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Aviation, climate change and sharing the load

Key messages

- It is essential that aviation contributes its fair share to our overall climate change goals. However, we are currently on course to fail to meet our climate change target for aviation and likely our overall goals as there are no controls on emissions from international flights.
- An international agreement being reached to control aviation emissions is far from certain.
- Direct unilateral regulation of aviation in the UK would be exorbitant (up to £600/tonne of CO₂) and therefore politically unfeasible.
- All of the guidance we have on emissions from aviation is based on the world as we would like it to be (with controlled emissions) rather than as it is (without).
- Controlling airport capacity is the only viable policy lever available to the UK government to directly restrict aviation emissions in the absence of a trading scheme.
- Uncontrolled expansion of aviation emissions will have a significant impact on the UK's ability to meet its carbon targets. Our best current estimate is that not controlling aviation emissions would penalise the rest of the economy with a potential cost of between £1 billion and £8.4 billion per year but the real cost is probably higher.

We need:

- New open dialogue on the climate change implications of aviation expansion so that all stakeholders fully understand the implications.
- The Government's Department for Transport to run models to show what will happen to emissions if we continue without emission controls.
- For any expansion in airport capacity to be contingent upon there being international agreement on effective controls on aviation emissions.

Introduction

Aviation will become an increasingly significant source of carbon dioxide as the sector expands and our need to curb emissions increases. Any decision to expand the UK's capacity to fly must be taken in the context of our climate change obligations under the Climate Change Act 2008¹. Even meeting our objectives will leave aviation representing nearly ¼ of total UK emissions.

When we consider the impact of aviation emissions on UK commitments we consider two objectives. The first is our overall carbon emission commitments. Whilst we do not yet formally include aviation in UK Carbon Accounts we do include it in the carbon budgets framework². This means that expected aviation emissions are factored into projections for total emissions and any increase in emissions from aviation has to be met by reduced emissions elsewhere in the UK.

The second objective considered is that the Committee for Climate Change has set a separate goal for aviation within the overall budget. It aims for emissions restricted to 37.5 tonnes of CO₂e per year by 2050³.

The CCC and the Airports Commission have both considered if it is possible to meet these targets whilst expanding capacity. They have reported back that it is possible but were not asked if it was probable nor what factors might prevent this from happening. The neutral language required by independent reports such as these can leave some with the impression that climate change implications of aviation expansion are unimportant or that it is dealt with. This is not the case.

The headline message from the CCC and, latterly, from the Airports Commission were actually analogous to saying:

“**Yes** we can expand the UKs capacity to handle flights and meet our climate change obligations **If** we also directly control emissions through a carbon market or tax.”

Which has been translated into a message from industry in the current debate as

“**Yes...**”

This is problematic because:

- 1) The caveats, being ignored by many in the current debate, refer to a system to regulate emissions from aviation which is not in place. The fact that these are being ignored and that there is no such system means that **we are currently on course to fail to meet our greenhouse gas targets with respect to aviation and overall targets.**

¹ <http://www.legislation.gov.uk/ukpga/2008/27/contents>

² <https://www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050/supporting-pages/carbon-budgets>

³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/266670/airports-commission-interim-report-appendix-3.pdf

- 2) Regulating emissions from aviation has proved politically difficult to date suggesting that **it is probable we will continue to fail to put in place measures to address these caveats.**
- 3) Directly regulating emissions for example via a carbon tax in the UK alone would be incredibly costly. £4billion per year in 2025 rising to £22 billion in 2050 if airports are allowed to grow. This cost would seem to make it unfeasible. The UK cannot bring about an international agreement alone and so **the only feasible policy lever the UK Government has to control its aviation emissions is to control airport capacity.**
- 4) We estimate that if aviation is neither regulated nor capacity constrained then by 2050 the extra carbon emitted may be significant. **In order to stay within our carbon budget obligations other parts of the economy will have to be in the order of £1 billion to £8.4 billion per year, and potentially much more. This is in the context of other sectors already significantly reducing emissions to stay within our legally binding emissions limits.** We need better research to fully understand the scale of this impact.

Where are the UK's aviation emissions regulated?

