“Identifying Emission Reduction Initiatives Across Major U.S. Airlines”

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HNRS 2000: Research & Exhibition

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December 12, 2021

Abstract

Carbon emissions related to commercial aviation are expected to increase by 300 – 700% by 2050. Various airlines have adopted strategies for minimizing these emissions, including fleet optimization and utilizing sustainable aviation fuels (SAFs). Through an analysis of the annual reports of ten major U.S. airlines, this research project will identify sustainability initiatives currently in place, compare the adoption of these initiatives across different airlines, and analyze the progression of previous initiatives over the last decade. The project will conclude with a discussion as to whether the current policies in place will be impactful enough to meet federal emission guidelines set for 2050.

Introduction

Aviation is amongst the most energy-intensive forms of consumption, accounting for a significant proportion of global emissions. The climate impact of aviation is mainly based on the emission of various substances into the atmosphere, including carbon dioxides, nitrogen oxides, and aerosols. Research indicates that the impact of air transport on climate change may be several times greater than the emission of greenhouse gasses alone, mainly due to the emission of other gasses in addition to carbon dioxide (Cowper-Smith & de Grosbois, 2011). NO_2 emissions can contribute quite strongly to climate issues, making fuel burn more costly than traditional sources of emissions. Individuals must also consider how aircraft primarily deposit emissions directly into a more climate-sensitive region of the upper atmosphere, as opposed to at ground level. At an altitude of 10,000 meters, fuel can be up to ten times more toxic for the environment (Cowper-Smith & de Grosbois, 2011). Compared to emissions stemming from other forms of transportation, those from aviation arguably present the greatest risk towards a sustainable future.

As of 2018, the aviation sector accounted for approximately 12% of transport-related emissions and 2% of all human-induced emissions (Müller, 2018). Aviation's share of emissions will continue to rise as more people and goods fly in the near future. Since 2005, global aviation emissions have increased by 70%, mainly due to significant increases in passenger traffic (Amankwah-Amoah, 2020). Demand for commercial aviation is expected to triple between 2020 and 2050, contributing even further to the growing proportion of emissions attributable to aviation (Gössling & Humpe, 2020). The aviation industry's contributions to the growing climate change crisis will soon reach a point in which the damage will be irreversible. To prevent this development from unfolding, measures designed to address climate issues must be implemented as soon as possible.

A transformation to a zero-carbon aviation sector will require coordinated innovation and leadership from the federal government, aircraft manufacturers, airlines, fuel producers, and airports. The International Air Transport Association (IATA) has established a four-pillar collaborative strategy based on (1) fuel-efficient aircraft technologies, (2) efficient flight operations, (3) improved airspace and airport infrastructure, and (4) market-based instruments (Müller, 2018). Following pressures from important stakeholders, airlines around the globe have begun to embrace these short-term and long-term environmentally sustainable practices. Across the industry, various strategies have been introduced, including upgrading to environmentally friendly aircraft and adopting fuel-efficient technologies. Unfortunately, a large share of emissions is still unaccounted for in global mitigation plans for aviation. Through an analysis of the fleet optimization and fuel enhancement policies within the U.S. aviation market, which accounts for roughly a quarter (25.6%) of global air transport, gaps in policy coverage may be located, and solutions can be recommended (Gössling & Humpe, 2020).

Sustainability Measures (Fleet Optimization)

An airline's costs are driven primarily by its fleet selection and flight schedule. Fleet selection determines a majority of an airline's capital costs, while also driving fuel burn rates (Baldanza, 1999). Because of this, decisions related to fleet building possess profound weight. Since 2009, the aviation industry has spent nearly $1 trillion to acquire over 12,000 new aircraft (Amankwah-Amoah, 2020). The introduction of an emission target may stimulate even more investments in modern, energy-efficient aircraft. This new generation of aircraft offers technological improvements which allow for significantly less fuel to be burnt, reducing CO_2 emissions by up to 15% (Amankwah-Amoah, 2020). The costs of newer aircraft will be justified, as they create ongoing operating cost savings, as well as reduced environmental damage. However, the considerable emission reduction potential of this new aircraft generation will not be fully realized unless fleet renewal is applied to older aircraft across the industry.

