INSTITUTE OF DIRECTORS

A Competitive Response to Climate Change

IoD POLICY PAPER

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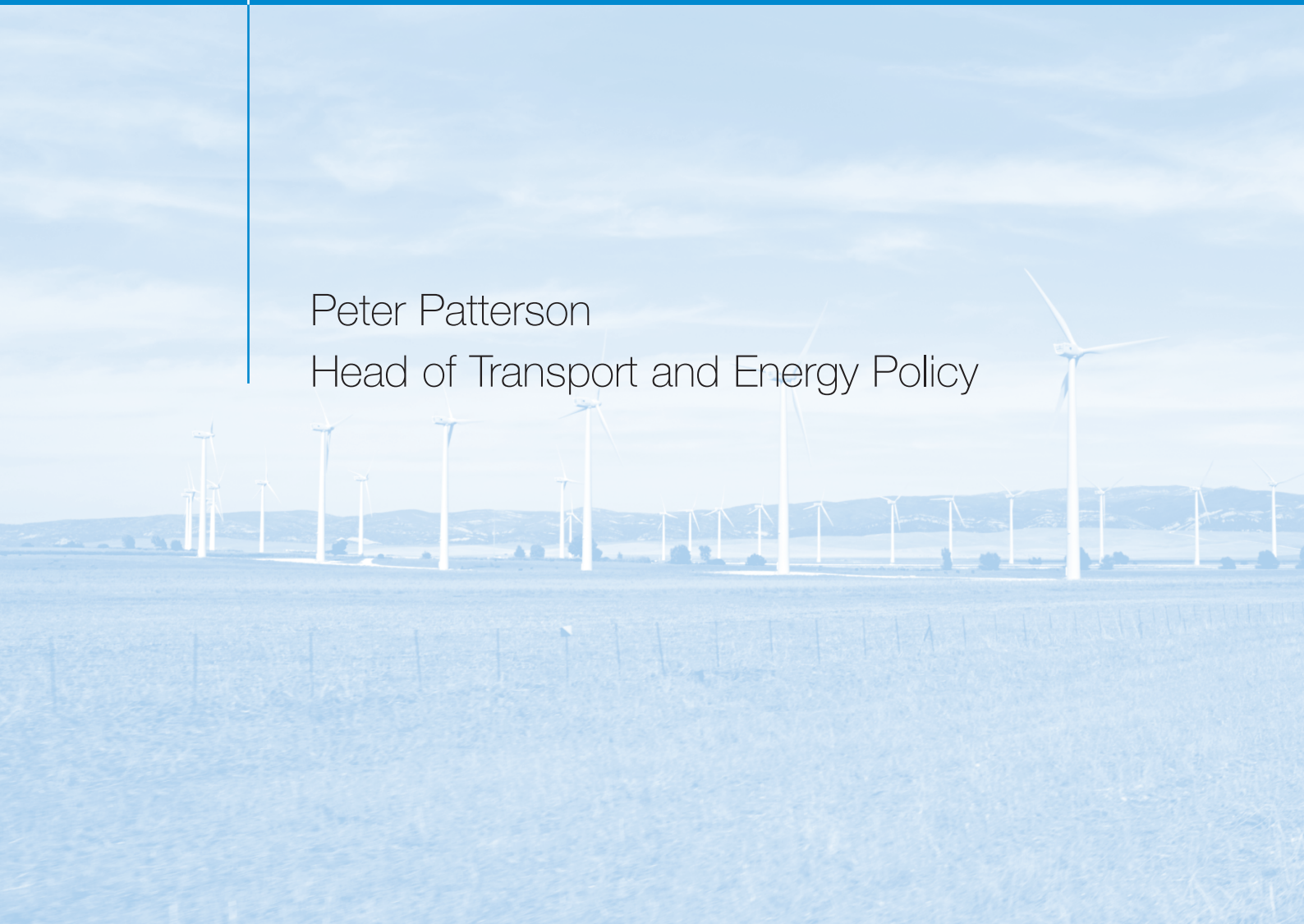

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ISBN 978 1904520 596

Published by the Institute of Directors
116 Pall Mall, London SW1Y 5ED

COPIES AVAILABLE FROM:

Book Sales
Membership Department
Institute of Directors
123 Pall Mall
London
SW1Y 5ED

Tel: 020 7766 8866
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Web: www.iod.com/policy

Price: £20.00 where sold

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1: Summary and introduction

This paper has been written to place the Institute of Directors (IoD) at the heart of the debate on how we should respond to the challenge of climate change. This is a subject where views are passionately held. The climate change debate can all too easily run out of control, with rational analysis of the optimal policy stance crowded out by emotion. All too often, green is portrayed as good regardless of cost, and environmental benefits are prayed in aid of support for pet projects of generally questionable worth.

Policy to tackle global warming must therefore be developed within an intelligent and coherent framework, including analysis of the full range of costs and benefits. This paper is a contribution to the discussion of how best to establish such a framework. It considers the route to effective policy design, and discusses the relative merits of a range of policy instruments that are available to tackle global warming.

We do not wish to play down the practical difficulties of implementing the policies discussed here. Rather we hope to indicate the broad direction in which we think policy should be heading. The sooner that consensus can be reached on this, the sooner we can devote energy to solving the detailed problems of implementation.

The main conclusions of this paper are:

- Establishing good environmental credentials should not be at the expense of damage to the United Kingdom's (UK) economic competitiveness. The worst way to reduce carbon emissions is to cut jobs in the UK, and send emissions abroad, often to locations that are less environmentally sensitive. It would be foolish to decimate parts of British industry in the pursuit of cuts in UK emissions that are a fraction of the annual growth of emissions in China.
- However, the desire for an international approach should not be allowed to block all progress on tackling climate change, and a modest measure of unilateralism in UK environmental policy should be possible without serious detriment to competitiveness. Moderate negative competitiveness effects can be alleviated at an aggregate level, for instance by recycling revenues raised from environmental policies or through offsetting reductions in other taxes – although there may still be an adverse impact for individual sectors or firms.
- Based on a rating against a number of criteria for optimal environmental policy, the "best" policy is one based on improving energy efficiency. This is a 'no-brainer' – it saves money, and therefore improves competitiveness, as well as saving the climate. And everyone can do their bit if they make just modest changes in their behaviour.
- Beyond this, a simple and comprehensive, economy-wide application of economic instruments scores well against our criteria. On a basis that is fiscally neutral for business as a whole, the establishment of a long term price for carbon emissions using either carbon taxation or a cap-and-trade scheme meets most of the desired objectives of an environmental policy regime and offers an effective, efficient and fair means of dealing with climate change.

- Both carbon taxes and cap-and-trade schemes have their pros and cons. For practical reasons associated with the credibility and experience already invested in them, we are inclined to favour emissions trading schemes as the best way forward. However, the optimal climate change policy is potentially a hybrid instrument that captures the best of both approaches.

- A policy regime that is applied consistently across all parts of the economy is preferable to a piecemeal approach. If such an over-arching policy framework were established, the risk of policy overkill is high if other well-intentioned but economically damaging climate change initiatives are also adopted. Climate change goals should not be an additional hoop through which policy formation and investment decisions – in both public and private sectors – must jump. This would amount to regulation by the back door and could have seriously harmful economic effects.

1.1 Summary of key points

Chapter 3 – The UK's record on environmental policy

- The UK has for some time been a leading proponent of the use of taxation as an instrument of environmental policy. Starting from such a position, climate change policy should consider carefully the potential impact on competitiveness of unilateral increases in the level of environmental taxes.

- However, the UK's position as a champion of environmental taxation has been significantly eroded since 1999 as the share of national income going to such taxes has fallen, principally because of successive freezes in the rates of fuel duties.

- The UK still has an above average level of environmental taxation compared with other developed economies. However, this partly reflects the impact of the low-tax economies of the United States (US) and Canada, and the other European Union (EU) economies are now not far below the UK.

- In contrast to its high road fuel duties, which are the highest in the EU, the UK imposes relatively low tax rates on consumption of electricity and gas, especially on household energy usage.

Chapter 4 – Selection of policy instrument

- Policies that seek to reduce the level of pollution per unit of output are less costly in economic terms than those that reduce emissions by cutting back on the level of economic activity itself.

- The use of economic instruments is desirable in dealing with environmental problems as they allow substantial changes in individuals' and firms' behaviour to be achieved at the minimum economic cost.

- Environmental policies should be assessed strictly according to their environmental benefits. Any revenues raised by environmental policies should not be a prime consideration in justifying the imposition of taxes or charges that are not worthwhile in environmental terms. Higher environmental taxes without compensating reductions in taxation elsewhere could damage competitiveness just as much as higher taxes in any other field.

- Both price-based and quantity-based economic instruments have their merits, according to whether society prefers to take greatest risks with environmental quality or with the costs of environmental policy. On balance economists tend to favour the use of price as an efficient and flexible instrument for encouraging good environmental behaviour. This points to instruments such as a carbon levy, a tax per unit of carbon emissions, applied on a global scale if possible.

- We should not be too dogmatic about the choice between carbon taxation and cap-and-trade schemes. Either offers a satisfactory basis for a successful environmental policy – especially if applied consistently across all sectors and on a broad geographical scale. However the EU emissions trading market already exists and we may not wish to sacrifice the hard won buy-in that quantity schemes have already secured. For these practical reasons we are inclined to fabour emissions trading as the best way forward.

- In practice, hybrid instruments – a tailored combination of price and quantity instruments, such as a trading scheme with a price ceiling or floor – may achieve a more efficient outcome than either taxes or trading systems can do alone.

- Environmental taxes should be revenue-neutral, fairly spread between businesses and consumers, simple and transparent in operation, and proportionate to the environmental problem being addressed.

- Policy makers should not over-egg the pudding. If a sensible policy regime – of carbon taxation or emissions trading – is in place, additional policy action on the environment should be unnecessary, and could be counter-productive.

Chapter 5 – Lessons from the EU's emissions trading scheme

- Operation of the EU's emissions trading scheme (ETS) has been flawed during its first phase, and sensible reforms are likely to be proposed for future phases. But it is unclear whether these will resolve the fundamental tensions at the heart of the ETS.

- The number of permits in phases 1 and 2 has principally been determined in a bottom-up manner by aggregating individual national allocation plans, with little role for a top-down scientific assessment of the appropriate level of emissions.

- The price of carbon has been volatile, and is sensitive to the cap on the overall number of permits. Reforms to the ETS must seek to promote greater stability in the price of carbon emissions.

- The absence of Kyoto-style emissions targets for years beyond 2012 means that the ETS cannot yet send long term price signals about the price of carbon emissions. This does not give investors the confidence they need to develop new low carbon technologies.

- The European Commission's proposed reforms – to be published later in 2007 – should improve its operation. But they need to be implemented as soon as possible in order to aid our understanding of the role that the ETS can play as a tool of climate change policy.

- There is a conflict between the role of the ETS as a driver of environmental improvement and that of stimulating investment in new technology. As currently set up, the ETS depends on a scarcity of permits to drive their price – the more successful it is at reducing emissions, the closer the price of permits falls towards zero, weakening the incentives for the development of new low carbon technologies.

Chapter 6 – What to look for in the policy response to climate change

- Recognition of the risks arising from climate change raises a new – and potentially potent – threat to economic prosperity from the adoption of poor policy responses. Environmental issues should not be an excuse for greater intervention in the economy, through either additional regulation or higher taxes.
- In seeking to encourage rational debate of the appropriate framework for climate change policies, the IoD has developed some *optimal policy rules* to allow climate change policies to be assessed against a number of desirable characteristics:
  - Efficient – seeking to achieve the maximum environmental benefit at the minimum economic cost;
  - Low running costs – modest administrative costs;
  - Well-targeted – focused on the specific cause for concern;
  - Neutral – minimising the distortions to rational economic decision-making;
  - Internationally competitive – as geographically broadly-based as possible;
  - Credible and consistent – sending consistent signals over the long term;
  - Technology-friendly – encouraging of the development of new technology;
  - Flexible – able to respond readily to changes in circumstances.
- A cautious approach to climate change policy is warranted by the uncertainties surrounding both the science and the economics of global warming.
- The IoD has fundamental concerns about the wisdom of adopting legally binding long-term emissions reduction targets over a period as long as 50 years, as proposed in the 2007 draft Climate Change Bill – formal target setting has a poor track record, and events will probably prove the targets inappropriate, to the detriment of their credibility.
- Climate change is a global problem and ideally requires a global solution. However, international deals take a long time to come to fruition. Even Kyoto has had a modest impact, in part because huge emitters such as China and India are excluded. It makes no sense to decimate parts of British industry when the resulting cuts in emissions are dwarfed by the growth in China's.
- However the desire for an international approach should not be allowed to block all progress on tackling climate change. Moderately detrimental competitiveness effects can be alleviated, for instance by recycling revenues raised from environmental policies or through offsetting reductions in other taxes.

- International climate change deals are difficult and slow to reach, and a more flexible approach may be beneficial, based on loosely harmonised national policies that are acceptable to each individual country. Such action may not be co-ordinated, although there may be benefits from a degree of harmonisation.

Chapter 7 – How do recent policy proposals shape up?

- An internal IoD assessment has assessed a wide range of environmental policies against its *optimal policy rules*.
- Unsurprisingly the 'no brainer' of improving energy efficiency comes top of the poll. The use of hybrid economic instruments – that take the best features of both price-based and quantity-based instruments – is also rated highly. A broad-based carbon levy comes out well, as do road fuel duties and moves to cut energy subsidies. However the EU's emissions trading scheme scores slightly lower, in part because of the administrative burden imposed by its operation.
- At the other end of the scale, some of the poorest policies are those which target specific sectors, either for support (renewable energy sources) or discouragement (air travel).

Chapter 8 – Should aviation be treated as a special case?

- Air travel has been singled out for stigmatisation by environmental campaigners. And yet aviation generates enormous economic benefits, which on most estimates are much larger than its environmental costs. Air travel should therefore be treated like any other environmentally-damaging activity and pay its environmental costs in full.
- An international solution is required to deal with air transport's environmental impact because it is an international activity. It is also a highly competitive industry, and unilateral action to restrict growth in UK air travel could have enormous domestic costs, but little impact on global emissions as the main impact would be to cause flights and passengers to be diverted to other locations.
- The EU's emissions trading scheme is probably the best way of ensuring that the carbon emissions from air travel are 'paid for' in the medium term. Contrary to common perception, this would not be an easy option for airlines who could end up paying significant sums of money for permits to pollute. However reforms to the ETS will be necessary to accommodate the presence of the airline industry and to mitigate the potential impact on other sectors of the economy.

1.2 Introduction

Global warming is now widely – though not universally – accepted as an established fact of life, as is (to a lesser extent) the hypothesis that it is caused, at least in part, by human activities. As a result, environmental concerns have climbed to the top of the political – and therefore the business – agenda, both in the UK and abroad.

However beyond broad agreement on the need to address climate change, the degree of consensus falls away as one looks more deeply into the matter.

There is a greater divergence of views about what climate change means for different regions of the world – about the impact in each region of given levels of greenhouse gas emissions on temperature and rainfall, and the repercussions of consequential developments such as rising sea levels.

Not surprisingly, estimates range widely of the economic costs imposed by different combinations of temperature rise and carbon concentrations in the atmosphere.

More importantly, there are different views about how best to respond – how much to rely on adapting behaviour, what role technology can play in devising more energy efficient ways of doing business, the extent of the need for mitigation through reducing the consumption of environmentally harmful activities, and the relative costs and benefits of different policy approaches.

The IoD is not in a position to comment authoritatively on scientific aspects of global warming. We must therefore rely for guidance on the views of the scientific community as a whole, and trust that the results of genuine scientific research are not hi-jacked to further the misleading claims of parties who wish to pre-judge the outcome to fit with their own prejudices.

In any event the views of businesses about the existence or otherwise of anthropomorphic (i.e. human-induced) climate change are to a significant degree immaterial. What matters to them is the reality that the policy regime has shifted sharply in the direction of tackling climate change by curbing the growth of greenhouse gas emissions. Businesses must live with that whether they agree with it or not. Their chief concern is therefore that the resulting policy framework is intelligently designed to achieve the optimum trade-off between environmental benefit and economic cost.

1.2.1 Policy response to climate change

There can be very little certainty about either the science or the economics of climate change, and there are therefore real and major differences in view about the causes and the precise impact of global warming. Despite this, the climate change debate has become highly polarised, with much of the public comment dominated by two highly vocal groups.

On the one hand there are those that support sweeping changes to lifestyles, brought about by dramatic limitations on the consumption of environmentally harmful activities or swingeing increases in their cost. The environmental lobby, their agenda reinforced by the strong recommendations contained in the Stern report, have succeeded in creating a substantial political climate change bandwagon during 2007, and governments and political parties in the UK and many parts of Europe have enthusiastically jumped aboard.

On the other hand, there has also been a strong pushback from those who feel that environmental campaigners have been too ready to accept stringent environmental policies uncritically. The most vocal members of this group argue that the case for global warming is unproven, and that there is no justification for government intervention at all. Away from this extreme, a number of scientists believe that the current state of climate change knowledge is too fragile to support the strident political posturing that has sometimes been based on it.

