

The impacts of COVID-19 on the aviation industry and environment

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2020



Figure 1: British Airways has moved a number of its planes to Bournemouth Airport (BBC News, 2020)

Foreword

For my Nuffield research placement, I have been a part of the Aviatrix Project, which is an online project looking into the coronavirus disease 2019 (COVID-19) and its impact on air travel. We were asked to research the financial, social and economic impacts of the COVID-19 crisis, focusing on the aviation industry.

The World Health Organisation (WHO) declared that the COVID-19 outbreak was a pandemic on the 11 March 2020, and as it has spread worldwide it has halted economic activity in many sectors, especially in aviation. In this paper I will primarily focus on what this means for the environment, both short and long term.

My project coordinator created a folder on google drive for all the students on the aviatrix project with over a hundred articles on the topic to look at, while my supervisor sent me any specific articles she thought would add to my project. I used these articles to complete pre-reading before starting my project to gain more of an understanding of how COVID-19 has impacted aviation.

I had a minimal amount of pre-existing knowledge about aviation before completing this reading, but through the course of the summer my depth in understanding of the subject matter greatly increased. This was through talking to and interviewing experts, reading reports and articles and watching the news, which helped me understand what was presently being done about the crisis.

As the issue was very current, I found that there were constantly new updates and decisions being made about what I was researching, which I needed to include. For example, the meetings with the IATA and ICAO about adjusting the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) due to covid, found in chapter 1 of my report, were going on over the course of time that I was writing.

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Introduction

Before I started this project, I already knew how the aviation industry has been suffering from the effects of the pandemic. This has been due to demand for air travel dropping to prevent spreading the virus. However, by doing more reading I realised not only has the pandemic seriously threatened public health but also greatly reduced global economic growth. I realised just how badly aviation has been affected and the large extent to which jobs and capital have been lost in the industry.

Many scholars have forecast that “the effect of the COVID-19 on the economy will outweigh that of the 2008 financial crisis.” (Wang and Su, 2020)

This made me wonder what was happening to the previously emerging environmental projects that I had heard of, such as CORSIA. With aviation companies losing the money to fund such projects and their priorities shifting to retain employees and keep afloat, I realised they will be far less likely to invest in these sustainability projects.

However, the idea emerged in the news that green strings and sustainability obligations could be attached to government rescue packages for airline industries. I read an article in the Guardian explaining how the Covid-19 crisis could be the “catalyst for greening the world's airlines”,(Watts, 2020) explaining “If governments want to address the twin challenges of Covid and climate change, the political moment is now, policies to curb frequent flying could benefit both public health and the global environment.”¹ This article helped solidify the idea that I wanted to focus primarily on the environmental implications of the pandemic, both short and long term. I believe that environmental sustainability is highly important and we should explore whether the pandemic might accelerate or decelerate aviation decarbonisation and the idea that rescue packages could promote a green recovery.

In addition, I wanted to look into other topics about the overall effect of COVID-19 crisis on the industry and environment, both long term like how the financial losses of aviation companies will impact the existing sustainability goals and short term, for example the extent of the dip in emissions.

So, to summarise, in this paper I aim to investigate how COVID-19 has impacted the aviation industry and the implications of this crisis on the environment.

¹ The opinion of Dan Rutherford, who is the aviation director at the International Council on Clean Transportation.

Methodology

For this project, I obtained secondary data from a wide variety of sources like new articles and research papers, many of these are newly published as the COVID-19 crisis is so current.

However, I also decided to collect primary data by creating an online survey, asking questions about the topics I will be researching so that I could gain a variety of views and perspectives on these issues and the results of this would help aid my conclusions. I wrote ten questions using survey monkey and they were sent to 40 people mainly in the aviation industry via email, but also to people in other industries and students. I aimed to gain a variety of people's opinions, but I also mainly sent the survey to those in the aviation industry as these people would know most about the issue. The replies were converted into bar graphs so I could analyse and understand the views of the public easily. To obtain more accurate results I should have gained a larger number of responses, but with 40 I could still understand the rough ratio of opinions and how much people knew about the issue.

To gain an in depth explanation of the real effect of COVID-19 on the environment, I decided to interview George Hibberd. George is a pilot and also an environmentalist, who's done a lot of research about sustainability in the aviation industry. I sent him an email with three questions about the effect of COVID-19 on the environment and he replied with detailed and lengthy answers. These replies provide an invaluable opinion which seem realistic and, in many cases, pessimistic about the effect of the pandemic on aviation sustainability.

Chapter 1: Financial impact of COVID-19 on aviation and CORSIA

1.1 Aviation financial losses

The aviation industry is of huge importance to the economy in most countries. With the pandemic causing air travel to be massively reduced this year, aviation has naturally been one of the industries most affected, with international borders being closed to prevent non-essential travel. In addition, with thousands of planes being grounded and so many jobs on the line it has been an extremely stressful and uncertain time for the industry. Some companies have attempted to avoid refunding cancelled trips or have laid off employees in an attempt to reduce their losses. As a result, the crisis has been described as the worst ever encountered in the history of the aviation industry.

The decrease in passenger demand will have important implications for both aviation's carbon footprint and the regulatory regimes that are attempting to reshape it, for example CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation.)

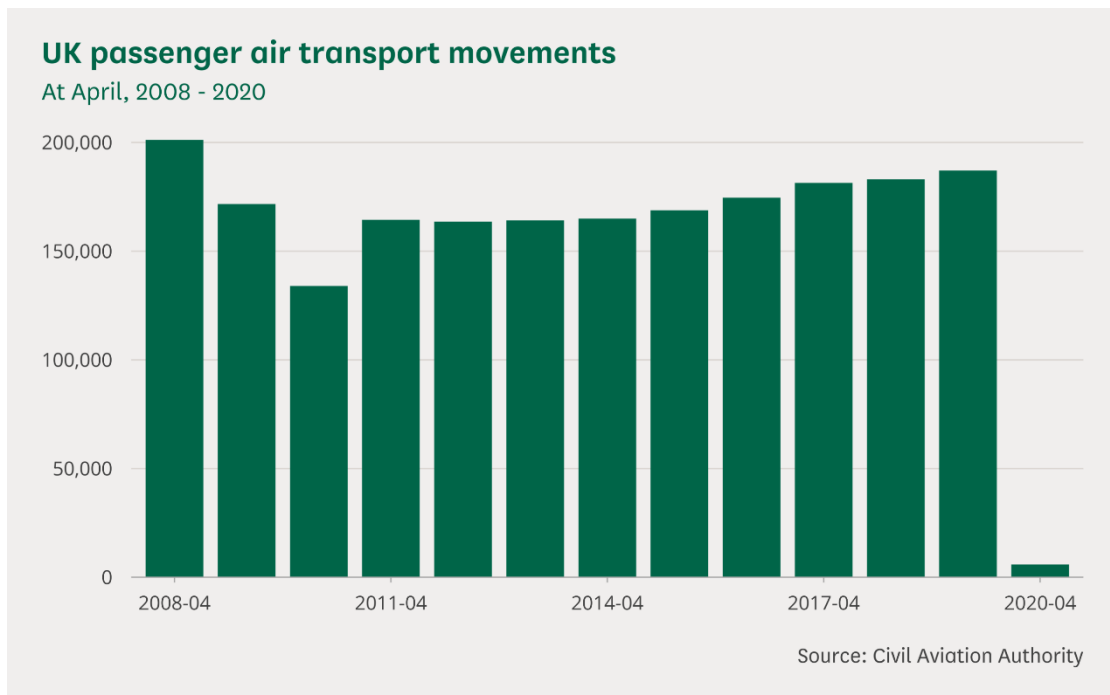


Figure 2: A chart showing the unprecedented steep decline in air travel in April 2020 compared to the same month in previous years. (Committee, 2020)

The table above (Committee, 2020) shows the large extent to which the number of flights have reduced in number this April, in comparison to the same month from previous years (it had reduced by 97% since last April).

Therefore, DURING THIS TIME, many aviation companies have understandably accessed Government financial support to help them remain afloat. "The Government's focus has been to offer bespoke support to individual companies, and only once other sources of financial support have been ex-

hausted.” (Committee, 2020) These companies have mostly accessed generic Government support schemes to deal with COVID-19 for example:

- The Coronavirus Job Retention Scheme (CJRS)
- VAT deferrals to a later date
- Covid-19 Corporate Financing Facility (CCFF)
- Coronavirus Business Interruption Loan Scheme (CBILS)

However, there has been a rising debate about whether these support schemes should come with sustainability obligations that must be met.

The Minister for Aviation told the House of Commons that “A bail-out by the taxpayer or any other Government support would need to comply with state aid rules and require us to meet our legal obligations, particularly on climate change.”² I will explore this idea later in my report.

On 17 March, the International Air Transport Association stated that its previous estimates were "outdated", and that airlines would require \$200 billion in bailouts to survive the crisis. They later estimated a forecasted revenue drop of \$314 billion. However, these values are highly unpredictable and likely to continue changing as time passes, so overall, the long term impact of the pandemic is certainly unclear.

1.2 The impact of financial loss on CORSIA and environment

On 6 October 2016, 191 member states of the International Civil Aviation Organisation (ICAO) adopted CORSIA, “a scheme intending to offset annual increases in CO2 emissions from a baseline level, to be calculated as the average of total CO2 emissions for the years 2019 and 2020 on relevant routes. Under CORSIA, aircraft operators will be required to offset any growth in CO2 emissions above the baseline level.” This scheme will operate for three years, and at the end of the three-year cycle each operator must offset an amount of emissions “by buying credits that are verified by ICAO as reducing emissions elsewhere.” (Moher and Phippard, 2020) Acts such as investing in renewable energy or projects like planting forests can count as this. This avoids airlines having to cut their greenhouse gas emissions and reduce aviation. Nonetheless, it is quite controversial as there are many people who believe it will do more harm than good, complicating the issue of aviation decarbonisation. The execution of CORSIA “forms part of the aviation industry's wider effort to improve its environmental credentials, which encompasses a range of other measures – improved engine and airframe technologies, more efficient flight planning and sustainable fuels” (Moher and Phippard, 2020) Despite being controversial, it is seen by many as a step in the right direction towards better environmental policies.

