REPUBLIC OF LEBANON

MINISTRY OF PUBLIC WORKS AND TRANSPORT

DIRECTORATE GENERAL OF CIVIL AVIATION

ENVIRONMENTAL PROTECTION

LEBANON'S ACTION PLAN

On

CO_2 Emissions Reduction from International Aviation

وزارة الأشغال العامة و النقل
MINISTRY OF PUBLIC WORKS AND TRANSPORT
المديرية العامة للطيران المدني
DIRECTORATE GENERAL OF CIVIL AVIATION

DIRECTORATE GENERAL OF CIVIL AVIATION

GOVERNING

ENVIRONMENTAL PROTECTION

By the virtue of the authorities assigned to the Director General of the Lebanese DGCA, this State Action Plan is hereby promulgated to achieve a sustainable aviation system in Lebanon.

Approved by:

Eng. Fadi El Hassan

Director General

Date: October 2023

PREFACE

State Action Plan (SAP) is a voluntary planning and reporting tool for ICAO State members to communicate information on their activities to address CO_2 emissions from international civil aviation to ICAO. It was established in 2010 as a result of Assembly Resolution A37-19.

The International Civil Aviation Organization (ICAO) is a United Nations (UN) specialized agency established to help countries share skies to their mutual benefit.

The Republic of Lebanon as a member State of ICAO, has the commitment to abide with the Convention on international aviation protocol which was signed in Chicago on December 7, 1944.

Building a strong green culture is a key of success, where training and education are essential tasks to achieve for this culture improvement.

The Lebanese Directorate General of Civil Aviation (DGCA) intends to mitigate the environmental impact of the civil aviation industry to achieve a sustainable aviation system in Lebanon with its three dimensions: Economy, Environment and Society.

Lately, an increase has been witnessed in the air transport growth in Lebanon within the recent years which means that possible and more emissions can occur, this increase will be considered through the implementation of the first version of our voluntary State Action Plan.

The Lebanese DGCA would like to assist ICAO towards meeting the goals set by the Assembly Resolution A37-19 and then reaffirmed by A38-18, A39-2, A40-18 and A41-21, by submitting the first version of its State Action Plan.

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LIST OF ABBREVIATIONS

ACAC	Arab Civil Aviation Commission
AIP	Aeronautical Information Publication
AO	Aeroplane Operator
APU	Auxiliary Power Unit
ATM	Air Traffic Management
BEY	Beirut
BIA	Beirut International Airport
BPR	By Pass Ratio
B-RHIA	Beirut – Rafic Hariri International Airport
CAA	Civil Aviation Authority
CNG	Carbon Neutral Growth
CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DGCA	Directorate General of Civil Aviation
EMP	Emission Monitoring Plan
FIR	Flight Information Region
FTO	Flying Training Organization
GDP	Gross Domestic Product
GMBM	Global Market Based Measure
GPU	Ground Power Unit
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
LARs	Lebanese Aviation Regulations
LCAF	Lower Carbon Aviation Fuels
LCC	Low-Cost Carriers

MEA	Middle East Airlines
MPWT	Ministry of Public Works and Transport
MRV	Monitoring Reporting Verification
nvPM	Non Volatile Particulate Matter
Pax	Passengers
RTK	Revenue Ton-Kilometer
SAF	Sustainable Aviation Fuel
SAP	State Action Plan
SARPs	Standard and Recommended Practices
SDGs	Sustainable Development Goals
UN	United Nations

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Chapter 1 INTRODUCTION: AVIATION IN LEBANON

1.1 HISTORY

Lebanon lies on the Eastern shore of the Mediterranean Sea, at the crossroad between the Occident and the Levant. The capital, Beirut, one of the oldest cities in the world, and despite being destroyed and rebuilt seven times over its lifetime of 5000 years, remains a vibrant, multicultural city, so have its airport: Beirut - Rafic Hariri International Airport (B-RHIA).

Lebanon was the first country in the Middle East that tasted the aviation experience, when a French pilot "Jules Védrines" landed in December 1913 on a grass strip in the district of Qarantina to the north of Beirut, just a year before the First World War.

Figure 1-1 First French Pilot Landed in Beirut, 1913

In 1920, Beirut welcomed its first military airbase in the district of Dora. The grass airfield established there was referred to "Champ d'Aviation".

Later in the same year, "Alfred Sursock" with a group of his compatriots, and with the full backing from the French mandate authorities set-up the "Aero-Club of Syria and Lebanon". It was envisaged as the national arm for training local pilots, aviation engineers and technical personnel.

With a long list of honorary and social members, French, Lebanese and Syrian flying members began operational activities from the airfields of Rayak and Damascus. The flying section in Lebanon was named "Victor Denain", name of the commander of the French Air Forces in Levant.

In 1924, a young man "Joseph Elias Akar" became the first ever Lebanese to receive his flying certificate.

Figure 1-2 Aerial Photo of Beirut - Bir Hassan Airfield in 1937

In August 1933, two pilots (Codos and Maurice) flew a "Blériot IIO" airplane, named after one of French great pilots "Joseph Le Brix", from New York, all the way to the French airbase of Rayak, Bekaa. Codos and Maurice successfully covered over 9000 Km in over 56 hours between the US and Rayak, to achieve a world record which they held on to for the next four years.

1.2 CIVIL AVIATION

For the French colonial powers of the 1920s, it was crucial to have a fast and efficient transportation link with their colonies.
A regular and reliable flow of information, mail and civil servants had to be maintained with central governments and overseas territories.
In October 1927, a lone wooden seaplane coming from Marseille, landed on the Beirut waters between the port of the city and "Ain el Mraysse". Subsequent flights, with the company "Air Orient" took charge of continued flights to arrive to Lebanese shores via Napoli, Corfu and Castellorizo.
June 1929, the Marseille-Beirut route was officially inaugurated.

In the 1930s, air service to Beirut, involved seaplanes disembarking passengers at the "St. Georges Bay wharf", site of the legendary St Georges hotel built in the 1920s to host Hollywood stars and international royalty.

In 1933, "Air France" was established by the merger of "Air Orient" and other companies and the bulk of the operation moved to Tripoli. "Air France" used giant hydroplanes, "Lioré et Olivier 242s", to bring passengers to the port of el-Mina.

1936, watched the construction of the first civilian airport "The Bir Hassan Airport" on the sand dunes of Beirut.

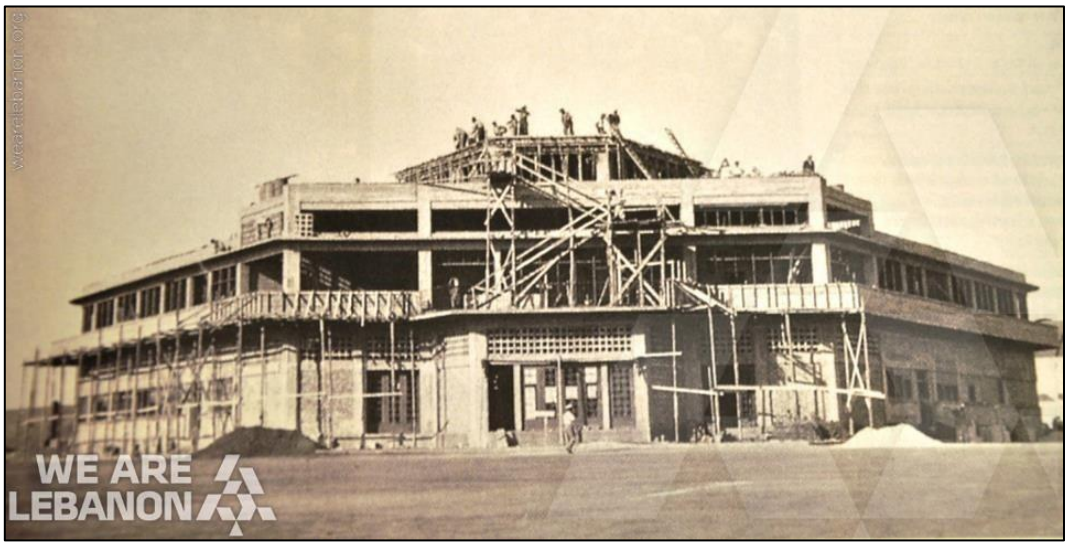

Figure 1-3 Beirut - Bir Hassan Airfield Building, 1933

April 1954, "Beirut International Airport" was officially inaugurated and replaced the smaller Bir Hassan Airfield which was located a short distance north, and which had become too small when Beirut became a convenient stopping point between Europe, Asia, and Africa.

At the time of its opening, the airport consisted of two asphalt runways and the terminal was very modern and it featured an excellent spotters terrace with a café.

Figure 1-4 Beirut International Airport - Ministry of Tourism

With the liberal economic policy of the State, lots of businesses as well as tourists from all over the world were attracted to Beirut. Beirut became the hub of economic, social, intellectual and cultural life in the Middle East. The Lebanese capital was generally considered as a heaven of liberalism.

With its seaport and airport, coupled with Lebanon's free economic and foreign exchange system, solid gold-backed currency, banking-secrecy law, and favorable interest rates, Beirut became an

established banking center for Arab wealth, much of which was invested in construction, commercial enterprise, and industry.

The large number of daily and weekly newspapers, journals, and other periodicals, which were normally uncensored, kept the Arab world informed about regional and world developments, and provided a full array of editorial opinion.

Beirut's schools, colleges, and universities for example: American University of Beirut, St. Joseph University, Lebanese University, and Beirut Arab University, attracted students from many Arab countries.

The growth of the service sector, which generated the overwhelming proportion of national income, and employed the largest proportion of the labor force, was related mainly to international transport and trade, and to the position of Beirut as a center of international banking and tourism.

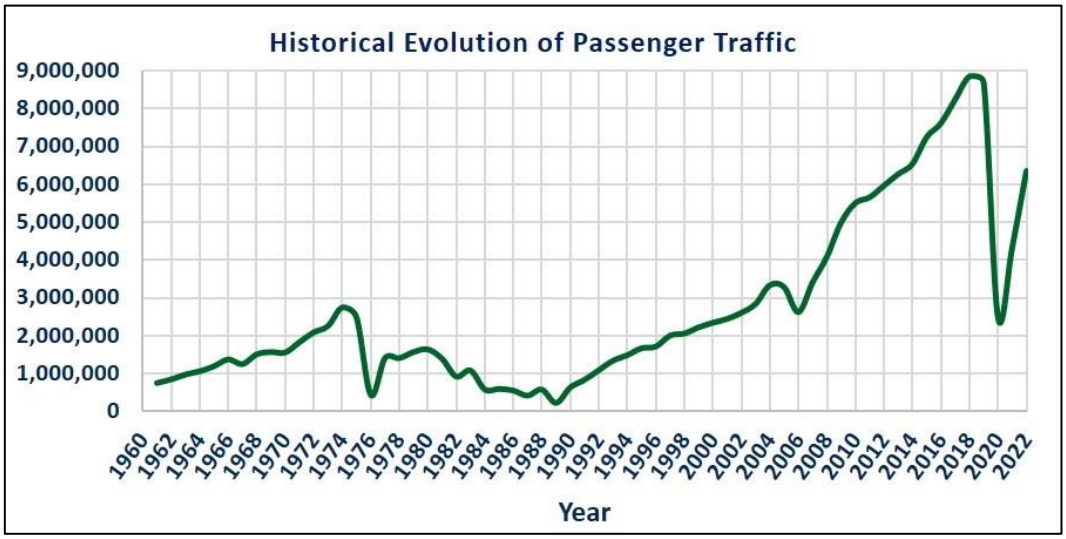

Figure 1-5 Evolution of Traffic since 1961 - Lebanese DGCA

Golden years faded away as the civil war begin in 1975.

After the civil war, which took place from 1975 to 1990, extensive reconstruction programs aimed to return Beirut to its status as a hub of finance and tourism. Renovations to Beirut Airport were undertaken to facilitate a return to its prewar importance.

In 1994, "Beirut International Airport" reconstruction started as one of the infrastructure rehabilitation projects. The completion of the rebuilding process of the airport enabled it to handle 6 million passengers a year.

In June 2005, "Beirut International Airport" was renamed "Beirut-Rafic Hariri International Airport" (B-RHIA), after former Lebanese Prime Minister Rafic Hariri was assassinated.

The new upgraded airport became a gateway to the Gulf countries, one of the busiest airports in the Middle East. B-RHIA with its runways were built to handle the largest jet airplanes in service, and a number of international airlines started to use it regularly.

1.3 AIR POLICIES

Since the landing of "Jules Védrines" at Beirut in December 1913, coming from Paris in an ambitious venture, Beirut never ceased to serve the needs of the travelers.

