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Strategies for the Further Development of Sustainable Culture at Xiamen Airlines in Response to Changes in China's Carbon Neutrality Policy

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Abstract: *Carbon-neutral policy has always been a main goal of the Chinese government, and airlines across the country are important players to achieve the goal of carbon neutrality as airlines has been one of the major polluters across various industries. As the country tightens its environmental regulations and strives for carbon neutrality by 2060, the airline has gradually implemented strategies to align with these goals. Where they have adopted more fuel-efficient aircraft, investment in sustainable aviation fuel (SAF), and the implementation of carbon offset programs. Additionally, Xiamen Airlines has also strengthened its corporate culture by promoting sustainability training for employees and engaging passengers in eco-friendly initiatives. The paper would mainly focus on the actions Xiamen airline has done and compare with other airlines, making economic interpretations to see the potential cost and benefits as well as giving out advice on what they can done.*

Keywords: *Airline Industry, Sustainability, Environment, Carbon Neutral*

1. Introduction

In 2021 there were 153 billion tonnes of CO_2 emitted worldwide, and China has cast a total of 10.15 billion tonnes of CO_2, which were new records for the 21st century. As there has been a large number of carbon emissions in China caused by mass industrialization over the past two decades, the Chinese government has proposed a primary strategy for reducing carbon emissions. Therefore, in the future 10-year period, industries will have a massive change in emission regulations. It is worth the research on developing measures and policies to reduce pollution inside enterprises. Statistics have shown that the airline industry is responsible for nearly 3% of global carbon dioxide emissions, which would demand airline firms to start to take actions in reducing emissions [1]. Taking Xiamen Airlines as an example, carbon neutrality brings many challenges to airlines and related industries. It also provides many opportunities and is conducive to promotion. Figure 1 is a graph which demonstrates the amount of pollution in relation to the number of flights executed in the EU region. It demonstrated that Italy had done the best job reducing carbon for countries with 30,000 flights per month. Only about 900,000 tonnes of carbon emissions were emitted from approximately 63000 flights, which could serve as a good example for other countries to follow [2].

However, the past research on carbon reduction in the aviation industry was more focused on the macro scale such as the aviation emissions in a country’s scale rather than specify into individual firms, resulting in a lack of necessary case studies into airline firms on how they have done in reducing emissions. Therefore, by studying Xiamen airline's case, this article would provide a specific vision of achieving carbon-neutral goals for the aviation industry. This article would contrast with various measures taken by other airlines to reduce emissions, which would be helpful to thoroughly analyze the proposal of airline departments facing challenges brought by carbon-neutral goals and unsolved problems.

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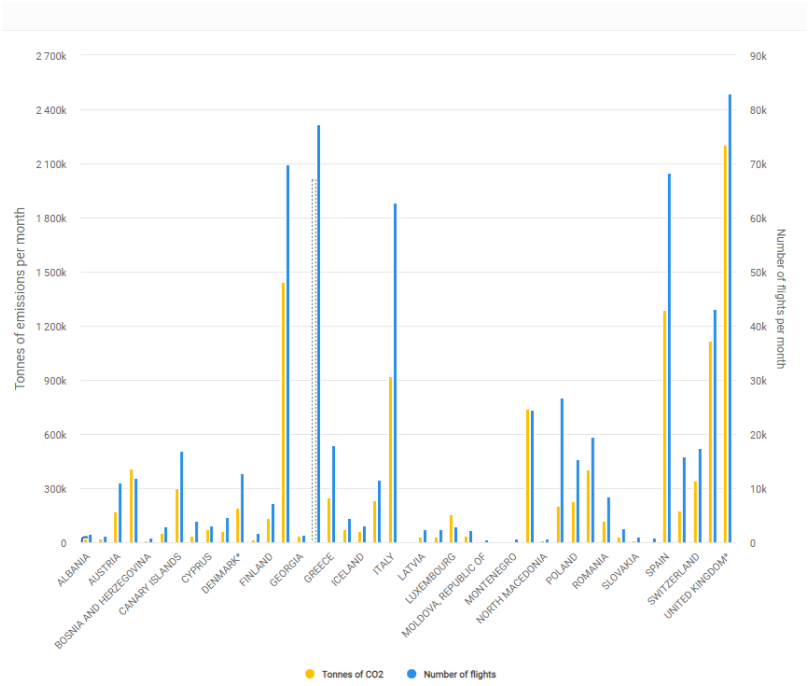