The IoD accepts the view that there is a climate change problem to be addressed, and that rising carbon emissions as a result of human activity have probably played some part in causing global warming. It also acknowledges that there may be significant asymmetries in the risks posed by different climate developments. If the potential damage from too high a level of carbon emissions is large relative to the costs of reducing emissions, then some precautionary action is likely to be beneficial.

But recognition of the risks from climate change raises a new – and potentially just as potent – threat to economic prosperity from the adoption of poor policy responses. In recent months, politicians and think tanks of all persuasions have produced a plethora of papers setting out ideas for tackling climate change. There will no doubt be many more in the months and years ahead. Many will wish to demonstrate their positive environmental credentials by seizing on new ideas, good or bad, regardless of the costs involved. A competitive process of policy design, where each group seeks to outbid its predecessors in producing ever more radical ideas to make stringent cuts in emissions, could be a serious threat to the economic prosperity of the country.

This report has therefore been written to place the IoD at the heart of the debate about how we as a nation – businesses, individuals and government – respond to the threat posed by climate change. Without being unduly prescriptive, it suggests some general guidelines for intelligent policy design, with the aim of being effective in reducing the environmental threat from global warming while inflicting the minimum damage on our economic well-being.

2: Background

2.1 Key climate change reports

A large number of reports and articles have contributed to an active and highly charged debate on climate change issues. Among them, a few stand out for their influential nature, in part reflecting the eminence of their authorship.

A United Nations (UN) body -the Intergovernmental Panel on Climate Change (IPCC) – has produced regular assessments of the science of global warming, its potential impact, and the costs of mitigation. It was established in 1988, and comprises the work of hundreds of environmental experts who assess published research on climate change. The latest set of reports – the Fourth Assessment Report – is in the process of publication this year (2007), with the final summary report due in November, in time for the UN climate talks in Bali, Indonesia, the following month.

The IPCC's Fourth Assessment Report concludes that it is "very likely" that human activities are causing global warming, leading to a probable rise in temperature of between 1.8°C and 4°C by 2100, and higher sea levels by 30-40 cm. Billions of people worldwide stand to be affected by hazards such as food and water shortages, or greater risk of flooding, with poorer people likely to be worst hit. If temperatures rise by 1.5 – 2.5°C, the IPCC estimates that 20-30% of plant and animal species could be at risk of extinction.

However, the IPCC believes that through a range of actions, including the use of low carbon energy sources such as renewables, improving energy efficiency, and reducing deforestation, it should be possible to curb the growth in greenhouse gas emissions at reasonable cost. Keeping greenhouse gas concentrations in the earth's atmosphere to levels of 445-535 ppm CO_2e (CO_2 equivalent) – compared with current levels of 425 ppm – might cost up to 3% of global GDP by 2030.

The IPCC's assessment reports are influential because they are the work of a large number of respected environmental experts. However as the climate change debate has gathered momentum, the IPCC has also attracted controversy. Some critics argue that its reports are sensationalist, trying to convey an element of certainty where none exists. On the other hand there are those who complain that the content is too conservative because it has been watered down by UN member governments.

In 2006, the UK government published the Stern Review, a highly influential and detailed report on the economics of climate change.[1] This concluded that, by taking strong action now, the worst impacts of climate change could be avoided. With immediate action, the review produced a central estimate of the costs of stabilising the concentration of greenhouse gas emissions in the earth's atmosphere at 450-550 ppm CO_2e of around 1% of global GDP. Failure to act would cause damage costing at least 5% of global GDP a year forever. Taking a broad range of risks and impacts into account, the cost of the damage could rise to 20% of GDP or more.

The Stern Review's conclusions have received widespread endorsement as a global call to action. However, there has also been a significant degree of criticism of both the scientific underpinnings of the report and the economic analysis behind its conclusions. On the economics, concern has focussed particularly on key assumptions, such as the choice of a low discount rate, the scope for adaptation, especially through the development of new technology, and the social cost of carbon emissions. Stern's results – if not his conclusions – are highly sensitive to some of these assumptions. According to critics, the effect is to exaggerate the potential costs of global warming, while understating the costs of taking early mitigating action. This has cast doubt on Stern's assertion that its conclusions represent central estimates of the relative costs and benefits of climate change action, when much of the analysis is predicated on assumptions that look like outliers to many commentators.

However the Stern team have robustly defended their conclusions, dismissing many of the criticisms as "simply wrong". They argue that their findings do not depend on any single modelling approach or assumption. They also justify the adoption of a low discount rate on largely ethical grounds – the interests of future generations should not be ignored, which would be the practical consequence of using higher discount rates over the long time horizons that are relevant for the impact of global warming.

We share many of the detailed concerns expressed in critiques of Stern's economic analysis. However while Stern may appear to overstate the case for action, few would suggest that this invalidates the overall conclusion that it is worthwhile and important that governments make a prompt and appropriate policy response to global warming.

2.2 Policy developments to date

Kyoto protocol

The Kyoto protocol represents the first major global initiative to address global warming. Adopted in 1997, it only came into force in 2005 because of delays in ratification in several countries. It contains mandatory targets for greenhouse-gas emissions for those of the world's leading economies that have accepted it. These targets vary between individual countries, but in aggregate the goal is to reduce overall emissions of greenhouse gases by at least 5% from 1990 levels in the commitment period 2008 to 2012. In almost all cases, the limits call for significant reductions in currently projected emissions. Future mandatory targets are due to be established for "commitment periods" after 2012.

Commitments under the protocol vary considerably between countries. The overall 5% target for developed countries is to be met through cuts (from 1990 levels) of 8% in the European Union (EU15 – the fifteen EU member countries prior to 2004), Switzerland, and most Central and East European states; 6% in Canada; notionally 7% in the United States (although the US has since withdrawn its support for the protocol); and 6% in Japan. New Zealand, Russia and Ukraine have to stabilise their emissions, while Norway may increase emissions by up to 1%, and Australia by up to 8%. (However Australia has also subsequently withdrawn its support for the protocol.) The EU's 8% target is distributed at different rates to its member states, ranging from a 28% cut by Luxembourg and 21% reductions for Denmark and Germany to increases of 25% or more for Greece and Portugal.

The protocol offers flexibility in how countries may meet their targets, for instance by allowing them to sponsor foreign projects that result in greenhouse-gas cuts in developing countries using specially designed mechanisms – such as the Clean Development Mechanism (CDM) and Joint Implementation (JI). The protocol also allows countries that have emissions units to spare – emissions permitted them but not "used" – to sell this excess capacity to countries that are exceeding their targets. However a single global carbon market has been slow to establish itself, and in practice the largest volume of trading takes place within the context of the separate EU emissions trading scheme.

Although Kyoto was an important step in securing climate change action on a widespread scale, its achievements have been modest. Many countries look set to fall short of their Kyoto protocol targets. Figures for 2004 show that aggregate greenhouse gas emissions in the participating countries have actually risen since 1999, although they were 3.3% below their 1990 level. The protocol also excludes all developing economies, including heavy polluters such as China – now the world's largest single emitter of greenhouse gases.

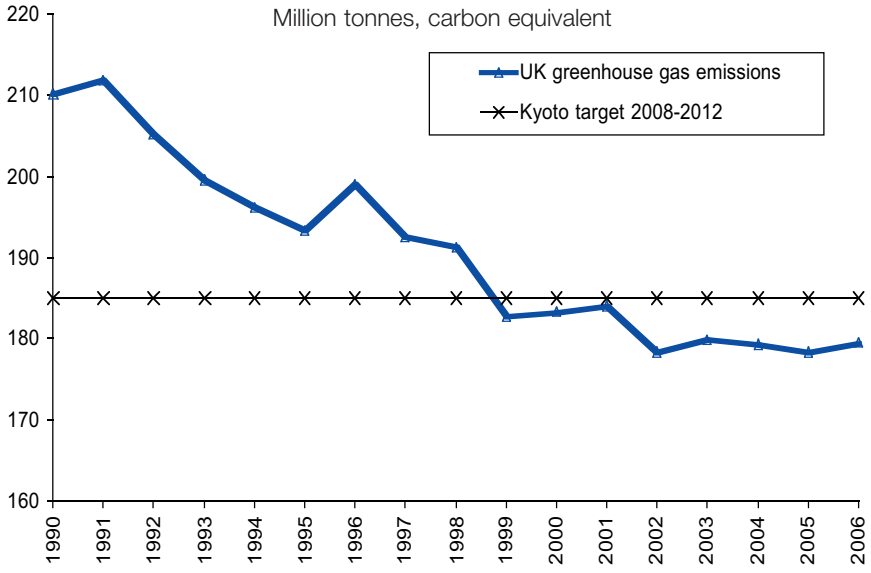
The protocol expects that future mandatory targets will be established for periods after 2012, to be negotiated well in advance of the periods concerned. In the long term, the success of the protocol will be judged as much according to the effectiveness of these successor regimes as to its performance in the period to 2012.

Targets for emissions reductions in the UK

The UK faces a number of targets for reducing its emissions, imposed both internationally and domestically.

Under the Kyoto protocol, the UK has its own target to reduce total greenhouse gas emissions by 12.5% by 2008-12 relative to 1990 levels, implying a cut from around 210 mtCe (million tonnes carbon equivalent) to 185 mtCe. This target was achieved a decade early, by 1999, with about half the reduction being the result of the 'dash for gas' in electricity generation in the 1990s. Since then, total greenhouse gas emissions have broadly stabilised at around 180 mtCe, just below the target level.

FIGURE 1: UK GREENHOUSE GAS EMISSIONS AGAINST KYOTO TARGET

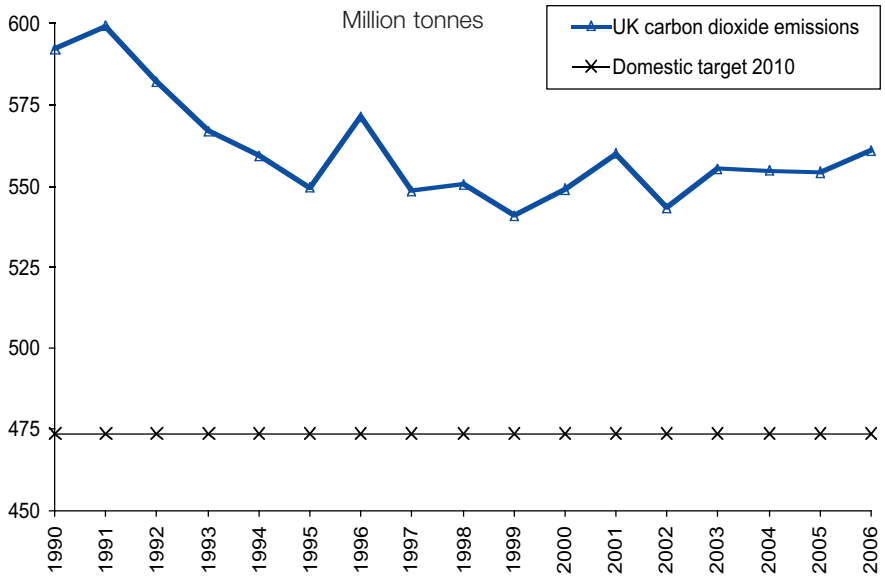


Source: Defra

The UK has also set itself a domestic target – expressed in terms of carbon dioxide rather than total greenhouse gases – to cut emissions by 20% by 2010 compared with 1990. This requires a cut from 161 mtCe to 129 mtCe (or in equivalent CO_2 terms, from 592 mtCO_2 to 474 mtCO_2), as shown in Figure 2.

Although they fell by nearly 9% between 1990 and 1999, CO_2 emissions have since been rising, and reached 560mt (just above 150 mtCe) in 2006. This domestic target will therefore almost certainly be missed.

FIGURE 2: UK CARBON DIOXIDE EMISSIONS AGAINST DOMESTIC TARGET

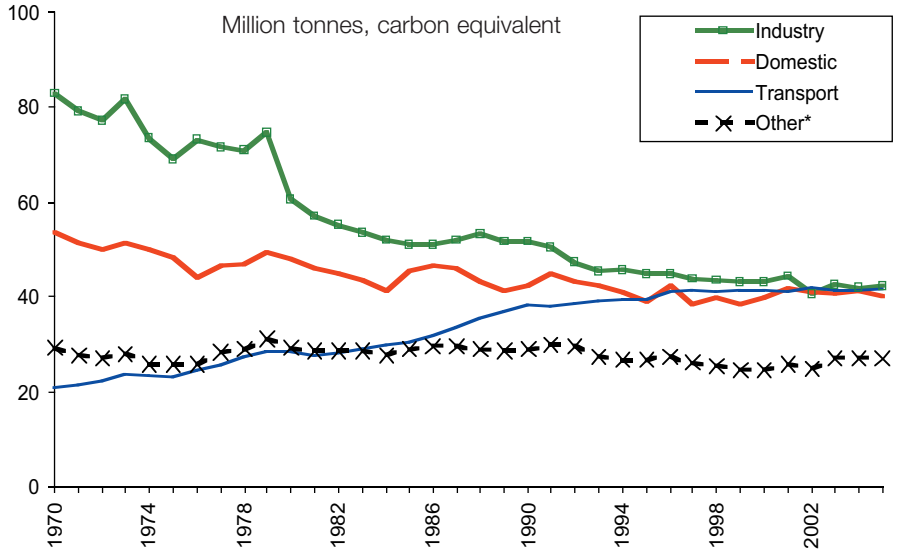


Source: Defra

The Draft Climate Change Bill of 2007 proposed a further, longer term target, seeking mandatory reductions in CO_2 emissions of 60% by 2050 (compared with a 1990 baseline), with an interim target of 26-32% cuts by 2020.

Looking at UK emissions by end user, between 1990 and 2005, CO_2 emissions from industry fell substantially, while transport emissions rose by 14%, largely due to growth in aviation. As a result, transport is now close to becoming the biggest single source of emissions, even though international air services are excluded from the figures.

FIGURE 3: UK CARBON DIOXIDE EMISSIONS BY END USER



Source: Defra
**Other is mainly commercial and public sectors*

EU Emissions Trading Scheme

The EU's emissions trading scheme (ETS) started on 1st January 2005. It works by issuing companies in the power sector and in energy-intensive industrial sectors – covering about 46% of European emissions – with tradable permits, which are required for each tonne of carbon dioxide that they produce. If they wish to emit more, they have to buy permits from companies that are willing to sell. There is therefore a ceiling on the total amount of CO_2 emitted by these sectors.

The first trading phase runs to the end of 2007. Designed as an initial trial phase, it only includes CO_2 emissions, with potential expansion in the second phase (2008-2012) to cover the other five greenhouse gases. There is currently no agreement on what happens after 2012, mirroring the absence of any Kyoto-style arrangements for the period beyond 2012.

Under the Kyoto protocol, the EU15 countries as a whole have a target to reduce combined emissions in the 2008-2012 period by 8% relative to the 1990 base year. By 2004, they had only cut emissions by 0.9%, and they therefore look likely to miss the target.

In the carbon trading market established for the purchase and sale of permits, the price of permits rose steadily from an initial level of around EUR 6 per tonne in January 2005 to reach a peak of around EUR 30 per tonne in the spring of 2006. However the price has since dropped sharply as investors lost confidence in the market once it became clear that the allocation of permits had been too generous. The price has since fallen further, and is now close to zero.

In the first phase, the UK set a cap on the emissions of its participating sectors of 245 $mtCO_2$ p.a., defined by its National Allocation Plan (NAP) in which the government allocated free emissions allowances to about 1500 UK sites covered by the scheme. The UK government gave fewer allowances to power generators than they expected to need, and allocated to other sectors in line with expected need. Verified emissions for 2005 indicate that the UK has set one of the most stringent caps of all EU countries.

The UK announced in June 2006 its cap for the second phase of 238 $mtCO_2$ p.a., 11% (29.3 $mtCO_2$ p.a.) below its projected need, and 7 $mtCO_2$ p.a. below the cap in the first phase, with the cut-backs allocated fully to the power sector. Within this, 7% of the allowances are to be auctioned. Holders of Climate Change Agreements and participants in the UK's own emissions trading scheme were allowed to opt out of phase 1, but no opt-outs will be allowed in phase 2.

3: The UK's record on environmental policy

A variety of policy levers may be used to influence environmental behaviour, including regulations, taxes and subsidies, and cap-and-trade schemes such as the EU ETS. All may have a part to play in different contexts. The use of taxation is simplest to measure in quantifiable terms, as figures are readily available on the total amount of revenues raised by each tax. This does not of course offer a reliable guide to the environmental impact of taxation. The most successful environmental taxes may appear to generate a low level of revenue because they are highly effective in curbing the level of environmental harm. Conversely a tax that generates large revenues may do so because it is ineffective in influencing environmental behaviour.

