The Rise of Flight Shaming in Europe: How Peer Pressure is Reshaping Transportation

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

The civil aviation industry is rapidly expanding. The International Air Transport Association (IATA, 2018) suggests that global annual commercial passengers could double to 8.2 billion by 2037 given projected growth prior to the covid-19 pandemic. With this growth comes unintended side effects. Carbon emissions from commercial aviation rose nearly 30% from 2013 to 2018 according to the International Council on Clean Transportation (ICCT, 2019). Growth in private and commercial air traffic is causing aviation to become a larger contributor to global pollution.

Government response to aviation pollution over the years has been minimal. Advocacy organizations and community led movements have been making attempts to help slow the increase with some success. Through social awareness campaigns and boycotts, a number of participants have helped spur a socially responsible flying movement. “Flight shaming” originated in 2018 in Sweden with the leadership of environmental activist Greta Thunberg. Aviation passenger numbers fell by 5% in Sweden in the year following the beginning of this movement (Center for Aviation 2019). As “flight shaming” has begun to spread internationally, there has been resistance to change from both the public and airlines. The reason behind this resistance is the importance of civil aviation. It is a major contributor to the global and U.S. economies. The FAA (2016) found it was responsible for $1.6 trillion in annual economic activity, supported 10.6 million jobs, and accounted for 5.1% of the total GDP in 2014 in America. The Air Transport Action Group (ATAG 2005) also estimates that 40% of international tourists travel by air. Aviation plays an increasingly important role in global economies and relations. In this paper I discuss the current and projected impact of civil aviation on society as a whole. I will then show how governments and the public must address the current state of civil

aviation pollution and what methods have proved most helpful in reducing carbon dioxide (CO2) emissions.

Part 1: The Current State of Civil Aviation Growth and Pollution

A Growing Sector

The civil aviation sector is a crucial part of the world's economy. Its impact intersects multiple different industries, ranging from tourism to freight. Its international transportation network is unique for its speed and efficiency. No other form of transportation can rival the time at which aviation can move people or products from one location to another, regardless of distance. Aviation's fuel efficiency by distance is only rivaled by rail, and is on pace to eclipse it in the future (FAA 2015). This makes aviation one of the most crucial forms of transportation for the domestic and global economy. As mentioned earlier, the aviation industry supports millions of jobs worldwide.

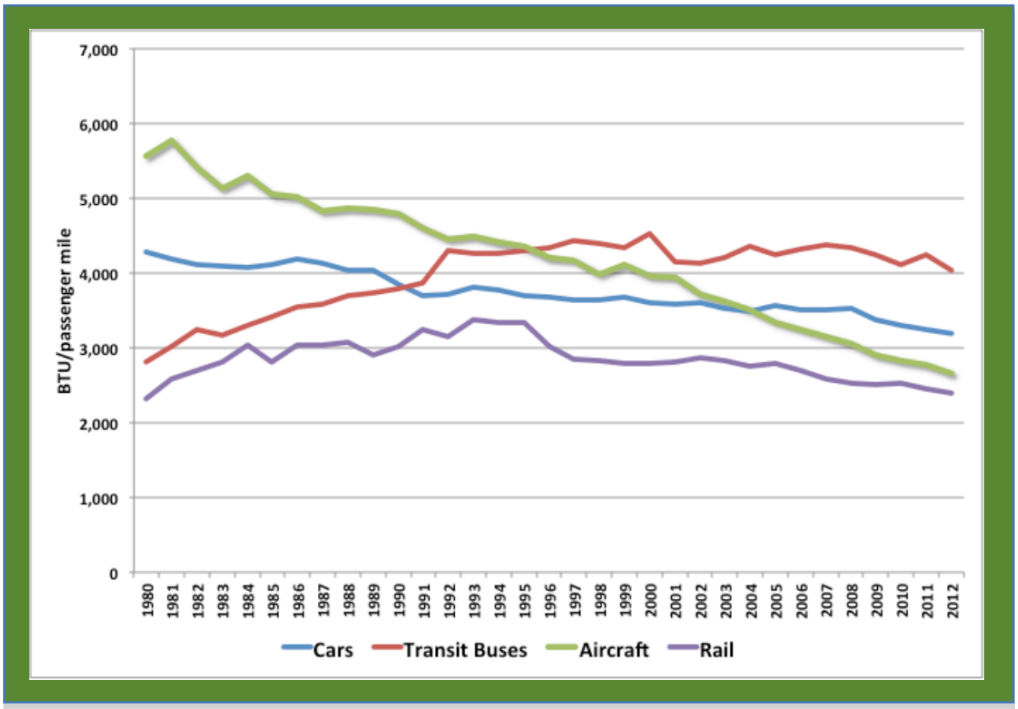

Figure 1: Vehicle Fuel Efficiency Comparison (FAA 2015)