Figure 1: Level of Emissions in relation to the number of Flights (Source: https://www.eurocontrol.int/aviation-sustainability)

2. Swot analysis of Xiamen Airline

2.1 Strengths

The most significant strength the airline possesses is that it has one of the 'youngest' fleets in the Chinese civil aviation industry. With an average age of 6 years for each aircraft, there would be less maintenance needed to keep it operational. Also, it would be easier to make modifications to suit the sustainable development target better. Recently, the Skyteam alliance has held a sustainability competition to test which airline can operate on a particular route but in the most environmentally friendly way. What Xiamen Airlines has done was clean all of the aircraft before take-off. They have also tried to reduce unnecessary weights of the aircraft to maximize fuel efficiency, which has achieved a great result where 45% of carbon emissions were decreased compared to a routine flight from Xiamen to Los Angeles [3]. Since they have made a broad effort to reduce their flight's carbon footprints, it is worth talking about how they have reduced their emissions and adopted sustainable development policies, such as the "low carbon flight" and "lightweight trip" programs [4].

2.2 Weaknesses

However, some weaknesses existed inside Xiamen airline's system. Since it was funded nationally, problems such as low administrative efficiencies would occur, where levels of meetings had to be made to make the final decision. It would lead to an excess administrative cost that could be put to better use, such as investing in more ground equipment that would reduce the amount of noise and greenhouse gas emissions during the startup of an airplane.

2.3 Opportunities

There is a wide range of opportunities for Xiamen airlines since, with economic growth of 8.1 percent in 2021, there is an increasing number of people willing and able to afford air travel. With almost 40 million passengers traveling with Xiamen airlines in 2021, the numbers would likely keep increasing, providing a more significant revenue space for the airline to keep reducing its carbon emissions. Also, during this summer vacation, there was a 40-time increase in tourists compared to the winter holidays, which led to a broader profit space for the airline to gain more funds to fund their sustainable activities.

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Recently, the Skyteam alliance has held a sustainability flight competition where Xiamen airlines have managed to reduce 45% of their fuel consumption from a popular route from Xiamen to Chengdu [3]. What it does also became an advertisement opportunity for them to show society that they are taking actions to become more sustainable, which has the benefit of increasing their publicity in the long term. The reduction of carbon emissions resulted from improving technologies where more specified equipment has been developed to deeply clean the inside of the aircraft to reduce carbon emissions and the risk of an accident occurring.

2.4 Threats

One of the significant challenges faced by airlines current was that traditional energy consumption is not sustainable and could be damaging to the planet. Currently, biofuel prices are still at a high level, where they could be seven times more expensive than conventional jet fuels. This would increase the price of carbon-neutral plane tickets, resulting in fewer people choosing the more sustainable traveling method just because they have to pay more. There were cheaper alternatives besides air travel, such as high-speed railway or buses, which would also cause an impact on its private cost, which would then decrease the marginal social benefit airline companies can generate from a carbon neutral program. It may also be a limit for further sustainable development.

During the COVID-19 pandemic, strict travel regulations have been implemented domestically, where the government encourages people to make as little travel as possible. It significantly impacts the entire airline industry since most of their planes are grounded and unable to make a profit for the airlines. It also slowed Xiamen airlines' pace in getting closer to its carbon-neutral goals. Also, as there was less international travel, one of the primary sources of the airline's profit would be reduced.

3. Existing practices of Xiamen Airline

Currently, Xiamen Airlines has already undertaken several policies to help improve its sustainability position. Recently, Xiamen Airlines released a program called "Carbon neutral air tickets" it is an innovative practice of domestic banks and airlines to explore green and low-carbon travel (Figure 2). It adopts carbon offset mechanism certification, that is, the Xiamen Property Rights Trading Center entrusted by the Xiamen Branch of Industrial Bank to purchase the marine carbon sink of the main body of carbon sinks through the "Blue Carbon Fund" to offset the carbon emissions generated by passengers over a specific limit of flight-related carbon emissions. Specifically, for every "carbon neutral ticket" sold by Xiamen Airlines, Industrial Bank will purchase a particular share of marine carbon sinks [5].

