

**Air transportation between climate change and carbon emissions (Case study: Borg El Arab airport, Egypt)**

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**Abstract**

One of the goals of environmental sustainability is the concern for the environment, and environmental sustainability means that it is the ability of the environment to continue to function properly. Therefore, the goal of environmental sustainability is to minimize environmental degradation, and sustainability requires nourishing it naturally, meaning that nature is able to renew the ecological balance, this can be achieved by incorporating environmental considerations when planning development so as not to damage the natural capital, as a minimum.

The purpose of this research is to reduce carbon emissions in the Egyptian airports, case study: Borg El Arab airport, Egypt.

**Keywords: Air transportation, climate change, carbon emissions, Borg El Arab Airport.**

**النقل الجوي بين تغير المناخ وانبعاثات الكربون (دراسة حالة: مطار برج العرب، مصر)**  
**المستخلص:**

أحد أهداف الاستدامة البيئية هو الإهتمام بالبيئة، والاستدامة البيئية تعني أنها قدرة البيئة على الإستمرار في العمل بشكل صحيح. لذلك، فإن الهدف من الإستدامة البيئية هو تقليل التدهور البيئي، والاستدامة تتطلب تغذيتها بشكل طبيعي، مما يعني أن الطبيعة قادرة على تجديد التوازن البيئي، ويمكن تحقيق ذلك من خلال دمج الإعتبارات البيئية عند التخطيط للتنمية حتى لا تتلف رأس المال الطبيعي كحد أدنى. الغرض من هذه الدراسة هو تقليل انبعاثات الكربون في المطارات المصرية، دراسة حالة مطار برج العرب، مصر.

**الكلمات الدالة:** النقل الجوي، التغيرات المناخية، إنبعاثات الكربون، مطار برج العرب.

## **1. INTRODUCTION**

Airports are a critical component of the air transportation system. They offer all of the infrastructure required for passengers and freight to transition from surface to air modes of transportation, as well as for aircraft to take off and land. Runways, taxiways, apron space gates, passenger and freight terminals, and ground transportation interchanges comprise the fundamental airport infrastructure. Airports bring together a diverse range of facilities and services in order to fulfill their function in the aviation industry (Sherry, 2019).

Airports are strategic to the regions they serve, in addition to playing an important role in the air transport sector. Airports can increase income, create significant employment possibilities, and

promote economic development as well as providing a lifeline to isolated areas (Graham, 2018).

The most recent mode of travel is air transport. In almost all the countries worldwide, the two world wars provided a big boost for the growth of air transport. Air transport's unusual feature is that a particular surface track is not needed for its operations. If your consumers need to move their products outside of Country, price is not the only consideration to be taken into account in selecting the best partner to collaborate with. Many other important factors will allow you to determine whether or not each foreign freight forwarder has the ability to meet the demands of your clients, for example, the urgency of delivery and the mode of transport requested.

Today the technology has made significant progress that ensures a profitable and totally secure air system. Air transport is one of the ways to move goods that have been very common in recent years when it comes to speed and distribution protection. We discussed beforehand the characteristics and benefits of transport methods, such as land or water, and in this step, we will concentrate on the key air benefits.

Air transport, which represents the next most substantial energy-consuming transport sector, includes passenger and freight airplanes, that is, aircraft configured for transporting

passengers, freight, or mail. According to the International Air Transport Association (IATA), in 2017, airlines carried 4.1 billion passengers globally. This value increased by 7.3% over 2016, which represented an additional 280 million trips by air between 2016 and 2017. In addition, as with many of the energy and transport-related statistics in recent times, airlines in the Asia-Pacific region carried the largest number of passengers. According to IATA statistics, the market share of passengers increased from 2016 to 2017 by region is as follows:

1. Asia-Pacific, 36.3%; 1.5 billion passengers (10.6% increase from 2016).
2. Europe, 26.3%; 1.1 billion passengers (8.2% increase).
3. North America, 23%; 941.8 million passengers (3.2% increase).
4. Latin America, 7%; 286.1 million (4.1% increase).
5. Middle East, 5.3%; 216.1 million (4.6% increase).
6. Africa, 2.2%; 88.5 million (6.6% increase).

### ***Advantages of Air Transport:***

1. High Speed: Air is the type of freight capable of traveling long distances in short periods of time. This makes this model an optimum choice if the client has an urgent need to ship a product or if their freight demands special standards of protection or acclimation. It is the quickest transport mode and is therefore ideal for long-distance transport of goods. It takes less time.

