Airport Environmental Sustainability

Introduction

The airline industry has consistently delivered substantial reductions in carbon emission intensity through continuous innovations in aircraft and engines, as well as the adoption of improved operational processes and infrastructure.

For example, each new generation of aircraft has had double-digit fuel efficiency improvements compared to the previous generation which has led to aircraft producing substantially less CO_2 per seat.

Despite the impressive gains in efficiency, the industry is today facing increasing pressures from investors, customers, and regulators to reduce greenhouse gas emissions.

IATA members are committed to meeting this challenge by achieving net zero carbon by 2050[1]. This will require the collective efforts of the entire air transport industry backed by supportive government policies.

Airports have also set out a net-zero carbon target for their own emissions and have been mapping out strategies to achieve this goal, as an essential enabler for continuing their current operations and to allow for future growth.

Airlines are committed to addressing environmental challenges; however, airport investments in environmentally sustainable infrastructure are ultimately reflected in an airport's cost base that airlines pay for through aeronautical charges. Therefore, these investments need to be carefully considered and based on a sound business case developed in consultation with airline users.

IATA Position

Securing the greatest environmental benefits means supporting, and not impeding, airlines' own ability to make investments in new fleet, fuels, and technologies that can make an even larger impact on tackling the climate crisis. This requires that airports be managed efficiently with a strong focus on reducing costs and maximizing efficiency, even beyond environmental initiatives.

Environmental sustainability should be an integral part of airport planning and the expected impact of different development options, including retaining still functional infrastructure and improving existing processes, should be weighed to assess the impact.

The investments required to become a 'green airport' can be substantial, based on the need either to retrofit existing airport facilities or build new infrastructure in line with net zero carbon standards.

Sustainability actions should therefore be prioritized based on what can practically deliver the greatest possible reduction in the air transport industry's overall carbon footprint in the most efficient way. This sometimes involves making difficult choices on where best to spend scarce resources, but the urgency of the climate crisis requires that tough decisions be made.

What should be prioritized?

First and foremost, it is important to note that aircraft account for the largest share of total air transport CO_2 emissions. Therefore, it is crucial that airlines retain the financial means to continue to innovate and invest in new technology, particularly aircraft. Airport charges that are affordable and appropriate help to sustain this effort.

However, airports also have a part to play in their role as infrastructure and service providers. Airport investments in ground infrastructure that support the industry's environmental ambitions are welcomed as long as projects are supported by a business case that demonstrates a positive cost / benefit analysis for users that is subject to a consultation process with them.

The greatest potential lies with initiatives that increase airline operational efficiency and reduce

[1] IATA members' AGM resolution on Net Zero 2050

aircraft fuel burn and emissions. These include improvements to airfield layouts and airside operations.

Based on studies[2] utilizing aircraft performance data, it is estimated that aircraft ground operations (taxi/runway movements and APU use) account for nearly 8% of total aircraft emissions, which is several times the amount of all other airport emissions combined. This highlights the fact that supporting airline efficiency and fuel burn reduction can have an outsized impact in reducing the industry's total emissions.

Airports also need to address environmental issues related to their own facilities and operations including greenhouse gas emissions (GHG). This includes the embodied carbon, associated with materials and construction processes during the entire lifecycle of airport infrastructure, and operational carbon which comes from its use.

Assessing Green Investments

Whatever environmental initiatives airports pursue; it is important to note that such green investments should be held to the same standards as other capital spending plans. That is, they must be based on in-depth analysis and the development of plans that:

- Are informed by consultation with airline-users and enjoy their explicit support.
- Identify short, medium, and long-term objectives and targets and how they will be achieved.
- Assess the impact on operations and demonstrate how airline user requirements for functionality and efficiency will be met.
- Consider capital, operations, and maintenance costs as well as the financial return through a detailed cost benefit analysis.
- Estimate the environmental benefits of different investment options (e.g., reductions in energy usage and GHG emissions).
- Assess the expected impact of alternatives, including retaining still functional infrastructure – premature replacement of which can have negative GHG impact compared to a successive renewal linked to the infrastructure's lifecycle.
- Identify possible alternative funding schemes such as government aid, green funds, or other third-party aid or seed funding.
- Conduct regular reviews of infrastructure plans to track performance and adjust if necessary.