However, it is problematic that CORSIA relied on a baseline defined by the average emissions for 2019 and 2020, as these figures would not represent the regular emissions by the sector. “IATA put the average emissions for 2019-2020 at 584m tonnes of CO2 in advance of the crisis. Factoring in the crisis, the revised 2019-2020 baseline prediction is expected to be 450m tonnes of CO2. Such a reduction in emissions figures for 2019-2020 would lead to offsetting requirements increasing by between 50-85%.” (Moher and Phippard, 2020)

² Kelly Tolhurst MP, Minister for Aviation. Stated on 3 June.

Consequently, concerns had been raised about the significant added cost that will arise when aviation traffic resumes to normal. This is due to the lower than expected baseline causing airlines to considerably rise their offset obligations. This will be most difficult for aviation companies badly hit by the pandemic who have little to no money to spare for investment in environmental projects.

The IATA appealed to use the 2019 average figures as a substitute baseline, telling ICAO that the baseline "must be adjusted to ensure the sustainable development of international aviation and avoid an inappropriate economic burden on the sector".³ However, for a while the ICAO appeared fixed with their decision to use the 2019-2020 baseline figures. "Indeed, the organisation has forged ahead with approval of six eligible emissions unit programmes that airlines can use to offset emissions during the pilot phase. The list has been provided by ICAO along with strict exclusions and reconciliations which will apply to their use." (Moher and Phippard, 2020)

Many environmental bodies lobbied for this to be the case and for the 2019-2020 baseline figures to be used saying that "the COVID-19 crisis should not precipitate a relaxation in the burgeoning Environmental, Social and Governance (ESG) movement's focus on the aviation industry. Airlines in receipt of government bailouts, such as Air France-KLM, which received €10bn, will face renewed public pressure to improve environmental performance." This idea is reflected in how the French government has attached "green conditionality" to the aforementioned loan, requiring, amongst other commitments, that Air France renew its fleet with more efficient aircraft and commit to obtaining 2% of its fuel requirements from sustainable sources by 2025." (Moher and Phippard, 2020)

However, despite the efforts of environmental bodies and other groups to use the 2019-2020 baseline figures for CORSIA, on July 02, 2020 the IATA welcomed the decision made by the ICAO to use 2019 as a baseline instead, choosing not to follow the example of France.

In this case, COVID-19 could have greatly affected the UN's plan to 'offset' growth in aviation emissions by lowering the baseline. However, due to the extreme financial losses the aviation industry has faced, this has not been the case. The industry is simply under too much pressure to commit to environmental projects, like CORSIA, that will cost them more money than they may have now, especially with such an uncertain future ahead.

Although the CORSIA scheme seems like an effective and great step forward, it has received longstanding criticism as offsetting regimes don't necessarily reduce carbon emissions. While the high cost of offsetting may lead to fewer flights, the whole concept is restricted by the difficulty of accurately calculating the amount of emissions to be offset, and how much has been saved by purchasing a credit. The EU Emissions Trading System, and other regimes already in operation by airlines on a voluntary basis have faced accusations of 'green washing'". (Moher and Phippard, 2020)

Additionally, in my interview, I asked the question to an expert in the field 'Do you trust that the current environmental policies and targets about aviation will be met?' His reply was:

"Simply put, no I do not think targets will be met. Aviation makes approximately 5-8% of the share of global heating and is set to double in the next 20 years. With the current so-called solutions, we will never meet our targets. CORSIA, for example, is riddled with flaws and causes more issues that it tries to mitigate. Only 2% of offset credits are likely to be effective, offsets often lead to ecological and human rights violations, they are a modern sale of indulgences and they divert attention from

³ What IATA has told ICAO. <https://www.theguardian.com/business/2020/apr/08/airlines-lobby-to-rewrite-carbon-deal-due-to-coronavirus>

real solutions. With the rise of the Black Lives Matter and racial justice movements, the aviation industry and CORSIA project is a prime example of systemic racism and social injustice.”⁴

George pointed me in the direction of the Stay Grounded website which broke down some of his opinions and gave many concerning facts about why CORSIA isn't enough to ensure a sustainable future for aviation. I learned how the carbon offsets that airlines can purchase for CORSIA are often “forest projects which can threaten the livelihoods and rights of forest dependent people” or use aviation biofuels “likely to rely on palm oil and palm oil products if used on a large scale”. (CORSIA - better or worse than nothing? Stay Grounded, 2020) These biofuels are proclaimed to be ‘carbon neutral’ whereas in reality it is not that simple and emissions are often not compensated for.

For example, an investigation by the Öko-Institut revealed that “85% of the UN Clean Development Mechanism (CDM) projects are unlikely to reduce emissions and only 2% are very likely to lead to an actual compensation.” (CORSIA Baseline Change: Aviation’s Climate Regulation Is Broken Beyond Repair, Stay Grounded, 2020)

Many of the offsetting projects seem to have issues with land acquisition meaning communities can lose their homes or farmland, which are replaced with forests or expanses of monoculture to be burnt.

On the Stay Grounded website, a campaigner states “CORSIA is a total wreck beyond repair. In fact, it was broken from the very beginning. It covers a tiny fraction of aviation’s projected emissions and completely ignores the huge climate impact of airplane emissions other than CO₂. It relies on harmful offsets and biofuels, both neo-colonial measures that shift the problems to communities in the Global South. CORSIA is not only a means for greenwashing aviation: holding on to it also blocks effective regulation and leads to further problems.”⁵

Perhaps this is a strong view, however I believe it holds some truth as we have very little time, 7 years as stated by the IPCC, “before we trigger ecological tipping points that will lead to irreversible and uncontrollable climate, ecological and societal collapse. We are in the midst of what's called "the sixth mass extinction" of species and it is hotter now than it has been on this planet for many millions of years. We are in truly uncharted territory where climate scientists are unsure that humans can survive.”⁶ I believe more should be done by the aviation industry to support the current environmental movement as it accounts for 5-8% of global heating.

To conclude, although CORSIA is a step in the right direction towards improving airline sustainability, and better than nothing, aspects of it are problematic, for example it has been described as ‘land grabbing’. In addition, the scheme could be seen as a way for the aviation industry to avoid cutting their greenhouse gas emissions while acting as a distraction to other measures which would more effectively reduce aviation’s climate impact. Due to the severe financial losses the industry has experienced due to the pandemic, the focus of airlines has shifted away from the environment. This is one of the reasons for the 2019-2020 baseline figures being scrapped along with the huge reduction

⁴ George Hibberd, 2020

⁵ says Stay Grounded campaigner Magdalena Heuwieser, 2020

⁶ George Hibberd, 2020

in 2020 emissions. If the 2019-2020 baseline figures were used as they were originally planned to be, COVID-19 would have positively impacted CORSIA for the environment as a lower baseline means more offsetting. Now the 2019 baseline will be used “airlines will need to focus considerable effort on the wider ESG movement as a key part of their business strategy when the crisis subsides.” (Möher and Phippard, 2020)

Chapter 2: Short term environmental impacts of COVID-19

2.1 Introduction

After lockdown measures were enforced around the world, to prevent the spread of COVID-19, many stories appeared on the news and in research papers about how air quality was massively improving and wildlife was returning to places it hadn't for a long time. Many described this as the 'silver lining' to the pandemic.

There's a large amount of existing research showing how pollution will increase with economic growth and decrease with economic decline. (Wang and Su, 2020) Therefore, the pandemic should mean a substantial decrease in pollution, especially with quarantine and the travel ban, which I will explore in this chapter. I will use china as a case study as it was the first country that was hit by COVID-19, and had a strict quarantine implemented.

2.2 Case study: China

COVID-19 originated in Wuhan, Hubei Province, China, where it was named by the WHO, before it quickly spread to other parts of Hubei Province. From January 16 to 24, the daily number of confirmed cases increased rapidly, reaching a peak on February 12. In order to suppress the virus, China issued a travel restriction, and swiftly went into lockdown. The residential areas of the cities and provinces most affected by the outbreak completely closed, so no one can enter or leave. The Chinese provincial governments announced strict restrictions on movement, from checkpoints at building entrances to outdoor activities. These measures included traffic restrictions on all non-emergency vehicles and the closure of all non-essential public places. Many train stations closed and in more rural areas villages were separated by temporary barriers. (Wang and Su, 2020)

In Wuhan, the quarantine measures were implemented and transportation and local businesses were shut down on January 23, 2020 to prevent the epidemic spreading. "This measure delayed the overall outbreak progress in mainland China by 3 to 5 days."⁷

⁷ Chinazzi, M., Davis, J.T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., et al., 2020. The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak. *Science*, eaba9757.



Figure 3: Wuhan train station before and after the quarantine. (Pasley and Frias, 2020).



Figure 4: Wuhan Yangtze River Bridge before and after the quarantine. (Pasley and Frias, 2020).

The figures above are satellite images from Planet Labs of NASA. They have captured scenes of traffic and parking lots near Wuhan Railway Station before and after the lockdown (January 12 and January 28, 2020), as shown in Figure 3. Figure 4 shows the Wuhan Yangtze River Bridge which is an important transportation hub in Wuhan, and the road became empty after the government imposed the lockdown. (Wang and Su, 2020) These figures reveal the extreme reduction in traffic the day after lockdown was enforced, to the point where roads became empty, so exhausts from car engines were clearly also reduced.

Because of the considerable reduction in urban transportation and industrial activities, China's energy consumption decreased significantly during the quarantine period. China is a large coal consumer, and the coal resource dominates the energy consumption structure. From the observed data in Figure 5, China's coal consumption declined during the epidemic.

