ICAO Action Plan on CO_2 Emission Reduction of Albania

June 2021

Albanian Civil Aviation Authority (ACAA)

Civil Aviation Authority (CAA)
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List of abbreviations

AAT- Aircraft Assignment Tool

ACA - Airport Carbon Accreditation

ACARE – Advisory Council for Research and Innovation in Europe

ACARS – Aircraft Communications Addressing and Reporting System

ACC – Area Control Centres

ACCAPEG – Aviation and Climate Change Action Plan Expert Group

ACI – Airports Council International

ADS-B - Automatic Dependent Surveillance-Broadcast

AEM – Advanced Emission Model

AFTF – Alternative Fuels Task Force (of ICAO CAEP)

AIRE – The Atlantic Interoperability Initiative to Reduce Emissions

ANS – Air Navigation Service

AOP -Airport Operation Plan

APER TG - Action Plans for Emissions Reduction Task Group of the ECAC/EU Aviation and Environment Working Group (EAEG)

ATC – Air Traffic Control

ATM – Air Traffic Management

BAU – Business as Usual

CAEP – Committee on Aviation Environmental Protection

CCD – Continuous Climb Departures

CDA – Continuous Descent Approach

CDA – Continuous Descent Approach

CDM - Collaborative Decision Making

CDO - Continuous Descent Operations

CEN -The European Committee for Standardization

CNG – Carbon neutral growth

CORSIA - Carbon Offsetting and Reduction Scheme for International Aviation

CPDLC – Controller-Pilot Data Link Communications

DSP - General Directorate of Standardization

EAER – European Aviation Environmental Report

EASA – European Aviation Safety Agency

EC – European Commission

ECAC – European Civil Aviation Conference

EEA – European Economic Area

EFTA – European Free Trade Association

EU – European Union

EU ETS – the EU Emissions Trading System

FAB – Functional Airspace Block

FANS – Future Air Navigation System

FP7 - 7th Framework Programme

GHG – Greenhouse Gas

GMBM – Global Market-based Measure

Green IA – Initial Approach

Green STAR – Standard Arrival

HVO – Hydro-treated Vegetable Oil

ICAO – International Civil Aviation Organisation

IEC - International Electrotechnical Commission

IFR – Instrumental Flight Rules

IPCC – Intergovernmental Panel on Climate Change

IPR – Intellectual Property Right

ISO - International Organization for Standartization

JTI – Joint Technology Initiative

LTO cycle – Landing/Take-off Cycle

MBM – Market-based Measure

MT – Million tonnes

MTOM – Maximum take-off mass

NOP - Network Operating Plan

OFA - Operational Focus Area

PRISME – Pan European Repository of Information Supporting the Management of EATM

RED – Renewable Energy Directive

RNAV – Area Navigation

RNP AR – Required Navigation Performance Authorization Required

RNP STAR – Required Navigation Performance Standard Arrival

RPAS – Remotely Piloted Aircraft

RPK – Revenue Passenger Kilometre

RTD – Research and Innovation

RTK – Revenue Tonne Kilometre

RTK - revenue tonne-kilometers

SAF – Sustainable Aviation Fuels

SES – Single European Sky

SESAR – Single European Sky ATM Research

SESAR JU – Single European Sky ATM Research Joint Undertaking

SESAR R&D – SESAR Research and Development

SWAFEA – Sustainable Ways for Alternative Fuels and Energy for Aviation

SWIM – System Wide Information Management

TMA - Terminal Manoeuvring Area

ToD – Top of Descent

UNEP - United Nations Environmental Programme

1. Introductions

Albania is a member of the European free trade association EFTA and the European Civil Aviation Conference (ECAC). ECAC is an intergovernmental organization covering the widest grouping of Member States[1] of any European organization dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1995.

ECAC States share the view that the environmental impacts of the aviation sector must be mitigated, if aviation is to continue to be successful as an important facilitator of economic growth and prosperity, being an urgent need to achieve the ICAO goal of Carbon Neutral Growth from 2020 onwards (CNG2020), and to strive for further emissions reductions. Together they fully support ICAO's on-going efforts to address the full range of those impacts, including the key strategic challenge posed by climate change, for the sustainable development of international air transport.

All ECAC States, in application of their commitment in the 2016 Bratislava Declaration, support CORSIA implementation and have notified ICAO of their decision to voluntary participate in CORSIA from the start of its pilot phase and have effectively engaged in its implementation.

Albania, 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.

Albania recognizes the value of each State preparing and submitting to ICAO an updated State Action Plan for CO_2 emissions reductions as an important step towards the achievement of the global collective goals agreed since the 38th Session of the ICAO Assembly in 2013.

In that context, it is the intention that all ECAC States submit to ICAO an action plan[2]. This is the action plan of Albania.

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

[2] ICAO Assembly Resolution A40-18 also encourages States to submit an annual reporting of international aviation CO_2 emissions, which is a task different in nature and purpose to that of action plans, strategic in their nature. Also this requirement is subject to different deadlines for submission and updates as annual updates are expected. For that reason, the reporting to ICAO of international aviation CO_2 emissions referred to in paragraphs 10 & 14 of ICAO Resolution A40-18 is not necessarily part of this Action Plan, and may be provided separately, as part of routine provision of data to ICAO, or in future updates of this action plan.

Albania strongly supports the ICAO basket of measures as the key means to achieve ICAO's CNG2020 target and shares the view of all ECAC States that a comprehensive approach to reducing aviation CO_2 emissions is necessary, and that this should include:

i. emission reductions at source, including European support to CAEP work in this matter (standard setting process);
ii. improvement and optimization of the Air Traffic Management and infrastructure use within Europe, in particular through the Single European Sky ATM Research (SESAR), and also beyond European borders through participation in international cooperation initiatives; and
iii. Market Based Measures, which allow the sector to continue to grow in a sustainable and efficient manner, recognizing that the measures at (i) to (iv) above cannot, even in aggregate, deliver in time the emissions reductions necessary to meet the ICAO 2020 CNG global goals.

In Europe, many of the action which are undertake within the framework of this comprehensive approach are in practice taken collectively, most of them led by the European Union. They are reported in Chapter 3, 4, 5 and 6 of this Action Plan, where the involvement of Albania is described, as well as that of other stakeholders.

In Albania a number of actions are undertaken at the national level, including those by stakeholders. These national actions are reported in Chapter 7 of this Plan.

In relation to European actions, it is important to note that:

i. The extent of participation will vary from one State and another, reflecting the priorities and circumstances of each State (economic situation, size of its aviation market, historical and industrial context, such as EU/non EU). The ECAC States are thus involved in different degrees and no 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. Acting together, the ECAC States have undertaken measures to reduce the region's emissions through a comprehensive approach. Some of the measures, although implemented by some, but not all of ECAC's 44 States, nonetheless yield emissions reduction benefits across the whole of the region (for example research, SAF promotion or ETS).

2. Current state of aviation in Albanian

2.1 Legal basis

The primary aviation legislation of Albania is the Law No. 96 of 23 July 2020 "Air Code of the Republic of Albania". On the basis of the Act regulations are implemented in different domains such as infrastructure, airworthiness, air traffic regulations, operating rules, air transport and many more.

The Albanian Civil Aviation Authority is a member of international organizations, requiring operation under certain standards and recommended practices and meeting the specific commitments relating to all aspects of operations.

Since 1989 Albanian Civil Aviation is member of International Civil Aviation Organization (ICAO), an organization specialized by the United Nations, found in 1947 with the purpose to foster cooperation among nations, so that international civil aviation can be developed on safe and regulated manner, and the international air traffic to be established on the basis of equal opportunity and operated properly and economically.

Since July 1998, Albanian Civil Aviation Authority is a member of the European Civil Aviation Conference (ECAC), founded in 1995 with 19 member states, the ECAC currently has 44 member states.

Since April 2002, Albania is member of European Organization for the Safety of Air Navigation (EUROCONTROL), an international organization working to achieve safe and seamless air traffic management across Europe. Founded in 1960, currently has 41 member states.

Albania participates in the European Aviation Safety Agency (EASA). Albania is also one of EASA's Pan-European Partners (PANEP), a community of non-EASA European countries with which EASA cooperates on the implementation of the EU aviation safety rules-either in the framework of comprehensive aviation agreements already concluded with the EU or in anticipation of such agreements.

2.2 Structure of the Civil Aviation Sector

The current Organization of the National Aviation Sector has the following institutional structure:

Ministry of Infrastructure and Energy

- Through the Transport and Infrastructure Development and Strategies Department, accomplished authorities in the field of aviation: the implementation of government policy; preperation and implementation of strategy for development of aviation; preperation of laws and preperation and promulgation of bylaws; the implementation of government policy on concessions, etc.

ACAA

- Albania Civil Aviation Authority, is a regulator to the national aviation sector, under the Ministry of Infrastructure and Energy. It is self-finances by the charges from air naviagation services, airport infrastructure, issuing licenses, approvals/premissions and consents and etc.

OKIIA

- National Body for Investigating Aviation Accident and Serious Incident (OKIIA), acts as an independent investigative body under the Decision of the Council of Ministers No. 686, date 02.06.2010.

ANSP (Albcontrol)

- Air Navigation Service Provider - Albcontrol is a 100% joint stock Albanian company, property of the Ministry of Economic Development, Trade, Tourism and Entrepreneurship.[3] It was established as a state-owned enterprise in 1992. Albcontrol is a member of EUROCONTROL since 2003 and a member of CANSO (Civil Air Navigation Services Organization) since 2009.

TIA

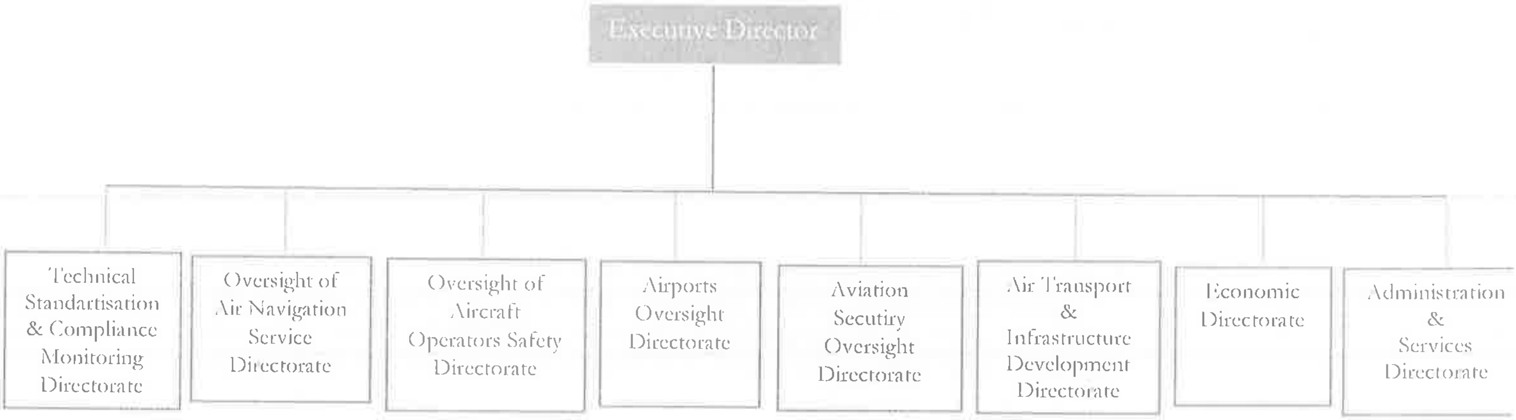
- Tirana International Airport - TIA was certified in last quarter of 2015 as an international traffic in accordance with Albanian Civil Aviation Regulations. Acts as a Public Private Partnership (PPP) under new management. In 2020 TIA has gone through the process of converting the certificate in accordance with European regulations. In December 2020, ACAA has issued the certificate.

KFZ

- Kukes International Airport sh.p.k - KFZ is certified in first quarter of 2021 for public air transport and general air transport in accordance with Albanian Civil Aviation Regulations. Acts as a Public Private Partnership (PPP) under new management.

The ACAA is an independent regulatory Authority and with financial autonomy under the supervision of Ministry of Infrastructure and Energy and its establishment as such provides efficient and timely execution of the regulatory functions including a safety oversight system, as well as other functions connected to the economic oversight, flight permissions etc. and its organizational structure provides efficient and timely execution of the safety regulatory functions described in ICAO Annex 19 and Doc 9734 (Safety Oversight System), as well as the other functions related to security oversight, economic oversight, traffic rights etc.

Figure.1: Organization Chart ACAA.



The Albanian Civil Aviation Authority (ACAA) is responsible for ensuring that civil aviation in Albania has a high safety standard and that it is in keeping with sustainable development. The ACAA aims to ensure the safe, best possible and environmentally friendly use of infrastructure, which includes airspace, air traffic control and aerodromes. The functions of the ACAA are executed by following Directorate:

Technical Standartisation and Compliance Monitoring Directorate, which is in charge of internal audit and progress of activities for the implementation of relevant strategies in the field of technical standardization and quality control and accurance

Oversight of Air Navigation Services Directorate, which is in charge of oversight air navigation service providers, certify and designate ATS providers and supervise the continued validity of compliance with these certifications and to take appropriate measures in case of non-conformance, and issue an individual license for the ATCO, etc.

Oversight of Aircraft Operators Safety Directorate, which is in charge of executing the main regulatory functions related to safety of air transport. The main regulatory functions of this Directorate include certification, oversight and enforcement measures related to aircraft operators, organizations engaged in aircraft manufacturing, design and maintenance, registration of aircraft, etc.

Airports Oversights Directorate, which is in charge of execution of the main regulatory functions related to safety of airport and airport services. The main regulatory functions of this Directorate include certification, oversight and enforcement measures related to airport infrastructure operators, airport service providers.

Aviation Security Oversight Directorate, which is in charge of executing functions related to security oversight of airports, airlines and air navigation service providers.

Air Transport and Infrastructure Development Directorate, which is in charge pursuing strategic priorities, permissions and slots, passengers rights and the monitoring process of the economic aspect, of the service providers in the field of air transport.

Economic Directorate, which is in charge of executing functions related the financial operation of the CAA.

Administration and Services Directorate, which is in charge of executing functions related to human resource and the administrative legal service, archival service, technological and logistics service of the CAA.

2.3 Albania Aircraft Register

Namely, there are five aircraft in the Albania registry. Current fleet of Albawings Airlines consists of three aircraft type Boieng and with MTOM more than 5 700 kg. Current fleet of Air Albania Airlines consist of one Airbus with MTOM more than 5 700 kg and one Boeing (wet lease) with MTOM more than 5 700 Kg.

Max. take-off mass	No. of aircraft
< 2250 kg	-
2250 – 5700 kg	-
>5 700 kg	5

2.4 Airports

Tirana International Airport "Nënë Tereza", often referred to as the Rinas International Airport, is the main international airport of Albania. The airport operates a contractual agreement of PPP from 2005 and this will last until 2027. On 1 April 2016, the Government of Albania and TIA signed an amendment to the Concession Agreement of TIA and took a major step towards the development of air transport and the liberalization of international flights in Albania. The Concession Period of TIA was immediately extended by two years, i.e. until April 2027, in exchange for the opening of Kukës Airport to international flights. On 2021 the Government of Albania and TIA signed another amendment to the Concession Agreement of TIA since the concessionaire changed, and this amendment consisted in increasing the concession period by 13 years as well as by defining some new obligations for the concessionaire.

According to a specific master plan updated for the airport in 2000, a significant rehabilitation of the airport was made, including working for reconstruction of the landing area and moving runway, enlargement of the airport, installation of new lighting system for the runway, equipment to help the navigation and metrological equipment. Afterwards, other works has been done to isolate the perimeter of TIA and runway maintenance, enlargement of the terminal main building and reconstruction of the old airport building. There are no flights for long distance destinations. TIA has carried out ongoing works for the rehabilitation of taxiways in accordance with the Airfield 2020 project. TIA also plans to rehabilitate the runway by 2021.

In 2015 ACAA has certified TIA as per national regulation.

In 2020 TIA went through certificate converting process in accordance with European regulations (EASA standards) and the certificate was issued in December 2020.

Tirana Airport is 17 km away from Tirana, and well connected with a new highway. The characteristics of the airport are:

- ✓ Can treat aircrafts of the 4C category as for example Airbus A 320/321 and Boeing B737-900. For larger aircrafts, TIA must obtain ACAA approval by performing initially operational safety assessment;
- ✓ The airport is certified for the Landing Instrument System for category one operations;
- ✓ The category of fire safety of the airport is Cat. 7;
- ✓ TIA is managed by a concessionary contract;

- ✓ The company from TIA has made work to upgrade terminal and goods objects, the internal roads and parking places for aircrafts as per concession agreement;
- ✓ The airport has currently 2 Albanian airline operator (Albawings and Air Albania) and 15 foreign airline operators with regular services programmed for Tirana.

