoara	708.871	864.371	889.136	993.702	1.138.552	1.201.961	1.039.141	755.117	735.100	925.319	1.162.531
Arad	23.561	65.943	128.828	88.599	16.803	1.022	14.988	42.257	28.088	8.573	381
Bacau	49.392	130.754	119.490	196.415	241.111	327.995	394.260	305.643	313.480	364.727	414.987
Baia Mare	6820	13.370	22.546	25.101	19.229	18.712	17.571	16.662	21.608	19.228	44
Cluj Napoca	259.782	418.220	759.555	853.495	1.071.322	1.025.906	936.140	1.036.438	1.182.265	1.487.953	1.884.993
Craiova	765	5.295	12.988	14.019	23.629	31.331	30.659	40.185	138.886	119.641	223.363
Iasi	66.461	124.009	144.057	148.538	159.796	184.311	171.026	232.170	273.047	381.603	882.628
Oradea	36.149	41.607	42.451	39.108	40.444	46.292	40.479	39.339	36.464	7.923	41.914
Satu Mare	9.111	6.172	7.306	11.101	18.865	23.469	24.338	16.500	13.092	17.467	23.840
Sibiu	73.226	111.062	175.316	221.607	226.120	189.820	206.574	222.678	250.651	308.897	391.971
Suceava	12874	20.893	23.592	31.239	34.604	27.197	25.181	20.048	219	2.359	57.223
Targu Mures	47.445	158.286	69.730	85.430	74.931	256.713	299.624	356.731	343.592	335.993	287.390
Tulcea	628	1.030	788	861	1.698	235	892	1.887	1.221	394	1.061
Tuzla	466	5.372	3.856	4.211	15.106	13.948	15.595	15.124	20.813	24.809	15.540
TOTAL	5.556.918	8.230.659	9.257.459	9.248.877	10.197.082	10.878.602	10.826.005	10.818.435	11.843.192	13.377.763	16.486.542

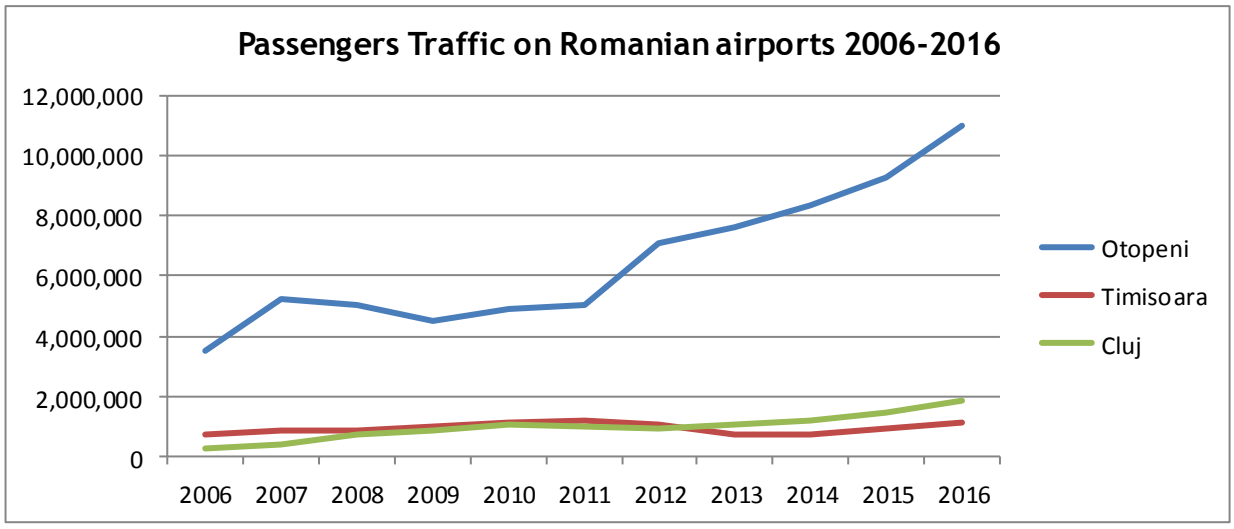


Figure. 6. Annual Passengers *Source: RCAA statistics*

Table .8. ***Aircraft movements 2006-2016***

Airport	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Otopeni	58.071	70.288	72.569	72.697	76.966	74.468	86.627	86.730	91.788	97.200	108.285
Baneasa	16.413	17.916	27.957	31.024	29.719	26.061	10.893	9.254	10.260	11.348	12.448
Constanta	4.569	4.715	4.297	4.368	3.819	3.984	3.275	2.812	4.913	5.271	4.461
Timisoara	24.956	25.326	24.520	24.737	25.830	23.215	19.002	14.190	10.255	11.997	14.158
Arad	1.675	2.532	3.383	2.852	1.881	1.402	2.190	2.314	2.544	3.028	2.014
Bacau	2.992	3.980	2.803	3.970	4.337	3.767	4.125	3.637	3.768	4.113	4.506
Baia Mare	544	732	1.092	1.310	834	822	1.256	996	1.126	1.304	12
Cluj-Napoca	9.076	9.416	12.280	13.486	16.408	15.599	11.628	12.241	13.335	15.468	19.152
Craiova	742	983	2.103	2.046	2.121	1.172	1.244	2.202	3.468	2.999	4.018
Iasi	2.367	3.770	4.276	5.299	4.991	4.792	4.296	4.769	4.851	6.057	10.309
Oradea	2.000	2.172	1.972	1.868	1.809	2.572	5.408	2.368	1.833	716	1.761
Satu Mare	773	999	1.373	1.036	1.049	1.128	1.276	1.062	997	1.132	1.440
Sibiu	4.132	5.498	6.729	6.984	6.498	5.279	5.363	4.834	4.902	5.534	6.331
Suceava	865	1.228	1.108	1.726	1.671	1.063	938	1.320	34	170	1.784
Targu Mures	2.289	3.214	2.498	2.635	2.035	3.154	3.101	3.484	3.391	3.200	2.558
Tulcea	1.469	2.510	3.624	3.914	3.420	1.928	1.813	1.745	1.977	1.687	1.619
Tuzla	6.304	11.098	22.622	25.313	17.359	5.093	6.831	1.095	8.212	9.378	6.821
TOTAL	139.237	166.377	195.206	205.265	200.747	175.511	169.266	155.069	167.651	180.620	201.677

Source: CAA statistics

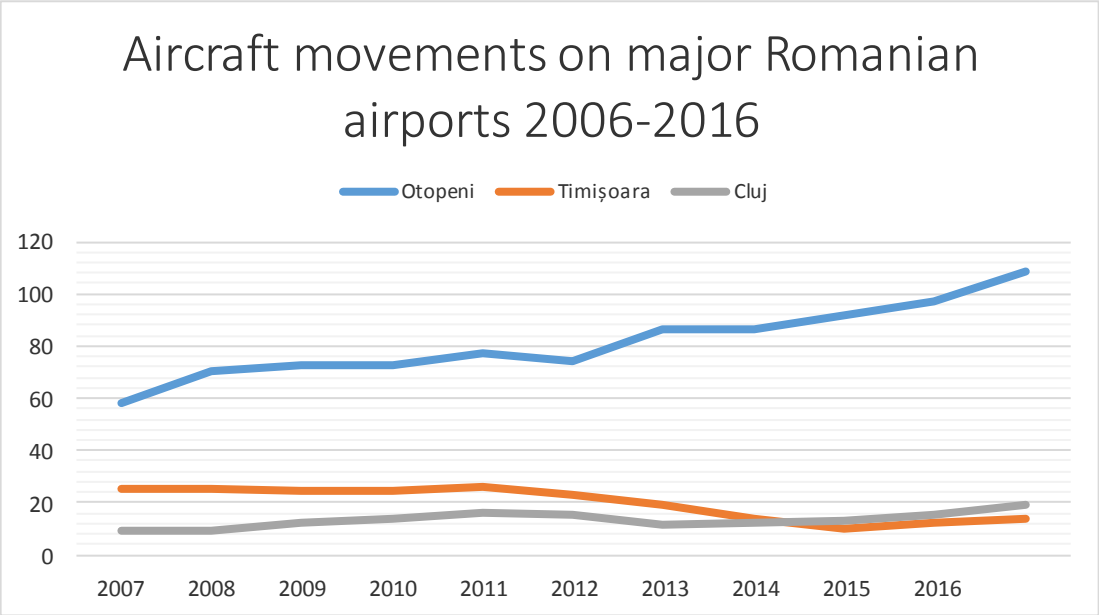


Figure. 7. Annual Aircraft Movements

As can be seen from Tables 7 and 8, passenger traffic increased by about 196%, and the number of aircraft movements in Romania increased by about 45% in 2006-2016.

Table .9. ***Air traffic statistics for Romanian air operators - 2011-2016***

Anul	Decolări	Pasageri transportați	Marfă transportată (tone)
2011	66.316	3.949.375	6.375
2012	60.296	3.905.790	10.045
2013	43.016	2.819.287	4.176
2014	50.313	3.901.453	4.265
2015	49.383	4.177.398	4.134
2016	61.439	5.640.621	3.257