Airport Environmental Initiatives

The suitability of different types of airport sustainability investments will depend upon the size, type, and local circumstances of each airport. For each part of an airport, there are key principles and practices that can be used to guide sustainability.

Airport Planning and Design

Airport planning and design decisions can have an enduring impact on an airport's environmental and operational performance; therefore, a sustainability strategy should be addressed in an airport's master plan and also embedded at an early stage into the concept, design, development, delivery, and implementation of airport projects. The following strategies should be considered:

- Maximize the use of existing assets to avoid unnecessary capital expenditure costs.
- Incorporate a concept of operations (how the facility will be used) that optimizes utilization, efficiency, and ultimately the required size.
- Use technology to increase the efficiency of airport processes and reduce the environmental footprint.
- Implement sustainable building standards and design tools to maximize energy efficiency, conserve resources, and minimize the CO_2 emissions associated with materials and construction processes throughout the whole lifecycle of the infrastructure.
- Design building envelopes to be more energy efficient such as by avoiding unnecessarily large spaces and/or non-functional

[2] Kesgin, U. (2006). "Aircraft Emissions at Turkish Airports", Zurich Airport (2017), "Taxi Emissions at Zurich Airport"

architectural features that result in extra embodied or operational carbon (energy use).

Airfield Configuration

An efficient airfield layout can optimize capacity and operational performance, while also reducing the aircraft fuel burn and emissions of airline users. Features that can improve efficiency and sustainability include:

- A terminal location and airfield layout that minimizes taxi distances from the gate or stand to taxiways and runways to reduce fuel burn and CO_2 emissions[3].
- Runway holding bays and bypass taxiways to facilitate aircraft flow and sequencing.

Airside Operations

Airside operations are a shared responsibility; therefore, requirements should be jointly defined by airports and airlines. Wherever economically feasible, and following a cost-benefit analysis, the following airside electrification and other initiatives can be considered to reduce noise and emissions and improve operational efficiency.

- Fixed Electrical Ground Power and Pre-Conditioned Air systems at aircraft stands to replace the use of auxiliary power units and diesel-powered ground power units that burn fuel and generate significant levels of emissions.
- Electric, hybrid or alternative fuel powered airside vehicle fleets and ground service equipment.
- Fuel hydrant systems that reduce the need for fuel trucks and the emissions they generate. It should be noted that these systems also require a significant investment and are best suited for airports with sufficient traffic volume and a need for efficient aircraft turnarounds. Where fuel trucks are used, alternative fuels can be considered.
- Assisted taxiing by hybrid or electric towing vehicles to reduce aircraft fuel burn and carbon emissions during ground movements.
- Airport Collaborative Decision Making (A-CDM) and digital technologies to improve the efficiency of aircraft turnarounds and the utilization of gates.

Each of these initiatives requires close collaboration with airlines and other stakeholders to assess their requirements.

Electrification, for example, will require a sufficient, reliable and continuous supply of electricity from low carbon sources and suitable infrastructure such as well-located charging points with standardized connectors.

Energy Use

The energy used to operate the airport is a significant source of CO_2 emissions, including what is generated on-site and what is purchased offsite. The mix of energy sources and the use of energy efficiency measures will influence the environmental impact. Mitigation strategies may include:

- Identify opportunities to shift to renewable energy sources (e.g., solar, wind, biomass, geothermal, hydroelectric) both off-site and on-site. The case for renewables has been bolstered by their increasing supply and falling costs which has been driven by improving technologies and economies of scale.
- Reducing energy consumption through the adoption of more efficient technologies to replace end-of-life lighting and heating, ventilation, and air conditioning (HVAC) systems. Costs vs. energy savings should be assessed.
- Monitoring electricity consumption of each airport system and adopting automatic power-down systems on escalators, conveyor motors and lighting systems, etc., when not in use.
- Employing alternative heating and ventilation methods e.g., solar, geothermal, displacement ventilation, etc.
- Using skylights and natural ventilation to provide energy savings if the climate permits.

