A note on the Government Response to the Committee on Climate Change Report on Reducing CO2 Emissions from UK Aviation to 2050

Prepared for Local Authorities Aircraft Noise Council

Ubina Environmental Consulting

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Summary

The Coalition Government inherited a self-contradictory aviation policy: on the one hand, a programme of airport expansion set out in the *Future of Air Transport* White Paper that would lead to emissions of around 60 $MtCO_2$ in 2050; on the other hand, a target for the sector to emit no more than 37.5 $MtCO_2$ in 2050. It also inherited a report from the Committee on Climate Change (CCC) that laid bare the disparity and made clear that given the likely pace of improvements to fleet efficiency, passenger growth would need to be restrained in order to meet the target.

By cancelling new runways and committing to develop a new Sustainable Framework for UK aviation, the Coalition indicated its willingness to tackle these contradictions. But its *Response* to the CCC report shifts the emphasis away from hard questions about how to allocate limited capacity, and onto ways – sometimes quite speculative ways – that policy might be used to increase efficiency gains beyond those already factored in to forecasts.

This note argues that in order to deliver a genuinely sustainable policy, the Government should:

- Confirm the 2050 Target for aviation, which is implied (as a minimum) by the provisions of the Climate Change Act;
- Clarify that, in order to meet the Target with a reasonable degree of certainty, airport capacity will be *planned* on the basis that fleet efficiency will improve at the rate forecast either in the CCC Likely scenario or its own central forecasts. Further capacity would only be released when there is evidence that additional gains have materialized in practice;
- Assess the effects of fiscal measures, working with HM Treasury, and incorporate this into its draft framework as one possible 'lever' to manage emissions;
- Commit to tackling aviation non-CO_2 impacts and be clear about the implications these might have for carbon budgets;
- Rule out policies that set mandatory levels of biofuel uptake, as these have been shown to drive unsustainable practices in the road sector.

A few comments are also offered on specific aspects of the underlying analysis, for instance forecasting beyond 2030, or the treatment of videoconferencing.

Background

In January 2009, the Department for Transport (DfT) made a series of major policy announcements, among them approval in principle for the building of a third runway at Heathrow airport and a new target for UK aviation emissions to be no higher in 2050 than they were in 2005 (37.5 $MtCO_2$). This target was to be in terms of absolute emissions, ie actual emissions on flights from aircraft departing from UK airports, with no account taken of carbon offsets or credits purchased via the EU Emissions Trading System (ETS). The DfT asked the Committee on Climate Change (CCC) to report on how this target could be met.

In December 2009, the Committee produced its report *Meeting the UK aviation target – options for reducing emissions to 2050* (the *CCC Report*)[1]. The report analysed Likely, Optimistic and Speculative scenarios for improvement in fleet fuel efficiency through airframe and engine technology, ground and air operations, and biofuels, as well as looking at possibilities for modal shift and travel substitution. The report also discussed the latest evidence on aviation's non-CO_2 climate impacts.

The report's central finding was that Likely annual efficiency improvements would average 0.9%, implying that the maximum number of UK airport passengers compatible with achieving the 2050 Target was 370 mppa (million passengers per annum), and that Government should plan its airports policy on this basis. This contrasted with the airport developments set out in the 2003 *Future of Air Transport* White Paper, which would lead (on DfT forecasts) to around 570 mppa in 2050. The Committee noted that deeper efficiency improvements might be achieved, thereby allowing additional passenger growth, but that the Government should not plan on the basis that these would materialize.

Immediately after its election, the Coalition Government ruled out new runways at Heathrow, Gatwick and Stansted[2]. By October of 2010 it had committed to developing a new Sustainable Framework for UK aviation to replace the 2003 White Paper[3], and in March 2011 it published a Scoping Document for consultation. The intention was for a six-month consultation period on this document; a draft policy to be published in March 2012 for a further 6-month consultation; and a final policy to be published in March 2013.