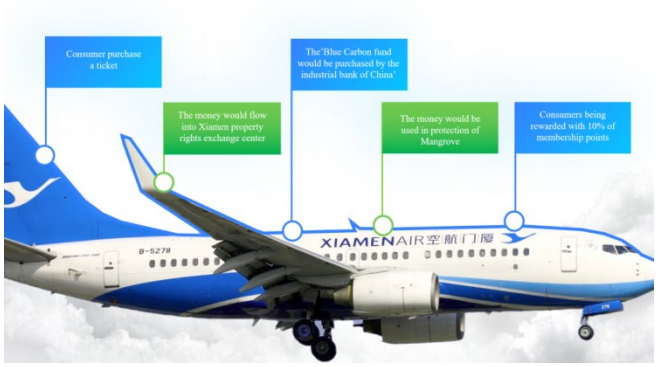

Figure 2: Process of Carbon Neutral Tickets

The Xiamen Property Rights Exchange Center conducts "carbon neutrality" certification for the corresponding tickets according to the carbon offset amount purchased by carbon sinks. The "Carbon Neutral Ticket" was sold on the Xiamen Airlines APP platform (Figure 3), covering some of the popular routes operated by Xiamen Airlines. To encourage passengers to take the initiative to reduce carbon emissions, Xiamen Airlines will give passengers who purchase "carbon neutral tickets" 10% more "Egret Points" compare to passengers who purchased a standard ticket. The extra money spent on buying carbon-neutral tickets would be invested into protecting the mangroves around the cost of the Southern Chinese region [6]. It would increase the forestation rate and restore the local natural habitat. However, there are also some limitations to this ticket offer. The most significant one is that consumers

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are unwilling to pay the extra money spent on carbon-neutral tickets.

Figure 3: Carbon Neutral Ticket on Xiamen Airlines' APP

Xiamen Air has a few plans for reducing carbon emissions from their daily flights. Some of their recent programs were the 'low carbon flight' MF8101 [7], which was put into service two days before the 2022 winter Olympic games. While on board, the flight crew would introduce to passengers the common methods that have been used in reducing carbon emissions and what the airline has done to reduce their pollution, where they would also promote to their customers their plans for future pollution reduction. Moreover, Xiamen Airlines has also released a "lightweight trip" program, which would reward passengers 2 percent of the membership points if the checked luggage was lighter than 10KG [4].

It would motivate passengers to comply with their pollution reduction idea. Furthermore, Xiamen airline has also retired their old-age aircraft, such as the Boeing 757, and replaced them with a more efficient Boeing 787. However, to shift to the new aircraft type, the airline needs to pay extra money to buy the new plane. Also, the production of a new aircraft would cause a certain amount of carbon emissions which may potentially not reduce the level of carbon emissions. Nevertheless, the increase in emissions is in a short-run case. In the long run, more emissions would be reduced due to the lower overall emissions during the operation of the aircraft. Also, the new aircraft will be used in medium and long-haul flights as their newly designed airframe, and the engine would provide the aircraft a greater fuel efficiency which would also put the airline closer to its carbon neutral goals.

4. Other Airline Companies' Practices

Currently, most of the attempts of airline firms going greener was by including greener fuel, carbon offsets, and utilizing the power of hydrogen. Launching a 300-ton plane full of people into the sky and propelling it at a speed of 500 miles (805 km) per hour requires high energy. So, operating with adding as less greenhouse gases to the atmosphere is a difficult but also a mandatory challenge for airlines. The airline industry, responsible for nearly 3% of global carbon dioxide emissions, has pledged to hit net zero by 2050 to help curb global warming. However, with the continuous increase in the demand for travel adding more than 100,000 flights annually, it would be imminent for airlines to take action to reduce their carbon emissions in their daily operation.

4.1 China Eastern Airlines

Take China Eastern Airlines as an example. On October 13th, 2021, they operated the first total life period Carbon neutral flights, where the CO_2 generated from the flight has been offset by supporting projects such as afforestation, renewable energy power generation, and natural gas power generation. Also, as a reward to the passengers who bought carbon-neutral tickets, they would receive a medal for their membership account.

