Airports' Journey to Net-Zero Carbon Emissions

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December 2022

Introduction

Climate change is a clear and pressing issue for people, businesses, and governments across the world. The Aviation sector is under the global spotlight when it comes to responding to threats of climate change. Aviation accounts for around 2.5% of global human induced carbon emissions, with airports contributing to approximately 2% of this total global share (IPCC, ACI). While this percentage of carbon emissions from aviation has not changed significantly since 1992, aviation's share of global emissions is expected to increase as air traffic grows and other sectors decarbonise. According to IATA, current projections estimate that demand for air passenger journeys in 2050 could exceed 10 billion. While EUROCONTROL predicts an increase in the number of flights at an average annual rise of 1.2% per year to 2050.

At a regional level, air transport activities account for 3.7% of Europe's economy-wide CO2 emissions, placing Europe above the sector's international average by 1.2% (European Parliament). Carbon emissions from commercial aviation in Europe increased by 30% between 2013 and 2019 to 151.8 million metric tons. Of this total, more than half of the emissions were attributable to international flights. These figures are even higher in the United Kingdom, as Aviation's share of emissions of UK Green House Gas (GHG) reached 7% (Climate Change Committee).

Given that more than 95% of emissions are aircraft-related, IATA has committed to net-zero carbon emissions operations by 2050. Their strategy focuses on 65% usage of sustainable aviation fuel (SAF), 13% investment in new aircraft technology, and 19% usage of approved offsets, including carbon capture and storage technology.

Airports Council International (ACI) has also committed to achieving net-zero carbon emissions operations by 2050 by implementing various initiatives some of them are airport-specific such as Airport Carbon Accreditation (in place since 2008 in Europe and worldwide since 2014), while other initiatives are more aircraft focused, such as Aircraft Ground Energy System Simulation (AGES-S). According to ACI Europe, 235 airports aim to achieve net-zero carbon by 2050 and 91 airports by 2030.

Emission of Greenhouse Gases (GHG) - A categorisation

When analysing aviation's environmental impact, the emission of Greenhouse gases (GHG) is generally indicated as the primary source of pollution.

Greenhouse gases are compound gases that cause heat or longwave radiation to be trapped in the atmosphere. The main gases responsible for the greenhouse effect include carbon dioxide, methane, nitrous oxide, and fluorinated gases.

Airports, irrespective of their size, have an impact on the environment, both locally and globally. Airports' GHG emissions are usually divided into three categories, namely Scope 1, Scope 2, and Scope 3. The difference lies in the source of such environmental-damaging gases.

Scope 1 emissions are direct GHG emissions stemming from the fuel combustion of assets owned or controlled by an airport. Fuel combustion is linked to two primary sources: the airport infrastructure and owned vehicles. Examples of GHG Scope 1 emissions include an airport's Heating, Ventilation, and Air Conditioning (HVAC) system, lighting, and power, Tracked Transit Systems (TTS), or Automated People Movers (APM).

Scope 2 emissions are linked to purchasing electricity, heat, or cooling. Although these GHG emissions are not produced within an airport premise, they result from the airport's energy use.

Lastly, Scope 3 emissions derive from activities of assets that are neither owned nor controlled by an airport but that the airport indirectly impacts in its value chain. The primary source of Scope 3 emissions at an airport are airside operations, such as aircraft taxi, hold, or engine testing. Secondary sources are linked to third-party airside vehicles, including baggage tugs, cargo handling vehicles, mobile stairs, and operations cars.

Regulatory guidance - What can airports do to further reduce their environmental effects?

In terms of regulatory compliance, airports must comply with a range of legislations with respect to the environmental effects that they generate. Failure to do so will lead to legal implications. Many airports strive to go beyond the minimum regulatory standards by seeking accreditation under schemes such as The Carbon Trust Standard, ISO 14001 Environmental Standard, and ACI Airport Carbon Accreditation Scheme.

