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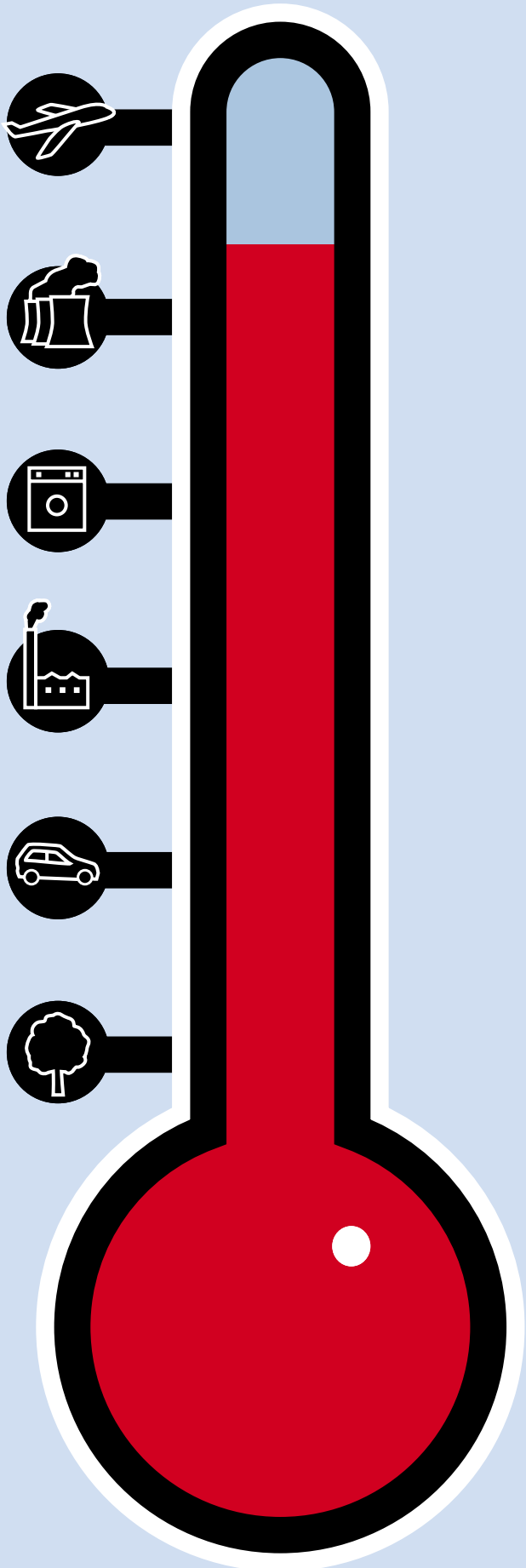

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The UK's Third National Communication under the United Nations Framework Convention on Climate Change

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Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, October 2001, on paper comprising 75% post-consumer waste and 25% ECF pulp. (01 ERA 0822)

Product code PB 6104.

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Foreword

By the Secretary of State for Environment, Food and Rural Affairs

I am pleased to present the UK's Third National Communication under the Framework Convention on Climate Change.

We are constantly reminded about the need to respond to the challenges that climate change will bring. The Intergovernmental Panel on Climate Change's Third Assessment Report concludes that there is new and stronger evidence that most of the warming observed over the last fifty years is attributable to human activities and that, without action to reduce greenhouse gas emissions, global temperatures will rise between 1.4° and 5.8°C over the next 100 years.

The Report's conclusions helped to drive forward international agreement on implementing the Kyoto Protocol. And they underline the importance of the agreement that we were able to reach in Bonn in July 2001. We showed that governments can work together to address global challenges. We must now ensure that the Seventh Conference of the Parties in Marrakesh completes the task.

I hope that the Bonn agreement will pave the way for ratification and entry into force of the Kyoto Protocol by 2002. The UK aims to ratify along with our EU partners next year. I hope that many other countries follow suit.

This Communication reports in detail the action the UK is taking to fulfil its commitments under the Framework Convention on Climate Change and the Kyoto Protocol. It sets out how we intend to meet our target under the Protocol to reduce our greenhouse gas emissions by 12.5% below 1990 levels by 2008-2012, and move towards our domestic goal to reduce carbon dioxide emissions by 20% below 1990 levels by 2010. It outlines how the UK is planning to adapt to the predicted impacts of climate change. It provides details of the UK's programme for research and systematic observation. And it gives information about the assistance that the UK is providing to developing countries.

The Communication highlights the UK's significant contribution to global action to fight climate change, and it reinforces the UK's commitment to playing a leading role. I am proud of the progress that we are making, that will continue well into the future.

The Rt Hon Margaret Beckett MP
October 2001

Executive Summary

This is the UK's Third National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). It provides a summary of the action that has taken place in the UK since the Second National Communication was published in 1997. It is based on the information contained within the UK's climate change programme that was published in November 2000.

The UK is firmly committed to tackling climate change. It plays a leading role in international negotiations, pressing for a strong global response to the problem. Its scientists have been at the forefront of efforts to understand climate change and predict its effects. The UK Government and the devolved administrations of Scotland, Wales and Northern Ireland have reinforced their commitment to action by setting tough emission reduction goals at home, and by introducing a comprehensive, strategic package of policies and measures to achieve them.

The UK is one of the few OECD countries to have reduced its emissions over the last decade. The UK Government and the devolved administrations are building on this solid foundation of action. The UK's climate change programme sets out how the UK will meet its Kyoto target to reduce greenhouse gas emissions by 12.5% below 1990 levels by 2008-2012, and move towards its domestic goal to reduce carbon dioxide emissions by 20% below 1990 levels by 2010.

The UK believes that it will benefit from strong action to tackle climate change. Its domestic goal is designed to give a clear signal of the direction in which policy is moving, allowing long term planning and stimulating innovative responses. The policies that are being introduced to deliver reductions in emissions are part of the Government's wider drive for a better quality of life, as well as economic and environmental modernisation. The UK believes that its climate change programme will enhance businesses' competitiveness, both at home and internationally, by improving efficiency and by opening up new markets for low carbon technologies.

The climate change programme has been developed in close consultation with key stakeholders, who have shown their support for the programme and who will be crucial in helping to deliver it. The programme is designed to ensure that the UK's emissions remain on a downward path, and that the UK is prepared for making bigger cuts in the future. The UK remains committed to reducing the energy intensity of its economy, and to breaking the link between economic development and higher carbon dioxide emissions.

Significant changes to the UK's climate are expected, even though it is unlikely to experience some of the more dramatic impacts of climate change that are forecast elsewhere in the world. The climate change programme examines likely impacts on the UK, considers how central and local government, businesses and other organisations might begin to adapt, and suggests priorities for action.

Some inventory data information and sectoral classifications in the Third National Communication differ from those used in the UK's climate change programme due to updated inventory information and the classifications requested by the UNFCCC's Reporting Guidelines. However, the projections and overall headline reduction figure remain the same.

National circumstances

The UK has enjoyed strong economic growth during the last decade. Other trends linked to this include:

- an increase in people's use of transport;
- more homes being built to house a rising population, and more people are living on their own;
- a continuation of the long term trend towards urbanisation; and
- greater energy consumption by households and some others.

The UK's greenhouse gas emissions have been falling despite these trends, but pressure on emissions is likely to increase in the future. The Government and the devolved administrations are introducing policies to address the environmental, economic and social effects of these trends, within the overall framework of sustainable development.

Greenhouse gas inventory information

The UK's total greenhouse gas emissions[1] were about 14.5% below 1990 levels in 1999. Over the same period:

- carbon dioxide emissions fell by 9%;
- methane emissions fell by 28%; and

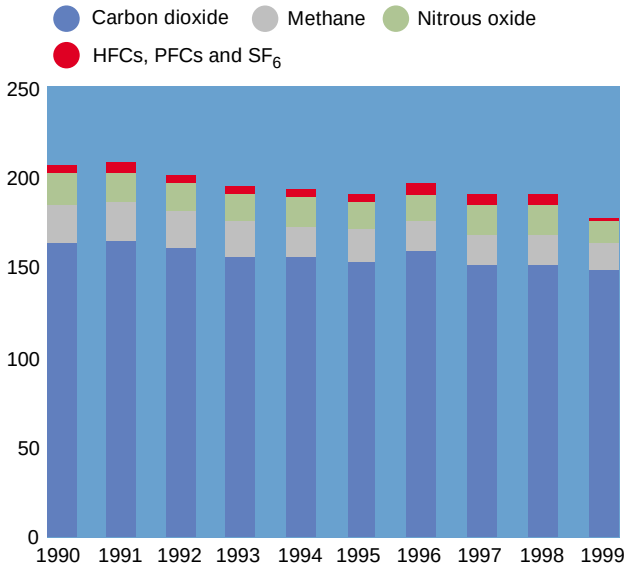
[1] Including the source from land use change and management, but excluding the forest sink.

- nitrous oxide emissions fell by 36%.

The UK has decided to use 1995 as the base year for fluorinated gases. Between then and 1999:

- hydrofluorocarbon (HFC) emissions fell by 60%;
- perfluorocarbon (PFC) emissions fell by 36%; and
- sulphur hexafluoride (SF_6) emissions increased by 18%.

The UK's greenhouse gas emissions, 1990 to 1999, MtC



The reductions in emissions have mainly been driven by the restructuring of the energy supply sector, the promotion of greater energy efficiency, the introduction of pollution control measures in the industrial sector, and policies to reduce methane emissions.

Policies and measures

The UK Government and the devolved administrations are introducing a substantial, integrated package of policies and measures to:

- improve business' use of energy, stimulate investment and cut costs:
  - the climate change levy package, which includes challenging improvement targets for energy intensive sectors, and additional support for energy efficiency measures in the business sector;
  - a UK-wide emissions trading scheme, with Government support of £215 million over five years;
  - the Carbon Trust, that will recycle around £100 million of climate change levy receipts over three years to accelerate the take up of cost effective, low carbon technologies and other measures by business and levy payers;
  - energy labels, standards and other product-related measures designed to deliver 'market transformation' in the energy efficiency of lighting, appliances and other key traded goods; and
  - Integrated Pollution Prevention and Control.
- stimulate new, more efficient sources of power generation:
  - a target for the renewables obligation that 10% of sales from licensed electricity suppliers will be generated from eligible renewable sources by 2010, subject to the cost to consumers being acceptable; and
  - a target to at least double the UK's CHP (combined heat and power) capacity by 2010.
- cut emissions from the transport sector:
  - European-level agreements with car manufacturers to improve the average fuel efficiency of new cars by at least 25% by 2008-2009, backed up by changes to vehicle excise duty and the reform of company car taxation; and
  - the 10 Year Plan: £180 billion of investment and public spending on transport over the next ten years to cut congestion and reduce pollution.
- promote better energy efficiency in the residential sector:
  - a new Energy Efficiency Commitment, through which electricity and gas suppliers will help their residential customers, particularly those on low incomes, to save energy and cut their fuel bills;
  - the New Home Energy Efficiency Scheme in England, similar schemes for Wales and Northern Ireland and, in Scotland, the Warm Deal and the Central Heating Programme; and
  - the promotion of new community heating and upgrading of existing systems.
- improve the energy efficiency requirements of the Building Regulations.

- continue cutting emissions and increasing removals in agriculture and forestry by:
  - better countryside management;
  - cutting fertiliser use;
  - protecting and enhancing forests; and
  - better energy efficiency and encouraging biomass energy use.

- ensure the public sector takes a leading role by:
  - new energy efficiency and emission reduction targets for central Government, schools and hospitals.

Projections

The projections reflect the positive action that the UK has already taken to reduce its greenhouse gas emissions. Baseline projections estimate that the UK's emissions will be about 15% below 1990 levels in 2010. These include the effect of some measures that have been introduced since Kyoto – the fuel duty escalator to 1999, the 10% renewables target and the price effect of the climate change levy.

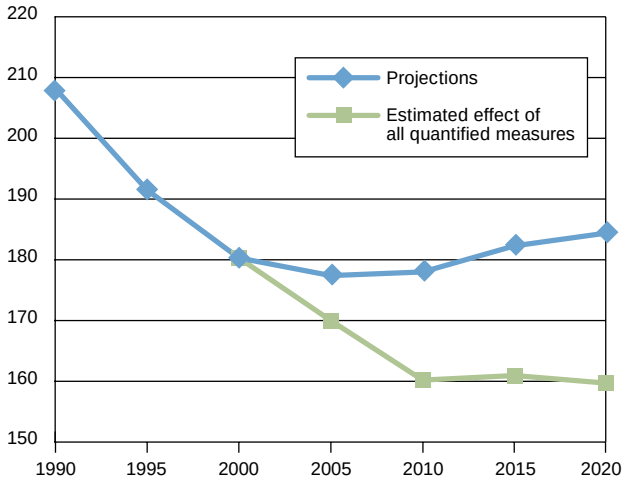
It is estimated that the additional policies and measures that have been identified, and are outlined in this Communication, could by 2010:

- reduce the UK's greenhouse gas emissions to 23% below 1990 levels;

- reduce the UK's carbon dioxide emissions to 19% below 1990 levels; and

- ensure emissions fall still further through the impact of other measures that cannot be quantified, for example, further action by the devolved administrations and local government as well as public awareness campaigns. The measures could mean that the UK's carbon dioxide emissions reach 20% below 1990 levels.

Projected greenhouse gas emissions and estimated effect of all quantified measures, MtC



Without further action, the UK's emissions are projected to stabilise and then increase again around 2010 as a result of economic growth, traffic growth and the progressive planned closure of nuclear power stations. The UK has already begun to introduce policies and measures to address these projected emission trends. These should continue to reduce the UK's emissions in the longer term, and start the transition to a low carbon economy. The UK Government and the devolved administrations are currently examining the need for greater resource efficiency, within the context of sustainable development. They are also reviewing the longer term, strategic issues, including those related to climate change, surrounding energy policy within the context of ensuring secure, diverse and sustainable energy supplies at competitive prices.

Impacts and adaptation

The UK needs to adapt to the predicted impacts of climate change. The Government and the devolved administrations have begun to build adaptation into many of their policies, including those on water resources, flood defence and planning. The UK Climate Impacts Programme has also continued its work to help stakeholders assess their vulnerability to climate change so that they can plan adaptation strategies.

An impacts assessment tool-kit has been developed for use by stakeholders which includes:

- national climate change scenarios;

- national socio-economic scenarios;

- a methodology for costing impacts and adaptation;
- guidelines for dealing with climate change risk and uncertainty in decision-making; and
- guidelines for undertaking impacts assessments within the context of the UK Climate Impacts Programme.

Financial assistance and technology transfer

The UK's development programme is increasing. New and additional resources are now available to deal with environmental problems such as climate change. The UK is also the fifth largest contributor to the Global Environment Facility, with a commitment of over £215 million since its inception, and over £200 million has been committed between 1997 and 2000 on climate change related activities through bilateral projects.

The UK provides support on climate change related technology transfer through its multilateral activities and a range of different programmes. These include the UK Technology Partnership Initiative and the Climate Change Projects Office.

Research and systematic observation

Climate research has a long history in the UK, and the Government continues to sponsor a wide range of research on climate change to improve our understanding of the climate system, the impacts of climate change on society and the human responses to climate change. Key developments include:

- the Hadley Centre has developed its third generation atmosphere-ocean climate model which avoids the use of ocean flux corrections. It has shown that most of the climate warming of the past 50 years is due to human influence;
- three Research Councils have formed the Tyndall Centre to undertake interdisciplinary research on climate change and to communicate results with industry and others stakeholders;
- the AATSR instrument, procured by the Government, is due to be carried on the European Space Agency's ENVISAT satellite later in 2001. It will continue the 10 year record of high accuracy sea surface temperature measurements begun by ATSR-1 in 1991 and continued by ATSR-2 in 1996.

Education, training and public awareness

The UK has greatly expanded its programmes to raise the public's awareness of climate change issues. They are included throughout the UK's education system, often under the wider banner of sustainable development, and a range of specific initiatives are being taken forward in partnership with other organisations.

The Government and the devolved administrations are developing and funding major public information campaigns on climate change and other environmental issues. More effective product information, advice, guidance and training is also being provided for consumers and organisations, in partnership with other groups.

Sources of further information

Supporting material for this Communication, including more information about impacts and adaptation and projects on technology transfer, can be found at: www.defra.gov.uk/environment/climatechange/3nc

Additional copies of the UK's Third National Communication are available from:

DEFRA Publications
Admail 6000
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Tel: 08459 556000

Website: as above

Copies of the UK's climate change programme are available from:

The Stationery Office
PO Box 29
Norwich NR3 1GN
Tel: +44 (0)845 7023 474
ISBN No: 0101491328

Website: www.defra.gov.uk/environment/climatechange/cm4913/index.htm

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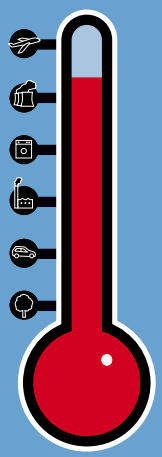
National circumstances



CHAPTER ONE

National circumstances

Government structure

1.1 The United Kingdom (UK) is made up of England, Scotland, Wales and Northern Ireland[2]. In 1999, devolution legislation was introduced to establish the Scottish Parliament, the National Assembly for Wales and the Northern Ireland Assembly. The UK Government retains overall responsibility for ensuring that a programme is put in place to deliver the UK's Kyoto target, for reserved policies like taxation, and for policies in England. The devolved administrations implement policies in areas of devolved responsibility.

1.2 The UK Government and the devolved administrations set the overall strategy for climate change policies. They also implement most policies through, for example, fiscal or economic instruments and regulation. Local government is responsible for implementing policies at a local level through their responsibilities, for example, as planning and waste authorities, and as housing and local transport providers. Central government frequently provides funding, guidance and encouragement for local government initiatives. The importance of regional level government in England is growing and is likely to play a more prominent role in the future in helping to reduce emissions and to adapt to the effects of climate change.

1.3 The Department for Environment, Food and Rural Affairs (DEFRA)[3] is responsible for the UK's policy on climate change and for co-ordinating action. Some of the policies and measures within the UK's programme are the responsibility of DEFRA. Many are the responsibility of other government departments including the devolved administrations, the Department for Transport, Local Government and the Regions, the Department of Trade and Industry, Her Majesty's Treasury, the Foreign and Commonwealth Office, the Forestry Commission, and the Department for International Development. Other agencies or groups involved in the UK's climate change programme include the Greater London Assembly, the Environment Agency for England and Wales, and the Scottish Environment Protection Agency.

Geographic and climate profile

1.4 The UK covers about 24 million hectares of land, most of which is in commercial use. The proportion of land used for agriculture has declined over the past 20 years, whilst woodland, urban and semi-natural areas are all increasing.

Proportion of land use in the UK

	Percentage of land per country					
	Intensively managed agricultural land	Less intensively managed agricultural land	Woodland	Urban and built up land	Aquatic ecosystems	Other† (unclassified)
England and Wales	59	16	10	13	1	1
Scotland	21	58	16	3	1	0
Northern Ireland	45	37	8	n/a	n/a	10
UK total	47	30	12	10	1	0

†Northern Ireland includes urban and built up land and aquatic ecosystems.
Source: *Accounting for Nature: Assessing Habitats in the UK Countryside*, 2000, Haines-Young R.H. *et al*.

[2] The UK's greenhouse gas inventory includes emissions from the Channel Islands and the Isle of Man. Emissions from Gibraltar will be included in the inventory to be published in April 2002.
[3] DEFRA was created on 8 June 2001. Before that date, the Department of the Environment, Transport and the Regions (DETR) was responsible for environmental policies.

1.5 The UK supports a wide range of terrestrial and aquatic ecosystems:

- around 47% of the land lies within intensively managed agricultural ecosystems. These include important wildlife habitats such as field margins and hedgerows, and support significant populations of farmland birds;
- 30% of land lies within less intensively managed, semi-natural ecosystems. These contain some of the most important sites for biodiversity in the UK;
- woodland ecosystems account for 12% of the land area;
- urban and built-up ecosystems make up most of the remaining 11% of the land. These support a variety of habitats typical of managed and disturbed situations including urban parks and gardens, derelict sites and amenity trees;
- aquatic ecosystems include rivers and streams, natural and artificial waterbodies, coastal and marine habitats.

1.6 The UK's climate is maritime: variably cool, moist, temperate and with a moderate annual temperature and limited ranges. Average annual precipitation rates range from less that one metre to over three metres. Space heating is needed in buildings throughout the winter months and the use of air-conditioning in the summer months is increasing. Central England temperature records show that there has been a warming of the UK climate of about 0.7°C since the 17th Century, of which about 0.5°C has occurred during the 20th Century. The warming has been greater in winter than in summer. In England, four of the five warmest years in a 340-year record have been in the 1990s, and 1999 was the joint warmest year ever.[4]

1.7 The UK's climate is expected to change as a result of climate change. Modelling suggests that average temperatures in the UK could rise by a further 3°C by 2100. Winters and autumns are expected to become wetter, and spring and summer rainfall patterns to change. Climate-induced sea level rise, together with natural vertical land movements, could be 41 centimetres in the east of England and 21 centimetres in the west of Scotland by the 2050s. Gradual changes in climate and sea level will also be accompanied by changes in the frequency of extreme weather events, such as severe floods.[5]

Population and urban profile

1.8 The UK's current estimated population and density are as follows.

The UK's population and average density, 1999

	Population in 1999 (000's)	Area (sq km)	No of persons per sq km in 1999
England	49,753	130,422	381
Wales	2,937	20,779	141
Scotland	5,119	78,133	66
Northern Ireland	1,692	13,576	125
UK total	59,501	242,910	245

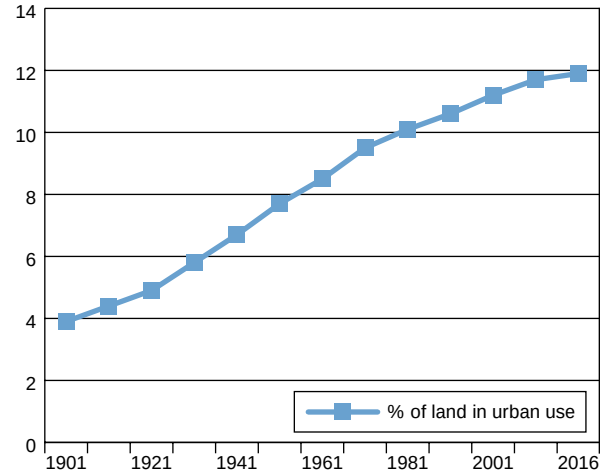
1.9 The UK's population is projected to grow by about 5% by 2021[6]. This is linked to a long term trend of urbanisation in the UK. In England, for example, land in urban uses is projected to reach 12% of the land area by 2016 compared to 10.6% in 1991, with relatively high rates of urbanisation in the south east and north west of England. Some areas are sparsely populated, however, including the Highlands of Scotland, parts of Wales and part of the north east of England.

[4] The UK has developed a set of 34 indicators to show how the UK's climate is changing. *Indicators of Climate Change in the UK*, 1999, DETR: www.nbu.ac.uk/iccuk/

[5] More information on climate change scenarios for the UK can be obtained from the UK Climate Impacts Programme: www.ukcip.org.uk/ukcip.html

[6] Although it is projected to begin falling after 2031.

Urbanisation in England, 1901-2016



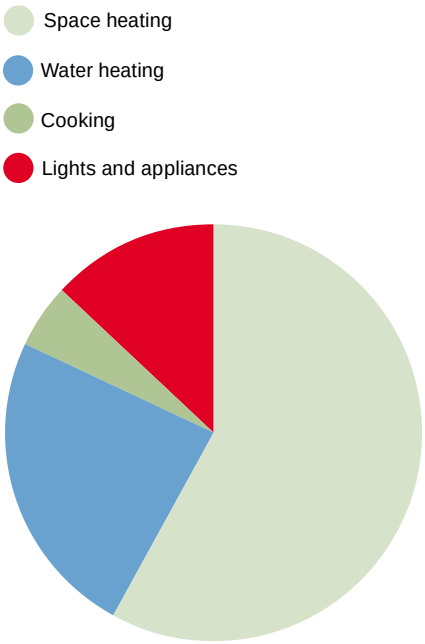
Sources: 1901-1981, various sources estimated to fit projected series; 1991-2016, *Urbanisation Projections*, DTLR.

1.10 There are currently about 25 million permanent dwellings in the UK. The most common type in England are semi-detached houses (31%), followed by terraced houses (29%), detached houses (21%) and purpose built flats (12%)[7]. The existing housing stock in England is relatively old: 62% of all dwellings were built before 1965 and 41% were built before 1944. The number of households in England is projected to increase by 19% between 1996 and 2021 reflecting, amongst other things, increasing numbers of people living on their own. There are large regional variations in this trend, with increases of about 25% in the south but only 10% in the north of England.

1.11 In December 1999, there were an estimated 2.3 million dwellings in Scotland. The most common types were flats or maisonettes (36%), followed by semi-detached (22%), terraced (21%) and detached (19%). The existing housing stock is also relatively old. In 1996, 64% of dwellings were built before 1965 and 36% before 1944. The number of households in Scotland are projected to increase by around 12% between 1998 and 2012, ranging from around 19% in East Lothian to projected 1% decreases in Dundee City and Inverclyde.

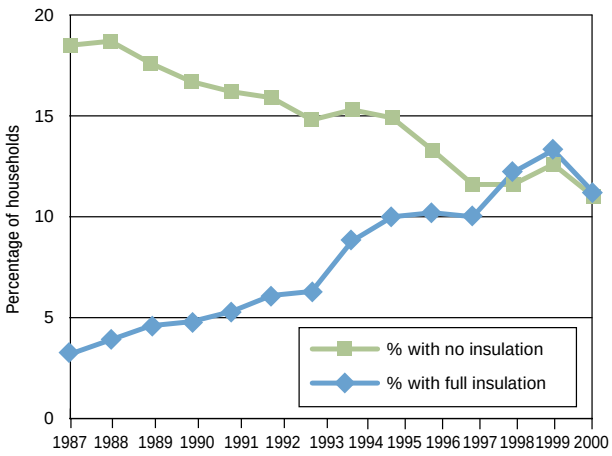
1.12 Energy use in Great Britain's[8] housing stock has risen at about 1% per year, more or less in line with the rate at which the stock is growing. The energy use of the average dwelling has not, however, increased between 1970 and 2000 and was in fact about 9% lower in 2000 than in 1970. Without the energy efficiency measures that have been implemented, carbon dioxide emissions could have been about 60% higher than they actually are. The figure below illustrates how energy use in Britain's housing stock in 1999 was distributed between the main end-uses.

Proportions of housing stock energy use by end use in 1999



1.13 It is clear from this that space heating accounts for the largest part of energy use. It is therefore important to ensure that homes are insulated to a good standard[9]. The following figure illustrates the progress that has been made in this area[10].

Percentage of households with full and no insulation

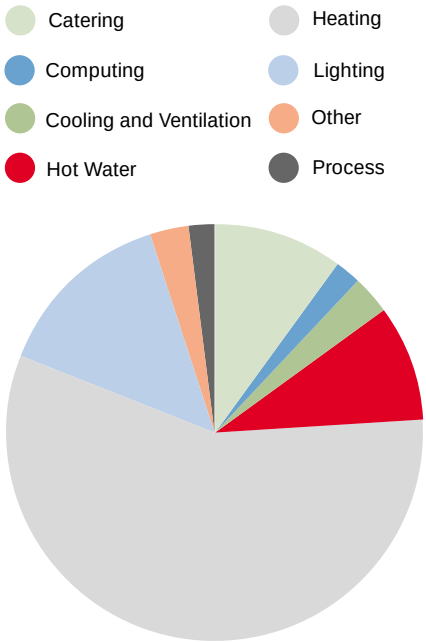


[7] Source: *Survey of English Housing*.
[8] Great Britain includes England, Scotland and Wales.
[9] That is, at least 100 mm loft insulation where there is a loft, cavity wall insulation where there is a cavity wall, and full double glazing.
[10] The fall between 1999 and 2000 is a fluctuation due to statistical sampling rather than an interruption of the trend.

1.14 The proportion of homes that are insulated to a good standard has risen from 3% in 1987 to 11% in 2000. Mirroring this change, the proportion of homes with no insulation at all has fallen from about 19% to 11% over the same period. Insulation and other energy efficiency improvements have been in progress for many years now and are expected to continue into the future.

1.15 The chart below gives details of energy consumption by end use in the service sector for 1997. Over half of service sector energy is used for heating, followed by lighting, catering and hot water.

UK service sector energy consumption by end-use (1997)



1.16 Changes to the population profile, urban structure and household growth are likely to exert increasing pressures on housing provision, land use, energy supplies and transport, with corresponding increases in greenhouse gas emissions. The Government is introducing policies (see chapter 3) that are aimed at minimising the impact on emission levels through, for example:

- planning policies that encourage the re-use of brownfield sites[11];
- sustainable housing policies[12];
- transport policies that aim to encourage more use of sustainable forms of transport, and smaller, more fuel efficient cars;
- policies to improve energy efficiency in homes and household appliances; and
- measures to improve the energy efficiency of commercial buildings.

Economic profile and industry

1.17 The UK enjoyed its ninth consecutive year of positive economic growth during 2000, and experienced the lowest inflation for over 30 years. Employment rose to a record high, with unemployment falling to its lowest level since the 1970s. GDP at current market prices – 'money GDP' – totalled £934 billion in 2000. GDP per head in 1999 was £14,987, or US$22,861 (based on OECD purchasing power parities). The service sector has become increasingly prominent in recent decades, accounting for some 70% of gross value added in the UK during 1999. Manufacturing activities contributed a further 19%, with the difference made up by other production industries (5%), construction (5%) and agriculture, hunting, forestry and fishing (1%). International trade plays a key role in the UK economy, with exports accounting for 27% of GDP during 2000. Some 52% of UK goods and services exports went to the EU, and around 18% to the USA. The EU supplied 52% of goods and services imports to the UK, with a further 16% coming from the USA.

Energy

1.18 The UK has a relatively varied and balanced supply with access to a wide range of fuels, and a diverse mix of primary fuels. The UK is a major producer of both natural gas and oil and a net exporter of oil, although oil and gas production are both expected to decline in the next few years. The UK will make increasing use of imports and is likely to revert to being a net importer of gas on an annual basis within the next five years.

[11] *Our Towns and Cities: The Future – Delivering an Urban Renaissance*, November 2000, DETR: www.regeneration.dtlr.gov.uk/policies/ourtowns/index.htm
[12] *Quality and Choice: A Decent Home for All – The Way Forward for Housing*, December 2000, DETR: www.housing.dtlr.gov.uk/information/statement/main/index.htm

119 There has been significant restructuring of the electricity (and gas) industry since privatisation and the introduction of competition in electricity (and gas) supply. Competition continues to exert downward pressure on prices. Industrial electricity prices have fallen by approximately 20% since early 1999, with residential electricity prices falling by 8% in real terms[13].

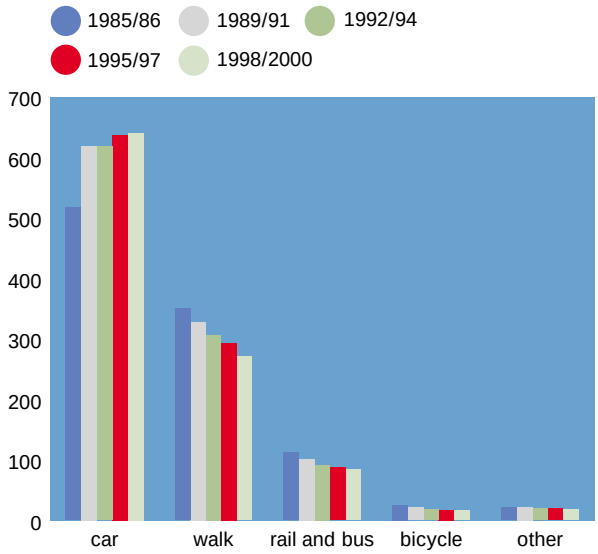
1.20 The 1990s saw a rising share of generation from gas, with the introduction of Combined Cycle Gas Turbine stations, and a decreasing share for coal. Nuclear stations currently account for around 25% of UK electricity supply[14], although that share is expected to decline over the next two decades as existing stations reach the end of their lives. Renewable sources of energy accounted for 2.8% of UK electricity generation in 2000, up from 2.1% in 1997. New and renewable sources are being encouraged through a range of measures. These include a target for the renewables obligation that 10% of sales from licensed electricity suppliers will be generated from eligible renewable sources by 2010, subject to the cost to the consumer being acceptable. The UK Government also has a target to at least double the capacity of Combined Heat and Power (CHP) to 10,000 MWe by 2010 (see chapter 3).

1.21 The energy intensity of the UK economy has been declining for some time. The energy ratio – calculated by dividing temperature corrected primary energy consumption by GDP at constant prices – has been falling steadily, at just under 1.5% a year since 1950. It was half its 1950 level in 1999. The downward trend can be explained by a combination of factors: improved energy efficiency; fuel switching; a decline in the relative importance of energy intensive industries; and the fact that some uses, such as space heating, do not increase in line with output. Transport is now the biggest energy user in the UK accounting for 34% of final energy use in 1999. Households account for 29%, industry 23% and services and agriculture 14%.

Transport

1.22 There has been a rapid growth in total passenger and goods transport in the UK over recent decades. Transport is now the third largest source of greenhouse gas emissions and, more importantly, it is the fastest growing source. The number of miles per year travelled by the average resident in Great Britain has increased by nearly a half since the early 1970s. Average journey lengths have increased by a quarter since the middle of the 1980s, the greatest change being in the length of commuting journeys. A quarter of car trips are less than two miles long, and over a quarter of households now have access to two or more cars. Road freight traffic has increased by 68% between 1980 and 2000. Left unchecked, car traffic could grow by about 20% over the next two decades and commercial traffic is forecast to grow by about 22%[15]. Action to tackle the impact of this growth on congestion and pollution, and to reduce transport's impact on the environment is being taken forward as one of the Government's main priorities (see chapter 3).

