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CARBON TAXES AND GLOBAL WARMING

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In recent years the issue of global warming has become of sufficient concern to the international community that the Climate Change Convention was agreed at the Earth Summit in Rio de Janeiro in June 1992 and has now been signed by 166 countries. Under the Convention, developed countries, including the UK, must adopt policies aimed at returning carbon dioxide (CO₂) emissions to their 1990 levels by the end of the century.

Different countries have proposed a variety of methods for reducing CO₂ emissions. One of the most popular ideas is the introduction of some type of carbon or energy tax on fuel and the European Community has a well developed proposal for such a tax. Additionally, in March 1993 the UK Government announced the introduction of VAT on domestic fuel and power, justifying the decision partly on environmental grounds.

This paper examines the environmental aspects of the introduction of such taxes, and discusses their effectiveness in reducing global carbon dioxide emissions. Further details of **VAT on Fuel and Power** can be found in Library Research Paper 93/36 (24 March 1993). Information on **Carbon Dioxide Targets** can also be found in POST Briefing Note 42 (April 1993).

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I. Introduction to Global Warming and the Greenhouse Effect

The Greenhouse effect is essential for life on Earth. Without the atmosphere, particularly water vapour and carbon dioxide, acting like the glass in a greenhouse, the Earth would be 33°C cooler and the oceans would be frozen solid [1]. However, in recent years, scientists have expressed concern that the changing composition of the atmosphere, with increasing levels of carbon dioxide and methane, might lead to global warming causing dramatic changes to the global climate and sea levels. For instance, in 1990, the Inter-Governmental Panel on Climate Change predicted that if emissions of greenhouse gases continued their current trend, the Earth would warm by about 0.3°C per decade resulting in a 3°C global temperature rise by the end of the next century, accompanied by a 65cm rise in global mean sea levels [2].

Conclusions of the Inter-Governmental Panel on Climate Change First Scientific Assessment 1990

- *there is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be.*
- *emissions resulting from human activities are substantially increasing the atmospheric concentration of the greenhouse gases: carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface. The main greenhouse gas, water vapour, will increase in response to global warming and further enhance it.*
- *under the IPCC Business-as-Usual (Scenario A) [prediction of future] emissions of greenhouse gases, [there will be] a rate of increase of global mean temperature during the next century of about 0.3°C per decade (with an uncertainty range of 0.2°C to 0.5°C per decade); this is greater than that seen over the past 10,000 years. This will result in a likely increase in global mean temperature of about 1°C above the present value by 2025 and 3°C before the end of the next century. The rise will not be steady because of the influence of other factors.*
- *under the IPCC Business as Usual emissions scenario, [there will be] an average rate of global mean sea level rise of about 6cm per decade over the next century (with an uncertainty of 3-10cm per decade), mainly due to thermal expansion of the oceans and the melting of some land ice. The predicted rise is about 20cm in global mean sea level by 2030, and 65cm by the end of the next century. There will be significant regional variations.*

Scientific Explanation of the Greenhouse Effect

The glass in a greenhouse allows short wavelength solar radiation, such as ultraviolet light, to pass through it and be absorbed by the plants and soil. These are warmed and then re-radiate longer wavelength infrared radiation much of which does not pass back out through the glass. Instead, the glass absorbs and then re-emits the radiation, raising the temperature inside the greenhouse.

The Earth's atmosphere, particularly the greenhouse gases - water vapour, carbon dioxide, methane, chlorofluorocarbons (CFCs), nitrous oxide and others - perform a similar function for the Earth as the glass does in a greenhouse. This is shown in diagrammatic form in Figure 1 below:

Figure 1: A simplified diagram illustrating the greenhouse effect
Source: IPCC Scientific Assessment 1990

It is important that the greenhouse effect is not confused with the depletion of the ozone layer. Although CFCs are greenhouse gases and the ozone layer does affect the absorption of ultraviolet solar radiation, the major scientific processes involved are very different. Further details concerning ozone depletion can be found in Library Research Paper 93/63, **The Ozone Layer: Science, Implications and Policy** (27 May 1993).