The DfT also committed itself to respond to the CCC report by July 2011. In the event, the *Response*[4], with accompanying updated *Forecasts*[5] and Marginal

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[1] www.theccc.org.uk/reports/aviation-report

[2] *The Coalition: Our Programme for Government,* May 2010. www.cabinetoffice.gov.uk/sites/default/files/resources/coalition_programme_for_government.pdf

[3] *Department for Transport Business Plan 2011-2015,* October 2010 www.number10.gov.uk/wp-content/uploads/DFT-Business-Plan1.pdf

[4] *Government Response to the Committee on Climate Change Report on Reducing CO_2 Emissions from UK Aviation to 2050,* August 2011 http://assets.dft.gov.uk/publications/response-ccc-report/ccc-response.pdf

Abatement Cost Curve (MACC) report[6] was published in August 2011. The DfT has extended the deadline for replying to the Scoping Document consultation to October 20th 2011 in recognition of this slight delay.

This note comments on strategic-level climate change policy issues arising from the *Response*, and is intended to assist LAANC in framing its overall response to the consultation. It follows the evidential trail into the *Forecasts* and *MACC Report* only where this is necessary to give informed comment, but is not intended to provide a detailed critique of, for instance, the DfT passenger forecasting methodology (which in any case has been extensively peer-reviewed).

Comments

The 2050 Target and inclusion of aviation in national carbon budgets

Paragraph 1.8 of the *Response* notes that

the Climate Change Act 2008 requires the Government, by the end of 2012, either to include international aviation and shipping emissions in the UK's wider 2050 climate change target and associated carbon budgets or to submit a report to Parliament explaining why it will not do so

and goes on to state that its decision will be informed by CCC advice due in March 2012. There is no reason in principle not to include such emissions, and if the CCC finds that there is an acceptable accounting method for doing so, its advice should be followed. The Response continues:

We also need to decide whether to adopt the 2050 aviation CO_2 target, announced by the previous administration in the context of its decision to support a third runway at Heathrow, now that decision has been reversed.

The equation of the 2050 Target with the decision to expand Heathrow is somewhat misleading, since it is not rendered unnecessary by the reversal of that decision. The 2050 Target is fact a statement, in unambiguous terms, of the implications of including aviation within the UK's overall climate framework.

In its first report in 2008[7], the CCC argued that in order to achieve the UK's overall target of an 80% cut on 1990 levels of greenhouse gases (GHG) by 2050, emissions

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[5] *UK Aviation Forecasts,* August 2011 http://assets.dft.gov.uk/publications/uk-aviation-forecasts-2011/uk-aviation-forecasts.pdf

[6] *Marginal Abatement Cost Curve (MACC) Model for the UK Aviation Sector,* August 2011 http://assets.dft.gov.uk/publications/response-ccc-report/mac-report.pdf

[7] *Building a low-carbon economy - the UK's contribution to tackling climate change,* December 2008 www.theccc.org.uk/reports/building-a-low-carbon-economy

from international aviation and shipping would have to be no higher than then current levels. (Emissions in 2008 were around 120% higher than in 1990, so this allocation is therefore already extremely generous relative to other sectors, which are required to make deep cuts on 1990 levels.) This treatment, together with a maximum feasible reduction of 70% for non-CO_2 gases, would require other sectors to cut their emissions by 90% if the economy as a whole was to meet the 80% reduction target.

Although the move to 90% for land-based sectors was reckoned to be feasible, it was not explicitly costed. Allowing more emissions from the aviation sector would require yet steeper cuts from other sectors, potentially reaching unfeasible levels and certainly increasing costs.

Furthermore, if the world is to stay on track to keep global surface temperature rise below 2°C, the CCC foresaw that 'in the long term, low cost opportunities to cut emissions in developing countries will diminish and radical reductions in emissions of developed countries will be unavoidable', and therefore that 'the majority of the 80% cut will in the long term need to be achieved via domestic action'.[8]

The 2050 Target for aviation should therefore be seen as flowing from the requirements of the Climate Change Act 2008, not as a gesture linked to the announcement to expand Heathrow. It represents a sector-specific statement, in unambiguous terms, of the maximum emissions from aviation that can be compatible with achieving the UK's legally binding climate change targets.

Why should such a sector-specific statement be required? It focuses minds on the task at hand and provides a yardstick for assessing progress in a way that simply including aviation within the overall mix of UK GHG emissions does not. Without a sector-specific target, the question remains (ostensibly) open of what a 'fair' proportion of aviation emissions in the overall mix might be; the answer to this question is then open to manipulation by special interests and vulnerable to short-term political decision-making. In fact, the question has been settled by the arithmetic presented in the 2008 CCC Report. It is far clearer policy to state as much, and also to remove the option to rely on offsets, which at best is only an interim solution, and at worst counter-productive as it distracts the industry from the urgent need to reduce its absolute emissions.