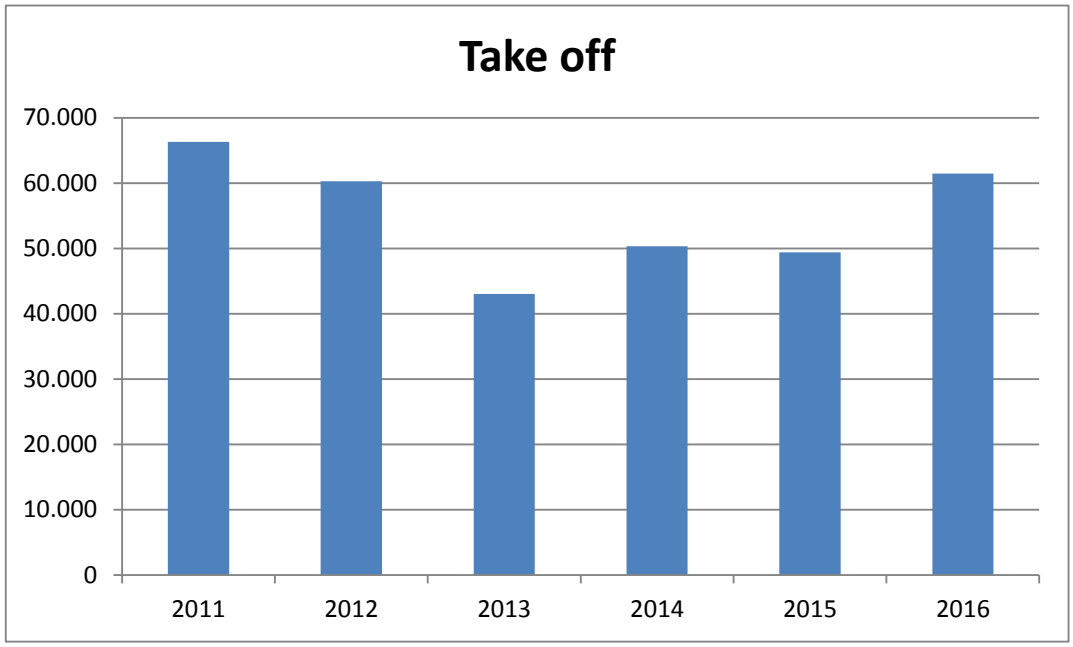


Figure.8 *Source: CAA statistics*

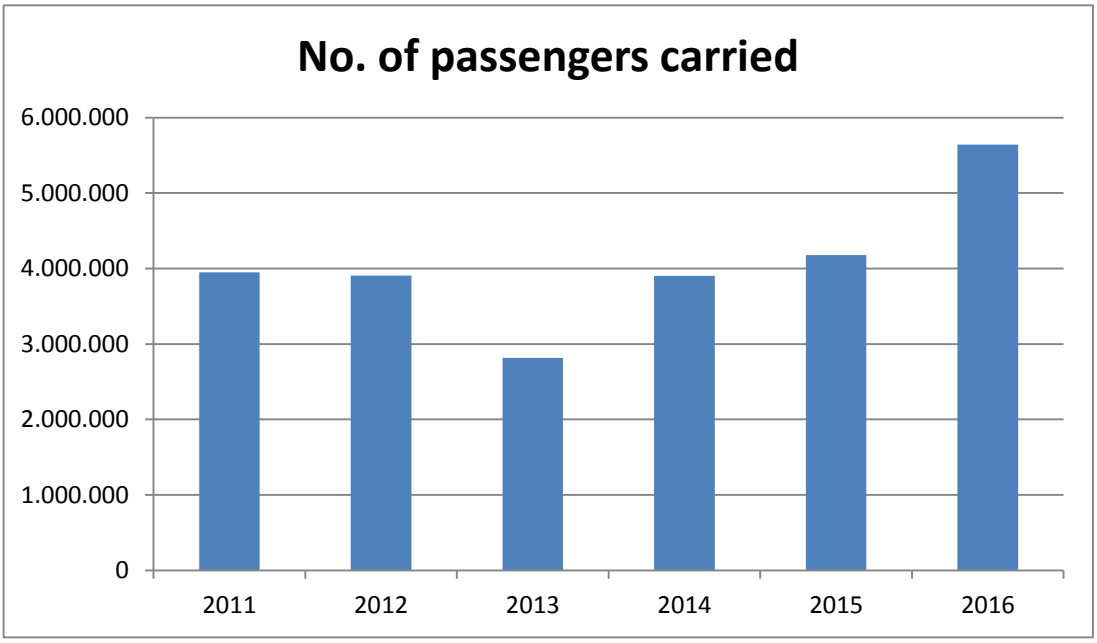


Figure 9 *Source: CAA statistics*

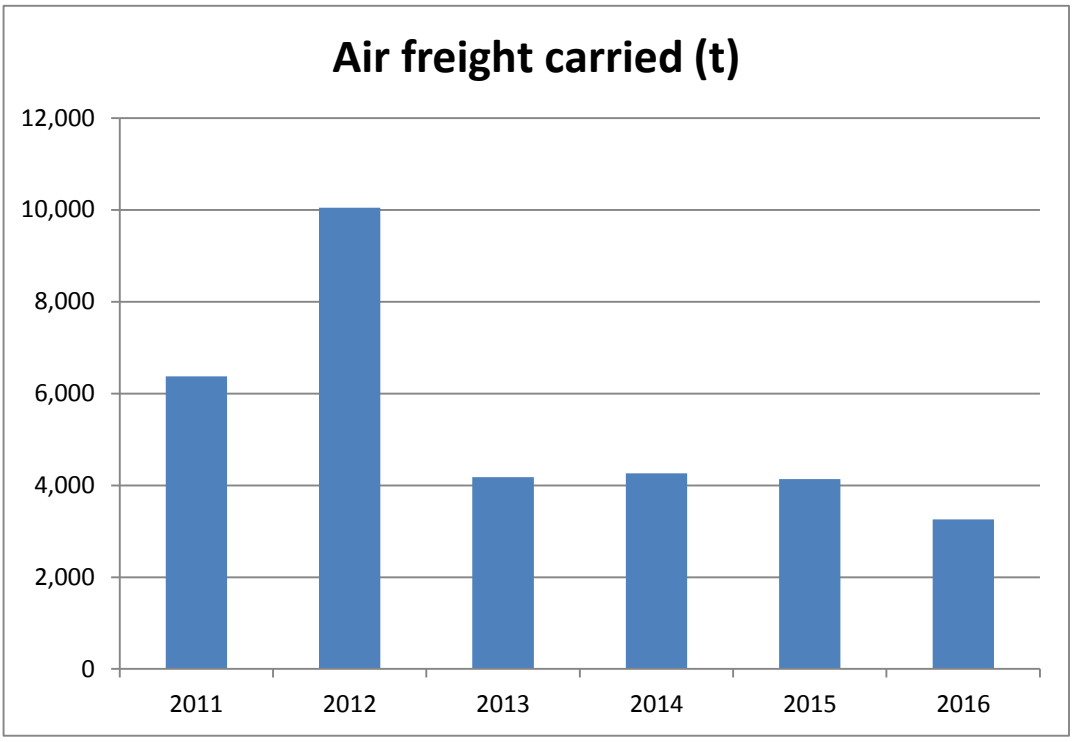


Figure 10 *Source: CAA statistics*

2.5. Forecasts

The forecasts of passenger traffic growth issued by the European Organization for the Cooperation of Air Navigation Safety (EUROCONTROL) estimates an average air traffic growth rate for Romania of 6% per annum by 2020.

Average annual growth per state 2020 v 2013

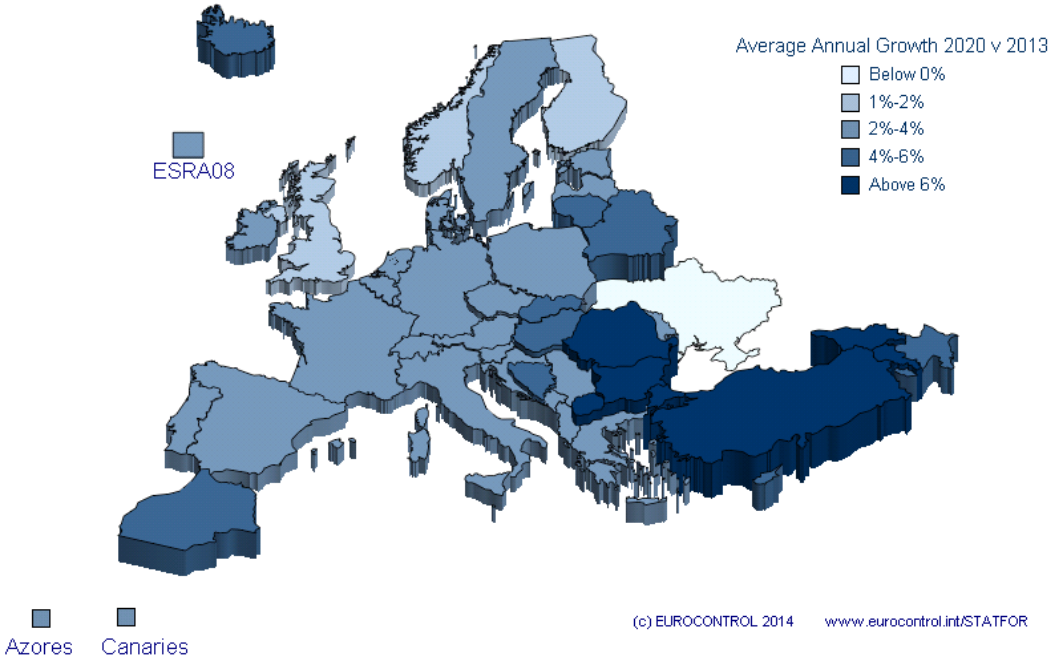
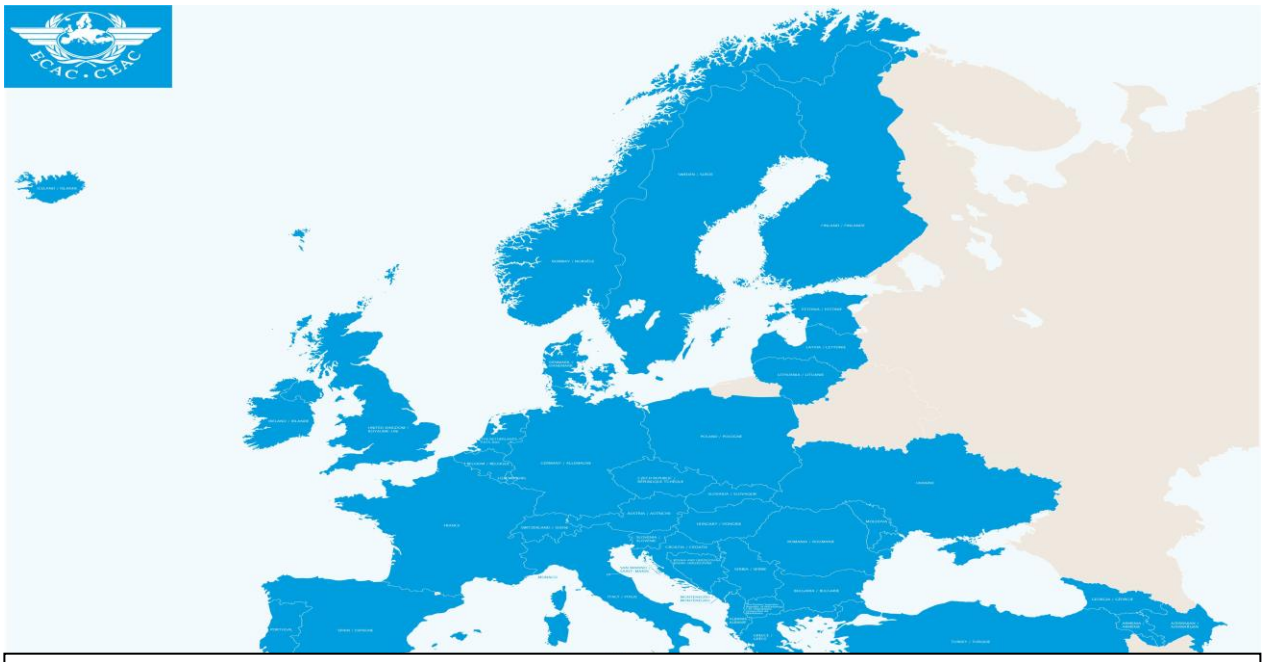


Figure 11. *Source : Eurocontrol*

As can be seen from Figure 11, Danube Fab airspace area expects to have the highest annual growth (5.1%, ± 2 pp) by 2020.