Climate Modelling

The greenhouse effect is a well established and well understood scientific process. But determining how changes in the magnitude of the effect, due to the changing composition of the Earth's atmosphere, lead to changes in the global climate are much more difficult to predict. The global climate is an immensely complicated system of interacting physical processes involving the land, the seas and oceans, the polar regions, clouds, the atmosphere and the sun. Many of the processes are inter-related, and the outcome of one process can affect the outcome of another. For instance, the polar ice caps currently reflect much of the incoming solar radiation rather than absorbing it. But were the temperature of the Earth to rise and the ice caps were to melt, then more solar radiation would be absorbed by the darker-coloured land revealed by the melting ice, creating even more warming. This is an example of a positive feedback effect. The whole of the Earth's climatic system abounds with such positive and negative feedback systems, making it very difficult to accurately predict future climate patterns. However, some attempt can be made using computer analysis of *General Circulation Models* (GCMs).

GCMs are mathematical models of the Earth's climate which try to take account of the major underlying physical processes affecting climate change. They make an estimate of the magnitude of the different processes and how they interact, so that predictions can be made on future climate patterns. These models are constantly modified as more information becomes available on a particular effect. One area in which there has been much work is on the availability of sinks which can absorb carbon dioxide, such as the oceans (in which carbon dioxide can dissolve) and forests (which take up carbon dioxide by photosynthesis, and produce oxygen). It is very difficult to estimate the size of these sinks and to predict how they will be affected by global warming. However, having said all this, GCMs remain the only way in which future climate patterns can be predicted, and there does seem to be quite a large degree of agreement between different models produced by different scientific research groups.

The whole issue of climate change has been examined in detail by the Inter-Governmental Panel on Climate Change (IPCC) as described in the Introduction. The IPCC was established in 1988 under the auspices of the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP). Three working groups were established, one of which, Working Group 1, was set up to *assess available scientific information on climate change*. The Group produced its first report in 1990 [2], the main conclusions of which are reproduced in the Introduction, and produced a Supplementary Report in 1992 [3]. The reports are divided into separate sections dealing with different areas such as sources of greenhouse gases, climate modelling, detection of global warming, sea level rise and effects on ecosystems.

Contribution of Greenhouse Gases to Global Warming

Different gases have different effects on the global climate and so contribute differently to global warming. A useful figure for comparing the effects of different gases is the Global Warming Potential (GWP). GWPs are calculated for each greenhouse gas and estimate the contribution the gas makes to global warming compared to an equivalent mass of carbon dioxide. The GWP depends on the ability of the gas to absorb solar radiation, its lifetime in the atmosphere, its molecular weight and the time period over which effects are of concern. For instance, methane has a GWP of 63 over a 20-year period but over a 100-year period its GWP is 21. The global warming potentials and the level of world emissions for the main greenhouse gases are shown in Table 1. For purposes of comparison, the magnitude of the effects produced by the different gases can be estimated by multiplying the level of emissions by the appropriate GWP. Figures for this are also shown in Table 1 and are based on GWPs over a 100 year period. These show that in 1990 man-made emissions of carbon dioxide contributed most to global warming followed by methane and CFCs.

Table 1: Global greenhouse gas emissions in 1990 and their contribution to global warming over 100 year timescale			
Gas	Man made emissions 1990 Million tonnes/year	Global Warming Potential relative to CO ₂	Proportion of total effects %
Carbon dioxide, CO ₂	26,000	1	61
Methane, CH ₄	300	21	15
CFCs	0.9	3,500-7,300	11
Nitrogen oxides, NO _x	66	40	6
Nitrous oxide, N ₂ O	6	290	4
Carbon monoxide, CO	200	1-2	1
Others	-	-	2

Source: IPCC Scientific Assessment 1990

Sources of CO₂: Countries and Sectors

Global warming is an international problem and as such emissions of greenhouse gases must be considered in a global context. For instance, although the USA, Japan and Germany are amongst the top five contributors to global carbon dioxide levels, overall the OECD countries only contributed to 48% of total global carbon dioxide emissions in 1990. Figures for those countries whose energy related CO₂ emissions contribute more than 2% to global emissions are shown in Table 2.

