Aviation and climate change: our position

Emissions from aviation continue to grow but need to fall. There are no technical fixes. Instead we need to curb frequent flying and stop airport expansion.
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Summary

Most people like to travel, and air travel continues to grow. But greenhouse gases and other emissions from aviation are a growing cause of global warming. There are no easy technical fixes to this problem. Instead, to avoid dangerous climate change we need to act urgently to reduce emissions from flying.

An ambitious emissions reduction target is needed. This will require higher taxes – they should be fair and based on the “polluter pays” principle\(^1\).

Facts about aviation

Emissions of greenhouse gases from aviation\(^2\) are becoming increasingly important. They were about 7.5% of the UK total in 2016, with most being from long-haul international flights. While relatively small, this proportion is increasing. Between 1990 and 2016, aviation emissions more than doubled, while overall emissions reduced by 43% over a similar period.

Indirectly acting emissions\(^3\). Aviation also produces emissions such as nitric oxide and nitrogen dioxide nitrogen oxides (NO\(_x\)) that indirectly contribute to global warming. The science is uncertain\(^4\), but it is estimated that this roughly doubles\(^5\) the harm caused by flying.

UK aviation is increasing substantially. It grew by around 4% per year between 2011 and 2016\(^6\). The Department for Transport forecasts that in the absence of airport
capacity constraints, aviation will grow from 267 million passengers per annum (mppa) in 2016 to 495 mppa in 2050, an increase of 85%\(^7\).

**Most air travel is for leisure.** In 2016, 72% of passengers to/from UK airports were traveling for leisure\(^8\). In most cases, more climate-friendly holidays could be taken closer to home.

**The majority of plane trips are made by relatively few people.** UK government statistics from a survey in 2014 showed that just 15% of passengers made 70% of all plane trips\(^9\) \(^10\).

**Unconstrained aviation growth is inconsistent with current and future UK emissions targets.** In 2008 the UK adopted a 2050 target to reduce overall greenhouse gas emissions by at least 80% compared to 1990 levels\(^11\). The Committee on Climate Change (CCC) indicated that meeting this target requires aviation growth to be no more than 60% above 2005 levels. Following the 2015 Paris Agreement, it now says a more ambitious overall UK target is needed: net zero emissions by 2050. The UK government has accepted the new target. Friends of the Earth welcomes this but believes that net zero by 2045 at the very latest is possible and necessary. The CCC has identified several possible aviation measures to help reach net zero, including further limits on growth.

**Technology developments are not able to keep up with the growth of passenger numbers.** Planes are gradually becoming more efficient and will continue to do so\(^12\), but not at the pace necessary to allow for unconstrained growth in flights and passenger numbers. This means that aviation needs to be limited.

**The problem**

Aviation is responsible for an increasing proportion of greenhouse gas and other emissions. There are no easy solutions. The industry is trying to stave off effective measures to constrain emissions by promoting alternative approaches. These alternatives don’t stand up to scrutiny.
Biofuels

The aviation industry is banking on biofuels as a future fuel\textsuperscript{13}. But this would require industrial-scale cultivation of biomass – things like maize, palm oil or woody crops. It would compete for land with food production and nature protection, as well as risk displacement of local communities. Clearance of forests to make way for plantations can itself lead to massive greenhouse gas emissions. Use of waste and newer biofuel production methods might help, but there’s currently no sustainable way to produce aviation biofuel at scale.

In addition, biofuel use won’t eliminate all climate-warming emissions. For example, reductions in emissions of NO\textsubscript{X} are small or insignificant\textsuperscript{14}. The CCC envisages a limited role for biofuels as aviation fuel (up to 10% in 2050).

Carbon offsetting and CORSIA

In theory, carbon offsetting enables individuals and institutions to pay for environmental projects that reduce carbon emissions with the aim of balancing out their own carbon footprints. But in practice, the vast majority of these projects will have happened or needed to happen anyway (see below). In other words, in most cases offsetting doesn’t work\textsuperscript{15, 16}. A better response to the environment and climate emergency\textsuperscript{17} that the UK parliament has declared is not to fly. That’s the simple truth.