2. Fast Service: Air transportation offers convenient, reliable and fast services of transport. It is considered the cheapest way to ship peregrinated goods. It offers a standard, convenient, reliable and fast service.

3. Send almost everywhere your freight: In regions that are not readily accessible to other modes of transport, air transport is considered to be the only means of transport. Open to all regions, irrespective of land interference. A vast network of airlines covering nearly the whole globe is available for many airlines. This ensures that the package can be sent almost anywhere.

4. High Standard of Security: High standard of protection with a low risk of robbery and injury. Shipping by air has a high degree of security since airport safety restrictions on cargo are strictly enforced. Tightly controlled airport controls also minimize cargo theft and loss.

5. Natural Route: An aircraft can fly to any location without seeing any natural obstacles or barriers. Since customs formalities are easily compiled. It eliminates the need for more time to seek clearance. Air travel is used for relief operations during earthquakes, floods, accidents, and famines.

6. There is less need for heavy packaging: Air exports, in general, entail less hard packaging than ocean shipments. This ensures you save both time and money by not having to provide extra packaging services.

***Disadvantages of Air Transport:***

Climate conditions that are adverse: Extreme weather will cause planes to be grounded and airports to close, halting shipments for several days and rendering the service ineffective.

1. Risky: Air travel is the riskiest mode of transport, since there can be considerable losses to goods, customer and crews as a result of a minor crash. Compared to other means of travel, the risks of collisions are higher.

2. Cost: Air travel is considered to be the most expensive means of transportation. The cost of maintaining aircraft is higher and the costs for the building of aerodromes and avions are much higher. That's why air travel is so expensive that it gets beyond ordinary people's grasp.

### 3. Some Product Limitation:

There is a whole variety of materials not suitable for such products, from explosives, gases, batteries, fired solids and liquids, which cannot be shipped by air to name but a few.

4. Capacity for Small Carriage: he aircraft have no room and therefore are not ideal for carriage of voluminous and cheaper materials. As is seen for rails, the load volume cannot be raised.

5. Enormous investment: Air travel calls for enormous spending in aerodrome building and servicing. It also calls for professional, qualified and qualified staff that need a significant investment.

## **2. LITERATURE REVIEW**

A study published by a center that tracks "carbon emissions of airports" showed that the carbon dioxide emissions of five of the largest European airports combined are comparable to that of Sweden in general. According to figures announced by The Airport Tracker, the total emissions from the airports of: London Heathrow, Paris Charles de Gaulle, Frankfurt, Amsterdam and Madrid Barajas amount to 53 million tons of carbon dioxide.

In 2020, Sweden released about 45.4 million metric tons of carbon dioxide, lower than the year before. The Airport Tracker Center, which tracks airports that emit the largest amounts of

carbon dioxide into the atmosphere, is a tool that shows emissions from aircraft departing from airports around the world.

Airplanes have a role in reducing carbon dioxide emissions using wind, and studies published last January revealed that airlines can significantly reduce their fuel consumption and carbon dioxide emissions if the aircraft they use become more efficient to fly and face the wind. In a study published at the time, scientists at the University of Reading said that commercial flights between New York and London during the winter of 2019-2020 could have used up to 16% less fuel if pilots had taken full advantage of the currents and strong winds.

Since many flights from these airports (London Heathrow, Paris Charles de Gaulle, Frankfurt, Amsterdam and Madrid-Barajas) have destinations outside Europe, they are exempt from the EU and UK cap-and-trade schemes, which only apply to domestic flights in the EU. For example, 80 per cent of the emissions from Paris Charles de Gaulle airport come from long-haul flights, while smaller airports, such as Krakow in Poland, largely rely on short-haul flights. Therefore, smaller airports are taxed more than larger airports, which have long flights and have the highest emissions.

Airports are strongly affected by extreme weather events, which are expected to increase in the coming years due to climate change. Examples of the potential impact of climate change on



airport operations include: Hotter summer seasons and colder cold seasons increase electricity and fuel consumption to operate coolers and boilers. Reduced rainfall affects water supply resources and increases groundwater depletion. Changes in wind direction and speed increase sandstorms and fire hazards, and reduce visibility. 95% of the direct emissions associated with airport activities come from fuel/electricity consumption. Several measures have been taken during the past seven years to reduce energy consumption. The total reduction in CO<sub>2</sub> emissions between 2012 and 2019 was 20%.