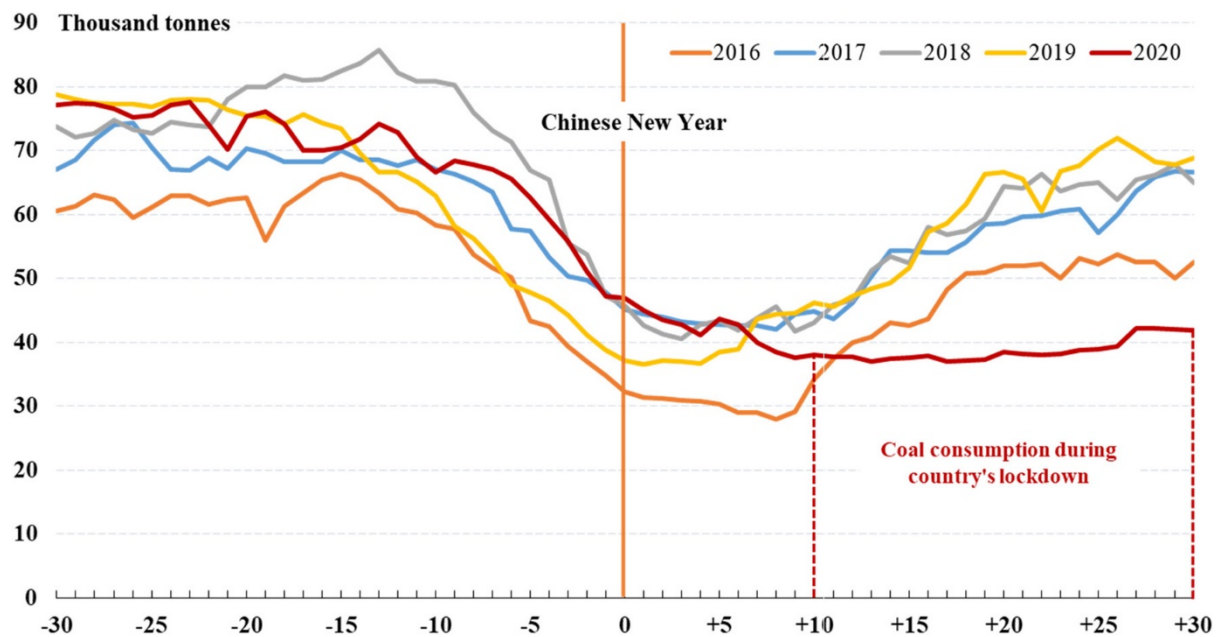


Figure 5: Coal consumption in China during the COVID-19. (Ghosh, 2020)

Because of the considerable reduction in urban transportation and industrial activities, China's energy consumption decreased significantly during the quarantine period. Figure 5 shows how China's coal consumption has reduced this year in comparison with preceding years. When analysing what this graph reveals, I took into account the effects of the lunar (Chinese) new year where there is usually a dip in coal consumption and focused on how during lockdown in 2020 these figures didn't start returning to normal.

China is a large coal consumer, and the coal resource dominates the energy consumption structure. From the observed data in Figure 5, China's coal consumption declined during the epidemic. As I mentioned before, it's important to note that China shuts down for one week during the Lunar New Year every winter. Therefore, it's expected that a large proportion of industries will stop operating and for a brief reduction in energy consumption to occur during this period. In the days after the Spring Festival, energy consumption will rise again with the production being resumed. The Spring Festival in 2020 seems to be an exception, due to the large-scale outbreak of COVID-19 and compared with the same period in previous years, coal consumption dropped significantly. After the Spring Festival in 2020, the decline in coal use was extended for 20 days, with no sign of a rebound. This is a result of the strict restrictions to extend the annual leave, aiming to control the virus and prevent its further spread. And after officially resuming work on February 10, coal consumption demand remains sluggish. (Wang and Su, 2020)

Although this isn't a good sign for economic growth, a reduction in coal consumption will benefit the environment. Not only will it clear photochemical smog in China, it means a decreased amount of climate change causing greenhouse gases being released into the atmosphere.

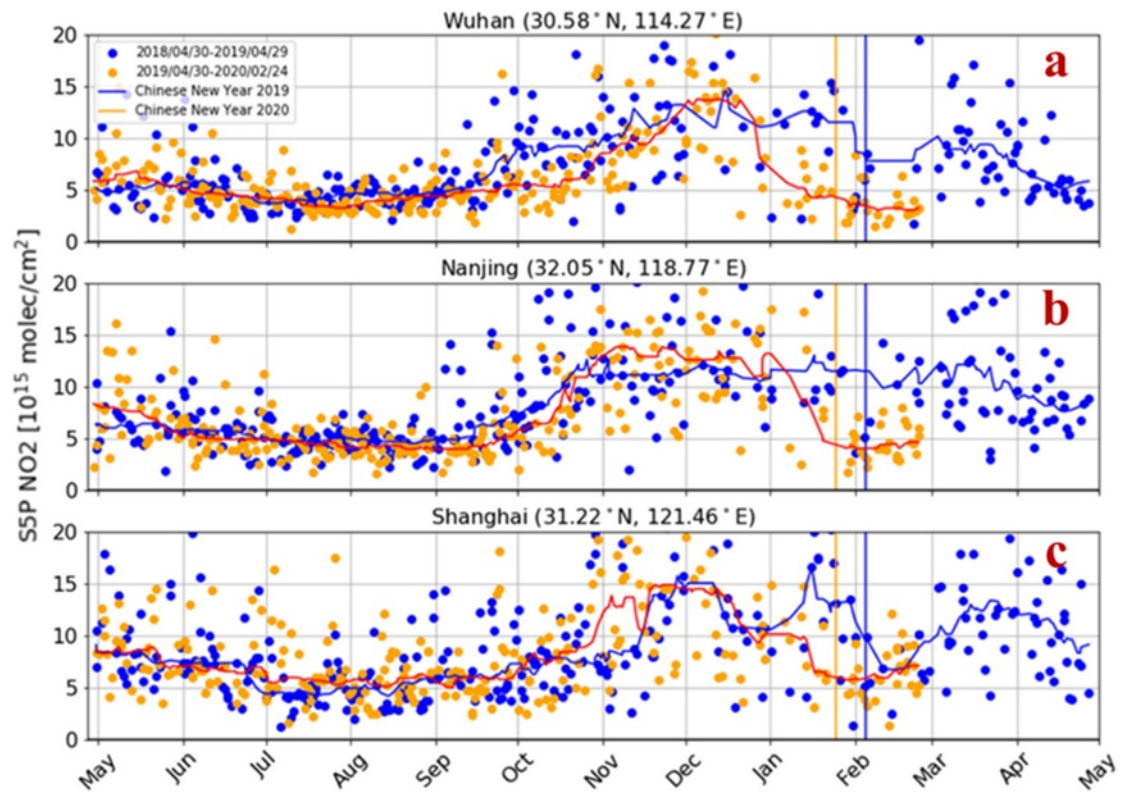


Figure 6: Changes in NO₂ emission in Wuhan, Nanjing, Shanghai. (Compernelle and Lefever, 2020)

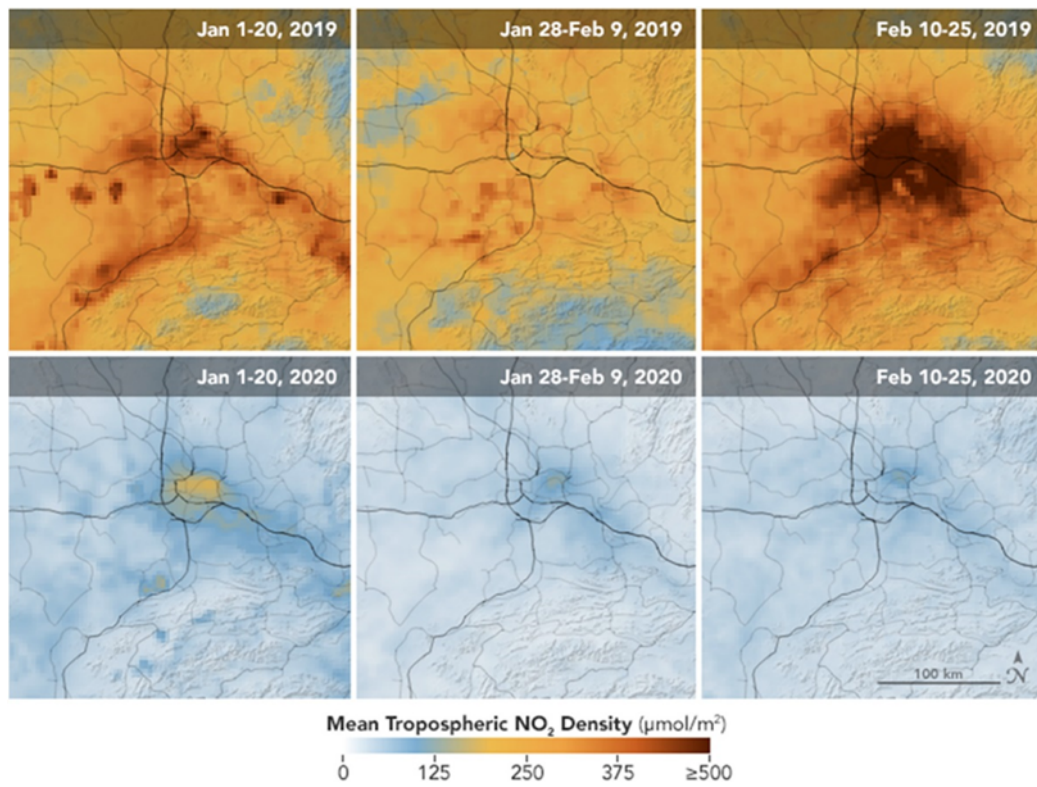


Figure 7: Changes in NO₂ emissions in Wuhan, China. (Ghosh, 2020)

Nitrogen dioxide(NO_2) is a gas that enters the atmosphere during many combustion processes, such as in a car's engine, in industry or in power stations. Therefore, tropospheric NO_2 is a key indicator for air pollution. Figures 6 and 7 show the trends of NO_2 levels in Wuhan, the industrial heart of China, before and after lockdown.

Figure 6 shows information from the TROPOMI sensor on board the Sentinel-5 Precursor platform. This “measures the composition of the atmosphere worldwide and on a daily basis with an unprecedented spatial resolution” providing “crucial information about air quality over China, and in particular above cities such as Wuhan or Nanjing, one of the cities in the pollution chain around Shanghai.” (Compernelle and Lefever, 2020) The graph produced reveals the time series of tropospheric NO_2 concentrations, confirming the decreased use of fossil fuels.

The concentrations towards the end on 2019 (when the first cases of the corona virus were reported) were still similar to the 2020 concentrations, and “the NO_2 concentration above Wuhan, the epicentre of the corona virus, only started to fall around the Chinese New Year on 5 February 2019 last year.” (Compernelle and Lefever, 2020)

However, toward the end of December 2019 onwards this year, the concentrations were falling at a very rapid pace. The minima eventually reached are approximately 50% lower than last year. “But unlike other years, when coal production is typically back to its normal level after 20 days, the trend continues even a month later” (Compernelle and Lefever, 2020) The NO_2 levels remaining persistently low is clearly a result of lockdown.

Figure 7 shows the average concentration of NO_2 in the atmosphere measured by the ozone monitor (OMI) on NASA's Aura satellite. The map shows the NO_2 values, as seen from space, of Wuhan before Chinese New Year (January 1–20), during New Year celebration (February 10–25) and after the celebration (February 10–25), along with the comparison with that time in 2019 for reference.

