



RESEARCH PAPER 08/08  
24 JANUARY 2008

# Aviation and Climate Change

Aviation is a growing industry. Government and the aviation industry recognise a link between aviation emissions and climate change, although there is uncertainty about the measurement of the exact effects. Given the predicted growth in the aviation sector, it seems likely that unless emissions are curbed, they will cancel out efforts made to reduce emissions in other sectors. This paper sets out to explain: the effects of emissions from aviation; the difficulties in making accurate calculations about how these emissions effect climate change; and what proposals and actions are being taken at various levels to reduce these emissions.

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## Summary

Aircraft emit several sorts of gases. Some of them, such as carbon dioxide, water vapour, sulphur and soot particles have been shown to have a direct effect on the atmosphere which can lead to warming of the earth's surface. Other gases, such as nitrogen oxides, have been shown to have an indirect effect, but which again can lead to warming.

In its 2003 report, *The Future of Air Transport*, the Government set out its view of the future of the UK aviation industry up to 2030. It highlighted that many UK airports are becoming increasingly congested and said that failure to provide additional capacity would be a barrier to economic growth and competitiveness. The report showed support for terminal extensions at many airports around the UK and also for several new runways: a new runway at Edinburgh; a new short wide-spaced runway at Birmingham; a new wide-spaced second runway at Stansted; a new third runway at Heathrow; and a second runway at Gatwick.

Under the Kyoto Protocol, the United Kingdom has a legally binding obligation to reduce greenhouse gas emissions by 12.5 percent below 1990 levels by 2008-2012. International emissions from aviation and shipping are excluded from this calculation principally because there is no internationally agreed methodology for calculating such emissions. Similarly, emissions from aviation and shipping are also excluded from UK targets for greenhouse gas reduction proposed by the *Climate Change Bill*. If the *Climate Change Bill* becomes law it will set a long term legally binding target of reducing UK carbon dioxide emissions - not all greenhouse gases - by 60% by 2050 compared to 1990 levels (592 million tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>)). There is concern that unless more is done to reduce aviation emissions that aviation growth will cancel out work done to reduce emissions in other sectors.

Calculating emissions from aviation is complex and figures vary depending on which basis is used to calculate the emissions: whether it is from flights arriving at UK airports; flights both arriving and departing from UK airports; on the basis of emissions from UK-registered airlines; or some other method. In addition to this there is disagreement about the extent to which aviation non-CO<sub>2</sub> emissions impact on climate change: sometimes a multiplier is used to account for this and sometimes not.

In 2005 the Government estimated total UK emissions, including both domestic and international aviation, to be 37.5 MtCO<sub>2</sub>. By 2050 they expect these emissions to reach between 53 to 67 MtCO<sub>2</sub>.

The European Commission and the UK Government are keen for the aviation sector to be included in the EU Emissions Trading Scheme as soon as possible as a way to incentivise emissions reduction, but this has been criticised for not being robust enough to do the job. The aviation industry itself appears to be much more in favour of technological advances to reduce emissions, but there is concern that not enough can be done here to counterbalance the predicted growth of the aviation sector.

Other proposals to reduce emissions from aviation, from organisations such as the Tyndall Centre for Climate Change Research and the Royal Commission on Environmental Pollution, include more restricted airport development coupled with greater competition for take-off and landing slots; greater efficiencies made within the existing infrastructure; and alternative fuels for aircraft.

A growing number of companies, including airlines, offer to offset the emissions from a flight by investing in a carbon reduction or saving made elsewhere. Some see this as a distraction from the task of tackling climate change head-on, others see it as a cost-effective and market driven approach to make emissions reductions. In part, due to the problems with calculating emissions from aviation, questions have been raised about the integrity of carbon offset schemes for aviation due to vast variations in price between offset providers. The Government supports the use of offsetting and has launched a draft voluntary code of best practice for carbon offsetting to offer a benchmark standard for the industry. It has also established the Government Carbon Offset Fund to offset the flights of ministers and officials.

Although aviation emissions are not included in the *Climate Change Bill* targets at present, the Bill does allow provision for them to be included at a later date. The Government explained that such emissions were not included at present due to both a lack of an agreed methodology and the limited emissions abatement opportunities in the aviation sector which would impact on pressure to reduce emissions in other sectors. Parliamentary committees and opposition parties have called the current non-inclusion of aviation emissions in the Bill a “weakness” and an “anomaly”.

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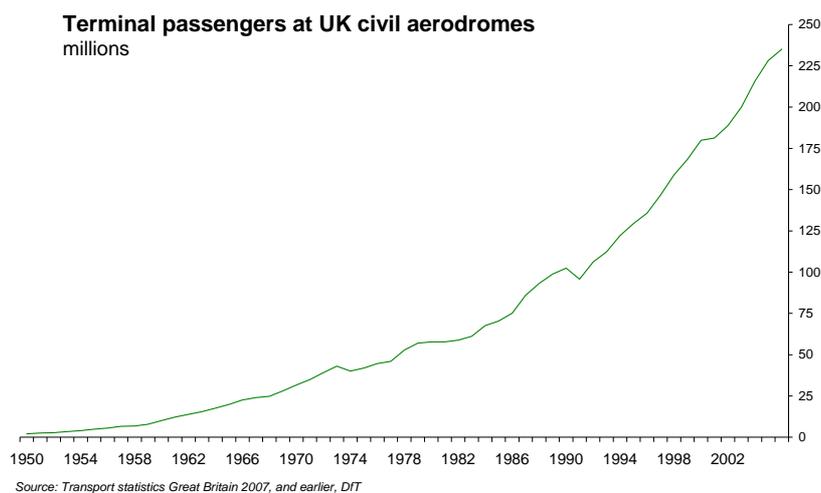
## I Background to aviation and climate change

This paper is primarily concerned with aviation emissions, the complexity of calculating such emissions and the different opinions about how to reduce them. For a more detailed examination of climate change science, including the accepted facts and key uncertainties, the Parliamentary Office of Science and Technology (POST) has produced a note, *Climate Change Science*, which goes into this issue in more depth.<sup>1</sup>

### A. Summary of trends in UK aviation and aviation emissions

235 million passengers passed through UK airports in 2006.<sup>2</sup>

The chart opposite shows their rapid and near continuous increase. The main periods of decline or slowdown were in times of recession and have been short lived. The number exceeded 10 million in 1960, 100 million in 1990 and 200 million in 2004. Growth in the number of flights shows a very similar pattern over time, although the scale of the increases is smaller due to increases in the size of passenger aircraft.



Growth in international passengers has outpaced domestic growth in recent decades. One in eight passengers were on domestic flights in 2006 and 60% of international passengers who passed through UK airports were arriving from/leaving to EU destinations.<sup>3</sup> Much of the increase in international flights in the last decade has been to/from EU member states. There have been especially large proportionate increases in travel between the UK and the new member states that joined the EU in 2004. This growth is associated with the rapid expansion of short-haul budget carriers.

The latest official forecasts of air passenger demand show total passenger numbers doubling between 2006 and 2030 to reach 480 million a year in the central estimate. The high/low range of forecasts is 450-505 million passengers a year.<sup>4</sup>

CO<sub>2</sub> emissions from domestic flights in the UK and international flights departing the UK totalled 37.5 million tonnes of CO<sub>2</sub> (MTCO<sub>2</sub>) in 2005. International flights were responsible for 93% of this. Emissions in 2005 were five times their 1970 level, compared to a seven-fold increase in passenger numbers. Only domestic aviation emissions count towards national CO<sub>2</sub> totals. The reasons for this are covered later in

<sup>1</sup> Parliamentary Office of Science and Technology, [Climate Change Science](#), number 295, November 2007

<sup>2</sup> Excludes transit passengers

<sup>3</sup> *Transport statistics 2007*, DfT; *UK airport statistics 2006*, CAA

<sup>4</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, November 2007

this paper. However, were all international and domestic aviation emissions to be included in national CO<sub>2</sub> totals then they would have made up an estimated 5.9% in 2005 compared to less than 1% in 1970.<sup>5</sup>

Official estimates covering the full range of emissions from these flights assign 9.9% of total climate change emissions to aviation in 2005.<sup>6</sup> Equivalent international estimates state that global emissions from aviation made up about 3.5% of the total contribution of man to global warming in the early 1990s.<sup>7</sup>

## B. Emissions in general

The University of Cambridge Institute for Aviation and the Environment website describes the conflict between aviation growth and climate change:

Aviation is a major enabler for global wealth creation, benefiting developed and developing countries alike and supports 8% of global economic activity. It is also a critical part of the UK economy, currently delivering more than 2% of GDP (>£25 billion). The UK has the second largest aerospace and aviation economy in the World and has been a global leader in the sector for over 60 years. Over the last 30 years there has been a six fold increase in air travel demand. At the same time there has been a 60% improvement in fuel efficiency and more than 20dB reduction in aircraft noise. These improvements have been delivered through fundamental aeronautical research focused primarily on technological and operational developments to improve efficiency and cost effectiveness. However, predictions show that global air transport demand could grow by a factor of four over the next 30 years. Whilst it is widely agreed that the consequences of this would bring significant economic and social benefits the associated environmental impacts of noise, local air quality, global warming and climate change will provide significant challenges for all.<sup>8</sup>

The Government's strategy on the long term development of aviation was set out in *The Future of Air Transport* White Paper, published in December 2003.<sup>9</sup> It highlighted the anticipated growth of air travel:

All the evidence suggests that the growth in the popularity and importance of air travel is set to continue over the next 30 years. In 2003 some 200 million passengers will pass through UK airports. Our latest published forecasts suggest that by 2030 this figure could, if sufficient capacity were provided, have risen to between 400 million and 600 million – in other words, these forecasts predict that demand will be between two and three times what it is today. This would imply an average of two return trips a year for each UK resident by 2030, compared to an average of just under one return trip each today.<sup>10</sup>

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<sup>5</sup> e-Digest of Environmental Statistics, climate change table 5, Defra

<sup>6</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, November 2007. Annex K

<sup>7</sup> *Aviation and the Global Atmosphere*, IPCC 1999

<sup>8</sup> University of Cambridge, [Institute for Aviation and the Environment , Background](#) (on 14 November 2007 – page since changed)

<sup>9</sup> DfT, [The Future of Air Transport](#), Cm 6046, December 2003

<sup>10</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003, para 2.8

A European Commission *Questions & Answers on aviation and climate change* sets out the aviation gases that can contribute to climate change:

#### **How do aircraft affect the climate?**

Aircraft typically operate at cruising altitudes of 8 to 13 km, where they release several types of gases and particles which alter the composition of the atmosphere and contribute to climate change.

Carbon dioxide (CO<sub>2</sub>) is the most important greenhouse gas because of the large quantities released and its long residence time in the atmosphere. Increasing concentrations have a well-known, direct effect which warms the Earth's surface.

Nitrogen oxides (NO<sub>x</sub>) have two indirect effects on the climate. Nitrogen oxides produce ozone under the influence of sunlight, but they also reduce the atmospheric concentration of methane. Both ozone and methane are strong greenhouse gases. They have opposite effects but the net result is that the ozone dominates the methane effect, thus warming the Earth.

Water vapour released by aircraft has a direct greenhouse gas effect, but as it is quickly removed by precipitation the effect is small. However, water vapour emitted at high altitude often triggers the formation of condensation trails, which tend to warm the earth's surface. Moreover, such "contrails" may develop into cirrus clouds (clouds of ice crystals). These are also suspected of having a significant warming effect, but this is still uncertain.

Sulphate and soot particles have a smaller direct effect compared with other aircraft emissions. Soot absorbs heat and has a warming effect; sulphate particles reflect radiation and have a small cooling effect. In addition, they can influence the formation and properties of clouds.<sup>11</sup>

*The Future of Air Transport* White Paper 2003 explains how some of these gases can have an impact on climate change above that of CO<sub>2</sub> alone:

The impact of aviation on climate change is increased over that of direct CO<sub>2</sub> emissions alone by some of the other emissions released and their specific effects at altitude. These effects include increased tropospheric ozone, contrail formation and a small amount of methane destruction. The environmental impacts of aircraft have been assessed by the Intergovernmental Panel on Climate Change (1999) and more recently by the Royal Commission on Environmental Pollution (2002), and they are thought to be 2–4 times greater than that from CO<sub>2</sub> alone. While further research is needed on these issues, the broad conclusion that emissions are significantly more damaging at altitude is clear.<sup>12</sup>

A Department for Transport (DfT) consultation of August 2007 on *the emissions cost assessment* sets out why aviation's climate change impacts are considered important:

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<sup>11</sup> European Commission, [Questions & Answers on aviation & climate change](#), 20 December 2006 (on 24 January 2008)

<sup>12</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003, p39-40

Aviation's climate change impacts are of particular interest for a number of reasons:

- The industry has seen strong growth in demand that is set to continue;
- Aviation has a range of environmental impacts that are recognised by Government and therefore accounted for in transport appraisals. Climate change effects are generally the most significant environmental impact for this sector;
- Its climate change impacts are greater than those of the carbon dioxide emitted alone; and
- Air transport is not taxed through VAT on tickets or fuel duty, and there are no clear external cost signals being given through taxation. Nor is there currently a price signal through emissions trading.<sup>13</sup>

A communication adopted by the European Commission in September 2005 on *Reducing the Climate Change Impact of Aviation* set out the Commission's view of aviation and climate change:

AIR TRANSPORT has become an integral part of society in the 21st century, enabling both passengers and freight to span large distances at an unprecedented speed. However, aviation also contributes to climate change. Although aircraft fuel efficiency has increased by more than 70% over the last 40 years, the total amount of fuel burned has still increased due to even higher growth in air traffic.

As a result, the impact of aviation on the climate is on the rise: whilst the EU's total emissions controlled under the Kyoto Protocol fell by 5.5% (-287 MtCO<sub>2</sub>e [million tonnes of CO<sub>2</sub> equivalent]) from 1990 to 2003, its greenhouse gas emissions from international aviation increased by 73% (+47 MtCO<sub>2</sub>e), corresponding to an annual growth of 4.3% per year.

Although aviation's share of overall greenhouse gas emissions is still modest (about 3%), the rapid growth undermines progress made in other sectors. If the growth continues as up to now, emissions from international flights from EU airports will by 2012 have increased by 150% since 1990. This growth in the EU's international aviation emissions would offset more than a quarter of the reductions required by the Community's target under the Kyoto Protocol. In the longer run, aviation emissions will become a major contributor if current trends continue.<sup>14</sup>

At an international level, aviation is governed by the International Civil Aviation Organisation (ICAO), a United Nations (UN) body with 189 member countries. The ICAO's role is set out in the 1944 Chicago Convention, the international treaty that governs civil aviation. As an organisation, it sets the basis for the operation of international air services, safety and technical standards, and facilitating work in other areas, such as aviation security and emissions. However, the position of the UK

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<sup>13</sup> DfT, [Consultation on the emissions cost assessment](#), August 2007, p10

<sup>14</sup> Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, [Reducing the Climate Change Impact of Aviation](#), COM/2005/0459 final

Government is that progress to reduce emissions at ICAO level is very slow. This was seen in the DfT's 2006 *Future of Air Transport Progress Report*.

However, despite a number of revisions, the Chicago Convention is in many ways now very out of date. This is particularly true in relation to the environment. ICAO has been considering since 1998 how best to respond to the issue of aviation emissions. While some constructive action has been agreed, overall progress has been too slow. Although the last ICAO Assembly in 2004 agreed a resolution on environmental policy, many countries still see aviation only as a very minor part of the global problem of climate change and are concerned about the potential impact on the industry of measures such as emissions trading. The Convention itself also stands as a barrier to action. While we have obtained formal recognition for our view that provisions such as fuel tax exemptions are anomalous, it has not yet been possible to reach consensus within ICAO with regard to specific economic instruments.<sup>15</sup>

### C. Local air quality standards

In addition to climate impacts aviation also impacts on air quality in the areas surrounding airports. On this matter the Civil Aviation Authority website states:

The impact of the aviation industry on local air quality, especially in the vicinity of airports, has long been recognised. The pollutants of concern are the emissions of nitrogen oxides, carbon monoxide, hydrocarbons and soot. Emissions limits from aircraft engine exhausts have been defined for these pollutants by the International Civil Aviation Organisation (ICAO), although the limits only apply during the Landing Take-Off (LTO) cycle. In addition to aircraft emissions, local air quality is further compromised by pollution from motor vehicles along extensive road networks that provide access to airports.<sup>16</sup>

The DfT 2005 report, *Valuing the External Costs of Aviation*,<sup>17</sup> sets out the damage poor local air quality can have on human health and the environment:

Health impacts include both mortality and morbidity effects while environmental impacts range from effects on crops, forest damage, damages to buildings and materials, to reduced visibility and effects on ecosystems.

[...] Based on advice from the Committee on the Medical Effects of Air Pollutants (COMEAP), only a limited number of health effects could be considered to have sufficiently robust evidence to allow quantification. These health effects included deaths brought forward (acute mortality) and respiratory hospital admissions. There is also emerging evidence of the effects of long-term exposure to air pollutants, notably particles, which would be much larger than the effect of short-term exposures considered up to now.<sup>18</sup>

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<sup>15</sup> DfT, [The Future of Air Transport Progress Report](#), December 2006 p7

<sup>16</sup> Civil Aviation Authority website, [Emissions section](#) (on 24 January 2008)

<sup>17</sup> DfT, [Valuing the external costs of aviation](#), December 2005

<sup>18</sup> DfT, [Valuing the external costs of aviation](#), December 2005, "noise" section

The DfT, *The Future of Air Transport* report describes what is being done nationally by Government to limit emissions affecting local air quality:

There are mandatory EU limits for levels of these pollutants [nitrogen dioxide (NO<sub>2</sub>) and particulates (PM<sub>10</sub>)] in the air, irrespective of the source of the emissions.<sup>19</sup> These limits come into effect in 2005 for particulates and 2010 for NO<sub>2</sub>. We are committed to meeting these standards, and it is clear that major new airport development could not proceed if there was evidence that this would likely result in breaches of the air quality limits. The Government has also set national objectives in the Air Quality Strategy. These targets have a different legal status from the EU limit values, but they form part of a joint DfT/Defra Public Service Agreement target and they will help underpin decisions on the future development of aviation in the UK.

Compliance with mandatory air quality standards is an issue that extends beyond the air transport sector. But we must make significant progress in reducing the expected impacts of airports on local air quality over the next six years and beyond if the mandatory EU limits are to be fully met. This will be particularly challenging at very busy airports served and surrounded by high levels of road traffic. (Clearly measures will also be required to reduce emissions from vehicles.)<sup>20</sup>

The December 2006 *Future for Air Transport progress report* gave an update of the Government's work to improve local air quality around airports:

The *Civil Aviation Act 2006* provides powers for all airports to introduce charges that reflect the pollution generated by each aircraft type, in the way that Heathrow and Gatwick already do. We are also using UK experience to help prepare guidance in ICAO on the introduction and use of such charges to address local air quality concerns.

Action by industry is also playing a key role in making progress to improve aircraft emissions. New engine developments emit lower NO<sub>x</sub> levels than previous engines. International standards have tightened on NO<sub>x</sub> emissions over the years. Industry has a target by 2020 to reduce NO<sub>x</sub> emissions by 80 per cent compared to aircraft in production in 2000.<sup>21</sup>

A report by the Aviation Environment Federation in February 2006, *Emissions: Impossible: An assessment of the noise and air pollution problems at Heathrow airport and the measures proposed to tackle them*, examined the current levels of local emissions at Heathrow airport and how these might increase in line with the DfT proposal to build a third runway at the airport. The report concluded that Heathrow might already be in breach of Directive 96/62/EC on air quality, depending on how the emissions were calculated and on how the Directive was interpreted. It concluded therefore that proceeding with proposed expansion would be "unlawful":

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<sup>19</sup> Council Directive 96/62/EC, Implemented into law by *The Air Quality Limit Values Regulations 2003*, SI no 2121 and the *Air Quality Standards Regulations 2007* SI no 64

<sup>20</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003, p37

<sup>21</sup> DfT, *The Future of Air Transport Progress Report*, December 2006 p25-26

The airport is already breaching the EU and UK legal limit for nitrogen dioxide; we argue here that this makes the present steady growth of the airport unlawful, even before further expansion is considered. To comply with its statutory duties, the Government should restrict the number of flights each year to the level at which it can be confident that air pollution limits will not be breached.<sup>22</sup>

On 22 November 2007 the DfT published a consultation on *Adding Capacity at Heathrow Airport*.<sup>23</sup> In regard to local air quality the consultation suggested that Heathrow could support expansion within the EU air quality limits:

The Government believes that, on the basis of improved modelling following the air quality technical panel work reported in July 2006, and with the benefit of substantial reductions in emissions expected over the next decade or so, a short third runway [...] could be added at Heathrow by around 2020 and EU air quality limits for PM<sub>10</sub> and NO<sub>2</sub> be met without the need for further mitigation measures. The ability to meet air quality limits in future years largely results from substantial improvements in road vehicle emissions due to further developments in European emissions standards. It also reflects trends in cleaner aircraft engines and moves towards a higher proportion of twin-engined, as opposed to four-engined aircraft with lower emissions.<sup>24</sup>

## II Proposed UK airport expansion

The 2003 White Paper, *The Future of Air Transport* set out the Government's policy and guidance on airport and runway expansion.<sup>25</sup> The Government had previously consulted on various options and used this report to set out its conclusions. The paper showed support for runway and terminal extensions at many airports around the UK. It also considered proposals for a new airport to be constructed in the South East at Cliffe, but concluded that the costs of new build were too great above those of simply expanding existing airports. The White Paper showed support for several new runways: a new runway at Edinburgh; a new short wide-spaced runway at Birmingham;<sup>26</sup> a new wide-spaced second runway at Stansted; and a new third runway at Heathrow. It said that there was a "strong case on its merits" for a second runway at Gatwick, but not until after 2019.<sup>27</sup> The White Paper invited 30 UK airports to prepare master plans where specific major developments were supported by the White Paper or where the airport is forecast to handle 20,000 or more flights annually by 2030. Each master-plan, or draft master-plan in some cases, is available online at the airport operator's website and gives further details of each proposal.

