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"Sustainability practices in Airline: A Step towards a Greener Future"

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Abstract
The aviation industry is starting to pay attention to green initiatives to reduce carbon emissions, aircraft noise, and environmental impact. As the worldwide air traffic is growing rapidly, the aviation industry is one of the major contributors of greenhouse gas affecting sustainability to a great extent, the augmentation of the demand for operation expansion and environmental sustainability. This study aims to identify the various sustainability initiatives which have been adopted by airlines, by focusing on strategies that encourage greener aviation industry. The study is a secondary data based on journal, industry reports, and official aviation data. The different practices include sustainable aviation fuel, adoption of fuel efficient aircraft, single engine taxiing, improved flight operation, green airport initiative waste and resource management. The results show that the utilization of sustainable fuel in contemporary aviation has a vital role in lessening pollution and raise the efficiency, also the adoption of technology and carbon off sets program helps airlines function more efficiently reducing the environmental impact. Green airport initiatives also play a significant role to reduce the overall ecological foot print. To conclude, sustainable initiatives help in reducing the environmental damages in long term to maintain long term economic efficiency and corporate social responsibility. This helps to move towards sustainable aviation which is critical for the future of the industry, as it helps to achieve balanced growth and environment protection.
Keywords: *Sustainable aviation, carbon emissions, green airports, environmental sustainability*

1. Introduction
The aviation sector is one of the most dynamic and fast-growing sectors of the world economy, which, by effectively bridging globe-spanning distances, plays a key role in international trade, tourism, and cultural exchange. Air transportation is now a very prominent feature of modern life, reconnecting the world at the speed of light. However, the continuously expanding aviation sector raises serious environmental implications, as the aviation sector remains the largest source of greenhouse gas emissions and has become increasingly placed at the centre of global sustainability initiatives. The environmental costs of air travel are increasingly being recognised and addressed, in both the public and private sectors, but the growth of the aviation sector has not yet been matched by environmental benefit. Thus, with increasing air traffic comes increasingly negative environmental impact, the most obvious being the atmospheric emissions of carbon dioxide CO2 and its contribution to climate change. Furthermore, aviation represents a major source of aircraft noise and energy use, thus impacting local communities. We therefore contend that we face an urgent problem, and that there is no alternative to reducing the ecological footprint of aviation. The industry's awareness of this need is growing and, in the interest of long-term sustainability, a technological transition is currently occurring. This transition is not only towards more fuel-efficient aircraft models (e.g., Airbus A320neo and Boeing 737 MAX) but also to the more efficient air traffic management systems enabled by AI. Additionally,

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industry stakeholders are complying with increasingly stringent policies and regulations (e.g., ICAO and IATA carbon-offsetting schemes) set by international governing bodies to ensure the trajectory of aviation's growth aligns with the international endeavour to mitigate climate change impacts. The growing environmental awareness of our present society, and the preference for airlines that are socially responsible, is another element contributing to the existing transition towards a "greener" future. Coupled with various government-sponsored hydrogen and electric propulsion projects, this is accelerating the industry's transition towards sustainability. While these efforts are worthwhile, we feel there is a gap in the existing literature regarding the immediate economic.

2. Research Gap

Although 2050 goals have been extensively covered by different organizations (IATA, ICAO), there is a major research gap in terms of operational and economic challenges of the 2024– 2026 transition period. The majority of literature is focused on the long-term, theoretical goals of the industry and there is a lack[1] of qualitative synthesis and explanations for why SAF has not penetrated the market above 1% despite mandates. This paper addresses this gap by looking into the different backlogs in terms of infrastructure and supply chain that will influence the aviation sector's ability to achieve the mid-decade targets[2].

Objectives

1- To identify and categorize the current methods of green transition

2- To analyse impact on the operation of CO2 reduction

3- To analyze the "Ambition-Implementation" gap

3. Literature Review

A clear conflict between fast moving technology targets and market economy emerges in the transition to sustainable aviation. ICAO targets net zero carbon emissions in 2050 but there is no agreement on how this can be attained in literature from recent industry. The SAF paradox: sustainable but unsustainable Sustainable Aviation Fuel (SAF) is mentioned by researchers as the most efficient way to achieve short term decarbonisation. IATA has reported an increase in SAF production in their 2025 annual review. However, some researchers e.g. Muller et al. (2025) argue that the competition for feedstock between maritime and road transport will restrict supply. The International Energy Agency (IEA) indicates that without[3] large government subsidies SAF will probably be two to five times more expensive than traditional Jet A-1 and impedes low cost carriers from adopting SAF. Voluntary compliance to mandatory regulation Transition to mandatory regulation has emerged in recent aviation research. The 2025 ICAO Periodic Review indicated that the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) pilot regime is on track for the implementation of its first mandatory phase (2024-26) and covers the majority of international flights. Advocates[4] of this regime claim it provides a market-based targeted incentive for efficiency. Environmental critics in 2026 argue that carbon offsetting should complement the core objective of the direct reduction of carbon emissions, e.g. by improving engine technology. Beyond the age of fossil fuel: New technology frontiers Airframe and engine design are the long arm of sustainability. While Airbus and its regional competitors are currently testing hydrogen-combustion prototypes, 2026 Aerospace Technology Institute (ATI) reports argue "Electric Vertical Take-off and Landing" (eVTOL) aircraft are the most likely to achieve zero emissions first but are limited to short urban runs. The literature range from marginal innovations such as winglets and gear-ratio optimisation and big, disruptive changes such as liquid hydrogen and solid-state batteries. The consensus so far is that the multi-solution approach[5] should be pursued. Beyond the airframe: The "green hub" of ground operations Beyond the aircraft, literature has identified the airport terminal and ground-handling operations as a key focus for future decarbonisation. The 2025 ACI (Airports Council International) Sustainability Report shows more "Tier 1" airports have achieved Level 4Transition/Transformation accreditation. This indicates progress in terms of actual Scope 3 emissions reductions. Hassan & Li (2026) argue that use of onsite renewable energy microgrids, especially large solar arrays and geothermal heating, is a key