Table 2: Energy Related CO₂ Emissions for 1990		
Country	CO₂ Emissions million tonnes	Percentage of global emissions
USA	5,020	23.3
Russia	2,400	11.1
China	2,400	11.1
Japan	1,060	4.9
Germany	1,039	4.8
Ukraine	660	3.1
India	594	2.8
United Kingdom	589	2.7
Canada	435	2.0
European Community	3,180	14.7
OECD	10,400	48.3
World	21,570	100

Source: Climate Change Policy Initiatives (IEA/OECD 1992)

The table shows that the UK was the eighth largest emitter of carbon dioxide in 1990, contributing 2.7% to energy related global emissions. These emissions arise from a variety of sources, the most important being power stations, industrial sources and road transport.

Detailed figures for the various sources are shown in Table 3, including those relating the emissions to the final consumer of the energy.

Table 3: UK CO₂ Emissions 1990¹		
Source of Emissions	Percentage of emissions	
	by: source	by: final energy consumer
Power Stations	34	-
Industry	22	30
Road Transport	19	21
Households	14	27
Commercial and public sector	5	6
Refineries	3	-
Railways, aircraft and shipping	3	3
Other	1	13

¹ Total emissions (1990) = 158 million tonnes of carbon (MtC)
= 580 million tonnes of carbon dioxide

Source: Digest of Environmental Protection and Water Statistics, No. 15 (HMSO,1992)

II. Climate Change Convention

The ultimate objective of the Climate Change Convention is to *achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*. The Convention states that *such a level should be reached within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner* [4].

Environmental groups have criticised the Convention because it does not contain a legally binding requirement for countries to stabilise carbon dioxide emissions at 1990 levels by the year 2000. Instead, the Convention commits developed countries to adopting national policies and measures *aimed* at returning anthropogenic emissions of carbon dioxide and other greenhouse gases to their 1990 levels by the end of the century. The draft version of the Convention did originally contain a legally binding commitment, but this was removed at the insistence of the USA [5]. The exact text of the Convention specifies that:

Each of these Parties [developed countries] shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification, and taking into account the differences in these Parties' starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties to the global effort regarding that objective. These Parties may implement such policies and measures jointly with other parties and may assist other Parties in contributing to the achievement of the objective of the Convention and, in particular, that of this subparagraph.

The Convention closed for signature on 19 June 1993, by which time 166 countries had signed it and of these 38 had ratified it as of 11 October 1993. The first Conference of the Parties must take place within one year after entry into force of the Convention, which happens 90 days after the Convention has been ratified by 50 states. This Conference will review the adequacy of the commitments contained within the Convention in the light of *best available scientific information and assessment on climate change and its impacts, as well as relevant technical, social and economic information*. A second review will take place not later than the end of 1998.

Although the Convention does not *require* countries to reduce carbon dioxide levels to their 1990 levels by the end of the decade (but merely to aim to achieve that target), after the Summit, the Prime Minister stated that (**HC Deb**, 15 Jun 1992, c649):

The United Kingdom has been able to go further than the convention requires by making a firm commitment, provided others do so as well, to reduce emissions of CO₂ and other greenhouse gases to 1990 levels by the year 2000.

