



All set for take off? Aviation emissions to soar under Airports Commission proposals

Aviation Environment Federation, 16 June 2015

Executive summary

Building a new runway in the South East of England will mean breaching the UK's targets for aircraft carbon emissions unless growth plans in all other regions are massively scaled back. The Airport Commission, which is due to pronounce soon on whether Heathrow or Gatwick should gain the new runway, has so far failed to explain how its recommendation squares with the UK Climate Change Act or to analyse the overall economic impact of the proposal once climate constraints are taken into account.

The legally binding Climate Change Act requires the UK to limit national carbon emissions to about 160 million tonnes (Mt) per year by 2050 – an 80% reduction on 1990 levels. The government and the Committee on Climate Change (CCC), its statutory adviser, say that emissions from aviation should not take up more than a quarter of that figure – 37.5 Mt – by 2050. Yet the Airport Commission predicts that aviation emissions will exceed this figure even in the absence of new runway capacity and that a new runway would put the target even further out of reach.

Analysis by the Aviation Environment Foundation (AEF) shows that airports in all other regions of the country would have to scale back their growth plans markedly if a new South East runway were built in order for aviation overall to remain within the 37.5 Mt figure. A new runway could mean 36% fewer passengers per year flying in and out of airports in the southwest; Scotland could lose 11% of passengers, the northwest of England (where Chancellor George Osborne hopes to grow a 'northern powerhouse' economy) 14%, and the West Midlands a whopping 55%.

Without these cuts around the UK, the new runway simply cannot be built without aviation emissions soaring. If aviation emissions were to exceed 37.5 Mt by 2050 (representing a 120% increase in emissions), energy, road transport, agriculture and homes would have to tighten further the 85% cuts they collectively face already, action the Committee on Climate Change regards as beyond the limit of what is feasible.

No official body – not the Airport Commission, the Department for Transport or the Committee on Climate Change – has calculated the overall impact of these tighter restrictions on the wider economy, nor on regions facing the prospect of restrictions on passenger growth. This undermines the economic rationale for the new runway capacity, which is further dented by the finding that the number of business flights by UK residents has *fallen* over the last 15 years. While the sharpest fall was caused by the 2007-8 financial crisis, business flight numbers have not recovered since, and show no signs of doing so.

Key messages

As the Government is finalising its negotiating position for the global climate talks in Paris at the end of this year, it must also decide whether or not to approve an infrastructure investment that could make our own national CO₂ commitments impossible to achieve.

Reconciling climate ambition with airport expansion has proved a major obstacle to building a new runway in the past, and the Airports Commission's final report is set to hand back to Government the challenge of how expansion at either Heathrow or Gatwick can be made to fit within the emissions limits determined by the Climate Change Act.

For aviation to be compatible with the 2050 CO₂ target legislated in the Climate Change Act, total national aviation emissions can't exceed 37.5 Mt by this date.

- Opposition from big green NGOs to the expansion of Heathrow, when this was last up for consideration, helped lead to the Government of the time to introduce national aviation emissions cap of 37.5 Mt by 2050, to ensure that any airport expansion could take place only within climate limits.
- The cap reflected work by the aviation industry claiming it could reduce emissions to 2005 levels even while allowing for significant passenger growth.
- Independent studies, however, including by the CCC, have since found that the industry's assumptions about carbon efficiency improvements from aircraft and engine technology, more efficient air traffic management, and the introduction of biofuels, were over-optimistic and that limiting

emissions to the level of the cap will require constraints on demand.

- CCC have indicated that a cap of 37.5 Mt, which would require other sectors of the economy to help compensate for aviation, is the maximum possible allowance for aviation if the UK its to meet the reductions required by the Climate Change Act.

There is no feasible way that aviation emissions can be limited to the level of the carbon cap if a new runway is built, given the growth in demand it would facilitate.

- Both Government and Airports Commission forecasts indicate that UK aviation emissions are on course to exceed 37.5 Mt even without adding a new runway.
- Commission figures, while lower than Government's, clearly illustrate that unless some new action was taken to reduce demand at other airports, adding a new runway would push aviation emissions even further above the cap than is predicted based on current capacity.

The economic case for expansion, already predicted by the Airports Commission to be marginal under some scenarios, could evaporate altogether once the costs of limiting emissions in line with the Climate Act are factored in.

- The CCC has repeatedly told the Airports Commission that the cost benefit analysis for all short-listed expansion options must factor in the cost of limiting passenger growth nationally to 60%, the maximum possible under an emissions cap of 37.5 Mt. The Commission has so far failed to do this and has instead quoted claims about economic benefits from expansion that do not include these costs.
- In contrast to claims made on billboard advertising, the

Commission's final consultation found that including the environmental costs so far calculated, the economic impact of expansion at Gatwick may be only marginally positive and that of either Heathrow option potentially negative. Recent recalculation by the Commission of the air quality impact of expansion has already more than doubled the estimated air quality costs for all options. Since the Commission's modelling indicates that building a new runway while limiting emissions to a level compatible with the Climate Act would require the cost of carbon to increase from around £5 per tonne today to between £329 and £1316, proper inclusion of these costs looks set to wipe out any purported economic benefit from expansion.

The aviation emissions challenge

2015 is an important year for climate policy. Momentum is building in advance of the Paris climate talks at which more than 190 countries will try to agree a new global approach for limiting emissions beyond 2020 to safe levels. In the face of growing evidence of immediate as well as future threats being posed by rising temperatures, there has been ambitious talk about a complete phase out of fossil fuels, and about the poorest and the richest countries all committing to national level targets and obligations towards decarbonisation.