CHAPTER 3. SUPRA-NATIONAL ACTIONS, INCLUDING THOSE LED BY THE EU



3.1. ECAC baseline scenario

As in all 20-year forecasts produced by EUROCONTROL, various scenarios are built with a specific storyline and a mix of characteristics. The aim is to improve the understanding of factors that will influence future traffic growth and the risks that lie ahead. In the 20-year forecast published in 2013 by EUROCONTROL, the scenario called 'Regulated Growth' was constructed as the 'most-likely' or 'baseline' scenario, most closely following the current trends. It considers a moderate economic growth, with regulation reconciling the environmental, social and economic demands.

The table below presents a summary of the social, economic and air traffic-related characteristics of the different scenarios developed by EUROCONTROL for the purposes of EUROCONTROL 20-year forecast of IFR movements[1].

Table 10. Summary characteristics of EUROCONTROL scenarios:

	A: Global Growth	*C: Regulated Growth*	*D: Fragmenting World*	*C': Happy Localism*
2019 traffic growth	High ↗	Base →	Low ↘	Base →
Passenger				
Demographics (Population)	Aging UN Medium-fertility variant	Aging UN Medium-fertility variant	Aging UN Zero-migration variant	Aging UN Medium-fertility variant
Routes and Destinations	Long-haul ↗	No Change →	Long-haul ↘	Long-haul ↘
Open Skies	EU enlargement later +Far & Middle-East	EU enlargement earliest	EU enlargement latest	EU enlargement earliest
High-speed rail (new & improved connections)	54 city-pairs faster implementation	54 city-pairs	42 city-pairs later implementation	54 city-pairs faster implementation
Economic conditions				
GDP growth	Stronger ↗	Moderate →	Weaker ↘↘	Weaker ↘
EU Enlargement	Later	Earliest	Latest	Earliest
Free Trade	Global, faster	Limited, later	None	More limited, even later
Price of travel				
Operating cost	Decreasing ↘↘	Decreasing ↘	No change →	Decreasing ↘
Cost of CO_2	Lowest	Lower	Highest	Lower
Price of oil	Lower	Low	High	High
Other charges	Noise: ↗ Security: ↘	Noise: ↗ Security: →	Noise: → Security: ↗	Noise: ↗ Security: →
Structure				
Network	Middle-East hubs ↗↗ Europe ↘ Turkey ↗	Middle-East hubs ↗↗ Europe and Turkey ↗	No change →	Middle-East hubs ↗↗ Europe and Turkey ↘
Market Structure	Medium ↗↗ Large - Very Large ↗	Medium to Very Large ↗	Large ↗ Very Large ↗	Large ↗ Very Large ↗

ECAC baseline scenario

The ECAC baseline scenario presented in the following tables was generated by EUROCONTROL for all ECAC States including the Canary Islands.

[1] The characteristics of the different scenarios can be found in Task 4: European Air Traffic in 2035, Challenges of Growth 2013, EUROCONTROL, June 2013 available at ECAC website

Over-flights of the ECAC area have not been included.The baseline scenario, which is presented in the following tables, does not include business and dedicated cargo traffic. It covers only commercial passenger flight movements for the area of scope outlined in the previous paragraph, using data for airport pairs, which allows for the generation of fuel efficiency data (in kg/RPK).

Historical fuel burn (2010) and emission calculations are based on the actual flight plans from the PRISME data warehouse, including the actual flight distance and the cruise altitude by airport pair.

Future year fuel burn and emissions (2020, 2035) are modelled based on actual flight distances and cruise altitudes by airport pair in 2014. Taxi times are not included. The baseline is presented along a scenario of engine-technology freeze, as of 2014, so aircraft not in service at that date are modelled with the fuel efficiency of comparable-role in-service aircraft (but with their own seating capacities).

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

The data and forecasts for Europe show two distinct phases, of rapid improvement followed by continuing, but much slower improvement after 2020. The optimism behind the forecast for the first decade is partly driven by statistics: in the 4 years 2010-2014, the average annual improvement in fuel efficiency for domestic and international flights was around 2%, [Source: EUROCONTROL] so this is already achieved. Underlying reasons for this include gains through improvements in load factors (e.g. more than 3% in total between 2010 and 2014), and use of slimmer seats allowing more seats on the same aircraft.

However, neither of these can be projected indefinitely into the future as a continuing benefit, since they will hit diminishing returns. In their place we have technology transitions to A320neo, B737max, C-series, B787 and A350 for example, especially over the next 5 years or so. Here this affects seat capacity, but in addition, as we exit from the long economic downturn, we see an acceleration of retirement of old, fuel-inefficient aircraft, as airline finances improve, and new models become available. After that, Europe believes that the rate of improvement would be much slower, and this is reflected in the ‘technology freeze’ scenario, generated by Eurocontrol.

Table 11. *Total fuel burn for passenger domestic and international flights (ECAC)*

Year	Traffic (millions of departing flights)	Total Fuel burn (in million tonnes)
2010	7,12	40,34
2020	8,48	48,33
2035	11,51	73,10

Table 12. *CO_2 emissions forecast*

Year	CO_2 emissions (in million tonnes)
2010	127,47
2020	152,72
2035	231,00

Table 13. *Traffic in RPK (domestic and international departing flights from ECAC airports, PAX only, no freight and dedicated cargo flights)*

Year	Traffic (in billion RPK)
2010	1 329,6
2020	1 958,7
2035	3 128,2

Table 14. *Fuel efficiency (kg/10RPK)*

Year	Fuel efficiency (in kg/10 RPK)
2010	0,3034
2020	0,2468
2035	0,2337

Table 15. *Average annual fuel efficiency improvement*

Period	Fuel efficiency improvement
2020 - 2010	-2,05%
2035 - 2020	-0,36%
2035 - 2010	-1,04%

In order to further improve fuel efficiency and to reduce future air traffic emissions beyond the projections in the baseline scenario, ECAC States have taken further action. A summary of the supranational measures taken by the Member States in order to to increase fuel efficiency and reduce greenhouse gases will be detailed in another section of Chapter 3 of this Action Plan.

It should be noted, however, that a quantification of the effects of many measures is difficult. As a consequence, no aggregated quantification of potential effects of the supranational measures can be presented in this Action Plan.

3.2. Aircraft- Related Technology Development

Aircraft emissions standards

European Member States fully supported the work achieved in ICAO's Committee on Aviation Environmental Protection (CAEP), which resulted in an agreement on the new aeroplane CO_2 Standard at CAEP/10 meeting in February 2016, applicable to new aeroplane type design from 2020 and to aeroplane type designs that are already in-production in 2023. Europe is contributing to this task notably through the European Aviation Safety Agency (EASA) which co-led the CO_2 Task Group within CAEP's Working Group 3, and which provided extensive technical and analytical support.

The assessment of the benefits provided by this measure in terms of reduction in European emissions is not provided in this action plan. Nonetheless, elements of assessment of the overall contribution of the CO2 standard towards the global aspirational goals are available in CAEP.

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. Set up as a Public Private Partnership between the European Commission and the European aeronautical industry, Clean Sky will pull together the research and technology resources of the European Union in a coherent programme, and contribute significantly to the 'greening' of aviation.

The first Clean Sky programme (Clean Sky1-2011-2017) has a budget of €1.6bn, equally shared between the European Commission and the aeronautics industry. It aim is to identify, develop environmental friendly technologies impacting all flying-segments of commercial aviation. The objectives are to reduce CO2 aircraft emission by 20-40%, NOx by around 60% and noise by up to 10dB compared to year 2000 aircraft.

It is estimated that Clean Sky 1 resulted in a reduction of aviation CO2 emissions by more than 20% with respect to baseline levels (in 2000), which represents an aggregate reduction of 2 to 3 billion tonnes of CO2 over the next 35 years

Clean Sky 1was followed up by a second programme Clean Sky 2 (2014-2024) with the objectives to reduce aircraft emission 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 €4billion.

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

Main remaining areas for Related Technology Development efforts under Clean Sky 2 are:

- **Large Passenger Aircraft**: demonstration of best technologies to achieve the environmental goals while fulfilling future market needs and improving the competitiveness of future products.
- **Regional Aircraft**: demonstrating and validating key technologies that will enable a 90-seat class turboprop aircraft to deliver breakthrough economic environmental performance and superior passenger experience.
- **Fast Rotorcraft**: demonstrating new rotorcraft concepts (tilt-rotor and Fast Craft compound helicopter) technologies to deliver superior vehicle versatility and performance.
- **Airframe:** demonstrating the benefits of advanced and innovative airframe structures (like a more efficient wing with natural laminar flow, optimised control surfaces, control systems and embedded systems, highly integrated in metallic and advanced composites structures). In

addition, novel engine integration strategies and investigate innovative fuselage structures will be tested.

