Energy

its impact on the environment and society





Department of Trade and Industry

Foreword

The UK has a long history of publishing detailed information about energy supply and use, from the Statistical Tables of the Mines Department in the 1930s through to the publication of the annual Digest of UK Energy Statistics (DUKES) that covers the production and use of all fuels in considerable detail.

But the world is now much more complicated than it used to be, and we need to understand more about energy than we used to. While the recording of fossil fuel production, power station outputs and end usage by sector remains important, and will continue to be available annually in DUKES, we need to be aware of a wider picture. That is the purpose of this publication.

The supply and use of energy have always had environmental consequences. Historically these were mostly local, and of specific interest to those directly affected by them. Later, as energy use grew, we began to see regional effects such as damage to forests and fish stocks from acid rain, and treaties were negotiated to improve air quality. More recently, the threat (and the emerging reality) of climate change has pushed energy to a central position in international debate. The question no longer focuses on whether energy will "run out": it is now about the energy we need and how much we will change the world if we do not change the way we use energy and how we will make such a change.

This environmental territory is covered by the first part of this publication, which looks at emissions, energy production and supply, and energy demand. It builds on the analysis which first appeared in the DTI's Energy Report, and shows, with figures and charts, where we have come from and where we are now, what the policy challenges are, and what the current responses are. It shows that the UK is on course to meet its international target under the Kyoto Protocol to reduce greenhouse gas emissions. Moreover, the UK has adopted a more challenging goal for the reduction of carbon dioxide, the main greenhouse gas, and put in a place a substantial programme of measures to achieve it. This is set out in the UK's Climate Change Programme which is one of many useful sources of reference to which there are links in this publication.

In the last decade, the UK energy market has undergone a transformation, and is now largely liberalised and, except for monopoly infrastructure, deregulated. This has been a success, with competition driving prices down, consumers able to switch suppliers to secure better deals, and better standards of service. This is the territory covered by the second part of the publication.

Our experience suggests that a competitive market brings real benefits to consumers and can bring innovation to bear though we accept that there can be tensions between cheaper energy prices and achieving environmental, security of supply and social objectives. A key social objective is the eradication of fuel poverty – that is, people who cannot afford to keep warm in winter even if prices are lower. We have made real progress with tackling fuel poverty. We are the first country to have developed a national strategy and we have established an Advisory Group to help with implementation. We are looking to maintain low prices and provide support through our benefits system but the key will be to improve the poor housing which many people inhabit.

This new publication has been designed to bring together the wider social and environmental aspects of energy use; and the reference sources it contains are useful signposts to those who want to delve deeper.

Brian Wilson

Contents

Introduction

This booklet, issued for the first time, looks at the social and environmental impact of the production and use of energy. Its aim is to increase awareness of the social and environmental aspects of energy use through the provision of a fuller range of analysis of the statistics that the DTI and others issue on a regular basis.

The booklet covers the evolution of the social and environmental impacts over recent years. It examines the key influences on the trends in the figures, including the interaction between economic, social and environmental trends. It looks at how Government policies have developed to limit the environmental damage that can be associated with the use of energy whilst, at the same time, ensuring that consumers can enjoy its benefits at an affordable cost.

The focus is on developments since 1990. This is the benchmark year for our international commitments in relation to the reduction of greenhouse gas emissions that contribute to climate change. This time span also covers the main developments of the liberalisation of gas and electricity markets that have brought significant benefits to all consumers in terms of service quality and lower prices. Comparisons over time are also complemented in some cases by comparisons of UK figures with other countries, especially in the case of environmental impacts for which global trends and policy responses are an essential part of the picture.

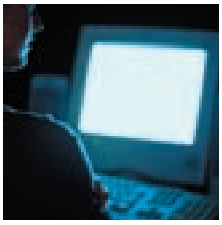
The booklet's content builds on and moves beyond material that has already been issued in the department's statistical publications - the Digest of UK Energy Statistics, Energy Trends and Energy Prices. Statistical information from other sources is also included where relevant to give the full picture. Some of the material is a development of information contained in the Annexes and Appendices to the earlier editions of the Energy Report. Most of the policy developments will have been described in the Energy Report. The Department's statistical publications, and Energy Indicators, will continue to show latest statistics.

It is hoped that the booklet will be accessible to a wide audience and will be useful to people with a general interest in the environmental and social aspects of energy use as well as people with a more substantial knowledge of this area. No specialist knowledge on the part of the reader is assumed but it is intended that those who want to know more should nevertheless be served through some of the more detailed analysis it contains and by signposts to more detail in other publications and on the internet.

The booklet is organised into short chapters. Each Chapter mixes the statistics with a description of the developments that they describe, the policy challenges they pose and the current policy responses. Some chapters are supplemented by more detailed looks at topics that it is hoped will interest readers. Chapters 1 to 3 cover environmental aspects of the use of energy and Chapters 4 to 6 at the social impact.

Chapter 1 looks at the growth in greenhouse gas emissions and explains the consequences of this growth, including climate change. It sets out the key commitments and policies to reduce the level of greenhouse gas emissions, including carbon dioxide, which is the most important greenhouse gas. Trends in carbon dioxide emissions are shown by sector and fuel. Developments in relation to non-greenhouse gas emissions that affect the quality of the air that we breathe, such as sulphur dioxide and particulates, are also discussed. There are Annexes on international trends in carbon dioxide emissions and on the drivers of the fall in sulphur dioxide emissions.

Chapter 2 describes the environmental impact of the production of energy, including, for example, through oil spillages and radioactive discharges, and the impact of policies in place to reduce such impacts. Each of the main fuels is examined in turn and the chapter looks at each stage of the overall process, including, as applicable, extraction, production, distribution and consumption. There is an Annex that looks at the issues around the decommissioning of offshore oil and gas installations and another that looks at the role of two key low carbon technologies: renewables and combined heat and power.



Chapter 3 looks at trends in energy demand and the drivers of its growth. It looks at how energy consumption is influenced by economic growth, changes in the structure of the economy and changes in energy efficiency. Policies that aim to increase energy efficiency and thereby reduce the growth in energy demand and its environmental consequences are outlined. The chapter gives a brief overview of overall demand before looking at each sector (domestic, industrial, services, and transport) in turn. Two Annexes look, first, at the potential for reducing energy consumption in commercial and public buildings and, secondly, the impact of Energy Efficiency Standards of Performance on domestic sector consumption. A further Annex looks at energy consumption patterns across the European Union.

Chapter 4 looks at competition and prices in domestic energy markets. It reviews the level of competition through information on numbers of customers who have switched suppliers, the characteristics of people who have switched, including the extent of switching amongst customers with prepayment meters. Competition can lead to lower prices for consumers and the evolution of domestic fuel prices in recent years is examined. Finally, the chapter looks at how lower prices have contributed to lower energy bills for consumers. There is an Annex on how prices differ between suppliers and by payment method.

Chapter 5 looks at the quality of service that electricity and gas companies provide to domestic consumers and the factors that influence it. Trends in complaints and why people complain are reviewed. The chapter looks at the extent of interruptions to customers' electricity supplies and companies' performance against standards that trigger payments to consumers when they are not met. Services supporting the disadvantaged are also outlined. There is an Annex on what happens when a gas or electricity supplier fails, as well as details of the Electricity and Gas Standards of Performance

Chapter 6 examines the extent of fuel poverty - where households have to spend a disproportionate amount of their income to keep warm - and Government policies to eradicate it. The characteristics of fuel poverty are described as well as the causes and effects of fuel poverty. Policies to tackle fuel poverty are outlined, including measures to use energy more efficiently, market based policies such as liberalisation that has reduced energy prices and income measures such as the winter fuel payments to pensioners. There are Annexes on possible definitions of fuel poverty, gas and electricity company initiatives to tackle fuel poverty, Ofgem's Social Action Plan and how income changes have affected the number of people in fuel poverty.

Its presentation is different from other DTI publications and experimental. Feedback on its usefulness is welcome. Specifically, does the publication cover all the social and environmental impacts of energy? Are there specific topics on which more detailed analyses would be warranted? Is the balance between data and descriptive analysis about right? Please send comments to Energy publications, ENP4F, DTI, Bay 1108, 1 Victoria Street, London SW1H 0ET, by telephone to 020 7215 2698 or email us at energy.publications@dti.gsi.gov.uk. This booklet is also accessible via the DTI website at http://www.dti.gov.uk/energy.

DTI, July 2002.

1. Emissions

- There is mounting evidence that man-made greenhouse gas emissions are causing unprecedented rates of climate change, both globally and in the UK.
- UK greenhouse gas emissions were 13 per cent below 1990 levels in 2000.
- The production and use of energy causes 83 per cent of overall UK greenhouse gas emissions and 90 per cent of carbon dioxide emissions.
- High levels of air pollution can have a harmful effect on human health and damage soil, water, wildlife, ecosystems and buildings.
- UK sulphur dioxide emissions, a major cause of acid rain, fell by 69 per cent between 1990 and 2000.

Introduction

1.1 Global temperatures have increased by some 0.6°C over the last century and there is new and stronger evidence that most of the warming observed over the last 50 years is due to human activities. The Intergovernmental Panel on Climate Change has predicted that global temperatures will rise during the 21st Century by between 1.4°C and 5.8°C and that sea levels will rise by between 0.09 and 0.88 metres. Such a rate of warming would be without precedent in the last 10,000 years.

1.2 One of the major causes of climate change is the increased level of man-made greenhouse gas emissions in the atmosphere, in particular those involving energy combustion. To address the problem of climate change and reduce levels of greenhouse gas emissions, we need to understand how the way in which we produce and use energy generates carbon dioxide and other greenhouse gases and act on this understanding. The Royal Commission on Environmental Pollution has proposed that, to arrest the rise in global emissions and limit climate change, the UK should aim to reduce its emissions of greenhouse gases by 60 per cent by 2050.

1.3 Emissions from energy production and use also contribute to pollution of the air we breathe. Clean air is important for human health and to protect our ecosystems and buildings. Industrial activities, transport, particularly road vehicles, and domestic energy use all contribute to air pollution. The main pollutants of concern are sulphur dioxide, nitrogen dioxide, fine particles, benzene, carbon monoxide, lead, 1.3-butadiene and low level ozone. The introduction of tighter controls has lead to substantial reductions in emissions and concentrations of these pollutants in the UK over the last ten years.

1.4 This chapter outlines trends in emissions being generated, both greenhouse gas emissions and air pollutants, as a result of energy use, and looks at some of the Government policies, measures and targets that should reduce them. Trends in these emissions reflect both increasing incomes and demand for energy services and the efficiency with which we use energy resources to satisfy demand. Further information is provided in Chapter 3 on energy demand which gives information on the main drivers of energy consumption and, as a result, the main drivers of emissions. Energy consumption through fossil fuel combustion accounts for more than 95 per cent of carbon dioxide, sulphur dioxide, nitrogen oxides and black smoke, 90 per cent of carbon monoxide emissions and two thirds of fine particles measured as PM_{10} emissions.

Greenhouse gas emissions

- UK greenhouse gas emissions fell 13 per cent between 1990 and 2000; under the Kyoto target, emissions need to be reduced by 12½ per cent between 1990 and 2008-2012.
- Carbon dioxide contributed 84 per cent of the potential warming effect of man-made emissions of greenhouse gases in 2000 in the UK.
- Carbon dioxide emissions in the UK fell by 6 per cent between 1990 and 2001 mainly due to fuel switching in electricity generation. The Government's domestic goal is to achieve a reduction of 20 per cent by 2010.
- The carbon intensity of the UK economy (carbon emitted per unit of output) reduced by 27 per cent between 1990 and 2001.
- Methane emissions declined 33 per cent and nitrous oxide emissions by 35 per cent in the ten years to 2000.