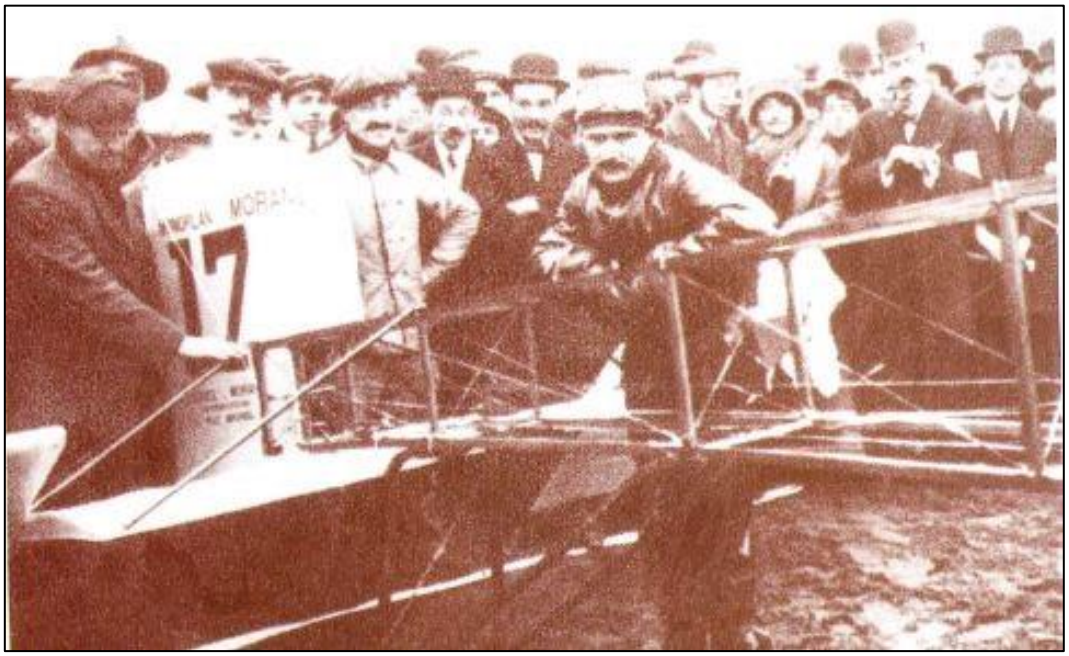

Figure 1-6 Jules Védrines, The First Aviator

Known as the Paris of the Middle East, Beirut became an admired destination for tourism after the end of World War II. Tourists from Europe and Middle East headed Beirut to enjoy its nightlife, social activities and Lebanon's nature and weather.

In 1996, and in order to protect the national carrier interests, Central Bank of Lebanon began financing "Middle East Airlines, (MEA)".

In 1999, Lebanon committed to an agreement amongst 16 States of the Arab Civil Aviation Commission (ACAC), which liberalized intra-regional Third and Fourth Freedom traffic rights by 2003, and Fifth Freedom traffic rights by 2005.

In November 2000, and to facilitate the State's economy and social goals, the primary objective of Lebanon's aviation policy was the State's air connectivity in a safe, competitive, cost-effective and sustainable manner.

The new Council of Ministers which came into office that same year, removed the restrictions on the foreign carriers, and announced various economic reform measures including the adoption of the "Open Skies" policy.

This policy lifted immediately the restrictions on aircraft capacity and frequencies related to Third, Fourth and Fifth Freedom traffic rights with an objective of increasing air passenger and cargo traffic, improving the country's economy.

1.4 THE IMPORTANCE OF AIR TRANSPORT

Air transport is a worldwide transportation network, which provides speedy connections between cities and enables the economic flows of people, goods, cargo and ideas that are the fundamental drivers of the economic growth. Air transport is also a major employer which generates directly and indirectly job opportunities.

Based on IATA "*The importance of Air Transport in Lebanon - 2019*", there is three ways of measuring air transport's impact: the jobs and spending generated by airlines and their supply chain, the flows of trade, tourism and investment resulting from users of all airlines serving the country and the city pair connections that make these flows possible.

Air transport market forecasted scenarios for passenger traffic, jobs and Gross Domestic Product (GDP) footprint, under IATA 2018 trends, showed a growth of 113% for the next 20 years. This growth would result in an additional 4.4 million passenger journey by 2037. If met, this would increase demand which will support approximately $12.4 billion of GDP and almost 300,000 jobs.

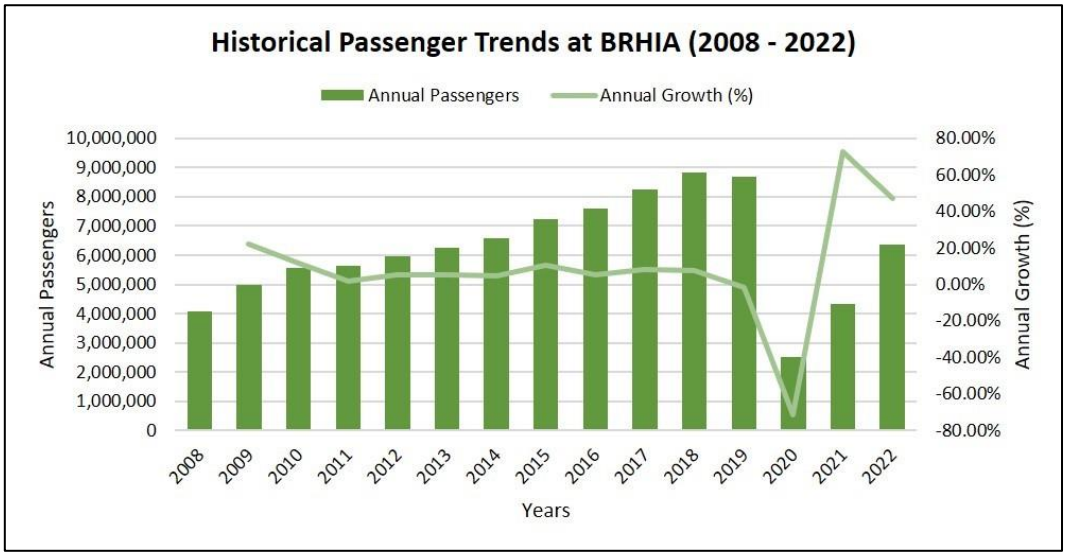

Figure 1-7 Drop in The Number of Pax During COVID-19 Pandemic - Lebanese DGCA

Unfortunately, IATA forecast scenarios had to be shifted and delayed as a result of the economic and financial crisis that started in October 2019, further exacerbated by the dual economic impact of the COVID-19 outbreak, and the massive Port of Beirut explosion in August 2020. Significant impacts

on the aviation industry due to abrupt measures and travel restrictions led to a drop in the movement of passengers (Figure 1-7).

The map below (Figure 1-8) shows Lebanon's connectivity at a regional level, and how it evolved. Lebanon's connections to the Middle East grown over the last five years.

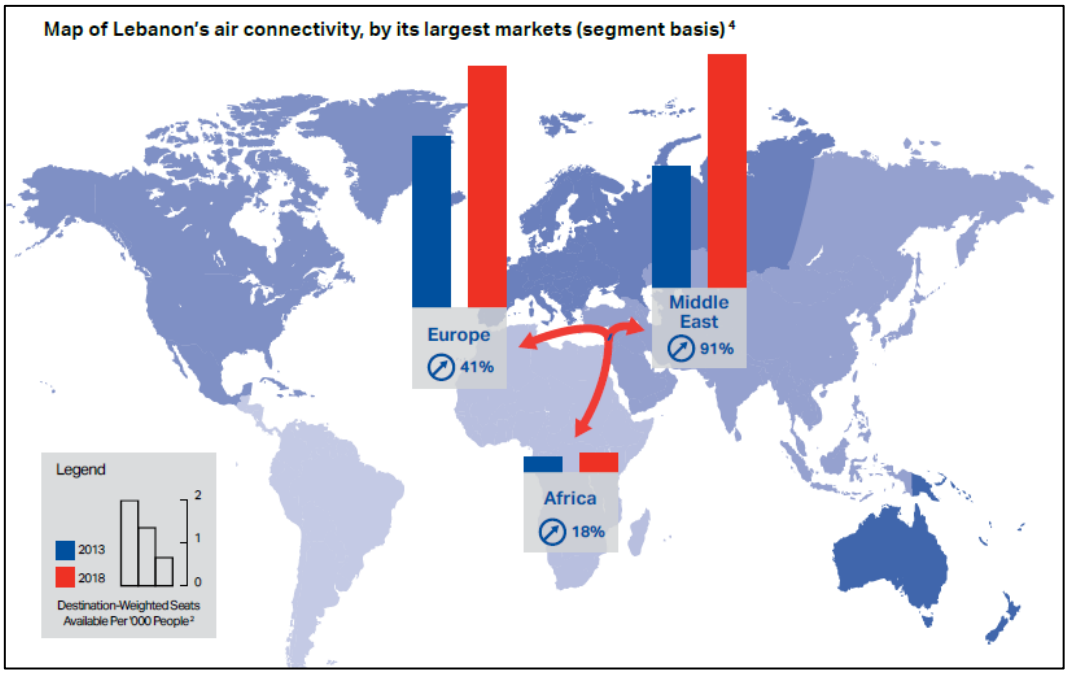

Figure 1-8 Lebanon Air Connectivity - IATA Source

1.5 LEBANON'S ECONOMIC REVIEW

Lebanon's economy is based on open trade, services, tourism, real estate and trans-border connectivity. The country's physical infrastructure was designed to achieve the above.

Between 2007 and 2010, Lebanon witnessed a period of high economic GDP growth of 9.1%, according to the national account figures for that period. This growth turned into stagnation between 2011 and 2017 with an average GDP growth of 1.8%.

A series of shocks, like persistent fiscal constraints, the gap between infrastructure supply and demand, has widened and needs have changed.

The impact of the Syrian crisis which started in 2011, was reflected in a significant decline in the Lebanese industrial sector.

Border closures have restricted trade with Syria and neighboring countries, and caused a drastic decline in industrial exports to neighboring countries. Coupled with the tense political environment which paralyzed political decision making during that period, played a major role in the drop of growth rates (Figure 1-9). This period was also marred by a worsening business environment.

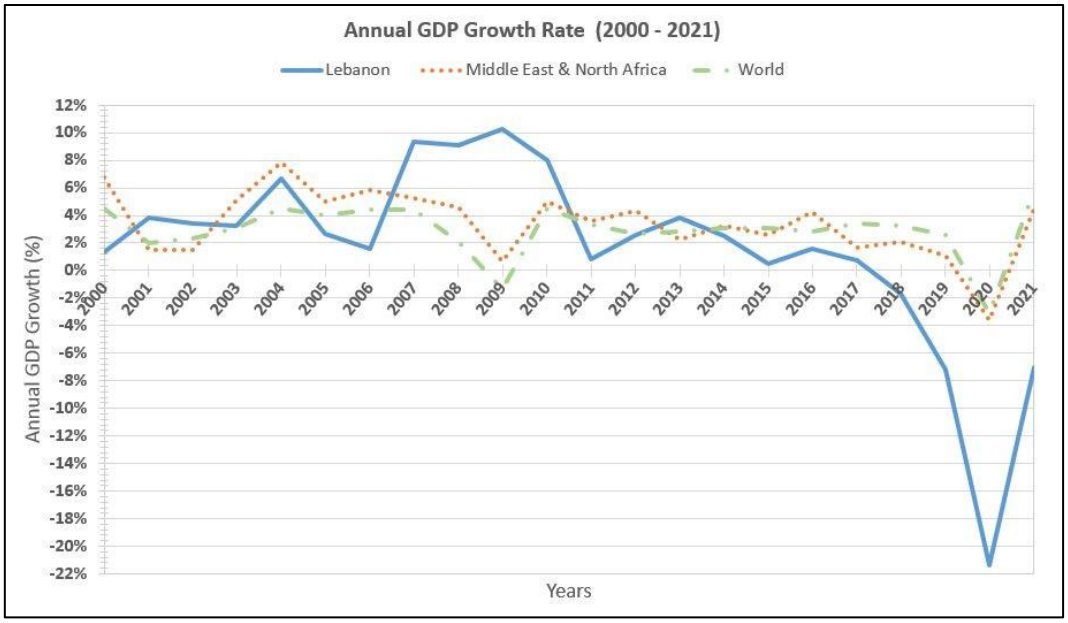

Figure 1-9 Annual GDP Growth Rate - Lebanese DGCA

With this period of economic stagnation, tourism, exports, real estate, and private investments were all affected. The real growth rate of GDP per employed person has been negative due to the weakening of the productive sectors.

For nearly three years, Lebanon has been assailed by the most devastating, multi-pronged crisis in its modern history.

The economic crisis had by far, the largest and most persistent negative impact. The "Lebanon Economic Monitor - Spring 2021 – World Bank" found that Lebanon's economic and financial crisis ranks among the worst economic crises globally since the mid-nineteenth century.

Nominal GDP plummeted from close to US$52 billion in 2019 to an estimated US$23.1 billion in 2021. The protracted economic contraction has led to a marked decline in disposable income.

GDP per capita dropped by 36.5% between 2019 and 2021, and by July 2022, Lebanon was reclassified by the World Bank as a lower-middle income country, down from upper middle-income status. Such a brutal contraction is usually associated with conflicts or wars.

Beirut - Rafic Hariri International Airport, which is the only commercial airport in the Republic of Lebanon, had also his part from the economic contraction.