It's also clearly visible with this that NO_2 emissions are significantly reduced compared to the same time last year. The decreasing NO_2 emissions have not recovered since the end of the Spring Festival. NASA stated that the reduction in NO_2 pollution initially appeared near Wuhan and eventually spread throughout the country. (Wang and Su, 2020)

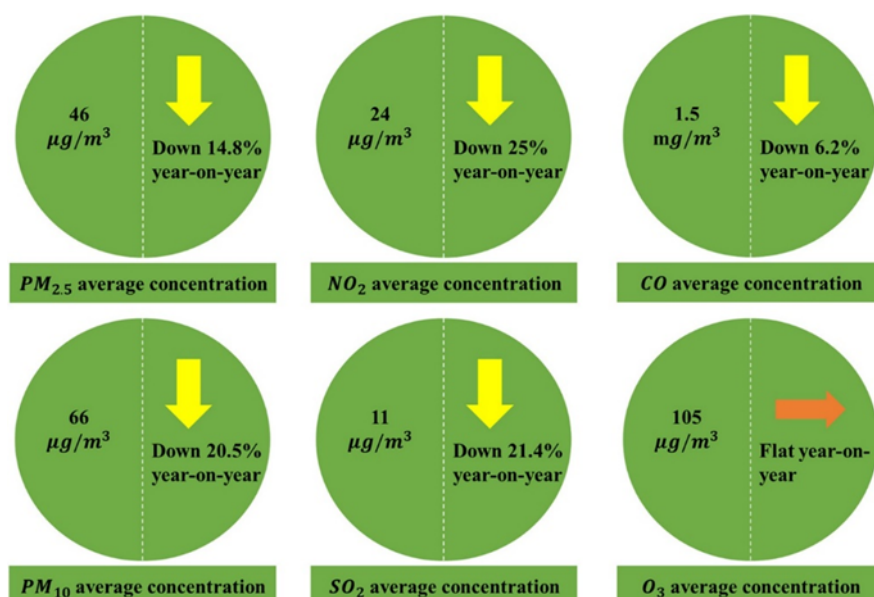


Figure 8: The concentration of major pollutants and the year-on-year change in the first quarter of 2020. (Ministry of Ecology and Environment of China, 2020)

The Ministry of Ecology and Environment of China monitored and evaluated air pollutants in 337 major cities across the country, providing evidence that air quality in most regions of China has improved significantly during the pandemic.

Figure 8 lists the emissions of six typical air pollutants during the epidemic situation. It can be seen from the figure that the emissions of five kinds of air pollutants have declined, indicating that the air quality is slowly improving. It reveals that year-on-year, PM_{2.5} concentration is down 14.8%; NO₂ is down 25%; CO concentration shows a decrease of 6.2%, PM₁₀ concentration was down 20.5%; SO₂ concentration was down 21.4%.

All the while, O₃ concentration was 105 µg/m³, flat year-on-year. This is because in many areas of the world, ozone pollution is known to increase during warmer months, as well as building up in cleaner areas. This happens as ozone is not directly emitted by any source but is formed by photochemical reactions between oxides of nitrogen (NO_x) and other volatile organic compounds (VOCs) and gases in the air under the influence of sunlight and heat.

Overall, in the short term, the COVID-19 outbreak greatly improved China's air quality and significantly contributed to global carbon emissions reduction. (Wang and Su, 2020)

2.3 Will the air quality improvements last?

“From the time dimension, China's energy consumption dropped sharply during the outbreak of COVID-19, especially the total coal consumption.” (Wang and Su, 2020) COVID-19 also effectively suppressed greenhouse gas emissions such as CO₂. However, the data observed only indicated that this beneficial effect occurs during quarantine.

“As some regions in China lifted the lockdown and enterprises resumed production, people and goods began to flow on a large scale. Meanwhile, declining energy consumption is showing an upward trend, and traffic congestion is gradually returning to the level before quarantine. It can be deduced from this that when China completely lifts the lockdown and resumes production, its energy use and GHG emissions are likely to exceed the level before the outbreak.” (Wang and Su, 2020)

This idea that the air quality in most places will gradually return to the levels it was at before isn't good news for both the environment or public health (especially for children or those with diseases such as asthma or lung cancer).

The expert I interviewed told me “Whilst [airline] emissions reduced during the crisis, they only reduced by around 6%. To meet our net zero target by 2050 (which in itself is woefully inadequate and too late, as stated by the Intergovernmental Panel for Climate Change) we need to reduce our emissions by something like 8% year on year. This shows just how much action we need to take to solve the climate crisis. The world ground to a halt and we still didn't meet the targets.”⁸

This told me that emissions drop from aviation as well as the other sources I was exploring before, for example industrial activity and other forms of transportation, didn't have a significant enough

⁸ George Hibberd, 2020

reduction to have a long term impact on the environment as I previously thought it might. However, drop in emissions greatly improved the short term environmental quality during lockdown.

This further proves the point that policymakers should fully take into account the environment while restoring the economy, especially as it has been proved how drastically the environment and human health benefits from a reduction in emissions.

Chapter 3: Long term changes to aviation environmental policies

3.1 Introduction

In regards to the financially devastating impact COVID-19 had on aviation, it is understandable that airlines should receive some kind of government bailouts to help pay their employees and cover expenses during this difficult time.

However, through reading various articles and Greenpeace campaigns I learnt how there are many environmental groups demanding these rescue packages come with 'green strings' and environmental obligations. An article I read in the guardian explains eight steps towards a cleaner aviation sector, "such as reduced carbon footprints and frequent flyer levies" it warns us that if these aren't implemented "the sector will return to the path that has made it the fastest rising source of climate-wrecking carbon emissions over the past decade." (Watts, 2020)

This matter is important as the decisions made now will hugely affect future generations, so while rescue packages should do their job of preventing bankruptcies and addressing immediate human welfare concerns, they should also promote sustainability. "The recovery packages can either kill these two birds with one stone – setting the global economy on a pathway towards net-zero emissions – or lock us into a fossil system from which it will be nearly impossible to escape." (Hepburn et al., 2020)

In this chapter I will explore this issue, looking into how could COVID-19 could affect aviation environmental policies, what changes should be made, who should make these policies and whether these changes are realistic.

3.2 How should COVID-19 affect aviation environmental policies?

"The COVID-19 crisis could mark a turning point in progress on climate change. This year, Global Greenhouse Gas (GHG) emissions will fall by more than in any other year on record. The percentage will decline likely in 2020, however, would need to be repeated, year after year, to reach net-zero emissions by 2050." (Hepburn et al., 2020) Therefore, unless governments intervene, emissions are likely to rebound once mobility restrictions are lifted and economies recover.

It is essential that fiscal recovery packages address climate change as an issue, as without a sustainable recovery from the pandemic, emissions will rise to previous levels, the private sector will fail to invest enough in clean technology with a depressed economy, so that the goals from the Paris Agreement won't be met. Taking into account the large scale of these rescue packages, a sustainable recovery from COVID-19 could possibly be sufficient to address climate change. When the macroeconomy has recovered and the prices of clean technologies are low enough, the private sector would need little further encouragement. (Hepburn et al., 2020)

“This blending of macroeconomic and microeconomic considerations is atypical of the approach to public economics involving a sequential focus on (i) stabilisation of national income; (ii) economic efficiency; and (iii) fair distribution (Musgrave, 1959) — get the macro right before worrying about micro issues such as carbon prices. However, the macro and micro are inescapably interlinked here, due to the scale and timing of the climate challenge and the pandemic.”⁹ (Hepburn et al., 2020)

I looked at current research¹⁰ identifying ‘stimulus policies’ which are perceived to “deliver large economic multipliers reasonably quickly, and shift our emissions trajectory towards net zero.” (Hepburn et al., 2020) Despite the fact that the majority of G20 governments have already implemented rescue packages (as of April 2020), “no government has fully exited lockdown and introduced significant recovery packages.” (Hepburn et al., 2020) These packages could either be ‘brown’, reinforcing the links between economic growth and fossil fuels, jeopardising future stranded assets, or be ‘green’, decoupling emissions from economic activity. (Hepburn et al., 2020) So far, they have primarily been ‘colourless’ however there is potential for future rescue packages not only to provide high economic multipliers but also have a positive impact on the environment.

The research I had been looking at from the Smith School of Enterprise and the Environment (Hepburn et al., 2020) made the following three suggestions for policy-makers designing COVID-19 recovery packages, based on literature review, their survey results and their own judgement. Below I will summarise their suggestions:

1. Recovery policies can deliver both economic and climate goals
 - Clean physical infrastructure investment e.g. renewable energy, grid modernisation, carbon capture and storage (CCS) technology
 - Natural capital investment for ecosystem resilience and regeneration including restoration of carbon-rich habitats and climate-friendly agriculture
 - Investment in clean R&D spending and training to address immediate unemployment

2. Co-benefits can be captured
 - non-economic, non-climate attributes of climate-positive policies which increase their overall desirability e.g. electric vehicle incentives reduce local air pollution, which is especially valuable in dense urban areas.
 - Energy efficiency work could be directed at lower income households to decrease social and health inequality by shrinking real electricity costs and keeping homes warmer in winter.

3. Policy design is important

⁹ Observations of Professor David Vines. BA Melbourne, MA PhD Camb, MA DPhil Oxf. Professor of Economics and Fellow.

¹⁰ Done by The Smith School of Enterprise and the Environment, University of Oxford, 2020

- Poorly designed recovery policies are likely to be ineffective in delivering economic, climate, and social outcomes.
- During the lockdown phase there was extreme urgency in delivering rescue packages. This time round there should be more policy timeliness and flexibility. This should be used to produce policies with significant long-run economic benefits and climate impact.

George Hibberd, the expert who I interviewed had the following opinion on the topic:

“Bailouts for high carbon industries, such as EasyJet, should instead be given to green, sustainable companies. However, the bailouts have been made so we need to use these bailouts wisely. High carbon industries should be using the bailouts to put workers first, rather than key stakeholders and those at the top. The money should be used to retrain those workers who are made redundant into green-sector jobs as part of a 'just transition'. This way, employment and income security is maintained and a green future is built.”

I agree with this idea of bailouts being primarily used for the good of the company’s workers, supporting smaller businesses and for creating a greener future for aviation.

