

Consultation on the emissions cost assessment

August 2007

An aviation emissions cost assessment: consultation

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Executive Summary

The Government is pursuing a sustainable approach to aviation policy - providing an outcome that balances economic, social and environmental considerations. A wide range of measures is being pursued to benefit national and regional economies, passengers, those living near airports and the global climate. These have been set out in *The Future of Air Transport White Paper* and the *Future of Air Transport Progress Report*.

It is essential that decisions - whether they are strategic Ministerial ones or day-to-day choices of individual passengers and businesses - are based on the best information available. We are becoming increasingly aware of the national and global challenge of climate change and its potential impacts on the economy and society.

The emissions cost assessment announced in the progress report will allow the social cost of aviation's climate change emissions to be considered against the extent to which the sector covers that cost. It will pull together data, knowledge and analysis in a new way, acting as a strategic assessment that will inform future decision making.

In order to take this forward, this consultation document sets out our proposals for collecting, assessing and reporting information which will ultimately provide Ministers with a robust, credible and transparent strategic assessment to inform future decision making. We propose that the assessment should be calculated for a given calendar year using the UK's annual Greenhouse Gas Inventory CO₂ emissions estimates for aviation (based on aircraft fuel uplifted), scientific estimates of the non-CO₂ climate change effects of aircraft, and Government guidance on the social cost of carbon; the resulting figures would then be compared with the total Air Passenger Duty and aviation gasoline duty receipts for that year.

We are particularly concerned to ensure that the emissions cost assessment is seen as a constructive tool which helps to take forward public debate on aviation issues in relation to climate change.

This is consistent with the report of Sir Nicholas Stern on the economics of climate change. That review highlighted that policy to reduce emissions should be based on three essential elements: carbon pricing, technology policy and the removal of barriers to behavioural change. The emissions cost assessment will draw regular attention to the extent to which prices in the aviation sector reflect the external climate change costs of air travel. And, by making the results available to open public scrutiny, it will help to ensure that lack of knowledge does not become a barrier to effective choices.

This consultation document also reflects the recommendations in the *Eddington Transport Study* (2006). Sir Rod Eddington advised that decisions should be based on the basis of an assessment of all costs and benefits including economic, environmental and social effects. The Government has made a commitment to ensure that the aviation sector covers its external climate change costs, and the emissions cost assessment provides a basis against which progress on this can be measured. The methodology for the assessment will be kept under review to ensure it is informed by the most up-to-date scientific evidence and policy.

We look forward to receiving consultees' responses to the specific questions on the emissions cost assessment so that we can set out a clear way forward to the regular reporting of this important information.

How to Respond

The consultation period began on 7 August 2007 and will run until 30 October 2007, please ensure that your response reaches us by this date. Further copies of this consultation document can be found at www.dft.gov.uk.

When responding please use the form at Annex C and state whether you are responding as an individual or representing the views of an organisation. If responding on behalf of a larger organisation please make it clear who the organisation represents, and where applicable, how the views of members were assembled.

Responses to this consultation document should be marked clearly "Emissions cost assessment" and sent by email to:

ECA.Consultation@dft.gsi.gov.uk

Or by post to:
Aviation Environment Division
Department for Transport
1/22 Great Minster House
76 Marsham Street
London SW1P 4DR

The email address above should also be used for general queries relating to this consultation. Please mark the subject field "Emissions cost assessment query".

Respondents in Scotland, Wales and Northern Ireland may wish to copy their responses to the relevant Devolved Administration.

For Scotland:
Martin.Ritchie@scotland.gsi.gov.uk

Or by post to:
Scottish Executive Aviation Branch
2G (North)
Victoria Quay
Edinburgh
EH6 6QQ

For Wales:
climate-change@wales.gsi.gov.uk

Or by post to:
Ruth Gow
Climate Change Team
1st Floor – CP2
Welsh Assembly Government
Cathays Park
Cardiff CF10 3NQ

For Northern Ireland:
Chris.McWilliams@doeni.gsi.gov.uk

Or by post to:
Christopher McWilliams
Environment Policy Division
Department of the Environment
River House
48 High Street
Belfast BT1 2AW

A list of organisations/stakeholders that we have sent this consultation to is included in Annex B. If you have any suggestions of others who may wish to be involved in the consultation process please let us know.

This consultation has been produced in accordance with the principles of the Government's "Code of Practice on Consultation" which are included at Annex A. An impact assessment has not been produced because there are no impacts and no additional requirements to produce new information.

A summary of responses to this consultation will be published on our website: www.dft.gov.uk after the consultation period has closed.

According to the requirements of the Freedom of Information Act (2000), all information contained in your response to this consultation may be subject to publication or disclosure. This may include personal information such as your name and address. If you want your response or your name and address to remain confidential, you should explain why confidentiality is necessary. Your request will be granted only if it is consistent with Freedom of Information obligations. An automatic confidentiality disclaimer generated by your e-mail system will not be regarded as binding on the Department.

In line with Government's policy of openness, at the end of the consultation period, copies of the responses we receive may be made publicly available through the main DfT Library telephone 020 7944 8090 or [@odpm.gsi.gov.uk](mailto:odpm.gsi.gov.uk). In Scotland, responses may be made publicly available through the Scottish Executive Library at Saughton House, Edinburgh EH11 3XD. For availability in Northern Ireland and Wales, please contact the relevant individuals at the addresses above. The information the responses contain may also be published in a summary of responses.

The library will supply copies of consultation responses to personal callers or in response to telephone or email requests (tel: 020 7944 8090, email: infopoint@odpm.gsi.gov.uk). Wherever possible, personal callers should give the library at least 24 hours' notice of their requirements. An administrative charge will be made to cover photocopying and postage costs.