More on that, in the check-in area and flight boarding gate of Shanghai Hongqiao Airport, where the flight departs, China Eastern has also set up a publicity screen to roll out the popular science video of the carbon neutral oil project to help passengers intuitively understand the concept of "carbon neutrality" and China Eastern's "Full life period carbon neutral flights" and "Low-Carbon Life, Green Building Future." During the flight, the cabin crew have carried out interactions, and to spread the

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knowledge of "carbon neutrality" to the passengers, also they promoted the concepts of green development, energy saving, environmental protection and low-carbon life style [8]. It is a positive step toward carbon neutrality since it has not only just made contributions to the carbon neutral goals, but it has also made an introduction to passengers on what they can do to reduce carbon emissions which was a perfect idea as if more people take actions then airlines and other industries would also be able to reach carbon neutral goals quicker.

Flight MU5103 on October 12,2021 not only completed carbon offset in flight operation like previous carbon neutral flights in Chinese and foreign civil aviation industry, but also moved to the upstream of the industrial chain, relying on China Eastern Airlines, Sinopec and COSCO Shipping to jointly complete China's first "full life cycle carbon neutral oil" sea transportation based on the positioning of civil aviation industry, energy industry and shipping industry respectively [8]. It has neutralized the carbon emissions generated by fuel in different links by purchasing carbon credits, so that the aviation fuel of this flight realized from crude oil extraction, transportation, "Carbon neutrality of the whole life cycle" of aviation fuel refining, storage, and combustion of refined oil products [8].

Through the actions that have been done by China Eastern Airlines, it is a valuable action for Xiamen Airlines to use as a reference since it does use a type of fuel named "carbon neutral oil," which has reduced its emissions by 30% throughout the entire flight. Also, there can be more advertisements made like China Eastern airlines to give the passengers a clearer idea of how airlines' carbon neutral policies works and also what they can do both in flight and in daily life they can to reduce their carbon emissions.

4.2 Emirates

According to the Emirates website, Emirates Airlines does not believe in passing on the responsibility of minimizing emissions to the customers. Instead, they do it themselves. Therefore, they believe in the principle that the emitter should pay the price. Emirates has one of the world's quickest, most modern low-emission fleets. Their average age is six years compared to that of the globe, which is 14 years. However, they are still running a significant amount of airbus A380, which has a higher operating cost and more emissions due to the four-engine propulsion. To reduce their carbon footprint and the negative impact that flying a plane has on the environment, Emirates has spent billions of dollars on low-emission efficient, low-emission aircraft. Additionally, the program is backed up by other on-ground projects such as recycling and waste minimization processes, water efficiency projects, and investment in conservation-based tourism developments. Examples such as collaboration with the Wolgan Valley Resort in Australia and the UAE's Dubai Desert Conservation Reserve [9].

From the actions done by Emirates, it is clear that they did something that has not been done by other airlines, where they have collaborated with tourist facilities such as resorts and hotels to expand their idea of sustainable travel. It is a step worth it for Xiamen Airlines to try since there is a 60 times increase in tourists during summer vacation compared to winter holidays [5]. It is an excellent opportunity for Xiamen airlines to work with well-known hotels around the city to advertise their idea of sustainable travel and carbon-neutral goals, which could both promote their flights and increase their publicity.

5. Economic Interpretation

Figure 4 illustrates the Social marginal cost (SMC) curve and the Private marginal cost curve (PMC), where the gap between the curves is the deadweight welfare loss. The graph mentioned that the demand curve means the private marginal benefit (PMB) and marginal social benefit (SMB). As airline companies reduces their carbon emissions, it would lead to a reduction of deadweight loss and creating more marginal social benefits, which would allow airline company to reduce their ticket price from P2 to P1, leading to an increase in the demand for a specific airline ticket. When airlines are taking action to reduce their pollution, they are trying to reduce the overall deadweight loss that a high pollution level initially caused. Whereas more actions airlines has done in reducing pollution, the gap between the SMC and PMC would become less, and the price would eventually come to an equilibrium point where it lies in the middle of the original price of P1 and P2. At the same time, the quantity demand for a ticket would also come to a middle point between Q2 and Q1 to achieve an equilibrium with the new price.