The International Civil Aviation Organisation (ICAO) is the UN's commercial aviation organisation. This body have repeatedly failed to meet promises since 1997 regarding reducing carbon emissions from the aviation sector. ICAO's most recent pledge to develop a global trading system by 2020, even if kept, is unambitious and unlikely to reduce emissions sufficiently. We hope for success in this process but it will be challenging. The timeline below shows the extent of historical inactivity in tackling the problem of expanding aviation emissions:

- 1997** - The job of tackling the aviation sector's growing emissions in countries signed up to the UN's Kyoto Protocol was handed to the ICAO⁴.
- 2001** - ICAO Assembly (made up of the representatives from all member states) issued a resolution on examining a range of potential GHG mitigating work including market based initiatives. It urged voluntary measures⁵.
- 2004** - ICAO put forward advice on setting up trading schemes⁶.
- 2005** - The European Commission recommended going ahead with an emissions trading scheme for aviation and put the wheels in motion⁷.
- 2010** - ICAO 37th Assembly (2010) again committed to *"undertake work to develop a framework for market-based measures (MBMs) in international aviation...for consideration by the 38th Assembly"*⁸
- 2011** - China and Russia stated that including aviation in the EU ETS will violate their sovereignty⁹
 - US and Russia led a meeting of 29 nations' aviation officials, they threatened to restrict access into their airspace¹⁰
 - US companies took the EU to court
- 2012** - President Obama signed a bill potentially banning US companies from taking part in the EU ETS.¹¹
 - Indian government told companies they must not comply¹²
 - Chinese government told companies they must not comply¹³
 - China Southern Airlines delayed purchase of European Airbus planes¹⁴
 - **Aviation was brought into the EU ETS officially but...**
 - **EU Ministers subsequently brought in blocking legislation to "Stop the**

⁴ <http://unfccc.int/resource/docs/convkp/kpeng.pdf>

⁵ http://www.icao.int/Meetings/AMC/MA/Assembly%2033rd%20Session/plugin-resolutions_a33.pdf

⁶ http://www.icao.int/Meetings/AMC/MA/Assembly%2035th%20Session/wp076_en.pdf

⁷ http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/87642.pdf

⁸ http://www.icao.int/publications/Documents/9958_en.pdf

⁹ See

http://www.sandbag.org.uk/site_media/pdfs/reports/Sandbag_Aviation_and_the_EU_ETS_2012_171213_1.pdf for a more thorough description of this period.

¹⁰ <https://www.govtrack.us/congress/bills/112/s1956#overview>

¹¹ <https://www.govtrack.us/congress/bills/112/s1956#overview>

¹² http://www.avocet.eu/risk/news_detail/indian_airlines_breach_eu_ets_regulations

¹³ <http://www.reuters.com/article/2012/02/06/us-china-eu-emissions-idUSTRE81500V20120206>

¹⁴ <http://uk.reuters.com/article/2012/04/26/us-china-eastern-boeing-airbus-idUSBRE83P15K20120426>

clock” holding back the full inclusion of aviation

- **To allow for further international negotiations**
- **Ensured no inclusion of international flights until 2014¹⁵**

- 2013** - In response ICAO promised:
- Plans for an international trading system by 2016 for implementation in 2020
 - Largely filled with caveats about protecting the aviation industry
 - To hold emissions at 2020 levels
 - Unless nations don't want to
 - Both connecting states have to agree
 - Developing countries (which could mean India and China) are not included¹⁶

- 2014** - The EU further delayed including international aviation until 2016 at least.
- There was an attempt, within the EU, to increase coverage to include all emissions inside EU airspace which might take us from 25% to 39 - 47%. This was not successful¹⁶.

¹⁵ http://ec.europa.eu/clima/policies/transport/aviation/documentation_en.htm

¹⁶ http://www.icao.int/publications/Documents/10022_en.pdf

Understanding emissions projections from aviation

The Department for Transport (DfT) has developed an interconnected model including passenger demand, airport capacity, commercial air fleet makeup and emissions. Though the model produces single values which give the impression of certainty we should take care in interpreting results. For instance it cannot predict global economic recessions which significantly reduce demand. The results are also increasingly uncertain the further into the future they progress.

Nevertheless, the DfT model presents the best guide we have to understanding what might happen. Many assumptions must be made to create a model of this sort. When estimating the impact of airport expansion on carbon emissions there are two outcomes requiring assumptions that we are interested in. The first is expansion itself: we could assume that no expansion happens or that all expansion possible happens. The second is regulation of carbon emissions: we could assume a European cap and trade system is in place, or a UK-only carbon tax, or even no system at all.

In order to examine the impact of expansion the researchers run different scenarios. Table 1 illustrates the scenarios that the Department for Transport has produced estimates for. These are in black and named A through D. Scenarios E through to H describe both the world as it actually is now with E and F describing the current lack of regulation and G and H describing the best we can currently hope for.