Airports have a wide array of actions to take in different areas to reduce their environmental impact further, and these can include:

1. Noise: through taking a balanced approach to noise management and encouraging airlines to use quieter aircraft through charges or incentives while promoting operational procedures that reduce aircraft noise, such as continuous descent or climb. Airports can also produce clear and simplified information for a better understanding of the impacts while reporting airline performance, to allow the public to compare airlines and use noise as a factor in choosing an airline (UK CAA).

2. Climate change: investing in energy-saving buildings and installing renewable energy power systems or buying green power while ensuring high recycling and re-use rates of waste. Airports can also encourage the use of different ways to operate the aircraft to reduce emissions, such as changing the way they climb and descend during take-off and when landing.

3. Air quality: through providing and encouraging the use of fixed electrical ground power and optimising the efficient flow of aircraft traffic to prevent unnecessary aircraft idling and taxiing. In terms of surface access, investing in transport links to encourage more use of public transport and supporting the use of lower emission ground vehicles.

4. Waste and recycling: through providing recycling facilities for aircraft waste and waste generated at the terminals or at facilities around the airport.

5. Water: through investing in improved handling facilities and processes to reduce the risk of groundwater or surface water pollution from de-icing and fuel handling equipment.

6. Biodiversity: through developing biodiversity strategies that balance the need to protect aircraft safety but maintain a positive natural environment.

Airport landside – Emission reduction touchpoints

There are two primary sources of energy consumption in the landside area of an airport: the terminal building and the facilities supporting its operation.

Notably, HVAC, lighting, and ICT usually require the most energy. To address the high energy consumption in the landside area, airports conduct cyclical energy audits to analyse consumption levels and implement strategies to improve energy distribution.

Track Transit System (TTS) or Automated People Mover (APM) offers a valid alternative to buses for connections between terminals. These technologies are already in use at Heathrow, Gatwick, and Stansted. Airport-owned cars represent the simplest way to achieve zero-emissions by replacing conventional fuel-powered cars with electric-powered ones.

Additionally, the landside area could be used to produce on-site renewable energy, for instance, by installing solar photovoltaics (PV) on the rooftop of airport buildings and parking garages.

Current and future decarbonisation initiatives for UK's top five busiest airports

Environmental strategies of Airports in the UK aim at achieving either zero or net-zero GHG emissions. While the former enables airports to eliminate environmentally damaging emissions entirely, the latter envisages a residual amount of GHG emissions to be produced, which are subsequently compensated through offset programs.

In 2021, the UK Government published the "Jet-Zero" strategy to support UK airports in reaching zero GHG emissions for operations by 2040. Consequently, various airports in the UK are putting their environmental plans into action in accordance with the official Jet-Zero strategy (Department for Transport).

London Heathrow (LHR)

Heathrow airport is the UK's primary hub for international and intercontinental flights. Therefore, its carbon footprint is considerably higher than other national airports. To minimise its GHG emissions, Heathrow Airports Holdings (HAL) has committed to replacing all its owned conventional fossil fuel vehicles with zero/low emissions vehicles by 2030. Additionally, HAL will support all stakeholders, such as handling companies, to follow suit. As of 2022, HAL procures 100% of its grid power via a Renewable Energy Guarantees of Origin – REGO tariff. Therefore, it reports zero emissions for grid electricity, which positively impacts its Scope 2 emissions.

London Gatwick (LGW)

Gatwick is the UK's second busiest airport, which handled 46.6 million passengers in 2019.

Gatwick Airport Limited (GAL) procures almost all its grid power via renewable REGO tariff, which enables the airport to record near-zero emissions for grid electricity. For 2030, the airport aims to reduce Scope 1 and Scope 2 emissions by 25%, sourcing 50% of on-site electricity and 50% of the heat network from renewable sources. Additionally, the airport plans to replace all vehicles with zero/ultra-low emissions vehicles.