However, it would appear that other countries have not made such commitments, and the UK has not committed itself to a definite reduction to 1990 levels by the year 2000 [19]. Despite this, firm commitments have been made on ratification of the Convention both by the EC and the G7 countries. In reply to a PQ on the subject, the Government confirmed that (**HC Deb**, 26 March 1993, c736W)

At this week's [EC] Environment Council [22-23 March 1993] all member states agreed to take the measures necessary to enable them to ratify the convention not later than the end of 1993. This matches the UK's earlier commitment, along with our Group Seven partners, to ratify the convention by the end of 1993.

The Council also made further progress on requirements of the Convention (**HC Deb**, 26 March 1993, c737W):

The Council agreed a decision which establishes a monitoring mechanism for emissions of carbon dioxide and other greenhouse gas emissions within the Community as a whole. This will require all member states to prepare and regularly update national programmes to limit these emissions. The programmes are needed to contribute fulfilment by the Community as a whole of the requirement, in the UN framework convention on climate change, to aim to return emissions of carbon dioxide and other greenhouse gas emissions to their 1990 levels by the year 2000, and of related Community Commitments. Secondly, the Council reached political agreement on a measure which will enable the Community to ratify the climate change convention. There was also a general discussion of progress on the Community's strategy, during which we described the significant announcements that my right hon. Friend the Chancellor of the Exchequer made in his budget speech last week.

However, recently it seems that the EC countries may not be in a position to jointly ratify the Convention by the end of the year. As a result of disagreements over the EC's proposed carbon/energy tax, some Member States have threatened to delay joint ratification. This issue discussed in further detail in Section IV.

III. Policy Measures to Reduce CO₂ Emissions

Carbon dioxide emissions can be reduced in two main ways, either by reducing demand for energy or by producing energy without the use of fossil fuels from renewable or nuclear sources. Demand for energy can be reduced either by encouraging energy efficiency or dampening demand through fiscal measures. Information on renewable energy can be found in Library Research Paper 93/83, **Renewable Energy** (29 July 1993). The issue of nuclear energy use in the UK will shortly be examined in a Nuclear Review conducted by the Department of Trade and Industry.

Energy efficiency measures can concentrate either on increasing the efficiency of overall generation of energy, such in the use of combined heat and power systems or reducing energy demand through the use of high efficiency appliances and heat insulation measures. The Government's consultation paper on the UK's national programme for CO₂ emissions comments that:

Much investment in energy efficiency is cost effective, that is the value of the savings from reduced energy consumption outweighs the cost of the initial investment in present value terms. Such investments can therefore bring environmental improvements through reduced emissions at no net economic cost.

The USA has recently revealed its national plan to combat global warming. The plan relies on the voluntary co-operation of industry and has few suggestions for legislation. An article in the **Economist**, 23 October 1993, reported that :

'Partnerships' is the magic word. It is meant over the next six years to convert \$1.9 billion in federal money (mostly squeezed from other programmes) into \$61 billion in private investment. The government plans 'partnerships' with industries from cars to chemicals to stimulate the development of energy-efficient motors or to cut greenhouse-gas emissions.

The plan includes such measures as schemes to promote car sharing and the use of public transport, the use of cleaner fuels such as natural gas or methane from landfill sites, and the labelling of energy efficient products. Originally, the plan had been expected to include an energy tax, but this was dropped after facing opposition from the Senate and Congress (see below).

Fiscal Measures and Carbon Taxes

Various different fiscal measures have been proposed to help reduce carbon dioxide emissions. The most popular of these measures is some type of energy or carbon tax which bases the size of the tax either on the carbon content of the fuel or on the energy content of the fuel or some combination of both. Many countries already have taxes on fuels, but a few

countries, such as the Netherlands, Finland and Sweden, have actually introduced new energy/carbon taxes with the specific aim of curbing CO₂ emissions [6]. However, many countries have refused to implement carbon taxes unless other developed countries adopt similar policies believing that unilateral action would both be ineffective in reducing global emissions of CO₂ and would place their energy intensive industries in an uncompetitive position.