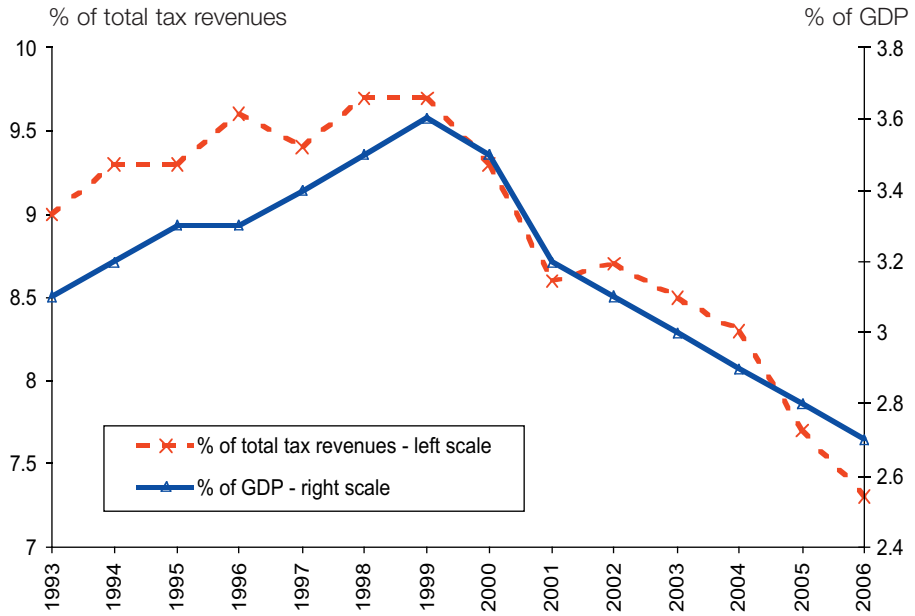
The main taxes imposed for environmental purposes are levied on energy and transport, with additional taxes on waste and pollution (such as the UK's landfill tax) and on the commercial exploitation of natural resources (the aggregates levy).

3.1 Environmental tax revenues in the UK

Whether by design or otherwise, the UK has been a champion in the use of taxes to achieve cuts in emissions. Using the classification currently adopted by the ONS, environmental taxes in the UK raised more than £35 billion in 2006, over 90% of which came from taxes on motoring. This has risen from less than £20 billion in 1993 (see Table 1). However, most of the growth in environmental tax revenues took place during the 1990s, and they have been declining in relative terms since 1999.

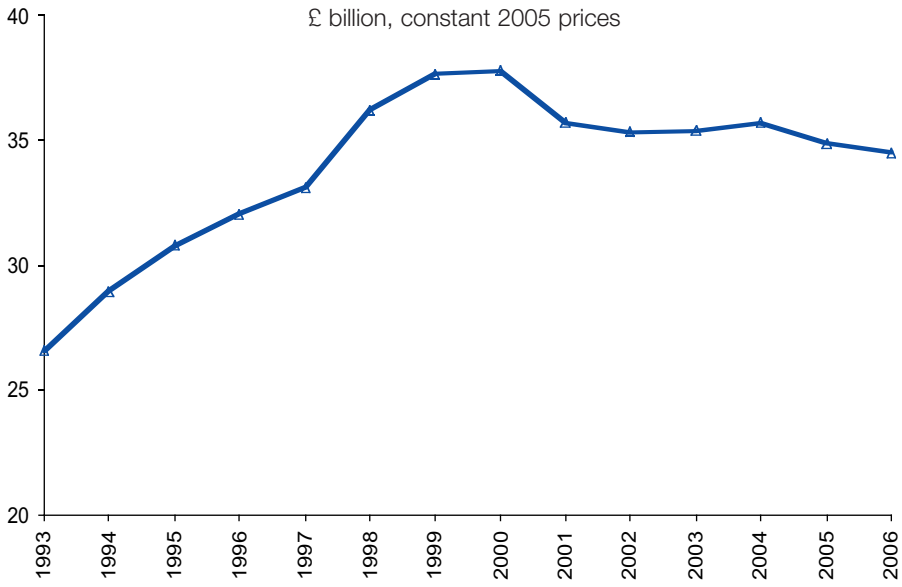
Relative to GDP, the revenues from environmental taxes grew from 3.1% of GDP in 1993 to a peak of 3.6% of GDP in 1999. Since then they have fallen to only 2.7% of national income in 2006. Similarly, as a share of total tax revenues, environmental taxes peaked in 1999 at 9.7%, up from 9% in 1993, before falling to 7.3% in 2006. In real terms, the peak in environmental tax revenues occurred in 2000, and they have fallen by more than 8.5% between 2000 and 2006.

FIGURE 4: UK ENVIRONMENTAL TAX REVENUES AS % OF GDP AND % OF TOTAL TAX REVENUES



Source: ONS

FIGURE 5: UK ENVIRONMENTAL TAX REVENUES IN REAL TERMS



Source: ONS

The main reason for the decline in the relative share of environmental taxes since 1999 has been the abandonment of the road fuel duty escalator. It has not been caused by lower pollution levels as UK greenhouse gas emissions have not fallen in recent years.

TABLE 1: REVENUES FROM ENVIRONMENTAL TAXES

£bn	1993	1999	2005	2006
Fuel duty	12.5	22.4	23.3	23.4
Vehicle excise duty	3.5	4.9	4.8	5.0
VAT on motor fuel	2.2	3.9	4.1	4.1
Air passenger duty	-	0.9	0.9	1.0
Climate change levy	-	-	0.7	0.7
Landfill tax	-	0.4	0.7	0.8
Aggregates levy	-	-	0.3	0.3
Total	19.8	32.6	35.0	35.4

Source: ONS

The ONS is in the process of revising its classification of environmental taxes, to bring them into line with international guidelines developed by Eurostat and the Organisation for Economic Co-operation and Development (OECD).[2] Although this has not yet been completed, the main changes currently proposed (subject to confirmation) are as follows:

- VAT on fuel duty – a tax on a tax – will no longer be included as an environmental tax. Because VAT is levied on most goods and services, it does not influence relative prices in the way that other environmental taxes do. This change will reduce the UK's environmental tax revenues by some £4bn a year.
- Income tax payments on benefits in kind will be included where they relate to use of company cars and vans and for fuel benefits – although these taxes are not levied primarily for environmental purposes, but in order to tax income that is not paid in cash. Together these taxes raised some £2.5bn in 2004-05.
- In statistical terms, Renewable Obligation Certificates (ROCs) are treated as imputed taxes, paid by electricity suppliers in cases where electricity generation is from non-renewable sources. These payments will also be included as environmental taxes. So too will (subject to Eurostat decision) the imputed taxes paid by businesses when purchasing permits required under the EU's emissions trading scheme in order to produce greenhouse gas emissions above their annual limit. Payments made under the UK's ETS do not qualify for classification as taxes as participation is purely voluntary.

The resulting level of environmental taxes under the new classification is not known at present as firm figures on the imputed tax payments for ROCs and EU ETS permits are not available. Table 2 summarises the new classification of environmental taxes for 2005.

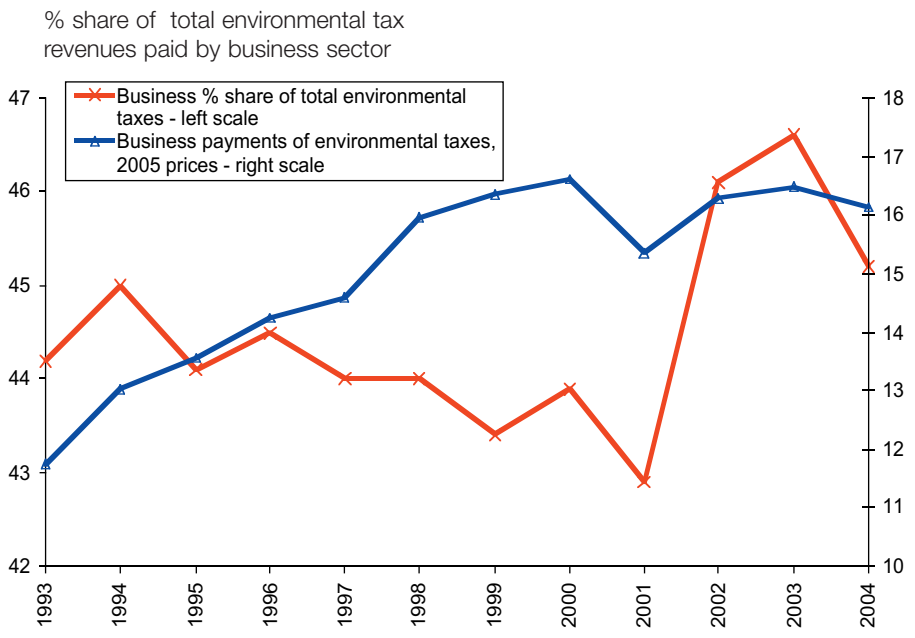
TABLE 2: REVISED CLASSIFICATION OF ENVIRONMENTAL TAXES IN 2005

£bn	2005
Fuel duty	23.3
Vehicle excise duty	4.8
Air passenger duty	0.9
Climate change levy	0.7
Landfill tax	0.7
Aggregates levy	0.3
Taxation of company cars*	2.0**
Taxation of company vans*	0.05**
Taxation of company fuel benefits*	0.5**
ROCs	?
EU ETS	?

Sources: ONS, HMRC
** includes national insurance contributions*
***2004-05*

ONS figures show that in the UK, businesses accounted for 45% of total environmental tax revenues in 2004. This share has remained remarkably steady since 1993. It showed a slight downward trend until 2001, but jumped in 2002. This was mainly the result of a decline in household payments of energy taxes, although business taxes also rose with the introduction of the aggregates levy and the climate change levy.

FIGURE 6: BUSINESS PAYMENTS OF ENVIRONMENTAL TAXES IN THE UK



Source: ONS

The UK's emissions trading scheme

The UK introduced its own emissions trading scheme in 2002, well ahead of the EU scheme, and ending in 2006. Participation was entirely voluntary. An auction was used to determine targets for emissions reductions by each of the 32 participating companies, with an incentive payment paid to those that achieved them. All of the companies 'complied' with their targets, and it is doubtful that the scheme achieved any cuts in emissions that would not have occurred anyway. Nevertheless it provided valuable experience of the operation of such a scheme and the behaviour of participants.

A new mandatory emissions trading scheme, the Carbon Reduction Commitment (CRC), was announced in the Energy White Paper 2007, designed to deliver emissions savings of 1.1 mtC a year by 2020. The scheme will cover large business and public sector organisations, such as supermarkets, hotel chains, large local authority buildings, banks and government departments, and will be revenue neutral. This sector accounts for roughly 10% of total UK CO_2 emissions.

3.2 Comparison of UK environmental taxes with other countries

There are three ways of comparing the scale of environmentally-related tax revenues between countries – as a share of total tax revenues, as a share of GDP, and on a per capita basis.

It is important to interpret international comparisons under each of these methods with care. For instance, a low level of revenues per capita from environmentally-related taxes may not necessarily be due to low tax rates or a narrow tax base. It might arise because of the sheer success of such taxes as an environmental deterrent, if they are effective in stimulating significant changes in behaviour and reducing environmentally damaging emissions. In a low tax country, environmental tax revenues per capita could be raised by significant foreign purchases of a product with a lower tax rate than in other countries. Exchange rate behaviour will also affect per capita comparisons, while differences in the share of total tax revenue generated by environmental taxes may be driven by differences in the levels of non-environmental taxes.

However it is calculated, it is evident that the UK has a higher than average level of environmental taxes. According to OECD figures (which are on a slightly different basis to the ONS figures used for the UK analysis above), environmental tax revenues in the UK amounted to about 2.6% of GDP in 2004, considerably higher than the OECD average of 1.7%. As a share of total tax revenues, the UK figure of 7.4% is also well above the OECD average of 5.8%.

TABLE 3: ENVIRONMENTAL TAX REVENUES IN THE UK AND MAJOR ECONOMIES, 2004

	% of GDP	% of total tax revenues	US$ per capita
UK	2.6	7.4	949
US	0.9	3.5	363
Japan	1.7	6.4	608
Germany	2.5	7.3	845
France	2.1	4.9	739
Italy	3.2*	7.5*	827*
Canada	1.3	3.7	397
OECD weighted average	1.7	5.8	557
OECD highest	4.8 (Turkey)	15.2 (Turkey)	2167 (Denmark)
OECD lowest	0.9 (US)	3.5 (US)	88 (Mexico)
UK ranking	13th=/30	12th/30	11th/30

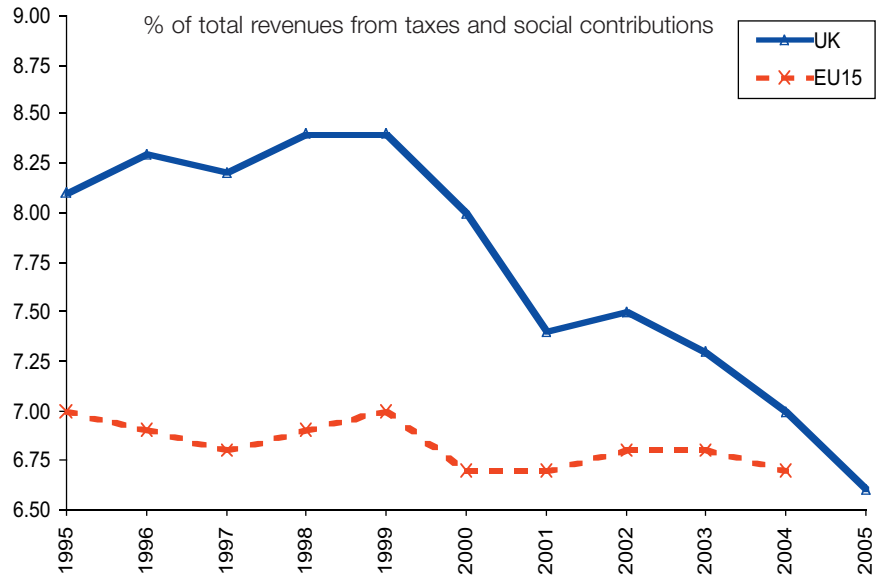
Source: OECD/European Environment Agency database on instruments used in environmental policy
**2003*

However, the gap between the UK and other countries has been narrowing since 1999. In terms of environmental tax revenues as a share of GDP, the UK's ranking within OECD economies has dropped from 9th= in 1999 to 13th= in 2004; as a share of total tax revenues from 8th to 12th; and on a per capita basis from 8th to 11th.

The OECD averages are pulled down by the low level of environmental taxation in the US and Canada. The UK's environmental taxes are much closer to the average of the EU15 countries. Figure 7 (which is on a different basis to both ONS and OECD figures already cited) shows that while UK environmental tax revenues have been higher as a share of total tax revenues than in the EU15 countries as a whole, the gap has closed somewhat since 2000.

However as well as the decline in UK environmental tax revenues, this may also reflect relatively slow rates of economic growth in the euro-zone's economies over this period, which could have reduced the scale of other (non-environmental) tax receipts.

FIGURE 7: UK AND EU15 ENVIRONMENTAL TAX REVENUES



Source: Eurostat

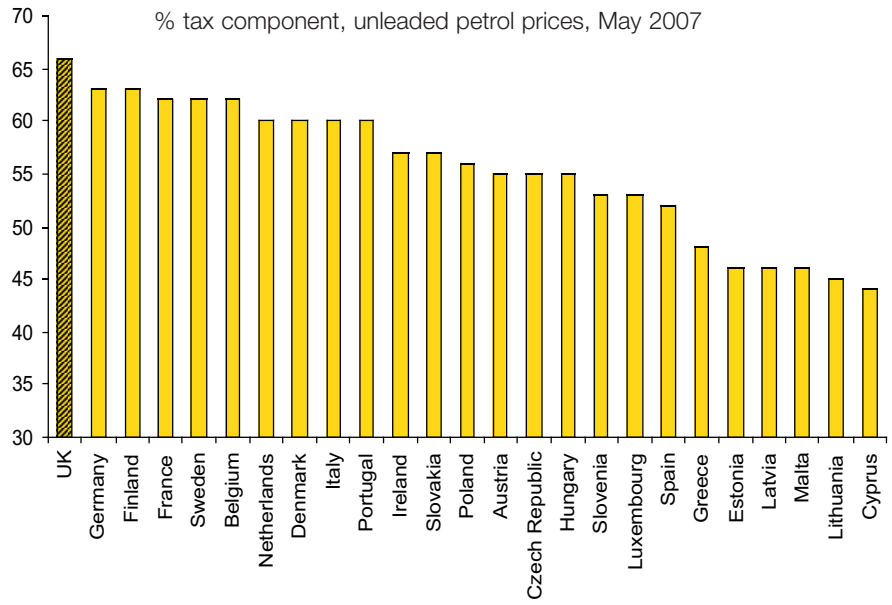
Across the OECD economies as a whole, more than 90% of revenues from all environmentally-related taxes are raised from motor fuels and motor vehicle taxes. This in large part accounts for the UK's above average level of environmental taxes, as the UK has one of the heaviest rates of motor fuel taxation among the industrialised economies, with only Turkey having a higher absolute rate per litre.