Aviation presents a growing challenge in this context. While most other sectors are now on a path to decarbonisation, aircraft remain almost completely dependent on kerosene, with no options for radical change on the horizon. In policy terms, meanwhile, aviation emissions often have an ambiguous status, with a lack of clarity about how responsibility for

tackling them should be allocated among nations. International policy measures that might fill the gap have, meanwhile, been elusive, despite over a decade of discussion at the UN aviation body ICAO.

Aviation & the UK Climate Change Act

In 2008 the UK introduced the world's first legally binding climate change target. The Climate Change Act had such strong cross-party support that only five MPs voted against it. The Act requires a cut of 80% of the emissions level in 1990, with a system of 4-year carbon budgets keeping the economy on track. An independent body, the Committee on Climate Change, was created under the Act to give advice to Government on delivering these budgets.

Given historic international disagreement about the appropriate way to allocate emissions from international aviation and shipping to individual states, these emissions were not formally included in carbon budgets, but the Act requires the Government to review this situation on a regular basis with a view to their inclusion as soon as is practicable. The legislation in any case requires that emissions from aviation and shipping be taken into account in the setting of appropriate carbon budgets for other sectors.

The approach of the Committee on Climate Change has been to allow 'headroom' in the long term economy-wide emissions target of 160 Mt of 43 Mt for emissions from aviation and shipping, of which aviation's share would be 37.5 Mt, equivalent to its level in 2005. The proportion of emissions from aviation would increase under this assumption from around 5% today to around 25% in 2050, with other sectors bearing an increased responsibility for emissions cuts. Even this target for the aviation sector, however, will be challenging to deliver.

The UK has a particularly important role in helping to resolve this impasse, given our unusually high level of aviation emissions; Heathrow alone is responsible for more emissions from its international flights than any other airport in the world¹. Currently responsible for around 5% of UK CO₂ emissions, the Committee on Climate Change assumes that aviation will be responsible for 25% of emissions by 2050, but says this is the maximum that can feasibly be allowed for. Yet demand for aviation – at least for leisure travel – continues to grow and emissions are forecast to overshoot this level even without adding any new airport capacity. How should UK policymakers respond? And how is a new runway even on the table in this context?

This paper sets out how climate change issues have been considered to date by the Airports Commission in the debate over a new runway in the South East, the limitations of this assessment, and the significance of the decision facing the new Government in what will undoubtedly be seen by the public as the first major environmental test of this administration.

Climate change and the runways debate

There has been political discussion for decades about whether or not to build a new runway in the South East. Historically, proposals have all failed to make it through the planning system given concerns about either environmental or economic factors or both.

But it is only in the past decade that climate change has become a serious consideration in the context of airport capacity questions. It was under the Labour government that a new South East runway was most recently considered, and the proposed

expansion at Heathrow attracted strong opposition on the basis of its likely climate change impacts. Greenpeace argued that with a new runway the airport would become the biggest single emitter in the UK² and the World Development Movement calculated that its emissions would be equivalent to those of Kenya³.

Three things happened in 2008 that led to the setting of an aviation emissions 'cap' of 37.5 Mt. Firstly, the UK aviation industry organisation Sustainable Aviation published a 'CO₂ roadmap' that set out a vision for reducing aviation emissions back to 2005 levels by 2050 at UK level through a combination of operational and technological efficiencies and the introduction of biofuels, while allowing for significant passenger growth.

Secondly, the UK Climate Change Act was passed, which requires UK emissions on average to be reduced by 80% of 1990 levels by 2050, and emissions from aviation to be accounted for (if not formally included in carbon budgets). Modelling by the Committee on Climate Change, set up to advise Government on delivery of the Act, about how different sectors will contribute to the 2050 target has assumed aviation emissions of 37.5 Mt in 2050, reflecting the target in the industry's roadmap. CCC has said that this is maximum level that can be allowed for.

Thirdly, in December 2008, the Government announced that while it continued in theory to support a new runway at Heathrow this would in future be subject to a condition that aviation emissions at a national level must be on course not to exceed 37.5 Mt by 2050. The policy essentially challenged the industry to perform against its own commitments. While the cap itself is not legally binding its

use by the Committee on Climate Change in determining how much effort must be made by other sectors remains critical to the question of whether or not airport expansion is compatible with climate ambition.

The need to manage demand

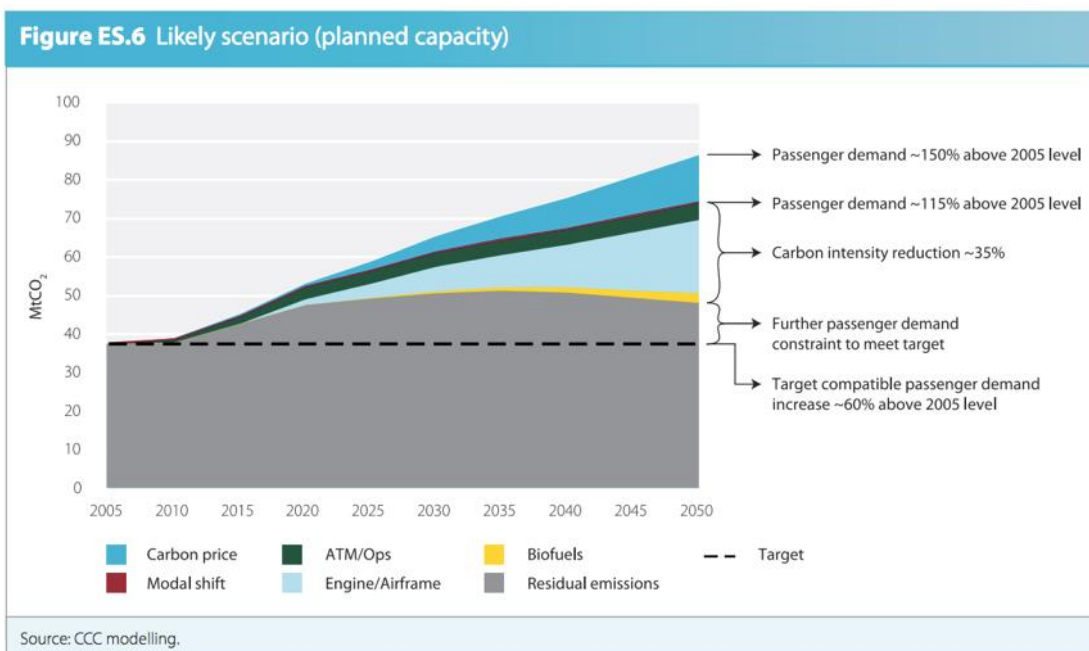
Rather than simply relying on industry aspirations, however, the Government asked the Committee on Climate Change (CCC) to conduct its own review of the likely future emissions from the aviation sector. Its conclusions were significantly different from those of the industry coalition Sustainable Aviation.