The global problem

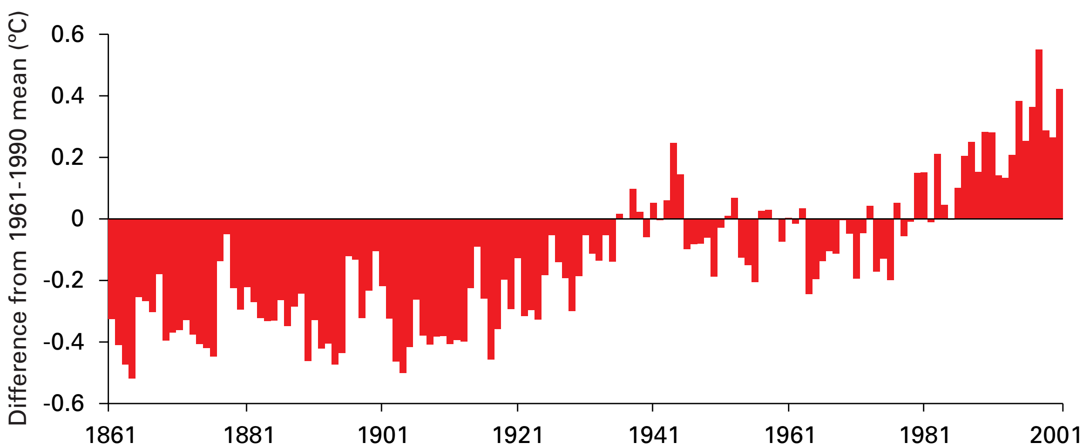
1.5 Naturally-occurring greenhouse gases maintain the earth's surface at a temperature 33°C higher than it would be in their absence. Water vapour is by far the most important natural greenhouse gas, and carbon dioxide the second most important, but there are also significant natural sources of methane, ozone and nitrous oxide.

1.6 Carbon dioxide contributed 84 per cent of the potential warming effect of man-made emissions of greenhouse gases in the UK in 2000. Prior to the industrial revolution its atmospheric concentration was about 280 parts per million (ppm). By 1998, it had reached 365 ppm and this is bound to increase as emissions continue to rise and because carbon dioxide remains in the atmosphere for 5-200 years. The Intergovernmental Panel on Climate Change has examined various scenarios for emissions over the next one hundred years and these indicate that, over this period, it could rise to three times the current level. The European Commission and the Royal Commission on Environmental Protection have recommended that levels are kept below 550 ppm.

1.7 IPCC figures show that methane concentrations in the atmosphere have doubled over the last century. Other greenhouse gas concentrations in the atmosphere are increasing as a result of human activities. This includes trace gases such as some halogenated compounds (for example, hydrofluorocarbons, HFCs) that are completely anthropogenic in origin.

1.8 The Met Office's Hadley Centre have used their climate change model to simulate the impact of climate change, in terms of global average temperatures, over the period 1861 to 2000, based on all natural and man made factors. The model explains well the rise in average global temperatures in the latter part of the twentieth century shown in Chart1.1. The model has also been used to simulate the rise in average global temperatures over the next hundred years.

Chart 1.1 Global temperatures since 1861



Source: Hadley Centre

1.9 Climate change is a global problem, affecting all countries, and having an adverse effect on the world's ecosystems. But its effects will vary from country to country. For example, agricultural production in some countries may benefit through longer growing seasons and increased rainfall whereas, in other areas, crops may fail and diseases such as malaria may spread to previously unaffected areas. Rising sea levels are inevitable in the face of global warming, which will put people's lives at risk.

1.10 Greenhouse gas emissions resulting from energy use are affected by how much fuel is burned and which fuels are used, for example, coal usually produces more emissions than oil or gas (see Table 1.1 below). Nuclear fuels and renewable sources produce negligible amounts of greenhouse gas emissions.

Table 1.1 Emission factors for stationary combustion of fossil fuels

Grams per GJ

	Natural gas	Oil	Coal
Carbon dioxide[1]	14,000	19,000	24,000
Methane	4	3	20

[1] Expressed in terms of weight of carbon produced.

1.11 During the twentieth century, greenhouse gas emissions rose very rapidly. Emissions of the main greenhouse gas, carbon dioxide, increased ten fold between 1900 and 1998. The fastest rate of increase was during the third quarter of the century. Further information on long term global trends in emissions, together with some analysis of international trends, is shown at Annex 1A. By comparison, in the last ten years, UK greenhouse gas emissions have been falling. In 2000, UK emissions fell to 13 per cent below their 1990 level. This took them below the target level under the Kyoto Protocol for the period 2008-2012. As shown in Table 1.2, emissions of most of the major greenhouse gases declined substantially between 1990 and 2000.

Table 1.2 UK emissions from the Kyoto basket of six greenhouse gases , 2000

Greenhouse gas	Percentage of total greenhouse gas warming potential	Percentage of emissions due to energy consumption	Percentage change in emissions between 1990 and 2000
Carbon dioxide	84	95	-8
Methane	8	4	-33
Nitrous oxide	7	20	-35
Hydrofluorocarbons	1	-	-18
Perfluorocarbons	<1/2	-	-71
Sulphur hexafluoride	<1/2	-	+113
Basket total	100	-	-13

The global response

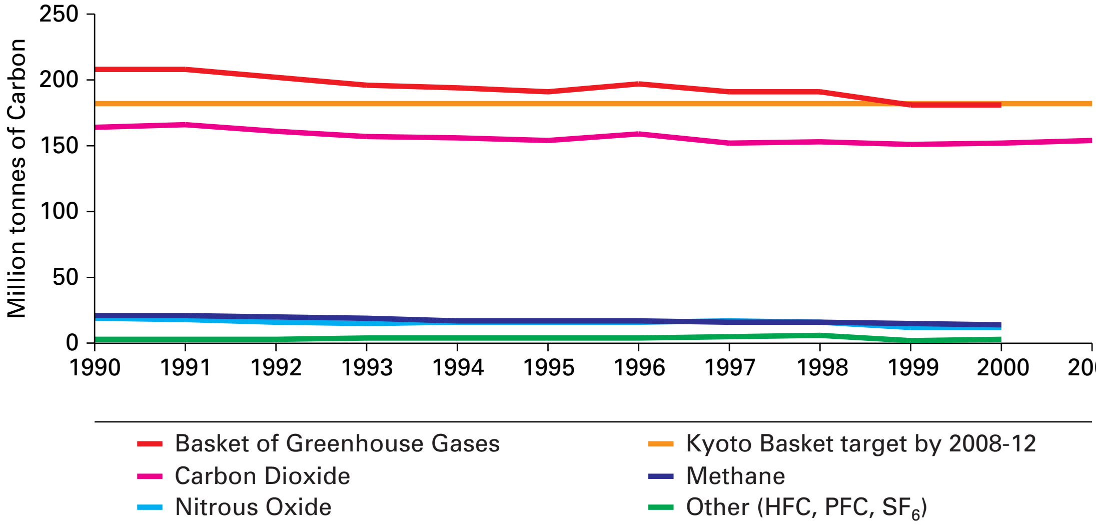
1.12 In response to increasing concerns about climate change, the United Nations Framework Convention on Climate Change was agreed at the Earth Summit in Rio de

Janeiro in 1992. Under the Convention, all developed countries agreed to aim to return their greenhouse gas emissions to 1990 levels by 2000. The UK achieved this through a reduction in greenhouse emissions which were about 13 per cent below 1990 levels by 2000. About two fifths of the reductions achieved so far have been due to fuel switching in power stations from coal to gas following the introduction of Combined-Cycle Gas Turbine power stations. The increased use of gas and nuclear fuel in place of coal in power stations has resulted in carbon dioxide emissions from power stations at levels 20 per cent lower than they would otherwise have been.

1.13 The Kyoto Protocol was agreed in December 1997 to take the commitment further. For the first time, many developed countries agreed to legally binding targets that will collectively reduce their emissions of a basket of six greenhouse gases to below 1990 levels over the period 2008-2012. The European Community and its Member States agreed to an 8 per cent target. This was subsequently reallocated between Member States to reflect their national circumstances, increasing the UK's reduction commitment to 12½ per cent.

1.14 By 2000, UK greenhouse gas emissions were 13 per cent below their 1990 level. The Government also has a separate domestic goal to reduce its carbon dioxide emissions by 20 per cent below 1990 levels by 2010. By 2001, carbon dioxide emissions were 6 per cent below their 1990 level. Chart 1.2 shows the UK Kyoto target and progress towards meeting it. As shown in Table 1.2, emissions of most of the major greenhouse gases declined substantially between 1990 and 2000.

Chart 1.2 Greenhouse gas emissions in the UK since 1990



Source: Department for Environment, Food and Rural Affairs

1.15 The commitments agreed in Kyoto by EU Member States and other developed countries are a small, though very important first step. The EU Member States together completed their ratification procedures on the 31 May 2002 and the UK continues to work for wider ratification of the Kyoto agreement leading to its early entry into force, for constructive reengagement of the United States, and for longer term commitments leading to stabilisation of greenhouse gases in the atmosphere at a safe level.

1.16 The Kyoto Protocol established three market mechanisms (known as the Kyoto Mechanisms) to assist countries who have undertaken to limit their greenhouse gas emissions to meet this commitment under the protocol. The basic idea behind these mechanisms is simple. International Emission Trading allows countries with emission limitations (so called Annex B Countries) to trade emission allowances between them, Joint Implementation allows these countries to undertake emission reduction projects in each others territory and the Clean Development Mechanism allows Annex B Countries to undertake agreed projects in countries which themselves do not have an emissions reduction or limitation commitment (Non-Annex B or developing countries).

Carbon dioxide

1.17 The most important anthropogenic greenhouse gas is carbon dioxide. Carbon dioxide contributed 84 per cent of the potential global warming effect of anthropogenic emissions of greenhouse gases in 2000 in the UK. Although this gas is naturally emitted by living organisms, these emissions are balanced by the uptake of carbon dioxide by plants during photosynthesis; thus there is no net effect on atmospheric concentrations. The burning of fossil fuels, however, releases carbon dioxide fixed by plants many millions of years ago, and thus increases its concentration in the atmosphere.

1.18 In 1999, the UK was responsible for 2½ per cent of the world's carbon dioxide emissions and 17 per cent of emissions from the EU. As shown in Table 1.3, the main sources of carbon dioxide emissions in the UK, in 2001, were power stations, industry, road transport and the domestic sector. Carbon dioxide emissions fell during the 1990s, mainly due to a large fall in emissions from power stations which was caused by fuel switching from coal to nuclear and gas.

1.19 While carbon dioxide emissions fell by 6 per cent between 1990 and 2001, the UK's Gross Domestic Product increased by 26 per cent leading to a decline of 27 per cent in carbon intensity (carbon emissions per unit of output) over this period. This decline in carbon intensity can be decomposed into two elements: a decline in the overall carbon emissions factor (carbon emissions per unit of energy consumed) of 15 per cent and a reduction of 14 per cent in energy intensity (energy consumption per unit of output).

1.20 Different fuels produce different levels of emissions per unit of energy burned as Table 1.1 shows. Since 1993, gas, which produces fewer carbon dioxide emissions than either coal or oil, has been used increasingly to generate electricity, in particular in Combined Cycle Gas Turbine power stations which operate at higher levels of efficiency than conventional thermal stations. Gas is now used to generate 38 per cent of the electricity that we use in the UK. However, these benefits have been offset by the continued increase in electricity consumption over this time - a trend that is expected to continue.

Table 1.3 Sources of carbon dioxide emissions in the UK

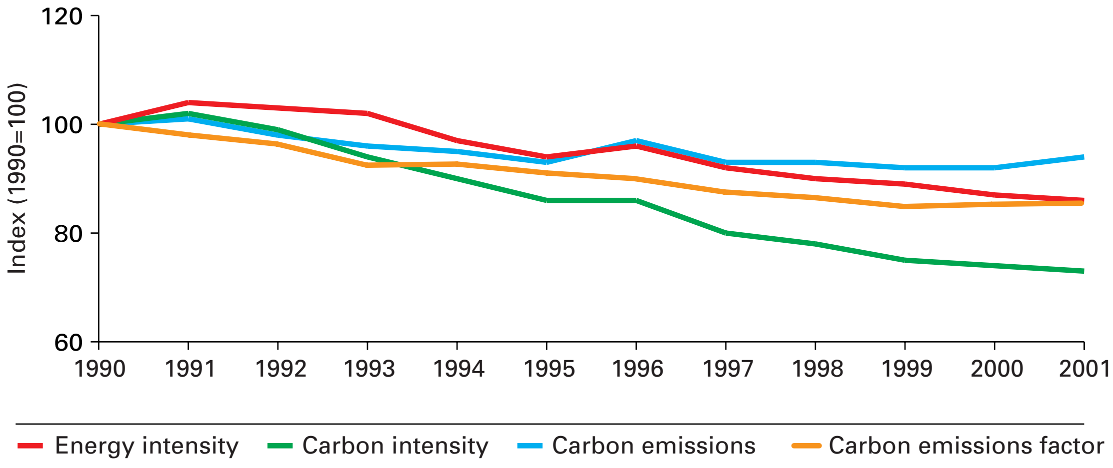
	1990	1995	2001	Million tonnes of Carbon Change between 1990 and 2001 (per cent)
By source				
Power stations	54.1	44.1	43.7	-19
Industrial combustion	37.6	38.3	37.2	-1
Transport	31.8	32.2	33.5	+5
Domestic	21.6	21.8	23.9	+11
Commercial and Public Services	8.3	8.5	8.5	+3
Other sectors	11.1	9.0	7.7	-31
Total	**164.5**	**153.7**	**154.4**	**-6**
By fuel				
Coal and other solid fuels	66.6	47.8	38.9	-42
Petroleum	56.8	54.7	49.9	-12
Natural gas	30.4	42.2	57.5	+89
Other emissions	10.6	9.0	8.1	-24
Total	**164.5**	**153.7**	**154.4**	**-6**

1.21 Looking forward, closures of nuclear generation plants that are carbon free (although there are other environmental issues surrounding nuclear power generation that are discussed in Chapter 2) can be expected to increase carbon emissions per unit of energy used. Fuel switching opportunities may reduce, so without other measures, the fall in emissions due to fuel switching in power stations between 1992 and 1999 is unlikely to be sustainable. Increasing power generation from renewable sources should, however, reduce the size of any increase in carbon emissions per unit of energy consumed. Renewables (including hydro electricity) were used for 2½ per cent of power generation in 2001 compared with just under 2 per cent in 1990. The Government has a target of 10 per cent of electricity to be generated from renewable sources by 2010.