		Airport Capacity	
		No Expansion	Expansion
Carbon Regulation	EU ETS	A	B
	UK Carbon Tax	C	D
	<i>Domestic Only EU ETS</i>	<i>E</i>	<i>F</i>
	<i>International deal with no growth beyond 2020</i>	<i>G</i>	<i>H</i>

Table 1: Scenarios explored to date through DfT models

So from scenario A we learn what happens to passenger demand and carbon emissions if there is no expansion of capacity but carbon is controlled by the EU ETS. From scenario D we learn what happens if new runways are built and carbon is controlled in the UK alone through a carbon tax.

In the following sections we discuss what these scenarios can and cannot tell us about what is likely to happen to UK carbon emissions from aviation. None of this is complicated but it does require us to think clearly about which scenarios we are comparing. What we really want to compare, but cannot currently, are scenarios F with E to understand the true impact of restricted expansion as the world is now. We also need to compare E & F with B as that would describe the difference between where we will be, with the world in which it was stated that we could meet our obligations. Finally if we compare E & F with H, this compares where we are currently with the best we can hope for under a global deal (which remains uncertain).

Where does this leave carbon emissions from aviation in the UK?

The Government has not published results from a scenario describing the impact upon the UK's carbon budget if aviation capacity expands without appropriate emission controlling regulation.

All of the scenarios for which the DfT has produced data (described in table 1) assume that carbon is either traded or taxed. No recent reports have been made which acknowledge the current state of play, i.e. with 75% of European aviation emissions entirely unregulated.

By assuming a functioning emissions trading system, the existing analysis gives the impression that carbon from aviation is already under control and that constraining airport capacity can have little benefit. In truth, constraining airports capacity is probably the only practicable policy tool UK politicians have to control UK aviation emissions.

The myth that constraint has little impact

The models produced by the Department for Transport suggest that the difference in emissions between a world with (scenario B in table 1) and without new runways (scenario A) amounts to around 5 million tonnes of CO₂ equivalents. This can be seen in Figure 1. In this figure, "unconstrained" describes demand and therefore carbon emissions without constraint on airport capacity (runways), "constrained" demand models the world with the current runway capacity.