Kukës Airport is in the north east of the country close to the Kosovo border. It's main characteristics are:

- ✓ It was completed in 2005, and at this stage in time Kukes Airport couldonly accommodate smaller aircrafts of the size of Beech 1900 and Embraer 120;
- ✓ In April 2021 ACAA has certified Kukes International Airport-Zayed (KFZ) by assessing compliance with safety and security standards, as per national regulation;
- ✓ KFZ is managed by a concessionary contract;
- ✓ KFZ can accommodate aircrafts of the 3C category;
- ✓ KFZ category of fire safety of the airport is Cat.6;
- ✓ The airport is certified for Visual Flight Rules only by day;
- ✓ The airport has a terminal with facilities for passenger checking and customs, with the standard infrastructure built in, including arrival and departure offices, and apron and RFFS buildings.

Figure.2: International Airports in Albania, 2021.

2.5 Traffic Performance

The Number of scheduled and charter traffic movements is delivered monthly by the airport. This information facilitates the organization of airport operations in the areas of safety, dispatching and passenger's information.

Table.1: Number of passengers and growth rate during 2005-2020 and Number of passengers by destinations for 2019.

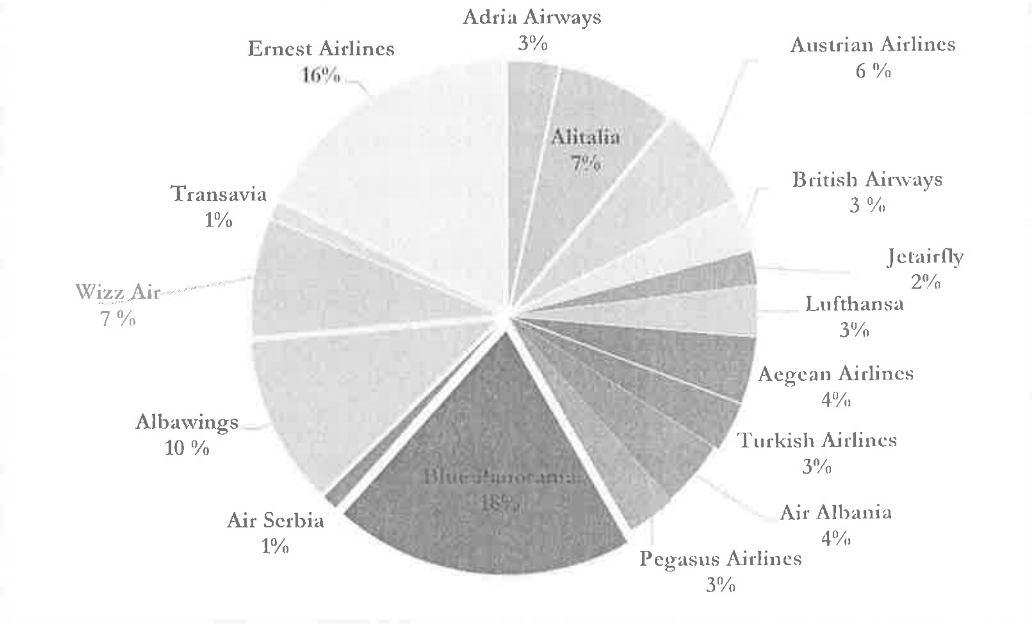
Year	No. of Passengers	Growth rate	No. of Passengers by Destinations, 2019		
			Destination	No. of Passengers	Percent (%)
2005	785,000				
2006	960,103	15.43	Italy	1,290,887	38.6
2007	1,105,770	15.17	Austria	187,257	5.6
2008	1,267,041	14.58	Turkey	253,010	7.6
2009	1,394,688	10.07	Greece	125,925	3.8
2010	1,653,602	18.6	Germany	126,771	3.8
2011	1,817,084	9.88	UK	223,800	6.7
2012	1,665,331	-8.35%	Serbi	48,786	1.46
2013	1,757,342	5.53	Other destination	1,081,711	32.4
2014	1,810,305	3.02			
2015	1,997,044	9.21			
2016	2,195,100	11.03			
2017	2,630,338	19.8			
2018	2,947,172	12.05			
2019	3,338,147	13.2			
2020	1,310,614	-60.7			

Source: Tirana International Airport, Instat (2021).

Table 1 shows the total passenger number for scheduled and charter traffic. As shown in above table, number of passenger at TIA increased steadily until 2011, but after a very tough year 2012, number of passengers is increase. The liberalization of visa restrictions for Albanians in 2010, increase in per capita income of the Albanian and the continued demand from foreign visitors for tourism activities strongly contributed to the surge in growth of air passenger traffic. During 2019, the passenger's numbers increased with

13.2 percent. During 2020, the number of passengers has been reduced with 60.7 percent compare with 2019 period, due to the COVID-19 pandemic.

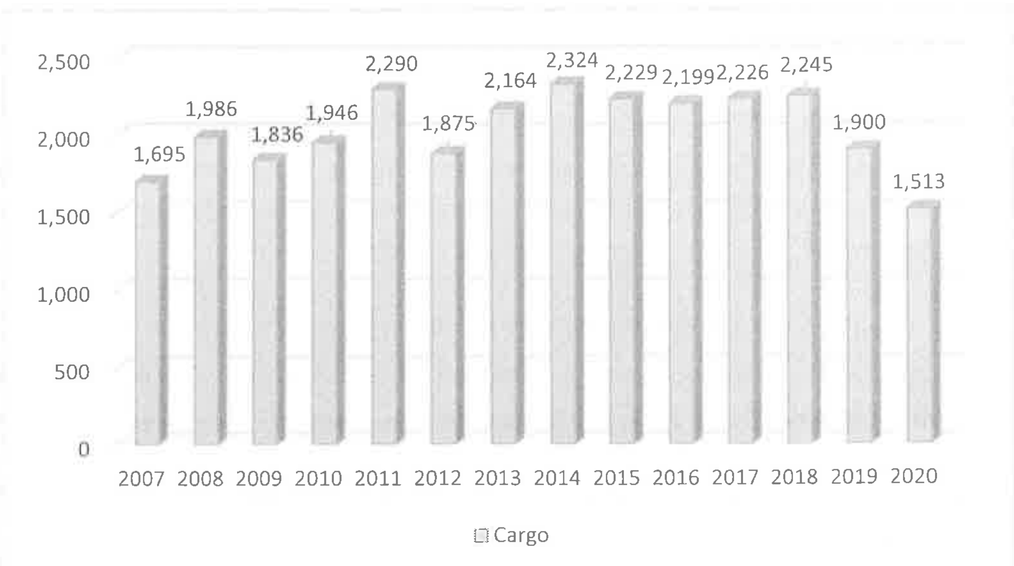
Figure.3: International market shares related to passengers, 2019.



Source: Albanian Civil Aviation Authority (2021).

Concerning air traffic, Blue Panorama Airlines, obtained 18 % of the market shares in 2019, followed by Ernest Airlines 16 % market share, and Albawings with 10 %, see figure 3.

Figure.4: Cargo in tonnes at TIA, 2007-2020.



Source: Instat (2021).

In total, 1,513 tonnes cargo arrived or departed at Tirana International Airport in 2020.

This is an decrease of 25.5 percent compare to 2019, see figure 4. The all-time high number were recorded in 2014, when 2,324 tonnes cargo arrived or departed.

3. ECAC Baseline Scenario

The baseline scenario is intended to serve as a reference scenario for CO_2 emissions of European aviation in the absence of any of the mitigation actions described later in this document. The following sets of data (2010, 2019) and forecasts (for 2030, 2040 and 2050) were provided by EUROCONTROL for this purpose:

- European air traffic (includes all commercial and international flights departing from ECAC airports, in number of flights, revenue passenger kilometers (RPK) and revenue tonne-kilometers (RTK));
- its associated aggregated fuel consumption; and
- its associated CO_2 emissions.

The sets of forecasts correspond to projected traffic volumes in a scenario of "Regulation and Growth", while corresponding fuel consumption and CO_2 emissions assume the technology level of the year 2019 (i.e. without considering reductions of emissions by further aircraft related technology improvements, improved ATM and operations, alternative fuels or market based measures).

3.1 Scenario "Regulated Growth", Most-likely/Baseline scenario

As in all 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. The latest EUROCONTROL long-term forecast[3] has been published in June 2018 and inspects traffic development in terms of Instrument Flight Rule (IFR) movements to 2040.

In the latter, the scenario called 'Regulation and Growth' is constructed as the 'most likely' or 'baseline' scenario for traffic, most closely following the current trends[4]. It considers a moderate economic growth, with some regulation particularly regarding the social and economic demands.

Amongst the models applied by EUROCONTROL for the forecast, the passenger traffic sub-model is the most developed and is structured around five main group of factors that are taken into account:

- **Global economy** factors represent the key economic developments driving the demand for air transport.

[3] Challenges of Growth – Annex 1 – Flight Forecast to 2040, EUROCONTROL, Septemeber 2018.

[4] Prior to COVID-19 outbreak.

- Factors characterizing the **passengers** and their travel preferences change patterns in travel demand and travel destinations.
- **Price of tickets** set by the airlines to cover their operating costs influences passengers' travel decisions and their choice of transport.
- More hub-and-spoke or point-to-point **networks** may alter the number of connections and flights needed to travel from origin to destination.
- **Market structure** describes size of aircraft used to satisfy the passenger demand (modelled via the Aircraft Assignment Tool).

Table 2 below presents a summary of the social, economic and air traffic related characteristics of three different scenarios developed by EUROCONTROL. The year 2016 served as the baseline year of the 20-year forecast results[5] (published in 2018 by EUROCONTROL). Historical data for the year 2019 are also shown later for reference.

Table.2: Summary characteristics of EUROCONTROL scenarios.

	Global Growth	Regulation and Growth	Fragmenting World
2023 traffic growth	High ↗	Base →	**Low ↘**
Passenger Demographics (Population)	Aging UN Medium-fertility variant	Aging UN Medium-fertility variant	**Aging UN Zero-migration variant**
Routes and Destinations	Long-haul ↗	No Change →	**Long-haul ↘**
Open Skies	EU enlargement later +Far & Middle-East	EU enlargement Earliest	**EU enlargement Latest**
High-speed rail (new & improved connections)	20 city-pairs faster implementation	20 city-pairs	**20 city-pairs later implementation.**
Economic conditions			
GDP growth	Stronger ↗	Moderate →	**Weaker ↘↘**
EU Enlargement	+5 States, Later	+5 States, Earliest	**+5 States, Latest**
Free Trade	Global, faster	Limited, later	**None**
Price of travel			
Operating cost	Decreasing ↘↘	Decreasing ↘	**No change →**
Price of CO_2 in Emission Trading Scheme	Moderate	Lowest	**Highest**
Price of oil/barrel	Low	Lowest	**High**
Change in other charges	Noise: ↗ Security: ↘	Noise: ↗ Security: →	**Noise: → Security: ↗**
Structure Network	Hubs: Mid-East ↗↗ Europe ↘ Turkey↗ Point-to-pointt: N-Atlant.↗↗	Hubs: Mid-East ↗↗ Europe&Turkey ↗ Point-to-point: N-	**No change →**

[5] Challenges of Growth - Annex 1 - Flight Forecast to 2040, EUROCONTROL, September 2018.

		Atlant.↗	
Market Structure	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions

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

3.2 COVID-19 impact and extension to 2050

Since the start of 2020, COVID-19 has gone from a localised outbreak in China to the most severe global pandemic in a century. No part of European aviation is untouched by the human tragedy or the business crisis. This unprecedented crisis hindered air traffic growth in 2020: flight movements declined by 55% compared to 2019 at ECAC level. It continues to disrupt the traffic growth and patterns in Europe in 2021. In Autumn 2020, EUROCONTROL published a medium-term forecast[6] to 2024, taking into account the impact of the COVID-19 outbreak. The latter is based on three different scenarios depending on how soon an effective vaccine would be made widely available to (air) travellers. Other factors have been included amongst which the economic impact of the crisis or levels of public confidence, to name a few. The Scenario 2: vaccine widely made available for travellers by Summer 2022, considered as the most likely, sees ECAC flights only reaching 92% of their 2019 levels in 2024.

In order to take into account the COVID-19 impact and to extend the horizon to 2050, the following adaptations have been brought to the original long-term forecast[7]. Considering the most-likely scenarios of the long-term forecast[7] and the medium-term forecast, an adapted version of the long-term flight forecast has been derived:

a) Replace the first years (2020-2024) of the long-term forecast[7] horizon by the most recent medium-term forecast[7] to account for COVID impact;
b) Update the rest of the horizon (2025-2040) with assuming the original growth rates of the long-term forecast[7], would remain similar to those calculated pre-COVID-19; and
c) Extrapolate the final years (2040-2050) considering the same average annual growth rates as the one forecasted for 2035-2040 period, but with a 0.9 decay[8].

[6] Prior to COVID-19 outbreak.

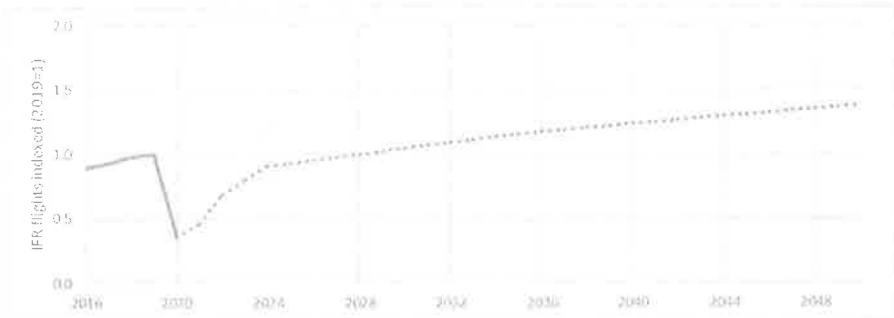
[7] Five-Year Forecast 2020-2024, IFR Movements, EUROCONTROL, November 2020.

[8] As the number of flights has not been directly forecasted via the system but numerically extrapolated, it does not include any fleet renewal, neither network change (airport pairs) between 2040 and 2050. This factor is aimed at adjusting the extrapolation to capture the gradual maturity of the market.

The method used relies on the calculation of adjustment factors at STATFOR[9] region-pair level and have been applied to the original long-term forecast[7]. Adjusting the baseline enables to further elaborate the baseline scenario as forecasted future fuel consumption and traffic to 2030, 2040 and 2050, in the absence of action.

Figure 5 below shows the ECAC scenario of the passenger flight forecasted international departures for both historical (solid line) and future (dashed line) years.

Figure 5. Updated EUROCONTROL "Regulation and Growth" scenario of the passenger flight forecast for ECAC international departures including the COVID-19 impact in 2020 and the following 4 years.



3.3 Fuhter assumption and results for the baseline scenario

The ECAC baseline scenario was generated by EUROCONTROL for all ECAC States. It covers all commercial international passenger flights departing[10] from ECAC airports, as forecasted in the aforementioned traffic scenario. The number of passengers per flight is derived from Eurostat data.

EUROCONTROL also generates a number of all-cargo flights in its baseline scenario. However, no information about the freight tonnes carried is available. Hence, historical and forecasted cargo traffic have been extracted from another source (ICAO[11]). This data, which is presented below, includes both belly cargo transported on passenger flights and freight transported on dedicated all-cargo flights.

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[9] STATFOR (Statistics and Forecast Service) provides statistics and forecasts on air traffic in Europe and to monitor and analyse the evolution of the Air Transport Industry.

[10] International departures only. Domestic flights are excluded. A domestic is any flight between two airports in the State, regardless of the operator or which airspaces they enter en-route. Airports located in overseas are attached the State having the sovereignty of the territory. For example, France domestic include flights to Guadeloupe, Martinique, etc.

[11] ICAO Long-Term Traffic Forecasts, Passenger and Cargo, July 2016. Cargo forecasts have not been updated as new ICAO forecast including COVID-19 effects will be made available after the end of June 2021, so those cannot be considered in this action plan common section.

Historical fuel burn and emission calculations are based on the actual flight plans from the PRISME[12] data warehouse used by EUROCONTROL, including the actual flight distance and the cruise altitude by airport pair. These calculations were made for about 99% of the passenger flights (the remaining flights had information missing in the flight plans). Determination of the fuel burn and CO_2 emissions for historical years is built up as the aggregation of fuel burn and emissions for each aircraft of the associated traffic sample characteristics. Fuel burn and CO_2 emission results consider each aircraft's fuel burn in its ground and airborne phases of flight and are obtained by use of the EUROCONTROL Impact environmental model, with the aircraft technology level of each year.

Forecast years (until 2050) fuel burn and modelling calculations use the 2019 flight plan characteristics as much as possible, to replicate actual flown distances and cruise levels, by airport pairs and aircraft types. When not possible, this modelling approach uses past years traffics too, and, if needed, the ICAO CAEP forecast modelling. The forecast fuel burn and CO_2 emissions of the baseline scenario for forecast years uses the technology level of 2019.

For each reported year, the revenue per passenger kilometre (RPK) calculations use the number of passengers carried for each airport pair multiplied by the great circle distance between the associated airports and expressed in kilometres. Because of the coverage of the passenger estimation datasets (Scheduled, Low-cost, Non-Scheduled flights, available passenger information, etc.) these results are determined for about 99% of the historical passenger traffic, and 97% of the passenger flight forecasts. From the RPK values, the passenger flights RTK can be calculate as the number of tonnes carried by kilometers, assuming that 1 passenger corresponds to 0.1 tonne.