The proposals

Climate change and the aviation sector

- 1.1 Throughout the last decade climate change has become an increasingly important issue; this Government believes that it is the greatest environmental challenge facing the world today. The UK has taken significant steps to meet this challenge, and has built on its experience of domestic policy to foster greater action at the international level – most notably with the progress on Kyoto Protocol commitments and the successful introduction of the EU Emissions Trading Scheme which draws many elements from our domestic emissions trading scheme.
- 1.2 The Government's strategy on the long term development of sustainable aviation was set out in *The Future of Air Transport White Paper*, published in December 2003¹. This strategy acknowledges the need to balance the economic and social benefits of air travel with its environmental impacts, in particular the growing contribution of aircraft emissions to climate change and the significant impacts that airports can have on those living nearby.
- 1.3 It was within a context of increasing demand for aviation that the Government rejected a 'predict and provide' approach and instead advocated making better use of existing capacity and supported targeted capacity increases. We recognised that there was a strong demand for air travel, but that this must be delivered in a way that manages aviation's environmental obligations. As a result, the White Paper committed the Government to ensuring that the price of air travel reflects its environmental and social costs. The White Paper Progress Report, published in December 2006², reaffirmed Government commitment to this comprehensive strategy which strikes a balance between our economic, social and environmental goals.
- 1.4 Since the Progress Report, the Government has published *Planning for a Sustainable Future*³, which proposes

¹ Available at <http://www.dft.gov.uk/about/strategy/whitepapers/air/thefutureofairtransportwhite5694>

² Available at <http://www.dft.gov.uk/about/strategy/whitepapers/air/aviationprogressreportsection/>

³ The planning white paper is available at <http://www.communities.gov.uk/index.asp?id=1510503>

introducing a new development consent regime for nationally significant infrastructure projects, including major airport projects. As a key part of this, it is envisaged that the Government would produce national policy statements which would provide the framework in which the proposed infrastructure planning commission would take decisions. Where relevant policy statements already exist, these might acquire the status of national policy statements for the purposes of decision making by the commission. However, in order for this to be possible, they would need to meet the core elements and standards for national policy statements with regard to both content and consultation, or need to be brought into conformity with them. We are considering the role *The Future of Air Transport* White Paper might play in the proposed new regime. The White Paper remains the government's strategy on the long term sustainable development of aviation.

- 1.5 Last year saw the publication of two important reports that have framed the debate on the long term strategy for managing the economic benefits and the environmental costs of aviation; the *Stern Review on the Economics of Climate Change*⁴ and the *Eddington Transport Study*⁵. The *Stern Review* stressed the need for an urgent and effective international response to the global problem of climate change. The Review considered the economic costs of the impacts of climate change, and the costs and benefits of action to reduce the emissions of greenhouse gases that cause it. Stern made a number of recommendations which fit within three overall approaches for tackling climate change: carbon pricing (for instance by taxes or trading); investing in new technology improvements; and removing barriers to, and encouraging, behavioural change.
- 1.6 While Stern examined climate change, Eddington looked at the long-term links between transport and the UK's economic productivity, growth and stability, setting these within the context of the Government's broader commitment to sustainable development. The Eddington report came to a similar conclusion that there is a strong economic and environmental case for ensuring transport users across all

⁴ Available at http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

⁵ Available at <http://www.dft.gov.uk/about/strategy/eddingtonstudy/>

modes face the true costs associated with their journeys (be they economic, social or environmental). The report said that in approaching a particular challenge or problem, full account of all costs and benefits - including environmental impacts - should be taken before the policies and interventions that offer the highest overall returns are pursued.

- 1.7 The Government has now responded to the *Stern Review* in the Budget 2007, setting out its framework for action, and will respond to the *Eddington Transport Study* in 2007.
- 1.8 The current position of the aviation sector raises many issues as it is a fast-growing industry with typically high abatement costs. Indeed, as Stern recognised, transport – and particularly aviation – is a sector with high abatement costs so it is only right that for economic efficiency to be achieved, those sectors with lower abatement costs should take the lead in abatement. However, the Government recognises that there is, of course, a case for taking action now with aviation, and hence it is committed to putting measures in place to ensure aviation covers its external climate change costs.
- 1.9 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 duty⁶, and there are no clear external cost signals being given through taxation. Nor is there currently a price signal through emissions trading.

⁶ In the case of aviation turbine fuel used by larger aircraft; as explained at paragraph 6.8, duty is charged on aviation gasoline.

- 1.10 It was in this context that we acknowledged in the Progress Report that major decisions on increases in aviation capacity needed to take account of climate change impacts as well as their effect on the local environment.
- 1.11 We therefore announced our intention to consult on a new emissions cost assessment to inform future decisions on major increases in aviation capacity. The cost assessment is intended to consider whether the aviation industry meets its climate change costs. This consultation paper sets out the Government's proposals for that emissions cost assessment and invites views.

Purpose of the emissions cost assessment

We propose that the emissions cost assessment should be:

- a strategic assessment covering the UK as a whole;
- used to enhance our contextual understanding of the climate change costs of aviation when considering major increases in aviation capacity; and
- carried out approximately every three years. We anticipate this will coincide with the regular review and report on progress in delivering the Future of Air Transport agenda.

We do not believe it should be carried out on an ad-hoc basis to inform the consideration by the planning system of individual airport development proposals.

2.1 The emissions cost assessment is intended to be a strategic assessment, looking across UK civil aviation and covering the UK as a whole. It will be carried out periodically, approximately every three years, so that its findings are available to inform the regular reviews of progress on The Future of Air Transport. The completion of such an assessment in a transparent and authoritative way will give Ministers a new tool to use in evaluating that progress and considering the way forward.

2.2 As the *Eddington Transport Study* notes, transport policy must respond to the challenge of climate change, for both environmental and economic reasons. Transport prices must fully reflect all externalities, be they environmental or economic, and transport planning must take account of these carbon costs. Eddington advocated considering a full range of policy options, and accounting for all social, environmental and economic costs and benefits, before choosing the highest return solution to a transport problem (for instance making better use of existing capacity or creating new capacity). The emissions cost assessment is not, nor is it intended to be, that full appraisal of proposals for new airport capacity.

- 2.3 We envisage the emissions cost assessment as a snapshot which shows the extent to which the costs of the climate change impacts of civil aviation within and from the UK are being met. This assessment would be retrospective and therefore be more robust than relying on forecasts or projections; over time, successive assessments would provide information on the longer term trend.
- 2.4 The assessment is not intended to be carried out in response to any specific proposals for development at an individual airport, and is not intended for use in the context of a planning inquiry. The data on which the assessment is based relates to the UK as a whole; we do not believe that attempting to break it down to the level of an individual airport would be proportionate, given that the assessment is not intended to be the sole determining factor in decisions on aviation capacity.
- 2.5 The emissions cost assessment will, however, enhance our contextual understanding of the climate change costs of aviation. It will ensure that the Government's strategic policy on aviation capacity is informed by that understanding of the climate change costs involved, along with other data and analysis.
- 2.6 It is crucial that the assessment is clear and transparent to all stakeholders. That is why we are consulting on our proposed methodology, and why we intend to base the assessment on data that is published and freely available in the public domain and relies on the most robust and up-to-date sources.