Civil aviation is projected to dramatically grow over the next two decades. As noted, global annual commercial passengers could double to 8.2 billion by 2037 (IATA 2018). The majority of this growth will be in China and India, who will account for roughly 1.5 billion of the new 4 billion passengers. Commercial aviation grows at a rate 2.4 times faster than GDP (Gonzalez & Hosoda 2016). As developing countries experience GDP growth explosions similar to those in China in the early 21st century, it can be expected that demand for commercial aviation will significantly expand. Growth in freight is also expected, further increasing the number of flights globally. Recent drops in ticket prices have helped create a surge in the use of aviation for tourism purposes. Ticket prices have dropped around 40% globally since the 1970's (ATAG 2005). These price reductions have changed how the public uses commercial aviation, making it more accessible to those using it for leisurely purposes. All of these factors contribute to a greater number of flights every year. With this increase in volume comes an increase in the side effects they produce.

A Growing Impact

Further growth in civil aviation demand is expected to significantly increase the growth in air pollution. Transportation has recently become the leading source of CO2 produced by sector in the United States. While cars and trucks are still the largest sources of transportation pollution, auto electrification has begun to lower global demand for gasoline. A 3.0% increase in demand for jet fuel (Rhodium 2019) was the largest contributor to the most recent growth in transportation emissions, with commercial aviation being the driving factor. Commercial aviation accounted for 2.4% of global CO2 emissions in 2018 (ICCT 2019). If treated as a nation, global aviation would have been the sixth largest source of CO2 emissions in the world (ICCT 2019). Nearly 80% of these emissions come from passenger flights (ICCT 2019). One

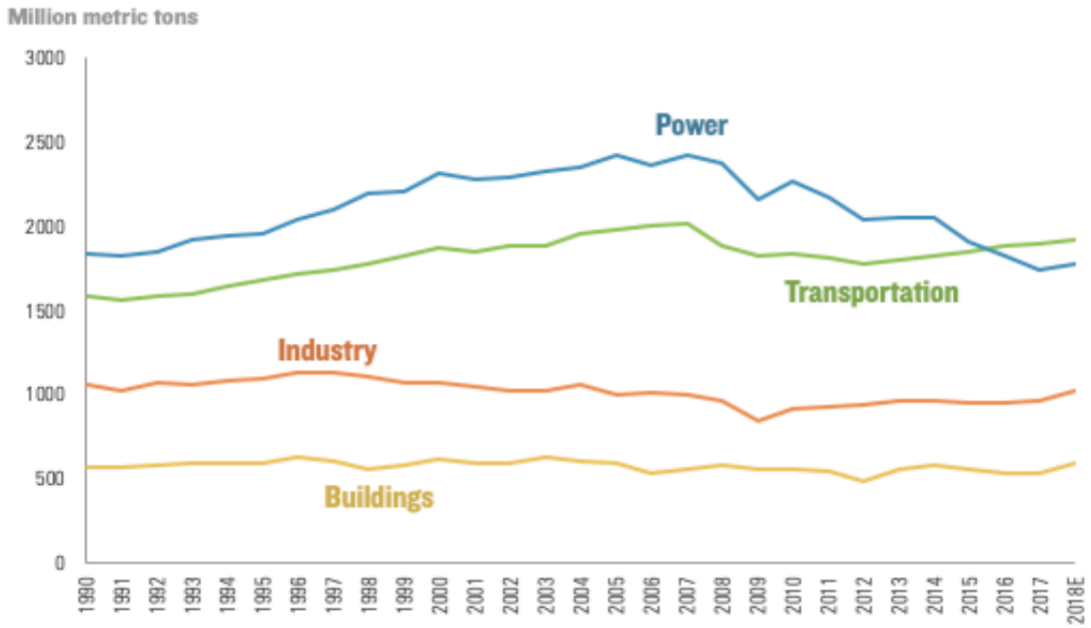

Figure 2: CO2 Emissions by Sector (Rhodium 2019)

source of the increase in demand of jet fuel could be dropping airline tickets. Flying has traditionally and still is a form of transportation mostly utilized by wealthy customers. As seen in figure 3 (ICCT 2019), an estimated 62% of CO2 emissions from commercial aviation in the U.S. come from those in high income tax brackets. Lower prices are allowing for those who previously could not afford it to now fly. This in turn is increasing demand and subsequently the volume of commercial aviation traffic. This increasing pollution is having a measurable impact on the economy and the public's wellbeing. Schafer & Waitz (2014) estimate greenhouse gas pollution from aviation costs nearly $10 billion annually in global damages, and would only continue to rise given current projections.