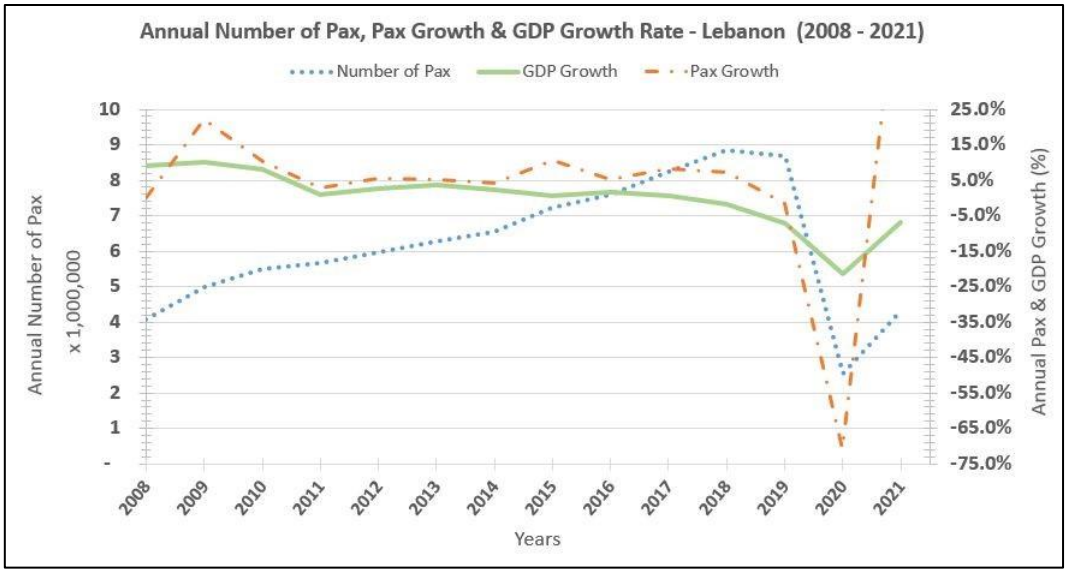

Figure 1-10 Annual Number of Pax Growth and GDP Growth Rate - Lebanese DGCA

However, different elements played an important role in the increase of the number of passenger at B-RHIA. The adoption of the "open sky" policy in 2000 by the Council of Ministers, the reestablishment of political stability and proper security conditions in May 2008 with the Doha Accord, the cancelation of the entry visa to Turkey in 2009, played a major role in the growth of passenger's number and helped to revive, gradually, recreational activity.

Despite the negative repercussions of the Syrian crisis on the economic, fiscal and social levels, B-RHIA traffic has been impacted positively. Used as a point of transition for a large number of displaced Syrians and businessman, Beirut Airport was an alternative to Damascus International Airport which was closed during the crisis. Passenger's traffic movement peaked up at the airport from 2014 till 2017, till visa measures started to be applied. Syrians used Beirut Airport as a gateway to reach other destinations like Jordan, Turkey and Arab countries (Figure 1-10).

With the Qatar diplomatic crisis in 2017, and the airspace ban imposed by different countries in the Middle East and Gulf Arab areas, Beirut airport became a transit point for citizens flying from banning countries to Qatar.

By October 2019, numbers of passengers started decreasing tremendously, as an economic and social crisis hit the country, followed by the COVID-19 pandemic to reach -70% in 2020 comparing to 2019.

With the relaxation of COVID-19 restrictions and the reopening of borders, the number of passengers at Beirut Airport between arrivals and departures, exceeded the capacity of the airport which is 6,000,000 passengers annually. Relying on previous forecast and following the 20th's trend, the number of passengers is expected to grow in the coming years with an average of 3% annually (Figure 4-3).

Chapter 2 DIRECTORATE GENERAL OF CIVIL AVIATION

2.1 ROLE OF THE DGCA IN LEBANON

The Directorate General of Civil Aviation (DGCA), is the Civil Aviation Authority in the Republic of Lebanon, one of several directorates within the Ministry of Public Works and Transport (MPWT), upon the Regulatory Decree number 1610 dated on the 26th of July 1971.

The DGCA conducts the supervision of the air transport in Lebanon and follows up with the safety of the air navigation. It assures the civil aviation communications and issues safety and security regulations and surveils their implementation.

In 2002, the Lebanese Parliament promulgated a new Law 481, entitled "Management of the Civil Aviation Sector". The general objectives of this Law, was the establishment of the "Civil Aviation Authority", the regulator Authority. The Law aims for the development of the Civil Aviation sector utilizing a modern organization of the matters of air transport management, commercial activities, supervision of airports and control.

The Civil Aviation Authority (CAA), as regulator, will contribute to the development of the Civil Aviation sector, and will oversee the management and investments of all sectors related to the civil aviation, including air transport services, aircraft navigation, safety of the civil aviation and the certification of civil airports. Unfortunately, this law was not implemented.

2.2 ORGANIZATIONAL STRUCTURE

The Lebanese DGCA under Decree number 1610, is composed of two directorates, the Directorate of Airports and the Directorate of Technical Exploitation, and four departments with the Diwan, the office of the Directorate.

- Directorate of Airports includes:
  - The Airport Studies Department, and
  - The Airport Management.

- Directorate of Technical Exploitation includes four departments:
  - Air Navigation Department,
  - Aeronautical Communication Department,
  - Technical Equipment Department, and
  - Maintenance Department.

- Meteorological Department
- Flight Safety Department
- Research and Studies Department
- Air Transport Department

2.3 ICAO CORSIA FOCAL POINT CONTACT INFORMATION

The State Action Plan Focal Point coordinates with ICAO, follow up with the development of the State Action Plan and is responsible for its submission to ICAO.
The contact information for the Focal Points within the Republic of Lebanon:

Name of the Authority	Director General of Civil Aviation
Primary Point of Contact	Dr. Ali Elchaar
Department	Meteorological Department
Title	Head of General Climate Section
E-mail Address	ashaar@beirutairport.gov.lb
Secondary Point of Contact	Dr. Angèle Aouad
Department	Research and Studies department
Title	Head of Research and Studies Department
E-mail Address	aouada@beirutairport.gov.lb
City	Beirut
Country	Lebanon
Address	Beirut - Rafic Hariri International Airport

Table 2-1 Focal Point Contact Information

Chapter 3 AVIATION STRUCTURE IN LEBANON

3.1 LEBANON'S AIRPORTS

Lebanon has three recognized airports according to Lebanon's B-RHIA Aeronautical Information Publication (AIP).

3.1.1 Kleiat Airport

Kleiat Airport (ICAO Code: OLKA), which is located in Akkar, in North Lebanon, is also known as the René Mouawad Air Base. It is around 7 km from the northern Lebanese-Syrian border and 26 km from Tripoli. Reaching it from the Beirut-Rafic Hariri International Airport by driving would take around 3 hours.

The small airport was established in 1934 by the Iraq Petroleum Company (IPC). The company used the airport by its fleet to carry its employees between Lebanon and Arab countries.

For a certain period and before the civil war, Middle East Airlines flew between the northern airport and Beirut Airport, serving as a domestic airport for North Lebanon.

Today, Kleiat Airport is under the control of the Lebanese Air Force.

Figure 3-1 Kleiat Airport - Google Earth

3.1.2 Rayak Airport

Rayak Airport (ICAO Code: OLRA), in the Bekaa Valley, in the eastern region of the country, is widely known as the "Air base", during the French Mandate, between 1920 and 1943. In 1949, Rayak Airport was the birthplace of the Lebanese Air Force.

The first establishment of a the Rayak Airport runway, was a simple track of sand, which can be traced back to a Bavarian air regiment that was stationed for about a year in the strategically well-positioned town of Rayak for operation 'Pascha II' during World War I.

Figure 3-2 Rayak airport - Google Earth

3.1.3 Beirut – Rafic Hariri International Airport

Beirut – Rafic Hariri International Airport (ICAO Code: OLBA), strategically located on the crossroads between Europe, Asia and Africa, is the sole operational commercial airport in Lebanon. Located at Khaldeh, in the Southern suburbs of Beirut, 9 kilometers from the city center, is the hub for Lebanon's national carrier, Middle East Airlines (MEA) and was the hub for the Lebanese cargo carrier "TMA cargo" and "Wings of Lebanon". B-RHIA caters more than 40 airlines to 74 destinations worldwide.

Constructed over a total area of 7 million of m^2, the airport has one international passenger terminal building with two concourses following the finger pier configuration, forming a U-shaped building. It has twenty-one contact gates served by passenger loading bridges and seven remote stands.

The terminal building was designed and built for a handling capacity of 6 million passengers per annum and an overall area of 131.529 m^2.

The airfield is comprised of three runways, east runway designated 03-21 and is 3.800 m long and 45 m wide, new west runway designated 16-34 and is 3.398 m long with 1.900 m protracting into the sea, and the old west runway designated 17-35 and is 3.000 m long, all runways are 45 m width.

Runways are connected to the terminal area with a comprehensive taxiway network (Figure 3-3).

Middle East Airlines has its headquarters located in the west side of the airport.

The airport has its General Aviation terminal building with associated apron, and aircraft hangars to accommodate VIP passengers and charter flights.

It has also a presidential pavilion dedicated for the reception of the president and heads of states.

The airport houses also "Beirut Air Base" which is the main base for the Lebanese Air Force.

Figure 3-3 Beirut - Rafic Hariri International Airport - Google Earth

In 2019, the number of passengers arriving and departing from B-RHIA reached 8.6 million and the number was expected to reach out 10 million by the upcoming years. Unfortunately, due to the financial crisis and the COVID-19 outbreak, the number of passengers decreased in 2020 to 2.5 million due to the different measures and restrictions taken due to the COVID-19 pandemic. Numbers are expected to grow in the near future (Figure 1-10).

3.2 REGISTERED OPERATORS

Subject to Article 70 of the Lebanese Civil Aviation Safety, (Act No. 663), aeroplane operators requesting or amending an Air Operator Certificate (AOC) must submit an application to the Ministry of Public Works and Transport in the form and manner required by the Commercial Air Services Standards. These Standards outlines the requirements needed by the aeroplane operator to comply with Lebanese Aviation Regulations LARs Part VII.

With reference to LARs Part VII, Subparts 3, 4 and 5, Commercial Air Services are divided into four types of services, Flight Training Operations (FTO), Air Taxi Operations, Commuter Operations and Airline Operations.

Each type of service has its own Commercial Air Services Standards that must be maintained by the aeroplane operator to request or amend for a specific AOC.

Table 3-1 includes Lebanese registered aeroplane operators.

Registered Operators	Type of Services	Number of Aircraft
Middle East Airlines	Scheduled Airline Pax + Cargo	22
Beirut Wings	Flight Training Organization + Air Taxi	4
IBEX Air Charter	Commuter	4
Cedar Executive	Commuter	2
Fly Executive	Commuter	1
Sky Lounge Services	Commuter	1
Total		**34**

Table 3-1 Registered Operators in Lebanon

3.3 MIDDLE EAST AIRLINES

Middle East Airlines – Air Liban S.A.L, is the national carrier of the Republic of Lebanon.

Established in 1945, soon after World War II, Middle East Airlines is a private company and is owned by the Central Bank of Lebanon. The national carrier launched its first service from Beirut to the neighboring cities, like Syria, Cyprus, Egypt, Saudi Arabia, Kuwait and other destinations in the Gulf, on a commercial basis.

In 1963, after the merger with Air Liban, Middle East Airlines – Air Liban S.A.L added new European, Middle Eastern and West African destinations to its worldwide network.

Despite the closure of Beirut International Airport (BIA) during Lebanon's civil war, between 1975 and 1990, MEA airlines managed to survive by leasing airplanes and seconding staff to international airline companies.

In 1990, MEA airlines succeeded in reinstating services to all its previous destinations, strengthened and improved its network to Europe, Middle East and the Gulf.

From 1998 to 2002, MEA airlines implemented its largest restructuring program, turning around the company from huge annual losses reaching 87 Million dollars in 1997 to achieve a net profit of 22 Million dollars in 2003, and 50 Million dollars in 2004. The business plan included the rationalization of MEA's network, streamlining its purchasing policy, cost reductions at all levels of the airline, the launch of the frequent flyer program and yield management systems, as well as a number of other measures destined to modernize and restructure the airline.

After 2006, when Beirut - Rafic Hariri International Airport (B-RHIA) was the first target chosen by Israeli aggression on Lebanon, the national carrier continued its expansion with the delivery of its first owned A330 (2008), and added more destinations like Baghdad, Erbil and Al Medina.

In 2007, a profit of US $ 62 Million was achieved, MEA airlines announced the purchase of ten aircraft, four A330's and six A320's.

In June 2012, MEA airlines officially joined Sky-Team Alliance and signed a contract to purchase new airplanes.

By 2017, MEA airlines inaugurated MEA Training and Conferences Center. The project total built-up area is 43,500 m^2, on a plot of 13,755 m^2 surface area. MEA Training and Conferences Center is open to all Arab and International airline companies, economic entities, private and public institutions in Lebanon and abroad to contribute to Beirut's pioneering regional role in culture and education.

MEA airlines fleet with its subsidiary company, Cedar Executive consists of the following aircraft fleet mentioned in the table below:

Operator	ICAO Type Designator	Powered By	Aircraft Registration	Total
MEA airlines	A332	Rolls-Royce Trent 772B-60	OD-MEA	4
			OD-MEB	
			OD-MEC	
			OD-MEE	
	A21N	Pratt & Whitney PW1100G-JM	T7-ME1	9
			T7-ME2	
			T7-ME3	
			T7-ME4	
			T7-ME5	
			T7-ME6	
			T7-ME7	
			T7-ME8	
			T7-ME9	
	A320	IAE V2500	OD-MRL	9
			OD-MRM	
			OD-MRN	
			OD-MRO	
			OD-MRR	
			OD-MRS	
			OD-MRT	
			T7-MRE	
			T7-MRF	
Cedar Executive	E550	HTF7500E	OD-CXJ	2
			OD-CXL	
Total				24

Table 3-2 MEA with its subsidiary company CDX Fleet

In an effort to preserve the environment and increase green areas, and in celebration of its 70th anniversary, MEA airlines launched an initiative in 2016 regarding Reforestation to plant 70 cedar trees in the reserves of the Shouf, Tannourine, Ehden, Becharri, and Jaj. The newly planted area within the Shouf Cedar Reserve was named "MEA's Cedar Forest."