Trips per person per year by main mode of travel: 1985/86–1998/2000



1.23 The growth in road traffic has been accompanied by limited improvements in vehicle fuel efficiency, especially for passenger cars, since the middle of the 1980s. Although there have been substantial improvements in engine efficiency during the past decade, these have been largely offset by the effects of greater vehicle weight due to increased size, better safety standards and the provision of additional features such as air conditioning. The UK Government is encouraging a sustainable market transformation to stimulate the development, manufacture and purchase of smaller, more fuel efficient cars. The Government and the devolved administrations are also committed to a sustainable distribution strategy.

[13] Restructuring of the Northern Ireland electricity industry was not completed until 1993. Impact of competition has been less marked. Prices in the period since privatisation to 2000 fell by 17% in real terms.
[14] Nuclear energy currently accounts for over 50% in Scotland, and renewables account for about 11%.
[15] More statistics about transport can be found in *Transport Statistics Great Britain: 2000 Edition*, 2000, DETR: www.transtat.dtlr.gov.uk

Waste

1.24 The amount of waste produced in the UK is as follows:

Amount of waste produced in the UK in 1998/99, million tonnes

Type of waste	England and Wales	Scotland	Northern Ireland	UK total
Industrial (excluding construction and demolition)	50	2	0.53†	79.5
Commercial	25	2		
Municipal (collected by or on behalf of a local authority)	28	3	1	32

Sources: Environment Agency; Municipal Waste Survey 1998/99; NI Waste Arisings Survey 1999-2000.
† Includes construction and demolition.

1.25 Most of the waste produced in the UK currently goes to landfill[16]. The rest is treated by other means, including waste-to-energy, recycling and composting. The Government and the devolved administrations have published waste strategies that aim to reduce the amount of waste produced and to increasingly recover value from it (see chapter 3). The strategies also set targets for reducing the amount of landfill and to increase the amount of recycling or composting. These will in turn reduce the level of methane emissions from the waste sector in the UK.

Agriculture

1.26 The total agricultural land area in the UK is 18.6 million hectares. Six million hectares is under arable production, dominated by the growth in cereals. 11.3 million hectares is under grass (including rough grazing), with the remainder in set-aside or farm woodland. In June 2000, there were 214 million livestock in the UK: 11.4 million cattle, 44.7 million sheep, 7.3 million pigs and 150.5 million poultry. Greenhouse gas emissions from this sector are falling and are forecast to continue doing so (see chapter 3).

Forestry

1.27 The area of woodland in the UK is now around 2.8 million hectares (12% forest cover). Of this, around 1.6 million hectares are conifers, mostly in plantations created during the last century.

UK forestry as at 31 March 2000

Country	Area (kha[17]) of woodland	Area (kha) of new planting	Area (kha) of restocking	Harvested timber (millions of cubic metres)
England	1,135	5.9	3.9	3.4
Wales	286	0.7	2.6	1.3
Scotland	1,318	10.4	8.0	4.7
Northern Ireland	83	0.8	0.6	0.3
UK total	2,822	17.8	15.1	9.7

Source: Forestry Commission

[16] 44% of industrial, 69% of commercial (52% for industrial and commercial together) and 82% of municipal waste went to landfill in 1998/99.
[17] Kilohectares.

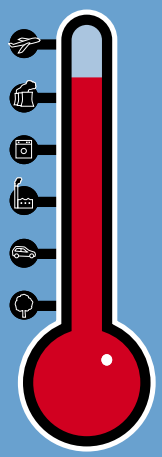
Sustainable management practices are promoted through *The UK Forestry Standard*[18], and have been independently assessed when woodland owners have sought certification under the UK Woodland Assurance Standard.

1.28 Each year, around 17 thousand hectares of new woodland are created, and around 15 thousand hectares restocked after harvesting. Most of the new woodland creation consists of broadleaves or native Scots pine. More than 9 million cubic metres of timber (standing volume) are harvested each year, and this is forecast to increase by more than 50% in the next 20 years as the large plantations of the 1960s and 1970s reach maturity. Chapter 3 includes more details of the trends in emissions and removals by sinks for UK land use and forestry activities.

[18] This document is available at: www.forestry.gov.uk

2

Greenhouse gas inventory information



CHAPTER TWO

Greenhouse gas inventory information

Key developments

- The UK's total greenhouse gas emissions were about 14.5% below 1990 levels in 1999.
- Over the same period, carbon dioxide emissions fell by 9%; methane emissions fell by 28%; and nitrous oxide emissions fell by 36%.
- The UK has decided to use 1995 as the base year for the fluorinated gases. Since then, HFC emissions fell by 60% below in 1999; PFC emissions fell by 36% and SF_6 emissions increased by 18%.

National system for preparing the UK greenhouse gas inventory

2.1 The UK greenhouse gas inventory is compiled and maintained by the National Environmental Technology Centre (NETCEN) of AEA Technology, under contract to DEFRA. The inventory is based largely on the National Atmospheric Emission Inventory, with emissions and removals from land use change and forestry provided by the Centre for Ecology and Hydrology, and agricultural emissions by DEFRA. DTI is the main source of energy and fuel statistics. Other data are provided by the Environment Agency, industry, the Forestry Commission and other DEFRA research contracts. A detailed description of the UK's national system will be published in its next national inventory report in April 2002.

Greenhouse gas emissions inventory and trends

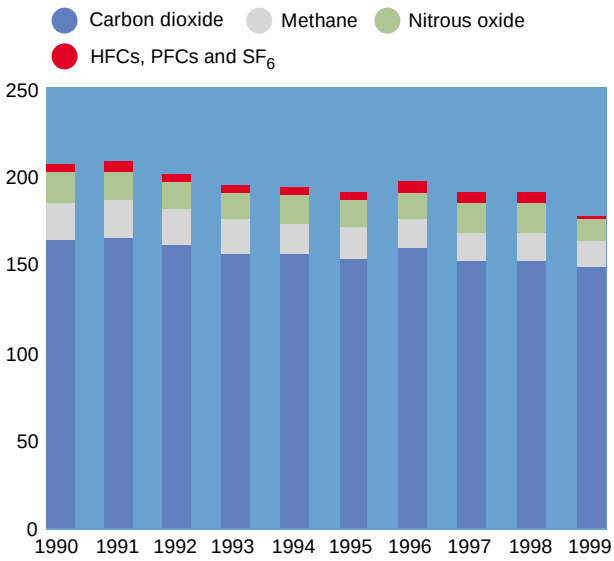
2.2 The emission figures used in this Communication differ from those used in the UK's climate change programme. This is due to updated inventory information that was submitted to the UNFCCC and published in April 2001[19].

2.3 The most significant of these changes concern carbon dioxide emission estimates from soil. This is a result of updating the estimates of (a) soil carbon densities and (b) rates of carbon uptake or loss following land use change. These estimates are highly uncertain and recent results suggest that the estimates published in the programme were towards the top end of the uncertainty range. This possibility was noted in the programme, and this Communication includes the revised data.

2.4 Carbon dioxide is the most important greenhouse gas in the UK, accounting for 79% of the direct global warming potential of emissions in 1990. Methane emissions contributed 10% and nitrous oxide emissions a further 9%. The remaining 2% was due to emissions of HFCs, PFCs and SF_6, all of which have high global warming potentials but low levels of emissions.

2.5 In 1990, the UK's emissions of the six greenhouse gases covered by the Kyoto Protocol were 208.4[20] million tonnes of carbon (MtC)[21]. Action in the UK is already driving a significant reduction in emissions, with annual emissions falling by about 14.5% between 1990 and 1999. Annex A includes tables that summarise the UK's greenhouse gas emissions. More details can be found in the UK's greenhouse gas inventory.

The UK's greenhouse gas emissions, 1990 to 1999, MtC



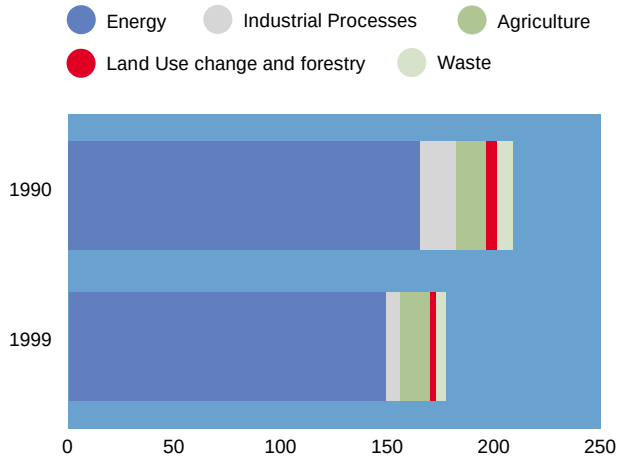
2.6 The chart below shows UK greenhouse gas emissions according to the source categories reported in the common reporting format. Carbon dioxide removals by forests are not included.

[19] *UK Greenhouse Gas Inventory*, 1990–1999, NETCEN: www.aeat.co.uk/netcen/airqual/reports/ghg/ghg2.html

[20] Base year emissions differ from the 1990 emissions reported in the common reporting format because (i) 1995 is used as the base year for emissions of fluorinated compounds in accordance with Article 3.8 of the Kyoto Protocol, and (ii) carbon dioxide removals by UK forests are not included.

[21] Greenhouse gas emissions are expressed throughout as million tonnes of carbon equivalent (MtC).

UK greenhouse gas emissions by source



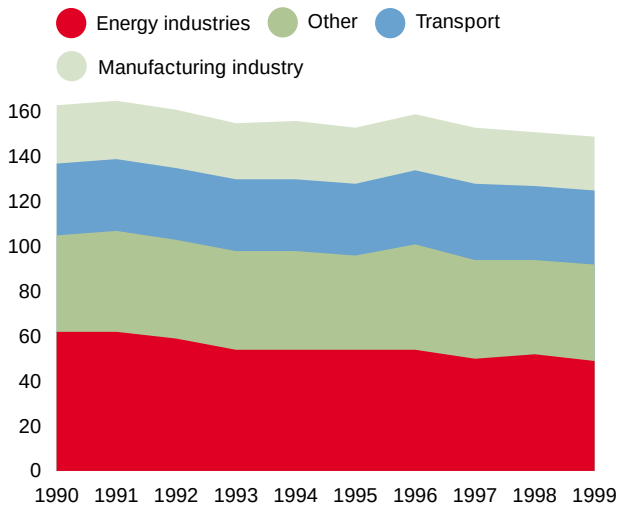
Carbon dioxide emissions

2.7 Carbon dioxide emissions were 164.4 MtC in 1990. They were 149.4 MtC in 1999 or 9% below 1990 levels, and are provisionally estimated to be 151.4 MtC in 2000 or about 7.9% below 1990 levels. These figures include revised estimates of emissions from loss of carbon due to land use change of 5.3 MtC in 1990 and projected emissions of 4.1 MtC in 2000. They do not include estimated removals by forests of 2.6 MtC in 1990 or projected removals by forests of 2.9 MtC in 2000.

2.8 Primary energy use rose by about 6.5% between 1990 and 1999. Over the same period, total carbon dioxide emissions fell by 9%. While carbon dioxide emissions from power stations fell by 29% between 1990 and 1999, electricity consumption increased by 16%. The reasons that emissions did not increase in line with electricity consumption was largely due to a switch from coal to gas in electricity generation, together with improved reliability and performance from nuclear generation. There have also been increases in the use of renewable energy and combined heat and power.

2.9 Carbon dioxide emissions are likely to have increased by about 2% between 1999 and 2000[22], mainly due to increased use of coal in power stations in that year as nuclear and combined cycle gas turbine stations were maintained and repaired, and as coal competitiveness improved with higher gas prices.

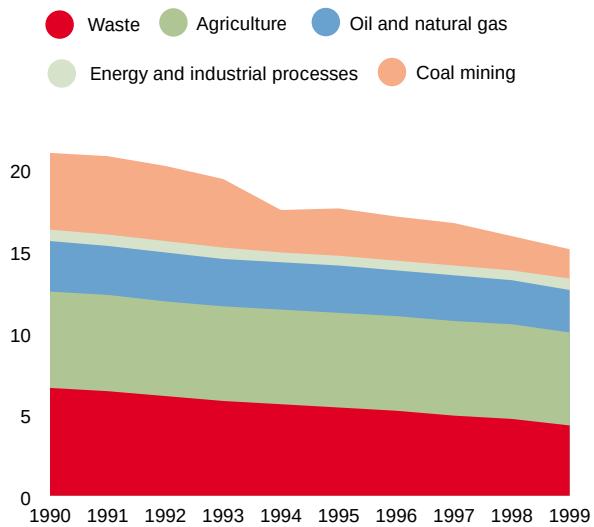
Carbon dioxide emissions by source[23], MtC



Methane emissions

2.10 Methane is the second most important greenhouse gas in the UK after carbon dioxide. It contributed around 10% of the UK's total emissions of greenhouse gases in 1990 or 21.0 MtC. The major sources were landfill waste, agriculture, natural gas distribution and coal mining. Annual emissions fell by 28% below 1990 levels to 15.1 MtC in 1999.

Methane emissions by source, MtC



[22] The inventory for the year 2000 is due to be finalised and published in April 2002.
[23] Not including carbon dioxide removals by forests.

2.11 The estimate of methane emissions from landfill sites has reduced significantly from that published in the UK's Second National Communication in 1997. Since then, the model to estimate national emissions has been revised to take better account of field measurement data.

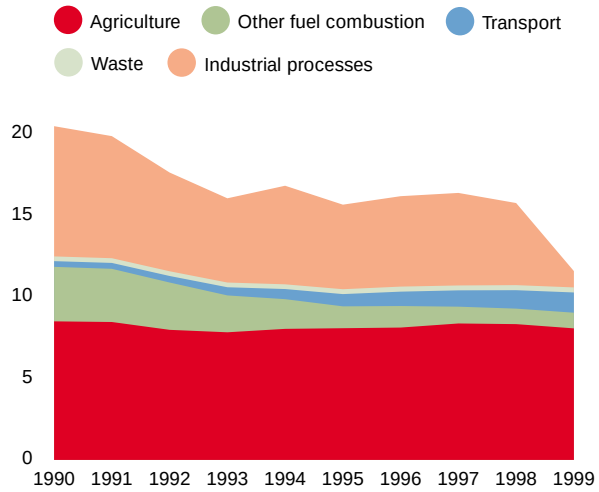
2.12 All the main sources of methane in the UK have reduced since 1990:

- landfill methane emissions fell by 36% between 1990 and 1999, mainly because of increased collection of landfill gas for use as energy and environmental control. There are also a number of Government and devolved administration policies aimed at reducing the landfilling of biodegradable waste;
- agriculture was the second highest source of methane in 1990. Increased productivity in dairy cows and falling cattle numbers has resulted in a 4% decrease in methane emissions from the dairy sector between 1990 and 1999;
- annual emissions from coal mining fell by 62% from 1990 to 1999 due to lower levels of production and the collection of methane for use as energy;
- emissions from natural gas distribution have fallen by 8% between 1990 and 1999, mainly as a result of the replacement of cast iron pipework. This reduction was despite an increase in throughput over the same period;
- emissions from the offshore oil and gas industry have fallen despite increased production. Emissions have reduced by 44% between 1990 and 1999 due to the industry implementing its own environmental guidelines on reducing emissions to air, and improving management systems, auditing and training.

Nitrous oxide emissions

2.13 Emissions of nitrous oxide from the UK in 1990 were 18.3 MtC or 8.8% of the UK's total greenhouse gas emissions. The major sources were agricultural soils and industrial processes, particularly fugitive nitrous oxide emissions from adipic acid manufacture. Annual emissions fell by 36% between 1990 and 1999.

Nitrous oxide emissions by source, MtC



2.14 Total nitrous oxide emissions from agriculture in 1990 were around 8.5 MtC, with about 60% resulting from the application of manures and fertilisers to soils. Indirect sources (leaching and atmospheric deposition) contributed 30%, while animal waste management and a group of smaller sources accounted for 5% each. Nitrous oxide emissions from this sector have fallen by 5% between 1990 and 1999, mainly because of reduced fertiliser use. Estimates for historic and projected emissions have increased by about a factor of ten since the UK's Second National Communication because of a reassessment of the emission factor for nitrous oxide emissions from inorganic fertiliser application and the inclusion of additional sources of nitrous oxide.

2.15 Nitrous oxide emissions from road transport have increased as a result of catalytic conversion to reduce emissions of oxides of nitrogen. Nitrous oxide emissions from road transport were 0.4 MtC in 1990, and increased to 1.2 MtC in 1999. The rise in nitrous oxide emissions is linked directly to increased use of three-way catalysts and the growth in traffic.

2.16 Chemical manufacturing processes accounted for 45% of nitrous oxide emissions in 1990. Nitrous oxide is emitted during the manufacture of adipic acid, an intermediate chemical in the production of nylon. Emissions from this process accounted for 6.8 MtC in 1990, and have reduced by 97% between 1990 and 1999. DuPont (UK) Ltd, which operates the

only adipic acid plant in the UK, commissioned a common off gas abatement unit in 1998. This has reduced emissions by 92% in its first year of operation and is expected to reduce nitrous oxide emissions by 95% or more over the next few years[24].

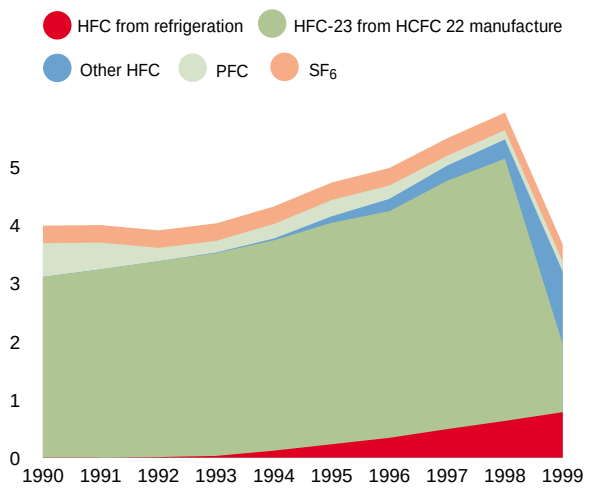
2.17 Manufacture of nitric acid was responsible for emissions of 1.1 MtC in 1990. Emissions decreased to 0.8 MtC in 1999, mainly due to the closure of one plant.

Fluorinated gases

2.18 The UK has decided to use 1995 as the base year for HFCs, PFCs and SF_6. The Government made this decision on the basis of informed responses to the consultation on the climate change programme that recommended the 1995 data were more reliable. The Government also believes that most other European member states will use 1995 and so this decision will help comparisons to be made within the EU.

2.19 Emissions of HFCs from the UK in 1995 were 4.1 MtC. The major source was fugitive emissions of HFC-23 from the manufacture of the refrigerant, HCFC-22. This represented 93% of HFC emissions in 1995. Investment has already been made by industry to reduce these emissions substantially. ICI Klea (now Ineos Fluor) installed a vent treatment unit in 1998 in its Rocksavage works to convert HFC-23 by-product emissions to harmless salts and water vapour. This has reduced emissions by 90%.

UK emissions of fluorinated gases, MtC



2.20 Other sources of HFC emissions are:

- refrigeration/air conditioning;
- foam blowing;
- general aerosols;
- metered dose inhalers;
- solvent cleaning; and
- firefighting.

2.21 HFCs were virtually unused before 1990 but, since then, consumption has risen in response to the phase out of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) under the Montreal Protocol. UK HFC consumption in these markets increased from 25 tonnes in 1990 to 4,000 tonnes in 1997. HFC emissions from these end use markets are estimated to have been 0.34 MtC in 1995.

2.22 HFC emissions are expected to fall by 29% from 1995 to 2010, mainly due to a substantial fall in HFC-23 emissions from HCFC-22 manufacturing plants. Emissions from end use markets such as aerosols, refrigeration and foam blowing are projected to increase significantly compared to 1995. However, reduced levels of leakage and increased use of alternative fluids in these markets are expected, and should limit the increase in HFC emissions from these sectors.

2.23 Emissions of PFCs in 1995 were 0.3 MtC. There are two main markets in which PFCs are used or are likely to be used in the near future: electronics and refrigeration/air conditioning. PFC use in these sectors has grown considerably since 1990 in response to the Montreal Protocol in both the refrigeration sector but, more significantly, in the electronics sector. UK PFC consumption in these markets increased from 22 tonnes in 1990 to 205 tonnes in 1997. PFC emissions from these end use markets are estimated to have been 0.18 MtC in 1995.

[24] The Environment Agency publishes details of emissions on its website: www.environment-agency.gov.uk

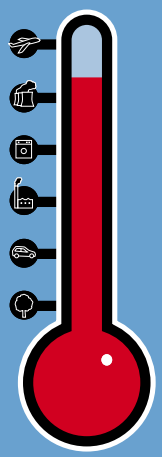
2.24 SF_6 is used in four main markets:

- electrical insulation;
- magnesium smelting;
- electronics; and
- training shoes.

2.25 Total use of SF_6 has increased by 18% over the past decade. SF_6 emissions from these end use markets are estimated to be 0.3 MtC and are expected to remain approximately the same in 2010. Projected increases in emissions from magnesium smelting and electrical insulation are expected to be approximately balanced by reduced emissions from other sources, such as training shoes.

3

Policies and measures



CHAPTER THREE

Policies and measures

Key developments

- The Government and the devolved administrations published the UK's climate change programme in November 2000.
- The programme sets out how the UK will meet its Kyoto target to cut greenhouse gas emissions by 12.5% below 1990 levels by 2008-2012, and move towards its domestic goal to cut carbon dioxide emissions by 20% below 1990 levels by 2010.
- Significant emission reductions will come from a range of policies and measures, covering all sectors of the economy. Key policies include:
  - the climate change levy package;
  - a UK-wide emissions trading scheme;
  - a target for the renewables obligation that 10% of sales from licensed electricity suppliers will be generated from eligible renewable sources by 2010, subject to the cost to the consumer being acceptable;
  - a target to at least double the capacity of combined heat and power by 2010;
  - European-level agreements with car manufacturers to improve the fuel efficiency of new cars by at least 25% by 2008-2009;
  - the 10 Year Plan for Transport;
  - better energy efficiency in the residential sector; and
  - improving performance standards in the Building Regulations.

Introduction

3.1 The UK plays a leading role in the fight against climate change. Action taken throughout the 1990s has significantly reduced greenhouse gas emissions and the UK will be one of a small number of OECD countries to meet the target under the Framework Convention on Climate Change to return emissions to 1990 levels by 2000[25].

3.2 The UK Government has pressed for a strong global response to climate change during international negotiations. It has also said that it intends to ratify the Kyoto Protocol at the same time as other EU member states by 2002.

3.3 At Kyoto in 1997, the European Community agreed to reduce its greenhouse gas emission by 8% below 1990 levels by 2008-2012. Following discussions with the EU and other member states on sharing out the EC's target, the UK's legally binding target is to reduce its emissions by 12.5%. The UK Government and the devolved administrations have reinforced this commitment to action by setting an additional domestic goal to reduce carbon dioxide emissions by 20% below 1990 levels by 2010. The UK published its climate change programme in November 2000. This sets out how it intends to meet its Kyoto target and move towards its domestic goal[26]. More details of the policies and measures described in this chapter can be found in the UK's programme. A summary can also be found in Annex B.

3.4 The UK's programme is supported by the Scottish climate change programme and by action being taken by the Welsh Assembly and the Department of the Environment in Northern Ireland. The UK's climate change programme includes a summary of this action but further details can be found in separate documents published by the devolved administrations[27].

Policy development process

3.5 The UK's programme is co-ordinated by the Department for Environment, Food and Rural Affairs, in close collaboration with a wide range of other government departments and the devolved administrations. During its development, two extensive consultations were carried out with business, local government, the general public and other organisations. The first of these was on the basis of a consultation paper in October 1998, the second on the basis of a draft programme in March 2000[28]. Summaries of the findings from both consultations were published[29].

3.6 The UK's climate change programme is based on a number of principles. It:

- reflects the importance of tackling climate change by the UK's ambitious domestic goal;

[25] The UK's greenhouse gas emissions are projected to be about 13.5% below 1990 levels in 2000, but this figure will not be finalised until the inventory for 2000 is completed in April 2002.

[26] *Climate Change: The UK Programme*, 2000, The Stationery Office: www.defra.gov.uk/environment/climatechange/cm4913/index/index.htm

[27] *Scottish Climate Change Programme*, 2000, Scottish Executive: www.scotland.gov.uk/climatechange; *Climate Change Wales – Learning to Live Differently*, National Assembly for Wales: www.wales.gov.uk/subienvironment/topicindex-e.htm

[28] *UK Climate Change Programme: Consultation Paper*, October 1998, DETR: www.defra.gov.uk/environment/consult/climatechange/index.htm
Climate Change: Draft UK Programme, March 2000, DETR: www.defra.gov.uk/environment/climatechange/draft/index/index.htm

[29] Both reports can be found at: www.defra.gov.uk/environment/climatechange/index.htm

- takes a balanced approach, with all sectors and all parts of the UK playing their part;
- safeguards, and where possible, enhances, the UK's competitiveness, promotes social inclusion and reduces harm to health;
- focuses on flexible and cost effective policy options that will work together to form an integrated package;
- takes a long term view, looking to targets beyond the Kyoto commitment period and considering the need for the UK to adapt to the impacts of climate change; and
- is kept under review.

3.7 The consultations showed that the programme is supported by many other stakeholders who recognise the wider benefits that policies and measures in the programme offer including:

- improved energy efficiency and lower costs for businesses and householders;
- more employment and commercial opportunities, through the development of new, environmental technologies;
- a better transport system;
- better local air quality;
- less fuel poverty; and
- improved international competitiveness for the UK.

3.8 Wherever practical, the impact of policies on carbon emissions has been quantified[30] in terms of MtC saved in 2010. The Government also carried out a qualitative assessment of the costs and benefits of the measures which was published as an annex to the climate change programme.

3.9 The UK's programme has been developed within the framework of other Government policies including those relating to sustainable development, transport, energy, waste, air quality, planning, and housing. Annex E provides information on where to find details of the respective Government policies on these issues.

Policies and measures at the European level

3.10 The UK's membership of the European Union has a strong influence on its response to climate change, as a number of important policies and measures to reduce emissions are, and will be, agreed in Europe. Important measures are already in place and form a good foundation. Additional measures will be brought forward by the European Commission as part of the European Climate Change Programme.

European-level measures already in place include:

- voluntary agreements between the European Commission and the European, Japanese and Korean car manufacturers to improve the fuel efficiency of new cars;
- measures under the Community-wide SAVE programme which aim to improve energy efficiency and reduce the environmental impact of energy use in the transport, industry, commerce and residential sectors;
- the European Best Practice Initiative, which is based on the successful UK Energy Efficiency Best Practice Programme. The Initiative builds on a UK-led feasibility study that showed the scope for co-ordinated action on energy efficiency best technology deployment, and is piloting key elements across the EU;
- regulation, such as the Integrated Pollution Prevention and Control and Landfill Directives;
- measures to raise the energy efficiency of appliances and equipment including mandatory labelling, industry wide agreements and minimum standards; and
- programmes to promote the collaborative research, development and demonstration of new and renewable energy options (ENERGIE); to help commercialise and promote renewable energy options (ALTERNER); and to promote the use of cleaner and more efficient solid fuel technologies as well as the development of advanced clean solid fuel technologies (CARNOT).

[30] Details of the assumptions used in the assessment of carbon savings was published in *Derivation of Carbon Savings Figures Included in the UK's Draft Climate Change Programme*, March 2000, DETR: www.defra.gov.uk/environment/consult/draftclimatechange/index.htm

The Kyoto mechanisms

3.11 In addition to taking domestic action, the Kyoto Protocol provides for three ways in which developed countries can take action abroad to help them meet their emission reduction targets. The three 'Kyoto mechanisms' comprise two project-based mechanisms, Joint Implementation and the Clean Development Mechanism, and International Emissions Trading.

3.12 The Government expects that the Kyoto mechanisms will make an important contribution to the delivery of the UK's targets, once the rules have been agreed internationally. The climate change programme does not, however, separately identify quantified carbon savings from this source, nor does it take account of possible sinks credits other than those linked to new forests planted since 1990 that were agreed during the Conference of the Parties in Kyoto in 1997.

3.13 In May 2001, the Government set up the Climate Change Projects Office (CCPO) to provide advice and support for UK businesses interested in carrying out emission reduction projects under the two project-based mechanisms. The CCPO will help UK firms to take advantage of new opportunities and markets in low carbon technology.[31]

Cross sectoral policies and measures

3.14 The UK's climate change programme includes policies and measures that are likely to affect emission levels in several sectors. For example, the climate change levy should bring emission reductions in both the business and public sectors. The amendment of Building Regulations should mean cuts in emissions from business, household and public sectors. And market transformation measures should help to reduce emissions in the business, household and transport sectors. These policies are outlined in more detail below.

Energy supply

Energy policy

3.15 The Government's central energy policy objective is to ensure secure, diverse, and sustainable suppliles of energy at competitive prices. This is best achieved by the operation of competitive markets in energy production and supply, in which commercial pressures ensure that companies strive at all times to improve their efficiency.

3.16 The Government is reviewing the longer term, strategic issues, including those related to climate change, surrounding energy policy. The main aim of the project is to set out the objectives of energy policy and to develop a strategy that ensures current policy commitments are consistent with longer term goals. Competitive markets will continue to be central to energy policy. In particular the project is considering the impact of current and projected energy demand and supply on: the potential conflict with environmental objectives; ensuring continued security and diversity of energy supplies over the longer term; and managing potentially conflicting policy goals for energy prices. An overall assessment of various energy related research and development activities is also being carried out.

3.17 The transformation of the UK's electricity generation has been significant, and these changes have been one of the main contributors to reductions in the UK's greenhouse gas emissions. However, this downward trend in emissions will not be maintained indefinitely and the large gains that came from the closure of older and less efficient coal stations will not be repeated. The UK's energy sector is still largely reliant on fossil fuels and, unless they can be replaced by plants with low or no emissions, this dependence will increase after 2010 as existing nuclear power stations *reach the end of their licensed lifetimes*. The Government is therefore focusing on policies and measures that are aimed at ensuring a step change in the way energy is generated and used.

[31] More information can be found at: www.defra.gov.uk/environment/climatechange/index.htm The CCPO's e-mail address is: CCPO@defra.gsi.gov.uk

3.18 The UK's Second National Communication explained some of the changes that had been made to the market. Since then, further significant changes have accompanied the Utilities Act 2000 and the introduction of the New Electricity Trading Arrangements (NETA)[32].

3.19 The Utilities Act reformed regulation of the gas and electricity sectors. Amongst a range of changes, it amalgamated the offices of the gas and electricity regulators. It provided for a new principal objective for the regulator to protect the interest of consumers wherever possible by promoting effective competition. At the same time, the Government recognises that economic regulation has an important contribution to make to the delivery of social and environmental objectives. The Act therefore places the regulator under a duty to have regard to guidance issued by the Secretary of State on social and environmental matters.

3.20 NETA replaced the Electricity Pool as the wholesale electricity market in England and Wales on 27 March 2001 (go-live). By establishing a market based on bilateral contracts, NETA, along with plant divestments, has introduced genuine competition into wholesale electricity trading.

3.21 The impact of NETA on smaller generators, including renewables and CHP, was, and continues to be, of great concern. Following a request from the then Minister of Energy, the regulator, Ofgem, has published a report on the impact of NETA on smaller generators, based on the first two months of NETA operation, as well as a report on NETA operation generally. Ofgem's key findings include: that compared with the Pool, smaller generators' export prices have fallen by 17% (a smaller reduction then for generation prices overall), and output has fallen substantially, CHP being the worst affected. Ofgem conclude that lower prices are one factor, but there is evidence that higher fuel costs, which have risen 14% in the last year, have also contributed. Ofgem also suggested that only wind power was unpredictable, and found that consolidation services (under which a third party would aggregate smaller generators' output to manage risk) had not emerged so far under NETA. The Government is working towards publishing a consultation document on possible remedial action as soon as possible. It will consider the range of potential options and implications, including views put forward by industry, both in the course of Ofgem's review, and to DTI.

3.22 A subsidy scheme for coal (the UK Coal Operating Aid Scheme) has been approved by the European Commission and will provide operating aid for coal produced between April 2000 and July 2002. The objective of this scheme is to provide an opportunity to elements of the industry with a viable future to overcome short term market problems. It is not expected to have a significant environmental impact. The subsidy does not enable purchases of coal to buy coal more cheaply than in the absence of this scheme. So overall coal burn should not be increased. However, the relative economics of coal and gas can change coal use for electricity generation, as was witnessed during 2000.

3.23 The Northern Ireland Executive's Programme for Government highlights the importance of energy infrastructure, and sets a target for the production of an energy market strategy for Northern Ireland in an all-island and European context by December 2001. Officials have also begun work on developing legislative proposals for a Northern Ireland energy Bill to cover a wide range of energy issues, tailored to meet the particular needs of the Northern Ireland energy market. Changes to the legislative framework for electricity and gas will also set in place the foundation for furthering the energy market strategy. Proposals for the draft energy strategy and draft legislation will be published for consultation later in 2001. The Northern Ireland Assembly's Enterprise, Trade and Industry Investment Committee is currently undertaking an inquiry into energy in Northern Ireland and will report its findings to the Assembly before the end of 2001. It will make recommendations on actions that will improve the current energy market and, in particular, the potential for the indigenous renewable energy market.