Without counteracting measures, CO2 emissions from commercial aviation may grow from 2% to 25% of the worldwide carbon budget by 2050 (ICCT 2019). In this same scenario, CO2 emissions would be 7-8 times what they were in 1990 (Volta et al., 2013). The airline industry has promised to halve emissions by 2050 (IATA 2018). Current CO2 projections make

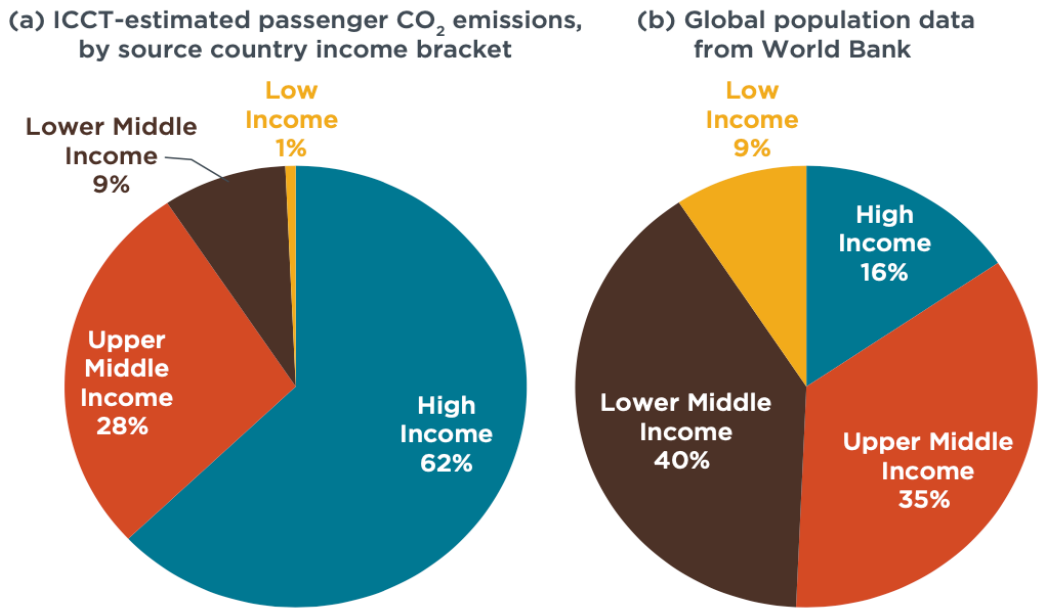

Figure 3: CO2 Emissions by Income Bracket (ICCT 2019).

meeting these goals unlikely. Given the projected rise in the volume of flights, airlines are mostly looking to reduce emission by investing in more efficient technology.

Current Status of Greener Aviation Technology and Better Practices

Advances in aviation technology could prove to be fruitful in reducing future CO2 emissions. One study found that aircraft have already seen a 70% decrease in fuel burn over the 1960-2000 timespan (Schafer & Waitz 2014). This same study found that CO2 emission could be further reduced by 20-40% by 2050 if certain steps are taken. This falls short of the promise mentioned by the IATA, but is significant nonetheless. Many advances have already been made in recent years in engineering more efficient aircraft. New composite materials called carbon-fiber-reinforced-polymers (CFRP) have been developed and are being integrated into traditional aluminum airframes. CFRPs are comparable in performance to aluminum, but have significant weight savings. A study on CFPRs shows that transitioning to these new aircraft would reduce

CO_2 emissions by about 15% (Timmis et al., 2014). Fully replacing all planes could further reduce CO_2 emissions by 20-25% (Timmis et al., 2014).

Alternative fuel sources have been researched and could be used to reduce CO_2 emissions. So far progress has been slow. Electric powered aircraft have gained attention in recent years as battery and solar technology has advanced. A study by Abbe and Smith (2016) highlights the short falls of electric aircraft. Airplanes require fuel sources with high energy densities in order to be able to support flight. The current energy density of batteries makes them infeasible for use in Airplanes. These densities don't come close to those of the hydrocarbons that comprise jet fuel. However, some electric aircraft that also utilize solar panels have shown promise. In 2016 Solar Impulse 2 made a round the world flight only on solar energy (Solar Impulse Foundation, n.d.). Scaling this design up could prove difficult as the plane could only travel at 45 miles per hour, cost $170 million to make and could only carry one passenger. Advanced technology could eventually solve our issues, however more immediate solutions are needed to lower emissions.