Legislative proposals for such taxes have also been introduced in the USA and the EC. However, the proposal in the US failed following opposition from the Senate. The tax proposal was originally introduced as a means of raising tax revenue to reduce the budget deficit rather than as an environmental measure to cut carbon dioxide emissions. The US administration hoped that a broad based energy tax, including a tax increase of 7.5 cents on a gallon of petrol could raise about \$71 billion over a period of 5 years [7]. Following the opposition from the Senate, the proposal for an energy tax was dropped, and agreement was reached on an increase in the petrol tax of 4.3 cents a gallon. This measure is expected to raise less than one-third the revenue of the original proposal.

IV. European Carbon Tax Proposals

Proposals for a European-wide energy/carbon tax have been in existence since the European Commission first proposed the idea in October 1991 [8]. The proposal was for a mixed energy and carbon tax, with 50% being levied on the level of CO₂ emissions produced by the fuel (ie. on its carbon content) and 50% on the energy (calorific) value of the fuel. It was suggested that the tax would be introduced at the rate of \$3 a barrel in 1993 rising to \$10 a barrel by the year 2000. Large scale exemptions were suggested for energy intensive industries with a large involvement in international trade such as the steel, chemicals, non-ferrous metals, cement, glass, and paper and pulp industries. The current proposal states that the EC will go ahead with carbon tax proposals only if other industrialised countries adopt similar measures. The proposal also contained measures which would provide exemptions to those countries with lower than average emissions per head of population. Portugal, Spain, France, Italy and Greece would all be exempted under such a scheme.

However, the proposal has run into difficulty with countries having differing views as to how such a tax should be implemented. In a meeting of the EC Energy and Environment Ministers on 23 April 1993, the UK was the only country out of the 12 Member states which did not accept the principle that a tax was needed to help the Community reduce its carbon dioxide emissions [9]. However, it would appear that several countries only supported the proposals on the grounds that they would be exempted from the tax and that in reality, only six member states were in favour of the tax.

The UK's position on the carbon/energy tax was outlined in detail by Sir John Cope, the Paymaster General at a recent EC Standing Committee B meeting [10].

...an EC-wide tax on carbon and energy is not the right answer for the UK. The UK will now work with other Member States to examine other solutions. These would allow member states to introduce such a tax to do so in a way compatible with the Single Market.

The Council of Finance Ministers met on 7 June to discuss the issue again. In reply to a parliamentary question on the results of the Economic and Finance Council (ECOFIN), the Chancellor of the Exchequer, Kenneth Clarke, commented (**HC Deb**, 11 June 1993):

In discussion of the Commission's proposals for a carbon/energy tax, I made it clear that the Government had already announced measures in the Budget which would reduce carbon dioxide emissions in the United Kingdom; and that we did not see a need for a harmonised tax at Community level. The topic was remitted for further consideration by officials.

In further talks held at the Environment Ministers' Council on 28-29 June 1993, no agreement was reached either on the tax itself or on a declaration supporting the need for an early agreement on the tax [11]. In response to this failure to reach agreement on the tax, the Dutch and German delegations refused to allow a Decision on ratification of the Climate Change Convention.

The most recent discussions on the tax were held at the Environment Council on 5 October 1993 in Luxembourg. At this meeting, EC Environment Commissioner, Ioannis Paleokrassas, presented the Commission's latest proposals on the tax. This contained "burden-sharing" proposals which would result in the poorer, "cohesion countries" (Portugal, Greece, Spain and Ireland) being exempted from the tax whilst their carbon dioxide emissions per capita and GDP per capita remained below a certain, combined level. This plan would result in the EC stabilising its total emissions at 1990 levels by the year 2000, but in doing this the more developed countries would have to reduce their emissions whilst the less developed countries could increase their emissions [12].