1.22 Energy intensity fell for a number of reasons including improvements in energy efficiency, structural change in the economy reducing the relative importance of energy intensive industries and fuel switching resulting in less energy being consumed per unit of output. These are explored in more detail in Chapter 3.

1.23 In addition to the Kyoto international target, the UK has a domestic goal to reduce carbon dioxide emissions to 20 per cent below 1990 levels by 2010. By 2001, carbon dioxide emissions were estimated to be 6 per cent below 1990 levels. The UK's Climate Change Programme (CCP) sets out the Government's strategy to meet this carbon dioxide target and its targets for reducing greenhouse gas emissions. The CCP outlines policies in all sectors of the economy. It is estimated that the policies in the programme could reduce greenhouse gas emissions by 23 per cent below 1990 levels by 2010.

Chart 1.3 Changes between 1990 and 2001 in carbon dioxide emissions, carbon dioxide emissions factor and carbon and energy intensity



Source: Department for Environment, Food and Rural Affairs; Department of Trade and Industry; Office for National Statistics

1.24 Carbon dioxide is the main challenge and the main focus of the Climate Change Programme, which sets out a wide range of policies to address these emissions. These include:

- An obligation on electricity suppliers to source 10 per cent of electricity from renewable sources subject to the cost to the consumer being acceptable;
- Measures to improve domestic energy efficiency including the new Energy Efficiency Commitment that requires electricity suppliers to promote energy savings by households;
- The Climate Change Levy on business use of energy, including exemptions for renewables and Combined Heat and Power;
- Climate Change Agreements with energy intensive sectors and the implementation of Integrated Pollution Prevention and Control (IPPC);
- Voluntary reductions through the first stage of the Emissions Trading Scheme launched in 2002;
- The Ten Year Plan for Transport.

'Climate Change - the UK Programme' issued in November 2000 sets out the Government's climate change policies in more detail.

Other greenhouse gases

1.25 Methane is the second most important greenhouse gas after carbon dioxide and, in 2000, contributed around 8 per cent of the UK's total emissions of greenhouse gases. The main energy-related sources of man-made methane emissions are from gas transmission and distribution, coal mining and offshore oil and gas production. Overall, methane emissions fell by 33 per cent between 1990 and 2000.

1.26 Nitrous oxide contributed 6½ per cent of anthropogenic greenhouse gas emissions in 2000. The major sources are from agricultural soils through the use of varieties of fertiliser, accounting for two thirds of all nitrous oxide emissions. Nitrous oxide emissions were reduced by 35 per cent between 1990 and 2000.

1.27 A fifth of all nitrous oxide emissions are from energy sources and these are mainly from road vehicles, particularly petrol vehicles fitted with catalytic converters. Nitrous oxide is formed as a by-product of the catalytic process reducing nitrogen oxide emissions from the exhaust. The increased number of cars equipped with catalytic converters in the fleet has led to a four-fold increase in nitrous oxide emissions from road transport between 1990 and 2000. The use of catalytic converters has, of course, brought about improvements in air quality that are discussed below.

1.28 Emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6) made up 1½ per cent of all greenhouse gases in 2000. Although levels that were emitted in real terms were small, the global warming potential per tonne of these emissions is greater than carbon dioxide, methane and nitrous oxide. The main sources of these emissions are from refrigeration, air conditioning and electronics rather than direct energy sources. Emissions of SF6 have increased since 1990 due to its use as a replacement for sulphur dioxide in magnesium production and growth in the electronics and electrical insulation sectors.

Air quality

- Sulphur dioxide emissions have fallen by 69 per cent between 1990 and 2000.
- Emissions of particles as PM_{10} have fallen by 45 per cent between 1990 and 2000.

1.29 Air pollution can have a serious effect on people's health, in particular those with asthma, lung diseases or heart conditions, and can also damage soil and crops, freshwaters and streams, ecosystems and accelerate corrosion of buildings and building materials.

1.30 The Government published an Air Quality Strategy for England, Scotland, Wales and Northern Ireland in 2000. The aim of the strategy is to provide the best practicable protection to human health by setting health based air quality standards and objectives for their achievement across the UK for the eight main pollutants: sulphur dioxide, PM_{10}, nitrogen dioxide, carbon monoxide, lead, benzene, 1,3-butadiene, and ozone. It also sets objectives for sulphur dioxide and nitrogen oxides for the protection of vegetation and ecosystems. Table 1.4 shows the extent to which emissions of these different air pollutants were caused by energy consumption in 2000 and how they have changed since 1990.

Table 1.4 Principal air pollutants caused by energy consumption in 1990 and 2000

Per cent

	Percentage of emissions caused by energyconsumption in 2000	Change in total emissions between 1990 and 2000
Nitrogen oxides[1]	96	-45
Sulphur dioxide	94	-69
1,3-Butadiene	93	-59
Benzene	84	-70
Carbon monoxide	94	-42
Lead	71	-82
PM_{10}	61	-45
Ozone[2]	-	n/a

[1] The Air Quality Strategy sets limits for nitrogen dioxide.
[2] There are no direct emissions of ozone. This pollutant is formed by atmospheric chemical reactions.

Nitrogen dioxide

1.31 Nitrogen dioxide adds to the natural acidity of rainfall and affects human health (airways and lung function can be affected, particularly in asthma sufferers) as well as vegetation. Nitrogen oxides are emitted from the combustion of fossil fuels. Although some of the nitrogen oxides are emitted directly as nitrogen dioxide, most of the nitrogen oxides are emitted as nitric oxide which reacts with ozone present in the air to produce nitrogen dioxide. Fuel combustion was the source of 96 per cent of nitrogen oxide emissions in 2000. Almost half of these emissions were from road vehicles and just under a quarter from power stations. Overall, in 2000, nitrogen oxides were 45 per cent below 1990 levels.

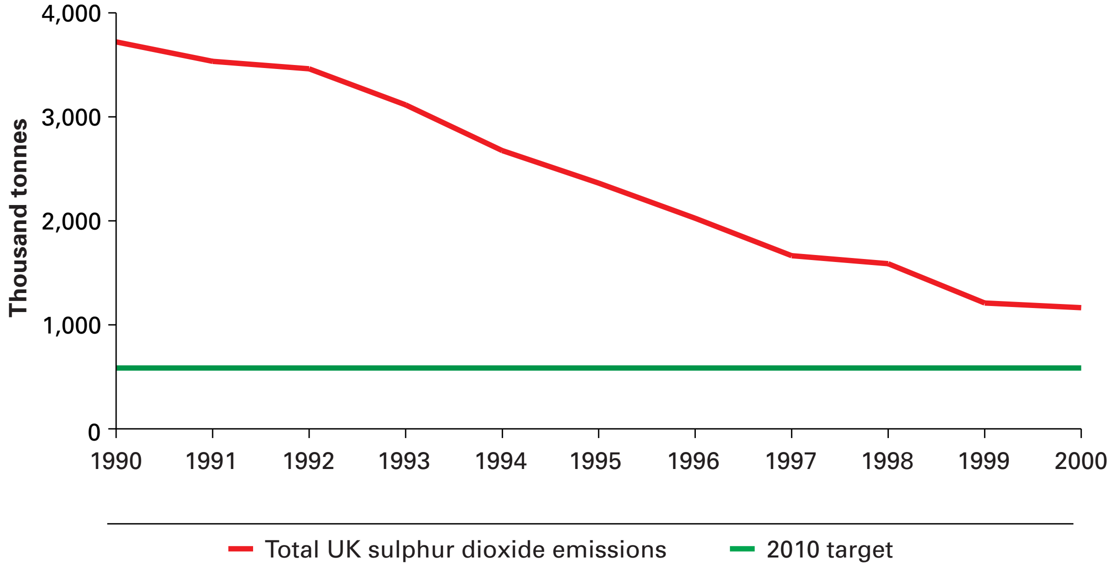
1.32 Emissions from power stations fell by 54 per cent between 1990 and 2000, with the switch towards gas from coal and oil generation the main cause, whilst the introduction of low NO_X burners at the remaining coal fired stations also helped. Emissions from road transport have reduced considerably over the last ten years, principally as the result of the introduction of catalytic converters that became compulsory on all new petrol cars from 1993. Emissions should continue to fall as older cars without catalytic converters are scrapped and as progressively tighter emission and fuel standards take effect over the next few years.

Sulphur dioxide

1.33 Sulphur dioxide is a gas produced by the combustion of sulphur-containing fuels such as coal and oil, and contributes to acid rain and local air pollution. Acidification has led to the loss of species at all levels of the food chain and has resulted in a reduction in biodiversity of these systems. Sulphur dioxide is an acid gas and can affect health and vegetation. It affects the lining of the nose, throat and airways of the lung, in particular among those who suffer from asthma and chronic lung disease.

1.34 Most sulphur dioxide in the UK is created through the combustion of coal, as it has been since the industrial revolution. Following the 1956 Clean Air Act and the increased use of alternative fuels for generating electricity as well as in direct end-uses, emissions of sulphur dioxide fell considerably. Between 1990 and 2000, sulphur dioxide emissions fell by 69 per cent, with the biggest contribution from the reduction in the use of coal at power stations. For more details see Annex 1B which looks at trends in sulphur dioxide emissions.

Chart 1.4 Sulphur dioxide emissions since 1990, with 2010 target



Source: Department for Environment, Food and Rural Affairs

1.35 The UK is committed to reducing annual emissions of sulphur dioxide to 585 thousand tonnes from 2010 under the EC National Emission Ceilings Directive. The aim is to reduce acidification, eutrophication and ground level ozone across Europe. The Directive sets emission ceilings for all Member States to achieve from 2001, as well as a set of indicative ceilings for the whole of the European Union to be reviewed in 2004. Chart 1.4 shows how levels of sulphur dioxide emissions have changed since 1990, together with the targets for the UK. Emissions were 1,165 tonnes in 2000.

1,3-Butadiene

1.36 Exposure to 1,3-butadiene may lead to leukemias and cancers of the lymphoid system. Combustion of fossil fuels is responsible for 93 per cent of UK emissions of this pollutant. This is almost entirely from the combustion of petrol and diesel in the road transport sector.

1.37 Emissions of 1,3-butadiene fell steadily throughout the 1990s mainly due to the increased use of catalytic converters in cars. Catalytic converters became compulsory for new road vehicles bought after 1993. Emissions were 59 per cent lower in 2000 than in 1990 and should continue to decline as older vehicles without catalytic converters are scrapped. Progressively stricter emission and fuel standards will continue to cut levels over the next few years.

Benzene

1.38 Benzene is a recognized human carcinogen which raises the risk of leukemia. It is a volatile organic compound for which the primary source is unburnt fuel in petrol vehicle exhaust gases and fuel evaporation during refuelling. There is also a small amount of emissions from diesel fuel. Together, petrol and diesel use in the road transport sector accounted for 47 per cent of benzene emissions in 2000. Other energy sources accounted for a further 37 per cent of these emissions. These are mainly from off-road machinery and from domestic combustion.

1.39 The increasing number of cars on the road with catalytic converters has driven the 70 per cent reduction in benzene emissions between 1990 and 2000. Since the beginning of 2000, EU legislation requires that the amount of benzene in petrol is below 1 per cent, down from its previous maximum limit of 5 per cent and this has further helped to bring down emissions.

Carbon monoxide

1.40 The presence of carbon monoxide prevents the normal transport of oxygen by the blood which can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease. It is derived from the incomplete combustion of fuel and the major source is from road transport.