Defining the 'aviation sector' for the purposes of this assessment

3.1 The White Paper Progress Report announced that the emissions cost assessment would consider whether the 'aviation sector' was meeting its external climate change costs. We need to define what the 'aviation sector' covers for the purpose of this assessment.

Emissions from aircraft

3.2 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.

3.3 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.

3.4 The assessment will need UK-wide carbon emissions data which are reliable, trusted and robust. However, it is not really practical to undertake "real time" monitoring of aviation emissions in flight. It would also be an onerous and intrusive requirement to oblige aircraft operators to report fuel use data from every flight. As we intend the emissions cost assessment to relate to overall emissions from the sector rather than to individual operations, the need and requirements of the assessment would not justify such a burden.

- 3.5 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 CO₂ 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)⁷.
- 3.6 The GHGI takes account of the annual uplift (and by implication the consumption) in the UK of both aviation gasoline (used by smaller aircraft) and aviation turbine fuel (used by larger aircraft such as those used for commercial air services). It therefore includes both UK and non-UK registered aircraft operators fuelling aircraft in the UK.
- 3.7 The emissions attributed to domestic civil aviation are reported to the UNFCCC under the UK's Kyoto commitments. There is currently no requirement to report carbon emissions attributed to departing international civil flights, as there is no internationally agreed way of assigning emissions to countries. These flights are reported as a memo item and are therefore quantified, but they are not included in national totals.
- 3.8 We believe that the GHGI reported figures for CO₂ from domestic and departing international civil flights⁸ 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.

⁷ Links to these National Inventory Reports (which include an explanation of the methodology they use) can be found at <http://www.naei.org.uk/reports.php?list=GHG>

⁸ That is, the sum of domestic aviation emissions plus the memo item relating to international flights.

- 3.9 The 2005 inventory, published in January 2007, provides the most recent annual figures for carbon emissions from domestic and departing international aviation. This reported that in 2005 international aviation (that is, all departing flights from the UK) and domestic aviation accounted for 6.3% of the UK's total carbon emissions (or 10.2 million tonnes of carbon (MtC)).
- 3.10 As this estimate is based on uplift of fuel from UK bunkers, it will not fully capture the impact of long-haul flights from the UK with more than one leg, where further refuelling will be required. It would be possible to apply a further uprating factor to the estimate to recognise this. But it would be hard to do so accurately, and it is not clear that this would represent a material change. It is not our intention to cover such refuelling unless consultees provide clear evidence that it would have a significant effect on the overall outcome of an emissions cost assessment.
- 3.11 The proposed inclusion of aviation in the EU Emissions Trading Scheme (EU ETS) may be on the basis of all arriving and departing international flights. This position has been adopted on the grounds that operating the scheme on this basis would encourage other states to establish similar carbon trading arrangements. Our preference for the emissions cost assessment is to use the method adopted in the UK's emissions reports to the UNFCCC.

Question 1: Are the UK emissions inventory carbon figures from domestic and departing international flights a satisfactory indicator of the UK aviation carbon emissions?

Question 2: Do you believe an uprating factor should be applied to the estimated carbon emissions to account for long-haul UK departing flights with more than one leg? Please explain your answer.

Other potential sources of aviation emissions

- 3.12 We have also considered whether climate change emissions from sources other than aircraft (and the degree to which the costs of those emissions are covered) should be included in the emissions cost assessment as belonging to the 'aviation sector'. These might include:

- Emissions from ground handling vehicles at airports;
- Emissions caused by the energy requirements of airport buildings;
- Emissions caused by surface access to airports; and perhaps even
- Emissions caused by construction of aircraft and airport premises.

3.13 These options reflect the fact that there are a number of sources that are not directly connected to the providers of airline services but could be indirectly associated with the 'aviation sector'. Clearly, the wider the scope of this definition, the more complex the data gathering would become as we would not only need to collect emissions data but also make a judgement on the external costs paid by each sub sector.

3.14 It is important to consider consistency of approach and practicality. Our current reporting of aviation-related emissions data to the European Commission and the IPCC relates to aircraft alone. To extend this scope in the emissions cost assessment would create the potential for significant distortion. For example, it is not feasible to separate out emissions at airports directly attributable to the aviation sector and those related to wider economic activity, for example, the shopping that takes place in airports. There is no emissions cost assessment proposed for the retailing sector generally and no reason why this assessment should cover similar issues. It would also be unrealistic to provide accurate analyses of emissions from surface access to the airport and the extent to which these external costs were met. It would not be practical to identify emissions from all of these sources as directly attributable to aviation.

3.15 The GHGI does report carbon emissions from aircraft support vehicles (0.12 million tonnes of carbon in 2005). However, as these vehicles will be powered by a variety of fuels it is doubtful that we would be able accurately to assess the extent to which the sector meets the social cost of these emissions. We do not propose to include these emissions in the assessment; in forming this opinion we have taken

account of the moves by many larger airports to become carbon neutral in their operations.

- 3.16 The activities associated with aviation are in some cases already subject to separate regulation or taxation (such as fuel and vehicle excise duties for surface transport). For example, BAA is already a member of the EU Emissions Trading Scheme, due to the presence of power generation plant at three of its airports. The new Carbon Reduction Commitment, announced in the Energy White Paper⁹, will apply to the energy-use emissions of airline companies and airports as it will to other large public and private sector organisations such as hotel chains, supermarkets, banks, Government departments and local authorities.
- 3.17 We intend to cover only emissions from aircraft for the purposes of this assessment. However, in considering the findings of the emissions cost assessment, Ministers will be aware that it is a representation of the climate change impacts of aviation based on flights, that they will need to continue to take into account other contextual factors, and that future decisions on major increases in airport capacity have a bearing on emissions in other sectors such as road transport and industry.
- 3.18 This decision does not diminish in any way the importance of minimising emissions in all relevant areas. We welcome measures which airports and others are taking to reduce carbon emissions from their activities and to ensure surface access plans reflect sustainability principles. Moreover we expect planning consideration of any major new developments to consider emissions in the vicinity of the site as they would for any comparable development and to set the costs of these emissions against the benefits of the development in reaching a decision.