Resources Management

The natural environment and resources can be conserved by:

[3] One kg of Jet-A fuel burned = 3.15 kg of CO_2

- Waste management that encourages the reduction, reuse, and recycling of waste.
- Avoidance of single-use materials.
- A lifecycle approach to the design, construction, operation, and decommissioning of facilities can reduce waste and keep valued resources in use.
- Use of local building materials and replacement of hazardous substances with more benign alternatives.
- Reducing water consumption through low-flow water fixtures, and the recycling of grey water and harvesting of rainwater.
- Protecting local water resources from storm runoff, and contamination from deicing fluid and fuel spills.
- Maintaining or restoring natural habitats to enhance and preserve biodiversity while monitoring and controlling wildlife hazards.

Surface Access

Airports also need to consider strategies to mitigate the environmental effects of landside access of passengers, staff, goods and freight to and from the airport and may consider:

- Strategies to promote convenient, reliable, and cost-effective transport modes that minimize vehicle emissions and congestion.
- Seamless links to public transport including high-speed, regional and local rail services.
- Terminal forecourt design that supports a free-flowing road network.
- Consolidation of off-airport car hire facilities and hotel shuttle services.
- Infrastructure to support the use of zero emission vehicles (e.g., EV charging points).
- Safe access for pedestrians and cyclists.

Governments should play a role in funding the transition to more environmentally friendly public transport including modes that support seamless regional connectivity.

Local Impacts

When a new airport or a major expansion is planned, it is also important to consider its environmental impact on the surrounding community.

The environmental impacts of noise, air, and water pollution can be minimized through:

- Land-use planning, management and zoning, land acquisition, encroachment protection, noise protection or insulation programs.
- Runway configurations that minimize aircraft noise and emissions impacts.
- Use of approved noise abatement operational procedures consistent with ICAO guidance[4].
- Construction of 'sound walls' or 'ground profiling' to reduce noise disturbance for neighbouring communities.
- Protection of local watercourses and soil from stormwater and hazardous liquid runoff.
- Nature-based planning approaches that maintain biodiversity without impacting safety.

Sustainable Aviation Fuel

Sustainable Aviation Fuel (SAF) is seen as one of the most effective and practical solutions to help the industry decarbonize. The primary challenge is the lack of supply and its high cost. Scaling up feedstocks and production is essential for making SAF affordable. It is important to keep in mind that:

- SAF is a drop-in fuel that requires no special investments or changes to infrastructure from airport operators.
- Airports can best promote the use of SAF by joining airlines in advocating for support from governments, the financial community, and others to incentivize and boost early production and make the price of SAF commercially viable. Such support can have positive effects on ramping up the supply and accelerating the learning curve.
- Airports should not mandate SAF use or modulate airport charges, which could result in

[4] ICAO 8168 PAN OPS Volume I (2018)

a costly patchwork of solutions that distort the market and lead to undesirable trade-offs.

Future Technologies

Intensive research has been underway on the next generation aircraft and engines that can provide the zero-carbon solutions needed to sustain commercial aviation for the long term.

This includes electric aircraft but their use is likely to be concentrated on small regional airliners and electric vertical take-off and landing aircraft with limited range. If these planes materialize, airports may need to upgrade their existing power grid.

Hydrogen-powered propulsion for aircraft is a promising longer-term prospect but needs to overcome many challenges before it can play an appreciable role in reducing aviation's CO_2 footprint. New aircraft fleets and substantial infrastructure and renewable energy would be required to produce, liquefy, and distribute green hydrogen.

While some airports are participating in the research, airlines cannot be expected to support airport investments in H_2 infrastructure until the technology is proven, and commercially viable aircraft are widely available.

Conclusion

Making progress to becoming an environmentally sustainable industry and achieving the goal of net zero carbon by 2050 will require the active participation of all aviation stakeholders. Actions will need to be prioritized according to what is financially sustainable and has the greatest effect on reducing aviation's impact on climate change.

Airports can maximize their contribution to sustainability by ensuring that airport infrastructure costs do not impede airlines' ability to invest in new technology. This can best be done by retaining a sharp focus on costs and efficiency while choosing green airport investments that make a positive difference and are based on a sound business case that is supported by airlines.

Supporting Documents

- IATA Airport Development Reference Manual 12th edition
- IATA Airport Infrastructure Business Cases paper