

Written response submitted by Green Alliance

About Green Alliance

Green Alliance is an independent think tank and charity focused on ambitious leadership for the environment. Our work crosses climate, the natural environment and resource use. Since 1979, we have been working with the most influential leaders in business, NGOs and politics to accelerate political action and create transformative policy for a green and prosperous UK.

Summary

Transport is the UK's largest emitting sector, accounting for 31% of carbon emissions in 2018.ⁱ Of those, aviation accounted for 7.3%, with international flights accounting for 6.8% and domestic flights 0.3%.ⁱⁱ These percentages are set to increase significantly as other sectors decarbonise. Carbon emissions from UK aviation have more than doubled since 1990 and 2019 saw the highest ever level of UK aviation emissions.ⁱⁱⁱ

Aviation also produces non-CO2 emissions which contribute to climate change, such as nitrogen oxides and cirrus contrails. It is estimated that because of these additional non-CO2 effects, aviation's total contribution to climate warming is three times higher than that associated with its CO2 emissions alone.^{iv}

To lower aviation emissions, policies must be put in place to limit the number of flights taken. This is because technological, efficiency and offset options alone cannot put the sector on track to net zero by 2050. The CCC balanced pathway allows for a 25% growth in demand by 2050 compared to 2018 levels, rather than the 68% growth projected by DfT in a business as usual scenario.^v Green groups have argued that even the 25% figure is too high given limitations in feasibility and scalability presented by other mitigation options.

Shipping accounted for 3% of emissions in 2018 and have reduced at a slow pace since 1990. To reduce emissions, the UK must make efficiency improvements and invest in zero carbon fuels such as ammonia.

The government recently announced it will include international aviation and shipping (IAS) emissions into the sixth and future carbon budgets. This is a welcome inclusion, and robust policies must now be put in place to support the effective reduction in emissions from the aviation and shipping sectors in line with the target to cut emissions by 78% by 2035.

1 What contribution can operational efficiencies make to reduce emissions from aircraft / shipping vessels

Aviation

The Climate Change Committee (CCC) estimates that the fuel efficiency per passenger of aviation will improve at 1.4% per annum, compared to 0.7% per annum in the baseline.^{vi} This includes 9% of total aircraft distance in 2050 being flown by hybrid electric aircraft. Operational efficiencies combined with new technologies such as hybrid planes are

expected to deliver emissions reductions of 8MtCO₂e by 2050, but we will only start seeing significant emissions reductions in the 2040s (2MtCO₂e in 2040).^{vii}

In the meantime, the UK aviation sector must reduce or manage the number of flights taken [see question 5] and use alternative fuels which emit zero carbon or have lower emissions than kerosene [see question 2].

Shipping

The CCC estimates that operational efficiencies can save 3MtCO₂e by 2050, or around 14% of the emissions reductions needed by 2050 compared to a business-as-usual scenario.^{viii} This includes 'slow steaming' – a practice whereby ships travel at a slower pace and use less fuel, which has the potential to significantly reduce emissions.^{ix} The rest of the emissions savings will need to come from zero carbon fuels, such as ammonia [see question 2].

2 How close are zero carbon fuels to commercialisation for aviation / shipping? How effective will the Jet Zero Council be in catalysing zero emissions technologies? What role should transitional fuels such as alternative hydrocarbon fuels play?

Aviation

Ekerosene is the only fuel which can be zero carbon for aviation. It is generated by combining hydrogen and carbon dioxide. To be zero carbon, the hydrogen used must be 'green hydrogen' (hydrogen produced through electrolysis using renewable energy sources) and the carbon dioxide must come from direct air capture (extracted from the atmosphere). It is not yet commercialised and is estimated to cost two to three times the average price of kerosene.^x

A mandate on alternative fuels, including from waste, (so-called 'Sustainable Aviation Fuels mandate' or 'SAF mandate'), should be introduced as early as possible to reduce emissions in the short and medium term. These fuels can be blended with kerosene to power aircrafts at lower emissions. However, none of the alternative fuels used in a mandate should come from products associated with deforestation and land degradation, including products derived from palm and coconut. Furthermore, we should aim to drastically reduce waste, and as measures are put in place to do so, the availability of waste-based fuels will be limited. It is also important to note that these alternative fuels are not zero carbon and are responsible both for emissions in the production process and at the tailpipe when burnt.

We would like to see a sub-mandate for ekerosene, as introduced in the EU^{xi}. This would encourage industry to invest more heavily in green hydrogen and direct air capture, as well as ekerosene plants, consequently making ekerosene more competitive and widely available. The Jet Zero council should play a role in encouraging the development ekerosene, including through investment.