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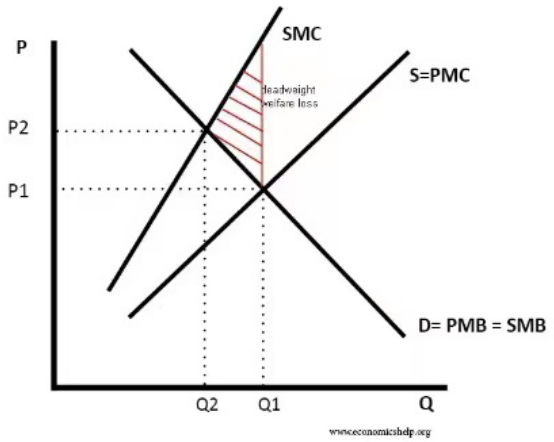

Figure 4: Marginal cost Diagram (Source: www.economicshelp.org)

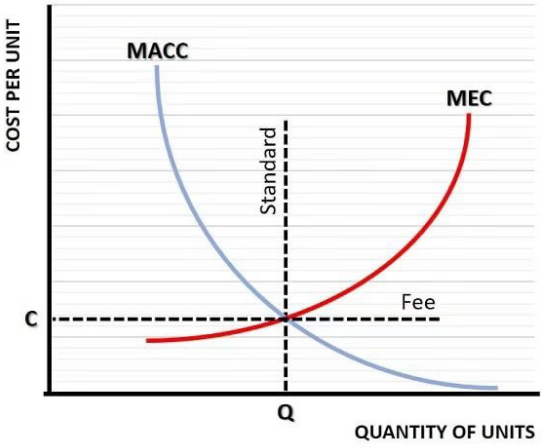

Figure 5: Marginal Abatement cost and Marginal External Cost (Source: www.dyingeconomy.com)

The Marginal Abatement Cost Curve (MACC) represents the cost of cleaning up each unit of pollution that the industry creates (Figure 5). It is a downward sloping curve because each additional unit of pollution can be cleaned up more cheaply than before. At some point, it is possible for an industry to adopt zero-emission technology such that any additional pollution beyond some minimal operational level can be cleaned up at no extra cost, and so the MACC slopes down towards a zero marginal cost point. At the same time, the Marginal external cost curve (MEC) represents the negative externalities which are the negative effects of third parties, in this case, such as pollution from the operation of aircraft.

When the marginal external cost is significant, it must be considered in production or consumption decisions if a firm wants to achieve optimal outcomes. In this case, as airlines spent most on reducing pollution, the MACC would be the highest while MEC would be the lowest [10]. When MACC is decreasing, then the MEC would start a gradual increase, causing more pollution, etc. Xiamen airline has to reduce the MACC and MEC curve to the equilibrium point of Q to reduce cost and cause a minimal amount of pollution.

6. Suggestions for Xiamen Airlines

6.1 Suggestions that is achievable by Xiamen airlines in the short term

Among the solutions applied to reduce greenhouse gas emissions in the studies performed in this field are the following: improving aviation operations and infrastructure and improving airplane engine performance. This measure can be applied in regular flight operations, in the short term, it is a effective measure since carbon neutral ticket hasn't been widely applied on every flight.

From the airport's perspective, they can use electrical carts and intelligence systems to optimize the passenger terminal air conditioning performance. These measures can effectively reduce the

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consumption of electricity. Since most of the electricity in China was generated by burning coal and fossil fuel, a reduction in the use of electricity could reduce the carbon footprint in operations of the airport.[11]

It is also possible for Xiamen airlines to develop lighter luggage container materials that can carry more items and also reduce the take-off weight (net weight); leading to less engine power is needed and a less consumption of jet fuel during take-off. Xiamen Airlines could also invest in more environmentally friendly ground service vehicles, which reduces the carbon emissions during ground operations, whereas most of the ground service vehicles still uses diesel as their primary fuel source, it could be a significant leap if Xiamen airlines were able to develop electric-power passenger buses and food trucks. (depending on the technology combination, they can reduce fuel consumption in a secondary fleet of an airline by up to 7% and reduce emissions by as much as 12%).