3.3 Current ideas/ technology regarding aviation sustainability

In this section of my report, I will explore the ideas that could be implemented into future aviation sustainability commitments.

“Although the aviation industry only makes up around 2% of global carbon emissions, it could consume around 22% of our worldwide carbon budget by 2050. All companies, not only airlines, are now looking to reduce their CO2 emissions to stave off the ill-effects of climate tipping points.” (Ash, 2020)

I have already looked at CORSIA and carbon offsetting in chapter 1, and this concept of airlines becoming carbon neutral is still a valid, although perhaps is not sustainable for the long term. It’s going to take both this idea and the growth new, clean technology to move forward in a sustainable way.

The transition to eliminating the industry’s CO2 emissions will be very gradual, and must begin with more near-term options. A group of aerospace technology experts brought together (by FlightGlobal during the FIA Connect virtual Farnborough air show) came to a conclusion about this topic: “For the aviation industry to substantially reduce or eliminate its carbon dioxide (CO2) emissions, it will take a revolution in aircraft propulsion technology. However, near-term reductions in airliner emissions will likely take a more evolutionary approach that relies on augmenting existing technologies.” (Thisdell, 2020) Many experts believe smaller companies and start-ups will be prime drivers of next generation technologies and older companies need to be open and collaborative to new ideas.

“Evolutionary changes to jet engines have reduced fuel burn 70% since the days of the Boeing 707. Longer term, he says, more revolutionary solutions involving new fuels including hydrogen and combustion cycles may prove effective, but they are inherently higher risk if they require a new way of integrating the power plant with the aircraft or demand dedicated infrastructure”¹¹, so this will re-

¹¹ says Frank Preli, Pratt & Whitney vice-president for propulsion and materials.

quire a greater commitment to execute, with more parties involved. Although hydrocarbon fuels will remain in use for the foreseeable future, there are currently efforts to provide aeroplanes with an alternative more sustainable fuel than standard jet fuel, for example biodiesel or Synthetic jet fuels. In the medium term these alternatives could even be mixed into standard jet fuel, to reduce the volume on fossil fuels which need to be combusted. Eventually, a revolution of electrification should occur. The industry's ultimate goal is to develop large, electric-powered commercial jets. However, in order to achieve this, there are two parallel paths the sector could pursue: "developing small, all-electric aircraft, while also equipping turbine-powered airliners with additional electric systems." (Thisdell, 2020)

I also read many articles and reports about specific, unique ways that the aviation industry could become more environmentally sustainable.

For an example, the Lufthansa Group announced on May 15, 2020, that it signed a Letter of Intent to bring sustainable sun-to-fuel technology into its operation, this brand-new technology is thought to be one of the most promising and innovative solutions. They hope this new Sustainable Aviation Fuel (SAF) will drive its carbon-neutral growth in the coming years. They will partner with leaders in sustainable fuel solutions and aim to bring concentrated sunlight fuel to the mass market. Synhelion is a company who promotes solar fuels to the mass market which the airline is partnering with. They are also working with Climeworks, who specialise in CO2 capture from the air. (Ash, 2020)

The ETH Zurich (a Swiss research university) announced in 2019 that it had pioneered this new kerosene alternative, which had been able to turn concentrated sunlight into liquid hydrocarbon fuels essential for the transportation sector. The technology works by carbon capture, extracting CO2 from the atmosphere and mixing it with water and concentrated sunlight, also known as Concentrated Solar Power (CSP). This produces synthesis gas that can then be converted into jet fuel. The consumption of this new sustainable fuel is completely carbon-neutral as it only ever produces as much CO2 as was extracted from the atmosphere. Therefore, it's a much cleaner and less resource-intensive method of producing jet fuel. However, the high cost is a clear drawback. (Ash, 2020)

Another example of a unique and promising way in which airlines could become more environmentally sustainable is by changing the flying altitude by just couple of thousand feet on fewer than 2% of all scheduled flights. This research was done by a study by a team of scientists at Imperial College London¹² and it concluded that the damage to the climate caused by one consequence of aviation could be reduced by as much as 59%. (Francesca Street, 2020)

It's all about eradicating airplane contrails (the white streaks in the sky after an airplane has passed overhead.) Contrails¹³ are "a type of ice cloud formed by aircraft as water vapour condenses around small dust particles, which provide the vapour with sufficient energy to freeze." These cloud-like formations can have a cooling effect, reflecting sunlight that would otherwise heat the Earth. Contrails can also block outgoing heat from escaping the earth, trapping heat. Contrails account for 14% of climate and air quality damages per unit aviation fuel burn.¹⁴ "Flying an airplane higher or lower could help get rid of contrails because they only form in thinner areas of atmosphere, with high humidity so it's theoretically possible to avoid them and reap the eco-benefits." (Francesca Street, 2020) Diverging from the flight path does lead to an increase in fuel consumption, but the research-

¹² <https://pubs.acs.org/doi/abs/10.1021/acs.est.9b05608>

¹³ says NASA https://www.nasa.gov/sites/default/files/atoms/files/contrails_k-12.pdf

¹⁴ a study by a group of MIT scientists concluded this in November 2019

ers say it's less than a 0.1% rise and the subsequent depletion in contrails offsets the extra CO2 released.

While this change, if adopted, would be a really quick way the industry could reduce emissions, it's unlikely to satisfy climate campaigners who want the aviation sector to drastically reduce its carbon footprint.

Until COVID-19, governments had been so focused on keeping airlines globally competitive that “they largely gave the sector a free ride in terms of emissions cuts and contributions to public revenues. Aviation fuel is completely untaxed in most countries. But the crisis has weakened airline claims that they should be treated as profit-seeking independent companies rather than public entities with social responsibilities.” (Watts, 2020)

The expert I interviewed said “In essence, the industry needs to drastically shrink, we need investment in greener alternatives (train travel etc.), the industry needs to be properly taxed and levies put on frequent flyers. All of this needs to be done in a way that does not favour the wealthy, white nations and detrimentally affect the poor and the global south.”¹⁵

I asked him who he thinks should these targets and policies for aviation companies to follow and this was his response:

“If I had the choice between the aviation companies and the government, I would choose the government. However, the current government is heavily lobbied and influenced by aviation companies whose sole interest is self-preservation and profit-making. A better solution would be to hold something called a 'Citizens Assembly', like that of 'Climate Assembly UK' which was held recently.

Citizens Assemblies are essentially a group of people chosen by a process called "sortition" from all social backgrounds, races, religions, genders, sexualities. They are presented with a problem or something to decide, they are presented with facts and potential solutions from unbiased, scientific sources, they have training on group-dynamics, teamwork and decision-making, then they come together to decide on a proposed solution.

'Climate Assembly UK' has recently shown that 93% of members agreed that as lockdown eases, government, employers and/or others should take steps to encourage lifestyles to change to be more compatible with reaching net zero.

They are the perfect way to make unbiased, informed decisions by the people rather than by corporations or governments who have many stakeholders and outside interests. It is the epitome of true democracy.

These assemblies do, however, have to be legally binding, rather than advisory, to have a true impact. This is how I, and many other environmentalists, propose to solve the climate crisis.”

I had heard of Citizens Assemblies before and think it would be a good idea to introduce it into our current system to ensure large scale representation of all groups in society, deliberation, and equity into the current political decision making system.

3.4 Are these changes realistic?

¹⁵ George Hibberd, 2020

“There seems now to be a theme emerging around the restart of aviation activities among pressure groups, think tanks and politicians: Build back better.” (Jopson, 2020)

However, there is a feeling of uncertainty surrounding whether COVID-19 will truly have a positive, long-term impact on aviation sustainability policies. This is due to factors such as the severe financial losses airlines have faced and the unpredictability how long the pandemic will last and whether there will be second or third waves. It is also unclear whether the current recession will progress to a deeper depression.

“However, the crisis has also demonstrated that governments can intervene decisively once the scale of an emergency is clear and public support is present. COVID-19 has precipitated a major increase in the role of the state. Decisive intervention has begun to stabilise infection rates, prevent health systems being overwhelmed, and save lives.” (Thisdell, 2020)

The climate emergency has been compared to the COVID-19 emergency, but it is in slow motion and much graver. “Both involve market failures, externalities, international cooperation, complex science, questions of system resilience, political leadership, and action that hinges on public support. Decisive state interventions are also required to stabilise the climate, by tipping energy and industrial systems towards newer, cleaner, and ultimately cheaper modes of production that become impossible to out-compete” (Thisdell, 2020)

The expert I interviewed believed that so far the Covid-crisis has not had a positive impact on environmental policies and aviation commitments, as environmentalists were hoping it would. He told me: “It was deemed humanities last chance to reset and solve the climate crisis. It was, of course, a failure. Instead of a green recovery, the treasury announced billions of pounds of bailouts for high carbon industries like aviation, auto mobility and fossil fuel energy supply. Whilst Rishi Sunak pledged £3billion for green investment, around £16billion of tax payers money was used to bailout corporations and high carbon industries. It is appalling that tax payers money is being used to prop up businesses that are threatening our very existence and destroying the natural world. The only silver lining of the covid-crisis was that it highlighted that government action in the face of a crisis is possible and that we can tackle crises if there is political motivation. Sadly, there is no motivation to tackle the climate crisis.”¹⁶

After all my research I agree with him to an extent, but I believe there is still hope for improvement in future bailouts, with all the research being done, and with groups like Greenpeace lobbying for this change. I believe that improvements in environmental sustainability may be costly in the short term, however in the long term energy security will benefit the economy.

Before the pandemic, public support for climate change action was reaching an all-time high, government and corporate action was also gathering momentum. Understandably, the pandemic has slowed this momentum, especially by delaying the international conference on climate (COP26) from 2020 to 2021.

“However, the momentum could find new impetus if, humbled by the ability of ‘natural’ forces to shock the global economy, humans recalibrate our sense of omnipotence. Furthermore, opinion polls in many countries show that people are noticing the clean air, uncongested roads, the return of bird-song and wildlife, and are asking whether ‘normal’ was good enough; could we not ‘build back better’?” (Thisdell, 2020)

¹⁶ George Hibberd, 2020

To summarise, so far the COVID-19 government bailouts for aviation have not favoured the environmental sustainability, however fiscal recovery packages put in place in the aftermath of lockdown and for future waves of the virus will have a significant impact on whether globally agreed climate goals are met. (Thisdell, 2020) I believe that this will only happen through environmental bodies continuing to lobby the government and educating the public on the issue so that the public begin demanding a clean recovery. At this point the future is unclear.