- **Engines:** validating advanced and more radical engine architectures.
- **Systems:** demonstrating the advantages of applying new technologies in major areas such as power management, cockpit, wing, landing gear, to address the needs of future generation aircraft in terms of maturation, demonstration and Innovation
- **Small Air Transport:** demonstrating the advantages of applying key technologies on small aircraft demonstrators and to revitalise an important segment of the aeronautics sector that can bring key new mobility solutions.
- **Eco-Design:** coordinating research geared towards high eco-compliance in air vehicles over their product life and heightening the stewardship in intelligent Re-use, Recycling and advanced services.

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

3.3. Alternative Fuels

3.3.1 European Advanced Biofuels Flightpath

The European Union issued in 2008 a 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.

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[1]. 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[2]) 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.

March 2011, the European Commission published a White Paper on transport[3]. 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.

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

2 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.

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

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

This initiative is a shared and voluntary commitment by its members to support and promote the production, storage and distribution of sustainably produced drop-in biofuels for use in aviation. It also targets establishing appropriate financial mechanisms to support the construction of industrial "first of a kind" advanced biofuel production plants. The Biofuels Flight path is explained in a technical paper, which sets out in more detail the challenges and required actions[4].

More specifically, the initiative focuses on the following:

1. Facilitate the development of standards for drop-in biofuels and their certification for use in commercial aircraft;
2. Work together with the full supply chain to further develop worldwide accepted sustainability certification frameworks
3. Agree on biofuel take-off arrangements over a defined period of time and at a reasonable cost;
4. Promote appropriate public and private actions to ensure the market uptake of paraffinic biofuels by the aviation sector;
5. Establish financing structures to facilitate the realisation of 2nd Generation biofuel projects;
6. Accelerate targeted research and innovation for advanced biofuel technologies, and especially algae.
7. Take concrete actions to inform the European citizen of the benefits of replacing kerosene by certified sustainable biofuels.

According to IATA statistics were 2000 flights worldwide using bio-kerosene blends performed by 22 airlines between June 2011 and December 2015.

4 http://ec.europa.eu/energy/technology/initiatives/doc/20110622_biofuels_flight_path_technical_paper.pdf

3.3.2 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 (2012-2015): this project had a budget of 10 million euros, money coming from the European Union, the purpose of the program being to assess 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 economic 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 CO_2 and water. This was done by coupling a two-step solar thermochemical cycle based on non-stoichiometric ceria redox reactions with the Fischer-Tropsch process. This successful demonstration is further complemented by assessments of the chemical suitability of the solar kerosene, identification of technological gaps, and determination of the technological and economical potentials.

Core-JetFuel: €1,2m EU funding (2013-2017) this action evaluates the research and innovation "landscape" in order to develop and implement a strategy for sharing information, for coordinating initiatives, projects and results and to identify needs in research, standardisation, innovation/deployment, and policy measures at European level. Bottlenecks of research and innovation will be identified and, where appropriate, recommendations for the European Commission will be elaborated with respect to re-orientation and re-definition of priorities in the funding strategy. The consortium covers the entire alternative fuel production chain in four domains: Feedstock and sustainability; conversion technologies and radical concepts; technical compatibility, certification and deployment; policies, incentives and regulation. CORE-JetFuel ensures cooperation with other European, international and national initiatives and with the key stakeholders in the field. The expected benefits are enhanced knowledge of decision makers, support for maintaining coherent research policies and the promotion of a better understanding of future investments in aviation fuel research and innovation.

3.4 IMPROVED AIR TRAFFIC MANAGEMENT AND INFRASTRUCTURE USE

3.4.1 The EU's Single European Sky initiative and SESAR

The European Union's Single European Sky (SES) policy aims to reform Air Traffic Management (ATM) in Europe in order to enhance its performance in terms of its capacity to manage larger volume of flights in a safer, more cost-efficient and environmental friendly manner.
The SES aims at achieving 4 high level performance objectives (referred to 2005 context):

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

SESAR (Single European Sky Air Traffic Management Research), 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 Joint Undertaking and kept up to date in the ATM Master Plan.

The projection of SESAR target fuel efficiency beyond 2016 (Step 1,2,3[1]) is depicted in Figure.12 :

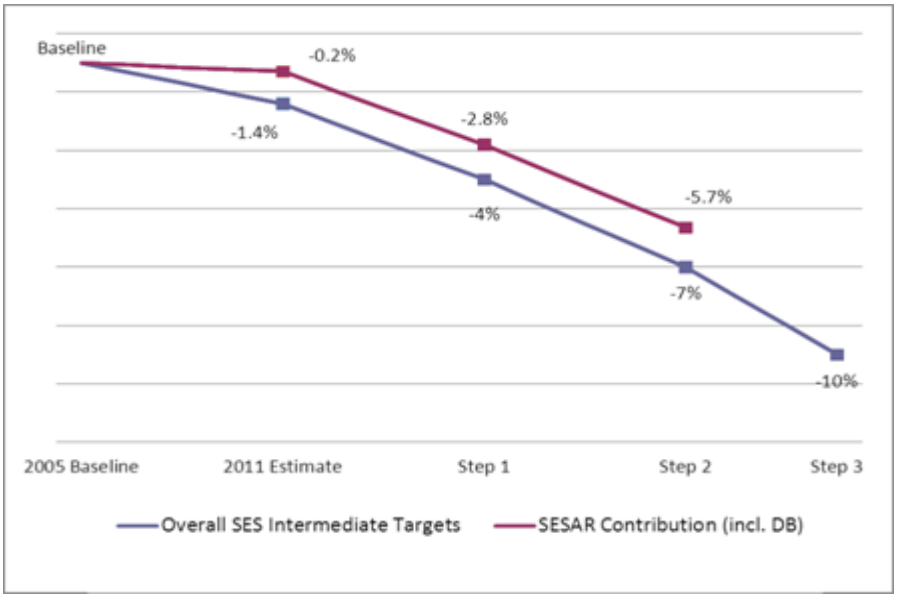


Figure.12 SESAR target fuel efficiency beyond 2016

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%.

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

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

Step 3, "Performance-based Operations" will achieve the high performance required to satisfy the SESAR target concept. The goal is the implementation of a European high-performance, integrated, network-centric, collaborative and seamless air/ground ATM system. "Performance-based Operations" is realised through the achievement of SWIM and collaboratively planned network operations with User Driven Prioritisation Processes (UDPP).

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.

3.4.2 SESAR Research Projects (environmental focus)

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

Environmental Research Projects:

So far, a series of environmental research projects have been completed within the framework of the SESAR program:

- Development of the Environment validation framework (Models and Tools);
- Development of environmental metrics;
- Development of a framework to establish interdependencies and trade-off with other performance areas;
- Future regulatory scenarios and risks;
- SESAR Environment support and coordination project (which ensures the coordination and facilitation of all the Environmental research projects activities).

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.

Beside these projects, 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 is an important area of SESAR 2020 work programme and although the safety aspects are considered to be the most challenging ones and will therefore mobilise most of research effort, the environmental aspects of these new operations operating from and to non-airport locations would also deserve specific attention in terms of emissions, noise and potentially visual annoyance.

SESAR demonstration projects:

In addition to its core activities, the SESAR JU co-finances projects where ATM stakeholders work collaboratively to perform integrated flight trials and demonstrations validating solutions for the reduction of CO_2 emissions for surface, terminal and oceanic operations to substantially accelerate the pace of change.

Since 2009, the SJU has co-financed a total 33 "green" projects in collaboration with global partners, under the Atlantic Interoperability Initiative to Reduce Emissions (AIRE), demonstrating solutions on commercial flights.

A total of 15767 flight trials were conducted under the AIRE initiative involving more than 100 stakeholders, demonstrating savings ranging from 20 to 1000kg fuel per flight (or 63 to 3150 kg of CO_2), and improvements to day-to-day operations. Other 9 demonstration projects took place from 2012 to 2014 focusing also on environment and during 2015 and 2016 the SESAR JU has co-financed 15 additional large-scale demonstrations projects more ambitious in geographic scale and technology. More information can be found at http://www.sesarju.eu

3.4.3 SESAR solutions and Common Projects for deployment

SESAR Solutions are operational and technological improvements that aim to contribute to the modernisation of the European and global ATM system. These solutions are systematically validated in real operational environments, which allow demonstrating clear business benefits for the ATM sector when they are deployed including the **reduction by up to 500 kg of fuel burned per flight by 2035 which corresponds to up to 1,6 tonnes of CO_2 emissions per flight, split across operating environments**.

By end of 2015 twenty-five SESAR Solutions were validated targeting the full range of ATM operational environments including airports. These solutions are made public on the SESAR JU website in a datapack form including all necessary technical documents to allow implementation.

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

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

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

- The Airport Integration and Throughput functionality is expected to improve runway safety and throughput, **ensuring benefits in terms of fuel consumption** and delay reduction as well as airport capacity.
- The Flexible Airspace Management and Free Route functionality is expected to enable a more efficient use of airspace, thus providing significant **benefits linked to fuel consumption** and delay reduction.
- The Network Collaborative Management functionality is expected to improve the quality and the timeliness of the network information shared by all ATM stakeholders, thus ensuring significant benefits in terms of Air Navigation Services productivity gains and delay cost savings.
- The Initial System Wide Information Management functionality, consisting of a set of services that are delivered and consumed through an internet protocol-based network by System Wide Information Management (SWIM) enabled systems, is expected to bring significant benefits in terms of ANS productivity.
- The Initial Trajectory Information Sharing functionality with enhanced flight data processing performances is expected to improve predictability of aircraft trajectory for the benefit of airspace users, the network manager and ANS providers, implying less tactical interventions and improved de-confliction situation. This is expected to have a positive impact on ANS productivity, **fuel saving** and delay variability.

3.4.4 SESAR 2020 programme

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

3.5 Economic / Market-Based Measures

3.5.1 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 CO_2 emissions, encompassing those from around 12 000 power stations and industrial plants in 31 countries, and, under its current scope, around 640 commercial and non-commercial aircraft operators that have flown between airports in the European Economic Area (EEA).

The EU ETS began operation in 2005; a series of important changes to the way it works took effect in 2013, strengthening the system. The third phase of EU-ETS (2013-2020) is significant different from the first two phases (2005-2007 and 2008-2012) and is based on much more harmonious rules at the level of the European Union. Instead of the national emission allocation system, there is now a European maximum ceiling (“cap and trade”), as well as a single European emissions register. Another rule is the auctions, compared to the free allocation method so far. The EU-ETS works on the "cap and trade" principle. This means there is a "cap", or limit, on the total amount of certain greenhouse gases that can be emitted by the factories, power plants, other installations and aircraft operators in the system. Within this cap, companies can sell to or buy emission allowances–from one another. The limit on allowances available provides certainty that the environmental objective is achieved and gives allowances a market value.