Under 'likely' assumptions in relation to aviation's future carbon intensity, the CCC found, projected demand for aviation would lead to emissions significantly in excess of the 37.5 Mt cap. While some growth in passenger numbers would be possible, this would need to be limited to around a 60% growth on 2005 levels, in contrast to the forecast at the time of growth more like 115%.

The Government's own forecasts have consistently reached a similar conclusion; the latest CO₂ forecasts published by the Department for Transport anticipated emissions of 47 Mt by 2050 even without the addition of new airport capacity.

The CCC refused to be drawn on the question of whether and if so how a new runway at Heathrow could be compatible with its recommendations to limit demand growth, but environmental organisations continued to highlight tensions between airport expansion and CO₂ targets. In 2009 a coalition of green NGOs, community groups and local authorities brought a legal challenge against the Government's case for Heathrow expansion, and in 2010 the High Court ruled that the introduction of the Climate Change Act required a review of aviation policy, concluding that it would be "untenable in law and in common sense" for the Government to retain the expansionist policy set out in the Air Transport White Paper⁴.

While the Labour Government



CCC analysis in 2009 found that passenger demand growth would need to be constrained if the target of limiting aviation emissions to the 2005 levels was to be achieved (from 'Meeting the UK Aviation target – options for reducing emissions to 2050')

continued to support Heathrow expansion, both the Liberal Democrats and the Conservatives adopted clear party policy opposing new runways anywhere in the South East on the basis of their likely environmental impacts and when the Coalition formed in 2010 it adopted policy that no new runways at Heathrow, Gatwick or Stansted would be pursued during its term of government.

A new aviation policy was drawn up on the basis that, as argued by the Transport Secretary, “The previous government's 2003 White Paper, *The Future of Air Transport*, is fundamentally out of date, because it fails to give sufficient weight to the challenge of climate change. In maintaining its support for new runways – in particular at Heathrow – in the face of the local environmental impacts and mounting evidence of aviation's growing contribution towards climate change, the previous

government got the balance wrong. It failed to adapt its policies to the fact that climate change has become one of the gravest threats we face.”⁵

But the new policy avoided specific mention of runways, and pressure quickly re-emerged for a review of the Government's position. The Government's solution was to set up the Airports Commission, headed by economist Sir Howard Davies and staffed largely by civil servants from the Department for Transport, to review the question of whether new airport capacity was required in order to maintain the UK's hub status. A timetable of work that required the Commission to report soon after the election left the Conservative party, now in Government, free to avoid making any commitment on airports in its manifesto except to say that it would consider the Commission's advice.

Is the CCC's approach to aviation tough enough?

Overall, the CCC has made recommendations that appear to be built around delivering the Climate Change Act at minimal cost and in way that is politically feasible. Aviation is tricky in both respects since meaningful emissions reductions are hard to come by, and since many politicians regard the sector with special affection.

Perhaps as a result, CCC has tended to tread somewhat carefully in relation to aviation. Its focus has been largely on the importance of allowing for aviation in the long-term 80% emissions target by increasing the necessary cuts from other sectors. In terms of the expected emissions reduction from aviation itself, CCC appears to have adopted the path of least resistance in using a 37.5 Mt cap (or 'planning assumption' in the CCC's terms) in its modelling. Evidence of the economic or social case for allowing aviation such a generous target has never been presented.

A target of 37.5 Mt is equivalent to a 120% increase on emissions in 1990 as against the 80% cut on 1990 emissions levels required from the economy overall, and takes no account of aviation's non-CO2 impacts. Other sectors are expected to reduce emissions by 85% on average in order to deliver an economy-wide 80% emissions cut, action the CCC has described as at the limit of what is feasible.

Beyond the headline conclusion of the CCC's 2009 report that delivering this target would require demand constraint, CCC has remained fiercely silent on what policies should be adopted (including on airport capacity) to deliver this, arguing that these are for the Government to address. In practice, however, public and political debate about runways has been taking place without the climate change constraint on growth being well understood.

The Airports Commission's approach on climate change

The Airports Commission has always said its recommendations will honour climate change commitments. But in fact it has been unable to show how a new runway could be compatible with an emissions target of 37.5 Mt.

The Commission has produced its own 'baseline' forecasts of emissions from aviation without expansion. These are unaccountably lower than the latest forecasts from the Department for Transport but still exceed the 37.5 Mt target level even without expansion. The Commission has also modelled the emissions impact of each of its short-listed runway schemes and concludes that they would all increase emissions yet further above this level (even if aviation was exposed to carbon pricing under an emissions trading system). This is labelled the 'carbon traded' emissions forecast.

