

The Commercial Impact of Sustainable Aviation Fuel Adoption in Commercial Airlines in the United Arab Emirates: An Economic and Industry Analysis

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Abstract— This study examines the commercial impact of Sustainable Aviation Fuel (SAF) adoption by commercial airlines in the United Arab Emirates (UAE). Using a mixed-methods approach combining quantitative economic analysis and qualitative insights from industry reports, the research investigates the economic implications, challenges, and opportunities associated with SAF implementation in the UAE's aviation sector. Findings indicate that while SAF adoption aligns with the UAE's economic diversification and sustainability goals, significant hurdles remain, including high production costs and feedstock availability. The study provides recommendations for policymakers and industry leaders to facilitate successful SAF adoption, contributing to the UAE's position as a global aviation hub while addressing environmental sustainability concerns.

Index Terms— SAF, Commercial Airlines, UAE SAF Roadmap, Carbon Emission Reduction, Commercial Impact, Environmental Sustainability.

1. Introduction

The global aviation industry faces increasing pressure to reduce its carbon footprint, with Sustainable Aviation Fuel (SAF) emerging as a promising solution to mitigate the sector's environmental impact. SAF, derived from sustainable feedstocks, offers the potential to reduce lifecycle carbon emissions by up to 80% compared to traditional jet fuel (KPMG International, 2024). As a major global aviation hub, the United Arab Emirates (UAE) has recognized the strategic importance of SAF in maintaining its competitive edge and meeting international sustainability commitments. The UAE's aviation sector plays a crucial role in the nation's economy. As the industry recovers and grows post-pandemic, the adoption of SAF presents both opportunities and challenges for the UAE's economic and environmental goals. This study aims to analyze the commercial impact of SAF adoption on commercial airlines in the UAE, examining economic implications, industry perspectives, and potential barriers to implementation.

2. Literature Review

A. Global SAF Development and Adoption

SAF is widely recognized as a critical component in the aviation industry's efforts to reduce its carbon footprint. The International Air Transport Association (IATA) projects that SAF will play a crucial role in achieving the industry's goal of net-zero carbon emissions by 2050, potentially contributing up to 65% of the required carbon reductions (KPMG International, 2024). Global SAF production has shown promising growth, with output doubling in 2023 to over 600 million liters and expected to reach nearly 1.9 billion liters in 2024 (KPMG International, 2024). However, this still represents only a fraction of the estimated 30 billion liters needed by 2030 to meet industry targets. The volume of SAF purchased by the U.S. aviation sector has increased from nearly zero in 2015 to about 4.5 million gallons in 2020 (Sharma & T, 2021)

B. Economic Impact of SAF Adoption

Studies have examined the economic implications of SAF adoption in various contexts. Staples et al. (2014) calculated the greenhouse gas (GHG) footprint of SAF produced from the Advanced Fermentation (AF) pathway and suggested that renewable jet fuel's GHG emissions range from -27.0 to 89.8 gCO₂e/MJ (Sharma & T, 2021). This wide range indicates the potential for significant emissions reductions but also highlights the variability depending on production methods. Research by Han et al. (2017) indicated that replacing conventional jet fuel with SAF could lower GHG emissions by 16-73%, subject to feedstock choice and conversion pathways (Sharma & T, 2021). Staples et al. (2018) further projected that SAF has the potential to reduce lifecycle GHG emissions from the aviation industry by up to 68% by 2050, but only if policies are introduced to incentivize the use of bioenergy and waste feedstocks for SAF production over other alternative uses (Sharma & T, 2021).

C. Challenges in SAF Implementation

Despite its potential benefits, SAF adoption faces several challenges:

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- *Cost Competitiveness*: SAF currently costs at least twice as much as traditional jet fuel, posing a significant barrier to widespread adoption (KPMG International, 2024).
- *Feedstock Availability*: Securing sustainable feedstocks for SAF production in sufficient quantities is a major challenge, particularly in arid regions like the UAE (National Renewable Energy Laboratory, 2024).
- *Regulatory Uncertainty*: The industry faces delay due to uncertainty around regulations and certification processes. Harmonization of global standards for SAF production and use remains a work in progress (National Renewable Energy Laboratory, 2024).