Renewable energy

3.24 The Government believes that the development of renewable energy must form part of the UK's long term response to climate change. Its potential is substantial, and the Government is aiming to transform renewables from a fledgling industry to a mainstream business activity. In 2000, renewable energy accounted for 2.8% of electricity generated in the UK. This is expected to rise towards 5% as new capacity built under the Non Fossil Fuel (NFFO) Arrangements[33] is commissioned. The Government target for the renewables obligation is that 10% of all

[32] Neither the Utilities Act 2000 nor NETA extend to Northern Ireland. Work has begun on the drafting of a broadly comparable Northern Ireland Energy Bill which will cover the reform of electricity trading arrangements.

[33] The NFFO in England and Wales, the Scottish Renewables Order (SRO) in Scotland and the Northern Ireland NFFO (NI-NFFO) require the public electricity suppliers licensees to secure electricity from a specified capacity of renewable electricity generating plant. Since 1990, the NFFO/SRO/NI-NFFO have provided over £600 million of support.

sales from licensed electricity suppliers will be generated from eligible renewable sources by 2010, subject to the cost to the consumer being acceptable. The NFFO arrangements have successfully established an initial market for renewables and driven down the costs. The prices of power from NFFO contracts have halved on average since 1990.

3.25 Changes to the structure of the electricity industry, notably the introduction of NETA and the splitting of the public electricity supply licences into separate licences for distribution and supply, have meant that the NFFO arrangements could not be retained in their present form. The Government will therefore place a renewables obligation on all licensed electricity suppliers to supply their customers with a specified proportion of their electricity from renewable sources. The Government has consulted the industry and consumer groups on the detail of the new renewables obligation, including the price implications of a 10% target by 2010.[34] Following the statutory consultation, the Government plans to lay an Order before Parliament in time for the Order to come into effect from 1 January 2002, subject to State Aid and Parliamentary approval.

3.26 The Government has a package of support measures for renewables worth over £260 million over this and the next two financial years. The Government is also making available a further £100 million, much of which is likely to be earmarked for early demonstration of offshore wind and biomass projects in the form of capital grants administered through existing Government programmes. A significant proportion of the UK's 10% target is likely to be required from offshore wind and biomass. There is also scope for support to bring on stream other new generation technologies, and a substantial budget is to be set aside for research and development.

3.27 In the absence of the obligation, renewables might have expanded towards perhaps 5% of generation in 2010. Achievement of a 10% target for renewable electricity in 2010 is therefore estimated to save around an additional 2.5 MtC. These savings have already been included in the baseline *with measures* projections for the energy supply sector.

3.28 The devolved administrations are also taking action to promote renewable energy, although it should be noted that any targets are included within the UK's overall 10% target. The Scottish Executive has set its own target to increase generation from renewables in Scotland from the expected 13% by the end of 2003 to 18% by 2010, subject to the cost to consumers being acceptable.

3.29 In Northern Ireland, a consultation paper was issued in September 2001 on the development of renewable energy sources. It sought views on:

- the introduction of a mechanism similar to the renewables obligation and the renewables (Scotland) obligation; and
- the need for and level of support for the less mature renewables technologies.

3.30 The Department of Enterprise, Trade and Investment and its counterpart in the Republic of Ireland, the Department of Public Enterprise, are considering the findings of a jointly commissioned report on the action required to establish an all-island energy market. The comprehensive report will cover all aspects of energy activity, including renewables, energy efficiency and CHP.

3.31 The National Assembly for Wales is committed to the development of renewable energy. It will seek to set targets for increased generation from renewables in Wales by 2010 through its Economic Development Committee's review of non-transport energy. The Assembly is committed to a target of 5% from renewable electricity in Wales by 2003 and fully supports the UK Government's targets.

Combined heat and power

3.32 CHP technology continues to be a key element of the Government's strategy for the energy supply sector. The UK's installed CHP capacity is currently around 4,700 mega watts on over 1,500 sites. The Government has set itself a target to achieve an installed capacity of at least 10,000 mega watts of Good Quality CHP by 2010. The following measures were introduced in April 2001 to help stimulate the take up of CHP:

- exemption of Good Quality CHP from the climate change levy;

[34] *Renewables Obligation Statutory Consultation Document*, August 2001, DTI: www.dti.gov.uk/renewable/consultations.htm

- eligibility for enhanced capital allowances offering tax incentives to companies investing in energy saving technologies, including Good Quality CHP; and

- exemption of CHP plant and machinery such as turbines and engines from business rating.

3.33 Good Quality CHP refers to CHP production that is energy efficient in operation. The Government funded CHP Quality Assurance Programme (CHPQA) assesses the quality of CHP schemes and provides a passport to climate change levy exemptions and other benefits. Over 1,200 CHP schemes have registered, with nearly 900 of them certified under CHPQA. In addition, there is a CHP Club that provides a one-stop shop for independent information and guidance for potential and new users on the design, implementation and operation of CHP schemes[35].

3.34 Current and other new policy measures will be drawn together in a comprehensive *CHP Strategy to 2010* that will address all issues relating to achieving the Government's CHP target. The Government expects to consult on the draft strategy later in 2001.

Business sector

3.35 Business' commitment to tackling climate change is growing in the UK. Many firms recognise that action to reduce emissions brings wide ranging benefits including lower costs, improved competitiveness and new market opportunities. There also remains great potential within this sector for further cuts in emissions. In consultation with business, the Government and the devolved administrations are developing a clear, flexible and stable framework that should allow for long term planning and investment in reducing emissions. The framework draws together in an integrated way a range of instruments and measures including:

- economic instruments – the climate change levy and climate change agreements for energy intensive industries; emissions trading; enhanced capital allowances and grant schemes;

- technology deployment – a new 'Carbon Trust' to deliver an integrated programme of support to accelerate the take up of low carbon technologies and other energy saving measures;

- regulation – implementation of IPPC through the Pollution Prevention and Control Regulations in England and Wales and through the Pollution Prevention and Control (Scotland) Regulations; and reviews of the energy efficiency provisions in the Building Regulations for England and Wales and the Building Standards (Scotland) Regulations;

- measures to make the market work better – providing advice and information; using a combination of market based measures to improve the energy efficiency of consumer products and other equipment; supporting benchmarking; and developing voluntary agreements;

- in England, improving public and company information – making it easier for businesses to measure their emissions and set public targets for improvement; and promoting a new Making a Corporate Commitment scheme; and

- other financial incentives – Loan Action Scotland offers interest free loans to Scottish based companies employing up to 250 people who invest to improve the energy efficiency of their businesses. A similar scheme operates in Northern Ireland and consideration is being given to extending the schemes to the rest of the UK.

3.36 The Government and the devolved administrations have identified carbon savings from some of the above measures, and further details of these are given below. Full details of all the measures can be found in the UK's climate change programme or via DEFRA's website at: www.defra.gov.uk[36]

The climate change levy and climate change agreements

3.37 Following extensive consultation with business, the Government introduced the climate change levy in the UK in April 2001. The levy applies to energy used in the business and public sectors. Revenues are recycled to levy payers via a 0.3% cut in employers' National Insurance Contributions and £120 million of additional support for energy saving measures. There

[35] More information can be found at: www.chpqa.com and www.chpclub.com
[36] Details of how these measures are being applied in Scotland, Wales and Northern Ireland can be found on their respective websites (see earlier footnote).

will be no net gain to the public finances as the levy package as a whole is expected to be broadly neutral between the manufacturing and service sectors of the economy.

3.38 The Government has given consideration to the impact of the levy on energy intensive sectors in view of their high energy usage, the need for them to comply with the energy efficiency requirements of the IPPC Directive and their exposure to international competition. The Government gives an 80% discount in the levy rates for those energy intensive sectors of industry that have agreed to meet challenging targets for improving energy efficiency or reducing greenhouse gas emissions within a climate change agreement. These arrangements will produce environmental benefits while allowing the industries to determine how best to achieve energy savings. The Government has also said that participants in agreements will be able to achieve their targets either by trading emission allowances with other companies in an agreement or by participating in the wider UK emissions trading scheme.

3.39 Renewable energy (with the exception of large scale hydro of more than 10MW) is exempt from the levy, providing an incentive for business to opt for electricity from this source. Good quality CHP is also exempt. This will deliver emissions reductions, increase industry's take up of CHP and enhance business competitiveness since CHP has a significant efficiency advantage over other forms of generation. Exemption gives CHP users levy-free electricity and heat, and the facility to sell levy-free electricity directly to other users.

3.40 It is estimated that the climate change levy, including the exemption for renewables and CHP, will save 2 MtC by 2010. These savings have already been included in the baseline *with measures* projections for this sector. The climate change agreements are estimated to save an additional 2.5 MtC per year by 2010.

Improving energy efficiency and developing low carbon technologies

3.41 The Government set up the Carbon Trust in April 2001 as a new, independent, non profit-making company that will recycle around £100 million of climate change levy receipts over three years to accelerate the take up of cost effective, low carbon technologies and other measures by business and levy payers. The Trust will run an integrated programme of measures, which will evolve over time, ranging from:

- advice and information;
- fiscal incentives including the enhanced capital allowances scheme;
- education and training;
- research, development and demonstration;
- strategic studies; and
- the business related elements of the Energy Efficiency Best Practice Programme.

3.42 The Trust will administer the enhanced capital allowances (ECA) scheme, which has been operational since April 2001. The ECA scheme will be worth £200 million over two years, depending on the take-up. The scheme gives 100% first year capital allowances for approved energy saving investments for businesses. Businesses can take this investment into account in calculating their corporation or income tax bills. More details of the scheme can be found at: www.eca.gov.uk

3.43 It is estimated that energy efficiency measures under the climate change levy package will save 0.5 MtC in 2010. This means that the climate change levy package as a whole is estimated to save at least 5 MtC per year by 2010.

Greenhouse gas emissions trading

3.44 The Government believes that an early start to emissions trading in the UK could give significant advantage to UK companies in what is set to develop into an important new international market. It has therefore been working alongside the Emissions Trading Group[37] to develop a UK-wide scheme, with the aim of trading beginning in April 2002. Details of how the scheme will operate can be found in the framework document that the Government published in August 2001[38].

[37] The Emissions Trading Group involves around 100 major companies, trade associations and other organisations. More information can be found at: www.uketg.com

[38] *Framework Document for the UK Emissions Trading Scheme:* August 2001, DEFRA: www.defra.gov.uk/environment/climatechange/trading/index.htm

3.45 The Government has made £215 million available over five years from 2003-2004 to help kick start emissions trading in the UK. The funds will provide a financial incentive for companies to take on binding emission reduction targets. An auction will be held in January 2002 to distribute the incentive and allocate targets[39].

3.46 It is estimated that the initial scheme could deliver annual emission savings of 0.8 MtC by 2010. Over time, a successful UK emissions trading scheme has the potential to save 2 MtC per year by 2010.

Amendment of the Building Regulations

3.47 The energy efficiency requirements of the Building Regulations in England and Wales and in Scotland are currently under review. A consultation document[40] that set out a proposed first stage of changes to the Regulations applying in England and Wales and an outline of three further stages of amendments in the period to about 2008 was published in June 2000. The Government laid the first stage amendments before Parliament on 11 October 2001 (SI 2001/3335) and the changes will come into force on 1 April 2002. In advance of formal publication, the Government published on 9 April 2001 the technical provisions[41] it was minded to introduce so that the industry had more time to prepare[42].

3.48 If these proposals are implemented in 2001 to 2003, they could reduce emissions in 2010 by about 1.4 MtC. The savings apply to both the business and residential sectors.

3.49 In Scotland, higher standards for the thermal performance of the building fabric have also been introduced. The amending Regulations were laid before the Scottish Parliament on 24 September 2001 (SI 2001/320) and will come into force on 4 March 2002. These reflect the nature of the construction industry in Scotland and the colder climate. An amendment was made to Part F of Northern Ireland's Building Regulations on 1 April 1999 involving similar requirements for the conservation of fuel and power.

Residential sector

3.50 The residential sector is an area where action to cut emissions can bring real benefits to people, especially those on low incomes. Increasing the take up of energy efficiency measures in the home is, however, a challenge. The Government and the devolved administrations are therefore developing different forms of encouragement for different types of household. They also see the need for a longer term, low carbon approach in the residential sector and they are looking at how work in this area can be integrated with that of the Carbon Trust.

3.51 There are four main strands to the Government approach for improving energy efficiency in homes. For social policy reasons, the Government is reluctant to introduce any policies that will raise fuel bills and so the use of economic instruments in the residential sector is largely ruled out[43]:

- the Government wants to ensure that advice and information on energy efficiency is easily available to everyone;
- where necessary, incentives or financial help are provided to encourage the installation of energy efficiency measures;
- where appropriate, regulations are introduced to improve energy efficiency; and
- the Government is working with others, including local authorities and the Energy Saving Trust[44], to provide a framework for the improvement of residential energy efficiency and to create a climate in which energy efficiency becomes a routine, accepted, part of life.

3.52 Full details of these measures can be found in the UK's climate change programme. It has been possible to quantify carbon savings from the following measures.

[39] *Incentives Bidding Mechanism: Options for a Mechanism to Allocate Incentives Funding and Set Emissions Reduction Targets in the UK Emissions Trading Scheme*, a report by Environmental Resources Management, May 2001, DETR: www.defra.gov.uk/environment/climatechange/trading/bidding/index.htm.
[40] The consultation document can be found at: www.safety.dtlr.gov.uk/bregs/consult/eep/index.htm
[41] These can be found at: www.safety.dtlr.gov.uk/bregs/br06q.htm
[42] Northern Ireland will consult on similar proposals in due course.
[43] The UK's Second National Communication noted that Value Added Tax on domestic fuel and power was introduced at 8% in 1994, and that this should save 0.4 MtC by 2000. The current Government reduced the rate to 5% in 1997 for social policy reasons.
[44] More information about the work of the Energy Saving Trust can be found at: www.est.org.uk

The Energy Efficiency Commitment

3.53 The Energy Efficiency Commitment[45] (EEC) is an obligation on the energy utilities to encourage or assist consumers to take up energy saving opportunities. This measure has demonstrated its effectiveness in the past in reducing both consumers' costs and greenhouse gas emissions. The scheme was extended to gas as well as electricity customers in 2000. The Government is now responsible for setting future EECs.

3.54 The shape of the new style EEC has been developed in close consultation with the energy industry. Obligations will focus on the energy savings which suppliers must help customers to gain. Companies will therefore have the freedom and incentive to develop the most innovative and cost effective programmes, and new ways of stimulating customers' interest in taking advantage of energy efficiency measures. Companies are increasingly likely to bring energy efficiency into the mainstream of their services to customers, shifting the focus of the energy products from simply selling units of energy at the lowest price, to offering customers the most economical packages of energy and energy efficiency.

3.55 The statutory consultation for the first new style EEC for 2002-2005 began in August 2001[46]. Around half of the energy benefits from the new EEC are focused on priority householders – those receiving health and income benefits. Since these groups take a substantial proportion of energy benefits in improved comfort, the estimated carbon saving from the EEC 2002-2005 is lower than would otherwise be expected at around 0.4 MtC a year.

3.56 It is estimated that a range of cost effective, simple measures in the residential sector could save up to 2.6-3.7 MtC per year in 2010. With the energy efficiency priorities of those on low-incomes addressed first, the Government is aiming to work towards this total carbon saving figure by 2010, taking into account the experience of the EEC 2002-2005 scheme.

Community heating

3.57 Community heating schemes, brought up to modern standards, can provide residents and organisations with low cost heating. The Community Energy Programme is a new, £50 million, UK-wide programme to promote community heating through grants to install new schemes, refurbish obsolete infrastructure and equipment, and spread knowledge and good practice. It is estimated that Community Energy will save 0.5 MtC per year in 2010, and add around 130 mega watts to the Government's CHP target. It is estimated that community heating overall could save 0.9 MtC per year in 2010.

The New Home Energy Efficiency Scheme

3.58 The Government's New Home Energy Efficiency Scheme (New HEES) was launched in England in June 2000. This followed a review of fuel poverty policy that identified the important role that energy efficiency could play in making a permanent difference to the problem of fuel poor households, as well as reducing carbon dioxide emissions. There were at least 4.3 million fuel poor households in England in 1996. New HEES has been designed to provide comprehensive packages of heating and insulation improvements for the most vulnerable households.

3.59 The New HEES budget for England has been raised from around £75 million a year in 1999-2000 to almost £613 million for 2000-2004. In that period, New HEES will help around 800,000 households, including approximately 480,000 low-income over-60s. It will incorporate an extensive study of the effect of the improvements on the health and well being of households. As the primary goal of New HEES is to alleviate fuel poverty, most of the potential energy savings will rightly be taken in the form of increased comfort. But New HEES is also expected to save 0.2 MtC per year in 2010.

3.60 The devolved administrations have developed schemes for Scotland, Wales and Northern Ireland:

- The Central Heating Programme in Scotland was introduced in 1 April 2001 to provide central heating, insulation, advice and other benefits to all council and housing association tenants that lack them, and in 40,000 private sector homes where the householder is aged 60 or over who lacks a central heating system or has a system that is wholly beyond repair. Sufficient investment

[45] The Energy Efficiency Commitment was formerly known as Energy Efficiency Standards of Performance (EESOPs).
[46] *Energy Efficiency Standard of Performance 2002-2005: Consultation Proposals*, August 2001, DEFRA: www.defra.gov.uk/consult/energy/eec/0801/index.htm

will be made to ensure that all such dwellings have central heating and insulation by March 2006;

- The Warm Deal in Scotland provides a package of home insulation measures up to the value of £500 for the elderly and those on low incomes. Applicants must be on one or more of the range of State benefits to qualify, but over 60s not on benefit can receive a lower grant of up to £125. The package includes cavity wall insulation and/or loft insulation, hot and cold tank and pipe insulation, draughtproofing, energy efficient lightbulbs and energy advice;

- Northern Ireland has introduced a new 'Warm Homes' scheme that will provide a comprehensive package of insulation measures for vulnerable private sector households in receipt of an income or disability based benefit. The new programme will also include improvements in both insulation and heating standards for over 60s private sector householders on income based benefits.

Appliance standards and labelling

3.61 A quarter of all the electricity used in the UK runs through appliances and lighting systems in the home. A further half of the total UK electricity consumption runs through products and product systems used in other sectors. The Government's Market Transformation Programme works across all these sectors with business, the Energy Saving Trust, the Carbon Trust and other partners to identify the scope for getting more efficient products and services onto the market. For the residential sector, the programme identifies the specific measures that will be the most cost effective for stimulating the necessary business competition and consumer take up. This process is important for the delivery of a significant share of the savings that the Government wants to achieve across the residential sector, although most of those expected savings are accounted for separately under a number of other programmes. One saving attributed specifically to this programme is that a further 0.2 – 0.4 MtC per year in 2010 could flow from new regulatory and negotiated measures relating to the energy performance of consumer products.

Public sector

3.62 The Government and the devolved administrations want to make sure that the public sector makes its own contribution to achieving emission reductions and that it leads by example.

3.63 The public sector is subject to the same pressures as others to improve its energy efficiency. The climate change levy applies to this sector, as does the amendment of the Building Regulations and measures to improve the energy efficiency of appliances. Other steps being taken are outlined below.

Action by the UK Government and the devolved administrations

3.64 The Government and the devolved administrations are ensuring that energy efficiency and other environmental issues are fully taken into account in government operations. They are committed to the introduction of Environmental Management Systems across departments. Each UK department also has a Green Minister with responsibility for integrating sustainable development and environmental issues into all Government decision making and operational activity. Green Ministers meet as a committee under the Minister for Environment and, in July 2001, became a sub-committee of the Cabinet Committee for the Environment. This is a move that has substantially raised their status.

3.65 Action being taken by the Government and the devolved administrations includes:

- improvements in the energy consumption of buildings. The Government estate expects to meet an energy reduction target of 20% below 1990-1991 levels by 2000. A new target was set from April 2000 to achieve an on-going reduction in carbon dioxide emissions of 1% per annum against 1999-2000 levels;

- a target to benchmark energy use in all non-office government buildings with more than 50 occupants. All office buildings with more than 50 occupants were required to be benchmarked by March 2001;

- a target for departments to carry out environmental assessments using the Building Research Establishment Environmental Assessment Method, or equivalent, of all projects to achieve at least 'very good' ratings on new builds and 'good' ratings on refurbishments by March 2002, and 'excellent' ratings on new builds and 'very good' ratings on refurbishments by 2003;

- a programme to acquire at least 5% of electricity from renewable, or climate change levy exempt, sources by March 2003, and at least 10% by 2008, provided this does not entail excessive cost[47]. The target in Scotland is to purchase 18% from renewable sources by 2010;

- reporting requirements for the public sector are being strengthened;

- targeted advice on how to improve energy efficiency is being provided under the Energy Efficiency Best Practice Programme;

- travel plans are being developed for all government departments and organisations. The Government is also building on progress by producing further guidance for its fleet managers, and by setting targets to increase the numbers of alternatively fuelled and low emission vehicles. A total of nine departments already have some alternatively fuelled vehicles in their fleet, and 16 departments will have a Uniform Mileage Rate by April 2002 that will help to discourage the use of vehicles with larger engines. 50% of the Scottish Executive's fleet is made up of vehicles powered by alternative fuels;

- Green Ministers are planning to include these targets and others in a new *Framework for Sustainable Development on the Government Estate* that should help to deliver further improvements in performance; and

- The National Assembly for Wales has a rolling programme to improve energy efficiency throughout its estate. This includes surveying the Assembly's buildings and implementing energy savings. The Assembly has set itself an ongoing target to reduce energy consumption across its estate by 1% each year from the base year of 2001-2002. Since 1 October 2001, 70% of the Assembly's electricity supply has come from renewable sources.

Local government

3.66 Local government has a vital role to play in the UK's climate change programme as it responsible for implementing many of the policies and measures. Action by local authorities influences that taken in many sectors, and further details of their responsibilities and work can be found in the UK's climate change programme. With respect to their own estate, local authorities in England have endorsed energy efficiency targets for their own buildings, excluding housing, in line with those for the Government estate. Authorities have made considerable efforts to improve the energy efficiency of their own estate. The Government also proposes a new requirement for English local authorities to benchmark the energy performance of their buildings and set their own targets for further improvement.

Schools and hospitals

3.67 Schools in England spend £300-£400 million per year on energy and there are significant savings to be made through better energy efficiency. The Government is allocating around £870 million over the next five years to capital projects in schools, which are likely to reduce energy consumption. The Government plans to require the energy efficiency of schools to be benchmarked within the next three years, with standards being improved over the next five years. A 10% overall reduction in energy use by the school sector, equivalent to a reduction of 0.16 MtC, is thought to be possible over the next ten years.

3.68 Energy consumption in hospitals is by far the largest in the healthcare sector and, while fossil fuel consumption has fallen steadily over the past 20 years, electricity use still accounts for about 50% of energy costs in England and Wales. The Government has set a target for all National Health Service Trusts to reduce energy consumption by 15% or 0.15 MtC by 2010.

3.69 In total, the Government estimates that 0.5 MtC per year could be saved from the public sector in 2010.

[47] More information can be found at: www.defra.gov.uk/environment/greening/energy/energy.htm

The Scottish Executive

3.70 The Scottish Executive is committed to reducing emissions by implementing a wide range of energy efficiency initiatives in its own buildings. It has adopted an energy efficiency target for the central estate of 5% against a 2000 base year by March 2003. This is in addition to the improved energy efficiency target of 20% cut below 1991-1992 levels by 2000. The Scottish Executive has already secured 100% of its electricity supply from renewable sources. The Scottish Environment Protection Agency has adopted a target of reducing carbon dioxide emissions by 20% below 1998-1999 levels by 2010, and an additional target of reducing carbon dioxide emissions by 22 tonnes per year from 2000-2001.

3.71 The National Health Service in Scotland has a longstanding commitment to energy conservation and, between 1985-1986 and 1998-1999, delivered a cumulative reduction in energy consumption of just over 28%. A new target of a 2% per annum reduction between 2001-2010 has been agreed. The reduction in energy consumption will inevitably bring further reductions in carbon dioxide emissions, although a specific target is not proposed, and will further increase the 1998-1999 figure of a 31% reduction below 1990 levels.

3.72 It is estimated that these initiatives could collectively save 0.1 MtC by 2010.

Transport

3.73 The UK's transport system is the fastest growing source of greenhouse gas emissions in the UK. The Government and the devolved administrations, in partnership with the private sector and local authorities, are developing a clear, strategic framework of action for reducing emissions from this sector. The approach being taken reflects the need to tackle rising emissions through a wide variety of policies and measures, all of which reinforce and support each other. As well as reducing emissions, the strategy will bring other benefits, for example, better local air quality, better access and choice for all, and a more efficient transport network that should help business to keep costs to a minimum. Action is being taken to:

- substantially increase levels of investment in the transport system through the 10 Year Plan for Transport, and similar plans by the devolved administrations[48]. These should lead to a reduction in emissions as well as delivering other benefits for people and business;
- build on the framework put in place by the Government's and the devolved administrations' integrated transport white papers[49]. For example, legislation has been introduced to improve the quality and capacity of public transport, and to allow local authorities to implement congestion charging and workplace parking levy schemes. Revenues from these schemes will be recycled and invested in the local transport network. Five year strategic, local transport plans have also been introduced and funded in England and, in Scotland, each local authority has prepared a local transport strategy;
- improve the fuel efficiency of cars through market transformation and the EU CO_2 from cars strategy; and the fuel efficiency of other commercial and public transport vehicles;
- support these measures through the use of economic instruments, for example, the fuel duty escalator between 1993 and 1999, and changes to vehicle excise duty and company car taxation;
- develop and promote new, cleaner technologies, including alternative fuels;
- work in partnership with others to deliver real changes on the ground; and
- begin to consider the sort of action which may be needed to reduce future greenhouse gas emissions from aviation and shipping and at what level it should be taken.

3.74 The UK's climate change programme provides full details of action being taken in the transport sector. It has been possible to identify carbon savings from the measures outlined below.

[48] *Transport 2010: The 10 Year Plan*, July 2000, DETR. The Plan's focus is on surface transport and access to ports and airports in England, with the exception of railways where the scope extends to Great Britain: www.dtlr.gov.uk/trans2010/index.htm *The Transport Delivery Plan for Scotland; The Transport Framework for Wales*.

[49] *A New Deal for Transport: Better for Everyone*, July 1998, The Stationery Office: www.dtlr.gov.uk/itwp/paper/index.htm A white paper for Scotland, *Travel Choices for Scotland*, a statement for Wales, *Transporting Wales Into the Future*, and a statement for Northern Ireland, *Moving Forward*, were also published alongside the UK white paper.

The UK's transport plans

3.75 The 10 Year Plan aims to transform Britain's transport system over the next ten years. £180 billion of investment is planned in a range of measures that will also help to reduce greenhouse gas emissions, including:

- more sustainable distribution, with improvements in the operational and fuel efficiency of the commercial vehicle fleet;
- an 80% growth in rail freight volumes as a result of improvements in rail freight's relative competitiveness, through reductions in rail costs and improvements in service quality;
- substantial improvements to local public transport;
- the delivery of a 50% increase in rail patronage, measured by passenger kilometres.

3.76 It is estimated that implementation of the 10 Year Plan could save 1.6 MtC per year in 2010.

3.77 The Scottish Executive's Transport Delivery Plan, which will be published later in 2001, aims to deliver a sustainable, efficient, integrated transport system. Investment priorities for the next 10 to 15 years are identified. They include substantial investment in public transport, a more sustainable distribution system, and efforts to double cycle use between 1996 and 2002 and to double it again by 2012.

3.78 The Transport Framework for Wales seeks to achieve substantial improvements in and greater accessibility to public transport. It also supports the UK Government's aim of achieving more sustainable distribution and an increase in freight carried by rail. These measures will complement the 10 Year Plan, as will Northern Ireland's Regional Transport Strategy.

3.79 It is estimated that additional action in Scotland and Wales could save a further 0.1 MtC per year in 2010.

EU CO_2 from cars strategy and changes to vehicle taxation

3.80 The Government is encouraging a market transformation for passenger cars through a combination of fiscal measures, initiatives to provide cleaner vehicles, and the European Union CO_2 from cars strategy which has a target of reducing average carbon dioxide emissions from new cars to 120 grammes of carbon dioxide per kilometre by 2005, or 2010 at the latest[50]. The main element of this strategy is the voluntary agreements between the European Commission and European, Japanese and Korean car manufacturers to reduce average carbon dioxide emissions from new cars by at least 25% below 1995 levels by 2008.

3.81 The Government is supporting the aims of the agreements through the UK's taxation system. Vehicle excise duty (VED) – the annual vehicle tax charge – has been reformed to encourage the use of less polluting vehicles. Owners of existing cars with engines up to 1,549 cc are now able to claim a £55 reduction in their VED. In March 2001, the Government introduced a graduated VED system for new cars, which are now placed in one of four VED rate bands according to their level of carbon dioxide emissions.

3.82 The Government has introduced a broadly revenue neutral reform of company car taxation based on carbon dioxide emissions. From April 2002, company cars first registered after January 1998 are to be taxed on a percentage of their list price according to one of 21 carbon dioxide emission bands. Older company cars will be taxed on the basis of engine size. The reform will remove the perverse incentive in the current system to reduce the tax due by driving unnecessary, extra business miles and it will provide a significant incentive to company car drivers to choose more fuel efficient vehicles.

3.83 It is estimated that the voluntary agreements, along with the changes to Vehicle Excise Duty and company car taxation, will save around 4 MtC per year by 2010.

Fuel Duty Escalator

3.84 The fuel duty escalator – annual fuel duty increases above the rate of inflation – has delivered reductions in emissions from road transport. The escalator was introduced in 1993, first at an annual rate of 3% above inflation and then at 5%. It was increased to 6% in July 1997 and has been very successful. It sent a clear signal to manufacturers to design more

[50] The average carbon dioxide emissions from new cars sold in the UK are currently around 185 g/km.

fuel efficient vehicles, and to motorists to avoid unnecessary journeys and to consider alternatives to the car. Taken in isolation, increases in duties between 1996 and 1999 are estimated to have produced annual carbon savings of between 1 and 2.5 MtC by 2010.

3.85 In November 1999, the Government announced that the appropriate level of fuel duties would be set on a Budget by Budget basis, taking account of economic, environmental and social objectives. Revenues from any real increases in fuel duty would go into a fund to be ringfenced for improving public transport and modernising the road network. Due to significant increases in oil prices, the Government decided in March 2000 that, other than the automatic rises due to inflation, there would be no increase in fuel duty for that year. Due to ongoing high oil prices, fuel duty was frozen in cash terms in Budget 2001.

Aviation and shipping

3.86 The UK recognises that aviation makes an important contribution to the economy, and that it brings many benefits in terms of employment and opportunities for travel. The Government is concerned however about the effect that rising levels of global traffic might have on climate change.

3.87 The UK believes that action to reduce emissions from aviation at international level is preferable to regional or local measures, as the environmental benefits would be greater. It will continue to press for such action through the International Civil Aviation Organisation (ICAO), but will support action at EU level if objectives cannot be achieved through ICAO.

3.88 The Government is proceeding where it can with measures in the UK which should help to reduce emissions associated with aviation, including:

- developing an air transport White Paper that will look 30 years ahead and will provide a framework for the sustainable development of aviation and airports in the UK;
- supporting research, either directly or in collaboration with others, to reduce the uncertainties about the impact of aviation on climate change, and to assess the effectiveness of measures to mitigate it;
- making best use of existing capacity, by encouraging the growth of regional airports to meet local demand for air travel, where this is consistent with sustainable development principles; and
- encouraging a higher proportion of journeys to airports to be made by public transport through surface access improvements.

3.89 Similarly, the UK plays an active role in discussions within the International Maritime Organisation (IMO), with a view to achieving an effective emissions reduction strategy from shipping. The UK will support technical, operational and market-based measures that are practicable and enforceable, including strategies such as an internationally agreed climate change levy or fuel tax. As with aviation, the UK believes that international action through the IMO is preferable to any regional or local measures. However, if action at IMO is not agreed, the Government will consider the case for action at European Community or local level, provided this does not harm the competitiveness of the UK's shipping industry and does not lead to other adverse environmental effects.

Industrial processes

3.90 The industrial processes sector includes emissions of nitrous oxide and fluorinated gases from large IPPC regulated sites. Carbon dioxide emissions from these installations are included in the business sector.

3.91 Full details of additional measures being taken by the Government to further reduce emissions of nitrous oxide, HFCs, PFCs and SF_6 can be found in the UK's climate change programme. One of the Government's main concerns has been the strong underlying upward trend in emissions of HFCs, as they are used to replace ozone depleting substances. The Government believes that action should be taken to limit the projected growth. It set out its position on HFCs in the climate change programme. It stated that:

- HFCs should only be used where other safe, technically feasible, cost effective and more environmentally acceptable alternatives do not exist;

- HFCs are not sustainable in the long term – the Government believes that continued technological developments will mean that HFCs may eventually be able to be replaced in the applications where they are used;

- HFC emission reduction strategies should not undermine commitments to phase out ozone depleting substances under the Montreal Protocol;

- HFC emissions will not be allowed to rise unchecked.

3.92 This policy takes account of the fact that HFCs are used in a wide range of applications and that they will continue to have a role in these applications where there are no acceptable alternatives. At the same time, industry and users are being given a clear signal to look closely at all the alternatives and to select those that are more acceptable where they do exist.

Agriculture

3.93 Most agricultural policy is directed at European level through the Common Agricultural Policy (CAP), reform of which under what is known as the second pillar will shift the emphasis from production related subsidies to a wide range of environmental concerns. There are a number of initiatives coming through from the European Commission that should help to reduce emissions including:

- changes to the CAP should mean that livestock numbers will continue to fall as a result of market and policy constraints;

- agri-environment schemes – in Wales Tir Gofal and in England the Environmentally Sensitive Areas (ESA) and Countryside Stewardship Schemes encourage more extensive farming, and some ESA prescriptions include no or low fertiliser regimes;

- implementation of the EC Nitrate Directive has led to the establishment of Nitrate Sensitive Areas and Nitrate Vulnerable Zones which limit the amount of nitrogen;

- the IPPC Directive applies to new and substantially changed, intensive pig and poultry farms above 2,000 pig places (750 breeding sows) and 40,000 poultry places. The Directive will come into force for existing units in 2007. It requires that emissions to soil, air and water are minimised or reduced.