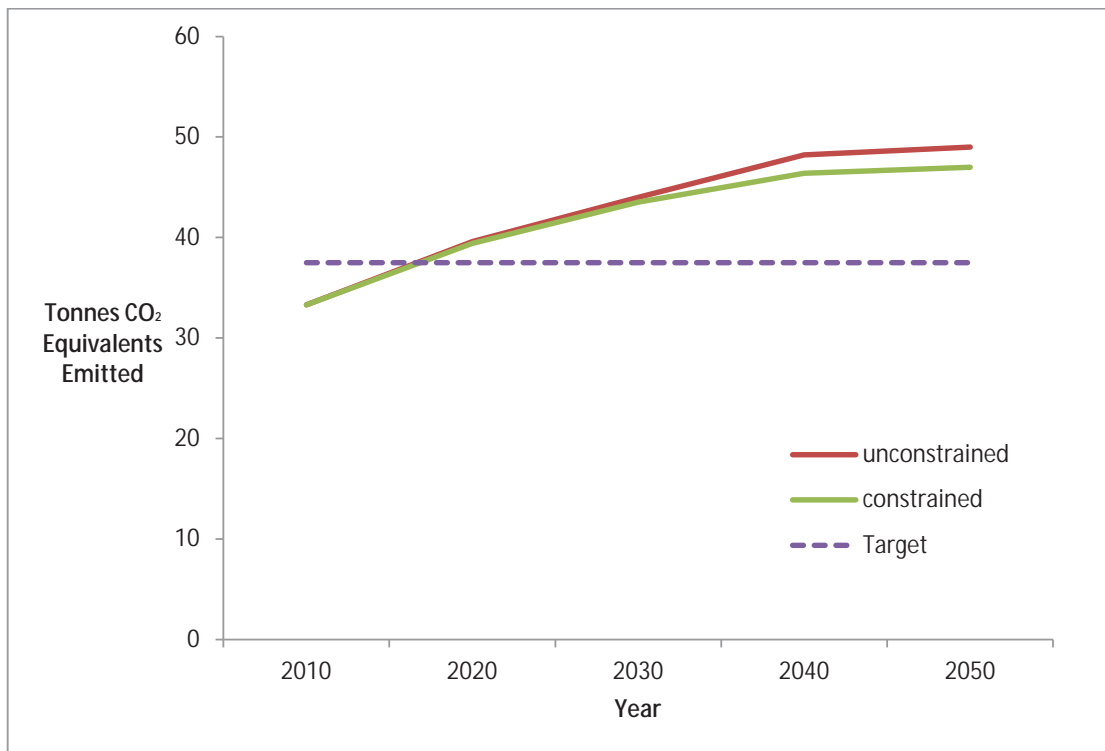


Figure 1: DfT 2013 estimates of carbon emissions.¹⁷

In Figure 1 both scenarios appear to miss the UK’s 2050 target (dotted) of 37.5 MT CO_{2e}/year. However we also know that these models assume carbon is being constrained by the EU ETS. As such the models imply that aviation does not break our overall emissions obligations since under a functioning EU emissions trading scheme, the aviation industry is obliged to buy the extra emissions from other sectors in the market, which would therefore allow the target to be ‘met’. The aviation industry is effectively paying other industries to reduce its emissions further to make up the difference between the dotted line (the arbitrary target for aviation) and actual emissions.

However, as set out above, we know that the EU ETS does not control aviation emissions at present and that there is no certainty that it will in the future. If the carbon market does not exist then can we assume that emissions will increase substantially if we increase capacity in the form of one or more new runways in the UK?

It is difficult to answer that question without actually running the DfT’s models to reflect this scenario. We can, however, look at another scenario using the same model which gives us a clue as to how much airlines would like to increase emissions. If they are willing to pay more for carbon it suggests a greater demand.

This scenario (comparing C with D in table 1) considered what would happen if the UK unilaterally attempted to control emissions from aviation to meet our 2050 target. Rather than a trading system the Committee for Climate Change and Airports Commission assume

¹⁷ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223839/aviation-forecasts.pdf

that government places a tax on aviation emissions which increases gradually such that by 2050 emissions are lowered to 37.5 tonnes per annum.

The tax is designed such that the same amount of carbon is produced with or without expansion of airports. What does differ, however, is the amount the Government needs to charge airlines to bring emissions down to the desired level. Without new runways the potential to expand is reduced and a relatively small tax is necessary to pull emissions down. If new runways are built there is a huge incentive to airlines to expand and the cost of putting them off is much higher. The tax rate required is displayed in figure 2.

