Analysis on Emission Reduction Strategies of Chinese Airlines Under the Dual Carbon Goals

Yadi Guo

School of Transportation Science and Engineering, Civil Aviation University of China, No. 2898, Jinbei Road, Dongli District, Tianjin, China
2019071052@cauc.edu.cn

Abstract: The carbon emission reduction work of the air transport industry under the dual carbon goals is an inherent requirement to achieve sustainable and high-quality development of transportation, and it has also attracted more and more attention from the society. Airlines, as the most important carbon emitters in the air transport industry, put forward higher requirements for their green development level by putting forward the dual carbon targets. Based on the current background of the green development of China’s civil aviation and the emission reduction strategies currently adopted by airlines, this paper puts forward the existing problems and challenges and then puts forward relevant countermeasures and suggestions.

Keywords: Dual carbon goals, Green development, Emission reduction strategies, Countermeasures and suggestions.

1. Introduction

On October 24, 2021, the “Opinions of the Central Committee of the Communist Party of China and the State Council on Completely, Accurately and Comprehensively Implementing the New Development Concept and Doing a Good Job in Carbon Peaking and Carbon Neutralization” was released, putting forward more specific requirements for accelerating the construction of a low-carbon transportation system. Although the aviation industry’s carbon emissions account for a small proportion of all industries in the world, the growth rate is relatively fast[1]. And because aviation carbon emissions are directly discharged into the stratosphere, the impact on the greenhouse effect is more direct. Therefore, the emission reduction of the air transport industry under the dual-carbon goal is an inherent requirement to achieve sustainable and high-quality development of transportation, and it has also attracted more and more attention from the society. As the main body of carbon emission in the air transport industry, airlines undertake the heavy responsibility of emission reduction. Therefore, this paper selects the energy saving and emission reduction strategies of airlines for key analysis.

At present, the research on the carbon emissions of airlines mostly focuses on the factors affecting carbon emissions and the measurement of efficiency. Using a Structural Equation Modeling (SEM) approach to determine the factors influencing the Greenhouse Gas (GHG) Emission Reduction Potential (ERP) in air transport, Singh found aircraft technology and design, aviation operations and infrastructure, socioeconomic and political measures, and alternative Fuel and fuel properties are key influencing factors in reducing greenhouse gas emissions[2]. Gantian measured the static and dynamic efficiency of carbon emissions of 13 airlines, and put forward relevant suggestions to improve carbon emissions efficiency[3]. Gong Yanfeng et al. analyzed the transportation efficiency of airlines on the basis of considering carbon emission constraints and technical heterogeneity of airlines[4]. Li Long conducted a static and dynamic analysis of the environmental efficiency of 20 airlines in China, and conducted a regression analysis on the factors that affect the environmental efficiency of airlines[5]. Miyoshi and Merkert calculated and compared the carbon emission efficiency of 14 major European airlines during 1986-2007, and found that there is a significant negative correlation between the carbon emission efficiency and unit cost of airlines[6]. Zheng Yuting et al. divided the operation process of airlines into two sub-processes of energy utilization and carbon emission, and applied the virtual frontier network SBM model to measure the total efficiency of 13 airlines in the Asia-Pacific region, and calculated the single factor efficiency of energy and environment[7]. Zhou et al. proposed a policy framework for reducing emissions from civil aviation, including a carbon tax on aviation fuel, R&D support to improve fuel efficiency, and a carbon offset program[8].

In this context, this paper first analyzes the current development status of China’s civil aviation industry, and then combines the emission reduction measures of Chinese airlines, analyzes the current shortcomings and challenges in the process of emission reduction, and finally puts forward relevant suggestions for airlines to reduce emissions.

2. The Overall Development Trend of China’s Civil Aviation Industry and the Status Quo of Carbon Emissions

2.1 The Overall Development Trend of China’s Civil Aviation Industry

China’s civil aviation is in a stage of rapid development, and the passenger volume is increasing year by year. Although the growth rate of cargo and mail turnover is slower than that of passenger traffic, it is also showing a growth trend as a whole, and air services are gradually becoming more popular. In 2019, China’s civil aviation completed a total transportation turnover of 129.325 billion ton-kilometers, passenger turnover of 1.170530 billion person-kilometers, passenger transport volume of 659.9342 million person-times, cargo and mail turnover of 26.320 billion ton-km, and cargo and mail transport volume of 7.5314 million tons. As shown in Figure 1, from 2009 to 2019, the growth rate of China’s civil aviation
passenger turnover has maintained a steady growth rate of about 10% at a medium-to-high rate. Although the growth rate has declined in recent years, it is still higher than the national average GDP growth rate. As shown in Figure 2, China’s cargo and mail turnover has maintained positive growth in the past five years, and since 2010, it has always remained above 15 billion ton-kilometers. By the end of 2019, there were 230 navigable cities in my country, with a total of 5,521 scheduled flight routes. There are 233 airports with regular flights in my country, of which 37 are airports with passenger throughput of 10 million, accounting for 83.6% of the national total. The continuous increase in the number of airports, navigable cities and routes has expanded the coverage of China’s domestic airline network, making China’s air transport network increasingly complex. The market size and growth rate of China’s civil aviation industry determine that China is the most important driving force in the current and future global air transport market.