3.94 Other action being taken by the Government and the devolved administrations to reduce emissions includes[51]:

- encouragement in the growth of renewable energy crops on intensively managed land. Short rotation coppice is most suited to conditions in some parts of the UK and, under the England Rural Development Plan[52], a new energy crops scheme will provide support for the growth of short rotation coppice and miscanthus. Details of the additional funding being provided for energy crops can be found in the section on renewables above;

- agricultural businesses are subject to the climate change levy, which should bring about improvements in energy efficiency. The Government has given a temporary 50% discount for up to five years for horticultural businesses, recognising that this sector includes a large number of small businesses, is energy intensive, and special treatment is given to horticultural firms in some other countries. Businesses in the intensive pig and poultry rearing sectors can also join climate change agreements and obtain an 80% discount from the levy;

- the UK is the only country to have operational poultry litter power stations which take dry matter from broiler production and burn it for energy. The stations have, in the past, consumed 42% of total poultry litter produced, but this figure had decreased to 16% in 2000 when one of the power plants began to use alternative biomass materials. This was an atypical year and it is expected that the amount burnt will increase again, especially as a further power station is expected on-line during 2001.

[51] Further details can be found on DEFRA's website at: www.defra.gov.uk
[52] In Northern Ireland, grant-aid for short rotation coppice is available through the forestry measures of the Northern Ireland Rural Development Plan.

Forestry

3.95 The UK's policies for forestry are based on two main aims:

- the protection and sustainable management of existing woodlands; and
- the continued steady expansion of woodland area to provide more benefits for society and the environment.

3.96 The UK is firmly committed to the principles of sustainable forest management and it has published a framework[53] to which all forestry activity is expected to conform. Responsibility for forestry policy has been devolved to the devolved administrations. Policies and measures are expressed through national strategies in England, Scotland and Wales[54]. The Department of Agriculture and Rural Development in Northern Ireland is currently carrying out a comprehensive review of forestry policy.

3.97 The English forestry strategy sets out priorities and programmes for woodland creation and management in England over the next five to ten years. It recognises the contribution of woodland to reducing greenhouse gas emissions through sequestration of carbon. The Scottish forestry strategy includes an aspirational target of 25% forest cover by 2050. Achievement of this target would deliver a range of economic, environmental and social goals, and open up opportunities in carbon sequestration and increased use of wood-fuel as a renewable source of energy. The National Assembly for Wales' strategy notes the uncertainties involved in predicting climate change and the consequent importance of building flexibility into forestry planning. The strategy has identified the development of renewable energy based on wood as a priority for action.

3.98 Woodland expansion is achieved through planting state forests and grant-aiding private owners to establish new woodland. These activities are subject to Environmental Impact Assessment (EIA) Regulations. One of the principal conditions for approval is conformity with *The UK Forestry Standard*. In England, Scotland and Wales, the felling of trees also requires approval from the forestry or a planning authority. Approval would normally be contingent on replanting. Exceptions, where woodland is converted to another land-use, for example, deforestation, are subject to the EIA Regulations throughout the UK. Such conversion would be permitted only where the competing land-use had a high social or environmental priority – for example restoration of a threatened non-woodland habitat.

3.99 The Government believes that the biggest contribution forestry can make towards reducing greenhouse gas emissions is through the provision of renewable energy and materials. Recent estimates suggest that the total annual wood fuel resource from forestry and arboriculture in England, Scotland and Wales is over 1 million oven dried tonnes.

3.100 Forestry policies implemented by the Government and devolved administrations mean that sequestration of carbon by woodlands could save up to 3.4 MtC in 2010, of which **0.6 MtC will be from afforestation since 1990**. Further details are given in chapter 4.

Waste management

3.101 Landfill methane emissions in the UK are falling, mainly because of increased collection of landfill gas for energy recovery and environmental control. There are also a number of Government and devolved administrations policies aimed at reducing landfilling of biodegradable waste. For example, the landfill tax was raised in 1999 to £10 per tonne of active waste to encourage recycling of methane generating waste that would otherwise be landfilled. The Government also announced in April 1999 that the tax would increase by £1 per tonne of active waste per year for the next five years, so that the standard rate will be £15 per tonne in 2004 at which point the tax escalator will be reviewed. In addition, the *Waste Strategy 2000*[55] for England and Wales and the corresponding strategies for Scotland and Northern Ireland set out a range of other policies which should reduce waste production and encourage re-use and recycling.

[53] *The UK Forestry Standard*, 1998, the Forestry Commission: www.forestry.gov.uk
[54] *A New Focus for England's Woodlands*, Forestry Commission, 1999; *Forests for Scotland: The Scottish Forestry Strategy*, Scottish Executive, 2000; *Woodland for Wales*, National Assembly for Wales, 2001. All these documents are available at: www.forestry.gov.uk
[55] *Waste Strategy 2000: England and Wales*, May 2000, The Stationery Office: www.defra.gov.uk/waste/strategy/index.htm *National Waste Strategy: Scotland*, December 1999; *Waste Management Strategy for Northern Ireland*, 2000.

3102 The European Community's Landfill Directive will have a significant effect on emissions as it imposes limits on the amount of biodegradable municipal waste that is landfilled. The targets (based on the amount of waste produced in 1995) and timescales likely to apply to the UK are[56]:

- a reduction to 75% of the total amount by 2010;
- to 50% of the total amount by 2013; and
- to 35% of the total amount by 2020.

3103 These targets are legally binding and the Government and the devolved administrations are committed to meeting them. In *Waste Strategy 2000*, the Government announced that it proposes to introduce tradable permits for local authorities in England to restrict the amount of biodegradable municipal waste landfilled. The Government will bring forward legislation to implement these arrangements as soon as the legislative programme allows, following consultation on the proposals. Similar permits are planned for Scotland. New arrangements are also proposed for Wales.

3104 The National Assembly for Wales has recently launched a consultation paper for a new waste strategy for Wales which proposes high levels of composting and recycling as the main means of complying with the targets for 2010 in the Landfill Directive.

Reducing emissions in the longer term

3105 The Government and the devolved administrations recognise that the UK will need to continue cutting its emissions beyond 2010. The UK's climate change programme therefore includes a number of policies that are designed to start changing current patterns of energy generation, technological development and consumption, and to encourage the move towards a low carbon economy. The impact of some of these policies by 2010 may be limited, but they will ensure that UK companies are well placed to exploit emerging business opportunities for low carbon goods and services. The most significant measures are:

- the UK's strategy on renewable energy which is designed to bring on stream those technologies which are cost effective now, to support the take up of those technologies further from the market, and to maintain research into options for the future;
- action to ensure fair access to the electricity distribution network and to start preparing the UK for the transformation in the way that energy is generated and transmitted, as numerous small and scattered sources of electricity supply come onto the market;
- market mechanisms, such as the climate change levy and emissions trading, which will encourage businesses to invest in renewables and low carbon technologies. These should, in turn, lead to further research and development in innovative technology by industry;
- the Carbon Trust, which will ensure that complementary low carbon programmes and other delivery mechanisms are brought together effectively;
- a significant expansion of programmes to increase the penetration of the next generation of fuel efficient technologies and to overcome barriers to their use;
- changes to the planning system, which will influence development patterns and reduce the need to travel;
- a Climate Change Projects Office that will give advice to businesses on new opportunities to reduce emissions through the two project-based Kyoto mechanisms – Joint Implementation and the Clean Development Mechanism;
- support for efforts at EU level to advance the thinking on 'Integrated Product Policy' so that the challenges of more sustainable consumption – and the policy solutions – can be more systematically addressed;
- work through the Foresight Programme and other research programmes to consider the technological implications of climate change for

[56] The target assumes a four year derogation period.

the UK, looking beyond normal commercial planning horizons; and

- DTI support for the IEA greenhouse gas R&D programme[57] and directly funded DTI research, including work undertaken by the British Geological Survey on long term storage of carbon dioxide in geological formations[58].

3106 These measures are only a first step, and the Government and the devolved administrations recognise that they will need to take further action to continue cutting emissions beyond 2010. To support further work in this area, the Government is carrying out the review of longer term energy needs that is mentioned above. It has also funded work by AEA Technology[57] to assess future technological options and how it can best contribute to their development.

Monitoring and evaluation

3107 The Government and the devolved administrations are confident that the policies and measures being introduced are an effective framework of action to reduce the UK's greenhouse gas emissions. The scale of action proposed to move towards the 20% domestic goal gives the UK security over the delivery of its Kyoto target. It will also mean that the UK will be well placed to show 'demonstrable progress' to the Framework Convention on Climate Change by 2005.

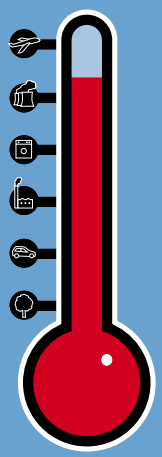
3108 The UK will monitor the programme carefully, to track annual emission levels and to check on progress with the implementation of policies. This will ensure that the Government and the devolved administrations are aware at an early stage of any problems, or any significant variation from projected emission trends, and can respond accordingly. The Government has published analyses of trends in CHP and renewable energy, trends towards current policy targets[60] and has sponsored work on the effectiveness of energy efficiency grant schemes using historical data[61].

3109 The Government is in the process of developing a framework for evaluation of its climate change programme. The framework identifies key elements to be evaluated for their impact, effects and costs and benefits to Government and other stakeholders. It will feed into a formal evaluation of the programme in 2004.

[57] See the following for more details: www.ieagreen.org.uk
[58] See the following website: www.etsu.com/en_env/html/disposal_co2.html
[59] *Role of Technology in Emissions Abatement Under the UNFCCC: The Medium to Long Term*, March 2001, AEA Technology: www.aeat.co.uk/emt
[60] *Digest of UK Energy Statistics*, The Stationery Office, 2001; www.dti.gov.uk/epa/dulcer.htm
[61] *Carbon Emissions from Energy Efficiency Improvements in the UK Housing Stock*, BRE, 2001; www.bre.co.uk

4

Projections of emissions and total effect of policies



Key developments

- The UK's baseline *with measures*, greenhouse gas projection indicates that emissions will be about 15% below 1990 levels by 2010. This projection includes, amongst other policies, the price effect of the climate change levy, the 10% renewables target and the fuel duty escalator to 1999, all of which have been implemented since the Kyoto Protocol was agreed in 1997.

- As a result of additional[62] policies and measures set out in the UK's climate change programme, the UK's greenhouse gas emissions could be reduced by 23% below 1990 levels by 2010, with a 19% reduction for carbon dioxide only. Further measures that cannot currently be quantified could mean that the UK's domestic goal will be met.

- Carbon dioxide emissions are the main challenge in the longer term, as the UK's emissions are currently forecast to begin increasing after 2010.

Projections of greenhouse gas emissions

4.1 The UK published new projections of carbon dioxide[63] and non-CO_2 greenhouse gas[64] emissions alongside the climate change programme in November 2000. These projections provide the basis for this Communication, except for land use change where the emissions projections have been updated to be consistent with the revised inventory estimates referred to in chapter 2.

4.2 The table below sets out the UK's base year emissions and the baseline *with measures* projection, disaggregated by greenhouse gas. The projection reflects trends in energy use and the changing fuel mix in the electricity supply industry. It includes emission reductions expected from some of the policies that the Government has implemented since Kyoto, notably the climate change levy, the 10% renewables target and the fuel duty escalator to 1999. Other implemented and adopted policies are identified below and have been included with the *with additional measures* projection.

4.3 Based on the baseline *with measures* projection, the UK's emissions of the basket of greenhouse gases are expected to be about 15% below 1990 levels in 2010, with emissions of carbon dioxide about 8% below. Carbon dioxide emissions are, however, forecast to begin rising again around 2010 because of continuing economic growth and the retirement of nuclear power stations.

Baseline *with measures* projections of UK greenhouse gas emissions, disaggregated by gas, MtC

Gas	Base year	2000	2005	2010	2015	2020
Carbon dioxide	164.4	151.4	149.1	150.9	155.5	158.2
Methane	21.0	14.3	12.7	11.6	10.9	10.1
Nitrous oxide	18.3	11.5	11.7	11.8	12.0	12.3
HFCs	4.1	2.5	3.1	2.9	3.0	3.0
PFCs	0.3	0.2	0.1	0.1	0.1	0.1
SF_6	0.3	0.4	0.3	0.3	0.3	0.3
Total greenhouse gas emissions	208.4	180.3	177.2	177.6	181.9	184.0
Change from 1990 levels (6-gas basket)		–13.5%	–15.0%	–14.8%	–12.7%	–11.7%
Change from 1990 levels (CO_2 only)		–7.9%	–9.3%	–8.2%	–5.4%	–3.8%

1990 has been used as the base year for carbon dioxide, methane and nitrous oxide. 1995 has been used as the base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
Column entries may not add up to totals due to rounding. This rule applies to other tables in this chapter but has not been repeated.

[62] Including some measures that have been implemented or adopted, but not yet included within the baseline *with measures* projection.
[63] *Energy Paper 68: Energy Projections for the UK*, November 2000, The Stationery Office: www.dti.gov.uk/energy-projections.htm
[64] *Projections of Non-CO_2 Greenhouse Gas Emissions for the United Kingdom and Constituent Countries*, November 2000, WS Atkins Consultants Ltd: www.defra.gov.uk/environment/climatechange/ggeproject/index.htm

Baseline *with measures* projections by sector

4.4 Base year and projected *with measures* emissions by sector are set out below, grouped by the sectors specified by the UNFCCC's reporting guidelines. The residential and public sectors are specified separately. The business sector includes energy use by industry and commerce, but excludes non-CO_2 emissions from industry that are reported separately under industrial processes. Tables provided by *end user* allocate carbon dioxide emissions from the energy sector to end users. Tables provided by *source* show emissions from the energy sector separately.

Greenhouse gas emissions by end user, MtC

Sector	Base year	2000	2005	2010	2015	2020
Business	73.3	61.0	59.1	58.9	60.3	60.4
Industrial Processes	15.4	6.6	6.1	5.5	5.5	5.5
Transport	39.7	41.6	44.9	47.8	50.4	53.0
Residential	43.2	40.4	39.3	39.5	40.6	40.9
Public	9.0	7.7	7.3	7.2	7.3	7.2
Agriculture	15.7	14.6	13.8	13.5	13.5	13.6
Land Use Change	5.3	4.1	3.4	2.8	2.3	1.9
Waste Management	6.9	4.3	3.2	2.4	2.0	1.5
Total	208.4	180.3	177.2	177.6	181.9	184.0

Greenhouse gas emissions by source, MtC

Sector	Base year	2000	2005	2010	2015	2020
Energy supply	67.4	50.2	46.6	46.7	48.6	47.9
Business	36.2	36.5	36.5	35.9	36.0	36.2
Industrial Processes	15.5	6.6	6.1	5.5	5.5	5.5
Transport	35.6	37.7	40.9	43.8	46.4	49.1
Residential	22.0	22.6	22.7	23.1	23.6	24.2
Public	4.4	4.4	4.4	4.4	4.4	4.4
Agriculture	15.2	13.9	13.3	13.0	13.1	13.2
Land Use Change	5.3	4.1	3.4	2.8	2.3	1.9
Waste Management	6.9	4.3	3.2	2.5	2.0	1.6
Total	208.4	180.3	177.2	177.6	181.9	184.0

4.5 Baseline *with measures* projections from the energy supply sector,[65] which include estimated savings from the UK's 10% renewables target, show that they are expected to be 31% lower than 1990 emissions by 2010.

4.6 Baseline *with measures* projections from the business sector[66], which include the price effect of the climate change levy, show that annual emissions are expected to fall by 20% below 1990 levels by 2010. The main reason for the reduction in carbon dioxide emissions has been fuel switching in the electricity supply industry, which has reduced the carbon intensity of the electricity used by business. There has also been a general move to gas from oil for direct use, and business' energy intensity has improved, although less rapidly.

End user emissions from the energy supply industry, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	58.9	45.3	41.8	41.9	44.2	44.0
Methane	7.8	4.2	4.1	3.9	3.6	3.2
Nitrous oxide	0.6	0.6	0.6	0.6	0.7	0.7
HFCs	0	0	0	0	0	0
PFCs	0	0	0	0	0	0
SF_6	0.1	0.1	0.1	0.1	0.1	0.1
Total greenhouse gas emissions	67.4	50.2	46.6	46.7	48.6	47.9
Change from 1990 levels (6-gas basket)		–26%	–31%	–31%	–28%	–29%
Change from 1990 levels (CO_2 only)		–23%	–29%	–29%	–25%	–25%

End user emissions from business, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	63.4	54.8	52.2	52.2	53.8	54.3
Methane	7.9	4.1	3.8	3.5	3.2	2.6
Nitrous oxide	1.3	0.6	0.8	0.8	0.8	0.8
HFCs	0.3	1.2	2.1	2.2	2.4	2.4
PFCs	0.2	0.1	0.1	0.1	0.1	0.1
SF_6	0.2	0.2	0.2	0.1	0.1	0.1
Total greenhouse gas emissions	73.3	61.0	59.1	58.9	60.3	60.4
Change from 1990 levels (6-gas basket)		–17%	–19%	–20%	–18%	–18%
Change from 1990 levels (CO_2 only)		–14%	–18%	–18%	–15%	–14%

[65] Emissions from the energy supply sector include those from the production of fuel for final consumption by other sectors. This includes electricity generation, oil production and refining, gas production and transmission, and the production of coal and other solid fuels. Carbon dioxide emissions from this sector are also included into the total end user figures for the other sectors in this chapter.

[66] The business sector includes emissions from the use of energy from both the manufacturing and commercial sectors; emissions of PFCs from the electronics, medical and refrigeration uses; emissions of SF_6 from electrical insulation and electronics uses. Emissions of nitrous oxide and fluorinated gases from large industrial processes are included within the industrial sector emissions.

4.7 Baseline *with measures* projections show that annual emissions from the residential sector are expected to fall by about 9% below 1990 levels by 2010. This fall is mainly due to fuel switching in the electricity supply sector, and to reduced heating requirements because of the upward trend in the outside temperature[67]. Without these changes, emissions from the residential sector would be expected to be higher in 2010 than in 1990 due to increased household numbers and demand for energy services.

4.8 Baseline *with measures* projections in the public sector[70] show that annual emissions are expected to fall by around 20% below 1990 levels by 2010. Much of the fall in carbon dioxide emissions between 1990 and 2000 has been as a result of fuel switching in the electricity supply industry, but there have been significant improvements in public sector energy efficiency.

End user emissions from the residential sector, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	42.6	39.7	38.6	38.7	39.8	40.0
Methane	0.4	0.4	0.4	0.4	0.4	0.4
Nitrous oxide	0.2	0.2	0.2	0.2	0.2	0.2
HFCs[68]	0.02	0.09	0.15	0.2	0.2	0.2
Total greenhouse gas emissions[69]	43.2	40.4	39.3	39.5	40.6	40.9
Change from 1990 levels (6-gas basket)		–6.4%	–9.0%	–8.6%	–6.0%	–5.4%
Change from 1990 levels (CO_2 only)		–6.7%	–9.3%	–9.0%	–6.5%	–6.1%

End user emissions from the public sector, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	9.0	7.7	7.2	7.1	7.2	7.1
Methane	0.01	0.01	0.01	0.01	0.01	0.01
Nitrous oxide	0.01	0.01	0.01	0.01	0.01	0.01
HFCs	0.01	0.02	0.03	0.04	0.04	0.04
Total greenhouse gas emissions	9.0	7.7	7.3	7.2	7.3	7.2
Change from 1990 levels (6-gas basket)		–14%	–19%	–20%	–19%	–20%

[67] The trend in the UK is an increase of about 0.3°C per decade, but this is not a prediction of actual temperatures in any given year, which may fluctuate by ±2°C or more about the trend value.
[68] HFC emissions are from domestic refrigeration.
[69] Total emissions from the residential sector in 2020 include 0.1 MtC from PFCs and SF_6.
[70] The public sector includes emissions from the central government estate (including government agencies and non-departmental public bodies), and the estates of the National Health Service, local authorities (except their housing stock which is covered in the residential sector), and the education sector.

4.9 Baseline *with measures* projections from the transport sector[71] show that, unless action is taken, emissions could increase by 20% above 1990 levels by 2010. The projections include the estimated savings from the fuel duty escalator to 1999. Most of the forecast increase is from road transport, resulting from a growth in incomes, a consequent rise in the levels of car ownership, greater travel and a greater demand for goods and services. These factors have been compounded by the limited improvements in vehicle fuel efficiency since the mid-1980s.

4.10 Emissions related to fuel sold to ships and aircraft engaged in international transport are reported separately in the common reporting format (see Annex A) and, in accordance with the UNFCCC's reporting guidelines, are not included either in the UK's base year or the projections. Emissions from aviation fuel loaded in the UK onto international flights are increasing at between 5% and 6% per annum. Total greenhouse gas emissions from fuel loaded onto international shipping vary by about ±10% but had no clear increasing or decreasing trend over the period 1990 to 1999. The UK is working within the International Civil Aviation Organisation and the International Maritime Organisation to moderate or reduce these emissions in future.

End user emissions from transport, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	39.1	40.0	42.9	45.4	47.7	50.1
Methane	0.2	0.1	0.1	0.1	0.1	0.1
Nitrous oxide	0.4	1.3	1.8	2.0	2.1	2.3
HFCs[72]	0.0	0.1	0.2	0.4	0.4	0.5
Total greenhouse gas emissions	39.7	41.6	44.9	47.8	50.4	53.0
Change from 1990 levels (6-gas basket)		5%	13%	20%	27%	33%
Change from 1990 levels (CO_2 only)		2%	10%	16%	22%	28%

4.11 Baseline *with measures* projections of nitrous oxide and the fluorinated gases from industrial processes have been substantially reduced over the last decade. Key highlights include:

- nitrous oxide emissions are due to fall by about 73% below 1990 levels by 2010. This is largely due to the installation of emission abatement technology in the chemicals industry. DuPont's installation of the common off-gas abatement unit in one plant has reduced the UK's total greenhouse gas emissions by 3.6 MtC. This reduction represents 2% of the UK's 1990 emissions;
- HFC emissions as a by-product of HCFC-22 manufacture are falling significantly in response to pollution control regulation. These emissions are expected to be around 70% below 1995 levels in 2000 due to the installation of mitigation technology. This reduction represents around 2% of the UK's total greenhouse gas emissions in 1990. Emissions from other sources are however increasing rapidly as HFCs are used as replacements for ozone depleting substances;

[71] The transport sector includes emissions from the production of fuel for the transport sector.
[72] HFC emissions are from mobile air conditioning.

- emissions of PFCs are expected to be around 70% below 1995 levels by 2010, mainly as a result of pollution control measures in the aluminium smelting industry;

- Emissions of SF_6 from magnesium smelting are forecast to increase from 0.16 MtC in 1995 to 0.20 MtC in 2010. SF_6 emissions from the electronics industry are forecast to decrease from 0.03 MtC to 0.01 MtC in 2010.

End user emissions from industrial processes[73], by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	3.4	3.7	3.7	3.7	3.7	3.7
Methane	0.02	0.02	0.02	0.02	0.02	0.02
Nitrous oxide	7.9	1.5	1.3	1.3	1.3	1.3
HFCs	3.8	1.1	0.8	0.3	0.2	0.2
PFCs	0.1	0.1	0.03	0.03	0.03	0.03
SF_6	0.2	0.2	0.2	0.2	0.2	0.2
Total greenhouse gas emissions	15.4	6.6	6.1	5.5	5.5	5.5
Change from 1990 levels (6-gas basket)		–57%	–60%	–64%	–64%	–64%

4.12 Baseline *with measures* projections show that emissions from agriculture are projected to decrease by 14% below 1990 levels by 2010. This is due to reductions in methane emissions from livestock, nitrous oxide emissions from fertiliser use and carbon dioxide emissions from fuel switching in the electricity supply industry.

End user emissions from agriculture, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Carbon dioxide	1.6	1.4	1.1	1.1	1.0	1.0
Methane	5.9	5.7	5.3	5.1	5.2	5.3
Nitrous oxide	8.2	7.5	7.3	7.2	7.3	7.3
HFCs[74]	0.0	0.0	0.0	0.1	0.1	0.1
Total greenhouse gas emissions	15.7	14.6	13.8	13.5	13.5	13.6
Change from 1990 levels (6-gas basket)		–7%	–12%	–14%	–14%	–13%
Change from 1990 levels (non-CO2 only)		–6%	–10%	–12%	–12%	–11%

[73] Includes all HFC emissions except those from residential or transport sectors; all PFC emissions from aluminium manufacture; and SF_6 emissions from magnesium smelting.
[74] HFC emissions are from refrigeration in the agricultural sector

4.13 The table below summarises the main trends in the UK's sources and sinks from land use change and forestry.

MtC/year	1990	1995	2000	2005	2010	2015	2020
Forest sink(a) ...	2.9	3.1	3.2	3.5 to 3.6	3.4 to 3.7	3.0 to 3.4	2.7 to 3.1
... which include these figures from trees planted since 1990(b)	0	0.2	0.3	0.5 to 0.6	0.6 to 0.8	0.9 to 1.2	1.2 to 1.6
Emissions from land use change(c)	5.3	4.4	4.0 to 4.7	2.8 to 5.0	1.8 to 5.5	0.9 to 6.0	0 to 6.3

Footnotes:
(a) Includes carbon accumulated in forests by woody biomass, soils, litter, 0.3 MtC annual removals by agricultural crops and changes in the quantity of forest products from timber grown in the UK.
(b) Entries for woodlands planted from 1990 exclude increasing pool of carbon in timber products.
(c) Sum of source and sink terms due to transitions between land use categories. The estimate has been revised since publication of the UK's climate change programme and includes (i) revised data for the equilibrium carbon content of Scottish soils; (ii) a revision of the rates of change of soil carbon during land use change to better reflect the range of published values; (iii) a projection of land use change activity data and use of dynamic models rather than a projection of net emissions data.

4.14 Baseline with measures projections show that emissions from waste management are projected to decrease by 65% below 1990 levels by 2010, mainly as a result of reduced methane emissions from landfill sites.

End user emissions from waste management, by gas, MtC

Gases	Base year	2000	2005	2010	2015	2020
Methane	6.6	4.0	2.9	2.1	1.7	1.2
Nitrous oxide	0.3	0.3	0.3	0.3	0.3	0.3
Total non CO2	6.9	4.3	3.2	2.4	2.0	1.5
Change from 1990 levels (non-CO2 only)		–38%	–53%	–65%	–71%	–78%

Supplementary projections by gas

4.15 The following tables summarise projections organised by gas and, in some cases, provide more detail than the sectors specified in the UNFCCC's reporting guidelines.

UK carbon dioxide emissions by source 1990 to 2020, MtC

	Base year	1995	2000	2005	2010	2015	2020
Energy supply	58.9	49.5	45.3	41.8	41.9	44.2	44.0
Business	35.1	34.1	34.6	33.8	33.2	33.1	33.2
Residential	21.5	21.7	22.2	22.3	22.6	23.2	23.7
Public	4.4	4.3	4.3	4.3	4.3	4.3	4.3
Transport	35.1	35.0	36.3	39.1	41.7	44.1	46.7
Industrial Processes	3.4	3.9	3.7	3.7	3.7	3.7	3.7
Agriculture	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Land use change	5.3	4.4	4.1	3.4	2.8	2.3	1.9
Total without land use change	159.1	149.2	147.3	145.7	148.1	153.2	156.3
Total with land use change	164.4	153.7	151.4	149.1	150.9	155.5	158.2

UK carbon dioxide emissions by end user 1990 to 2020, MtC

	Base year	1995	2000	2005	2010	2015	2020
Business	63.4	56.5	54.8	52.2	52.2	53.8	54.3
Residential	42.6	40.1	39.7	38.6	38.7	39.8	40.0
Public	9.0	8.2	7.7	7.2	7.1	7.2	7.1
Transport	39.1	39.2	40.0	42.9	45.4	47.7	50.1
Industrial Processes	3.4	3.9	3.7	3.7	3.7	3.7	3.7
Agriculture	1.6	1.4	1.4	1.1	1.1	1.0	1.0
Land use change	5.3	4.4	4.1	3.4	2.8	2.3	1.9
Total without land use change	159.1	149.2	147.3	145.7	148.1	153.2	156.3
Total with land use change	164.4	153.7	151.4	149.1	150.9	155.5	158.2

UK methane emissions by source, 1990 and projections to 2020, MtC

	Base year	2000	2010	2020
Waste	6.4	3.8	1.9	1.0
Agriculture	5.9	5.7	5.1	5.3
Coal mining	4.7	1.4	1.3	0.7
Natural gas distribution	2.4	2.2	2.1	2.1
Offshore oil and gas	0.7	0.5	0.3	0.2
Fuel combustion	0.7	0.5	0.6	0.6
Wastewater treatment	0.2	0.2	0.2	0.2
Total	21.0	14.3	11.6	10.1

UK nitrous oxide emissions by source, 1990 and projections to 2020, MtC

	1990	2000	2010	2020
Agriculture	8.5	7.5	7.2	7.3
Industrial processes	8.0	1.5	1.3	1.3
Fuel combustion	1.2	1.0	1.1	1.1
Waste	0.3	0.3	0.3	0.3
Transport	0.3	1.3	1.9	2.3
Total	18.3	11.5	11.8	12.3

Emissions of HFCs, PFCs and SF_6 by market sector, MtC

	1995	2000	2010	2020
HFCs				
Refrigeration/air conditioning	0.23	0.92	1.30	1.27
Foam	0.00	0.03	0.59	0.80
General aerosols	0.11	0.32	0.32	0.32
Metered dose inhalers	0.0004	0.09	0.30	0.30
HFC-23 from HCFC-22 manufacture	3.80	1.13	0.24	0.24
Solvents	0	0	0.09	0.09
Losses from HFC manufacture	0.004	0.008	0.014	0.000
Fire fighting	0.001	0.006	0.013	0.016
Total UK HFC emissions	4.1	2.5	2.9	3.0
PFCs				
Electronics	0.18	0.11	0.05	0.05
Aluminium smelting	0.10	0.06	0.03	0.03
Other PFC uses	0.0001	0.0012	0.0017	0.0017
Refrigeration/air conditioning	0.00002	0.00004	0.00003	0.00002
Total UK PFC emissions	0.28	0.17	0.09	0.09
SF_6				
Magnesium smelting	0.16	0.20	0.20	0.20
Electrical insulation	0.05	0.07	0.12	0.12
Other SF_6 uses	0.10	0.10	0.01	0.00
Electronics	0.03	0.01	0.01	0.01
Total UK SF_6 emissions	0.34	0.37	0.34	0.33
Total UK emissions of HFCs, PFCs and SF_6	4.8	3.1	3.3	3.5

Assessment of total effect of policies and measures

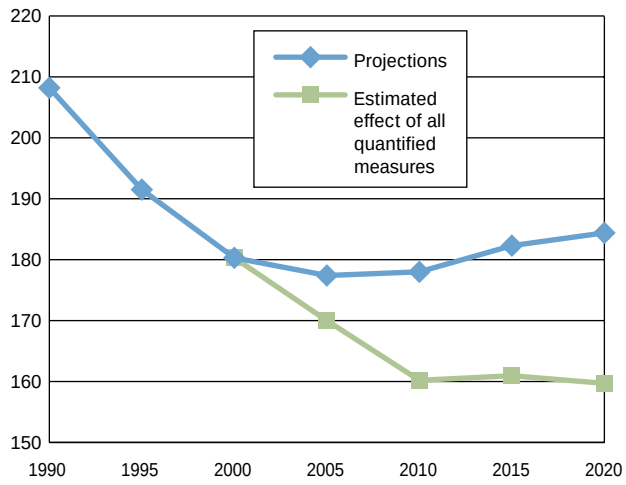
4.16 The UK's climate change programme, which includes all the additional policies and measures set out in chapter 3, represents a substantial programme of action. It should take the UK well beyond its Kyoto target, and demonstrates clear commitment by the Government and the devolved administrations to the domestic goal. The Government estimates that by 2010, the policies and measures included in the programme could:

- reduce the UK's emissions of the basket of greenhouse gases covered by the Kyoto Protocol to 23% below 1990 levels;
- reduce the UK's carbon dioxide emissions to 19% below 1990 levels; and
- ensure emissions fall still further through the impact of unquantified measures such as further action by the devolved administrations, improving the quality of local authority housing stock, improved management of traffic speed, further action by local authorities, voluntary carbon offset schemes and public awareness campaigns. These additional measures could mean that carbon dioxide emissions reach 20% below 1990 levels.

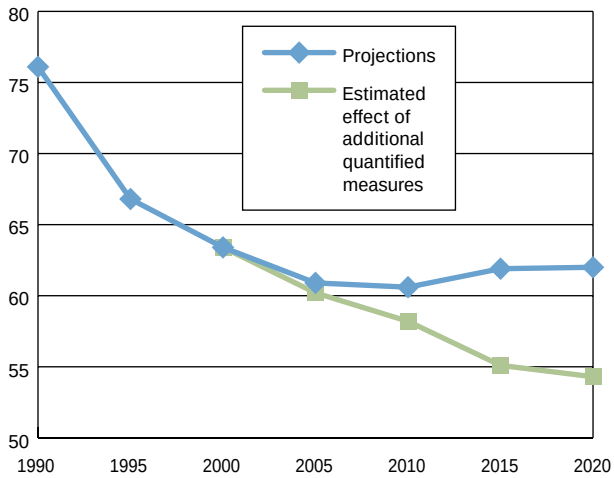
4.17 The following figures show the effect of subtracting the total of the additional policies and measures identified in chapter 3 and Annex B from the baseline *with measures* projection described above. Some measures are not quantified in 2000 and 2005 and linear interpolation has therefore been used for this period. Policy projections beyond 2010 are increasingly uncertain and have been kept constant where other information was not available.

