2021

GEORGIAN CIVIL AVIATION AGENCY

ACTION PLAN OF GEORGIA

TO REDUCE CO2 EMISSIONS IN AVIATION

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LIST OF ABBREVIATIONS

AAT - Aircraft Assignment Tool

ACARE – Advisory Council for Research and Innovation in Europe

ACA – Airport Carbon Accreditation

ACI – Airports Council International

AIRE – The Atlantic Interoperability Initiative to Reduce Emissions

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

ATM – Air Traffic Management

CAEP – Committee on Aviation Environmental Protection

CNG – Carbon neutral growth

CORSIA - Carbon Offsetting and Reduction Scheme for International Aviation

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

GHG – Greenhouse Gas

ICAO – International Civil Aviation Organisation

IFR – Instrumental Flight Rules

IPCC – Intergovernmental Panel on Climate Change

IPR – Intellectual Property Right

JU – Joint Undertaking

MBM – Market-based Measure

MT – Million tonnes

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

RED – Renewable Energy Directive

RPK – Revenue Passenger Kilometre

RTK – Revenue Tonne Kilometre

RTD – Research and Technological Development

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

SMEs - Small and Medium Enterprises

I. INTRODUCTION

Georgia, is a member of the European Civil Aviation Conference (ECAC) since 2005. ECAC is an intergovernmental organization covering the widest grouping of Member States of any European organization dealing with civil aviation. It is currently composed of 44 Member States, and was created in 1955.

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

Georgia, 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.

Georgia recognizes the value of each State preparing and submitting to ICAO an updated State action plan for CO2 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 Georgia submits to ICAO an action plan. The present document represents the action plan of Georgia. This document is an update of the previous state action plan submitted in 2012. The major changes since the last submission are the airlines' fleet composition and updates of their future equipage plans. These changes will reduce the CO2 emissions in the near future beyond the expected results that were presented in the former action plan.

Georgia shares the view that a comprehensive approach to reducing aviation CO2 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. Research and development on emission reductions technologies, including public-private partnerships;

iii. Development and deployment of sustainable aviation fuels, including research and operational initiatives undertaken jointly with stakeholders;

iv. Improvement and optimization of Air Traffic Management and infrastructure use, within Europe, in particular through the Single European Sky ATM Research (SESAR), and also beyond European borders through participation in international cooperation initiatives; and

v. Market Based Measures, which allow the sector to continue to grow in a sustainable and efficient manner, recognizing that the measures at (i) to (iv) above cannot, even in aggregate, deliver in time the emissions reductions necessary to meet the ICAO 2020 Carbon Neutral Growth (CNG) global goal.

Georgia shares 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's goal of CNG from 2020 onwards (CNG2020), and to strive for further emissions reductions. Georgia fully supports 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.

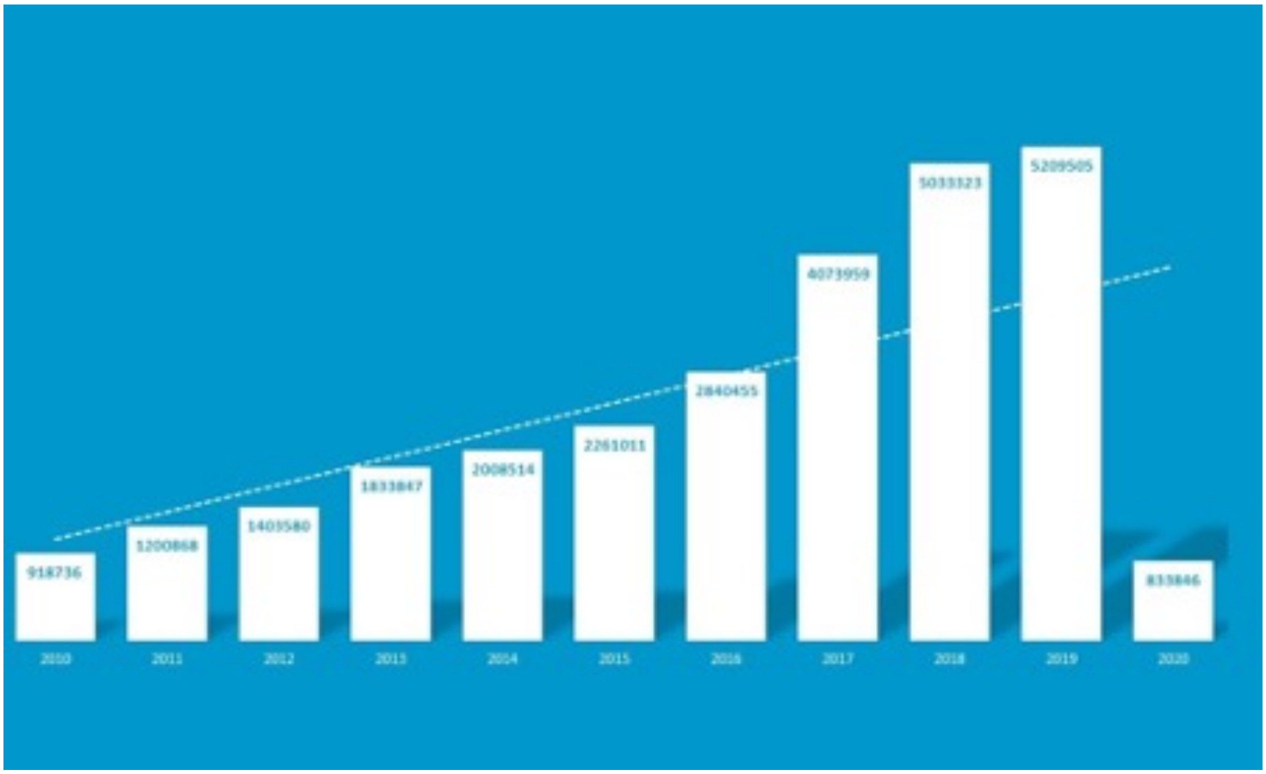
In Georgia a number of actions are undertaken at the national level, including those by stakeholders. These national actions are reported in Section III of this Plan.

1.1. BACKGROUND

International aviation emissions currently account for less than 2% of total global CO2 emissions, but are projected to grow as a result of the continued development of the sector. While the overall contribution may be small, emissions from international aviation are growing faster than almost any other sector. The aviation industry has been able to achieve significant improvements in fuel efficiency as a result of aircraft technology and more efficient operational procedures (such as more direct flight paths), but these improvements have been offset by even stronger growth in demand for international air transport.

Over the next 20 years, the International Air Transport Association (IATA) predicts fuel efficiency to improve by around 1.5 percent per annum, while air passengers are expected to grow by around 4.5 percent per annum (to 7.4 billion in 2034). The Intergovernmental Panel on Climate Change estimates that aviation's contribution to climate change could grow to 5% by 2050 if no action is taken to reduce emissions.

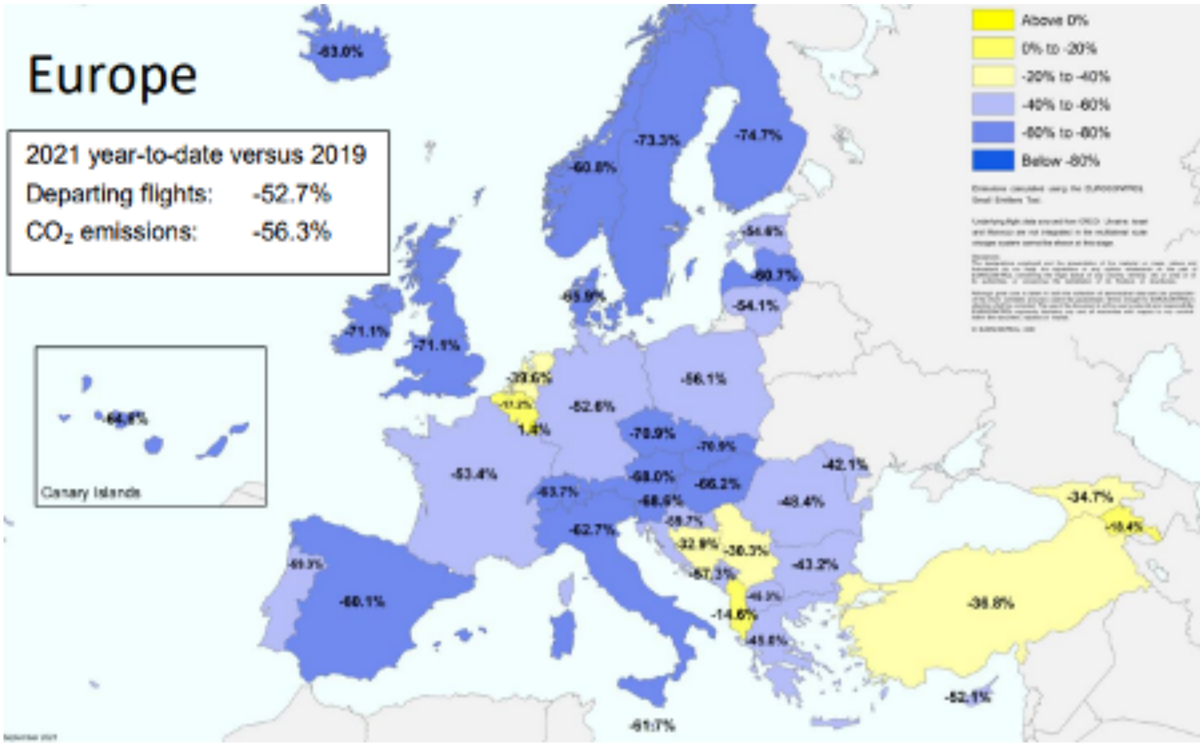
2010-2020 total pax from Georgian Airports:



Impacts of the COVID-19 Pandemic

In January, EUROCONTROL reviewed CO_2 emissions from European flights in 2020 compared to 2019. Following summer's strong traffic recovery in 2021, the first eight months of 2021 were compared with the same period in 2019.

According to the above Study, Restrictions on short-haul and long-haul travel have continued from 2020 into 2021 but, mostly for short-haul, in summer 2021 there has been some significant relaxation. There were 52.7% fewer departing flights so far in 2021 than in the same period in 2019, in the countries shown on the map below:

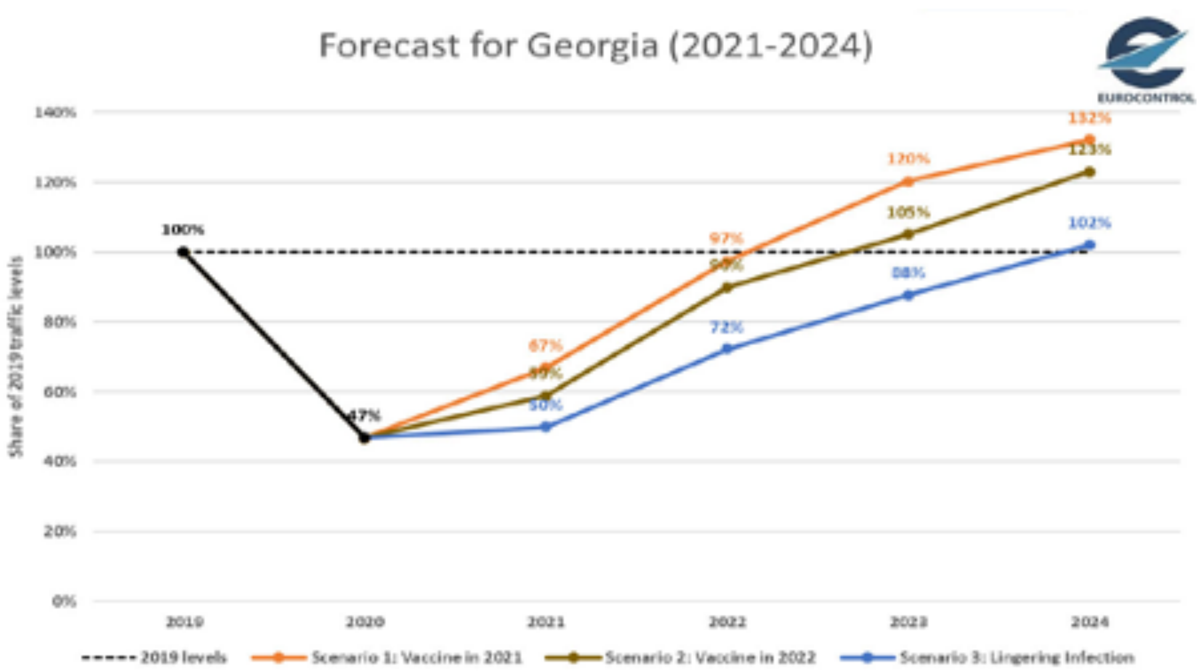


CO_2 emissions were down a little more than flights: 56.3% lower than in January-August 2019. The decline in CO2 is deeper than that of flight departures because medium- and long-haul, which emit more CO2, have recovered more slowly than short-haul. For example, within that overall 52.7% decline in flights, medium-haul flights are down 57%, while very short-haul (which are often domestic) are down only 40%.

The map shows that there remains considerable variation between countries in their CO_2 emissions.

Emissions calculated by using EUROCONTROL's Small Emitters Tool shows that Georgia's CO2 emissions from flights so far in 2021 were -34.7%.

The forecast prepared by EUROCONTROL bellows shows the traffic recovery scenarios for Georgia for the period of 2021-2024:



II. SECTION I

2.2. CURRENT STATE OF AVIATION IN GEORGIA

2.2.1 GEOGRAPHIC AND DEMOGRAPHIC STRUCTURE OF GEORGIA

Georgia is a country in the Caucasus region on the Black Sea. The land has a total area of 69,700 km² (26,911 mi²) and a total coastline of 310 km (192.6 mi).

There are direct national borders with the 4 neighbouring countries Armenia, Azerbaijan, Russia and Turkey.

Coordinates: 42°00′N 43°30′E / 42.000°N 43.500°E

Highest point: Mount Shkhara 5 · 201 m (17 · 064 ft)

Lowest point: Between Poti and Kulevi · (-1.5-2.3 m)

Longest river: Alazani River 407 km (253 mi)

Largest lake: Paravani Lake · 37.5 km2 (14.5 sq mi)

Land use:

5% Urban areas: 3,603 km²

37% Agricultural areas: 25,559 km²

41% Forest: 28,312 km²

0% Water areas: 210 km²

18% Others: 12,226 km²

Population:

Population: 3,714,000

Population per km²: 53.29

Official Language: Georgian

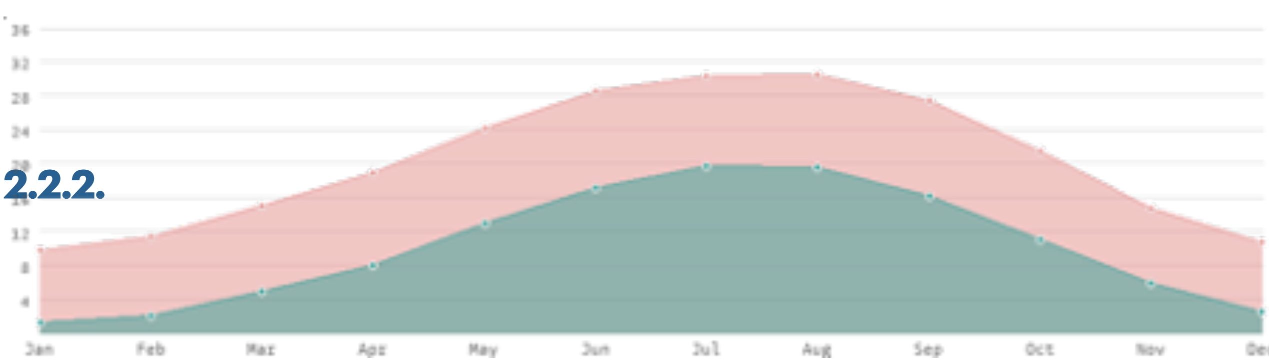
Constitution: Georgia is a representative democratic parliamentary republic, with the President as the ceremonial head of state, and Prime Minister as the head of government. The country is a pluralist multi-party parliamentary representative democracy.