Retrofits of the existing fleet can be a viable alternative to purchasing new aircraft. Retrofits not only contribute to achieving short-term CO_2 emission reductions but also bear economic potential for airlines. Requiring only small investments, retrofits can make significant contributions to achieving short-term emission targets at reasonable costs. Retrofit options include blended winglets, electric taxiing, cabin weight reduction, and re-engining (Müller, 2018). Modifications can typically be installed during routine maintenance checks, taking little time to be implemented. Applying any combination of the four retrofit options previously mentioned can reduce emissions anywhere from 2% to 15% (Müller, 2018). In order to meet upcoming federal emission guidelines, airlines must begin escalating efforts to modernize their fleets. A goal of this project will be to analyze the prevalence of retrofitting across the industry, as well as identifying airlines that prioritize purchasing the newest generation of aircraft.

Sustainability Measures (Development of SAFs)

Aviation fuel has long been a significant component of an airline's carbon footprint. Recently, alternatives to traditional forms of petroleum-based fuels have been explored, with sustainable aviation fuel (SAF) emerging as a viable option for future use. SAF is made from renewable biomass and waste resources, including corn, grain, oilseeds, algae, fats, oils, greases, agricultural residues, forestry residues, wood mill waste, municipal solid waste streams, wet wastes, and dedicated energy crops (U.S. Department of Energy Bioenergy Technologies Office). It holds the potential to deliver the same performance as traditional jet fuel but with a fraction of its carbon footprint. Compared to fossil fuels, SAF can reduce emissions by up to 80% (Reichmann, 2021). SAF has also caught the attention of those within the aviation industry due to its "drop-in" characteristics, which allow it to be blended with Jet A and used in aircraft without the need for modifications (Reichmann, 2021). These benefits have caused many companies to cite SAF as a major part of their strategy for achieving net-zero emissions.

Production of SAF has been unable to match recent demand. The airline industry hopes to have two billion gallons of SAF in the market by 2030, however, current domestic production is only 4.5 million gallons per year (U.S. Office of the Press Secretary). Limited supply has contributed to SAF making up less than 1% of available fuel in the market, which in turn has caused SAF to cost up to four times more than conventional jet fuel (Reichmann, 2021). These margins do not make SAF an economically sustainable option for airlines at the given moment. Only through a combination of policy incentives, capital investments, time, and collaboration will these types of fuels become an effective sustainable solution for the industry. Progress has already gotten underway, with private corporations, airports, airlines, and the federal government all working together to make extensive SAF use a reality.

Research Methodology

This research will identify specific emission-reducing initiatives implemented by ten major U.S. airlines, analyze the effectiveness of these strategies, quantify the progress that's been made over the last decade, and determine whether the measures currently in place will be sufficient enough to meet federal emission guidelines set for 2050. Initiatives related to sustainable aviation fuels (SAFs) and fleet optimization will be the primary focus of the project. Data will be collected from airlines' Corporate Social Responsibility (CSR) or Environmental, Social, & Governance (ESG) reports. These documents will be accessed from the Sustainability Accounting Standards Board (SASB) website for airlines who adhere to SASB standards. As of November 2021, only 6 of the airlines included in this study reported on sustainability measures in this fashion. If an airline has chosen to ignore SASB reporting principles, CSR/ESG reports will be accessed from the public websites of these airlines.

The ten largest U.S. mainline passenger airlines were selected for involvement in this study, which includes Alaska Airlines, Allegiant Air, American Airlines, Delta Air Lines, Frontier Airlines, Hawaiian Airlines, JetBlue, Southwest Airlines, Spirit Airlines, and United Airlines. Together, these airlines accounted for approximately 78% of the U.S. Domestic Market Share in 2018 (Bureau of Transportation Statistics). The most recent annual reports available as of November 2021 will be examined for each airline. This includes reports for the following periods:

1 January 2021 to 31 December 2021: Alaska Airlines, Delta Air Lines, Frontier Airlines

1 January 2020 to 31 December 2020: American Airlines, Hawaiian Airlines, United Airlines, Allegiant Airlines

1 January 2019 to 31 December 2019: JetBlue, Southwest Airlines, Spirit Airlines

Measures

The research measures for this project were inspired by a 2010 study comparing the adoption of CSR practices across the airline industry (Cowper-Smith & de Grosbois, 2011). These measures will allow for data to be analyzed using a qualitative content method. Initiatives identified by the preliminary data analysis will be organized into two categories: Fleet Optimization & Biofuel Development. These categories will be divided into four themes: Emissions, Energy, Waste, and Noise. Under each theme, specific goals will be identified. The number of airlines reporting a commitment to each goal will be recorded, as well as measurements related to the contributions made towards achieving these goals. If an airline provides information about the specific initiatives implemented to reach a given goal, this data will also be collected. The classification and collection of information in this manner will allow for meaningful results to be extracted from the data.

Expected Findings

Over the course of this research project, I expect to discover a number of significant findings. Outside pressures have forced the aviation industry to take a more proactive stance on environmental issues. Because of this, I believe every airline will report at least some form of emission reduction policy. However, certain groups of airlines will have implemented more initiatives than others. I expect that Full-Service Network Carriers (FSNC) will perform better than Low-Cost Carriers (LCC) in terms of sustainability initiatives. Full-Service Network Carriers tend to invest more money into aircraft operations, whereas Low-Cost Carriers cut costs wherever they can. In the context of this study, this means Alaska, American, Delta, Hawaiian, Jetblue, and United should perform substantially better than Allegiant, Frontier, Southwest, and Spirit.

I also expect to find considerable sustainability progress compared to ten years ago. Various environmental policies have now been in place for multiple years, with the effects of these changes most likely reflected by reduced emission levels. Even with this potential progress, I believe the industry has not done enough in order to meet proposed emissions guidelines. The Biden Administration recently released new expectations for the industry as part of the Build Back Better agenda, which included reaching net-zero greenhouse gas emissions by 2050 (U.S. Office of the Press Secretary). The aviation sector has historically struggled to even remotely approach net-zero carbon emissions, and recent developments have not indicated this trend will change anytime soon. More action will be necessary to meet these guidelines in the future.

Conclusion

As the issue of climate change continues to worsen, society must begin seriously exploring potential remedies for this alarming situation. This includes minimizing carbon emissions from the aviation industry. Multiple strategies have already been recommended to airlines, including fleet optimizations and the development of sustainable aviation fuels. As these types of initiatives continue to be implemented, it will be important to monitor the progress of the industry as a whole, as well as hold each airline accountable for its actions. By identifying holes in policy coverage and providing recommendations to airlines, this project will contribute to these conversations of progress and accountability. At the end of the day, it will take a unified, collective effort to create a more sustainable environment. I hope this project is able to make a difference in these efforts.

References

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Budget

In terms of funding, this project will not require significant resources. An experiment designed to conduct physical research is not necessary in this context, saving outside investors considerable sums of money. All of the required research can be conducted online via free websites or databases. Therefore, there will be no materials expenses for this project.

The budget will be primarily composed of labor costs. In order to fairly compensate myself for the time I'll spend on the project, I've decided to log the total amount of hours worked. For each hour I work, the compensation rate will be $21. This is 1.5 times the current minimum wage for the state of California. I expect to have worked approximately 100 hours on the project upon completion. Therefore, labor costs for this project will equal roughly $2100.

Materials: $0

Labor: $2100

Total Budget: $2100

Timeline

Week 0

Development of Research Project

Initial Research (20HRs)

Proposal Draft (10HRs)

Presentation Draft (5HRs)

35 Hours Total

Week 1

Conduct Research On 5 Airlines (2HRs Each)

10 Hours Total

Week 2

Conduct Research On Remaining 5 Airlines (2HRs Each)

10 Hours Total

Week 3

Analyze Data Using Previous Measures (10 HRs)

Develop Results (5 HRs)

15 Hours Total

Week 4

Compose Research Manuscript (20 HRs)

Compose Presentation On Research Results (10 HRs)

30 Hours Total

Total Time Expectation: 100 Hours

Expected Project Duration: 4 Weeks (1 Month)