Question 3: Are you content that the UK emissions inventory figures for UK domestic and departing international flights provide a satisfactory indicator for total UK aviation sector activity?

⁹ *Meeting the Energy Challenge*, May 2007. Available at <http://www.dtistats.net/ewp/>

Climate change impacts of aviation

4.1 Aviation is different from many other sectors because its climate change impact is not caused solely by greenhouse gases such as carbon dioxide (CO₂). Other emissions arising from aircraft use that can influence climate change include:

- Water vapour from engine exhausts, which leads to the formation at altitude of contrails and cirrus clouds;
- Nitric oxide and nitrogen dioxide (or NO_x), which contributes to the formation of ozone that acts at low altitudes as a greenhouse gas;
- Particulates (soot, nitrate and sulphate particles), some of which reduce and some of which increase aviation's total climate impacts; and
- Other compounds including some hydrocarbons, carbon monoxide and radicals such as the hydroxyl radical, which affect the formation and removal of many of the above emissions.

Radiative forcing

The effects of emissions are usually calculated in terms of the climate metric 'radiative forcing'. Aviation was shown by the Intergovernmental Panel on Climate Change (IPCC) (1999)¹⁰ to have a total radiative forcing of 2.7 times that of its CO₂ radiative forcing¹¹ - the so-called Radiative Forcing Index, or RFI.

More recently, radiative forcing was evaluated by Sausen et al. (2005)¹²; the findings implied an RFI of 1.9, based upon better scientific understanding, which mostly reduced the contrail radiative forcing.

¹⁰ *Aviation and the Global Atmosphere* (1999) Available at [http://www.ipcc.ch/pub/av\(E\).pdf](http://www.ipcc.ch/pub/av(E).pdf)

¹¹ These findings (with a sensitivity range for RFI of 2 to 4) were based on a 1992 fleet and excluded any effect from enhanced cirrus cloudiness which was too uncertain to be given a 'best estimate'.

¹² These findings were based on a 2000 fleet. *Aviation radiative forcing in 2000: An update on IPCC* (1999) *Meteorologische Zeitschrift* 14: 555-561 - available at <http://www.ingentaconnect.com/content/schweiz/mz/2005/00000014/00000004/art00013>

- 4.2 Currently, there is no suitable climate metric to express the relationship between emissions and radiative effects from aviation in the same way that the global warming potential¹³ does but this is an active area of research. Nonetheless, it is clear that aviation imposes other effects on the climate which are greater than that implied from simply considering its CO₂ emissions alone.
- 4.3 The application of a ‘multiplier’ to take account of non-CO₂ effects is a possible way of illustratively taking account of the full climate impact of aviation. A multiplier is not a straight forward instrument. In particular it implies that other emissions are linked to production of CO₂, which is not the case. Nor does it reflect accurately the different relative contribution of emissions to climate change over time, or reflect the potential trade-offs between the warming and cooling effects of different emissions.
- 4.4 On the other hand, it would not be right to exclude consideration of the non-CO₂ climate change effects of aviation in the emissions cost assessment, and there is currently no better way of taking these effects into account.
- 4.5 In order to recognise the varying scientific views on radiative forcing and to demonstrate the potential magnitude of significance of these other effects, we propose to apply a range of multiplier values to the figure for carbon emitted, to give an indicative range.
- 4.6 Having reviewed the evidence base on this issue, we propose three different factors from different sources that could be used to illustratively account for radiative forcing:
- The lower bound factor of 1 implying that other, non-CO₂ effects are not accounted for;
 - A factor of 1.9, estimated by Sausen et al (2005) on the basis of their most recent modelling analysis; and
 - The upper bound factor of 4, reflecting the upper end of the range proposed by the IPCC (1999).

¹³ Each greenhouse gas has a different capacity to cause global warming, depending on its radiative properties, its molecular weight and its lifetime in the atmosphere. Its so-called global warming potential (GWP) encapsulates these. The GWP is defined as the warming influence over a set time period of a gas relative to that of carbon dioxide.

4.7 Although these factors were derived from different sources and on the basis of different modelling, we believe that for the purposes of illustration, they reflect the best available evidence.

Question 4: Do the proposed values for the factor for non-CO₂ effects provide a robust way forward, recognising there are uncertainties that must be taken into account?

Social cost of carbon

- 5.1 To place a monetary value on the climate change costs of aviation, the volume of emissions (that is, CO₂ emissions with a multiplier applied) should be multiplied by the social cost of carbon.
- 5.2 In January 2002, a Government Economic Service (GES) working paper '*Estimating the Social Cost of Carbon Emissions*¹⁴ was published as a joint Defra-Treasury publication. This suggested a global damage cost of £70/tC in the year 2000, in 2000 prices. This was accompanied by a sensitivity range of £35 to £140/tC to reflect the inherent uncertainties and risk profile associated with estimating global climate change damage costs. The value was to rise by £1/tC per year in real terms to reflect the increasing marginal cost of emissions over time as atmospheric concentrations increase.
- 5.3 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.
- 5.4 As the emissions cost assessment is aggregate and strategic, it is not considering any specific equity or distributional impacts associated with climate change.

Question 5: Do the proposed values for the social cost of carbon provide a robust way forward, recognising there are uncertainties that must be taken into account?