Better staging practices at airports could also lead to reductions in CO_2 emissions. Significant amounts of fuel are wasted during taxiing and congestion delays. By reducing the number of airplanes on the runway, significant amounts of fuel waste can be prevented. According to a study by Nakahara and Reynolds (2013), with more efficient taxiing practices billions of gallons of fuel can be saved over the next two decades in just the top 35 US airports alone. These practices involve keeping airplanes at gates longer and only releasing them immediately prior to take off, as is seen in figure 4. This would prevent between 22 million and 37 million metric tons of CO_2 emissions per year, which translates to a 1% reduction in all commercial aviation emissions (Nakahara & Reynolds 2013). These savings would be easy to

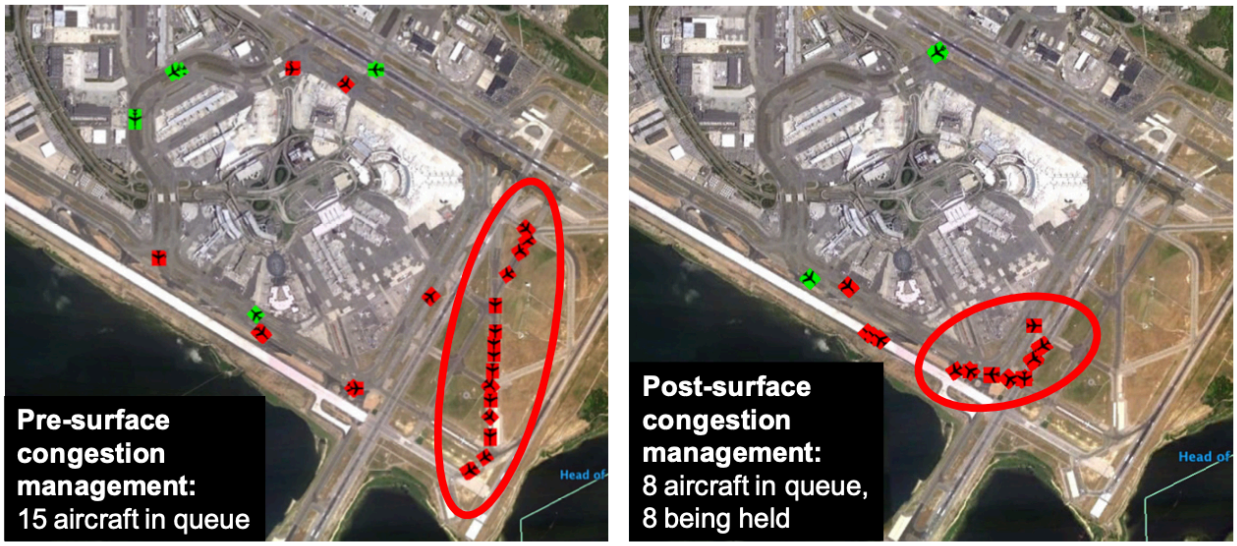

Figure 4: Visualization of Congestion Management (Nakahara & Reynolds 2013).

implement and would result in an immediate reduction in CO2 emissions. Airlines would also see between $6 and $10 billion in fuel savings, incentivizing them to adopt these new practices. However it currently appears that implementing these practices would first require policy-makers to embrace and support them.

Part 2: Government Intervention

Carbon Taxes and Modern Fleets

A carbon tax on commercial jet fuel could prove to be a promising method of reducing CO2 emissions in the mid future. No such tax has been implemented in either the United States or globally. In the United States commercial jet fuel taxes of any kind are nearly nonexistent at 4.3 cents a gallon (Taxpayer Relief act of 1997). In comparison, auto related gasoline taxes average 48 cents per gallon in the United States (Energy Information Administration 2020). Measuring the environmental impact of jet fuel taxes is hard to quantify. However, recent changes in jet fuel taxes in Japan have allowed us to do so. In the 1970's Japan implemented a tax on all jet fuel for domestic aviation for the purpose of infrastructure investments. Following

pressure in the late 2010's from the public, the tax was subsequently reduced by 30%. This allowed for CO2 emissions before and after the tax reduction to be compared. A study by González and Hosoda (2016) used a Bayesian time series approach to contrast the results of the tax reduction. They found that the tax break caused CO2 emissions from domestic flights to be about 0.5% higher than if the jet fuel tax had not been adjusted (González & Hosoda 2016). The authors concluded that by implementing a jet fuel tax, significant reductions in CO2 emissions could be made. They also noted that the Japanese commercial aviation fleet is much more modern and efficient than that of the American one. This means that similar reductions in aviation fuel demand in the United States could translate into even great CO2 emission savings, making an increased commercial fuel tax even more effective.