1.41 Energy sources account for 94 per cent of carbon monoxide emissions. Around three quarters of these emissions emanate from road vehicles. Between 1990 and 2000, emissions from all energy sources fell by 33 per cent and from road transport by 45 per cent. The latter was the result of the increased use of catalytic converters in petrol cars. Also, there are now more diesel cars which emit less carbon monoxide than non-catalyst equipped petrol-fuelled cars.

Lead

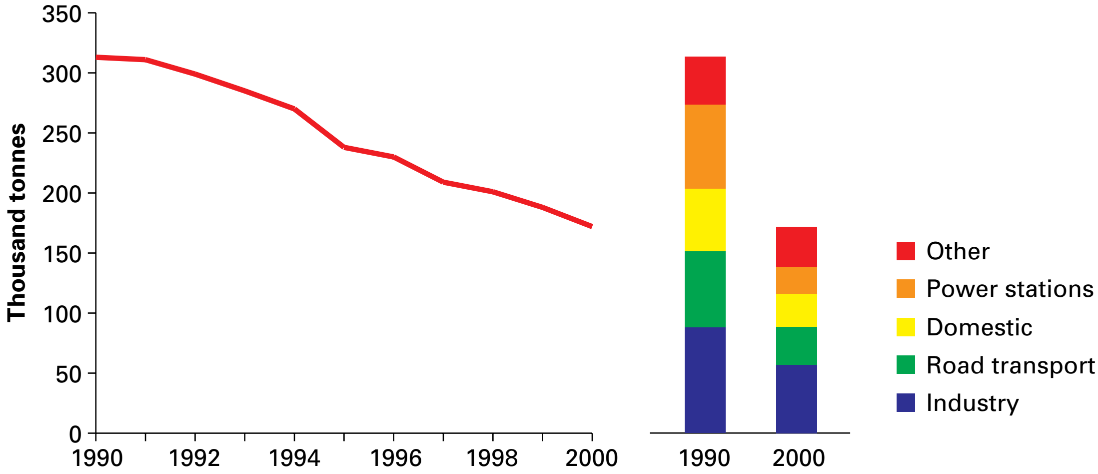
1.42 The main sources of lead in air have been lead in petrol, which was used to improve the octane rating, coal combustion and metal works where it is widely used in a number of industrial applications including the manufacture of batteries. Lead is harmful to people, particularly through food and water, when dust and rain containing the metal fall on crops and on the soil. High levels of exposure to lead can affect the kidneys and nervous system.

1.43 Energy sources were responsible for 76 per cent of lead emissions in 2000. Of these, over two thirds were from road vehicles. Lead emissions from road vehicles fell by 85 per cent between 1990 and 2000 reflecting the steady replacement of leaded petrol by unleaded at the pumps - the share of unleaded petrol grew from 34 per cent to 93 per cent between the beginning and the end of this period. The introduction of lead-free petrol in the early 1990s and tighter controls on industrial processes have cut lead levels in the air considerably. The banning of lead in petrol, since the end of 1999, has helped to further reduce levels in the UK.

Particulate matter

1.44 Airborne particulate matter consists of small particles that may come from a wide range of man-made and natural sources, including incomplete fuel combustion, wind-blown soil, and dust generated by activities such as mining and quarrying. These particles harm our health and can be responsible for a number of respiratory problems. They cause premature deaths for some people with existing lung problems and heart disease.

Chart 1.5 PM_{10} emissions by sector, since 1990



Source: Department for Environment, Food and Rural Affairs

1.45 Experts advise that on present evidence, the standard of air quality with regard to particulate air pollution is best measured through PM_{10}, which essentially includes all respirable particles. Chart 1.5 shows how emissions have been falling in the UK since 1990. Overall emissions of PM_{10} fell by 45 per cent between 1990 and 2000 and within this total, the largest falls have been for emissions from power stations, road transport and the domestic sector.

1.46 Direct emissions of PM_{10} are only partially responsible for the concentrations found in the air. Further particulates in this size range are present as sulphate and nitrate aerosols produced by chemical reactions in the air. Much of the PM_{10} present in the air in the UK originates from activities that take place within the UK. However, additional emissions originating from mainland Europe are thought to contribute up to 20 per cent of PM_{10} concentrations in the UK.

Ozone

1.47 In the stratosphere, ozone plays a beneficial role by shielding the earth from harmful ultra-violet radiation. However at ground level, high concentrations of ozone can damage people's respiratory systems, cause irritation to eyes and nose and have a harmful effect on vegetation and ecosystems.

1.48 Ozone is not emitted directly from any one source. It arises from chemical reactions of a number of different pollutants in the air under the presence of sunlight, which is why levels are highest in summer months. This reaction takes place over several hours or days which leads to highest concentrations many miles from the original source of the pollutants. Ozone is one of the main transboundary pollutants in the UK.

1.49 Action is targeted at cutting emissions of the pollutants of the precursors which lead to the formation of ozone - oxides of nitrogen, sulphur dioxide and volatile organic compounds – for example, by tighter emission standards for road vehicles, controls on petrol vapours from petrol storage and distribution, tighter emission standards for power stations and other industrial processes concerned. There is also a great deal of action underway at international level in view of the transboundary nature of ozone.

Further reading

- Climate Change - The UK Programme, DETR (now DEFRA), November 2000
  http://www.defra.gov.uk/environment/climatechange/cm4913/index.htm
- Digest of Environmental Statistics, DEFRA
  http://www.defra.gov.uk/environment/statistics/des/index.htm
- Energy Sector Indicators, DTI
  http://www.dti.gov.uk/energy/inform/energy_indicators/
- CO2 emissions from fuel combustion 1971-1999, International Energy Agency
  http://www.iea.org/
- Energy Paper 68: Energy Projections for the UK, November 2000, The Stationery Office
  http://www.dti.gov.uk/energy/inform/energy_projections/
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Working Together for Clean Air. DETR.
  http://www.defra.gov.uk/environment/airquality/strategy/index.htm
- 'Energy – The Changing Climate' by the Royal Commission on Environmental Pollution (RCEP)
  http://www.rcep.org.uk/newenergy.html
- Long-Term Reductions in Greenhouse Gas Emissions in the UK – Report of an Inter-departmental Analysts Group, February 2002,
  http://www.dti.gov.uk/energy/

Useful websites

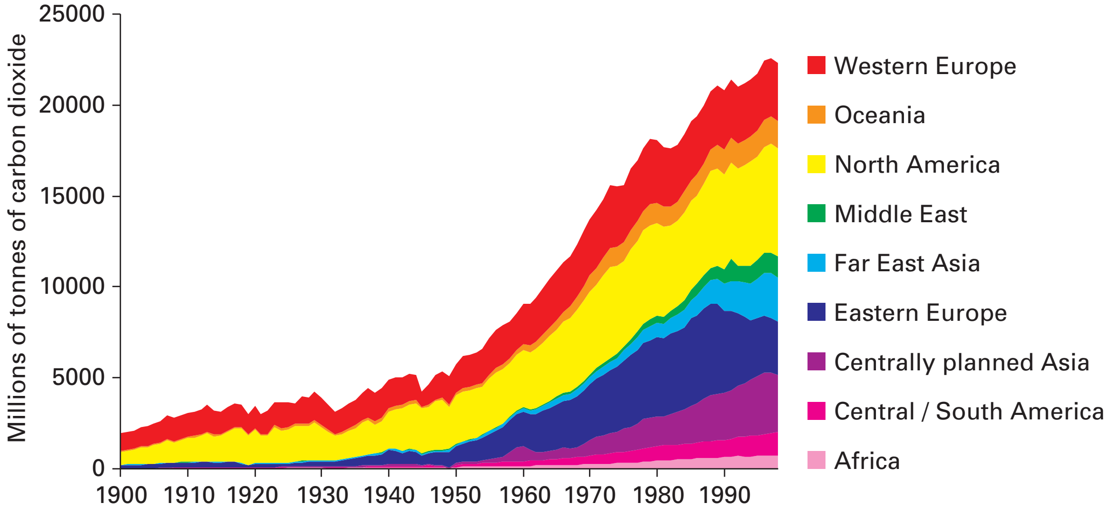
DTI:	http://www.dti.gov.uk/
DEFRA:	http://www.defra.gov.uk
RCEP:	http://www.rcep.org.uk/
NETCEN:	http://www.aeat.co.uk/netcen/airqual/naei/

Annex 1A
Trends in international carbon dioxide emissions

1A.1 A global effort will be needed to reduce greenhouse gas emissions and to arrest climate change. The Intergovernmental Panel on Climate Change (IPCC) have predicted that unless emissions of greenhouse gases decrease there will be a temperature increase of between 1.4°C and 5.8°C by 2100. This Annex looks at carbon dioxide emissions, the most important anthropogenic greenhouse gas.

1A.2 The global emissions of carbon dioxide through the combustion of fossil fuels have increased rapidly over the last century. Chart A1.1 shows that global carbon dioxide emissions increased ten fold from 1900 to 1998. The growth in carbon dioxide emissions has been particularly rapid in the last fifty years, though the rate of increase has slowed to some extent in the last two decades.

Chart 1A.1 Global emissions from fossil fuel combustion from 1900 to 1998.



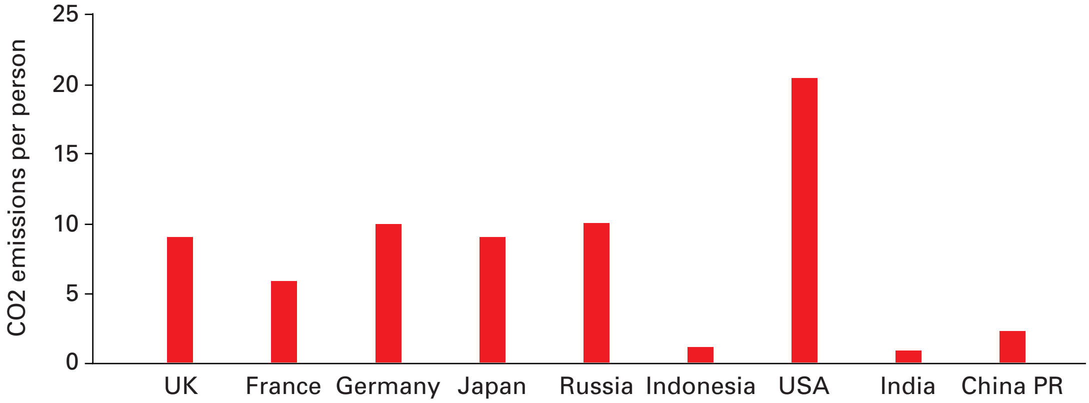
Source: Marland, G., T.A. Boden, and R. J. Andres, Global, Regional, and National CO2 Emissions 2001, Carbon Dioxide Information Analysis Centre, Oak Ridge National Laboratory.

1A.3 Chart 1A.1 shows that Europe and North America were responsible for 97 per cent of global carbon dioxide emissions at the start of the twentieth century, with Western Europe accounting for 62 per cent and North America 35 per cent. During the century, Western Europe's emissions increased five fold and North America's increased more than eight fold. However, their combined share of global emissions had fallen to 54 per cent at the end of the twentieth century, as emissions from other continents increased much faster from a low base. At the close of the twentieth century, Middle Eastern countries, whose carbon dioxide emissions were more than one thousand times higher than in 1900, contributed 5 per cent of global emissions. Centrally planned Asia (mainly China) contributed 14 per cent of global emissions following a six thousand-fold increase over the century.

1A.4 Between 1990 and 1999, global carbon dioxide emissions have grown by 9 per cent, according to figures from the IEA. Western Europe has seen a fall of about 0.5 per cent in emissions, over the same period. The biggest increases have been in Asia and the Middle East, with both regions showing a growth of over 50 per cent in their carbon dioxide emissions over this period, due primarily to economic growth and increased energy consumption. Falls in emissions were seen in former Communist countries, with a reduction of 36 per cent from the states of the former Soviet Union, and reductions in Eastern Europe of 27 per cent, following a rapid decline in their industrial sectors.

1A.5 Despite their faster growth in emissions, developing countries such as those in Asia still emit a lot fewer emissions per head of population than wealthier countries in Europe and North America. Average emissions were 8.2 tonnes of carbon dioxide per person in the EU in 1999 and 20.5 tonnes in the USA, compared with 2.4 tonnes in China and 0.9 tonnes in India. Chart 1A.2 shows figures for some of the wealthiest and most populous countries in Europe and the world.

Chart 1A.2 Carbon dioxide emissions per person for selected countries, 1999.