By the 30th April each year, companies, including aircraft operators, have to surrender allowances to cover their emissions from the previous calendar year. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or sell them to another company that is short of allowances.

The flexibility that trading brings ensures that emissions are cut where it costs least to do so. The number of allowances reduces over time so that total emissions fall. The volume of certificates at European level is reduced annually by applying the linear reduction factor of 1.74%, this measure leading to a reduction in the GES emissions.

As regards aviation, legislation to include aviation in the EU ETS was adopted in 2008 by the European Parliament and the Council[1]. The 2006 proposal to include aviation in the EU ETS was accompanied by detailed impact assessment[2]. 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.

In order to provide an impetus for the establishment and implementation of this global market-based mechanism (MBM) was approved the EU Regulation no.41/2014 amending Directive 2003/87/EC, establishing a scheme for trading the emission allowances with greenhouse effect within the Community, with a view to the implementation by 2020 of an international agreement on the application of a global market-based measure for emissions from international aviation. The implementation of this Regulation has decided to temporarily limit the scope of aviation activities covered by the EU ETS only to intra-European flights.

The temporary limitation applies for 2013-2016, following on from the April 2013 'stop the clock' Decision[3] 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.

Between 2013 and 2016, the EU ETS only covers emissions from flights between airports which are both in the EEA. The derogation established under the Regulation also applies to flights between an aerodrome located in one of the outermost regions within the meaning of Article 349 of the Treaty on the Functioning of the European Union (TFEU) and an aerodrome located in another region of the European Economic Area.

The complete, consistent, transparent and accurate monitoring, reporting and verification of greenhouse gas emissions remain fundamental for the effective operation of the EU ETS.

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

[2] 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

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[3] and 601/2012.[4]

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- they are excluded from the European certificate trading system, this means that many aircraft operators from developing countries are exempted from the EU ETS. Indeed, over 90 States have no commercial aircraft operators included in the scope of the EU ETS. From 2013 also flights by non-commercial aircraft operators with total annual emissions lower than 1 000 tonnes CO_2 per year are excluded from the EU ETS up to 2020.

A further administrative simplification applies to small aircraft operators emitting less than 25 000 tonnes of CO_2 per year, who can choose to use the small emitter`s tool rather than independent verification of their emissions. In addition, small emitter aircraft operators can use the simplified reporting procedures under the existing legislation.

The EU legislation foresees that, where a third country takes measures to reduce the climate change impact of flights departing from its airports, the EU will consider options available in order to provide for optimal interaction between the EU scheme and that country's measures. In such a case, flights arriving from the third country could be excluded from the scope of the EU ETS. The EU therefore encourages other countries to adopt measures of their own and is ready to engage in bilateral discussions with any country that has done so. The legislation also makes it clear that if there is agreement on global measures, the EU shall consider whether amendments to the EU legislation regarding aviation under the EU ETS are necessary.

Impact on fuel consumption and/or CO_2 emissions

The environmental outcome of an emissions trading system is determined by the emissions cap. Aircraft operators are able to use allowances from outside the aviation sector to cover their emissions. The absolute level of CO_2 emissions from the aviation sector itself can exceed the number of allowances allocated to it, as the increase is offset by CO_2 emissions reductions in other sectors of the economy covered by the EU ETS.

Verified CO_2 emissions from aviation activities carried out between aerodromes located in the EEA amounted to 56,9 million tonnes of CO_2 in 2015. This means that the EU ETS will contribute to achieve more than 17 million tonnes of emission reductions annually, or around 68 million over 2013-2016, partly within the sector (airlines reduce their emissions to avoid paying for additional units) or in other sectors (airlines purchase units from other ETS sectors, which would have to reduce their emissions consistently). While some reductions are likely to be within the aviation sector, encouraged by the EU ETS's economic incentive for limiting emissions or use of aviation biofuels, the majority of reductions are expected to occur in other sectors.

[3] 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

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 European Comission supports the reduction of greenhouse gas emissions through NER300 Programme, one of the largest global funding programs for innovative deployment projects in the field of carbon reduction. It supports ecological carbon capture and storage systems and the development of renewable energy technologies that can be used on a commercial scale across the EU. 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.

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. The purposes for which revenues from allowances should be used are stipulated in O.U.G 115/2011, regarding the establishment of the institutional framework and the authorization of the Government, through the Ministry of Public Finance, to auction the greenhouse gas emission allowances attributed to Romania at the level of the European Union, namely: 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.

3.5.2 The Bratislava Declaration and the 39th Meeting of the General Assembly of the International Civil Aviation Organization

ICAO, after several years of intensive negotiations at its 39th General Assembly in September/October 2016, reached – for the first time – an agreement on an ICAO Resolution for the implementation of a global market based measure (GMBM) to address the growth in international aviation emissions globally, from 2021 through a compensation system designed to enable the indicative target to stabilize emissions from international civil aviation at 2020 levels in the form of CORSIA (Carbon Offseting ans Reduction Scheme for International Aviation).

A proposal for a Regulation amending Directive 2003/87 / EC was tabled in January 2017 to maintain the current scope limitations for aviation activities and to prepare for the implementation of a global market-based measure from 2021 onwards, which provides for the continued application of the provisions of EU Regulation No 421/2014 for the period 2017-2020 for the application of the EU-ETS scheme.

In its first phase of GMBM (2021 - 2026), participation will be explicitly voluntary, with the option of applying it (66 Member States were volunteered); all countries should then participate in its second phase starting in

2027, except least developed countries, land-locked developing countries, small island developing states and states with a small share of international aviation activity (revenue tonne kilometre (RTK) of below 0.5% individually or below 10% in cumulative terms).

The EU and its Member States expressed their intention to apply the GMBM during its voluntary phase. While the aspirational goal and the basic nature of the GMBM as offsetting are agreed, a number of important features of the GMBM, key for its effectiveness and environmental integrity from a climate perspective, still need to be developed and agreed in ICAO before the GMBM can be implemented in 2021.

Any delays in agreeing on these elements risk delaying the operationalization of the GMBM.

Bratislava Declaration

In the context of Europe's engagement to reduce CO2 emissions and in line with the Paris Agreement at COP21, Directors General of European Civil Aviation Conference (ECAC) Member States agreed to commit to being part of the GMBM scheme from its start during their DGCA meeting hosted by the Republic of Slovakia. To this effect, they have endorsed a common declaration, the Bratislava Declaration, stating:

•They intend to implement the Global Market-Based Measure scheme for international aviation from the start;
•They welcome the commitment of a number of key aviation States and Regions of the world to also join the first implementation phase of the GMBM scheme and call on other major aviation States and those having the capacity to do so to do likewise and make their decision public before the end of the ICAO Assembly;
•They will work actively with other partners in order to reach a successful outcome at the ICAO Assembly; and
•They will strive to address, together with others, any future needs that may arise from States requiring technical assistance and capacity building in order to stand ready for the implementation of the scheme, including the ICAO Standards and Recommended Practices to be developed under the future GMBM scheme.

3.6. 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 aim of this programme is to encourage and enable airports to implement best practice carbon and energy management process and to gain public recognition of their achievements. The airports have to measure their CO_2 emissions in accordance with the World Resources Institute and World Business Council for Sustainable Development GHG Protocol and to get their emissions inventory assured by an independent third party.

This industry-driven initiative was officially endorsed by Eurocontrol and the European Civil Aviation Conference (ECAC). It is also officially supported by the United Nations Environmental Programme (UNEP). The programme is overseen by an independent Advisory Board.

In 2014 the programme reached global status with the extension of the programme to the ACI North American and Latin American & Caribbean regions, participation has increased to 125 airports, in over 40 countries across the world. These airports welcome 1,7 billion passengers a year, or 27,5 % of the global air passenger traffic.

Airport Carbon Accreditation is a four-step programme, from carbon mapping to carbon neutrality. The four steps of certification are: Level 1 "Mapping", Level 2 "Reduction", Level 3 "Optimisation", and Level 3+ "Carbon Neutrality".

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 CO_2 reduction associated with the activities they control.

In Europe , participation in the programme has increased from 17 airports to 92 in 2015. An number of 92 airports mapped their carbon footprints, 71 of them actively reduced their CO_2 emissions and engaged others to do so, and 20 became carbon neutral. European airports participating in the programme now represent 63, 9% of European air passenger traffic.

Anticipated benefits:

The Administrator of the programme has been collecting CO_2 data from participating airports over the past two years. This has allowed the absolute CO_2 reduction from the participation in the programme to be quantified.

Table no.16 **Emissions performance summary**

Variable	2013 -2014		2014-2015	
	Emissions	Number of airports	Emissions	Number of airports
Aggregate carbon footprint for 'year 0' for emissions under airports' direct control (all airports)	2 044 683 tonnes CO_2	85	2 089 358 tonnes CO_2	92
Carbon footprint per passenger	2,01 kg CO_2		1,89 kg CO_2	
Aggregate reduction in emissions from sources under airports' direct control (Level 2 and above)	87 449 tonnes CO_2	56	139 022 tonnes CO_2	71
Carbon footprint reduction per passenger	0,11 kg CO_2		0,15 kg CO_2	
Total carbon footprint for 'year 0' for emissions sources which an airport	12 777 994 tonnes CO_2	31	14 037 537 tonnes CO_2	36

may guide or influence (level 3 and above)				
Aggregate reductions from emissions sources which an airport may guide or influence	223 905 tonnes CO_2		550 884 tonnes CO_2	
Total emissions offset (Level 3+)	181 496 tonnes CO_2	16	294 385 tonnes CO_2	20

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 Landing and take-off 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.

CHAPTER 4. NATIONAL ACTION PLAN TO REDUCE EMISSIONS OF GREENHOUSE GASSES IN CIVIL AVIATION FOR 2011-2020

4.1. General Provision

Globally, aviation contributes significantly to climate change, being the transport sector which records the fastest growth, the trend for the coming years being one of considerable growth.