The International Civil Aviation Organization has nonetheless adopted a carbon offsetting scheme (CORSIA) that will require airlines to buy carbon offsets to compensate for their growth in CO\textsubscript{2} emissions.

Even if the principle of offsetting aviation emissions were accepted, CORSIA would be a very poor scheme. It has a weak overall target that allows gross aviation emissions growth, rather than the decrease that the planet needs. It doesn’t cover domestic aviation (or most private aviation\textsuperscript{18}), ignores emissions other than CO\textsubscript{2}, and its rules fail to ensure it has an effective offset mechanism.

Many CORSIA offsets are likely to be based on the United Nations’ Clean Development Mechanism (CDM). Evidence shows that such offsetting often doesn’t work in practice.
In 2016, a report for the European Commission found that only 2% of projects under the CDM had a high likelihood of being effective\textsuperscript{19} \textsuperscript{20} \textsuperscript{21}. In any case, the CCC net zero advice rules out international offsets.

**Innovation**

Several innovative solutions are being investigated, including electric and hybrid aircraft, more efficient engines, and use of renewable electricity to produce fuel. These may have a role to play, but none is currently ready on the scale needed, and most will not be readily available for decades.

**Non-climate change impacts**

Noise and air pollution are also serious problems caused by aviation, as is the impact on nature from airport expansion, although these are not the focus of this short paper.

**How we can reduce emissions from aviation**

Emissions from aviation must not be allowed to grow. Instead they need to decrease, starting now. The UK government needs to adopt a range of measures, including a tougher emissions target:

**Encourage alternatives to air travel**

We need to develop alternatives to air travel. For example, long distance train travel (which has much lower emissions per passenger mile), and improved wifi and video-conferencing facilities.

**Support development of new technology, but don’t rely on it until it’s ready**

New technologies and innovations may bring new solutions in future. But we can rely only on technology that’s known to be workable at large scale and that will be available when we need it.
Encourage institutional responsibility

Businesses and other institutions should be encouraged to limit their use of aviation and to consider the environmental impacts before choosing to fly. A requirement for organisations to report on their air travel should be considered. Individuals should also be encouraged to use alternatives to flying.

Constrain aviation

We need to reduce emissions from air travel. With current aviation technology, that can only mean fewer flights. This will require measures such as a frequent flier levy, removal of tax breaks on aviation fuel, and limiting numbers of flights at airports. Taxes should be fair and based on the polluter pays principle, for example with higher payments for longer distances. The funds raised could be used in many areas (eg, better public transport, energy efficiency, tree planting, peatland restoration).

Reject airport capacity increases

A number of airports across the UK are seeking to expand. But we need fewer flights and less emissions, not more. We must stop plans to expand airport capacity and government must withdraw its support for Heathrow expansion proposals in light of the zero carbon target.

Ensure fairness

A frequent flyer levy would be a step in the right direction. Flying shouldn’t become a luxury reserved for the wealthy. Alternative approaches, such as rationing of flying, may be worthy of exploration.

Reject false solutions and promote a much better international aviation agreement

The UK government should formally reject CORSIA and offsetting. It should also more actively promote an international aviation agreement that reduces aviation, rules out unsustainable use of biofuels, covers all climate-warming emissions, and is consistent with the 1.5°C limit. But it shouldn’t wait for this agreement – it should show
international leadership and adopt these measures on its own.

**Set a tougher UK emissions reduction target for aviation**

Aviation needs to play its part in ensuring the UK delivers on the Paris Climate Change Agreement to limit global warming to 1.5°C. Friends of the Earth is calling for an aviation emissions target that is more stringent than the 22 million tonnes of CO$_2$ equivalent (MtCO$_2$e) per year in the CCC’s ambitious “speculative” demand-constraint option. This is because this CCC target ignores the indirectly acting emissions mentioned above.