Source: International Energy Agency, Global CO2 Emissions From Fuel Combustion 2001.

1A.6 Wealthier countries tend to be responsible for more emissions because they consume more energy, which usually comes from fossil fuels. However countries with similar national income have widely different emission levels. Both these tendencies can be seen in Table 1A.1, which shows total emissions, population, GDP per head and emissions per head in a selection of larger and wealthier countries. Chart 1A.3 shows emissions per head against GDP per head for the most populous and most wealthy countries in the world.

1A.7 There are large differences in the level of emissions per head in countries with similar per capita incomes. While the richest countries do show some of the largest carbon dioxide emissions per capita, emissions do not rise proportionally with income so the line of best fit to current data in chart 1A.3 will not necessarily be representative of the future relationship between GDP per capita and emissions per capita. This is because economies tend to become less energy intense and more energy efficient over time. Indeed, over the period 1990 to 1999, the world energy intensity (the amount of energy consumed per unit GDP) fell by 12 per cent.

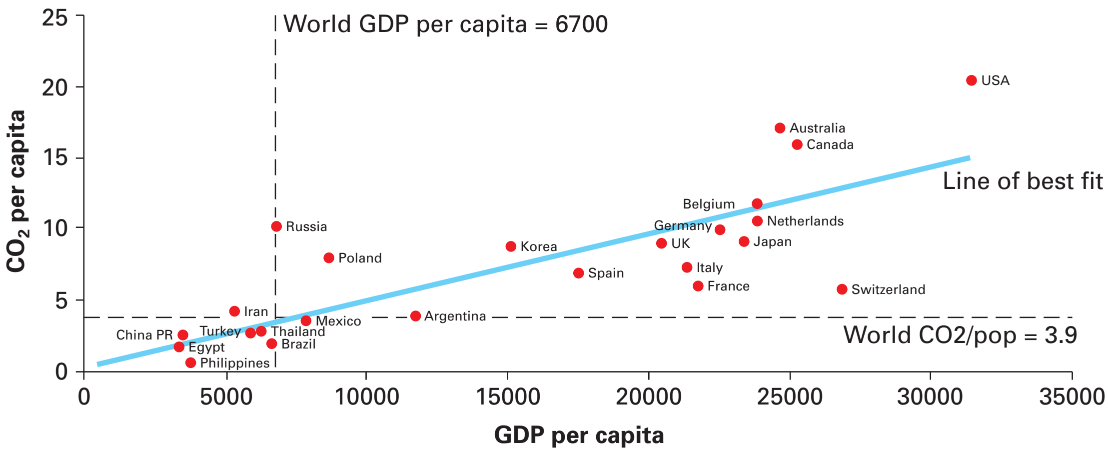
1A.8 Emissions per head are high relative to national per capita income in the USA, Canada and Russia. They are lower relative to per capita income in Switzerland, France, Brazil and the Philippines. In addition to its wealth, the level of emissions in a country is influenced by a variety of factors. On the supply side, these include use of renewable sources of energy and the extent of nuclear generation of electricity, as well as the balance between coal, gas and oil in a country's use of fossil fuels. On the demand side climate can have a strong influence on the amount of energy used for heating purposes in colder climates. Transport demand is also much higher in some countries than others.

Table 1A.1 Total carbon dioxide emissions, population, GDP per head and emissions per head for selected countries, 1999.

Country	Carbon dioxide emissions (million tonnes of carbon dioxide)	Population (millions)	GDP per capita (1995 US$ per person)	CO2 emissions per capita
UK	535.3	59.5	20452.1	9.0
France	361.4	60.3	21762.1	6.0
Germany	821.7	82.1	22547.2	10.0
Japan	1158.5	126.7	23399.6	9.1
Russia	1486.3	146.2	6859.7	10.2
Indonesia	244.92	207.0	2633.2	1.2
USA	5584.8	273.0	31456.8	20.5
India	903.82	997.5	2171.3	0.9
China	3006.8	1253.6	3476.2	2.4

Source: International Energy Agency, Global CO2 Emissions From Fuel Combustion 2001

Chart 1A.3 Carbon dioxide emissions per person plotted against GDP per capita for a selection of the most populous countries, 1999.



Source: International Energy Agency, Global CO2 Emissions From Fuel Combustion 2001

1A.9 The Earth Summit in Rio de Janeiro in 1992 led to the adoption of the UN Framework Convention on Climate Change (UNFCCC). The aim of the Convention was that signatories would attempt to stabilise their greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. By June 2002, 186 countries had ratified the Convention, which had come into force in March 1994.

1A.10 The developed countries, together with some former USSR countries and Eastern Europe agreed to go further and to adopt policies and measures, that would aim to reduce their greenhouse gas emissions to 2000 levels by 1990. They agreed to submit data annually to the UNFCCC. Data for 1998 are available for 30 of the 38 countries involved. In 1998 eleven of these 30 countries had emissions below 1990 levels. Of these eleven countries, nine were either part of the former USSR or formed part of Eastern Europe. Of the developed countries that have reported, only Germany and the UK had 1998 emissions figures below those in 1990. According to UK figures national carbon dioxide emissions in 2001 were 6 per cent below their 1990 level.

Annex 1B

An evaluation of the effects causing the reduction in sulphur dioxide emissions

1B.1 Sulphur dioxide (SO_2) is an acid gas, which can affect our health and vegetation, and contributes to acid rain and local pollution. Those who suffer from asthma and chronic lung disease are particularly likely to suffer from its impact: sulphur dioxide causes constriction of the airways by stimulating nerves in the lining of the nose, throat and airways of the lung.

1B.2 Sulphur dioxide emissions have fallen rapidly over the last decade as shown in Table 1B.1. The burning of fossil fuels or the smelting of sulphide ores produces sulphur dioxide. Almost all emissions in 2000 emanated from energy sources. Table 1B.1 shows the emissions of sulphur dioxide by source in 1990 and 2000, and the percentage change between these two dates. It shows that sulphur dioxide emissions have fallen from all sources, and in most cases have at least halved.

1B.3 In the UK in 2000, over three quarters of sulphur dioxide was produced by the combustion of coal, primarily in the generation of electricity at power stations. Emissions from this source fell by 68 per cent between 1990 and 2000. The main cause was a fall in the amount of coal used in electricity generation, from 49.84 million tonnes of oil equivalent (Mtoe) in 1990 to 28.67 Mtoe in 2000.

1B.4 The introduction of flue gas desulphurisation at two major power stations has also contributed to the fall. Since 1993, flue-gas desulphurisation has come progressively into operation at the Drax and Ratcliffe-on-Soar power stations. These represent the coal-fired power stations with the largest and fourth largest capacities, accounting for almost 6 GWe of power. This desulphurisation process, which usually involves using crushed limestone to react with sulphur dioxide in the hot flue gases, can reduce sulphur dioxide emissions by 90 per cent. The process is expensive to install, with the Drax and Ratcliffe installations costing in excess of £900 million. The ductwork is tall enough to accommodate a double-decker bus. The calcium sulphate formed by the process can be used in the manufacture of plaster wallboards. A side effect of the process is a reduction in the efficiency of the transformation of coal into electricity, increasing coal use by about 2 per cent for the same electrical output, and thereby increasing carbon dioxide and other emissions by 2 per cent.

1B.5 The EC Large Combustion Plants Directive (88/609/EEC) required a reduction in total sulphur dioxide emissions from existing and new combustion installations with an annual capacity of 50MW(th) of 20 per cent by 1993 and 40 per cent by 1998, taking 1980 as the baseline. This includes both power stations and industrial installations. There is a target of a 60 per cent reduction by 2003. In 1999, emissions from large combustion installations were almost 70 per cent lower than in 1980. The Directive has recently been revised to extend to older (pre 1987) plant.

Table 1B.1 Estimated emissions of sulphur dioxide by source category in 1990 and 2000

Source category	1990	2000	Percentage change between 1990 and 2000
	SO_2 emissions (thousand tonnes of SO_2)		
Energy sources	3,677	1,141	-69
Power stations	2,723	826	-70
Refineries	153	72	-53
Manufacturing industries and construction	450	129	-71
Transport	90	25	-72
Other sectors	206	65	-69
Other energy sources	9	6	-34
Fugitive emissions from fuels	38	10	-74
Non-energy sources	43	24	-44
Production processes	59	24	-40
Others	4	1	-82
Total	**3,721**	**1,165**	**-69**

Source: DEFRA, Digest of Environmental Statistics, 2002.

1B.6 Chart 1B.1 shows an analysis of the main causes of the reduction of sulphur dioxide from power stations. It shows that approximately 60 per cent of the reduction in sulphur dioxide emissions from power stations between 1990 and 2000 was due to falling use of coal in power generation, just over a quarter was due to reductions in the average sulphur dioxide level of coal and about 13 per cent was due to flue gas desulphurisation.

1B.7 Two other large coal-fired power stations, West Burton and Eggborough are due to have installed flue gas desulphurisation systems by the end of 2004, whilst the second largest coal-fired generator, Longannet in Scotland has developed ‘gas reburn’, a new technology for reducing its emissions in 2001. This technology is primarily designed to reduce emissions of nitrogen oxides by 80 per cent by injecting natural gas into the combustion zone. Emissions of sulphur dioxide are also reduced by 20 per cent because the ‘gas reburn’ process reduces the amount of coal needed in power generation. These measures are likely to ensure that sulphur dioxide emissions from this sector will continue to fall.

1B.8 Table 1B.2 below shows the emissions of sulphur dioxide by fuel. Aside from the emissions from coal combustion, the biggest source of sulphur dioxide emissions is the combustion of petroleum, which contributed about 15 per cent of all emissions in 2000. Such emissions have fallen by almost 80 per cent since 1990, primarily due to large reductions in fuel oil use in favour of gas in electricity generation and a general move away from oil to gas as the fuel of choice for use in industry.

1B.9 Sulphur dioxide emissions from petroleum are likely to continue to fall because of the EC Sulphur Content of Liquid Fuels Directive, which was implemented in the UK in June 2000. This limits the sulphur content of gas oil to 0.2 per cent from 1 July 2000 and to 0.1 per cent from 1 January 2008. Heavy fuel oil sulphur content will be limited to 1 per cent from 1 January 2003 as compared to a current specification of 3.5 per cent. The already small amount of sulphur dioxide emitted from motor spirit and diesel fuel has fallen and should fall further due to the introduction of ultra low sulphur petrol and diesel.

Chart 1B.1 Factors affecting the reduction in emissions from power stations between 1990 and 2000

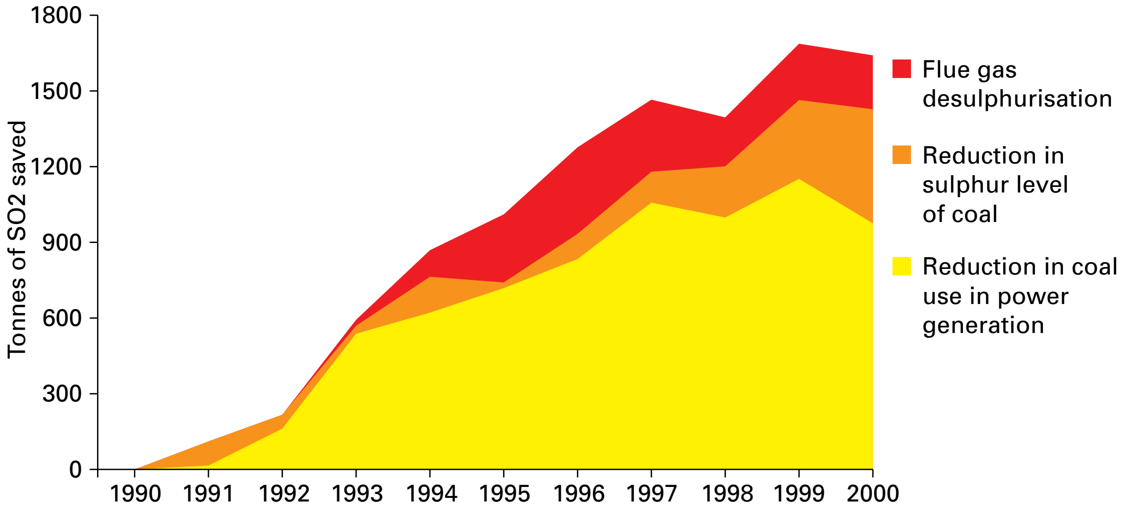


Table 1B.2 Estimated emissions of sulphur dioxide by fuel in 1990 and 2000

thousand tonnes of SO_2

Fuel Type		**1990**	**2000**	**Percentage change between 1990 and 2000**
Coal		2,721	881	-68
Other solid fuels		59	26	-56
Petroleum	Fuel oil	623	84	-87
	Other petroleum products	188	91	-52
Gaseous fuels		10	14	-40
Other emissions		120	70	-42
Total		**3,721**	**1,165**	**-69**

1B.10 In addition to the overall fall in sulphur dioxide emissions levels, a further useful measure of the success of reducing sulphur dioxide levels is a consideration of ambient air concentrations of SO2 measured at the national monitoring network sites. This monitoring network of some 67 sites covers urban, suburban and rural areas to ensure the UK complies with mandatory limit values set by the European Union Air Quality Directive and the UK's own national air quality standards and objectives.