A report by the European Environment Agency (AEM) of 2010 pointed out that emission of greenhouse gases from international civil aviation in the 32 AEM member states increased from 19.19 million tons of CO_2 to 29.65 million tons of CO_2, between 1990 and 2007. Considering the number of kilometres travelled on the flights performed, civil aviation remains the mode of transport with the most considerable increase in the transport sector.

Measures that could be taken globally to reduce emissions of greenhouse gases have been identified by the Working Group on CO_2 emissions in aviation established by ICAO. The working group was set up in 2007 and focused on analysing the impact of civil aviation on climate change. The developed study led to the identification of the following areas in which measures can be taken to reduce emissions of greenhouse gases, namely:

a) Economic - market measures "Market Based Measures" (EU ETS, taxes, offset / offset emissions);
b) Operational (reduced use of auxiliary power unit - APU, efficient flight procedures, measures to reduce aircraft weight, aircraft ground movement procedures - "one engine taxi in & out" etc.);
c) Technological (including fleet renewals, alternative fuels, efficient technologies and equipment that will be developed through Clean Sky etc.);
d) ATM and infrastructure;
e) Legislation.

4.2. Objectives

The National Action Plan on reducing of greenhouse gases emissions in civil aviation for the period 2011-2020 aims at:

a) the fulfilment of strategic EU commitment to reduce emissions of greenhouse gases;
b) capping CO_2 emissions from the international civil aviation sector by 2020.

4.3. Actions/ projects already initiated and/ or implemented in Romania to achieve the objectives

Based on studies and analysis presented in section 4.1, the activities conducted to date in Romania in order to reduce CO_2 emissions from aviation activities were focused on the *operations, ATM* and *infrastructure* through the implementation of specific projects, in collaboration with various organizations/ institutions/ companies.

Some of these actions are listed below:

a) **"Save One Minute initiative"** - a project undertaken by Romanian Air Traffic Services Agency (ROMATSA) which includes measures to reduce emissions of greenhouse gases:
   - identifying operational opportunities to minimize flight time and to ensure fuel economy;
   - providing direct routes for the air operators by the air traffic control units;
   - allocation of the optimum flight level;
   - providing accurate weather forecasts.

b) **"Basic Continuous Descent" / B-CDA Project**
   A project initiated by the National Company "Bucharest Airports" / International Airport "Henri Coanda" and consisting of reducing the consumed fuel and the airport noises generated by aircraft in the landing sequence, by identifying the methodology of implementation of this procedure (CDA Guidelines). Project developed through collaboration between Tarom, ROMATSA and RCAA in 2003-2005 and funded by EUROCONTROL.

c) "Airport Local Air Quality Studies "
   A project initiated by the National Company "Bucharest Airports" / International Airport "Henri Coanda" and consisting of identifying the impact of air and road traffic on the air quality, setting up through a dedicated software of a database regarding the atmosphere. The project was carried out with the collaboration between the National Company of "Airports Bucharest" S.A, the "Est Consult" Commercial Company S.A and ENV-ISA (France) Commercial Company in 2005 and financed by EUROCONTROL.

d) "Environmentally Responsible Air Transport" / ERAT Project
European project which aims at reducing the environmental impact of air traffic on airport neighbourhood, by the development and integration into an unified concept of airline operating process;
The project was co - funded by EU and was completed in 2011 by the National Company of "Bucharest Airports" / International Airport "Henri Coanda", together with To70 - Aviation & Environment - integrator and project manager, Eurocontrol Experimental Centre, Airbus France, National Aerospace

Laboratory, Deutsche Lufthansa, National Air Traffic Services, SNECMA, Deutsche Zentrum fur Luft und Raumfahrt, Luftfartsverket, ENV-ISA.

e) "Continuous Descent Approach" (CDA) Project

The project represents the continuation of the projects for "landing trajectory optimization", the first project being initiated during 2003-2005 (B-CDA / Basic Continuous Descent Approach) together with EUROCONTROL.

European project initiated by TAROM and Airbus aiming to optimize the continuous landing trajectory. TAROM local partners in this project are: ROMATSA, RCAA and the National Company "Bucharest Airports" / International Airport "Henri Coanda".

f) **"Direct To"-** a project involving the introduction of direct flights and shorter routes within the Flight Information Region (FIR) Bucharest.

In the action program to improve flight efficiency, ROMATSA developed this project which contributes to this process through operational measures, giving users shorter routes and direct flights in FIR Bucharest.

g) Implementation of fuel consumption optimization program at TAROM

The goal of the program is to fuel fuel efficiency and to identify areas where fuel savings can be made so as to reduce the amount of emissions produced by Tarom's aircraft.

Measures under the program are represented by the application of procedures for "fuel efficiency":

- take-off by FLEX method/ Assumed Temp/ Derate to protect engines and low consumption on long-term;
- taking off with minimum flaps;
- accelerating at more economical speed "Enroute climb", under 100 where possible;
- use Cost Index to ensure compliance with flight schedule and minimum fuel consumption;
- use cruise optimal level;
- continuous descent approach;
- minimum flaps landing where possible;
- use of the reversers on "idle" (minimum) for most landings;
- single engine taxi;
- optimizing the use of APU;
- reducing aircraft weight by limiting the number of magazines, newspapers, catering etc.;
- loading the aircraft so that the position of the weight centre in flight is at the back as much as possible, thus ensuring a minimum consumption of fuel;
- optimization of each flight schedule, according to the conditions of the day;
- transmission of flight schedule closer to take-off time;
- use of 3 Cost Index values according to the flight duration and the wind, resulting in more economic flights, according to the conditions of the day;

- quality flight planning software implementation;

h) Application of Winglet devices for Boeing 737-700 aircraft of TAROM fleet.

4.4. Description of actions at national level for reducing of emissions of greenhouse gases in civil aviation during the period 2011-2020

Detailed description of actions to be undertaken at national level to achieve the objectives mentioned in section 4.2 is presented in Annex 2.

4.5. National institutions with responsibilities

The institutions responsible for implementing the action plan: Ministry of Transport, Ministry of Environment and subordinated authorities, aircraft operators, airport administrations, research institutes, according to the proposed actions.

4.6. Resources needed to implement the proposed actions

Depending on the actions outlined in the plan, the following aspects were identified:

a) human resources - the staff of the specialized departments of the institutions responsible for the implementation of the action plan;
b) financial resources - financial resources necessary to implement the action plan will consist of: own sources of economic agents involved, funds obtained through EU or World Bank programs and other funds that could be accessed depending on the programs available for this area.

4.7. Assessment actions

Romanian air carriers, airport administrations, ROMATSA and Romanian Civil Aviation Authority presents annually to Ministry of Transport a report containing the description of the projects and measures implemented or being implemented in accordance with the actions provided in Annex 2.

Reporting deadline: up to 1 March of each year, for the previous year (first report, for activities performed in 2011 will be submitted until 31 March 2012).

Reports shall contain a description of projects/ measures implemented/ under implementation and an evaluation of their effects in terms of fuel consumption efficiency and reduction of CO2 emissions.

Reports will also contain the following global statistics related to air transport activity in the monitored calendar year: tonne-km (data calculated in accordance with EU Regulation no. No 601/2012 on monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87 / EC of the European Parliament and Council, as amended) and the amount and type of fuel used. MT ensures confidentiality of data and information provided by operators.

Ministry of Transport may request to National Agency for Environment Protection to transmit data on total CO_2 emissions and aggregated data on different types of fuel used by Romanian air carriers covered by Annex no. 1 of the Directive 2008/ 101/ EC, provided they respect confidentiality of data and information provided by operators. Transmission of these data will be subject to a protocol between the two institutions.

Based on data received, Ministry of Transport elaborates the annual report on actions for aviation fuel consumption efficiency and reducing emissions of greenhouse gases due to civil aviation activities. The first report was issued by Ministry of Transportation in 2012 for actions undertaken in 2011.

4.8. Update of the action plan

The National Action Plan is a dynamic instrument that will be updated regularly in order to facilitate decisions on policies and measures in civil aviation, so it can adapt to economic development of Romania and of the European Union established objectives for reducing emissions of greenhouse gases. The action plan will be updated by a joint Decision of the Ministry of Transport and the Ministry of the Environment.

Periodic reports to the International Civil Aviation Organization are made by the Ministry of Transport, the Air Transport Directorate through the person designated as the National Focal Point for the Action Plan, with the support of the other authorities and units with responsibilities in this area.

CHAPTER 5
Annexes to the National Action Plan

`

Annex no. 1- Legislation in the field of environmental protection is an integral part of this national action plan.
Annex no.2- The description of the actions covered by the National Action Plan for the reduction of greenhouse gas emissions in the field of civil aviation for the period 2011-2020 is an integral part of this National Action Plan.

ANNEX 1

LEGISLATION IN THE FIELD OF ENVIRONMENTAL PROTECTION

I. International Treaties

- Convention on International Civil Aviation, signed at Chicago on 7 December 1944, hereinafter referred to as the Chicago Convention, ratified by Romania by the Decree no. 194/ 1965, published in Official Gazette no. 14 of April 29, 1965. As a Contracting State to the Chicago Convention, Romania has the obligation to implement and enforce such provisions of the Convention, as well as standards set out in annexes.

- United Nations Framework Convention on Climate Change ratified by Law no. 24/ 1994. This Convention establishes the general framework of intergovernmental actions of response to climate change challenge and is mainly aimed at achieving stabilization of greenhouse gas concentrations in atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

- Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted on 11 December 1997, ratified by Law no. 3/ 2001. Romania has signed the Kyoto Protocol in 1999. The value of commitment to reduce emissions of greenhouse gases adopted by Romania is 8% as compared to 1989. The Kyoto Protocol entered into force internationally on 16 February 2005. The Protocol also provides for the possibility of using voluntarily the three flexible mechanisms: Joint Implementation (JI), Clean Development Mechanism (CDM) and International Emissions Trading (IET).

II. European Legislation

1. EU ETS scheme

- Directive 2003/ 87/ EC of the European Parliament and the Council of 13 October 2003 establishing a scheme for trading greenhouse gas emission quota within the Community and amending Council Directive 96/ 61/ EC, transposed into national legislation by Government Decision no. 780/ 2006 regarding the establishment of emissions trading scheme, with subsequent amendments;
- Directive 2008/101 / EC of the European Parliament and of the Council amending Directive 2003/87 / EC to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community;
- Regulation (EU) 1031/ 2010 of 12 November 2010 on the schedule, administration and other aspects of the auctioned allowances of greenhouse gas emissions pursuant to Directive 2003/ 87/ EC of the European Parliament and Council establishing a trading system for the emissions of greenhouse gases within the Community.