4.18 Policies and measures marked with an asterisk in Annex B are already included in the baseline (*with measures*) projection and so have not been subtracted as indicated in the previous paragraph. Otherwise the assessment of the total effect of policies and measures avoids double counting by estimating the effect of individual policies relative to a sector specific business as usual case.

Projected greenhouse gas emissions and estimated effect of all quantified measures, MtC

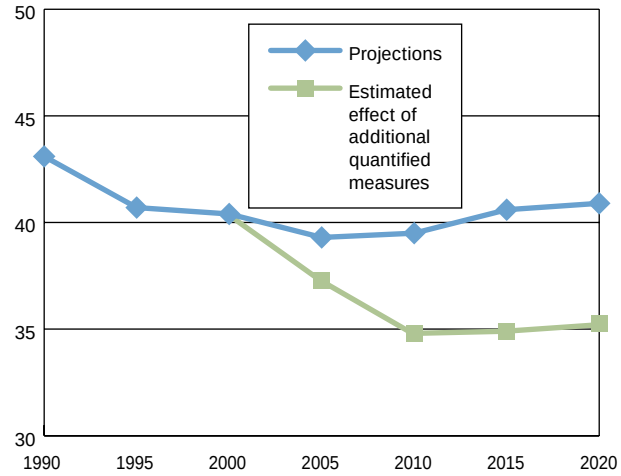


Projections of greenhouse gas emissions from business and estimated effect of all quantified measures, MtC[75]

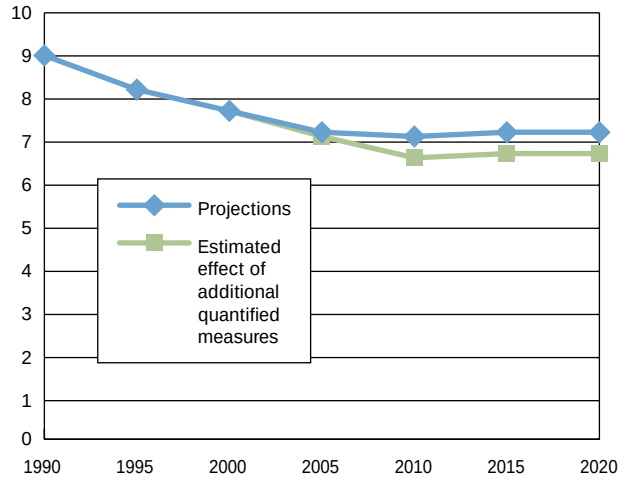


[75] The business share of the carbon savings from the amendment of the Building Regulations has been included.

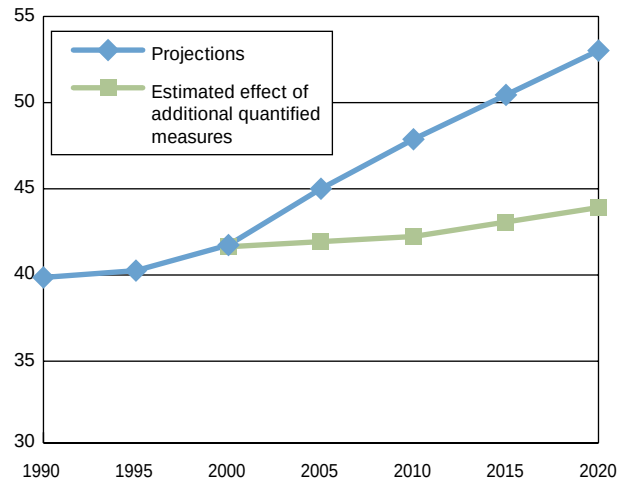
Projections of greenhouse gas emissions from the residential sector and estimated effect of all quantified measures, MtC[76]



Projections of greenhouse gas emissions from the public sector and estimated effect of all quantified measures, MtC[77]



Projections of greenhouse gas emissions from the transport sector and estimated effect of all quantified measures, MtC[78]



Methodology

4.19 Projections of the UK's carbon dioxide emissions are derived from the DTI's Energy Model as described in *Energy Paper 68*†. This is made up of a set of interlocking models of final user energy sectors and the electricity supply sector. It is predominantly a 'top down' model, based around econometrically estimated relationships between energy demand, economic activity (income) and energy prices, and an optimising model for the electricity supply industry. The projections provide a view of possible future levels and composition of energy demand, based on a set of different scenarios for economic growth and world energy prices, rather than one single forecast.

4.20 The energy model originated in the 1970s for energy planning purposes and has evolved, notably since the mid to late 1980s, to deal with environmental issues, particularly carbon dioxide and sulphur dioxide emissions. Currently the model has about 130 econometric equations representing energy demand in 13 sectors of the UK economy which, for present purposes, have been aggregated as required by the UNFCCC reporting guidelines. It is not practicable to identify all assumptions here but the following table provides a summary of key variables. Further details can be found in *Energy Paper 68*.

Summary of key variables and assumptions in the projections analysis

GDP growth	2.5% a year for 2001-2005 and 2.25% a year for 2006-2020
Oil price	Ranges from $10 to $20 a barrel in 1999 prices
Tax structure	Current UK structure maintained in real terms
Temperature	Continuing the recent upward trend

[76] The residential sector share of the carbon savings from the amendent of the Building Regulations has been included.
[77] The potential effect of the climate change levy, the amendent of the Building Regulations and appliance standards and labelling has not been included.
[78] The potential effect of the climate change levy, the amendent of the Building Regulations and appliance standards and labelling has not been included.
† See earlier footnote for reference.

4.21 *Energy Paper 68* considers six main scenarios, comprising combinations of three assumptions for economic growth and two for the overall level of energy prices. This Communication assumes the average of the scenarios representing central economic growth under low and high fuel price cases to be representative, although the effect of using other assumptions is shown below. Existing Government policy is, as far as is practicable, incorporated into the projections. These include the effect of some of the measures that the Government has introduced since Kyoto in 1997. *Energy Paper 68* also contains an assessment of the uncertainty in projections arising from the economic modelling process, as distinct from the uncertainty due to different assumptions about the economic drivers. Both sources of uncertainty are combined in the overall sensitivity assessment below.

4.22 The projections take account of projected closure dates for nuclear generation plant. They embody a steady rundown in nuclear output as existing stations reach the end of their lives. There is, of course, some uncertainty about those lifetimes and the UK's projections consider sensitivities around a baseline projection. Since the projections were published in November 2000, announcements by British Nuclear Fuels plc suggest that it is possible that a couple of plants that were assumed to be operating in the baseline projection in 2010 may close before then. If that were to occur, then annual emissions could be around 1 MtC higher in 2010 than has been assumed. This is within the range considered in *Energy Paper 68*.

4.23 The first table below compares fossil energy related carbon emissions and *with measures* projection estimates between the Second and Third National Communications. Although base year emissions agree to better than 0.6%, the projections diverge increasingly. This is mainly due to lower projected emissions from power stations, including extra renewables and conventional fuel switching, and from industry and road transport.

4.24 Land use change emission estimates are from a spreadsheet model developed by the Centre for Ecology and Hydrology, under contract to DEFRA. The model uses land use data derived from periodic surveys, supplemented by an annual census of agricultural land uses. The central scenario assumes the prevailing pattern of land use change to continue into the future. It is combined with information on soil carbon density and dynamics to estimate annual gains and losses associated with the transitions involved. Separate estimates are made for Scotland, England, Wales and Northern Ireland. This method guarantees continuity between the inventory and the projections. A combination of varying assumptions on areas and rate constants is used to generate upper and lower projections around the central scenario.

4.25 The second table below compares land use change emission projections between the Second and Third National Communications. There is a slowly increasing offset reaching about 4 MtC in 2010, mainly due to a more realistic assessment of Scottish soil carbon density profiles, and a better assessment of rate constants based on a systematic assessment of literature values and use of Monte Carlo analysis to combine ranges. In addition, the projections are now driven by future land use scenarios rather than simply projecting inventory time series. The inventory aspects of this work are described in the UK's national inventory report and the development of projections will be available in November 2001[79].

4.26 Projections of the non-CO_2 greenhouse gases[80] covered by the Kyoto Protocol are derived from close consultation with sector representatives and other government departments. The methodologies for calculating projected emissions are refined as and when improved information is available. Projections are calculated using a specially built spreadsheet model that calculates emissions based on activity statistics, emission factors and sector specific assumptions. Emissions are disaggregated by sector and are calculated each year from 1999 to 2012 and for 2015 and 2020.

[79] Milne, R. 2001: *Future projections of removals and emissions of atmospheric carbon dioxide by afforestation and land use change in the UK* (in preparation). Available at: www.nbu.ac.uk/ukcarbon/docs/1999_Projections_UK_plus_regions.pdf

[80] See earlier footnote for reference.

Comparison of energy related CO_2 emissions, and *with measures* projections between Second and Third National Communications (MtC/yr)

	Second National Communication	Third National Communication	Difference
1990	158.2	159.1	0.9
2000	150.0	147.3	–2.7
2010	162.3	148.1	–14.1
2020	186.0	156.3	–29.7

Comparison of projections of emissions due to land use change between Second and Third National Communications (MtC/yr)

	Second National Communication	Third National Communication	Difference
1990	8.5	5.3	–3.2
2000	7.6	4.1	–3.5
2010	6.8	2.8	–4.0
2020	6.5	1.9	–4.6

4.27 The spreadsheet estimates the range of uncertainty associated with the total emissions for each gas using probabilistic modelling to calculate the confidence range for the projections. The projections are based on a *with measures* scenario, taking account of existing agreed policies. Central estimates for sector projections are aggregated to calculate the best estimate for total emissions. Uncertainty ranges for each greenhouse gas source, including carbon dioxide, are combined probabilistically to determine the overall uncertainty range for total greenhouse gas emissions.

4.28 Projections are regularly checked and verified by comparing trends in actual historic emissions with future emission estimates. If there is a significant variation, projection methodologies and assumptions are revised accordingly. Additionally, in certain sectors, projection methodologies are verified using a combination of 'bottom up' and 'top down' information.

4.29 The table, facing page, summarises and explains the main changes in non-CO_2 greenhouse gas emision estimates and projections since the Second National Communication.

4.30 In addition to updating the projections, the range of uncertainty associated with the total emissions have been estimated for each gas together with the overall global warming potential. This was achieved through probabilistic modelling to calculate the confidence range for the emissions estimates for each greenhouse gas. The updated projections for the non-CO_2 greenhouse gases also refined the methodology for some sectors to take account of local differences between each constituent country of the UK.

4.31 The projections are consistent with the 2000 inventory submission except for the land use change projection which has been revised because of the significant change in inventory methodology between the 2000 and 2001 submissions.

Sensitivity analysis

4.32 Four sources of uncertainty are identified in the previous paragraphs. The table, facing page, shows the spread that these may introduce into the projections in 2010, based on data from the underlying reports and from the land use change emissions ranges tabulated above.

4.33 The combined range of uncertainty is obtained using the error propagation equation. This is valid if the uncertainties are uncorrelated. This assumption is unlikely to be strictly true, but the largest uncertainty is unlikely to be correlated with any of the other factors, and cross correlation between the other factors themselves will only be partial.

4.34 The uncertainty of ± 10 MtC in 2010 corresponds to an uncertainty of about 5% of base year emissions in the baseline *with measures* scenario. So the fall in the UK's greenhouse gas emissions between 1990 and 2010 without any additional measures would be 15 ± 5%. The upper end of this range fails to meet the UK's Kyoto commitment by about 2.5% of base year emissions, or 5 MtC per year. Since the additional measures are worth 17.5 MtC per year in 2010, it seems likely that the target will be met even if the baseline *with measures* scenario proves optimistic and the additional measures deliver less than anticipated.

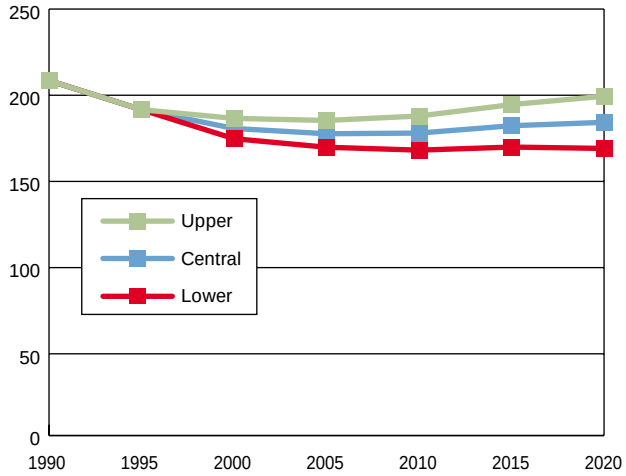
4.35 This process can be repeated using data for other years with the result shown graphically below.

Changes between non-CO_2 greenhouse gas emissions estimates and projections between the Second and Third National Communications. All emissions in gigagrammes gas

Gas	Second National Communication			Third National Communication			Main reasons for changes
	Baseline	2010	Projected change	Baseline	2010	Projected change	
Methane	4402	2852	–35%	3670	2023	–45%	Updated estimates of landfill methane emissions and projections based on new modelling, field measurement and the effect of the landfill directive on methane emissions.
Nitrous oxide	111.7	50.8	–55%	215.6	139.7	–35%	Increase in emission factor for soils consistent with IPCC guidelines
HFCs	1.05	2.19	108%	2.0	7.3	265%	Replacement of CFCs by HFCs driving an increase in emissions. Total global warming potential of emissions however projected to reduce by 31% in 2010 because of abatement of HFC-23 emissions from HCFC-22 manufacture
PFCs	0.31	0.13	–57%	0.16	0.05	–71%	Closure of an aluminium smelting plant
SF_6	0.02	0.04	83%	0.05	0.05	16%	Updated estimate of consumption

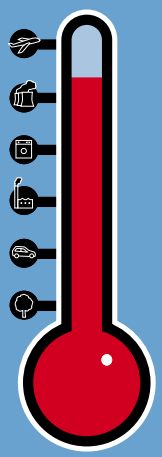
Source of uncertainty in projections relative to base year emissions estimate	Uncertainty introduced estimated as ± MtC/yr relative to central scenario
Combination of GDP and fuel price	± 4
Economic modelling process for energy related CO_2	± 9
Area and parameter assumptions driving land use change emissions projection	± 2
Non-CO_2 greenhouse gas range	± 1
Combination (overall uncertainty)	± 10

Overall sensitivity of UK total greenhouse gas emissions to scenario and modelling assumptions, MtC



5

Impacts and adaptation



Key Developments

- A set of indictors has been developed to monitor how the UK's climate is changing, the pace of change, and how it may be affecting aspects of our lives and natural environment.
- The UK Climate Impacts Programme has continued to help stakeholders assess their vulnerability to climate change so that they can plan adaptation strategies. It also published a synthesis of the first three years of regional and sectoral research into impacts and adaptation.
- An impacts assessment tool-kit has been developed which includes:
  - national climate change scenarios;
  - national socio-economic scenarios;
  - a methodology for costing impacts and adaptation[81];
  - guidelines for dealing with climate change risk and uncertainty in decision-making[82]; and
  - guidelines for undertaking impacts assessments within the context of UKCIP.
- The Government and devolved administrations have commissioned research to identify potential adaptation strategies for the UK. They have also begun to build adaptation into many of their policies, including those on water resources, flood defence and planning.

Introduction

5.1 This chapter describes how the UK is developing adaptation strategies. It looks at what the impacts of climate change are likely to mean for the UK, it provides an initial view of adaptation priorities, and it outlines the action that the Government and the devolved administrations are taking to prepare for climate change.

Observed changes in the UK

5.2 The first signs of a changing climate are already emerging. The Government has published a set of indicators[83] to monitor how the UK's climate is changing, the pace of change, and how it may be affecting aspects of our lives and natural environment. For many of the indicators, it is possible to find a climate variable that is closely related to year-to-year fluctuations. For example, hot, dry summers are associated with high rural ozone levels, greater use of irrigation water, more insurance claims for subsidence, more domestic tourism, more outdoor fires, poor health of beech trees and greater insect abundance. Mild winters and springs have been shown to be associated with poor skiing, lower human mortality in winter, earlier emergence of leaves and flowers and larger populations of some insects and birds. Although the set of 34 indicators was developed to illustrate future changes, it revealed initial evidence that changes to the climate are now beginning to affect aspects of the UK's environment and economy.

5.3 All aspects of the UK economy, environment and society are vulnerable to climate change and will need to respond. Impacts and adaptation responses will be driven both by the underlying incremental changes to sea levels and temperatures and by increasingly frequent extreme weather conditions, such as the hot summer of 1995 and the intense precipitation and storms that caused flooding in large parts of England and Wales in autumn 2000. These events have noticeably increased public awareness about the costs of extreme events and the need to adapt.

Impacts assessments

5.4 In 1997, the Government established The UK Climate Impacts Programme (UKCIP) to provide a co-ordinated framework for assessing climate change impacts and identifying potential adaptation strategies in the UK. UKCIP facilitates and supports organisations – the 'stakeholders' – to initiate studies which assess their own vulnerability to climate change impacts and work out their responses. Studies are currently funded by the stakeholders.

[81] To be published at the end of 2001.
[82] To be published Spring 2002.
[83] *Indicators of Climate Change in the UK*, 1999, DETR: www.nbu.ac.uk/iccuk/

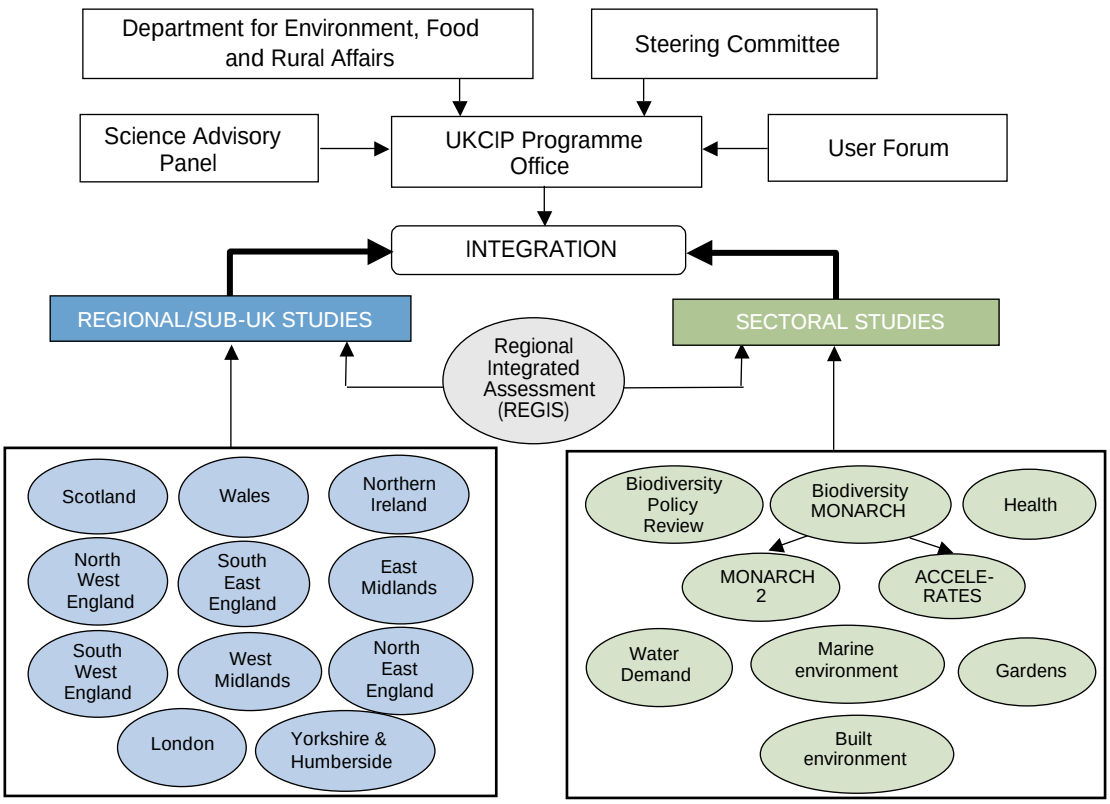
5.5 A common integrated framework for UKCIP studies is required so that results can be synthesised and outputs generated for national and regional policy. Integration is being achieved principally through: the common use of core data sets and scenarios; development of networks of funders and researchers; and development of specific methodologies.

5.6 Key features of the UKCIP approach are:

- forming direct links between the science and decision-making communities so that outputs are geared to policy needs at national, regional and local level and research is user driven;
- the development of new partnerships of stakeholders for the impacts assessments;
- the coherent framework of tools to support assessments so that a wide variety of studies can be integrated to provide useful inputs for policy making at national level; and
- a focus on raising institutional awareness of climate change impacts through communication and dissemination of information.

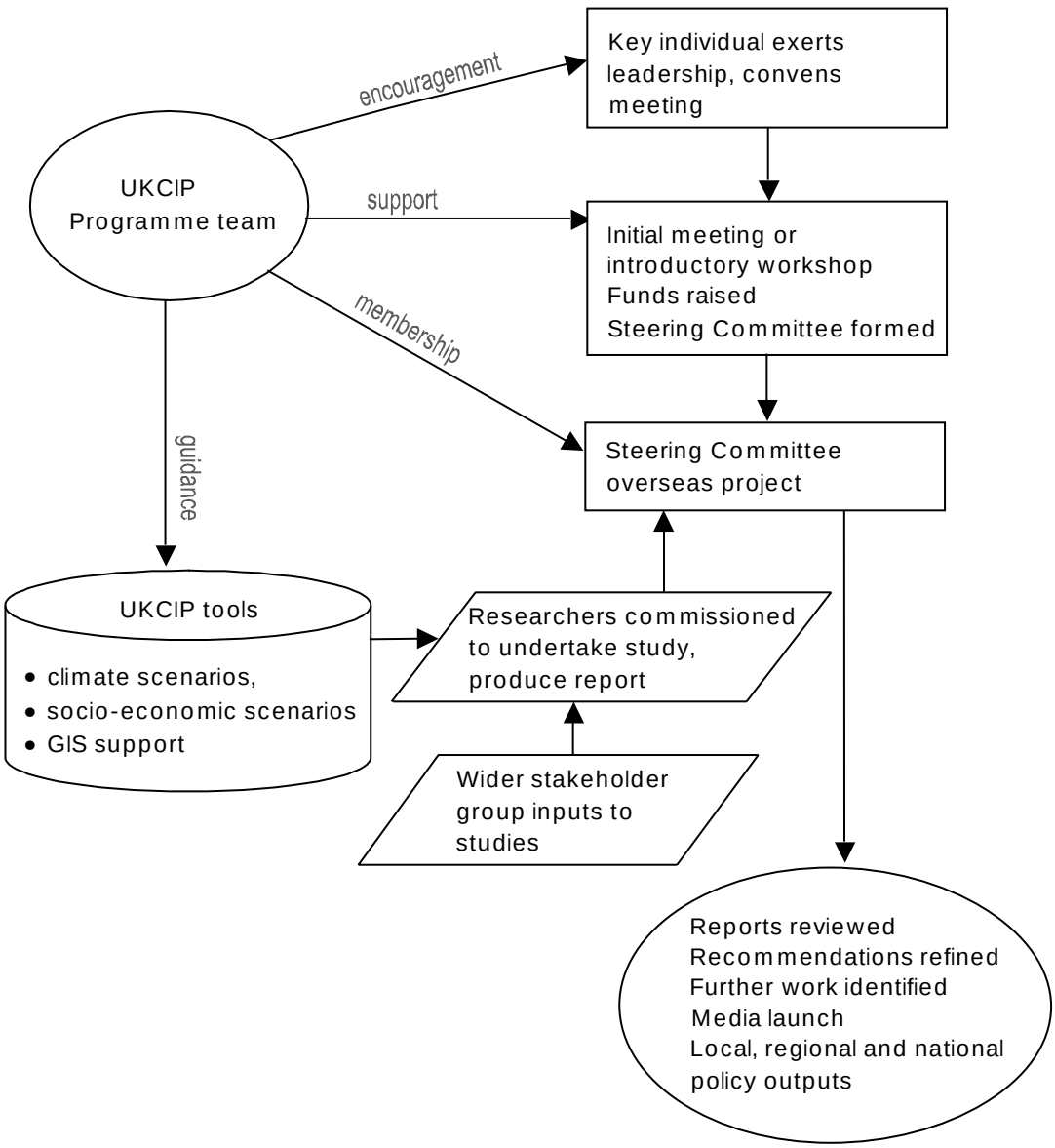
5.7 The UKCIP is advised by a Steering Committee comprised of representatives of key Government departments, public agencies, the private sector and NGOs. A Science Advisory Panel oversees the integrity of the work, and a User Panel enables organisations seeking to work on climate change impacts to interact directly with the Programme. The Programme structure is shown in the diagram below.

Programme Structure of the UK Climate Impacts Programme



5.8 In its first three years, the UKCIP has brought together a wide range of organisations to undertake stakeholder-led sectoral, national and regional climate change impacts assessments. Initial studies have been completed for Scotland, Wales, and three regions of England: the north west, the south east and the east midlands. A study in Northern Ireland is underway and others are at inception in the west midlands, Yorkshire and Humberside, south west England and London. These scoping studies have provided accessible summaries of vulnerability and initial inputs for policy making on adaptation within the regions. The general process followed in undertaking a regional scoping study is illustrated below. More detailed quantitative assessment is likely to be required to further explore potential impacts and opportunities.

Process for undertaking a UKCIP regional study



5.9 Initial studies on the impacts of climate change on biodiversity and health have been completed, as has an integrated modelling assessment on four sectors (water, biodiversity, agriculture and coasts) which aims to develop methodologies to inform further impacts assessments. A major study on the UK's marine environment is underway. New modular studies on the different components of the built environment are being developed in a linking project between relevant stakeholders and the research community.

5.10 UKCIP also provides the fundamental tools for undertaking impacts assessments. The UKCIP 1998 national climate change scenarios were commissioned for the Programme from the Climatic Research Unit at the University of East Anglia based on model output from the Hadley Centre's global

climate model. They have been used in all UKCIP studies and have become the 'standard' scenarios for impact assessments in the UK. However, most impact assessments require climate change predictions at a finer resolution. To meet this demand, new UKCIP climate change scenarios will be introduced in early 2002, which will be based on the model output from the Hadley Centre's regional climate model and will provide greater spatial detail and more information on extreme events.

5.11 UKCIP has developed additional supporting products for undertaking impacts assessments: socio-economic scenarios for the UK; a methodology for costing the impacts of climate change in the UK; and guidance to decision-makers on dealing with risk and uncertainty in decision making in the context of climate change.

5.12 In 2000, UKCIP published summary and technical reports synthesising the first three years of work under the Programme. Further information can be found on the UKCIP website at: www.ukcip.org.uk/ukcip.html

5.13 The table below gives a summary of impacts in key sectors. Further details can be found at: www.defra.gov.uk/environment/climatechange/3nc

Impacts of climate change in the UK

Water Resources

Climate change is likely to result in increased and more intense rainfall throughout the UK, particularly in autumn and winter, and changes in the seasonal distribution of rainfall. For example, in spring and summer, south east England and the east of Scotland are likely to be drier, and north west England and the west of Scotland are likely to be wetter. Higher temperatures and demographic trends could stretch water resources and increase demand in parts of the UK, such as south east England. Pressure on water resources could also affect the industrial and agricultural sectors.

Flooding

Flooding is likely to increase in the UK as a result of rising sea levels, more intense rainfall and possible increased storminess. Sea level rise will have profound effects on the frequency of high tide levels around parts of the UK coast. If the frequency or severity of storm surges increase, coastal areas could face a significant risk of increased flooding, inundation and erosion with consequent damage to property and natural assets. Many cities, major industrial plants, and transport infrastructure, such as ports, coastal roads and railway lines are located in coastal areas or river flood plains which could be affected by increased flooding. Continued and increased investment in flood defences will reduce, but not remove, these risks.

Countryside and biodiversity

Climate change will affect the UK's agriculture, forestry, and wildlife. Habitats and species (including pests and diseases) will respond directly to changing climatic conditions and are expected to move northwards and to higher altitudes as temperatures rise. They will also have to adapt to climate-induced changes in land use, such as shifting patterns of agriculture, the introduction of new crops and the re-alignment of sea defences. Some wildlife habitats are particularly vulnerable to changes in sea level, availability of water, warmer conditions or increased storminess, for example, coastal habitats such as mudflats and saltmarshes, which are of international importance, are threatened by coastal erosion and flooding.

In the high mountains in the north and west it is forecast that some species, which are at the southern or lower limit of their natural 'arctic and alpine' habitats, are likely to become more restricted or disappear. At the same time, species that are currently at their northern limit are likely to flourish, provided suitable habitats are available.

The agricultural industry is likely to be affected, although it should be able to adapt to the changing climate to some extent. Farmers in Scotland and north west England are likely to face heavier rainfall, presenting operational difficulties over waste water management and the use of machinery on waterlogged land. Farmers in the south could face water shortages that would affect crop production. There may,

however, be opportunities to produce certain crops earlier in the season and to grow alternative crops, such as soya bean, sunflowers and grapevines, in the south of England. Forestry is likely to benefit from climate change, as increased concentrations of carbon dioxide and higher temperatures improve growth and yields. These benefits could, however, be offset by more damage from wind, fire, pests and diseases.

Health

Climate change may have wide ranging effects on human health. An initial study[84] indicates that, by the 2050s, higher summer temperatures and heatwaves are likely to lead to an increase in heat related deaths, to around 2,800 cases per annum. Milder winters, however, are likely to lead to a decline in the number of cold related deaths, by perhaps 20,000 cases per year. Warmer temperatures are likely to lead to significant increases in cases of food poisoning, by perhaps 10,000 cases per year. Risks associated with severe weather gales and coastal flooding may also increase significantly. In general, the effects of air pollution on health are likely to decline, but the effects of ozone during the summer are likely to increase. The overall effects of climate change on vector-borne and water-borne diseases are likely to be small. Many of these potential impacts may be reduced by further research and planning.

Built environment

Climate change could impact significantly on the quality of built environments. Higher temperatures and humidity, greater risk of flooding and subsidence could lead to the deterioration of built structures, and disruption of road, rail and power supplies, with significant economic costs. The health of occupants may be affected by changing internal conditions in buildings leading, for example, to greater risks from legionella and heat stress. Mould growth and condensation, leading to health problems such as asthma, could increase with increased relative humidity, but would decrease with greater use of natural ventilation. These impacts have implications for the planning and development of built environments in the future. Given highly variable UK weather conditions, it is difficult to give a clear picture of how storms and winds are likely to change. However, the UK climate change scenarios suggest autumns may become windier. The Government is commissioning more work on this issue because of the far-reaching implications for design standards of all types of infrastructure.

Economy

Many aspects of the UK economy are sensitive to the climate. Extreme weather events, such as floods and storms, can disrupt some businesses, while operating and processing techniques may need to change in response to higher temperatures and water shortages. Climate change may indirectly alter market demand and supply, through impacts in the UK and globally. An analysis of the unusually warm year of 1995 identified a range of economic impacts including: agricultural losses (due to reduction in the yields of some crops and livestock problems); costs associated with higher water demand; and subsidence related costs to the insurance industry.

Adaptation

5.14 The concentration of greenhouse gases already in the atmosphere means that some further climate change will happen and the UK must take action to adapt. The Government and the devolved administrations aim to ensure a strategic response, but recognise that a range of organisations in both the public and private sectors have a critical role to play. Some of the most immediate adaptation priorities fall to organisations responsible for planning and developing major infrastructure, such as river and coastal flood defences, transport networks, new buildings and reservoirs. Action in these sectors must be a priority because they work to long planning horizons and the infrastructure is

[84] *Health Effects of Climate Change in the UK*, 2001, Department of Health: www.doh.gov.uk/hef/airpol/climatechange/index.htm

designed to last for 30 to 50 years or more. Decisions taken over the next few years will determine how robust the UK's infrastructure is when faced with the expected changes to the climate, particularly extreme weather events. Adaptation in the UK therefore needs to be undertaken in a staged and prioritised way, with regular reviews of progress along the way.

5.15 Initial work has been undertaken to identify strategic adaptation priorities for the UK over the next 30 to 50 years. Water resource management; coastal and river flood defence; enhanced resilience of buildings and infrastructure; management of wildlife, forestry and agriculture; and co-ordinated approaches to planning were identified as key priorities for adaptation. The work also made a preliminary assessment of financial costs for options to address these issues, and suggested how no or low regrets action could be taken in the five priority areas.

5.16 The UK Government and the devolved administrations have already started to respond to the threat of climate change, building adaptation into many of their policies. Full details can be found at: www.defra.gov.uk/environment/climatechange/3nc The table below provides examples of some priority areas.

Priority areas for adaptation

Water resources

Climate change projections are taken into account in strategies and plans for water resource management, catchment abstraction management, and maintenance of supplies in drought conditions. Efficient use of water by households has been promoted through new Water Regulations, by water companies in England and Wales, through water bylaws by water authorities in Scotland, and through Government public information campaigns. Guidance has been provided to industrial water users and government departments on best practice and water conservation. The use of Sustainable Urban Drainage Systems has the potential to bring benefits in terms of water quality control, reduction in flood impacts and likely increase in groundwater recharge, and is therefore being encouraged.