The White Paper summarised the current limitations on growth and why more capacity at airports was needed:

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<sup>22</sup> Aviation Environment Federation, [Emissions: Impossible: An assessment of the noise and air pollution problems at Heathrow airport and the measures proposed to tackle them](#), February 2006 p19

<sup>23</sup> DfT, [Adding Capacity at Heathrow Airport](#), 22 November 2007

<sup>24</sup> DfT, *Adding Capacity at Heathrow Airport*, 22 November 2007, executive summary p12

<sup>25</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003

<sup>26</sup> The 2006, *The Future of Air Transport Progress Report* said that is not now likely to be needed until at least 2020 p34 and then in September 2007 plans for this were abandoned in favour of runway expansion: see BBC news website, [Second airport runway abandoned](#), 26 September 2007

<sup>27</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003 chapters 5-11

The availability of sufficient airport capacity is an important constraint on future growth. Our starting point is that we should make the best use of existing airports before supporting the provision of additional capacity. A sustainable approach entails first making better use of existing infrastructure, wherever possible, and this has been a primary consideration in developing our conclusions.

However, even at current levels of use, many airports in the UK are becoming increasingly congested as they attempt to cope with rising passenger numbers. In some cases, the capacity of terminals and runways is at, or near, saturation point. At Heathrow – the busiest international airport in the world – the two runways are already full for virtually the whole day. The same is true at Gatwick, already the world's most intensively used single-runway airport. The pressures are less intense outside the South East, but Birmingham's runway is already close to its existing capacity during peak times and will have reached it within the next five to six years. And Edinburgh is approaching the limit of its existing terminal capacity and urgently needs further investment.

The provision of some additional airport capacity will therefore be essential if we are to accommodate, even in part, the potential growth in demand. The most significant quantifiable benefit from additional capacity would be savings in travellers' costs. Direct and wider economic benefits and costs are described in the South East consultation document. Failure to provide additional capacity would become a barrier to future economic growth and competitiveness. Airports would become more congested; air fares would rise as slots became increasingly sought-after; and much of the future growth in air travel – along with the associated economic growth – could in due course migrate elsewhere. In the case of international traffic, this would often mean to other European countries.

At the same time, we have to balance that with the environmental impacts of air travel. We have to recognise that simply building more and more capacity to meet potential demand would have major, and unacceptable, environmental impacts, and would not be a sustainable approach.<sup>28</sup>

The inclusion of a proposal for a new runway or terminal building in the White Paper does not mean that the proposed development will definitely go ahead. It will be up to each airport operator to decide whether and how to expand. Each proposal will be subject to further consultation and the formal planning process before any definite proposals go ahead. However, the Government has stated that the 2003 White Paper will be a National Policy Statement in the reformed planning system.<sup>29</sup> This means that it will be the main document to be used by the Infrastructure Planning Commission in deciding applications for development consent for airports.

The 2006 progress report on the White Paper gave an update on the proposals from the 2003 report stating that some of the expansion would now not be needed until a later date:

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<sup>28</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003 p24-25

<sup>29</sup> HC Deb 27 November 2007 cc15-16WS

Since publication of the White Paper, some airport operators have, after detailed analysis, decided that there is not sufficient justification to take forward the proposals in the timescale envisaged in 2003. For instance, the White Paper suggested that at Birmingham and Edinburgh new runways may be needed around 2016 and 2020 respectively. The airports now believe new runways will not be needed before 2020 at the earliest, as a result of making better use of their existing capacity. At Bristol and Leeds-Bradford Airports runway extensions were supported in the White Paper, but the airport operators currently have no plans to take this forward.<sup>30</sup>

## 1. Runway proposals

Although all airport expansion will have an impact on climate change, it is the proposals for new runways which will potentially give rise to the biggest increase in emissions as they will allow for more aircraft to land and take-off. The sub-sections below set out the proposals for new runways in more detail alongside passenger increase forecasts.

### a. Heathrow expansion

On 22 November 2007 the DfT published a consultation on *Adding Capacity at Heathrow Airport*.<sup>31</sup> It set out the following potential scenarios for growth:

Scenario	Year	Air Transport Movements (000s pa)	Passengers (million pa)
Outturn	2000	460	64
	2006	471	67
Maximum Use of existing runways	2015	480	85
	2030	480	95
Mixed Mode 2015–2019 at 540,000 ATMs, then Third Runway at 605,000 ATMs rising to 702,00 ATMs in 2030	2015	540	90
Third Runway 2020 at 605,000 ATMs rising to 702,000 ATMs in 2030	2030	702	122

32

The consultation also set out BAA's (the airport operator) proposals for expansion at Heathrow:

BAA's latest proposals are for:

A new runway at 2,200m operational length - this would be slightly longer than previously envisaged (2,000m) to accommodate an efficient mix of all but the largest four-engined aircraft and allow the airport as a whole to operate

<sup>30</sup> DfT, *The Future of Air Transport Progress Report*, December 2006 p41

<sup>31</sup> DfT, [Adding Capacity at Heathrow Airport](#), 22 November 2007

<sup>32</sup> DfT, [Adding Capacity at Heathrow Airport](#), annex C, 22 November 2007 p205

effectively. The slightly longer runway length would not itself increase the land-take or require any additional properties. It would not affect the forecast mix of short-haul and long-haul traffic across the airport as a whole. Thus, it does not imply more carbon emissions.

An additional passenger terminal, with direct access to existing rail services, that meets the needs of air passengers and airline alliances under mixed operations (both long-haul and shorthaul traffic), and reduces the need for aircraft to taxi across the existing northern runway.

Adding a third runway with associated passenger terminal facilities would require additional land, with a loss of around 700 properties including the community of Sipson.<sup>33</sup>

The consultation sets out how the Government reconciles these proposals with climate change and a carbon pricing scheme:

Our approach is entirely consistent with the Stern Review (The Economics of Climate Change) and the Eddington Transport Study. Stern recommended that the best way to tackle the complex pattern of carbon emissions is to ensure that each activity which produces carbon is priced in a way that reflects its true cost to society, and to the environment. Eddington is equally clear that seeking artificially to constrain the natural growth of aviation, once carbon pricing is fully in place, would pose a significant cost to the UK economy, with no additional environmental benefit. Referring specifically to Heathrow, Eddington stated that "even once users pay the full environmental costs of their journeys, there will remain a strong economic case for additional runway capacity".<sup>34</sup>

The *Independent* reported that local councils and other environmental groups were opposed to the proposed expansion, citing that it was at odds with climate change targets:

Councils opposed to a third London runway threatened legal action yesterday after Ruth Kelly, the Transport Secretary, provoked fury by signalling a massive expansion of Heathrow .

Environment groups accused Gordon Brown of hypocrisy for claiming to be leading the world in combating climate change four days before consulting on an expansion of aviation in his own backyard.

The Government's plans were backed in a move that appeared to be coordinated by all sides of the pro- expansion lobby, including unions, the CBI, chambers of commerce and the airlines. But ministers may find the threats of legal action against "sham" consultation more worrying.

Serge Lourie, the Liberal Democrat leader of Richmond council, which is under the Heathrow flightpath, said that his authority would be seeking legal advice on a possible judicial review against Ms Kelly for announcing consultation on a plan

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<sup>33</sup> DfT, [Adding Capacity at Heathrow Airport](#), summary 22 November 2007 p8

<sup>34</sup> DfT, [Adding Capacity at Heathrow Airport](#), summary 22 November 2007 p7

to allow the third runway after already having said that it was vital for the economy.

[...]

The consultation covers a sixth terminal, changes to runway take-off and landing patterns, and changes to the routes that Heathrow aircraft take. The public has until 27 February next year to make its views known.

Ms Kelly said that unless the third runway was built by 2020, Heathrow's status as a world-class airport would be eroded, jobs would be lost and the economy would suffer. The consultation document said that a third runway would bring net economic benefit of around £5bn. Ms Kelly claimed that the expansion could be completed within acceptable noise and pollution targets.<sup>35</sup>

The article went on to survey views from interested and political parties:

Willie Walsh, the chief executive of British Airways, said: "If airlines want to fly more, they will have to pay for emissions reductions in other industries - so overall carbon dioxide in the atmosphere will not rise because of a third runway."

Steve Ridgway, the chief executive of Virgin Atlantic, said: "Limiting growth at Heathrow wouldn't prevent climate change because that growth would only go elsewhere."

But Peter Lockley, the head of transport policy at the conservation group WWF, said: "The expansion of Heathrow is completely at odds with the Government's climate change targets, and there are alternatives - such as video conferencing and high-speed train travel." The London Mayor, Ken Livingstone, said: "I am firmly opposed to this expansion of Heathrow airport as it runs contrary to all the growing evidence we now have on the impact of aviation on climate change."

The Liberal Democrat transport spokeswoman, Susan Kramer, said: "Given the need to greatly reduce carbon emissions, the last thing that ministers should be doing is doubling the capacity of a major airport." The Tories did not oppose the Heathrow expansion plan.<sup>36</sup>

The consultation closes on 27 February 2008.

The earlier section on page 11 of this paper, on local air quality standards, highlights further the arguments on either side about reconciling Heathrow expansion with climate change issues.

#### **b. Stansted expansion**

The Stansted Airport Interim Master Plan of 2006 gives a passenger increase forecast given the constraints of a single runway. Passenger numbers were 23.7 million in 2006.<sup>37</sup> The master-plan shows that Stansted's passenger numbers could be able to grow slowly

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<sup>35</sup> "Legal action threatened over "sham" Heathrow consultation", *The Independent*, 23 November 2007

<sup>36</sup> "Legal action threatened over "sham" Heathrow consultation", *The Independent*, 23 November 2007

<sup>37</sup> *UK Airport Statistics: 2006 – annual*, CAA

beyond 35mppa [million passenger per annum] in 2015, up to around 40mppa at some future date.<sup>38</sup>

The 2006 *Future of Air Transport progress report* detailed the proposal for a new, second runway at Stansted airport:

BAA's consultation on options for a second runway, published in December 2005, proposed a new wide-spaced parallel runway of 3,048 metres in length, operating in mixed mode as its preferred option. By reducing the length of the second runway and the space between the new and existing runways, BAA's preferred option is expected to require significantly less land (627 ha compared to 700 ha) and loss of property (87 compared to 140) than had been envisaged in The Future of Air Transport White Paper. In addition, the number of people living within the 57 dBA Leq noise contour by 2030 is expected to be significantly fewer than the White Paper had anticipated (6,845 compared to 14,000).

BAA has worked closely with the Department for Transport, the Highways Agency and Network Rail to identify improvements that would be needed to the road and rail networks to serve a new runway. This work has also taken account of planned growth within the London-Stansted-Cambridge-Peterborough growth area and the need to ensure that other road and rail users are not adversely affected by the new runway.<sup>39</sup>

The progress report explained that the proposals would be subject to the planning process and that any new runway was not likely to be operational until 2015.<sup>40</sup> There has been opposition to this proposal, largely coordinated by the group Stop Stansted Expansion.<sup>41</sup> One of their concerns about the expansion is the effect on climate change:

SSE has estimated that Stansted Airport emitted the equivalent of 5 million tonnes of carbon dioxide in 2006. This figure would rise to around 7 million tonnes if full use of the runway were allowed and to 12 million tonnes if a second runway were built. 12 million tonnes is more than the emissions of all 2.23m homes in the six counties that comprise the East of England Region.<sup>42</sup>

The local council is also opposed to the plans and has previously rejected planning applications which would have enabled expansion.<sup>43</sup> The council made a resolution in August 2007 which said:

Uttlesford District Council is unanimous in opposing the proposed expansion at Stansted Airport and approved a motion in the name of all its political group leaders at its Extraordinary Council Meeting on 13 August. All Members were horrified by the prospect of the devastating effect the proposals would have on the District and neighbouring areas. The four political Group Leaders pledged

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<sup>38</sup> BAA, [Stansted Airport Interim Master Plan](#), May 2006, c5

<sup>39</sup> DfT, *The Future of Air Transport Progress Report*, December 2006 p44

<sup>40</sup> DfT, *The Future of Air Transport Progress Report*, December 2006 pp44-45

<sup>41</sup> [Stop Stansted Expansion website](#) (On 24 January 2008)

<sup>42</sup> Stop Stansted Expansion website [FAQs](#) (on 24 January 2008)

<sup>43</sup> "Stansted expansion fails to take off", The Times, 30 November 2006

themselves to take on the government in what will, if necessary, be the biggest environmental protest campaign the UK has ever seen.<sup>44</sup>

### c. **Gatwick expansion**

Following the 2003 *Future of Air Transport* report, BAA, the Gatwick airport operator, published an Interim Master Plan for Gatwick airport.<sup>45</sup> The plan makes the following forecasts:

Forecasts of growth in passenger numbers at Gatwick reflect the constraint of the runway's capacity, as the number of aircraft movements edges closer to the number of runway slots available at times that are commercially suitable for airlines.

[...]

Gatwick is expected to maintain its strong bias towards leisure travel, and to be the starting or finishing point for most of its users' air journeys. The proportion of transfer air passengers is forecast to be 14%. The following non-transfer passenger mix underlies our forecasts:

Country of residence/ journey purpose	2005 actual (%)	2015 forecast (%)
UK business	10.9	11.0
UK leisure	68.2	69.0
Foreign business	4.9	6.0
Foreign leisure	16.1	14.0

Our 'base' forecast, which reflects the assumptions explained in this chapter and was included in the table, has also been reviewed against two sensitivity tests:

- One to reflect feedback from some airline representatives, who feel that our assumption on runway capacity is on the high side
- The second anticipates that 'open skies' liberalisation of air traffic rights between the EU and the USA could facilitate some relocation of North Atlantic traffic from Gatwick to Heathrow, replaced at Gatwick by traffic on average using smaller aircraft.

The following tabulation contains our May 2006 'base case' passenger forecast and those reflecting the two sensitivity tests:<sup>46</sup>

<sup>44</sup> [Uttlesford District Council website](#) [on 24 January 2008]

<sup>45</sup> BAA, *Interim Master Plan for Gatwick Airport*, October 2006

<sup>46</sup> BAA, *Interim master Plan for Gatwick Airport*, October 2006 p20

Year	Passengers (millions)		
	Base	Low test	Open skies
2007/08	35.3	-	-
2008/09	36.2	34.6	35.7
2009/10	36.9	35.1	36.1
2010/11	37.5	35.5	36.5
2011/12	38.2	36.0	37.2
2012/13	39.0	36.5	38.0
2013/14	39.7	37.3	38.7
2014/15	40.0	37.6	39.3
2015/16	40.0	38.0	39.5

The plan examined two different future scenarios for the airport, one with a new runway and one without:

Our plan's first scenario is that Gatwick remains a single runway airport, with the overall land use very similar to 2015. By 2030, all aircraft maintenance activity would probably be in the airport's North West Zone (with none to the south of the runway).

The second scenario, which is a response to the Government's White Paper, sees two runways at Gatwick. If a second runway is needed and permitted, it could not happen before 2019 and if construction were to begin that year, the runway could open in 2023/24. It would be likely to be approximately 1km south of the existing runway. The land use plan for this scenario shows a third passenger terminal and aircraft stands occupying much of the land between the runways. However, if the passenger capacity of the airport were to be significantly less than the projected 80 million, it is possible that the construction of a large new terminal between the runways would enable the existing South Terminal to be replaced.

The plan shows airport extensions totalling 667 hectares – which is slightly less than the area within our current operational boundary. The extensions largely occupy the open land between the airport and the M23. The plan recognises that, if planning permission is ever sought for a second runway, surface access, environmental issues and the mitigation of the runway's adverse impacts, would require very thorough study. The precise proposals for a second runway could consequently be different from those indicatively shown in the interim master plan. But the time for that work is not now. If the construction of a second runway were to start in 2019 its design would probably not begin until 2011.<sup>47</sup>

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<sup>47</sup> BAA, *Interim Master Plan for Gatwick Airport executive summary*, October 2006 p6

#### d. *Edinburgh expansion*

The Edinburgh airport master-plan makes the following growth predictions:

**Table 4: Annual Passenger Forecasts (millions)**

Year	Low	Central	High
2005 (Actual)		8.5	
2013	11.9	12.7	13.7
2020	14.8	17.6	18.1
2030	18.8	23.0	26.0
Average Growth	3.2%	4.2%	4.5%

The current international passenger volume at Edinburgh is 2.3 million. Of this figure, roughly half of all passengers are using traditional or fullservice carriers, 32% are on no-frills operators and 17% are using charter flights. Average annual growth in the international market of 7% over the full period is forecast. Of this, the no-frills market share is expected to increase to around 50% of international traffic. Long-haul traffic is expected to increase from the current figure of approx 139,000 passengers a year to 1.7 million by the end of the period. Domestic passengers as a proportion of the total are forecast to decrease from the current 73% to 45% by the end of the period.<sup>48</sup>

The Master Plan indicated that need for a new runway would probably not occur before 2020 at the earliest:

In reality, the requirement may not materialise until much later than that. The Government's view, which is broadly endorsed by BAA, is that an additional runway is likely to be needed at Edinburgh Airport before 2030.

Given that the need for an additional runway is some way off, BAA considers it impractical, at this time, for a precise alignment and runway design to be identified. This is primarily because the planning and operation of a future runway is dependent on a number of complex and interrelated factors and many of these cannot be predicted with any certainty so far in advance of construction.<sup>49</sup>

### III Calculating emissions

Under the Kyoto Protocol, the United Kingdom has a legally binding obligation to reduce greenhouse gas emissions by 12.5 percent below 1990 levels by 2008-2012.<sup>50</sup> Aviation is split into domestic and international for the purpose of calculating emission levels and for Kyoto. International carbon dioxide emissions from aviation do not come under the Kyoto agreement and so are not calculated in the UK's (or those of any other signatory nation to the Kyoto Protocol) emission totals for this purpose. The DfT states that this is

<sup>48</sup> BAA, [Edinburgh Airport Master Plan](#), July 2006, p21

<sup>49</sup> BAA, [Edinburgh Airport Master Plan](#), July 2006, section 9.3

<sup>50</sup> Department for Environment, Food and Rural Affairs [Climate Change webpages](#) (on 24 January 2008)

because “there is no international agreement yet on ways of allocating such emissions.”<sup>51</sup> Despite this, under Kyoto, signatory nations do report estimates of international aviation bunker fuel emissions as a “memo item” in their national greenhouse gas inventories.

The DfT sets out some of the different ways that emissions could be calculated for the UK in its 2007 *Consultation on the emissions cost assessment*.

Climate change emissions due to aircraft activity in the UK could be calculated in a number of ways:

- On the basis of flights within the UK;
- On the basis of flights departing UK airports;
- On the basis of flights departing and arriving at UK airports;
- On the basis of emissions in airspace over the UK;
- On the basis of emissions from UK-registered airlines, wherever they occur; or
- On the basis of emissions related to travel by UK passport holders, wherever they occur.

Many of these options would be hard to calculate given the difficulty in collecting accurate and meaningful data. The more complicated options also have the potential for introducing a significant burden on airlines and any organisation which had to collect and verify the data, and may not tell Ministers what they need to know to make robust decisions.<sup>52</sup>

The consultation set out the Government’s view of the best method to calculate emissions for both domestic and international flights:

In order to minimise the burden and to ensure that the cost assessment makes use of the verified data that is already collected and made publicly available, our intention is to base the assessment on the climate change impact of those flights reported in the UK emissions national inventory; that is, to base the assessment on CO<sub>2</sub> emissions from flights departing UK airports (domestic and departing international flights). These are already calculated annually by the Government for the purposes of the UK Greenhouse Gas Inventory (GHGI) submitted to the EU and to the United Nations Framework Convention on Climate Change (UNFCCC).

[...]

We believe that the GHGI reported figures for CO<sub>2</sub> from domestic and departing international civil flights are, for the purposes of the emissions cost assessment, comprehensive enough to capture a realistic share of the global aviation market driven by the UK economy. Using the GHGI data avoids introducing measures which are too complex to assess or which fail to provide a reasonable measurement of emissions attributable to the UK. The GHGI figures are assessed using a transparent and verified methodology which offers an approximate but reliable basis for assessing the impact of UK aviation.<sup>53</sup>

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<sup>51</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003, para 3.36

<sup>52</sup> DfT, [Consultation on the emissions cost assessment](#), August 2007 p14

<sup>53</sup> DfT, [Consultation on the emissions cost assessment](#), August 2007 p14

A report produced by the International Civil Aviation Organisation's (ICAO) environment unit also detailed further complexities of calculating aviation emissions:

The subject of emission sources is a complex topic. This complexity is compounded by the fact that sources of airport emissions other than those associated with aircraft include ground support equipment (e.g. passenger buses, mobile lounges, fuel trucks, aircraft tractors, etc.), landside vehicles (cars, taxis, trains, etc.) and stationary power generation plants.<sup>54</sup>

A report by the Tufts Climate Initiative,<sup>55</sup> revised in April 2007, detailed some of the complications of calculating emissions through fuel use:

During the take-off and landing, the engine is at full thrust and more fuel is consumed during take-off and climbing. Shorter flights therefore have a lower overall fuel efficiency; i.e. use more fuel per mile than long-distance flights. As the aircraft climbs and begins to cruise - that is, above the altitude of 3000 feet - drag and therefore rate of fuel use decreases. On longer flights (those over approximately 994 miles) the amount of fuel used during take-off is less significant compared to the whole. This efficiency gain is partly offset on long distance flights by the added weight of the fuel that an airplane needs to carry on such long trips. On the other hand, cirrus clouds from contrails only develop at higher altitude. On short-haul flights the percentage of time the plane will spend at high altitude is less than on long-distance flights. That means the increased warming effect from cirrus clouds is less strong on short haul flights.<sup>56</sup>

#### **a. Radiative forcing**

One of many complexities in calculating the impacts of aviation is that at high altitudes, aviation's other emissions, such as NO<sub>x</sub> and contrail formation (the condensation trails and artificial cirrus clouds made by the exhaust of aircraft engines), may result in an additional contribution to climate change above that due to CO<sub>2</sub> alone. To account for this extra impact, a radiative forcing impact factor of aviation at altitude is often applied. This is sometimes called an uplift factor or a multiplier. The Intergovernmental Panel on Climate Change (IPCC) explain what radiative forcing is:

What is radiative forcing? The influence of a factor that can cause climate change, such as a greenhouse gas, is often evaluated in terms of its radiative forcing. Radiative forcing is a measure of how the energy balance of the Earth-atmosphere system is influenced when factors that affect climate are altered. The word radiative arises because these factors change the balance between incoming solar radiation and outgoing infrared radiation within the Earth's atmosphere. This radiative balance controls the Earth's surface temperature. The

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<sup>54</sup> ICAO, [ICAO Environmental Report 2007](#),

<sup>55</sup> The Tufts Climate Initiative is an American initiative aimed at developing the field of climate change mitigation at institutions of higher learning.