Shipping

Ammonia is the most effective alternative to current shipping fuels for reducing emissions. It is produced from hydrogen and air separation through electrolysis. There is the potential to retrofit ship engines at relatively low cost so that they can run on ammonia. Moreover, ammonia has higher energy density compared to hydrogen and costs less to produce than methanol (which relies on CO₂ direct air capture).^{xii}

The technology for ammonia exists but ammonia remains expensive to make. That said, the CCC recommends that a full roll-out plan for zero-carbon shipping fuels, and accompanying fleet retrofits or modifications, be in place by the mid-2020s.^{xiii} It also advises that zero-carbon fuels should make up 33% of fuels used in UK shipping by 2035.^{xiv} Looking at the EU, it is estimated that by 2030, e-fuels including ammonia could supply up to 7% of EU shipping demand.^{xv}

Ammonia should therefore be the preferred option and investment in this technology by the government should be scaled up, alongside a plan to roll out this fuel at scale. The electrolysis process used to make ammonia should rely on renewable energy.

3 What new technologies are there to reduce emissions from aircraft / shipping vessels and how close to commercialisation are they?

Aviation

As part of efforts to decarbonise aviation, research has gone into developing zero emissions technologies such as hydrogen or electricity powered aircrafts. In 2020, a hydrogen fuel cell powered commercial grade aircraft – created by the ZeroAvia company – completed a flight at Cranfield Airport. ZeroAvia, which receives funding from the government, is now working on developing a 19-seater aircraft.

However, these technologies are far from commercialisation and, if commercialised before 2050, are not expected to take up any more than a very small share of aircraft sales.^{xvi} This is in part due to the weight of batteries needed for electric planes, and the volume of hydrogen needed for hydrogen aircrafts. If commercialised, new technology aircrafts are only likely to be able to replace short flights, rather than long haul flights which make up the large majority of aviation emissions. Therefore, in the meantime, efforts should be focused on limiting the number of flights and making remaining flights less polluting.^{xvii}

4 How should the Government's net zero aviation strategy support UK industry in the development and uptake of technologies, fuels and infrastructure to deliver net zero shipping and aviation?

The government's net zero aviation strategy should make more funding available for R&D into ekerosene, as well as announce a sub-mandate for ekerosene [see question 2] to provide certainty to the private sector and encourage investment. The strategy should also promote the scaling up of green hydrogen through its proposed business models and policy measures, and ensure the targeted deployment of green hydrogen to aviation and other sectors where it is required and will add the most value (i.e. shipping, steel, heavy industry).

The strategy should also support the development of zero emission aircrafts (such as hydrogen and battery powered aircrafts), although these cannot be relied on as a main solution to decarbonising the aviation sector as the technologies are still uncertain [see question 3]. The government should also ensure there is a plan for airports and airlines to develop the necessary infrastructure for handling new technologies and fuels as soon as possible.

Obligations must be put in place on companies to invest in these technologies and an Office for carbon removal – to regulate the use of carbon offsets in the UK – must be created [see question 7].

5 What is the most equitable way to reduce aircraft passenger numbers (e.g. reforming air passenger duty and taxes, frequent flyer levies, bans on domestic flights where trains are available, restrictions on airport capacity)? Are there any policy mechanisms that could reduce our reliance on shipping?

Aviation

Different policies should be used in combination to reduce aircraft passenger numbers.

Given that new technologies and alternative fuels are yet to be deployed at scale, there should be no expansion of any airport in the UK. Reducing the number of flights and air miles flown is currently the best way to reduce aviation emissions, preferably capping numbers at 2019 levels. The CCC says that, compared to 2019 figures, passenger numbers should rise by no more than 68 million in 2050.^{xviii} Heathrow's new terminal could grow passengers by 55 million, and plans to expand Gatwick, Stansted and Luton could increase the number by a further 58 million.^{xix} Outside London, Leeds-Bradford, Southampton and Bristol airports also have plans to expand, which would again grow passenger numbers. These expansions are incompatible with pathways to net zero and should not go ahead. Instead, the government should issue a moratorium on all airport expansions.

Taxation must also be reformed to better reflect the environmental costs of aviation and so that the sector makes a fair contribution to HMG's finances. There is public support for green tax measures: 59% support using the tax system to make environmentally damaging behaviours more expensive.^{xx}

Air transport in the UK is currently exempt from VAT on tickets and kerosene. This places flights, which are largely for leisure, in the same VAT class as necessities like food and medicines.^{xxi} Taxing aviation fuel directly would be an efficient and fair way to address climate change externalities, in the same way that motor fuels are subject to VAT and fuel duties. However, there are several barriers to taking the same approach in the skies, including international agreements that prevent the taxation of fuel for international flights. The UK could instead tax fuel for domestic flights, as do several other countries including Norway, the USA and Canada. Furthermore, the planned reduction in domestic air passenger duty should be cancelled.