Because of this overshoot, the Commission also conducted a model run whereby a new runway is built but emissions at a national level are capped at 37.5 Mt through the application of an increased cost of carbon, which has the effect of reducing travel demand. Even under this 'carbon capped' forecast, the Commission says, demand for aviation *in the South East of England* is strong enough to justify a new runway. There the Commission rests its case for expansion.

Speculation versus reality and the unintended consequences of a new runway

The problem, however, is that the 'carbon cap' remains nothing more than a modelling assumption. With no policies to implement it, as the Commission's own figures make clear, the cap won't be achieved and building

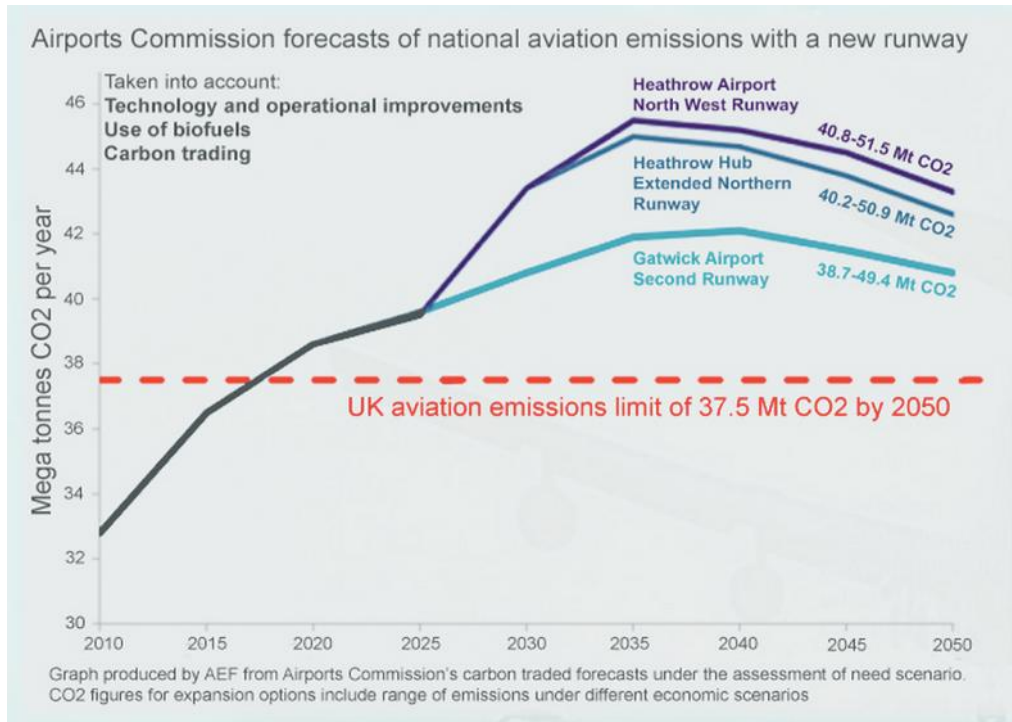
a new runway will have the effect of increasing emissions. So how in practice could the emissions cap be enforced if a new runway was built?

Climate limits, airport capacity, and meeting demand where it arises: a summary of previous AEF research

Most airports in the UK have spare runway capacity but would need to expand their terminal capacity and/or to apply for new planning permissions in order to make full use of it. Government (and subsequently Airports Commission) forecasts are based largely on the premise that an airport's capacity is limited only by its runway, with incremental growth as a result of the lifting of planning caps or expansion of terminals assumed to be permitted.

Since under this assumption passenger growth and emissions are forecast to overshoot the maximum level possible under the Climate Change Act, in 2011, AEF undertook research, commissioned by WWF-UK, on the maximum level of passenger demand that could be accommodated by the UK's airports if the Government were to implement a moratorium on all planning applications for airport growth.

At a national level, our research found, sufficient runway and terminal capacity already exists to allow for the maximum level of growth possible under the carbon cap. Even at a regional level, in most areas sufficient capacity exists to meet the target-compatible level of growth where it arises. In areas of under provision in terminal capacity (Scotland, the North of England and the South East) we identified feasible options for addressing this without airport expansion, including a more ambitious stance towards rail, the promotion of videoconferencing, and an increase in average passengers per aircraft at Heathrow in line with the industry's own forecasts.



The Airports Commission's own emissions forecasts indicate that all expansion options will exceed the level of the carbon cap. (graph produced by AEF using Airports Commission figures)

The Airports Commission's Analysis – Outstanding Questions

When the Commission makes its final recommendation, will it have answered one of the key political questions that got in the way of a runway last time round, namely how to square this with action on climate change?

Question 1 The Commission has always said it will honour the Climate Change Act. But it has also admitted that all its short-listed expansion options will breach the recommended aviation carbon cap even if aviation is fully included in a carbon trading scheme. What's the solution to bringing emissions down and how much harder will this be to achieve with a new runway than without?

Question 2 The Committee on Climate Change said that the Airports Commission's cost benefit analysis for each shortlisted scheme should include the cost of measures to limit national air passenger growth to 60% over 2005 levels in order to limit emissions. Why did the Commission not do this work in time for its final consultation and why did it begin claiming economic benefits from expansion before calculating these costs?

We can see only two possible policy approaches. First, the supply of airport capacity elsewhere in the UK could be directly limited, for example through the imposition of planning restrictions. The Commission's model effectively assumes that the UK's entire airport network is redesigned such that there is more capacity in the South East and less elsewhere in the UK. But with the Government's aviation policy explicitly supporting growth at regional airports it is hard to see this being an attractive option.