The fuel efficiency represents the amount of fuel burn divided by the RPK for each available airport pair with passenger data, for the passenger traffic only. Here, the RPK and fuel efficiency results corresponds to the aggregation of these values for the whole concerned traffic years. The following tables and figures show the results for this baseline scenario, which is intended to serve as a reference case by approximating fuel consumption and CO_2 emissions of European aviation in the absence of mitigation actions.

[12] PRISME is the name of the EUROCONTROL data warehouse hosting the flight plans, fleet and airframe data.

Table.3: Baseline forecast for international traffic departing from ECAC airports.

Year	Passenger Traffic (IFR movements) (million)	Revenue Passenger Kilometres[13] RPK (billion)	All-Cargo Traffic (IFR movements) (million)	Freight Tonne Kilometres transported[14] FTKT (billion)	Total Revenue Tonne Kilometres[15] RTK (billion)
2010	4.56	1,114	0.198	45.4	156.8
2019	5.95	1,856	0.203	49.0	234.6
2030	5.98	1,993	0.348	63.8	263.1
2040	7.22	2,446	0.450	79.4	324.0
2050	8.07	2,745	0.572	101.6	376.1

Table.4: Fuel burn and CO_2 emissions forecast for the baseline scenario.

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Fuel efficiency (kg/RPK[16])	Fuel efficiency (kg/RTK[17])
2010	36.95	116.78	0.0332	0.332
2019	52.01	164.35	0.0280	0.280
2030	50.72	160.29	0.0252	0.252
2040	62.38	197.13	0.0252	0.252
2050	69.42	219.35	0.0250	0.259
For reasons of data availability, results shown in this table do not include cargo/freight traffic.				

Figure.6: Forecasted traffic until 2050 (assumed both for the baseline and implemented measures scenarios).

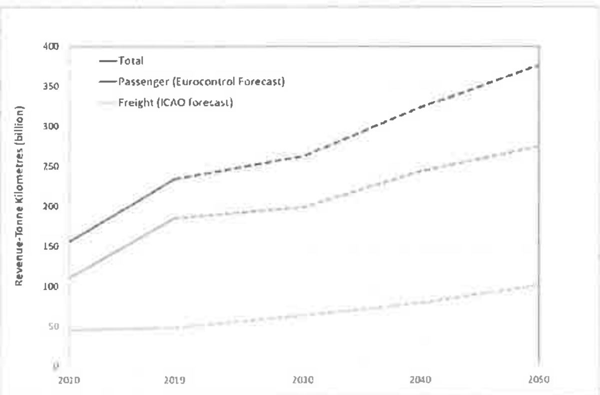
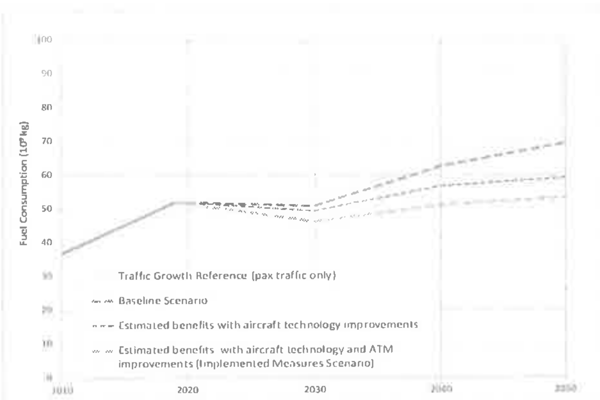


Figure.7: Fuel consumption forecast for the baseline and implemented measures scenarios (international passenger flights departing from ECAC airports).



[13] Calculated on the basis of Great Circle Distance (GCD) between airports, for 97% of the passenger traffic for forecast years.
[14] Includes passenger and freight transport (on all-cargo and passenger flights).
[15] A value of 100 kg has been used as the average mass of a passenger incl. baggage (ref: ICAO).
[16] Calculated on the basis of Great Circle Distance (GCD) between airports, for 97% of the passenger traffic for forecast years.
[17] A value of 100 kg has been used as the average mass of a passenger incl. baggage (ref: ICAO).

The impact of the COVID-19 in 2020 is not fully reflected in Figure 7, as this representation is oversimplified through a stairght line between 2019 and 2030. The same remark applies for Figures 8.

3.3 ECAC Scenario with Implemented Measured, Estimated Benefits

In order to improve fuel efficiency and to reduce future air traffic emissions beyond the projections in the baseline scenario, ECAC States have taken further action. Assumptions for a top-down assessment of effects of mitigation actions are presented here, based on modelling results by EUROCONTROL and EASA. Measures to reduce aviation's fuel consumption and emissions will be described in the following chapters.

For reasons of simplicity, the scenario with implemented measures is based on the same traffic volumes as the baseline case, i.e. updated EUROCONTROL's "Regulation and Growth" scenario described earlier. Unlike in the baseline scenario, the effects of aircraft related technology development and improvements in ATM/operations are considered here for a projection of fuel consumption and CO_2 emissions up to the year 2050.

Effects of **improved aircraft technology** are captured by simulating fleet roll-over and considering the fuel efficiency improvements of new aircraft types of the latest generation (e.g. Airbus A320NEO, Boeing 737MAX, Airbus A350XWB etc.). The simulated future fleet of aircraft has been generated using the Aircraft Assignment Tool[18] (AAT) developed collaboratively by EUROCONTROL, EASA and the European Commission. The retirement process of the Aircraft Assignment Tool is performed year by year, allowing the determination of the number of new aircraft required each year. In addition to the fleet rollover, a constant annual improvement of fuel efficiency of 1.16% per annum is assumed for each aircraft type with entry into service from 2020 onwards. This rate of improvement corresponds to the 'Advanced' fuel technology scenario used by CAEP to generate the fuel trends for the Assembly.

This technology improvement modelling is applied to the years 2030 and 2040. For the year 2050, as the forecast traffic reuses exactly the fleet of the year 2040, the technological improvement is determined with the extrapolation of the fuel burn ratio between the baseline scenario and the technological improvement scenario results of the years 2030 to 2040.

The effects of **improved ATM efficiency** are captured in the Implemented Measures Scenario on the basis of efficiency analyses from the SESAR project. In SESAR, a value

[18] https://www.easa.europa.eu/domains/environment/impact-assessment-tools.

of 5,280 kg of fuel per flight for ECAC (including oceanic region) is used as a baseline[19]. Based on the information provided by the PAGAR 2019 document[20], and compared to a 2012 baseline, the benefits at the end of Wave 1 could be about 3% CO_2/fuel savings achieved by 2025 equivalent to 147.4 kg of fuel/flight. So far, the target for Wave 2 remains at about 7% more CO_2/fuel savings (352.6 kg of fuel) to reach the initial Ambition target of about 10% CO_2/fuel savings (500 kg fuel) per flight by 2035. The 2030 efficiency improvement is calculated by assuming a linear evolution between 2025 and 2035. As beyond 2035, there is no SESAR Ambition yet, it is assumed that the ATM efficiency improvement are reported extensively for years 2040 and 2050. The as yet un-estimated benefits of Exploratory Research projects[21] are expected to increased the overall future fuel savings.

While the effects of **introduction of Sustainable Alternative Fuels (SAF)** where modelled in previous updates on the basis of the European ACARE goals[22], the expected SAF supply objectives for 2020 were not met, and in the current update the SAF benefits have not been modelled as a European common measure in the implemented measures scenario. However, numerous initiatives related to SAF (e.g. ReFuelEU Aviation) are largely described in Section 4.3 Chapter 4 and it is expected that future updates will include an assessment of its benefits as a collective measure.

Effects on aviation's CO_2 of **market-based measures** including the EU Emissions Trading Scheme (ETS) with the linked Swiss ETS, the UK ETS and ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) have not been modelled explicitly in the top-down assessment of the implemented measures scenario presented here as, at the time of the submission of this action plan, a legislative proposalfor the revision of the EU ETS Directive concerning aviation, is under development to complete the implementation of CORSIA by the EU and strengthen ambition level the EU ETS. CORSIA is not considered a European measure but a globe one. It aims for carbon-neutral growth (CNG) of aviation as a compared to the average of 2019nand 2020 levels of emissions in participating States, and an indication of a corresponding (hypothetical) target applied to Europe is shown in Figure 8,[23] while recalling that this is just a reference level, given that CORSIA was designed to contribute to the CNG 2020 globally and not in individual States or regions.

[19] See SESAR ATM Master Plan – Edition 2020 (www.atmmasterplan.eu) – eATM.

[20] See SESAR Performance Assessment Gap Analysis Report (PAGAR) updated version of 2019 v00.01.04, 31-03-2021.

[21] See SESAR Exploratory Research projects - https://www.sesarju.eu/exploratoryresearch.

[22] https://www.acare4europe.org/sria/flightpath-2050-goals/protecting-environment-and-energy-supply-0.

[23] Note that in a strict sense the CORSIA target of CNG is aimed to be achieved globally (and hence not necessarily in each world region).

Tables 5-7 and Figures 8 summarize the results for the scenario with implemented measures. It should be noted that Table 5 and Table 7 show direct combustion emissions of CO_2 (assuming 3.16 kg CO_2 per kg fuel). More detailed tabulated results are found in Appendix A, including results expressed in equivalent CO_2 emissions on a well to-wake basis (for comparison of SAF benefits).

Table.5: Fuel burn and CO_2 emissions forecast for the Implemented Measures Scenario (new aircraft technology and ATM improvements only).

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Fuel efficiency (kg/RPK[24])	Fuel efficiency (kg/RTK[25])
2010	36.95	116.78	0.0332	0.332
2019	52.01	164.35	0.0280	0.280
2030	46.16	145.86	0.0229	0.229
2040	51.06	161.35	0.0206	0.206
2050	53.18	168.05	0.0192	0.192
2050 vs 2019			*-32%*	
For reasons of data availability, results shown in this table do not include cargo/freight traffic.				

Table. 6: Average annual fuel efficiency improvement for the Implemented Measures Scenario (new aircraft technology and ATM improvements only).

Period	Average annual fuel efficiency improvement (%)
2010-2019	-1.86%
2019-2030	-1.82%
2030-2040	-1.03%
2040-2050	-0.74%

Table.7: CO_2 emissions forecasts for the scenarios described in this chapter.

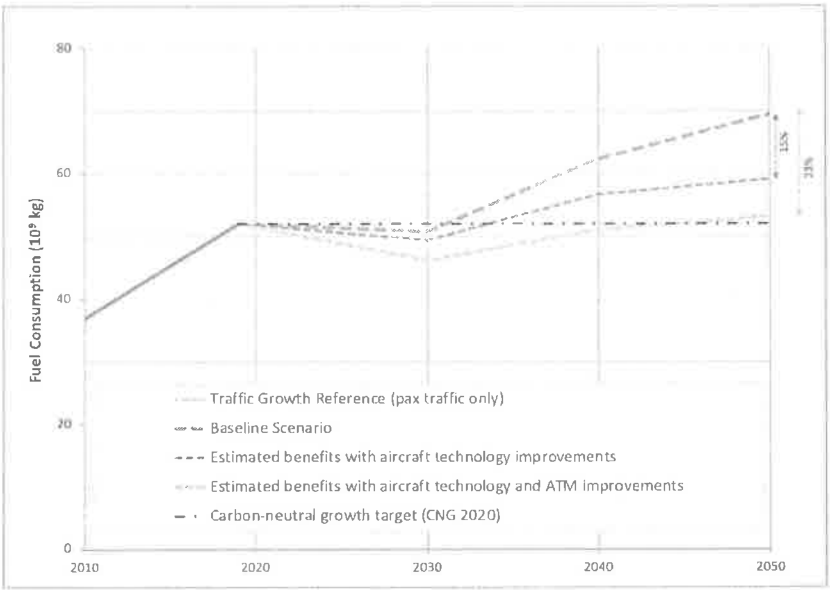
Year	CO_2e emissions (10^9 kg)			% improvement by Implemented Measures (full scope)
	Baseline Scenario	Implemented Measures Scenario		
		Aircraft techn. improvements only	Aircraft techn. and ATM improvements	
2010	116.78			NA

[24] Calculated on the basis of Great Circle Distance (GCD) between airports, for 97% of the passenger traffic for forecast years.

[25] Calculated on the basis of Great Circle Distance (GCD) between airports, for 97% of the passenger traffic for forecast years.

2019	164.35			NA
2030	160.3	156.0	*145.9*	- 9%
2040	197.1	179.3	*161.4*	-18%
2050	219.4	186.7	*168.0*	-23%
For reasons of data availability, results shown in this table do not include cargo/freight traffic. Note that fuel consumption is assumed to be unaffected by the use of alternative fuels.				

Figure.8: CO_2 emissions forecast for the baseline and implemented measures scenarios.



As shown in Figure 8, the impact of improved aircraft technology indicates an overall 15% reduction of fuel consumption and CO_2 emissions in 2050 compared to the baseline scenario. Overall CO_2 emissions, including the effects of new aircraft types and ATM related measures, are projected to improve to lead to a 23% reduction in 2050 compared to the baseline.

As detailed in Table 6, under the currently assumed aircraft and ATM improvement scenarios, the fuel efficiency is projected to lead to a 32% reduction from 2019 to 2050. Indeed, the annual rate of fuel efficiency improvement is expected to progressively slow down from a rate of 1.82% between 2019 and 2030 to a rate of 0.74% between 2040 and 2050. Aircraft technology and ATM improvements alone will not be sufficient to meet the post-2020 carbon neutral growth objective of ICAO, nor will the use of sustainable aviation fuels even if Europe's ambitious targets for SAF are met. This confirms that additional action, particularly market-based measures, are required to fill the gap. There are among the ECAC Member States additional ambitious climate strategies where carbon neutrality by 2050 is set as the overall objective. The aviation sector will have to contribute to this objective.

4. Supra-National Measure

4.1 Aircraft emissions standards

European Member States fully support ICAO's Committee on Aviation Environmental Protection (CAEP) work, on the development and update of aircraft emissions standards, in particular to the ICAO Aircraft CO_2 Standard adopted by ICAO in 2017. Europe significantly contributed to its development, notably through the European Aviation Safety Agency (EASA). It is fully committed to its implementation in Europe and the need to review the standard on a regular basis in light of developments in aeroplane fuel efficiency. EASA has supported the process to integrate this standard into European legislation (2018/1139) with an applicability date of 1 January 2020 for new aeroplane types.

The assessment of the benefits provided by this collective European This is a European contribution to a global measure (CO_2 standard). Its contribution to the global aspirational goals are available in CAEP.

4.2 Research and development

Clean Sky[26] is an EU Joint Undertaking that aims to develop and mature breakthrough "clean technologies" for air transport globally. Joint Undertakings are Public Private Partnership set up by the European Union on the EU research programmes. By accelerating their deployment, the Joint Undertaking will contribute to Europe's strategic environmental and social priorities, and simultaneously promote competitiveness and sustainable economic growth. The first Clean Sky Joint Undertaking (**Clean Sky 1 -** 2011-2017) had a budget of €1.6 billion, equally shared between the European Commission and the aeronautics industry. It aimed to develop environmental-friendly technologies impacting all flying-segments of commercial aviation. The objectives were to reduce aircraft CO_2 emissions by 20-40%, NO_x by around 60% and noise by up to 10dB compared to year 2000 aircraft.

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

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

[26] http://www.cleansky.eu/.

Main remaining areas for Rearch and Technological Development (RTD) efforts under Clean Sky 2 were:

- **Large Passenger Aircraft**: demonstration of best technologies to achieve the environmental goals whilst fulfilling future market needs and improving the competitiveness of future products.
- **Regional Aircraft:** demonstrating and validating key technologies that will enable a 90-seat class turboprop aircraft to deliver breakthrough economic and environmental performance and a superior passenger experience.
- **Fast Rotorcraft:** demonstrating new rotorcraft concepts (tilt-rotor and compound helicopters) 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 innovative fuselage structures will be investigated and 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 a future generation of aircraft in terms of maturation, demonstration and Innovation.
- **Small Air Transport:** demonstrating the advantages of applying key technologies on small aircraft demonstrators 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 with intelligent Re-use, Recycling and advanced services.

In addition, the **Technology Evaluator**[27] will continue to 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).

[27] https://www.cleansky.eu/technology-evaluator-te.

4.2.1 Disruptive aircraft technological innovations: European Partnership for Clean Aviation

With the Horizon 2020 programme coming to a close in 2020, the Commission has adopted a proposal to set up a new Joint Undertaking under the Horizon Europe programme (2021-2027). The **European Partnership for Clean Aviation (EPCA)**[28] will follow in the footsteps of Clean Sky 2. The EU contribution proposed is again € 1.7 billion. The stakeholder community has already formulated a Strategic Research and Innovation Agenda (SRIA), which is intended to serve as a basis of the partnership once established. Subject to the final provisions of the partnership and the EU budget allocation, industry stakeholders have proposed a commitment of € 3 billion from the private side.