The rest of this note therefore assumes that the 2050 Target is retained.

The overall narrative and approach to efficiency improvements

The *Response* seeks to change the narrative of the *CCC Report* in a way that plays down awkward questions about managing the growth in demand. The CCC presented a stark disparity between a target-compatible level of passenger growth and the level endorsed by the Government through the White Paper. The 'gap' was

[8] ibid, Executive Summary page 3.

21.5 $MtCO_2$, which translated to about 200mppa in 2050 (the difference between the White Paper's 570mppa and the target-compatible 370 mppa). 18 months later, a combination of the recession, and the Coalition's 'no new runways' policy has reduced the size of the disparity, but a gap still remains. The gap is now 11.5 $MtCO_2$, but the *Response* declines to translate this into a gap expressed in terms of passenger numbers, instead presenting an analysis of 'levers' that might reduce emissions faster than the baseline forecast.

It should be emphasised that the baseline forecasts already factor in significant efficiency improvements and biofuel uptake, at a level that reflects expert judgment of likely developments. There is already considerable commercial pressure to improve fuel efficiency given the high cost of kerosene (as well as the incentive for biofuel use offered by its zero emissions factor in the EU ETS), meaning that much of the feasible reduction potential is already projected to be captured. The CCC's approach was to take this likely level of improvement into its central (Likely) scenario, and recommend that passenger/airport growth be planned on this basis, with further capacity being released where faster reductions were proven in practice.

While it is of course possible, in theory, to drive efficiency improvement at a faster rate through policy, it would be preferable for the DfT to acknowledge clearly that this is an uncertain proposition, and that it does not intend to plan allowable capacity/passenger numbers on the basis that faster reductions will be achieved.

A precautionary approach to achieving the target is all the more important because:

- Historic trends are for emissions growth to track passenger growth very closely, with fuel efficiency improvements lost in practice;
- Aviation's non-CO_2 impacts may require its target to be strengthened once they are accounted for in policy-frameworks – ie the target is a minimum.

These points are discussed in more detail on pages 8 and 9 below.

Fiscal Measures

In fact, the Response and MACC Report do discuss demand levers: Capacity Constraint (where no further incremental expansion of airports is allowed) and two behavior-change incentives that have a very small effect. The analysis is, glaringly, missing any discussion of fiscal measures. The reason for this omission is that fiscal measures are 'a matter for HM Treasury' (*Response* 1.13).

This is inadequate. Is it impossible to work cross-departmentally to develop policy? It did not seem to be at the time of the White Paper, which promised (3.42) that (as well as developing EU ETS):

the Government will continue to explore and discuss options for the use of other

economic instruments for tackling aviation's greenhouse gas emissions.

Aviation fuel has long been free from fuel duty and many areas of the industry's operations are zero-rated for VAT. The combined exemptions are acknowledged to cost the Treasury around £10 billion a year.[9] Fuel tax on domestic flights could be introduced tomorrow, and between pairs of European countries by mutual agreement. A change to VAT rules or a Europe-wide fuel tax would require EU agreement, but the relevant Directives are currently up for review. Failing any more radical change, APD can be increased at will, and as European neighbours (Germany, Austria) have recently introduced similar taxes, the scope for doing so without generating leakage to other hubs is expanding.

Since increased Government revenue is counted as a benefit in the cost-benefit analysis of measures, fiscal measures that recoup some of the lost £10 billion are likely to rate as cost-effective. HM Treasury has in the past been willing to estimate the emissions savings from changes to APD.[10] (see eg Pre-Budget Report 2007).

DfT should avoid a Departmental silo approach to policy-making as it draws up the draft Sustainable Aviation framework and work with the Treasury to analyse the effectiveness of further fiscal measures to manage demand and ensure aviation makes a fair contribution to the public purse.