Secondly, demand could be regulated through the imposition of new taxes or charges on tickets. But with Air Passenger Duty having recently been cut and the significant obstacles remaining to the introduction even of the kind of carbon trading assumed in the Commission's baseline forecasts, again it is very difficult to see how this could be realised. The cost of a one way ticket to Europe may need to be increased by as much as £110 by 2050,

AEF has estimated, based on Airports Commission figures.

The other big gap in the Commission's work on this issue to date has been its failure to calculate the overall cost of introducing the carbon cap itself and how this affects the supposed economic benefit from expansion. In July 2013, the CCC published an open letter to the Airports Commission⁶ recommending that the economic impact of any proposal for new airport capacity should take account of the cost of limiting growth in air passenger numbers at a national level to no more than 60% of the level in 2005.

The Airports Commission admitted in its final consultation however that it had not undertaken this analysis, making its published claims about the economic impact of expansion (in fact already marginal or even negative under some assumptions) too high. Figures published so far by the Commission suggest that fully including these carbon abatement costs could in fact demolish the economic case for expansion.

Impacts of expansion on regional airports under a carbon cap

Maintaining the carbon cap while building a new runway would be, it appears, both costly and politically extremely challenging. Given political ambition to rebalance economic activity away from South East England, the Government will need to consider whether or not it is even desirable.

Under carbon capped forecasts, the Commission's model illustrates, passenger numbers would not increase (or would increase only very marginally) at a national level as a result of adding a new runway. Instead much of the 60% allowable growth in passenger

numbers that would have taken place at regional airports is simply redistributed to the South East.

Under the Commission's 'Assessment of Need' forecast (see table below) all regions of the UK are predicted to see passenger growth in a 'no new runways' scenario, even if the carbon cap is achieved. But building a new runway at any of the short-listed sites would reduce the level of passenger growth that could take place at other airports. Only London and the South East would see any benefit in terms of increased passenger growth.

The necessary reduction in growth elsewhere in the UK is forecast by the Commission to be greater in the case of a runway at Heathrow than at Gatwick. This finding rests, however, on the assumption that the growth facilitated by Gatwick expansion would be predominantly in short-haul leisure travel rather than long-haul flights (which generate higher emissions per flight).

If in fact Gatwick expansion were to be accompanied by an increase in long-haul business flights, as the airport hopes, differences in terms of the carbon impacts of the three expansion proposals (and therefore in terms of impacts on airports outside the South East) would reduce.

Airports Commission forecasts of passenger numbers in 2050 both with and without a new runway (table constructed by AEF based on Assessment of Need carbon capped forecast, published November 2014)

UK region	Forecast total passenger numbers in 2050 under 'no new runway' carbon capped scenario	Expansion option	Difference in passenger numbers (millions) with expansion compared with the 'no new runway' scenario (under a carbon cap)	Percentage difference compared with 'no new runway' scenario
Scotland	36.70	Heathrow North West runway	-4.06	-11.05
		Gatwick runway	-0.35	-0.95
		Heathrow extended runway	-3.79	-10.32
Northern Ireland	13.66	Heathrow North West runway	-1.59	-11.64
		Gatwick runway	-0.18	-1.34
		Heathrow extended runway	-1.36	-9.93
Wales	2.72	Heathrow North West runway	-0.70	-25.75
		Gatwick runway	-0.14	-5.08
		Heathrow extended runway	-0.70	-25.75
North West	54.71	Heathrow North West runway	-7.69	-14.07
		Gatwick runway	-0.81	-1.49
		Heathrow extended runway	-6.35	-11.61
North East	7.54	Heathrow North West runway	-1.13	-15.02
		Gatwick runway	-0.05	-0.65
		Heathrow extended runway	-1.13	-15.02
Yorkshire and Humber	9.80	Heathrow North West runway	-1.25	-12.79
		Gatwick runway	-0.97	-9.88
		Heathrow extended runway	-1.25	-12.79
West Midlands	21.56	Heathrow North West runway	-11.93	-55.34
		Gatwick runway	-5.40	-25.05
		Heathrow extended runway	-10.72	-49.75
East Midlands	10.84	Heathrow North West runway	-2.72	-25.12
		Gatwick runway	-2.28	-21.03
		Heathrow extended runway	-2.72	-25.12
East	56.57	Heathrow North West runway	-10.06	-17.79
		Gatwick runway	-0.29	-0.51
		Heathrow extended runway	-6.92	-12.23
South West	17.44	Heathrow North West runway	-6.33	-36.30
		Gatwick runway	-3.27	-18.77
		Heathrow extended runway	-6.16	-35.32
South East	53.19	Heathrow North West runway	-10.10	-19.00
		Gatwick runway	19.43	36.54
		Heathrow extended runway	-7.45	-14.00
London	100.95	Heathrow North West runway	41.24	40.85
		Gatwick runway	-0.48	-0.48
		Heathrow extended runway	34.87	34.54

Are new runways essential to meet passenger growth?

Demand for air travel keeps growing, particularly internationally. Despite taking a hit from the recession, as much as 6% annual growth in passenger km is anticipated for the Asia-Pacific region between now and 2030, around 5% in the Middle East, and 4% in Europe. The terms of reference given to the Airports Commission include a requirement to identify ‘the steps needed to maintain the UK’s global hub status’, partly perhaps with a view to the UK catering for some of this growth. But the key political argument – that new runways are necessary for British business – is not in fact well evidenced.