Chapter 4: Survey

4.1 Survey introduction

As part of my research I created an online survey to assess the views of the public, especially those in the aviation industry, on the topics I was looking into. I thought that it would supplement my research well to gain the opinions of the public, not just experts. Through using the survey monkey I could only present the results of 40 responses however, with more responses the results would hold more weight.

I carefully created ten questions which would be quick and easy to answer. None of the respondents skipped any of the questions because of this effort I made. The first two questions had the function of defining my audience. I didn't include any open ended questions, but for some questions I included an option where they could specify or explain their answer. I learnt a lot while analysing the results from my survey.

In the section below I will include what questions I chose and the results I obtained from them, and the respondents identities will remain anonymous.

4.2 The survey questions and findings

1. What industry do you work in?

From this question I learned that 60% of my respondents were air crew so would know a lot about aviation before taking this survey. 5% of respondents were engineers, 5% worked in transport and logistics while 2.5% worked in Airline Ground Operations/ Management and 2.5% Airports/ ATC, so these people would also have knowledge on aviation 7.5% were students and 17.5% selected 'other' specifying they worked in other industries like education, airline recruitment, charity worker or said they were a retired RAF and airline pilot. I think this is a good range of people to have completed my survey, however no one from an environmental background answered, which causes a lack of representation from this group. It would have been good for someone who works with environmental matters to have completed the survey as this is what I've been doing my research on.

2. How old are you?

5 of my respondents were under age 25, 17 of them were age 25-50, 16 were age 51-70, and 2 people were over 70. This is good as a diversity of ages are represented in this survey.

3. Have you ever thought about the consequences of COVID-19 in the aviation industry and the impact on sustainability?

95% of the respondents replied 'yes' and only 5% hadn't thought about it. This shows that the majority of people had previously thought about the topic I am researching, and I'm sure this is because it is so current and there's lots in the news about it.

4. How long do you predict it will take for the aviation industry to fully recover from COVID-19?

30% thought it would take 1-2 years, 57.5% thought it would take 3-4 years while 12.5% thought it would take over 5 years. This shows most of the public believe it will take several years for the aviation industry to recover from this crisis, but

no one knows if this will be the case due to the unpredictability of the future at the moment.

5. Do you believe that COVID-19 has had an overall positive impact on the environment?

21 people replied with 'yes', and 15 replied with 'no', while 4 people didn't know. The people who said no probably made their decision based off knowing the dip in emissions won't last and by thinking of how the financial losses may cause a reduction in investment in clean technology.

Those who believed COVID-19 had an overall positive impact on the environment were most likely referring to the improvements in air quality and decrease in emissions seen during lockdown. They may also think so due to reading in the news that government bailouts for aviation companies should come with "green strings" attached which leads on to the next question.

6. Do you think that government bailouts for aviation companies should come with "green strings" attached or any sustainability obligations?

For this question, despite there being a lack of environmentalists/ people working in the environment sector and a majority of respondents being air crew with their jobs on the line, 55% answered with yes. This supports my conclusion as I would also answer 'yes' to this question after doing this research. It also links back to what George Hibberd told me about citizens assemblies in part 5.3 of this report and the public's appetite for a green recovery. However, 32.5% of responses were 'no' and 12.5% were 'don't know'. These people could have thought that rescue packages should have public welfare or other concerns as bigger priorities.

7. What do you think is the most effective way to make the aviation industry more sustainable?

I provided three options in this question as well as an additional 'Other (please specify)' option.

20% of respondents chose 'To shrink the aviation industry', 17.5% chose 'Carbon offsetting (CORSIA Project)', 50% chose 'New technology (i.e. new electric propulsion systems)' while 12.5% chose 'other'. 4 of the 5 people who picked 'other' specified a combination of the three (which will most likely be the way forward in the future) and the other person gave this interesting answer:

“Green incentives as opposed to quotas or obligations. Modern LCCs are multiple times more efficient than many older legacy airlines flying older aircraft. Incentives like the carbon offset or carbon credits will help ensure the most efficient airlines will thrive, thereby making the industry as a whole more efficient.”

8. Do you trust that the current environmental commitment and targets within the present airline industry are enough to ensure a sustainable future?

10% of respondents answered ‘yes’, 70% answered ‘no’ and 20% answered ‘don’t know’. The response to this question supports my conclusion that the current environmental commitment and targets aren’t enough to ensure a sustainable future, despite CORSIA being praised by the media.

9. Who do you think should set the environmental targets for the aviation industry?

4 people answered ‘National governments’, 17 answered ‘International bodies (i.e. G7 Summits)’, 14 answered ‘ICAO (International Civil Aviation Authority)’ and only one person chose ‘Own targets by individual airlines’. The rest of the respondents chose ‘other’ and specified that a citizens assembly should set the environmental targets, sharing the viewpoint of George Hibberd, that these decisions should be apolitical and backed by scientific evidence. I agree with this choice.

10. Should the costs of carbon offsetting projects be...?

52.5% of the respondents chose ‘Included in airline passenger tickets’, 32.5% chose ‘Paid by central governments’ and 15% chose ‘Paid by individual airlines’. However, nobody chose the option ‘Paid by personal voluntary contributions’, and I agree that this would unlikely be effective.

Discussions and conclusions

To conclude, COVID-19 has severely impacted airlines as the demand for flights has significantly dropped in order to prevent the spread of the virus. As a result of this, there has been a positive short term impact on the environment, as emissions have dropped to an all-time low and air quality has improved in the majority of cities.

However, this short-lived dip in emissions is set to bound back to higher than pre-covid levels as we come out of lockdown, and so far there has been no strong evidence that COVID-19 will have a long term, positive impact on the environment. Government bailouts have favoured high carbon, climate destroying industries rather than green, sustainable industries, and there have been no "green strings" attached or any sustainability obligations. But this doesn't mean there is no hope of a green recovery. The past bailouts were made in a hurry and there is now more time and flexibility to form 'green' fiscal rescue packages for airlines, and this is especially likely with environmental bodies and the public continuing to lobby for this change.

Although these policies would benefit the environment, they would also benefit people and the economy in the long term. The money should be used to retrain those workers who are made redundant into green-sector jobs. This way, employment and income security is maintained as we transition to a green future. The policies should also capture co-benefits.

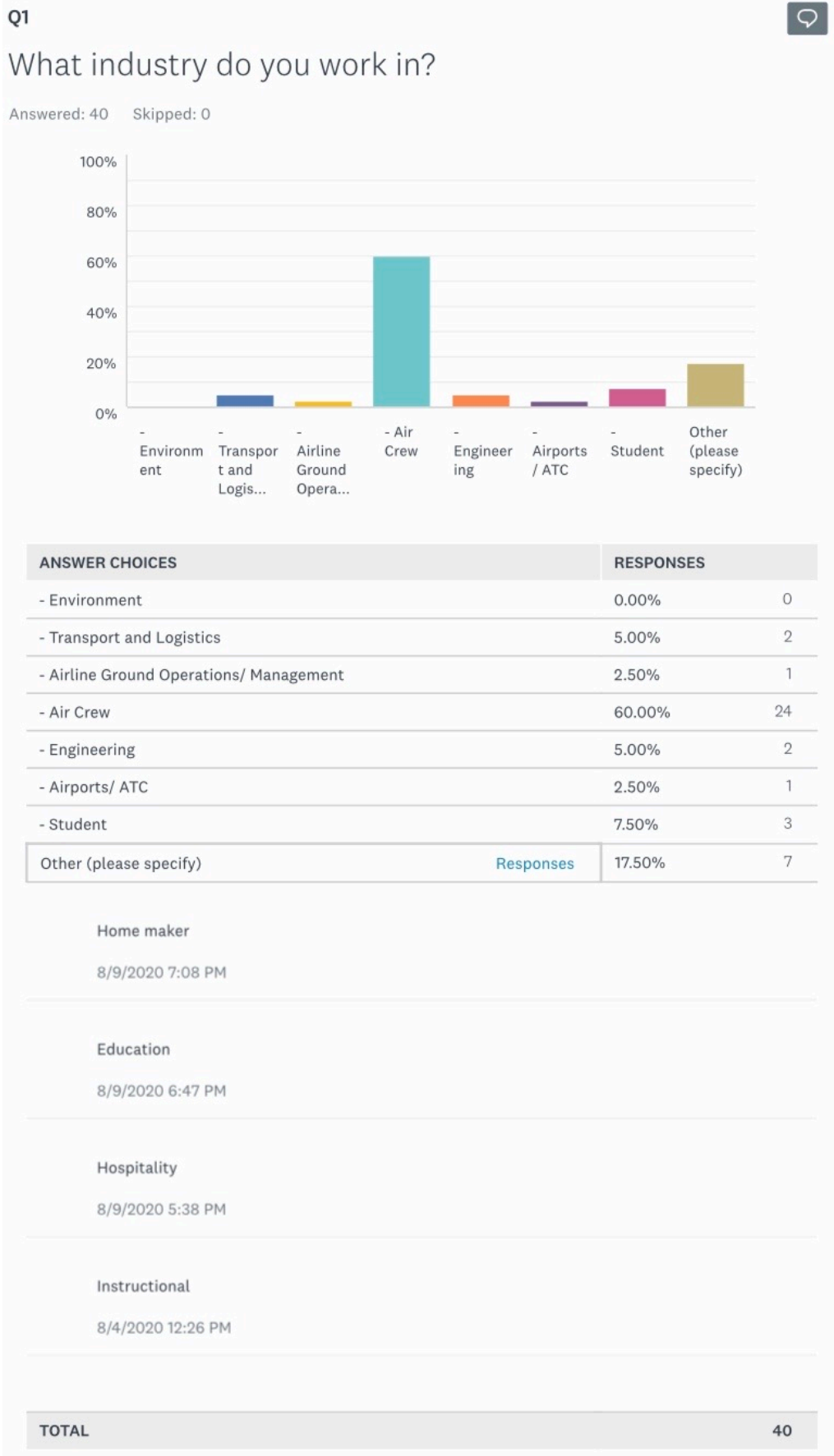
"Climate Assembly UK and polls from Ipsos MORI have shown that public appetite for a green recovery and a drastic change to how we live is very high. We need to trust scientists and trust the people."¹⁷

Before doing this research project, I believed that EasyJet and the CORSIA program were a good step in the right direction. However, now I don't believe that this is the case, especially since their decision to scrap the 2019-2021 baseline figure and use the 2019 figures. Carbon offsetting should still be used by airlines in the future, however, this shouldn't be the only technique used to be environmentally sustainable. More work should be done towards finding alternative aeroplane fuels and towards electrifying planes.