Aviation fuel taxes could be repurposed to help modernize the aging American commercial aviation fleet. A study by Adler, Martini and Volta (2013) showed that the continued use of less efficient older aircraft by commercial airline companies is emitting extra CO2 that could be prevented by upgrading aircraft more frequently. The authors then note that the revenue from an aviation fuel tax could be taken and used to subsidize loans that would be offered to airlines to purchase new aircraft or upgrade older ones (Volta et al., 2013). These loans could act as a catalyst to phasing out older, less efficient aviation technology. The authors used two major European airports as candidates for their analysis, looking at how a modern fleet would affect emissions. They found that newer technologies would decrease carbon emissions by 11% at one airport and 16% at the other. Implementing this system would allow for carbon saving to be made by both a reduction in aviation fuel demand and an increase in the use of more efficient technology(Volta et al., 2013). However, such policies would almost certainly face resistance from the commercial aviation industry.

Public Resistance

Implementing an aviation tax would require international agreement if it were to be successful. González & Hosoda (2016) noted that if a tax were not equally adopted globally, airlines would need to change their operational behavior or would otherwise face being uncompetitive. A tax applied regionally to flights would only cause a loss in market share. Current international agreements within the ICAO (1944) also prevent the taxation of fuel for international flights. This agreement was reached in 1944 following the end of World War 2 and was established in order to increase international trade. Many now believe it is outdated. However, recent calls to repeal this agreement has seen no progress.

Government regulation and intervention in the aviation industry has also been met with resistance in domestic legislative bodies. The large importance of commercial aviation to our economy makes policy makers hesitant to implement regulations that could cost jobs. In 2015 the EPA (2015) proposed a method for setting international CO2 emissions standards and recognized the fact that carbon emissions from aviation are detrimental to public health. This did little more than recognize that there was a problem, and has not progressed any further under the new Trump administration. Large trade associations have been created by companies with significant economic interests in the aviation sector to ensure that they are protected. The IATA (n.d.), which has 299 member airline companies, releases reports highlighting the positive economic impacts of the aviation industry. These reports largely ignore the environmental and health costs that come with commercial aviation. Because of this the public is largely educated on the benefits of aviation in their daily lives, but are unaware of the costs it is incurring to the public as a whole. This makes implementing regulation difficult. Public resistance currently the main obstacle to restructuring aviation away from fossil fuels(González & Hosoda 2016).

Part 3: Social Movements

Social Campaigning Effectiveness

Advocacy organizations and community led movements in recent years have begun to spread awareness of the costs aviation travel and global warming have as a whole. Through the use of public awareness campaigns and organized boycotts, these groups have made an impact in how the world views the commercial aviation sector and its responsibility to reduce emissions. An very notable trend called “flygkam” or “flight shaming” has been taking place across Europe. The loosely organized movement originated in Sweden when celebrities across the country began to use social media to pledge to reduce their use of air travel. Among the celebrities was teenage activist Greta Thunberg (2018) and her mother. The movement specifically targeted the use of domestic air travel and encouraged others to use trains to travel when possible. While the efficiency between rail and aviation is comparable when aviation is looked at on average (FAA 2015), short range air travel is extremely inefficient. As can be seen in figure 5, domestic flights have an extremely high carbon intensity. Shorter flights also comprise a significant portion of all carbon emitted by commercial aviation. Because these flights can be easily replaced by rail travel in Europe, they were the perfect candidate for the “Flight Shaming” movement. Other movements with messages similar to this one have also gained traction recently in Europe.

