Growth scenarios for EU and UK aviation

Contradictions with climate policy

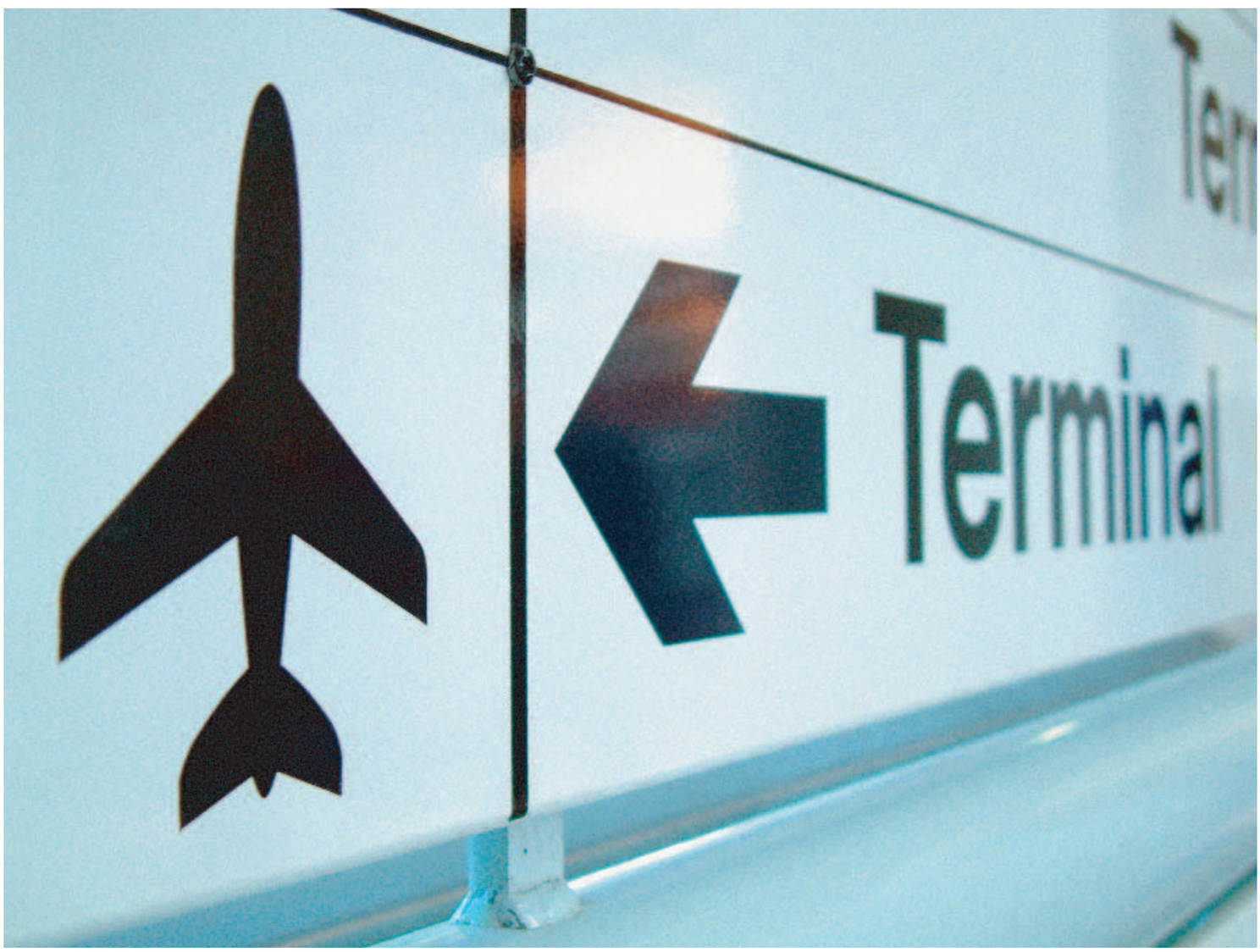


Image Source

Summary of research by the Tyndall Centre for Climate Change Research for Friends of the Earth Trust

Friends of the Earth

Tyndall Centre for Climate Change Research

Introduction

Climate change is the most pressing environmental issue facing humanity. Tony Blair recently described it as "a challenge so far reaching in its impact and irreversible in its destructive power, that it alters radically human existence".

There is compelling evidence that climate change is happening, but we can still avoid its worst impacts if Governments and citizens take action to cut emissions of carbon dioxide (CO_2) and other greenhouse gases.