While Friends of the Earth’s target is exacting it does not rule out flying altogether. For illustration, taking into account the direct and indirect climate impacts from aviation, and sharing out aviation fairly, it would still allow for every person in the UK to take just over two return economy class trips to Rome every three years, or one economy-class return flight to Australia every 17 years.

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1. Polluter Pays Principle: This is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment. See LSE, "What is the polluter pays principle?,” 2018 (http://www.lse.ac.uk/GranthamInstitute/faqs/what-is-the-polluter-pays-principle/ accessed 27 July 2019).
2. Greenhouse Gas Emissions from Aviation: These include carbon dioxide (CO2), nitrous oxide (N2O), water vapour, and some methane. Of these, CO2 has by far the largest effect. Carbon dioxide, methane and nitrous oxide are among a basket of greenhouse gases identified by the Kyoto Protocol, which also includes methane (CH4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6). The UK Climate Change Act of 2008 limits emissions of Kyoto Protocol gases. Water vapour is not a Kyoto Protocol gas, and so isn’t covered by the Act.
3. Indirectly Acting Emissions: In addition to carbon dioxide, aviation also produces “non-CO2” emissions, including other greenhouse gases and gases that indirectly lead to warming or cooling. For example, nitrogen oxides (NOx) lead to the formation of ozone (O3) which has a warming effect, and a reduction in atmospheric methane with a resulting cooling effect. Overall, these two opposing effects result in a net warming. Other indirectly acting emissions from aviation include water, sulphur oxides, hydrocarbons and soot, and lead to the

4. Uncertainty in Scale of Effects of Indirectly Acting Emissions: This uncertainty is described in a report published along with the UK government’s Aviation 2050 strategy consultation document. Figure 1 in the report shows very large error bars for the “radiative forcing” associated with various emissions. The report also highlights that there are difficulties even in determining how indirectly acting emissions should be measured. See Note 3 above for references.


8. Most Aviation is for Leisure: In 2016, 19% of passengers starting or ending their journeys at UK airports were flying for business. Along with the 72% flying for leisure purposes, this accounts for 91% of passengers. The remaining 9% of passengers were making international transfers. See p60 of Department for Transport, “UK aviation forecasts”, 2017 (https://www.gov.uk/government/publications/uk-aviation-forecasts-2017, accessed on 22 June 2019).

9. 15% of passengers made 70% of all plane trips: This has been verified by Full Fact, from relevant data needed published by the DfT and additional information they received from the DfT. This clarified that the average number of flights taken by frequent fliers over 12 months was 7.6 (private communication with Full Fact). See https://fullfact.org/economy/do-15-people-take-70-flights/ (accessed 19 June 2019). See also p2 in the report and Table ATT0601 in Annex A of Department for Transport, “Public experiences of and attitudes towards air travel: 2014” (https://www.gov.uk/government/statistics/public-experiences-of-and-attitudes-towards-air-travel-2014).
10. People who fly more tend to have higher incomes: In 2016, the DfT found that “The proportion of people who took at least one international flight in the last 12 months increased with household income level, from 30% in the lowest quintile to 70% in the highest.” See p26 of Department for Transport, “National Travel Survey: 2016 report” (https://www.gov.uk/government/statistics/national-travel-survey-2016, accessed on 22 June 2019).


12. Technology Improvements to Reduce Emissions: The CCC and DfT commissioned a project to review the potential for reducing aviation emissions, which considered improvements in a range of areas including engines, aircraft design, airline operations (eg, aircraft speeds), and air traffic management (eg, optimal routing). The key finding was that by 2050 there’s potential to reduce aviation emissions by up to around 40% versus a comparable year 2000 aircraft. See p172 of Committee on Climate Change, “Net Zero Technical report”, 2019 (https://www.theccc.org.uk/publication/net-zero-technical-report/, accessed 22 June 2019).