As shown in Figure 4, the growth rate of the total carbon emissions of Chinese aviation companies showed a fluctuating growth trend from 2011 to 2017, and the growth rate was above 10% from 2013 to 2017. The growth rate of total carbon emissions in 2018 and 2019 began to decline, which shows that as China’s civil aviation attaches great importance to carbon emissions, and in 2019, the monitoring, reporting and verification of carbon dioxide emissions from aviation activities of Chinese airlines was launched for the first time in 2019. During the verification work, various airlines have adopted a series of energy-saving and emission-reduction measures, which have effectively increased the fuel efficiency of aircraft and reduced the growth of carbon emissions caused by aircraft activities.

However, at present, airlines still face many problems and challenges in terms of technology and operation, national policies and international situation to reduce emissions. A series of improvement measures are needed to improve fuel efficiency and resource allocation in order to achieve the goal of low-carbon flight.

The total turnover of China Civil Aviation from 2009 to 2019 is shown in Figure 3. It can be seen from the figure that there is a strong correlation between the fuel consumption and turnover of my country’s air transport industry, and the trend lines of the two are relatively consistent, which shows that with the scale of air transport increases, the fuel consumption also increases. Fuel combustion produces carbon dioxide, so an increase in jet fuel consumption usually means an increase in CO₂ emissions. At present, CO₂ emissions are usually calculated according to the guidance method proposed by The Intergovernmental Panel on Climate Change (IPCC). The formula is as follows:

\[ E = AD \times EF \]  

In the formula, AD is the fuel consumption, and the data is taken from “Civil Aviation from Statistics”; EF is the emission factor. In this paper, the aviation fuel emission factor is taken as 3.15[9].

Figure 1: Growth of China’s civil aviation passenger turnover from 2000 to 2019

Figure 2: Growth of China’s civil aviation cargo and mail turnover from 2000 to 2019

2.2 Current Situation of Carbon Emissions from Civil Aviation in China

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Figure 3: Trend chart of China’s total air transport turnover and aviation fuel consumption

Figure 4: Growth of total carbon emissions from air transport in China

3. Problems and Challenges Faced by Airlines in Reducing Emissions

3.1 The Construction of the Civil Aviation Carbon Emission Big Data Platform Needs to be Further Promoted

Since the carbon emissions of civil aviation are mainly related to aircraft flight activities, and the amount of information of
flight activity data is huge, relying on traditional manual data management and analysis methods can no longer meet the existing development requirements of enterprises. At present, major airlines have completed the construction of the flight activity big data system, and can analyze the flight operation quality based on the data platform. However, there is still a lack of ability to analyze flight data, and it is impossible to coordinate the effective use of resources, especially the lack of effective connection between flight data and airline emission reduction, and it is impossible to analyze the fuel consumption of different aircraft types and different flight stages. Efficiency for refined management. Due to the limitations of their own development capabilities and resources, some small and medium-sized airlines still have the problem of imperfect information system construction, resulting in insufficient data integrity, continuity and accuracy, which not only reduces work efficiency but also directly affects subsequent carbon emissions, monitoring, reporting and verification processes.

3.2 The Degree of Specialization of the Talent Team for Carbon Emission Management of Airlines Still Needs to be Improved

As the aviation department’s emission reduction is a systematic project, which involves all aspects of airline operations, such as aircraft technical modification and operational technology improvement, construction of carbon emission management information systems, and follow-up of domestic and international carbon emission reduction policies and measures, therefore it is necessary to build a team of high-quality compound talents that can be in line with international standards, with comprehensive professional coverage. As the issue of emission reduction by airlines has only been paid more and more attention in recent years, airlines generally have the problems of insufficient staffing of carbon emission management personnel, low degree of professionalism of personnel, and insufficient communication and coordination with personnel from other departments. In terms of talent training, there is currently a lack of a mature and reasonable training system for carbon emission management personnel, and insufficient investment in corporate training funds, resulting in a slow growth rate of talents, which cannot provide effective support for future airline companies’ emission reduction work.

3.3 The Complex Types of Models Increase the Difficulty of Emission Reduction

Due to historical reasons, many large and medium-sized domestic airlines currently have two or more different types of aircraft, including old aircraft and high-energy-consuming aircraft. The simultaneous operation of different aircraft types not only increases the complexity of airline management, but also makes it difficult for airlines to reduce emissions. Looking at the airlines with the leading green development ability in the world, they usually regularly review the emission reduction performance of the existing fleet, introduce aircraft with high fuel efficiency, continuously update their fleet and eliminate old aircraft, so as to keep the fleet young and efficient.