Figure 3-4 MEA Headquarters

Chapter 4 LEBANON TRAFFIC STATISTICS AND TRENDS

4.1 AIR TRAFFIC STATISTICS

Beirut Airport was opened in 1954, replacing the much smaller Bir Hassan Airfield.

Named in 2005, by "Beirut-Rafic Hariri International Airport" (B-RHIA), the international airport of Beirut is the only entry into the country by air, and it is largely used by Middle East Airlines, a full service carrier.

Since 2008, B-RHIA is witnessing a significant growth in the number of passengers, numbers increased from around 4 million passengers to reach more than 8 million passengers by the end of 2018. By the beginning of 2019, the airport was operating beyond its original design capacity of 6 million passengers.

Unfortunately, with the economic and financial crisis that started in October 2019, and the COVID-19 pandemic restrictions, the airport reduced, then ceased its operation for a certain period before recovering and restarted gradually its operation by the end of 2021 (Figure 1-10).

The increase in the number of non-scheduled flights during summer, holidays and pilgrimage seasons, the cancelation of the need for a visa to enter several countries such as Armenia, Georgia, Iran, Jordan, Oman, Turkey, Qatar, and the facilitation of visa procedures to countries such as Egypt, facilitated the process of travelling in the region (Figure 4-1).

This growth is anticipated to continue in the future, and there is a need for the airport to expand its facilities to cope with increasing traffic.

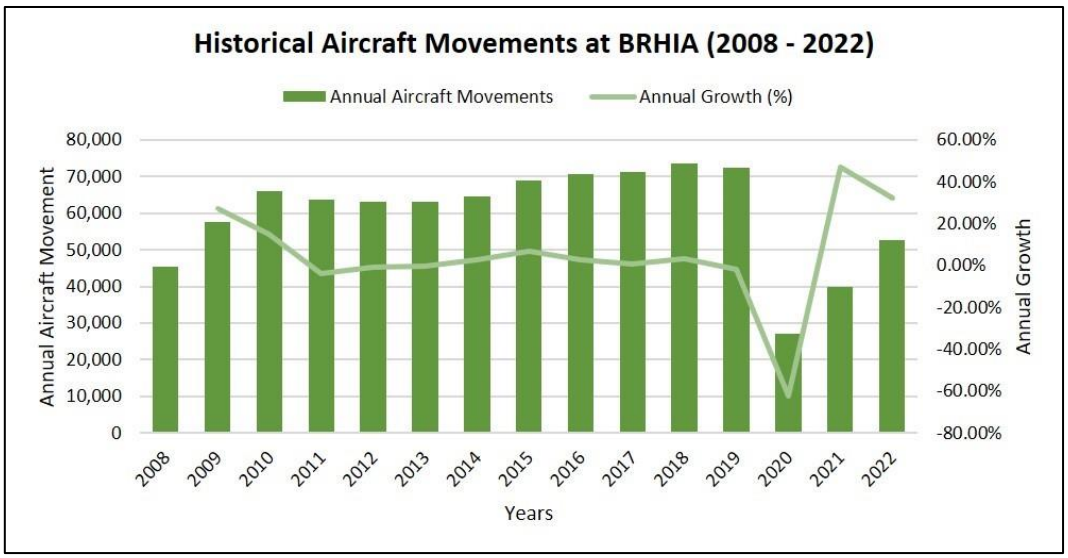

Figure 4-1 Historical Aircraft Movements at B-RHIA from 2008-2022 - Lebanese DGCA

Looking deeply at the annual growth between 2008 and 2018, we can see that the growth percentage increased continuously, usually above 4%, varying between 4% and 22%.

Since 2020, the passenger's growth percentage and the aircraft movements growth percentage are above 25%. To be conservative and taking in considerations incidents that can arise in the future, we used a growth percentage of 3%, for the number of passengers between 2023 and 2050.

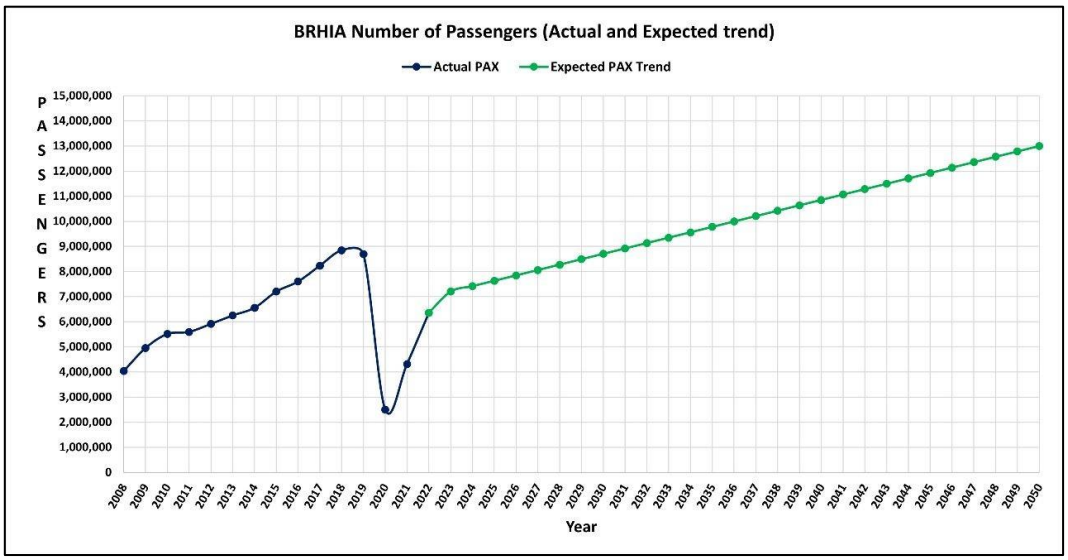

Figure 4-2 Actual and Expected Number of Pax at B-RHIA

The number of passengers presented in figure 4-2, 13,000,000 Pax for the year 2050 can be reached if the situation is prospering.

4.2 AIR TRAFFIC MOVEMENTS

Low-Cost Carrier

The integration of the Low-Cost Carriers (LCC) have exhibited a strong upward trend, driven by the growth of local traffic. Number of LCC is continuously growing. The capacity share reached the range of 13.9% during 2022 (Figure 4-3). The devaluation of the Lebanese pound, combined with the Lebanese diaspora in the Gulf region and in Europe, contributed partially to the growth of the LCC at B-RHIA.

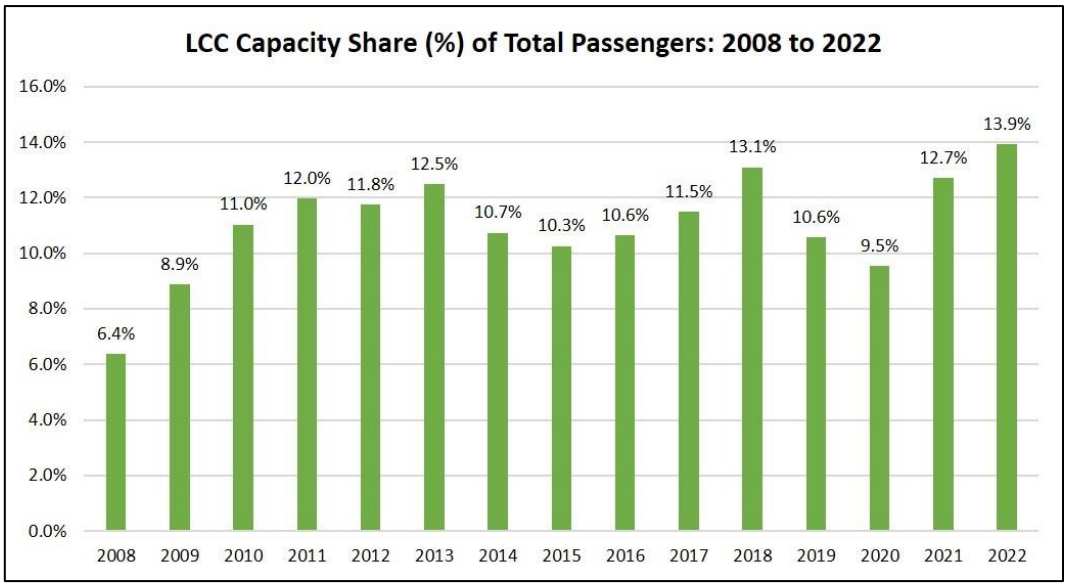

Figure 4-3 LCC Capacity Share (%) of Total Pax from 2008 till 2022 - Lebanese DGCA

Passenger Traffic distribution

Knowing that B-RHIA is a point to point airport, and considering the traffic distribution data collected from 2008 till 2022, we can see that the United Arab Emirates (17%), Turkey (12.28%), Kingdom of Saudi Arabia (9.59%), France (8.31%) and Egypt (5.85%) are the busiest destinations from and to B-RHIA, and constitute 53%, more than half of the passenger distribution (Figure 4-4).

UAE has the highest percentage of Passenger Traffic distribution due to the vacancies and opportunities that attract Lebanese citizens to it, especially with the actual economic crisis that Lebanon is going through. UAE, is also a major hub for international travel, serve as transit area for Lebanese residents flying to eastern countries.

With the cancelation of the need for a visa, Turkey is the second country to have the highest percentage of passenger traffic distribution. Lebanese people visit Turkey for tourism and business. Istanbul's international hubs are also a gateway to Europe and the world from Beirut.

France has the highest percentage in Europe (8.31%), It is a home to large Lebanese diaspora since years and a majority of students mastering the French language travel to France to pursue their highest education.

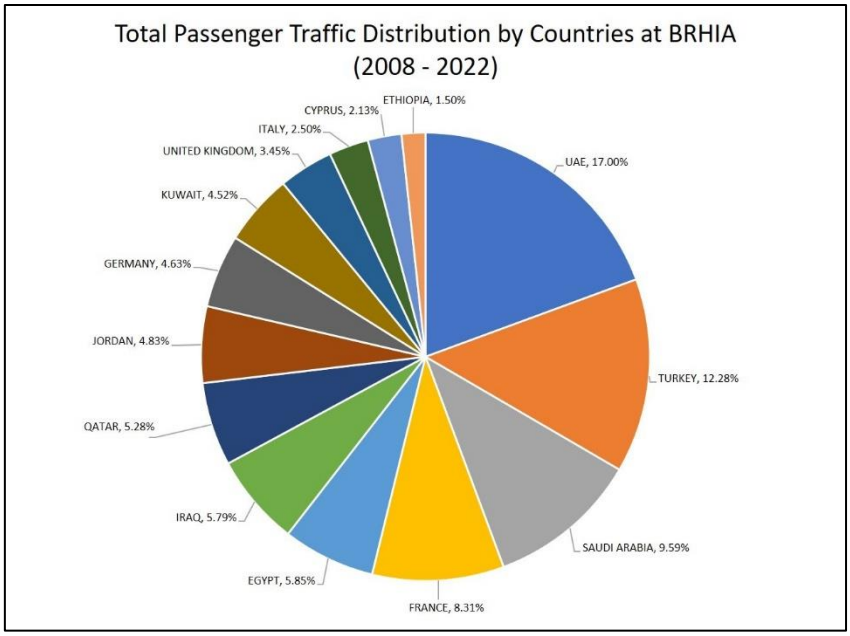

Figure 4-4 Total Pax Traffic Distribution by Countries at B-RHIA from 2008 till 2022 - Lebanese DGCA

Airline Passenger Traffic Share

The airline passenger traffic share in (Figure 4-5), shows that the MEA airlines, the national carrier for Lebanon holds around 37.5 % of the traffic. MEA airlines, which uses B-RHIA as a hub for the company is followed by Emirates airlines with (5.86 %), and Turkish (5.65%). The contribution of all other airlines is below 5%, percentages can evolve and change based on the local and the region stability.