TABLE 4: FUEL DUTIES IN UK AND MAJOR ECONOMIES

	Tax rates on unleaded petrol EUR per litre (as at 1st January 2007)
UK	0.71
US (Federal+States)	0.09
Japan	0.37
Germany	0.66
France	0.61
Italy	0.56
Canada (Federal+Provinces)	0.17
OECD highest	0.75 (Turkey)
OECD lowest	0.09 (US)
UK ranking (highest – 1st)	2nd/29

Source: OECD

FIGURE 8: TAX COMPONENT OF EU PETROL PRICES



Source: BERR

Figure 8 shows that in May 2007, nearly two thirds of the UK's pump petrol prices went in tax, the highest share among all EU countries. (In most economies, the precise share varies according to the price of oil, since fuel duties are specified as a fixed nominal amount.) This is well down on the peak share of around 85% in 1999, and the tax share in several other countries (including Germany, France and Sweden) is now close to that in the UK. The perception that the UK motorists pay high road fuel taxes is still correct, but the gap has narrowed sharply relative to taxes in many European countries.

However the UK imposes relatively low tax rates on consumption of electricity and gas, especially on household energy usage.

TABLE 5: TAX COMPONENT OF EU PETROL PRICES

As at 1st January 2007	% share of taxes (inc VAT) in household electricity prices	% share of taxes (exc VAT) in industrial electricity prices	% share of taxes (inc VAT) in household gas prices	% share of taxes (exc VAT) in industrial gas prices
UK	4.7	2.5	4.8	2.8
Germany	26.5	11.5	24.3	8.4
France	23.9	7.8	15.2	2.6
Italy	28.8	26.0	35.7	5.8
Spain	18.0	4.8	13.8	0
Sweden	36.5	0.8	43.2	9.4
EU average	23.3	10.7	21.9	5.4
Highest	54.6 (Denmark)	26.0 (Italy)	55.8 (Denmark)	19.4 (Austria)
Lowest	4.7 (UK)	0 (11 countries)	4.8 (Portugal)	0 (11 countries)
UK ranking (highest=1st)	27th/27	12th/27	22nd=/23	9th/23

Source: Eurostat

According to Eurostat, the EU's statistics office, energy taxes accounted for 76% of total environmental taxes in the EU member economies in 2003, with transport taxes adding a further 21%. Households and business paid roughly equal amounts of energy taxes in the EU15 economies in 2003, even though business consumption of energy was almost three times as great as that of households. In the UK business paid just over half of all energy taxes, this share having risen slightly since 1995.

But households paid more than two thirds of transport taxes in 2003, and 80% of the total in the UK. The level of transport taxes in the EU15 rose sharply between 1995 and 2000, as it did in the UK. According to Eurostat, in the UK there was a sharp fall in transport taxes paid by the business community which almost halved between 2000 and 2003 when measured in euros. This was not a feature in the EU as a whole, where business payments of transport taxes remained fairly stable in nominal terms.

If the UK raises more than average revenues from environmental taxes, how does it compare with other countries on its environmental performance? A cursory glance at some basic statistics on energy intensity suggests that the UK's performance is fairly average. It uses slightly more energy per unit of GDP than the other major European economies, despite being less dependent on industrial activities than many. However this does not necessarily say much about the efficiency with which energy is used, as it may also reflect a range of other factors – for instance the weather, which will affect the demand for energy for heating purposes.

The UK also generates more carbon dioxide emissions per capita than France and Italy, although less than Germany.

However its relatively high burden of environmental taxation means that the UK ranks third among EU25 economies in the level of energy taxes per unit of energy consumption.

TABLE 6: ENERGY INTENSITY AND EMISSIONS PERFORMANCE

	Energy intensity*, 2005	CO_2 emissions per capita, 2003	Implicit tax rate on energy**, 2004
UK	203	9.1	233
US	309 (2004)	-	-
Japan	121 (2004)	-	-
Germany	157	10.2	210
France	185	6.4	147
Italy	191	7.9	239
Spain	219	7.2	142
Sweden	204	5.6	207
EU15 average	185	8.6	191
EU25 average***	202 est	8.5	-
EU25 highest	967 (Estonia)	22.1 (Luxembourg) 13.9 (Estonia)	327 (Denmark)
EU25 lowest	114 (Denmark)	3.0 (Latvia)	61 (Estonia)
UK ranking	9th lowest/25	15th lowest/25	3rd highest/25

Source: Eurostat

** ratio of gross inland energy consumption to GDP (1995 euro), measured in kg of oil equivalent per 1000 euros*

*** ratio of energy tax revenues to final energy consumption, measured in euros per thousand tonnes of oil equivalent*

**** the 25 EU member economies from 2004, but excluding Bulgaria and Romania*

Despite its moderate relative environmental performance, the UK is better placed to meet its Kyoto targets for greenhouse gas emissions in 2008-2012 than other EU countries. As mentioned above, the UK achieved its target of a 12.5% reduction in emissions from the 1990 level by 1999, fortuitously benefiting from the 'dash for gas'. The EU (as represented by the 15 member countries before the accession countries joined in 2004) had a target of an 8% reduction in emissions over the same period, but by 2004 had cut emissions by only 0.9%.

4: Selection of policy instrument

Governments can choose from a lengthy menu of policy options to support their efforts to tackle climate change and other environmental problems. As well as the use of energy taxes, including carbon taxes, other policies adopted in recent years include:

- Emissions trading schemes;
- Regulations, e.g. on fuel efficiency, and other measures to stimulate greater energy efficiency;
- Arrangements to support emissions reductions in other parts of the world where the cost of abatement is lower;
- Voluntary agreements with the government, such as those permitted to reduce liability for the UK's climate change levy;
- Subsidies to support the development of low-carbon technologies, such as the UK's Renewables Obligation.

This section considers the efficacy of different types of policy instrument in different circumstances.

It is possible to distinguish two mechanisms through which an environmental policy can have its effect. The first controls the amount of pollution principally by restraining the level of output of a good or service. A policy which imposes a short term limit on the level of emissions is an example of this. In the process output is reduced, creating a 'scarcity rent' which may accrue to the producing firm, perhaps in the form of windfall profits. Alternatively it may be taxed, in which case the rent goes to the government.

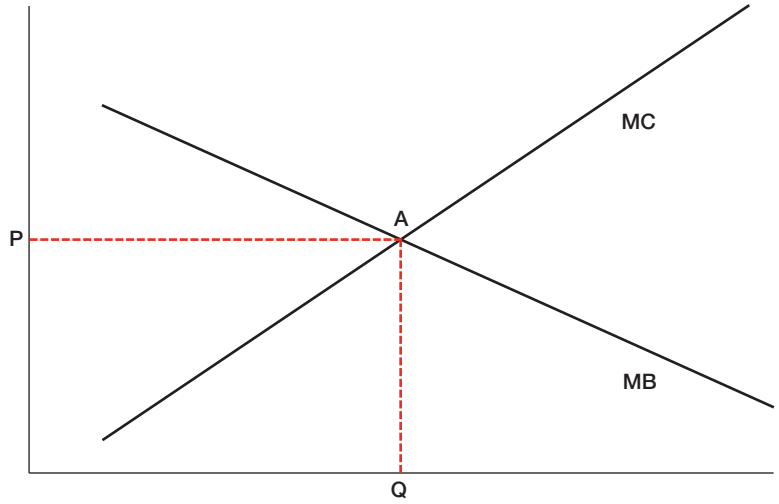
The other type of policy – for instance, a regulation that a certain technology must be adopted, or a move to encourage the development and application of new technologies – seeks to reduce the level of pollution for each unit of output, and does not force firms to cut production. (However if it imposes higher costs, firms may of course react by reducing output.) This produces a more efficient solution, avoiding the creation of scarcity rents, and it may allow low cost firms to enter the market freely.

Policies which do not create scarcity rents are usually preferable to those which do, as the latter are likely to impose a higher economic cost in terms of lost output.

The optimal level of pollution

The optimal level of emissions is typically not zero. Complete elimination of environmental pollution is likely to be expensive, and more than can be justified by society's valuation of the resulting environmental improvement.

FIGURE 9: MARGINAL COSTS AND BENEFITS OF POLLUTION ABATEMENT



In Figure 9 the marginal cost of abatement (curve MC) is shown as rising with the amount of pollution reduction achieved (measured along the horizontal axis). This is because the easiest cuts in emissions are made first, and reducing emissions further becomes progressively more difficult, and therefore more expensive. The marginal benefit of pollution abatement (curve MB) is downward sloping, tending to decline as the level of abatement increases. The most effective methods of reducing emissions are those that achieve the greatest benefits, and these will be deployed first.

If the marginal benefit of abatement is greater than the marginal cost, then additional net gains can be realised by further cuts in emissions. The point A on the chart represents the intersection of the MB and MC curves – denoting the level of abatement at which marginal costs and benefits are equal. There is nothing to be gained – indeed there will be net disbenefits – from further abatement, even though there is still some pollution taking place. The optimal amount of pollution abatement is therefore Q, which will be achieved with the value of marginal benefits and cost both equal to P.

If the cost of pollution is not priced – and there is a negative externality – then applying a tax of P per unit of abatement should achieve the optimal outcome.

4.1 Regulation v. economic instruments

Most environmental policy instruments take the form of either command-and-control (CAC) regulation or economic instruments such as taxes. CAC regulation typically requires firms to comply with specific standards or rules, and is widely applied in the field of health and safety regulation. Although less common in the economic arena, the strengths of CAC regulation lie in conditions where the policymaker has reliable information about the nature of the environmental hazard and its impact, when the risk of government failure in specifying the regulation is low, and when the impact on different firms and their responses is symmetric. For instance, CAC regulation may be the best way of tackling the problem of a pollutant whose optimal level is zero. The appropriate instrument in such circumstances is an outright ban.

Because there is a high degree of uncertainty about many aspects of climate change, the risk of serious government error through poor targeting of CAC regulation is high. This could impose severe costs on the economy and on individual firms.

CAC regulation tends to be 'all-or-nothing' in nature. It may offer a strong incentive to meet a particular regulatory target, but there is no encouragement to go beyond that point and to reduce emissions further.

In order to have a serious impact on the environment, policies may need to achieve extensive changes to existing behaviour by firms and individuals. Such behavioural changes may be costly to the economy if not implemented efficiently, and this has generated widespread interest in the use of incentive-based environmental regulation in order to minimise these potentially substantial economic costs.

Economic instruments such as taxes, charges and tradable permits are useful in achieving incremental rather than all-or-nothing changes in behaviour. In terms of the discussion in the box, they enable emissions reductions to be made right up to the point where the marginal cost of further cuts in emissions is equal to the marginal benefit to society of the abatement.

Economic instruments allow the market do most of the work by sending explicit price signals to firms and individuals in order to minimise the cost of achieving a given reduction in pollution. This is especially useful when the appropriate response differs between different players – for instance because some sectors can reduce greenhouse gas emissions more cheaply than others – or when there is insufficient information about the relative costs of reducing emissions by different sectors.

It is often suggested that the deployment of economic instruments has the advantage that new revenue streams are generated. These can be used to deal directly with environmental problems or to reduce other taxes. However the argument is more complex than this. Taxes cause distortions by changing the behaviour of those who face them and high taxes therefore are potentially more damaging than low ones. If environmental taxes are imposed in such a way as to distort behaviour in a mild or beneficial manner, and the revenues are used to cut other more harmful taxes, then society as a whole may benefit from the shift in the balance of taxation towards less distorting forms.

However if the money from environmental charges is not used in such a beneficial manner, then it makes no more sense to argue in favour of higher taxes and higher public spending in the environmental field than in any other area of government policy. And careless use of the proceeds from environmental policies may do outright harm to the economy.

The revenues raised by environmental policies should not therefore be a prime consideration in arguing for the imposition of taxes or charges that cannot be justified in strictly environmental terms. Higher environmental taxes without compensating reductions in taxation elsewhere could damage competitiveness more explicitly than direct regulations. Environmental policies should be assessed according to their environmental benefits alone.

4.2 Price-based v. quantity-based instruments

Economic instruments have therefore come to play an increasingly important role in the debate about environmental policy. Within this category, we consider the relative merits of price-based instruments (taxes and subsidies) and quantity-based instruments (for instance cap-and-trade schemes such as the EU's Emissions Trading Scheme, ETS). Although under ideal conditions, there is a one-to-one correspondence between the use of price and quantity instruments – a quantity instrument will deliver a corresponding (implicit) price, and vice versa – in practice there are many imperfections and uncertainties in the market, and the two types of instrument may produce substantially different outcomes.

If taxation measures are used to curb pollution, the 'price' of polluting is fixed, guaranteeing an upper limit to the marginal abatement costs of pollution. But the overall level of pollution abatement actually undertaken is uncertain, as it depends on individual polluters' responses to the tax incentive. This may be an important consideration in cases where there is a critical pollution threshold, above which the environmental damage per unit of emissions rises sharply. Reducing emissions below the threshold is then a policy priority, and the level of tax may need to be adjusted – perhaps regularly – in order to achieve this.

The use of quantitative instruments such as direct regulation or tradable permits ensures that a given pollution target will be met, for instance through limits on the number of permits issued in a cap-and-trade scheme. But the cost of the abatement is uncertain, and may fluctuate.

What matters is whether society prefers to take greatest risks with environmental quality or with the costs of environmental policy. In practice, hybrid instruments – a tailored combination of price and quantity instruments, such as a trading scheme with a price ceiling or floor – may achieve a more efficient outcome than either taxes or trading systems can do alone.

The relative merits of price- and quantity-based instruments are discussed in greater detail in the following sections of the chapter.

4.3 Principles of environmental taxation

The most common price-based instrument for pursuing environmental policy objectives is taxation. The theory of taxing externalities in order to achieve an efficient outcome is well-established as a means of ensuring that a polluter takes into account the costs that his actions impose on the rest of society.

In a world of certainty, taxes would be set to ensure that the external costs (or benefits) generated by a particular good or service were reflected in its price. In practice, there is enormous uncertainty about many aspects of environmental economics, including the magnitude of external costs. In the case of global warming, there are still sharp disagreements about the role played by human activity. Even the sign of some externalities is disputed – are they positive or negative if global warming confers benefits on some regions of the world? The appropriate level and structure of environmental taxation is therefore subject to large error margins.

Identifying the correct level of taxation is complicated by the fact that the impact of emissions on climate change depends on the stock of greenhouse gases in the atmosphere. Current emissions will affect this stock for an indefinite period in the future, depending on the speed with which the existing capital stock is replaced, thereby allowing new low-carbon technologies to be introduced, and how quickly emissions decay. The appropriate level of taxation, and its path over time, is therefore sensitive to parameters such as the relative weights given to the interests of present and future generations, and the optimal rate of depletion of finite energy resources.

Despite these difficulties, tax instruments have a number of attractions. For instance, in conditions of uncertainty, it is helpful to be able to adjust policy instruments quickly and easily in order to achieve governments' environmental aims effectively. There is greater flexibility to adjust taxes over time in response to changed circumstances than to change permit quantities, which typically have to be set for lengthy periods in order to provide credible long term signals to investors. However, frequent and unpredictable changes in tax levels are clearly undesirable.

Taxes may also be more conducive to stimulating long term investment spending because they place an upper limit on abatement costs – if abatement is more costly per unit than the level of taxation, then firms will simply pollute and pay the tax. If the implicit price of abatement fluctuates, this sends erratic signals to potential investors in new technologies who look for greater certainty and stability in a policy regime.

In practice, taxes tend to generate more public revenue than quantity instruments, even with auctions which – unless carefully designed – may not raise the optimum amount of revenue. The use of auctions in allocating permits to pollute is discussed in the next chapter. However, as argued earlier, policies to improve the environment should be assessed according to their environmental benefits, rather than the amount of revenue they raise.

In order to prevent the creation of (unintended) economic distortions through the poor application of environmental taxation, the IoD has developed some broad principles for assessing the suitability of taxes to achieve the policy goal in question.[3]

- Increases in revenue raised from environmental taxes should be matched by reductions in the revenue raised from other taxes. Environmental taxes must not become a tool to increase the size of the overall tax burden.
- Taxes should apply equally to businesses and to private consumers, and the amounts due should appear on bills or tickets sent to private consumers. This will ensure that consumers are fully aware of the burdens that are being imposed in the name of the environment.
- Environmental taxes should be simple in design and straightforward in their application. They must also be introduced with ample warning and with advance publication of detailed guidance on what needs to be done.

- Environmental taxes should be designed to do their job properly. The level of a tax should match the cost of the environmental damage. The onus must be on the Government to demonstrate the scale of the relevant costs. A full appraisal should be conducted to ensure that a new tax or tax change will not cause the offending behaviour simply to relocate to another country and continue to do the same (or possibly more) damage.

4.4 Quantity-based instruments

Cap-and-trade schemes operate by targeting a precise quantity of emissions reduction, determined by the quantity of permits to pollute. Each participating organisation must obtain sufficient permits to match the level of their emissions. The market can then determine the price of permits (effectively the price of emissions) by balancing the demand for permits against their supply. Difficult and often controversial decisions must be made on the overall number of permits to be distributed and the allocation to individual polluters. The means of distribution – by freely handing permits out or auctioning them – may also have a significant effect on the outcome of the process.