General objectives of EPCA:

a) *To contribute to reduce the ecological footprint of aviation by accelerating the development of climate neutral aviation technologies for earliest possible deployment, therefore significantly contributing to the achievement of the general goals of the European Green Deal, in particular in relation to the reduction of Union-wide net greenhouse gas emissions reduction target of at least 55% by 2030, compared to 1990 levels and a pathway towards reaching climate neutrality by 2050.*
b) *To ensure that aeronautics-related research and innovation activities contribute to the global sustainable competitiveness of the Union aviation industry, and to ensure that climate-neutral aviation technologies meet the relevant aviation safety requirements, and remains a secure, reliable, cost-effective, and efficient means of passenger and freight transportation.*

Specific objectives:

a) *To integrate and demonstrate disruptive aircraft technological innovations able to decrease net emissions of greenhouse gasses by no less than 30% by 2030, compared to 2020 state-of-the-art technology while paving the ground towards climate-neutral aviation by 2050.*
b) *To ensure that the technological and the potential industrial readiness of innovations can support the launch of disruptive new products and services by 2035, with the aim of replacing 75% of the operating fleet by 2050 and developing an innovative, reliable, safe and cost-effective European aviation system that is able to meet the objective of climate neutrality by 2050.*
c) *To expand and foster integration of the climate-neutral aviation research and innovations value chains, including academia, research organizations, industry, and SMEs, also by benefitting from exploiting synergies with other national and European related programmes.*

[28] https://clean-aviation.eu/.

The quantitative assessment of the technology improvement scenario from 2020 to 2050 has been calculated by EUROCONTROL and EASA and it is included in Section 3.3 above (ECAC Baseline Scenario and Estimated Benefits of Implemented Measures) and in Appendix A.

Table.8: Fuel consumption and CO_2 emissions of international passenger traffic departing from ECAC airports, with aircraft technology improvements after 2019 included:

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Well-to-wake $CO_{2}e$ emissions (10^9 kg)	Fuel efficiency (kg/RPK)	Fuel efficiency (kg/RTK)
2010	36.95	116.78	143.38	0.0332	0.332
2019	52.01	164.35	201.80	0.0280	0.280
2030	49.37	156.00	191.54	0.0232	0.232
2040	56.74	179.28	220.13	0.0217	0.217
2050	59.09	186.72	229.26	0.0202	0.202

For reasons of data availability, results shown in this table do not include cargo/freight traffic.

Table.9: Average annual fuel efficiency improvement for the Implemented Measures Scenario (new aircraft technology only).

Period	Average annual fuel efficiency improvement (%)
2010-2019	-1.86%
2019-2030	-1.22%
2030-2040	-0.65%
2040-2050	-0.74%

4.3 RefuelEU Aviation Initiative

On 15 January 2020, the European Parliament adopted a resolution on the European Green Deal in which it welcomed the upcoming strategy for sustainable and smart mobility and agreed with the European Commission that all modes of transport will have to contribute to the decarbonisation of the transport sector in line with the objective of reaching a climate-neutral economy. The European Parliament also called for "*a clear regulatory roadmap for the decarbonisation of aviation, based on technological solutions, infrastructure, requirements for sustainable alternative fuels and efficient operations, in combination with incentives for a modal shift*".

The Commission's work programme for 2020 listed under the policy objective on Sustainable and smart mobility, a new legislative initiative entitled "*ReFuelEU Aviation – Sustainable Aviation Fuels*".

This initiative aims to boost the supply and demand for sustainable aviation fuels (SAF) in the EU. This in turn will reduce aviation's environmental footprint and enable it to help achieve the EU's climate targets.

The EU aviation internal market is a key enabler of connectivity and growth but is also accountable for significant environmental impact. In line with the EU's climate goals to reduce emissions by 55% by 2030 and to achieve carbon neutrality by 2050, the aviation sector needs to decarbonise.

While several policy measures are in place, significant potential for emissions savings could come from the use of SAF, i.e. liquid drop-in fuels replacing fossil kerosene. However, currently only around 0.05% of total aviation fuels used in the EU are sustainable.

The ReFuelEU Aviation initiative aims to maintain a competitive air transport sector while increasing the share of SAF used by airlines. The European Commission aims to propose in spring 2021 a Regulation imposing increasing shares of SAF to be blended with conventional fuel. This could result in important emission savings for the sector, given that some of those fuels (e.g. synthetic fuels) have the potential to save up to 85% or more of emissions compared to fossil fuels, over their total lifecycle.

ASSESSMENT:

A meaningful deployment of SAF in the aviation market will lead to a net decrease of the air transport sector's CO_2 emissions. SAF can achieve as high as 85% or more emissions savings compared to conventional jet fuel, and therefore, if deployed at a large scale, have important potential to help aviation contribute to EU reaching its climate targets.

At the time of the submission of this Action Plan the legislative proposal under the ReFuelEU Aviation initiative, as well as its supporting impact assessment, were not yet adopted. As a result, the assessment of the benefits provided by this collective European measure in terms of reduction in aviation emissions is expected to be included in a future update of the common section of this action plan.

4.3.1 Addresing barriers of SAF penetration into the market

SAF are considered to be a critical element in the basket of measures to mitigate aviation's contribution to climate change in the short-term using the existing global fleet.

However, the use of SAF has remained negligible up to now despite previous policy initiatives such as the European Advanced Biofuels Flightpath, as there are still significant barriers for its large-scale deployment.

The European Aviation Environmental Report (EAER) published in January 2019, identified a lack of information at European level on the supply and use of SAF within Europe. EASA completed two studies in 2019 to address the lack of SAF monitoring in the EU.

4.3.1.1 Sustainable Aviation Fuel "Facilitation Initiative"

The first study, addressing the barriers of SAF penetration into the market, examines how to incentivise the approval and use of SAF as drop-in fuels in Europe by introducing a SAF Facilitation Initiative.

The remaining significant industrial and economic barriers limit the penetration of SAF into the aviation sector. To reduce the costs and risk that economic operators face in bringing SAF to the aviation market, this study examined how to incentivise the approval and use of SAF as drop-in fuels in Europe by introducing a SAF Facilitation Initiative.

The report begins by analysing the status of SAFs in Europe today, including both more established technologies and ones at a lower Technology Readiness Level (TRL). It reviews one of the major solutions to the obstacle of navigating the SAF approval process, namely the US Clearing House run by the University of Dayton Research Institute and funded by the Federal Aviation Administration (FAA). The issue of sustainability is also examined, via an analysis of the role of Sustainability Certification Schemes (SCS) and how they interact with regulatory sustainability requirements, particularly those in the EU's Renewable Energy Directive (RED II) and ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Through interviews with a wide range of stakeholders the best form of European facilitation initiative has been identified. This study recommends that such an initiative be divided into two separate bodies, the first acting as an EU Clearing House and the second acting as a Stakeholder Forum. The report is available at EASA's website: 'Sustainable Aviation Fuel 'Facilitation Initiative'.

4.3.1.2 Sustainable Aviation Fuel "Monitoring System"

In response to a lack of information at the EU level on the supply and use of SAF within Europe identified by the European Aviation Environmental Report, EASA launched a second study to identify a cost effective, robust data stream to monitor the use and supply of SAF, as well as the associated emissions reductions.

This included identifying and recommending performance indicators related to the use of SAF in Europe, as well as the associated aviation CO_2 emissions reductions achieved.

The study followed five steps:

1. Identification of possible performance indicators by reviewing the current 'state of the art' SAF indicators and consultation with key stakeholders.
2. Identification of regulatory reporting requirements, and other possible sources of datasets and information streams in the European context, with the potential to cover the data needs of the proposed performance indicators.
3. Examination of sustainability requirements applicable to SAF, and potential savings in greenhouse gas (GHG) emissions compared to fossil-based fuels.
4. Review of SAF use today and future expectations for SAF use within Europe.
5. Definition of a future monitoring and reporting process on SAF use in Europe and related recommendations to implement it. The results will be used as a basis for subsequent work to include SAF performance indicators in future EAERs, which will provide insight into the market penetration of SAF over time in order to assess the success of policy measures to incentivize uptake.

The report is available at EASA's website: 'Sustainable Aviation Fuel 'Monitoring System'.

ASSESSMENT:

While these studies are expected to contribute to addressing barriers of SAF penetration into the market, its inclusion is for information purposes and the assessment of its benefits in terms of reduction in aviation emissions is not provided in the present action plan.

4.3.2 Standards and requirements for SAF

4.3.2.1 European Union standards applicable to SAF supply

Within the European Union there are currently applicable standards for renewable energy supply in the transportation sector, which are included in the revised Renewable

Energy Directive (RED II) that enetered into force in December 2018 (Directive 2018/2001/EU).

It aims at promoting the use of energy from renewable sources, establishing mandatory targets to be achieved by 2030 for a 30% overall share of renewable energy in the EU and a minimum of 14% share for renewable energy in the transport sector, including for aviation but without mandatory SAF supply targets.

Sustainability and life cycle emissions methodologies:
Sustainability criteria and life cycle emissions methodologies have been established for all transport renewable fuels supplied within the EU to be counted towards the targets, which are fully applicable to SAF supply.

These can be found in RED's[29] Article 17, *Sustainability criteria for biofuels and bioliquids.* Those requirements remain applicable on the revised RED II (Directive (EU) 2018/2001) 38, Article 29 *Sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels* paragraphs 2 to 7, although the RED II introduces some new specific criteria for forestry feedstocks.

Transport renewable fuels (thus, including SAF) produced in instillations starting operation fro 1 January 2021 must achieve 65% GHG emissions savings, with respect to a fossil fuel comparator for transportation fuels of 94 g CO_2eq/MJ. In the case of transport renewable fuels of non-biological origin[30], the threshold is raised to 70% GHG emissions savings.

To help economic operators to declare the GHG emission savings of their products, default and typical values for a number of specific pathways are listed in the RED II Annex V (for liquid biofuels). The European Commission can revise and update the default values of GHG emissions when technological developments make it necessary.

Economic operators have the option to either use default GHG intensity values provided in RED II (Parts A & B of Annex V) so as to estimate GHG emissions savings for some or all of the steps of a specific biofuel production process, or to calculate "actual values" for their pathway in accordance with the RED methodology laid down in Part C of Annex V.

[29] Directive 2009/28/EC.

[30] In the case of renewable fuels of non-biological origin, two types are considered: a) Renewable liquid and gaseous transport fuels of non-biological origin (including categories commonly referred as Power to Liquid - PtL-, Electro-fuels and Synthetic fuels). b) Waste gases, which are under the category of REcycled FUel from NOn-BIOlogical origin (also known as REFUNIOBIO).

In the case of non-biobased fuels, a specific methodology is currently under development to be issued in 2021.

4.3.3 ICAO standards applicable to SAF supply

Europe is actively contributing to the development of the ICAO CORSIA Standards and Recommended Practices (SARPs), though the ICAO Committee on Aviation and Environmental Protection (CAEP), establishing global Sustainability Requirements applicable to SAF as well as to the CORSIA Methodology for Calculating Actual Life Cycle Emissions Values and to the calculation of CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels; CORSIA standards are applicable to any SAF use to be claimed under CORSIA in order to reduce offsetting obligations by aeroplane operators.

ASSESSMENT:

The inclusion of European requirements for SAF respond to ICAO Guidance (Doc 9988) request (Para. 4.2.14) to provide estimates of the actual life cycle emissions of the SAF which are being used or planned to deploy and the methodology used for the life cycle analysis. It is therefore provided for information purposes only and no further assessment of its benefits in terms of reduction in aviation emissions is provided in this action plan common section.

4.4 Research and Development project on SAF

4.4.1 European Advanced Biofuels Flightpath

An updated and renewed approach to the 2011 Biofuels FlightPath Initiative[31], was required to further impulse its implementation. As a result, the European Commission launched in 2016 the new Biofuels FlightPath to take into account recent evolutions and to tackle the current barriers identified for the deployment of SAF.

The Biofuels FlightPath was managed by its Core Team, which consists of representatives from Airbus, Air France, KLM, IAG, IATA, BiojetMap, SkyNRG and Lufthansa from the aviation side and Mossi Ghisolfi, Neste, Honeywell-UOP, Total and Swedish Biofuels on the biofuel producers' side.

[31] In June 2011 the European Commission, in close coordination with Airbus, leading European airlines (Lufthansa, Air France/KLM, & British Airways) and key European biofuel producers (Choren Industries, Neste Oil, Biomass Technology Group and UOP), launched the **European Advanced Biofuels Flight-path**. This industry-wide initiative aimed to speed up the commercialisation of aviation biofuels in Europe, with an initial objective of achieving the commercialisation of 2 million tonnes of SAF by 2020, target that was not reached due to the commercial challenges of SAF large-scale supply. https://ec.europa.eu/energy/sites/ener/files/20130911_a_performing_biofuels_supply_chain.pdf.

A dedicated executive team, formed by SENASA, ONERA, Transport & Mobility Leuven and Wageningen UR, coordinated for 3 years the stakeholder's strategy in the field of aviation by supporting the activities of the Core Team and providing sound recommendations to the European Commission.

A number of communications and studies were delivered and are available[32].

The project was concluded with a Stakeholders conference in Brussels on 27 November 2019, and the publication of a report summarizing its outcomes.

4.4.2 Projects funded under the European Union's Horizon 2020 research and innovation programme

Since 2016, seven new projects have been funded by the Horizon 2020 Research and Innovation program of the EU.

BIO4A[33]: The *"Advanced Sustainable Biofuels for Aviation»* project plan to demonstrate the first large industrial-scale production and use of SAF in Europe obtained from residual lipids such as Used Cooking Oil.

The project will also investigate the supply of sustainable feedstocks produced from drought-resistant crops such as Camelina, grown on marginal land in EU Mediterranean areas. By adopting a combination of biochar and other soil amendments, it will be possible to increase the fertility of the soil and its resilience to climate change, while at the same time storing fixed carbon into the soil.

BIO4A will also test the use of SAF across the entire logistic chain at industrial scale and under market conditions, and it will finally assess the environmental and socio-economic sustainability performance of the whole value chain.

Started in May 2018, BIO4A will last until 2022, and it is carried out by a consortium of seven partners from five European countries.

KEROGREEN[34]: *Production of sustainable aircraft grade kerosene from water and airpowered by renewable electricity, through the splitting of CO_2, syngas formation and Fischer-Tropsch synthesis* (KEROGREEN), is a Research and Innovation Action (RIA) carried out by six partners from four European countries aiming at the development and testing of an

[32] https://www.biofuelsflightpath.eu/ressources.
[33] www.bio4a.eu.
[34] www.kerogreen.eu.

innovative conversion route for the production of SAF from water and air powered by renewable electricity.

The new approach and process of KEROGREEN reduces overall CO_2 emission by creating a closed carbon fuel cycle and at the same time creates long-term large-scale energy storage capacity which will strengthen the EU energy security and allow creation of a sustainable transportation sector.

The KEROGREEN project expected duration is from April 2018 to March 2022.

FlexJET[35]: *Sustainable Jet Fuel from Flexible Waste Biomass* (flexJET) is a four-year project targeting diversifying the feedstock for SAF beyond vegetable oils and fats to biocrude oil produced from a wide range of organic waste. This is also one of the first technologies to use green hydrogen from the processed waste feedstock for the downstream refining process thereby maximising greenhouse gas savings.

The project aims at building a demonstration plant for a 12 t/day use of food & market waste and 4000 l/day of Used Cooking Oil (UCO), produce hydrogen for refining through separation from syngas based on Pressure Swing Adsorption technology, and finally deliver 1200 tons of SAF (ASTM D7566 Annex 2) for commercial flights to British Airways.
The consortium with 13 partner organisations has brought together some of the leading researchers, industrial technology providers and renewable energy experts from across Europe. The project has a total duration of 48 months from April 2018 to March 2022.

BioSFerA[36]: The *Biofuels production from Syngas Fermentation for Aviation and maritime use* (BioSFerA)project, aims to validate a combined thermochemical - biochemical pathway to develop cost-effective interdisciplinary technology to produce sustainable aviation and maritime fuels. At the end of the project next generation aviation and maritime biofuels, completely derived from second generation biomass, will be produced and validated by industrial partners at pilot scale. The project will undertake a full value chain evaluation that will result in a final analysis to define a pathway for the market introduction of the project concept. Some crosscutting evaluations carried out on all tested and validated processes will complete the results of the project from an economic, environmental and social point of view.

[35] www.flexjetproject.eu.
[36] https://biosfera-project.eu.

The project is carried out by a consortium of 11 partners from 6 European countries and its expected duration is from 1 April 2020 to 31 March 2024.

BL2F[37]: The *Black Liquor to Fuel* (BL2F) project will use "Black Liquor" to create a clean, high-quality biofuel. Black liquor is a side-stream of the chemical pulping industry that can be transformed into fuel, reducing waste and providing an alternative to fossil fuels. Launched in April 2020, BL2F will develop a first-of-its-kind Integrated "Hydrothermal Liquefaction" (HTL) process at pulp mills, decreasing carbon emissions during the creation of the fuel intermediate. This will then be further upgraded at oil refineries to bring it closer to the final products and provide a feedstock for marine and aviation fuels.