Aviation is a rapidly growing industry and the fastest growing source of climate changing emissions. This means that tackling emissions from aviation is essential if we are to bring climate change under control. However, the Kyoto Protocol does not include emissions from international aviation.

The UK Government in its 2003 Air Transport White Paper *The Future of Air Transport* chose to promote long-term growth in air travel. The White Paper also made bringing intra-EU aviation into the existing EU emissions trading scheme (ETS) its key policy to reduce climate emissions from the sector. This is one option that the EU is considering, but it is also discussing taxes and emissions charges. The Commission is due to communicate its views on the policy options in the summer of 2005.

Executive summary

Friends of the Earth Trust is working to define a sustainable aviation industry, particularly in regard to its climate impacts. As part of this work Friends of the Earth commissioned the Tyndall Centre, the UK's leading climate change research body, to report on its examination of the implications of aviation growth for policies designed to tackle climate change. Tyndall also looked at the implications of this growth for other sectors of the UK economy and for the EU emissions trading system (ETS).

Tyndall investigated aviation growth trends and calculated that emissions from the sector will rise rapidly between now and 2050, assuming these trends continue. It took account of the way in which air transport markets mature and assumed that significant improvements in fuel efficiencies will be achieved. Tyndall assumed that each country takes responsibility for 50 per cent of the emissions from international flights to and from its airports. Tyndall then compared this emissions growth with the declining profiles of total emissions under a contraction and convergence climate policy – a policy increasingly being recommended for avoiding the worst impacts of climate change.

Tyndall concluded that if aviation growth continues, it could take up the entire emissions space for all sectors of the EU economy by 2040, and similarly for the UK by 2037, based on an atmospheric stabilisation target of 450 parts per million by volume (ppmv). Moreover, between 2010 and 2020, UK and EU aviation emissions could already be equivalent to their respective 2050 targets at the expense of other sectors.

Tyndall states: this report demonstrates severe consequences for both the UK and the EU in terms of meeting their obligations to reduce carbon dioxide emissions under a contraction and convergence regime, if European governments continue to permit, or indeed promote, historically high levels of aviation growth.

Friends of the Earth concludes that forecast aviation growth will make it virtually impossible for the Government to meet its 60 per cent CO_2 reduction target. Therefore, the Government must withdraw its aviation White Paper and introduce the economic measures and sector targets to achieve stabilisation of CO_2 at 450ppmv by 2050.

Outline

Growth trends

Since 1960 global air passenger traffic, measured in passenger kilometres, has increased by nearly 9 per cent per year, reducing to 5 per cent per year in 1997. The Intergovernmental Panel on Climate Change (IPCC) has predicted that this rate of growth will continue for at least the next 10 to 15 years. In the UK, air passenger growth averaged 6.4 per cent a year between 1993 and 2001.

For the purposes of this study Tyndall assumed this rate of growth for the period 2002 to 2015, with a reduced rate of 3.3 per cent per year for 2016 to 2050. The same growth assumptions were made for the other countries that were members of the EU before 2004 (known as the EU15). The countries that joined the EU in 2004 have younger aviation industries that are growing faster and were therefore assumed to grow at current rates until 2025.

Contraction and Convergence and carbon concentration targets

Contraction and Convergence (C&C) is increasingly seen as the only substantive policy route for bringing carbon emissions from all countries to an equal level per capita, within a timeframe that avoids dangerous climate change. C&C would require industrialised nations to make substantial cuts in their emissions, while permitting some industrialising countries to increase theirs within the equal level per capita objective. C&C has been supported explicitly by the Royal Commission on Environmental Pollution (RCEP) and implicitly by the UK Government in its 2003 Energy White Paper.

The UK Government is committed to reducing UK carbon emissions to 60 per cent below 1990 levels by 2050. This would help stabilise CO_2 concentrations at 550 parts per million by volume (ppmv). However, recent research increasingly indicates that stabilisation at 550ppmv will not be enough to avoid the worst effects of climate change, and that concentrations will have to be reduced to 450ppmv.

DEFRA has recently acknowledged that current science suggests this and would require emissions to be cut to approximately 80 per cent below 1990 levels by 2050. In 1996 the European Council made a commitment to a maximum temperature rise of 2°C average global warming; this would require similar cuts in carbon emissions. Carbon dioxide concentrations in the atmosphere are currently 378ppmv. The report assesses the impact of aviation expansion against both the 550ppmv and 450ppmv targets.