Apparently, Ministers were still not convinced by these new proposals, with the UK remaining opposed to the tax, and France wanting a CO₂ tax only rather than a carbon/energy tax. The journal **Europe Environment**, 12 October 1993, reported after the meeting that:

The Commission and the Council are now planning to work together with the Member States, on a bilateral or trilateral or even a multilateral basis in a bid to try and win them round to the principle of a tax, which would at least enable the EC countries to ratify the Framework Convention on Climate Change as one before the end of the year.

According to a report in **The Guardian**, 6 October 1993, the UK Government is prepared to ratify the Climate Change Convention on its own, if joint ratification by all the EC countries does not happen before the end of the year. As described above, some member states believe that their ratification of the Convention would not be credible without a united commitment to the carbon/energy tax. In the article, Tim Yeo, the environment minister is quoted as saying that "*If others want a carbon/energy tax, we are quite relaxed about it. But we don't see it is necessary at home*" and that Britain would never abandon its opposition to the tax.

Because of these arguments amongst member states about the proposals it is impossible to say, at present, when or even if the EC will eventually be able to reach a common position on the carbon/energy tax. Even if a common position were reached, as far as the proposal currently stands, the tax itself would only be introduced if other industrialised countries were prepared to adopt similar measures.

V. UK's National Programme for CO₂ Emissions and VAT on Fuel

The UK needs to reduce its emissions by 10 million tonnes of carbon (MtC) per annum to meet its target under the climate change convention. In order to achieve this target and to enable it to produce a nation plan for reduction CO₂ emissions (which is another requirement of the convention), the Government published a consultation paper in December 1992. This paper, [13], sought views on the scope for individuals to take further voluntary action on reduction of carbon dioxide emissions. In his introduction to the paper, Michael Howard stated that *the more each sector of our economy can achieve through voluntary action to meet self-imposed targets, the less will be the need for Government intervention*. The paper addressed the various voluntary options in some depth and also examined possible Government measures.

In the sector which involves the greatest contribution to global warming, electricity generation, the paper concentrated on measures to reduce demand and the use of combined heat and power systems. The use of different types of fuel to minimise carbon dioxide emissions was not really discussed in detail. Nuclear power is the best type of fuel in this regard, but gas is significantly better than coal. The Trade and Industry Committee found in their report on **British Energy Policy and the Market for Coal**, that new combined cycle gas turbine power stations produce, on average, only half the carbon dioxide emissions in generating a unit of electricity that coal fired stations do. The Government's consultation paper merely stated that in principle savings can be made from *switching to less carbon intensive sources of energy* and did not investigate the matter any further.

Commenting on the proposed EC carbon/energy tax the Consultation paper stated that:

A carbon or carbon/energy tax would be likely to have the greatest impact on energy use by industry. Of the emission savings brought about by the Commission's proposed tax about half could come from reductions in energy use by industry. Individuals tend to be less sensitive to changes in energy prices in the short to medium term. However, low income groups spend a greater proportion of their income on energy than the average. In considering whether or not such a tax should be introduced the Government would need to be satisfied that it would not have unacceptable impacts on any particular groups of households or on the competitive position of UK industry (which might simply displace CO₂ generating activities to other countries). The Government has also separately sought the views of industry and other interested groups on the Commission's proposals.

As it has subsequently transpired, the UK Government does not believe that a European wide carbon tax is necessary, and instead at the last budget in March 1993, it announced its own fiscal measures for reducing carbon dioxide emissions: VAT on domestic fuel; and a 3% real rise in transport fuel duties. These were introduced both as green measures but also *to raise revenue at the same time* [HC Deb, 16 March 1993, c. 182]. In his budget statement, having discussed the climate change convention, the Chancellor stated that:

The largest contribution to the growth in United Kingdom carbon dioxide emissions in the coming years is expected to come from the transport sector. I therefore propose to make it clear today the Government's long-term intention on road fuel duty. We intend to raise road fuel duties on average by at least 3 per cent a year in real terms in future Budgets...[This] should provide a strong incentive for motorists to buy more fuel-efficient vehicles, and it will raise at least a further £520 million in 1994-5 and £950 million in 1995-6.