Manchester Airport (MAN)
Manchester airport, owned and managed by Manchester Airport Holdings, is the UK's third largest airport, with an average annual passenger number of 27 million. Similar to Heathrow and Gatwick, Manchester airport currently sources 100% of its grid power from a renewable REGO tariff. To achieve net zero operations, the airport infrastructure will rely entirely on renewable energy by 2030. By the same year, all vehicles owned by the airport should be 100% ultra-low emission.

London Stansted (STD)
UK's fourth busiest airport serves as one of the most important bases for the Irish Low-Cost Carrier (LCC) Ryanair. Stansted Airport also procures 100% of its grid power from a renewable REGO tariff. Both Stansted and Manchester Airports follow the same decarbonization strategy and implementation timeline given that both airports are owned and managed by their parent company Manchester Airport Group.

London Luton Airport (LTN)
In 2018, London Luton completed a three-year development that improved the overall infrastructure with a Direct Air Rail Transit (DART) system in place. Currently London Luton Airport is reporting remarkably higher Scope 2 emissions, and it aims at achieving 50% onsite renewables by 2030.

Regarding waste management and recycling, UK airports adopt different strategies. For instance, AGS Airports, which owns Glasgow, Aberdeen, and Southampton airports, adopts a circular economy perspective on sustainability to reduce waste. The security bags used at their airports are biodegradable, which saves more than 2.5 million single-use plastics every year.

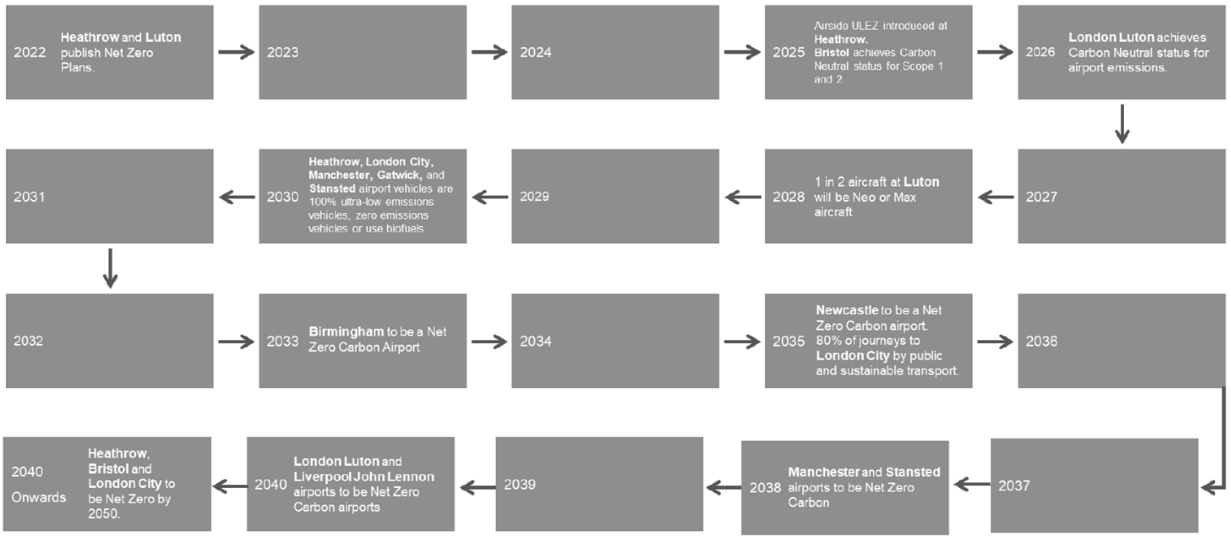
Additionally, most airports are engaged in transforming their waste into energy, given the availability of systems to recover energy from waste through incineration. A few airports, however, operate their own incinerators and use the heat recovered within the airport.