D. SAF Initiatives and Targets

Several global initiatives aim to accelerate SAF adoption:

- The Clean Skies for Tomorrow Coalition aims to accelerate the supply and use of SAF technologies to reach 10% of global jet aviation fuel supply by 2030 (KPMG International, 2024).
- The "Making Net-Zero Aviation Possible" strategy, endorsed by major global aviation leaders, outlines how the aviation sector can reach net-zero emissions by 2050 (KPMG International, 2024).
- Many airlines have individually committed to reaching net-zero emissions by 2050, including major carriers like Delta, United Airlines, British Airways, and Qantas (KPMG International, 2024).

3. Research Questions

This study aims to address the following research questions:

- What is the projected economic impact of SAF adoption on commercial airlines in the UAE by 2030?
- How does the development of a SAF industry align with the UAE's economic diversification goals?
- What are the primary challenges facing SAF adoption by commercial airlines in the UAE, and how do industry stakeholders propose to address them?
- How can policymakers and industry leaders in the UAE facilitate successful SAF adoption while balancing economic and environmental considerations?

4. Research Methodology

This study employs a mixed-methods approach, combining quantitative economic analysis with qualitative insights from industry reports and peer-reviewed literature. The methodology includes:

- *Literature Review*: A comprehensive review of peer-reviewed journal articles, industry reports, and government publications on SAF adoption and its economic impacts.
- *Economic Modeling*: Utilizing available data on SAF production costs, projected adoption rates, and economic

indicators to model the potential impact on UAE commercial airlines.

- *Policy Analysis*: Examining existing and proposed policies related to SAF adoption in the UAE and comparable markets.
- *Case Studies*: Analyzing successful SAF implementation strategies from other regions to identify best practices applicable to the UAE context.

5. Data Analysis

A. SAF Production and Adoption Trends

Global SAF production is projected to grow significantly:

- SAF production doubled in 2023 to over 600 million liters and is expected to reach nearly 1.9 billion liters in 2024 (KPMG International, 2024).
- The U.S. government has announced a SAF Grand Challenge with goals to reach 3 billion gallons of SAF domestic production annually by 2030, and 35 billion gallons per year by 2050 (Sharma & T, 2021).

B. Cost Analysis

The cost of SAF remains a significant challenge for commercial airlines:

- Current SAF production costs range from \$6.4 to \$19.01 per gallon, which is two to seven times more expensive than traditional jet fuel (Yachao, 2024). In 2024, the airline industry is paying around \$2,350 per tonne for SAF, approximately 3.1 times the price of conventional jet fuel (Yachao, 2024).
- For 2025, SAF is estimated to cost \$2,500 per tonne, 3.8 times the price of conventional jet fuel (Yachao, 2024).

C. Environmental Impact

Studies have shown significant potential for emissions reduction through SAF adoption:

- Replacing conventional jet fuel with SAF could lower GHG emissions by 16-73%, depending on feedstock choice and conversion pathways (Sharma & T, 2021).
- SAF has the potential to reduce lifecycle GHG emissions from the aviation industry by up to 68% by 2050 (Sharma & T, 2021).
- A recent transatlantic flight using 100% SAF showed a 95 tonnes CO₂e reduction and around a 40% reduction in particulate matter emissions compared to a standard flight (KPMG International, 2024).

6. Findings

A. Economic Impact

The adoption of SAF by commercial airlines in the UAE is projected to have significant economic implications:

Investment Requirements: Producing substantial quantities of SAF will require significant investment in production facilities and infrastructure.

Job Creation: The development of a SAF industry is expected to create new jobs across the value chain, from feedstock

production to fuel manufacturing and distribution.

Export Potential: As a regional leader in aviation, the UAE has the potential to become a major SAF exporter, benefiting the local economy.

B. Challenges for UAE Commercial Airlines

Cost Burden: The higher cost of SAF compared to conventional jet fuel poses a substantial economic challenge for airlines, potentially impacting ticket prices and profitability.

Feedstock Availability: The UAE's arid climate presents challenges for biomass-based SAF production, necessitating innovative approaches to feedstock sourcing.

Infrastructure Development: Significant investment in SAF production and distribution infrastructure will be required to meet adoption targets.

C. Opportunities

First-Mover Advantage: UAE-based airlines could gain a competitive edge by leading in SAF adoption and positioning themselves as environmentally responsible carriers.