13. Banking on Biofuels: The airline industry association (IATA) says that “In the medium term, SAF [Sustainable Aviation Fuels] will be the only energy solution to mitigate the emissions growth of the industry”. The term “Sustainable Aviation Fuels” includes advanced biofuels. Although SAF can also be produced through non biological means (eg power to liquid), none of these can currently operate at scale. See International Air Transport Association, “Sustainable Aviation Fuels Fact sheet”, May 2019 (https://www.iata.org/whatwedo/environment/Pages/sustainable-alternative-jet-fuels.aspx, accessed on 22 June 2019).


15. Offsetting is Inadequate for Aviation: Offsetting is inadequate as a way to manage UK aviation emissions. Key reasons for this include that very few offsetting cases work and that most UK aviation is avoidable, for example the majority is for leisure purposes. The very small number of genuine offsetting projects need to be reserved for unavoidable emissions, like the use of gas for home heating. Until heating has been decarbonised
(eg, by the roll out of heat pumps), asking people not to heat their homes would cause real hardship.

16. Voluntarily Offsetting: A small amount of flying can’t reasonably be avoided. For these flights responsible institutions and individuals may want to voluntarily purchase offsets for the resulting emissions. Friends of the Earth does not have details on which offset projects are genuine, however WWF has worked with others to identify “gold standard projects”. Such voluntary offset schemes may be helpful if used responsibly, but they’re no substitute for robust measures put in place by government to reduce emissions from aviation.


19. Additionality is Problematic: In order to work, offset projects must be “additional” – they wouldn’t have happened anyway. Establishing this is inherently problematic and has been wittily summarised as follows: “Offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened.” Or putting it another way: “The key difficulty lies in the need to compare the projects’ actual emissions to a counterfactual scenario reflecting another reality, one in which the activity is not implemented as an offset project.” See Carbon Offset Research and Education, 2011 (https://www.co2offsetresearch.org/consumer/Additionality.html, accessed 29 June 2019).

20. There are Flaws in the CDM: In practice much offsetting has been ineffective. A report for the European Commission on the effectiveness of the CDM says “Our analysis suggests that the CDM still has fundamental flaws in terms of overall environmental integrity. It is likely that the large majority of the projects registered and CERs [offset credits] issued under the CDM are not providing real, measurable and additional emission reductions.” See Cames et al, “How additional is the clean development mechanism?”, European Commission, 2017 (https://ec.europa.eu/clima/sites/clima/files/ets/docs/clean_dev_mechanism_en.pdf, accessed 27 June 2019).

21. Offsetting needs Robust Eligibility Criteria. In addition to the European Commission report mentioned in the previous note, a Nature Climate Change paper finds that “If the scheme [CORSIA] allows airline operators the unlimited use of offset credits from already implemented [offset] projects, it will result in no notable emissions reductions beyond those that would occur anyway…” The paper recommends limiting eligibility for offsetting to new projects or projects that are at risk of discontinuing greenhouse gas abatement without further support. See Warnecke et al. “Robust eligibility criteria essential for new global scheme to offset aviation emissions”, Nature Climate Change, 9: 218–221, 2019 (https://www.nature.com/articles/s41558-019-0415-y, accessed 27 June 2019).
Friends of the Earth's Aviation Emission Target: Our target is to reduce UK aviation emissions (including non-CO2 emissions) by 2045 to a level that is expected to have the same long term (100 years) warming effect as 22 MtCO2 per year. The actual emission level(s) should be set according to the best scientific understanding. They should be reviewed from time to time as scientific understanding progresses and may be varied accordingly. This approach ensures that indirectly acting non CO2 emissions are covered by the target, but also recognises that adjustments may be needed as scientific understanding progresses.

Aviation Within Friends of the Earth’s Target: These illustrative trips were produced using a carbon footprint calculator, with a multiplier of 1.9 (see Note 5) to account for non-CO2 emissions, and the population of the UK taken as 66 million. Business class flying is more carbon intensive, and so the figures would need to be modified accordingly. The calculator is available from Carbon Footprint Ltd (https://www.carbonfootprint.com/calculator.aspx, accessed on 29 June 2019).