Currency: Georgian Lari

Capital City: Tbilisi

The climate in Georgia: A moderate climatic zone determines the weather in Georgia. As usual, in the northern hemisphere, the days in the summer months are not only warmer but also longer. Depending on the season, the average daytime temperatures range between 10 and 31 degrees. In some parts of the country, the temperature raises up to 32 °C. In the colder months and depending on the region, the temperature lowers down to 1°C in a month's average.

Average daytime and night-time temperatures:



2.2.2. HISTORICAL BACKGROUND

For much of the 20th century, Georgia's economy was within the Soviet model of command economy. Since the fall of the USSR in 1991, Georgia embarked on a major Structural reform designed to transition to a free market economy. As with all other post-Soviet States, Georgia faced a severe economic collapse. The civil war and military conflicts aggravated the crisis. The industry output diminished. By 1994 the gross domestic product had shrunk to a quarter of that of 1989.

With the post war development policies, Georgia is envisaged towards a massive development phase, civil aviation has been clearly identified as a catalyst to propel economic growth through establishing its position in the region as an aviation activity hub. Some of the prerequisites to meet this requirement that have been taken to enhance the stakeholder capabilities include liberalizing the existing regulatory procedures and productive infrastructure investments for the stakeholders and sub-sectors of aviation.

Transport plays a major role in every modern society as a means for economic development and a prerequisite for achieving social and regional cohesion. The transport sector in Georgia is of an exceptional importance for raising the competitiveness of national economy and for providing services to its citizens. Favourable geographic location of Georgia provides opportunities for the development of transit transport along the five Pan-European transport corridors, crossing the country, and favourable conditions for communication between Western and Eastern Europe and the Middle East, Western and Central Asia. The Minister of Economy and Sustainable Development of Georgia is in charge of implementing the state policy in the field of transport, and coordinates the process of drafting and implementation of a strategy for development and restructuring of transport. Executive agencies (Civil Aviation, Maritime and Road Transport) have been established within the Ministry of Economy and Sustainable Development of Georgia, which function as regulatory bodies for the individual transport modes.

Since early 21st century, visible positive developments have been observed in the economy of Georgia. In 2007, Georgia's real GDP growth rate reached 12%, making Georgia one of the fastest growing economies in Eastern Europe. The World Bank dubbed Georgia "the number one economic reformer in the world" because it has in one year improved from rank 112th to 17th in terms of ease of doing business.

Starting from 2010, huge reforms in the field of Civil Aviation was initiated, which mostly related to strengthening of safety, security and environmental regulations. Aviation Authority was established, with independent budgetary source, subordinated to the Ministry of Economy and Sustainable Development.

The institutional framework of the civil aviation sector in Georgia presents as proper separation of functions between policy making, technical regulation, operation of the infrastructure and the investigation of incidents and accidents.

Technical regulation/supervision is conducted by the Georgian Civil Aviation Agency (GCAA), a legal entity of public law, which is professionally run and in the process of full compliance with high standards of safety and security. GCAA was created in April 2011, when the Government of Georgia realized needs of reforms in that field and demolished United Transport Administration which was responsible for the regulation of Road Transport and Maritime transport as well, creating at the same time three independent agencies.

In December 2010, Georgia signed a Common Aviation Area Agreement with EU and its Member States, which involves the harmonization of European standards and regulations, aiming to enhance aviation safety, air traffic control, flight crew licensing, airworthiness, security and environment.

The air traffic services is operated by "Sakaeronavigatsia" Ltd, a public corporation responsible for the provision of communication, air navigation, surveillance, air traffic management, aviation meteorological services and aeronautical information services over the Georgian airspace.

2.2.3. NATIONAL STAKEHOLDERS

2.2.3.1. CIVIL AVIATION REGULATOR(S)

2.2.3.1.1. GENERAL INFORMATION

Civil aviation in Georgia falls under the responsibility of the Ministry of Economy and Sustainable Development.

The main stakeholders involved in Georgia are:

- Ministry of Economy and Sustainable Development

A. Transport Policy department under the Ministry, and

B. Aircraft Accident and Incident Investigation Bureau (AAIB) under the Ministry.

- Ministry of Defence;
- Georgian Civil Aviation Agency (GCAA), under the state control of the Ministry of Economy and Sustainable Development;
- Sakaeronavigatsia LTD- the only Air Navigation Service Provider in Georgia (ANSP is organized under private law, responsible for the provision of ANS in Georgia);
- United Airports of Georgia LLC;
- TAV Urban Georgia LLC (Airport Operator) operating two international airports in Georgia;
- Air Operators;
- Training Institutions/Organizations.

The activities of stakeholders are detailed in the following subchapters.

Different national entities having regulatory responsibilities in Georgia are summarized in the table below:

Activity in:	**Organisation responsible**	**Legal Basis**
Rule-making	GCAA Ministry of Economy and Sustainable Development of Georgia Parliament of Georgia	Air Code of Georgia Law of Georgia on Administration and Regulation in the Field of Transportation– of 30.03.2007
Safety Oversight	GCAA	Air Code of Georgia Law of Georgia on Administration and Regulation in the Field of Transportation– of 30.03.2007

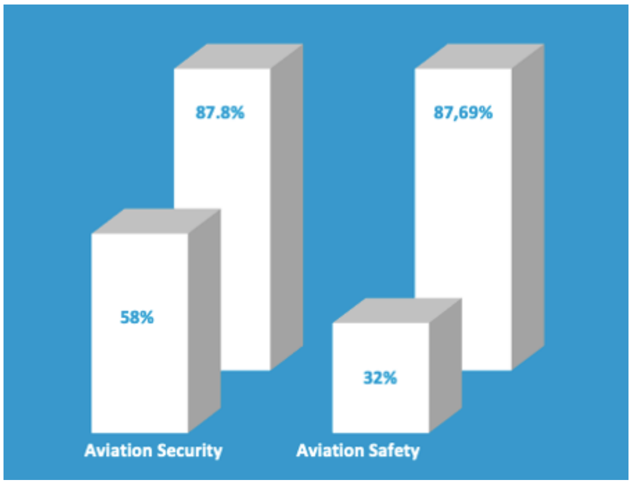
Enforcement actions in case of non-compliance with safety regulatory requirements	GCAA	Code on Administrative Offences of Georgia
Airspace	President of Georgia GCAA / Ministry of Defence	Air Code of Georgia Governmental decree N276 on Airspace structure and classification of 23.106.2016. Presidential decree N253 on distribution of responsibilities and roles between state agency regarding civil and state aviation oversight and control of 09.06.2003.
Environment	GCAA Ministry of Environment	Air Code of Georgia
Security	GCAA MIA	Air Code of Georgia
Accident investigation	AAIB	Ministerial Order №1-1/242 on Incident and accident investigation rules in civil aviation

2.2.3.1.2. GEORGIAN CIVIL AVIATION AGENCY (GCAA)

The Civil Aviation Authority of Georgia – "Georgian Civil Aviation Agency" (GCAA) is the Legal Entity of Public Law under the Ministry of Economy and Sustainable Development of Georgia. It has its own operating budget.

GCAA is responsible for monitoring the status and development of civil aviation in Georgia. It is responsible for ensuring that civil aviation in Georgia has a high safety standard and is in keeping with sustainable development. GCAA aims to ensure the safe, best possible and environmentally friendly use of the infrastructure, which includes airspace, air traffic control and aerodromes. It also supervises aviation companies to which it issues an operating licence based on a technical, operational and financial evaluation. GCAA bases itself mainly on internationally agreed standards and practices for its supervisory activities. In addition, GCAA is responsible for the formulation and implementation of aviation policy decisions. Agency is also involved in various international organizations or collaborates closely with them.

Development and Achievements: The Agency was created on April 15, 2011. In 2010, the decision to establish an aviation authority was made with the aim of improving flight safety and security standards in Georgia.



Since 2013, Georgian Civil Aviation Agency has improved its aviation safety oversight rates from 32% to 87.69%. As for aviation security oversight, rates have improved from 58% to 87.8%. According to the results of the ICAO audit conducted in 2018, the overall rate of effective implementation of international civil aviation standards and practices by Georgia became 87.69%.

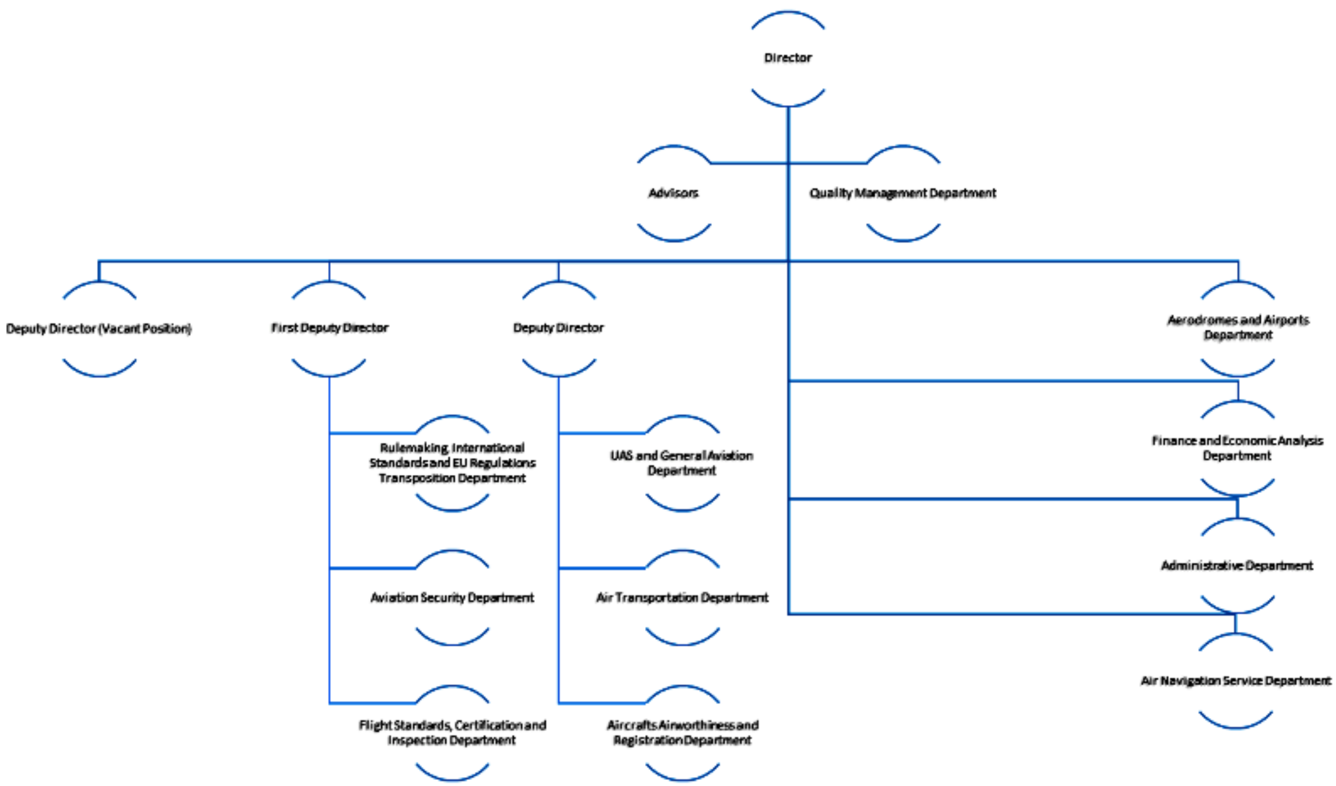
According to the new indicators, Georgia ranks first in the region in terms of implementation of international aviation standards and oversight activities, and tenth in Europe.

In the interests of passengers and flight safety, the Agency consistently implements the EU regulations related to aviation safety, aviation security, maintenance, consumer protection and air traffic management. Under the Common Aviation Area Agreement between Georgia and the European Union and its Member States (CAAA), more than thirty regulations have already been introduced, including such areas as protection of passengers' rights, inspection of foreign aircraft (EU SAFA program), assessment of financial sustainability of airlines, occurrence reporting and other important regulations.

In 2019, at the ICAO Assembly, Georgia was awarded special certificates by the President of the ICAO for significant reforms and high results achieved in the field of flight safety and aviation security oversight.

Complementary information on the work of GCAA could be found on www.gcaa.ge.

Organizational structure of the Georgian Civil Aviation Agency (GCAA)



2.2.3.1.3. AIR NAVIGATION SERVICE PROVIDER –SAKAERONAVIGATSIA LTD

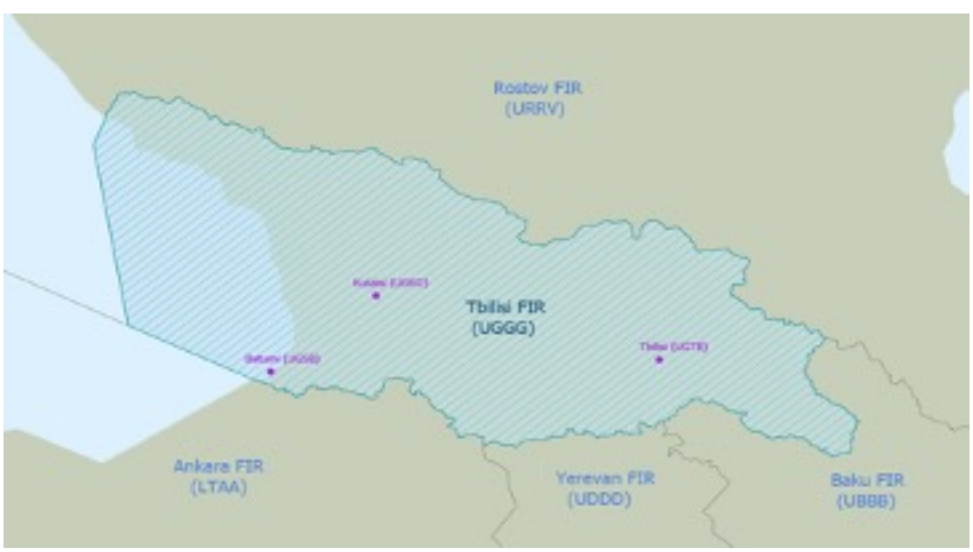
SAKAERONAVIGATSIA LTD provides with the following services:

- Air Traffic Management in the Georgian airspace
- Flight Information Services (FIS/AFIS)
- Aeronautical Information Services (AIS)

- Provision of Emergency Messages
- Airspace Management
- Navigation service
- Radio Surveillance service
- Meteorological service
- Lightning services
- Aeronautical Rescue Coordination Center (ARCC)

Governance:	Limited Liability Company	**Ownership:**	100% State owned
Services provided	**Y/N**	**Comment**	
ATC en-route	Y		
ATC approach	Y		
ATC Aerodrome(s)	Y		
AIS	Y		
CNS	Y		
MET	Y		
ATCO training	Y	Initial Training is outsourced. Transitional Training, Refresher and other local specifics related is provided in-house.	
Others		AFIS	
Additional information:	None		
Provision of services in other State(s):	N		
Annual Report published:	N		

Sakaeronavigatsia's web address: www.airnav.ge.