Overall, progress on climate change will depend considerably on policy choices in the coming months; the right choices could drive a long-term downward trend in GHG emissions, and possibly mean that the goals set in the Paris agreement are met. When the governments make these policies they should be led by findings from Citizens Assemblies so they make fair, unbiased, decisions informed by science. The current solutions aren't effective enough, but COVID-19 has given the opportunity for this to change, before it's too late. We will need to balance societies that need to fly with its environmental costs, as the aviation industry is fundamental to the economy in many places.

¹⁷ George Hibberd, 2020

Appendix: Data from survey

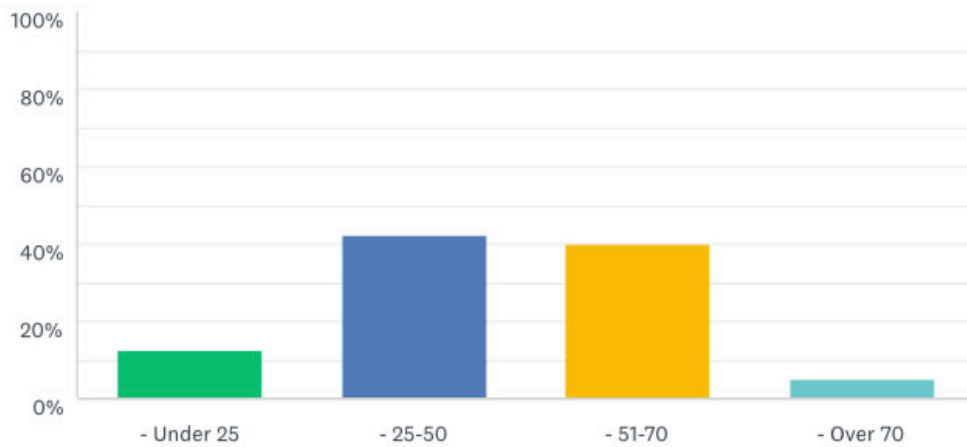


Q2



How old are you?

Answered: 40 Skipped: 0



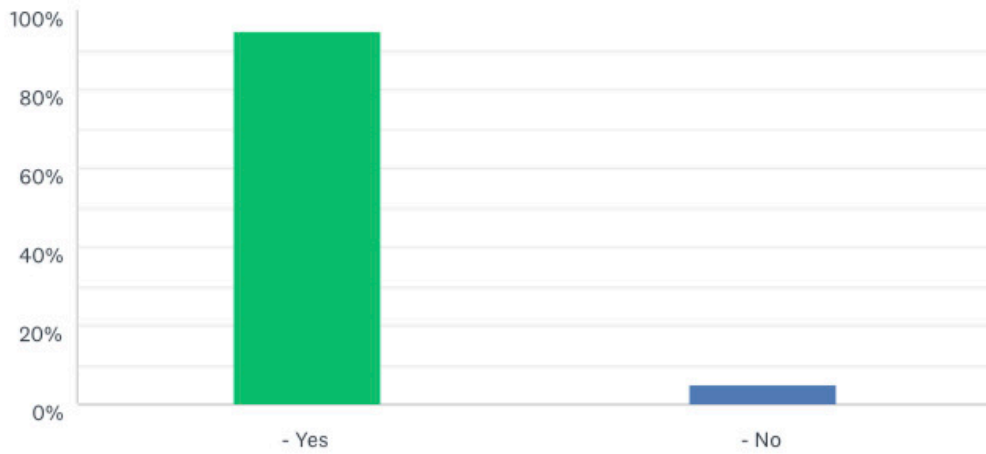
ANSWER CHOICES	RESPONSES	
- Under 25	12.50%	5
- 25-50	42.50%	17
- 51-70	40.00%	16
- Over 70	5.00%	2
TOTAL		40

Q3



Have you ever thought about the consequences of COVID-19 in the aviation industry and the impact on sustainability?

Answered: 40 Skipped: 0



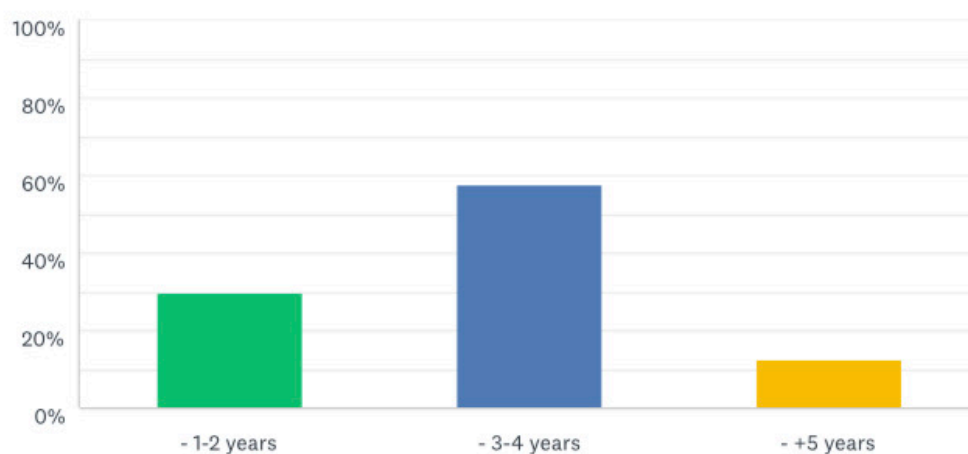
ANSWER CHOICES	RESPONSES	
- Yes	95.00%	38
- No	5.00%	2
TOTAL		40

Q4



How long do you predict it will take for the aviation industry to fully recover from COVID-19?

Answered: 40 Skipped: 0



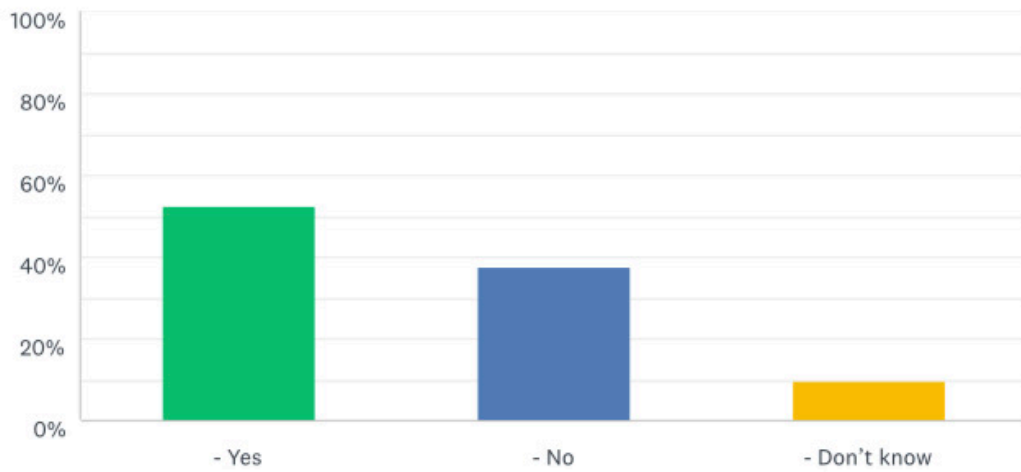
ANSWER CHOICES	RESPONSES	
- 1-2 years	30.00%	12
- 3-4 years	57.50%	23
- +5 years	12.50%	5
TOTAL		40

Q5



Do you believe that COVID-19 has had an overall positive impact on the environment?

Answered: 40 Skipped: 0



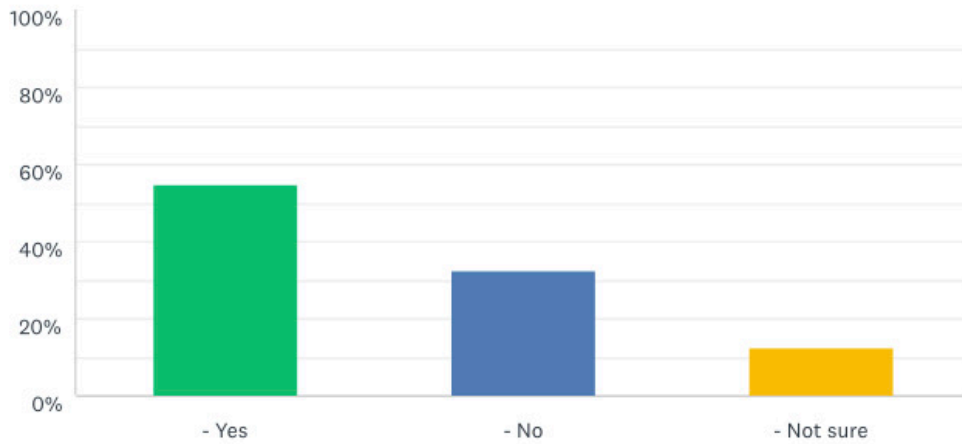
ANSWER CHOICES	RESPONSES	
- Yes	52.50%	21
- No	37.50%	15
- Don't know	10.00%	4
TOTAL		40

Q6



Do you think that government bailouts for aviation companies should come with “green strings” attached or any sustainability obligations?

Answered: 40 Skipped: 0



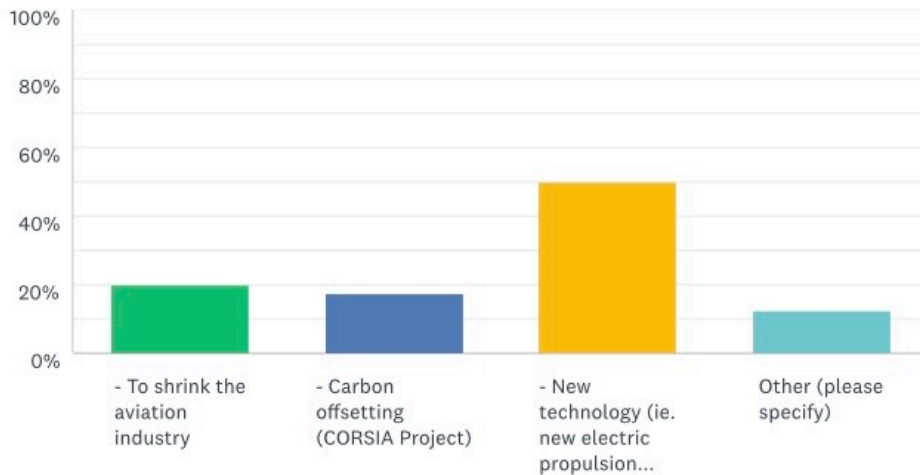
ANSWER CHOICES	RESPONSES	
- Yes	55.00%	22
- No	32.50%	13
- Not sure	12.50%	5
TOTAL		40

Q7



What do you think is the most effective way to make the aviation industry more sustainable?