The main virtue of such schemes is that because individuals or firms are able to exchange or trade permits with each other, the permits are likely to end up with those who value them most.

The EU's carbon emissions trading scheme (ETS) is the best-established example of a large scale cap-and-trade scheme. But its operation so far has been flawed – this is discussed in more detail in Chapter 5. The failure to set a realistic cap on the number of permits in the first stage of the ETS meant that the cap was much too loose, with the result that the price has dropped steadily, and is now close to zero. The caps look to be tougher in phase 2, but it remains to be seen how well they work in practice.

Emissions trading depends on the existence of a credible ceiling of emissions on which to define property rights. In the absence of a Kyoto-style agreement, or any other arrangements, covering the years beyond 2012, there is so far no effective market in emissions – and therefore no price – beyond 2012. This does not give investors in carbon-free technology the incentives they need to commit funds to expensive and long-lasting emissions reduction projects.

Emissions caps should therefore be extended to cover periods beyond 2012. Policy will inevitably need to be adjusted over time in response to new technologies, better information, and changed political circumstances. But too many shifts in policy will cause problems for firms that depend on benefits accruing over a lengthy period. It also gives rise to gaming where players try to influence the severity of future regulatory regimes. Credible commitment to future policy may mitigate these problems, but it reduces the flexibility to adjust policy when required.

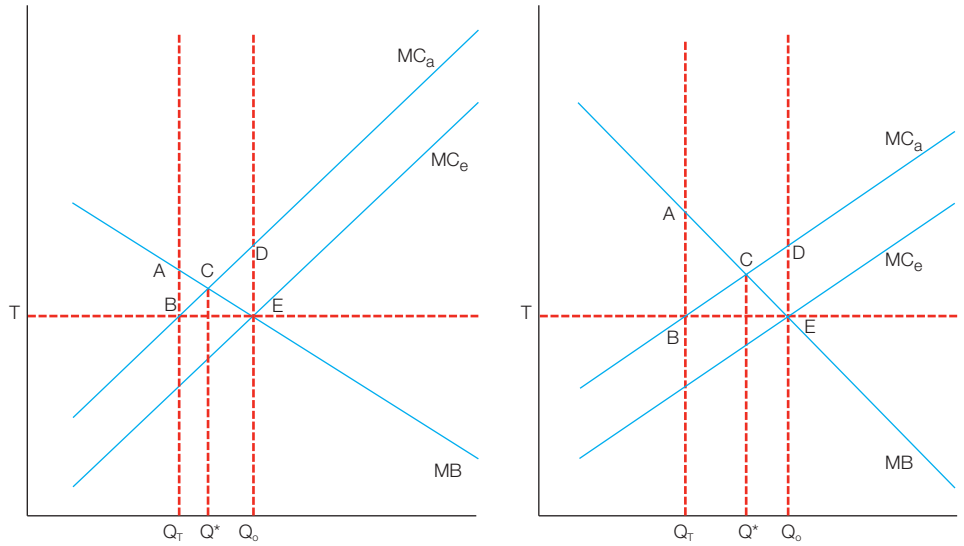
A tradable permit scheme may be more expensive to operate than a tax on emissions, because of the institutional costs of establishing a trading scheme, making the initial allocation of property rights, and ensuring the continuing competitive operation of the market.

Furthermore, price risk is likely to reduce long term R&D investment in abatement technologies, as it adds to the already substantial technology development risk. The inability to guarantee a degree of price stability is a potential drawback of emissions trading.

4.5 Are price-based or quantity-based instruments preferred?

A key result from economic theory is that when the marginal costs of supplying a good are uncertain, using a price instrument is *more* efficient than a quantity instrument when the marginal benefits of that good are relatively *flat* compared with the marginal costs (and vice versa). This is expounded in a 1974 article by Weitzman.[4]

FIGURE 10: PRICE- AND QUANTITY-BASED INSTRUMENTS UNDER UNCERTAINTY



The two panels of Figure 10 demonstrate the impact of uncertainty, showing the results for different shapes of marginal cost and benefit curves.

In Figure 10 the expected marginal cost curve is denoted by the line MC_e. This intersects with the marginal benefit curve MB at point E. If a tax is used to achieve the optimal level of pollution abatement, then this should be applied at rate T in order to obtain abatement Q_o. Likewise a cap-and-trade scheme should target abatement level Q_o, which is expected to generate a permit price of T. If there were no uncertainty, and this were the correct MC curve, then price- and quantity-based approaches would achieve the same result.

However there is (quite realistically) some uncertainty about the precise path of the marginal cost curve, and the true (but unknown) marginal cost is given by MC_a. In other words, the true marginal cost of any given level of abatement is actually somewhat higher than expected. The optimum outcome should therefore be at point C, with an optimal level of abatement Q*.

The price-based approach has levied the tax at too low a level, giving rise to the outcome at point B. The level of abatement Q_T is lower than the optimal level Q*, and welfare could be increased by increasing the tax and thus achieving a higher level of abatement. In Figure 10 the amount of welfare 'lost' because of ignorance about the true marginal cost curve is shown by the triangle ABC.

The quantity-based approach has achieved too much abatement. By reducing the amount of abatement from Q_o to Q* – and thus increasing the amount of pollution – there would be welfare gains shown by the area of triangle CDE.

The cost of uncertainty – in terms of lost welfare – therefore varies according to the instrument being used. The relative merits of price- and quantity-based instruments depend on the relative sizes of the two triangles ABC versus CDE. If ABC is larger than CDE, then the use of a carbon tax gives rise to larger welfare losses than using a cap-and-trade scheme, and vice versa.

The relative magnitudes of triangles ABC and CDE is determined by the shapes of the marginal cost and benefit curves. In the left-hand panel, the marginal cost curve is relatively steep, indicating that costs rise rapidly as more abatement is achieved. Meanwhile the marginal benefit curve has a fairly gentle slope. In this case, ABC is smaller than CDE, and the welfare loss would be smaller if taxes were used as the policy instrument. This supports Weitzman's conclusion that using a price instrument is *more* efficient than a quantity instrument when the marginal benefits of abatement are relatively *flat* compared with the marginal costs.

Conversely, the right-hand panel shows a flatter marginal cost curve and a more steeply declining marginal benefit curve. In this case, ABC is larger than CDE, and the potential loss is smaller if quantity-based instruments are used.

Climate change example

Suppose the marginal cost of reducing emissions increases quickly as the easiest 'low hanging fruit' solutions are exhausted, and more difficult sources of emissions – such as aviation – remain to be tackled. If damage from climate change is mainly related to the *stock* of carbon in the atmosphere, such that there is only a weak relationship with emissions over short periods (up to 5 years), the marginal benefit from abatement is relatively flat. A price instrument – such as a carbon tax – is the appropriate instrument to use. An equivalent absolute emissions cap is less attractive because if the cap turns out to be wrong, the economic costs could rise sharply and offset the environmental benefits.

Alternatively, if we are on the brink of a tipping point, such that emissions now do much less damage than emissions in five years' time, then an immediate restriction on the quantity of emissions would be advisable.

If EU member states could agree to make a long term commitment to the ETS over periods of several decades ahead, then quantity instruments become more attractive. This flattens the marginal cost curve (by allowing abatement costs to be phased over a longer time period) and steepens the marginal benefit curve (in the long term the damage from emissions will rise sharply as the stock of emissions increases).

On balance economists tend to favour the use of price as an efficient and flexible instrument for the encouragement of good environmental behaviour. This points to the use of instruments such as a carbon levy – a tax per unit of carbon emissions, applied consistently to all sectors across the economy, and on a global scale if possible.

Carbon taxes do not guarantee a specific level of emissions reduction. But they may form the basis of a flexible policy framework for controlling emissions, where the price can be adjusted relatively easily at regular intervals in order to converge on desired emissions levels. And it should avoid the destabilising volatility of carbon prices that we have seen with the EU's emissions trading scheme – see Chapter 5.

However a drawback of carbon taxation is that it offers little incentive for long term stability. As a tax, it would always be unpopular among those groups that have to pay it, and therefore there would be little to prevent future governments from reneging on a commitment to long term carbon taxation.

In practical terms, consideration of the best climate change policy should acknowledge the fact that the EU emissions trading market exists already and many players have invested money and reputations in it as an institution in its own right. The difficulty of achieving international collective action in a credible manner means that we may not wish to sacrifice the hard won buy-in that quantity schemes have already secured – not least the vested interest of the major financial institutions in ensuring that carbon trading continues.

There would therefore be some institutional costs associated with switching to a price-based scheme. There may also be resistance from the various lobbying interests. The environmental movement might resist shifting to a system that left emissions uncapped, while industry would oppose higher taxes.

There is a case therefore for saying that it is better to continue down this road, and not to throw away the credibility and the reputation that emissions trading has already earned.

We should not be dogmatic about the choice between carbon taxation and cap-and-trade schemes. On a basis that is neutral for business as a whole, either should provide an acceptable basis for a successful environmental policy – especially if applied consistently across all sectors and on a broad geographical scale. For practical reasons associated with the credibility and experience already invested in them, we are inclined to favour emissions trading schemes as the best way forward.

A hybrid combination of price- and quantity-based instruments – such as the McKibbin and Wilcoxen proposal discussed in Chapter 6 – might offer the best of both worlds.

Policymakers should not over-egg the pudding. With a sensible carbon tax or emissions trading regime in place, there should be little need for further policy action. Policy overkill could be seriously counter-productive by interfering with rational economic decision-taking. The Government should abandon its urge to micro-manage the climate change agenda by placing it at the heart of every policy initiative, effectively introducing a policy of regulation via the back door. Climate change objectives should not become an additional hurdle to be cleared by new projects – in both public and private sectors – lest such an approach deters worthwhile investments that are beneficial to the economy.

The social cost of carbon

The social cost of carbon (SCC) is the monetary valuation of the global cost to society caused over time by long term trends in human carbon dioxide emissions. Values refer to the cost in the current period, but because greenhouse gas emissions cumulate in the atmosphere, it implies that the SCC will rise for future emissions as the stock of gases increases.

It is a key parameter in assessing the optimal settings for environmental policy instruments such as taxes, and in prioritising adaptation policies according to their effectiveness.

However it is difficult to gauge with any precision, as estimates are highly sensitive to assumptions about discount rates – the relative valuation of the interests of current and future generations – and whether it allows for factors such as so-called 'climate catastrophe' (e.g. melting of the West Antarctic ice sheet, Gulf Stream suppression) and the prospects of events such as famine or mass migration. Unsurprisingly therefore, studies produce a wide range of estimates for the value of the SCC.

A Government Economic Service (GES) Working Paper[5] estimated that a value of around £70/tC ($30/tCO$_2$) was a defensible illustrative value for carbon emissions in 2000. This figure should then be raised by £1/tC in real terms for each subsequent year. The paper also recommends the use of £35 and £140 (half and double the central estimate) as a sensitivity range, pointing out that this does not cover the full uncertainty involved in the estimation of the social cost of carbon.

A 2005 review for the Department for Environment, Food and Rural Affairs (DEFRA)[6] concluded that it was reasonable to regard £35/tC as a lower bound for the likely range of estimates of the SCC, suitable for global decisions committed to reducing the threat of dangerous climate change. An upper limit to the SCC for global policy contexts is more difficult to deduce but the risk of higher values is significant.

The modelling in the Stern Review produced an estimate of the social cost of carbon of $300/tC ($85/tCO$_2$) in year 2000 prices in a 'business as usual' context, and around $30/tCO$_2$ on a path towards a level of emissions concentrations of 550 ppm CO$_2$e. A 2005 review by Richard Tol[7] of 28 published studies suggested a central estimate of $29/tC. Using standard assumptions about discounting and aggregation, he estimated that the marginal damage costs of carbon dioxide emissions are unlikely to exceed $50/tC, and are probably much smaller.

5: Lessons from the EU's emissions trading scheme

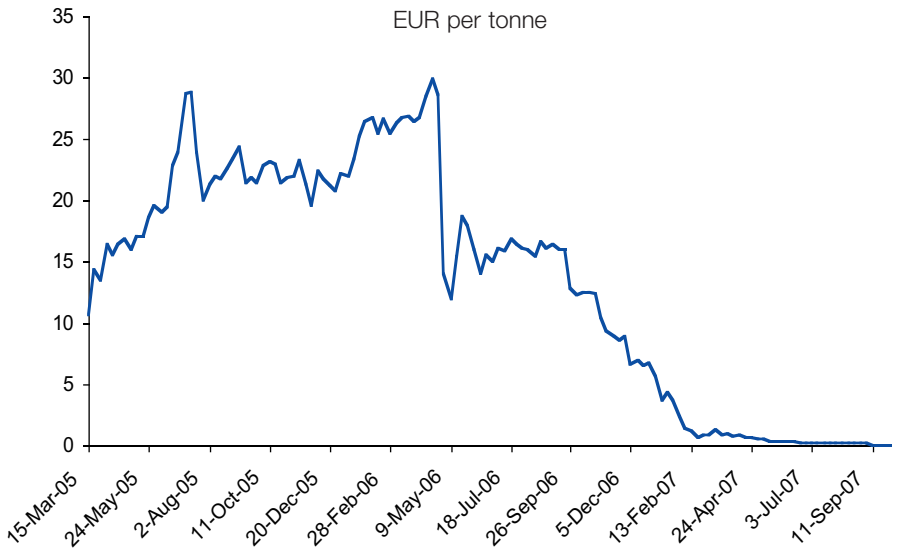
The ETS operates by setting a cap on the quantity of emissions and allowing the price to be determined by the demand for and supply of permits. This has the desirable property that it establishes a precise level of emissions, determined by the number of permits issued. If applied on a global scale, the cap could be set to achieve scientifically-based targets for greenhouse gas concentration levels in the atmosphere.

Whatever its theoretical merits, the performance of the EU's emissions trading scheme since its inception in 2005 has in practice been seriously flawed. Among the more oft-mentioned deficiencies are the following:

- Over-supply of permits has caused the price to drop to close to zero;
- Price volatility has sent poor and inconsistent signals to investors;
- The absence of a long-term carbon price offers poor long-term investment incentives;
- It is not global in coverage;
- Limited use of auctioning of permits has allowed windfall profits for incumbents.

The price of carbon during the first phase of the EU's emissions trading scheme has been very volatile. The price of permits in the carbon trading market rose steadily from an initial level of around EUR 6 per tonne in January 2005 to reach a peak of around EUR 30 per tonne in the spring of 2006. The price then dropped sharply to under EUR 10 per tonne when it became apparent that the allocation of permits had been too generous. The subsequent loss of confidence in the market has seen the price fall further, settling at less than EUR 1 per tonne for much of this year, and currently as low as EUR 0.10. This highlights the sensitivity of the price of carbon to the size of the cap on the overall number of permits.

FIGURE 11: ETS CARBON PERMIT PRICES DURING PHASE 1



Source: Thomson Datastream

The number of permits in phase 1 was principally determined in a bottom-up manner by aggregating individual national allocation plans (NAPs), leaving little role for any top-down scientific assessment of the appropriate level of carbon emissions. The national allocation plans are agreed as a result of discussion with participating entities within each country. This political, international negotiating process is subject to gaming by participants in the ETS and by individual member state governments, trying to protect their national interests. This may have increased the overall supply of permits.

In phase 1, the total level of allowances permitted was not a long way below the full demand for emissions, and therefore provided little effective restraint on participants' behaviour. The result is that it is difficult under current institutional arrangements to be sure that the resulting price of carbon will be sensible, realistic, and effective in achieving the EU's climate change goals.

Nearly all allowances were allocated free of charge under the practice known as 'grandfathering', where allocations are based on historical emissions levels. Some studies suggest that this has generated 'windfall' profits for many incumbent firms. Greater use of auctions would alleviate this problem, and this is discussed later in this chapter.

Matters should improve in the second phase of the scheme's operation, beginning in 2008. The caps look to be tougher, with the number of permits restricted so as to require absolute cuts in emissions compared with current levels. As a result the price of carbon in December 2008 is around EUR 20 per tonne. However this is below most estimates of the cost of carbon, and it remains to be seen whether the price will remain around this level, or whether the number of permits has again been set at too high a level.

The instability in the price of carbon is unsettling for affected businesses, who have to take account of the cost of emissions permits in their business planning. Risky ventures are riskier still if the price of carbon is volatile and unpredictable, and this may deter investment in low carbon technologies. It is therefore important that a means is established to promote greater stability in the price of carbon emissions – perhaps through the imposition of a price ceiling and floor, or another adaptation of the existing scheme.

A particular shortcoming of the current ETS relates to the absence of long term price signals. Not only have no post-2012 ETS caps yet been set, but neither are there any Kyoto-style arrangements in place for years beyond 2012. There is therefore no effective market in emissions – and no price – beyond the next five years. This does not give investors in carbon-free technology the confidence they need to commit funds to expensive, long term, low emissions projects.