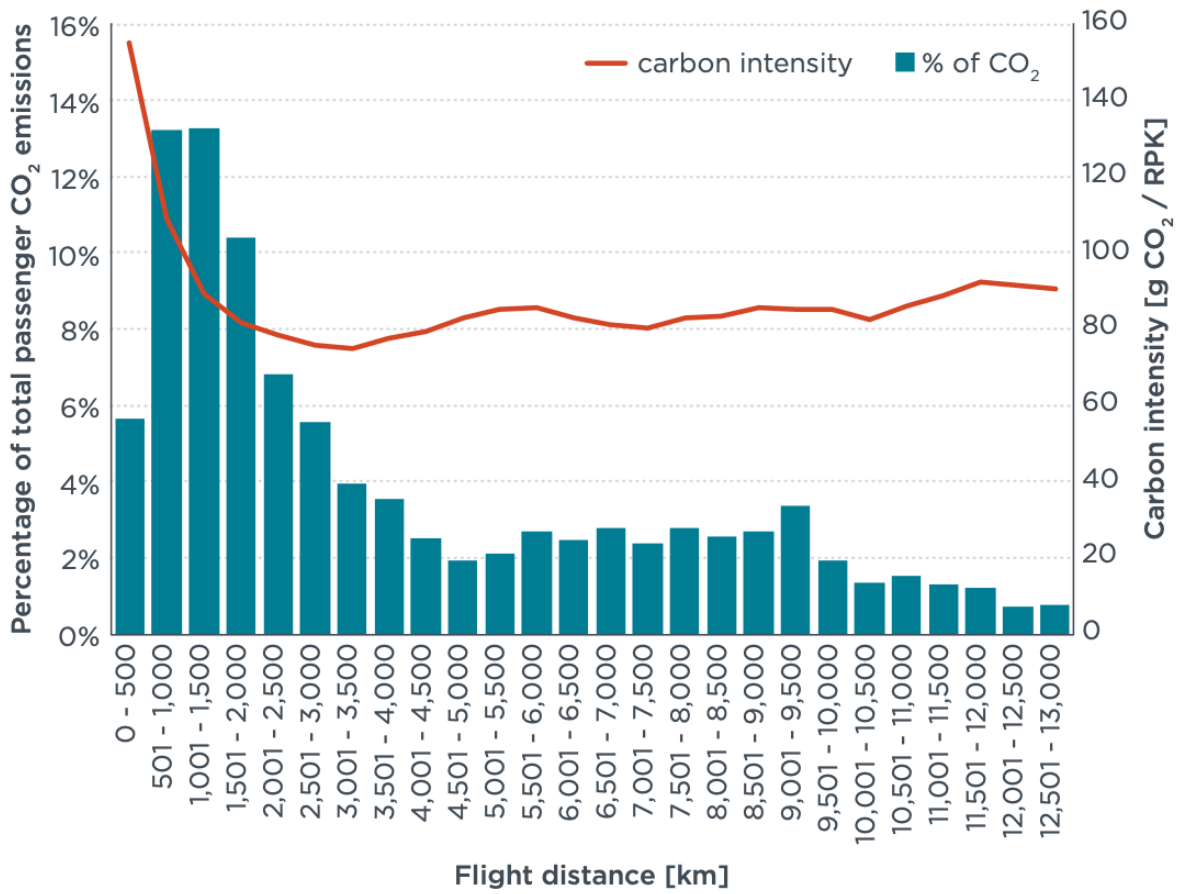

Figure 5: Share of CO2 emissions by flight length (ICCT 2019).

Fridays for Future (FF, n.d.) are organized advocates of climate conservation. Started by Greta Thunberg, its participants aim to raise awareness through protesting and campaigning. As of April 2020, their website claims the movement has over 13 million participants (FF, n.d.). They too advocate for more responsible flying. The Swedish organization We Stay On The Ground (WSG, n.d.) also has ties to the movement. They describe themselves as an "organization that aims to spread awareness about the climate impact from flying" (WSG, n.d.). They help inform the public using awareness campaigns over social media. They have organized and supported grassroots boycotts across Sweden, The UK, USA, Peru, Australia, Germany, Canada, France, Slovenia, Netherlands, and Belgium aimed at getting participants to pledge not to use aviation

travel for a year. The “Flight Free” campaign has the goal of reaching 100,000 signatures within the United States alone (Flight Free USA, n.d.). For those that cannot cease flying for various reasons, they can sign a pledge to reduce their air travel. These methods have educated the public and encouraged more thought about conscientious air travel.

There is evidence these movements have been making significant impacts on aviation travel. Following the increase in the popularity of the “Flight Shaming" movement in Sweden in 2019, the country experienced a 5% decline in all air travel as can be seen in figure 6 (Center for Aviation 2019). These numbers indicate that social movements organized by the public are an effective way of reducing the number of flights people are taking in the short term. Airline companies have quickly realized the credibility of these movements and have moved to publicly