Gatwick airport is one of the first in the world to have a waste processing and conversion facility on-site. Food wastes, meal plates, and cups are dried, pelletised, and fed to an incinerator, and the recovered energy is used to heat part of the terminal. The facility can generate about 1 MW of renewable energy per year (Sebastian and Louis).

London Stansted partnered with Bio-Bean, a British company, to produce fuel pellets from coffee grounds collected from airports, which have a calorific value higher than wood pellets at an appropriate density.

Decarbonisation forward outlook

The commitments that are being made by UK Airports to date show where the current net-zero trajectories sit and a forward outlook towards decarbonisation plans. Birmingham Airport booked the earliest slot for net-zero by 2033, while Heathrow's net-zero attainment is delayed until 2050.



Source: Mott MacDonald (2022)

The role of technology in Airports' journey to Net-Zero

Underpinning all these initiatives is technology and data analytics. Many of the emissions reduction solutions available today are focused on addressing smart airport and airline operations.

For example, EasyJet analysed the demand for food on different routes and at different times of the day. By understanding the patterns of how passenger consumed their meals, they were able to make a few simple changes to meal plans to reduce food wastage by 25%.

Airports of the future are infused with data analytics – combining big data, artificial intelligence, and machine learning technologies. Being tech-driven is vital to understanding the source and extent of the sector's emissions and mapping a clear path to reducing those emissions. Airports are becoming more and more tech-driven through partnering with net-zero technology companies to drive efficiencies toward achieving their sustainability targets. Such partnerships focus on reducing the consumption of energy and on taping into renewable energies at a large scale. Airports are investing in infrastructure for huge-scale renewable energy supplies and converting hundred-gigawatts of wind and solar parks into green hydrogen or green ammonia. Other airports are actively getting involved in the Sustainable Aviation Fuels value chain through the integration of SAF at the airports. Heathrow, Schiphol airport, and Swedavia have started SAF funds and incentives that airlines can apply to when they refuel SAF at these airports. Luxembourg Airport took a step further and invested in SAF production.

A recent study on the feasibility of Airport operations in the UK pointed out that the main challenges airports face in achieving net zero emissions are technological and commercial. Some technologies are still being developed and tested, and, once available, their costs might be inaccessible, creating more environmental disparities. Furthermore, airports are complex realities, with multiple stakeholders whose different economic interests often hinder the agreement on harmonised environmental policies. Lastly, smaller airports are generally characterised by less confidence from investors, who tend to be more alert when securing investments.

However, airports are better positioned in terms of responsiveness to overcome the technological and commercial barriers to achieving net zero when compared with airlines. Net-Zero airports of the future will also progressively adopt breakthrough technologies such as Urban Air Mobility, aiming to minimise the environmental impact of surface transport to/ from the airport. Additionally, Biometrics will be implemented at progressively more stages of passenger processing, offering a seamless, contactless experience for passengers transiting the terminal. Artificial Intelligence, and the Internet of Things (IoT), will boost efficiencies in managing passenger flow. These technologies will enable a complete revolution of the airport experience, where passengers are placed at the centre and the front by becoming more independent and in control of their own green decisions while their environmental footprint is progressively eliminated.

Conclusion

In conclusion, given the scope of the task at hand, all hands are required on deck to succeed. It is mandatory that all stakeholders, whether private, public, or governmental agencies, fully engage in developing and implementing efficient environmental strategies.

Airports are willing to pull their weight in accelerating the decarbonisation of the aviation industry as a whole. They can facilitate the introduction of low emissions aircraft technologies and operations, the deployment of Sustainable Aviation Fuels or charging infrastructure for electrified aircraft operations, preserving biodiversity, and reducing waste and much more. This collaborative approach is essential to unlocking the full potential of CO2-reducing opportunities and finding innovative measures faster.

Since connectivity is a vital part of the modern world, airports will need to continue to make progress and work with the wider aviation industry so that one day, people will continue to travel without harming the planet.

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