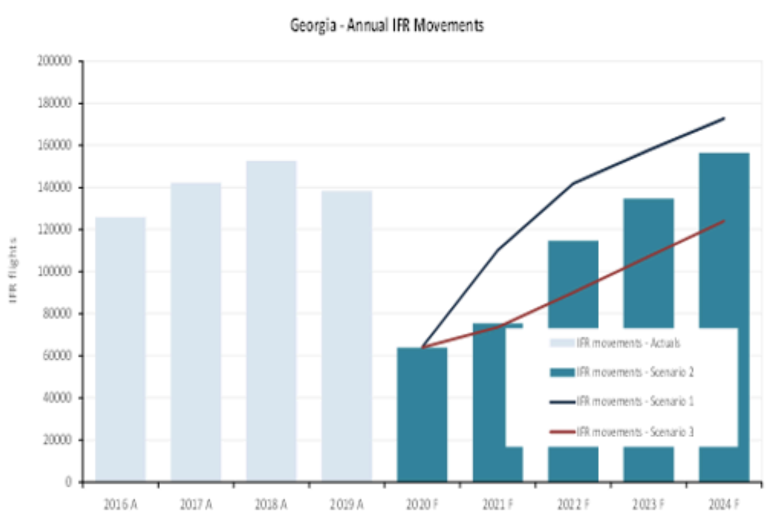
Geographic Area (FIR)

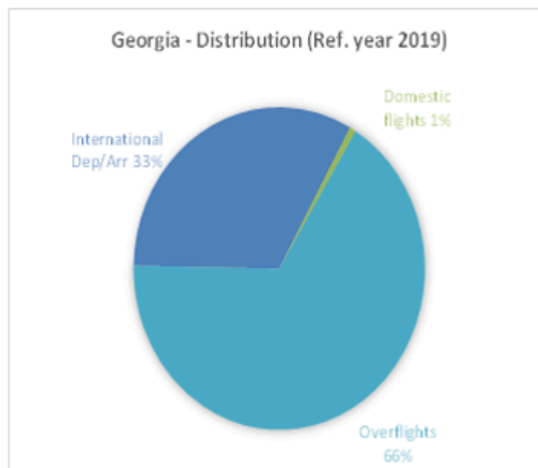
Geographical description of the FIR(s): Tbilisi FIR is surrounded by the following 4 State FIRs: Rostov FIR (Russia), Baku FIR (Azerbaijan), Yerevan FIR (Armenia), Ankara FIR (Turkey). This is graphically presented in the figure below:

Flight and information area controlled by SAKAERONAVIGATSIA scope 89,300 km2 and encompasses the following:

- Dryland of the country;
- State territorial waters;
- A part of the Neutral Waters in the Black Sea aquatic area.

Traffic in figures/Evolution of Traffic is shown on the below charts:





Traffic in Georgia decreased by 53% in 2020 compared to 2019 (A=Actual/ F = Forecast)

EUROCONTROL Five-Year Forecast 2020-2024									
IFR flights yearly growth		2017 A	2018 A	2019 A	2020 F	2021 F	2022 F	2023 F	2024 F
Georgia	Sc1				-53.6%	71.7%	28.8%	11.1%	9.5%
	Sc2	13.2%	7.2%	-9.3%	-53.7%	17.9%	51.9%	17.6%	16.0%
	Sc3				-53.8%	15.0%	22.4%	19.1%	15.6%
ECAC	Sc1				-55.1%	61.9%	21.9%	8.9%	6.8%
	Sc2	4.0%	3.8%	0.8%	-56.4%	16.6%	41.9%	14.1%	12.2%
	Sc3				-56.6%	14.5%	17.5%	14.8%	11.6%

2.2.3.1.4. AIRPORTS IN GEORGIA

Three international airports in Georgia, (UGTB Tbilisi International Airport, UGSB Batumi International Airport, and UGKO Kutaisi International Airport) are organized as State Enterprises, owned by the Government of Georgia. At the same time, Operational rights of Tbilisi and Batumi airports are transferred under the concession to the Turkish Company TAV. Four domestic airports are in operation in Mestia (UGMS), Ambrolauri (UGAM), Telavi (UGTT), and Natakhtari. Military airdromes are not available for civilian flights.

United Airports of Georgia LLC is a state-owned company in Georgia established in 2011, functioning under the Ministry of Economy and Sustainable Development. It is the owner on behalf of the Georgian government of the country's civil airports, of which it operates three. The civil airports comprise Tbilisi International Airport and Batumi International Airport, which are both operated by TAV Georgia, and those operated by UAG itself, which are Kutaisi International Airport and two domestic airports, namely, Mestia Airport, and Ambrolauri Airport.

All those airport terminals have been fully rebuilt and all airport infrastructure has been modernized during last 8 years.

For additional information, please visit:

http://www.airports.ge

http://www.kutaisiairport.ge

TAV Georgia

Tbilisi International Airport

In 2005, TAV Airports won the tender for the operation rights of Tbilisi International Airport and included the first airport operation abroad to its portfolio. Located at a strategic position in the Caucasus region in terms commerce and transportation, the airport has been listed among the 'Top 10 Airports in the Eastern Europe' by Skytrax for four years in a row. Putting the new terminal into operation in 2007, TAV holds the right to operate Tbilisi

International Airport until February 2027.

For the official web site, please visit: www.tbilisiairport.com

Batumi Airport

Located in Batumi, the most important tourism center of Georgia, Batumi Airport has been operated by TAV Airports since its start of operations in 2007. Batumi Airport is a shared facility for both Georgia and Turkey as a token of cooperation between the two countries. The terminal building was renovated and doubled in capacity in 2021. TAV holds the right to operate Batumi Airport until August 2027.

For the official web site, please visit www.batumiairport.com.

United Airports of Georgia

United Airports of Georgia LLC, is 100% state owned enterprise. As the airports authority of the state, UAG owns all airports in the country, including 3 international and 2 domestic airports at the moment. All those airport terminals have been fully rebuilt and all airport infrastructure has been modernized during last 8 years.

Mestia Airport (Queen Tamar Airport) was officially opened in December 2010 to support mountain regions of Georgia and facilitate tourism development. The Airport is operated by UAG.

Kutaisi David the Builder International Airport was opened in September 2012. Kutaisi Airport is first low cost airport in the whole region and is focused to attract low cost carriers and facilitate tourism development in the country. Kutaisi Airport is also operated by UAG.

Total Numbers of Passenger by Airports 2011-2021:

Georgian International Airports	Passenger, Gargo, Flight	2011Y	2012Y	2013Y	2014Y	2015Y	2016Y	2017Y	2018Y	2019Y	2020Y	2021Y (01.01-31.08)
TOTAL	Passenger	1201441	1403543	1833807	2008514	2261011	2840455	4073959	5033323	5200494	829787	1387724
TOTAL	Cargo	15490520	16247266	16649672	16902142	14885068	29078,96	25542,14	17031,8	17289,13	18725,2	9744,074
TOTAL	Flight	11942	12294	12707	13076	13667	15318	20980	24606	24386	7134	8846
TBILISI INTERNATION AIRPORT	Passenger	1058482	1219174	1436046	1575327	1847116	2252535	3164139	3808619	3692136	590123	930509
TBILISI INTERNATION AIRPORT	Cargo	11724,005	12304,77	12361,65	12735,384	10623,49	29078,96	25542,14	17031,8	17289,13	18725,2	9744,074
TBILISI INTERNATION AIRPORT	Flight	9675	9756	10187	10303	11069	11986	16267	19004	18212	5577	6446
BATUMI INTERNATION AIRPORT	Passenger	133852	168510	208937	213841	226476	312343	495668	598891	624151	51412	333298
BATUMI INTERNATION AIRPORT	Flight	1762	2026	1563	1599	1504	1908	2687	3055	2852	452	1676
KUTAISI INTERNATION AIRPORT	Passenger	4527	12932	187939	218003	182954	271363	405173	617373	873616	183873	119812
KUTAISI INTERNATION AIRPORT	Flight	51	74	895	1092	900	1238	1614	2174	2907	904	602
AMBRALAURI	Passenger	0	0	0	0	0	0	1723	1582	1966	1214	1200
AMBRALAURI	Flight	0	0	0	0	0	0	113	102	105	65	74
MESTIA QUEEN TAMARA AIRPORT	Passenger	4580	2927	885	1343	4465	4214	7256	6858	8625	3165	2905
MESTIA QUEEN TAMARA AIRPORT	Flight	454	438	62	82	194	186	299	271	310	136	48

2.2.3.1.5. AIRLINES WITH A GEORGIAN AOC

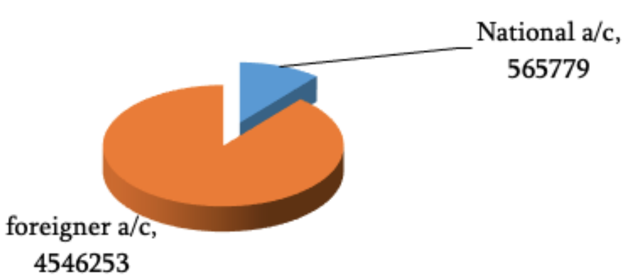
N	Operator	Operation Type
1	**a/c Aero Expedition**	Pax/Cargo/ General Aviation
2	**a/c Tusheti**	General Aviation
3	**a/c Airline Geo Sky**	Cargo
4	**a/c Aviaservice**	Pax/Cargo/ General Aviation
5	**LTD a/c Ak-Air**	Pax
6	**LTD TCA**	Pax/Cargo/ General Aviation
7	**My-Way Airlines Co LTD**	Cargo/General Aviation
8	**LTD Serviceair**	Domestic Pax/ General Aviation
9	**LTD Sky Travel**	Hot air balloon
10	**LTD Georgian Airways**	Pax/Cargo
11	**LTD Easy Charter**	Cargo
12	**Georgian Aviation University**	Pax (light)

Number of Carried passengers per airline in 2019 (national and foreign A/C):

A/C	Pax
Wizz Air	825290
Turkish Airlines	572181
Georgian Airways	500482
Ukraine International	207588
Flydubai	204364
Ural Airlines	190341
Pobeda Airlines	180684
Pegasus Airlines	180761

SkyUp Airlines	156186
Air Arabia	144216
Azerbaijan Airlines	136599
Qatar Airways	133034
Belavia	136532
El Al Israel Airlines	127166
IsrAir	121596
Qeshm Air	115278
Lufthansa	104099
Aeroflot	97338
S7 Airlines	95608
Air Astana	85388
LOT Polish Airlines	79293
Air Baltic	62497
Flynas	53645
Aegean Airlines	53029
Yanair	49629
Taban airlines	47803
MyWay Airlines	42537
China Southern	38725
Jazeera Airways	36908
Arkia	30244
Gulf Air	27289
SCAT Airlines	26879
Air Cairo	27507
A/C Armenia	29952

Nordavia	22561
a/c AirGeorgia	22760
Tarom	18453
Air France	17101
AtlasGlobal	13645
Travel Service	13261
Iran Air	10463
Uzbekistan Airways	10346
Ryanair	18849
Wings of Lebanon	8341
Fly Jordan	6746
Ellinair	6677
Kuwait Airways	6460
Enter Air	6174
Red Wings	3869
Bravo	3173
Air Malta	2224
Severstal Air Company	261
Total	5112032



2.2.3.1.6. INTERNATIONAL MEMBERSHIP

Georgia is a member of the following international organizations:

Organisation	Member	Since
ECAC	✓	2005
EUROCONTROL	✓	January 1st 2014
European Union		Associate Member (2014)
EASA		Working Agreement (signed 2009)
ICAO	✓	1994
WMO	✓	1993

REGIONAL COORDINATION AND PROJECTS

The CAAA (Common Aviation Area Agreement) is an agreement initiated and managed by the European Commission, aiming at the establishment of equal conditions of competition and common rules in aviation, including ATM and environment. As for ATM, the agreement will seek the highest degree of cooperation with the view to extending SES among the States concerned.

Georgia has accepted to align its national aviation legislation to the complete aviation *acquis* of the Community. To this end, Georgia signed the CAA Agreement in December 2010 which was ratified in February 2011.

In light of the SES implementation and predefined safety and performance objectives, Technical support project was initiated between the NSA and EUROCONTROL.

Application of the agreements will bring many benefits and improvements in Aviation sector, including strengthening of oversight capabilities as well.

III. SECTION II-EUROPEAN STATES' ACTION PLAN

ECAC/EU COMMON SECTION

The European section of this action plan presents a summary of the actions taken collectively throughout the 44 States of the European Civil Aviation Conference (ECAC) to reduce CO2 emissions from the aviation system and which are relevant for each State, and provides an assessment of their benefit against an ECAC baseline. It also provides a description of future measures aimed to provide additional CO2 savings.

Aviation is a fundamental sector for the European economy, and a very important means of connectivity, business development and leisure for European citizens and visitors. For over a century, Europe has promoted the development of new technology, and innovations to better meet societies' needs and concerns, including addressing the sectorial emissions affecting the climate.

Since 2019, the COVID-19 pandemic has generated a world-wide human tragedy, a global economic crisis and an unprecedented disruption of air traffic, significantly changing European aviation's growth and patterns and heavily impacting the aviation industry. The European air transport recovery policy is aiming at accelerating the achievement of European ambitions regarding aviation and climate change.

3.1. ECAC BASELINE SCENARIO

The baseline scenario is intended to serve as a reference scenario for CO2 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 kilometres (RPK) and revenue tonne-kilometres (RTK);

• Its associated aggregated fuel consumption; and

• Its associated CO2 emissions.

The sets of forecasts correspond to projected traffic volumes in a scenario of "Regulation and Growth", while corresponding fuel consumption and CO2 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, sustainable aviation fuels or market based measures).

Traffic Scenario "Regulation and Growth"

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[1] was 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.[2] 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.
- Factors characterising the **passengers** and their travel preferences change patterns in travel demand and travel destinations.

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

[2] Prior to COVID-19 outbreak.

- **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 1 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 (published in 2018 by EUROCONTROL). Historical data for the year 2019 are also shown later for reference.

Table 1. Summary characteristics of EUROCONTROL scenarios

	Global Growth	***Regulation and Growth***	*Fragmenting World*
2023 traffic growth	High ↗	Base →	Low ↘
Passenger			
Demographics (Population)	Ageing UN Medium-fertility variant	Ageing UN Medium-fertility variant	Ageing 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	Hubs: Mid-East ↗↗ Europe ↘ Turkey ↗	Hubs: Mid-East ↗↗ Europe & Turkey ↗	No change →
Network	Point-to-point: N-Atlantic. ↗↗	Point-to-point: N-Atlantic. ↗	
Market Structure	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions	Industry fleet forecast + STATFOR assumptions

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[3] 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.

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

Considering the most-likely scenarios of the long-term forecast6 and the medium-term forecasted version of the long-term flight forecast has been derived:

a) Replace the long-term forecast6 horizon by the most recent medium-term forecast7 to account for COVID impact;

b) Update the rest of the horizon (2025-2040) assuming that the original growth rates of the long-term forecast6, 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 the 2035-2040 period, but with a 0.9 decay.[4]

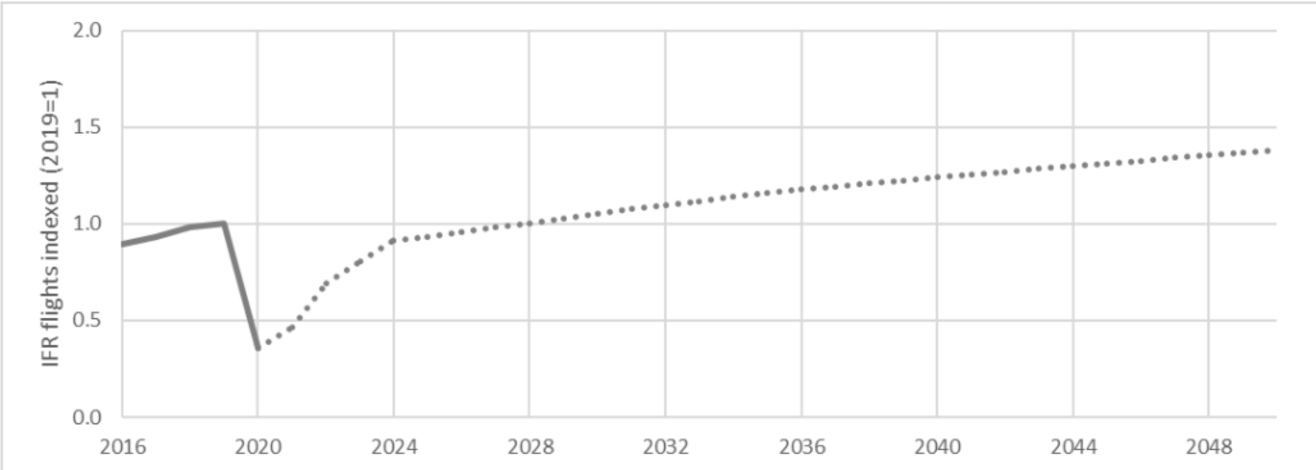
The method used relies on the calculation of adjustment factors at STATFOR[5] region-pair level and have been applied to the original long-term forecast5. Adjusting the baseline enables to further elaborate the baseline scenario as forecasted future fuel consumption and to 2030, 2040 and 2050, in the absence of action.