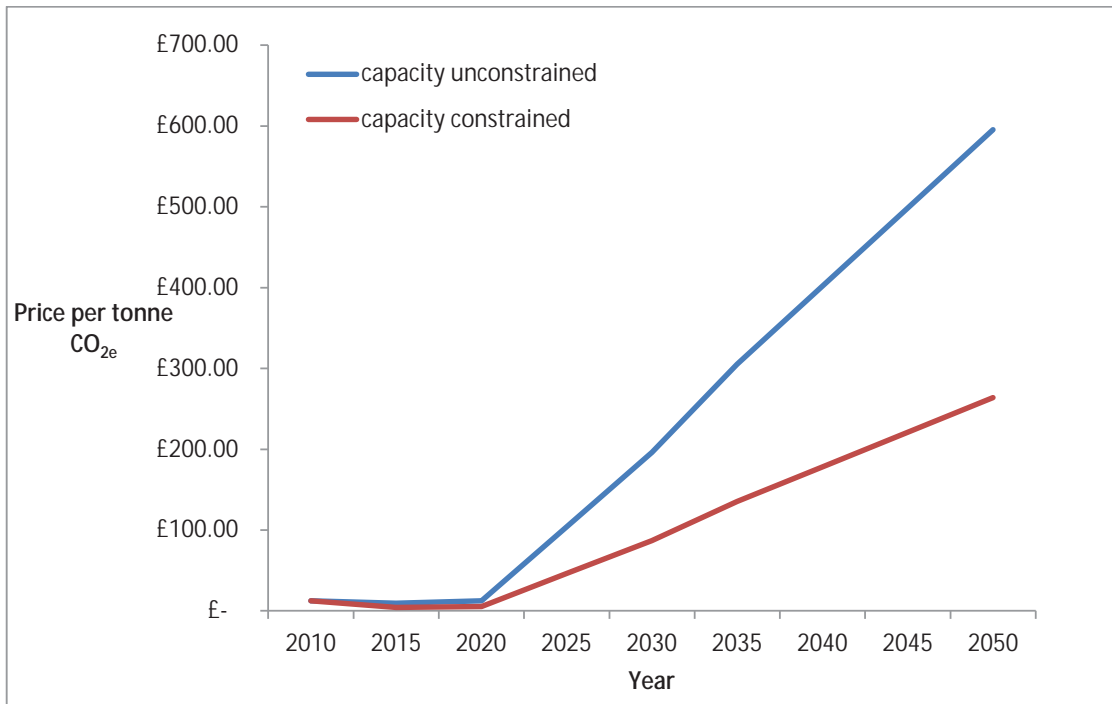


Figure 2: Carbon tax rates required to meet climate change obligations with and without new runways¹⁸

By 2050 the constrained system has followed a path similar to that predicted for the EU ETS with a value not much above it. In the unconstrained model the tax required to dissuade growth reaches an incredible £600 per tonne by 2050. The current carbon price is around £4 per tonne.

Multiplying the carbon tax by the total emissions expected tells us how much the airlines would be paying in 2050 if there is no constraint on runway development. The total cost being placed on the industry to hold within emissions targets would jump from £0.5 billion in 2020 to £4 billion per year by 2025 if expansion is allowed. Figure 3 compares the total tax revenues from a carbon tax with and without new runways. By 2025 the difference is £2 billion per year in tax with and without expansion. By 2050 the difference rises to £12 billion suggesting that restricting airport capacity does have a significant impact on total potential emissions.

¹⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/266670/airports-commission-interim-report-appendix-3.pdf

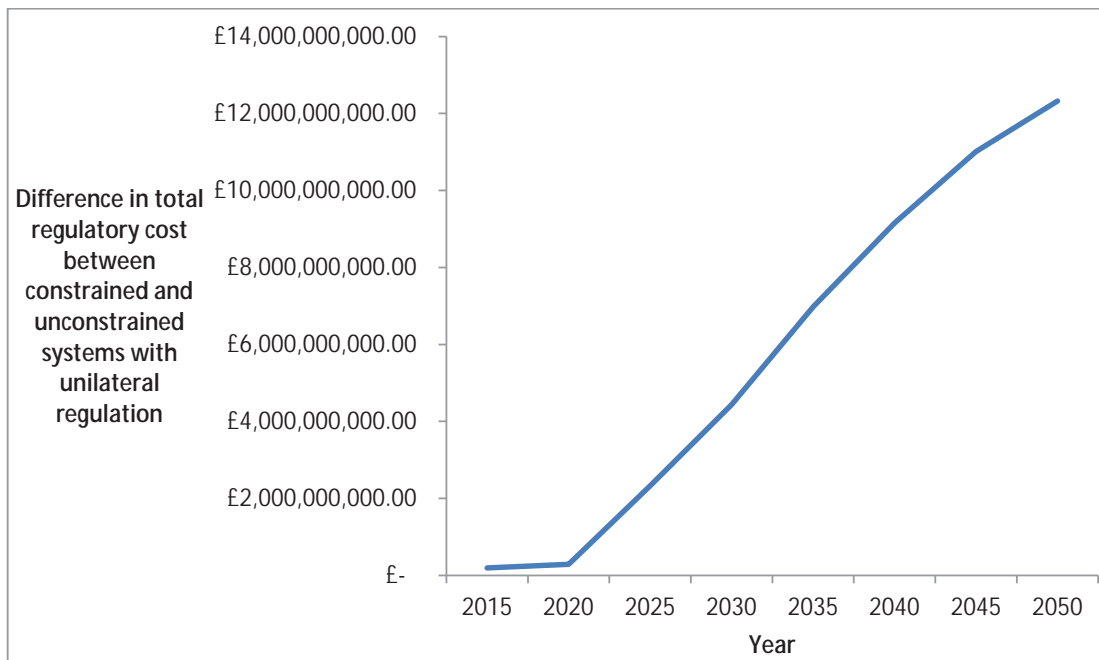


Figure 3: Difference in revenues from a unilateral UK carbon tax between a world with and without new runways ¹⁹

Because we do not have scenarios describing demand and emissions in the absence of carbon regulation (of any sort) we have no direct guide as to the impact on the UK’s carbon reduction obligations if we expand airport capacity without controlling emissions. However, the fact that the difference in the cost of controlling emissions is a factor of three suggests that emissions might increase significantly if we expand airport capacity without controlling emissions.