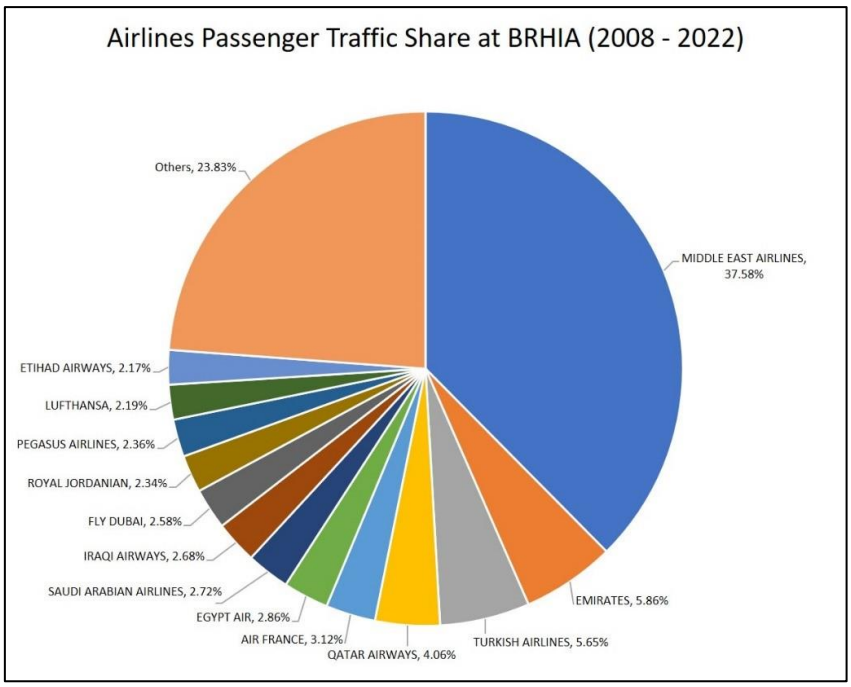

Figure 4-5 Airlines Pax Traffic Share at B-RHIA from 2008 till 2022 - Lebanese DGCA

Chapter 5 BASELINE DEVELOPMENT

5.1 BASELINE SCENARIO DEVELOPMENT

The baseline scenario describes the historic evolution of fuel burn, and traffic data. It is also used to project in the future what would happen in the absence of the mitigation actions, and estimates CO_2 emissions from international aviation.

Regarding Lebanon, the baseline scenario includes annual fuel burn, CO_2 emissions, and traffic data from "International flights", between 2010-2022.

Forecasting future data will define 2050 as the year used as time horizon, and 2030 as the intermediate year.

Lebanese DGCA applies the ICAO definition for "International flights" which is "The operation of an aircraft from take-off at an aerodrome of a State or its territories and landing at an aerodrome of another State or its territories".

With the MEA airlines historical data, and since its fleet size is higher than ten airplanes, the "Method B" shall be applicable.

In order to calculate the CO_2 emissions emitted from international flights, two methodologies are available in accordance with ICAO Doc. 9988: "ICAO methodology" and "IPCC methodology".

All ICAO member States with registered Aeroplane Operator (AO), are encouraged to follow the ICAO methodology: Annex 16, Volume IV, CORSIA – Chapter 2, Monitoring, Reporting and Verification (MRV) of aeroplane operator annual CO_2 emissions.

IPCC methodology is applicable for States with no registered Aeroplane Operator (AO) or States that already use this method for dealing with international aviation CO_2 emissions.

In light of the Monitoring, Reporting and Verification (MRV) requirements mandated by Annex 16, Volume IV, and ICAO Doc 9501, Lebanon with its registered operator, MEA airlines, is following the ICAO methodology for the accounting of the CO_2 emissions from international aviation for the purpose of this State Action Plan (SAP) document.

5.2 BASELINE SCENARIO USING METHOD B

The approach to develop a baseline scenario is based on the extrapolation of historical activity data, and emissions inventory, in order to develop forecasts for MEA airlines, air transport activities.

Method B allows us to consider the past trend of fuel efficiency improvement, in our baseline.

The specific steps for developing a baseline using Method B are as follows:

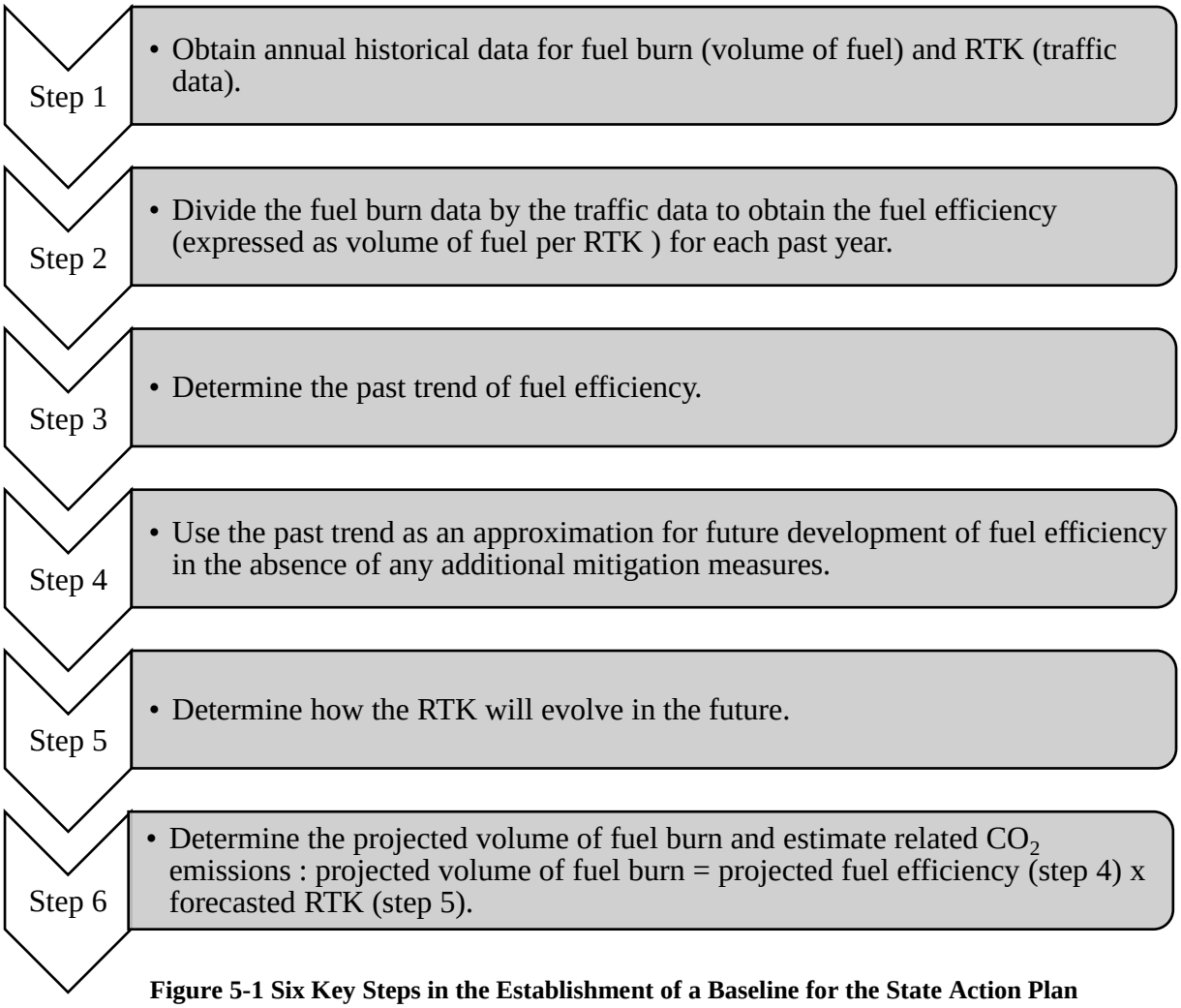

Figure 5-1 Six Key Steps in the Establishment of a Baseline for the State Action Plan

5.2.1 Historical Data Collection

Step 1

- Obtain annual historical data for fuel burn (volume of fuel) and RTK (traffic data).

The historical data of the national carrier, MEA airlines is used from 2010 to 2022, for international flights that operated during this period from Lebanon:

- The fuel burn data was provided in US Gallons and converted to liters by multiplying the data by 3.7854 (1 USG = 3.7854 Liters). In figure 5-2 and table 5-1, the values of fuel burn provided in Liters were converted first to kilograms by multiplying them by the conversion factor 0.8 kg/liter and converted then to Ton.
- Revenue Ton Kilometers (RTK) is the sum of the product obtained by multiplying the number of tons of revenue load carried on each flight by the corresponding flight distance, during a certain year.

Figure 5-2 shows consecutively the historical data of the fuel burn, and the Revenue Ton Kilometers between 2010 and 2022.

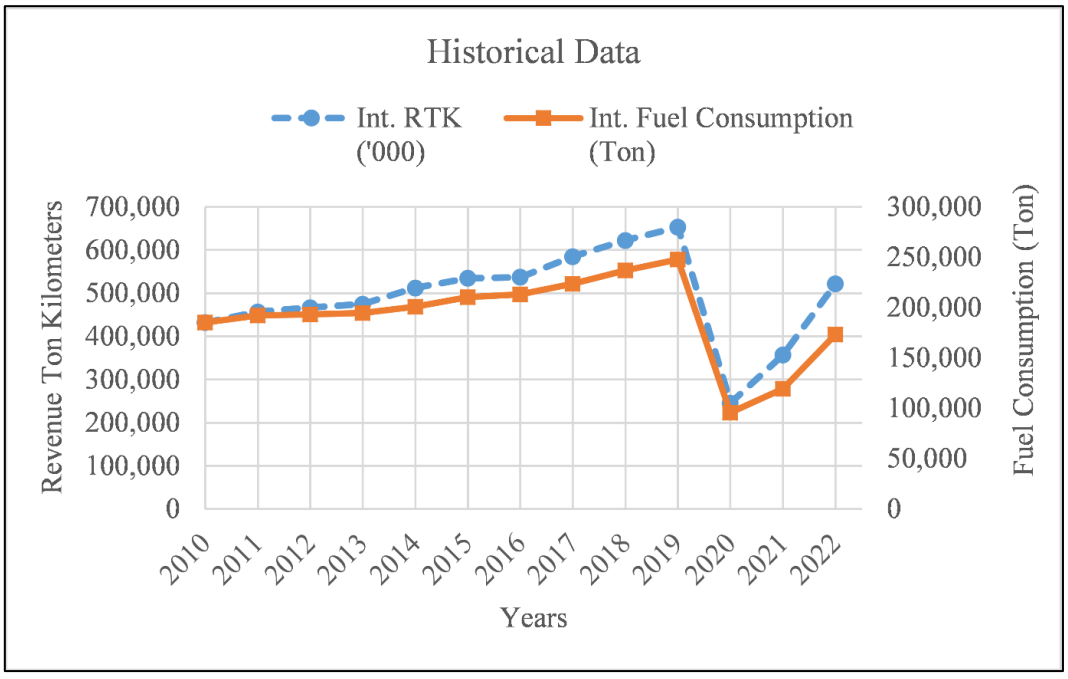

Figure 5-2 Fuel Burn and RTK Between 2010 and 2022

The economic crisis, the Beirut's Port explosion, together with COVID-19 pandemic that hit the country between 2019 and 2021, are well identified in figure 5-2.

5.2.2 Fuel Efficiency

Step 2

- Divide the fuel burn data by the traffic data to obtain the fuel efficiency (expressed as volume of fuel per RTK) for each past year.

In 2010, ICAO Assembly adopted at its 37th Session, the aspirational goals for the international aviation sector with 2% annual fuel efficiency improvement.

Fuel efficiency refers to how many miles an airplane can travel with one gallon of fuel.

For each past year, the fuel efficiency can be obtained by dividing fuel burn by RTK.

$$\text{Fuel Efficiency} = \frac{\text{Fuel burn (Ton)}}{\text{RTK (Ton kilometers)}}$$

Year	Fuel burn (USG)	Fuel burn (Liters)	Fuel burn (Ton)	Revenue Ton Kilometers RTK ('000)	Fuel Efficiency
2010	61,194,729	231,646,527	185,317.22	431,809	0.43
2011	63,410,417	240,033,793	192,027.03	456,717	0.42
2012	63,753,071	241,330,875	193,064.7	466,439	0.41
2013	64,233,681	243,150,176	194,520.14	474,664	0.41
2014	66,384,092	251,290,342	201,032.27	512,154	0.39
2015	69,442,618	262,868,086	210,294.47	534,880	0.39
2016	70,354,876	266,321,348	213,057.08	537,162	0.40
2017	73,898,996	279,737,259	223,789.81	584,924	0.38
2018	78,274,719	296,301,121	237,040.9	622,559	0.38
2019	81,807,870	309,675,511	247,740.41	652,940	0.38
2020	31,567,543	119,495,777	95,596.62	245,484	0.39
2021	39,432,106	149,266,294	119,413.04	356,721	0.33
2022	57,202,707	216,535,127	173,228.1	521,870	0.33

Table 5-1 Table showing MEA airlines Historical Data with Fuel Efficiency

5.2.3 Past Trend of Fuel Efficiency

Step 3

- Determine the past trend of fuel efficiency

The Environmental Benefits Tool (EBT) was created to support States with the development of their SAP. The EBT allowed us to verify the data trend for the baseline scenario for Lebanon.

The exponential equation was used with R-squared 0.8065 as a trend to project the efficiency for the future, till 2050.

Figure 5-3 shows a slight increase during 2020, and this is due to the COVID-19 pandemic effect, petroleum products prices, combined with local situation in the Republic of Lebanon.