Figure 1 below shows the ECAC scenario of the passenger flight forecasted international departures for both historical (solid line) and future (dashed line) years.

Figure 1. 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.

[4] 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.

[5] 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.



Further assumptions 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[6] 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. How-ever, no information about the freight tonnes carried is available. Hence, historical and fore-casted cargo traffic have been extracted from another source (ICAO[7]). This data, which is presented below, includes both belly cargo transported on passenger flights and freight transported on dedicated all-cargo flights.

Historical fuel burn and emission calculations are based on the actual flight plans from the PRISME[8] 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 CO2 emissions for historical years is built up as the aggregation of fuel burn and emissions for each aircraft of the

[6] 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 overseas are attached to the State having the sovereignty of the territory. For example, France domestic include flights to Guadeloupe, Martinique, etc.

[7] 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.

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

associated traffic sample characteristics. Fuel burn and CO2 emission results consider each aircraft's fuel burn in its ground and air-borne 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 CO2 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 data sets (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 were calculated as the number of tonnes carried by kilometres, 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 CO2 emissions of European aviation in the absence of mitigation actions.

Table 2. Baseline forecast for international traffic departing from ECAC airports

Year	Passenger Traffic (IFR movements) (million	Revenue Passenger Kilometres RPK	All-Cargo Traffic (IFR movements) (millio	Freight Tonne Kilometres transported FTKT	Total Revenue Tonne Kilometres RTK (billion)
2010	4.56	1,114	0.198	45.4	156.8
2019	5.95	1,856	0.203	49.0	234.6

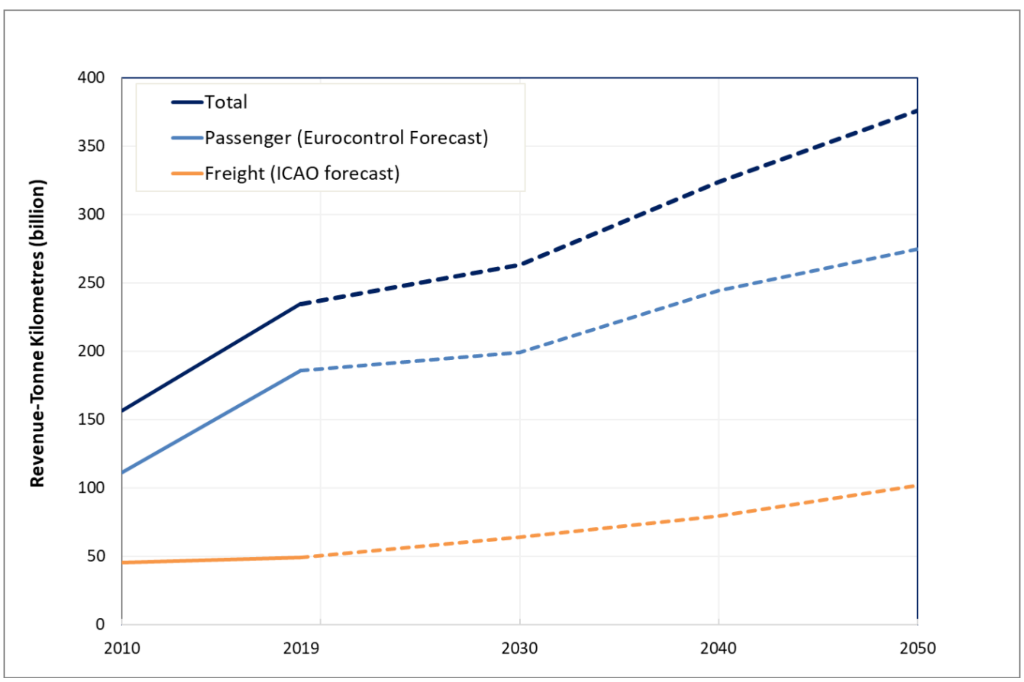
2030	5.98	1,993	0.348	63.8	263.1
2040	7.22	2,446	0.450	79.4	324.0
2050	8.07	2,745	0.572	101.6	376.1

Table 3. Fuel burn and CO_2 emissions forecast for the baseline scenario

Year	Fuel Consump tion (10^9	CO_2 emission s (10^9 kg)	Fuel efficiency (kg/	Fuel efficiency (kg/
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	0.250

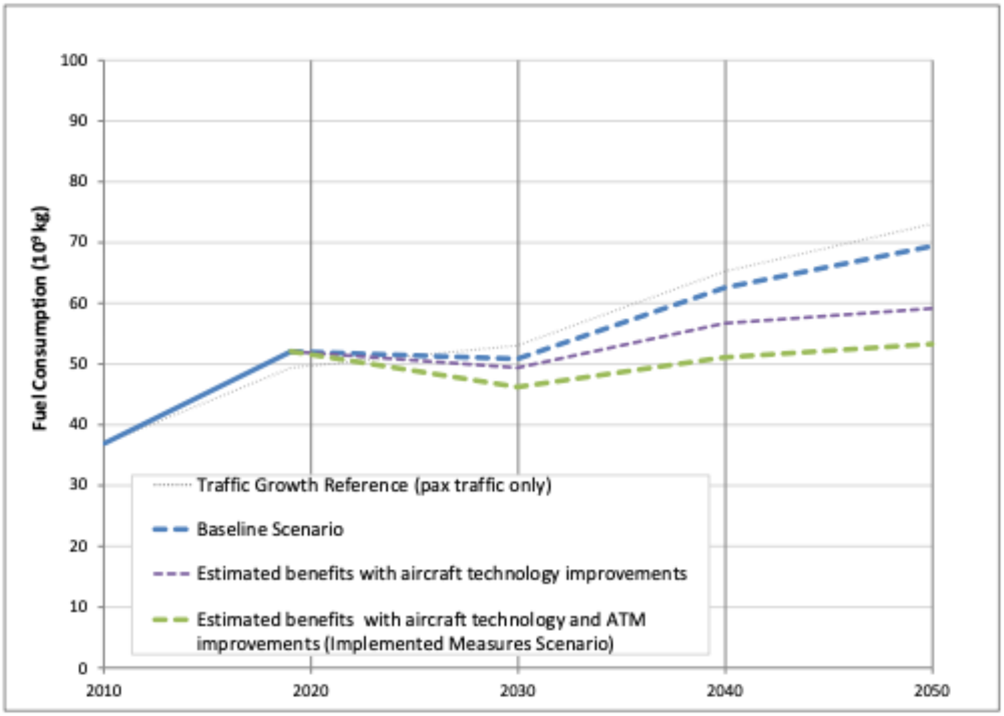
For reasons of data availability, results shown in this table do not include cargo/freight traffic.

Figure 2. Forecasted traffic until 2050 (assumed both for the baseline and implemented measures scenarios).



The impact of the COVID-19 in 2020 is not fully reflected in Figure 2, as this representation is oversimplified through a straight line between 2019 and 2030. The same remark applies for Figure 3 and Figure 4.

Figure 3. Fuel consumption forecast for the baseline and implemented measures scenarios (international passenger flights departing from ECAC airports).



3.2. ECAC SCENARIO WITH IMPLEMENTED MEASURES: ESTIMATED BENEFITS

In order to improve the 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 CO2 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 air-craft has been generated using the Aircraft Assignment Tool[9] (AAT) developed collaboratively by EUROCONTROL, EASA and the European Commission. The retirement process of AAT 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 fore-cast 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 of 5,280 kg of fuel per flight for ECAC (including oceanic region) is used as a baseline[10]. Based on the information provided by the PAGAR 2019 document[11], and compared to a 2012 baseline, the benefits at the end of Wave 1 could be about 3% CO2/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 CO2/fuel savings (352.6 kg of fuel) to reach the initial ambition target of about 10% CO2/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 improvements are reported extensively for years 2040 and 2050.

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

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

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

The as yet estimated benefits of Exploratory Research projects[12] are expected to increase the overall future fuel savings.

While the effects of **introduction of Sustainable Aviation Fuels (SAF)** were modelled in previous updates on the basis of the European ACARE goals[13], 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. How-ever, numerous initiatives related to SAF (e.g. ReFuelEU Aviation) are largely described in Section B chapter 2 and it is expected that future updates will include an assessment of its benefits as a collective measure.

Effects on aviation's CO2 emissions of **market-based measures** including the EU Emissions Trading System (ETS) with the linked Swiss ETS, the UK ETS and the ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) have not been modelled 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 proposal for the revision of the EU ETS Directive concerning aviation, is under development to complete the implementation of CORSIA by the EU and to strengthen the ambition level of the EU ETS. CORSIA is not considered a European measure but a global one. It aims for carbon-neutral growth (CNG) of aviation as compared to the average of 2019 and 2020 levels of emissions in participating States, and an indication of a corresponding (hypothetical) target applied to Europe is shown in Figure 4[14], 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.

Tables 4-6 and Figure 4 summarise the results for the scenario with implemented measures. It should be noted that **Table 4** show direct combustion emissions of CO2 (assuming 3.16 kg CO2 per kg fuel). More detailed tabulated results are found in Appendix A, including results expressed in equivalent CO2 emissions on a well-to-wake basis (for comparison purposes of SAF benefits).

Table 4. Fuel burn and CO2 emissions forecast for the Implemented Measures Scenario (new aircraft technology and ATM improvements only)

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

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

[14] 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).

Year	Fuel Consumption (10^9 kg)	CO_2 emissions (10^9 kg)	Fuel efficiency (kg/RPK[22])	Fuel efficiency (kg/RTK[12])
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 5. Average annual fuel efficiency improvement for the Implemented Measures Scenario (new aircraft technology and ATM improvements only)

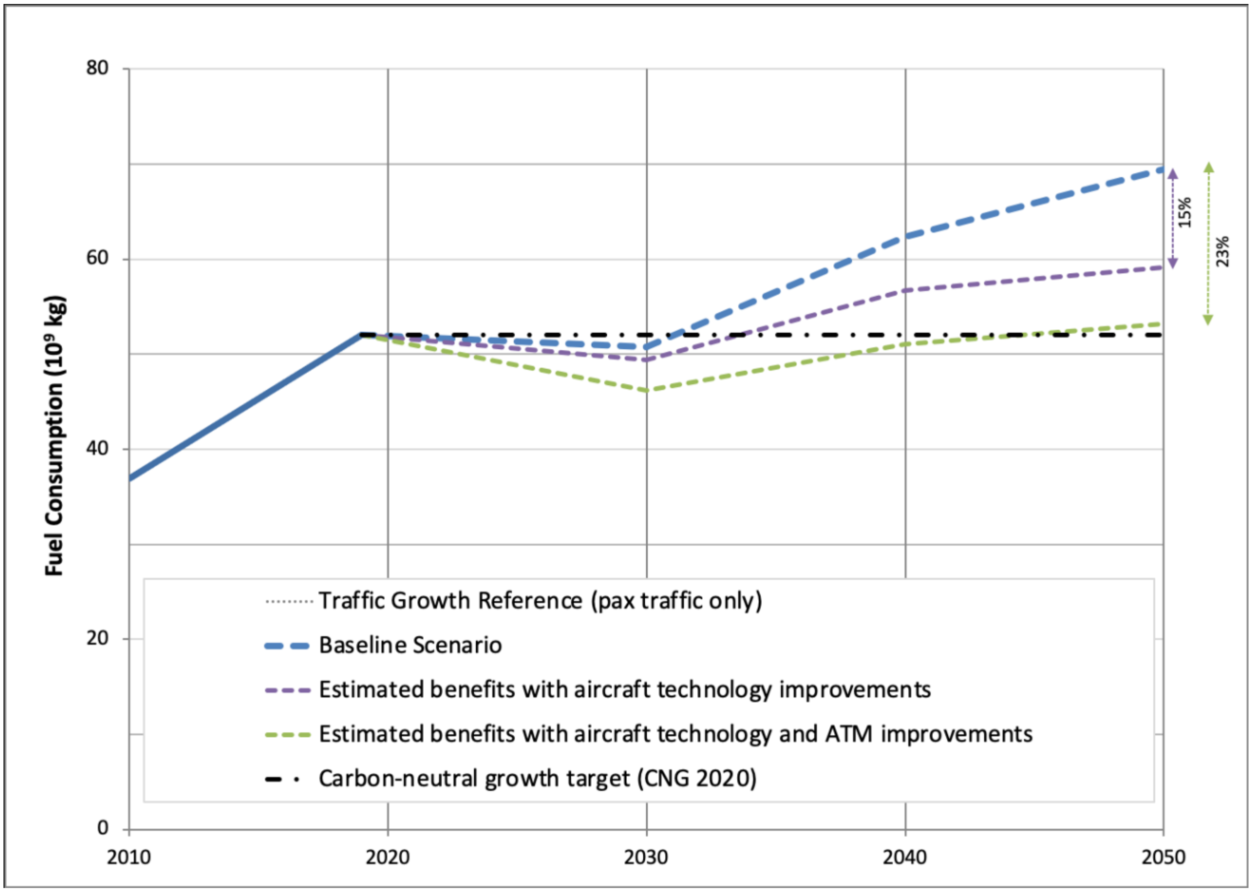
Period	Average annual fuel efficiency improvement (%)
2010-2019	-1.86%
2019-2030	-1.82%
2030-2040	-1.03%
2040-2050	-0.74%

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 sustainable aviation fuels.

Table 6. CO2 emissions forecast for the scenarios described in this chapter.

Year Baseline Scenario Aircraft techn. improvements only	CO_2 emissions (10^9 kg) Implemented Measures Scenario Aircraft techn. and ATM improvements			% improvement by Implemented Measures (full scope)
2010	116,78	NA		
2019	164,35	NA		
2030	160,3	160,3	160,3	-9%
2040	197,1	197,1	197,1	-18%
2050	219,4	219,4	219,4	-23%

Figure 4. Fuel consumption forecast for the baseline and implemented measures scenarios.



As shown in Figure 4, the impact of improved aircraft technology indicates an overall 15% reduction of fuel consumption and CO2 emissions in 2050 compared to the baseline scenario. Overall CO2 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.

From Table 4, under the currently assumed aircraft technology 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 slowdown 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. This confirms that additional action, particularly market-based measures and SAF, 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.

3.3. ACTIONS TAKEN COLLECTIVELY IN EUROPE

3.3.1. TECHNOLOGY AND STANDARDS

3.3.1.1. 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.

ASSESSMENT
This is a European contribution to a global measure (CO2 standard). Its contribution to the global aspirational goals are available in CAEP.

3.3.2. RESEARCH AND DEVELOPMENT

3.3.2.1. CLEAN SKY

Clean Sky 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 CO2 emissions by 20-40%, NOX 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.

Main remaining areas for Research 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 new key 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 **Clean Sky Technology** Evaluator 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).

3.3.2.2. 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) will follow in the footsteps of CleanSky2. The EU contribution proposed is again €1.7 billion. The stakeholder community has already formulated a Strategic Research and Innovation Agenda (SRIA), which is in-tended 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 organisations, industry, and SMEs, also by benefitting from exploiting synergies with other national and European related programmes.

ASSESSMENT

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 A above (ECAC Baseline Scenario and Estimated Benefits of Implemented Measures) and in Appendix A.