In the UK, where the aviation market is relatively mature, future demand growth looks much more modest than in many other countries. UK aviation experienced particularly rapid growth between 1990 and 2005, with ticket prices consistently falling and many UK airports expanding. The 2003 Air Transport White Paper set out policy for aviation expansion throughout the UK including three new runways before 2030 (one to serve the South East, one in the Midlands and one in Scotland) and airports subsequently published very optimistic figures about their potential for growth.

In fact, however, demand growth has been much slower than anticipated and Government forecasts have fallen each time they’ve been revised. Even post-recession the Government now foresees passenger growth of only 1-3% annually between now and 2030.

Passenger demand growth is fuelled to some extent by air fares being artificially low as a result of tax exemptions: aviation is zero-rated for VAT and no tax is levied on jet fuel. The case for revision of the ban on fuel tax

remains strong, as argued by economists from the World Bank and IMF⁷. Since a lot of air travel is discretionary, demand, particularly for leisure travel, is quite sensitive to price increases and would be expected to reduce further in response to any future increase in taxation.

Even on current trends, however, it is worth considering who the main users of a new runway would be. The ‘assessment of need’ that the Commission undertook, and on which it bases its case for a new runway, was essentially an assessment of demand. But this conflates leisure and business demand. If the justification for paying the price both environmentally and economically for a new runway rests on assumed business needs, it is worth looking specifically at trends in business travel.

Falling UK demand for business travel

The rhetoric used by those arguing for new airport capacity has changed somewhat from the last time South East expansion was on the table, when the headline argument was a supposed £5 billion benefit for the UK as a whole. This time round, the talk has been all about ‘connectivity’: the idea that UK business requires more (preferably direct) connections by air to business destinations, particularly in emerging economies.

There are plenty of questions arising from this assumption, for example about the direction of causality between direct air connections and trade relations, or about whether it harms British business to have to hub in Frankfurt or Dubai rather than in South East England. More fundamentally, though, is there in fact a strong demand for business travel that can’t be met with current infrastructure?

The evidence is perhaps surprising. Business flights accounted for less than a sixth of all international travel to and from UK airports last year, and UK demand for business travel has fallen over the past 15 years, both in absolute and percentage terms. The trend may be partly attributable to the embedding of carbon accounting as part of standard business practice as well as greater scrutiny of business' environmental performance by shareholders.

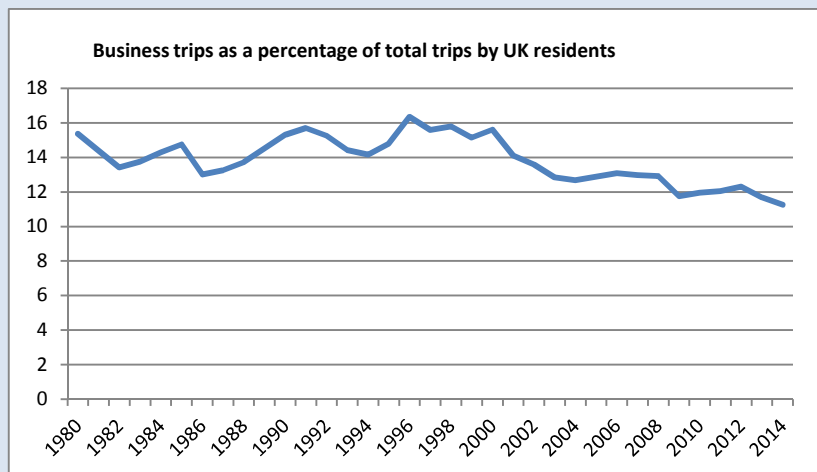
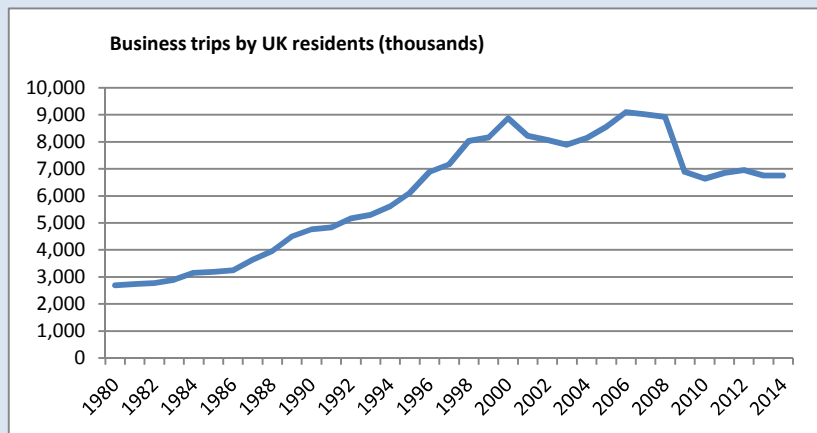
Research published in 2011 on travel practices among FTSE 350 companies by WWF-UK⁸ suggested that reductions in business flying during the recession were likely to outlive it. Of those companies that had cut their flying

during the recession, 85% did not intend to return to 'business as usual' levels of flying. Overall, 91% of respondents agreed with the statement 'Reduced flying and greater use of alternatives are now important parts of our corporate responsibility agenda.' The assumed business case for airport expansion may then need further scrutiny.

Could technology improvements offer a better way to tackle emissions than restricting demand?

There are a number of ways in which aviation is expected to become more carbon efficient in future, but each of these has significant limitations. The

Business travel by UK residents has been falling both in absolute and percentage terms (graphs by AEF based on data from 'ONS Travel Trends 2014', published May 2015)



headline conclusion of the work of the Committee on Climate Change on aviation in 2009 was that technology improvements won't take place fast enough to allow for unlimited passenger growth without increasing emissions. Both academic and Government studies have reached similar conclusions. The key options are considered below.