¹⁴ Available at <http://www.hm-treasury.gov.uk/media/209/60/SCC.pdf>

How aviation is meeting its climate change costs

- 6.1 As Stern pointed out, greenhouse gases are an externality; those who produce greenhouse gas do not face the full consequences of the costs of their actions themselves. He therefore recommended that policy to reduce emissions needed to include carbon pricing. Putting an appropriate price on carbon, through taxes, trading or regulation, means that people are faced with the full social cost of their actions. In the case of aviation, this means reflecting climate change costs in the price of air travel. If this is not done, prices will be too low and hence demand for a good or service too high to achieve a long term sustainable outcome.
- 6.2 A range of mechanisms exist for ensuring that prices reflect these external costs. Targeted taxes and charges can be set at a level which means the price paid by consumers fully accounts for the external costs. Or, a trading scheme could be introduced where an emissions cap is set on the level of emissions or pollution and allowances are allocated equal to the level of the cap. Participants in the market buy and sell carbon allowances depending on the abatement costs they face. The price per allowance is determined by the market.
- 6.3 Of course, this is not the only way that behaviour can account for the climate change costs of undertaking a particular activity. By offsetting emissions (that is, reducing emissions from another area of activity) overall levels of emissions can, in aggregate, be reduced¹⁵.
- 6.4 Aviation businesses pay a range of taxes and charges. However, most of these (such as corporation tax, national insurance and the climate change levy) also apply to other UK businesses and cannot be said to have any special application to aviation. Unlike many other areas of the economy, however, VAT is not charged on air passenger tickets (or other forms of public transport in the UK).
- 6.5 Air Passenger Duty (APD) is levied, on a per flight basis, on the carriage of air passengers from UK airports. The rates vary according to whether or not the final destination is in

¹⁵ For more detail on how this approach might be applied to aviation, see the March 2003 joint paper by HM Treasury and the Department for Transport, *Aviation and the Environment: Using Economic Instruments*, available from http://www.hm-treasury.gov.uk/media/8C8/60/Aviation_Environment.pdf.

designated areas of Europe, and whether travel is in the lowest class or other classes on a particular flight. The tax is paid by the aircraft operators to HM Revenue and Customs on the basis of how many chargeable passengers flew in the previous calendar month, and are paid alongside other taxes into the Consolidated Fund.

- 6.6 APD does not cover cargo flights or general aviation¹⁶, as aircraft that do not carry fare-paying passengers, that have a maximum take-off weight of less than ten tonnes, or have fewer than twenty passenger seats are exempt. Similarly, transit and transfer passengers and those departing some airports in the Scottish Highlands and Islands are exempt.
- 6.7 In common with other taxes, APD revenue is not hypothecated towards any particular spending commitment but provides resources for the Government's priorities, including public transport and the environment. Nevertheless, because this tax is directly related to the activity that creates the emissions - passenger air travel - it can be interpreted as having a role to play in covering climate change costs and can also reduce the climate change impact of air travel through demand reduction. APD also plays a valuable role in ensuring that passengers understand and acknowledge the environmental costs of their actions. APD is of course not a perfect instrument for doing this because it does not correlate exactly with the climate change impacts of flying.
- 6.8 The aviation turbine fuel that commercial aircraft use is exempt from duty. This exemption stems from International Civil Aviation Organisation (ICAO) policy; the UK Government's position that this is anomalous has been formally recognised but the great majority of ICAO's member states still oppose any change to the exemption. However, aviation gasoline (AVGAS), which smaller (often non-commercial) aircraft use, is subject to fuel duty, currently charged at 28.84 pence per litre. We therefore propose to include this fuel duty revenue as a further proxy for the aviation sector's payment towards the social cost of its climate change impacts.

¹⁶ General aviation is defined as civil aviation operations other than scheduled air services and air transport operations for remuneration or hire. It therefore covers private flying and training, amongst other activities.

Question 6: Should APD and duty collected on AVGAS be treated as contributing to the climate change costs of aviation?

Offsetting

6.9 The practice of carbon offsetting – buying emission reduction credits (or carbon credits) generated by projects that have reduced carbon emissions – is permitted under the Kyoto Protocol as a way for member states to meet their emissions reduction commitments¹⁷. Since April 2006, all central Government ministerial and official air travel has been offset by purchasing credits. Offsetting is also growing in popularity with individuals who choose to offset the emissions caused by their air travel. We do not propose to take individuals' offsetting decisions into account in the emissions cost assessment, as this is an additional payment made by the air traveller rather than the industry which is not possible to monitor. However, were a part of the airline industry covered by the emissions cost assessment to take its own systematic action to offset its carbon emissions, purchasing approved credits, we would in future consider the case for adjusting the assessment accordingly.

Emissions trading

6.10 In *The Future of Air Transport* the Government announced its support for emissions trading as the best way of ensuring that aviation contributes towards the goal of climate stabilisation. We have been pursuing emissions trading through the International Civil Aviation Organisation (ICAO), but until a truly global solution can be found, the existing EU Emissions Trading Scheme (EU ETS) represents the best multilateral option available.

6.11 In December 2006 the European Commission published a draft legislative proposal to include aviation in the EU ETS. The UK remains committed to ensuring aviation is included in the scheme as soon as possible. The key elements of the scheme currently under consideration are the scope, the date of introduction, the emissions cap, the method for allocating initial free allowances and the detail of how auctioning allowances will work. Negotiations on the design of the scheme began in early 2007 and are going well.

¹⁷ More information is available on the UN's website at http://unfccc.int/kyoto_protocol/mechanisms/items/1673.php.

- 6.12 Airlines will have to think about developing strategies for managing their carbon emissions. This could involve investment in new technologies and operational improvements and/or the purchase of carbon allowances from other sectors to cover any deficit in allowances. Clearly entry of aviation into the EU ETS will affect the extent to which the aviation sector is paying its external costs.
- 6.13 The financial implications of emissions trading on airlines are difficult to assess at this stage given the current round of negotiations on the free allowance allocation methodology, the levels of auctioning and the overall emissions cap for the sector.
- 6.14 Once the design details of the scheme have been determined, further work can be initiated on how airlines' costs relating to emissions trading (such as the need to purchase allowances to cover emissions) might be included in the emissions cost assessment. This may need to take account of the difference between the market price of carbon in an emissions trading scheme and its estimated social cost, and also the issue of the extent to which airlines have incurred cost in order to obtain carbon allowances.

Question 7: Are there any other actions, in addition to offsetting and emissions trading, taken by the aviation industry which you would regard as relevant to the emissions cost assessment?

Local environmental effects

- 6.15 Air travel also has local environmental effects which impose social costs, in particular noise and local air quality effects. These will not form part of the cost basis for the emissions cost assessment, which is concerned with climate change. However, these local environmental impacts are another important consideration that will be taken into account by Ministers when they take strategic decisions on future increases in aviation capacity. They will also be relevant factors in the consideration by the planning system of any specific development proposals brought forward by airport operators.