1B.11 There are three health objectives of the Air Quality Strategy that relate to sulphur dioxide levels. The first two of these are also EC directives, in particular that the one hour mean sulphur dioxide level should not exceed 350µg/m^3 more than 24 times a year and that the 24 hour mean should not exceed 125µg/m^3 more than three times a year by 31st December 2004. These objectives were already met at all sites in the year 2000. The third objective, that the 15-minute sulphur dioxide mean should not exceed 266µg/m^3 more than 35 times a year by 31st December 2005, was met at all sites except Belfast East, where the sulphur dioxide level was above 350(g/m3 for 38 15-minute periods. The higher use of solid fuels, such as coal in Northern Ireland is the reason for this.

2. Energy production and supply

- Emissions from power generation have fallen sharply over the last decade.
- The majority of oil spills from the oil and gas industry are relatively small and disperse naturally, resulting in no idenifiable environmental impact.
- Gas leaks accounted for 15 per cent of all methane emissions in 2000.

Introduction

2.1 Energy is essential for the smooth running of everyday life. It is also big business. The energy industries' output of £30 billion per year contributes 3 per cent of GDP and the industries employ 170,000 people. Minimising the environmental impact of the production, distribution and use of fuels is a big challenge. This chapter considers some of these issues for four key energy sources: coal, oil, gas and electricity.

Coal

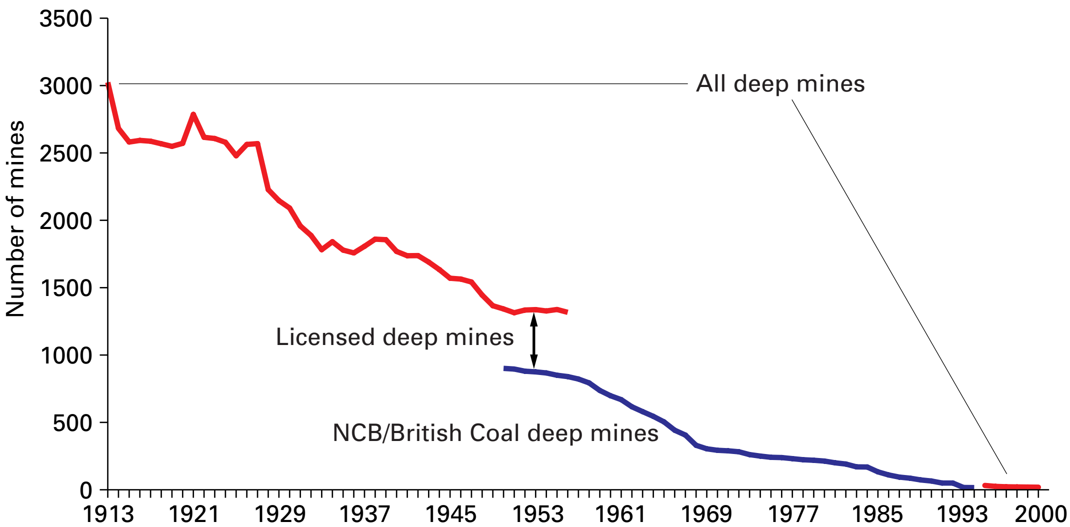
- Coal mining activities resulted in 11 per cent of all UK methane emissions in 2000, compared to 22 per cent in 1990.
- Coal combustion accounted for 76 per cent of UK sulphur dioxide emissions in 2000.
- Sulphur dioxide emissions from coal combustion fell by 68 per cent between 1990 and 2000

2.2 Environmental impacts for coal range from the impact of mining activities on the visual environment to the release of methane into the atmosphere, the release of contaminated water and the generation of waste products. There are social impacts too, including diseases that coal miners can contract and, when coal mining ceases, the loss of coal mining jobs in communities that traditionally depended on such employment opportunities.

Coal mining

2.3 The visual impact of coal mining varies from one mine to another depending on its size, age and other factors. Open cast sites have greater visual impact than deep mines and are subject to strict planning controls. An increasing proportion of domestic coal production now comes from open cast mines, which were introduced in the UK in 1942 to boost coal output during the Second World War, and there are now more opencast sites than deep mines. By May 2001 there were 33 deep mines and 45 opencast sites in operation in the UK, compared with 2,500 deep mines in 1920. The dramatic reduction in the number of deep mines is shown on Chart 2.1.

Chart 2.1 Number of deep coal mines in the United Kingdom, 1913 to 2000



Source: Department of Trade and Industry

2.4 During the activity of coal mining, methane is released into the atmosphere, although about one third is captured before it enters the mine ventilation air and is used as a fuel (see paragraphs 2.32 on gas production). In 2000, 11 per cent of methane emissions were produced as a result of coal mining activities, compared with 41 per cent in 1970 and 22 per cent in 1990. The majority of these emissions are from deep mine operations. Measures to control methane from mines are driven mainly by safety concerns.

2.5 Other environmental problems occur when water is pumped from working mines or flows from abandoned mines into water supplies. Thirteen minewater treatment schemes to clean water from abandoned coal mines had been implemented by mid-2001 by the Coal Authority and the Environment Agency. As in all types of mining, waste products are generated during the coal mining process that need to be disposed of carefully. Particulate matter is released that can affect local air quality (see Chapter 1 for more information about particulate matter).

2.6 As a result of working in dusty conditions, coal miners can contract lung disease and as a result of using vibrating tools, they can develop vibration disease. The Department of Trade and Industry (DTI) runs two major personal injury compensation schemes for negligent exposure to dust and vibration in British Coal mines. By the middle of May 2002, there were more than 327,000 claimants across both schemes and the DTI had paid out more than £850 million in compensation.

2.7 Concessionary fuel is distributed to former British Coal employees under agreements established with trade unions. In 1995, this liability was passed to the DTI and, in April 2002, 54,000 households were in receipt of concessionary fuel, accounting for an eighth of UK domestic sector coal consumption. A further 85,000 former British Coal Corporation employees were in receipt of cash payments in lieu of fuel. The Government has acted as guarantor to the two former British Coal Pension Schemes since the industry was privatised in 1994. The guarantee ensures that miners' pensions rise in line with inflation.

2.8 When coal mines close, the land can become derelict due to the presence of chemical wastes or the presence of physical hazards such as shafts, holes, tunnels. The National Coalfields Programme is a ten-year programme that started in 1996 and aims to deliver environmental improvements and develop the infrastructure that can help realise the potential of coalfield communities in England. This includes reclaiming land to enable commercial, industrial and residential developments to proceed. Since the National Coalfields Programme began, 944 hectares of land have been brought back into use, including 292 hectares in 2001. There are 88 sites being developed in 2002 under the programme and a further 53 sites have been put forward for consideration.

2.9 Subsidence occurs throughout Britain as a result of coal mining activities. When property is damaged by coal mining subsidence, a claim can be made for the repair of the damage. The Coal Authority will usually be responsible if the damage resulted from mining which took place before the privatisation of the coal industry in 1994. Mining companies are usually responsible for repairing subsidence damage caused by their mining activities since 1994. Of the 1,552 claims received by the Coal Authority in 2000-01, there were 859 claims for residential property.

2.10 Employment has fallen at a faster rate than the falling number of mines as more modern, mechanised production methods have been introduced. Employment in the UK coal industry in 1920 was 1.2 million men underground. By 1990, employment was down to 49,000 employees and fell further to 8,300 employees in December 2001. As mines have closed, unemployment has increased in former coal mining areas where an increasing number of new jobs are temporary and low paid. Poverty and its related problems persist.

Distribution

2.11 Coal and coal spoil are transported either by road, rail or canal in the UK and strict guidelines are applied to minimise the distribution of coal particles into the air. Where coal is transported by road, arrangements need to be made to clean the road after use and it should be transported in closed containers.

Consumption

2.12 The main uses of coal in the UK are for electricity generation and coke manufacture. Since the late 1980s, more than three quarters of all coal consumed in the UK has been for electricity generation. Electricity generation is covered in paragraphs 2.40 to 2.48, although the impact of the introduction of cleaner coal technologies on the environment is discussed in paragraph 2.14 below. Much of the coal now consumed in the UK comes from imports, which made up 57 per cent of total coal demand in 2001. One of the reasons for such high levels of coal imports is that virtually no coking coal is produced in the UK, and that the sulphur and chlorine content of most UK deep-mined coal is significantly higher than coal available internationally.

2.13 When coal is burned, emissions of carbon dioxide, sulphur dioxide and nitrogen oxides are produced at higher levels than for either oil or gas. Table 1.1 in Chapter 1 shows the figures for the amount of carbon dioxide and methane emissions that are produced through the combustion of different types of fuels. Few methane emissions are emitted as a result of coal being combusted: in 2000 this accounted for only 1 per cent of all methane emissions in the UK. Table 2.1 shows how emissions from coal combustion have changed between 1990 and 2000 for the emissions for which coal is a major emitter.

Table 2.1 Emissions from coal combustion (including coal burned in power stations) in 1990 and 2000

	Thousand tonnes			Percentage
	1990	**2000**	**Change between 1990 and 2000**	**Contribution to all emissions in 2000**
Sulphur dioxide	2,712	881	-68	76
Particulate Matter (PM10)	123	41	-67	24
Carbon dioxide[1]	58,225	30,242	-48	20
Nitrogen oxides	757	297	-61	20

[1] Measured as thousand tonnes of carbon.

2.14 The government has introduced a cleaner coal technology programme to encourage the development of cleaner coal technologies. These will help to protect the environment through reduced levels of emissions that will help to meet emissions targets (see Chapter 1 for more information on emissions). The environmental challenges of sulphur dioxide (SO_2) and nitrogen oxides (NOx) from coal combustion are mostly now manageable due to technologies such as flue gas desulphurisation for SO_2 and selective catalytic reduction for NOx. Although expensive to fit and operate, they are now relatively well developed and proven. Carbon dioxide is therefore likely to be the biggest challenge for coal in the future.

Oil

- Oil spills are negligible in comparison with total oil production, although a major spill from this industry has the potential to cause serious damage to the surrounding environment.
- Oil combustion was responsible for 80 per cent of all carbon monoxide emissions and 57 per cent of all nitrogen oxides in 2000.

2.15 Oils vary in their chemical and physical composition and the characteristics of an individual spill will determine the impact it may have if spilled into the environment. The toxicity of an oil spill depends largely on its concentration in the water. Being biodegradable, at low concentrations it should be broken down rapidly. At higher concentrations, spilled oil is likely to be toxic to most life forms and will cover the surface of water, preventing oxygen exchange and coat wildlife and plants. Oil leakages can occur during exploration, production, transportation, in tankers and pipelines, during refinery activities and during distribution including at petrol stations.

Oil extraction

2.16 Environmental impacts may occur at any time during the lifetime of an oil field, as a result of exploration, production and decommissioning activities. It is a legal requirement that the potential effects on the environment of oil exploration and activities must be carefully investigated before an oil field is explored, appraised and developed. The Government requires an Environmental Impact Assessment to be carried out and submitted for approval to ensure that any environmental risk is minimal and that activities are carried out with minimal environmental impact.

2.17 In 2000, 275 wells were drilled for exploration, appraisal and development, compared with 261 in 1999. The numbers of wells drilled for exploration and appraisal have steadily fallen since the early 1990s, from 107 in 1991 to 26 in 2000 for exploration and from 79 wells in 1991 to 33 in 2000 for appraisal. The number of wells drilled for development has increased from 144 in 1991 to 216 in 2000.

2.18 When a well is drilled in rock to reach oil and gas trapped underneath, drill cuttings are generated. Drilling muds are used to lubricate the drill bit and to maintain drill safety and some mud may adhere to the drill cuttings. The cuttings are either discharged to the seabed, taken ashore for treatment or re-injected into wells depending on contamination levels and legislative requirements. When cuttings accumulate, as they have done in the central and northern areas of the North Sea where the currents are weaker at the seabed than in other places, the top layers of the cuttings prevent oxygen and other seawater constituents from penetrating to layers below resulting in slower biodegradation. The full environmental impact of these cuttings on the sea bed has recently been investigated by a group of North Sea operators. The results are currently under consideration.