Table 7 Fuel consumption and CO2 emissions of international passenger traffic departing from ECAC airports, with aircraft technology improvements after 2019 included:

Year	Fuel Consumption (10^9	CO_2 emissions (10^9	Well-to-wake CO_2e	Fuel efficiency (kg/	Fuel efficiency (kg/
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 8 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%

3.4. SUSTAINABLE AVIATION FUELS

Sustainable aviation fuels (SAF) including advanced biofuels and synthetic fuels, have the potential to significantly reduce aircraft emissions and ECAC States are embracing their large-scale introduction in line with the 2050 ICAO Vision.

The European collective SAF measures included in this Action Plan focuses on its CO2 reductions benefits. Nevertheless SAF has the additional benefit of reducing air pollutant emissions of non-volatile Particulate Matter (nvPM) with up to 90% and sulphur (SOX) with 100%, compared to fossil jet fuel[15]. As a result, the large-scale use of SAF can have important other non-CO2 benefits on the climate which are not specifically assessed within the scope of this Plan.

3.4.1. 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 decarbonization of the transport sector in line with the

[15] ICAO 2016 Environmental Report, Chapter 4, Page 162, Figure 4.

objective of reaching a cli-mate-neutral economy. The European Parliament also called for "a clear regulatory roadmap for the decarbonization 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 including not only advanced biofules but also synthetic fuels. 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 ac-countable 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 decarbonize.

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 com-pared 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 CO2 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.

3.4.2. ADDRESSING 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.

3.4.2.1. 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 operator's 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'.

3.4.2.2. 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 CO2 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.

3.4.3. STANDARDS AND REQUIREMENTS FOR SAF

3.4.3.1. 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 entered 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[16] 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.

[16] Directive 2009/28/EC.

Transport renewable fuels (thus, including SAF) produced in installations starting operation from 1 January 2021 must achieve 65% GHG emissions savings with respect to a fossil fuel comparator for transportation fuels of 94 g CO2eq/MJ. In the case of transport renewable fuels of non-biological origin[17], 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;

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

3.4.3.2. 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

[17] 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).

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.

3.4.4. RESEARCH AND DEVELOPMENT PROJECTS ON SAF

3.4.4.1. EUROPEAN ADVANCED BIOFUELS FLIGHTPATH

An updated and renewed approach to the 2011 Biofuels Flightpath Initiative[18], 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 bio-fuel producers' side.

A dedicated executive team, formed by SENASA, ONERA, Transport & Mobility Leuven and Wageningen UR, coordinated for three 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.

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

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18 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

3.4.4.2 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, which is the biggest Research and Innovation program of the EU.

BIO4A: 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 feed-stocks 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: Production of sustainable aircraft grade kerosene from water and air powered 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 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 CO2 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: 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 pro-cess 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 Absorption 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: 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. 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: 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% CO2 emitted compared to fossil fuels. A large deployment of the pro-cesses 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: 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: Is an industrially driven project aiming to be a game-changer in the cost-effective production of SAF from CO2 and hydrogen. The unique TAKE-OFF technology is based on conversion of CO2 and H2 to SAF via ethylene as intermediate. Its industrial partners will team up with research groups to deliver a highly innovative 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, utilising industrial captured CO2 and electrolytic ally 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.

3.5. OPERATIONAL IMPROVMENTS

3.5.1. THE EU'S SINGLE EUROPEAN SKY INITIATIVE AND SESAR

3.5.1.1. SESAR PROJECT

SES and SESAR

The European Union's Single European Sky (SES) policy aims to reform Air Traffic Management (ATM) in Europe in order to enhance its performance in terms of its capacity to man-age variable volumes of flights 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 Man-ager) 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 foot-print of air traffic management, from CO2 and non-CO2 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 CO2 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 CO2 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. Large-scale 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 P**erformance 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 CO2 reduction, highlighted by the green dotted rectangle of **Figure 5** below:

Key performance area	SES high-level goals 2005	Key performance indicator	Performance ambition vs. baseline: Baseline value (2012)	Ambition value (2035)	Absolute improvement	Relative improvement
Capacity	Enable 3-fold increase in ATM capacity	**Departure delay**[4], min/dep	9.5 min	6.5-8.5 min	1-3 min	10-30%
		IFR movements at most congested airports[5], million	4 million	4.2-4.4 million	0.2-0.4 million	5-10%
		Network throughput IFR flights[5], million	9.7 million	~15.7 million	~6.0 million	~60%
		Network throughput IFR flight hours[5], million	15.2 million	~26.7 million	~11.5 million	~75%
Cost efficiency	Reduced ATM services unit costs by 50% or more	**Gate-to-gate direct ANS cost per flight**[1] · EUR(2012)	EUR 960	EUR 580-670	EUR 290-380	30-40%
Operational efficiency		**Gate-to-gate fuel burn per flight**[2], 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%
		Within the: Gate-to-gate flight time per flight[3], 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**[6], #/year Includes in-flight accidents as well as accidents during surface movement (during taxi and on the runway)	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 Unit rate savings will be larger because the average number of Service Units per flight continues to increase.
2 "Additional" means the average flight time extension caused by ATM inefficiencies.
3 Average flight time increases because the number of long-distance flights is forecast to grow faster than the number of short-distance flights.
4 All primary and secondary (reactionary) delay, including ATM and non-ATM causes.
5 Includes all non-segregated unmanned traffic flying IFR, but not the drone traffic flying in airspace below 500 feet or the new entrants flying above FL 600
6 In accordance with the PRR definition: where at least one ATM event or item was judged to be DIRECTLY in the causal chain of events leading to the accident. Without that ATM event, it is considered that the accident would not have happened.

Figure 5: Performance Ambitions for 2035 for Controlled airspace (Source: 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 synchronised 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 net-work. 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).

1. 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 is planned to be completed by 2027. However, the benefits highlighted in **Figure 6** below have been measured where the functionalities have already been implemented.

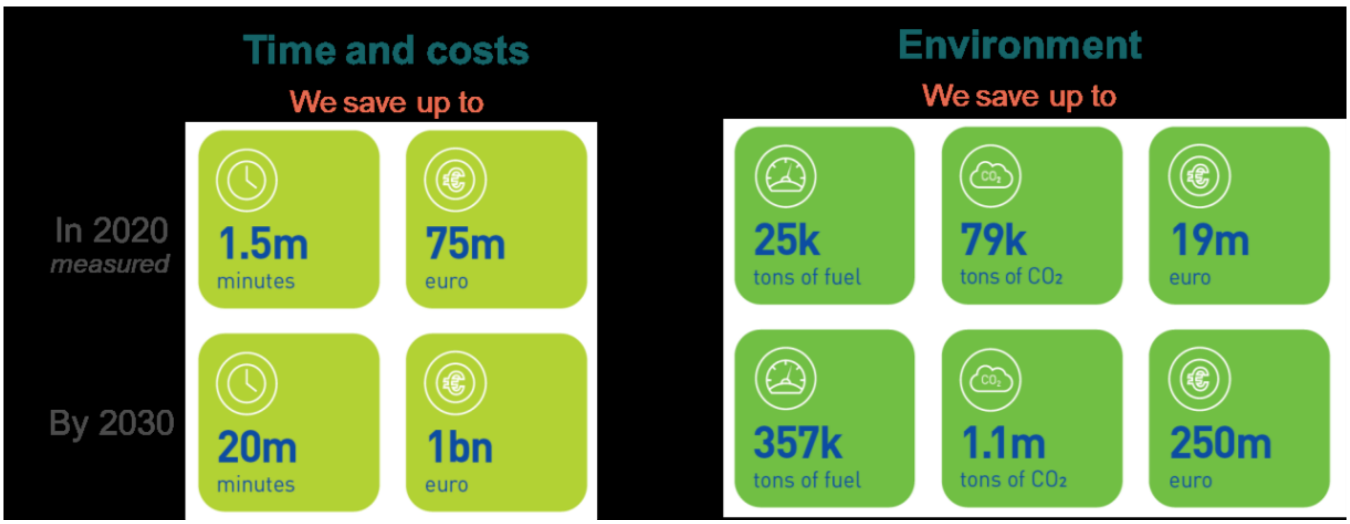


Figure 6: First results of the first common project implemented.

3.5.1.2. 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.

3.5.1.3. SESAR INDUSTRIAL RESEARCH & VALIDATION PROJECTS (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 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 been 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.

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 be-come 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 and those addressing environment impacts are identified by the following pictogram.

3.5.1.4. SESAR2020 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/CO2 efficiency of 500kg of fuel savings on average per flight.

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

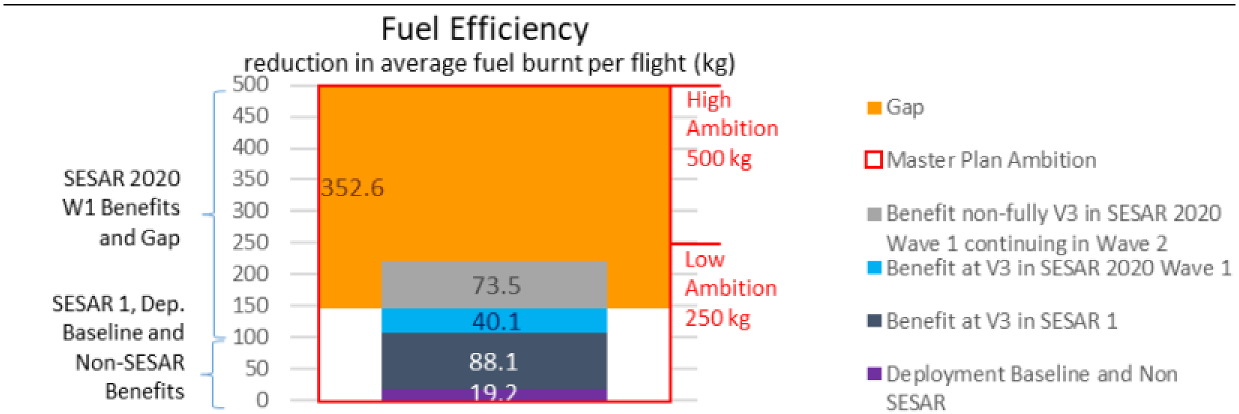


Figure 7: SESAR fuel efficiency achievement versus gap (Source: Updated version of PAGAR 2019)

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 CO2 saved, equivalent to the CO2 emitted by 165,000 Paris-Berlin flights; or a city of 258,000 European citizens; or the CO2 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[19]. Based on the information provided by the PAGAR 2019

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

document[20], the benefits at the end of Wave 1 could be about 3% CO2/fuel savings achieved by 2025 equivalent to 147.4kg of fuel/flight. So far, the target for Wave 2 remains at about 7% more CO2/fuel savings (352.6kg of fuel) to reach the initial Ambition target of about 10% CO2/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[21].

3.5.1.5. SESAR AIRE DEMONSTRATION PROJECTS

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 CO2 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 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 CO2), 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.

3.5.1.5. 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.

SESAR JU has recently awarded ALBATROSS, a consortium of major European aviation stakeholder groups to demonstrate how the technical and operational R&D

[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

achievements of the past years can transform the current fuel intensive aviation to an environment-friendly industry sector.

The ALBATROSS consortium will carry a series of demonstration flights, which the aim to implementing a "perfect flight" (in other 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 utilise over 1,000 demonstration flights.

3.5.1.6. 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 identifies inter-alia the need to continue working on "optimum green trajectories", on non-CO2 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 Figure 7 above and it is included in Section A above (ECAC Baseline Scenario and Estimated Benefits of Implemented Measures).

Table 9. CO2 emissions forecast for the ATM improvements scenarios.

Year	**Baseline Scenario**	CO_2 emissions (109 kg)
		Implemented Measures Scenario
CO_2 emissions (109 kg)		**ATM improvements**
2030	160.29	149.9
2040	197.13	177.4
2050	210.35	197.4

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 sustainable aviation fuels.

3.6. MARKET-BASED MEASURES

3.6.1. THE CARBON OFFSETTING AND REDUCTION SCHEME FOR INTERNATIONAL AVIATION

ECAC Member States 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 CO2 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 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.

3.6.1.1. 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 co-leading the WG4 task on maintaining the Annex 16, Volume IV and related guidance material.

3.6.1.2. CORSIA IMPLEMENTATION

In application of their commitment in the 2016 "Bratislava Declaration" the 44 ECAC Member States have notified ICAO of their decision to voluntarily 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.

Impact on fuel consumption and/or CO_2 emissions

The EU ETS has delivered around 200 MT of CO2 emission reductions between 2013 and 2020[22]. While the in-sector aviation emissions for intra-EEA flights kept growing, from 53,5 million tonnes CO2 in 2013 to 69 million in 2019, the flexibility of the EU ETS, whereby air-craft operators may use any allowances to cover their emissions, meant that the CO2 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 com-pared to 2018 continued to grow, albeit more modestly, with an increase of 1% compared to the previous year, or around 0.7 million tonnes CO2 equivalent[23].

To complement the EU ETS price signal, EU ETS auctioning revenues should be used to sup-port 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 break-through technologies and drive the price gap down.

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 CO2 emissions will continue to

[22] 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

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

increase in the future un-der 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[24]
Those benefits illustrate past achievements

Year	Reduction in CO_2 emissions
2013-2020	~200 MT

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

3.7. ADDITIONAL MEASURES

3.7.1. ACI AIRPORT CARBON ACCREDITATION

Airport Carbon Accreditation is a certification programme for carbon management at air-ports, based on international carbon mapping and management standards, specifically de-signed 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 CO2 emissions in accordance with the World Resources Institute and World Business Council for Sustainable Development GHG Protocol and to get their emissions inventory assured by an independent third party.

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.

The six steps of the programme are shown in Figure 8 and are as follows: Level 1 "Mapping", Level 2 "Reduction", Level 3 "Optimisation", Level 3+ "Neutrality", Level 4 "Transformation" and Level 4+ "Transition".

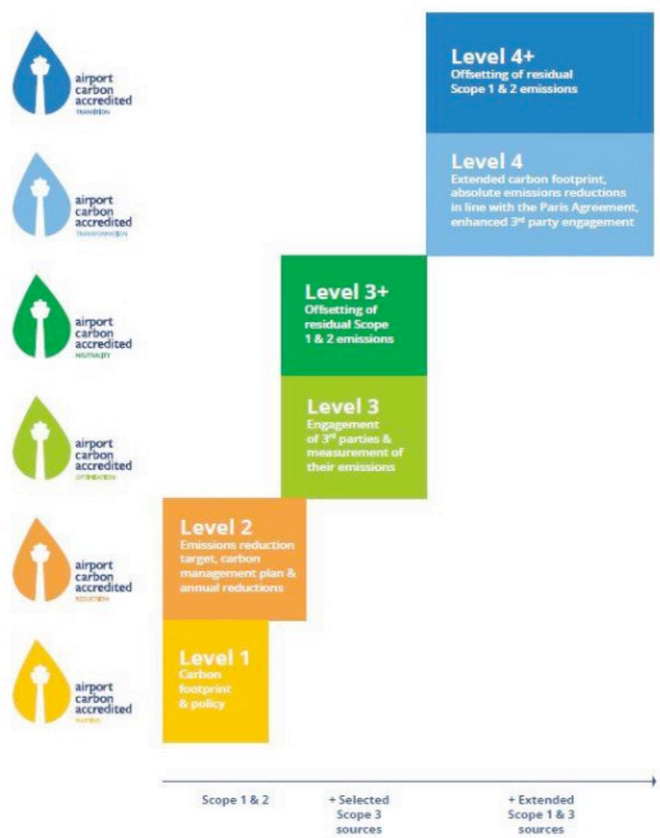


Figure 8 Six steps of Airport Carbon Accreditation

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, 96 a Level 2, 63 a Level 3 and 60 a Level 3+ accreditation. Furthermore, five airports have al-ready 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 CO2 data from participating airports since the programme launch. This has allowed the ab-solute CO2 reduction from the participation in the programme to be quantified.