<sup>56</sup> Tufts Climate Initiative, [Voluntary Offsets For Air-Travel Carbon Emissions](#), revised version April 2007, p27

term forcing is used to indicate that Earth's radiative balance is being pushed away from its normal state.<sup>57</sup>

The 2006 DfT *Future of Air Travel Progress Report* highlights how radiative forcing is still an uncertain area:

Understanding of the impacts of carbon emissions is relatively good. For other emissions there are greater uncertainties, although the impacts of NO<sub>x</sub> emissions are better understood than other non-CO<sub>2</sub> emissions. Further research is ongoing - for example through the EU QUANTIFY project – to understand better the effects of these other emissions at altitude. These 'radiative forcing' impacts were estimated by the Inter-Governmental Panel on Climate Change (IPCC) in 1999 to be 2-4 times greater than that from carbon dioxide alone (excluding cirrus cloud enhancement). More recently the total radiative impacts were estimated, by the EC TRADEOFF project, to be approximately twice those of CO<sub>2</sub>, once again excluding cirrus. Separately, the upper limits of cirrus impacts have recently been estimated to be potentially twice those estimated by the IPCC in 1999.<sup>58</sup>

The issue has implications for any emissions trading scheme that aims to include aviation. A paper published in *Atmospheric Environment* in 2005,<sup>59</sup> examined the compatibility of using a radiative forcing index in an emissions trading scheme. The paper concluded that a number of issues would have to be dealt with before it could be used:

1. For fairness, any emission-based weighting of non-CO<sub>2</sub> climate effects (beyond emissions of gases included within the Kyoto Protocol) should be applied to all sectors – not solely aviation.
2. The use of a single value of the RFI [radiative forcing index] as an emissions index is clearly inappropriate and misleading, as it tends to exaggerate the climate impact of aviation emissions. It is important to choose an index which is emissions based (eg related to the GWP [global warming potential] or GTP [global temperature change potential]), but a robust emissions based index is not yet available. When choosing this metric, model uncertainties, the fact that the metric values may be dependent on the location of the emissions, varying climate efficacies and the role of negative forcings will require many decisions to be made by policy makers.
3. A suitable time horizon (eg 100 years) needs to be chosen.<sup>60</sup>

It concluded that adopting any weighting for the non-CO<sub>2</sub> effects of aviation before assessing these considerations would be “premature”.

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<sup>57</sup> IPCC, *Changes in Atmospheric Constituents and in Radiative Forcing*. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 2007 p136

<sup>58</sup> DfT, [The Future of Air Travel Progress Report](#), 13 December 2006

<sup>59</sup> P.M.d.F. Forster, K.P. Shine and N. Stuber, *It is premature to include non-CO2 effects of aviation in emission trading schemes*, *Atmospheric Environment* 40(6), 2006

<sup>60</sup> P.M.d.F. Forster, K.P. Shine and N. Stuber, *It is premature to include non-CO2 effects of aviation in emission trading schemes*, *Atmospheric Environment* 40(6), 2006 p1121

A 2007 report into the Voluntary Carbon Offset Market by the Environmental Audit Committee also highlighted the uncertainty here:

While it ought to be fairly straightforward for Defra to provide some sensible average for CO<sub>2</sub> emissions for a given length of flight, the issue of radiative forcing has the capacity to make aviation offsets more complicated and variable still. As we stated above, one of the reasons for differing calculations for aviation offsets—in terms of carbon effect and thus in terms of cost—was down to whether or not an RF factor was used: even if an RF factor was used the size of the factor also varied considerably, from just over 1 to almost 4.

[...]

We believe there is clearly a need for new research until some appropriate successor system to the current use of the Radiative Forcing Index is identified and agreed upon. The European Commission is engaged in drawing up an instrument that will take account of aviation's non-CO<sub>2</sub> effects, and we support this approach whole-heartedly. Given the complexities of climate change science, and the number of often conflicting climatic factors for which aviation is responsible, it may well be the case that no consensus emerges, or that there is insufficient basis in science to conclude that aviation's impacts extend significantly beyond its CO<sub>2</sub> impacts.<sup>61</sup>

#### **b. Calculating UK Emissions**

A written answer of May 2007 sets out the Government's most recent figures for the proportion of CO<sub>2</sub> emissions contributed by aviation:

Using a radiative forcing multiplier of two, emissions from flights departing the UK contributed approximately 13 per cent of total UK emissions in 2005. However, the figures for non-aviation sources do not include any radiative forcing attributable to them, as conclusive figures are not available.<sup>62</sup>

The table below shows how aviation emission levels have increased between 2000 and 2005 for both international and domestic flights leaving UK airports:

#### **CO<sub>2</sub> emissions from UK aviation -domestic and internat**

MTCO<sub>2</sub>

	Domestic	International <sup>(a)</sup>	<b>Total</b>
2000	1.96	30.25	<b>32.21</b>
2001	2.06	29.49	<b>31.55</b>
2002	2.07	28.94	<b>31.01</b>
2003	2.11	29.64	<b>31.76</b>
2004	2.30	33.13	<b>35.43</b>
2005	2.46	35.01	<b>37.47</b>

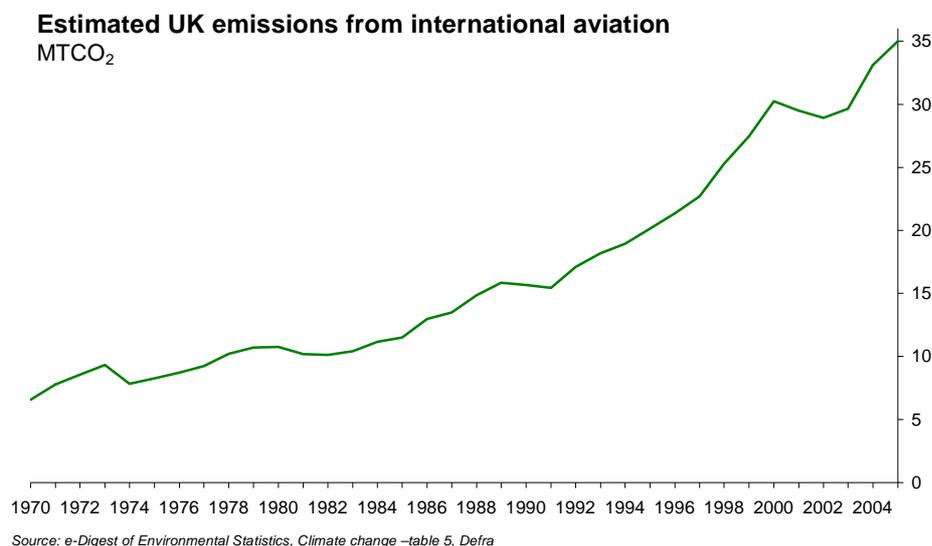
(a) International flights leaving the UK. Definition of the UK excludes UK overseas terri

Source: HC Deb 19 March 2007 c589W

<sup>61</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, Sixth Report Session 2006-07, HC 331-I, 23 July 2007

<sup>62</sup> HC Deb 2 May 2007 c1670W

The chart below which illustrates trends in emissions that have been assigned to the UK since 1970 puts the above figures into context. The underlying growth rate has been steady for most of this period at just under 5% a year. There have only been a few years when emissions have fallen – in economic downturns and after the terrorist attacks on the US.



Emissions in 2005 were more than double those in 1992 and more than five times the estimated level in 1970. Furthermore, because total emissions have generally fallen over time international aviation's share (were it to be included in the total) has increased from less than 1% in 1970 to just over 2% in 1986, more than 4% in 1998 and 5.9% in 2005.

## A. Emission forecasts

### a. UK

The Government set out its calculations and plans for air travel growth in the 2003 *Future of Air Transport Report*.<sup>63</sup> This report and the 2006 progress report both forecast a rise in air travel demand. The 2006 progress report set out the reasons for this:

The four main factors underlying the forecast rise in demand are:

- international competitiveness;
- trade and freight transport;
- aviation's direct contribution to economic development; and
- people's aspiration to travel.<sup>64</sup>

<sup>63</sup> DfT, *The Future of Air Transport*, Cm 6046, December 2003

<sup>64</sup> DfT, *The Future of Air Transport Progress Report*, December 2006 p23

Annex C to the 2006 progress report gives full details about exactly how the forecasts were calculated.<sup>65</sup> The forecasts factored in the “introduction of some form of economic measure or charge to ensure that air travellers pay the costs of their climate change emissions”:<sup>66</sup>

Our new forecasts remain fully in line with what we said in 2003. Assuming passengers pay their climate change costs, but no limit on the supply of flights, we forecast overall demand would grow from 228 million in 2005 to 490 million passengers passing through UK airports per year by 2030.

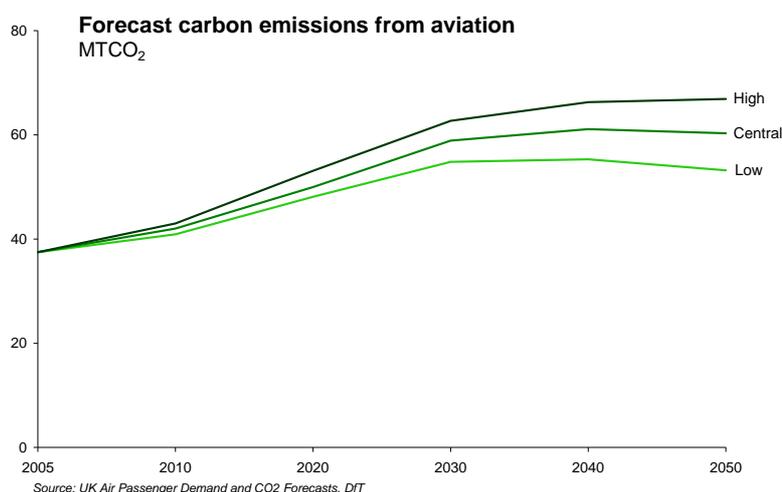
However, the additional airport development supported in the White Paper would not be sufficient to support all of this unconstrained demand. After accounting for future UK airport capacity constraints outlined in the White Paper, national air travel demand is forecast to grow under the central case to 465 million in 2030.<sup>67</sup>

The *Future of Air Transport Report* made predictions about how aviation emissions might rise up to the year 2030:

Forecasts have suggested that by 2030 CO<sub>2</sub> emissions from UK aviation (in this context UK aviation is defined as all domestic services plus all international departures from the UK) will amount to some sixteen to eighteen million tonnes of carbon<sup>68</sup> [59-66 MtCO<sub>2</sub>], of which some 97 per cent would be from international flights. This could amount to about a quarter of the UK’s total contribution to global warming by that date.<sup>69</sup>

The DfT has recently updated its forecasts of passenger demand and CO<sub>2</sub> emissions.<sup>70</sup> These used current estimates of emissions from domestic and international flights and looked at forecasts of the distance flown by aircraft leaving the UK and forecasts of the fuel efficiency of aviation. These were combined with a variety of assumptions about future improvements in fuel efficiency, fuel prices, economic growth and the shadow price of CO<sub>2</sub>.

The results of three scenarios are shown opposite. Forecasts for 2030-2050 are more tentative than the earlier figures. The central case assumed efficiency improvements of around 1% a year and extra runways at Stansted and Heathrow. The high figures assume the high end of demand forecasts and low end



<sup>65</sup> DfT, [The Future of Air Transport Progress Report annex C](#), December 2006

<sup>66</sup> DfT, [The Future of Air Transport Progress Report annex C](#), December 2006

<sup>67</sup> DfT, [The Future of Air Transport Progress Report](#), December 2006 p23

<sup>68</sup> Note that Defra’s figures are measured in tonnes of carbon dioxide, whereas the DfT figures are measured in tonnes of carbon. 18 million tonnes of carbon is roughly equivalent to 66 million tonnes of carbon dioxide.

<sup>69</sup> DfT, [The Future of Air Transport](#), Cm 6046, December 2003, para 3.5

<sup>70</sup> DfT, [UK Air Passenger Demand and CO<sub>2</sub> Forecasts](#), November 2007

of efficiency projections, and *vice versa* for the low emission forecasts.

Each scenario shows increases in emissions up to 2030. The range of increases (compared to 2005) is 46-67%. The central case sees emissions increasing by just over 21 MTCO<sub>2</sub> between 2005 and 2030. The gaps between the different scenarios are more noticeable from 2030 when emissions in the low scenario level out and start to fall (from 2040). Under the central case emissions in 2050 are forecast to be just over 60 MTCO<sub>2</sub>; more than 60% above their 2005 level. The report compared these emissions, which include domestic and international aviation, to the 2020 and 2050 CO<sub>2</sub> targets. This was done by adding the international share to the denominator. Total aviation emissions were 6.4% of UK emissions plus international aviation in 2005. The central forecasts see this increase to 10.3-11.1% in 2020 and 20.6% in 2050.<sup>71</sup> While not relating to actual targets (because of the inclusion of international aviation) this does illustrate the growing importance of aviation emissions compared to the rest of the economy if the emission reduction targets are to be met. Including international aviation within a single target could result in even more stark contrast.

Further details can be seen in the tables below taken from the DfT November 2007 report, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*. The report makes the following estimates of aviation's share of total UK climate change emissions in 2020 and 2050. These assume the UK meets its emission reduction targets in these years:<sup>72</sup>

<b>Aviation's share of total UK climate change emissions</b>				
MTCO <sub>2</sub> e				
	Aviation <sup>(a)</sup>	UK inventory - actual and targets <sup>(b)</sup>	Combined UK inventory and international aviation	<b>Total aviation as a % of combined</b>
<i>CO<sub>2</sub> emissions only; radiative forcing factor=1</i>				
2005	37.5	554.2	589.2	<b>6.4%</b>
2020	50.0	402.7-438.2	450.3-485.8	<b>10.3%-11.1%</b>
2050	60.3	236.9	293.1	<b>20.6%</b>
<i>All greenhouse gas emissions; radiative forcing factor=1.9</i>				
2005	71.3	588.0	722.8	<b>9.9%</b>
2020 <sup>(c)</sup>	95.0	494.1-529.6	584.6-620.1	<b>15.0%-15.9%</b>
2050 <sup>(c)</sup>	114.6	291.2	395.64	<b>29.0%</b>

(a) Domestic and international aviation. Central forecasts for 2020 and 2050

(b) Includes domestic aviation only. Target reductions of 26-32% in 2020 and 60% in 2050

(c) As the non-CO<sub>2</sub> impact of aviation are included with a radiative forcing factor of >1 non-CO<sub>2</sub> greenhouse gases from the rest of the economy are included in the inventory total for 2005 and projections for 2020 and 2050

Source: DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, November 2007 annex K

<sup>71</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, November 2007 annex K

<sup>72</sup> DfT, [UK Air Passenger Demand and CO<sub>2</sub> Forecasts](#), 22 November 2007 p139

These figures use the central forecasts of emissions from aviation. If the high/low range is used along with a radiative forcing factor of 1.9, then total aviation could make up 26-32% of the UK's contribution to climate change emissions in 2050.<sup>73</sup>

A report by the Tyndall Centre for Climate Change in 2006 concluded that (all) UK aviation emissions could account for 35-38% of UK emissions in 2050, if it is to meet its 60% reduction target and international aviation is included within the current limit. If an 80% reduction target were adopted then aviation would account for 77-100% of UK emissions.<sup>74</sup>

The Government has also sponsored technical research on forecasting emissions. This includes:

- Manchester Metropolitan University final report to Defra, [Allocation of International Aviation Emissions from Scheduled Air Traffic – Future Cases, 2005-2050](#), March 2006; and
- QINETIQ report for the DTI, [Forecasts of CO<sub>2</sub> emissions from civil aircraft for IPCC](#), November 2006

#### **b. Global**

A report by the Tyndall Centre for Climate Change Research in 2006 examined forecasts from the aviation industry, including Airbus, Boeing and Rolls Royce.<sup>75</sup> The report details the Airbus forecast as:

Airbus predicts that global passenger traffic will grow on average at 5.3% per year between 2004 and 2023 and world passenger kilometres are expected to triple by 2023. This world average incorporates an average growth in passenger-kilometres of some 8.2% per year in China.

[...]

In terms of growth within different regions of the world, growth for airlines domiciled in Europe is predicted to be around 5.2% per year between 2004 and 2023, with a higher rate of growth of 5.8% per year between 2004 and 2013. This prediction takes into account the mounting importance of low-cost carriers in Europe. The UK is likely to experience a rate similar to that of the rest of Europe.<sup>76</sup>

The Rolls Royce forecast is reported as:

In overview, they predict strong global growth in the commercial aircraft and jet engine market of the coming 20 years, driven predominantly by the rapid growth in the Asian market, as well as continued demand for new aircraft in other, more mature, markets. In its regional traffic forecasts, it predicts a 5% per year world growth between 2005 and 2024, with a corresponding 4.4% per year growth for

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<sup>73</sup> *ibid.*

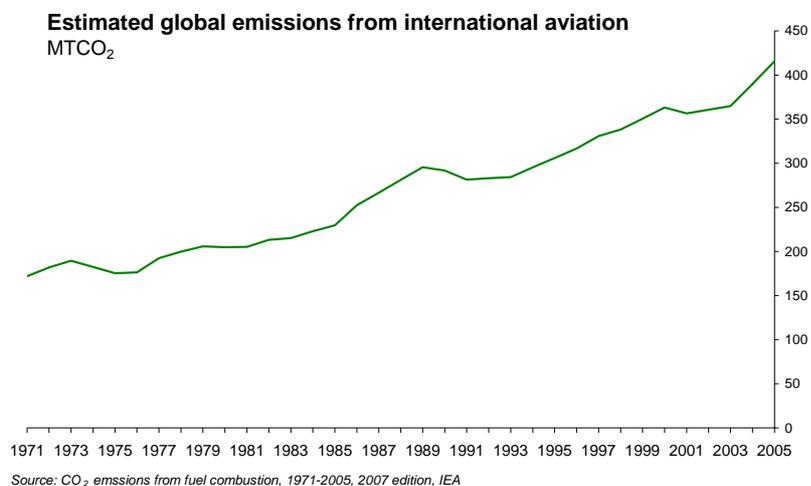
<sup>74</sup> Bows et al, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic: Tyndall Centre Technical Report 40*, Tyndall Centre for Climate Change

<sup>75</sup> Bows et al, [Contraction & Convergence: UK carbon emissions and the implications for UK air traffic: Tyndall Centre Technical Report 40](#), Tyndall Centre for Climate Change, February 2006

<sup>76</sup> Bows et al, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic: Tyndall Centre Technical Report 40*, Tyndall Centre for Climate Change, February 2006 p17

Europe. Within the European markets, the highest growth is predicted to be in the Europe-Asia Pacific market, with a 6.1% per year growth in traffic. The lowest growth figure for Europe is the Intra-European flight market, which is forecast to grow at 3.4% per year. World air cargo within this forecast set is predicted to grow at 6.9% per year.<sup>77</sup>

Trends in estimated emissions from all international aviation are illustrated opposite.<sup>78</sup> The trend is broadly similar to that seen in the UK, although the underlying growth rate has been lower over the whole period (2.6% a year), and particularly since 1990 (2.4% v 5.5% in the UK). International emissions made up 1.53% of all emissions from fossil fuel combustion in 2005. This was below the 1.55% peak in 2000 but clearly above the 1.22% level seen at the start of the period.



Looking at individual countries the US had the largest gross emissions from international aviation in 2005 at just over 52 MTCO<sub>2</sub>, but if these were included in national totals they would only add 0.9% to its total emissions<sup>79</sup>. The highest percentage was 23% for Singapore; the UK figure was 7.0%. China had a below average figure of 0.4%.<sup>80</sup>

The Intergovernmental Panel on Climate Change (IPCC) estimated that in 1992 aviation across the world was responsible for 2% of CO<sub>2</sub> emissions from human activities and, after including the impact of radiative forcing, about 3.5% of the total contribution of man to global warming. Under their reference scenario this was projected to increase to 5% by 2050.<sup>81</sup> The IPCC's latest estimate is that aviation accounted for 'around 3%' of the total contribution of man to global warming in 2005. There is still considerable uncertainty about this figure.<sup>82</sup>

<sup>77</sup> Bows et al, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic: Tyndall Centre Technical Report 40*, Tyndall Centre for Climate Change, February 2006 p17

<sup>78</sup> International Energy Association, CO<sub>2</sub> emissions from fuel combustion, 1971-2005, 2007 edition

<sup>79</sup> Emissions from fossil fuel combustion only

<sup>80</sup> CO<sub>2</sub> Emissions from Fuel Combustion 1971-2005, 2007 edition, IEA

<sup>81</sup> *Aviation and the Global Atmosphere*, IPCC 1999

<sup>82</sup> *Climate Change 2007 – Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the IPCC*. Chapter 5

## B. Climate change cost of aviation

The 2004 DfT report on *Aviation and Global Warming* attempted to calculate the cost of UK aviation carbon emissions and make a prediction of this cost in the year 2030:

In *Aviation and the Environment: Using Economic Instruments*, the cost of UK aviation carbon emissions in 2000 was calculated as:

$$8 \text{ MtC} \times 2.5 \times \text{£}70/\text{tC} = \text{£}1.4\text{bn}^{83}$$

This figure was derived as follows:

- [...] UK civil passenger aviation produced 30 MtCO<sub>2</sub>. [...] This gives a figure of approximately 8 MtC of carbon emissions but does not include the carbon contribution from air freight, which is 0.6 MtC, nor emissions from surface access transport to and from airports.<sup>84</sup>

A radiative forcing factor of 2.5 is used to give:

- [...] A social damage cost of carbon, of £70/tC. [...] The £70/tC rises at £1 per tonne of carbon per annum as the future damage costs of carbon increase. [This is based on] the 2002 Government Economic Service (GES) paper 140, *Estimating the Social Cost of Carbon Emissions*.