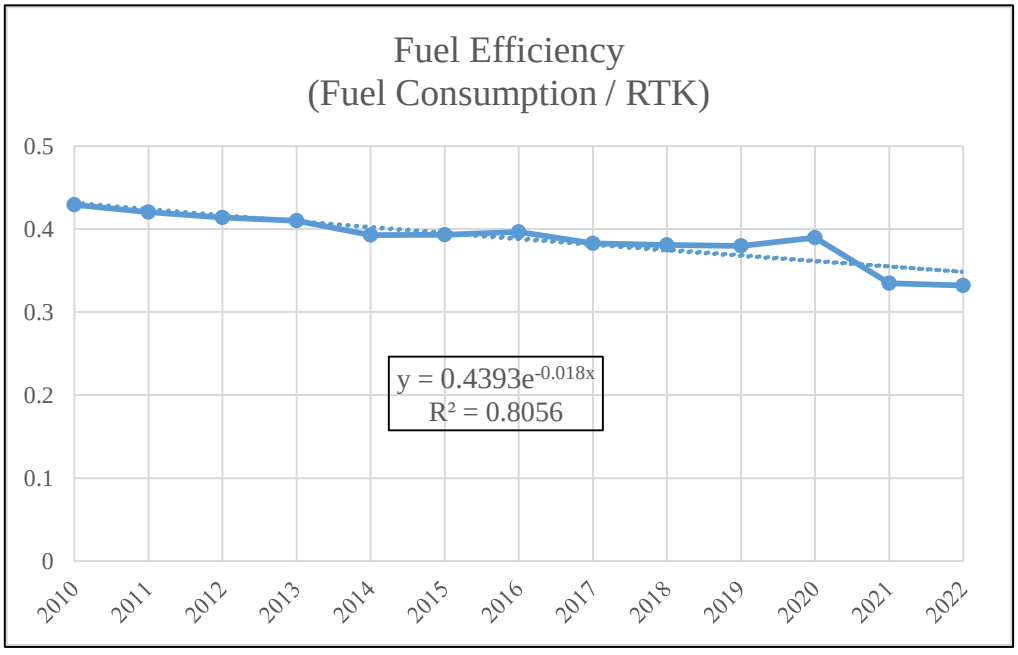

Figure 5-3 Past Trend of Fuel Efficiency Used as a Projection for Future Years

5.2.4 Projected Fuel Efficiency

Step 4

- Use the past trend as an approximation for future development of fuel efficiency in the absence of any additional mitigation measures.

The past trend of the fuel efficiency between 2010 and 2022 is used as a base projection for the future, in the absence of any additional mitigation measures. This projection is based on the exponential model and is given by the equation shown in figure 5-3. Table 5-2 that shows the projected volume of Fuel burn in Ton from 2023 till 2050.

5.2.5 Future Baseline RTK

Step 5

- Determine how the RTK will evolve in the future.

To determine how the RTK will evolve from 2023 to 2050, two options are available according to ICAO Doc. 9988, Chapter 3:

1- considering national projections,

2- using default regional growth rates available in ICAO Circular 333.

Based on EBT, and the ICAO Circular 333, the annual international RTK growth rate is 7.60% for the Middle East region. The projection shown in Figure 5-4 is an exponential equation of the RTK. Values from 2023 to 2050 are based on the annual international RTK growth rate of 7.60% for the Middle East region stated in ICAO Circular 333.

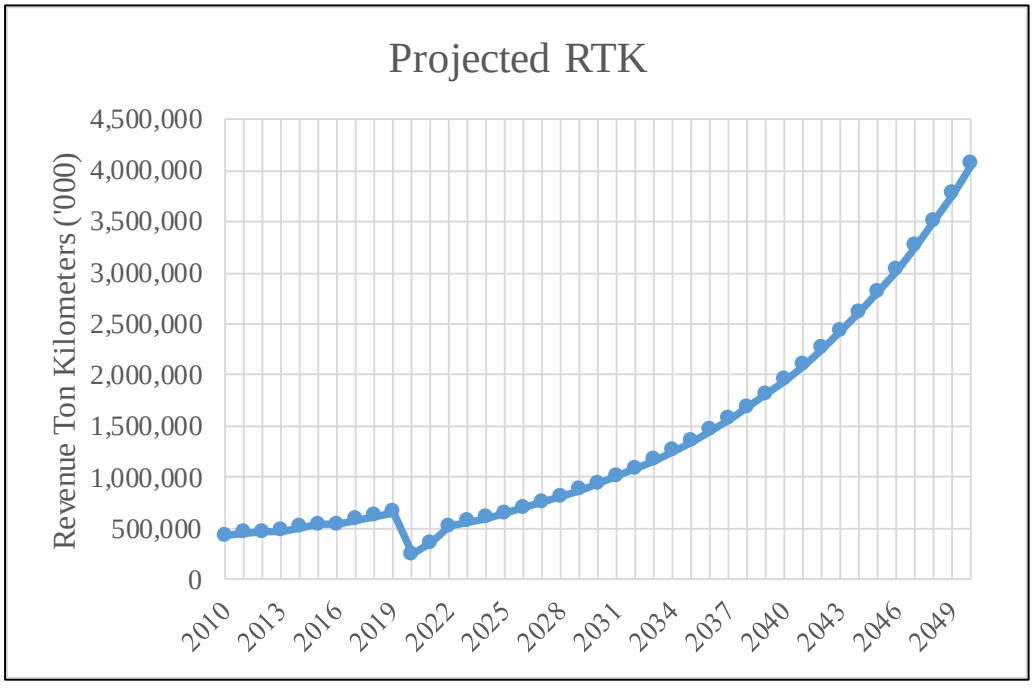

Figure 5-4 Projected Revenue Ton Kilometers till 2050

5.2.6 Future Baseline for Fuel Burn

Step 6

- Determine the projected volume of fuel burn and estimate related CO_2 emissions: projected volume of fuel burn (Ton) = projected fuel efficiency (step 4) x forecasted RTK ('000) (step 5).

Based on the Fuel Efficiency projection and RTK values described in 5.2.4 and 5.2.5, table 5-2 shows the "Projected Volume of Fuel burn" in Ton from 2023 till 2050.

Future Year	Projected Fuel Efficiency	Forecasted RTK ('000)	Projected Volume of Fuel burn (Ton)
2023	0.34	561,532	192,198
2024	0.34	604,208	203,149
2025	0.33	650,128	214,723
2026	0.32	699,538	226,957
2027	0.32	752,703	239,888
2028	0.31	809,908	253,555
2029	0.31	871,461	268,001
2030	0.30	937,693	283,271
2031	0.30	1,008,957	299,410
2032	0.29	1,085,638	316,469
2033	0.29	1,168,146	334,499
2034	0.28	1,256,926	353,557
2035	0.28	1,352,452	373,701
2036	0.27	1,455,238	394,993
2037	0.27	1,565,836	417,497
2038	0.26	1,684,840	441,283
2039	0.26	1,812,888	466,426
2040	0.25	1,950,667	493,000
2041	0.25	2,098,918	521,089
2042	0.24	2,258,436	550,777
2043	0.24	2,430,077	582,158
2044	0.23	2,614,763	615,326
2045	0.23	2,813,485	650,384
2046	0.23	3,027,310	687,439
2047	0.22	3,257,385	726,606
2048	0.22	3,504,946	768,004
2049	0.21	3,771,322	811,760
2050	0.21	4,057,943	858,010

Table 5-2 Projected data till 2050

"Projected Volume of Fuel burn" in Ton is plotted in the same graph with the "Projected Fuel Efficiency".

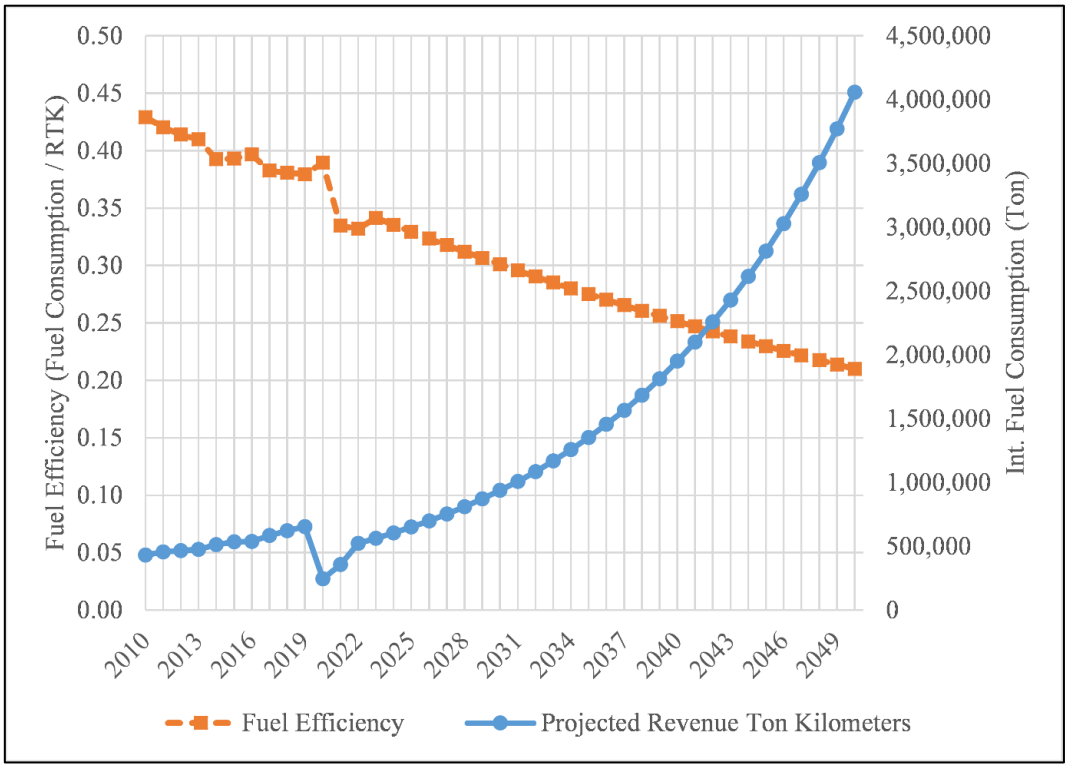

Figure 5-5 Fuel Efficiency and Fuel Burn (Ton) Between 2010 and 2050

5.3 CO_2 EMISSIONS IN LEBANON

The amount of CO_2 emissions for the period between 2010 and 2022 (table 5-3 and figure 5-6), and the projected period from 2023 to 2050 (table 5-4 and figure 5-7), of fuel burn from international flights is calculated by multiplying the amount of the "volume of fuel burn" by the "Fuel Conversion Factor (FCF)". The FCF of the conventional jet fuel (Jet-A1) used by MEA airlines, is 3.16 kg CO_2/kg fuel.

CO_2 Emissions (2010-2022) = Volume of Fuel burn (Ton) x FCF

Year	Projected Volume of Fuel burn (Ton)	CO_2 Emissions (Ton)
2010	185,317	585,602.42
2011	192,027	606,805.43
2012	193,065	610,084.45
2013	194,520	614,683.65
2014	201,032	635,261.98
2015	210,294	664,530.52
2016	213,057	673,260.37
2017	223,790	707,175.79
2018	237,041	749,049.23
2019	247,740	782,859.69
2020	95,597	302,085.32
2021	119,413	377,345.19
2022	173,228	547,400.80

Table 5-3 Fuel burn and CO_2 Emissions in Ton from 2010 till 2022

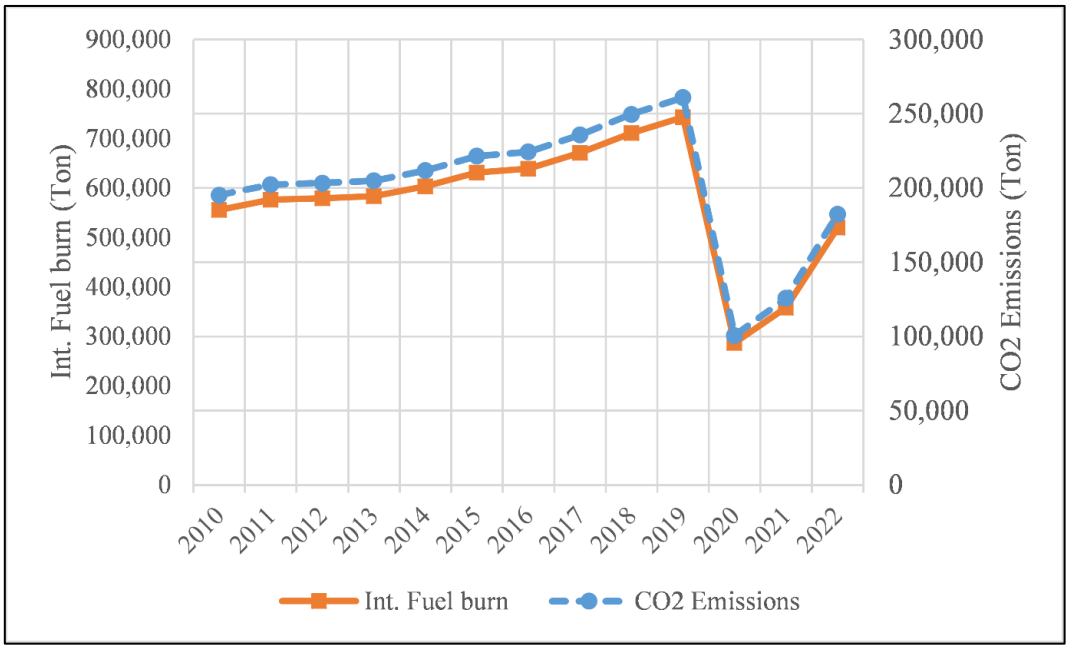

Figure 5-6 Fuel Burn and CO_2 Emissions Data from 2010 till 2022

CO_2 Emissions (2023-2050) = projected Volume of Fuel burn (Ton) x FCF

Year	Projected Volume of Fuel burn (Ton)	CO_2 Emissions (Ton)
2023	192,198	607,347.22
2024	203,149	641,950.57
2025	214,723	678,525.42
2026	226,957	717,184.11
2027	239,888	758,045.37
2028	253,555	801,234.68
2029	268,001	846,884.68
2030	283,271	895,135.56
2031	299,410	946,135.53
2032	316,469	1,000,041.19
2033	334,499	1,057,018.10
2034	353,557	1,117,241.25
2035	373,701	1,180,895.59
2036	394,993	1,248,176.61
2037	417,497	1,319,290.93
2038	441,283	1,394,456.96
2039	466,426	1,473,905.54
2040	493,000	1,557,880.67
2041	521,089	1,646,640.25
2042	550,777	1,740,456.87
2043	582,158	1,839,618.65
2044	615,326	1,944,430.12
2045	650,384	2,055,213.19
2046	687,439	2,172,308.07
2047	726,606	2,296,074.39
2048	768,004	2,426,892.23
2049	811,760	2,565,163.37
2050	858,010	2,711,312.44