Projected efficiency improvements vs historic trends

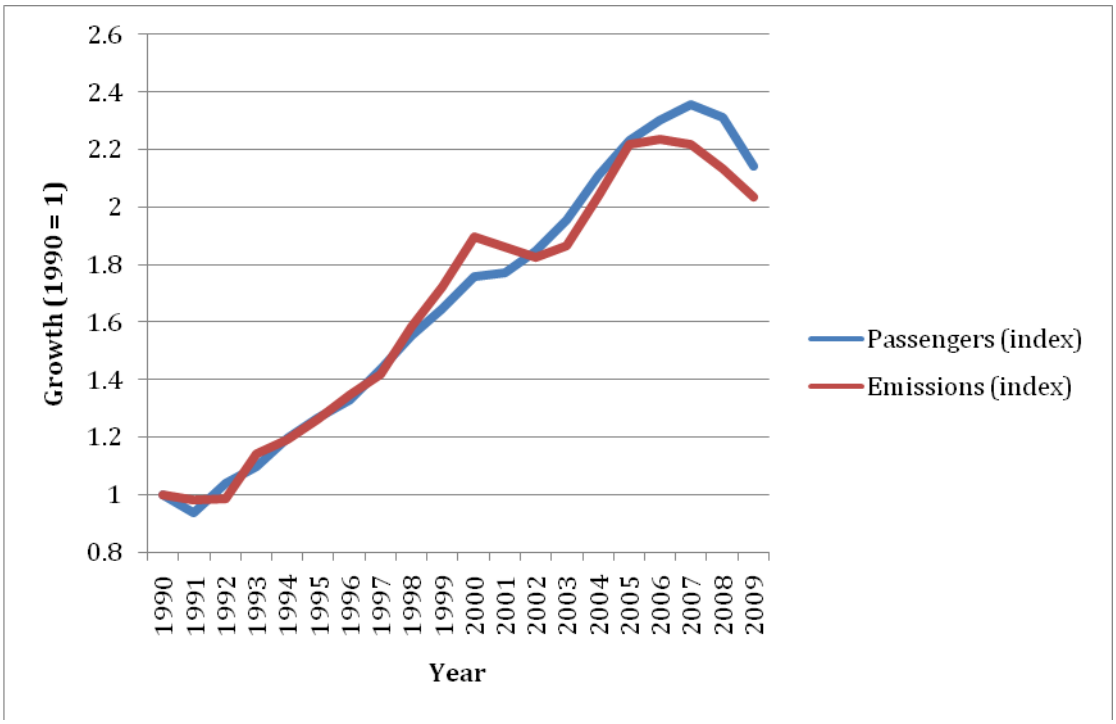
The *Response* notes (para 1.4) that 'in order to grow the industry needs to create headroom by reducing its environmental impact.' Where the industry target is for no increase in emissions, this statement is literally true, and should be fundamental to the policy approach. Furthermore, an environmentally robust approach requires that this headroom should be demonstrated in practice *before* growth is allowed, as future efficiency gains are highly uncertain.

This argument has even greater force when the growth rate of passenger numbers and the growth in emissions since 1990 are compared. Despite claimed efficiency improvements over the period, it is clear that little or no 'de-coupling' has taken place.

[9] Treasury Minister Angela Eagle MP stated in a Commons debate on June 10, 2008 that if aviation fuel were taxed at the same rate as cars, coaches and diesel trains then it would pay an additional £6.5 billion in tax. The Transport Select Committee in 2010 calculated that removing the VAT exemption would raise another £2.3 billion. Duty free is a further effective subsidy amounting to around £1 billion. See *A new basis for aviation taxation*, Policy Studies Institute, June 2010 for details. www.psi.org.uk/pdf/ANewBasis**Aviation**Taxation-Final.pdf

[10] eg *Pre-Budget Report 2007*, HMT October 2007, www.hm-treasury.gov.uk/pbr_csr07_repindex.htm

Figure 1: Trends in UK terminal passengers and emissions from UK aviation



Source: CAA airport Statistics and UK National GHG Inventory data (DECC)

The reasons for this failure to de-couple are not clear. With the rise of (almost exclusively short-haul) low-cost carriers in the 1990s, one would expect both the average distance flown per passenger to have decreased, and the average load factor per plane to have increased – both factors that would tend to *improve* emissions per passenger.