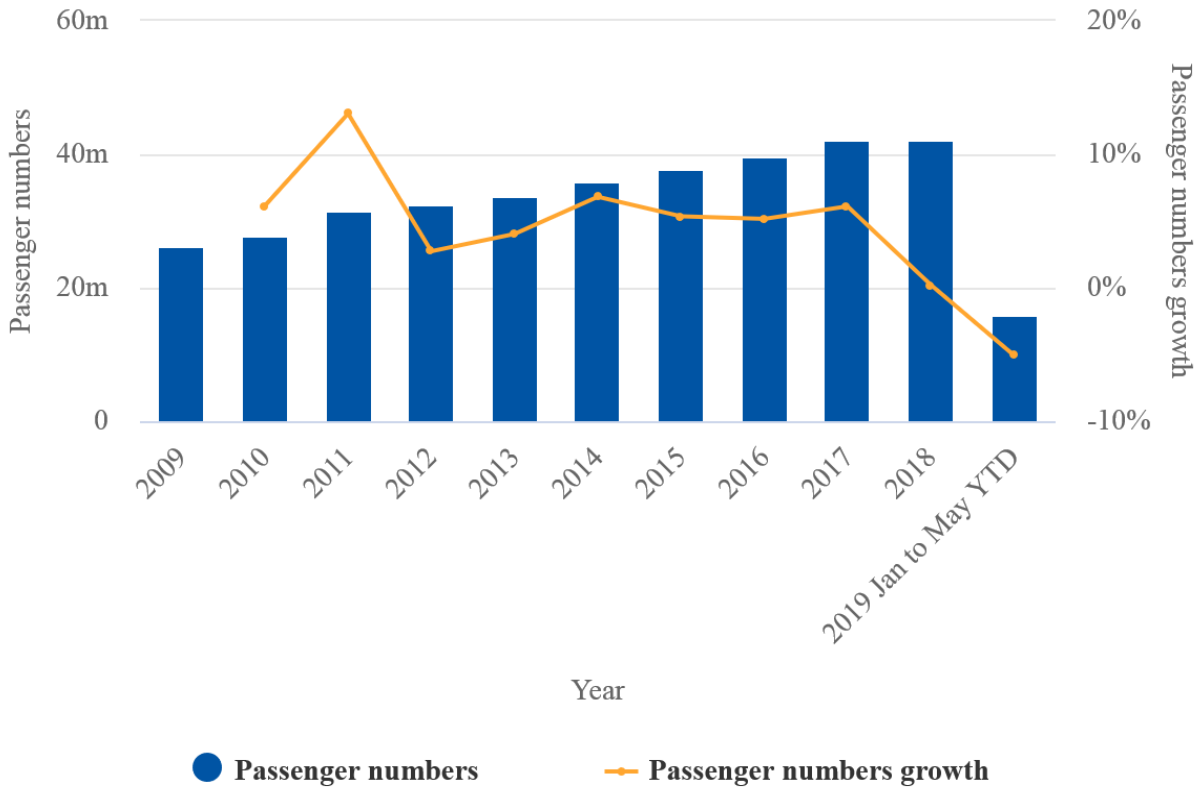

Figure 6: Annual commercial aviation passengers in Sweden (Center for Aviation 2019).

address them. Airline KLM released an open letter in 2019 that called on the public and other airlines to "fly responsibly". KLM (2019) and many other airlines have pledged to offset their carbon by investing in projects that help recapture it. Flight shaming has been effective at forcing airlines to address environmental issues they have been ignoring. If airlines continue to not attempt to reduce their carbon footprint they face the risk of losing customers. By the public collectively confronting airlines as a movement, they have been given an economic incentive that did not involve government intervention by means of taxation and regulation. As of early 2020 the "flight shaming" movement was beginning to take shape in the United States. If "flight shaming" is able to continue to grow in size, it could make even more significant impacts in the near future.

Where Social Movements Fall Short

While these campaigns may be a good way to reduce demand and mitigate carbon emissions in the short run, they will be unable to make significant impacts in the long run by affecting demand alone. Global growth in passenger aviation demand is set to outpace the potential reduction that social campaigns have caused. The movements have so far been mostly limited to a handful of Western countries in Europe and the Americas. While these areas currently account for a large portion of aviation emissions, a majority of the growth in aviation travel is expected to take place in developing countries in Asia (IATA 2018). Another important fact to note the discrepancies in available infrastructure around the world. While rail may be a viable substitute to domestic flight in countries in Europe, current rail infrastructure in the United States is much less comprehensive. Figure 7 compares the available rail in the state of Virginia to that in Austria; a European nation comparable to Virginia in population, size and GDP. It can clearly be seen that Virginia is lacking in rail infrastructure, as is the situation across the United