Introducing a frequent flyer levy would be an effective way to reduce emissions from the aviation sector. This policy was a preferred option of the Climate Assembly UK: 80% of

assembly members ‘strongly agreed’ or ‘agreed’ that taxes that increase as people fly more often and as they fly further should be part of how the UK gets to net zero.^{xxiii} The top 25% of households by income spend five times as much on international air fares as the bottom 25%, and 60% of flights in Great Britain were taken by only 15% of people in 2014.^{xxiii, xxiv}

Other forms of taxation could also be considered to reduce the demand in the aviation sector and where possible enable a modal shift to other, less polluting forms of transport. These include:

- Scrapping air miles reward schemes
- A tax on businesses who exceed a certain proportion of business travel with aviation
- A higher tax on business and first-class flyers
- An increase in air passenger duty

6 What further action is needed by the International Civil Aviation Organization and International Maritime Organization to drive emissions reductions? What can the UK Government do to drive international action on emissions?

Aviation

As recommended by the CCC, the ICAO should set a long term, global emissions reductions goal for aviation consistent with the Paris Agreement and strengthen the CORSIA scheme to align with this long term goal. The UK government must use its diplomatic resources to push for a target and an emissions plan at the ICAO, preferably to be agreed at the 2022 ICAO general assembly.

Shipping

Similarly, the UK should push for a long term emissions target and action plan at the IMO. Currently the IMO has a target to reduce global shipping emissions by 50% by 2050, compared to 2008 levels. This is vastly insufficient and jeopardises the Paris Agreement.

The UK government should also use its COP presidency to encourage other countries to include emissions from international aviation and shipping in their carbon budgets.

7 How effective will the global offsetting scheme for international airlines (ICAO’s CORSIA) and the UK and EU ETS be at stimulating technology improvement and/ or behaviour change to reduce emissions from aviation / shipping?

Aviation

There has been significant interest from the aviation industry in the potential of carbon offsetting to help reduce its impact on the climate. UK airlines have announced plans to offset their emissions and CORSIA aims to offset growth in emissions between 2020 and 2035 (i.e. emissions which surpass 2019 levels). This scheme is estimated to raise between £4 billion and £18 billion per year from airlines by 2035. It will be important to make the best use of this investment.

However, offsets have a bad track record: at least 73% of Clean Development Mechanism (CDM) offsets are unlikely to deliver the emissions reductions claimed.^{xxv} And because CORSIA will only offset emissions above a 2019 baseline up to 2035, even if offsets are reliable, there will be no overall reduction in net emissions between 2020 and 2035, and there are no solid plans for emissions after this. To limit these risks and take advantage of this new stream of funding, we propose that the government should create a new ‘Office for carbon removal’ to regulate the industry.

Overreliance on offsets risks locking in dangerous levels of emissions: most scenarios which limit global heating to 1.5C already rely on carbon removals as well as deep emissions cuts. Foregoing deep emissions cuts on the basis that net zero can be reached with carbon removals will, in turn, require even more carbon removal capacity. Moreover, carbon removal technologies such as bioenergy with carbon capture and storage (BECCS) and direct air carbon capture and storage (DACCS) are expected to be high cost and are, so far, unproven.

Global emissions from international flights, not including domestic flights, are expected to grow if further action is not taken to reduce emissions. If reliance on offsets allows this emissions growth to happen then international aviation alone would use up nearly a third (32%) of estimated global carbon removal capacity in 2050.^{xxvi} Other UK sectors such as land use and industry will require carbon removal in 2050, and the aviation sector should not receive a disproportionate share of this capacity.

In its current form CORSIA is therefore incompatible with both global and UK climate targets.

Although the UK Emissions Trading Scheme covers domestic flights and flights to the EEA, meaning these flights are subject to some carbon pricing, most of this is negated by free allocation. The appropriateness of free allocation should be reviewed by the government in its reforms to the scheme. While the UK should continue to press for international measures to address the impacts of aviation, this cannot be relied on, and the government must also act unilaterally in the meantime.

Shipping

Shipping emissions should be included in the UK-EU ETS.

⁸ How should the UK define its ownership of international aviation and shipping emissions (i.e., arrivals, departures or both) in order to include them in legislative targets?

The UK government’s inclusion of international aviation and shipping emissions in its carbon budgets is genuinely world leading. As we look to other countries to replicate this decision, we must ensure that emissions from these sectors are accounted for in the same way across the globe, to avoid both double counting and undercounting. In order to do this the UK should follow guidance issued by the IPCC.

Therefore the UK should define its ownership of international aviation emissions as any flight departing from the UK. To measure international shipping emissions, the convention is to use bunker fuel sales.

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