The climate change costs of UK aviation for 2030, under the ‘high airport capacity’ scenario (480 mppa) in *Aviation and the Environment: Using Economic Instruments* was calculated as:

$$19 \text{ MtC} \times 2.5 \times \text{£}100/\text{tC} = \text{£} 4.8\text{bn}$$

The figure of 19 MtC again excludes air freight and surface access carbon contributions. Freight contributes 1.84 MtC and surface access 0.89 MtC, thus a gross 2.73 MtC. The 2030 social cost of carbon of £100/tC was used in the 2030 calculation.<sup>85</sup>

In August 2007 in the DfT *Consultation on the emissions cost assessment*, the Government stated that the social cost of carbon value was currently under review:

This value forms the basis of current cross-Whitehall guidance published by Defra. It is currently being reviewed with revised guidance due to be published shortly. The approach adopted for the emissions cost assessment would be revised to remain in line with new guidance.<sup>86</sup>

Despite the review of the value, the consultation still asked for views on whether the social cost of carbon provides a “robust way forward”.<sup>87</sup> This figure proved to be

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<sup>83</sup> DfT, [Aviation and Global Warming](#), January 2004, p9

<sup>84</sup> DfT, [Aviation and Global Warming](#), January 2004, p9

<sup>85</sup> DfT, [Aviation and Global Warming](#), January 2004, p9

<sup>86</sup> DfT, [Consultation on the emissions cost assessment](#), August 2007 p22

<sup>87</sup> DfT, [Consultation on the emissions cost assessment](#), August 2007 p23

contentious. In response to the DfT consultation, the Aviation Environment Federation explained why it disagreed with the value, saying that it was far too low to be effective:

The figure of £70/tC (now updated to £84) for the social cost of carbon was based on a study by Clarkson and Deyes. They pointed out that it was only sufficient to achieve the modest Kyoto target for the UK, not the more ambitious target of a 60% cut by 2050. The Treasury also stated that it did not include the possibility of climate catastrophes such as the melting of the West Antarctic ice sheet, or Gulf Stream suppression, or the possibility of famine or mass migration.

It was just these uncertainties that Sir Nicholas Stern recommended should be included. Indeed the Stern Review put the social cost of carbon at \$85 per tonne of CO<sub>2</sub> at 2000 prices.

That figure needs to be converted to pounds sterling, to carbon instead of CO<sub>2</sub>, and to current prices. The fairly simple mathematical calculation shows that at current prices the social cost of carbon is about £280 per tonne (£238 at 2000 prices).

Stern himself confirmed that his figure was higher than previous estimates, explaining that he had taken account of the risk of climate catastrophes, famines and mass migration which scientists are now more certain are real risks, but which were excluded from the previous £70t/C figure. We are glad to note that the consultation document states that the official figure for the social cost of carbon is 'currently being reviewed with revised guidance due to be published shortly.'

Stern also pointed out that his figure was based on a target of stabilising emissions at 500-550ppm which he considered the lowest that would be politically feasible. The Environmental Audit Committee has criticised the Government for not adopting a tougher target. To achieve the tougher target of 450-500ppm CO<sub>2</sub>, which many scientists consider is more desirable, Stern pointed out that the social cost of carbon would need to be three times as high.<sup>88</sup>

The consultation closed in October 2007. On 24 August 2007, the Department for Environment, Food and Rural Affairs (Defra) published interim guidance on its website about a replacement for the social cost of carbon; the shadow price of carbon. This was updated with full guidance in December 2007 which set out what the difference was between the shadow and social cost of carbon:

The shadow price of carbon (SPC) is used to value the expected increase or decrease in emissions of greenhouse gas emissions resulting from a proposed policy. Put simply, the SPC reflects the damage costs of climate change caused by each additional tonne of greenhouse gas emitted – converted into carbon dioxide equivalent (CO<sub>2</sub>e) for ease of comparison.

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<sup>88</sup> Aviation Environment Federation response to the DfT [Consultation on the aviation emissions cost assessment](#), 7 August 2007

The SPC is different from the previously used social cost of carbon (SCC) in that it takes more account of uncertainty and is based on a stabilisation trajectory.<sup>89</sup>

The shadow price of carbon is £26.50 per tonne of CO<sub>2</sub> equivalent (almost £100 per tonne of carbon) in 2008 prices.<sup>90</sup>

The November 2007 DfT report, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts* shows that the Government now uses the shadow price of carbon in its assumptions:

Following the Stern Review, the government has updated its guidance on the social cost of carbon. DEFRA's previous guidance set the 2000 social cost of carbon at £70/tC in 2000 prices, rising by £1/tC pa in real terms. Its new guidance recommends a 2000 shadow price of carbon dioxide emissions of £19/tCO<sub>2</sub> (in 2000 prices), rising by 2% pa in real terms.

The guidance recommends that all appraisals using the shadow price of carbon dioxide emissions should include a sensitivity test varying the 2000 shadow price by [at least] [+/-5%] to check for policy conclusions which depend critically on this value. DEFRA have since recommended that it would be prudent to test a wider range of -10% to +20%, or £17/tCO<sub>2</sub> to £23/tCO<sub>2</sub>. This wider range has therefore been adopted in our sensitivity test assumptions.<sup>91</sup>

Using the updated shadow price of carbon, this report says that the estimated value of the climate change impacts of UK aviation in 2005 would have been £1.7bn and that in 2030 it will be £4.3bn (in 2006 prices).<sup>92</sup> These figures are slightly lower than the figures shown above in the DfT's 2004 estimates. The report sets out the reasons for the difference:

The central estimates are lower than in 'Aviation and Global Warming', reflecting the net effect of:

- a slightly lower carbon dioxide forecast;
- a lower central value for the radiative forcing factor; but,
- a faster growth rate of the shadow price of carbon dioxide.<sup>93</sup>

## IV Measures to address aviation emissions

### a. *A brief introduction to the EU Emissions Trading Scheme*

One of the main proposals to address the problem of increasing emissions from aviation (particularly by the European Commission and the UK Government) is to include aviation in the EU Emissions Trading Scheme (EU ETS), a cap-and-trade scheme. The EU ETS is a market-based mechanism that is used to incentivise greenhouse gas emissions reduction. The scheme operates through the allocation and trade of greenhouse gas

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<sup>89</sup> Department for Environment, Food and Rural Affairs website, [How to use the Shadow Price of Carbon in policy appraisal](#) (on 24 January 2008)

<sup>90</sup> ENDS Report Bulletin, *Government sets shadow price of carbon*, 4 January 2008

<sup>91</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, 22 November 2007 p20

<sup>92</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, 22 November 2007 p136

<sup>93</sup> DfT, *UK Air Passenger Demand and CO<sub>2</sub> Forecasts*, 22 November 2007 p137

emissions allowances throughout the EU. At present, an overall limit, or 'cap', is set by each Member State on the total amount of emissions allowed from all the installations covered by the scheme. Participants are then allocated a number of allowances by Member States, detailed in their national allocation plans (NAPs), in proportion to the amount of carbon dioxide they are expected to emit over the coming phase and based on the Member States' Kyoto emissions reductions targets.

The EU ETS began in January 2005 and covers 12,000 installations in 25 countries. The first phase (Phase I) commenced on 1 January 2005 and ran until 31 December 2007. The second phase (Phase II) runs from 1 January 2008 to 31 December 2012 and five year phases will follow thereafter.

An August 2007 DfT report set out the main ways that allowances might be issued to aircraft operators: grandfathering; auctioning and benchmarking:

In principle, there are three ways to allocate allowances among aircraft operators:

1. grandfathering, i.e. free allocation on the basis of an airlines' historical emissions;
2. auctioning, i.e. no free allocation;
3. benchmarking, i.e. free allocation on the basis of an indicator of the output, efficiency, or fleet characteristics.

Grandfathering has the advantage that every existing airline will face the same relative shortfall but the disadvantage of this method is that it does not reward early action for decreasing emissions. In fact, airlines that have increased their efficiency may have exhausted the cheapest options to reduce emissions and may thus be disadvantaged under grandfathering.

Auctioning can be an efficient non-discriminatory way of allocating permits, is consistent with the 'polluter pays' principle, and can generate revenues for environmental expenditure.

Benchmarking can be a good way to reward early action whilst making free allocation of allowances possible at the same time. It is also the allocation method proposed by the European Commission and supported by most Member States.<sup>94</sup>

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<sup>94</sup> DfT, [Aviation and emissions trading benchmarking study: impacts of different benchmarking methodologies on airlines](#), August 2007

## A. Europe

### a. *The European Commission proposal to include aviation in the EU ETS*

On 20 December 2006, the Commission adopted a proposal for legislation to include aviation in the EU Emissions Trading Scheme (ETS).<sup>95</sup> The proposal explains the background to how it came about:

On 27 September 2005 the Commission adopted a Communication on Reducing the Climate Change Impact of Aviation. The key conclusion drawn in the Communication was that, in view of the likely future growth in air traffic, further policies and measures are needed to address the climate impact of aviation. Having analysed a number of options, the Commission decided to pursue a new market-based instrument at Community level in preference to other financial measures such as tax and charges and considered that "...the best way forward from an economic and environmental point of view, lies in including the climate impact of the aviation sector in the [Community] scheme". On the basis of this conclusion, the Commission announced that it intended to present a legislative proposal to this effect and invited the other Community institutions to consider the policy and design recommendations made in the Communication. The present proposal aims at implementing this key pillar of the strategy without affecting its other means of addressing climate change through a comprehensive approach based on improved technology and utilisation of aircraft (including improvements in air traffic management, research etc.)<sup>96</sup>

The accompanying press release to this proposal explains broadly how including aviation in the EU ETS would work:

The directive will treat all airlines equally, whether EU-based or foreign. From 2011 all domestic and international flights between EU airports will be covered, and from 2012 the scope will be extended to all international flights arriving at or departing from EU airports. It is estimated that by 2020 CO<sub>2</sub> savings of as much as 46%, or 183 million tonnes, could be achieved each year – equivalent for example to twice Austria's annual greenhouse gas emissions from all sources – compared with business as usual.

To limit the rapid growth in aviation emissions, the total number of emission allowances available will be capped at the average emissions level in 2004-2006. Some allowances will be auctioned by Member States but the overwhelming majority will be issued for free on the basis of a harmonised efficiency benchmark reflecting each operator's historical share of traffic.

To reduce administrative costs, very light aircraft will not be covered, and each operator will be administered by only one Member State.

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<sup>95</sup> [COM\(2006\) 818 final](#)

<sup>96</sup> European Commission, [Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community](#), COM/2006/0818 final - COD 2006/0304 (on 24 January 2008)

The directive is part of a comprehensive approach to addressing aviation emissions which also includes more research into greener technologies and improvements in air traffic management.

### **Impact on ticket prices**

Assuming airlines fully pass on any extra costs to customers, by 2020 the price of a typical return flight within the EU could rise by between €1.8 and €9. Long-haul trips could increase by somewhat more depending on the exact journey length, due to their higher environmental impact. Nevertheless, ticket price increases are in any case expected to be significantly lower than the extra costs passed on to consumers due to world oil price increases in recent years.<sup>97</sup>

On 2 October 2007 the European Parliament's Environment Committee approved a draft directive aimed at including aviation in the EU ETS. Details of this were reported on the Euractiv website:

The Parliament's Environment Committee gave overwhelming support to Commission proposals aimed at limiting CO<sub>2</sub> emissions from planes, backing the report by MEP Peter Liese (EPP-ED, Germany) by 50 votes in favour, none against and one abstention.

Under the text voted upon by MEPs on 2 October, all flights would be included in the EU's carbon trading scheme as of 2010, including international flights connecting with non-EU countries. This is one year earlier than the Commission had initially proposed.

MEPs also voted to require auctioning for half of the pollution permits that are to be issued under the scheme, in order to avoid airlines making so-called 'windfall profits' when passing on the costs to air travellers. The Commission initially recommended that only 10% of permits be auctioned.

The total emission cap was set at 75% of the average emissions recorded by the airline sector between 2004 and 2006. Again, this is more stringent than the Commission had originally foreseen. In its first draft, the EU executive suggested calculating the cap as representing 100% of emissions recorded during that period.

And under another provision, airlines would need to buy two pollution credits for every one they wish to use for their own sake, in order to take account of other gases emitted by airlines, such as NO<sub>x</sub>, which have a higher global warming potential than CO<sub>2</sub>.<sup>98</sup>

Reactions to the Committee's proposals were varied:

The Greens were upbeat after the vote, saying MEPs "succeeded in significantly improving" what they described as a "weak proposal from the European Commission". Caroline Lucas, the rapporteur for Parliament's earlier opinion on

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<sup>97</sup> European Commission press release, [Climate change: Commission proposes bringing air transport into EU Emissions Trading Scheme](#), 20 December 2006

<sup>98</sup> Euractiv.com website, [MEPs vote to tighten emission limits on aircraft](#) (on 24 January 2008)

aviation and climate change, welcomed the provision to limit airlines' capacity to buy pollution credits from other sectors such as chemicals or steelmaking once aviation is included in the scheme.

But the overall tightening of the cap was rejected as "disastrous" by the Association of European Airlines (AEA) which represents major carriers, including Air France-KLM, British Airways and Lufthansa.

Speaking to EurActiv, AEA communications manager Françoise Humbert said that the tightening would be "disastrous", especially for the Central and Eastern European countries that joined the EU in 2004, as it does not take account of the economic growth that is taking place there thanks to EU membership.

"These countries' connectivity has inevitably increased since accession," Humbert pointed out, adding that she hoped this could be rectified when the bill is voted upon in the parliament plenary later this year. She also questioned the scheme's viability with regard to WTO trade rules, warning that Europe could be "heading towards commercial conflicts."

However, this was not the view of environmental NGO Transport and Environment (T&E). "While it is somewhat reassuring that MEPs have strengthened the Commission's proposal, they have not gone far enough in tackling rising emissions from the sector", said João Vieira of T&E.

Delia Villagrassa of WWF added that other measures "such as a fuel tax and the end of VAT exemptions are also needed" in order to tackle the rising impact of aviation on the climate.<sup>99</sup>

On 13 November 2007 there was a plenary vote in the European Parliament on this matter. The vote and the decision were reported by the European Federation for Transport and the Environment website:

MEPs supported the inclusion of all flights in the EU ETS in 2011; the Commission proposed the inclusion of Intra-EU flights in 2011 and all flights in 2012. MEPs said the proposed emissions cap should be set at 90% of the baseline emissions (2004-2006). This cap represents emissions around 70% higher than their 1990 level. The Parliament also proposed that only 25% of emissions permits should be auctioned.

[...] The proposal of the Commission ignored the non-CO<sub>2</sub> impacts of aviation. The Parliament voted in favour of a multiplier to address NOx emissions on a provisory basis, until the Commission adopts legislation to specifically address these emissions.<sup>100</sup>

On 20 December 2007 the Member State Environment Ministers, the European Environment Council reached agreement on including aircraft emissions in the EU emissions trading scheme. The agreement was similar to the Commission's original proposal in December 2006, but did have some changes. These changes are outlined in

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<sup>99</sup> Euractiv.com website, [MEPs vote to tighten emission limits on aircraft](#) (on 24 January 2008)

<sup>100</sup> European Federation for Transport and Environment website, [European Parliament strengthens aviation emissions plan](#), 13 November 2007 (on 24 January 2008)

a press release on the European Commission website, the main one being that plans to include internal EU flights in the EU ETS a year earlier (in 2011) have been dropped:

- The one-year introductory phase for intra-EU flights proposed by the Commission has been dropped, and the scheme will now become operational in a single phase, starting in 2012.
- Emissions will be capped at 100 percent of the average level for the years 2004-2006.
- The level of auctioning has been increased to 10 percent, and revenue from the auctioned allowances should be used to combat climate change.
- An exemption has been introduced for operators with very low traffic levels on routes to, from or within the EU. Under this mechanism many operators from developing countries with only limited air traffic links with the EU will be exempt. This will not have a significant effect on the emissions covered by the scheme.
- A special reserve of free allowances for new entrants or very fast-growing airlines has been added. While this was not contained in the original Commission [proposal], it was found to be acceptable as the reserve is taken from within the overall cap and does not therefore affect the environmental effect of the scheme.
- A new mechanism to ensure consistent and robust enforcement throughout the EU has been introduced. As a last resort, Member States could ask for an operator to be banned from operating in the EU if it persistently has failed to comply with the scheme and other enforcement measures have proven ineffective.<sup>101</sup>

The website also reported that the political agreement reached will now formally be adopted as a "common position" at some point in 2008. It will then be sent to the European Parliament for a second reading.

**b. *The European Commission view of technology and aviation emissions***

The Commission adopted a Communication in September 2005 which set out a *strategy for reducing the Climate change impact of aviation* [COM (2005) 459 final]. The main conclusion was that the EU Emission Trading Scheme (ETS) should be extended to include aviation. However, it also concluded that more work was needed to be done in:

- giving research into 'greener' technology highest priority in the 7th Framework Programme for Research & Technical Development
- improving the efficiency of European Air Traffic Management (ATM) through the Single European Sky SESAR initiative
- removing legal obstacles to the taxation of aviation fuel to facilitate more consistent transport energy taxation policy
- working in ICAO on developing more stringent technical design standards to reduce aircraft emissions at source<sup>102</sup>

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<sup>101</sup> European Commission website, [Environment: Commission welcomes Council agreement on aviation](#), 20 December 2007

<sup>102</sup> European Commission, [Aviation and Climate Change website](#) (on 24 January 2008)

At European level, the Clean Sky “Joint Technology Initiative” (JTI) aims to improve aviation technology in order to reduce emissions. A press release from the European Commission sets out what this is:

Clean Sky aims to create a radically innovative Air Transport System centred on the reduction of the environmental impact of air transport through reduction of noise and gaseous emissions, and improvement of the fuel economy of aircraft for the benefit of society at large.<sup>103</sup>

Its aims are as follows:

[...] to develop advanced technologies for the next generation of aircraft in order to establish an innovative and competitive Air Transport System. Through the development of full scale demonstrators, Clean Sky will perform an overall assessment of individual technologies at the fleet level, thus ensuring earliest possible deployment of its research results. The activity will cover all main flying segments of the Air Transport System and the associated underlying technologies identified in the Strategic Research Agenda for Aeronautics developed by the Aeronautics Technology Platform ACARE.

Clean Sky will be built upon 6 different technical areas called Integrated Technology Demonstrators (ITDs), which will perform preliminary studies and select research areas, then lead large-scale demonstrations either on the ground or in-flight, in order to bring innovative technologies to a maturity level where they can be applied to new generation “green aircraft”. The JTI will ensure that there are links between the various ITDs and that they exchange information and results. The ITDs are:

- The SMART fixed wing aircraft ITD, focused on active wing technologies that sense the airflow and adapt their shape as required, as well as on new aircraft configurations to optimally incorporate these novel wing concepts.
- The Green Regional Aircraft ITD, focused on low-weight configurations and technologies using smart structures, low-noise configurations and the integration of technology developed in other ITDs, such as engines, energy management and new configurations.
- The Green Rotorcraft ITD, focused on innovative rotor blades and engine installation for noise reduction, lower airframe drag, diesel engine and electrical systems for fuel consumption reduction and environmentally friendly flight paths.
- The Sustainable and Green Engine ITD will integrate technologies for low noise and lightweight low pressure systems, high efficiency, low NOx and low weight core, novel configurations such as open rotors or intercoolers.
- The Systems for Green Operations ITD will focus on all-electric aircraft equipment and systems architectures, thermal management, capabilities for “green” trajectories and mission and improved ground operations.
- The Eco-Design ITD will address the full life cycle of materials and components, focusing on issues such as optimal use of raw materials,

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<sup>103</sup> European Commission, press release, [Development of environmentally friendly technologies for the Air Transport System: the Clean Sky Initiative](#), 20 June 2007

decreasing the use of non-renewable materials, natural resources, energy, the emission of noxious effluents and recycling.<sup>104</sup>

## **B. Government**

### **a. *The Government's proposal to include aviation in the EU ETS***

The Defra website sets out the Government's opinion that the best way to tackle aviation emissions is through emissions trading:

The Government believes that the best way of ensuring that aviation contributes towards the goal of climate stabilisation would be through a well-designed emissions trading regime. An international industry requires an international solution and we are therefore pursuing this within the International Civil Aviation Organisation. However, until a truly global solution can be found, we are seeking to show EU leadership by pressing for the inclusion of aviation in the EU ETS as soon as possible and certainly before the end of Phase II of the scheme.<sup>105</sup>

In April 2007, the Government reconfirmed its support for the inclusion of aviation in the EU ETS:

**Dr. Cable:** To ask the Secretary of State for Transport what assessment he has made of the cost-effectiveness of different abatement measures for reducing carbon dioxide emissions from the aviation sector. [132361]

**Gillian Merron:** As set out in the Air Transport White Paper (2003) and its progress report (2006), the Government believes that aviation's climate change impacts are best addressed through a Global Emissions Trading scheme. This approach is endorsed by the Stern Review on the economics of climate change which strongly supports carbon pricing to ensure that economic decisions fully reflect social and environmental costs. Until a truly global solution can be found, the inclusion of aviation in the existing EU Emissions Trading scheme represents the best multilateral option available.