However, in order to meet the commitment that we entered into at Rio, action will be required not just in the transport sector, but across the whole economy, and in deciding how best to meet our carbon emissions target, we will need to ensure that the right incentives are in place throughout the economy - encouraging people to consume less and conserve more. Above all, it is crucial to avoid taking measures that will have a disproportionate impact on the competitiveness of British industry.

Against this background, I have one further measure to propose that will not only encourage greater energy efficiency in every household in the country, but will also raise a considerable amount of revenue for the Exchequer over the years ahead.

Fuel and energy supplies to industry pay VAT in Britain. Those to the home do not. In this respect, we are unique in the European Community. I therefore propose, over the next two years, to end the zero rate of VAT on domestic fuel and power. Again this change will not come into effect immediately, but in 1994. VAT will be charged at 8 per cent from 1 April 1994 and at 17½ per cent from 1 April 1995.

This measure will raise some £950 million in 1994-5, £2.3 billion in 1995-96 and around £3 billion a year thereafter. For the first time, the rate of VAT on domestic fuel and power will be the same as that charged on goods like loft insulation material, which improve energy efficiency. This will bring to an end the current anomaly, which makes a nonsense of any attempt to use the tax system to improve the environment.

The Government has estimated that the imposition of VAT on domestic fuel will reduce carbon dioxide emissions by 1.5 MtC per annum, and that the real rise in excise rates will reduce emissions by a similar amount. Further details on this issue can be found in Library Research Paper 93/36, **VAT on Fuel and Power** (24 March 1993).

The consultation period for the UK's national plan on CO₂ emissions closed at the end of March 1993, but in April the Government published an **Addendum to the Discussion Document** [14] which addressed such developments as the imposition of VAT on domestic fuel and the outcome of the Coal Review. In looking at the Coal Review and commenting on how the changes in the balance of fuels used in the electricity generating sector might affect CO₂ emissions, the Addendum states that projections of future use of gas and nuclear power remain unaffected by the Coal Review. The Addendum made no comment on whether

the current or future balance of fuels was appropriate but stated that *against this background the Government believes that it remains appropriate to use a target of savings of 10 MtC as the basis for preparing the CO₂ programme.*

The figure of 10 millions tonnes of carbon (MtC) per annum as the required saving to stabilise UK emissions was obtained from predictions of future CO₂ emissions made by the DTI in its **Energy Paper 59** [15]. These projections assumed a fairly rapid increase in the use of gas for electricity generation and a decline in the use of coal and nuclear energy.

In April the Government stated that two-thirds of the required savings had already been identified and that the national plan would be published by the end of the year (**HC Deb**, 29 April 1993, c467W):

An extensive consultation exercise is currently taking place on the United Kingdom's national programme for limiting emissions of carbon dioxide. Two thirds of the programme is already in place. The complete programme will be incorporated in the national plan under the climate change convention to be published by the end of the year.

The individual measures which made up to this two-thirds reductions are shown in the table below (**HC Deb**, 22 Mar 1993, c495W; 20 Apr 1993, c83W):

Reduction measure	Saving MtC
VAT on domestic fuel	1.5
3% real rise in transport fuel duties	1.5
Energy Saving Trust	2 - 3.5
Energy conservation: Building regulations	0.25
Energy Management Assistance Scheme	0.25 - 0.5
EC SAVE Programme	?
Total	5.5 - 7.25 + SAVE

As a conclusion to the consultation process, the DOE organised a conference on the UK's national programme in London on 7 May 1993 [16]. According to some press reports, business leaders at the conference called on the Government to impose tougher regulations to help reduce carbon dioxide emissions. A report in the **Guardian** from 8 May 1993 stated that:

...the delegates said regulations were crucial because neither the free market nor 'enlightened self-interest' would work to force a cut in emissions dramatic enough to stop global warming.