Aggregated data are included in the Airport Carbon Accreditation Annual Reports thus en-suring transparent and accurate carbon reporting. At Level 2 of the programme and above, airport operators are required to demonstrate CO2 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. There-fore, the tables below show carbon performance metrics until the 2018/2019 regular re-porting 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 there are 167 airports in the programme. These airports account for 69.7% of European air 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	222339	252218	321170	375146

Table 13: Airport Carbon Accreditation key performance indicators 2018/2019:

Indicator	**Unit**	**Time Period (2018/2019)**	**Absolute change compared to the 3-year rolling average**	**Change (%)**
Aggregate scope 1 & 2 emissions from airports at Levels 1-3+	tCO_2	6,520,255	-322,297	-4.9%
Scope 1 & 2 emissions per passenger from airports at Levels 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 emissions 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 Levels 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 de-crease 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.

3.7.2 EUROPEAN INDUSTRY ROADMAP TO A NET ZERO EUROPEAN AVIATION: DESTINATION 2050

Holders (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 to the

baseline[25]. In 2030, net CO2 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 CO2 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 Way Point 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.

3.7.3. 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 Environ-mental 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

[25] A hypothetical 'no-action' scenario whereby CO_2 emissions are estimated based on the assumption that aircraft deployed until 2050 have the same fuel efficiency as in 2018.

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 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 indica-tors were reviewed, including the absolute CO2 emissions and average CO2 emissions per passenger-kilometre of airlines.

The pilot phase covering the period 2021-2023 will further expand the scope of indicators and consider 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 as-assessment of the label.

While the potential CO2 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 CO2 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.

3.7.4. 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.

3.7.4.1. EASA CAPACITY-BUILDING PARTNERSHIPS

EASA has been selected as an implementing Agency for several of these initiatives, including the EU-South East Asia Cooperation on Mitigating Climate Change impact from Civil Aviation (EU-SEA CCCA), launched in 2019, and a Capacity Building Project for CO_2 Emissions Mitigation in the African and Caribbean Region, launched in 2020.

The overall objective of these projects is to enhance the partnership between the EU and partner States in the areas of civil aviation environmental protection and climate change, and to achieve long-lasting results that go beyond the duration of the projects. The specific objectives of the two projects are to develop or support existing policy dialogues with partner States on mitigating GHG emissions from civil aviation, to contribute to the CORSIA readiness process of partner States, as well as to implement CORSIA in line with the agreed international schedule, including considerations of joining the voluntary offsetting phase starting in 2021 or at the earliest time possible. On top of the CORSIA-related support, these projects are assisting the partner States in the development and update of the State Action Plans to reduce CO2 emissions from civil aviation, as well as providing support in the development of emission data management tools supporting the implementation of State Action Plans and CORSIA.

By January 2021, the EU-SEA CCCA had improved the technical readiness of all the 10 partner States in the region, as well as their aeroplane operators' capabilities to comply with CORSIA requirements. Five States had implemented emission data management solutions to generate CORSIA Emission Reports, and eight States had successfully submitted their 2019 CORSIA CO2 Emissions Reports to ICAO. 4 CORSIA verification bodies had been accredited in the region with dedicated support to their respective National Accreditation Bodies to finalise the accreditation process.

In addition, EASA is implementing, on behalf of the Commission, technical cooperation projects in the field of aviation in Asia, Latin-America and the Caribbean, which include an environmental component aiming at cooperation and improvement of environmental standards.

These projects have been successful in supporting regional capacity building technical co-operation to the partner States regarding environmental standards. With regard to CORSIA, support is provided for the development or enhancement of State Action Plans, as well as for the implementation of the CORSIA MRV system. Projects have also been successful in engaging with key national and regional stakeholders (regulatory authorities, aero-plane operators, national accreditation bodies, verification bodies), thereby assessing the level of readiness for State Action Plan and CORSIA implementation on wider scale in the respective regions, and to identify further needs for additional support in this area.

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 author-ity 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 CO2 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.

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.

3.7.5. 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 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 in-crease their contribution to mitigating climate change.

<u>Expected outcomes:</u>

The projects will perform large-scale demonstrations of green airports, demonstrating low-emission energy use (electrification or sustainable aviation 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 recharging/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.

3.8. SUPPLEMENTAL BENEFITS FOR DOMESTIC SECTORS

Although the benefits of all the European collective measures included in this action plan are focused on international aviation, they are also applicable to domestic aviation (except CORSIA) and thus, will bring supplemental benefits in terms of CO2 emissions reductions in the domestic European air traffic.

In addition, a number of those measures taken collectively in Europe and contained in this action plan offer as well additional supplemental benefits for domestic sectors beyond CO2 savings. Those are summarized below.

3.8.1. ACI AIRPORT CARBON ACCREDITATION

Airport Carbon Accreditation is referred among the measures contained in this action plan aiming to encourage and enable airports to implement best practice carbon and energy management processes.

While its main objective is supporting airport actions to voluntarily mitigate and reduce their impact on climate change, the programme's main immediate environmental benefit is the improvement of local air quality linked to the non-CO2 additional emissions benefits from the reduction of fuel burn that an airport operator can control, guide and influence.

3.8.2. REFUELEU AVIATION INITIATIVE

Through the large-scale use of SAF, emissions of other pollutants impacting local air quality and other non-CO2 effects on the climate can also be reduced, implying important potential supplemental benefits beyond CO2 emissions reductions.

In addition to the reduction of CO2 emissions, SAF has the additional benefit of reducing air pollutant emissions around airports when emitted during take-off and landing as emissions of non-volatile Particulate Matter (nvPM) with up to 90% and sulphur (SOX) with 100%, com-pared to fossil jet fuel.

Preserving the quality of natural resources can be considered an additional benefit of any policy measure aiming to increase the sustainability of aviation by boosting the SAF market while paying particular attention to the overall environmental integrity of the SAF incentivised, as it is the case of the ReFuelEU Initiative.

Finally, the production of SAF notably from biogenic waste could contribute and be an in censive for more effective waste management in the EU.

3.8.3. SAF RESEARCH AND DEVELOPMENT PROJECTS

One European research project funded by the Horizon 2020 Research and Innovation pro-gram of the EU, is currently assessing, among other objectives, the additional supplemental benefits for domestic sectors of the use of sustainable aviation fuels, beyond its climate benefits.

AVIATOR PROJECT: The project "Assessing aviation emission Impact on local Air quality at airports: Towards Regulation" aim to better understand air quality impacts of aviation is-sues, developing new tools and regulation, and linking with the health community, providing unbiased data to society.

The project will measure, quantify and characterise airborne pollutant emissions from air-craft engines under parking (with functioning APU), taxiing, approach, take-off and climb-out conditions, with specific reference to total UFPs, NOX, SOX and VOC under different climatic conditions.

It includes among its objectives measuring emissions from aircraft engines using commercially available sustainable aviation fuels to investigate its impact on total Particulate Matter formation and evolution in the plume as well as the wider airport environment.

Will perform measurements of air quality in and around three international airports: Madrid-Barajas, Zurich and Copenhagen, to validate model developments under different operational and climatic conditions and develop a proof of concept low-cost and low-intervention sensor network to provide routine data on temporal and spatial variability of key pollutants including UFP, total PM, NOX and SOX. it 17 partners from 7 countries involved, the project started in June 2019 and it is expected to finalize in 2022.

3.8.4. THE EU'S SINGLE EUROPEAN SKY INITIATIVE AND SESAR

The European Union's Single European Sky (SES) initiative and its SESAR (Single European Sky ATM Research Programme) programme are aiming to deploy a modern, interoperable and high-performing ATM infrastructure in Europe, as has been described above in detail in this action plan, among its key operational measures to reduce CO2 emissions.

But the environmental outcomes of SESAR implementation go far beyond reducing fuel burn, and the key deliverables from the SESAR Programme have also a significant potential to mitigate non-CO_2 emissions and noise impacts.

local or global level) and noise impacts, the ATM Master Plan requires that each SESAR solution with an impact on these environmental aspects assesses them to the extent possible and within available resources.

In this context, for example the EUROCONTROL Integrated aircraft noise and emissions modelling platform IMPACT, which delivers noise contour shape files, surface and population counts based on the European Environment Agency population database, estimates of fuel burn and emissions for a wide range of pollutants, and geo-referenced inventories of emissions within the landing and take-off portion, is one of the recommended models for conducting environmental impact assessments in SESAR.

3.8.5. GREEN AIRPORTS RESEARCH AND INNOVATION PROJECTS

The European Commission's Green Airports research and innovation projects referred in this action plan among the "Other measures" commonly implemented in Europe has key objectives to achieve important supplemental benefits beyond CO2 emissions reductions, among them:

Circular Economy:

- Developing the built environment (construction/demolition) using more ecologically friendly materials and processes and incorporating these improvements in the procurement processes to sustainably decrease the ecological footprint.
- Promoting the conversion of waste to sustainable fuels.
- Addressing the sustainable evolution of airports, also in the context of circular economy (e.g. activities linked to aircraft decommissioning and collection/sorting of recyclable waste), considering institutional and governance aspects, ownership, regulation, performance indicators and balance of force between regulators, airlines and airport operators.

- Addressing the feasibility of a market-based instrument to prevent/reduce Food Loss and Waste (FLW) and to valorise a business case of transformation of FLW into new bio-based products. This includes FLW measurement and monitoring methodologies and the subsequent mapping of FLW total volume at stake in the considered airport.

Biodiversity:

- Enhancing biodiversity, green land planning and use, as well as circular economy (e.g. repair, reuse and recycling of buildings and waste, in the context of zero-waste concepts).

Non-CO_2 impacts:

- Addressing air quality (indoor, outdoor, including decontamination from microbiological pathogens) and noise trade-off.
- Assessing non-technological framework conditions, such as market mechanisms and potential regulatory actions in the short and medium term, which can provide financial/operational incentives and legal certainty for implementing low emission solutions.
- Developing and promoting new multi-actor governance arrangements that address the interactions between all airport-related stakeholders, including authorities, aircraft owners and operators, local communities, civil society organisations and city, regional or national planning departments.

IV. SECTION III- NATIONAL ACTIONS IN GEORGIA

4.1. OVERVIEW

4.1.1. OBJECTIVES

Preliminary National Action Plan to reduce emissions of greenhouse gases with deviation from business as usual scenario in civil aviation for the period 2021-2030, hereinafter referred to as national action plan, aims at:

a) Limiting CO2 emissions from civil aviation activities starting with 2020;

b) Informing the aircraft operators and ANSP and Airport operators on new technologies promoted internationally;

c) Encouraging involvement of national aviation stakeholders in international and national projects aiming at reducing GHG emissions.

4.1.2. ACTIONS

Actions to be undertaken to achieve the proposed targets are:

a) legal and inter-institutional actions;

b) economic activities;

c) operational activities;

d) inventory activities;

e) technological actions;

f) ATM/ infrastructure actions;

g) Other actions.

4.1.3. NATIONAL INSTITUTIONS WITH RESPONSIBILITIES

The institutions are responsible for implementing the action plan (in coordination and consultation with MOEP) and subordinated authorities, aircraft operators, SAN, TAV Georgia, and United Airports of Georgia according to the proposed actions.

4.1.4. RESOURCES NEEDED TO IMPLEMENT THE PROPOSED ACTIONS

Depending on the actions in the plan, the following issues were identified:

a) Human Resources – staff of specific departments of the institutions responsible for the implementation of the action plan;

b) Financial resources – financial resources necessary to implement the action plan will consist of own sources of economic agents involved.

4.2. ASSESSMENT ACTIONS

Starting from 2022, Georgian carriers, airport administrations, ANSP and GCAA will annually present a report containing the description of the projects and measures implemented or being implemented in accordance with the actions provided. Reporting deadline: up to 31 March of each year for the previous year (first report for the activities will be performed in 2022 and will be submitted by 31 March 2023).

The report shall contain a description of projects /measures implemented/ under implementation and an evaluation of their effects in terms of fuel consumption efficiency and reduction of emissions. Reports will also contain the following global statistics related to air transport activity in the monitored calendar year.

GCAA may request to appropriate bodies to transmit data on total CO2 emissions and aggregated data on different types of fuel used by Georgian air carriers. Transmission and confidentiality of these data will be subject to protocol between appropriate institutions.

Annual report on actions for aviation fuel consumption efficiency and reducing emissions of greenhouse gases due to civil aviation activities will be prepared. The first report will be prepared in 2023 for actions undertaken in 2022.

Update of the action plan: the National Action Plan is a dynamic instrument that will be updated regularly in order to facilitate decisions on policies and measures in civil aviation, so it can adapt to economic development of Georgia and established objectives for reducing emissions of greenhouse gases.

4.3. TBILISI INTERNATIONAL AIRPORT

TAV Georgia

Environmental Strategy and Existing Measures

Modern lifestyles rely on large amounts of energy and resources. Airport operators must seek to contribute to improving the comfort and lifestyles of people around the world, and play a crucial role in conserving our global environment.

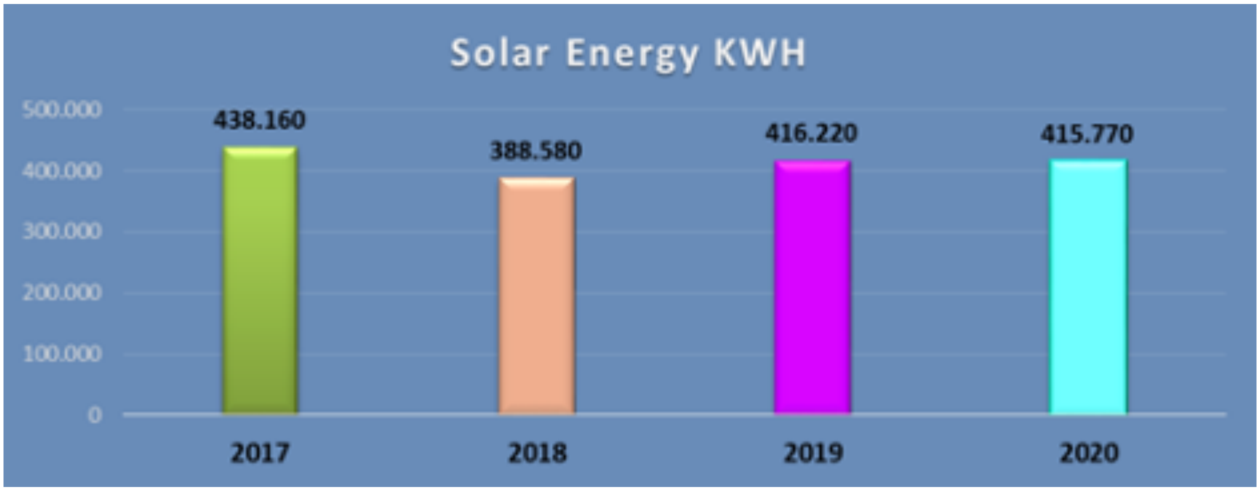
Tbilisi International Airport since 2008 holds ISO 14001 Certificate, the standard that provides the organization with a systematic approach to planning, implementing and managing an environmental management system.