The UK Government have led the debate within Europe for aviation's inclusion in the EU ETS since the UK presidency of the EU in 2005. The UK welcomed the publication of the European Commission's proposal on 20 December 2006 to include aviation into the EU Emissions Trading scheme (EU ETS) and now looks to the German and Portuguese presidencies of 2007 to give this issue priority so prompt progress can be made with negotiations.

Emissions trading and other economic instruments form part of an overall strategy which includes using operational measures and new technology to minimise the environmental impact of aviation.<sup>106</sup>

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<sup>104</sup> European Commission, press release, [Development of environmentally friendly technologies for the Air Transport System: the Clean Sky Initiative](#), 20 June 2007

<sup>105</sup> Department for Environment, Food and Rural Affairs website, [Including aviation and surface transport in the EU ETS](#) (on 24 January 2008)

<sup>106</sup> HC Deb 19 Apr 2007 c770W

On 30 March 2007 the Government launched a public consultation on the Commission's proposal on how to include aviation in the EU ETS.<sup>107</sup> This closed on 22 June 2007. The Government also published a partial regulatory impact assessment alongside the Consultation which considers the potential impacts of the Commission proposals in more detail; however, it does not draw many conclusions at this stage.<sup>108</sup> The section on Parliament in this paper (see page 48) sets out further some of the arguments levied against some of the proposals for how to include aviation in the EU ETS.

Defra and the DfT commissioned research for *A Study to Estimate Ticket Price Changes for Aviation in the EU ETS*, the results were published in November 2007.<sup>109</sup> The study examined the extent to which airlines are likely to pass the costs of emissions allowances through to ticket prices when included in the EU ETS. The report concluded that under current proposals there would be potential for airlines to make windfall profits from free allocations similar to those made by power generators in the UK:

Although the aviation market is unusual in its characteristics in some important ways from other sectors, including other sectors covered by the ETS, this empirical evidence supports the theoretical result that the rate of cost pass-through will be around 100%.

The periodic updating of free allocations of allowances, as currently proposed, would diminish the level of cost pass-through (and also weaken the incentive to abate) relative to the levels quoted above. Nevertheless, the consequence of the results set out here is that a high level of free allocation will generate windfall profits. A substantial level of auctioning will be needed if this outcome is to be avoided.<sup>110</sup>

Agreement on a final scheme for including aviation in the EU ETS is expected mid-2008.<sup>111</sup>

#### **b. The Government view of research and technology and aviation emissions**

The Government set out its work and investment made into research to develop technology to reduce aviation emissions together with industry initiatives in a written answer in June 2007:

**Mr. Iain Wright:** To ask the Secretary of State for Transport if his Department will commission research and development into minimising (a) carbon dioxide emissions and (b) general environmental impacts caused by commercial aircraft engines. [140604]

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<sup>107</sup> DfT and Department for Environment, Food and Rural Affairs, [Consultation on the Commission's proposal to include aviation in the European Union emissions trading scheme](#), March 2007

<sup>108</sup> DfT and Department for Environment, Food and Rural Affairs, [Partial Regulatory Impact Assessment as part of Consultation on the Commission's proposal to include aviation in the European Union emissions trading scheme](#), March 2007

<sup>109</sup> The Department for Environment, Food and Rural Affairs and the DfT, [A Study to Estimate Ticket Price Changes for Aviation in the EU ETS](#), November 2007

<sup>110</sup> The Department for Environment, Food and Rural Affairs and the DfT, [A Study to Estimate Ticket Price Changes for Aviation in the EU ETS](#), November 2007 pvi

<sup>111</sup> DfT, [Towards a Sustainable Transport System Supporting Economic Growth in a Low Carbon World](#), October 2007 p36

**Gillian Merron:** Government are committed to ensuring that effective policy development and environmental action relies upon sound research, evidence and knowledge transfer. This is why we are investing in initiatives such as the new knowledge transfer network called OMEGA (Opportunities for Meeting the Environmental Challenge of Growth in Aviation). OMEGA defines specific areas where work is needed, facilitates inter-disciplinary research and supports strategic longer-term thinking. A number of other collaborative research programmes funded through the DTI collaborative research mechanism are set to deliver improvements. These include the £95 million Environmentally Friendly Engine programme. I refer my hon. Friend to the answer given by my right hon. Friend the Minister for Industry and the Regions on 18 June 2007, Official Report, column 1492W.

Government are also supporting work from the aviation industry. We welcomed the Sustainable Aviation initiative, launched in June 2005, which aimed to place sustainability at the forefront of the sector's strategic planning. The Government also welcomed the Advisory Council for Aeronautics Research in Europe (ACARE), which adopted stretching European targets for environmental performance of new aircraft and engines by 2020. These include reducing the fuel consumption and hence carbon emissions by 50 per cent., relative to new aircraft in the year 2000, with 20-25 per cent. savings from airframe developments, 15-20 per cent. from the engines and 5-10 per cent. from improved air traffic management.

On an international level the UK is playing an important role and is contributing to a number of work streams in the Committee for Aviation Environmental Protection under the auspices of the UN's International Civil Aviation Organisation (ICAO).<sup>112</sup>

This work was also set out in the DfT 2007 report the *Low Carbon Transport Innovation Strategy*.<sup>113</sup> It set out "the operational and technological options which are or may become available in time for reducing emissions from the aviation sector."<sup>114</sup> These included: air-traffic management options for reducing emissions; improving the fuel economy of the current aviation fleet; improving the fuel economy and emissions performance of future aircraft; longer-term options for re-designing aircraft to optimise fuel efficiency; and the scope for powering aircraft from renewable or alternative fuels. The report concluded:

It is clear that technology innovation can play a significant role in carbon reduction in the aviation sector. At the same time the Government recognises that, on current trends, and in the short-medium term at least, carbon reductions achieved from improved air traffic management and improved aeroplane efficiency are likely to be outweighed by continued growth in the demand for aviation, leading to continued overall growth in total carbon emissions from this sector. It is also likely that, even with significant improvements in fuel economy, the full climate impacts of aviation (when taking account of the additional impacts of emissions at altitude) will remain significant compared to other transport modes. These considerations will continue to be taken into account by the

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<sup>112</sup> HC Deb 19 Jun 2007 c1616W

<sup>113</sup> DfT, [Low Carbon Transport Innovation Strategy](#), May 2007

<sup>114</sup> DfT, [Low Carbon Transport Innovation Strategy](#), May 2007 p50

Government in developing its policies towards the aviation sector, alongside consideration of aviation's economic and social benefits.<sup>115</sup>

In a similar vein, a Parliamentary Office of Science and Technology (POST) note in April 2003 suggested that any improvements in technology to reduce emissions were likely to be outweighed by the predicted increase in air travel:

There is scope to reduce the environmental impacts of aviation using technological means:

- aircraft engines and airframes can be made quieter
- the emissions of air pollutants and greenhouse gases can be reduced by improving the efficiency of engines
- the environmental impacts of airport operations can be lessened through careful engineering and mitigation (e.g. recycling wastes, ensuring energy efficiency in buildings and locating infrastructure away from sensitive habitats).

However, there are likely to be diminishing returns of incremental improvements to the environmental performance of aircraft. Furthermore, significant improvements in the technology to control noise, air pollution and greenhouse gas emissions will not become widely available or adopted throughout national or global aircraft fleets within the next 20 years. Moreover, even if available in the short term, were air travel to grow at forecast rates, these improvements would be negated within a decade.

Therefore, within the time horizon for the government's current consultation on aviation (to 2030), it is highly likely that after a period of relative improvement to around 2015-2020, local environmental impacts from aviation could worsen. With regard to climate change, year-on-year increases in emissions are likely as growth in air travel outstrips technological improvements.<sup>116</sup>

The Tyndall Centre for Climate Change Research was also cautious in a 2006 study about how much technology could be used to help to reduce emissions, citing long design runs and lives as barriers to more immediate reductions:

[...] whilst this relatively competitive industry continually pursues technical and operational improvements, there is little evidence to suggest that such improvements will offer more than relatively small incremental reductions in fuel burn. Hydrogen is often mooted as an alternative to kerosene, but foreseeable problems include enhanced water vapour emissions and the practicalities of both low-carbon production and storage. Biofuel and biofuel-kerosene blends are possibly more plausible in the medium term; however the land-take implications, though still characterised by uncertainty, are likely to be very substantial. Consequently, the aviation industry is in the unenviable position of seeing the demand for its services grow at unprecedented rates, whilst at the same time being unable to achieve substantial levels of decarbonisation in the short to medium term. Indeed the new airbus A-380 continues to use high-pressure, high-bypass jet turbine engines that contain only incremental improvements over their predecessors. Moreover, a combination of both long design runs (already 35 years for the Boeing 747) and design lives (typically 30 years), locks the industry

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<sup>115</sup> DfT, [Low Carbon Transport Innovation Strategy](#), May 2007 p58

<sup>116</sup> Parliamentary Office of Science and Technology, [Aviation And The Environment](#), April 2003, number 195

into a kerosene-fuelled future. If the A380 were to follow a similar path to the 747 it will, in gradually modified form, be gracing our skies in 2070. Consequently, decisions we make now in relation to purchasing new aircraft and providing the infrastructure to facilitate their operation have highly significant implications for the UK's and EU's carbon emissions profile from now through until 2070.<sup>117</sup>

### c. ***Air Passenger Duty (APD)***

As with calculating emissions, taxing aviation is also a difficult and controversial area due to the international nature of the industry. Excise duty is charged on most types of hydrocarbon oil, and represents a substantial proportion of the pump price paid by motorists. However, aviation kerosene (AVTUR) which is used in jet engines is exempt from duty, under international agreement. There have been moves to end this anomaly, in particular at a European level, and the UK has encouraged these, but to date progress has been slow. Even if agreement was reached for all Member States to charge duty, it is likely this would have only limited effect. Imposing duty on all flights - not just 'domestic' ones within the EU - would pose the threat of "tankering": carriers filling their aircraft as full as possible whenever they landed outside the EU to avoid paying tax. In turn this would worsen the problem of aviation emissions, as aircraft would be burning up extra unnecessary fuel and adding to emissions whenever they did this, given the extra weight of a full fuel tank.<sup>118</sup>

The Government uses Air Passenger Duty (APD) as a fiscal tool to help to control emissions from aviation.<sup>119</sup> It was introduced in the November 1993 Budget and came into effect on 1 November 1994. APD is currently charged per passenger on all passenger flights from UK airports. The current rates are an increase on previous levels and were announced by the Chancellor in the 2006 Budget.<sup>120</sup> They came into effect in February 2007 and are:

- £10 for intra-EU economy class;
- £20 for intra-EU non-economy class;
- £40 for long-haul economy class; and
- £80 for long-haul non-economy class.<sup>121</sup>

Total receipts from APD in 2006/07 were £971 million.<sup>122</sup>

When the new rates were announced, reaction to them was mixed as to how much they would benefit the environment. The increase in APD rates was criticised both for being too high, and for not being high enough. The *Financial Times* reported on reactions to the announcement as follows:

<sup>117</sup> The Tyndall Centre for Climate Change Research, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*, February 2006 p66

<sup>118</sup> For details see, Laurie Michaelis, *Special issues in carbon/energy taxation: carbon charges on aviation fuels*, OECD March 1997.

<sup>119</sup> For more information on APD see House of Commons Library Standard Note: Air Passenger Duty Standard Note: SN/BT/413, last updated: 25 April 2007

<sup>120</sup> HC Deb 6 December 2006 c 310

<sup>121</sup> DfT website [FAQs](#) (on 24 January 2008)

<sup>122</sup> *Air Passenger Duty Bulletin December 2007*, HMRC

Airlines and travel groups yesterday attacked the doubling of air passenger duty as a "punitive windfall tax" and an ineffective way of tackling global warming ... British Airways called the increases "highly regrettable". Martin Broughton, chairman, warned there was a risk airlines could become "demonised" in the same way as tobacco companies. BA said air passenger duty was "an extremely blunt instrument that provides the Treasury with extra funds for general public expenditure without any benefit to the environment whatsoever". The increase was "revenue-raising pure and simple, with aviation being treated as a cash cow". The doubling in the flat-rate duty will have the biggest relative impact on the lowest-cost airlines. EasyJet said it was "a complete U-turn" ... The Federation of Tour Operators called it "a punitive windfall tax", while First Choice, whose shares fell yesterday nearly 2 per cent, said it was putting into effect its own green measures and should be exempt. Gary Shiels, tax partner at PwC, said the narrow margins in the travel industry meant holidays would cost more than just the rise in air passenger duty. "This will increase consolidation of the industry." ...

Friends of the Earth said the increase was not enough. Jeff Gazzard, spokesman for the GreenSkies Alliance, said the "alarming" growth in emissions would continue unless the government "raises the duty again and again to reach an environmental target to either stabilise or reduce greenhouse gases from air transport".<sup>123</sup>

The Pre-Budget 2007 set out the Government's current position on APD and the environment and also announced plans to change the duty so that it is charged per plane, rather than per passenger, from November 2009:

The Government believes that domestic air passenger duty (APD) is playing a valuable role in encouraging behavioural change, reducing emissions from aviation and ensuring that air travel makes a fair contribution towards the Government's spending priorities, including public transport and the environment. The changes to APD rates announced in the 2006 Pre-Budget Report will deliver reductions equivalent to 2.75 MtCO<sub>2</sub> a year by 2010. Following an earlier consultation, with effect from 1 November 2008, the Government will correct an anomaly to ensure passengers on 'business class only' flights are liable for the standard rate of APD.

The Government now intends to reform the taxation of aviation to send better environmental signals and ensure aviation makes a greater contribution to covering its environmental costs. Therefore from 1 November 2009, the Government proposes to replace APD with a duty payable per plane rather than per passenger, and will begin a consultation shortly. The consultation will consider ways to make aviation duty better correlated to distance travelled and encourage more planes to fly at full capacity. In introducing this duty, the Government will also take into account the impact on freight and transit and transfer passengers, consistent with its wider economic and social objectives. In advance of the introduction of a per plane duty, APD rates will be frozen at their current level for 2008-09.<sup>124</sup>

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<sup>123</sup> "'Punitive' increase in cost of air travel", *Financial Times*, 7 December 2006

<sup>124</sup> HM Treasury, [2007 Pre-Budget Report and Comprehensive Spending Review](#), October 2007 Cm 7227 p122-123

**d. Government Carbon Offset Fund**

Another way in which the Government has sought to reduce the impact of emissions from aviation has been to launch the Government Carbon Offset Fund (GCOF) which is used to offset official and Ministerial air travel. It was launched in April 2006 and is run by EEA Fund Management. The Defra website explains how the scheme works:

The central feature of the GCOF is a portfolio of projects under the Kyoto Protocol Clean Development Mechanism (CDM), which will deliver up to 305,000 tonnes of Certified Emission Reductions (CERs). The Portfolio of projects consists of selected project types from within the CDM, focusing on those which are small-scale, involve renewable energy and/or energy efficiency, and have additional sustainable development benefits. Each CER purchased through the GCOF will be cancelled to remove it from the market and ensure integrity. Further information on the portfolio will be published here soon.

The portfolio will offset the total estimated emissions of participating departments and agencies for a period of three years, from April 06 to April 09. The fund is flexible enough to allow for additional and unforeseen offsetting requirements.

While most departments participate in the GCOF, others are running their own offsetting schemes.<sup>125</sup>

For more information about carbon offsets, see section VI of this paper.

**C. Views of opposition parties**

**1. The Conservative Party**

The Conservative Party's views about reducing aviation emissions were published in the March 2007 consultation document *Greener Skies, A Consultation on the Environmental Taxation of Aviation*. In the introduction, the Shadow Chancellor of the Exchequer, George Osborne set out why he believes a revised form of aviation taxation is needed:

I do not agree with those who argue that we need to stop flying altogether if we are to tackle climate change. However, I believe the case for acting now to reduce the future growth in greenhouse gas emissions from aviation is compelling.

The current system of aviation taxation in the UK is fundamentally flawed. In particular, Air Passenger Duty is not directly linked to carbon emissions and provides no incentives for airlines to use more fuel-efficient aircraft. Even the Government admit that it is a "blunt instrument" that is "not designed for environmental ends". Together with our Quality of Life policy group, I want to consult with the industry, with environmental groups, and with the public in order to create a sustainable regime of aviation taxation that has broad support.<sup>126</sup>

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<sup>125</sup> Department for Environment, Food and Rural Affairs website, [Carbon Offsetting: Government Emissions](#) (on 24 January 2008)

<sup>126</sup> Conservatives, *Greener Skies, A Consultation on the Environmental Taxation of Aviation*, March 2007 p2

The purpose of the report was to consult on how to reform aviation taxation, including whether there is a case for charging fuel duty and/or VAT on domestic flights and whether Air Passenger Duty should be reformed. The report set out five principles that a reformed system should consider:

1. The aim of any reform should be to reduce the overall growth in emissions from aviation.
2. International cooperation is of primary importance in addressing the environmental impact of aviation, but there remains a crucial role for national policies.
3. Any new environmental taxes should be replacement taxes, not additional taxes.
4. Any reforms should link tax incentives more closely to carbon content and provide better incentives for fuel efficiency.
5. Any reforms should ensure that the distributional impact is not regressive.<sup>127</sup>

The party also welcomed including aviation in the EU ETS, but recommended some changes to the European Commission proposals:

While the inclusion of aviation within the EU ETS is a welcome development, there are several reasons why this is not likely to be a sufficient solution.

First, the European Commission itself admits that including aviation in the scheme will do little to constrain demand for air travel. It estimates that if airlines pass on all of the marginal costs of the scheme, ticket prices for return flights within the EU would only increase by between €1.8-9.0, while a longhaul flight to New York would cost an extra €8-20. What is more, if the carbon price remains low, expanding the EU ETS to aviation will knock just 0.1% off the projected growth in air travel.

Second, there are some concerns that with very limited auctioning of permits, airlines could make large windfall profits if they pass on costs to customers.

Third, the current proposals take no account of the indirect warming effects of aviation emissions, which increase their impact by between 2 and 4 times as discussed above. This means that the true environmental costs of aviation will continue to be under-reflected by the market even after aviation's inclusion in a well-functioning EU ETS.<sup>128</sup>

The submission to the Conservative Shadow Cabinet by the Quality of Life Policy Group report, *Blueprint for a Green Economy* in September 2007 suggested a number of policy options to reduce emissions from aviation. These included:

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<sup>127</sup> Conservatives, Greener Skies, *A Consultation on the Environmental Taxation of Aviation*, March 2007 p3

<sup>128</sup> Conservatives, Greener Skies, [A Consultation on the Environmental Taxation of Aviation](#), March 2007 p12

- Air Passenger Duty should be reformed as a per-flight rather than per passenger charge to reflect emissions more closely and give airline companies the incentive to fill empty planes;<sup>129</sup>
- VAT to be introduced on domestic flights;
- A moratorium on planned airport expansion should be put in place, with no new runways at Gatwick or Stansted and reconsideration of runway plans at Heathrow until effects of effort to shift short haul flights to rail have been assessed.<sup>130</sup>

## 2. Liberal Democrats

The Liberal Democrat position on aviation is set out on their website. They advocate a duty on aviation fuel and inclusion of aviation in emissions trading:

Whilst the damaging effects of aviation are becoming clear, we are also faced with another legacy. Air travel is big business. The economy has come to depend on swift transport of people and goods. Hundreds of thousands of people are employed in the aviation industry and many more depend on it through related businesses such as tourism. It is an important contributor to GDP, both directly and indirectly, and a major employer particularly in the South East. The dilemma which faces policy makers therefore is to accept the need for air travel on the one hand, but also to accept the imperative of sustainability on the other.

Air passenger duty is trumpeted as a “green” tax yet it was introduced by the Tories to fill a hole in the budget and has little or no impact on airlines. A tax on airplanes rather than passengers would encourage airlines to become more environmentally efficient. In particular, if it was related to the emission level of the aircraft, as we propose, it would lead to more fuel efficient engines and discourage planes being flown when half empty.

We would impose duty on aviation fuel and press for an international agreement to extend emissions trading to aviation.

Whatever the actual instruments used, the aviation industry must accept the principle that ‘the polluter pays’. The true cost of flying must be reflected in the price – there is no alternative.<sup>131</sup>

## D. Parliament

### a. *House of Lords European Union Committee*

On 9 February 2006 the House of Lords European Union Committee published a report, *Including the Aviation Sector in the European Union Emissions Trading Scheme*.<sup>132</sup> As well as considering including aviation in the EU ETS, the Committee also looked at other possible ways to reduce pollution from aviation. These included: fuel tax; en-route

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<sup>129</sup> Note that this was written before the Government amendment to APD in October 2007

<sup>130</sup> Conservatives, [Blueprint for a Green Economy](#) September 2007, Executive Summary p11

<sup>131</sup> Liberal Democrats website, [air travel](#) (on 24 January 2008)

<sup>132</sup> House of Lords European Union Committee, [Including the Aviation Sector in the European Union Emissions Trading Scheme](#), 21<sup>st</sup> report Session 2005-06, HL 170, 9 February 2006

charges; carbon offset schemes; investment in new technology; and improved efficiency of Air Traffic Control. Having considered evidence on these options, the Committee concluded that “emissions trading was the best way forward as the primary instrument to tackle the climate change impacts of aviation CO<sub>2</sub> emissions.”<sup>133</sup>

The Committee went on to consider how aviation would fit into the EU ETS and considered aspects such as: its interplay with Kyoto Protocol; coverage of climate impacts (which of aviation’s climate-change impacts should be included in the ETS?); geographical scope of the scheme; decision on allocation rules; trading entities; allocation method for allowances; and monitoring method.