Table 5-4 Projected Fuel burn and CO_2 Emissions in Ton from 2023 till 2050

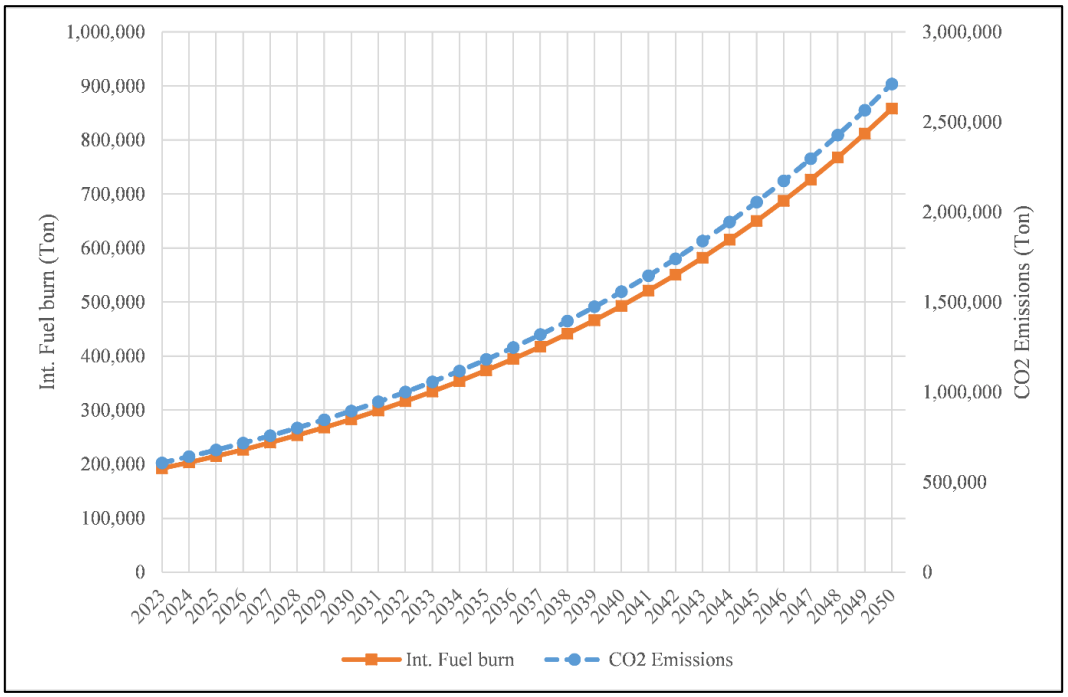

Figure 5-7 Projected Fuel Burn and CO_2 Emissions Data from 2023 till 2050

Chapter 6 MITIGATION MEASURES

6.1 THE BASKET OF MEASURES

Based on ICAO recommendations regarding policy development and standards to limit and reduce the impact of aviation on the global climate, ICAO Member States demonstrated interest in taking action and advancing initiatives on environmental protection.

The aim of the State Action Plan is to establish a long-term strategy on CO_2 emissions for the international aviation sector, involving all interested parties at national level, such as Aviation Authority, Aeroplane Operators, Airport Operators, and other stakeholders.

In addition to define a quantified baseline scenario, stakeholders are encouraged to work together to select appropriate emissions mitigation measures from ICAO's basket of measures.

In 2010, two global aspirational goals for the international aviation sector were adopted at the 37th Session of the ICAO Assembly: 2% annual fuel efficiency improvement through 2050 and Carbon Neutral Growth (CNG) from 2020 onwards.

ICAO is pursuing a basket of measures including:

1. Aircraft technology improvements
2. Operational improvements
3. Sustainable Aviation Fuels (SAF)
4. Market Based-Measure – Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

The Republic of Lebanon with its DGCA and involved parties are working together to implement mitigation measures stated earlier, in order to offset and reduce CO_2 emissions from international flights.

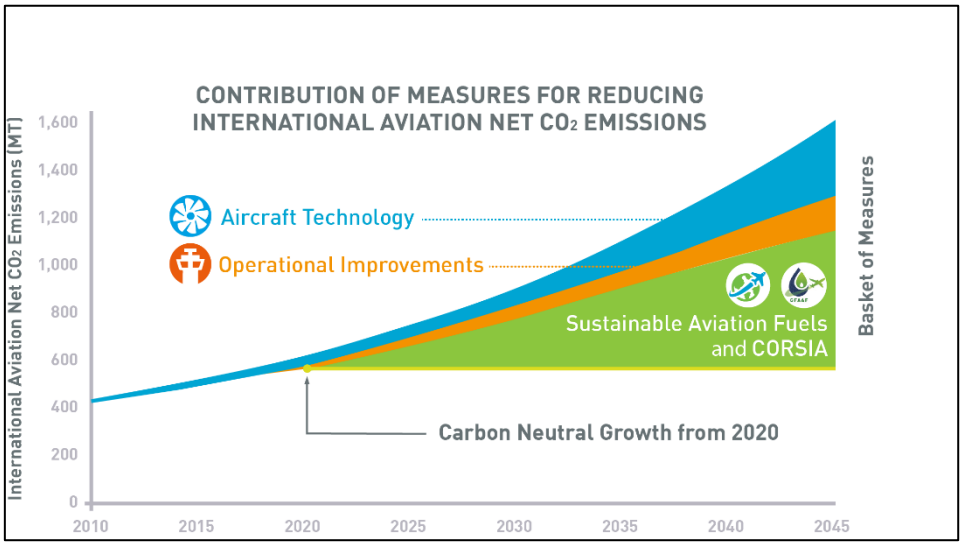

Figure 6-1 ICAO Global Environmental Trends on CO_2 Emissions and Contribution of Measures for Reducing International Aviation Net CO_2 Emissions

6.1.1 Aircraft Technology Improvements

6.1.1.1 Regulations

To understand how technology affects aircraft emissions, the interaction between the four forces of flight (Thrust, drag, lift and weight) should be kept in mind. For example, improving the aerodynamics of an aircraft produces less drag, and as a result, less thrust is needed, which leads to fewer CO_2 emissions.

The place of action that causes emissions is the jet engines. Today's airplanes are approximately 80% more efficient in use of fuel per passenger kilometer than that in 1960s.

The main objective of the functions in aircraft design is to decrease fuel consumption with economically appropriate technologies. According to Clean Sky (2020), an airline aircraft has a lifetime of 15-20 years, necessitating renewal of the fleet from time to time, with the most fuel-efficient aircraft. The progress on fuel efficiency improvement is the result of airframe, aero-engine, and aircraft systems that manufacturers continuously drive to develop new and innovative technologies. An aircraft also deteriorates over time and causes a fuel bias of 1% per 6,000 hours (Wild, 2018).

Lebanese Aviation Regulations (LARs) Part II – Aircraft Marking and Registration of Aircraft, states: "No person shall operate an aircraft on Lebanese AOC unless the aircraft age is equal or below 15 years."

6.1.1.2 Technological improvements

a) The new engine option (neo) for MEA airlines fleet

The Lebanese flag carrier, MEA airlines, continually invests in modernizing its fleet. In July 2020, MEA airlines received the first A321neo from the manufacturer Airbus in Hamburg- Germany.

The manufacturer Airbus is continuously investing in R&D (Research and Development) to design a fuel-efficient aircraft that achieve better environmental performance, including pollutants emissions. The A320 Family is a perfect example of this improvement.

The neo is available for the A320 Family's three largest versions, A319neo, A320neo and A321neo.

Aeroplane Operators have the choice to select between two advanced turbofan engines, the Pratt & Whitney GTF (Geared TurboFan) and the LEAP-1A from CFM International.

With these enhancements, A320neo Family aircraft benefit from 20% fuel burn reduction when compared to previous-generation aircraft.

MEA airlines - A321 neo fleet, is powered by a pair of Pratt & Whitney (PW1100G-JM) engines that are of higher "By Pass Ratio (BPR)". They are lighter, and with high temperature materials, than the previous turbofan engines, they contribute to an increase in propulsive efficiency, energy consumption, and low CO_2 emissions. This will result in reducing the operation cost of the company and 50% reduction of the ground noise.

Figure 6-2 MEA A321neo, PW1100G-JM Engine

b) Airbus Sharklets

All A321neo aircraft delivered to MEA airlines are equipped with Sharklets. A piece made of composite materials, triangular in shape and is mounted on the tips of the wings. The 2.4-meter-tall wingtip devices are standard on neo aircraft, and result in up to 4% reduced fuel burn over longer sectors, corresponding to an annual reduction in CO_2 emissions of around 900 tons per aircraft. Sharklets are also available for the earlier version A320 ceo (current engine option), two A320 ceo (T7-MRE and T7-MRF) were delivered to the Lebanese flag carrier MEA airlines with Sharklets on their wingtips.

Figure 6-3 MEA, A321neo, Sharklet

c) A320neo innovative Airspace Cabin

Reduction in aircraft weight is a key factor in reducing fuel burn. The combination of lighter weight materials and innovative structural technologies result in lower weight airframes, thus reduction in CO_2 emissions.

Improvements in the A320neo Family cabin enhance comfort and well-being aboard. This include ceiling lighting, redesigned window bezels for better roominess and unobstructed views. New sidewall panels that provide an additional inch for extra personal space, as well as a new spacious lavatory design. Stated by Airbus, the large overhead storage bins for the A320neo Family can hold eight bags instead of five, providing highly sought-after additional volume for carry-ons.

The fleet of MEA airlines, A321neo, is configured with room for 160 passengers, 28 in business class and 132 in economy. The aircraft cabin specifications took into consideration the needs of passengers with limited abilities. MEA's fleet is equipped with ventilated and temperature controlled cargo compartments for the carriage of live animals and perishable cargo.

Figure 6-4 MEA A321neo Interior Cabin

6.1.2 Operational Improvements

In order to become eco-friendly, MEA airlines, introduced in 2010 operational procedures that can result in reducing the emission of CO_2, on ground and during flights.

- Re-planning and optimizing the company's flight routes to all destinations in order to decrease the flight time and distance/path. Stated by Airbus, (Airbus, 2023), "Direct routings can result in approximately 10% less fuel consumption, as well as significantly reduced CO_2 and noise emissions."
- Connecting external power, a Ground Power Units (GPU), while the aircraft is parked at the gate waiting the boarding or the disembarking of the passengers, instead of using the power from the Auxiliary Power Unit (APU). This procedure reduce the amount of the fuel consumed by the aircraft and reduce the noise in the vicinity of the airport.
- Single engine taxiing before taking off and after landing at B-RHIA
- Reducing weight on board will lead to less fuel to be burned during flight. Introducing the Electronic Flight Bag (EFB) to pilots has substituted the presence of bulky and heavy aircraft manuals that are required to be on board the aircraft.
- Adding maintenance procedures like engine wash which keeps the engine in optimum conditions.

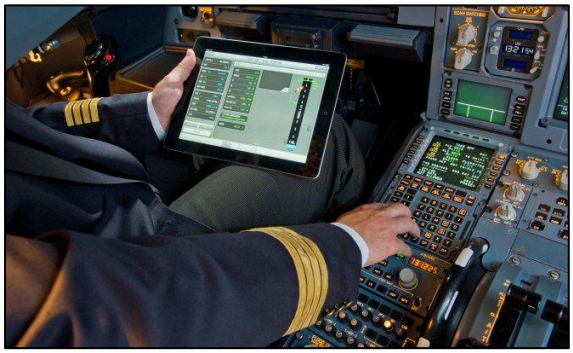

Figure 6-5 Electronic Flight Bag

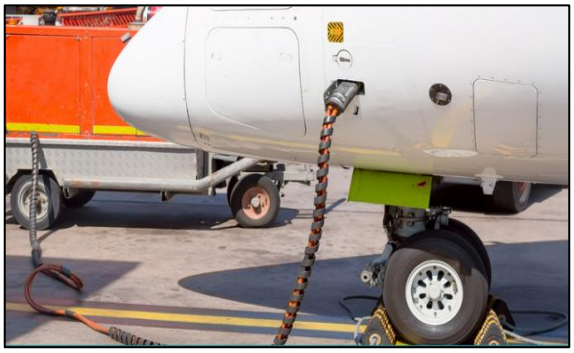

Figure 6-6 Ground Power Unit Connection

6.1.3 Sustainable Aviation Fuels (SAF)

The aim of using Sustainable Aviation Fuels (SAF) is to reduce CO_2 emissions from international flights. Furthermore, SAF has the additional benefit of reducing air pollutant emissions of non-volatile Particulate Matter (nvPM).