The Government's 60 per cent target does not include emissions from international aviation: for future targets to be meaningful, these emissions must be included. Friends of the Earth believes that the contraction and convergence model underestimates the reductions required in developed countries because it fails to account for historic emissions.

Radiative forcing

Because they are emitted at altitude, aircraft emissions have a greater relative climate impact than surface emissions. The index "radiative forcing" is used by the IPCC to compare the impacts of different emissions. As well as emitting CO_2, aircraft emit nitrogen oxides, water vapour and particles which form contrails and probably increase cirrus cloud formation, both of which contribute to climate change. To assess the total climate impact of aviation, aircraft CO_2 emissions are typically "uplifted" to account for this additional impact.

The science surrounding this is complex and subject to some uncertainty, meaning that there is no exact uplift factor. Nevertheless, the IPCC estimated an impact in the range of two to four times that of CO_2 alone, with an average uplift factor of 2.7. The UK Government uses a figure of 2.5, but recent research indicates that the figure could be as high as 4.0. The report presents three scenarios: no uplift, and uplift factors of 2.7 and 3.5.

The potential for technology to reduce aircraft emissions

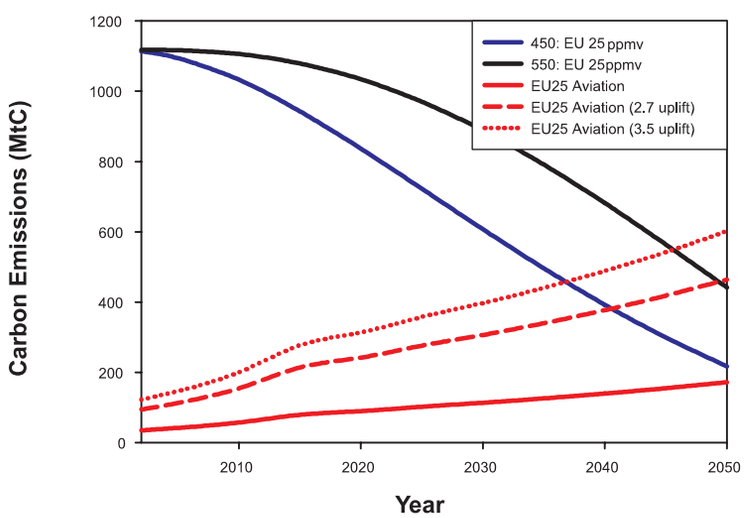
In the past 40 years more efficient airframes, larger aircraft and improved engine technology have improved aircraft fuel efficiency and therefore reduced emissions by 70 percent per passenger kilometre. Tyndall accepted research by the RCEP, based on work by the IPCC, regarding the future potential for technology to further reduce aircraft emissions. The RCEP concluded that the environmental benefits of hydrogen-powered aircraft are uncertain and that although more efficient blended wing-body designs have much potential, they are unlikely to have a significant impact on aircraft fleets before 2050.

With no step-change in technology on the horizon Tyndall has used the IPCC estimate of future efficiency improvements to the global fleet of 1.2 per cent per year. This could be achieved through improvements to engine design, air traffic control, aircraft design and size. Tyndall did not explicitly explore the possibility of lowering the altitude of flights to avoid contrails and cirrus formation, and thus reduce the radiative forcing uplift factor. Research suggests that this is worth further investigation; in any case Tyndall has modelled scenarios with no uplift.

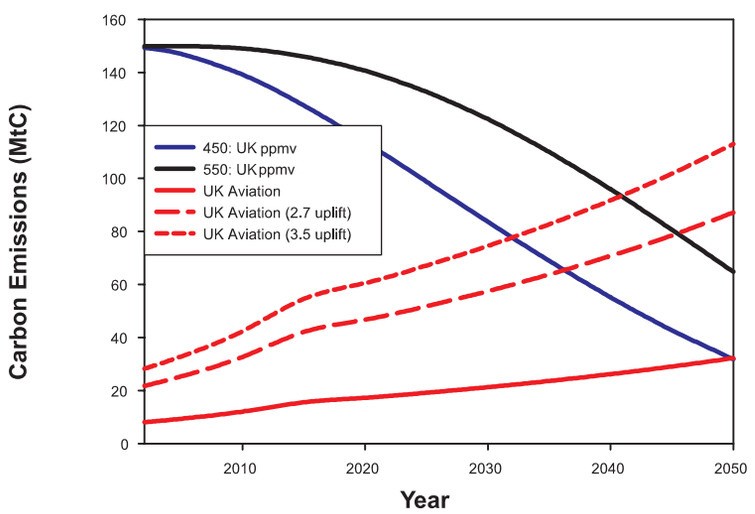
Findings

The Tyndall findings are dramatic and have huge implications for aviation and climate policy, both in the UK and the EU. These are summarised in the graphs below.