- Regulation (EU) No 600/2012 on verifying greenhouse gas emissions reports and tonne-kilometre data and accreditation of verifiers in accordance with Directive 2003/87 / EC of the European Parliament and of the Council;
- Regulation (EU) 601/2012 on monitoring and reporting of greenhouse gas emissions in accordance with Directive 2003/87 / EC of the European Parliament and of the Council;
- Decision No 377/2013/EU of the European Parliament and of the Council of 24 April 2013 derogating temporarily from Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community;
- 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.

2. Alternative fuels

- Directive 2001/77/EC of the European Parliament and the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, transposed by Government Decision no. 443/ 2003 regarding the promotion of electricity from renewable energy sources, as amended;

- Directive 2003/ 30/ EC of the European Parliament and the Council of 8 May 2003 to promote use of biofuels and other renewable fuels for transport, transposed by Government Decision no. 1.844/ 2005 to promote biofuels and other renewable fuels for transport, with subsequent amendments;

- Directive 2009/ 28/ EC of the European Parliament and the Council of 23 April 2009 on promoting renewable energy use, for the modification and subsequent cancelation of Directives 2001/ 77/ EC and 2003/ 30/ EC;
- Decision 2009/ 548/ CE Decision of 30 June 2009 establishing a model for national action plans on energy from renewable sources under Directive 2009/28/EC of the European Parliament and the Council.

ANNEX 2

Description of actions at national level for reducing of greenhouse gas emissions in civil aviation during the period 2011-2020

1. Legal and inter-institutional actions

1.1. Adoption of international regulations / legislation in the field of reducing GHG emissions

The relevance of including this action: depending on the evolution of specific regulations at the international level, including the European one, it will be necessary to update the national legislation.

Detailing shortcomings: not applicable.

Description of action: national transposition and implementation of international legislation, including European legislation in the field.

Institutions responsible for implementing the action: Ministry of Environment, Ministry of Transport, with the support of other authorities and units with responsibilities in this area.

Deadline for implementation of action: continuous

Resources needed for implementation: None.

Expected effects due to the implementation of action: implementation of the specific international law, including European law.

1.2. Participation in the negotiations on environmental impact of civil aviation

The relevance of including this action:
It must take in to account:
In October 2016, at the 39th Session of the General Assembly, the ICAO adopted a Global Market-based Measure (GMBM) resolution to limit global aviation emissions from international aviation from 2021 onwards, a compensation scheme designed to enable the indicative target to stabilize emissions from international aviation at 2020 levels. During the first phase of the GMBM (2021-2026), participation in the GMBM will be explicitly voluntary. All major aviation countries should apply GMBM from the beginning of the second phase in 2027;
The Kyoto Protocol represents only a first step in addressing climate change issues;

The Paris Agreement is an agreement under the United Nations Framework Convention on Climate Change. It provides measures to reduce greenhouse gas emissions in order to limit the average increase in global temperatures to no more than 2 °C against the pre-industrial period and with the prospects of stopping this increase to 1.5 degrees Celsius relative to the same period.

Detailing shortcomings:
It has to be considered a number of priorities regarding Romania's participation in activities post-2012 (taking into account the EU's approach):

- commitments to reduce GHG emissions after 2012;
- long-term policies and measures to reduce GHG emissions, including technological innovation;
- distribution on sectors of the commitments to reduce GHG emissions in the EU post-2012;
- the integration of the issues on climate change in long-term investments in transportation/ aviation and in the sector of renewable energy sources/ alternative fuels.

Description of action: Participation of the representatives of the Ministry of Transport and the Ministry of Environment at the meetings organized at the level of the structures within the EU, at the working groups of the European Commission, the Council of Europe, etc., which discuss aspects regarding the reduction of aviation emissions from aviation activities through the implementation of the EU ETS scheme, as well as in the framework of international negotiations on climate change;
Preparing studies on greenhouse gas emissions projections in the field of civil aviation and the consequences of future commitments on the Romanian economy. Ministry of Transport, with technical assistance from Ministry of Environment, will develop medium and long-term scenarios of national air transport development and GHG emissions reduction to base decisions on future commitments. In this context, the National Environmental Protection Agency can only provide data on the CO2 emissions of aircraft operators.

Institutions responsible for implementing the action: Ministry of Transport, Ministry of Environment.

Deadline for implementation of action: 2012-2020

Resources needed for implementation: in the case of the participation of line ministries at various meetings, the line ministries will continue to negotiate the actions and deadlines for their implementation in the civil aviation sector with Ministry of Transport consultation / collaboration. At the level of these ministries there will be organized working groups specialized in the field of climate change.

Expected effects due to the implementation of action: Romania will be prepared to have a position on the future commitments regarding the reducing of GHG emissions in civil aviation, reflecting national and economic priorities as well as a sustainable development.

2. Economic level actions (See Chapter 3.5)

Implementation of the EU ETS scheme

The relevance of including this action: Directive 2008/101 / EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87 / EC to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community. This regulation has been transposed into national legislation by Government Decision no.780 / 2006 establishing the greenhouse gas emission allowance trading scheme, as amended and supplemented.

Detailing shortcomings: completing the existing human resources at National Environmental Agency Protection, which is responsible for ensuring the implementation of Directive 2008/101 / EC.

Description of action:
The EU Emissions Trading System (EU ETS) is key tool based on "cap and trade" principle, and the participation of the aircraft operator which carries out aviation activities covered by the Directive 2008/101/EC implies compliance with certain obligations under European regulations:

- aircraft operators are required to monitor and report greenhouse gas emissions in accordance with the provisions of Regulation (EU) No.601 / 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87 / EC of the European Parliament and of the Council and emission monitoring plans approved by National Environmental Protection Agency;
- aircraft operators have the obligation to submit to the National Environmental Protection Agency, by March 1st of each year, the monitoring report for the previous calendar year, verified by an accredited verifier;
- aircraft operators shall be required to return, by 30 April each year, a number of greenhouse gas emission allowances equal to the total quantity of greenhouse gas emissions generated in the previous calendar year. The National Environmental Protection Agency has the competence to verify and approve the monitoring plans drawn up by the aircraft operators, to verify and validate the monitoring reports for greenhouse gas emissions, verified by the verification bodies accredited by the national accreditation body or the accreditation body from another EU Member State, in accordance with Regulation No.600 / 2012. Also, the National Environmental Protection Agency has the competence to verify in the Single Registry the compliance of aircraft operators with the return of the number of greenhouse gas emission allowances corresponding to the value of emissions from the previous year.

At the end of a calendar year, aircraft operators may be in the following situations:

- emit under the limit of the allocated ceiling, so they are able to decide on the marketing of a number of greenhouse gas emission allowances available; in this situation we can find aircraft operators who invest in fuel-efficient aircraft, use aircraft with the capacity to load demand and optimum flight routes;
- emit over the limit of the allocated ceiling- in which case they must acquire greenhouse gas emission certificates on the market in order to comply with their obligation to return the certificates

to the registry. In this situation, it is possible to find aircraft operators that operate on short distances, use older aircraft or carry fewer passengers or cargo. They are more affected by inclusion in the EU ETS scheme, than operators with a higher degree of efficiency considering the cost of the fuel used;
- emit in the limit of the allocated ceiling.

For the effective implementation of Directive 2008/101 / EC are necessary:
- increasing and improving the institutional capacity at NEPA level, ensuring the participation of NEPA representatives in training sessions in the field, seminars, international conferences, programs and projects;
- stepping up awareness and dissemination of information to aircraft operators through the organization of seminars or other information on the implementation of the EU ETS scheme, allocation of emission allowances, operator compliance, monitoring of GHG emissions according to the approved PM, improvement report , the benefits of implementation, participation in research on climate impact mitigation by reducing CO2 and fuel efficiency.

Institutions responsible for implementing the action: Ministry of Environment, National Environmental Protection Agency, aircraft operators.

Deadline for implementation of action: 2012-2020.

Resources needed for implementation: funds from the state budget, European programs.

Expected effects due to the implementation of action: the contribution of the aviation sector to reducing greenhouse gas emissions, in line with the EU's commitment, on average by 20% by 2020 and by 50% by 2050 (as compared to 1990), capping CO2 emissions from aviation activities starting with 2020.

3. Operational actions

3.1. Implementation of measures in the management of airport activities to reduce CO_2 emissions

The relevance of including this action: Airports Council International (ACI) estimates that 5% of CO_2 emissions from aviation activities are due to airport activities.

Detailing shortcomings: Not applicable.

Description of action:
- implementation of the concept A-CDM (Airport Collaborative Decision Making) at all airports with significant traffic in Romania (over a million passengers/ year or over 25,000 aircraft movements/ year);

- maintaining the qualification level for Phase II "Reduction" of "Henri Coanda" International Airport Bucharest, within the airport carbon accreditation program launched by ACI.

Institutions responsible for implementing the action: the administrations of airports with over one million passengers/ year or 25,000 aircraft movements / year.

Deadline for implementation of action: 2011-2020
Resources needed for implementation: Airports resources, public funding.

Expected effects due to the implementation of action: reducing traffic congestion in airports, reduce emissions of NO_x, CO_2 VOC / VOC (volatile organic compounds) and thus reduce the effect on the ozone layer O3 and noise.

3.2. Continuous promotion of practices and procedures at operational level with an impact on reducing fuel consumption

The relevance of including this action: improve fuel efficiency.

Description of action:

- Using best practices and procedures in ground operations to reduce fuel consumption:
  - use a Cost Index range to ensure compliance with the flight schedule and minimum fuel consumption;
  - "Single engine taxi";
  - optimizing of the use of auxiliary power units (APU);
  - reducing aircraft weight;
  - loading the aircraft so that the position of the centre of gravity in flight is as backward as possible, thus ensuring a minimum consumption of fuel;
  - optimization of each flight schedule, according to the conditions of the day;
  - transmission of flight schedules as close as possible to take-off time;
  - use of 3 values of the Cost Index depending on the flight duration and the wind, resulting in a total of more economical flights, based on the conditions of the day;
  - quality flight planning software implementation/ selection of efficient aircraft for the flights according to flight duration and distance.
- Using best practices and procedures during the flight:
  - use of optimal cruise level;
  - extending the studies regarding the impact of applying some CDA procedures (Continuous Descent approach) at all airports with significant traffic;
  - minimum landing flaps, where possible;
  - take-off with FLEX method/ Assumed Temp/ Derate for the engines protection and as low consumption as possible on long-term;
  - take off with minimum flaps;

- accelerating at a more economical "Enroute climb" speed, under level 100 where possible;
- use the reversers on "idle" position (minimum) for most landings.