On geographical scope, the Committee concluded:

An ETS scheme with aviation should include all flights departing EU airports. We agree that this is a desirable goal but we identified doubt whether the EU can unilaterally impose a scheme upon non-EU airlines. It is important that this legal uncertainty is resolved speedily. Otherwise, the EU may be forced to introduce a scheme based on intra-EU flights only and even then there may be challenge on the inclusion of non-EU airlines.

We do not believe that a wider scheme to include in the ETS all flights arriving as well as departing EU airports is desirable or practical. Such a scheme would go well beyond dealing with the CO<sub>2</sub> emissions for which the EU could reasonably take responsibility.<sup>134</sup>

On an allocation method for allowances the Committee raised the issue of the potential for windfall profits that a benchmarking allocation system might bring and concluded:

We agree that, unless basic CO<sub>2</sub> emissions allowances for all industries were put up for auction in Phase 2 of the EU ETS, there is a strong argument against auctioning initial aviation CO<sub>2</sub> emissions allowances.

Economic analysis suggests, however, that even if initial emissions allowances are distributed free of charge, airlines might still raise airfares in the medium term to cover the opportunity cost of those allowances. In that event, airlines would make windfall profits equal to the value in the market place of their free CO<sub>2</sub> allowances. This would strengthen the case for auctioning. Airlines, air fares and airfreight charges should come under close scrutiny for evidence of windfall profit taking in the event that allowances are issued free of charge.<sup>135</sup>

The Government response to this report is available on the Parliament website and addresses a number of issues raised by the Committee.<sup>136</sup> It restated strongly the

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<sup>133</sup> House of Lords European Union Committee, *Including the Aviation Sector in the European Union Emissions Trading Scheme*, 21<sup>st</sup> report Session 2005-06, HL 170, 9 February 2006 para 85

<sup>134</sup> House of Lords European Union Committee, *Including the Aviation Sector in the European Union Emissions Trading Scheme*, 21<sup>st</sup> report Session 2005-06, HL 170, 9 February 2006 para 128-129

<sup>135</sup> House of Lords European Union Committee, *Including the Aviation Sector in the European Union Emissions Trading Scheme*, 21<sup>st</sup> report Session 2005-06, HL 170, 9 February 2006 para 147-148

<sup>136</sup> [Government Response to the House of Lords EU Committee Report: Including the Aviation Sector in the European Union Emissions Trading Scheme](#), undated

Government's commitment to include aviation emissions within the EU ETS as soon as possible. On the point about the method for allocating allowances, the Government said:

We are taking into consideration lessons learnt in Phase I of the EU ETS and are still assessing which methodology is the most appropriate for aviation. We acknowledge the pros and cons of auctioning as highlighted by the Committee and recognise that existing EU ETS sectors favour benchmarking as the most appropriate approach to free allocation, as it delivers the right messages for emissions reductions and recognises early action. Any benchmarking methodology would need to be developed in collaboration with industry and we think this is an area where further dialogue would be helpful.<sup>137</sup>

**b. House of Commons Environmental Audit Committee**

The House of Commons Environmental Audit Committee published a number of reports concerning aviation and emissions during the calendar years 2003 and 2004, as well as Government responses to them.<sup>138</sup> One of the main focuses of these reports was the difference between the Committee's projected forecasts for aviation emissions growth and the much lower ones provided by the DfT. The reports are:

- [Budget 2003 and Aviation](#), HC 672 2002-03, 29 July 2003
- [The Government's Response to the Environmental Audit Committee's Report on Budget 2003 and Aviation](#), December 2003, Cm 6063
- [Pre-Budget Report 2003: Aviation Follow-up](#), HC 233-I 2003-04, 16 March 2004
- [Aviation: Sustainability and the Government Response](#), HC 623 2003-04, 7 June 2004
- [Aviation: Sustainability and the Government's second response](#), HC 1063 2003-04, 23 September 2004

The Environmental Audit Committee returned to the topic of aviation emissions in its 2006 report, *Reducing Carbon Emissions from Transport*. The Committee recommended that the Government needed to rethink its policy in terms of expansion of the aviation sector:

Under DfT's "best case" projections, then, aviation will grow from around 5% of the UK's carbon emissions today to 24% in 2050 (in neither case counting radiative forcing, which would increase these proportions). In other words, even under the Government's own and most optimistic projections, every other sector of the economy would have to cut its share of UK emissions, while that of aviation would be assisted to almost quintuple. Given that these are both "best case" figures and do not take into account radiative forcing, this is likely to be a very substantial understatement of the actual figure to which the Government's current expansion policies are leading.<sup>139</sup>

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<sup>137</sup> *Government Response to the House of Lords EU Committee Report: Including the Aviation Sector in the European Union Emissions Trading Scheme*, undated, p9

<sup>138</sup> Environmental Audit Committee [publications session 2003-04](#) (on 24 January 2008)

<sup>139</sup> Environmental Audit Committee, [Reducing Carbon Emissions from Transport](#), Ninth Report of Session 2005-06 HC 981-I, 7 August 2006 p61

The Committee concluded that if the Government continues in its policy of allowing just this one industry to grow, it will either cause severe pain to all other sectors or provoke so much opposition as to “fatally undermine its 2050 target”.<sup>140</sup>

Another recommendation of this report was to raise further public awareness of the climate change impacts of flying by providing better information to passengers about the effects and by a cautious use of offset schemes:

[...] the Department should force airlines which operate services from and within the UK prominently to display (eg, on all their adverts, tickets, and webpages) a fuel efficiency label, similar to that for new cars, based on the average fuel efficiency of their entire fleet which flies out of UK airports. Additionally, wherever airlines advertise the routes which they operate from the UK, they should be compelled to state the relevant carbon emissions per passenger—according to a nationally-set methodology for calculating them – alongside the fare.<sup>141</sup>

With regard to carbon offsetting it concluded that offsets should be a compulsory charge on the price of an airline ticket:

We welcome the Government’s new commitment to offset all its air travel through the new Government Carbon Offsetting Fund. Equally, we share its enthusiasm for voluntary offsetting schemes. At the same time, we fully recognise that offsetting is not the solution to the global warming problems caused by growth in aviation, which fundamentally requires a stabilisation of its absolute emissions. Also, we retain concerns as to the potential for offsetting schemes to be subject to fraud. Given that offsetting payments are relatively cheap, help to tackle climate change, and can be used to improve the lives of deprived communities in the developing world, the Government should make them a compulsory charge on all airline tickets. It is important, however, that this is accompanied by rigorous auditing of the projects funded as a result. Moreover, the public should not be encouraged to think that offsetting implied that growth in aviation emissions was environmentally tenable.<sup>142</sup>

The Environmental Audit Committee also published a report on the EU Emissions Trading Scheme in February 2007. The Committee raised concerns about the strength and effectiveness of the Commission’s proposals to include including aviation in the EU ETS:

While we support the principle of including aviation in the EU ETS, this will only be effective if the terms of its inclusion are such to constrain and ultimately reverse the rise in aviation emissions. However, we have severe doubts as to its effectiveness under current proposals. Notably, the impact on airfares, and hence demand for flying, is projected to be relatively minor. Meanwhile, a proportion of what increase in prices there will be is expected to lead to windfall profits for

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<sup>140</sup> Environmental Audit Committee, [Reducing Carbon Emissions from Transport](#), Ninth Report of Session 2005-06 HC 981-I, 7 August 2006 p61

<sup>141</sup> Environmental Audit Committee, [Reducing Carbon Emissions from Transport](#), Ninth Report of Session 2005-06 HC 981-I, 7 August 2006 p67

<sup>142</sup> Environmental Audit Committee, [Reducing Carbon Emissions from Transport](#), Ninth Report of Session 2005-06 HC 981-I, 7 August 2006 p67

airlines, given that their initial allocation of allowances will be given to them almost entirely for free, and as they, like power companies, will be able to pass on the market value of their allowances to customers. Moreover, there are still no concrete proposals for reflecting the total contributions of aviation to global warming, considered in most estimates to be between two and four times that from CO<sub>2</sub> alone.<sup>143</sup>

In October 2007, the Committee published the Government's Response which addressed the issues raised about allocation of allowances. It stated that work on allocation methods was still ongoing:

Under the European Commission's proposal aviation will be allocated allowances by reference to the sector's average emissions between 2004-2006. Aviation will not therefore receive allowances for its total emissions on the proposed date of inclusion in 2011. Consequently, emissions trading will provide an incentive to reduce emissions since it creates a market for reductions in carbon. Companies that innovate to reduce emissions more quickly than expected, will benefit financially from their progress, while those that make less progress will be required to contribute to reducing emissions by funding reductions made elsewhere.

Whatever the final cap level, the UK Government recognises that there may be limits to the extent to which aviation will be able to invest in abatement equipment to reduce emissions in the medium term; but the Government believes that it is right that the costs of flying should reflect the environmental impact as measured in the carbon price. The benefit of the EU ETS therefore is that fixed arbitrary limits in the aviation sector do not need to be set, but instead focuses on the emissions performance of the overall economy.

This provides a cost-effective way of reducing CO<sub>2</sub> emissions whilst responding to the strong demand for air travel. The Government recognises the potential for windfall profits for the aviation sector if allowances are to be allocated for free. We are conducting further work on the potential for cost pass through, as in a competitive industry such as aviation the extent of cost pass through is uncertain, in order to determine the optimum level of auctioning for aviation. We have invited comments on this issue in our consultation. While the Commission's proposal covers CO<sub>2</sub> emissions only, it has made a commitment to bring forward a proposal to address the impacts of non-CO<sub>2</sub> emissions from aviation by the end of 2008.

The contribution of non-CO<sub>2</sub> emissions from aircraft to climate change, especially at high altitudes, are less well understood than those of CO<sub>2</sub> and consequently are more difficult to address. Our view is that this would best be done through an ancillary instrument that addresses directly the emission or emissions targeted. We therefore welcome the Commission's commitment to look at this. Expansion of the ETS to other greenhouse gases is also being analysed within the general review of the scheme.<sup>144</sup>

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<sup>143</sup> Environmental Audit Committee, *The EU Emissions Trading Scheme: Lessons for the Future* Session 2006-07, 20 February 2007

<sup>144</sup> Environmental Audit Committee, [Emissions Trading: Government Response to the Committee's Second Report of Session 2006-07 on the EU ETS](#) Eighth Report of Session 2006-07 HC 1072, 16 October 2007, p44

## E. The International Civil Aviation Organisation

International aviation is regulated by the UN agency, the International Civil Aviation Organisation (ICAO). The ICAO details action taken to reduce emissions at an international level:

Improving the environmental performance of aviation is a challenge ICAO takes very seriously. In fulfilling its responsibilities, the Organization developed a range of standards, policies and guidance material for the application of integrated measures to address aircraft noise and engine emissions embracing technological improvements, operating procedures, proper organization of air traffic, appropriate airport and land-use planning, and the use of market-based options.

All of this has contributed to aircraft operations that today can be 70% more efficient than in the 1970s.

In 2004, ICAO adopted three major environmental goals, to:

- limit or reduce the number of people affected by significant aircraft noise;
- limit or reduce the impact of aviation emissions on local air quality; and
- limit or reduce the impact of aviation greenhouse gas emissions on the global climate.

The ICAO Council also adopted six Strategic Objectives, with high priority given to environmental protection, while the new Business Plan asserts the Organization's status as the leading international organization pursuing unified and coordinated measures to reduce civil aviation's impact on the environment.<sup>145</sup>

The ICAO recognises that there are differences among its members about how to deal with emissions:

Although all ICAO member States agree that we need to ensure that environmental considerations are duly taken into account in ICAO's work there are different views on the urgency to address such matters and the extent to which they would be willing to take action. That is more evident in the matters related to market-based measures to reduce emissions.

ICAO held a Colloquium on Aviation Emissions in May 2007 to enhance the level of information available to States in this area and help pave the way for discussions in the (next) 36th Session of the Assembly. ICAO will be issuing its first Environmental Report in September 2007.<sup>[146]</sup>

It is very important that States be engaged in the dialogue on possible future actions to address noise and emissions from aviation and that they be open to cooperation in these fields. ICAO encourages the dialogue between States and groups of States in these areas and ICAO will be ready to facilitate the wider

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<sup>145</sup> [International Civil Aviation Organization, Air Transport Bureau \(ATB\) website](#) (on 24 January 2008)

<sup>146</sup> Now available at [ICAO Environmental Report 2007](#).

dialogue to arrive in a consensual path forward to address the impact of aviation on the environment as the only means to achieve sustainable aviation.<sup>147</sup>

A press release from the European Commission explains that at the 36<sup>th</sup> session of the ICAO Assembly in September 2007, no clear agreement was reached on a way forward to deal with reducing greenhouse gases from international aviation. The press release highlights the Commission's disappointment:

The 36th Assembly of the International Civil Aviation Organization (ICAO) ended on Friday without clear agreement on a way forward to reduce greenhouse gas emissions from international aviation. Europe pressed for a more ambitious outcome, but safeguarded its ability to introduce an aviation emissions trading scheme.

Speaking for Europe at the end of the talks in Montreal, Luis Fonseca de Almeida, Director General of Civil Aviation for Portugal, said "We strongly believe that it would be best if the international community could reach an effective mechanism on tackling aviation emissions. We are disappointed by the outcome and believe ICAO has abdicated the leadership role given to it in the Kyoto Protocol. That is a very great failing that should concern us all."<sup>148</sup>

And:

At the Assembly, a majority of delegates refused to sign up to meaningful targets to reduce aviation emissions. A European compromise suggestion to set up an urgent high-level ICAO process to fix such targets and provide input to the UN negotiations on a successor to the Kyoto Protocol was watered down and will only look at "possible aspiration goals".

A key point for Europe was to ensure that market-based measures such as emissions trading can be used in efforts to manage aviation's climate impact. Although many delegates pushed for individual states to have veto-rights over other countries' use of such schemes, there was not global consensus on this point, and by registering a formal reservation on this particular point, Europe made its view clear that it will not feel bound by this part of the conclusions.<sup>149</sup>

## **F. Industry**

### **1. International Air Transport Association (IATA)**

The International Air Transport Association (IATA) is an international trade body which represents over 240 airlines and is responsible for 94% of scheduled international air traffic. It also "represents, leads and serves the airline industry in general."<sup>150</sup> IATA's Director General and CEO, Giovanni Bisignani, gave IATA's view of aviation emissions

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<sup>147</sup> [International Civil Aviation Organization, Air Transport Bureau \(ATB\) website](#) (on 24 January 2008)

<sup>148</sup> European Commission, [Europe stands firm on ambitious action to cut Aviation Emissions](#), 28 September 2007

<sup>149</sup> European Commission, [Europe stands firm on ambitious action to cut Aviation Emissions](#), 28 September 2007

<sup>150</sup> [IATA website, "about us" section](#) (on 24 January 2008)

at the World Air Transport Forum in Cannes on 18 October 2007. A press notice to accompany his speech highlighted dissatisfaction with the emphasis on the EU ETS being seen as such a large part of the solution to reduce emissions:

“Airlines are leading the debate on environment with a vision to become carbon neutral in the medium-term and zero carbon emissions in the long term. We are setting the benchmark on environmental performance for other industries to follow,” said Bisignani.

IATA’s 240 member airlines agreed a four-pillar strategy on climate change:

1. Invest in new technology
2. Build and use efficient infrastructure
3. Operate planes effectively and
4. Consider positive economic measures while working with governments to define an emissions trading scheme that is fair, global and voluntary.

“The strategy is not just words. We have delivered real results,” said Bisignani. In 2006, IATA’s fuel campaign saved six million tonnes of CO<sub>2</sub> by shortening 350 routes; eight million tonnes of CO<sub>2</sub> by working with airlines on best practice in fuel management; and one million tonnes of CO<sub>2</sub> through better operational procedures.

“We cannot do it all on our own - governments must be involved,” said Bisignani. All 179 states attending the recent triennial Assembly of the International Civil Aviation Organization endorsed the IATA four-pillar strategy, including a target to improve fuel efficiency 25% by 2020.

“Our biggest disappointment was with the European States. They are taking a completely political and totally irresponsible approach by unilaterally pursuing emissions trading rather than taking a global approach. This will cause diplomatic trade battles, but will do nothing for the environment,” said Bisignani.

Specifically, Bisignani criticised Europe for the 12 million tonnes of CO<sub>2</sub> wasted each year from the inefficiency of its air traffic management system, comprising 34 air navigation service providers. “Europe has been discussing a Single European Sky for 15 years, wasting a lot of hot air in discussions, with no action. On the environment it is acting like a hypocrite: charging for airline emissions without fixing the mess in its own air traffic management.”<sup>151</sup>

IATA’s four pillar strategy on climate change is set out on its website as:

Technology is key. Accelerated technological advancements and work on potential alternative fuels for aviation must be the primary means to address aviation’s greenhouse gas emissions. IATA urges governments, researchers and manufacturers to accelerate technological development and seek improvements beyond their current goals.

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<sup>151</sup> IATA, [Aviation Sets a Benchmark on Environmental Performance For Other Industries to Follow](#), 18 October 2007

Infrastructure and operations should be further enhanced. IATA airlines have a voluntary commitment to improve fuel efficiency by 10% between 2000 and 2010. They are on track to beat this target. IATA calls upon governments, airports and air navigation service providers to put their full weight behind further infrastructure improvements, which could yield fuel efficiency benefits of up to 12% worldwide.

Fuel and greenhouse gas taxes and charges must be avoided. Taxes and charges increase industry costs and undermine socio-economic benefits from aviation, especially in developing economies. They also take funds away from airlines, making it more difficult for them to invest in newer, cleaner equipment. IATA urges States not to implement fuel and greenhouse gas taxes and charges.

Emissions trading is preferred over taxes and charges, if properly designed. Emissions trading can achieve environmental objectives whilst costing 75% less than taxes or charges. However, it may still impose substantial costs on airlines. Voluntary agreements can provide more flexibility and potential cost savings. IATA encourages the use of voluntary initiatives - including emissions trading - to address greenhouse gas emissions from aviation. If States consider including aviation in emissions trading, certain essential elements should be incorporated.<sup>152</sup>

As part of this strategy, IATA has put forward what it calls “essential elements of emissions trading for aviation”, which indicate a strong opposition to auctioning of credits:

ICAO’s global leadership and authority must be preserved since it has a unique mandate to establish policies for greenhouse gas emissions from international aviation.

Competitive distortions must be minimised and ICAO guidelines should be followed. Unilateral inclusion of flights to/from third countries should be avoided.

Airlines should have open access to trading markets in order to ensure the fair treatment of aviation, to contain costs and to accommodate future demand. Aviation emissions allowances should be fully interchangeable with other existing emissions trading schemes.

Initial distribution of emissions allowances should be free of charge, based on equal treatment, and should not be auctioned. Auctioning would result in costs similar to those associated with fuel taxes.

Only CO<sub>2</sub> emissions should be included, given current scientific knowledge. Other emissions are better addressed through different means, according to their climate change impact.

Targets and baselines should treat airlines equally - they must take account of historical efficiency improvements by airlines and should not penalise airlines for existing infrastructure inefficiencies.<sup>153</sup>

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<sup>152</sup> [IATA industry-wide strategy to address climate-change](#), December 2005

<sup>153</sup> [IATA industry-wide strategy to address climate change](#), December 2005

## 2. British Airways

The British Airways website details its approach to reducing emissions:

In the short-term, British Airways is committed to increasing the fuel efficiency of our aircraft and buildings. We are targeting a 30% improvement in our aircraft fuel efficiency between 1990 and 2010 and a 2% per annum reduction in energy consumption in our buildings.

[...]

British Airways does not accept that the right way to limit emissions is to discourage flying – by punitive taxes or constraints on industry growth. This has not been effective in curbing road transport growth and, if applied to air transport, would lead to extremely negative social and economic effects for the European economy.

Instead we believe that a well-designed emissions trading scheme is a cost-effective and environmentally beneficial policy instrument. Whilst an international approach through the International Civil Aviation Organisation (ICAO) must be the ultimate objective, we recognise that some regions may need to move faster than others in developing measures to address climate change.<sup>154</sup>

The website also shows a theoretical support for inclusion of aviation emissions in the EU ETS:

We believe that including air transport within emissions trading – initially within the EU but eventually within a broader international scheme – is the most environmentally effective and economically efficient mechanism for dealing with carbon dioxide (CO<sub>2</sub>) emissions from air transport.

To ensure that emissions trading can be introduced for European air transport without distorting international competition or imposing unreasonable cost burdens on airlines, a practical and pragmatic approach to the scheme design is needed. In particular we highlight the following design elements:

- Emissions allowances should be distributed without cost using a benchmarking method to avoid high financial burden.
- Allocation and target setting should be harmonised at EU level to avoid competitive distortion.
- Coverage should initially focus on emissions from intra-EU air services to avoid international disputes and competitive distortion.
- An international solution to integrate air transport into global policy action on climate change should be sought.<sup>155</sup>

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<sup>154</sup> British Airways website, [Air transport and climate change](#) (on 14 November 2007)

<sup>155</sup> British Airways website, [Air transport and climate change](#) (on 14 November 2007)

### 3. easyJet

EasyJet published a paper on their website in April 2007, *How to green Europe's skies*.<sup>156</sup> It views the inclusion of aviation emissions into the EU ETS as only a part of the total solution:

Within Europe, it is generally recognised that including aviation in the EU Emissions Trading Scheme (ETS) is considered the best solution to address aviation emissions in the medium-term (from 2011 onwards). Nevertheless, the industry is being asked to consider what else can be done. easyJet argues that, whilst the majority of action should rightly come from the industry itself, politicians should take a lead and, using the same philosophy that has reduced aircraft noise emissions, should seek to remove 678 oldest, dirtiest aircraft from Europe's skies by banning any aircraft built before 1990 from operating after 1st January 2012 – the date that aviation is intended to become fully included in the ETS.<sup>157</sup>

On 14 June 2007, easyJet announced a new “ecojet” which it expects to be in operation by 2015 which would reduce emissions by 50% compared to new aircraft today:

Dubbed the “easyJet ecoJet”, the aircraft would need to be 25% quieter and would emit 50% less CO<sub>2</sub> and 75% less NO<sub>x</sub> than today's newest aircraft (the 737 and A320 families of aircraft).