Aircraft and engine technology

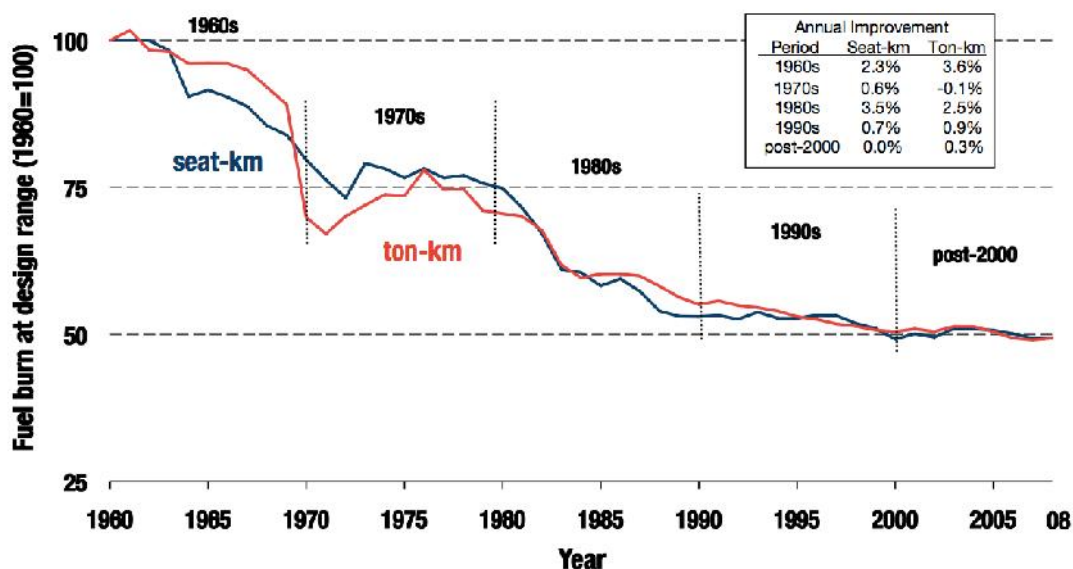
Historically, there have been impressive technological improvements in jet aircraft. Between 1960 and 2000, for example, aircraft efficiency improved by an average of 70%⁹. But more recently these trends have been flattening out, with the gains becoming ever harder to come by. There is some evidence in fact that even where more efficient aircraft models are available, they are not necessarily the preferred option for airlines renewing their fleet. Research in 2009 from the International Council on Clean Transportation¹⁰ found, for example, that over the previous two decades there had been

no improvement in the emissions performance of newly purchased aircraft on a per passenger basis.

Operational improvements

Improving the efficiency of air traffic management appears to offer a win-win solution, since measures such as more direct routing of aircraft and reductions in the time aircraft spend holding and stacking while they wait for landing slots should be beneficial to the aviation industry while also yielding CO₂ reductions. But in practice there are real challenges to implementing operational efficiencies. Some are simply political; states have been reluctant to want to cede control to more centralised systems of air traffic management and there remains something of a patchwork of air traffic management blocks.

Alongside this, tensions are increasingly evident between noise management and fuel efficiency particularly in relation to lower airspace. Recent trials of new flight paths (at Gatwick,



ABSTRACT 1. AVERAGE FUEL BURN FOR NEW AIRCRAFT, 1960-2008

Historic improvements in the efficiency of new aircraft are flattening out (ICCT 2009 'Efficiency trends for new commercial jet aircraft')

Heathrow and Birmingham, for example) that were designed to help deliver a more efficient UK airspace have been halted following unexpectedly strong community opposition from communities that were newly overflown. With one in three people in the UK now saying they are disturbed by aircraft noise¹¹, this challenge is unlikely to diminish.

Finally, some operational efficiency appears to be compromised by the very nature of both airports and airlines operating competitively in their own interests. In the case of Heathrow, for example, operating at full capacity reduces the airport's resilience to bad weather, congestion or other delays. Meanwhile the requirement for aircraft to wait in holding stacks arises in part because pilots choose to attempt early arrivals rather than arriving at a designated time, thereby creating congestion.

Alternative fuels

Some sectors may in future be able to run entirely on renewable electricity, and the UK's climate change strategy for transport assumes a very significant decarbonisation of the road and rail sectors. But for aviation, the only alternative energy source currently on the table is biofuel. Once the industry's big hope, it now seems likely that biofuel will have only a very small impact on the sector's emissions. With many sources of biofuel now widely acknowledged as having unacceptable environmental and social impacts the aviation industry has focussed on the idea of making fuel from sources of energy that would otherwise go to waste.

Yet sourcing environmentally sustainable biofuel in sufficient quantity to have a meaningful impact on total emissions and at a cost that is

not prohibitive now appears hugely challenging. The Government estimates that only 2.5% of aviation fuel is likely to come from alternative sources by 2050¹².

How much, in total, can these measures do to limit emissions?

The combined benefit of technological and operational improvements, together with alternative fuels, is a likely reduction in the carbon intensity of aviation if around 0.8% annually until 2050, the Committee on Climate Change estimated in 2009¹³. Other research, including the Government's own forecasting, reaches similar conclusions.

Each of these components could in theory have a bigger impact if the regulatory and economic environment was right. Aviation could have more biofuel if less is used by other sectors for example, while a technology efficiency standard for aircraft could speed up the adoption of new technology. But each would have cost implications, which in turn could impact on demand.

Can inclusion of aviation in international carbon markets make up for any shortfall in emissions reduction?