2.19 Water present in the oil producing strata and, in some circumstances, water injected for reservoir pressure maintenance, are produced in addition to oil and this water is referred to as produced water. Table 2.2 below shows that the average content of oil in produced water for 2000, for the UK Continental Shelf (UKCS) as a whole, was 21.5 parts per million, the same as in 1999 which was the lowest value yet recorded in the UKCS. The discharge of oil-contaminated produced water from offshore installations is permitted by an exemption granted under the Prevention of Oil Pollution Act 1971, but the oil content must not exceed 40 parts per million. Ocassionally installations fail to meet this target. In 2000, of 68 oil installations discharging produced water, only five exceeded this target when averaged over the whole year. These installations took steps to identify specific problems and made improvements to systems to ensure that, by the end of 2000, there were significant improvements in performance.

Table 2.2 Oil discharged with produced water between 1995 and 2000

	1995	1996	1997	1998	1999	2000
Total oil discharged (tonnes)	5,855	5,706	5,767	5,692	5,641	5,395
Total water discharged (million tonnes)	192	210	234	253	261	244
Number of installations permitted to discharge oil	55	60	64	64	73	68
Average oil in water content (mg/kg)	30	27	25	22	22	22

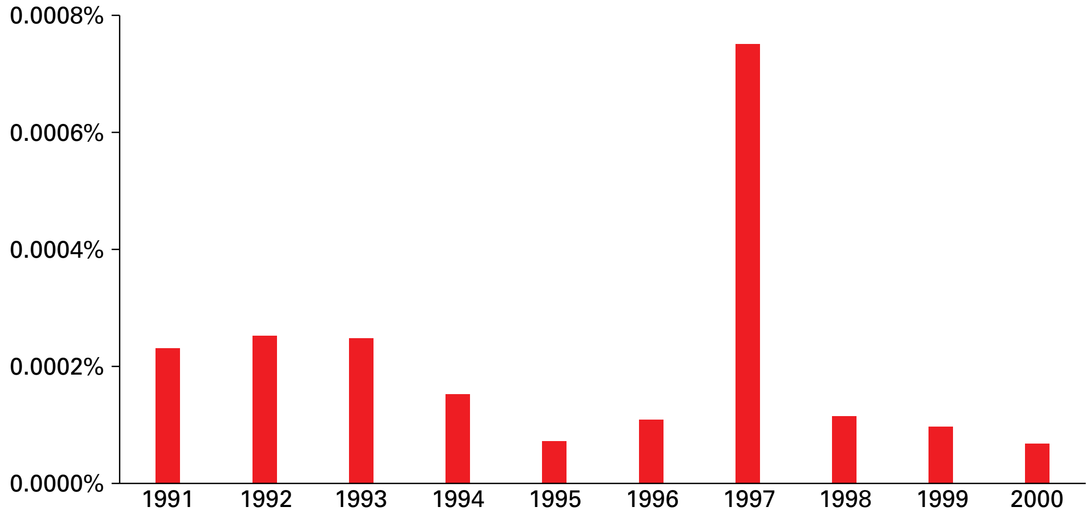
2.20 Oil spills can originate from installations or from the transportation of oil from an oil field to shore. Oil spills from transportation are covered here as well as spills from oil exploration and production as the environmental effects from both are often similar. Although most oil spillages are low relative to total oil production and they are usually rapidly dispersed in the sea and are biodegradable naturally, large spills may have a significant effect on the surrounding environment. Birds are the most likely victims of oil spills from offshore platforms as they cannot distinguish between water and oil, with the result that their wings can become water-logged with oil. This can lead to drowning, since they are unable to fly away, or poisoning from attempts to clean their plumage. When oil spills occur in coastal waters they can carry the risk of polluting the coastline, including coastal animals and habitat.

2.21 Since 1986, the UK has carried out surveillance flights over offshore installations in accordance with international agreements under the Bonn Agreement. These flights are unannounced and cover all offshore installations on the UKCS. The DTI uses a computer link to the aerial surveillance aircraft that transmits photographic images of pollution incidents as they happen. Table 2.3 gives a breakdown of oil spills reported to the DTI during the period 1995 to 2000. The total amount of oil spilled and reported to the DTI during 2000 was 78 tonnes which continues the downward trend of recent years. This does not reflect a reduction in the number of reports made to the DTI, which rose from 372 in 1999 to 423 in 2000. It is evident that the trend for reporting even the smallest of spills continues with 96 per cent of reports for a spill of less than 1 tonne.

Table 2.3 Oil spills reported to the DTI between 1995 and 2000

	1995	1996	1997	1998	1999	2000
Total amount of oil spilled (tonnes)	84	127	866	137	120	78
Number of installations reporting spills	52	77	96	101	112	117
Total number of reports	145	300	349	392	372	423

Chart 2.2 Oil spillages as a percentage of total oil production, 1991 to 2000



Source: Department of Trade and Industry

2.22 The EU Habitats Directive requires all Member States to protect specified rare plant and animal species and certain endangered local environments or “habitats”. The Directive is applied to oil and gas activities on the UKCS beyond the 12-mile territorial waters limit under Regulations that were introduced in 2001, so that any oil and gas activity likely to have a significant impact on such a habitat is subject to assessment by DTI. Similar provisions already exist for activity within the 12-mile limit for the Department for Environment, Food and Rural Affairs, the Scottish Executive and the Joint Nature Conservation Committee.

2.23 DTI is responsible for the implementation and development of Government policy on decommissioning offshore oil and gas installations and pipelines. The approach is governed by environmental concerns and the aim is to completely remove oil and gas installations for re-use, recycling or final disposal on land, except for some concrete installations and the ‘footings’ of large steel jackets where justification for them to remain in place has been provided. Organisations carrying out the decommissioning will need to have shown that they have fully investigated opportunities for re-use. Tax allowances for decommissioning costs now make the prospect of re-use more attractive. Further information on decommissioning is shown at Annex 2A.

Distribution

2.24 In order to transport oil from oil fields to refineries, the oil is either shipped on tankers or piped through oil pipelines. While pipelines distribute a higher level of oil, tankers are used for transporting oil over longer distances. There are more than 8,500 kilometres of offshore pipelines in the UK transporting crude oil, natural gas and condensate. They are considered to be the safest mode of transport for oil, although problems can occur if leaks go undetected.

2.25 The environmental impact of oil spills was discussed more fully in the previous section. Over the last ten years there have been two major oil spills as a result of shipping accidents in UK waters; the Braer in January 1993 (84,000 tonnes) and the Sea Empress in February 1996 (about 70,000 tonnes). The impact of the Sea Empress oil tanker running aground off the coast of South Wales was estimated to have caused the death of nearly 70,000 birds, as well as damaging shore seaweeds and invertebrates in large quantities and leaving masses of cockles and shellfish stranded.

2.26 The impact of refineries on the environment includes discharge of waste water, emissions that are created as a result of combustion, flaring and fugitive losses and through leakage of hydrocarbons during storage, loading and unloading at the refinery. Once crude oil has been refined into petroleum products at the refinery, the oil is again transported to its final destination by pipeline, sea, road and rail to distribution terminals and depots.

Consumption

2.27 Oil combustion was responsible for 80 per cent of all carbon monoxide emissions and 57 per cent of all nitrogen oxides emissions in 2000. The reduction in the amount of oil used in electricity generation and changes in technology such as the introduction of catalytic converters on cars have resulted in the large falls in emissions that are shown in Table 2.4. Regulations controlling oil specifications for use in the transport sector have tightened over the past few years with the banning of the general sale of leaded petrol at the end of 1999 and the introduction of low sulphur petrol to meet specifications introduced as part of the EU Auto-Oil Programme.

2.28 Vapour fumes from petrol arise as petrol is distributed and held at petrol stations for final consumption by motorists. The fumes made up 6 per cent of non-methane volatile organic compounds (NM-VOC) in 2000, although they have halved since 1990 due to the introduction of regulations that were introduced in 1994 and implemented in 1996 to control NM-VOC emissions that arise from the storage and distribution of petrol. Other environmental problems caused by petrol stations are leaks from pipework, which can contaminate groundwater and surface water.

Table 2.4 Emissions from oil combustion in 1990 and 2000 (including oil burned in power stations)

	Thousand tonnes			Percentage
	1990	**2000**	**Change between 1990 and 2000**	**Contribution to all emissions in 2000**
Carbon monoxide	5,720	3,318	-42	80
Nitrogen oxides	1,689	865	-49	57
Carbon dioxide [1]	56,159	49,157	-12	33
Volatile Organic Compounds	1007	471	-53	28
Particulate Matter (PM10)	83	41	-50	24
Sulphur dioxide	811	175	-78	15

[1] Measured as thousand tonnes of carbon.

2.29 Oil is used for making all sorts of non-energy products that we use in everyday life, such as pens, telephones, deodorants, shampoo, upholstery, carpets, contact lenses, non stick pans, paint, detergents, insulating material, CDs, camera film as well as providing coatings for pills and binding agents for creams.

Gas

- Offshore activities, primarily through the use of gas, accounted for 4 per cent of all UK carbon dioxide emissions in 2000.
- Gas leaks accounted for 15 per cent of all methane emissions in 2000.
- Gas emits fewer emissions per unit of energy burned than coal or oil.

Gas extraction

2.30 Gas behaves quite differently to oil, since leakages are released into the atmosphere rather than having an adverse effect on the sea environment. Since gas is extracted at the same point as oil, many of the environmental issues that result from the extraction of oil apply to gas as well, such as drill cuttings and decommissioning.

2.31 Gas flaring is used to separate gas from oil when the mixture is too volatile to be transported to land. Under the terms of petroleum production licences, gas may be flared only with government consent. During 2000, an average of 4.76 million cubic metres of gas was flared each day at offshore installations. Flaring at onshore fields was minimal during 2000. When gas is flared, emissions of carbon dioxide, methane and nitrous oxides are released into the environment. Gas flaring accounted for nearly a quarter of all carbon dioxide emissions created as a result of offshore activities in 2000. The other major source of carbon dioxide emissions from offshore sources was from gas use during oil and gas extraction activities. All offshore sources accounted for 4 per cent of all carbon dioxide emissions in the UK in 2000.

2.32 A small amount of gas is extracted at operational coal mines as colliery methane, when it is released from coal seams in deep mines. The methane is piped to the surface and either consumed at the colliery or transmitted by pipeline to consumers. In 2001, colliery methane contributed 0.03 per cent to the total amount of natural gas produced in the UK. More information about methane emissions that occur as a result of coal mining activities is given at paragraph 2.4.

Distribution

2.33 All gas is transported through pipelines from the gas fields to terminals and customers. Transmission and distribution activities have direct effects on the environment through gas losses which release methane into the atmosphere. In 2000, around 330,000 tonnes of methane were released into the atmosphere as a result of gas leakage, representing 15 per cent of all methane emissions. Within the Local Distribution Zones, leakage represents 0.8 per cent of the throughput. In 1995, Transco voluntarily undertook to reduce leakage from the low pressure distribution system and reduced leakage by 8.7 per cent between 1991 and 1999.

2.34 Currently, approximately 80 per cent of households in Great Britain have access to a mains gas supply. Many of the remaining 20 per cent of households that are not connected are located some distance from a gas main and may require the installation of a significant length of new pipeline. From a social perspective, rural consumers could benefit from access to gas as it would increase their choice of fuel and provide access to cheaper tariffs and more efficient appliances. Although there are cost efficiency concerns about extending the country's gas network, it is being considered and is highlighted in the UK Fuel Poverty Strategy. More information on fuel poverty can be found in Chapter 6.

Consumption

2.35 Gas combustion accounted for 38 per cent of carbon dioxide emissions, 15 per cent of NOx emissions, 6 per cent of PM_{10} emissions and less than 2 per cent of other emissions such as methane, carbon monoxide and sulphur dioxide in 2000. The growth in emissions of carbon dioxide, nitrogen oxides and PM_{10} since 1990, as shown in Table 2.5, reflect the increased use of gas between 1990 and 2000 as it has replaced other fuels. However, gas emits fewer emissions per unit of energy burned than other fossil fuels (see Table 1.1 of Chapter 1), so the fuel switching that has occurred has had a positive environmental impact.