Flood and coastal defence

Government issues guidance to flood defence operating authorities in England and Wales which includes allowances for sea level rise and higher river flows as a result of climate change. Climate change and sea level rise projections will also be considered in Shoreline Management Plans, Coastal Habitat Management Plans and River Catchment Flood Management Plans, which will be used to inform long-term policies on land use planning and coastal and river management. Investment has been made in improving flood warning services, increasing public awareness of flood risk, improving flood and coastal defence infrastructure, and promoting new high level targets for flood and coastal defence, aimed at reducing long term risk.

In Scotland, the Scottish Executive has published research on climate change impacts on flood risk on Scottish rivers and the coast so that local authorities, and others, may take account of climate change in developing appropriate measures. The Executive has also conducted research to consider *Potential Adaptation Strategies for Climate Change in Scotland*. This research, and subsequent consultation, will inform consideration of a climate change adaptation strategy for Scotland. Flood prevention and coastal protection will be part of that consideration. Additional resources have been made available for improvements to flood warning dissemination, flood prevention and coast protection infrastructure.

Building regulations

Climate change projections are being considered as part of the rolling programme of review of the Building Regulations in England and Wales, Scotland, and in Northern Ireland. This includes considering any revisions to the technical requirements that may be required to address climate change impacts.

Countryside and Biodiversity

Research has been undertaken into the effects of climate change on biodiversity and UK species and habitat conservation policy. Action has been taken to strengthen the protection and management of Sites of Special Scientific Interest (SSSIs), which will help the management of sites adjust to changing climatic conditions; and increased support has been given to agri-environment schemes which will help to maintain and enhance biodiversity in the wider countryside.

To raise awareness of climate change issues within the agricultural community, the Government produced a booklet on climate change and agriculture in April 2000. This urges farmers to start to anticipate a changing climate in their day-to-day and longer term planning decisions and provides advice on how to reduce emissions of greenhouse gases from agriculture. A project is also underway to establish a forum for liaison with key stakeholders on climate change impacts, assessing the industry's priorities for information, the value of existing information, and facilitating information provision.

The National Assembly for Wales' strategy, *Woodlands for Wales*, notes the uncertainties involved in predicting climate change and the consequent importance of building flexibility into forestry planning.

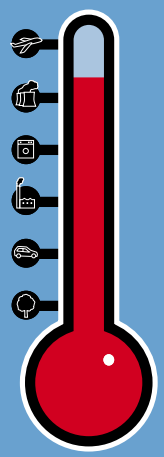
Land use planning

Following the widespread flooding in England and Wales in 2000, planning guidance on development in areas at risk of flooding has been strengthened to advise a precautionary and risk-based approach. This guidance will be reviewed three years after publication, in the light of increasing knowledge of the likely impacts of climate change and emerging experience of its implementation and effectiveness. Planning guidance in Scotland continues to be based on avoiding development where there is a significant risk of flooding, and managing the threat in other areas where the risk is less acute. The National Assembly for Wales is undertaking a full review of its land use planning policies, in partnership with local government, government agencies, business and the voluntary sector. The draft document, *Planning Policy Wales*, contains a new section on climate change and planning and new policy on flood risk and climate change. A final policy document is expected in early 2002.

A UK-wide guide is being developed to help those involved in land use planning focus on the role of planning in responding to climate change, including identifying measures that could be taken through the land use planning system to adapt to its effects.

6

Financial assistance and technology transfer



Key Developments

- The UK's development assistance programme is increasing. New and additional resources are available to deal with global environmental problems such as climate change. The UK intends to meet its share of the commitment made by donors in Bonn in July 2001.
- The UK is the fifth largest contributor to the Global Environment Facility (GEF) with a commitment of over £215 million since its inception. The UK supports a 50% increase in GEF resources for the third replenishment.
- Over £200 million was committed in the three year period 1997-1998 to 1999-2000 on climate change related activities through bilateral projects.
- The UK provides support on climate change related technology transfer through its multilateral activities and a range of different programmes.

New and additional financial resources

6.1 The UK's development programme is increasing. The UK in 2000 became the fourth largest donor to poor countries, with its highest ever spend on official development assistance as recorded by the Development Assistance Committee (DAC) of the OECD. DAC figures showed that UK development assistance rose to US$4.5 billion (£2.94 billion) in 2000 – a 40% rise from the previous year.

6.2 The International Development budget is set to continue to rise over the next three financial years to a total of almost £3.6 billion (approximately US$5.3 billion) for the financial year 2003-2004, representing about 0.33% of GNP.

6.3 Climate change is highlighted in the Government's Second White Paper on International Development, *Eliminating World Poverty: Making Globalisation Work for the Poor*[85], as a serious global environmental problem for the 21st Century. The White Paper outlines a number of areas where the Government will increase its efforts including support for an increase in resources for the third replenishment of the GEF, enhanced capacity building and greater integration into ongoing development efforts.

6.4 At the resumed Sixth Conference of the Parties in Bonn, many donors made a political declaration reaffirming their commitment to climate change funding for developing countries. The UK intends to meet its share of the US$410/€450 per year contribution by 2005.

6.5 There have been a number of new sources of funding for climate related activity, for example, the climate change challenge fund (see below), as well as scientific research and funding from the private sector.

Multilateral activities

6.6 The UK makes a major contribution to the aid programmes of the UN development agencies and other international financial institutions, funding projects in developing countries that are related to the implementation of the United Nations Framework Convention on Climate Change (see Annex C). The UK also provides significant resources to European Community programmes.

6.7 The UK believes that it is vital for developing countries to participate in the Convention and the Intergovernmental Panel on Climate Change (IPCC). The Government therefore makes an annual contribution to Convention and IPCC Trust Funds that enable developing country participants to attend meetings.

Global Environment Facility

6.8 The GEF finances the incremental costs to developing countries of protecting the global environment in four focal areas: climate change, biodiversity, depletion of the ozone layer and the pollution of international waters. It was recently agreed that the GEF would also become the financial mechanism for the Convention on Persistent Organic Pollutants. It supplements the funds provided for sustainable national development from national resources and by aid donors and international development agencies.

[85] This is available on: www.dfid.gov.uk

6.9 US$2 billion of new resources were agreed for the second replenishment of the GEF Trust Fund. The UK pledged an additional £2 million on top of its regular contribution, plus a further £4.25 million on condition that certain requirements were met. This brought total UK commitments to the GEF so far to over £215 million, making it the fifth largest contributor. The UK supports a significant (50%) increase in resources for the third replenishment of the GEF from 2002 to 2006. The negotiations on this replenishment are currently underway.

6.10 GEF supports projects through the three climate change operational programmes (removing barriers to energy efficiency and conservation, promoting the adoption of renewable energy and reducing the long-term costs of low greenhouse gas-emitting energy technologies). Climate change is an important element of the GEF capacity development initiative that aims to develop the institutional capacity of developing countries to implement the UNFCCC. GEF also provides support for initial and second national communications including inventories and national strategies, as well as assistance with capacity building for adaptation to the adverse effects of climate change. Total GEF commitments to projects in the climate change focal areas were valued at US$1.14 billion in December 2000.

Bilateral activities

6.11 The Government in 2000 looked at the volume of resources from the Department for International Development which contribute to dealing with climate change. Between 1997-1998 to 1999-2000, some 222 projects supported either emissions reduction or adaptation to the impacts of climate change. The value of climate change activities was estimated to be £201 million, out of a total commitment value for these projects of £685 million. 35 of the projects supported technology transfer while 151 assisted capacity building.

6.12 The climate change challenge fund was launched in 1999. It is operated by the Foreign and Commonwealth Office, aims to help developing countries move towards less carbon intensive economic growth and help UK expertise take advantage of the opportunities offered by the need for climate-friendly economic growth.

Emissions reduction

Energy Efficiency

6.13 The UK funds a number of energy efficiency and renewable energy projects overseas. The UK spent over £244 million in the financial years 1997-1998, 1998-1999 and 1999-2000 on bilateral aid projects, either wholly or partly concerned with energy efficiency and climate change (see Annex C).

6.14 Examples include:

- India – Andhra Pradesh Power Sector Restructuring Project. This involves energy efficiency improvements to the power sector leading to a reduction of the burden on government of Andhra Pradesh finances and the removal of a key constraint on economic growth;

- Micro Solar Lanterns – Development and Marketing. This is a five-year project to design, develop and market an affordable and reliable solar lantern for production in developing countries. The objective of the project is to improve the access that poor people have to good quality, affordable lighting. The project also aims to build the capacity of local companies to develop and invest in new products for rural mass markets.

Forestry

6.15 The Government promotes sustainable forest management in poorer countries, including support for research on forest issues. It has about 155 forestry projects underway, or in preparation, in 40 countries at a total cost of about £150 million. The UK participates in international efforts on forestry conservation (see Annex C).

Adaptation

6.16 The UK supports a number of projects through the international development programme which help developing countries adapt to the impacts of climate change. These projects include assessments of vulnerability to climate change, the evaluation of policy options for monitoring systems and response

strategies, the assessment of policy frameworks for implementing adaptation measures and response strategies in the context of coastal zone management, disaster preparedness, agriculture, fisheries and forests, and the building of national, regional and/or sub regional institutional capacity.

6.17 The Government is supporting a study to assess the extent to which climate change will impact on the ability of the international community to achieve the international development targets. This should help the UK and its partners to integrate consideration of impacts, adaptation issues and efforts to reduce greenhouse gas emissions into development policies.

6.18 The UK is undertaking a collaborative programme with India to assess the impacts of climate change in India. The project will develop national climate change and socio-economic scenarios and will assess the sectoral impacts of climate change on sea level variability, water resources, forests, agriculture, health, and energy, industry and transport infrastructure. The research will be carried out by scientists at Indian research institutions, will build on research previously undertaken, and provide a platform for future impacts and adaptation research.

6.19 The UK is also involved in a collaborative project with China on the impacts of climate change for agriculture in China. National climate change scenarios, based on selected IPCC SRES emission scenarios for the 2020s, 2050s and 2080s, and socio-economic scenarios relevant to agriculture for the 2020s and 2050s will be developed. The vulnerability and impacts assessment will focus on the overall effects of climate change on agriculture in China, including economic costs of damages and/or adaptation. The research will be carried out by local scientists and will also aim to build capacity through collaboration with UK experts and training of Chinese scientists at UK institutions during study visits.

Technology transfer

6.20 The UK provides support on climate change related technology transfer in a number of different ways. This is mainly through its multilateral activities, as mentioned elsewhere in this chapter, as well as a range of different programmes and funding undertaken by government departments and agencies. Some of the key elements are briefly described here. Further details of other Government activities are contained in the supporting material for this Communication which can be found at: www.defra.gov.uk/environment/climatechange/3nc

6.21 The UK Technology Partnership Initiative was launched in 1993. Through its information network, it aims to encourage the transfer of environmental technology and know-how to developing countries on a commercial basis. It facilitates access to UK sources of environmental technology and services, as well as providing regular information through a quarterly newsletter and case studies.

6.22 The UK launched the Climate Change Projects Office (CCPO) in May 2001 to facilitate and promote the UK's participation in Joint Implementation and Clean Development Mechanism projects (see chapter 3). It also aims to enhance the UK's ability to capitalise on other significant anticipated commercial climate change opportunities. The CCPO will develop and provide general advice, and signpost project developers to other sources of more specific assistance where appropriate. Over time, it is anticipated that the CCPO will act as Government to Government project broker internationally.

6.23 The UK has supported the development of the International Energy Agency's Greenhouse Gas Technology Information Exchange (GREENTIE) and will continue to participate in the practical implementation of this project. The database, which is available on CD-ROM and on the Internet, is intended to help developing countries to locate information on new technologies and identify equipment suppliers and centres of excellence.

6.24 The UK participates in the Climate Technology Initiative, that was launched by the OECD and International Energy Authority countries at the First Conference of Parties to the UNFCCC in Berlin in 1995. The mission of the Initiative is to promote the objectives of the Convention by speeding up development and dissemination of cost effective, environmentally friendly technologies, reducing barriers to the use of existing technology and encouraging the development of medium to long term technologies. The Initiative also works closely with the Secretariat to the UNFCCC with the aim of accelerating technology transfer.

6.25 The UK participates, as a member of the EU, in a wide range of European environmental programmes which have relevance to climate change and technology transfer.

Science

6.26 The UK is funding the development of a Portable Regional Climate Change Model through the Met Office's Hadley Centre for Climate Prediction and Research (see chapter 7) which will enable developing countries to generate their own national climate change scenarios for use in impact studies. This programme will provide training in the use of the modeling software and encourage further dialogue to enable developing country scientist and policy makers to use the results in making recommendations and decisions.

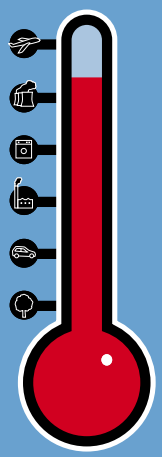
6.27 The Foreign and Commonwealth Office's Climate Change Challenge Fund is providing financial support for scientists from developing countries. For example, a student from Ghana was able to pursue an MSc at the University of East Anglia and a Chinese representative was able to take part in Working Group 1 of the IPCC's Third Assessment Report. The Government is also providing financial support for a student from South Africa who is studying the impact of climate change on South Africa's water resources at the Hadley Centre.

Financial Contribution to the Global Environment Facility and other Multilateral Institutions and Programmes

Institution or Programme	Contribution (millions of £ sterling)		
	1997-1998	**1998-1999**	**1999-2000**
Global Environment Facility	9.29	10.83	10.92
Multilateral institutions	189.63	170.86	166.71
1. World Bank	0.18	0.18	0.18
2. International Finance Corporation	17.18	19.19	16.76
3. African Development Bank	32.17	32.07	34.71
4. Asian Development Bank	5.99	8.19	10.26
5. European Bank for Reconstruction and Development	4.53	4.52	1.07
6. Inter-American Development Bank	22.60	30.85	36.71
7. United Nations Development Programme	4.50	4.50	4.49
8. United Nations Environment Programme	4.50	4.50	4.50
9. UNFCCC	0.47	0.69	0.70
10.World Meteorological Organisation	2.3	2.3	2.3

7

Research and Systematic Observation



Key Developments

- The Hadley Centre has developed its third generation atmosphere-ocean climate model which avoids the use of ocean flux corrections. It has shown that most of the climate warming of the past 50 years is due to human influence.
- Three Research Councils have formed the Tyndall Centre to undertake interdisciplinary research on climate change and to communicate results with industry and other stakeholders.
- The Natural Environment Research Council has instigated thematic research programmes covering clouds and water vapour, and processes in the upper troposphere and lower stratosphere. It has recently announced a new five year programme to investigate rapid climate change related to the North Atlantic Thermohaline Circulation.
- The UK agreed in 1999 to contribute to 5% of the Argo project that will monitor the temperature and salinity of the global ocean using an array of 3,000 autonomous profiling floats.
- The AATSR instrument, procured by the Government, is due to be carried on the European Space Agency's ENVISAT satellite later in 2001. It will continue the 10 year record of high accuracy sea surface temperature measurements begun by ATSR-1 in 1991 and continued by ATSR-2 in 1996.

Introduction

7.1 Climate research has a long history in the UK, and the Government continues to sponsor a wide range of research on climate change to improve our understanding of the climate system, the impacts of climate change on society and the human responses to climate change. The following paragraphs provide information about some of the UK's activities in this area.

General policy on and funding of research and systematic observation

7.2 Climate research and procurement of climate related observations are highly devolved activities in the UK. They are sponsored by various government departments in order for them to meet each of their responsibilities. The UK does not therefore have national plans for climate research and observations. Activities are co-ordinated through a high level committee (the Global Environmental Change Committee), chaired by the Chief Scientist of DEFRA. DEFRA has the lead on climate change policy and provide funds of about £12 million for climate research and observations to advise the UK's policy and its impacts and response strategies.

7.3 DTI funds work on new technologies and provides funding for the Research Councils. The Councils are responsible for maintaining the science base and operate at arms length from Government. They are responsible for basic research on climate prediction and processes and for some monitoring activities. The Met Office, as the national meteorological agency, also has a strong involvement in climate research and observation.

Policy driven research

Climate predictions programme

7.4 Along with the Ministry of Defence, DEFRA commissions research from the Met Office's Hadley Centre for Climate Prediction and Research[86]. The Hadley Centre monitors global and national climate trends, and develops state of the art ocean-atmosphere coupled climate models. It uses them to assess the natural causes of climate change and to provide long term global and regional projections.

7.5 An independent scientific review of the Hadley Centre's climate prediction work was carried out during 2000. The review assessed the merit of the scientific work carried out by the Hadley Centre, and wider questions about funding. It concluded that the Hadley Centre was "second to no other climate modelling centre world wide".

[86] More details can be found at: www.met-office.gov.uk/research/hadleycentre

7.6 Plans for future work aim to maintain the Hadley Centre's leading position amongst climate modelling centres by continually improving the model's ability to represent past and current climate, and to address policy relevant questions concerning future climate. Work will continue in detection and attribution, and in developing a finer resolution to improve regional climate predictions for impact studies. New work will aim to assign probabilities to future climate change regimes.

7.7 A portable regional climate model is being developed. This will be made available to developing countries who can run it on a fast personal computer to generate their own climate change scenarios for use in vulnerability and adaptation assessments.

The UK Climate Impacts Programme

7.8 The Government set up the UK Climate Impacts Programme in 1997 to encourage a wide range of stakeholders to be involved in the assessment of climate change impacts and adaptation in the UK. Further details can be found in chapter 5.

Global Impacts of Climate Change

7.9 DEFRA instigated a programme (Fastrack) to provide globally quantitative estimates of the impacts of climate change in five key sectors – ecosystems, water resources, agriculture, health and sea level rise – by bring together experts from these areas and the Hadley Centre. Work has been published and presented at several Conferences of the Parties to the UNFCCC.

Response strategies

7.10 Research is commissioned into the emissions inventory and options and costs of reducing greenhouse gas emissions. The results of this work are reflected in the UK's climate change programme. Details and applications of this work can be found in chapters 3 and 4, and the Annexes.

The Research Councils

7.11 The Research Councils are involved in climate change research to varying degrees.

7.12 The Natural Environment Research Council[87] (NERC) spent some 28% (£64 million) of its budget in 1999-2000 on 'Global Change' science in support of significant programmes of research linked to climate change. It focuses on understanding and predicting the environment, including its response to change. Its programmes include:

- understanding relevant processes in the atmosphere, the oceans and coastal zone, and the cryosphere;
- investigating the role of and impact on terrestrial processes, the nitrogen cycle, ocean circulation, ocean-atmosphere interactions, and terrestrial-atmosphere interactions; and
- understanding past climate change.

7.13 The Economic and Social Research Council's[88] (ESRC) Global Environmental Change Programme officially ended on 30 June 2000. The Programme was funded for 10 years, with a total spend of more than £15 million, supporting 150 research projects, fellowships and PhD studentships across the UK.

7.14 The Programme operated in parallel with the Centre for Social and Economic Research on the Global Environment (CSERGE), based jointly at the University of East Anglia and University College London. Global warming is one of the main themes of this Centre, which was recently awarded a further five years funding for research focusing on environmental decision-making.

7.15 The Engineering and Physical Sciences Research Council's[89] (EPSRC) has recently launched a £2 million programme on the impacts of climate change on the built environment, transport and utilities in collaboration with UKCIP. The Programme will focus on engineering solutions as part of adaptation strategies, while acknowledging that such adaptation

[87] More details can be found at: www.nerc.ac.uk
[88] More details can be found at: www.esrc.ac.uk
[89] More details can be found at: www.epsrc.ac.uk

strategies need to be consistent with UK strategies for economic, social and environmental sustainability. EPSRC also supports research across a spectrum of activities related to adapting to climate change and reducing emissions, including sustainable electricity generation and supply, the sustainable urban environment and water resource management.

7.16 Three of the Research Councils (NERC, ESRC and EPSRC) set up a new interdisciplinary centre for climate change research – the Tyndall Centre – in October 2000. The Tyndall Centre focuses on strategies to reduce emissions and adapt to the impacts of climate change. It brings together economists, environmental scientists, social scientists and engineers. The Centre works with business leaders, policy advisers, the media and the general public as well as the research community. The Research Councils will provide funding of up to £10 million over five years, with additional funding from DTI[90].

7.17 The Biotechnology and Biological Sciences Research Council[91] (BBSRC) supports research on the impact of climate change on the function and behaviour of plants, animals and microbes, and on soil processes. There are no specific programmes on climate change at present, but research and training in this area can be supported through responsive mode and through training schemes. In addition, two BBSRC sponsored Institutes have a particular interest in this area – the Institute of Arable Crops Research and the Institute of Grassland and Environmental Research. Both Institutes are involved in monitoring through their participation in the Environmental Change Network.

7.18 The Medical Research Council[92] (MRC) and NERC are currently running an initiative aimed at stimulating collaborative research into the human health impacts of the environment, including climate change. The Councils are specifically seeking proposals that bring the two research communities together in collaborative projects. Grants awarded under the initiative include a co-operative group at the London School of Hygiene and Tropical Medicine, focused on climate change, ozone depletion and human health.

[90] More details can be found at: www.tyndall.ac.uk
[91] More details can be found at: www.bbsrc.ac.uk
[92] More details can be found at: www.mrc.ac.uk

Other research in the UK

7.19 From its inception, the DTI's Foresight Programme has considered the implications of climate change for many sectors, and the possible consequences for the UK's competitiveness and quality of life in the longer term. The Programme brings together diverse interests to develop a view on actions that can be taken today to meet climate change challenges likely to arise well beyond normal commercial planning considerations. It has already stimulated a number of initiatives, particularly in the transport and energy fields.

7.20 DTI also has a Sustainable Energy Programme that focusses on R&D in renewable energy, with a budget of £55.5 million over this and the next two financial years.

7.21 The Carbon Trust is building its low carbon technologies' R&D portfolio, starting with R&D projects supported under the Government's Energy Efficiency Best Practice Programme which has been transferred to the Trust. To help deliver its innovation remit, the Trust is developing a large scale programme to support projects that will, or have the potential to, make a contribution to reducing greenhouse gas emissions. The programme will cover the full spectrum of low carbon projects, including renewables, from the early research through demonstration to production, infrastructure support, marketing of new technologies and achieving critical mass and, subsequently, increasing market penetration.

7.22 The Scottish Executive sponsors a research programme that looks at areas of particular interest to Scotland including regional impacts of climate change, and impacts of climate change on flooding and snowfall. The National Assembly for Wales is researching climate change indicators for Wales to evaluate those which could provide a local signal of effects.

7.23 The Forestry Commission has a significant capacity in forest and environmental modelling and prediction that includes the impacts of predicted climate scenarios on tree growth and physiology, validated against data from controlled environmental chambers and monitoring plots. Data and information on the methods will be made available via the Internet. This programme has recently been extended to hydrological modelling, an activity that will continue to increase in recognition of the major

interactions between forests and water resources in parts of the UK. The Forestry Commission is also researching the potential for adaptation within and between tree species.

7.24 Research into energy crops is co-ordinated through the Inter-departmental Group on Energy Crops, which includes the Forestry Commission and the Department of Agriculture and Rural Development in Northern Ireland. Both forestry authorities are actively involved in research into the use of biomass (short rotation coppice and forestry-derived wood-fuel) as renewable energy sources.

Participation in international research

7.25 The UK recognises the global scale of climate change and is committed to all of the major international research programmes including the World Climate Programme, the International Geosphere-Biosphere Programme, the International Human Dimensions Programme and the Global Climate Observing System.

Information exchange

7.26 In general, data for research is made available at little or no cost to other researchers. Climatic data gathered systematically by the UK is generally deposited with international data centres.

7.27 Provision has been made through DEFRA's LINK Programme, located at the University of East Anglia, to make the Hadley Centre's model data and observational data sets freely available to the research community in the UK and internationally. The LINK programme is designated as an IPCC Data Centre. UKCIP also provides guidance, tools and data freely to users to enable them to undertake impact assessments.

Capacity building

7.28 The UK has many links with developing countries in terms of research collaboration and training. In the past five years, eight scientists from developing countries and two from countries with economies in transition have worked at the Hadley Centre, which is, as mentioned above, developing a portable regional model, largely with developing countries in mind. DEFRA is also working with India and China on the impacts of climate change in these countries (see chapter 6).

7.29 The Foreign and Commonwealth Office established its Climate Change Challenge Fund (CCCF) in 1999 to help developing countries and economies in transition to move towards less carbon intensive economic growth, in the context of the UK's wider objective to promote sustainable growth world-wide. Since its conception, the CCCF has distributed £1.7 million to a wide variety of projects globally. An example of this is the Wind Energy Resource Mapping Project in Botswana. The provision of energy is a key stimulant to economic growth and the project provides a blueprint for doing so using renewable, low carbon technology. The actual construction of turbines is not a part of the project, but the results will allow the exploitation of the wind resource in the future. An advantage of carrying out the study across the whole country is that it includes rural areas, so new technologies that are often ideally suited to such conditions can be deployed in rural areas, starting the shift from a subsistence to an enterprise based economy.

Research achievements and developments

7.30 The Hadley Centre has made a number of significant advances in climate modelling, being the first to avoid the need for flux corrections in the model ocean and undertake historic simulations. These have allowed the Hadley Centre to make the detailed assessments of the likely contribution of human activities to climate change that have featured prominently in the IPCC's Third Assessment Report. Development of interactive carbon cycle modelling has revealed the potential risks that warming has for the carbon balance of the biosphere, with threats to major ecosystems such as the Amazonian Rain Forest, and the possibility that the terrestrial carbon sink could change into a source around the middle of the century. The UK and the Norwegian Governments have initiated a significant programme of research – to be developed by the NERC, the Scottish Executive and the Hadley Centre – to investigate in more depth the risks to the North Atlantic Circulation posed by climate change.

7.31 UKCIP has set up a new approach to stakeholder involvement in impact and adaptation assessment which is being emulated by others (see chapter 5).

7.32 Research sponsored by the NERC has provided additional evidence for rapid climate change in the Holocene and for the natural variability of climate over longer timescales. Analysis of sediment cores by the British Antarctic Survey shows that a small ice shelf in Prince Gustav Channel retreated at the start of an earlier period, about 5000 – 2000 years ago, when other evidence suggests that there was a warming of the Antarctic Peninsula. This ice shelf re-formed and has been present and stable for the last 1900 years until 1995, when it collapsed completely, along with parts of the adjacent northern Larsen Ice Shelf.

7.33 Research carried out at Imperial College and Southampton Oceanography Centre has provided the first quantitative information on long term variations in atmospheric carbon dioxide levels. It shows that carbon dioxide concentrations remained relatively constant over the past 25 million years, with the exception of two periods of low carbon dioxide that coincided with large expansions in the polar ice sheets. Collectively, these studies demonstrate the complexity of the relationship between the size of the polar ice sheets and atmospheric carbon dioxide levels, and provide information on the long term, natural variability of the global climate.

Systematic observation

7.34 Many agencies in the UK engage in the systematic observation of elements of the climate system. The Met Office is the lead agency for most meteorological and atmospheric observations with significant contributions from other agencies. Responsibility for oceanographic and terrestrial observing systems is widely distributed, involving a mixture of Government agencies and research laboratories, academic institutions and commercial companies.

7.35 The UK has a comprehensive observational coverage of its own territories and contributes to the overall network through stations on its overseas territories. It contributes significantly to shared programmes involving ocean and space based measurements. It has the longest instrumental temperature record in the world and pays considerable attention to quality control, data archiving, and rescue of historic data both in the UK and elsewhere. It also provides the global database for sea levels.

7.36 The tables below summarise the contribution of the UK to systematic observation to meet the needs for meteorological, atmospheric, oceanographic and terrestrial observations of the climate system as identified by the Global Climate Observing System (GCOS) and its partner programmes. Further details can be found in the UK's GCOS report at: www.defra.gov.uk/environment/climatechange/3nc

7.37 National networks not designated as contributing to GCOS include 20 Core Climatological stations, 20 Surface Sunshine and Radiation stations, six Upper Air Network Stations, three Total Ozone Column stations and two Surface Spectral Ultraviolet Radiation stations that report their data to international data centres. In addition there is a network of 112 automated air pollution stations measuring surface concentrations of ozone, nitrogen oxides, carbon monoxide, sulphur dioxide, particulates and hydrocarbons. The Hadley Centre hosts a number of climate data sets that are listed below.

Participation in the global atmospheric monitoring systems

	GSN	GUAN	GAW	Other
How many stations are the responsibility of the Party?	9	6+	3++	163
How many of those are operating now?	9	6	3	163
How many of those are operating to GCOS standards now?	8	4	3	0
How many are expected to be operating in 2005?	9	6	3	163
How many are providing data to international data centres now?	9	6	3	45

\+ In addition, financial contributions are provided in support of 4 foreign GUAN stations.
++ In addition, financial contributions are provided in support of the Global GAW station at Mace Head, Republic of Ireland.

Available homogeneous data sets for meteorological observations

Data Set Name	Climate Parameters	Stations or Grid Resolution and Region covered	Time Period
CET	Central England temperature	Central England	1659 to present
HadEWP	Rainfall	England and Wales	1766 to present
HadCRUG	Global temperature	Global	1856 to present
GISST	Sea surface temperature and sea-ice	Global	1871 to present
GMSLP	Sea level pressure	Global	1949 to 1994
MOHMATN	Nighttime marine air temperature	Global	1856 to present
MOHSST	Sea surface temperature	Global	1856 to present

Participation in the global oceanographic observing systems

	VOS	SOOP	TIDE GAUGES (GLOSS)	SFC DRIFTERS (DBCP)	SUB-SFC FLOATS	MOORED BUOYS	ASAP
For how many platforms is the Party responsible?	552	14	13	51	11	15+	2
How many are providing data to international data centres?	552++	14	10	37	11	14+,+++	2
How many are expected to be operating in 2005?	<550	14	10	≥25	150-200	15+	2

\+ 2 buoys operated jointly with Météo-France
++ The number of VOS providing data at any one time will vary according to a variety of factors e.g. ship trading patterns, ship crewing arrangements etc.
+++ One buoy (K7) has recently been lost and is not reporting

7.38 The UK hosts the Permanent Service for Mean Sea Level (PSMSL) at the Proudman Oceanographic Laboratory. The PSMSL was established in 1933, and is the global data bank for long term sea level change information from tide gauges, containing data from over 1,800 tide gauge stations around the world.

7.39 The UK's National Marine Monitoring Programme (NMMP) was initiated in the late 1980s to co-ordinate marine monitoring in the UK between a number of organisations. The NMMP aims to detect long-term trends in the quality of the marine environment, to ensure consistent standards in monitoring, to establish appropriate protective regulatory measures, to co-ordinate and optimise marine monitoring in the

Participation in the global terrestrial observing systems

	GTN-P	GTN-G	FLUXNET	Other
How many sites are the responsibility of the Party?			3	54
How many of those are operating now?			1	54
How many are providing data to international data centres now?			1	54
How many are expected to be operating in 2005?			3	54

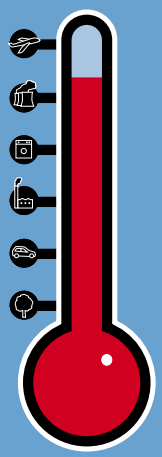
UK, and to provide a high quality key data set for key variables. DEFRA is a major founder of the NMMP which involves the Centre for Environment, Fisheries and Aquaculture Science, the Fisheries Research Service, the Department of Agriculture and Rural Development in Northern Ireland, the Environment Agency and the Scottish Environment Protection Agency. The UK also undertakes routine hydrographic surveys between Faeroes and Shetland, the Ellett Line between the west coast of Scotland and Rockall, in the Antarctic Drake Passage and, in conjunction with Norway, the North Sea JONSIS section. The north east Atlantic surveys maintain continuous records stretching back over a century.

7.40 The UK has contributed to data quality/archiving procedures in FLUXNET and provided software to log and re-process eddy covariance data that is in use in about 45 FLUXNET sites worldwide.

7.41 The UK maintains an Environmental Change Network (ECN) of 12 terrestrial and 42 freshwater sites throughout the UK, sponsored by a consortium of 15 UK government departments and agencies. ECN encompasses the spirit of the entire GCOS/GOOS/GTOS climate monitoring principles and relevant best practices, and is one of the leading national terrestrial observing networks in the world. All data are maintained and disseminated through a central database at the Centre for Ecology and Hydrology. The ECN provides metadata about its sites and measurements to the GTOS-TEMS meta-database.

8

Education, training and public awareness



Key Developments

- Programmes to raise the public's awareness of climate change issues have been greatly expanded.
- Climate change issues are included throughout the UK's education system, often under the wider banner of sustainable development. A range of specific initiatives are being taken forward in partnership with other organisations.
- The Government and the devolved administrations are developing and funding major public information campaigns on climate change and other environmental issues. More effective product information, advice, guidance and training is also being provided for consumers and organisations, in partnership with other groups.

Introduction

8.1 The Government and the devolved administrations believe that education, awareness and training at all levels is an important element of action on climate change. They continue to develop and expand programmes in these areas, working in partnership with other Government agencies, professional and educational bodies and the private sector.

Education

8.2 Much of the work relating to the education of children and young people in England about climate change is being taken forward under the wider banner of sustainable development. The Sustainable Development Education Panel was set up in 1998. The Panel is made up of sustainable development education experts and its role is to advise on gaps, opportunities, priorities and partnerships for action in providing sustainable development education in England, and to highlight good practice. In its first Annual Report[93], the Panel put forward a 10-year plan with various goals for central and local government, schools, youth services, further and higher education, the professions, the workplace, and the general public. The Panel's aim is to ensure a better understanding of sustainable development within each sector.