Whatever the reasons, the historical trends clearly illustrate the danger of relying on theoretical projections of fleet efficiency improvements.

Non-CO_2 climate impacts

The *CCC Report* devoted a whole chapter to aviation's non-CO_2 effects. By contrast, they are barely mentioned in the *Response*.

Para 1.15 states that the 'analysis concentrates on reducing emissions of CO_2 as these represent the bulk of aviation's contribution to climate change.' On its own, this statement is misleading: CO_2 is responsible for around half of aviation's warming impact (see below) – hardly 'the bulk'. The picture is further confused by a footnote stating that 'CO_2 makes up 99% of the Kyoto basket of 6 greenhouse gas emissions from aviation' (note 12). While technically true, this gives the highly misleading impression that CO_2 is responsible for 99% of aviation's warming, when in fact it has very significant *non-Kyoto* warming impacts.

The Response continues:

Research to reduce uncertainties about the non-CO_2 impacts of aviation such as NO_x and water vapour is ongoing. As our understanding of the non-CO_2 effects of aviation increases we will be in a position to address their impact.

The non-CO_2 impacts, in fact, are well enough understood to factor them into policy decisions about the overall level of aviation growth. And it is only by indicating a willingness to account for these impacts that policy-makers will give the aviation industry an incentive to reduce them. The cursory treatment in the *Response* gives the impression that the issue is will continue to be studied indefinitely. Despite advances in scientific understanding, the language in 2011 is weaker than in 2003, when the White Paper was able to comment: 'While further research is needed on these issues, the broad conclusion that *emissions are significantly more damaging at altitude is clear.'* (box on p.40, emphasis added).

The *CCC Report* presented the latest scientific work, which is solidifying understanding and quantification of these impacts and also moving towards developing a policy-relevant metric to compare them to CO_2 emissions. In brief, using the Radiative Forcing Index as an emissions multiplier (as a number of environmental groups have done in the past) is incorrect, and this has allowed the industry to characterize the whole concept of 'multipliers' as unscientific. However, estimates are now available of an entirely appropriate metric, the 100-year Global Warming Potential (GWP(100)) – the metric used to weight Kyoto gases. Estimates of a GWP(100) for aviation indicate that its overall climate impact of aviation is around twice that of CO_2 alone.

In the CCC's view, these effects will in due course be sufficiently well understood to be included in policy frameworks; this implies either a reduction (potentially of a half) in the available aviation CO_2 budget, a further emissions reduction demand placed on land-based sectors, or some combination of both. The *CCC Report* concluded (page 132) that

It is reasonable to assume […] that some additional emissions reduction effort would be required in aviation.

This, then, is a further reason to take a precautionary approach to achieving the 2050 Target: there is a strong chance that it may have to be revised downward in a decade or so.

In terms of reducing the non-CO_2 impacts themselves, there are technological options to reduce NOx emissions, and operational possibilities for avoiding contrails. Despite potential trade-offs against CO_2 emissions, both are worth exploring, and the beginnings of a strategic prioritization are emerging: it is understood, for instance, that it is most worth avoiding contrails at night, when they cause the greatest warming.[11] But the *Response* gives no sense that such approaches are being

[11] See for instance *elib.dlr.de/44088/1/Poster_avoid_TAC2006_HM.pdf*

evaluated, or even that they would be worthwhile. And one would hardly expect the industry to pursue them, when their current liability for contrails is nil, and that situation looks set to continue.

Treatment of EU ETS

As noted above, a UK-specific target should be in terms of absolute, not net emissions. To its credit, the bulk of the *Response* proceeds on this basis. Where it discusses the ETS, however, it takes a very 'perfect-world' view of its effects, assuming uncritically that all emissions reductions are of precisely equal robustness.

Paragraphs 2.11 and 3.13 are two sides of this coin: at 2.11 it is argued that aviation's net contribution cannot exceed the cap; at 3.13 that reductions in actual aviation CO_2 emissions have no net effect:

because an ETS cap on aviation emissions is set at the EU level [so that]reductions from within the aviation sector would reduce their [sic] demand for ETS allowances from other sectors, therefore displacing emission reductions from elsewhere within the system (rather than being additional).