Constraint Impact Conclusions

This analysis suggests that unilateral UK efforts to curb aviation emissions and meet our climate change obligations would be economically and therefore politically impossible to achieve if we do not take action now to constrain aviation capacity i.e. runways. No government can unilaterally charge an industry £22 billion a year for carbon whilst foreign competitors are not charged.

Furthermore, the huge difference in the cost of regulating carbon unilaterally between scenarios C and D would suggest that controlling airport capacity does have a significant impact when carbon is not regulated. In other words the difference in the cost to aviation between scenarios C and D suggests that there might be quite significant differences in emissions between scenarios E and F.

If an international emissions cap and trade system (EU or global) is the only feasible scale at which to regulate carbon directly then the physical constraint of airports is the only politically feasible unilateral option available to Britain. Whether it is used as a lever to push UK based

industry to lobby the ICAO for a functioning market based system or as a physical control on emissions, runway constraint remains an important policy lever for carbon emissions.

Consequences for other industry

If aviation emissions are not controlled it will be left to other sectors to fill the gap in emissions reductions needed. This gap could be very significant. We do not know for certain what difference new runways will make without carbon regulation. However the analysis above gives a clue as to the scale of the problem if we continue without any regulation and build more runways.

As context, by 2050 the UK's Climate Change Act (2008) requires the economy as a whole to reduce emissions by 80%. At this point, domestic vehicles need to be near zero emissions and electricity production needs to be entirely decarbonised through a radical reshaping of our energy production infrastructure. All of our homes will need to have an emissions footprint of close to zero.

Radical changes are being pushed through in our homes, transport and energy production. To date aviation is not pulling its weight. Currently the industry claims to care about climate change targets, and can theoretically meet them yet concurrently can lobby against EU based carbon trading.

If carbon is unconstrained by aviation, it will have to be constrained further by others to meet our obligations. Directly estimating the cost of this is not currently possible but we can start to estimate the scale by looking at existing analysis. Under the EU trading scenarios aviation will consume £1 billion more carbon when airports are unconstrained by 2050. This is therefore around the minimum it could cost the rest of the economy to cover the costs if aviation emissions are not regulated and we expand airport capacity.

Another way to think about it however would be to consider the full amount that airlines would have to pay to buy the carbon they want under a trading scheme. By 2050 aviation would buy £8.4 billion worth of carbon credits from the rest of the economy which would then be able to use that money to help avoid emissions.

The true cost however should be based on the difference in emissions in an unregulated and unconstrained system (scenario F) against emissions under international trading (scenario H) or the EU ETS (scenario B). This cost could be very significant and we do not currently know what it is. We can therefore currently only debate policy, and government can only decide policy, based on the world as we would hope it to be rather than as it actually is.

Conclusions

There are many benefits to asking an independent technical group, such as the Airports Commission, to analyse a politically sensitive issue. However, to ensure that they remain impartial, that technical group will only answer the question they are asked and no more. If you ask, "Can I leap over that hole" they can run the numbers and the executive summary

will say “YES” with a footnote referring to a dense appendix. If you have the time to read and understand the appendix it might tell you that 7 leaps out of 10 you will fall into the hole; but nowhere in that report will it tell you what will happen if you fall into the hole. It isn’t what you asked the group. This is not a criticism it is just a necessary downside to the process.

So for aviation we have been told that, “Yes you can expand aviation capacity and remain within climate change limits.” So it is theoretically possible to jump over the hole. The appendices tell you that this relies on international regulations which are not yet in place OR charging businesses many billions of pounds per year unilaterally. Therefore more curious readers can infer that there is a pretty good chance that we might fall down the hole (though we do genuinely hope the ICAO process will succeed). Finally we have no analysis examining what happens if we expand aviation capacity without any regulation on aviation. We have no idea if we will survive the fall.

The conclusions are therefore relatively simple:

- Carbon emissions from aviation remain a significant concern in the debate over airport expansion though many have come to believe they are not.
- We need better data so that we can understand the implications of expansion without regulation or with the new regulation promised.
- We need to understand and debate those issues once we have those data.
- Finally, we need commitments to use the only policy lever we have (controlling airport expansion) to ensure no expansion can happen unless the Government or the International Community is prepared to commit to the necessary levels of regulation of emissions from aviation which will allow us to meet our obligations.

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Cover: Heron over the Thames Estuary near reclaimed marshland on the Isle of Grain – proposed site of a new airport.
RSPB Northward Hill on Hoo Peninsula by Eleanor Bentall

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