3.4 The Proposal of CORSIA Mechanism Brings Severe Challenges to Airlines

In October 2016, the 39th ICAO Assembly adopted a resolution on the implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), the world’s first industry-wide market mechanism for reducing emissions. Since the CORSIA mechanism is a distribution mechanism based on the “grandfather principle”, that is, its offset is based on the increment of carbon emissions and does not take into account the growth space of developing countries. Serious challenge[10]. If corsia mechanism is added, the offset amount of CO2 emitted by Chinese airlines will be much higher than that of airlines in developed countries with the same scale, which will have a negative impact on the international market competitiveness and income level of Chinese Airlines[11,12].

4. The Countermeasures and Suggestions for Airlines to Reduce Emissions

4.1 Improve the Carbon Emission Management Information System and Improve Data Governance Capabilities

It is necessary to build a complete data management information system to ensure the integrity and accuracy of carbon emission data to meet the requirements of all aspects of the carbon emission MRV system (monitoring, reporting, and verification). First, optimize various information management systems of airlines, improve data quality, improve the efficiency of information flow, and strengthen the monitoring of abnormal and fluctuating values during flight operations. Then, the various data management information systems of the airline are connected with the carbon emission management system. Then connect various data management information systems of the aviation company with the carbon emission management system, deeply analyze the flight quality, operation quality and aircraft health through the collection and processing of the data of the whole process of flight operation, strengthen the effective analysis and utilization of the data, and carry out the fine management of the whole process of aircraft fuel efficiency. With the improvement of data management ability, the goal of improving aircraft fuel efficiency and reducing carbon emissions in flight and ground operation can be achieved.

4.2 Establish Carbon Emission Management and Technology Research and Development Departments, and Increase Talent Introduction and Training

Establish a carbon emission management department to implement overall and centralized management of emission reduction work, and strengthen coordination with various departments to jointly promote the effective implementation of emission reduction work. Introduce high-end management and technical talents with carbon emission related knowledge, strong innovation and forward-looking, build a high-level emission reduction work team, and promote the steady development of green development work. Strengthen the emphasis on energy saving and emission reduction technology work, increase investment in technological
innovation, set up emission reduction technology research and development departments, and study emission reduction technology measures suitable for the development of airlines according to their own characteristics. For example, reduce flight resistance, reduce aircraft weight and improve engine efficiency through aircraft transformation, save fuel cost and improve aircraft operation efficiency through route optimization, corner cutting and straightening. Tracking the latest trends of domestic and international aviation carbon reduction technology, qualified aviation companies can cooperate with sustainable fuel manufacturers to jointly develop sustainable aviation fuel (SAF), and commercialize it after achieving results, so as to improve the competitiveness of aviation companies.

4.3 Improve the Efficiency of Resource Allocation and Realize the Whole Process of Emission Reduction

First, optimize the fleet structure in a planned way, reduce the types of aircraft, eliminate old aircraft and high energy consuming aircraft, and introduce new aircraft with high fuel efficiency to reduce emissions from the source of flight operation. Second, improve the operation capacity, lean plan the route network, carefully plan routes and flights, and encourage crew members to make full use of opportunities to save fuel, build carbon neutral flights and reduce carbon in the whole life cycle by setting up fuel-saving awards and performance appraisal. Third, strengthen exchanges and cooperation with the airport, air traffic control and other relevant departments, optimize the ground taxiing path, reduce the aircraft ground taxiing time, replace the ground support vehicles with electric vehicles, and replace APU (auxiliary power unit) with bridge mounted power supply unit (GPU) to reduce carbon emissions.

4.4 Deeply Participate in the Construction of Carbon Market and Trading System

On July 16, 2021, the online trading of the national carbon emission rights trading market was officially launched, and it was included in the key emission units of the power generation industry. With the development and improvement of my country’s carbon market trading mechanism in the future, emission units related to the transportation industry will also participate in it. Airlines should turn passive into active. First, they should actively participate in and study the carbon market, understand the operation mechanism of the carbon market, and the formulation and operation rules of CORSIA and other international aviation emission reduction mechanisms, and actively cooperate with the industry authorities in emission reduction. The second is to explore the construction of a carbon asset management system, strengthen carbon asset management capabilities, deepen industry-university-research cooperation with universities and research institutes, and innovate carbon asset and carbon finance management models.

5. Conclusion

The proposal of the dual carbon goal has brought both challenges and opportunities for the development of Chinese airlines. Through the analysis of the status quo of airlines’ emission reduction, this paper finds that there is room for improvement in my country’s aviation carbon emission data management, talent team construction, and complex fleet structure. At the same time, the CORSIA mechanism has also brought development pressure to my country’s airlines. Based on the above problems and challenges, this paper proposes corresponding countermeasures to provide a reference for Chinese airlines to achieve sustainable development and help the country achieve carbon peaking and carbon neutrality goals.

References