Contraction and Convergence Profile for EU25 Compared with Aviation Forecasts



Contraction and Convergence Profile for the UK with Aviation Forecasts



The graphs plot:

- the contraction profile of overall carbon emissions necessary to stabilise carbon concentrations at both 450ppmv and 550ppmv; and
- the projected increase in aviation emissions using the three radiative forcing scenarios outlined above.

The points at which the emissions lines and contraction profiles intersect indicate the date from which aviation alone consumes the entire carbon emissions budget for all sectors under a C&C policy. This implies that from this date, all other sectors of the economy would be required to totally eliminate their CO_2 emissions to accommodate aviation growth. The graphs and tables show that, assuming the radiative forcing uplift factor is 2.7 and the target is to stabilise emissions at 450ppmv, then:

- in the UK aviation could be responsible for the entire overall carbon emissions budget by 2037; and
- in the EU as a whole, this could occur by around 2040.

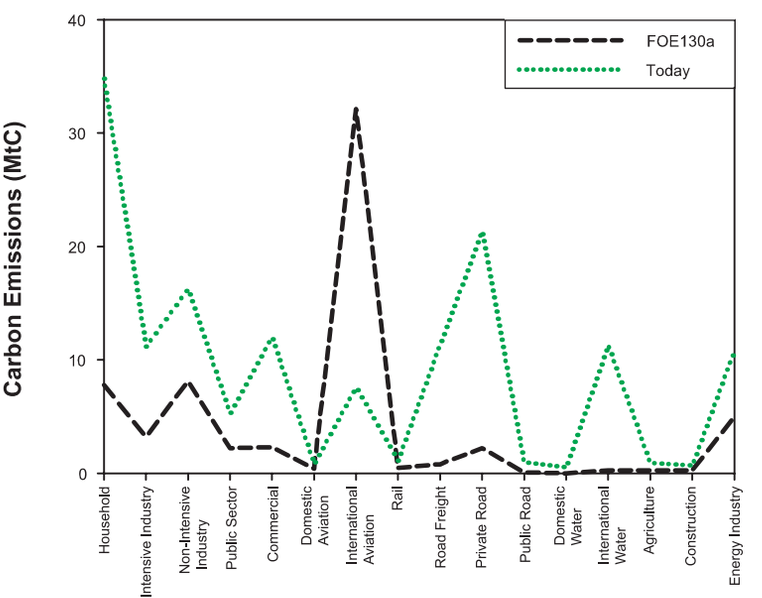
The graphs show that between 2010 and 2020, UK and EU aviation emissions are already equivalent to the 2050 targets for the UK and EU as a whole. From this period onwards other sectors will need to reduce their emissions to compensate, with their emissions falling to zero by 2037 and 2040 respectively.

Implications for other sectors

Tyndall went on to examine the possible implications of aviation growth for other sectors of the UK economy. It examined four possible scenarios of economic growth and energy use, each representing different ways in which other aggregated sectors could fit around 2050 aviation emissions.

The scenarios show that with a 550ppmv target, even under the most conservative economic growth assumptions, accommodating aviation growth would require drastic emissions cuts from other sectors. These calculations do not factor in any uplift to account for radiative forcing, and the level of assumed aviation emissions is less than the Government's forecast for uplifted UK aviation emissions in 2030. With a 450ppmv carbon concentration target, Tyndall concluded that every UK sector except aviation would have to reduce its carbon emissions to zero before 2050.

2050 Carbon Emissions Comparison for 550ppmv "Conservative" UK Energy Consumption Scenario: FOE 130a



FOE 130a scenario assumes annual economic growth of 1.6 per annum and primary energy consumption of 130 million tonnes of oil equivalent (Mtoe) compared to 170Mtoe today

Friends of the Earth's conclusions and policy demands

By permitting aviation growth according to its forecasts, the Government will find it extremely demanding, and politically inconceivable, to achieve its own 60 per cent CO_2 reduction target.