The aircraft will incorporate the latest research by airframe and engine manufacturers around the world – all of which can be incorporated into an aircraft that should be in operation by 2015. The projection for the 50% CO<sub>2</sub> reduction is based on the findings from the latest research by the industry leaders and will come from the engines (25%), the lightweight airframe (15%) and from improvements to air traffic control technology and design (10%).<sup>158</sup>

## V Other proposals, research and opinion

### a. *The Tyndall Centre for Climate Change Research*

In February 2006 the Tyndall Centre for Climate Change Research published a report, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*.<sup>159</sup> The main focus of the report was concerned with reconciling the UK's position on carbon reduction and the growth of the aviation sector. It examined how growth in air travel would affect efforts to keep carbon dioxide below what it sees as the “dangerous” level of 550ppm (parts per million).<sup>160</sup> The report concludes:

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<sup>156</sup> easyJet, [How to green Europe's skies](#), April 2007 (on 24 January 2008)

<sup>157</sup> easyJet, [How to green Europe's skies](#), April 2007 (on 24 January 2008)

<sup>158</sup> easyJet, [The “easyJet ecoJet”: to cut CO2 emissions by 50% by 2015](#), 14 June 2007 (on 24 January 2008)

<sup>159</sup> Tyndall Centre for Climate Change Research, [Contraction & Convergence: UK carbon emissions and the implications for UK air traffic](#), February 2006

<sup>160</sup> Tyndall Centre for Climate Change Research, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*, February 2006 p2

The project reveals the enormous disparity between the UK's position on carbon reduction and the Government's inability to recognise and adequately respond to the rapidly escalating emissions from aviation. A comparison of forecasts and scenarios reflecting growing aviation emissions with contraction and convergence profiles clearly illustrates this point. Results show that at an annual growth rate of only half of that experienced by UK aviation in 2004, the UK's aviation sector accounts for 50% of permissible emissions in 2050 under the 550ppmv regime, and consumes the entire carbon budget under the 450ppmv level. Key project conclusions:

1. The UK Government must urgently update its aviation forecasts
2. Without swift action to curtail aviation growth, all the other UK sectors will have to almost completely decarbonise by 2050 to compensate
3. The proposed partial inclusion of aviation within the EU's emissions trading scheme will do little to mitigate carbon emissions
4. Aviation growth must be curbed until sufficient steps are taken to ensure fuel efficiency gains balance growth in activity, or until there is widespread use of alternative fuels that significantly reduce the industry's carbon emissions.<sup>161</sup>

The report also examined various proposals in detail to reduce emissions from aviation. These included: alternative aviation fuels such as biodiesel and kerosene and hydrogen; better aircraft design and engine technology; better air traffic management; and the use of fuel efficiency and targets. The findings are summarised in the conclusions:

[...] one way to curb growth in the interim, and avoid an irresolvable situation in the future, would be to put a freeze on the expansion and construction of new airports and runways. It is difficult to see how, once a new airport is built, it will be in the government's or private developer's best interests to leave the airport dormant – a foreseeable problem in light of the urgency to address the climate issue.

An alternative way of preventing the construction of new airport infrastructure and capacity, is to pay significant attention to increasing load factors on planes. The current average load factor in Europe is 60%, but it could possibly be pushed closer to 90% by investing in more sophisticated and integrated ticketing arrangements, encouraging greater flexibility on the side of the passenger and facilitating a radical shift in the relationships between the companies who bring about these changes.

The consideration of a slower form of flight offers large fuel efficiency gains due to the relationship between drag and speed, and could therefore be employed to reduce emissions per passenger. This is also something that could be implemented without any change to the aircraft's airframe or technology. Airships may also offer low-carbon forms of flight, but a great deal of research and funding will be required to boost the industry enough to encourage the new infrastructure it would require, and also possibly engender cultural change.

The one fuel that offers a low-carbon alternative future to the aviation industry is Fischer-Tropsch kerosene produced from biomass or synfuel from coal. However,

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<sup>161</sup> Tyndall Centre for Climate Change Research, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*, February 2006 p3

industry stakeholders generally rejected its use within the industry as it is assumed that it will be used primarily in road transport. However, it should be borne in mind that road transport also has the option of using electrically powered or hydrogen powered vehicles. One could ask therefore, if such kerosene proved viable for aviation, would it not be better to use this alternative fuel in the one industry that has no other alternative low-carbon supply, so that, along with all of the other industries, the aviation industry begins to play its, arguably obligatory, role towards alleviating climate change?<sup>162</sup>

**b. The Royal Commission on Environmental Pollution**

The Royal Commission on Environmental Pollution made a study in 2002, *The Environmental Effects of Civil Aircraft in Flight*.<sup>163</sup> The report examined the environmental impact of aircraft emissions and made the following recommendations to government:

We have made recommendations in this Report which encompass a wide range of measures that the government ought to be taking to reduce demand for air travel and to moderate the damage caused by the future growth that does take place:

- impose climate protection charges for aircraft taking off and landing within the EU, and press for such charges to be adopted beyond Europe
- restrict airport development to encourage greater competition for, and raise the implicit price of, the available take-off and landing slots, in order to optimise the use of those slots towards longer-haul flights and to increase the prospects for a modal shift to rail for domestic journeys
- encourage a modal shift to more environmentally benign methods of transport for short-haul flights, including the development of major airports into land-air hubs integrated with an enhanced rail network
- support technological development to lessen the damage done by air travel, continuing airframe improvements and optimising aircraft routing
- include international aviation in the emissions trading scheme that is envisaged as one of the Kyoto Protocol's implementing mechanisms.<sup>164</sup>

**c. Friends of the Earth**

In September 2007 Friends of the Earth commissioned research by the Tyndall Centre which was published in the report, *Aviation in a low carbon EU: How the Aviation Emissions Trading Proposal Must be Improved*.<sup>165</sup> This report followed a 2005 report *Growth Scenarios for EU and UK Aviation*.<sup>166</sup> In a similar vein to the 2005 report, the 2007 report concluded that including aviation in the existing EU ETS was unlikely to constrain emissions as it would not set a high enough price for carbon:

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<sup>162</sup> Tyndall Centre for Climate Change Research, *Contraction & Convergence: UK carbon emissions and the implications for UK air traffic*, February 2006 p65-66

<sup>163</sup> The Royal Commission on Environmental Pollution, [The Environmental Effects Of Civil Aircraft In Flight](#), March 2002

<sup>164</sup> The Royal Commission on Environmental Pollution, [The Environmental Effects Of Civil Aircraft In Flight](#), March 2002, p37

<sup>165</sup> Friends of the Earth, [Aviation in a low carbon EU: How the Aviation Emissions Trading Proposal Must be Improved](#), September 2007

<sup>166</sup> Friends of the Earth, [Growth Scenarios for EU and UK Aviation](#), 2005

The Tyndall research investigated the potential for low-carbon aviation emission pathways and how the EU ETS could facilitate them. It found that:

- Current and envisaged CO<sub>2</sub> prices of below €50/tonne will have virtually no impact on demand for flights – and hence emissions.
- Even a much higher carbon price of €300 per tonne would result in only a modest increase in ticket prices and therefore a modest reduction in demand and emissions growth.
- Efficiency improvements in aviation – for example, a stepchange in aircraft fuel efficiency – must happen much more quickly than in the past.

The Tyndall research concludes that in order for aviation to be part of a 450ppm CO<sub>2</sub> future, the aviation ETS proposal must be made much more effective. Specifically:

- Aviation should be included in the ETS as soon as possible, preferably in 2010 or before.
- A 1990 baseline measurement of CO<sub>2</sub> aviation emissions (or 50 per cent of 2005/06 levels, which is approximately equivalent) must be adopted.
- In order to provide maximum economic incentive for airlines to improve their technology and operations it is recommended that the ETS:
  - Allocates all carbon permits by auction.
  - Produces a carbon price [of] an order of magnitude higher than currently envisaged.

Tyndall also finds:

- Aviation emissions are likely to grow substantially before the sector is included in the ETS. Immediate policies are therefore necessary to substantially constrain passenger-kilometre growth.
- The Aviation ETS will require additional and substantial flanking instruments.<sup>167</sup>

From these findings, Friends of the Earth concluded that including aviation in the EU ETS would only be effective if the price of carbon was high enough:

For aviation to play its part in a low carbon EU, it must achieve efficiency gains much faster than in the past. This will only happen if the price of carbon is high enough. Current proposals to include aviation in the ETS will not deliver this high price for carbon and as a result, Friends of the Earth believes, would be selling the climate short. The EU Council and Parliament must strengthen the aviation ETS significantly, introduce it in 2010 to cover all flights and initiate additional economic, technology and operational changes to curb the growth in aviation emissions as soon as possible.<sup>168</sup>

#### **d. Joint NGO statement**

In June 2007, the NGOs: Aviation Environment Federation; Christian Aid; Friends of the Earth; Green Alliance; Greenpeace; RSPB; World Development Movement and WWF-

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<sup>167</sup> Friends of the Earth, [Aviation in a low carbon EU: How the Aviation Emissions Trading Proposal Must be Improved](#), September 2007 p2

<sup>168</sup> Friends of the Earth, [Aviation in a low carbon EU: How the Aviation Emissions Trading Proposal Must be Improved](#), September 2007 p2

UK, released a joint statement on including aviation in the EU ETS.<sup>169</sup> They welcome the European Commission proposals to include aviation, but want to see improvements made:

According to the European Federation for Transport and Environment (T&E), the inclusion of aviation in the ETS will reduce emissions from the sector by just 3%. This is equivalent to less than one year's growth of emissions from aviation. In addition, the Commission estimates that the costs incurred from inclusion will only slightly lower the demand for air travel - by 2020, demand will have grown by 135% (compared to 2005 levels) - compared to 142% in the absence of a trading scheme.

The inclusion into the ETS should therefore be seen as only the first step in addressing the climate change impacts of aviation – complementary policies and measures are absolutely essential and should be taken forward in parallel. However, if this first step is to be at least adequate then the legislative proposal needs to be considerably improved as outlined in this joint statement.<sup>170</sup>

The statement then goes on to detail the improvements suggested by the NGOs. These are:

- The cap should be strengthened in order to ensure that the aviation sector's contribution to emissions reductions is meaningful and fair compared with other ETS sectors.
- The climate impacts of aviation are higher than the impact of CO<sub>2</sub> alone and should be accounted for from the start of the scheme.
- All flights departing and arriving in the EU should be included from the start of the scheme.
- 100% of allowances should be allocated by auctioning.<sup>171</sup>

It then explains the other policy measures that the NGOs would like to see taken alongside inclusion into the EU ETS:

- improved air traffic management systems and more direct routing;
- the immediate ending of VAT exemption, for example with a tax on air tickets;
- a kerosene tax on fuel for domestic flights, and where there is agreement a tax on fuel on flights between two member states;
- en-route NOx emissions charges (once the current ICAO moratorium expires in October of this year); and
- a concrete proposal on tackling contrail-formation, where appropriate. Work to quantify the impacts of contrails and contrail cirrus and to determine appropriate Air Traffic Control measures to mitigate them should be prioritised.

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<sup>169</sup> [Including aviation in the EU Emissions Trading Scheme – Joint NGO statement on key improvements](#), June 2007 (on 14 November 2007)

<sup>170</sup> [Including aviation in the EU Emissions Trading Scheme – Joint NGO statement on key improvements](#), June 2007

<sup>171</sup> [Including aviation in the EU Emissions Trading Scheme – Joint NGO statement on key improvements](#), June 2007

Furthermore, measures to constrain capacity are also essential if emissions from aviation are to be adequately controlled.<sup>172</sup>

## VI Aviation and carbon offset schemes

### a. Offsets: background and introduction

In establishing the Government Carbon Offset Fund, the Government has signalled that such schemes can be “a useful element of what we can all do to address climate change”.<sup>173</sup> Defra offers an explanation of what it means to ‘offset’ carbon emissions in its consultation on *Establishing a voluntary Code of Best Practice for the provision of carbon offsetting to UK customers*:

Offsetting involves buying emission reduction credits (or carbon credits) generated by projects that have reduced carbon emissions. These projects often involve small-scale or large industrial renewable energy or energy efficiency technologies. In practice, offsetting involves two stages:

- a. Calculating the amount of emissions to be offset from the activity carried out. The results of these calculations can be presented in the form of carbon, CO<sub>2</sub> or CO<sub>2</sub>e (CO<sub>2</sub> equivalent) emissions, depending on which greenhouse gases have been taken into account. It is best to make these calculations using a standard metric to ensure consistent and accurate emissions are offset, and
- b. Investing in projects that prevent or remove an equivalent amount of emissions from the atmosphere or buying and cancelling credits from such projects. For example, if a flight abroad on holiday has created 2.5 tonnes of CO<sub>2</sub>e, a consumer can offset this by buying 2.5 tonnes worth of carbon credits. Currently, there are a wide range of different carbon credits available.<sup>174</sup>

There is a wide divergence of opinions as to whether offsetting can be seen as a total solution for reducing emissions, part of a solution or indeed detrimental to efforts to reduce emissions. The Environmental Audit Committee recently examined this subject in its report *The Voluntary Carbon Offset Market*.<sup>175</sup> The CarbonNeutral Company (an offset retailer) told the Committee that offsets:

[make] a significant contribution to the fight against dangerous environmental change driven by global warming [...] [they] deliver real reductions in carbon emissions in a cost effective way and..., by taking a market driven

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<sup>172</sup> Including aviation in the EU Emissions Trading Scheme – Joint NGO statement on key improvements, June 2007

<sup>173</sup> Department for Environment, Food and Rural Affairs website, [climate change: carbon offsets](#) (on 24 January 2008)

<sup>174</sup> Department for Environment, Food and Rural Affairs [Consultation on establishing a voluntary Code of Best Practice for the provision of carbon offsetting to UK customers](#), January 2007 p8

<sup>175</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07

approach,...foster the implementation of innovative solutions to the problem of reducing carbon.<sup>176</sup>

Whereas the NGO the World Development Movement told the Committee:

It is nonsensical to suggest that climate change can be tackled by cutting emissions from poor people, whilst allowing activities of the rich, such as flying, to continue unabated. Yet this is the basis on which offsetting projects in developing countries are supposed to work.<sup>177</sup>

In its report the Committee summarises views on the role of offsetting:

The views of the majority of organisations from whom we received evidence fall somewhere in-between these positions. The Co-operative Group told us that they: “see offsetting as an important part of the solution to climate change, rather than a panacea.” The Energy Saving Trust told us that offsetting has a role to play after UK citizens and businesses have worked to reduce their own carbon footprint first. The Carbon Trust has a three stage carbon management strategy whereby offsetting comes at the bottom of a hierarchy of actions, below reducing direct emissions and then indirect emissions.<sup>178</sup>

The carbon offset market is a mixture of different standards and different types of credit. Many credits emerge from what is known as the compliance market which provides for “flexible mechanisms”<sup>179</sup> to enable signatories to the Kyoto Protocol to meet their emission reduction targets. In the compliance market credits which are generated from projects within it have to meet certain standards as laid down by the United Nations Framework Convention on Climate Change (the UNFCCC).

Outside the compliance market is the voluntary market. In the voluntary market there are no overarching or compulsory standards or methodologies for creating credits. There are however, a number of voluntary standards emerging in an attempt to bring greater robustness and harmonisation to the voluntary offset marketplace.

The Environmental Audit Committee inquiry examined the strengths and weaknesses of both the compliance market and the voluntary market. Strengths of the voluntary market included its flexibility to be a source of innovation for new projects and its ability to offer “value-added” benefits to a credit in addition to emissions reductions, for example extra sustainability or biodiversity benefits.<sup>180</sup> However, the Committee’s report highlighted contention around how robust some of the voluntary market projects can be and how

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<sup>176</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 Ev70

<sup>177</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07

<sup>178</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07

<sup>179</sup> The flexible mechanisms are: The Clean Development Mechanism (CDM); Joint Implementation (JI) and Emissions Trading

<sup>180</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p16

emissions are calculated, tracked and verified to ensure against bad practice such as a credit being sold twice.<sup>181</sup>

Strengths of the compliance market were that it can guarantee that its resulting credits have emerged from a project which has met stringent criteria for approval; the emissions savings or reductions have been calculated in a transparent manner according to a specified methodology and are certified by a Designated Operational Entity (DOE) which gives a level of independence and reliability to the process; and credits which result from this market are officially registered and retired, thus reducing the risk of double-counting. However, as the Committee highlights, methodologies to calculate how a particular project is saving or reducing emissions can be slow and that there is a lack of expertise to do this.<sup>182</sup> Another problem highlighted is the public perception of the compliance market: often money from compliance market projects goes towards reducing the carbon emissions from polluting companies. The Committee heard evidence that many consumers do not want to see their money going to big companies that are actually a cause of pollution.<sup>183</sup>

In addition to these issues with the projects and credits themselves, there has also been negative publicity about the way in which some of these credits have been sold and the profit that some retailers can make. An example of distrust in this market is seen in a report in *The Guardian* about the views of easyJet.<sup>184</sup> EasyJet's concern here was that offset providers in the voluntary market make too much profit:

Toby Nicol, easyJet's communications director, said the company had been shocked by how much money carbon offsetting firms wanted for their service. "We have been quite surprised at the percentage that the offsetting companies would like to take out of the scheme for administration costs. Between 25% and 30% of every pound put in by consumers would go into administering the company and that was simply too expensive," he said.

"There are a lot of people who have dived into the market who are desperate to make a margin from it. There are too many snake oil salesmen in the business."

Mr Nicol said buying the UN-backed carbon credits on the open market and selling them to passengers was better than turning to brokers. "It gets rid of the expensive middleman and it addresses the valid concern about whether it will make any difference to carbon emissions," he said. Carbon credits cost up to pounds 7.50 per tonne. "It's a fledgling industry with high demand and yet there are no standards over the carbon credits themselves. There is no regulation in the business."<sup>185</sup>

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<sup>181</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p18

<sup>182</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p27

<sup>183</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p28

<sup>184</sup> EasyJet slams 'snake oil sellers' in offset market and goes it alone, *The Guardian*, 30 April 2007 p23

<sup>185</sup> EasyJet slams 'snake oil sellers' in offset market and goes it alone, *The Guardian*, 30 April 2007 p23

In January 2007 the Government launched a consultation, *Establishing a voluntary Code of Best Practice for the provision of carbon offsetting to UK customers*<sup>186</sup> following concern about damage to consumer confidence in the voluntary carbon offset market. The deadline for consultation responses was April 2007 and the Defra website states that it hopes to publish the Code “at the end of the year”.<sup>187</sup> The end of the year here is 2007. At the time of writing, the Code had not been published.

The then Secretary of State for Environment, Food and Rural Affairs, David Miliband, explained the reasoning behind the Government proposal for the new code in a Defra press release:

[...] consumers need [...] assurance that when they offset their emissions, their money is spent on projects that have genuine carbon dioxide emission reductions.

People need to be sure that the way they offset is actually making a difference. The Government's standard and code of practice, with a quality mark so people can check easily before they choose an offsetting product, will help to provide that certainty.

Ultimately, this is about providing certainty for consumers in an emerging environmental market.<sup>188</sup>

#### **b. Offsetting aviation emissions**

An article from December 2006 in the *Observer* highlighted the growing trend of travel companies and airlines to associate with carbon offset projects:

Celebrities, big corporations and in particular travel companies have been rushing to sign up for offset schemes and to bathe in the righteous glow of eco-responsibility, and the column inches that follow. In the last fortnight alone, Lastminute and Silverjet have announced new schemes. And while previously airlines and tour companies asked for a donation after you made your booking, some are pushing it even harder. Tomorrow, Crystal will announce it will start automatically adding a offsetting fee, which remains optional but which you must opt out of. Silverjet, the all-business class airline, goes further still, with a mandatory charge that everyone must pay.<sup>189</sup>

Whilst the carbon offset has generic problems and issues which apply to all types of credits and projects, offsetting and aviation have their own issues. This is largely to do with the difficulties in calculating aviation emissions as discussed earlier in part III of this paper. Different offset retailers calculate the emissions from A to B in slightly different ways. A 2006 report by the Tufts Climate Change Initiative sets these out:

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<sup>186</sup> Department for Environment, Food and Rural Affairs, Consultation on *establishing a voluntary Code of Best Practice for the provision of carbon offsetting to UK customers*, January 2007

<sup>187</sup> Department for Environment, Food and Rural Affairs website, [Climate change: carbon offsets](#) (on 24 January 2008)

<sup>188</sup> Department for Environment, Food and Rural Affairs news release 11/07, *Standard for offsetting to deliver much needed clarity*, 18 January 2007

<sup>189</sup> The Great Green Rip-off?, *The Observer*, 10 December 2006, p1

There are three basic ways customers can calculate emissions from their air travel:

**A. Entering the total miles flown.**

CarbonCounter, Carbonfund and NativeEnergy require customers to enter the mileage they would like to offset. It is assumed that users can find this information for themselves. There are other websites (such as <http://www.webflyer.com>) which compute the distance between major airports. None of the offset companies that ask for mileage have links to such sites. Adding such links would increase the user friendliness of these sites.

**B. Entering origin and destination of the trip**

atmosfair, Climate Care, The CarbonNeutral Company, climate friendly, and Offsetters have calculators that let customers enter their airport of origin and their destination. Multiple flights may be calculated using this method and then offset simultaneously. Myclimate offers a choice between entering mileage and entering the origin and destination of the flight.