BL2F aims to contribute to a reduction of 83 % CO_2 emitted compared to fossil fuels. A large deployment of the processes developed by BL2F, using a variety of biomass, could yield more than 50 billion litres of advanced biofuels by 2050.
The project brings together 12 partners from 8 countries around Europe and its expected duration is from 1 April 2020 till 31 March 2023.

FLITE[38]: The *Fuel via Low Carbon Integrated Technology from Ethanol* (FLITE) consortium proposes to expand the supply of low carbon jet fuel in Europe by designing, building, and demonstrating an innovative ethanol-based Alcohol-to-Jet (ATJ) technology in an ATJ Advanced Production Unit (ATJ-APU). The ATJ-APU will produce jet blend stocks from non-food/non-feed ethanol with over 70% GHG reductions relative to conventional jet. The Project will demonstrate over 1000 hours of operations and production of over 30,000 metric tonnes of Sustainable Aviation Fuel.
The diversity of ethanol sources offers the potential to produce cost competitive SAF, accelerating uptake by commercial airlines and paving the way for implementation.

The project is carried out by a consortium of five partners from six European countries and its expected duration is from 1 December 2020 till 30 November 2024.

TAKE-OFF[39]: Is an industrially driven project aiming to be a game-changer in the costeffective production of SAF from CO_2 and hydrogen. The unique TAKE-OFF technology is based on conversion of CO_2 and H_2 to SAF via ethylene as intermediate. Its industrial partners will team up with research groups to deliver a highly innovative

[37] https://www.bl2f.eu.
[38] https://cordis.europa.eu/project/id/857839.
[39] https://cordis.europa.eu/project/id/101006799.

process which produces SAF at lower costs, higher energy efficiency and higher carbon efficiency to the crude jet fuel product than the current benchmark Fischer-Tropsch process. TAKE-OFF's key industrial players should allow the demonstration of the full technology chain, utilizing industrial captured CO_2 and electrolytically produced hydrogen. The demonstration activities will provide valuable data for comprehensive technical and economic and environmental analyses with an outlook on Chemical Factories of the Future.

The project is carried out by a consortium of nine partners from five European countries and its expected duration is from 1 January 2021 till 24 December 2024.

ASSESSMENT:
This information on SAF European Research and Development projects are included in this common section of the action plan to complement the information on Sustainable Aviation Fuels measures and to inform on collective European efforts. No further quantitative assessment of the benefits of this collective European measure in terms of reduction in aviation emissions is provided in the common section of this action plan.

4.5 The EU's Single European Sky Initiative and SESAR

4.5.1 SESAR Project

SES and SESAR

The European Union's Single European Sky (SES) policy aims to reform Air Traffic Management in order to enhance its performance in terms of its capacity to manage variable volumes of flight in a safer, more cost-efficient and environmentally friendly manner.

The SESAR (*Single European Sky ATM Research*) programme addresses the technological dimension of the single European sky, aiming in particular to deploy a modern, interoperable and high-performing ATM infrastructure in Europe.

SESAR contributes to the Single Sky's performance targets by defining, validating and deploying innovative technological and operational solutions for managing air traffic in a more efficient manner. SESAR coordinates and concentrates all EU research and development (RTD) activities in ATM.

SESAR is fully aligned with the Union's objectives of a sustainable and digitalised mobility and is projected towards their progressive achievement over the next decade.

To implement the SESAR project, the Commission has set up with the industry, an innovation cycle comprising three interrelated phases: definition, development and deployment. These phases are driven by partnerships (SESAR Joint Undertaking and SESAR Deployment Manager) involving all categories of ATM/aviation stakeholders.

Guided by the European ATM Master Plan, the SESAR Joint Undertaking (SJU) is responsible for defining, developing, validating and delivering technical and operation solutions to modernise Europe's ATM system and deliver benefits to Europe and its citizens. The SESAR JU research programme is developed over successive phases, SESAR 1 (from 2008 to 2016) and SESAR 2020 (started in 2016) and SESAR 3 (starting in 2022). It is delivering SESAR solutions in four key areas, namely airport operations, network operations, air traffic services and technology enablers.
The SESAR contribution to the SES high-level goals set by the Commission are continuously reviewed by the SESAR JU and are kept up to date in the ATM Master Plan.

SESAR and the European Green Deal objectives
The European Green Deal launched by the European Commission in December 2019 aims to create the world's first climate-neutral bloc by 2050. This ambitious target calls for deep-rooted change across the aviation sector and places significantly stronger focus on the environmental impact of flying. Multiple technology pathways are required, one of which is the digital transformation of air traffic management, where SESAR innovation comes into play. Over the past ten years the SESAR JU has worked to improve the environmental footprint of air traffic management, from CO_2 and non-CO_2 emissions, to noise and local air quality. The programme is examining every phase of flight and use of the airspace and seeing what technologies can be used to eliminate fuel inefficiencies. It is also investing in synchronised data exchange and operations on the ground and in the air to ensure maximum impact. The ambition is to reduce by 2035 average CO_2 emissions per flight by 0.8-1.6 tonnes, taking into account the entire flight from gate to gate, including the airport.

Results
To date, the SESAR JU has delivered over 90 solutions for implementation, many of which offer direct and indirect benefits for the environment, with more solutions in the pipeline in SESAR 2020. Outlined in the SESAR Solutions Catalogue, these include solutions such as wake turbulence separation (for arrivals and departure), optimised use of runway configuration for multiple runway airports, or even optimised integration of arrival and departure traffic flows for single and multiple runway airports. Looking

ahead, it is anticipated that the next generation of SESAR solutions will contribute to a reduction of some 450 kg CO_2 per flight.

Considering the urgency of the situation, the SESAR JU is working to accelerate the digital transformation in order to support a swift transition to greener aviation. Largescale demonstrators are key to bridging the industrialisation gap, bringing these innovations to scale and encouraging rapid implementation by industry. Such large-scale efforts have started now with the recently launched ALBATROSS project. They will also be the focus of the future SESAR 3 Joint Undertaking, which is expected to give further and fresh impetus to this important endeavour.

The **Performance Ambitions for 2035** compared to a **2012 baseline** for Controlled airspace for each key performance area are presented in the figure below, with the ambition for environment, expressed in CO_2 reduction, highlighted by the green dotted rectangle of **Figure 9** below:

Figure.9: Performance Ambitions for 2035 for Controlled airspace.

Key performance area	SES high-level goals 2035	Key performance indicator	Performance ambition vs. baseline: Baseline value (2012)	Ambition value (2035)	Absolute improvement	Relative improvement
Capacity	Enable [illegible] increase in ATM capacity	Departure delay, min/dep	9.5 min	6.5-8.5 min	1-3 min	10-30%
		IFR movements at most congested airports, million	4 million	4.2-4.4 million	0.2-0.4 million	5-10%
		Network throughput IFR flights, million	9.7 million	~15.7 million	~6.0 million	~60%
		Network throughput IFR flight hours, million	15.2 million	~26.7 million	~11.5 million	~75%
Cost efficiency	Reduced ATM service unit costs by 50% or more	Gate-to-gate direct ANS cost per flight, EUR(2012)	EUR 960	EUR 580-670	EUR 290-380	30-40%
Operational efficiency		Gate-to-gate fuel burn per flight, kg/flight	5280 kg	4780-5030 kg	250-500 kg	5-10%
		Additional gate-to-gate flight time per flight, min/flight	8.2 min	3.7-4.1 min	4.1-4.5 min	50-55%
		Gate-to-gate flight time per flight, min/flight	(111 min)	(116 min)		
Environment	Enable 10% reduction in the effects flights have on the environment	Gate-to-gate CO_2 emissions, tonnes/flight	16.6 tonnes	15-15.8 tonnes	0.8-1.6 tonnes	5-10%
Safety	Improve safety by factor 10	Accidents with direct ATM contribution, #/year	0.7 (long-term average)	no ATM related accidents	0.7	100%
Security		ATM related security incidents resulting in traffic disruptions	unknown	no significant disruption due to cyber-security vulnerabilities	unknown	

1 [illegible]
2 [illegible]
3 [illegible]
4 [illegible]
5 [illegible]
6 [illegible]

Source (2021): European ATM Master Plan 2020 Edition.

While all SESAR solutions bring added value to ATM performance, some have a higher potential to contribute the performance of the entire European ATM network and require a coordinated and synchronised deployment. To facilitate the deployment of these SESAR solutions, the Commission establishes common projects that mandate the synchronized implementation of selected essential ATM functionalities based on SESAR solutions developed and validated by the SESAR JU.

The first common project was launched in 2014 and its implementation is currently being coordinated by the SESAR Deployment Manager throughout the entire European ATM network. It includes six ATM functionalities aiming in particular to:

- Optimise the distancing of aircraft during landing and take-off, reducing delays and fuel burn while ensuring the safest flying conditions.
- Allow aircraft to fly their preferred and usually most fuel-efficient trajectory (free route).
- Implement an initial, yet fundamental step towards digitalising communications between aircraft and controllers and between ground stakeholders allowing better planning, predictability, thus less delays and fuel optimisation and passenger experience.

The first common project[40] is planned to be completed by 2027. However, the benefits highlighted in **Figure 10** below have been measured where the functionalities have already been implemented.

Figure.10: First results of the first common project implemented.

4.5.2 SESAR Exploratory Research (V0 to V1)

SESAR Exploratory Research projects explore new concepts beyond those identified in the European ATM Master Plan or emerging technologies and methods. The knowledge acquired can be transferred into the SESAR industrial and demonstration activities. SESAR Exploratory Research projects are not subject to performance targets but should address the performances to which they have the potential to contribute.

[40] https://ec.europa.eu/transport/modes/air/sesar/deployment_en.

4.5.3 SESAR Industrial Research and Validation Project (environmental focus)

The main outcomes of the industrial research and validation projects dedicated to the environmental impacts of aviation in SESAR 1 were:

- The initial development by EUROCONTROL of the IMPACT[41] web-based platform which allows noise impact assessments and estimates of fuel burn and resulting emissions to be made from common inputs, thus enabling trade-offs to be conducted. IMPACT has since be continuously maintained and developed by EUROCONTROL, used for ICAO Committee on Aviation Environmental Protection Modelling and Database Group (CAEP) assessments, the conduct of studies in support of the European Aviation Environment Report (EAER) editions 2016 and 2019, and has been adopted by a large range of aviation stakeholders.
- The initial development/maintenance Open-ALAQS that provides a mean to perform emissions inventory at airports, emissions concentration calculation and dispersion.
- The development of an IMPACT assessment process[42].

It should be noted that these tools and methodology were developed to cover the research and the future deployment phase of SESAR, as well as to support European states and agencies in conducting environmental impact assessments for operational or regulatory purposes. They are still in use in SESAR.

SESAR Industrial Research and Validation assesses and validates technical and operational concepts in simulated and real operational environments according to a set of key performance areas. These concepts mature through the SESAR programme from V1 to V3 to become SESAR Solutions ready for deployment.

SESAR has a wide range of solutions to improve the efficiency of air traffic management, some of which are specifically designed to improve environmental performance, by reducing noise impact around airports and/or fuel consumption and emissions in all phases of flight.

A catalogue of SESAR Solutions is available[43] and those addressing environment impacts are identified by the following pictogram:

[41] https://www.eurocontrol.int/platform/integrated-aircraft-noise-and-emissions-modelling-platform.

[42] https://www.sesarju.eu/sites/default/files/documents/transversal/SESAR%202020%20%20Environment%20Impact%20Assessment%20Guidance.pdf.

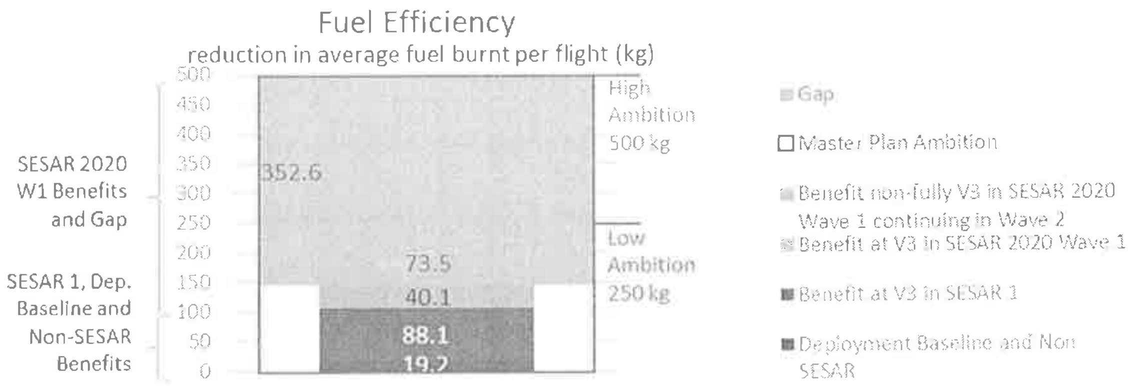
[43] https://www.sesarju.eu/news/sesar-solution-catalogue-third-edition-now-out.

4.5.4 SESAR 2020 Industrial Research and Validation – Environmental Performance Assessment

The systematic assessment of environmental impacts of aviation are at the heart of SESAR Industrial Research and Validation activities since SESAR 1, with a very challenging target on fuel/CO_2 efficiency of 500kg of fuel savings on average per flight.

SESAR Pj19.04 Content Integration members are monitoring the progress of SESAR Solutions towards this target in a document call Performance Assessment and Gap Analysis Report (PAGAR). The Updated version of PAGAR 2019 provides the following environmental achievements:

Figure.11: SESAR fuel efficiency achievement versus gap.



Source: Updated version of PAGAR 2019.

The Fuel Efficiency benefits at V3 maturity level in SESAR 2020 Wave 1 represents an average of 40.1 kg of fuel savings per flight. There would therefore be a gap of 352.6 kg in fuel savings per flight to be filled by Wave 2, compared to the high fuel savings Ambition target (and a gap of 102.6 kg with respect to the low Ambition target, as the Master Plan defines a range of 5-10% as the goal). Potentially 73.5 kg might be fulfilled from Wave 1 Solutions non-fully V3 continuing in Wave 2.

A fuel saving of 40.1 kg per ECAC flight equates to about 0.76% of the 5,280kg of fuel burnt on average by an ECAC flight in 2012 (SESAR baseline). Although this might seem marginal, in 2035, ECAC-wide, it would equate to 1.9 million tonnes of CO_2 saved, equivalent to the CO_2 emitted by 165,000 Paris-Berlin flights; or a city of 258,000

European citizens; or the CO_2 captured by 95 million trees per year. In SESAR, a value of 5,280 Kg of fuel per flight for the ECAC (including oceanic region) is used as a baseline[44]. Based on the information provided by the PAGAR 2019 document[45], the benefits at the end of Wave 1 could be about 3% CO_2/fuel savings achieved by 2025 equivalent to 147.4kg of fuel/flight. So far, the target for Wave 2 remains at about 7% more CO_2/fuel savings (352.6kg of fuel) to reach the initial Ambition target of about 10% CO_2/fuel savings (500kg fuel) per flight by 2035. Beyond 2035, there is no SESAR Ambition yet. To this could be added the as yet non-estimated benefits of Exploratory Research projects[46].

4.5.5 SESAR AIRE demonstration procejts

In addition to its core activities, the SESAR JU co-financed projects where ATM stakeholders worked collaboratively to perform integrated flight trials and demonstrations of solutions. These aimed to reduce CO_2 emissions for surface, terminal, and oceanic operations and substantially accelerate the pace of change. Between 2009 and 2012, the SESAR JU co-financed a total of 33 "green" projects in collaboration with global partners, under the Atlantic Interoperability Initiative to Reduce Emissions (AIRE).

AIRE[47] is the first large-scale environmental initiative bringing together aviation players from both sides of the Atlantic. So far, three AIRE cycles have been successfully completed.
A total of 15 767 flight trials were conducted, involving more than 100 stakeholders, demonstrating savings ranging from 20 to 1 000kg of fuel per flight (or 63 to 3150 kg of CO_2), and improvements in day-to-day operations. Another nine demonstration projects took place from 2012 to 2014, also focusing on the environment, and during 2015/2016 the SESAR JU co-financed fifteen additional large-scale demonstration projects, which were more ambitious in geographic scale and technology.

4.5.6 SESAR 2020 Very Large-Scale Demonstrations (VLDs)

VLDs evaluate SESAR Solutions on a much larger scale and in real operations to prove their applicability and encourage the early take-up of V3 mature solutions.

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[44] See SESAR ATM Master Plan – Edition 2020 (www.atmmasterplan.eu) – eATM.
[45] See SESAR Performance Assessment Gap Analysis Report (PAGAR) updated version of 2019 v00.01.04, 31-03-2021.
[46] See SESAR Exploratory Research projects - https://www.sesarju.eu/exploratoryresearch.
[47] https://ec.europa.eu/transport/modes/air/environment/aire_en#:~:text=The%20joint%20initiative%20AIRE%20(Atlantic,NEXTGEN%20in%20the%20United%20States.