This implies that the EU ETS is a sealed system, and aviation will need to purchase emissions from eg EU steel plants if its emissions grow. In practice, all sectors have access to carbon reduction credits imported into the system from Kyoto Clean Development Mechanism and Joint Implementation projects; many of these represent future emissions 'avoided' rather than directly reduced and are themselves of questionable additionality[12].
As well as questions over additionality, there are other reasons why reducing direct aviation emissions is preferable to the purchase of low-quality offsets:

- As discussed on page X above, offsets may not be readily available in the longer term, and all sectors must therefore maintain a focus on reducing direct emissions;
- most methods of reducing aviation will also reduce the associated non-CO_2 impacts.

[12] There is a sizeable literature on this point, from all points on the spectrum from anti-market climate justice campaigners to carbon investors. To select one just example, the United States Government Accountability Office reported in 2008 that 'available evidence suggests that some offset credits were awarded for projects that would have occurred even in the absence of the CDM, despite a rigorous screening process. Such projects do not represent net emission reductions and can compromise the integrity of programs--including the ETS--that allow the use of CDM credits for compliance'. See http://www.gao.gov/products/GAO-09-151

Biofuels

The measure that delivers the largest emissions reduction according to the MAC curve analysis is the mandatory uptake of biofuels (reaching 3% penetration in 2030 and 20% by 2050 in the mid policy case, as against 2.5% in the baseline forecast).[13] This policy is problematic for the following reasons:

- Biofuels are assumed to have an emissions factor of zero. Although this is in line with international carbon reporting practice (and reflected in the Climate Change Act) it is admitted to be a fiction.
- Mandatory targets risk driving the production of unsustainable biofuels, as has already happened in practice with the Renewable Transport Fuel Obligation (RTFO).

Emissions factors: it is true that the zero emissions factor is in line with IPCC, EU ETS and Climate Change Act accounting, but the justification for this choice is weak. The *Response* argues (3.22) that 'Any emissions from biofuel production and transportation would count against the emissions of the relevant sectors'. If this is the case, the capture of atmospheric carbon as the feedstock is grown should be counted as a reduction in the land-use sector of the growing country, since that is where the draw-down takes place – and it must be balanced against any increased emissions from land-use change. Other than a small adjustment to take account of the increased calorific content of synthetic fuel, the emissions of CO_2 from aircraft using biofuel are the same at the exhaust as for fossil fuel.

It would be more logical to account for emissions from the aviation sector as 1 (or 0.99), and capture benefits and disbenefits of agricultural effects in the growing country. In the absence of emissions caps in many of the developing countries where biofuels are grown, this may not be possible; an alternative would be to certify the lifecycle savings from each type of biofuel and use this factor to count emissions savings in the UK ETS and for the purposes of UK carbon accounting (with periodic checks to ensure that the rated saving is being delivered in practice).

Recognising the possibility for land-use changes to reduce life-cycle GHG savings, the *CCC Report* assumed an average 50% lifecycle GHG reduction in its analysis.

Mandatory biofuel targets: The RTFO sets mandatory targets for the biofuel percentage of road fuel at given dates. In response to criticism that this artificial stimulus was triggering a rush for unsustainable biofuels, the Government commissioned the *Gallagher Review of the indirect effects of biofuel production*[14], which reported in 2008. The Review recommended that the drive to increase biofuel blends should be slowed, until greater sustainability safeguards were in place and

[13] MACC Report, page 67

[14] http://webarchive.nationalarchives.gov.uk/20110407094507/http://renewablefuelsagency.gov.uk/sites/renewablefuelsagency.gov.uk/files/_documents/Report_of_the_Gallagher_review.pdf

genuine lifecycle emissions savings were demonstrably being achieved.

At a time when many of Gallagher's recommendations have been accepted by Government, it is disconcerting to find the DfT analysing a policy that not only mandates a level of biofuel far above the business as usual level (20% in 2050 with the policy, 2.5% without) but is, by its accounting procedure, blind to the lifecycle GHG savings (or increases) achieved by the fuel. The *Response* goes some way to acknowledging this (3.27):

Further, it is assumed that the amount of biofuel required to be available to the aviation sector in order to achieve the assumed mandated levels of take-up could be supplied sustainably. Limits to the amount of sustainable biofuel that could be supplied would result in either higher biofuel prices (thus reducing the cost-effectiveness of the policy) or would render the policy unachievable.