8.3 The revised Schools National Curriculum for England and the curriculum for Wales[94], which came into effect in September 2000, provides many opportunities for children between the ages of five and 14 to learn about climate change, its causes and its effects:

- in science, pupils learn about the benefits and drawbacks of scientific and technological developments on the environment, health and quality of life. They learn how the impact of humans on the environment depends on social and economic factors, including industrial processes and levels of consumption and waste;
- in geography, pupils learn why weather and climate vary, the reasons for environmental change including, for example, deforestation, the water cycle and ecosystems, the effects of resource use on the environment, and how the environment may be improved and sustained, for example, by reducing the number of cars and car based trips;
- in studying geography in Wales, the theme of climate is introduced at primary school level and is developed with greater focus, together with the theme of ecosystems, at secondary school level. There, pupils should be taught to understand how changes in geographical patterns and processes affect people's lives, their attitudes and their values (including their own), and how they impact upon the quality of life of present and future generations. The programme of study also requires pupils to be taught about global environmental change, and in particular, about the nature, possible consequences and potential effects, and how considerations of sustainable development affect international responses to the change;
- in citizenship in England, pupils learn about global interdependence and responsibility, and consider topical political, moral, social issues, problems and events; and

[93] Copies of the Panel's reports, plus other papers can be found at: www.defra.gov.uk/environment/sustainable/educpanel/index.htm
[94] Details can be found at: www.qca.org.uk/ca/5-14/gen5_14.asp In Wales: www.accac.org.uk

- in personal and social education (PSE) in Wales, pupils learn about how environmental issues affect the future quality of life. They are helped to understand the principles of stewardship and sustainability and to develop an informed concern for and responsible use of the environment. PSE also aims to empower pupils to develop a global perspective, and to encourage positive attitudes and behaviours towards the environment and the principles of sustainable development locally, nationally and globally.

8.4 Sustainable development education is included throughout the curriculum, and pupils are encouraged to develop the knowledge, skills, understanding and values to enable them to participate in decisions including those taken individually, collectively, locally and globally, that will improve the quality of life now without damaging the planet for the future. The Government is developing web-based support material[95] to assist teachers across England to fulfil their enhanced responsibilities to cover sustainable development.

8.5 There is no statutory national curriculum in Scotland. Responsibility for the management and delivery of the curriculum belongs to education authorities and headteachers or, in the case of independent schools, the boards of governors and headteachers. However, broad guidance and advice is produced by the Scottish Executive Education Department and Learning and Teaching Scotland. The importance of education for sustainable development is set out in guidance to education authorities and schools for every stage of the school curriculum. With particular reference to climate change, national guidelines for the 5-14 curriculum stress the importance of pupils delivering appropriate knowledge and understanding of issues related to weather and climate. The guidelines also include, as an example of good practice, an initiative by pupils to gather information on weather and climate, both nationally and internationally, through establishing e-mail contacts with schools in other countries.

8.6 The Government runs an interactive website for children and young people between seven and sixteen which explains the causes of climate change, why it is causing concern and what they can do to help reduce emissions[96]. An information pack is also available for children between seven and eleven years old. The pack includes activities that children can do at home and at school, games and a poster. It is available through the website.

8.7 Environmental Campaigns Limited (formerly known as Going for Green)[97] is a close partner of the Government in running a number of campaigns and programmes, many of which are aimed at schools and young people:

- Green Code Programme for Schools introduces school communities to the issues surrounding sustainable development, including the need to save energy;

- Eco Schools Award Scheme (www.eco-schools.org.uk) is part of a European wide structured programme to encourage and acknowledge school action for the environment, including energy management;

- Planet Pledge (www.planetpledge.co.uk) encourages individuals, families and businesses to pledge to make specific lifestyle changes for the good of the future environment.

8.8 Under the Environmental Action Fund, the Government funds the Atmospheric Research and Information Centre (ARIC) at Manchester University[98]. ARIC is helping to meet the Government's environmental objectives by providing information to schools and others, and by helping to promote public awareness about atmospheric pollution. The Atmosphere, Climate & Environment Information Programme provides information on key air pollution and sustainability objectives, the UK's Sustainable Development Strategy, the UK's climate change programme and the Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

8.9 The Government and the devolved administrations are keen for schools to adopt a 'whole school approach' to energy efficiency, incorporating both sound energy management and the education of pupils and through them, the wider community. The National Curriculum is supported by a range of other projects aimed at schools, some of which are funded by Government and some which involve private sector companies working in partnership. An example is the School*Energy* programme[99], run by the Energy Saving Trust with a major gas supplier in

[95] Details can be found at: www.nc.uk.net/esd/
[96] The website can be found at: www.defra.gov.uk/schools/index.htm
[97] See: www.tidybritain.org.uk/tbg/pages/programmes/programmes.eduction.asp
[98] Details can be found at: www.doc.mmu.ac.uk/aric/
[99] See the following website for more details: www.schoolenergy.org.uk

the UK. The programme offers schools rebates on energy efficiency measures and curriculum pack for use in the classroom. Since the programme started in 1996, over 1,400 schools have benefited. The Energy Efficiency Best Practice Programme also promotes the whole school approach through its work, providing advice on energy efficiency measures for school buildings supported by material for the classroom. The Centre for Research Education and Training in Energy (CREATE), which is partly funded by the Government, plays a key role in raising awareness in schools about the need to save energy and managing and delivering energy education projects.

Public information campaigns

8.10 The Government and the devolved administrations believe strongly that action by individuals is important, whether at home, at work or in making transport decisions. Within the UK, however, research has shown that people are not generally aware of the collective impact of their individual actions on the environment. In particular, many do not know about the link between their use of energy in their homes or in their cars, and climate change. The challenges for publicity campaigns are to help people to make this link and to motivate them to take action to reduce emissions.

8.11 The 'are you doing your bit?' publicity campaign was launched in 1998 with the aim of motivating people to take action to benefit their local and global environment by making small but important behavioural changes in their everyday lives. Campaign messages are promoted through the media and PR promotions – including TV and radio adverts, press advertising, high profile promotions in national media, poster sites, and a mobile exhibition which visits major venues around England. Campaign literature, posters, the website (www.doingyourbit.org.uk) and the interactive waste website (www.useitagain.org.uk), are used to help disseminate the campaign's messages and support promotional activity.

8.12 The campaign's branding, media presence, promotional activity and literature help to reinforce the environmental activities of campaign partners which include environmental organisations, local authorities, and businesses. Public participation is also crucial in directing the campaign. Independent research is commissioned to look at the awareness, motivation and actions of individuals to measure the campaign's impact and inform its strategic approach. Recent research reveals high levels of campaign recognition and shows that people are becoming increasingly aware of the environmental impact of their actions.

8.13 While 'are you doing your bit?' focuses on the simple actions that people can take and the links to climate change, the Energy Saving Trust's 'energy efficiency' campaign[100] aims to increase consumers' take-up of energy efficiency products and services by:

- heightening consumers' awareness that energy efficiency puts money in their pocket; and
- ensuring that energy efficiency products, services and home improvements are high quality and can be purchased easily and with confidence.

8.14 The campaign's messages are promoted through advertising and PR, supported by grants and other incentives, to motivate people to invest in energy efficiency measures. The initial focus concentrated on saving money and energy as a personal motivator. This has been changed to reflect closer links with the 'are you doing your bit?' campaign and energy efficiency is now presented as a decision people cannot afford to ignore, with the emphasis on both financial and environmental benefits.

8.15 The Scottish Executive has developed an environmental awareness campaign around the slogan, 'do a little: change a lot'. The campaign is designed to demonstrate how, collectively, small actions can make a big difference to improve the environment. The campaign uses a butterfly logo to represent the beauty and fragility of Scotland's environment and will be used extensively by the Executive and its partners to persuade people to do a little to change a lot.

8.16 The Executive has also developed a travel awareness programme in Scotland called 'Learn to Let Go' that was launched in June 2001. The aim of the campaign is to increase the number of journeys

[100] More details can be found at: www.est.org.uk/ee/index.html

by walking, cycling and public transport and to encourage more sustainable use of the car. 'Learn to Let Go' does this by reminding people that most of them do have an alternative for some of their journeys, particularly those into town or city centres. Like 'are you doing your bit?', the campaign has used customer research to help design and inform the creative and strategic work. Media used has been chosen to target car drivers, especially when in their cars, and a roadshow and website supplement the advertising[101]. A similar campaign to address environmental issues is due to be launched by the Executive later in 2001.

Consumer information

8.17 The Government wants to see better product information being made available to consumers to help them make informed choices about environmental issues. The Advisory Committee on Consumer Products and the Environment was set up in 1999 to consider ways of reducing the environmental impacts associated with products, and it has examined the use of consumer labelling on on-line information for purchasers. Its first report[102] recommended introducing a 'family' of graded labels for cars, home and domestic goods, based on the design of the EU energy label. The Government is actively exploring this idea, which has the appeal of offering a standard form of presentation about energy efficiency that could cover up to 90% of households' carbon dioxide emissions. Feasibility work is under way on another important recommendation from the Committee to set up an internet information service about the effects of consumer products and the opportunities for choosing less damaging product options. This service would help to steer consumers towards products with good energy efficiency performance and those that meet high environmental standards, such as those of the EU ecolabel scheme.

8.18 The Standard Assessment Procedure (SAP) is the Government's standard for home energy rating, and helps enable consumers to make comparisons between dwellings. SAP ratings provide a simple but relaible indicator of the efficiency of energy use for space and water heating in new and existing dwellings, and are expressed on a scale of 1 (poor) to 100 (excellent). This scale may be changed to a maximum of 120 when proposed revisions to the SAP, known as SAP 2001, are agreed and published shortly.

8.19 The SAP methodology can be used to calculate carbon dioxide emissions and units of energy used. The SAP takes into account only those aspects of a dwelling which are fixed, such as the heating system, controls, insulation levels, and double glazing, and is not affected by occupancy patterns, the use of domestic appliances, individual heating patterns, or regional weather variations. SAP ratings are delivered by four independent, Government authorised organisations: Elmhurst Energy Services; MVM Starpoint; National Energy Services and ThermaCheck. To achieve this status, organisations are required to have their SAP software checked and approved by the Building Research Establishment, on behalf of the DEFRA. In addition, their systems and procedures for issuing SAP ratings must meet the standards of BS EN ISO 9002 for Quality Assurance against the DEFRA's quality statement for SAP.

Information for organisations

8.20 The Government and the devolved administrations believe that it is vitally important to provide businesses, local government and other organisations with advice, information and guidance about climate change issues. Details of the Energy Efficiency Best Practice Programme, now being managed by the Carbon Trust, can be found chapter 3. The Institute of Energy is another key organisation that is helping to promote, develop and provide training and education for the workplace, in collaboration with the Government, industry, trade unions and academic institutions. It will also work closely with the Carbon Trust in developing and taking forward its training strategy.

8.21 The Scottish Energy Efficiency Office (SEEO), which is part of the Scottish Executive, offers a one-stop shop approach to delivering essential energy and environmental services to small and medium sized companies throughout Scotland. The SEEO aims to

[101] See: www.learntoletgo.org.uk
[102] *Choosing Green,* October 2000: www.defra.gov.uk/environment/consumerprod/accpe/report01/index.htm

offer fast and effective solutions to operational problems encountered by companies regardless of location, sector or role. Routes to impartial and confidential professional services can be provided to companies, including support to improve overall financial and environmental performance. The SEEO funds the activities of the Carbon Trust, the Energy Efficiency Best Practice Programme and the Energy Saving Trust in Scotland.

8.22 Organisations need to measure their impact if they are to develop viable climate change strategies. To help them do this, the Government has published guidelines[103] on how to measure and report publicly on greenhouse gas emissions. The guidelines allow organisations in all sectors to report publicly to a common standard and to demonstrate their commitment to action. The Government has published similar guidance on waste and water, and will publish general guidance on environmental reporting later in 2001. The guidelines back up the Prime Minister's challenge to the top 350 UK companies to report on environmental performance by the end of 2001. It is hoped that public reporting will encourage companies to set challenging targets for reducing emissions.

8.23 The Government and local government organisations have been working in partnership to develop advice and information for local government. The Councils for Climate Protection scheme is working with a number of local authorities to help them develop climate change strategies for their areas[104]. The Government and the devolved administrations have also issued guidance[105] to all chief executives of local authorities which aims to raise awareness of climate change issues at the highest level within local authorities. It asks chief executives to consider what more their authority can do to help reduce emissions and adapt to the impacts of climate change.

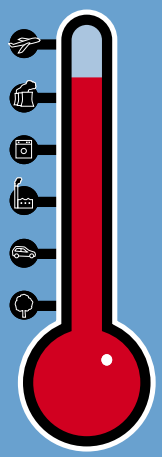
Resource and information centres

8.24 The Energy Saving Trust provides free impartial advice to householders and small organisations through 52 energy efficiency advice centres. The main tool for encouraging action has been the DIY Home Energy Check, which is analysed by computer with a personalised report provided to the customer. To date, the network of advice centres has advised over 900,000 customers and saved nearly 80,000 tonnes of carbon. The network can be contacted on 0800 512 012.

8.25 The Energy Saving Trust also funds an Energy Efficiency Helpline which gives advice to people on how to save energy. The telephone number is 0345 277 200 and the website address is: www.saveenergy.co.uk

[103] The guidelines can be found at: www.defra.gov.uk/environment/envrp/gas/03.htm
[104] More details of the scheme can be found at: www.idea.gov.uk/climate
[105] This can be found at: www.defra.gov.uk/environment/climatechange/laceoguide/index.htm

ANNEXES



Summary Report for National Greenhouse Gas Inventories (IPCC Table 7A), 1990

Greenhouse Gas Source and Sink Categories	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals a	**602,826**	**–10,556**	**3,670.3**	**216**	**41.77**	**11,373.84**	**250.18**	**2,281.00**	**0.11**	**0.03**	**2,759**	**7,154**	**2,479**	**3,754**
1. Energy	**568,692**		**1,480.0**	**17.62**							**2,732.1**	**6,479.1**	**1,520.0**	**3,720.0**
A. Fuel Combustion Reference Approach	572,762													
Sectoral Approach	556,554		119.8	17.31							2,726.1	6,408.0	1,072.7	3,683.2
1. Energy Industries	228,089		7.6	7.22							883.4	142.5	10.9	2,917.3
2. Manufacturing Industries and Construction	94,578		11.7	3.79							278.7	511.7	30.1	463.3
3. Transport	116,581		29.8	4.14							1,389.1	5,254.9	927.9	90.1
4. Other Sectors	112,041		70.4	1.95							139.4	485.5	101.5	203.2
5. Other b	5,265		0.3	0.21							35.5	13.4	2.2	9.2
B. Fugitive Emissions from Fuels	12,138		1,360.2	0.30							6.0	71.1	447.3	36.9
1. Solid Fuels	3,000		819.2	0.00							0.7	36.6	0.2	20.6
2. Oil and Natural Gas	9,138		541.0	0.30							5.3	34.5	447.1	16.2
2. Industrial Processes	**14,123**		**2.7**	**94.46**	**41.77**	**11373.84**	**250.18**	**2281.00**	**0.11**	**0.03**	**12.5**	**405.2**	**228.4**	**29.7**
A. Mineral Products	9,555		0.0	0.00							0.0	0.0	9.8	0.0
B. Chemical Industry	1,358		1.9	94.42	0.00	0.00	0.00	0.00	0.00	0.00	8.1	61.1	145.2	23.0
C. Metal Production	3,210		0.8	0.04				2,031.00		0.02	4.4	344.1	1.8	6.8
D. Other Production	1E										0.0	0.0	0.0	0.0
E. Production of Halocarbons and SF_6						11,373.17		0.00		0.00				
F. Consumption of Halocarbons and SF_6					41.77	0.67	250.18	250.00	0.11	0.01				
G. Other	0		0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
3. Solvent and Other Product Use d	**0**			**0.00**									**684.1**	
4. Agriculture	0		**1,037.2**	**100.43**							9.1	266.0	35.0	
A. Enteric Fermentation			913.2	0.00									0.0	
B. Manure Management			111.3	5.11									0.0	
C. Rice Cultivation			0.0	0.00									0.0	
D. Agricultural Soils			0.0	95.07									0.0	
E. Prescribed Burning of Savannas			0.0	0.00							0.0	0.0	0.0	
F. Field Burning of Agricultural Residues			12.7	0.25							9.1	266.0	35.0	
G. Other			0.0	0.00							0.0	0.0	0.0	

Summary Report for National Greenhouse Gas Inventories (IPCC Table 7A), 1990 *(continued)*

Greenhouse Gas Source and Sink Categories		CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF6		NO_x	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)						(Gg)			
5. Land-Use Change and Forestry	a	**19,348**	**–10,556**												
A. Changes in Forest and Other Woody Biomass Stocks	f		–9,456												
B. Forest and Grassland Conversion		0													
C. Abandonment of Managed Lands		0	0												
D. CO_2 Emissions and Removals from Soil		15,439	0												
E. Other	hi	3,908	–1,100												
6. Waste		**663**		**1,150.4**	**3.47**							**5.1**	**3.3**	**11.3**	**4.6**
A. Solid Waste Disposal on Land		0		1,117.0	0.00							0.0	0.0	11.2	0.0
B. Wastewater Handling	j	0		33.4	3.33							0.0	0.0	0.0	0.0
C. Waste Incineration		663		0.0	0.13							5.1	3.3	0.1	4.6
D. Other		0		0.0	0.00							0.0	0.0	0.0	0.0
7. Other (please specify)		**0**	**0**	**0.0**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Memo Items: (7)															
International Bunkers	k	**21,349**		**3.5**	**0.87**							**192.4**	**75.6**	**41.3**	**95.3**
Aviation	k	14,791		2.9	0.45							72.8	60.1	36.9	2.8
Marine	k	6,559		0.6	0.42							119.6	15.5	4.4	92.5
Multilateral Operations		NO		NO	NO							NO	NO	NO	NO
CO_2 Emissions from Biomass	kl	3,850													

Summary Report for National Greenhouse Gas Inventories (IPCC Table 7A), 1999

Greenhouse Gas Source and Sink Categories	CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
	(Gg)				CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals a	**547,800**	**–11,539**	**2,630.8**	**138**	**9,653.09**	**6,205.55**	**541.23**	**678.19**	**0.11**	**0.05**	**1,602**	**4,757**	**1,565**	**1,187**
1. Energy	**518,049**		**874.2**	**27.55**							**1,594.5**	**4,305.1**	**920.1**	**1,165.9**
A. Fuel Combustion Reference Approach	541,095													
Sectoral Approach	509,917		108.6	27.35							1,590.5	4,263.7	598.0	1,160.4
1. Energy Industries	179,116		32.8	7.80							422.2	94.4	10.3	883.4
2. Manufacturing Industries and Construction	88,668		12.0	3.31							225.2	476.0	29.2	159.1
3. Transport	121,576		18.4	14.68							784.5	3312.4	477.6	33.6
4. Other Sectors	117,427		45.2	1.43							135.7	373.0	79.4	78.0
5. Other b	3,136		0.2	0.13							22.9	7.9	1.3	6.3
B. Fugitive Emissions from Fuels	8,132		765.6	0.20							4.0	41.4	322.1	5.5
1. Solid Fuels	2,242		310.9	0.00							0.4	27.4	0.1	0.8
2. Oil and Natural Gas	5,891		454.7	0.20							3.6	14.0	321.9	4.7
2. Industrial Processes	**13,480**		**2.6**	**11.79**	**9653.09**	**6205.55**	**541.23**	**678.19**	**0.11**	**0.05**	**6.0**	**448.5**	**165.8**	**20.3**
A. Mineral Products	9,136		0.0	0.00							0.0	0.0	7.7	0.0
B. Chemical Industry	1,108		1.9	11.76	0.00	0.00	0.00	0.00	0.00	0.00	2.3	78.8	77.5	14.4
C. Metal Production	3,237		0.7	0.03				209.87		0.03	3.7	369.7	1.7	5.9
D. Other Production	1E										0.0	0.0	78.9	0.0
E. Production of Halocarbons and SF_6						1,926.5		0.00		0.00				
F. Consumption of Halocarbons and SF_6 c					9,653.09	4,279.04	541.23	468.32	0.11	0.02				
G. Other	0		0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
3. Solvent and Other Product Use d	**0**			**0.00**									**471.6**	
4. Agriculture	**0**		**1,001.8**	**95.40**							**0.0**	**0.0**	**0.0**	
A. Enteric Fermentation			892.4	0.00									0.0	
B. Manure Management			109.5	5.15									0.0	
C. Rice Cultivation			0.0	0.00									0.0	
D. Agricultural Soils			0.0	90.25									0.0	
E. Prescribed Burning of Savannas			0.0	0.00							NO	NO	NO	
F. Field Burning of Agricultural Residues			0.0	0.00							0.0	0.0	0.0	
G. Other			0.0	0.00							0.0	0.0	0.0	

Summary Report for National Greenhouse Gas Inventories (IPCC Table 7A), 1999 *(continued)*

Greenhouse Gas Source and Sink Categories		CO_2 emissions	CO_2 removals	CH_4	N_2O	HFCs		PFCs		SF6		NO_x	CO	NMVOC	SO_2
						P	A	P	A	P	A				
		(Gg)				CO_2 equivalent (Gg)						(Gg)			
5. Land-Use Change and Forestry	a	**16,271**	**–11,539**												
A. Changes in Forest and Other Woody Biomass Stocks	f		–10,439												
B. Forest and Grassland Conversion		0													
C. Abandonment of Managed Lands		0	0												
D. CO_2 Emissions and Removals from Soil		12,663	0												
E. Other	hi	3,608	–1,100												
6. Waste		**0**		**752.1**	**3.62**							**1.1**	**3.7**	**7.3**	**0.8**
A. Solid Waste Disposal on Land		0		716.0	0.00							0.0	0.0	7.2	0.0
B. Wastewater Handling	j	0		36.0	3.45							0.0	0.0	0.0	0.0
C. Waste Incineration		0		0.1	0.17							1.1	3.7	0.2	0.8
D. Other		0		0.0	0.00							0.0	0.0	0.0	0.0
7. Other (please specify)		**0**	**0**	**0.0**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Memo Items: (7)															
International Bunkers	k	**31,896**		**4.9**	**1.19**							**243.1**	**110.5**	**62.5**	**89.5**
Aviation	k	25,539		4.3	0.79							127.3	95.4	58.2	6.5
Marine	k	6,357		0.6	0.41							115.9	15.0	4.3	83.1
Multilateral Operations		NO		NO	NO							NO	NO	NO	NO
CO_2 Emissions from Biomass	kl	7000													

Footnotes
a) Net flux may be estimated as the sum of emissions and removals
b) Naval vessels and military aircraft
c) Emissions arise from refrigeration, electronics applications, electrical insulation, foams, aerosols and training shoes
d) The CO_2 equivalent of solvent NMVOC (excluding 3C) is 1644 Gg in 1990 and 1136 Gg in 1999
e) Field burning ceased in 1993
f) 5A Removals include removals to forest litter and to forest products
g) 5D Emissions include removals to soils due to set aside of arable land and emissions due to liming
h) 5E Emissions include emissions from soils due to upland drainage, lowland drainage and peat extraction
i) 5E Removals are increases in crop biomass
j) Emissions from own wastewater treatment by industry are not estimated
k) Emissions are for information only and are not totalled
l) Emissions arise from wood, straw, biogases and poultry litter combustion for energy production

Summary Report for CO_2 Equivalent Emissions, 1990

Greenhouse gas source and sink	CO_2[1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Categories	CO_2 equivalent (Gg)						
Total (Net Emissions)[1]	**592,270.11**	**77,075.47**	**66,948.88**	**11,373.84**	**2,281.00**	**724.17**	**750,673.47**
1. Energy	**568,692.17**	**31,079.62**	**5,460.79**				**605,232.58**
A. Fuel Combustion (Sectoral Approach)	556,554.16	2,515.22	5,367.23				564,436.61
1. Energy Industries	228,089.43	160.65	2,238.27				230,488.35
2. Manufacturing Industries and Construction	94,577.95	245.48	1,174.81				95,998.25
3. Transport	116,580.82	625.24	1,283.01				118,489.07
4. Other Sectors	112,040.52	1,478.47	605.69				114,124.68
5. Other	5,265.43	5.39	65.44				5,336.26
B. Fugitive Emissions from Fuels	12,138.01	28,564.40	93.56				40,795.97
1. Solid Fuels	3,000.36	17,203.24	0.00				20,203.60
2. Oil and Natural Gas	9,137.65	11,361.16	93.56				20,592.37
2. Industrial Processes	**14,123.40**	**55.89**	**29,281.18**	**11,373.84**	**2,281.00**	**724.17**	**57,839.49**
A. Mineral Products	9,554.79	0.00	0.00				9,554.79
B. Chemical Industry	1,358.31	39.53	29,270.08	0.00	0.00	0.00	30,667.92
C. Metal Production	3,210.31	16.36	11.11		2,031.00	478.00	5,746.78
D. Other Production	IE						0.00
E. Production of Halocarbons and SF_6				11,373.17	0.00	0.00	11,373.17
F. Consumption of Halocarbons and SF_6				0.67	250.00	246.17	496.84
G. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use	**0.00**		**0.00**				**0.00**
4. Agriculture	**0.00**	**21,781.28**	**31,132.58**				**52,913.86**
A. Enteric Fermentation		19,177.21					19,177.21
B. Manure Management		2,338.03	1,582.76				3,920.79
C. Rice Cultivation		0.00					0.00
D. Agricultural Soils[2]		0.00	29,472.05				29,472.05
E. Prescribed Burning of Savannas		0.00	0.00				0.00
F. Field Burning of Agricultural Residues		266.04	77.76				343.81
G. Other		0.00	0.00				0.00
5. Land-Use Change and Forestry[1]	**8,791.21**	**0.00**	**0.00**				**8,791.21**

[1] For CO_2 emissions from land-use change and forestry, the net emissions are reported. A positive number for land-use change and forestry denotes a net emission, a negative number denotes an uptake.
[2] CO_2 emissions from agricultural soils are included in land-use change and forestry, according to IPCC Guidelines.

Summary Report for CO_2 Equivalent Emissions, 1990 *(continued)*

Greenhouse gas source and sink	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Categories	CO_2 equivalent (Gg)						
6. Waste	**663.33**	**24,158.68**	**1,074.33**				25,896.34
A. Solid Waste Disposal on Land	0.00	23,457.00					23,457.00
B. Wastewater Handling		701.02	1,033.30				1,734.32
C. Waste Incineration	663.33	0.65	41.03				705.02
D. Other	0.00	0.00	0.00				0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Memo Items:							
International Bunkers	**21,349.41**	**72.56**	**270.61**				**21,692.58**
Aviation	14,790.50	59.86	140.49				14,990.86
Marine	6,558.91	12.69	130.12				6,701.72
Multilateral Operations	**NO**	**0.00**	**0.00**				**0.00**
CO_2 Emissions from Biomass	**3,850.11**						**3,850.11**

Greenhouse gas source and sink	CO_2	CO_2	Net CO_2	CH_4	N_2O	Total
Categories	emissions	removals	emissions/removals			emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-7,304.00	-7,304.00			-7,304.00
B. Forest and Grassland Conversion	0.00		0.00	0.00	0.00	0.00
C. Abandonment of Managed Lands	0.00	0.00	0.00			0.00
D. CO_2 Emissions and Removals from Soil	15,439.30	-2,152.33	13,286.97			13,286.97
E. Other	3,908.24	-1,100.00	2,808.24	0.00	0.00	2,808.24
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	19,347.54	-10,556.33	8,791.21	0.00	0.00	8,791.21

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	741,882.27
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	750,673.47

Summary Report for CO_2 Equivalent Emissions, 1999

Greenhouse gas source and sink	CO_2[1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Categories	CO_2 equivalent (Gg)						
Total (Net Emissions)[1]	**536,261.06**	**55,245.77**	**42,891.87**	**6,205.55**	**678.19**	**1,314.17**	**642,596.61**
1. Energy	**518,049.24**	**18,358.13**	**8,541.15**				**544,948.52**
A. Fuel Combustion (Sectoral Approach)	509,916.99	2,281.01	8,479.37				520,677.37
1. Energy Industries	179,116.20	689.31	2,416.99				182,222.50
2. Manufacturing Industries and Construction	88,668.35	252.28	1,025.37				89,945.99
3. Transport	121,575.57	386.94	4,552.12				126,514.63
4. Other Sectors	117,421.29	949.14	444.79				118,815.21
5. Other	3,135.58	3.35	40.11				3,179.03
B. Fugitive Emissions from Fuels	8,132.24	16,077.12	61.78				24,271.15
1. Solid Fuels	2,241.63	6,528.48	0.00				8,770.11
2. Oil and Natural Gas	5,890.61	9,548.65	61.78				15,501.04
2. Industrial Processes	**13,479.81**	**55.03**	**3,655.34**	**6,205.55**	**678.19**	**1,314.17**	**25,388.10**
A. Mineral Products	9,135.60	0.00	0.00				9,135.60
B. Chemical Industry	1,107.50	39.53	3,645.89	0.00	0.00	0.00	4,792.93
C. Metal Production	3,236.71	15.50	9.45		209.87	717.00	4,188.53
D. Other Production	IE						0.00
E. Production of Halocarbons and SF_6				1,926.51	0.00	0.00	1,926.51
F. Consumption of Halocarbons and SF_6				4,279.04	468.32	597.17	5,344.53
G. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Solvent and Other Product Use	**0.00**		**0.00**				**0.00**
4. Agriculture	**0.00**	**21,038.56**	**29,573.96**				**50,612.52**
A. Enteric Fermentation		18,739.43					18,739.43
B. Manure Management		2,299.13	1,596.69				3,895.81
C. Rice Cultivation		0.00					0.00
D. Agricultural Soils[2]		0.00	27,977.27				27,977.27
E. Prescribed Burning of Savannas		0.00	0.00				0.00
F. Field Burning of Agricultural Residues		0.00	0.00				0.00
G. Other		0.00	0.00				0.00
5. Land-Use Change and Forestry[1]	**4,732.01**	**0.00**	**0.00**				**4,732.01**

Summary Report for CO_2 Equivalent Emissions, 1999 *(continued)*

Greenhouse gas source and sink	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Categories	CO_2 equivalent (Gg)						
6. Waste	**0.00**	**15,794.05**	**1,121.42**				**16,915.47**
A. Solid Waste Disposal on Land	0.00	15,036.00					15,036.00
B. Wastewater Handling		756.34	1,069.59				1,825.92
C. Waste Incineration	0.00	1.71	51.83				53.54
D. Other	0.00	0.00	0.00				0.00
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Memo Items:							
International Bunkers	**31,895.86**	**102.11**	**369.76**				**32,367.73**
Aviation	25,539.33	89.82	243.75				25,872.89
Marine	6,356.53	12.29	126.02				6,494.84
Multilateral Operations	**NO**	**0.00**	**0.00**				**0.00**
CO_2 Emissions from Biomass	**7,000.26**						**7,000.26**

[1] For CO_2 emissions from land-use change and forestry, the net emissions are reported. A positive number for land-use change and forestry denotes a net emission, a negative number denotes an uptake.
[2] CO_2 emissions from agricultural soils are included in land-use change and forestry, according to IPCC Guidelines.