If a safer 450ppmv CO_2 concentration target were adopted, projected aviation growth would make it impossible to meet the target, even if other sectors eliminated their carbon emissions – which is completely unrealistic.

There is no technological fix on the horizon for the aviation industry that would deliver the emissions reductions necessary by 2050. The only solution is to reduce the growth in flights.

Decision makers in both the UK and the EU have a stark choice – manage the demand for aviation or face the consequences for their policies to tackle climate change.

Including aviation in the existing EU emissions trading scheme is unlikely to effectively constrain emissions.

In the absence of low-cost abatement options to reduce emissions from air travel, the aviation sector will need to purchase credits to accomodate projected growth. This means that there will be enormous political pressure to provide generous allocations to the aviation sector. This pressure will be generated by both the aviation industry and the industries already in the scheme who will worry about the effect of increased demand on allowance prices. Generous allocation would undermine the effectiveness of trading in internalising the cost of emissions from the sector and potentially also further undermine the environmental integrity of the existing sheme.

In theory a dedicated aviation-only or transport-only Emissions Trading Scheme (ETS) with a stringent cap on emissions designed to achieve C&C targets could bring emissions from the sector down in line with a C&C policy. The price of carbon permits would become very expensive but other sectors more vulnerable to external competition would be protected, and the aviation industry would have to take responsibility for its own emissions reductions instead of passing responsibility to other sectors. A dedicated ETS would need a restricted gateway from the main ETS so that aviation met its own sector reduction target rather than solely through purchase of credits from other sectors.

ICAO (International Civil Aviation Organisation) has dismissed the option of a closed ETS (aviation-only) so this is not being considered by the EU. However, a dedicated ETS with a gateway is being considered by the EU.

It is therefore clear that bringing aviation into the existing EU ETS will be insufficient: additional fiscal measures to restrain demand will also be necessary.

If an emissions trading scheme for aviation is introduced it must be mandatory, closed, include a cap set at an earlier level than historic emissions, use auctioning as an allocation methodology and account for radiative forcing uplift.

An emissions charge could be introduced as a alternative to a dedicated ETS, but also as an addition to ETS, should a kerosene tax not be possible.

Aviation growth must be constrained with economic measures

One of the main reasons for aviation's enormous growth is the falling cost of flights facilitated by special tax exemptions that were set up in the 1940s to protect a vulnerable fledgling industry. Friends of the Earth believes that a rapidly growing UK industry does not justify this special treatment. The UK Government's own air passenger demand computer model shows how removing the VAT, duty free and fuel tax exemptions would keep prices roughly constant instead of allowing them to fall. It would also massively reduce the growth in flights and thereby cut the sector's projected emissions. Removing these exemptions would bring aviation into parity with other sectors – particularly important if it is to be accepted by them into the existing EU ETS.

The UK Government must:

- increase Air Passenger Duty year on year as a proxy until other measures can be introduced
- press for an EU emissions charge
- lift domestic VAT and kerosene tax exemptions and press for EU/international action on these as well.

The UK Government must withdraw the Air Transport White Paper (ATWP)

The Tyndall report shows that it is clear that the level of aviation growth proposed and supported by the Government in the 2003 ATWP is incompatible with its commitments to tackle climate change. Friends of the Earth believes that the ATWP should therefore be withdrawn. A new White Paper must include emissions targets (and derived numbers of flights/passengers) for aviation that reflect its responsibility to play its part in reducing total emissions from all sectors such that a 450ppmv carbon dioxide concentration can be achieved. A new White Paper should also rule out new runways – unnecessary if growth restraint measures compatible with meeting climate targets are introduced.

The UK Government and the EU must set absolute carbon-reduction targets for all sectors including aviation

A radical shift in both UK and EU policy is required if emissions are to be brought under control. Key to this are targets for emissions reductions overall and for individual sectors. The policy measures necessary to achieve the emissions targets should also be identified. These should not be restricted to the measures that the industry regards as acceptable.

About this summary

This is a summary of research carried out by the Tyndall Centre for Climate Change Research on behalf of Friends of the Earth Trust. The full report can be downloaded at www.foe.co.uk/resource/reports/aviation_tyndall_research.pdf

A briefing by Friends of the Earth, *Aviation and the economy*, can be downloaded at: www.foe.co.uk/resource/briefings/aviation and the economy.pdf

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