The technologies for SAF production already exist. The challenge is to accelerate SAF deployment, reduce its cost, and ensure the environmental integrity of the SAF production.

The Republic of Lebanon through its DGCA, supports the introduction of SAF in line with the 2050 ICAO Vision and is taking actions to encourage its registered operator (MEA).

According to Airbus, A320neo(s) with PW1100G-JM engines have a 15% fuel burn improvement compared to an A320ceo delivered with V2500 engines. (FPG Amentum. 2018)

Aeroplane Operators can achieve up to 80% CO_2 emissions reduction per ton of conventional fuels substituted by SAF. (https://www.airbus.com)

The A320neo Family, is capable of operating with a 50% SAF blend. Airbus is committed up to 100% SAF and intends to have this capability for the A320neo by 2030. (https://www.airbus.com)

6.1.4 The Market-based Measure, CORSIA

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) was adopted at the 39th session of the ICAO Assembly in 2016. The ICAO Council approved on June 27th 2018, this global market-based measure to address CO_2 emissions from international aviation and adopted the First Edition of Annex 16, Volume IV, entitled: "Carbon Offsetting and Reduction Scheme for International Aviation" (CORSIA). This new (SARPs) became effective on October 22nd, 2018 and applicable on the 1st of January 2019.

CORSIA complements the other elements of the basket of measures to help ICAO achieve its aspirational goal of Carbon-Neutral Growth (CNG) from 2020 onwards by offsetting the amount of CO_2 emissions that cannot be reduced through the use of the other measures.

The Directorate General of Civil Aviation is transposing ICAO's SARPs of Annex 16, Volume IV, into national regulations in order to participate in offsetting CO_2 emissions from international flights. In 2019, the Lebanese DGCA issued a circular requesting all aeroplane operators registered in Lebanon to submit their Emissions Monitoring Plan (EMP) in order to start implementing CORSIA MRV. With reference to Annex 16, Volume IV, Part II, Chapter 1, 1.1.2 and Chapter 2, 2.2.2, MEA airlines with its subsidiary company, Cedar Executive (CDX) is the only aeroplane operator registered in Lebanon, applicable to CORSIA MRV requirements.

The Lebanese national flag carrier MEA airlines submitted the first version of its EMP in March 2019 to the DGCA, in reference to Annex16, Volume IV and Doc.9501, Environmental Technical Manual (ETM), in addition to the Emissions Reports (ER) and Verification Reports for the years: 2020, 2021 and 2022.

The Lebanese DGCA is checking the data received from the registered Aeroplane Operator and its verification body by performing an order of magnitude check and then submit all data to ICAO through the CORSIA Central Registry (CCR) which the CORSIA Focal Point has access to.

6.2 EXPECTED RESULTS

The use of A321 neo and the GTF PW1100G-JM by MEA airlines will have a positive impact on the fuel efficiency and CO_2 emissions.

With the support of the Environmental Benefits Tool (EBT), MEA airlines data, and its number of A321 neo fleet (9), and knowing that (LARs) Part II includes the statement: "No person shall operate an aircraft on Lebanese AOC unless the aircraft age is equal or below 15 years", and taking in consideration that the average of flight time per aircraft (hr) is 3000 (average annual flight time for one aircraft is usually between 2500 and 4000 hours), and the average fuel burn (kg/hr) is 3968, the annual fuel saving shall be 14,463.36 Ton (EBT calculations).

Year	**Fuel burn before implementation of mitigation actions** (Ton)	**Fuel burn after implementation of mitigation actions** (Ton)	**Change Fuel savings** (%)	**CO_2 emissions before implementation of mitigation actions** (Ton)	**CO_2 emissions after implementation of mitigation actions** (Ton)
2022	173,228.00	158,764.64	-8.35	547,400.48	501,696.26
2023	192,198.49	177,735.13	-7.53	607,347.22	561,643.00
2024	203,148.91	188,685.55	-7.12	641,950.57	596,246.35
2025	214,723.23	200,259.87	-6.74	678,525.42	632,821.20
2026	226,957.00	212,493.64	-6.37	717,184.11	671,479.90
2027	239,887.78	225,424.42	-6.03	758,045.37	712,341.15
2028	253,555.28	239,091.92	-5.70	801,234.68	755,530.46
2029	268,001.48	253,538.12	-5.40	846,884.68	801,180.46
2030	283,270.75	268,807.39	-5.11	895,135.56	849,431.35
2031	299,409.98	284,946.62	-4.83	946,135.53	900,431.31
2032	316,468.73	302,005.37	-4.57	1,000,041.19	954,336.97
2033	334,499.40	320,036.04	-4.32	1,057,018.10	1,011,313.89
2034	353,557.36	339,094.00	-4.09	1,117,241.25	1,071,537.04
2035	373,701.14	359,237.78	-3.87	1,180,895.59	1,135,191.37
2036	394,992.60	380,529.24	-3.66	1,248,176.61	1,202,472.39
2037	417,497.13	403,033.77	-3.46	1,319,290.93	1,273,586.71
2038	441,283.85	426,820.49	-3.28	1,394,456.96	1,348,752.74
2039	466,425.80	451,962.44	-3.10	1,473,905.54	1,428,201.33
2040	493,000.21	478,536.85	-2.93	1,557,880.67	1,512,176.46
2041	521,088.69	506,625.33	-2.78	1,646,640.25	1,600,936.03
2042	550,777.49	536,314.13	-2.63	1,740,456.87	1,694,752.65
2043	582,157.80	567,694.44	-2.48	1,839,618.65	1,793,914.43

2044	615,325.99	600,862.63	-2.35	1,944,430.12	1,898,725.91
2045	650,383.92	635,920.56	-2.22	2,055,213.19	2,009,508.97
2046	687,439.26	672,975.90	-2.10	2,172,308.07	2,126,603.85
2047	726,605.82	712,142.46	-1.99	2,296,074.39	2,250,370.17
2048	768,003.87	753,540.51	-1.88	2,426,892.23	2,381,188.01
2049	811,760.56	797,297.20	-1.78	2,565,163.37	2,519,459.15
2050	858,010.27	843,546.91	-1.69	2,711,312.44	2,665,608.22

Table 6-1 Expected Results

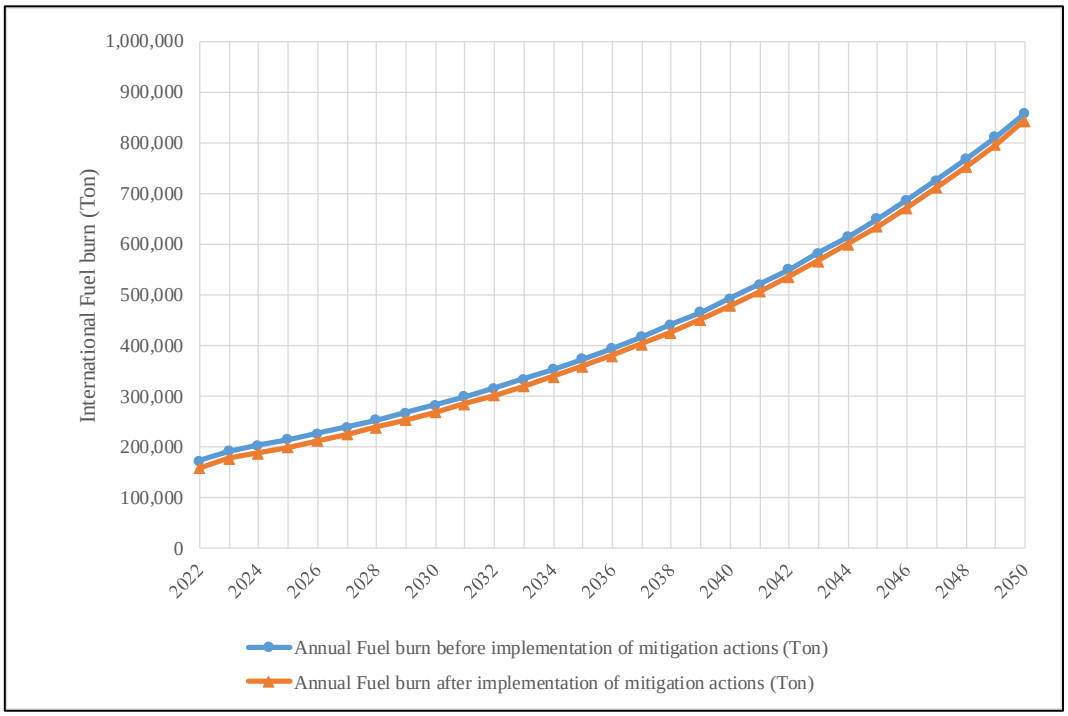

Figure 6-7 Annual Fuel Burn Before and After Implementation of Mitigation Measures (Ton)

Figure 6-7 shows the annual fuel burn from 2022 to 2050 in case of the absence of mitigation measures (circle marks) and in case of implementation of the mitigation measures (triangle marks). The two curves are overlapping with a small change where an exponential increase is obvious.

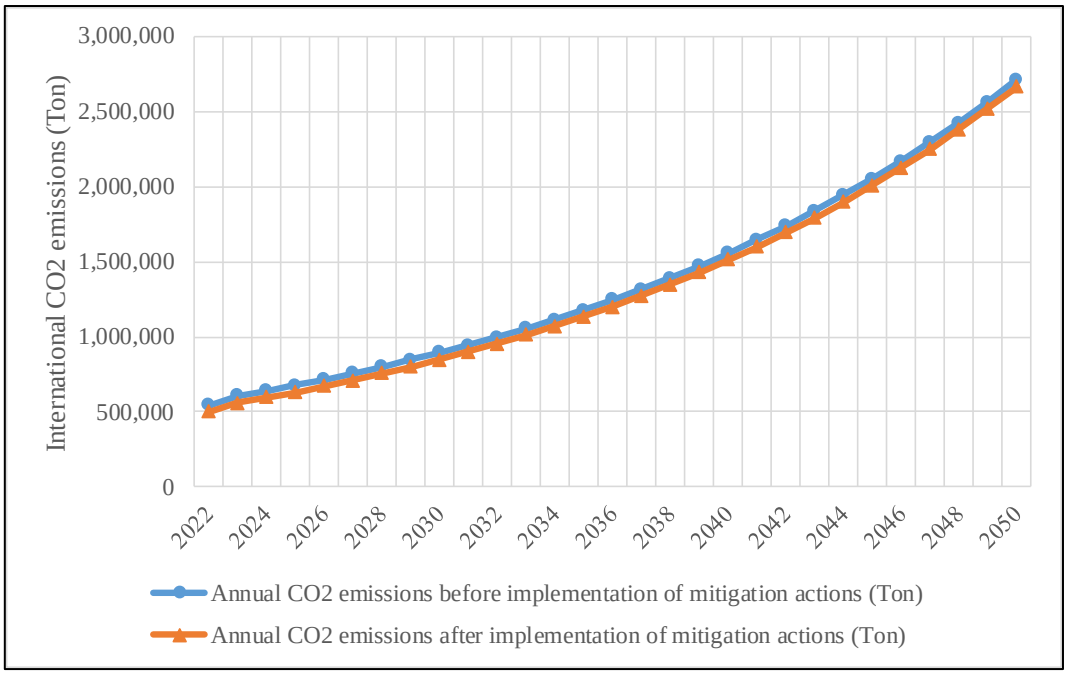

Figure 6-8 Annual CO_2 Emissions Before and After Implementation of Mitigation Actions (Ton)

Figure 6-8 shows the annual CO_2 emissions values from 2022 to 2050 increasing exponentially before the implementation of mitigation measures (circle marks) and after implementation of the mitigation measures (triangle marks). The two curves are overlapping.

CONCLUSION

The Lebanese Government through its Directorate General of Civil Aviation is fully committed to address the climate change impacts of commercial aviation and achieve CO_2 emissions reduction by establishing a long-term strategy using this Action Plan.

The efforts for implementing all measures declared in this document to reduce CO_2 emissions from international aviation, shall be the result made by the Lebanese DGCA, registered operators and B-RHIA service providers.

With reference to ICAO, Lebanon's Action Plan shall be updated every three years from its first date of issuance. In case of significant change happens, this Action Plan will be amended immediately.

The Future Plan of the Lebanese civil aviation shall be as follow:

- Get ready to participate in CORSIA (Offsetting) by the beginning of the second phase of implementation (From 2027).
- Optimize the Air Traffic Management (ATM) in order to shorten the flights distances (SID/STAR) which lead to reduction in fuel consumption and in CO_2 emissions.
- Update airport procedures for aeroplane operators operating at B-RHIA in order to reduce aeroplane and ground CO_2 emissions, by using single engine taxiing and GPUs.
- Encourage MEA airlines to use CORSIA Eligible Fuels, Sustainable Aviation Fuel (SAF) or Lower Carbon Aviation Fuels (LCAF).

To be able to implement the points described above, a technical as well as financial assistance from external stakeholders is required to:

- Implement a system for a continuous monitoring of CO_2 emissions in the Lebanese FIR.
- Support in the implementation of mitigation measures;
- Support in collaborate research endeavor's.
- Have a training under ACT-CORSIA program, and
- Benefit from the Technical Cooperation Bureau (TCB)

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