SESAR JU has recently awarded ALBATROSS[48], a consortium of major European aviation stakeholder groups to demonstrate how the technical and operational R&D achievements of the past years can transform the current fuel intensive aviation to an environmentfriendly industry sector.

The ALBATROSS consortium will carry a series of demonstration flights, which the aim to implementing a "perfect flight" (in order words the most fuel-efficient flight) will be explored and extensively demonstrated in real conditions, through a series of live trials in various European operating environments. The demonstrations will span through a period of several months and will utilize over 1,000 demonstration flights.

4.5.7 Preparing SESAR

Complementing the European ATM Master Plan 2020 and the High-Level Partnership Proposal, the Strategic Research and Innovation Agenda (SRIA) details the research and innovation roadmaps to achieve the Digital European Sky, matching the ambitions of the 'European Green Deal' and the 'Europe fit for the digital age' initiative.

The SRIA[49] identifies inter-alia the need to continuing working on "optimum green trajectories", on non-CO_2 impacts of aviation, and the need to accelerate decarbonisation of aviation through operational and business incentivisation.

ASSESSMENT:

The quantitative assessment of the operational and ATM improvement scenario from 2020 to 2050 has been included in the modelled scenarios by EUROCONTROL on the basis of efficiency analyses from the SESAR project indicated in the Figure 11 above and it is included in Sub-Chapter 3.3 above (ECAC Baseline Scenario and Estimated Benefits of Implemented Measures).

5. Market – Based Measures

ECAC members have always been strong supporters of a market-based measure scheme for international aviation to incentivise and reward good investment and operational choices, and so welcomed the agreement on the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

The 39th General Assembly of ICAO (2016) reaffirmed the 2013 objective of stabilising CO_2 emissions from international aviation at 2020 levels. In addition, the States adopted the introduction of a global market-based measure, namely the '*Carbon Offsetting and*

[48] https://www.sesarju.eu/projects/ALBATROSS.

[49] https://www.sesarju.eu/node/3697.

Reduction Scheme for International Aviation' (CORSIA), to offset and reduce international aviation's CO_2 emissions above average 2019/2020 levels through standard international CO_2 emissions reductions units which would be put into the global market. This major achievement was most welcome by European States which have actively promoted the mitigation of international emissions from aviation at a global level.

5.1 Development and update of ICAO CORSIA standards

European Member States have fully supported ICAO's work on the development of Annex 16, Volume IV to the Convention on International Civil Aviation containing the standards and recommended practices (SARPs) for the implementation of CORSIA, which was adopted by the ICAO Council in June 2018.

As a part of the ICAO's Committee on Aviation Environmental Protection (CAEP) work programme for the CAEP/12 cycle, CAEP's Working Group 4 (WG4) is tasked to maintain the Annex 16, Volume IV and related guidance material, and to propose revisions to improve those documents as needed.

Europe is contributing with significant resources to the work of CAEP-WG4 and EASA in particular by providing a WG4 co-Rapporteur, and by leading the WG4 task on maintaining the Annex 16, Volume IV and related guidance material.

5.1.1 CORSIA implementation

In application of their commitment in the 2016 "Bratislava Declaration" the 44 ECAC Member States have notifited ICAO of their decision to voluntary participate in CORSIA from the start of the pilot phase in 2021 and have effectively engaged in its implementation. This shows the full commitment of the EU, its Member States and the other Member States of ECAC to counter the expected in-sector growth of total CO_2 emissions from air transport and to achieving overall carbon neutral growth.

On June 2020, the European Council adopted Council Decision (EU) 2020/954 on the position to be taken on behalf of the European Union within the International Civil Aviation Organization as regards the notification of voluntary participation in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) from 1 January 2021 and the option selected for calculating aeroplane operators' offsetting requirements during the 2021-2023 period.

ASSESSMENT:

CORSIA is a global measure which assessment is undertaken globally by ICAO. Thus, the assessment of the benefits provided by CORSIA in terms of reduction in European emissions is not provided in this action plan.

5.2 The EU Emissions Trading System and its linkages with other systems (Swiss ETS and UK ETS)

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.

The 30 EEA States in Europe have already implemented the EU Emissions Trading System (ETS), including the aviation sector with around 500 aircraft operators participating in the cap-and-trade approach to limit CO_2 emissions. It was the first and is the biggest international system capping greenhouse gas emissions. In the period 2013 to 2020 EU ETS has saved an estimated 200 million tonnes of intra-European aviation CO_2 emissions.

It operates in 30 countries: the 27 EU Member States, Iceland, Liechtenstein and Norway. The EU ETS currently covers half of the EU's CO_2 emissions, encompassing those from around 11 000 power stations and industrial plants in 30 countries, and, under its current scope, around 500 commercial and non-commercial aircraft operators that fly between airports in the European Economic Area (EEA). The EU ETS Directive was revised in line with the European Council Conclusions of October 2014[50] that confirmed that the EU ETS will be the main European instrument to achieve the EU's binding 2030 target of an at least 40%[51] and will be revised to be aligned with the lastest Conclusions in December 2020[52], prescribing at least 55% domestic reduction (without using international credits) of greenhouse gases compared to 1990.

The EU ETS began operation in 2005, for aviation in 2012; a series of important changes to the way it works took effect in 2013, strengthening the system. The EU ETS works on the "cap and trade" principle. This means there is a "cap", or limit, on the total amount of certain greenhouse gases that can be emitted by the factories, power plants, other installations and aircraft operators in the system. Within this cap, companies can sell to or buy emission allowances from one another. The limit on

50 http://www.consilium.europa.eu/en/meetings/european-council/2014/10/23-24/

51 Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0410.

52 1011-12-20-euco-conclusions-en.pdf (europa.eu).

allowances available provides certainty that the environmental objective is achieved and gives allowances a market value.

For aviation, the cap is calculated based on the average emissions from the years 2004-2006, while the free allocation to aircraft operators is based on activity datat from 2010.

The cap for aviation activities for the 2013-2020 phase of the ETS was set to 95% of these historical aviation emissions. Starting from 2021, free allocation to aircraft operators is reduced by the linear reduction factor (currently of 2.2%) now applicable to all ETS sectors. Aircraft operators are entitled to free allocation based on a benchmark, but this does not cover the totality of emissions. The remaining allowances need to be purchased from auctions or from the secondary market. The system allows aircraft operators to use aviation allowances or general (stationary installations) allowances to cover their emissions. Currently, 82% of aviation allowances are distributed through free allocation, 3% are part of a special reserve for new entrants and fast growers, and 15% are auctioned.

The legislation to include aviation in the EU ETS was adopted in 2008 by the European Parliament and the Council[53].

Following the 2013 ICAO agreement on developing CORSIA, the EU decided[54] to limit the scope of the EU ETS to flights between airports located in the European Economic Area (EEA) for the period 2013-2016, and to carry out a new revision in the light of the outcome of the 2016 ICAO Assembly. The European Commission assessed the outcome of the 39th ICAO Assembly and, in that light, a new Regulation was adopted in 2017[55].

The legislation maintains the scope of the EU ETS for aviation limited to intra-EEA flights and sets out the basis for the implementation of CORSIA. It provides for European legislation on the monitoring, reporting and verification rules through a delegated act under the EU ETS Directive of July 2019[56]. It foresees that a further assessment should take place and a report be presented to the European Parliament and to the Council considering how to implement CORSIA in Union law through a revision of the EU ETS Directive. The European Green Deal and 2030 Climate Target Plan clearly set out the Commission's intention to propose to reduce the EU ETS

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

[54] 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

[55] Regulation (EU) 2017/2392 of the European Parliament and of the Council of 13 December 2017 amending Directive 2003/87/EC to continue current limitations of scope for aviation activities and to prepare to implement a global market-based measure from 2021, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.350.01.0007.01.ENG&toc=OJ:L:2017:350:TOC

[56] Commission Delegated Regulation (EU) 2019/1603 of 18 July 2019 supplementing Directive 2003/87/EC of the European Parliament and of the Council as regards measures adopted by the International Civil Aviation Organisation for the monitoring, reporting and verification of aviation emissions for the purpose of implementing a global market-based measure https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2019.250.01.0010.01.ENG

allowances allocated for free to airlines. This work is currently ongoing and is part of the "Fit for 55 package"[57].

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 facilitate interaction between the EU scheme and that country's measures and flights arriving from the third country could be excluded from the scope of the EU ETS. This is the case between the EU and Switzerland[58] following the agreement to link their respective emissions trading systems, which entered into force on 1 January 2020.

As a consequence of the linking agreement with Switzerland, from 2020 the EU ETS was extended to all departing flights from the EEA to Switzerland, and Switzerland applies its ETS to all departing flights to EEA airports, ensuring a level playing field on both directions of routes. In accordance with the EU-UK Trade and Cooperation Agreement reached in December 2020, the EU ETS shall continue to apply to departing flights from the EEA to the UK, while a UK ETS will apply effective carbon pricing on flights departing from the UK to the EEA.

Impact on fuel consumption and/or CO_2 emissions

The EU ETS has delivered around 200 MT of CO_2 emission reductions between 2013 and 2020[59]. While the in-sector aviation emissions for intra-EEA flights kept growing, from 53,5 million tonnes CO_2 in 2013 to 69 million in 2019, the flexibility of the EU ETS, whereby aircraft operators may use any allowances to cover their emissions, meant that the CO_2 impacts from these flights did not lead to overall greater greenhouse gas emissions. Verified emissions from aviation covered by the EU Emissions Trading System (ETS) in 2019 compared to 2018 continued to grow, albeit more modestly, with an increase of 1% compared to the previous year, or around 0.7 million tonnes CO_2 equivalent[60].

To complement the EU ETS price signal, EU ETS auctioning revenues should be used to support transition towards climate neutrality. Under the EU ETS (all sectors covered), Member States report that from 2012 until 2020, over €45 billions of ETS auction revenue has been used to tackle climate change, and additional support is available under the existing ETS Innovation Fund that is expected to deploy upwards of €12 billion in the period 2021-2030. The EU ETS' current price incentive per tonne for zero emission jet fuel, is by itself insufficient to bridge the price gap with conventional kerosene. However, by investing auctioning revenues through the Innovation Fund, the EU ETS can also support deployment of breakthrough technologies and drive the price gap down.

[57] 2021_commission_work_programme_new_policy_objectives_factsheet_en.pdf (europa.eu)

[58] Commission Delegated Decision (EU) 2020/1071 of 18 May 2020 amending Directive 2003/87/EC of the European Parliament and of the Council, as regards the exclusion of incoming flights from Switzerland from the EU emissions trading system, OJ L 234, 21.7.2020, p. 16.

[59] See the 2019 European aviation environmental report: "Between 2013 and 2020, an estimated net saving of 193.4 Mt CO2 (twice Belgium's annual emissions) will be achieved by aviation via the EU ETS through funding of emissions reduction in other sectors.", https://www.eurocontrol.int/publication/european-aviation-environmental-report-2019

[60] https://ec.europa.eu/clima/news/carbon-market-report-emissions-eu-ets-stationary-installations-fall-over-9_en

In terms of its contribution towards the ICAO carbon neutral growth goal from 2020, the states implementing the EU ETS have delivered, in "net" terms, the already achieved reduction of around 200 MT of aviation CO_2 emissions will continue to increase in the future under the new legislation. Other emission reduction measures taken, either collectively throughout Europe or by any of the 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.

ASSESSMENT:

A quantitative assessment of the EU Emissions Trading System benefits based on the current scope (intra-European flights) is shown in **Table 10**.

Table.10: Summary of estimated EU-ETS emission reductions.

Estimated emissions reductions resulting from the EU-ETS[61]

Year	Reduction in CO_2 emissions
2013-2020	~ 200 MT[62]

Those benefits illustrate past achievements.

6. AIC Airport Carbon Accreditation

Airport Carbon Accreditation is a certification programme for carbon management at airports, based on international carbon mapping and management standards, specifically designed for the airport industry. It was launched in 2009 by Airport Council International (ACI) EUROPE, the trade association for European airports. Since then, it has expanded globally and is today available to members of all ACI Regions.

This industry-driven initiative was officially endorsed by EUROCONTROL and the European Civil Aviation Conference (ECAC). The programme is overseen by an independent Advisory Board comprised of many distinguished, independent experts from the fields of aviation and environment, including the European Commission, ECAC, ICAO and the UNFCCC.

The underlying aim of the programme is to encourage and enable airports to implement best practice carbon and energy management processes and to gain public recognition of their achievements. It requires airports to measure their CO_2 emissions in accordance

[61] Include aggregated benefits of EU ETS and Swiss ETS for 2020.

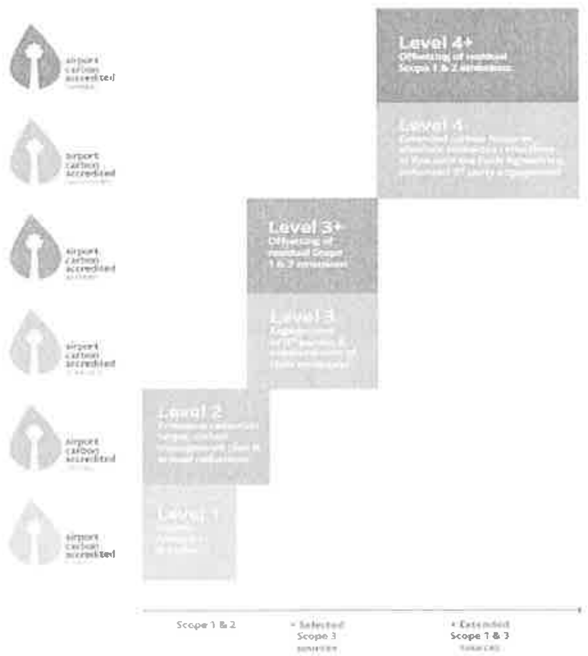
[62] See the 2019 European aviation environmental report: "Between 2013 and 2020, an estimated net saving of 193.4 Mt CO_2 (twice Belgium's annual emissions) will be achieved by aviation via the EU ETS through funding of emissions reduction in other sectors.", https://www.eurocontrol.int/publication/european-aviationenvironmental-report-2019.

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.

In addition to the already existing four accreditation levels, in 2020 two new accreditation levels were introduced: Level 4 and Level 4+. The introduction of those two new levels aims on one hand to align the programme with the objectives of the Paris Agreement and on the other hand to give, especially to airports that have already reached a high level of carbon management maturity, the possibility to continue their improvements[63].

The six steps of the programme are shown in **Figure 12** and are as follows: Level 1 "Mapping", Level 2 "Reduction", Level 3 "Optimisation", Level 3+ "Neutrality", Level 4 "Transformation" and Level 4+ "Transition".

Figure.12: Six steps of *Airport Carbon Accreditation*.



As of 31 March 2021, there are in total 336 airports in the programme worldwide. They represent 74 countries and 45.9% of global air passenger traffic. 112 reached a Level 1,

[63] Interim Report 2019 – 2020, *Airport Carbon Accreditation* 2020.

96 a Level 2, 63 a Level 3 and 60 a Level 3+ accreditation. Furthermore, five airports have already achieved accreditation at the newly introduced levels: 1 a Level 4 and 4 airports a Level 4+ accreditation.

One of its essential requirements is the verification by external and independent auditors of the data provided by airports. The Administrator of the programme has been collecting CO_2 data from participating airports since the programme launch. This has allowed the absolute CO_2 reduction from the participation in the programme to be quantified.

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, airport operators are required to demonstrate CO_2 reductions associated with the activities they control.

The Annual Report, which is published in the fall of each year, typically covers the previous reporting year (i.e., mid-May to mid-May) and presents the programme's evolution and achievements. However, because of the extraordinary conditions faced in 2020 due to COVID-19 pandemic, special provisions are applied to all accredited airports, including the merge of programme years 11 and 12, which implies the extension of accreditation validity by one year. Thus, the current *Airport Carbon Accreditation* certification period covers the timespan May 2019 to May 2021. For this reason, the last published Report is considered as an Interim Report which addresses only a part of the on-going reporting period (i.e., from 16th May 2019 to 11th December 2020), and as such does not include the usual carbon Key Performance Indicators, but only valuable information regarding key achievements and developments, the most significant global and regional trends, and case studies highlighting the airports' commitment to continued climate action in spite of the current crisis. Therefore, the tables below show carbon performance metrics until the 2018/2019 regular reporting cycle.

For historical reasons European airports remain at the forefront of airport actions to voluntarily mitigate and reduce their impact on climate change. The strong growth momentum is still being maintained as these are 167 airports in the programme. These airports account for 69.7% of European passenger traffic.

Table.11: Emissions reduction highlights for the European region.

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Total aggregate scope 1 & 2 reduction ($ktCO_2$)	51.7	54.6	48.7	140	130	169	156	155	169	158
Total aggregate scope 3 reduction ($ktCO_2$)	360	675	366	30.2	224	551	142	899	1160	1763

Table.12: Emissions offset for the European region.

	2015-2016	2016-2017	2017-2018	2018-2019
Aggregate emissions offset, Level 3+ (tCO_2)	222339	252 218	321170	375146

The table above presents the aggregate emissions offset by airports accredited at Level 3+ of the programme in Europe. The programme requires airports at Level 3+ and 4+ to offset their residual Scope 1 & 2 emissions as well as Scope 3 emissions from staff business travel.