**C. Offsetting a fixed amount without calculating the precise emissions.**

A number of the offset companies offer a simpler alternative to calculating emissions. The CarbonNeutral Company offer in addition to their point to point calculator the option of choosing a short, medium and long haul flight, instead of calculating the precise emissions. Better World Club's system is not based on a careful calculation. Instead, they use a loose approximation of one ton per flight, for which they donate \$11 to the Tides Foundation as an offset. Solar Electric Light Fund (SELF) does not offer calculators on its website, but has links to calculators to determine the amount of carbon emitted per flight and offers a program (SELF's Carbon Neutral Club) where people can donate \$10 per ton of CO<sub>2</sub> they emit.<sup>190</sup>

Another point here is that some offset companies use a radiative forcing factor in their calculations and some do not. Due to the varied ways of calculating emissions for a particular journey, there is a corresponding variation in the cost of an offset for what may appear to be the same journey, depending upon the offset retailer used. Reports in the press have shown that this has led to some confusion and distrust in using credits to offset emissions. The *Observer* set this out:

Another key issue is the confusion over how the existing companies work out the price they charge for offsetting flights. As private firms they are free to do their calculations however they want, and the result is that offsetting the same flight with one firm can work out wildly different to the next.

Climate Care says that a flight from London Heathrow to Sydney and back generates 5.61 tonnes of carbon dioxide, which will cost pounds 42.11. The CarbonNeutral Company calculates it at 3.7 tonnes, which you can offset by planting trees for pounds 27.38. A third company, Grow a Forest, agrees with 3.7 tonnes, but asks pounds 46.15 for its trees to offset it. Such variations do little to inspire public trust.

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<sup>190</sup> Tufts Climate Initiative, [Voluntary Offsets for Air Travel Carbon Emissions](#), December 2006, p20-21

Sisman's greatest objection is that though there's no suggestion that the existing offsetters are anything other than scrupulously honest and well meaning, the system itself lacks clarity. 'If the same company is collecting the money, and spending it, it can decide exactly how much it wants to keep,' he says. 'The public often has no idea where its money is actually going.'<sup>191</sup>

The Environmental Audit Committee examined this issue in its inquiry into the offset market and welcomed the introduction of a carbon calculator launched by Defra to give a benchmark for such calculations.<sup>192</sup> The Committee concluded:

There is a need for an authoritative evaluation so that the average consumer, whether individual or commercial body, can assess the robustness of the various avenues for offsetting available. We welcome the launch of DEFRA's Act on CO<sub>2</sub> Calculator and hope that the data, methodologies and assumptions upon which it is based prove acceptable to the airlines. We also note that DEFRA is content for its work to be used by companies in their own proprietary calculators, and we welcome the effect this may have in helping standardize the currently too great range of calculations for carbon emissions from flights. We also hope that where airlines do not themselves offer a carbon calculator they will be happy to refer customers to the Act on CO<sub>2</sub> Calculator.<sup>193</sup>

The Committee also considered whether offsets should be mandatory for flights until the inclusion of aviation in the EU ETS. Whilst it did not support a mandatory system outright, it recommended that the price of an offset should be included in the price of a flight, unless the consumer chooses to opt out:

Of course there are possible practical difficulties with mandating the purchase of an offset with each air ticket. Some commercial bodies offset in advance (or in retrospect) their total emissions, for travel or for all their activities, and thus in principle might be forced to offset twice. The Government itself falls into this category, of having its own comprehensive and multi-departmental offsetting scheme for air travel: and other public or charitable bodies do likewise. A small if increasing number of individuals also take care to offset their carbon footprint annually or otherwise outside of the act of purchasing an airline ticket. For that reason we support the Government's proposals to require all those selling air tickets within the UK to include in the price offered the cost of an offset, and to retail that offset along with the ticket unless the customer requests otherwise.<sup>194</sup>

However, evidence to the Committee from the World Development Movement examined the impact that making offsets mandatory might have. It concluded:

Furthermore, the scale of offsetting which would be required to cover aviation emissions alone is huge:

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<sup>191</sup> The Great Green Rip-off?, *The Observer*, 10 December 2006, p1

<sup>192</sup> [The Defra CO2 calculator](#) (on 24 January 2008)

<sup>193</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p48

<sup>194</sup> Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 p47

- If the UK's current aviation emissions were to be offset, it would be the equivalent of stopping all emissions from Bangladesh. Bangladesh contains 139.2 million people.
- To offset the UK's aviation emissions in 2020 would be the equivalent of stopping all current emissions from Vietnam. Vietnam contains 83.1 million people.
- To offset the UK's aviation emissions in 2050 would be the equivalent of stopping all current emissions from Pakistan. Pakistan contains 154.8 million people.

If offsetting were made mandatory, there would be a massive increase in demand for offsetting projects. It is likely that such an expansion in demand would lower the quality of offset projects, both in terms of the actual carbon emissions reduction achieved, and the negative impacts on communities in developing countries of certain offsetting projects.<sup>195</sup>

## VII The Climate Change Bill

### A. The draft Bill

In March 2007 the Government published a draft *Climate Change Bill* which if enacted would set a duty on the Secretary of State to ensure that the net UK carbon account for the year 2050 is at least 60% lower than the 1990 baseline.<sup>196</sup> Clause 15 of the draft Bill excludes emissions from international aviation and shipping in the calculation of this target. In the consultation paper accompanying the draft Bill, the Government set out its reason for not including them:

The emissions reduction targets do not currently apply to carbon dioxide emissions from international aviation and shipping. These emissions are not part of the Government's existing targets, nor are they part of the current Kyoto Protocol target or EU ETS. And there is currently no international agreement on how to include these emissions in national inventories. However, there is scope in the Bill to include these sectors in the legislative framework should international policy change.<sup>197</sup>

A Joint Committee of the House of Commons and House of Lords examined the draft Bill and reported in August 2007.<sup>198</sup> In evidence to the Joint Committee, Professor Sir David King, Chief Scientific Adviser to HM Government said that it was an "anomaly" that shipping and aviation emissions were excluded from the target:

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<sup>195</sup> World Development Movement memoranda submitted to the Environmental Audit Committee, *The Voluntary Carbon Offset Market*, 23 July 2007, HC 331 2006-07 Ev 227

<sup>196</sup> HM Government, [Draft Climate Change Bill](#), Cm 7040, March 2007, part 1

<sup>197</sup> HM Government, [Draft Climate Change Bill Consultation](#), Cm 7040, March 2007, para 5.8

<sup>198</sup> House of Lords and House of Commons Joint Committee on the Draft Climate Change Bill, [Draft Climate Change Bill](#), 3 August 2007, HC 542-I and HL Paper 170-I

I have no doubt that aviation and shipping ought to be included. Just to pick up your point, I feel it is an anomaly that should be dealt with.<sup>199</sup>

In a memorandum to the Joint Committee inquiry, Friends of the Earth said including emissions from aviation and shipping could add as much as 10% to the UK's yearly emissions:

[...] the Bill will (initially at least) exclude emissions from international aviation and shipping, which could add as much as 10% to the UK's emissions each year. Not counting these emissions is equivalent to someone weight watching deciding not to count the calories from chocolate while on a diet—it undermines the whole purpose of counting in the first place. It is not the case that we cannot allocate these international emissions to the UK—the Government already report these emissions as a “memo item” under the Kyoto protocol (that is to say they are reported but are not counted against the targets). This methodology should be used to include the UK's share of international aviation and shipping emissions from the first carbon budget period.<sup>200</sup>

The Joint Committee concluded that not including aviation emissions in the 60% target was a “weakness”. It also expressed concern that the Government's predicted figures for growth of aviation emissions were not up-to-date. It concluded:

The draft Bill currently does not include within the scope of the targets, and the net UK carbon account, emissions from international aviation. We consider this to be a serious weakness which, in view of the significant likely growth of such emissions, has the effect of reducing the credibility of the 60% carbon reduction target. Given the clear expectation of the Secretary of State that international aviation emissions could be included in the net UK carbon account once they are incorporated within the EU ETS, we expect the Government to take all necessary steps to ensure that this is achieved. The draft Bill should be amended in such a way that it requires both the Government and the Committee on Climate Change to include separately international aviation emissions within the scope of their monitoring and reporting, including projections of future emissions – in a manner similar to the parallel reporting we are recommending in relation to non-CO<sub>2</sub> greenhouse gases.

The Bill should clearly provide for the inclusion of international aviation emissions in the carbon budget once EU agreement is reached on the measurement and allocation of such emissions.

The Government must also clarify whether it intends, when bringing international aviation within the regime established by this Bill, for aviation emissions to fit within the UK's existing targets and budgets (thereby increasing the pressure on other sectors to reduce emissions), or for the targets and budgets to be inflated so as to accommodate it. If the latter, the Government must publish at an early stage, a proposed baseline for the inclusion of aviation emissions, an analysis of

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<sup>199</sup> House of Lords and House of Commons Joint Committee on the Draft Climate Change Bill, [Draft Climate Change Bill Oral and Written Evidence](#), 22 August 2007, HC 542-II and HL Paper 170-II, Q101

<sup>200</sup> House of Lords and House of Commons Joint Committee on the Draft Climate Change Bill, [Draft Climate Change Bill Oral and Written Evidence](#), 22 August 2007, HC 542-II and HL Paper 170-II, Ev204

how this would affect the UK's share of global cumulative emissions, and the basis on which it decides the level of its 2050 target.<sup>201</sup>

The Joint Committee was also concerned that aviation and shipping emissions had been coupled together and that finding an agreed methodology for shipping emissions might be holding back the inclusion of aviation emissions in targets. They said:

We do not want to see progress held back by any coupling of 'aviation and shipping', and therefore recommend that the Government press on with plans to include international aviation within the UK's targets, even if issues remain to be resolved over international shipping.<sup>202</sup>

The Environment, Food and Rural Affairs Select Committee also held an inquiry into the draft *Climate Change Bill*. In their report, they summed up the evidence they received on the exclusion of aviation emissions:

Much of the evidence we received called for inclusion of the UK's emissions from international aviation and shipping within the Bill from the outset. The Natural Environment Research Council describes the exclusion of international aviation and shipping as being "of particular concern", while Friends of the Earth argues that the inclusion of emissions from aviation and shipping was implicit in the 60% target originally recommended by the Royal Commission on Environmental Pollution. The Aviation Environment Federation points out that the UK already submits information on emissions from international bunker fuels to the United Nations Framework Convention on Climate Change (UNFCCC) as part of its annual greenhouse gas emissions inventory. It argues that special provision for aviation and shipping could be made at the outset, with flexibility to alter those provisions should international policy change. Professor Grubb noted that "the Committee [on Climate Change] has to consider any contribution that is making the climate change problem worse, which would obviously include international bunker fuels. [...] Irrespective of how the carbon budget is defined, the Committee surely should be allowed to comment on the state of international aviation and marine transport."<sup>203</sup>

The Committee made several recommendations:

We recommend that the Committee on Climate Change should be required to report on the UK's emissions from international aviation and shipping, whether or not they are counted as part of the statutory target, in order more accurately to inform its recommendations regarding budgets and targets which will affect all other sectors of the economy. Pursuant to this, the Government must make every effort to achieve international agreement as soon as possible on allocation mechanisms so that the powers provided for in Clause 15 (3) can be exercised. We further recommend that once international agreement is reached, the

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<sup>201</sup> House of Lords and House of Commons Joint Committee on the Draft Climate Change Bill, *Draft Climate Change Bill*, 3 August 2007, HC 542-I and HL Paper 170-I p16

<sup>202</sup> House of Lords and House of Commons Joint Committee on the Draft Climate Change Bill, *Draft Climate Change Bill*, 3 August 2007, HC 542-I and HL Paper 170-I p17

<sup>203</sup> Environment, Food and Rural Affairs Committee, [Draft Climate Change Bill](#), Fifth Report, Session 2006-07, HC 534-I, 4 July 2007, para 124

Committee on Climate Change should include the UK's share of emissions from international aviation and shipping in its recommendations for the targets.<sup>204</sup>

The Environmental Audit Committee also examined various aspects of the draft *Climate Change Bill*. It dismissed the Government's argument that aviation emissions should not be included in the target simply because there was no internationally agreed methodology and concluded that "the flexibility currently there in the draft Bill threatens to undermine the UK's overall emissions targets":

Overall, we are unimpressed by the Government's arguments for excluding international aviation and shipping emissions from the UK's carbon reduction regime. While the draft Bill contains provisions that allow these emissions to be included in the future, we recommend that they be included immediately. Despite the arguments of the Secretary of State, we do not believe the Government needs to wait until the terms under which aviation will enter the EU ETS are fully confirmed before doing this. There already is an internationally agreed methodology for attributing and recording these emissions as memo items to national Kyoto accounts; the Government should simply use this to track these emissions within the UK's carbon budgets. This, in turn, means the Government should only count the simple weight of CO<sub>2</sub> from international aviation within these carbon budgets, rather than multiplying it by a factor of 2 or more to reflect the wider global warming impacts of flying. These extra impacts should not be ignored, however, but merit additional policy responses.

If the inclusion of international aviation and shipping has to be delayed, the Bill should be more prescriptive about [how] and when they are to be included. The flexibility currently there in the draft Bill threatens to undermine the UK's overall emissions targets. The draft Bill's qualification that a future Secretary of State "may only" include these emissions if there has been an international agreement on them seems potentially to tie the hands of future Governments for no good purpose, and should be removed.<sup>205</sup>

The Government responded to the pre-legislative scrutiny of the draft Bill in October 2007.<sup>206</sup> On the point of including international aviation emissions in the *Climate Change Bill* it undertook to ask the proposed new Committee on Climate Change to look at the implications of including these emissions as part of a review of the 2050 target. It also undertook to publish revised aviation emissions forecasts "later this year [2007]":

As set out in our evidence to the different parliamentary inquiries, the Government believes that there are a number of important issues which need to be addressed, and we are already taking steps to do so. As the parliamentary committees recognised in their reports, including international aviation emissions in the UK's targets could have an impact on both the level of the targets and on the effort required from other sectors of the economy. We will therefore ask the new, independent Committee on Climate Change to look at the implications of

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<sup>204</sup> Environment, Food and Rural Affairs Committee, [Draft Climate Change Bill](#), Fifth Report, Session 2006-07, HC 534-I, 4 July 2007, para 128

<sup>205</sup> Environmental Audit Committee, [Beyond Stern: From the Climate Change Programme Review to the Draft Climate Change Bill](#), seventh report of session 2006-07, HC 460, 30 July 2007, para 96-97

<sup>206</sup> HM Government, [Taking Forward the UK Climate Change Bill: The Government Response to Pre-Legislative Scrutiny and Public Consultation](#), 29 October 2007 Cm 7225

including international aviation in the UK's targets, as part of its overall review of the 2050 target.

In addition, as noted above there is not yet international agreement on how to allocate international aviation emissions to individual countries. To include these emissions in the UK's targets, we would therefore need a workable methodology to calculate "the UK's share" of these emissions, and which took account of the international context. In addition, given that aviation emissions are likely to be included in the EU ETS soon, any methodology to include these emissions in the UK's targets would also need to be compatible with the way that emissions and credits are allocated under the EU ETS rules. Therefore, once the EU ETS rules have been finalised, we will ask the Committee for its advice on whether there is a methodology for including international aviation emissions which was workable and compatible with the EU ETS and takes account of progress in the UNFCCC and the wider international context, and on the impacts of adopting it.

To ensure transparency and in response to the recommendations of the parliamentary committees, we intend to place a requirement on the Secretary of State to report annually to Parliament on emissions from international aviation, in line with UNFCCC practice. In addition, revised aviation emissions forecasts will be published later this year, building on the Air Transport White Paper Progress report.<sup>207</sup>

## B. The Bill

On 14 November 2007 the *Climate Change Bill* (HL Bill 9 2007-08) was introduced in the House of Lords by Defra Minister, Lord Rooker. It sets a statutory target to ensure that "the net UK carbon account" for 2050 is at least 60% lower than the "1990 baseline", which is defined in clause 1, subsection (2) as the net amount of "targeted greenhouse gases" emitted in the UK in 1990.<sup>208</sup> As in the draft Bill, the Bill does not include aviation (or shipping) emissions in the targets at present, but clause 25 does allow for them to be included in the future:

### 25 Emissions from international aviation or international shipping

- (1) Emissions of greenhouse gases from international aviation or international shipping do not count as emissions from sources in the United Kingdom for the purposes of this Part, except as provided by regulations under this section.
- (2) The Secretary of State may by order define what is to be regarded for this purpose as international aviation or international shipping. Any such order is subject to negative resolution procedure.
- (3) The Secretary of State may make provision by regulations as to the circumstances in which, and the extent to which, emissions from international aviation or international shipping are to be regarded for the purposes of this Part as emissions from sources in the United Kingdom.
- (4) Such provision may be made only—
  - (a) in relation to emissions of a targeted greenhouse gas, and

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<sup>207</sup> HM Government, [Taking Forward the UK Climate Change Bill: The Government Response to Pre-Legislative Scrutiny and Public Consultation](#), 29 October 2007 Cm 7225 p17-18

<sup>208</sup> HL Bill 9 2007-08 Explanatory Notes

- (b) if it appears to the Secretary of State appropriate in consequence of or in connection with a change in European or international law or policy relating to emissions from international aviation or shipping.
- (5) Regulations under this section may make provision—
  - (a) as to the period or periods (whether past or future) in which emissions of the targeted greenhouse gas are to be taken into account as UK emissions of that gas, and
  - (b) as to the manner in which such emissions are to be taken into account in determining the 1990 baseline in relation to those periods.
- (6) They may, in particular—
  - (a) designate a different base year, or
  - (b) designate a number of base years, and provide for the emissions in that year, or the average amount of emissions in those years, to be taken into account as if part of the 1990 baseline.
- (7) Regulations under this section are subject to affirmative resolution procedure.<sup>209</sup>

Clause 2, sub-section 2(b)(ii) allows the Secretary of State to amend the 2050 target if emissions from international aviation or shipping are added to the target.

Alongside the Bill a Final Impact Assessment was published.<sup>210</sup> It examined the costs and benefits of bringing aviation and shipping emissions within the targets of the Bill. On the benefits side it states:

Including international aviation and shipping in the Bill's targets would ensure all 'UK' emissions are within the targets, thus providing greater environmental certainty over future 'UK' emissions. Not adjusting the target to reflect the inclusion of emissions from aviation and shipping would result in a higher overall level of emission reductions compared to reducing the target. However, because of the relative cost of reducing emissions in these sectors, not adjusting the target would require other sectors of the economy to undertake a greater level of emission reductions, with an associated increase in overall costs.<sup>211</sup>

On the costs side it states:

In order to include international aviation and shipping, one must first create a methodology to define the UK's share of these emissions along with the UK's share of emission credits purchased by these sectors. There is a risk that by unilaterally adopting a particular methodology, the UK could compromise negotiations on developing an internationally agreed methodology and delay international action on tackling these emissions.

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<sup>209</sup> HL Bill 9 2007-08 clause 25

<sup>210</sup> Department for Environment, Food and Rural Affairs, [Climate Change Bill Final Impact Assessment](#), November 2007

<sup>211</sup> Department for Environment, Food and Rural Affairs, [Climate Change Bill Final Impact Assessment](#), November 2007 para 3.2.37

It would be possible, when including international aviation and shipping emissions, to reduce the Bill targets proportionally, so as to avoid imposing any additional cost to the economy.

Alternatively, it would be possible to include these emissions and leave the Bill targets unchanged. On that basis, some analysis using the MARKAL-Macro model has been conducted to show the possible impacts of including international aviation emissions in a long-term emissions reduction target. These results suggest that the reduction in GDP related to a 60% reduction in greenhouse gases against a 2000 baseline (including those from aviation) are 50% higher in 2005, or around 1.2% in 2050, compared with 0.8% excluding aviation. Including aviation therefore has a similar economic cost in terms of GDP as setting a 70% reduction target excluding aviation.

It raised the concern that, given the international nature of aviation, savings made in UK emissions might “simply result in increases elsewhere.”<sup>212</sup> It also found that if aviation emissions were included in the target, other sectors would have to do even more to reduce their emissions in order to be able to meet it, given the “very limited abatement opportunities in the aviation sector, now and in the future.”<sup>213</sup> It examined the effect on other sectors of the economy in meeting the target:

Analysis by Department for Transport (DfT) suggests that against a 1990 baseline the emissions reductions required by other sectors of the economy would be between 69-76% if the 60% emissions target included aviation and shipping, assuming that current aviation and shipping forecasts are correct. This may overstate the required effort, as it assumes no additional abatement within the aviation and shipping sectors.

The terms of aviation's inclusion in the EU-ETS are still subject to negotiation, but the current proposal is that aviation would be included from 2011 and that aviation would only be allocated allowances equivalent to its emissions at average 2004-6 levels (216 million tonnes CO<sub>2</sub>), with any further emissions needing to be met through the purchase of emission reductions elsewhere within the EU-ETS. Thus, in the presence of aviation's inclusion in EU-ETS there will be no growth in net aviation emissions from 2004-6 onwards. On this basis, DfT analysis suggests the inclusion of international aviation emissions into the Bill's targets would require the rest of the sectors of the economy to reduce emissions by 64% in order to meet an overall reduction of 60%.<sup>214</sup>

It concluded:

The Bill retains the flexibility for inclusion of international aviation and shipping at a later stage. In reviewing whether to change the targets as a result - and if so, how to do so – the Government would need to take into account a range of

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<sup>212</sup> Department for Environment, Food and Rural Affairs, *Climate Change Bill Final Impact Assessment*, November 2007 para 3.2.42

<sup>213</sup> Department for Environment, Food and Rural Affairs, *Climate Change Bill Final Impact Assessment*, November 2007 para 3.2.41

<sup>214</sup> Department for Environment, Food and Rural Affairs, *Climate Change Bill Final Impact Assessment*, November 2007 para 3.2.38

factors, including advice from the Committee, the broader international context and the potential economic cost.<sup>215</sup>

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<sup>215</sup> Department for Environment, Food and Rural Affairs, *Climate Change Bill Final Impact Assessment*, November 2007 para 3.2.45