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reason for recent progress in achieving operational carbon neutrality by major airports in the Middle East and Europe. The 2025 ICAO Periodic Review shows fast uptake of Electric Ground Support Equipment (eGSE) and "Pre-Conditioned Air" (PCA) systems at gates, which reduces aircraft running of the Auxiliary Power Units (APU) when parked. As World Economic Forum (2026) highlights, the main barrier to progress is the "Infrastructure Gap" as many airports lag in replacing their electrical infrastructure to meet the high power demand of future electric fleets[6].

4. Methodology

This study is qualitative, as are the researchers who have secondary data that they have studied in a systematic manner. The researchers gathered data using three separate methods to gather current data on the aviation industry that is in operation during the year 2025–2026.

- The data collected was from industry reports that contained data from ICAO and IATA, data from academic journals, and data from environmental news outlets[7 – 10].
- This paper includes sources from the years 2023-2026, which I intentionally selected as I was interested in using all the information that is available regarding current technologies and the current Sustainable Aviation Fuel (SAF) and carbon-offsetting regulations.
- The data has been reviewed by creating major themes, namely Fuel Efficiency, Green Airports, and Government Regulations. Comparing reports has helped to identify the challenges and benefits that airlines are experiencing when trying to operate in an ecological-friendly way.

5. Findings

The need for Sustainable Aviation Fuel (SAF)The research findings indicate that the only fuel the current aircraft can fly on is SAF.The research findings indicate that the SAF can cut of CO_2 emission by 80% according to the research findings. The actual result: IATA data from 2025 indicates that the production has increased, but its cost is three times the base fuel price and it is difficult for the small airlines to change all of them without the help of the government[11 -16]. Technological Efficiency and New Fleets Airlines are lowering the aviation emission by changing their fleet hardware. Newer aircrafts such as Airbus A320neo and Boeing 737 MAX are 20% fuel efficient than the older aircrafts. The performance of the system to improve the fuel efficiency, such as the single engine taxi and AI optimized flight paths, offer the quick “wins” without using new technologies. Green Airports as “Energy Hubs “The research findings indicate that the sustainability practices are shifting from the air side towards the ground side.

- Airports modernization, including the installation of large solar power facilities and the implementation of electric vehicle system for luggage and passenger transportation.
- Official statistics confirm that major airports have cut down the landfill waste by 40% with improved recycling and the banning of single use plastic in their terminals.

The “Ambition-Implementation” Gap- There is a big gap between the ambition of airlines and what they have actually achieved: By 2026 sustainable aviation fuel (SAF) will still account for less than 1% of the world’s fuel consumption. In order to hit the 5% SAF target set for 2030 industry will need huge financial support by the end of this year, for which many players are not willing to take the risk given the high interest rates and the uncertain economic situation. 2. Feedstock Scarcity and Competition- The main technical challenge is a lack of raw material, the basic input for the production of SAF. The competition: used cooking oil and waste fat account for 80% of SAF production. However, aviation competes with sea and road transport for the same resource. The limit: It is estimated that waste-based fuels can only account for about 10% of total aviation demand. The future energy city will be “synthetic fuels” (e-SAF) but the technology is only at the demonstration level and is not able to support a global scale distribution.

3. Infrastructure and “Hydrogen Readiness”- Most airports are not ready to receive green aircraft even now. Ground operations: hydrogen aircraft requires

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different tanks and cooling systems (for liquid hydrogen) and special refueling trucks. The cost: Conversion of a large international airport into a "Hydrogen Hub" will cost in the billions of dollars. The cost of operating regional airports is too high, to the point where a "two tier" system is created where only wealthy airports are able to take the green approach.

4. Supply Chain and Workforce Crisis- The process of transition itself is hampered by "hardware" issues. Backlogs: the aircraft industry is facing its biggest backlog situation since there are more than 15000 unmatched aircraft orders that Boeing and Airbus need to deliver by 2026.

Skills Gap: The template response is that the existing demand for technicians with the skillset to service high voltage electric motors and hydrogen fuel systems is constrained. This skill gap restricts maximum utilization of the next generation fleets.

Conclusion

The aviation sector must achieve environmental sustainability since it is now necessary for the sector to continue operating. The study found that aviation operations produce large amounts of greenhouse gas emissions, which can be reduced by using a "multi-pillar" sustainability strategy that incorporates operational enhancements, technological advancements, and regulatory frameworks. The results show that the best ways to reduce carbon emissions in the coming years are fleet modernisation and Sustainable Aviation Fuel (SAF). Instantaneous emission reductions are made possible by the "drop-in" solutions, which do not require a complete transformation of environmental infrastructure. Together with AI-based operational improvements like single-engine taxiing and optimised flight paths, the green airport projects provide crucial "quick wins" that reduce environmental harm while increasing operational effectiveness. In the challenges section, the team's main challenges are the infrastructure limitations and current "Green Premium" costs. To meet its 2050 Net-Zero goals, aviation must switch to electric and hydrogen-powered propulsion systems for short-haul flights. There needs to be a new level of global cooperation to achieve a sustainable development despite environmental challenges resulting from a rapidly growing population. Aviation can play a role in creating a sustainable future which supports the planet as well as international connections through traveling by integrating its corporate social responsibility initiatives with international regulations such as ICAO's CORSIA. This transition represents a major change in the way the world thinks about modern aviation.

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