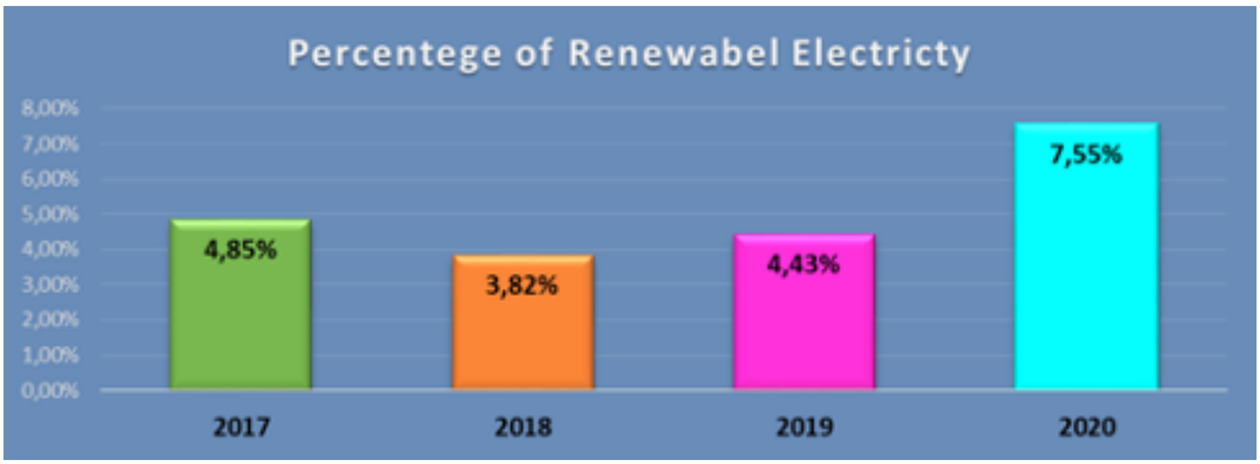
Their strategy for environment protection is based on the following priorities:

- Renewable energy
- Energy Conservation
- Emission reduction
- Noise Monitoring

Renewable energy

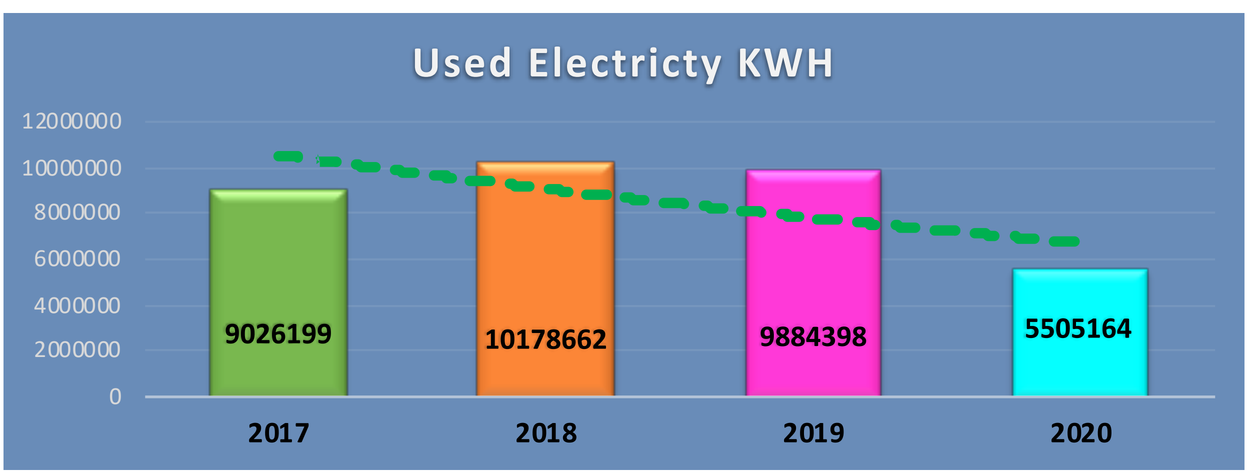
In 2016, Clean Energy produced by Solar Electricity Generation System was introduced at Tbilisi International Airport. Solar panels were installed in the airport parking area on two locations. The project further facilitated the use of green energy and energy conservation program granting reduction of CO2 emission by 182 Tons per year.





The Organization started their energy conservation program focusing in electricity, water and gas with the target of reduction of usage.

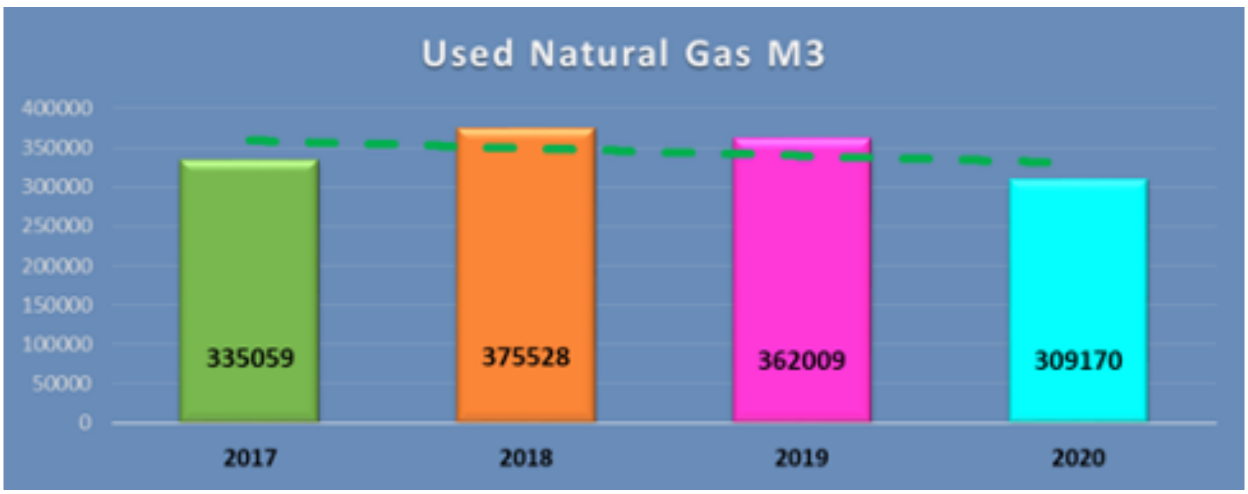
A few examples of the electricity conservation efforts initiated include some basic measures which were easy to accomplish such as turned off lights, machinery and compressors after working hours, employees are encouraged to turn off computers and equipment when not in use. Also changing existing electrical equipment and appliances with more energy-efficient products.

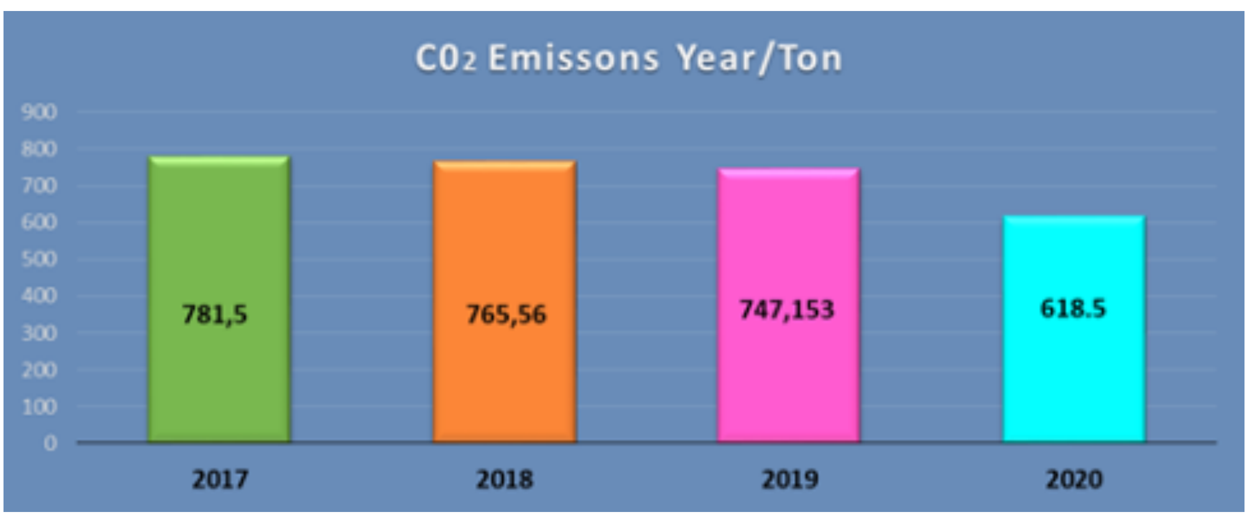


Emission Reduction & Noise Monitoring

As a legal requirement an obligation of TAV Urban Georgia is to measure emissions and submit monitoring to ministry of environmental protection of Georgia. Schedule routes to minimize waste and reduce carbon footprint, all vehicles are to be serviced and maintained to ensure their efficiency. To monitor Carbon emission of the fleet. To consider the carbon emission when purchasing any new fleet vehicle and to encourage suppliers to implement 'environmentally friendly' practices.

TAV Georgia performs noise monitoring activities. The process is performed quarterly by the Independent Consultant.





4.4. RELEVANT LEGISLATION ON ENVIRONMENTAL PROTECTION

4.4.1. INTERNATIONAL TREATIES

Georgia ratified the **Convention on International Civil Aviation**, signed at Chicago on 7 December 1944, hereinafter referred to as the Chicago Convention, on 7th of December 1993. Since then, Georgia has the obligation to implement and enforce the provisions of the Convention, as well as standards set out in its annexes.

United Nations Framework Convention on Climate Change was ratified by the Parliament of Georgia on 29 July, 1994. This Convention establishes the general framework of intergovernmental actions of response to climate change challenge and is mainly aimed at achieving stabilization of greenhouse gas concentration in atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted on 11 December 1997: The Kyoto Protocol entered into force internationally on 16 February 2005. The protocol also provides for the possibility of using voluntarily the three flexible mechanisms: joint Implementation (JI), Clean Development Mechanism (CDM) and International Emissions Trading (IET). Georgia ratified the protocol in 1999.

The **Paris Agreement** is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. Georgia ratified the Paris Agreement in 2017.

European Legislation: Georgia, as a signatory part of Common Aviation Area Agreement, shall implement European regulations forming the part of the EU aviation acquis.

4.5. NATIONAL STRATEGY ON ENVIRONMENTAL PROTECTION

4.5.1. GEORGIA'S 2030 CLIMATE CHANGE STRATEGY

Georgia joined the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and the parliament ratified the Kyoto Protocol on May 28, 1999 with the resolution N1995. The ultimate goal of this Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at the level that would prevent dangerous anthropogenic interference with the climate system. Such level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

On June 7, 2017, Georgia ratified Paris Agreement and started preparing its Nationally Determined Contribution (NDC) document. The ability of the International Community to achieve the set objective by reducing Greenhouse Gases (GHGs) emission, depends on the knowledge and understanding of the trends in GHG emissions. According to Article 4(1) (a) and Article 12(1) (a) of the Convention, all parties are required to provide the supreme body of the Convention – the Conference of the Parties – with the information about national GHGs emissions and sources of their removal. Up to 2012, National Communication was the main reporting mechanism for Non-Annex 1 countries of the Convention. A decision taken by the 16th Conference of the Parties held in Cancun (2010), requires all countries, starting 2014, to present a biennial independent and complete report (BUR- Biennial Update Report) including the trends of national GHG emissions.

Georgia's Nationally Determined Contribution (NDC) was updated with the support of the EU-funded EU4Climate project, implemented by the United Nations Development Programme (UNDP). The NDC was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) on 5 May 2021.

In the updated NDCs, Georgia commits to unconditionally reducing its total greenhouse gas (GHG) emissions to 35 per cent below its 1990 baseline level (an approximately 16 per cent per capita reduction) by 2030. The country also sets out feasible targets for limiting emissions in seven sectors (transport, buildings, energy generation and transmission, agriculture, industry, waste and forestry) and promises to shift to low-carbon development approaches in the construction, waste management and agriculture sectors.

4.5.2. INSTITUTIONAL ARRANGEMENT OF THE NATIONAL GHG INVENTORY

The Government of Georgia is a body accountable to the UNFCCC. The Ministry of Environmental Protection and Agriculture of Georgia elaborates and implements the policy on climate change. The Department of Environment and Climate Change is a structural unit of the Ministry; the subunit of the above Department – The Climate Change Division, along with other functions, is responsible for coordination of periodic compilation of inventory report and its submission to the Convention Secretariat.

4.5.3. STRATEGY OVERVIEW

Georgia's 2030 Climate Change Strategy and Action Plan (Climate Strategy and Action Plan – CSAP, Climate Action Plan – CAP) are a planning and implementation mechanism for coordinated effort towards meeting the nationally determined targets for climate change mitigation.

Climate Strategy and Action Plan identify the ways for reaching Georgia's 2030 greenhouse gas (GHG) emissions reduction targets for climate change mitigation, as set in Georgia's Updated Nationally Determined Contribution (NDC) to the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC).

Climate Strategy and Action Plan identify a long-term vision of GHG emissions reduction by 2030 and specific planned actions. Through the approval of the Paris Agreement in 2017, Georgia joined 191 Parties and committed to contribute towards the goals of the Paris Agreement, among others, to hold the global average temperature increase well below 2 °C, and pursuing efforts to limit to 1.5 °C compared to the pre-industrial level. The NDC aims to reduce national GHG emissions to 35% below the emission levels in 1990 (excluding emissions from land-use, land-use change and forestry (LULUCF))1, meaning GHG emissions should not exceed 29.25 MtCO2e in 2030.

According to the Paris Agreement, , Georgia is expected to show a progression with regards to emission reduction targets or policies and measures with each update insofar as possible, and to strive for net-zero GHG emissions in the second half of the century. The Climate Strategy and Action Plan rely on the definition of Climate Neutrality by the Intergovernmental Panel on Climate Change (IPCC) as the "concept of a state in which human activities result in no net effect on the climate system" (IPCC, 2018), Georgia's Climate Strategy and Action Plan identify specific directions and actions for GHG reduction that support the development of the Georgian economy and infrastructure in a way 1 In accordance with the requirements of the UNFCCC, the commitment of GHG reduction shall exclude emissions from land use, land-use change and forestry (LULUCF) sector. In order to explore the options for adapting to the adverse effects of climate change and plan the appropriate measures, Georgia is preparing National Adaptation Plan (NAP) on the basis of updated Nationally Determined Contribution. Climate Strategy and Action Plan set out the national climate change mitigation policy in the following sectors: Energy Generation and Transmission, Energy Consumption in Transport, Energy Consumption in Buildings, Energy Consumption in Industry and Industrial Processes, Agriculture, Waste Management and Forestry.

The Government of Georgia expresses its willingness to actively cooperate in the implementation process of the Climate Strategy and Action Plan and to seek funding from international partners. In addition to the specific activities set out in the Action Plan, the document provides information on priority areas for each sector. Georgia explicitly requests support from the international community to advance in these priorities, leading to the identification of new activities for the next Action Plan and enabling enhanced climate change mitigation ambition. Georgia recognises the importance and role of technologies in improving climate change resilience and reducing GHG emissions and openly expresses its willingness to cooperate in technology development and transfer.

The Climate Strategy and Action Plan are directly derived from other objectives and international commitments of the country. It is in line with the European Union legal acts.

Climate Action Plan measures, such as reducing emissions from the transport sector or transforming the energy sector, and increasing the share of renewable energy therein, are not directly connected to SDG 13, but they help improve air quality, increase energy security, create more jobs, etc. Consequently, this will have a positive impact on fulfilling other SDGs that are indirectly related to climate change.

4.5.3.1. OVERVIEW OF THE CURRENT SITUATION ANALYSIS: THE SITUATION WITH GREENHOUSE GAS EMISSIONS

According to 2015 data, the GHG emissions in Georgia amounted to 17.6 MtCO2e. GHG emissions are generated in seven sectors: energy generation and transmission, transport, 10 buildings, industry, agriculture, waste management, and the forest. Therefore, the Climate Strategy and Action Plan are divided according to these sectors

4.5.3.2. THE TRANSPORT SECTOR

The transport sector is growing rapidly off the back of growing road-based passenger transportation. Private vehicles, most of which are old and environmentally inefficient models, made up nearly 70% of passenger transport activity in 2015, while the shares of buses, minibuses and rail (including Tbilisi metro) accounted for 13%, 14% and 4%, respectively. In 2015 GHG emissions from the transport sector accounted for about 24% of total national GHG emissions (see Figure 1.) (MEPA, 2019). Road passenger transport emissions accounted for approximately 68% of the transport sector emissions in 2015, with light-duty vehicles (LDVs) accounting for 88%, buses for 5%, and minibuses for 6%. Freight transport, consisting of trucks, rail, and off-road vehicles (mainly for agriculture), accounted for the remaining 32% of the sector's emissions, with emissions from heavy trucks responsible for the majority (29%)

Transportation activity in Georgia generally remains low compared to other countries in the region and in Europe, however is projected to steadily increase in the coming years. Emissions in the transport sector are projected to increase by approximately 71% (to 7.11 MtCO2e) by 2030 under a reference scenario (see Figure 2), driven primarily by the continuing growth of passenger transport. From 2015 to 2030, passenger activity is expected to increase by almost 60% and freight activity by 240%.

a) Source-category description and calculated emissions

Georgia is the transportation hub for the South Caucasus region (Georgia, Armenia, and Azerbaijan) and Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan), providing routes to Russia, Turkey and (over the Black Sea) to Europe. Georgia's oil and gas pipelines, the Black Sea ports, developed railway system, and airports with direct air services to 44 destinations are also playing an increasingly important role in linking East and West. The transport sector in Georgia, similarly to the majority of the world's countries, is one of the most significant emitters of greenhouse gases, and therefore major focus is made on the inventory of emissions from this sector and on the implementation of mitigation measures.