Technological Innovation: The UAE has the opportunity to become a leader in innovative SAF production methods suitable for arid climates, such as power-to-liquid technology.

Alignment with National Goals: SAF adoption aligns with the UAE's economic diversification strategies and sustainability commitments.

7. Discussion

The findings of this study reveal both the potential benefits and significant challenges associated with SAF adoption by commercial airlines in the UAE. While the environmental benefits of SAF are clear, with potential GHG emissions reductions of up to 68% by 2050 (Sharma & T, 2021), the economic implications are more complex. The cost premium of SAF, currently 2-7 times higher than conventional jet fuel (Yachao, 2024), presents a substantial barrier to widespread adoption. This cost differential could significantly impact airline operating costs and potentially lead to higher ticket prices, affecting competitiveness in a price-sensitive market. However, the projected growth in global SAF production and ongoing technological advancements suggest that costs may decrease over time, potentially improving the economic viability of SAF for commercial airlines. The UAE's unique geographic and climatic conditions present both challenges and opportunities. While the arid climate poses difficulties for biomass-based feedstock production, it also creates an impetus for innovation in SAF production methods. The development of technologies such as power-to-liquid SAF, which could leverage the UAE's abundant solar resources, represents a potential area for the UAE to establish leadership in sustainable aviation technology. The alignment of SAF adoption with the UAE's broader economic diversification and sustainability goals is a significant factor. By investing in SAF production and adoption, the UAE could create new industries, generate employment opportunities, and position itself as a regional hub for sustainable aviation. This aligns with initiatives such as UAE Vision 2021 and UAE Centennial 2071, which emphasize

economic diversification and sustainability. However, several research gaps remain:

Long-term Economic Viability: Further research is needed to assess the long-term economic viability of SAF production and use in the UAE context, considering factors such as technological advancements, economies of scale, and potential policy interventions.

Policy Frameworks: There is a need for comprehensive analysis of effective policy frameworks to support SAF adoption in the UAE, balancing economic incentives with environmental goals.

Lifecycle Analysis: More detailed lifecycle analyses specific to the UAE context are required to accurately assess the full environmental and economic impacts of SAF adoption.

Market Dynamics: Further study is needed on how SAF adoption might affect market dynamics in the highly competitive aviation industry, particularly in the context of the UAE as a global aviation hub.

8. Conclusion

The adoption of SAF by commercial airlines in the UAE presents a complex landscape of challenges and opportunities. While the environmental benefits are clear, the economic implications require careful consideration and strategic planning. The success of SAF adoption will depend on a combination of technological advancements, supportive policy frameworks, and innovative approaches to overcome the unique challenges posed by the UAE's geographic and economic context. To facilitate successful SAF adoption, policymakers and industry leaders should consider:

- Implementing financial incentives and risk-sharing mechanisms to bridge the cost gap between SAF and conventional jet fuel.
- Investing in research and development, particularly in feedstock production methods suitable for arid climates and innovative SAF production technologies.
- Developing a clear regulatory framework that aligns with international standards while addressing local context.
- Promoting public-private partnerships to leverage expertise and resources across sectors.
- Exploring the potential for the UAE to become a regional leader in SAF production and export.

By addressing these challenges and capitalizing on its strategic advantages, the UAE can potentially establish itself as a global leader in sustainable aviation, contributing significantly to the decarbonization of the aviation industry while driving economic growth and diversification. However, this will require a concerted effort from all stakeholders, including government entities, airlines, fuel producers, and research institutions.

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Procurement & Contracts at flydubai, he has successfully led engine acquisition and maintenance programs, negotiated cost-effective agreements, and achieved significant cost savings for the airline. Mr. Das holds a Master's degree in Procurement, Logistics, and Supply Chain Management from the University of Salford, UK, and a Bachelor's degree in Mechanical Engineering from Gauhati University, India. He is a Chartered Member of CIPS (UK), designated as Chartered MCIPS, and a Fellow of the Chartered Institute of Logistics and Transport (FCILT, UK). His expertise spans lifecycle cost analysis, strategic sourcing, and procurement optimization within the aviation sector.

Biography

Chandan Das is a Strategic Procurement Expert with over 27 years of experience in aviation engineering procurement. As Senior Manager – Aircraft