This fails to grasp, however, the risk that a weak definition of 'sustainable' is agreed, or that even a reasonably robust definition cannot be enforced effectively, and that the policy simply drives the use of unsustainable biofuel under a figleaf of sustainability, with consequent negative impacts on land-use change, food production and GHG emissions.

Tourism effects

The *Response* at 3.31 states that 'there could be a loss to the UK economy if tourists and business people are discouraged from travelling to the UK, but goes on to state that 'On the other hand the UK economy may benefit from UK residents spending more of their incomes in the UK rather than overseas.'

We are left with the impression that these two effects are likely to be of equal magnitude. Although they are not quantified in the underlying *MACC Report*, it should be possible to give some comment on the likely relative magnitude: in both numbers of passengers, and aggregate spending, UK travellers abroad outstrip foreign visitors, by a factor of very roughly two to one[15]. The benefits of a measure that reduced the attractiveness of flying (eg fiscal measures or capacity constraint), are therefore likely to outweigh the disbenefits to the UK economy, since reduction in outbound travel and spending is likely to outweigh reduction in inbound travel and spending.

Post-2030 – passengers and CO_2

It is stated in several places in the *Response* and *Forecasts* that 'the effects of market maturity and airport capacity constraints cause the growth of activity at UK airports to slow' in the period 2030-2050. (eg Response 2.7). Since around 10 years of growth have been lost due to the recession, it is not clear why 'market maturity' should still

[15] *International Passenger Survey*, Office of National Statistics (ongoing)

occur around 2030, as it did in pre-recession forecasts. In fact, the description rather overstates the slowdown that is forecast to take place – while annual percentage increases might be lower after 2030, roughly the same number of passengers is added to the airport system in the 2030's and 2040's as in previous decades.

Table 1: increase in absolute passenger numbers by decade

Year	Forecast pax (mppa)	Change over 10 years (mppa)
2010	211	n/a
2020	270	+59
2030	335	+65
2040	405	+70
2050	470	+65

Source data: *Forecasts* table 2.11

So there is no slowdown of growth in absolute passenger numbers, and the 'slowdown' cannot be the reason why (absolute) emissions are beginning to fall by 2050. Table 3.4 (page 79) of the *Forecasts* show that the annual fleet efficiency improvement for 2040-2050 is assumed to be 2.0%, compared to 1.0% for 2020-2040. Table 3.6 shows that by 2050, over 80% of aircraft-kms will be flown by 'Future Generation' (post-2020) aircraft. While this estimate is not objectionable in itself given typical fleet roll-over times, it does illustrate the degree to which the emissions trajectory in the final years of the *Forecasts* is dependent on assumptions about the fuel efficiency of such unknown aircraft types.

An airports policy geared to achieving an emissions target with a high degree of uncertainty should recognize such uncertainties explicitly and ensure that capacity increases are conditional on delivery of the technological assumptions that underpin emissions forecasts.

Videoconferencing lever

The assessment of the potential for videoconferencing to reduce emissions is somewhat superficial and dismissive. Paragraph 3.40 reports that the

modelling suggests that this policy would not reduce emissions. The reason for this is that as airports fill up, reductions in (generally shorter) business trips frees up capacity for (generally longer) leisure trips.

It would be helpful to have a reference to data supporting the statement about the average flight lengths of business trips and leisure trips. Even if this is the case, the financial and emissions saving from substituting a longer flight with videoconferencing is greater than that for substituting a shorter flight, so to the extent that this trend is cost- or environment-driven, the picture may not be so

simple. Nor is it clear whether the higher emissions factor for business-class travel has been accounted for.

The assessment also ignores any secondary effects on airline revenues from a reduction in business travel; although the proportion will vary with the airline's business model, premium travellers make up a far greater proportion of revenues than they do passengers. A weakening of this demand may drive up leisure fares, which are subsidized by premium travellers in many airlines business models. This would tend to dampen leisure demand and offset the supposed 're-bound' effect.

Finally, no account has been taken on the significant cost-savings to companies, or the resilience benefits to the UK economy of a well-developed virtual meeting architecture as was demonstrated during the airspace shut-down from the volcanic ash cloud in 2010 – or might arise from a sustained future oil price shock.