Year /Subcategories	1A3a Civil aviation total in Gg CO2eq.	1A3b Road Transportation total in Gg CO2eq.	1A3c Railways total in Gg CO2eq.	1A3d National Navigation total in Gg CO2eq.	1A3e Other Transportation (pipelines, off road) total in Gg CO2eq.	Total from sector in Gg CO2eq.
2012	1.8	2,459	3.45	4.20	204	2,672
2013	2.2	3,103	0,04	4.08	191	3,301
2014	2.5	3,500	3,76	2,12	227	3,735
2015	2.0	3,912	2.19	2.10	221	4,139
2016	3.3	4,427	3.76	2.12	222	4,658
2017	1.8	3.941	4.07	6.02	190	4.143

In Georgia, the growth of emissions from the transport sector is mainly due to several factors: annual growth of vehicle fleet, large share of second-hand cars in this fleet, and the growth of transit. Since Georgia is a transit country, the number of transit trucks consuming fuel purchased in Georgia is increasing along with the growth of local vehicles fleet. Annual growth of both local and transit transport causes the increase of carbon dioxide and other greenhouse gases, as well as local pollutants which seriously affect human health. In addition, energy transit pipelines Baku-Tbilisi-Supsa (WREP), Baku-Tbilisi-Ceyhan (BTC) oil and South Caucasus Gas (SCP) pipelines pass through the territory of Georgia. Service Company British Petroleum uses natural gas and diesel at the substations to operate the pipelines. Under the transport sector, Georgia's GHGs Inventory includes road transport, rail transport, civil aviation, domestic navigation, and pipelines. The trends of greenhouse gases from the transport sector are provided in Table 3-15. As can be seen from the tables, similar to other source-categories of fuel combustion, carbon dioxide is the dominant greenhouse gas in this sector, accounting for 98% of the emissions in 2017.

GHGs Emissions from Transport Sub-Categories (Gg CO2 eq) are shown on the below table:

b) Methodological issues

Estimation Method

In the transport sector, emissions for all subcategories were calculated using the IPCC Tier 1 sectoral approach. For this sector, carbon dioxide emissions were calculated based on the consumed fuel statistics using the Tier 1 (top down) approach, since the carbon dioxide emission factor is dependent on the type of consumed fuel only, rather than the type of transport that has combusted the fuel. Methane and nitrous oxide emissions are dependent on the motor vehicle type, catalyzer type and the mode of operation, and higher-tier methods are recommended for calculating their emissions.

Such detailed information is not available in Georgia; therefore, the Tier 1 sectoral approach was applied for all greenhouse gases.

4.5.3.3. OBJECTIVE I- ENCOURAGE THE REDUCED DEMAND ON FOSSIL FUEL AND THE USE OF BIOFUELS

Since fossil fuel use in transport has a negative impact on greenhouse gas emissions, this objective aims to reduce its consumption, promote the use of environmentally friendly fuels and increase the share of energy from renewable sources, including biofuels in the total consumed fuel in transport with up to 10% by 2030. The option of increasing the fuel tax will be examined and biodiesel production will be supported and encouraged to that end.

4.5.3.4. OBJECTIVE II- IMPLEMENT INNOVATIVE, EVIDENCE-BASED INITIATIVES IN THE TRANSPORT SECTOR

This objective includes conducting analysis and studies and raising financial resources to implement additional, evidence-based initiatives for reducing greenhouse gas emissions in the transport sector. This will help to identify new measures for the next version of the Climate Action Plan, based on a cost-benefit analysis of existing alternatives.

4.5.4. ENVIRONMENTAL IMPACTS OF CLIMATE CHANGE IN GEORGIA

According to the Intergovernmental Panel on Climate Change, "Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history". Furthermore, it is stated that climate change will significantly increase the current risks for both environmental and human systems, and the amount of damage caused by climate change depends on the scope and quality of global response. (IPCC, 2014). Therefore, according to the IPCC, climate change mitigation (GHG reduction) measures are urgent and necessary to halt climate change as far as possible and reduce existing risks for the environment and society (IPCC, 2018). It should be noted that the climate change processes have significantly intensified in Georgia, with a wide range of adverse impacts (MEPA, 2020). In particular:

Average Temperature

Between 1986 and 2015, as compared to 1956-1985, average annual air temperatures have increased almost throughout the country within the range of up to 10 C with average increase of 0.50 C.

Precipitation

Between 1986 and 2015, as compared to 1956–1985, annual precipitation has increased in most parts of western Georgia, while it decreased in some areas of eastern Georgia. More specifically, 5 to 15% increase in precipitation was recorded for a significant part of western Georgia. The upward trend in precipitation in western Georgia seems to be caused by the increase in rainfall. In contrast to western Georgia, precipitation has decreased by 5 to 15% in most parts of eastern Georgia over the last 30 years. In the south and east of the country (especially in Kakheti and 29 Mtskheta-Mtianeti), precipitation indices reflect a decrease in precipitation due to the increase in the duration of the dry periods. Humidity Relative humidity has increased throughout the country, with fluctuations between -1% - 5%. High humidity is observed in winter months in western Georgia and should be driven by extremely humid days (10-12 days/ year), with decreasing trends most intensely observed in early summer-autumn.

Average Wind Speed

Average wind speed has decreased throughout the country during all seasons by about 1-2 m/s. It should be noted that observations show the most significant decline in the areas (Mount Sabueti, Poti), which are considered in the Wind Atlas as the most prospective sites for wind energy development. While average wind speed is decreasing, the number of days with strong winds is increasing in some areas, , which should be attributed to the increasing frequency of such days over the last 15 years and is most frequently observed in Riv, Mtkvari Valley (Gori, Tbilisi). The expected adverse effects will amplify even more in the future. Without the development of climate-resilient practices, climate change mitigation measures, and the improvement of the country's preparedness and capabilities, the most climate-sensitive sectors will become more vulnerable, and other negative impacts of climate change will also increase, in particular: - Increase of the frequency and intensity of extreme hydrometeorological events in the context of climate change, a trend already observed in Georgia; - Increase of the scales and frequencies of landslide/gravity and mudflow processes, a trend already observed in Georgia; - Intensive melting of glaciers, a trend already observed in Georgia; - Accelerated processes of flooding and loss of coastal areas due to anthropogenic impacts. Sea level rise – the major adverse effect of global warming for coastal areas – makes Georgia's coastline particularly vulnerable; 30 - Soil erosion, one of the main causes of degradation of agricultural, forest and alpine lands. - Temperature rise affects livestock farming and its productivity, as well as perennial and grain crops and biodiversity; - Rising temperatures are contributing to the reduction of water resources, a trend already observed in Georgia; - The adverse climate impact on forests is evident in terms of both the progression of existing pests and diseases, as well as the emergence of new harmful insects and diseases. According to the quantitative survey conducted by the Regional Environmental Centre for the Caucasus (REC Caucasus) on behalf of the EU and United Nations Development Programme (UNDP) in 2020, more than 91% of Georgia's population believes that climate change is a real process that poses a danger for life on Earth. Among the adverse impacts of climate change, the people are most concerned about global warming and droughts (96.11%), natural disasters (92.84%), melting of glaciers, and shrinking of ice layers in the oceans (91.83%).

Climate Change Impacts on Human Health

Climate change has a significant impact on human health, healthcare, and social security systems. According to the data from the National Center for Disease Control and Public Health of Georgia, cardiovascular diseases remained the leading cause of death in Georgia in 2017. Respiratory diseases were the second leading cause of death in 2005 but moved to fifth place in 2017. However, number of diseases (chronic obstructive pulmonary disease, asthma) that may be associated with climate change and high emissions steadily remain at the leading positions. Cases of infectious and parasitic diseases doubled between 2008 and 2017 (MEPA, 2020).

4.5.5. VISION OF THE CLIMATE CHANGE STRATEGY AND ACTION PLAN

Long-term vision of the Climate Strategy and Action Plan involves reducing the total GHG emissions to 35% below 1990 levels by 2030 for all the key sectors of the economy relevant to climate change mitigation. This vision derives from Georgia's updated NDC, prepared for submission to the UNFCCC Secretariat in 2021. The document communicates Georgia's pledge to reduce GHG emissions across all the key sectors of the economy. It includes one unconditional commitment and two additional conditional scenarios for further emission reductions, implementation of which would be dependent on international support:

- Georgia undertakes an unconditional commitment to reduce its national greenhouse gas emissions to 35 % below the 1990 level by 2030. This target does not include emissions from land-use, land-use change and forestry (LULUCF). This would imply that total national emissions, excluding LULUCF, should be limited to no more than 29.25 MtCO2e in 2030.

- Georgia undertakes a conditional commitment to reduce its total national greenhouse gas emissions by 50-57% compared to the 1990 level by 2030. In the case, if the world follows the scenario of limiting the average global temperature increase to 2˚C or 1.5˚C, respectively, with international support. As opposed to continuing with the current situation, the measures identified in this Climate Strategy and Action Plan will have an impact on greenhouse gas emissions reduction at the national level. The GHG emissions projection exercise was conducted with different models, while aggregation was performed in the LEAP model. According to the modelling results, emissions from all the key sectors of the economy (excluding LULUCF) are projected to increase on average 4% per year between 2020 and 2030, if measures to reduce emissions would not be implemented, i.e., under the reference scenario. Emissions would reach 30.8 MtCO2e in 2030, 75% more compared to 2015 level (17.6 MtCO2e). The 32 measures listed in the Climate Action Plan (assumptions made during calculation of measures to be noted) would reduce the emissions in 2030 by approximately 11%, compared to the reference scenario, resulting in emissions of 27.5 MtCO2e in 2030.

4.5.6. GOALS OF THE CLIMATE STRATEGY AND ACTION PLAN

To achieve the long-term vision declared for 2030, which means reducing GHG emissions to 35% below 1990 levels by 2030 for all sectors of the economy, the Climate Strategy and Action Plan set the following goals for each sector:

Goal 1: Reduce greenhouse gas emissions in the energy generation and transmission sector to 15% below the reference scenario projections by 2030;

Goal 2: Reduce greenhouse gas emissions in the transport sector to 15% below the reference scenario projections by 2030;

Goal 3: Support development of low-carbon approaches in the buildings sector by promoting climate-smart and energy-efficient technologies and services; 2 An internal analysis of further potential and ambition, and negotiations with potential partners on the declared conditional commitment target are in progress;

Goal 4: Support development of the low-carbon approaches in the industry sector by promoting climate-smart and energy-efficient technologies and services to reduce greenhouse gas emissions to 5% below the reference scenario projections by 2030;

Goal 5: Support the low carbon development of the agriculture sector by encouraging the climate-smart and energy-efficient technologies and services;

Goal 6: Support the low carbon development of the waste sector by promoting climate smart and energy-efficient technologies and services;

Goal 7: Increase the carbon capturing capacity of the forestry sector by 10% for 2030 compared to 2015. It should be noted that according to the results of the CAP mitigation measures modelled with SCAN Tool and various international studies, the fulfilment of the goals and objectives set out in the document will improve following in the long run: economic condition and development, air and water quality, public health, availability and quality of jobs, quantitative and qualitative aspects of biodiversity, and number of the new and clean technologies integrated into everyday life.

4.5.7. SECTORAL PRIORITIES, GOALS AND OBJECTIVES

The goals, objectives and activities set for the priority sectors of the Climate Strategy and Action Plan have been identified with participation of various stakeholders. The selection of priority sectors for the Climate Strategy and Action Plan was based on the Kyoto Protocol Annex A and the IPCC 2006 National Greenhouse Gas Inventory Methodology. According to these documents, greenhouse gas emissions and their inventory take place in the following sectors: energy, industrial processes, and product consumption, waste, agriculture, land use, changes in land use and forestry.

4.5.7.1. SECTORAL PRIORITY

Transport

This section of the Climate Strategy and Action Plan cover the emissions from the energy consumption in the transport sector. The main sources of emissions are passenger and freight transport over road, rail and off-road vehicle (e.g., agricultural) use. This section includes the direct emissions (direct combustion of fuels in transport) as well as indirect emissions (electricity consumption).

Goals and Objectives is to reduce the greenhouse gas emissions in the transport sector by 15% below the reference scenario projection by 2030. This goal can be achieved through the fulfilment of the following objectives:

Objective 1. Increase the share of low- and zero-emission and roadworthy private vehicles in the vehicle fleet This objective includes increasing the share of electric and hybrid vehicles in the total registered vehicles in Georgia with 5% and 20%, respectively, by 2030, since the vehicles with this type of engine do not consume or consume less gasoline and diesel, resulting in zero or low emissions. The objective also involves increasing the share of roadworthy vehicles to reduce greenhouse gas 3 Amaranthus, a plant 41 emissions, including in terms of exhaust fumes.

This will be measured by reduction of the share of vehicles failing the first technical inspection, from the current 55% to 30% by 2030. The strategy includes making amendments to the normative acts on technical inspection of transport and the Administrative Offences Code to reduce the tendency of avoiding inspections and making one-time manipulations. The objective also includes more effective enforcement of fines and road control of vehicle exhausts using modern technologies. These activities serve to remove non-roadworthy and environmentally inefficient vehicles from operation and reduce emission intensities. The strategy also aims to encourage the use of low- and zero-emission vehicles and electric transport and reduce the activity of gasoline and diesel engine vehicles and imports of older, environmentally inefficient vehicles. In order to encourage the use of electric vehicles, the government will identify additional optimal tax incentive alternatives based on cost-benefit analysis, improve infrastructure for electric vehicles in Tbilisi, examine the option of increasing the import tax on old light-duty vehicles on the basis of an economic feasibility study and will introduce an emission standard for imported vehicles based on cost-effectiveness analysis (Engine EUR4 / EUR5). Removing the least efficient vehicles from the vehicle market and upgrading the vehicle fleet will increase not only its average efficiency but also the air quality in general. An increase in the incoming electric vehicles (as well as improvement of the infrastructure for electric vehicles) and the gradual replacement of the existing fleet will be ensured. In parallel to the reduction of vehicle activity, part of the drivers will switch to using public transport as their main means of transportation. Objective

Objective. 2. Encourage the reduced demand on fossil fuel and the use of biofuels. Since fossil fuel use in transport has a negative impact on greenhouse gas emissions, this objective aims to reduce its consumption, promote the use of environmentally friendly fuels and increase the share of energy from renewable sources, including biofuels by 2030. The option of increasing the fuel tax will be examined and biodiesel production will be supported and encouraged to that end.

The use of biofuel to be encouraged under the CORSIA implementation plan, according to which the carbon offsetting requirements will be minimized by using the CORSIA eligible fuels which itself will result in the decrease of the carbon emitted in the upper layer of the atmosphere. CORSIA to be implemented in Georgia to the full extent by January 2022.

Objective 3. Improve average efficiency of thermal power plants

The strategy also involves improvement of the average efficiency of thermal power plants. The objective will be measured by increase in the efficiency of electricity generation in thermal power plants with more than 50% by 2030. It is planned to carry out technical works on thermal power plants, strengthen the infrastructure of national transmission systems, and equip the new, combined-cycle thermal power plants with up-to-date technologies to double their energy efficiency. Gardabani 3 combined cycle gas thermal power plant will be built by 2023.