Answered: 40 Skipped: 0



ANSWER CHOICES	RESPONSES	
- To shrink the aviation industry	20.00%	8
- Carbon offsetting (CORSIA Project)	17.50%	7
- New technology (ie. new electric propulsion systems)	50.00%	20
Other (please specify)	12.50%	5

A combination of all 3

8/9/2020 7:08 PM

Both shrinking and new technology. Also banning private jets and first class/business class tickets.

8/9/2020 5:38 PM

Shrink as well as increased spending in R&D for viable alternatives

8/7/2020 11:19 AM

Green incentives as opposed to quotas or obligations. Modern LCCs are multiple times more efficient than many older legacy airlines flying older aircraft. Incentives like the carbon offset or carbon credits will help ensure the most efficient airlines will thrive, thereby making the industry as a whole more efficient.

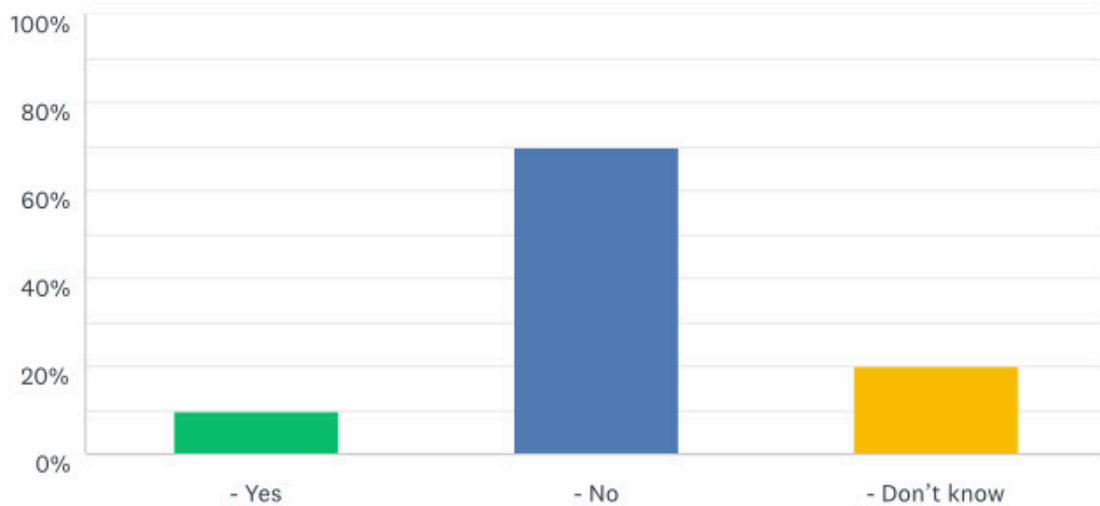
TOTAL	40
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Q8



Do you trust that the current environmental commitment and targets within the present airline industry are enough to ensure a sustainable future?

Answered: 40 Skipped: 0



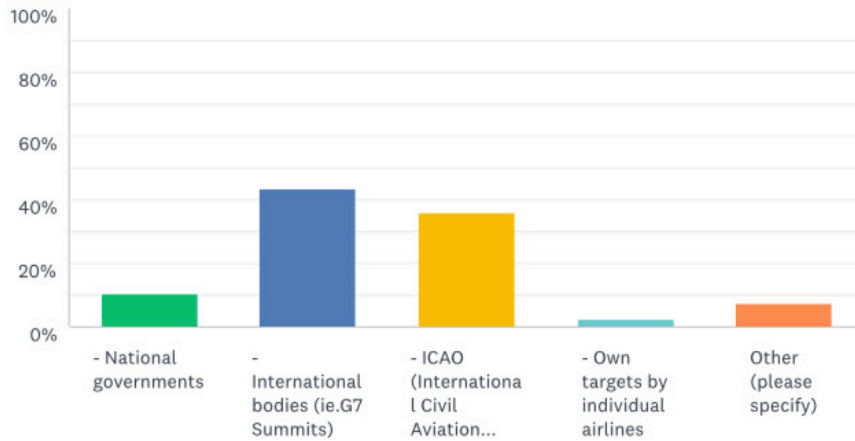
ANSWER CHOICES	RESPONSES	
- Yes	10.00%	4
- No	70.00%	28
- Don't know	20.00%	8
TOTAL		40

Q9



Who do you think should set the environmental targets for the aviation industry?

Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES	
- National governments	10.26%	4
- International bodies (ie.G7 Summits)	43.59%	17
- ICAO (International Civil Aviation Authority)	35.90%	14
- Own targets by individual airlines	2.56%	1
Other (please specify) Responses	7.69%	3

Citizens Assembly

8/7/2020 11:19 AM

Governmental policies led by National Citizens' Assemblies (like Climate Assembly UK, but the results of which should be legally binding, not as guidance as it currently stands).

8/7/2020 11:14 AM

Impartial independent bodies comprised of representatives from industry and science.. must be apolitical

8/4/2020 12:22 PM

TOTAL

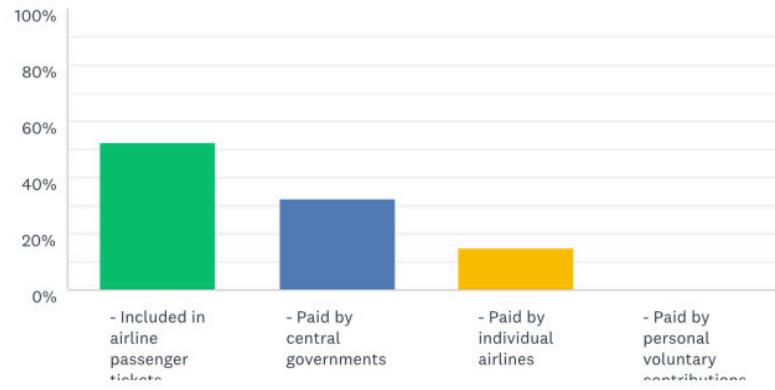
39

Q10



Should the costs of carbon offsetting projects be...

Answered: 40 Skipped: 0



ANSWER CHOICES	RESPONSES	
- Included in airline passenger tickets	52.50%	21
- Paid by central governments	32.50%	13
- Paid by individual airlines	15.00%	6
- Paid by personal voluntary contributions	0.00%	0
TOTAL		40

List of figures

Figure 1: BBC News, 2020. British Airways Has Moved A Number Of Its Planes To Bournemouth Airport. [image] Available at: <<https://www.bbc.co.uk/news/uk-england-london-52089046>> [Accessed 6 August 2020]. Page 1.

Figure 2: Committee, T., 2020. Coronavirus Has Reduced Air Travel By 97% This Year. [online] Houseofcommons.shorthandstories.com. Available at: <<https://houseofcommons.shorthandstories.com/coronavirus-impact-aviation-transport-report/index.html>> [Accessed 16 August 2020]. Page 5.

Figure 3: Pasley, J. and Frias, L., 2020. Satellite Photos Show The Deserted Streets Of Wuhan As The City Enters Its 8Th Day Of Quarantine. [online] Business Insider. Available at: <<https://www.businessinsider.com/wuhan-satellite-photos-show-deserted-streets-coronavirus-quarantine-2020-1?r=US&IR=T#but-by-january-29-major-roads-were-completely-deserted-during-the-day-12>> [Accessed 19 August 2020]. Page 10

Figure 4: Pasley, J. and Frias, L., 2020. Satellite Photos Show The Deserted Streets Of Wuhan As The City Enters Its 8Th Day Of Quarantine. [online] Business Insider. Available at: <<https://www.businessinsider.com/wuhan-satellite-photos-show-deserted-streets-coronavirus-quarantine-2020-1?r=US&IR=T#but-by-january-29-major-roads-were-completely-deserted-during-the-day-12>> [Accessed 19 August 2020]. Page 10

Figure 5: Ghosh, I., 2020. These Satellite Photos Show How COVID-19 Lockdowns Have Impacted Global Emissions. [online] World Economic Forum. Available at: <<https://www.weforum.org/agenda/2020/03/emissions-impact-coronavirus-lockdowns-satellites>> [Accessed 19 August 2020].

Figure 6: Compennolle, S. and Lefever, K., 2020. TROPOMI Observes The Impact Of The Corona Virus On Air Quality In China. [online] Royal Belgian Institute for Space Aeronomy. Available at: <<https://www.aeronomie.be/en/news/2020/tropomi-observes-impact-corona-virus-air-quality-china>> [Accessed 21 August 2020].

Figure 7: Ghosh, I., 2020. These Satellite Photos Show How COVID-19 Lockdowns Have Impacted Global Emissions. [online] World Economic Forum. Available at: <<https://www.weforum.org/agenda/2020/03/emissions-impact-coronavirus-lockdowns-satellites>> [Accessed 19 August 2020].

Figure 8: Ministry of Ecology and Environment of China. 2020. Report On The State Of Surface Water And Ambient Air Quality Nationwide In March And January–March.. [online] Available at: <http://www.mee.gov.cn/xxgk2018/xxgk/xxgk15/202004/t20200414_774254.html> [Accessed 20 August 2020].

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Acknowledgements

This research paper would not have been possible without the exceptional support of my supervisor, Maria Digings. She has been a pilot for 30 years and is now a training captain on A320. She has also completed a master's degree, on Aviation Safety Management, so has knowledge not only about aviation but also the process of research. Her enthusiasm, knowledge and exacting attention to detail have been an inspiration and kept my work on track from my initial ideas to the final draft of this paper.

I also want to thank Kanchana Vanhove, my project coordinator, who I could turn to with any problem I faced for advice. She provided me with all the resources that I could possibly need for this project.

I thank George Hibberd, who is a pilot and environmentalist, an expert on what I have been researching. He gave great answers to my questions which have been invaluable to my research.

Lastly, thank you to Sally Moore, Julianne Law and the Nuffield research team for providing me with this opportunity and teaching me all about the process of research before I completed this paper.