Since 2008, the aviation industry has asked governments to develop a global market-based measure for international aviation. Other airlines also have an emissions trading scheme that sets an overall limit on emissions and allows companies to buy and sell emission allowances to meet their target. Moreover, green taxes were levied on aviation companies, which would force them to invest in more sustainable operation methods, contributing to the resolve of over-polluting problems.[12]

6.2 Implementing a tradable pollution permit

From the research completed in the essay, it is clear that the worldwide aviation industry also requires a policy suitable for all airlines to encourage them to reduce pollution in their operations. What ICAO (International civil aviation organization) can do is to set up a tradable pollution permit that offers each airline a certain amount of pollution level they can reach, which can be set depending on the airline's size. The pollution permit can be tradable if one of the airlines has managed to reduce their pollution below the permit. Therefore it can be sold to other airlines struggling to reduce their pollution.

One of the strengths of setting this type of tradable pollution permit is that there would encourage airline firms to reduce their overall emissions due to that the pollution permits can be sold at a price level set by the particular airline, which would become an extra profit and also an offset with the cost during reduction of carbon emissions in their operations, which can also be used in furthermore investments in their infrastructure and also in searching for a greener fuel source. However, it depends on the pollution level they have managed to reduce [13], where a trim level of reduction may not offset the cost of reducing the pollution. Whereas Xiamen airline is likely to reduce some of its pollution already, there is a high chance that they could sell the permit to gain an extra profit. Which then can be invested into developing techniques to reduce their pollution further.

Another advantage of a tradable pollution permit is that it would allow governments in each region to measure the marginal social and private costs and benefits brought by the reduction of pollution in the airline. Where it offers a standard variable to define the marginal cost and benefit level, it would also be more precise for both airlines and the government to set pollution goals to get closer to carbon neutrality. Nevertheless, it depends on whether the airline or the government has the incentive to measure the costs and benefits created. Due to that, it may also have to cost both money and the workforce to measure the final effect of the reduction in emissions accurately.[14]

Besides advantages, there are also downsides of tradable pollution permits, one of which is that there may be barriers before implementing relative policies. Governments in each region may need relative legislation before the tradable pollution permit can be fully implemented. For Xiamen airlines, since it is a state-owned company, it would likely comply with the legislation related to environmental regulations. But for private airline firms in other regions may take more time to comply with the regulations, resulting in extra pollution entirely. In addition, a considerable amount of emissions would be generated between the period where the pollution permit is set and when it has become fully implemented.[15]

7. Discussion and Evaluation

Throughout the research, some points are worth mentioning and limitations from my research. In the study, I offer suggestions for some basic things Xiamen Airlines can do to reduce pollution. There is also a macro solution to the current pollution problems: offering a tradable pollution permit worldwide, incentivizing airlines to reduce their pollution and allowing global aviation and Xiamen airline to get

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closer to carbon neutral goals. Also, there is a bigger idea provided where a tradable pollution permit can be used among airlines which could encourage Xiamen Airlines and other airlines globally to reduce pollution in operation together. As Xiamen Airlines has already started to take action, they would likely be the first few airlines to benefit from the tradable pollution permit.[16]

However, some limitations existed in this research; whereas there are only second-hand research has been conducted, the study has not included the opinions of employees inside the airline and what they think the airline can be done better, which may result in suggestions provided in the research may not be suitable for the current situation of Xiamen Airlines. This can also be a direction for those that would like to research a similar topic, especially for those that can have an interview with managers inside the airline.[17] There were also some areas that have not been covered in the research, such as what strategy Xiamen airline can do to make their future sustainability marketing plans more attractive to society and how they were able to promote their goals to increase their sustainability goal's publicity.

8. Conclusion

To conclude, from the current research, it is clear that Xiamen airlines have already taken a vast amount of actions to reduce carbon emissions during their normal flight operations, such as introducing 'carbon neutral ticket' and also providing 'low carbon flight' service on a popular route from Xiamen to Beijing. In the short term, it would be easy for them to increase the usage of more electrical carts to start their plane. Also, in the short-run, they could invest in the development of lighter luggage containers to reduce the take-off weight when fully loaded. However, in the long run, a tradable pollution permit can be implemented, allowing airlines worldwide to reduce their emissions together. Currently, they are already getting ahead of many other airlines regarding pollution reduction, which could reach their goals quicker and make them more competitive in the market. For other airlines in China, it is also viable to take the same way as Xiamen airlines did to reduce their carbon emissions from their operations. It would lead to a trend of globally reducing carbon emissions to protect the environment from over emitting carbon dioxides.

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