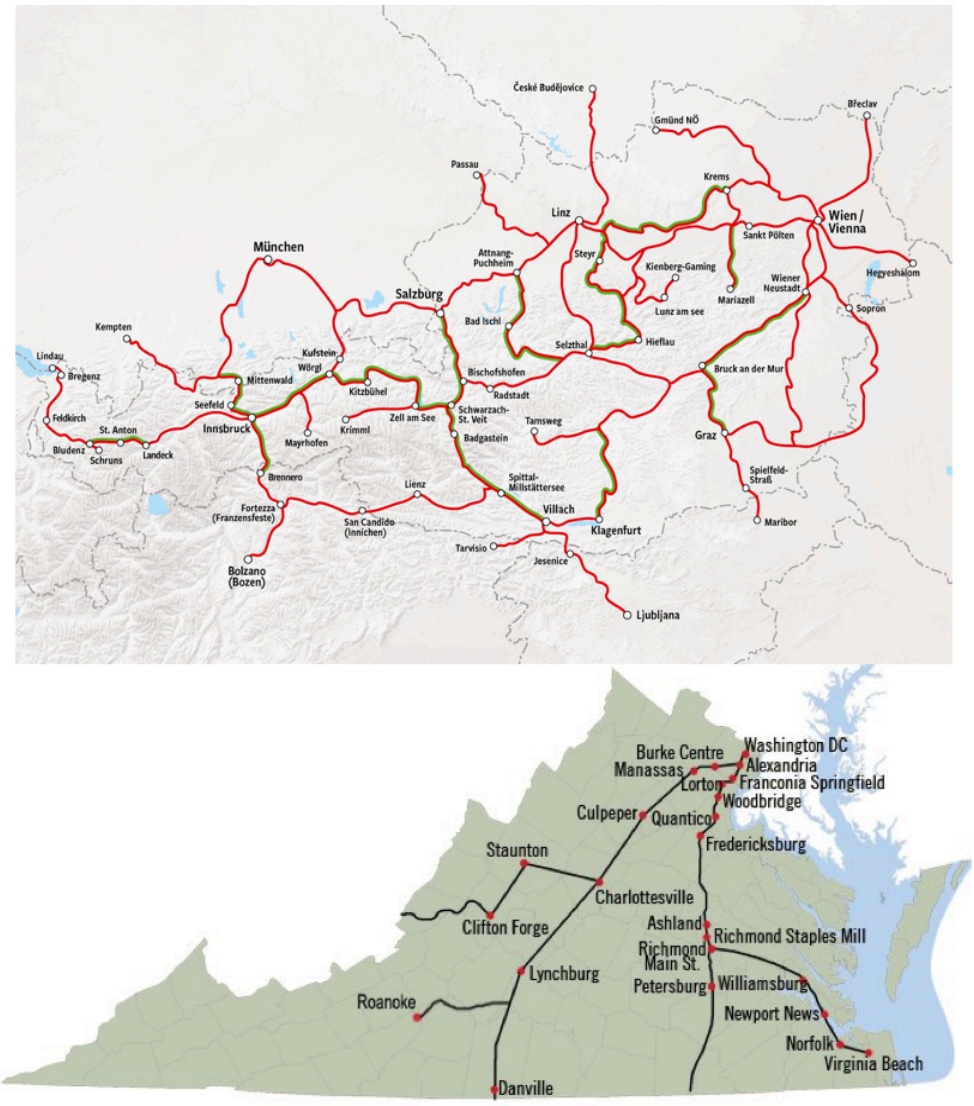

Figure 7: Comparison of rail infrastructure between Austria (top) and Virginia (Carter 2019).

States. American rail services are also significantly more delayed and unreliable than their European counterparts. The only close possible substitute for flying in America would be driving, which is significantly less efficient than both flying and rail (FAA 2015). This limits how many people can realistically limit or completely stop flying without significantly affecting their day to day lives.

Conclusion

Looking to the future

Current projections of growth in global aviation and the associated increase in carbon pollution indicate that action must be quickly taken in order to mitigate the global warming impacts. More fuel efficient airplanes will be required to effectively reduce emissions in the long term. Alternate fuel sources, such as biofuels and electric airplanes, will one day potentially make significant reductions to carbon emissions in aviation. However, progress in developing these technologies has been slow. More immediate changes to the aviation sector are required if it is to meet the reductions promised by the industry. Aviation fuel taxes, more efficient runway practices, and more common use of the most modern aviation technologies have shown promise in being able to help reduce carbon emissions in the short and mid-term. Lack of acceptance from both the public and policy makers has made adopting these measures difficult. The monetary costs associated with changing our current system and lack of knowledge of the economic costs that climate change inflict are the motivating factors behind this.

Social awareness campaigns and movements such as “Flight Shaming” have proven effective at educating the public of the environmental crisis in front of us. The stigma that is being attached to excessive and unnecessary flight has motivated both airlines and the public to take action. I believe these campaigns to currently be the most effective means of both reducing carbon emissions in the short and mid-term, as well as encouraging investment in better technologies that will help reduce carbon emissions in the long run. Our historical overuse of planes needs to be addressed if humanity wishes to be able to continue using them in the future. Social movements are the key to solving the biggest issue currently preventing our shift towards more responsible use of aviation transportation. That problem is public resistance. By educating

the public and giving them all the facts, social movements help reduce the possibility of reactance that could come with forced regulation. While the fate of "Flight Shaming" and commercial aviation is unclear following the Covid-19 pandemic, it is likely that demand will eventually return to its current state. When this happens, the renewal of social movements will be crucial in helping spur more change towards a greener commercial aviation industry.

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