In environmental terms, as well as in relation to economic competitiveness, it would clearly be preferable for aviation emissions to be tackled effectively at an international level rather than the UK taking action alone. In recent years both the EU and the UN aviation body ICAO have made moves towards regulating aviation emissions, but even under the best possible outcome, the current picture suggests that complementary national level

action by states, including the UK, will be necessary alongside any international measures.

Europe and its heavily compromised emissions trading regulations

The 1990s saw a rapid growth in European aviation, and therefore in aviation emissions, that became increasingly at odds with EU climate and energy policy. Europe's preferred solution was to introduce aviation into its pre-existing Emissions Trading System, which imposes a cap on emissions (reducing gradually over time) and after an initial allocation to polluters, allows them to buy and sell permits equivalent to their emissions. In theory, this allows emissions reductions across economies to be made in the most cost effective way possible. Legislation was passed in 2008 requiring that from 2012 airlines either entering or departing from the EU must surrender emissions permits based on the fuel consumed during their flight.

States outside Europe, however, most notably the USA and China, argued strongly that the EU had no right to try to regulate emissions outside EU airspace or on other countries carriers. In 2013 the EU conceded, agreeing to 'stop the clock' on the legislation except insofar as it covered short-haul flights both departing from and arriving in European states. As a result, only around 25% of the emissions that would have been covered by the original legislation are currently accounted for.

The hope is that this suspension will allow time for ICAO to agree an alternative scheme that has international support. Irrespective of the outcome at ICAO, however, any attempt to expand the EU ETS in the future is likely to be met with fierce

international opposition, limiting the EU's ability to tackle this issue effectively at a regional level.

Slow UN progress on aviation emissions

Aviation emissions at an international level are expected to increase significantly, potentially generating as much as a five-fold increase between now and 2050.

The industry's proposed response to this challenge has been to agree a goal of carbon-neutral growth from 2020. Emissions would be allowed to grow uncapped until then, but from 2020 any increase would be subject to a carbon offsetting or trading scheme. The International Civil Aviation Organisation of the UN – ICAO – has taken this target as the basis for its work in developing a global market-based measure for the sector, and hopes to reach agreement on this at its Assembly in autumn 2016. But there are significant hurdles to be overcome before this becomes possible, including finding a deal that is acceptable to both developed and developing countries.

If it could in fact be delivered, would a climate measure based on this target be in line with the requirement to stabilise global temperature growth at 2 degrees, or with the commitment made by all EU and all G7 members to make emissions cuts of at least 80% by 2050? It's a question ICAO has yet to even consider. At present, while the industry has set a target of a 50% reduction in emissions below 2005 levels by 2050, ICAO has no goal beyond its net 2020 target.

In terms of UK climate policy the answer is clearer. Emissions forecasts for aviation already assume that the sector will in future be covered by a

fully functioning global emissions trading system and even so exceed maximum limits required under the Climate Change Act.

Recommendations: How to square aviation policy with climate policy

The Government should rule out new runways in the UK.

- AEF work has shown that we have enough capacity already to cater for a 60% growth in passenger demand consistent with the CCC's advice on how to keep emissions at or below 2005 levels by 2050. Furthermore, the capacity exists to meet demand in the regions where it originates, without displacing passengers to remote airports in the UK.
- Modelling by the Airports Commission clearly shows that additional runways will make it much harder to reduce aviation emissions to an appropriate level.
- Trying to impose a carbon cap while building a new runway would, our work shows, mean either higher ticket prices or constraints on other airports; neither seems a price worth paying.

Aviation should be taxed more fairly

- Demand for aviation has been sustained by air fares that have become progressively cheaper in real terms. Arguably, air fares have become artificially low as there is no tax on fuel for international flights and no VAT on tickets.
- While air fares have been falling, buses and trains have been becoming more expensive¹⁴.
- While Air Passenger Duty (APD) compensates in part for this anomaly, Treasury estimates suggests that if aviation paid duty and VAT equivalent to that paid by the motorist, the tax revenue would

be as much as four times that from APD. This would have a significant impact on air fares and demand.

Both Government and business should support and invest in alternative means of connectivity

- Connectivity and mobility do not have to involve air transport. There is a case, on environmental grounds, for not licensing air routes where fast and frequent rail links are in place given that rail is significantly less carbon intensive than air travel.
- Many companies, including leading multinational businesses, are now actively managing their carbon footprint, and for many that means cutting back on corporate travel. BT, BSkyB and LloydsTSB, for example, have all been participants in recent years in a programme to cut 20% of their business flights (the 1 in 5 challenge¹⁵). These businesses believe that their success does not depend on increasing use of air travel, and have begun to adopt different business practices and to invest in video-conferencing.

Aviation should be formally included in carbon budgets.

- While carbon budgets for other sectors have been set so as to allow 'headroom' for international aviation and shipping emissions, formally including these sectors in carbon budgets would provide certainty about their future treatment, and reinforce the importance of continuing to account for them in the long term 80% carbon target.

Government should continue to support the development of international measures to reduce aviation emissions

- The wider the scope of action to tackle climate change the more

- effective it will be. This is true for all sectors; there is nothing unique about aviation in this respect. But to the extent that international policy can be developed to tackle aviation emissions, this will of course help to address any concerns about the competitiveness impacts of action to tackle aviation emissions. AEF is actively supporting the current UN work on developing a global Market Based Measure for aviation through our participation in ICSA, a global coalition of environmental NGOs campaigning on aviation emissions.
- Even if these difficult negotiations are successful, however, a measure will not be introduced before 2020. Complementary, national level action will still be necessary to tackle the industry's rising emissions.

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