In 2021, Airport International Group announced its commitment to the Paris Agreement with the goal of achieving net zero emissions by 2050, and reducing emissions by 59% by 2035, compared to the initial Scope 1 and 2 emissions count published in 2012, reflecting an ambitious path towards net zero. In order to reduce global warming to 1.5° C. Based on this forecast, the airport's emissions for 2021 were assumed to be 24,673 tons of CO<sub>2</sub>, while the actual emissions were 20,267 tons; This is a 17.9% decrease from the forecast for 2021. In 2021, emissions from aircraft movement (including flight emissions and service providers (Scope 3) were 542,282.15 tons of CO<sub>2</sub>; This is a 40% decrease compared to 2019 (excluding 2020 due to the COVID-19 pandemic).

In terms of overall aviation CO2 emissions, while the majority is produced from flying aircraft, it doesn't mean airports' ground operations can't become more sustainable. Airports will need to comprehensively switch to renewable energy and invest in energy efficiency and energy storage to reduce carbon emissions. Mapping and modelling energy use across airports' complex estates, including optimizing airfield layout, is a vital first step.

The impact of the air transport industry on the environment is significant. There's no denying that airlines rely heavily on single-use plastics with more than 5 million tonnes of cabin waste created in a single year, according to IATA. However, recent initiatives, from tackling carbon emissions to reducing single-use plastic both on the ground and inflight, indicate that airlines and airports are united in their efforts to reduce their impact on the environment.

Here we highlight a few of the latest initiatives from Air New Zealand, SAS, Hi Fly, Dubai Airport, Etihad, Qantas and Singapore Airlines.

Air New Zealand has introduced a series of initiatives to reduce single-use plastic on its flights, and it has this year committed to removing nearly 55 million plastic items from its flights.

To mark Plastic Free July, the airline has removed individual plastic water bottles from its Business Premier and Premium Economy cabins, as well as from its Works Deluxe offering on Tasman and Pacific Island services. This initiative is expected to divert more than 460,000 bottles from landfill annually and reduce carbon emissions by more than 300,000 kilograms per year by reducing weight on the aircraft.

Individual plastic sauce packets are being removed from Business Premier cabins on mainland North America and Hong Kong services, and these will be eliminated entirely from the global network by the end of October. Customers will instead be served sauce in reusable dishes, which is expected to prevent around 200,000 plastic packets going to landfill each year.

The airline is also set to roll out coffee cups made from plants rather than plastic across its domestic and international networks from October, while plastic water cups will be transitioned to recyclable alternatives from September. The total number of cups being replaced by the end of the year is expected to reach 44.5 million.

Air New Zealand's Acting Head of Sustainability, Anna Palaret, says the airline is focused on reducing the amount of single-use plastic products it purchases at source, as the lack of composting infrastructure in New Zealand at present poses a challenge.

“Single-use plastic is a highly topical and visible issue for us and our customers, so we’re really pleased to be able to share this progress to celebrate Plastic Free July. The lack of composting infrastructure available in New Zealand is a challenge so we have been focused on reducing the amount of single-use plastic products we purchase in the first place. It’s great to see more and more customers are bringing their reusable drink bottles and keep cups on board, and we encourage people to do this – our cabin crew team is happy to fill these.”

Etihad Airways claimed to have become the first airline in the United Arab Emirates to operate a flight without any single-use plastics on board, in a bid to raise awareness of plastic pollution. The flight from Abu Dhabi to Brisbane landed on 22 April, which marked Earth Day 2019. Etihad identified that over 95% of single-use plastic products are used across its aircraft cabins. Once removed from the Earth Day flight, Etihad prevented over 50 kilograms of plastics from being landfilled.

Passengers on board enjoyed replacement products, provided by Etihad’s current supplier of amenity products Buzz, including sustainable amenity kits, award-winning eco-thread blankets made out of recycled plastic bottles, tablet toothpaste and edible coffee cups, while children were treated to eco-plush toys.

The milestone flight is part of Etihad's ongoing commitment to the environment, to go beyond Earth Day celebrations, and pledge to reduce single-use plastic usage by 80% not just in-flight, but across the entire organization by the end of 2022.