Extending the period of the targets would fit with the timescale of the climate change problem, signalling to both demand and supply sides of the market and crucially assisting long term capital investment and R&D. In practice, there are a number of political reasons why such a clear-cut approach is unlikely to be taken. These include the international nature of the problem, which has already prevented the participation in the Kyoto process of major polluting countries such as the US and China, and the inability to bind successor governments. The risk of *ex post* reneging on policy commitments damages credibility and raises the private cost of capital for projects dependent on the price of carbon.

5.1 Reforming the EU's emissions trading scheme

Most of these problems are not terminal and should be susceptible to successful resolution through relatively modest adjustments. To its credit, the European Commission is considering a number of constructive ideas for improving the operation of the ETS and repairing its weaknesses. It is due to publish its proposals towards the end of 2007. Among the ideas under consideration are:

- Ending the system of national permit allocation plans, and imposing a single EU-wide cap post 2012;
- Switching to a harmonised system, i.e. the same reduction target per sector across the EU;
- New sectors to be added to the ETS (e.g. aviation and maritime transport), although entry dates will vary for each sector;
- Vehicle emissions to be included – in late 2007 or early 2008, the Commission will present legislation on the reduction of CO_2 emissions from automobiles;
- Increasing requirements for member states to undertake auctioning, although how far these requirements will go is as yet unclear;
- Devising strict benchmarking formulae for the allocation of those permits that are distributed free of charge;
- Setting longer trading periods than the five years of phase 2 in order to improve the credibility of long term carbon prices and thereby stimulate investment. An emissions reduction target would be specified for the end of the longer period, with an implicit glide-path for intervening years.
- Ensuring greater visibility for the use of the Kyoto protocol's CDM and JI mechanisms post 2012 if there is no direct equivalent successor to the protocol itself.

These are generally sensible ideas, and should further improve the workings of the ETS. However, it is unclear that this will effectively solve the problem of price volatility. Without a mechanism to control price movements, the price of permits is vulnerable to the tensions inherent within the ETS. In particular there is a fundamental conflict between the role of the ETS as a driver of environmental improvement and that of stimulating investment in new technology. The ETS depends on a scarcity of permits to drive their price – if there is no scarcity, then the price will tend to fall to zero.

So the more successful the ETS at reducing emissions, the closer the price of permits will fall towards zero and the weaker the incentive offered for the development of new low carbon technologies. Effective operation of the ETS in both achieving environmental gains and development of new technology may therefore require more radical remedial action.

This could take the form of the imposition of a floor and ceiling for permit prices in order to limit their range of movement. Otherwise, more frequent adjustment of aggregate permit numbers may be necessary to preserve a degree of scarcity and thus greater price stability. Such a process would be at odds with the prevailing market-driven credentials of the ETS, and could offer additional scope for harmful political interventions. This danger could be mitigated by the introduction of rules for determining the number of permits made available in any period, depending on factors such as recent permit prices and emissions levels.

We recognise the potential of the ETS as a tool of climate change policy. But it needs modification if it is to be effective in the long term. The necessary adjustments must be carried through quickly and without being compromised during the political negotiating process. If the nature of the beast is that it is incapable of being successfully reformed into an effective and practical policy instrument, then we need to know as soon as possible, before too much economic damage can be inflicted by use of inappropriate policies. And if it is to be a useful tool, the sooner the ETS is working properly the better.

5.2 The use of auctions

An important feature of a cap-and-trade scheme is the method of distributing permits. They can be given to participants for free – based on historical emissions ('grandfathering') or projected emissions – or benchmarked according to another criterion. Alternatively, permits can be auctioned.

Economists almost always recommend more auctioning, because it helps permits find their way to the users who can extract most value from them.

But incumbent firms tend to dislike auctions because they reduce the relative costs of entry for new participants. To date, grandfathered permits have been the dominant method of allocating allowances in existing trading schemes – probably because the upfront costs are lower and such schemes are more politically acceptable. Grandfathering also allows legislators to exert some degree of control over the distribution of permits. Auctions of emissions permits have therefore tended so far to be the exception rather than the rule.

The majority of participants in phase 1 of the EU ETS are thought to have made substantial profits from the system of free allocations, as predicted by economic theory. Firms can offset the increased marginal cost of polluting in three ways – by passing on the costs to consumers, by changing behaviour to adopt new technologies which might mitigate emissions, and because they are given most of the allowances for free. Recent industry estimates[8] suggest that electricity generators could make windfall profits of around £1.5bn a year in phase 2 of the ETS for this reason.

Hepburn, Quah and Ritz[9] have tried to identify the share of allowances that should be freely allocated in order to achieve a neutral impact on firms' profits. The answer to this depends on the strength of competitive forces in each market. In a perfectly competitive market, for instance, any increase in costs should be exactly matched by higher prices, with no change in profits. Firms operating in such markets should therefore be indifferent between grandfathering and auctioning of permits. More generally, in markets where several firms are in competition some element of grandfathering may be required in order to protect their profits, with the necessary degree of grandfathering being greater for large firms and for whole industries.

Their conclusions for policy are therefore that:

- Individual countries should auction the full 10% of allowances that is permissible in phase 2 of the ETS;
- When new sectors such as aviation are included in the ETS, careful economic analysis should be undertaken to identify the impact of auctioning or grandfathering on profitability before deciding what proportion of permits to auction;

- In periods after 2012, a proportion of allowances, probably in excess of 50%, should be auctioned.

Several theoretical and practical arguments can be put forward in favour of auctioning.

- Auctions reduce the potential distortion of dynamic incentives, e.g. the incentive to increase output or emissions now in order to be granted a larger (free) licence allocation in the future.
- Grandfathering benefits incumbents since new entrants have to buy permits, although a reserve of permits could be held back for such purposes.
- Firms may have better information than the authorities, allowing them to over-bid for permits in the initial allocation, whereas auctioning does not encourage this.
- Free allocation gives rise to large lobbying costs by both firms and government.
- Requiring payment from those who pollute probably reflects a fairer allocation of property rights – if they wish to pollute, they should purchase the right to do so from the public.
- There may be adverse distributional consequences if licences are grandfathered to firms, as the rents will ultimately accrue to shareholders, who are generally more affluent than the general population.
- Firms and individuals act by using rules of thumb rather than calculating the optimal response. Raising revenue directs management attention to the policy problem and is therefore more likely to provoke an active change of behaviour.
- Legal considerations may place limits on free allocation of allowances as the resulting windfall profits, at the expense of consumers and taxpayers, could give rise to state aid considerations.
- Raising revenue through auctions may generate a double dividend – providing an incentive for firms to reduce pollution while generating funds to pursue other ways of mitigating environmental damage. The revenue could be recycled to offset the adverse macroeconomic impact of environmental instruments, or to correct adverse distributional impacts.

There are drawbacks with auctions too. The precise impact of an auction depends on a number of factors, including the design of the auction itself – the type of auction (ascending bid, sealed bid, etc.), eligibility and participation, the allocation of any remaining free allowances, periodicity of auctions, and (in the case of the EU's ETS) whether there is competition or coordination between member states.

But many will remember the enormous price bids generated during the auctioning of third generation mobile phone licenses, costs which nearly bankrupted some firms and which are still being paid off by the "successful" bidders. The potential cost of bidding for permits through auctions can be a deterrent for incumbents with significant market shares. This may result in a sub-optimal allocation of permits if those who cannot afford the cash drain for purchase lose out to other (less efficient) firms.

Auctions may also produce greater price volatility, giving rise to uncertainty about future carbon prices. The risk of low CO_2 prices represents a significant hurdle for low-carbon investments, and could lead to delay in investment decisions – especially as companies tend to be risk averse in areas outside their core business.

One way of achieving a greater degree of price stability is to impose a price ceiling and floor. In practical terms, auctions of ETS permits could not achieve an absolute, unbreakable price ceiling when only 10% of the total allowances are available to auction in phase 2. But auctioning could reduce the risk of price spikes if some allowances were held in reserve and only released onto the market in the event that price rose above a pre-determined level for a certain duration. Auctions can also offer support for a price floor, for instance by agreeing that part of the allowance held back for auction would be sold above a certain reserve price.

6: What to look for in the policy response to climate change

Given the enormous uncertainty surrounding both the science and the economics of climate change, opinions are remarkably firmly entrenched. From the passionate tone of much of the public debate, it is difficult to imagine that many of the participants can be in any doubt whatsoever about global warming – its causes, its impact, or its remedies.

The IoD tries to take a detached view of the issues. Unsurprisingly, we are inclined to pursue a pragmatic middle way somewhere between the extremes of the climate change hawks and doves. This view accepts that there is a climate change problem to be addressed, and that rising carbon emissions as a result of human activity have probably played some part in causing global warming. It also acknowledges that there may be significant asymmetries in the risks posed by different climate developments. If the potential damage from allowing too high a level of carbon emissions is large relative to the costs of acting to reduce carbon emissions, then some precautionary action is likely to be beneficial.

But recognition of the risks arising from climate change raises a new – and potentially just as potent – threat to economic prosperity from the adoption of poor policy responses. Environmental issues should not just become an excuse for greater intervention in the economy, through either additional regulation or higher taxation.

The risk is greater because many in the environmental lobby are naturely hostile to the capitalist economic model, and would be happy to see it discredited. In addition, politicians have a tendency to tinker in order to be seen to be taking decisive action. This encourages a competitive process of policy design, as different groups seek to outbid their predecessors with calls for ever bigger cuts in emissions. If allowed to go unchecked, such policy leap-frogging could result in serious harm to the economic prosperity of the country.

Many policy proposals are sensible and practical, and could profitably form the basis for future policy development. Some are less attractive and appear designed to grab media headlines rather than as serious contributions to the debate – for instance, proposals for personal flight allowances, and the suggestion that airline tickets should contain ‘health warnings’.

There are other proposals that would do outright damage to the economy. The airline industry in particular has become a whipping boy for environmental campaigners and air travel itself has been demonised. If this hostile attitude starts to pervade government thinking, this could endanger future airport expansion proposals, so putting at risk the UK’s longer term economic prosperity.

The entirely reasonable need to ensure that environmental costs are fully captured in everyday decisions has in these extreme cases been overtaken by an excessively zealous approach that fails to balance costs against benefits, and places the whole emphasis on ecological issues and none on the economics. Such an approach may well reduce the harm to the environment but it risks throwing out the huge benefits that arise from many polluting activities at the same time.

As ever more new policy ideas materialise for the handling of climate change, it is important to try to bring an element of rational thought into this highly-charged and polarised debate. This chapter therefore discusses some basic principles that might help to assess the potential worth of new climate change policies.

6.1 Guidelines for assessing climate change policy proposals

It is possible to draw up a list of the most desirable features of any climate change policy initiative. Drawing upon the discussion in this paper, we suggest that policies designed to tackle global warming should be assessed according to the following basic principles – the IoD's *optimal policy rules*:

- *Efficient* – Policies should be subjected to rigorous cost-benefit analysis to ensure that they achieve the maximum environmental benefit at the minimum economic cost. There are real and important trade-offs involved in any policy change, and these have to be examined with care.
- *Low running costs* – Administrative costs should be modest in relation to the expected benefits, both for those charged with policy implementation and for the individuals and firms that it affects.
- *Well targeted* – Policies should be targeted at the specific cause for concern and not broadened to cover unrelated matters. The interests of the environment should not be used as an excuse to target other activities which may be closely related but are not causing any environmental harm.
- *Neutral* – A good environmental policy should minimise the resulting distortions to economic behaviour by individuals, firms and other institutions. Simple policies are likely to be more effective than complex ones, which may have unforeseen consequences.
- *Internationally competitive* – Climate change is a global problem and requires global solutions. But the UK is only a small player. Ideally policies should be global in coverage, or as broadly based in geographical terms as possible. Policies adopted at EU level are therefore preferable to go-it-alone UK action, which could damage UK competitiveness while having little impact on global emissions.
- *Credible and consistent* – Because many of the investments required to deal with global warming will have long development and production lead times, policies must be devised in such a way as to ensure that the incentives for good environmental behaviour remain stable, consistent and credible over the long term. Investors need to be certain that the rules are not going to be changed regularly.
- *Technology-friendly* – In a similar vein, such policies should offer encouragement to the development of new technologies, since the least-cost routes to tackling climate change over the longer term are likely to be those that make best use of new technological opportunities.
- *Flexible* – Policies must be flexible enough to permit simple and prompt adjustments in response to changes in knowledge on the science and economics of climate change, and as experience cumulates of the behavioural responses of firms and individuals to climate change policies.

6.2 Gradualism in climate change policy

In addition to the criteria outlined above, the way in which policies are implemented is also an important consideration. For instance, should climate change policy take a 'short, sharp shock' approach, or should it be implemented cautiously?

The uncertainty about both the science and the economics of climate change suggests that a gradual approach is best. This fits with the so-called 'precautionary principle', which justifies taking early action to reduce emissions, even though we cannot be sure that it is strictly necessary, simply because the potential impact of failure to act could eventually be catastrophic.

Thus in the absence of certainty about the 'correct' carbon price, whether the outcome of a carbon tax regime or a trading scheme, it is wise to pursue gradual convergence towards an optimal equilibrium price. It does not make sense to lock into a precise carbon price or emissions outcome, which cannot be known reliably at the outset, and which may well be followed by destabilising lurches in price whenever the state of climate change knowledge moves on.

For this reason, the IoD has fundamental concerns about the wisdom of adopting legally binding long-term emissions reduction targets, as proposed in the UK Government's draft Climate Change Bill of 2007. We hope that the Government will proceed cautiously in this area in order to avoid damaging policy mistakes.

We have two key concerns. First, formal target setting has had a poor track record in recent years, and the impact of targets has been damaging in a number of policy areas. The danger that institutional behaviour is distorted in order to meet arbitrary government targets at the expense of more sensible policy goals is well recognised, and has been demonstrated for instance in the health service.

Rigorous targets tend to acquire a political status out of all proportion to their merit, and may come to dominate both policy and behaviour long after they have been discredited. There is a serious danger of getting locked in to policies that are inefficient and costly, and maybe even counter-productive.

Second, in the climate change arena in particular, we doubt the wisdom of setting legally binding targets for a period as long as 50 years ahead. Who knows what might happen over a period of this duration? Almost certainly the science or the economics of climate change will be revised, whether for better or worse, and the optimal policy responses may therefore change too. The risk in locking into a particular set of targets is that they acquire totemic political status which hinders the rapid re-adjustment of policy should that be necessary.

It is necessary to have a good idea of the broad direction of policy, and indicative targets or projections may well be an essential input into the policy process. But targets should not become the be-all-and-end-all of climate change policy, and it is potentially dangerous to be too prescriptive at the outset.

We support an approach that gives clear, consistent and reliable signals about the desired and expected trends in emissions, and a timely and transparent approach to the inevitable adjustments that will be required from time to time. This is preferable to the adoption of a precise legally-binding emissions target whose credibility stands to suffer every time it has to be modified. If the parameters of policy turn out to be incorrect, they should be adjusted slowly and steadily – away from the glare of publicity that their exaggerated status would guarantee in the event of missed targets – in order to restore emissions levels gradually to the desired long-term path. A gradualist approach such as this minimises the risk that a sharp change in policy will deter investment in long term assets.

6.3 The international dimension

The international nature of climate change also indicates a cautious approach to policy implementation in order to protect the UK's economic interests. Climate change is a global problem, and it ideally requires the widest possible international participation in efforts to find a solution. Unilateral national targets may be ineffective, as a single country by itself is powerless to reduce global emissions significantly. The case for strong unilateral action by an individual country is valid only if it provides a demonstration of good practice which may be picked up by other countries. And other countries will only be induced to follow suit if the policies are successful.

Indeed unilateral action may be counter-productive in its environmental impact if it merely serves to divert economic activity away from low polluters such as the UK to high-emitting emerging market economies.

The risk to business competitiveness is often cited as a reason to avoid taking strong unilateral action. This concern is entirely justified. Governments too often take a cavalier approach to competitiveness, and business hardly needs an additional burden of taxes and regulations in the cause of bolstering the Government's environmental credentials.

Nevertheless the entirely valid concerns about competitiveness and the resulting desire for an international approach should not be allowed to block all progress towards tackling climate change. Limited action by individual countries or groups of countries should be encouraged as a trigger to action on a wider scale in subsequent periods.

Efficient and flexible economies should to some extent be able to adjust fairly readily to modest losses of competitiveness over time, at least in most sectors. It is also possible to preserve the incentive effects of climate change policy while not allowing it to have a damaging effect on competitiveness at an aggregate level, for instance by recycling tax or auction revenues or by making offsetting reductions in other taxes. In order to remain competitive, the overall burden of tax on business should not be raised as a result of environmental policies. A shift in the balance of taxation towards green taxes will itself hone incentives for good environmental behaviour.

Clearly, while protecting competitiveness at a national level, it should be noted that there would still be adverse competitiveness effects for individual sectors or firms.

Competitiveness is important, but there are ways forward which in practice do little harm to the economic interests of a country – especially if they are matched by policy improvements designed to boost competitiveness in other respects.

But if a modest measure of unilateralism in UK environmental policy should be possible without seriously undermining our economic performance, it is too easy to overstep the line between what is reasonable and what is not. And any detriment to the economy would be futile considering the scale of the resulting cuts in UK emissions set against the huge increases in pollution in many developing countries. It would be utter folly to decimate parts of UK industry in the pursuit of cuts in domestic emissions that are a fraction of the annual *growth* of emissions in China.