- 6.16 As the Department commented in *Valuing the external costs of aviation*¹⁸, although there have been previous attempts to place a monetary value on the social costs of aircraft noise using a hedonic pricing approach, these estimates are subject to significant margins of error¹⁹. There is also a wide range of uncertainty concerning the quantification of the effects of poor air quality and the values that might be given to them.
- 6.17 We have considered whether it would be appropriate to take other environmental effects into consideration for the purposes of the emissions cost assessment and to balance them against the revenues from APD and AVGAS duty receipts (that is, to consider such revenues as ‘covering’ the costs of other environmental effects too). However, given the emissions cost assessment relates specifically to climate change – a global problem – whereas other environmental effects are by their very nature highly location and time specific, it is not considered that this would be justifiable.

¹⁸ *Valuing the external costs of aviation*, DfT, December 2003. Available at <http://www.dft.gov.uk/pgr/aviation/airports/valuingtheexternalcostsofavi2843>.

¹⁹ The Attitudes to Noise from Aviation Sources in England (ANASE) study being carried out for the Department has developed a stated preference methodology for valuing attitudes to aircraft noise and applied it. However, the final report will not be issued until later this year and any consequent policy changes will need to be considered carefully.

Time period covered by the assessment

- 7.1 As noted above at paragraph 2.3, we envisage the emissions cost assessment as a snapshot, covering a single year. We are clear that the information used to calculate it must relate to a consistent calendar year (the basis on which carbon emissions data is collected). Information on carbon emissions is typically collected with a short time lag (eg information on carbon emissions for 2005 was published in January 2007), but other information may be collected more quickly.
- 7.2 This means that the emissions cost assessment will be carried out using the most recent published - and therefore verified - data, which is one to two years old. There may have been changes in the meantime (for instance, in the rate at which APD is payable) which we would need to account for when preparing a meaningful analysis. However, this appears to be the only credible way in which to use the data. Contextual information about any such changes since the period covered by the emissions cost assessment will be available to Ministers alongside the assessment itself.
- 7.3 Because there are already uncertainties and assumptions involved in the values for carbon emitted, radiative forcing and cost of carbon, we do not feel that it would be appropriate to make an emissions cost assessment on the basis of projected figures. Whilst emissions forecasts are available²⁰, it is not possible to make long-range predictions regarding the incidence of economic instruments such as APD, fuel duty or emissions trading. We would not therefore have a clear and authoritative basis on which to assess the extent to which climate change costs from aviation might be covered in the future. Of course, over time as successive emissions cost assessments are made it will be possible to see any trends. This and the availability of emissions forecasts will help to place the findings of an individual emissions cost assessment in context.

Question 8: Should the emissions cost assessment be based on the most recent calendar year for which a full and consistent data set is available?

²⁰ See *Aviation and Global Warming*, DfT, 2004. Available at <http://www.dft.gov.uk/about/strategy/whitepapers/air/docs/aviationandglobalwarmingreport>

Proposed methodology: example assessment

8.1 To summarise, our proposed methodology for the emissions cost assessment is:

- to take the most recent available Greenhouse Gas Inventory estimates of UK carbon emissions from domestic and departing international flights;
- to apply a multiplier value of 1.9, with sensitivity range values of 1 and 4; then
- multiply this by the appropriate monetary value for the social cost of carbon, using a sensitivity range; and
- to compare this range of values with the Air Passenger Duty and aviation gasoline duty receipts for the year concerned.

8.2 Using the data for 2005, the most recent year for which the emissions estimates are currently available, this would result in the following assessment:

Figure 1: Summary of results

Scenario	Climate change costs in 2005 (£bn)	Actual 2005		Illustrative 2005 if APD rates had been doubled	
		APD and AVGAS duty revenues in 2005 (£bn)	Net coverage of climate change costs (£bn) ¹	AVGAS duty and APD revenues in 2005 (£bn) - APD doubled	Net coverage of climate change costs (£bn) ^{1, 2}
Central case: RFI = 1.9; carbon cost £84/tC	1.6	0.9	(0.7)	1.8	0.2
Scenario 2: RFI = 1; carbon cost £84/tC	0.9	0.9	0.04	1.8	0.9
Scenario 3: RFI = 4; carbon cost £84/tC	3.4	0.9	(2.5)	1.8	(1.6)
Scenario 4: RFI = 1.9; carbon cost £163/tC	3.2	0.9	(2.3)	1.8	(1.4)
Scenario 5: RFI = 1.9; carbon cost £45/tC	0.9	0.9	(0.03)	1.8	0.9

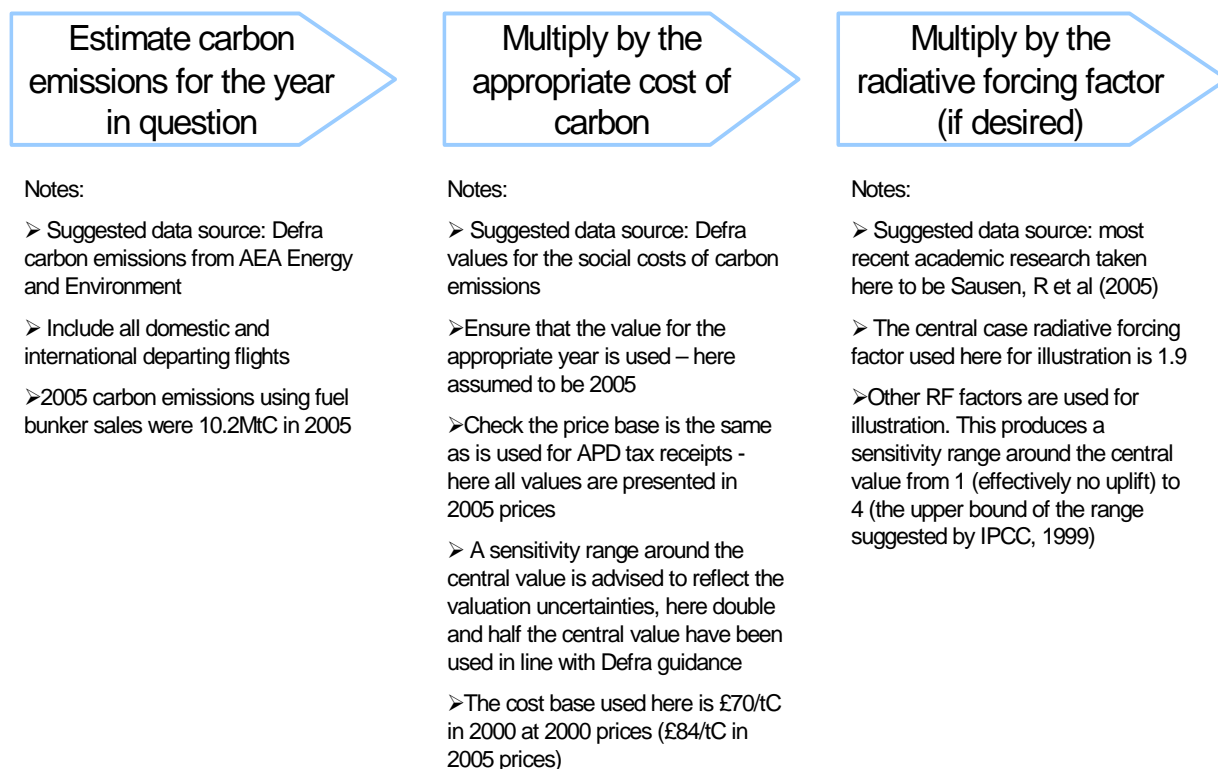
1: Black: climate change costs are more than covered; in brackets and red: extent to which costs are not covered