### **3. RESEARCH AREA AND EMPIRICAL STUDY**

Borg El Arab Airport in Alexandria is witnessing the implementation of the first environmental projects, the start of solar energy, and the start of solar energy. Exploitation of the project of the first building at Burj Al Arab Airport to work in the state's plan to activate the incoming tourist movement to Egypt, and to increase the movement of passengers and travel and the rates of development in the various governorates. Execution business of commercial projects, an area of about 100,000 flats, an area of 5 million passengers annually from the current million passengers, the construction of commercial projects and the existing lane increasing the capacity of the existing lane of 20 images of 10 movements per hour.

The development work also includes the establishment of a car park for a thousand cars, in addition to service buildings and commercial areas to serve depositors and recipients, and the establishment of a sewage station, sub-electricity stations, a water tank, etc., as the design of the new passenger building makes it the first environmentally friendly building in Egypt, due to the presence of well-studied strategies to provide energy and

reduce carbon dioxide emissions. The cost of constructing the new building is approximately \$176 million, funded by JICA, with a repayment period of 40 years, in return for 0.5% interest. energy and reduces heat emissions. It is scheduled to provide larger areas for the use of natural lighting, in addition to industrial LED lighting, which saves energy consumption, and serves the expansion projects at Burj Al Arab Airport that serve the state's development plans in the region, such as the New Delta project, which aims to cultivate 2 million acres in the El Dabaa area.

The project of the first environmentally friendly passenger building at Borg El Arab Airport, in cooperation with the Japanese agency "JICA", is among the most important civil aviation projects within the framework of the transformation of environmentally friendly airports through the use of solar and renewable energy, rationalization of energy consumption and reduction of pollution, in line with the strategic objectives of Egypt's Vision 2030, which It aims to achieve the state's plan to activate the incoming tourist movement to Egypt, and to increase the movement of passengers and travel and the rates of development in the various governorates.

The cost of constructing the new building is approximately \$176 million, financed by JICA, with a repayment period of 40 years, at 0.5% interest. The building will be equipped with the latest technologies available in the field of airports worldwide.

The building area is about 34 thousand square meters, with a capacity of 4 million passengers annually. The total capacity of the airport is expected to reach 6 million passengers annually, which is the expected traffic volume in 2030.

The building includes 40 counters to finalize travel procedures, and 16 counters for passports. The airport will include technical and technological systems that will be installed in the new building in accordance with the latest technologies available in the field of airports globally. The development work at the airport includes the construction of a new apron that can accommodate 20 medium-sized aircraft, with a total area of 100,000 square meters, and roads linking the current and new apron, and the current runway. Establishment of a car park with a capacity of 1000 cars. A service area and shops to serve travelers. A sewage station, a sub-electricity station, and a water tank.

The new passenger building at Borg El Arab Airport is distinguished as the first environmentally friendly building in Egypt due to the presence of well-studied strategies to save energy and reduce carbon dioxide emissions, including the use of the solar energy system and the VRV air conditioning system.



**Figure (1) environmentally friendly passenger building at Borg El Arab Airport.**

The airport is expected to serve the investment movement in the region, especially in shipping goods abroad, in addition to air traffic, in line with the strategic objectives of Egypt's Vision 2030, which aims to achieve the state's plan to activate the incoming tourism movement to Egypt, and increase the movement of passengers and travel and development rates in various governorates. Borg El Arab Airport is the second Egyptian airport in terms of air traffic after Cairo Airport.



The airport was built to relieve pressure from Alexandria Airport, and it is about 49 km from Alexandria in the western direction, and about 14 km from the city of Burj Al Arab, and it was opened in 2010 And its real capacity during the first year reached 1.7 million passengers annually, while the actual capacity of the airport was 2.8 million passengers in 2018, and it is expected to reach 4.8 million passengers annually in 2025.



**Figure (2) environmentally friendly passenger building at Borg El Arab Airport.**

#### **4. CONCLUSION:**

Many solutions to climate change can achieve economic benefits while improving our livelihoods and protecting the environment. In addition, global frameworks and agreements have also been concluded to guide progress, such as: the

Sustainable Development Goals, the United Nations Framework Convention on Climate Change, and the Paris Agreement. There are three general categories of action: reducing emissions, adapting to climate impacts, and financing needed adjustments.

Converting energy systems from fossil fuels to renewable energy sources, such as solar or wind energy, will reduce emissions that cause climate change. But we have to start now. A growing coalition of countries commits to zero emissions by 2050, yet emissions must be cut by about half by 2030 to keep warming below 1.5°C, and fossil fuel production must fall by about 6 percent per year during the 2020 decade -2030.

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