Table.13: Summary of Emissions under airports direct control.

Indicator	**Unit**	**Time Period (2018/2019)**	**Absolute change compared to the 3-year rolling average**	**Change (%)**
Aggregate scope 1 & 2 emissions from airports at Level 1-3+	tCO_2	6,520,255	-322,297	**-4.9%**
Scope 1 & 2 emissions per passengers from airports at Level 1-3+	Kgs of CO_2	1.81	-0.09	**-4.3%**
Scope 1 & 2 emissions per traffic unit from airports at Levels 1-3+	Kgs of CO_2	1.55	-0.08	**-4.3%**
Indicator	Unit	Time Period (2018/2019)	Absolute change (vs. previous year)	**Change (%)**
Offsetting of aggregate scope 1 & 2 & staff business travel emisssions from airports at Level 3+	TCO_{2e}	710,673	38.673	**5.8%**
Indicator	Unit	Time Period (2018/2019)	Absolute change (vs. previous year)	**Change (%)**
Scope 3 emissions from airports at Level 3 and 3+	**TCO_2**	**60,253,685**	**6,895,954**	**12.9%**

The programme's main immediate environmental co-benefit is the improvement of local air quality.

Costs for the 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 as of Level 3, aircraft emissions are also covered. Thus, airlines can benefit from the gains made by more efficient airport operations to see a decrease in their emissions. This is consistent with the ambition of the European Green Deal, the inclusion of aviation in the EU ETS and the implementation of CORSIA and therefore can support the efforts of airlines to reduce these emissions.

ASSESSMENT:
The inclusion of this collective European measure is descriptive for information purposes, and no quantitative assessment of its benefits in terms of reduction in aviation emissions is provided in the common section of this action plan.

6.1 European industry roadmap to a net zero European aviation: Destination 2050
The Destination 2050[64] is an initiative and roadmap developed by aviation industry stakeholders (A4E, ACI EUROPE, ASD, CANSO and ERA) showing an ambitious decarbonisation pathway for European aviation.

These European industry organizations commit to work together with all stakeholders and policymakers to achieve the following climate objectives:

- Reaching net zero CO_2 emissions by 2050 from all flights within and departing from the European Economic Area, Switzerland and the UK. This means that by 2050, emissions from these flights will be reduced as much as possible, with any residual emissions being removed from the atmosphere through negative emissions, achieved through natural carbon sinks (e.g., forests) or dedicated technologies (carbon capture and storage). For intra-EU flights, net zero in 2050 might be achieved with close to no market-based measures.
- Reducing net CO_2 emissions from all flights within and departing from the European Economic Area, Switzerland and the UK by 45% by 2030 compared

[64] www.destination2050.eu.

to the baseline[65]. In 2030, net CO_2 emissions from intra-EU flights would be reduced by 55% compared to 1990 levels.

- Assessing the feasibility of making 2019 the peak year for absolute CO_2 emissions from flights within and departing from the European Economic Area, Switzerland and UK.

With the Destination 2050 roadmap and through these commitments, the European aviation sector contributes to the Paris Agreement, recognising the urgency of pursuing the goal of limiting global warming to 1.5°C.

By doing so, the European aviation sector is also effectively contributing to the collective European Green Deal and EU's climate neutrality objectives. This roadmap is complementary to the WayPoint 2050 Air Transport Action Group (ATAG) global pathway for the decarbonization of aviation.

ASSESSMENT:
The inclusion of this collective European measure is descriptive for information purposes, and no quantitative assessment of its benefits in terms of reduction in aviation emissions is provided in the common section of this action plan.

6.2 Environmental Label Programme
In response to the growing expectations of citizens to understand the environmental footprint of their flights, the European Union Member States, Switzerland, Norway, Lichtenstein, the United Kingdom and the European Commission have mandated EASA to explore voluntary environmental labelling options for aviation organisations. The proposals will be aligned with the European Green Deal, established in December 2019 and that strives to make Europe the first climate-neutral continent. The overall objective of the EASA Environmental Labelling Programme is to increase awareness and transparency, and ultimately to support passengers and other actors in making informed sustainable choices by providing harmonised, reliable and easily understandable information on their choices' environmental impacts, co-ordinated within EASA Member States. It should allow rewarding those air transport operators making efforts to reduce their environmental footprint. The label initiative covers a wide range of components of the aviation sector, including aircraft, airlines and flights.

In the proof-of-concept phase, EASA developed potential technical criteria and label

[65] A hypothetical 'no-action' scenario whereby CO2 emissions are estimated based on the assumption that aircraft deployed until 2050 have the same fuel efficiency as in 2018.

prototypes for aircraft technology and design as well as airline operations, to inform European citizens on the environmental performance of aviation systems. Such information would be provided on a voluntary basis by aviation operators that have chosen to use the label. Different scenarios were developed and tested to consider how citizens could interact with labelling information, e.g. on board the aircraft and/or during the booking process as well as on a dedicated website and smartphone application. Various key environmental indicators were reviewed, including the absolute CO_2 emissions and average CO_2 emissions per passenger-kilometre of airlines.

The pilot phase covering the period 2021-2023 will further expand the scope of indicators and take into account life-cycle considerations, e.g. to cover aspects from the extraction of raw materials to recycling and waste disposal. The pilot phase also foresees an impact assessment of the label.

While the potential CO_2 emissions reductions generated by such a label were not quantified at this stage, it is proposed to keep the ICAO updated on future developments concerning the European environmental labelling initiative, including on potential CO_2 emissions savings.

ASSESSMENT:
The inclusion of this collective European measure is descriptive for information purposes, and no quantitative assessment of its benefits in terms of reduction in aviation emissions is provided in the common section of this action plan.

6.3 Multilateral capacity building projects

The European Union is highly committed to ensuring sustainable air transport in Europe and worldwide. In this endeavour, the EU is launching a number of initiatives in different areas to assist partner States in meeting the common environmental commitments.

6.3.1 ICAO – European Union Assistance Project

The assistance project *Capacity Building on CO_2 mitigation from International Aviation* was launched in 2013 with funding provided by the European Union, while implementation was carried out by ICAO Environment.

Fourteen States from Africa and the Caribbean were selected to participate in this 5-year programme, successfully implemented by ICAO from 2014 to 2019, achieving all expected results and exceeding initial targets.

The first objective of the ICAO-EU project was to create national capacities for the development of action plans. ICAO organized specific training-seminars, directed the establishment of National Action Plan Teams in the selected States, and assisted each civil aviation authority directly in the preparation of their action plans.

By June 2016, the 14 selected States had developed action plans fully compliant with ICAO's guidelines, including robust historical data and a reliable baseline scenario. A total of 218 measures to reduce fuel consumption and CO_2 emissions were proposed in the action plans, including those related to aircraft technology, operational measures, and sustainable aviation fuels.

Four pilot mitigation measures and five feasibility studies were executed with project funding in the beneficiary States. In addition to those, the beneficiary States implemented 90 mitigation measures within the project timeframe, which had been included in their action plans[66].

With the support provided by the ICAO-EU project, ICAO has succeeded in assisting the beneficiary States transform the organizational culture towards environmental protection in aviation, through the establishment of Environmental Units with dedicated staff in the Civil Aviation Authorities along with the voluntary decision of seven selected States of the project to join the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) from its outset.

The Phase two of this project is currently being implemented by ICAO and EASA. It covers ten African States: Benin, Botswana, Cabo Verde, Comoros, Côte d'Ivoire, Madagascar, Mali, Rwanda, Senegal and Zimbabwe. The project will run between 2020 and 2023.

ASSESSMENT:

The inclusion of this collective European measure is descriptive for information purposes, and no quantitative assessment of its benefits in terms of reduction in aviation emissions is provided in the common section of this action plan.

6.4 Green Airports research and innovation projects

Under the EU research and innovation actions in support of the European Green Deal and funded by the Horizon 2020 Framework Programme, the European Commission

66 https://www.icao.int/environmental-protection/Documents/ICAO-EU_Project_FinalReport.pdf.

has launched in 2020 the call for tenders: ***Green airports and ports as multimodal hubs for sustainable and smart mobility.***
A clear commitment of the European Green Deal is that "transport should become drastically less polluting", highlighting in particular the urgent need to reduce greenhouse gas emissions (GHG) in aviation and waterborne transport.

In this context, airports play a major role, both as inter-connection points in the transport networks, but also as major multimodal nodes, logistics hubs and commercial sites, linking with other transport modes, hinterland connections and integrated with cities.

As such, green airports as multimodal hubs in the post COVID-19 era for sustainable and smart mobility have a great potential to immediately contribute to start driving the transition towards GHG-neutral aviation, shipping and wider multimodal mobility already by 2025.

The scope of this research program is therefore addressing innovative concepts and solutions for airports and ports, in order to urgently reduce transport GHG emissions and increase their contribution to mitigating climate change.

Expected outcomes:
The projects will perform large-scale demonstrations of green airports, demonstrating low-emission energy use (electrification or sustainable alternative fuels) for aircraft, airports, other/connected and automated vehicles accessing or operating at airports (e.g. road vehicles, rolling stock, drones), as well as for public transport and carpooling, with re-charging/re-fuelling stations and use of incentives.

They will also put the focus on the development of SAF for its use at airports.

The deadline to receive project proposals was closed in January 2021 and at the time of this action plan update the proposals are under revision. Future action plan updates will provide further information on the benefits of the implementation of this measure.

ASSESSMENT:
The inclusion of this collective European measure is descriptive for information purposes, and no quantitative assessment of its benefits in terms of reduction in aviation emissions is provided in the common section of this action plan.

7. National Measures

In this chapter, actions taken in national level and co-benefits which are obtained from international civil aviation activities are referred. In many cases, national activities and actions in Albania that are described in this Chapter are illustrations of how supra-national actions are implemented and are going to be implemented in Albania.

Recent regulatory activities, developed primarily by ICAO and later embraced by the European Civil Aviation Conference, in regards to the reduction of CO_2 emission gasses, arose the need of cooperation amongst Civil Aviation Stakeholders in the Republic of Albania. Furthermore, this cooperation, which has the full optimization of activities for the reduction of CO_2 emission gases as it purpose.

The stakeholders of the Aviation Industry of Albania, namely Tirana International Airport (TIA), Albcontrol and Air Operators are all familiar with the influence that their activities have on climate change and how relevant every action on reducing the green house gases is.

Many activities and projects that are intended to limit the emission of carbon dioxide from civil aviation in Albania are based on extensive cooperation. The stakeholders involved are airports, air navigation services providers (ANSP), aircraft operators, research institutes and universities as well as central government and regional authorities and enterprises.

7.1 Aircraft related technology development

The current fleet of Albawings Airlines consists of three aircraft type Boeing, specifically three B 737-400 and the fleet of Air Albania consists of two aircraft type Boicing and Airbus, spefically one B 737-800 and one A319.

We are confidents that in the forseen furture there are plans to improve the aircraft fleet in order to result and contribute to reducing fuel consumption during both flight and LTO operations and will have significant contribution in reducing CO_2 emission and other environmental benefits attributed to new technologies.

7.2 Alternative fuel

Standards/requirements for alternative fuel use

General Directorate of Standardization (DPS) is the recognized National Standards Body of Albania, in charge of organizing all standardization activities at the national level. DPS is a legal entity of public law depending on the Minister responsible for the economy, with offices in Tirana It represents the Republic of Albania before European and international standards organizations. DPS is a full member of ISO (International

Organization for Standartization), an associate member of the IEC and an affiliate member of CEN (The European Committee for Standardization) and as a obligation of that all standards and requirements which will be adopted in those two institution address to alternative fuels (including alternative fuels for air transportation) will be automatically adopted and became national standards in Republic of Albania.

At the moment there are no measures taken by aerodromes nor aviation industry to introduce alternative fuels.

Fuel and oil types
FUEL: AVGAS - Octane 100 aviation gasoline A1 - Jet A1 aviation fuel OIL: Nil

7.3 Improved Ait Traffic Management and Infrastructure Use

In compliance with international and national legal requirements, and in accordance with the Minister of Transport Directive No. 115 date 23.10.2012 *"Common Requirements for Provision of Air Navigation"* Annex I, paragraph 3.2 (e), Albcontrol fulfilled an Integrated Management System related to the environment in accordance with ISO 14001:2004. In accordance with SESAR 2020, Albcontrol aims to reduce CO_2 emission and to have a positive impact on air quality, noise level, water quality and wastes. Aiming to improve environmental performance and to minimize environmental impacts on land, and controlled air space, Albcontrol implemented new direct routes such as ATS Route AKIKA-TRN-DIMIS, approx. 5 km shorter.

From May 2017, 729 aircrafts used ATS Route AKIKA-TRN-DIMIS with a benefit on the environment and reducing CO_2 emissions by 52.874 kg[67].

Within the scope of the pan-European network FRA initiatives, Albcontrol has made available permanent free route operations, for overflying traffic. Based on **F**ree **R**otue Airspace **Alb**ania (FRALB) pilots cover the shortest routes, thus contributing to the reduction of fuel consumption, and consequently CO_2 emission.

7.4 More efficient Operators

Technological improvements are not the only means to reduce emissions. Better planning of operations is also a key factor when trying to find a way towards cleaner aviation. This is also a priority for the Albanian aviation industry. ANSP has for example

[67] Albcontrol (2017): Annual Report 2016, p.74.

implemented procedures and instructions to its controllers to always give clearance to the aircraft to follow that nearest/shortest route that the traffic allows.

7.5 Economic/Market based Measures

As decided within the ECAC, in reference to the Bratislava Decleration Albania expressed her intention to implement the CORSIA scheme to compensate international aviation CO_2 emissions from the very beginning in 2021. In Albania like any other member state of ICAO, transition of the SARPs into legislation has initiated and planned to finalized in 2021. Albania in in the list of States that intend to volunteer in CORSIA from its outset as of 24 May 2017.

7.6 Regulatory Measures/Other

The Airport Carbon Accreditation Scheme is described in Chapter 6. The scheme was launched in June 2009. Tirana International Airport since 2011 has been part of Carbon Accreditation (ACA). In 2017, TIA was listed among carbon-accredited airports, maintaining its annual certificate at accreditation level 2, Reduction, in recognition of the efforts made to manage and reduce CO_2 emissions.

Figure.13: Certificate of Accreditation.

7.7 Airport Improvement

Since 2011, TIA has been part of the Airport Carbon Accreditation (ACA) Scheme developed by ACI Europe in partnership with WSP Environment & Energy (Scheme Administrator) aiming to address the challenge of climate change by assessing and reducing carbon emissions from airport operations.

TIA assessed and calculated the carbon footprint of CO_2 emissions based on ACI Europe's Airport Carbon Accreditation Scheme requirements and successfully upgraded in 2015 its accreditation from Level 1 "Mapping", to Level 2 "Reduction", towards a reduced carbon footprint, awarded in recognition of TIA's efforts to manage and reduce carbon emissions. In this regard, the TIA Energy and Carbon Policy has been revised and a Carbon Management Plan established, setting up the goals and targets towards the optimisation of its energy performance and a continuous reduction in greenhouse gases and carbon emissions.

Following the main objective of the United Nations Framework Convention on Climate Change (UNFCCC) "stabilize global warming at a non-hazardous level", TIA considers as very important the taking of action to reduce its carbon footprint, independently of the size of its contribution.

TIA can produce both direct emissions (Scope 1) and indirect emissions (Scope 2). However, these two sources of emissions account for a small part of the total emissions at the Airport. All other emissions fall within Scope 3, with the vast majority of these attributable to aircraft en route to their destinations.

Table.14: Annual emissions of CO_2 tons (t), 2011–2019

Source	2011	2012	2013	2014	2015	2016	2017	2018	2019
Scope 1 (direct emissions)	963.80	1116.00	982.10	773.93	936.00	993.70	1,153.00	1,058.60	1,146.00
Scope 2 (Indirect emissions)	73.62	69.01	41.40	39.36	40.00	41.90	45.90	49.30	49.00
Total (Scope 1 & 2)	1,037.42	1,185.01	1,023.50	813.30	976.00	1,035.60	1,198.90	1,107.90	1,195.00

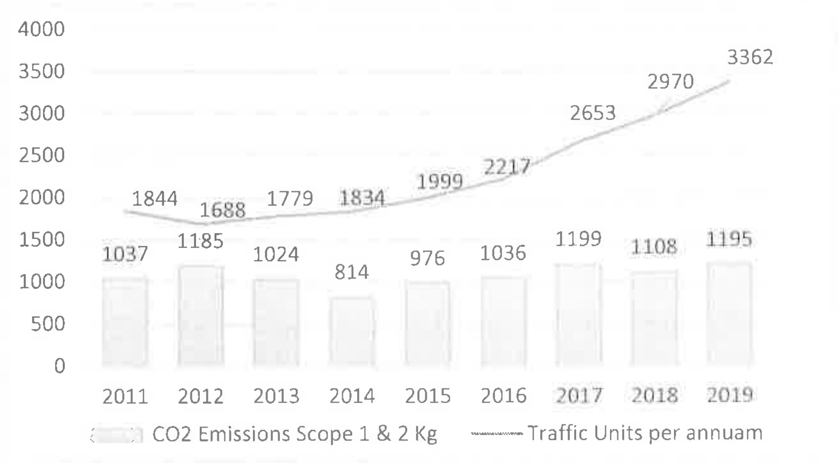
Source: Environment Social Bulletin (2020).