2: This assumes that APD revenues are doubled because rates have doubled as from February 2007.

8.3 Figure 1 shows that:

- Under the central case, the aviation sector's climate change (carbon) costs in 2005 were around £1.6 billion;
- Under the central case, in 2005, some £0.7 billion of the climate change costs were left uncovered;
- APD rates were doubled in February 2007. If rates had been doubled in 2005 then, assuming no demand impact and hence revenues doubled, under the central case the climate change costs for 2005 would have been broadly covered;
- With a higher carbon cost and/or higher radiative forcing factor, a significant proportion of the climate change costs - in the region of £1.5 to £2.5 billion - remain uncovered, even if APD revenues had doubled in 2005;
- With a lower radiative forcing factor and/or a low cost of carbon, the costs are broadly covered with current revenues and if APD revenues were doubled, the costs would have been covered with an excess of some £0.9 billion

Figure 2: Methodology, data and assumptions for estimating the climate change impacts of aviation to compare against APD revenues



- 8.4 There are, of course, limitations to the analysis:
- This has been carried out for one year only so can only give a snapshot picture. Earlier or later years may provide different conclusions;
 - The APD comparisons do not give a fully accurate picture of the revenues because the rates changed in February 2007, which has only been illustratively accounted for above by doubling revenues; and
 - The social cost of carbon emissions is subject to uncertainty and the results change significantly when the upper and lower bounds of the sensitivity range are used.

Sources of data for the emissions cost assessment

9.1 We need to ensure that the data used to carry out the emissions cost assessment is robust, consistent and reliable. The sources we intend to use are set out below:

Information needed	Purpose	Sources
UK carbon emissions	To demonstrate carbon emitted from all departing flights in the UK	UK Greenhouse Gas Inventory
Radiative forcing multiplier	To take account of non-CO ₂ climate change effects	IPCC and European Commission scientific research
Social cost of carbon	To value the marginal damage cost from one tonne of carbon emitted	Government guidance
Aviation sector contribution to its external climate change costs	To assess how much the aviation sector is currently paying towards its climate change costs	APD receipts (HM Revenue and Customs) Aviation gasoline duty receipts (HM Revenue and Customs) Data on carbon offsetting by aircraft operators* Data on payments made by airlines through the EU Emissions Trading Scheme *

*data that may be required in future depending on how policy and practice develops

Question 9: Are there any other data sources you believe might be relevant to carrying out an emissions cost assessment?

Carrying out the assessment

- 10.1 The emissions cost assessment methodology proposed here involves the collection of data (currently all produced by Government) and the performance of a relatively simple calculation. As such, it does not seem to us to be a sufficiently intensive or challenging task to require a specific body to be established to carry it out.
- 10.2 As the information is produced by Government and the methodology used in the assessment will be transparent, one option is for it to be carried out by the Department for Transport's own analysts. Alternatively, it might be possible for another Government-sponsored body such as the Office of Climate Change to produce the emissions cost assessment one step removed from the Department and its policymakers.

Question 10: Should the assessment be carried out by the Department, or by another Government body?

Question 11: Do you agree that the assessment should be based on Government data, such as the social cost of carbon, radiative forcing factor and emissions data, in order to ensure consistency and credibility going forward?

Future developments

- 11.1 The methodology for the emissions cost assessment will need to be kept under review to ensure it is informed by the most up-to-date scientific evidence and policy. Recent scientific advice on the appropriate value for the RFI for example, has been taken into account; future changes in scientific understanding and Government policy will of course need to be incorporated over time. For instance, as the EU Emissions Trading Scheme develops into a market for the trade of carbon allowances, and aviation is included in that market, airlines will begin to pay towards their climate change costs through that means as well. We would then need to ensure that the price of the aviation industry's carbon allowances was accounted for in assessing whether their external climate change costs were being covered. In doing so, we would need to adjust for differences between the market's carbon allowance price and the Government's estimated social cost of carbon.
- 11.2 Any future changes to the methodology will of course be consulted on before they are made.

Question 12: Should the methodology be kept under review to take account of developments in the evidence base and policy?

Consultation Questions

Question 1: Are the UK emissions inventory carbon figures from domestic and departing international flights a satisfactory indicator of the UK aviation carbon emissions?

Question 2: Do you believe an uprating factor should be applied to the estimated carbon emissions to account for long-haul UK departing flights with more than one leg? Please explain your answer.

Question 3: Are you content that the UK emissions inventory figures for UK domestic and departing international flights provide a satisfactory indicator for total UK aviation sector activity?

Question 4: Do the proposed values for the factor for non-CO₂ effects provide a robust way forward, recognising there are uncertainties that must be taken into account?

Question 5: Do the proposed values for the social cost of carbon provide a robust way forward, recognising there are uncertainties that must be taken into account?

Question 6: Should APD and duty collected on AVGAS be treated as contributing to the climate change costs of aviation?

Question 7: Are there any other actions, in addition to offsetting and emissions trading, taken by the aviation industry which you would regard as relevant to the emissions cost assessment?

Question 8: Should the emissions cost assessment be based on the most recent calendar year for which a full and consistent data set is available?

Question 9: Are there any other data sources you believe might be relevant to carrying out an emissions cost assessment?