The **Financial Times** has also reported that workshops organised by the DOE in preparation for the conference on 1-2 March 1993 concluded that the reduction figure of 10MtC was too low, and that the voluntary basis of the present government schemes was inadequate [17,18].

The final one-third package of measures to meet the total required 10 MtC reduction in emissions was announced by John Gummer, Secretary of State for the Environment on 26 July 1993 in response to a written PQ from Dr Robert Spink [**HC Deb** , 26 July 1993, c.709W). The main elements of these proposals, as summarised in a press release, were:

- *strengthening the Energy Efficiency Office programmes of information and advice, to stimulate additional savings from business , and to reinforce the work of the Energy Saving Trust in encouraging households to use energy efficiently. Public sector bodies will provide a lead.*
- *further savings to be achieved in transport emissions*
- *an increase in the target for combined heat and power to 5000 megawatts*

In addition to these measures, on 21 July 1993, the Minister for Energy announced further renewable energy orders under the Non-Fossil Fuel Obligation, in pursuit of increase in the objective for renewable energy. Further details can be found in Library Research Paper 93/83, **Renewable Energy** (29 July 1993). This paper also includes information on the EC energy efficiency programme, SAVE, and the renewables research programmes, THERMIE and ALTNER.

VI. Effectiveness of Carbon Taxes

Determining the magnitude of reduction in carbon dioxide emissions as a result of a specific fiscal measure is a difficult process, and experts often disagree as to the effect a particular measure will have. For instance, after the UK's decision to apply VAT to domestic fuel was announced, some researchers predicted that the savings in carbon dioxide emissions could be up to twice that predicted by the Government [18]. This discrepancy in calculated future emissions can be attributed to different assumptions about the effects of the fiscal measure and about future policy initiatives. For instance, in the UK, the size of special payments introduced to help those on low incomes meet higher fuel bills, will effect the amount of savings in CO₂ emissions.

There have also been the debates on the cost effectiveness of carbon taxes. According to a report by the International Energy Agency, **World Energy Outlook to 2010**, most of the 24 industrialised nations that make up the OECD would get better returns from making a concerted effort to improve energy efficiency rather than introducing moderate carbon taxes [20]. This report also examined the effect of carbon taxes in OECD countries of \$12 and \$36 a barrel, and found that even with the \$36 tax, global carbon output would still rise by 36% of its 1990 levels. Within the OECD, this tax would also leave carbon emissions significantly above 1990 levels. This obviously brings into question the relative effectiveness of the \$10 tax proposed by the EC. A report produced by the EC Commission in October 1992 suggested that the proposed tax would produce a 4% saving in emissions, one-third of the total required [21].

The House of Lords Select Committee on the European Communities produced a substantial report on the Carbon/Energy Tax in March 1992 [22]. The Committee concluded that they could not support a carbon/energy tax and recommended greater effort towards energy efficiency as the key policy to tackle global warming.

Obviously, from a global perspective, the overall effectiveness of any national strategy to reduce carbon dioxide emissions depends crucially on the others countries adopting similar measures to reduce emissions. In the introductory chapter to a recent book on **Climate Change: Designing a practical tax system** [23], the following conclusions were drawn on the future prospects for carbon taxes:

Overall, carbon taxes are a practical tool for near term domestic policy aimed at reducing GHG [Greenhouse Gas] emissions. Unfortunately, the domestic use of carbon taxes is likely to be ineffective until serious concerns about the effect of such taxes on industry and international trade are resolved. This concern also needs to be addressed internationally (or at least multilaterally). If this "competitive position" problem can be sorted out amongst groups of countries, this could lead toward a fully-harmonised set of national GHG taxes. In the meantime, increasing domestic experience with the carbon tax is providing valuable insights into important elements of its design, and may clear the way for the use of tax systems to reduce greenhouse gas emissions globally.

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