The total carbon footprint for TIA in 2019 was 1,195.00 tons of CO_2. The emissions for years 2011-2019 are reported in Table 14.

The largest CO_2 emissions sources at TIA are Scope 1, owned and controlled sources of CO_2 direct emissions, including heating boilers, TIA ground support equipment, emergency power and fleet vehicles, according for 96 percent, compared with Scope 2 – indirect emissions such as purchased electricity, accounting for four percent, particularly low because of the very low emissions factor of hydropower electricity in Albania.

In 2019, TIA was listed among carbon-accredited airports, maintaining its annual certificate at accreditation level 2, reduction, in recognition of the efforts made to manage and reduce CO_2 emissions. These efforts from part of the airport industry response to the challenge of climate change.

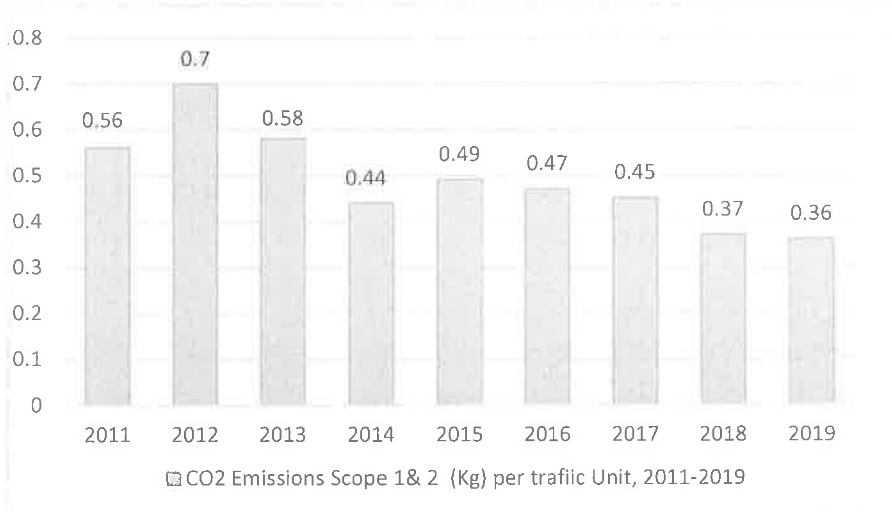
Figure.14: Scope 1 and Scope 2 CO_2 emissions compared with traffic units, 2011-2019



Source: Environment Social Bulletin (2020).

Figure 14 shows the change in TIA, Scope 1 and 2 CO_2 emissions per traffic unit from 2011–2019. Compared with the baseline year of 2011, in 2016, TIA traffic units increased by more than twenty percent, while the total carbon footprint in absolute terms was still lower, resulting in a reduction in the carbon footprint per traffic unit of seventeen percent. The graphs ssshow that the range of the Airport's total footprint over the past three years was between 1,100 and 1,200 tons, while the carbon footprint per traffic unit has fall, from 0.45 kg to 0.35 kg.

Figure.15: Scope 1 & 2 CO_2 Emissions (kg)



Source: Environment Social Bulletin (2020).

Following the Energy Management Action Plan 2011–2015, the Energy Carbon Management Plan 2015–2018 established energy and carbon key performance indicators with a target of 0.51 kg of CO_2 per traffic unit achieved by 2018 compared with 0.56 kg of CO_2 per traffic unit for the baseline year of 2011, when the first carbon footprint calculation took place. Figure 14 and figure 15 shows the change in TIA traffic units (number of passengers and kg of cargo), total Scope 1 and 2 CO_2 emissions, and Scope 1 and 2 CO_2 emissions per traffic unit from 2011–2019. Compared with the baseline year of 2011, in 2019, TIA traffic units increased by more than eighty percent, while the total carbon footprint in absolute terms was still lower, resulting in a reduction in the carbon footprint per traffic unit of seventeen percent. Over this period, 2019 was the best year in terms of kg of CO_2 emissions per traffic unit, with a figure of 0.36 kg. in 2019, the Carbon Management Plan was reviewed and new targets set fo Scope 1 and Scope 2 emissions, of 0.35 kg of CO_2 per traffic unit for 2021, compare wuth 0.56 kg baseline.

TIA has continued with implementation of its Energy and Carbon Reduction Action Plan 2015–2021 for achievement of the objectives and targets for energy consumption reduction and an increase in energy efficiency as set out in TIA's Carbon Management Plan.

Some of the projects and activities implemented during 2019 include the following:

1. Enlargement of the Ground Handling fleet.
2. Installation of new standalone air conditioners with inverters in the Server Room (Cargo and Terminal).
3. Replacement of burned-out halogen lamps with new LED lamps for the perimeter lighting.
4. Installation of sun protection foil in administration building windows.
5. Technical assessment of energy reading meters in the main station.
6. Installation of new fuel meter readings.
7. Repair and renovation of the refrigerator room in Cargo unit, chiller compressor at TIA administration building, and installation of a new 100 KVA transformer at the perimeter.

TIA's infrastructure improvements and progress with its fuel management process for optimisation of energy use in 2019 show good results and target achievements in terms of energy efficiency compared with baseline data for 2011, in absolute terms, TIA consumed about eight percent more energy, mainly due to higher fleet fuel consumption and electricity for air conditioning and ventilation, while at the same time serving 80 percent more passengers and traffic units. The larger number of cooling degree days is the main reason for the increase in energy consumption, specifically electricity use for cooling in the passenger terminal and other buildings. In 2019, in terms of energy efficiency, energy (including all fuel and electricity) consumption per traffic unit has decreased by 46 percent compared to 2011 and nine percent compared to 2018.

8. Conclusion

In this action plan comprehensive statistical data regarding to aviation sector is demostrated in order to reflect the extensive growth of the sector in Albania. Furthermore an overview of the measures taken for environmental protection both international and national level are provided. As briefly explained in the report the measures includes, investments on the new aircraft tecnology in the near future, route optimization by improving the air traffic management, airports improvements and economic measures.

A plan to reduce energy consumption and an increase in energy efficiency, called the Energy and Carbon Reduction Action Plan initiated by TIA.

On the national level ACAA evaluated possible measures to reduce CO_2 emissions in collaboration with stakeholders of aerodromes, air traffic control and airline.

This Action Plan of Albania is a strong base for the future projects and joint program of CORSIA, against CO_2 emissions to compleate all the phase, pilot phase, first phase and second phase.

I. Referencat

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APPENDIX A – DETAILED RESULTS FOR ECAC SCENARIOS FROM SUB-CHAPTER 3.3

1. BASELINE SCENARIO

a) Baseline forecast for international traffic departing from ECAC airports

Year	Passenger Traffic (IFR movements) (million)	Revenue Passenger Kilometres[68] RPK (billion)	All-Cargo Traffic (IFR movements) (million)	Freight Tonne Kilometres transported[69] FTKT (billion)	Total Revenue Tonne Kilometres[70] RTK (billion)
2010	4.56	1,114	0.198	45.4	156.8
2019	5.95	1,856	0.203	49.0	234.6
2030	5.98	1,993	0.348	63.8	263.1
2040	7.22	2,446	0.450	79.4	324.0
2050	8.07	2,745	0.572	101.6	376.1

Note that the traffic scenario shown in the table is assumed for both the baseline and implemented measures scenarios.

b) Fuel burn and CO_2 emissions forecast for the baseline scenario

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Fuel efficiency (kg/RPK)	Fuel efficiency (kg/RTK)
2010	36.95	116.78	0.0332	0.332
2019	52.01	146.35	0.0280	0.280
2030	50.72	160.29	0.0252	0.252
2040	62.38	197.13	0.0252	0.252
2050	69.42	219.35	0.0250	0.250

For reasons of datat availability, results shown in this table do not include cargo/freight traffic

2. IMPLEMENTED MEASURES SCENARIO

2A) EFFECTS OF AIRCRAFT TECHNOLOGY IMPROVEMENT AFTER 2019

[68] Calculated based on the basis of Great Circle Distance (GCD) between airports, for 97% of the passenger traffic for forecast years.

[69] Includes passenger and freight transport (on all-cargo and passenger flights).

[70] A value of 100 kg has been used as the average mass of a passenger incl. baggage (ref: ICAO).

Fuel consumption and CO_2 emissions of international passenger traffic departing from ECAC airports, with aircraft technology improvements after 2019 included:

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Well-to-wake CO_2e emissions (10^9 kg)	Fuel efficiency (kg/RPK)	Fuel efficiency (kg/RTK)
2010	36.95	116.78	143.38	0.0332	0.332
2019	52.01	164.35	201.80	0.0280	0.280
2030	49.37	156.00	191.54	0.0232	0.232
2040	56.74	179.28	220.13	0.0217	0.217
2050	59.09	186.72	229.26	0.0202	0.202

For reasons of data availability, results shown in this table do not include cargo/freight traffic.

b) Average annual fuel efficiency improvement for the Implemented Measures Scenario (new aircraft technology only)

Period	**Average annual fuel efficiency improvement (%)**
2010-2019	-1.86 %
2019-2030	-1.22 %
2030-2040	-0.65%
2040-2050	-0.74%

2B) EFFECTS OF AIRCRAFT TECHNOLOGY AND ATM IMPROVEMENTS AFTER 2019

Fuel consumption and CO_2 emissions of international passenger traffic departing from ECAC airports, with aircraft technology and ATM improvements after 2019:

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Well-to-wake CO_2e emissions (10^9 kg)	Fuel efficiency (kg/RPK)	Fuel efficiency (kg/RTK)
2010	36.95	116.78	143.38	0.0332	0.332
2019	52.01	164.35	201.80	0.0280	0.280
2030	46.16	145.86	179.09	0.0217	0.217
2040	51.06	161.35	198.12	0.0196	0.196
2050	53.18	168.05	206.33	0.0182	0.182

For reasons of data availability, results shown in this table do not include cargo/freight traffic.

b) Average annual fuel efficiency improvement for the Implemented Measures Scenario (new aircraft technology and ATM improvements)

Period	**Average annual fuel efficiency improvement (%)**
2010-2019	-1.86 %
2019-2030	-1.82 %
2030-2040	-1.03%

2040-2050	-0.74%

c) Equivalent (well-to-wake) CO_2e emissions forecasts for the scenarios described in this common section

Year	Well-to-wake CO_2e emissions (10^9 kg)			% Improvement by Implemented Measures (full scope)
	Baseline Scenario	**Implemented Measures Scenario**		
		Aircraft techn. Improvements only	**Aircraft techn. And ATM improvements**	
2010	143.38			NA
2019	210.80			NA
2030	196.8	191.5	179.1	-9%
2040	242.0	220.1	198.1	-18%
2050	269.3	229.3	260.3	-23%

For reasons of data availability, results shown in this table do not include cargo/freight traffic.
Note that fuel consumption is assumed to be unaffected by the use of alternative fuels.

APPENDIX B
NOTE ON THE METHODS TO ACCOUNT FOR THE CO_2 EMMISSIONS ATTRIBUTED TO INTERNATIONAL FLIGHTS

1. Background

The present note addresses recommendations on the methodologies to account the CO_2 emissions, for the guidance on the development of the common European approach for ECAC States to follow, in view of the submission to ICAO of their updated State Action Plans for CO_2 Emissions Reduction (APER).
The ECAC APER guidance shall be established on the basis of the ICAO 9988 Guidance on the Development of States' Action Plans on CO_2 Emissions Reduction Activities document (3rd edition). One of its objectives is to define a common approach for accounting CO_2 emissions of international flights: two different methods are proposed for CO_2 accounting, namely ICAO and IPCC. Because of their intrinsic definitions, it is expected that these two different approaches induce both accounting differences, and practical issues, and furthermore, two ways to target the CO_2 Emissions Reduction Activities, and to define the action plans, de facto.

As the objective of the definition of the common section of the ECAC APER guidance consists into determining a common approach for all the foreseen activities, including CO_2 accounting and monitoring, the ECAC APER Task Group required to assess the details of each methods and to propose recommendations in this present note.

2. Accounting methods

The ICAO Doc 9988 document 3rd edition defines the two CO_2 accounting methods (§3.2):

a) ICAO: each State reports the CO_2 emissions from the international flights operated by aircraft registered in the State (State of Registry).
b) IPCC: each State reports the CO_2 emissions from the international flights departing from all aerodromes located in the State or its territories (State of Origin).

The international flights concern aircraft movements from a country to another country. Each method determines the country assignment of the movement.

Method	ICAO	IPCC
Definition	The ICAO methodology is based on the State of nationality of the airline, and defines an	The IPPC methodology defines international aviation as flights

	"international" flight as one undertaken to or from an airport located in a State other than the airline's home State, i.e each State reports only the international activity of its own commercial air-carriers.	departing from one country and arriving in another, i.e. each State report to IPCCs in respect of all flights departing from their territory, irrespective of the nationality of the operator.
Use in Projects	CORSIA/ETS (partially)	IPCC EAER UNFCCC

2.1 Comparisons: flown distance and number of operations

The comparison of the number of operations and flown distance of 2019, aggregated at ECAC or State levels provide a good indication of the possible differences for CO2 accounting. At the ECAC area level, the relative difference between the ICAO and IPCC methods, is - 0.66% for operations number and + 0.26% on flown distance (Source EUROCONTROL/CRCO). This is explained by the fact that movements of the operators registered outside the ECAC area member states are not counted in.

The table hereafter lists the countries for which the relative differences of counting the number of operations or flown distance is more than 50% or less than -50% (Source EUROCONTROL/CRCO).

Departure Country	(ICAO-IPCC) % difference number of operations	(ICAO-IPCC) % difference number of flown distance
ALBANIA	-71.04%	-75.34%
ARMENIA	-80.76%	-84.64%
AUSTRIA	114.51 %	104.81%
BOSNIA & HERZEGOVINA	-83.45%	-80.73 %
CROATIA	-52.08%	-65.54%
CYPRUS	-84.06%	-92.75%
DENMARK	-68.07%	-53.81%
ESTONIA	-67.93%	-53.48%
FAROE ISLANDS	-100.00%	-100.00%
GEORGIA	-68.62%	-66.45%
GREECE	-58.26%	-65.83%
HUNGARY	213.95%	245.36%
IRELAND	509.31%	478.00%
ITALY	-71.45%	-63.90%
LIECHTENSTEIN	2100.00%	8572.91%
lITHUANIA	-78.83%	-65.95%
LUXEMBOURG	55.29%	54.05%
NORTH MACEDONIA	-98.69%	-98.90%
MALTA	97.00%	125.78%
MONACO	100.17%	708.97%

SLOVAKIA	-73.46%	-72.30%

The previous table highlights the possible relative differences for a country-by country approach:

- High differences for low-cost origin countries (Ireland, Austria, Hungary) as all the movements exceed the departures capacity: nb operations ICAO >> nb operations IPCC
  - ✓ Example: Ireland (Ryanair), Austria (EasyJet), Hungary (Wizzair)
- High differences for business jet country locations: nb operations ICAO > nb operations IPCC
  - ✓ Example: Monaco, Malta, Liechtenstein
- Difference for countries with lot of low-cost departures: nb operations ICAO < nb operations IPCC
  - ✓ Example: Greece, Italy

3. Impact on the action plan definitions

The choice of the method entails two significantly different approaches. The ICAO approach would bring the focus on the capability of a State to manage the emissions evolution of only its own "flag carriers". A State having a significant aviation activity operated by non-flag carriers would therefore not be able to reflect in the plan its possible policy on the evolution of its overall aviation activity. Also, if the State flag carriers have an important aviation activity between third countries, this would become a "responsibility" of the State in terms of emissions reduction plans.

The IPCC method, on the contrary, brings the focus on the management of the emissions reductions for the State related aviation activity, integrating the State's policy in terms of evolution and importance of the aviation business for it and national plans to reduce emissions (e.g., promotion of operations with more fuel-efficient aircraft). Allowing States to use the ICAO or the IPCC method has the risk of under estimation for some as well as double counting for others if consolidating the States action plans. It is also worth noting that the IPCC method actually allows consolidating and correlating the data with the CORSIA reporting. Indeed, under CORSIA emissions are reported by States aggregated at country pair level with no info on the operator. If all States were reporting action plans based on the IPCC approach aggregating at country pair level, this info can be consolidated and correlated with the CORSIA reported one. The ICAO method for the action plans would not allow this.

3.1 IMPACT on the baseline definition (ECAC)

The selection of the ICAO/IPCC method also affects the definition and estimation of the CO_2 emissions of the international flights at the ECAC level. The Base year dataset and the forecasts dataset that EUROCONTROL shall define and assess (at the ECAC level), are based on the IPCC. The ICAO method cannot be used for such assessments.