Greenhouse gas source and sink	CO_2	CO_2	Net CO_2	CH_4	N_2O	Total
Categories	emissions	removals	emissions/removals			emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	0.00	-8,121.67	-8,121.67			-8,121.67
B. Forest and Grassland Conversion	0.00		0.00	0.00	0.00	0.00
C. Abandonment of Managed Lands	0.00	0.00	0.00			0.00
D. CO_2 Emissions and Removals from Soil	12,663.01	-2,317.33	10,345.68			10,345.68
E. Other	3,608.00	-1,100.00	2,508.00	0.00	0.00	2,508.00
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	16,271.01	-11,539.00	4,732.01	0.00	0.00	4,732.01

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry	637,864.61
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry	642,596.62

Emission Trends (Carbon Dioxide)

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
1. Energy	**568,692.17**	**574,772.59**	**560,979.16**	**546,802.71**	**542,849.59**	**534,254.74**	**552,635.53**	**529,069.83**	**531,332.13**	**518,049.24**
A. Fuel Combustion (Sectoral Approach)	556,554.16	565,038.53	551,386.75	537,694.52	531,563.30	525,043.69	543,635.54	520,790.18	523,366.59	509,916.99
1. Energy Industries	228,089	226,050	215,977	199,254	196,560	197,766	197,683	183,604	188,985	179,116.20
2. Manufacturing Industries and Construction	94,578	95,291	93,761	92,363	93,863	91,653	92,532	92,667	89,806	88,668.35
3. Transport	116,581	116,051	117,504	118,683	119,042	117,939	122,571	123,631	122,767	121,575.57
4. Other Sectors	112,041	123,373	120,077	123,269	118,154	113,815	127,060	117,276	118,627	117,421.29
5. Other	5,265	4,272	4,068	4,125	3,945	3,871	3,789	3,613	3,181	3,135.58
B. Fugitive Emissions from Fuels	12,138.01	9,734.06	9,592.41	9,108.18	11,286.30	9,211.05	8,999.99	8,279.65	7,965.54	8,132.24
1. Solid Fuels	3,000.36	2,300.39	2,178.20	1,939.61	1,786.99	1,986.56	1,628.45	1,967.71	1,688.09	2,241.63
2. Oil and Natural Gas	9,137.65	7,433.67	7,414.21	7,168.57	9,499.31	7,224.49	7,371.54	6,311.94	6,277.45	5,890.61
2. Industrial Processes	14,123.40	11,768.80	11,158.92	11,293.66	12,474.42	12,523.92	13,340.56	12,616.31	12,397.18	13,479.81
A. Mineral Products	9,554.79	8,160.48	7,619.17	7,663.96	8,448.89	8,553.92	8,787.19	9,615.54	9,630.86	9,135.60
B. Chemical Industry	1,358.31	1,358.30	1,379.03	1,379.03	1,379.03	1,379.03	1,379.03	888.48	1,110.52	1,107.50
C. Metal Production	3,210.31	2,250.01	2,160.72	2,250.67	2,646.50	2,590.97	3,174.34	2,112.30	1,655.80	3,236.71
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Emission Trends (Carbon Dioxide) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
4. Agriculture	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry(1)	**8,791.21**	**8,868.93**	**8,327.21**	**6,610.40**	**5,384.13**	**4,687.38**	**4,968.99**	**4,772.93**	**4,995.38**	**4,732.01**
A. Changes in Forest and Other Woody Biomass Stocks	-7,304.00	-7,395.67	-7,670.67	-7,982.33	-8,191.33	-8,517.67	-8,426.00	-8,316.00	-8,184.00	-8,121.67
B. Forest and Grassland Conversion	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C. Abandonment of Managed Lands	NE	NE	NE	NE	NE	NE	NE	NE	NE	
D. CO_2 Emissions and Removals from Soil	13,286.97	13,482.00	13,262.97	11,905.53	10,816.68	10,421.86	10,729.35	10,514.07	10,752.50	10,345.68
E. Other	2,808.24	2,782.60	2,734.90	2,687.21	2,758.79	2,783.19	2,665.64	2,574.85	2,426.88	2,508.00
6. Waste	**663.33**	**661.87**	**632.30**	**568.43**	**428.07**	**415.35**	**407.18**	**0.00**	**0.00**	**0.00**
A. Solid Waste Disposal on Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Waste-water Handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Waste Incineration	663.33	661.87	632.30	568.43	428.07	415.35	407.18	0.00	0.00	0.00
D. Other										

Emission Trends (Carbon Dioxide) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Emissions/ Removals with LUCF	**592,270.11**	**596,072.20**	**581,097.59**	**565,275.20**	**561,136.22**	**551,881.38**	**571,352.26**	**546,459.07**	**548,724.69**	**536,261.06**
Total Emissions without LUCF	583,478.90	587,203.27	572,770.38	558,664.80	555,752.09	547,194.01	566,383.26	541,686.14	543,729.31	531,529.05
Memo Items:										
International Bunkers	**21,349.41**	**20,909.28**	**22,760.69**	**23,813.92**	**24,005.94**	**25,610.85**	**27,447.23**	**29,616.67**	**32,910.21**	**31,895.86**
Aviation	14,790.50	14,569.76	16,120.55	17,240.81	17,856.11	19,011.82	20,237.57	21,552.32	24,122.22	25,539.33
Marine	6,558.91	6,339.52	6,640.14	6,573.11	6,149.84	6,599.03	7,209.66	8,064.35	8,787.99	6,356.53
Multilateral Operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,850.11**	**4,008.28**	**4,295.14**	**4,446.66**	**4,832.75**	**5,222.87**	**5,476.83**	**5,760.86**	**6,117.51**	**7,000.26**
Forest Sink	**–10,556.33**	**–10,666.33**	**–10,846.00**	**–11,073.33**	**–11,286.00**	**–11,528.00**	**–11,612.33**	**–11,557.33**	**–11,528.00**	**–11,539.00**
Emissions from Land Use Change	**19,347.54**	**19,535.26**	**19,173.21**	**17,683.73**	**16,670.13**	**16,215.38**	**16,581.32**	**16,330.26**	**16,523.98**	**16,271.01**

(1) Category 5, Land Use Change and Forestry, is partitioned according to the memo items consistent with the discussion in Chapter 4.
NO – Not occurring
NE – Not estimated
NA – Not applicable
C – Confidential

Emission Trends (Methane)

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
Total Emissions	**3,670.26**	**3,620.92**	**3,528.14**	**3,380.36**	**3,067.99**	**3,053.47**	**2,983.60**	**2,890.92**	**2,762.74**	**2,630.75**
1. Energy	**1,479.98**	**1,485.52**	**1,442.54**	**1,349.00**	**1,066.22**	**1,097.88**	**1,057.71**	**1,022.42**	**942.15**	**874.20**
A. Fuel Combustion (Sectoral Approach)	119.77	123.32	116.99	115.49	102.20	90.93	94.86	94.10	95.52	108.62
1. Energy Industries	7.65	8.39	9.86	11.69	12.95	15.64	17.48	20.63	22.66	32.82
2. Manufacturing Industries and Construction	11.69	11.76	11.20	11.16	11.49	11.75	12.21	12.68	12.43	12.01
3. Transport	29.77	29.38	28.54	26.73	25.30	23.76	22.58	21.21	19.72	18.43
4. Other Sectors	70.40	73.56	67.17	65.70	52.27	39.58	42.39	39.39	40.55	45.20
5. Other	0.26	0.23	0.21	0.21	0.20	0.19	0.19	0.19	0.16	0.16
B. Fugitive Emissions from Fuels	1,360.21	1,362.20	1,325.55	1,233.51	964.02	1,006.95	962.85	928.32	846.62	765.58
1. Solid Fuels	819.20	838.26	803.85	724.34	456.59	504.25	473.63	445.57	372.34	310.88
2. Oil and Natural Gas	541.01	523.94	521.69	509.17	507.43	502.70	489.23	482.75	474.29	454.70
2. Industrial Processes	**2.66**	**2.41**	**2.34**	**2.32**	**2.44**	**2.58**	**2.67**	**2.57**	**2.51**	**2.62**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88
C. Metal Production	0.78	0.53	0.46	0.44	0.56	0.70	0.79	0.69	0.63	0.74
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**

Emission Trends (Methane) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
4. Agriculture	**1,037.20**	**1,021.69**	**1,017.47**	**1,010.56**	**1,018.35**	**1,006.65**	**1,015.91**	**1,003.69**	**1,006.86**	**1,001.84**
A. Enteric Fermentation	913.19	900.34	899.50	899.60	906.63	896.77	905.05	892.96	895.04	892.36
B. Manure Management	111.34	110.50	110.11	110.79	111.71	109.88	110.86	110.73	111.82	109.48
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of										
Agricultural Residues	12.67	10.85	7.87	0.17	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Forest and Grassland Conversion	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Abandonment of Managed Lands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. CO_2 Emissions and Removals from Soil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Emission Trends (Methane) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
6. Waste	**1,150.41**	**1,111.29**	**1,065.79**	**1,018.49**	**980.99**	**946.36**	**907.31**	**862.24**	**811.22**	**752.10**
A. Solid Waste Disposal on Land	1,117.00	1,080.00	1,031.00	984.00	945.00	912.00	872.00	826.00	774.00	716.00
B. Waste-water Handling	33.38	31.26	34.76	34.46	35.96	34.33	35.27	36.21	37.15	36.02
C. Waste Incineration	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.07	0.08
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Other *(please specify)*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items:										
International Bunkers	**3.46**	**3.33**	**3.60**	**3.67**	**3.81**	**3.98**	**4.21**	**4.51**	**4.85**	**4.86**
Aviation	2.85	2.74	2.98	3.06	3.24	3.37	3.55	3.76	4.04	4.28
Marine	0.60	0.58	0.61	0.61	0.57	0.61	0.66	0.74	0.81	0.59
Multilateral Operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass										

NO – Not occurring
NE – Not estimated
NA – Not applicable
C – Confidential

Emission Trends (Nitrous Oxide)

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
Total Emissions	**215.96**	**209.75**	**187.43**	**175.68**	**190.10**	**181.64**	**188.32**	**194.05**	**187.86**	**138.36**
1. Energy	**17.62**	**17.89**	**18.05**	**18.64**	**20.20**	**21.41**	**23.22**	**24.56**	**26.33**	**27.55**
A. Fuel Combustion (Sectoral Approach)	17.31	17.63	17.80	18.41	19.89	21.17	22.98	24.36	26.13	27.35
1. Energy Industries	7.22	7.22	6.92	6.59	6.85	7.01	7.27	7.33	7.82	7.80
2. Manufacturing Industries and Construction	3.79	3.91	4.11	3.84	3.73	3.61	3.49	3.42	3.24	3.31
3. Transport	4.14	4.28	4.73	5.87	7.39	8.86	10.39	11.88	13.38	14.68
4. Other Sectors	1.95	2.03	1.88	1.94	1.77	1.54	1.67	1.58	1.56	1.43
5. Other	0.21	0.18	0.17	0.17	0.16	0.16	0.16	0.15	0.13	0.13
B. Fugitive Emissions from Fuels	0.30	0.26	0.24	0.23	0.31	0.23	0.25	0.21	0.20	0.20
1. Solid Fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and Natural Gas	0.30	0.26	0.24	0.23	0.31	0.23	0.25	0.21	0.20	0.20
2. Industrial Processes	**94.46**	**88.51**	**71.61**	**61.07**	**71.50**	**61.30**	**65.49**	**67.02**	**59.45**	**11.79**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	94.42	88.48	71.58	61.04	71.47	61.27	65.45	66.99	59.42	11.76
C. Metal Production	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**

Emission Trends (Nitrous Oxide) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
4. Agriculture	**100.43**	**99.92**	**94.30**	**92.52**	**94.95**	**95.44**	**95.98**	**98.90**	**98.43**	**95.40**
A. Enteric Fermentation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Manure Management	5.11	5.07	4.97	4.99	5.06	5.01	5.09	5.03	5.03	5.15
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	95.07	94.63	89.18	87.53	89.89	90.43	90.90	93.87	93.41	90.25
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.25	0.21	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Forest and Grassland Conversion	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Abandonment of Managed Lands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. CO_2 Emissions and Removals from Soil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**3.47**	**3.43**	**3.47**	**3.46**	**3.45**	**3.50**	**3.62**	**3.57**	**3.64**	**3.62**
A. Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Waste-water Handling	3.33	3.31	3.34	3.33	3.35	3.39	3.51	3.50	3.50	3.45
C. Waste Incineration	0.13	0.13	0.13	0.13	0.10	0.11	0.11	0.06	0.15	0.17
D. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Emission Trends (Nitrous Oxide) *(continued)*

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories					(Gg)					
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Memo Items:										
International Bunkers	**0.87**	**0.85**	**0.92**	**0.95**	**0.94**	**1.01**	**1.08**	**1.18**	**1.30**	**1.19**
Aviation	0.45	0.45	0.49	0.53	0.55	0.58	0.62	0.66	0.74	0.79
Marine	0.42	0.41	0.42	0.42	0.39	0.42	0.46	0.52	0.56	0.41
Multilateral Operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass										

NO – Not occurring
NE – Not estimated
NA – Not applicable
C – Confidential

Emission Trends (HFCs, PFCs and SF_6)

Greenhouse gas Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories	(Gg)									
Emissions of HFCs – CO_2 equivalent (Gg)	**11,373.84**	**11,858.80**	**12,346.17**	**12,904.59**	**13,813.85**	**15,205.03**	**16,290.29**	**18,446.80**	**20,182.62**	**6,205.55**
HFC-23	C	C	C	C	C	C	C	C	C	C
HFC-32	C	C	C	C	C	C	C	C	C	C
HFC-41	C	C	C	C	C	C	C	C	C	C
HFC-43-10mee	C	C	C	C	C	C	C	C	C	C
HFC-125	C	C	C	C	C	C	C	C	C	C
HFC-134	C	C	C	C	C	C	C	C	C	C
HFC-134a	C	C	C	C	C	C	C	C	C	C
HFC-152a	C	C	C	C	C	C	C	C	C	C
HFC-143	C	C	C	C	C	C	C	C	C	C
HFC-143a	C	C	C	C	C	C	C	C	C	C
HFC-227ea	C	C	C	C	C	C	C	C	C	C
HFC-236fa	C	C	C	C	C	C	C	C	C	C
HFC-245ca	C	C	C	C	C	C	C	C	C	C
Emissions of PFCs – CO_2 equivalent (Gg)	**2,281.00**	**1,790.25**	**959.28**	**810.59**	**979.73**	**1,094.10**	**905.30**	**661.24**	**651.74**	**678.19**
CF_4	C	C	C	C	C	C	C	C	C	C
C_2F_6	C	C	C	C	C	C	C	C	C	C
C_3F_8	C	C	C	C	C	C	C	C	C	C
C_4F_{10}	C	C	C	C	C	C	C	C	C	C
c-C_4F_8	C	C	C	C	C	C	C	C	C	C
C_5F_{12}	C	C	C	C	C	C	C	C	C	C
C_6F_{14}	C	C	C	C	C	C	C	C	C	C
Emissions of SF_6 – CO2 equivalent (Gg)	**724.17**	**776.22**	**832.80**	**888.98**	**1,061.26**	**1,133.51**	**1,270.45**	**1,262.59**	**1,289.33**	**1,314.17**
SF_6	0.030	0.032	0.035	0.037	0.044	0.047	0.053	0.053	0.054	0.05

NO – Not occurring
NE – Not estimated
NA – Not applicable
C – Confidential

Emission Trends (Summary)

Greenhouse gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories	CO_2 equivalent									
Net CO_2 emissions/removals	592,270.11	596,072.20	581,097.59	565,275.20	561,136.22	551,881.38	571,352.26	546,459.07	548,724.69	536,261.06
CO2 emissions (without LUCF)[2]	583,478.90	587,203.27	572,770.38	558,664.80	555,752.09	547,194.01	566,383.26	541,686.14	543,729.31	531,529.05
CH_4	77,075.47	76,039.23	74,090.92	70,987.63	64,427.84	64,122.79	62,655.61	60,709.29	58,017.64	55,245.79
N_2O	66,948.88	65,021.87	58,102.71	54,460.64	58,931.62	56,308.82	58,377.92	60,154.78	58,235.86	42,892.05
HFCs	11,373.84	11,858.80	12,346.17	12,904.59	13,813.85	15,205.03	16,290.29	18,446.80	20,182.62	6,205.55
PFCs	2,281.00	1,790.25	959.28	810.59	979.73	1,094.10	905.30	661.24	651.74	678.19
SF_6	724.17	776.22	832.80	888.98	1,061.26	1,133.505	1,270.45	1,262.59	1,289.33	1,314.17
Total (with net CO_2 emissions/removals)	**750,673.47**	**751,558.58**	**727,429.46**	**705,327.64**	**700,350.51**	**689,745.64**	**710,851.83**	**687,693.76**	**687,101.89**	**642,596.81**
Total (without CO_2 from LUCF)[2]	**741,882.27**	**742,689.65**	**719,102.26**	**698,717.24**	**694,966.38**	**685,058.26**	**705,882.84**	**682,920.83**	**682,106.51**	**637,864.80**
Total (with LUCF emissions)	**761,229.81**	**762,224.90**	**738,275.46**	**716,400.99**	**711,636.51**	**701,273.63**	**722,464.16**	**699,251.08**	**698,633.11**	**654,135.62**

Greenhouse gas source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Categories	CO_2 equivalent									
1. Energy	605,232.58	611,513.04	596,867.11	580,910.57	571,502.40	563,945.90	582,046.92	558,155.56	559,279.76	544,948.52
2. Industrial Processes	57,839.49	53,682.64	47,545.49	44,876.89	50,544.36	49,013.94	52,163.40	53,816.87	53,002.71	25,388.10
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4. Agriculture	52,913.86	52,430.85	50,600.21	49,901.65	50,820.03	50,724.55	51,088.85	51,734.96	51,658.85	50,612.72
5. Land-Use Change and Forestry[3]	8,791.21	8,868.93	8,327.21	6,610.40	5,384.13	4,687.38	4,968.99	4,772.93	4,995.38	4,732.01
6. Waste	25,896.34	25,063.12	24,089.45	23,028.13	22,099.59	21,373.87	20,583.67	19,213.45	18,165.19	16,915.47
7. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[2] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO_2 emissions and removals from Land-Use Change and Forestry.
[3] Net emissions.

Sector	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of Instrument	Status	Implementing entity or entities	Estimate of savings (MtC) 1990	1995	2000	2005	2010	2015	2020
Projected greenhouse gas emissions in 2010													
Energy Supply	**NFFO***	Electricity generation and supply	CO_2	Regulatory	No longer in place	Electricity regulator	0.0	0.3	0.7	1.5	1.5	1.5	1.5
Energy Supply	**Renewables Obligation***	Electricity generation and supply	CO_2 CO_2	Regulatory Regulatory	Adopted Adopted	Industry regulator (Ofgem)	0.0	0.0	0.0	0.5	2.5	2.5	2.5
Business and public	**Climate change levy***	Energy use by business and public sectors	CO_2 CO_2	Fiscal (taxation)	Imple-mented	Government	0.0	0.0	0.0	1.0	2.0	2.0	2.0
Transport	**Fuel duty escalator to 1999***	Transport demand and fuel efficiency	CO_2 CO_2	Fiscal (taxation)	No longer in place	Government	0.0	0.0	n/q	n/q	1-2.5	1.8	1.8
Waste management	**Waste strategy and EU Landfill Directive***	Waste minimisation	Methane	Regulatory and fiscal	Imple-mented	Government	0.0	0.0	0.0	n/q	0.1-0.5	n/q	n/q
Percentage change from 1990 levels, all greenhouse gases											**-14.8%**		
Percentage change on 1990 levels, CO_2 only											**-8.2%**		
Additional measures													
Business	**Climate change agreements and IPPC (a)**	Energy use by energy intensive sectors and those regulated by IPPC	CO_2	Negotiated agreements and regulatory	Imple-mented	Government	0.0	0.0	0.0	1.3	**2.5**	3.3	>4.2
Business and public	**Energy efficiency measures under the climate change levy package (b)**	Energy use by business and public sectors	CO_2	Fiscal (tax incentive)	Imple-mented	Carbon Trust	0.0	0.0	0.0	0.3	**0.5**	>0.5	>0.5
Business	**Emissions trading scheme (c)**	All UK companies	All	Economic (trading)	Imple-mented	Government	0.0	0.0	0.0	2.0	**2.0**	>2.0	>2.0

Sector	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of Instrument	Status	Implementing entity or entities	Estimate of savings (MtC) 1990	1995	2000	2005	2010	2015	2020
Projected greenhouse gas emissions in 2010													
Business, residential and public	**Amendment of Building Regulations (d)**	Energy use in buildings	CO_2	Regulatory	Adopted	Government	0.0	0.1	0.3	0.8	**1.4**	>1.0	>1.0
Residential	**Residential energy efficiency, including Energy Efficiency Commitment (e)**	Energy use in homes	CO_2	Regulatory and fiscal (grant assistance)	Adopted	Government, Industry regulator (Ofgem) and energy supply companies	n/q	n/q	1.4	2.0	**2.6-3.7**	4.5	4.5
Residential	**Community heating (f)**	Energy use in homes	CO_2	Fiscal (grant assistance)	Imple-mented	Government, various public and private sector bodies	n/a	n/a	n/a	n/q	**0.9**	0.9	0.9
Residential	**New HEES (g)**	Energy use in homes	CO_2	Fiscal (grant assistance)	Imple-mented	Government	n/a	n/a	n/q	n/q	**0.2**	i/e	i/e
Residential	**Appliance standards and labels (h)**	Energy use in homes	CO_2	Regulatory	Imple-mented	Government	n/q	n/q	n/q	n/q	**0.2-0.4**	i/e	i/e
Residential	**Central heating for pensioners and families (i)**	Energy use in homes	CO_2	Fiscal (grant assistance)	Imple-mented	Scottish Executive	n/a	n/a	n/q	n/q	**0.1**	0.1	0.1
Public	**Public sector targets (j)**	Energy use in public buildings	CO_2	Voluntary agreements	Adopted	Public sector Public sector	n/a	n/a	n/q	n/q	**0.5**	0.5	0.5
Public, business and residential	**Reform of Building Regulations and public sector targets (i)**	Energy use in buildings	CO_2	Regulatory and voluntary agreements	Adopted	Scottish Executive	0.0	0.0	0.0	0.0	**0.1**	0.1	0.1

Sector	Name of policy or measure	Objective and/or activity affected	GHG affected	Type of Instrument	Status	Implementing entity or entities	Estimate of savings (MtC)						
							1990	1995	2000	2005	2010	2015	2020
Projected greenhouse gas emissions in 2010													
Transport	**EU level voluntary agreements on CO_2 from cars, backed up by changes to company car taxation and vehicle excise duty (k)**	Vehicle fuel efficiency	CO_2	Voluntary agreements and fiscal (taxation)	Imple-mented	Government, car manufacturers, European Commission	n/a	n/a	n/a	n/q	**4.0**	5.75	7.5
Transport	**Ten Year Plan (l)**	System improvements	CO_2	Fiscal (investment)	Adopted	Government	n/a	n/a	n/a	n/q	**1.6**	1.6	1.6
Transport	**Sustainable distribution (m)**	System improvements in Scotland	CO_2	Fiscal (investment)	Adopted	Scottish Executive	n/a	n/a	n/a	n/q	**0.1**	0.1	0.1
Forestry	**Afforestation (n)**	Extended forest area since 1990	CO_2	Fiscal (grant assistance)	Imple-mented	Government and devolved administrations	0.0	0.2	0.3	0.5	**0.6**	0.9	1.2
Total of all 'additional measures' in 2010							n/a	n/a	2.5	7.4	**17.95**	21.25	24.20
Percentage change on 1990 levels, all greenhouse gases											**-23%**		
Percentage change on 1990 levels, CO_2 only											**-19%**		

*

* Measure is included in baseline with measures projections.
n/a = not applicable
n/q = not quantified
i/e = included elsewhere

Notes

(a) Estimate for 2005 and 2010 are from references (5) and (4) respectively. 2020 estimate assumes that climate change agreements and IPPC will eventually deliver all potential currently regarded as achievable.

(b) Estimate for 2010 based on administration by the Carbon Trust of enhanced capital allowances scheme, plus expenditure of about £50 million from climate change levy receipts and Energy Efficiency Best Practice Programme. Savings beyond 2010 are expected to increase as Carbon Trust programmes develop (see reference 9).

(c) Estimate for 2005 assumes generators take part in the scheme. Estimate for 2010 from reference 7, depending on emergence of a successful emissions trading scheme from the initial round which will begin in April 2002, and that trading becomes self-sustaining in the long term.

(d) The revision of the Building Regulations which came into force in July 1995 is estimated to have saved 0.25 MtC per year in 2010 (see reference 1). The current reform is expected to come into force in 2002 and to save 1.4 MtC per year in 2010 (see reference 2). The 2005 value is found by linear interpolation. The Government has declared its aim for another amendment coming into effect around 2008 that would make a further significant impact on carbon emissions arising from energy use in buildings.

(e) Estimate for 2000 is for corresponding residential sector measures quantified in reference 1. Estimates for 2005, 2015 and 2020 are based on a scaling of the savings of the efficiency scenario relative to the reference scenario in reference 3.

(f) Assumes installed capacity of 1.5 GWe by 2010. Residential sector CHP displaces about 0.6 MtC/GWe.

(g) See reference (9) for 2010 estimate. Estimates beyond 2010 included with Residential Energy Efficiency (2 rows above).

(h) See reference (9) for 2010 estimate. Estimates beyond 2010 included with Residential Energy Efficiency (3 rows above).

(i) Estimate by Scottish Executive published in Scottish Climate Change Programme. Available at: www.scotland.gov.uk/climatechange/scccpub.asp

(j) See reference (9) and reference (11), which discusses public sector targets and other policies relevant to non-domestic buildings.

(k) See reference (9). Estimates beyond 2010 from DTLR assuming continued penetration of efficient vehicles in fleet.

(l) See reference (10).

(m) DTLR estimate for Scotland consistent with, and additional to, line above.

(n) Projections made using the C-Flow model (see reference 8) assuming current planting rates continue.

References:

(1) Second National Communication.

(2) DTLR assessment.

(3) L. Shorrock, J. Henderson, J. Utley, G. Walters: *Carbon Emission Reductions from Energy Efficiency Improvements in the UK Housing Stock*, Building Research Establishment, 2001.

(4) W. Nixon and R. Bell: *Climate Change Agreements – Sectoral Energy Efficiency Targets*. Report No 01023/2, AEAT, 2001

(5) J. Collingwood, personal communication of analysis consistent with reference 4.

(6) DEFRA assessment.

(7) Laurence Smith: *Emissions Targets –Modelling Incentives*, Volterra, June 2000. Unpublished report for DEFRA.

(8) R. Milne: *Future projections of removals of atmospheric carbon dioxide by afforestation and land use change in the UK* (in preparation), 2001. To be available at: www.nbu.ac.uk/ukcarbon/docs/1999_Projections_UK_plus_regions.pdf

(9) The derivation of the carbon savings figures included in the UK's 'Draft Climate Change Programme'. Available at: www.defra.gov.uk/environment/consult/draftclimatechange/index.htm

(10) *Transport 2010 – the background analysis*, DTLR 2000. Available at: www.dtlr.gov.uk/trans2010/background/index.htm

(11) C. Pout, F. Mackenzie, R. Bettle: *Carbon dioxide emissions from non-domestic buildings: 2000 and beyond*. BRE 2001 (in preparation).

Bilateral financial contributions related to the implementation of the Convention 1997-1998 (£ million)

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
1 Angola				1.055					
2 Bangladesh	0.606			3.178					
3 Belize			0.852						
4 Bolivia			0.452	1.094					
5 Botswana				1.397					
6 Brazil			1.770						
7 Cameroon			1.418						
8 China	5.246								
9 Costa Rica			0.173						
10 Cote d'Ivoire			0.450						
11 Cuba				1.801					
12 Dominica	9.506								
13 Ecuador			0.197	7.256					
14 Ghana	4.165		1.033						
15 Grenada			0.174						
16 Guyana			0.336						
17 Honduras			0.686						
18 India	22.073		4.509	3.923					
19 Indonesia	6.611		4.269	9.115					
20 Kenya				4.597					
21 Lesotho	0.557								
22 Malawi	3.470		0.254	1.206					
23 Mexico			0.647						
24 Montserrat	0.534								
25 Mozambique				0.928					
26 Nepal			1.026	2.538					

Bilateral financial contributions related to the implementation of the Convention 1997-1998 (£ million) *(continued)*

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
27 Nicaragua			0.156						
28 Pacific region	4.000								
29 Pakistan	0.962			6.052					
30 Panama	0.361								
31 Philippines	7.913								
32 Poland	0.790			2.271					
33 Russian Federation	1.620			1.108					
34 Saint Lucia	9.143								
35 South Africa, Republic of			0.622	0.806					
36 Sri Lanka	1.481		0.521						
37 Tanzania			1.973	1.104					
38 Thailand	1.099								
39 Uganda	2.019			6.351					
40 Ukraine	0.960			2.786					
41 Zambia				2.569					
All others	1.356		1.088						

(a) Figures are included only for the top twenty recipients in each category
(b) The UK does not identify spending in these categories separately

Bilateral financial contributions related to implementation of the Convention 1998-1999 (£ million)

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
1 Afganistan				1.000					
2 Bangladesh	0.910			3.515					
3 Belize			0.148	7.790					
4 Bolivia			0.321	1.048					
5 Bosnia	0.786								
6 Botswana				1.132					
7 Brazil			1.590						
8 Cameroon			1.211						
9 Caribbean regional	0.073								
10 China	4.893								
11 Cote d'Ivoire				2.671					
12 Ecuador			0.090	4.018					
13 Ghana	9.460		0.819						
14 Grenada			0.108						
15 Guyana			0.886						
16 Honduras			0.550						
17 India	35.837		4.889	3.402					
18 Indonesia	2.575		3.319	2.366					
19 Kenya			0.117	9.285					
20 Lesotho	0.646								
21 Malawi	5.130			5.534					
22 Mexico			0.586						
23 Montserrat	0.155		0.089						
24 Mozambique				1.253					

Bilateral financial contributions related to implementation of the Convention 1998-1999 (£ million) *(continued)*

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
25 Nepal	0.170		1.052	2.040					
26 Pakistan				2.138					
27 Panama	0.297								
28 Philippines	4.036								
29 Poland				2.423					
30 Romania	0.076								
31 Russian Federation	0.702			1.778					
32 Saint Helena	0.221								
33 South Africa, Republic of			1.098	0.920					
34 Sri Lanka	0.199		0.109						
35 Tanzania			0.993	1.165					
36 Thailand	0.308								
37 Uganda	2.233		0.092						
38 Ukraine	0.486			2.576					
39 Zimbabwe			0.167	1.473					
All others	0.003		0.623						

[a] Figures are included only for the top twenty recipients in each category
[b] The UK does not identify spending in these categories separately

Bilateral financial contributions related to implementation of the Convention 1999-2000 (£ million)

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
1 Bangladesh	0.723			2.875					
2 Belize				10.661					
3 Bolivia			1.857	2.322					
4 Bosnia	0.214								
5 Brazil			1.622						
6 Cambodia			0.200						
7 Cameroon			1.601						
8 China	3.970								
9 Costa Rica				1.897					
10 Dominican Republic	29.458								
11 Ecuador				6.345					
12 Ghana	1.012		2.982						
13 Grenada			0.158						
14 Guatemala	12.361								
15 Guyana	4.372		1.513						
16 Honduras			0.290						
17 India	24.245		3.618	3.283					
18 Indonesia	2.379		3.147	37.663					
19 Kenya			0.449	2.514					
20 Lesotho	0.118								
21 Malawi	2.650		0.213	4.734					
22 Mexico			0.250						
23 Montserrat			0.161						
24 Mozambique				1.820					
25 Nepal			1.223	2.094					
26 Nigeria			0.408						

Bilateral financial contributions related to implementation of the Convention 1999-2000 (£ million) *(continued)*

Recipient country [a]	Mitigation						Adaption		
	Energy	Transport [b]	Forestry	Agriculture	Waste management [b]	Industry [b] building [b]	Capacity management [b]	Coastal zone	Other [b]
27 Pakistan				1.769					
28 Panama	0.233								
29 Philippines	4.450								
30 Poland				1.689					
31 Romania	0.057								
32 Russian Federation	0.149			2.312					
33 Saint Helena	0.564								
34 South Africa, Republic of			1.555	6.189					
35 Sri Lanka	0.824								
36 Tanzania			1.163	1.244					
37 Thailand	0.170			2.419					
38 Uganda	1.426		0.710	1.334					
39 Ukraine	0.630			1.775					
40 Zimbabwe			0.249	1.949					
All others	0.377		0.405						

[a] Figures are included only for the top twenty recipients in each category
[b] The UK does not identify spending in these categories separately

List of relevant publications

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Further information on policies and measures

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Air Quality Strategy for England, Scotland, Wales and Northern Ireland, January 2000, The Stationery Office: www.defra.gov.uk/environment/airquality/index.htm

Quality and Choice: A Decent Home for All – The Way Forward for Housing, December 2000, DETR: www.housing.dtlr.gov.uk/information/statement/main/index.htm

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Quality of Life Counts: Indicators for a Strategy for Sustainable Development in the UK: a Baseline Assessment, December 1999, DETR: www.sustainable-development.gov.uk/indicators/index.htm

Transport Statistics Great Britain: 2000 Edition, 2000, DETR: www.transtat.dtlr.gov.uk

Digest of United Kingdom Energy Statistics, DTI: www.dti.gov.uk/epa/dukes.htm

Note: The Department of Environment, Transport and the Regions (DETR) ceased to exist on 8 June 2001, when its responsibilities were taken over by the Department for Trade and Industry (DTI) and the newly formed Department for Environment, Food and Rural Affairs (DEFRA) and the Department for Transport, Local Government and the Regions (DTLR).

ANNEX E

Glossary of terms

AATSR	Advanced Along Track Scanning Radiometer
ARIC	Atmospheric Research Information Centre
BBSRC	Biotechnology and Biological Sciences Research Council
BRE	Building Research Establishment
CAP	Common Agricultural Policy
CCPO	Climate Change Projects Office
CFC	Chlorofluorocarbon
CH_4	Methane
CHP	Combined Heat and Power
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRF	Common Reporting Format
CSERGE	Centre for Social and Economic Research on the Global Environment
DEFRA	The Department for Environment, Food and Rural Affairs (formed on 8 June 2001)
DETR	The Department of the Environment, Transport and the Regions, which ceased to exist on 8 June 2001 when its responsibilities were taken over by DTI and the newly formed DEFRA and DTLR
Devolved administrations	The Scottish Executive, the National Assembly for Wales and the Department of the Environment in Northern Ireland
DFID	Department for International Development
DTI	The Department of Trade and Industry
DTLR	The Department for Transport, Local Government and the Regions (formed on 8 June 2001)
EA	Environment Agency for England and Wales
ECA	Enhanced Capital Allowance
EEC	Energy Efficiency Commitment
EIA	Environmental Impact Assessment
EMS	Environmental Management Systems
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
EST	Energy Saving Trust
ETG	Emissions Trading Group
EU	European Union
GCOS	Global Climate Observation System
GDP	Gross Domestic Product
GECC	Global Environmental Change Committee
GEF	Global Environment Facility
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon

HFC	Hydrofluorocarbon
ICAO	International Civil Aviation Organisation
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
MRC	Medical Research Council
MtC	Million Tonnes of Carbon Equivalent
MWe	Megawatt
N_2O	Nitrous Oxide
NERC	Natural Environment Research Council
NETA	New Electricity Trading Arrangements
NETCEN	National Environmental Technology Centre
New HEES	New Home Energy Efficiency Scheme
NFFO	Non-Fossil Fuel Obligation
NI-NFFO	Northern Ireland Non-Fossil Fuel Obligation
NMVOC	Non Methane Volatile Organic Compound
NOx	Nitrogen Oxides
OECD	Organisation for Economic Cooperation and Development
Ofgem	Office of Gas and Electricity Regulation
PFC	Perfluorocarbon
Programme	The UK's Climate Change Programme
SE	Scottish Environmental Protection Agency
SF_6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
SRO	Scottish Renewables Obligation
UK	United Kingdom of England, Scotland, Wales and Northern Ireland
UKCIP	UK Climate Impacts Programme
UNFCCC	United Nations Framework Convention on Climate Change
VED	Vehicle Excise Duty
VOC	Volatile Organic Compound

ANNEX F

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Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, October 2001 on paper comprising 75% post-consumer waste and 25% ECF pulp.

Product code PB 6104