Institutions responsible for implementing the action: Air carriers, airports, ROMATSA.

Deadline for implementation of action: 2011-2020

Resources needed for implementation: training of the crew and of the aeronautical staff on the application of the best practices and procedures in the flight operations.

Expected effects due to the implementation of action: at international level, following studies, it is expected that measures to improve the practices and procedures applicable in the field of flight operations can lead to a reduction in CO_2 emissions by 2020 up to 3%.

4. Technological actions

4.1. Development of research in environmental protection in civil aviation. The familiarization of the civil aviation industry with the new technologies and procedures with impact on reducing the GHG emissions.

The relevance of including this action: promoting research in environmental protection in civil aviation, informing the industry correctly on new technologies applied in the field.

Detailing shortcomings: lack of research projects in environmental protection in civil aviation.

Description of action: promoting opportunities to finance research and development projects aiming to support long-term climate objectives. Seminars and workshops with the theme of promoting innovation and new technologies will be organized in order to contribute to achieving long-term emission reduction and to improve efficiency and competitiveness of air operators.

Institutions responsible for implementing the action: Ministry of Environment, Ministry of Transport/ Romanian Civil Aviation Authority, air operators, airport administrations, ROMATSA, research institutes in the field.

Deadline for implementation of action: 2012-2020

Resources needed for implementation: National financing, European programs.

Expected effects due to the implementation of action: encouraging research and development in civil aviation, familiarization of aviation industry with the new technologies and procedures applicable with the effect of reducing the impact of aviation on the environment, setting up conditions for the transition, after 2020, to a program to reduce GHG emissions by using new technologies and equipment.

4.2. Promote use of bio-fuels in civil aviation (see also Chapter 3.3.)

The relevance of including this action:

- 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. Currently biofuels are used in aviation only at the experimental level.
- In March 2011, the European Commission published a White Paper on transport. 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.

Detailing shortcomings: Not applicable.

Description of action:

- Actions to be included in order to promote use of bio-fuels in aviation:
  - exploring the possibilities of subsidizing producers of alternative fuels;
  - participation in specific European / international projects;
  - identifying own initiatives through participation in common projects developed with the aviation industry and promoting Romanian existing opportunities.

Institutions responsible for implementing the action: MECMA, according to the National Action Plan on renewable energy, developed under Directive 2009/ 28/ EC, airlines.

Deadline for implementation of action: 2012-2022

Resources needed for implementation: sources of funding: public (including european programs) and private.

Expected effects due to the implementation of action: the use of biofuels in aviation. Currently biofuels are used in aviation only at the experimental level. Utilization of a maximum rate of 6% alternative fuels by 2020 in civil aviation will lead to a reduction of CO_2 of 5%.

4.3. Acquisition/ use of more efficient aircraft in terms of energy

The relevance of including this action: acquisition/ use of more efficient aircraft in terms of energy is one of the EU key objectives to reduce GHG emissions. IATA expects that implementation of these measures, according to current business plans of the airlines, can provide a reduction in CO_2 emissions by 21% until 2020.

Detailing shortcomings: fleet renewal depends on the appropriate funding.

Description of action: implementation by air carriers of some programs for the renewal/modernization of their fleet.
Institutions responsible for implementing the action: Air carriers.

Deadline for implementation of action: according to the business plans of air operators, subject to the identification of financial resources.

Resources needed for implementation: financial resources of air operators.

Expected effects due to the implementation of action: significant reduction in CO_2 emissions. In the context of the implementation of the EU ETS scheme, air carriers developing their traffic will avoid the risk of additional costs generated by the need to purchase emission certificates from the market (due to operation of an inefficient fleet in respect of energy).

5. Actions undertaken at the level of ATM/ infrastructure

5.1. Development/ Modernization of airport infrastructure and related equipment to allow the efficient procedures for take-off/ landing

The relevance of including this action: increasing flight safety, fuel efficiency.
Detailing shortcomings: there are airports where the quality of the infrastructure and related equipment do not allow improvement of the flight activities.

Description of action:

- Development/ modernization of the infrastructure at the airports in Romania, in accordance with the General Transport Master Plan of Romania approved by the Government Decision no.666 / 2016
- completion of the operational implementation of ILS / DME systems at all airports in Romania.

Institutions responsible for implementing the action: ROMATSA, airport administrations, Ministry of Transport/ Romanian Civil Aviation Authority (for the certification of works).

Deadline for implementation of action: 2011-2020

Resources needed for implementation: ROMATSA and airports own resources, public funds, european funds.

Expected effects due to the implementation of action: optimizing airport activity, improving services and environment quality, reduce fuel consumption through the possibility of implementing efficient procedures for take-off/ landing.

5.2. Implementation of the Single European Sky SES / SESAR regulation package and Performance Base Navigation (PBN) concept

The relevance of including this action:

- EU regulatory package SES/ SESAR/PBN-ICAO requires the achievement of the SESAR objectives (see point 1.2.2) and the performance targets set in accordance with Commission Regulation (EU) No 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No 2096/2005 laying down common requirements for the provision of air navigation services.

Detailing shortcomings: Not applicable.

Description of action:

- optimizing the airspace structure for making efficient the flight activity within the DANUBE FAB;
- extension of using the "Direct to" and „Free routes" concept in the DANUBE FAB air space;
- establishment of national environmental targets which have to be met by the air navigation service providers during 2015-2020, taking into account the relevant EU targets; Development and Implementation of ATM ROMATSA 2015^{+} Program.
- developing the national plan towards the implementation of the PBN (Performance Based Navigation Program) concept.

- **Institutions responsible for implementing the action:** Ministry of Transport, Romanian Civil Aviation Authority, ROMATSA.

Deadline for implementation of action: 2011-2020

Resources needed for implementation: ROMATSA and airports own resources, public funds.

Expected effects due to the implementation of action:

- IATA believes that implementing an efficient ATM system, such as the one promoted through the SES / SESAR package, may lead to a 4% reduction in CO 2 emissions by 2020;
- at national level it is expected a reduction in the total time of flight in the airspace of Romania and Bulgaria of about 7,000 hours/ year as a result of implementing DANUBE FAB project. At the same time, the concept of "Direct to" will lead to an average reduction of flight time with two minutes/ each route.
- reduce aviation congestion, conserve fuel, protect the environment, reduce the impact of aircraft noise and maintain reliable, all-weather operations, even at the most challenging airports. It provides operators with greater flexibility and better operating returns while increasing the safety of regional and national airspace systems.

5.3. Development of cooperation ATM projects with neighbouring States

The relevance of including this action: implementation of an efficient ATM system is difficult without the cooperation with neighbouring countries.

Detailing shortcomings: lack of cooperation with neighbouring countries in the ATM may lead to an inefficient own ATM system.

Description of action:

- continuing and developing ATM cooperation mechanisms with : Turkey, Bulgaria ,Moldavia, Hungary, Serbia and Ukraine;
- support non-EU neighbouring states in understanding the concept SES/ SESAR and analysis of opportunities of coordination/ cooperation between air navigation services providers, including implementation of actions promoted in the SES (optimization of space structures, functional airspace blocks, etc.).

Institutions responsible for implementing the action: Ministry of Transport, Romanian Civil Aviation Authority, ROMATSA.

Deadline for implementation of action: 2011-2020

Resources needed for implementation: Bilateral projects can be co-financed through EU programs or by air navigation service providers.
Expected effects due to the implementation of action: ATM efficiency in neighbouring airspace leads to an expansion of opportunities to improve the efficiency of flight activities provided by air carriers, having as impact also the reduction of CO_2 emissions.

6. Other actions

6.1. Promoting international and european projects to reduce the impact of aviation on the environment

The relevance of including this action: participation in international and European projects in the field of reducing greenhouse gas emissions offers opportunities and expertise for their development and implementation at national level.

Detailing shortcomings: not applicable

Description of action: the participation of aviation organizations in Romania in environmental impact projects carried out in different fields: ATM, Technology, Operations, Economic. Examples of ongoing projects: Clean Sky, SES/SESAR, CDA, A-CDM.

Institutions responsible for implementing the action: Ministry of Transport, Romanian Civil Aviation Authority, airport administrations, air carriers, ROMATSA.

Deadline for implementation of action: 2011-2020.

Resources needed for implementation: international projects may be funded by community funds or industry.

Expected effects due to the implementation of action: obtaining new information, reducing impact / emissions, new technologies, know-how.

6.2 Promoting the concept of Carbon Footprint

The relevance of including this action: carbon footprint is the amount of CO_2 produced through energy consumption, including oil; for example, an aircraft produces carbon footprint through the fuel used. This is measured in units of carbon dioxide (CO_2). ICAO has developed the carbon emissions calculator which allows passengers to estimate emissions from the flights. It is easy to be used and requires only a limited amount of information from the user. The methodology applies the best data available from industry in order to take into account various factors, such as aircraft type, route specific data, load factors for the passengers and goods transported. Some airlines use this tool to determine the CO_2 emitted on the route requested by the passenger.

Detailing shortcomings: does not currently apply in Romania.

Description of action: this tool for calculating CO_2 emissions can be used by passengers to find out the amount of CO_2 emitted for a desired flight route. Airlines will develop carbon offset projects (CO_2 compensation) through which, requiring passengers to participate in them, may request an additional fee to the ticket, a voluntary participation, etc.

Institutions responsible for implementing the action: air carriers.

Deadline for implementation of action: not applicable

Resources needed for implementation: campaigns to inform the population on this action and awareness on the impact of each flight on the environment. External funding opportunities, analysing European and international programs, which may be eligible for this type of projects. Participation of passengers in carbon offset scheme may lead to the financing of smaller projects.

Expected effects due to the implementation of action: public awareness on the effects of each flight on the environment in terms of CO_2 emissions quantity.