Question 10: Should the assessment be carried out by the Department, or by another Government body?

Question 11: Do you agree that the assessment should be based on Government data, such as the social cost of carbon, radiative forcing factor and emissions data, in order to ensure consistency and credibility going forward?

Question 12: Should the methodology be kept under review to take account of developments in the evidence base and policy?

Annex A: Code of Consultation

The code of practice applies to all UK public consultations by government departments and agencies, including consultations on EU directives.

Though the code does not have legal force, and cannot prevail over statutory or other mandatory external requirements (e.g. under European Community Law), it should otherwise generally be regarded as binding unless Ministers conclude that exceptional circumstances require a departure.

The code contains six criteria. They should be reproduced in all consultation documents. There should be an explanation of any departure from the criteria and confirmation that they have otherwise been followed.

Consultation criteria

1. Consult widely throughout the process, allowing a minimum of 12 weeks for written consultation at least once during the development of the policy.
2. Be clear about what your proposals are, who may be affected, what questions are being asked and the time-scale for responses.
3. Ensure that your consultation is clear, concise and widely accessible.
4. Give feedback regarding the responses received and how the consultation process influenced the policy.
5. Monitor your department's effectiveness at consultation, including through the use of a designated consultation co-ordinator.
6. Ensure your consultation follows better regulation best practice, including carrying out a Regulatory Impact Assessment if appropriate.

A full version of the code of practice is available on the Cabinet Office website at:

<http://www.cabinet-office.gov.uk/regulation/consultation/code.asp>

If you consider that this consultation does not comply with the criteria or have comments about the consultation process please contact:

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Consultation Co-ordinator
Department for Transport
Zone 4/13 Great Minster House
76 Marsham Street
London, SW1P 4DR

email: Consultation@dft.gsi.gov.uk

Annex B: List of stakeholders

Aberdeen Airport
Airbus
Airport Operators Association
Altnagalvin Health and Social Services Trust
Antrim Borough Council
Ards Borough Council
Armagh City & District Council
Association of Colleges Northern Ireland
Association of International Couriers & Express Services (AICES)
Aviation Environmental Federation
BAA
BAA Scotland
Ballymena Borough Council
Ballymoney Borough Council
Banbridge District Council
Bar-UK
BBGA
Belfast City Airport
Belfast City Council
Belfast Education & Library Board
BHPB
BMI
BP
Britannia
British Air Transport Association (BATA)
British Airways
British International Freight Association
Business in the Community Northern Ireland
Carbon Capture and Storage Association
Carbon Registry Services
Carbon Trust NI
Carrickfergus Borough Council
Castlereagh Borough Council
Causeway H&SS Trust
CBI
CBI NI
Charter Airline Group
Chief Executive of each Scottish Local Authority
Civil Aviation Authority (CAA)
Climate Change Group
Coleraine Borough Council
Confederation of British Industry Construction & Advisory Division
Cookstown District Council
Craigavon Borough Council
CSMA
Dale Farm Ltd
Department for Employment & Learning (DEL)
Department for Regional Development (DRD)
Department for Social Development (DSD)
Department of Agriculture & Rural Development (DARD)
Department of Culture, Arts & Leisure (DCAL)
Department of Education (DE)
Department of Enterprise Trade & Investment (DETI)
Department of Finance & Personnel
Department of Health, Social Services & Public Safety (DHSSPS)
Department of Regional Development (DRD)
Department of the Environment (DOE)
Dept of Finance & Personnel
Derry City Council
Diageo
Down District Council
DRD (NI) Water Service
DRD Roads Service
DRD Water Service
Dungannon & South Tyrone Borough Council
Eastern Airways
Easyjet
Edinburgh Airport
AEF
ELFAA
Emissions Trading Group
Environment Agency
ETG Aviation Subgroup
European Express Association
Fed Ex Europe
Fermanagh District Council
First Choice
First Scotrail

Flybe
 Friends of the Earth
 Friends of the Earth Scotland
 Glasgow Airport
 Glasgow Prestwick International
 Airport
 Green Alliance
 Greenpeace
 Greenpeace Scotland
 Highland Airways
 Highlands and Islands Airports Ltd
 Highlands and Islands Transport
 Partnership
 Hughes Energy Systems Ltd
 Institute for European
 Environmental Policy
 Institute for Public Policy Research
 Invest Northern Ireland
 Jurysdoyle Hotel Group
 Larne Borough Council
 Less carbon Ltd
 Limavady Borough Council
 Lisburn City Council
 Logan Air
 Luton Airport
 M&E Consulting
 Magherafelt District Council
 Manchester Airport
 Monarch
 Moy Park Ltd
 Moyle District Council
 My Travel
 Nera/AEAT/SPRU
 Newry & Mourne District Council
 Newtownabbey Borough Council
 NI Energy Agency
 NI Environment Link
 Noribic
 North Down Borough Council
 North East of Scotland Transport
 Partnership
 Northern Ireland Executive
 Northern Ireland Local Government
 Association
 Office of the First Minister & Deputy
 First Minister (OFMDFM)
 Omagh District Council
 Over-all Building Systems
 Point Carbon
 Prospect
 Queens University
 Rolls-Royce
 Royal Aeronautical Society
 RSPB
 SASIG
 Scot Airways
 Scottish Council for Development
 and Industry
 Scottish Environment Link
 Scottish Executive
 SERA
 Shell
 Shetland Transport Partnership
 Siemens
 Society of British Aerospace
 Companies Ltd
 South East of Scotland Transport
 Partnership
 South Eastern Education & Library
 Board
 South West of Scotland Transport
 Partnership
 Southern Education & Library
 Board
 STC Carbon Services
 Strabane District Council
 Strathclyde Partnership for
 Transport
 Sustainability Alliance
 Sustainable Development
 Commission
 Sustrans Scotland
 Tayside and Central Scotland
 Transport Partnership
 TCI Renewables
 TGWU
 The Carbon Trust
 The Climate Group
 Thomas Cook
 TIE Ltd
 TRANSform Scotland
 Translink
 Transport 2000
 Transport Scotland
 TUC
 TUSDAC
 Tyndall Centre
 Ulster Supported Employment Ltd
 UMIST
 University of Ulster
 Uttlesford District Council
 UTV
 Virgin
 Welsh Assembly

Welsh Transport Research Centre
White Young Green

World Development Movement
WWF