In truth, one of the reasons that Kyoto has achieved so little of practical value in reducing global temperatures is because huge emitters such as China and India are excluded. Even if there is a global consensus on the need to cut carbon emissions, this does not extend to how to share the burden between countries. Achieving such a consensus will be difficult and time-consuming.

Even where international agreement can be reached, there is an ever-present risk that participants renege on their commitments or otherwise seek to change the rules to suit their own domestic constituencies. The involvement of an independent global regulator could help to ensure fair play between countries and to minimise the risk that political interference and regime volatility undermine the long term credibility of policy.

Instead of endless debate about how to move the climate change agenda forward on an international basis, a more flexible approach – based on loosely harmonised national policies that are acceptable to individual countries – might be more successful.

Even trading schemes could sensibly work on such a loosely harmonised framework, with permits traded nationally rather than internationally. It might not be perfect, but on a voluntary basis it would be a step on the path to achieving the desired environmental goals. And because it would not require international agreement on elaborate rules and processes, it can happen a lot sooner than a more sophisticated international scheme that would take years to negotiate. Indeed if the policy were seen to be successful in reducing emissions without significantly damaging economic growth, non-participating economies may well be encouraged to join in too.

If a number of countries could agree to sign up to the same policy instrument, how should they seek to harmonise policy? For instance, should each country aim for the same scale of targeted cuts in emissions, or for the same tax rate used to achieve those cuts? This may depend on circumstances, but harmonised tax rates are easier to verify than the cuts in emissions actually achieved.

This raises the question whether it matters if such policy action is not co-ordinated. It would doubtless lead to a more efficient pattern of abatement between economies if each country adopted the same instruments, with the same parameters, to deal with climate change. But it will be impossible to secure the agreement of all countries to sign up to the same policies, and we cannot afford to be over-prescriptive. If everybody contributed voluntarily towards global action on climate change, even by ‘doing their own thing’, that would be an immense step forward.

A hybrid policy for controlling national emissions

Proposals by McKibbin and Wilcoxen[10]

In their proposal, McKibbin and Wilcoxen (M&W) start from the position that climate change policy must have long term credibility if it is to be effective in encouraging the investment in new technologies that will be necessary to deliver much of the required reductions in emissions. Future governments will be tempted to relax or reverse climate change policy, perhaps for electoral reasons or in response to strong lobbying pressures. A carbon tax is particularly vulnerable to easing or abolition in the face of powerful lobby groups.

To minimise the risk of such a default, M&W argue that to have long term credibility, a policy "must create a constituency with a strong financial interest in perpetuation of the policy". They argue that this could be achieved through the issue of long-lived or perpetual trading permits, allowing one tonne of emissions every year for the life of the permit. Once distributed, each permit will be a valuable financial asset with a price that depends on the credibility of the policy. That credibility will be reinforced by the strong financial interest that permit owners will have in ensuring that the policy is maintained and enforced.

By itself this would not produce an economically efficient policy. It would, though, act towards achieving a specific emissions target by a given date, regardless of the cost of doing so. In order to include the positive efficiency properties of a carbon tax, it is therefore necessary to augment the supply of long-term permits with a flexible supply of short-term permits giving the right to emit a tonne of carbon for a period of, say, a year. Whereas the number of long term permits would be restricted to a quantity less than the current level of emissions, the annual permits would be available in unlimited quantity at a specified price. The price of the latter would be fixed by the Government, implicitly reflecting the desired level of carbon taxation (for which this policy effectively acts as a proxy). The price would be varied over time in order to meet the Government's aspirations for reducing carbon emissions, in the same way that a carbon tax rate could be adjusted.

Firms would be required to match their carbon emissions with a combination of long term and annual permits. Both types of permit would be freely traded without restriction.

Their limited supply would ensure that long term permits were highly valuable, and their price would be heavily influenced by the price of annual permits as a close substitute.

The proposal therefore amounts to a hybrid scheme which incorporates the best features of both a carbon tax and a cap-and-trade mechanism. It mimics the incentive properties of a carbon tax, while delivering long term credibility through the creation of a private sector constituency with a clear financial interest in seeing the policy maintained and enforced.

M&W go further and suggest that the permits should only be valid within the country of issue – i.e. they would not be traded internationally. Individual countries could voluntarily join the scheme, agreeing to establish a hybrid scheme and to charge a specified price for annual permits.

The benefits of such an arrangement are that it would not require complex international trading rules, negotiations over the allocation of permits between countries, or the ceding of national sovereignty to an outside body. A scheme could therefore be established quickly and easily, perhaps initially with a limited number of participants. Eventually all countries should be expected to participate, but many developing countries would not choose to do so at the outset.

In summary, the main features of the policy would be as follows:

Perpetual or long term permits

- Limited in quantity, perhaps specified as a proportion of 1990 emissions;
- Distributed once only, at the time the policy is first enacted;
- Could be bought, sold or leased within the country of issue without restriction;
- No international trading – only valid in the country of issue;
- Price determined by the market.

Annual permits

- Sold for a stipulated price, say $20 per tonne of carbon;
- Valid only in the year and country of issue;
- No limit on the quantity that would be available.

7: How do recent policy proposals shape up?

In this section, we consider a number of different policy proposals for tackling climate change, and assess them subjectively against the criteria set out in the previous chapter. Based on an internal IoD assessment, the results are shown in Table 8 at the end of this paper. Although this is necessarily a subjective exercise, it provides a sound basis for discussion of the relative merits of different policy initiatives. For the purposes of policy selection, it is the relative positions of different policies that matter, and so the ranking of policies is more important than the raw scores.

The ratings say nothing about the suitability of each policy for particular sets of circumstances. Some policies will be inappropriate in certain contexts. In other cases a combination of policies may be necessary to achieve the optimum effect. For instance, some instruments offer incentives to consumers and others act on the behaviour of producers. A combination of consumer and producer taxes may deliver better results than neither on their own.

Many of the ratings will depend on the precise manner of implementation of each policy, and the efficiency with which this is conducted. As an example, most policies might be expected to score superior ratings – especially for long-term credibility – if they were administered by an independent regulator rather than by governments or other bodies that are open to political and electoral influences. However in some cases policies can achieve a similar effect through their intelligent design.

The scoring of policies against the 'internationally competitive' criterion is difficult to assess, as many approaches are in theory international in scope if enough countries can be persuaded to adopt them. For the purposes of this exercise, we have given most policies a medium rating in this category, with higher ratings for policies that seem most likely to be adopted on a broader international scale, and lower ratings for those that look unlikely to be imitated elsewhere.

The main policy proposals considered for this exercise are described briefly in the following paragraphs. Some of them are generic, and are scored here in correspondingly general terms. However the same approach could be used – to even greater effect – in the assessment of finely detailed environmental policies.

Carbon tax

A simple carbon tax is levied according to the carbon content of goods and services, including the carbon emitted during the manufacture of a good or the provision of a service. In order to remove the risk of double-counting, the tax might need to be structured like VAT, with each stage of the supply chain liable for tax only on the carbon content added during its stage of the production and delivery process – a carbon added tax (CAT) perhaps?

The Conservatives consulted in November 2006 on a more sophisticated hybrid proposal[11] to replace the climate change levy (which does not discriminate consistently between energy sources according to their carbon content, although there is an exemption for renewable energy) with a carbon levy. Partly to address the deficiencies of the EU's emissions trading scheme, they suggest the use of a carbon levy, co-existing with the ETS, in order to provide a floor beneath which the price of carbon cannot fall. The levy would be revenue neutral overall for business, and would not apply to domestic household emissions in order to reduce its regressive impact.

There are many ways in which a carbon levy could be imposed. One way of giving it greater credibility as a long-term instrument of environmental policy would be to pre-announce a rising rate of tax per unit of carbon emissions, starting at a modest level of say £15-20 per tonne and rising gradually over time.

Personal carbon allowances

Emissions from the domestic sector of the economy – households – accounted for more than a quarter of the UK's total carbon emissions in 2005. This has led some commentators to call for the introduction of a personal carbon trading scheme, along similar lines to the EU's emissions trading scheme for businesses.

Under such a scheme, each household or individual would be given a carbon allowance, which they could use in any manner they wish – heating the home, travel by road or air, etc. Should they wish to indulge in further carbon-emitting activities, over and above their allowance, they would have to buy such permits in the associated market.

While this is in many respects a logical extension of the principles behind the existing emissions trading scheme, it could be costly to administer, especially the measures required to prevent potentially high levels of non-compliance. And the method of allocating permits could be politically very controversial.

In any event, such a policy for household emissions should be redundant if a carbon tax or cap-and-trade scheme is in place. Carbon pricing at the production stage should ensure that the carbon content of most goods and services consumed by households is already reflected in their prices.

Green Miles Allowances

As a variation on this theme, the Conservatives recently consulted on a proposal to introduce a 'Green Miles Allowance',[12] entitling everyone to one short-haul return flight per year at the standard rate of tax, with additional flights taxed at a higher rate. The attraction of such a proposal is that it avoids the potentially unpalatable distributional effects associated with other measures to curb air travel, which generally act by discouraging travel among less well off households. However, despite the existence of extensive systems for the identification of passengers, already used for security as well as commercial purposes, it could pose a significant administrative burden on airlines, passengers, and government.

As in the case of personal carbon allowances, this policy would be expensive to administer and its introduction is politically risky. It also discriminates against the aviation industry, as it restricts air travel but does nothing to curb other carbon-emitting activities.

Climate change levy

This tax is levied on the amount of energy supplied to business, charged to the users rather than the generators. This gives little incentive for energy suppliers to switch to low-carbon forms of generation, although it encourages users to do so. There is also no distinction between power generated by different energy sources, whether low carbon or otherwise. However firms can reduce their climate change levy (CCL) bills by 80% if they reach a Climate Change Agreement (CCA) with DEFRA.

Renewables Obligation

The Government has set targets for the share of the UK's electricity supply that is generated by renewable energy sources. Power generators therefore have to demonstrate their conformity with this approach – known as the Renewables Obligation (RO) – by purchasing Renewables Obligation Certificates (ROCs) if their share of renewables generation falls below the target.

The RO may initially have fulfilled a necessary function in kick-starting the development of alternative energy sources. But over time, it has failed to stimulate the generation of electricity from some of the less developed technologies, with most renewable power still coming from wind farms. But it has raised the cost of generated electricity, and amounts to an open-ended subsidy to forms of generation that may not be viable over the longer term.

The proposal in the 2007 Energy White Paper to introduce different bands in the RO for different technologies, in order to direct support towards those technologies that are most in need of development support, is an improvement. But the RO remains a high-cost route to lower greenhouse gas emissions, and one which discriminates against non-renewable, low carbon energy sources, such as nuclear and 'clean coal'.

Reduce energy subsidies

An estimated $200bn is spent annually on global energy subsidies. Many of these could be eliminated over time. Such a policy would make a helpful and efficient contribution to the fight against global warming. But the subsidies were initiated to secure other policy ends, in many cases to protect those on low incomes from high energy costs. If these are still relevant, these goals would then have to be met in another manner, which may be less efficient than the original subsidies.

EU emissions trading scheme

This scheme – discussed in detail in Chapter 5 – has the potential to achieve significant and beneficial reductions in emissions in an efficient manner. But it requires some substantial improvements in its working if it is to overcome the blemishes of its first phase of operation as well as its deeper structural limitations. If successfully achieved, this could pave the way for the ETS to form the basis of a global emissions trading mechanism.

Kyoto CDM and JI mechanisms

Participants in the ETS are allowed to purchase credits in the Kyoto protocol's Clean Development Mechanism (CDM) and Joint Initiative (JI) schemes. As with carbon offsetting – see below – it does not directly reduce the participant's own emissions, but buys into positive action in other parts of the world, usually developing economies. Some critics see this as offering an easy option for European polluters, and it needs careful policing to verify that the resulting outcomes are ones that would not have happened anyway.

Hybrid price/quantity-based carbon pricing schemes

Combining the best features of both price-based and quantity-based carbon pricing schemes may achieve better results than either on their own. The Australian government has presented a hybrid carbon permit plan based on the ideas of two economists, Warwick McKibbin and Peter Wilcoxen – see Chapter 6. Under their scheme, the government issues long term or perpetual permits to emit carbon, such that annual permitted emissions are less than the current level. In addition, it issues additional single-year permits to make up the present demand for permits, initially priced at say $20 per tonne but rising over time. While mimicking the incentive properties of a carbon tax, it also gives the owners of perpetual permits a strong interest in the continuity and effective enforcement of the scheme in order to sustain the value of their holdings of long term permits, whose price should also rise over time as the price of annual permits rises. This vests the scheme with greater long-term credibility than most policies, and would thereby offer firmer long-term incentives to investment in new technology and R&D.

Carbon offsetting

Carbon offsetting is the process of allowing individuals and firms to "offset" their emissions by investing in emissions reduction schemes in other parts of the world – often in developing countries. It began with planting trees, but has now expanded into a much broader range of environmental improvement projects.

However, it may be regarded as an easy option for consumers of environmentally damaging products such as air travel, and should be seen as a 'second best' way of tackling global warming – perhaps better than nothing, but not to be recommended as a prime instrument of environmental policy.

Its drawbacks are well documented. The easy dissolution of people's guilt about their environmental behaviour may itself act as a block on more radical changes in behaviour. In addition, there is no consistent, independent check on the validity of many of the offset schemes that are available to consumers, to verify that the activities being financed are ones that would not have occurred anyway.

Improving energy efficiency

This is a 'win-win' solution, which reduces households' and firms' costs as well as delivering potentially large environmental gains. It is therefore a 'no-brainer' in terms of its desirability as an effective form of environmental policy. The big problem lies in persuading consumers and firms to pursue it vigorously, as it typically relies on a very large number of small individual acts of energy saving, rather than a few big headline grabbing actions. This requires persistence in trying to adapt ingrained habits – not something that comes naturally to normal human nature. It can be encouraged through fiscal incentives, although this risks introducing other distortions to people's behaviour.

Aviation environmental policies

The only quasi-environmental tax on the UK aviation industry at present is air passenger duty (APD), a flat rate tax per departing passenger from UK airports, with differential rates for shorthaul and longhaul air services, and for travel in premium and economy cabins. This has poor properties as an environmental tax, as it provides no incentive to airlines to improve their environmental performance. Instead it acts to reduce growth in air travel per se by raising the cost of air fares.

Some commentators have called for the tax to be levied on a 'per flight' rather than a 'per passenger' basis, and the Government has announced that it will consult on such a proposal. This would encourage airlines to fill as many empty aircraft seats as possible. It could be further refined to incentivise airline investment in new, lower emissions aircraft by varying the rate of duty for different aircraft according to their normal emissions performance. Likewise, by relating it to distance travelled, it might discourage longer air journeys.

Many environmental campaigners have called on the Government to refuse to sanction the addition of new UK airport capacity. This is perhaps one of the poorest of all policy options. It discriminates aggressively and unfairly against the UK aviation industry, and achieves limited environmental benefits in global terms. And yet it comes at potentially enormous cost to the UK economy, as passengers – and increasingly trade and business activity – gradually divert to other global business centres in Europe and beyond.

Other policies have been suggested to curb the growth in air travel. The Liberal Democrats[13] have proposed a climate change charge on domestic flights, rather surprisingly levied on a 'per passenger' basis. There are also calls for the auctioning of airport slots in order to raise the cost of landing at congested UK airports – although this is less of an environmental policy and more one of efficient allocation of scarce airport capacity.

The environmental treatment of aviation is discussed in Chapter 8.

Road fuel duties

Road fuel duties are levied on fuel consumption – the input that leads to the creation of greenhouse gas emissions – rather than on the output of emissions themselves. Even so, they are an efficient form of environmental taxation because of the close link between fuel consumption and emissions. Duties are open to added sophistication, for instance, by varying duty rates between different types of fuel or vehicle.

That said, current duty levels are considerably higher than is warranted by any plausible estimates of the external costs of carbon emissions from motoring.

Motoring taxation

Road transport generates multiple externalities, including congestion, noise and emissions of carbon and other noxious substances. This probably requires a combination of taxes or other instruments to deal effectively with the different externalities.

Fuel duties are an effective instrument for dealing with the emissions from burning fossil fuels in motor vehicles, despite being levied on consumption of an input (fuel) instead of production of an output (emissions). It would be difficult and expensive to levy a tax on the quantity of emissions themselves, because of the requirement to measure accurately the emissions of each vehicle, which depend on the nature of the use of the vehicle and its age, as well as characteristics of the vehicle itself. Taxing the quantity of fuel consumed is a good proxy for emissions, and is easily enforceable.

Policy could be made more sophisticated in a number of ways, perhaps by varying the tax bands according to fuel and by vehicle type, or by tightening vehicle emissions standards. The graduation of vehicle excise duty by emissions bands has already gone some way in this direction. But the greater the complexity of the tax system, the greater is the scope for evasion or error. For instance, charging separate rates of fuel duty by vehicle type would not be correctly administered at the pump.

It is difficult to estimate the optimal level of fuel taxes justified by the carbon emissions of motor vehicles. But for any plausible estimate of the cost of carbon, UK petrol prices are considerably above that level. The logic of carbon pricing is therefore that the rate of road fuel duties should be lowered.

Motoring generates another significant externality in the form of congestion, and this may also be put forward as a justification for current high levels of UK motoring taxation. However, fuel taxation is a poor instrument for tackling congestion, as it does not discriminate between driving on congested and uncongested roads. A system of road pricing – based on mileage driven, type of road used, and time of day – is a more effective means of charging for the congestion externality, although it must be accompanied by new road investment. The revenues raised could be deployed to ease the burden of road fuel duties on motorists, although this would of course have negative implications for the government's environmental targets compared with the status quo.

The interaction between the two externalities therefore needs to be considered carefully.

It is in theory quite possible to handle both externalities in a single mechanism. For instance if a system of tracking all vehicle movements, by time of day and by roads used, were to be deployed to implement a national road pricing scheme, the same mechanism could be used to charge for pollution as well as congestion. However there are serious concerns about the loss of personal privacy inherent in such a system.

R&D subsidies

Lawrence Summers[14] has argued that the major industrialised economies should commit themselves to a large increase in research funding into new technologies, together with the licensing of intellectual property to developing countries on preferential terms. The World Bank and regional development banks should provide subsidised capital for projects that have environmental benefits that go beyond national boundaries.

Many new technologies undoubtedly require financial support in order to get kick started, and promoting R&D subsidies is a vital element of the process of not only developing such technologies but also bringing them to the market.

However as with any subsidies, there is a risk that they end up financing projects that are not viable in the long run. Financing the successful development of new technologies can bring huge rewards but inevitably involves significant risk of failure. Government involvement in such activities requires extremely careful management if R&D subsidies are not to be an open-ended source of finance for unsuccessful ventures.

UK draft Climate Change Bill

The UK's draft Climate Change Bill 2007 does not propose policies as such, but sets out legally binding targets for reducing greenhouse gas emissions. Governments do not have control over emissions levels, and rely on incentivising firms and individuals to behave in such a way as to achieve the targets. The targets may have some value as a powerful force for change, but only if they are allied to more immediate practical and effective policy proposals, of the sort discussed in this paper. Other than as an exhortation to good behaviour, commitments to carbon reductions in 40-50 years' time are meaningless, bearing in mind the huge uncertainties involved in assessing what will happen in the intervening period.

Furthermore the use of targets can distort behaviour in order to meet the targets at the expense of more sensible policy goals, with the danger of getting locked in to policies that are inefficient and costly.

More rail investment – new high speed rail lines

There is often confusion about the justification for extra rail investment. The Rail White Paper[15] sets out the case for additional railway capacity, not primarily as an instrument of environmental policy, but in order to provide the capacity to meet expected future growth in demand. However others wish to see the rail network play a bigger role in supporting environmental policy, by diverting passengers from road or air to rail.

The implications for extra rail capacity may be different according to whether you are trying to attract passengers from planes or from cars. New high-speed rail lines between the UK's major cities, including the proposed north-south high-speed rail link, may be part of the answer for those who wish to see domestic air passengers switching to rail services. However significant shifts from road to rail might require more emphasis placed on improving existing rail services, concentrating on the parts of the network that serve large conurbations and other urban areas.

This policy is likely to be expensive, and may have relatively little environmental benefit. Car transport accounted for 85% of domestic passenger mileage in 2005, so even a 50% increase in the railways' 6% share would amount to just one or two year's growth in road transport.

Car emissions targets

The European Commission has proposed mandatory 20% cuts in new vehicle CO_2 emissions to 130 g/km by 2012, compared with the 2005 level of 162 g/km, to be achieved as a result of new technology, with the aspiration of reducing emissions further in subsequent years. Together with action to increase the use of bio-fuels and other measures, such as encouraging more fuel-efficient driving and reducing the weight of cars, this is expected to see emissions fall to 120 g/km by 2012. However there are no proposed incentives to achieve this, and European car manufacturers have warned that such tough targets could lead to factory closures and job losses.

Bio-fuels

The increasing use of bio-fuels is controversial, not only because of its implications for the agricultural sector and the resulting upward pressure on world food prices, but also because the production of some sources of bio-fuels is thought to be highly carbon-intensive. However many experts are optimistic that an eventual breakthrough in bio-fuel technology will see bio-fuels become a common source of fuel for cars and shipping, although it will take rather longer to find a suitable substitute for aviation fuel.

Governments have therefore introduced targets for the share of vehicle fuel consumption taken by such fuels. For instance, the UK Government's Renewable Transport Fuel Obligation (RTFO) requires transport fuel suppliers to ensure that 5% of total fuel sales are from renewable sources by 2010/11, with consultation taking place on raising this to 10% by 2015. The EU also has a (conditional) 10%-by-energy-content bio-fuels target by 2020 as part of its attempt to achieve 20% of total EU energy consumption from renewable sources by that date.

Green tax breaks

There are regular calls for tax breaks to be offered to stimulate the consumption or production of environmentally products. While superficially an attractive way of encouraging good environmental behaviour, tax breaks distort the characteristics of the tax system, and can have unintentionally adverse consequences beyond their immediate sphere of application.

7.1 Scoring of environmental policies

Each of the above policies is scored against the IoD's eight *optimal policy rules*, as outlined in Chapter 6. A five-point scale is used, ranging from '5' for the best policies to '1' for the poorest. Table 8 gives the detailed assessment of policies, and the average results are summarised in Table 7 below. (In practice, we might expect to value some criteria more highly than others, and to assign them higher weights in our analysis. But unless there is substantial variation in the weights, the results are unlikely to differ significantly from the unweighted figures shown here.)

Not surprisingly, the 'no brainer' of improving energy efficiency comes out on top, with a near-perfect score of 4.9. It saves money, and therefore improves competitiveness, as well as saving the climate. And everyone can do their bit if they make just modest changes in their behaviour.

After that, the use of hybrid economic instruments – that take the best features of both price-based and quantity-based instruments, such as the McKibbin-Wilcoxen scheme – score highest. A broad-based carbon levy also comes out well, as do road fuel duties and moves to cut energy subsidies. The EU's emissions trading scheme scores slightly lower, in part because of the administrative burden imposed by its operation.

At the other end of the scale, some of the poorest policies are those which target specific sectors, either for support (renewable energy sources) or discouragement (air travel). These initiatives all score poorly on the neutrality rule. The proposal that new airport expansion should be restricted is bottom of the list, suggesting that it has little to recommend it as an environmental policy. In practice the policy's worth will depend crucially on the precise details. For instance, a proposal to restrict expansion at Heathrow Airport is likely to score poorly against these criteria because of the enormous economic cost of limiting expansion at the UK's major international hub airport, which is of huge importance to business travellers. The same conclusion might conceivably apply less forcibly to other airport expansion plans if the economic benefits at stake were much smaller.

TABLE 7: SCORING OF ENVIRONMENTAL POLICIES

	Average score (unweighted)
Improving energy efficiency	4.9
Hybrid price/quantity-based economic instruments	4.0
Carbon levy	3.8
Reduce energy subsidies	3.8
Road fuel duties	3.8
EU Emissions Trading Scheme	3.4
Personal carbon allowances	3.3
Climate change levy	3.1
Car emissions targets	3.1
Rail investment	3.1
Aviation flight tax	3.0
Bio-fuels	3.0
Kyoto CDM & JI mechanisms	2.9
Green tax breaks	2.9
Carbon offsetting	2.8
R&D subsidies	2.8
UK draft Climate Change Bill	2.8
Renewables Obligation	2.5
Air Passenger Duty	2.4
Personal air travel allowances	2.3
Curbing airport expansion	2.1

Scale of rating against optimal policy rules:

1 – very poor *2 – poor* *3 – average* *4 – good* *5 – very good*

TABLE 8: RATING OF POLICIES AGAINST THE IoD'S OPTIMAL POLICY RULES

	Efficient	Low running costs	Well-targeted	Neutral	Internationally competitive	Credible & consistent	Technology-friendly	Flexible
Carbon levy	4	4	4	5	3	2	4	4
Personal carbon allowances	4	1	4	4	3	3	4	3
Personal air travel allowances	3	1	2	2	3	2	2	3
Climate change levy	3	4	2	3	3	3	3	4
Renewables Obligation	2	2	2	1	3	3	4	3
Reduce energy subsidies	5	5	5	5	3	3	2	2
EU ETS	4	2	4	4	4	3	3	3
Kyoto CDM-JI mechanisms	3	2	2	3	4	3	3	3
Hybrid price/quantity-based economic instruments	4	4	4	4	3	5	4	4
Carbon offsetting	2	2	2	3	4	3	3	3
Improving energy efficiency	5	5	5	5	5	5	4	5
Air Passenger Duty	2	4	2	1	2	3	1	4
Aviation flight tax	3	4	3	2	3	3	2	4
Curbing airport expansion	2	5	1	1	2	3	2	1
Road fuel duties	4	4	4	3	3	4	4	4
R&D subsidies	2	2	3	2	3	3	4	3
UK draft Climate Change Bill	2	3	3	3	3	3	3	2
Rail investment	4	5	2	3	4	4	2	1
Car emissions targets	2	2	4	3	4	4	4	2
Bio-fuels	3	3	3	2	4	3	4	2
Green tax breaks	2	2	2	2	4	3	4	4

Scale of rating against optimal policy rules:
1 – very poor *2 – poor* *3 – average* *4 – good* *5 – very good*

8: Should aviation be treated as a special case?

Air travel is a vital element of the infrastructure that allows the economy to function efficiently. It permits businesses to make contact with customers and suppliers, and to gain access to markets for their goods and services, in increasingly distant locations. Good air travel links are a vital element of the UK's international competitiveness.

And yet, despite its huge economic contribution, the aviation industry has come in for heavy criticism on account of its adverse environmental effects. While policy is 'behind the curve' on aviation and the environment – in the sense that aviation is widely seen as not paying its full environmental costs – the current fashion for demonising air travel has been taken to unreasonable lengths in some quarters, and is potentially dangerous.

Aviation is a positive force for the economy, despite its environmental downside. Most estimates suggest that the wider economic benefits of air travel are much larger than the environmental costs. It would therefore be immensely damaging for the UK's status as a major international business centre – and for the prosperity of its people – if the denigration of aviation were to trigger adverse changes in aviation policy on key issues such as airport expansion.

This must not be allowed to happen. The airline industry must get its act together to confront its environmental impact more readily, but the Government should also speak out in support of the value of air travel for the UK and its economy.

On the whole, there is a widespread public desire to strike a balance between permitting expansion in air travel in pursuit of economic prosperity and leisure goals on the one hand, while mitigating the resulting damage to the environment on the other. It would be neither sensible nor realistic to stifle growth in air travel by neglecting the provision of much-needed new capacity. Equally, air travel cannot be allowed to grow indefinitely without ensuring that its contribution to global warming and other environmental harm is fully reflected in the cost of flying.

8.1 The environmental impact of air travel

Air travel is not the only environmentally-damaging activity, nor even the worst. Aviation is officially recorded as being a relatively small contributor to global warming at present, accounting for just 1.6% of global greenhouse gas emissions.[16] However there is no clear agreement about the impact of aviation on climate change, which is thought to be greater than this figure suggests "because of other gases released by aircraft and their effects at high altitude". Carbon dioxide emissions are expected to grow more than three-fold in the period to 2050, making aviation one of the fastest growing sources of emissions. According to the Stern report, aviation would account for around 5% of the total global warming effect in 2050 under 'business as usual' projections. The impact of aviation on climate change is surrounded by huge uncertainties, and many commentators believe that aviation holds a bigger share of the blame for future emissions. Whatever the correct figure, air travel must pay in full for its external costs.

8 SHOULD AVIATION BE TREATED AS A SPECIAL CASE?

The UK's contribution to global warming is small. Targeting UK aviation alone with environmental charges would barely scratch the surface of global carbon emissions, but would damage the economy. Aviation is an industry where the competitiveness of air carriers is under constant threat. Airlines operate in highly competitive markets, and policy should seek to maintain a level playing field for the UK and EU airline sectors – especially as many non-EU airlines already receive greater government aid.

Unilateral action by the UK to tax airlines would just cause passengers and flights to switch to other EU airports, with negligible environmental benefit but imposing substantial costs on the UK economy.

Action to restrict domestic and other shorthaul flights – where the train offers a reasonable substitute – has also been suggested, but this too is misguided. If the railway network can offer a competitive customer proposition in terms of both price and jouney time, then point-to-point passengers will readily switch from air to the relatively hassle-free alternative of the train. This has been readily demonstrated on routes from London to Paris and Brussels where Eurostar quickly became the preferred mode of travel for the majority of direct passengers.

However many passengers on short UK air services are flying in order to transfer to another (usually longer) flight at a hub airport such as Heathrow. For them the train cannot offer a convenient alternative. Faced with restrictions on their ability to travel to UK hub airports, they will simply divert to continental European hubs such as Paris, Amsterdam or Frankfurt (which suffer fewer capacity restrictions and much less congestion than airports in this country).

Widespread action on an international scale is therefore required if an effective means of reducing aviation's greenhouse gas emissions is to be found. The UK government has been commendably proactive in pushing for more action on environmental goals, and should step up its attempts to persuade other governments at the widest possible level to tackle global aviation emissions.

The IoD therefore supports moves to make air travel pay its full environmental and social costs. But this should be done in an intelligent rather than a punitive way – in a way that achieves the most efficient environmental gains for the minimum economic losses.

Air passenger duty (APD) is a poor environmental tax in this respect. As a straight passenger tax, it may reduce the rate of growth in the demand for air travel. But beyond this it does nothing to address environmental issues, as it offers no incentives for good environmental performance. The Government has announced that it will consult on a proposal to change the basis of the tax by levying it on each flight. This would at least provide the incentive to fill as many seats on the aircraft as possible, although it would still be a blunt instrument for achieving environmental goals.

An appropriate policy framework, using economic instruments on an extensive geographical scale, would encourage aviation to take the right course of action. It would stimulate the quest for new technology to reduce noise and emissions even further than now – building on the airline industry's outstanding record of improvement in this area. And it would recognise that transport in general, and aviation in particular, finds it more difficult than most industries to reduce its dependency on fossil fuels.

8.2 Aviation's inclusion in the EU emissions trading scheme

Setting a carbon price – either by means of taxes or via an emissions trading scheme – allows environmental policy to be directed fairly at aviation emissions, without favourable or unfavourable treatment in relation to other sources of carbon emissions. The use of taxes requires direct government intervention in levying taxes, and changes in the level of taxes may have to be made regularly and frequently. Decisions on changes to tax rates may be open to distortion by political influences. In the case of aviation, it is not clear which authority within the EU would determine the level of taxes or charges, who would levy them, and what would happen to the revenues raised. To be effective, a carbon taxation regime would have to be imposed consistently across a broad geographical basis, raising concerns about the implicit loss of sovereignty and re-awakening fears about EU-wide tax harmonisation.

There are therefore merits in the inclusion of aviation within the EU's emissions trading scheme.

Perhaps because airlines have warmed to it so readily, the ETS has come to be regarded as an easy option for the aviation industry. This perception does not stand up to close scrutiny. If the ETS is operated in a strict manner, with none of the laxity of phase 1, airlines will have to pay heavily for their right to pollute. And the greater their share of total emissions, the more they will have to pay.

Some have expressed fears that the growth in air travel will cause aviation to infect other industries in achieving cuts in greenhous gas (GHG) emissions. For instance, the Tyndall Centre[17] estimates that unconstrained growth in air travel could account for more than the UK's entire carbon budget (65 mtC) by 2050. In practice, this phenomenon would appear in the form of sharply higher permit prices within the ETS, adding substantially to the cost of pollution by all sectors of the economy. It would also increase the cost of flying enormously.

These fears are probably exaggerated. In reality, prices would be pushed up more gradually over a period of many years, incentivising all sectors to improve their performance through new technology and fuel efficiencies. By raising permit prices for other sectors, the market is signalling that the most efficient solution is for them to invest in low carbon technologies. Airlines face greater difficulty in finding alternatives to aviation fuel, and will be left to fork out higher prices to pay for their own pollution.

Attempts to stigmatise air travel are therefore misplaced, and contrary to the principles of intelligent policy design. Air travel should be treated in exactly the same way as any other environmentally-damaging activity, and pay its full environmental costs – no more, no less.

Policies that are aimed explicitly at reducing the growth of air travel in its own right have not been evaluated properly for their impact on the environment, the economy and society's general well-being. An optimal policy framework would seek to bear down on total greenhouse gas emissions regardless of their source, while leaving society to determine how the reductions should be allocated to different activities. The market – if supported by policies to ensure that environmental externalities are fully captured in prices – is best placed to do this, making full allowance for consumers' preferences, and the different marginal costs of abatement of different industries. Attempts to force particular activities such as air travel to bear the brunt of emissions reductions will only increase the costs to the economy and to society of achieving any given reduction in pollution.

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