2.36 The large growth in gas consumption in the electricity generation sector over the past ten years is due to the introduction of Combined Cycle Gas Turbines (CCGTs) in the electricity industry from 1992. By 2001, 28 per cent of all gas consumed in the UK was for electricity generation. CCGT stations combine gas turbines and steam turbines in the same plant connected to one or more electrical generators. This enables electricity to be produced at higher efficiencies than is otherwise possible when either gas or steam turbines are used in isolation. The efficiencies of CCGT stations are presented in Table 2.7 of the electricity section in this chapter. The other two large consumers of gas are the domestic sector, where gas is mainly used for space heating and hot water, and the industrial sector. More information on the domestic and industrial sectors can be found in Chapter 3.

Table 2.5 Emissions from gas combustion in 1990 and 2000 (including gas burned in power stations)

	Thousand tonnes		Percentage	
	1990	**2000**	**Change between 1990 and 2000**	**Contribution to all emissions in 2000**
Carbon dioxide [1]	30,374	57,092	+88	38
Nitrogen oxides	160	229	+43	15
PM10	6	10	+58	6

[1] Measured as thousand tonnes of carbon.

2.37 Gas consumption also brings risk from carbon monoxide poisoning and explosions. The numbers fluctuate from year to year, but there were 31 fatal injuries in 2000/01 resulting from incidents relating to the supply and use of flammable gas. Of these, 24 occurred as a result of carbon monoxide poisoning, one of which was a suicide, and seven occurred as a result of explosions or fires. There were 296 non-fatal injuries, including 261 as a result of carbon monoxide poisoning and 35 as a result of explosions or fires.

2.38 In total, there were 133 incidents involving carbon monoxide poisoning in 2000/01, compared with 118 incidents in 1999/2000, 132 in 1993/94 and 89 in 1991/92. There were 36 incidents involving explosion or fire. The average number of incidents involving explosion or fire between 1991/92 and 1999/2000 was 43 incidents per year.

Electricity

- Emissions from power stations have fallen as a result of fuel switching and the introduction of more efficient power stations
- Transmission and distribution losses were 8 per cent of all electricity supplied in 2001.

2.39 The environmental impact of the production and use of electricity is primarily when it is generated. Although consumption itself has no impact, increased consumption requires increased generation with greater overall environmental impact. Efficiency in the way we use electricity therefore is an important and effective way to reduce the environmental impact of both its generation and supply.

Generation

2.40 The environmental impact of electricity generation is largely dependent on the choice of fuels that are used to generate it. Fossil fuels produce greenhouse gas emissions when combusted, as well as other emissions that impact on local air and water quality. Electricity generation from nuclear fission results in radioactive discharges into the air and water. Table 2.6 summarises the main emissions from power stations.

Table 2.6 Emissions from power stations in 1990 and 2000

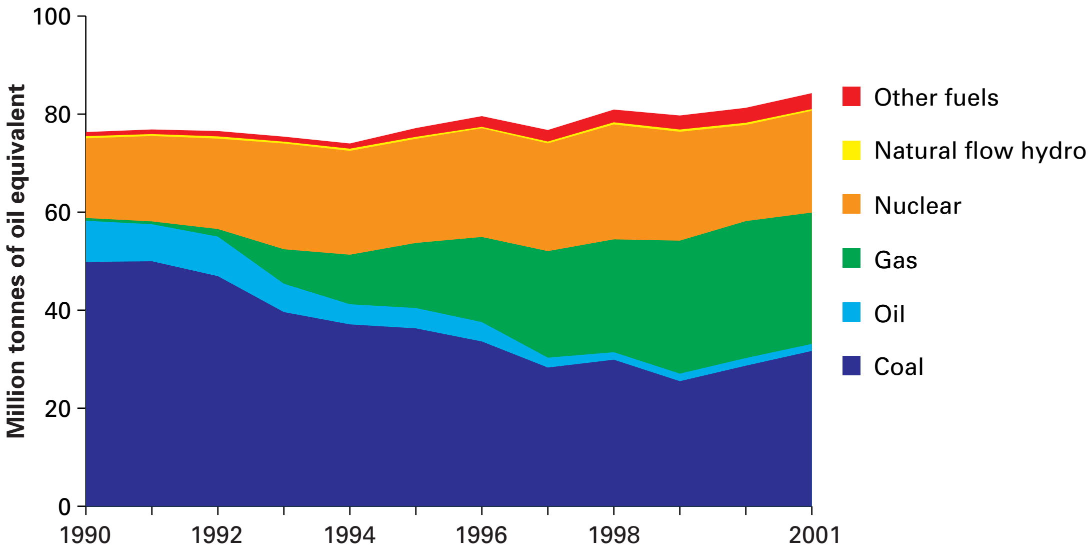
	Thousand tonnes			Percentage
	1990	**2000**	**Change between 1990 and 2000**	**Contribution to all emissions in 2000**
Sulphur dioxide	2,723	826	-70	71
Carbon dioxide 1	54,137	42,037	-22	29
Nitrogen oxides	781	358	-54	24
PM_{10}	70	22	-68	13
Nitrous oxide	6	7	+9	5

1. Measured as thousand tonnes of carbon.

2.41 Between 1990 and 2000, the amount of electricity generated increased by 13 per cent. At the same time, emissions of sulphur dioxide, carbon dioxide, nitrogen oxides and PM_{10} all fell, while emissions of nitrous oxide increased, although at a lower rate than electricity generation. The change in fuel mix has been responsible for a large portion of the reduction, as fuels such as gas and nuclear have been used to replace fuels such as coal and oil which emit more per unit of energy burned. If fuel switching had not occurred (but efficiencies had improved) and the same fuel mix was used in 2000 as in 1990, then carbon dioxide emissions from power stations would have been 28 per cent higher than their actual levels by 2000.

2.42 The introduction of technologies such as flue-gas desulphurisation and more efficient power stations (combined heat and power and combined cycle gas turbine) has helped to reduce emissions further. If both fuel mix and efficiencies had been the same in 2000 as in 1990 then carbon dioxide emissions from power stations would have been 54 per cent higher than actual emissions in 2000. Table 2.7 shows the relative efficiencies of different types of generating stations and the contribution that each made to the total amount of electricity supplied in 2000. Although the efficiency of coal-fired stations has fallen between 1993 and 2000, efficiencies can be over 40 per cent in some plants. Combined heat and power (CHP) plants have the highest efficiencies because they involve the simultaneous generation of usable heat and power.

Chart 2.3 Amount of fuel used in electricity generation, by fuel type, between 1990 and 2001



Source: Department of Trade and Industry

2.43 The waste products that are created during electricity generation using coal are often recycled; the ashes can be used in the construction industry while the residues from flue gas cleaning can be used in the production of gypsum products, such as plaster of paris.

2.44 Nuclear power contributed 24 per cent to the UK's electricity supply in 2001 and plays an important role in helping the UK to meet its climate change targets. While the generation of electricity from nuclear sources does not produce any greenhouse gas emissions, there are other environmental concerns about the use of nuclear fuel as its by-products can be harmful to humans and animals and require safe and long-term disposal. However electricity has been generated safely by civil nuclear power in the UK for nearly 50 years and the nuclear industry is tightly regulated for both operational safety and environmental impact.

Table 2.7 Efficiency of different types of power station[1] in 1993 and 2000

Per cent

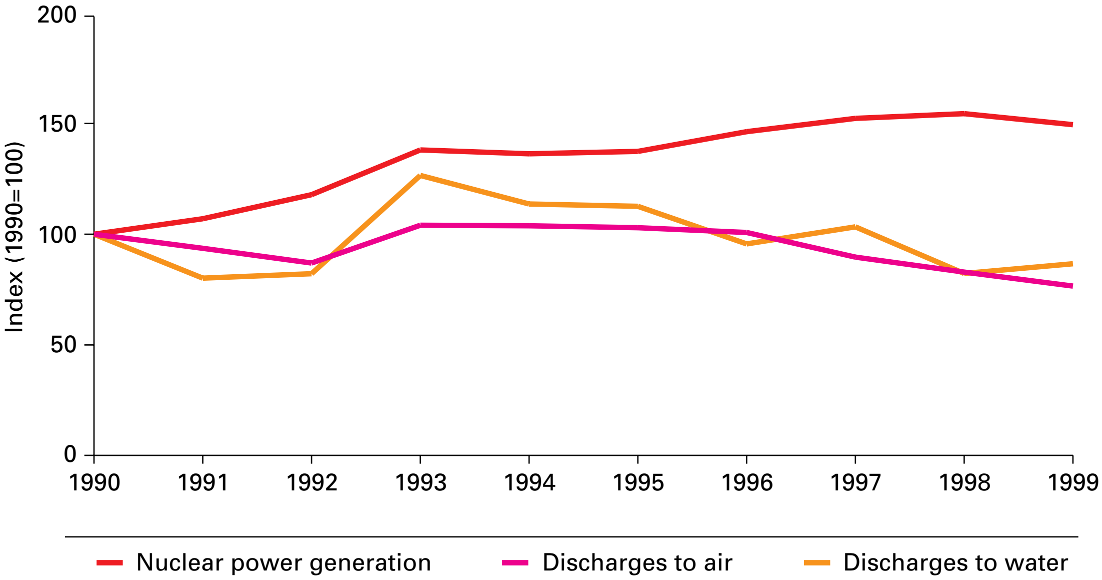
	1993	2000	Contribution to total amount of electricity supplied in 2000
Coal fired stations	37.4	36.2	32
Nuclear stations	35.6	37.3	22
CCGT stations	44.8	49.8	35
Combined heat and power[2]	71.4	71.2	6

[1] Note that oil fired stations, non-CCGT gas-fired stations and mixed or dual fired stations are not included in this table, so the totals will not sum to 100 per cent for the final column.
[2] CHP plants include some combined cycle.

2.45 Radioactive waste is regulated under the Radioactive Substances Act 1993 and by conditions imposed in nuclear site licences under the Nuclear Installations Act 1965. Chart 2.4 shows how water and air emissions have reduced relative to electricity generation from nuclear power stations over the last 10 years. Discharges to air fell by 23 per cent and discharges to water fell by 13 per cent between 1990 and 1999. These reductions were achieved against the background of a 34 per cent increase in electricity supplied from nuclear sources.

2.46 Decommissioning of nuclear power stations has to take into account the natural decay of radioactivity. Radioactive structures need to be maintained safely for up to 90 years while residual radioactivity decays to a level allowing final dismantling and clearance.

Chart 2.4 Water and air emissions compared with electricity generation from nuclear power stations between 1990 and 1999



Source: Department for Environment, Food and Rural Affairs

2.47 Combined Heat and Power (CHP) plants generate usable heat and power (usually electricity) simultaneously in a single process enabling the very efficient use of energy where there is a demand for both the electricity and heat outputs. CHP plants tend to be much smaller than electricity-only plants in order to make use of the available heat (although some large CCGT power stations are also partially CHP plants), and they are connected to a lower voltage distribution system. Further information on CHP is shown at Annex 2B.

2.48 Renewable energy can be thought of as energy sources that occur naturally and repeatedly in our environment, whether in the shape of hydro electricity, wind, solar or biofuels. Renewable sources of energy emit no greenhouse gas or are neutral over their life-cycle. For example, energy crops produce carbon dioxide when they are burned, but the new crop growth absorbs an equivalent amount of carbon dioxide from the atmosphere, making the process carbon neutral. Further information on renewable sources of energy is shown at Annex 2B.

Distribution

2.49 Electricity is distributed through a mixture of overhead lines and underground cables. In general, overhead lines carry electricity in rural areas and underground lines carry electricity in urban areas. There were 812,380 kilometres of electricity cables in the UK in 2000/01, of which 463,153 kilometres were underground cables and 349,227 kilometres were overhead lines. Only 3 per cent of electricity is carried on pylons that are used for the highest voltages on the network. There is little evidence in the UK that overhead lines adversely affect human health through electric and magnetic fields, although they do affect the visual environment. Companies now use computer models to map out new routes using the natural contours of the landscape to mask power line networks.

2.50 When electricity is distributed along the high voltage transmission system of the National Grid, losses are incurred. These losses represented 1½ per cent of electricity available in 2001. A further 6 per cent was lost between the grid supply points (the gateways to the public supply system's distribution network) and customers' meters. If losses were reduced, less electricity would need to be generated and greenhouse gas emissions would fall.

2.51 Companies are encouraged to reduce losses through price control arrangements. In addition, energy that is generated locally (called distributed or embedded generation) reduces or removes the need for and impact of the transmission system. For example, CHP plants are situated closer to the point at which power and heat are required and they are usually connected to a lower voltage distribution system. This avoids significant transmission and distribution losses. Other small scale and renewable energy generators can also contribute to embedded generation.

Table 2.8 Losses from electricity distribution between 1996 and 2001

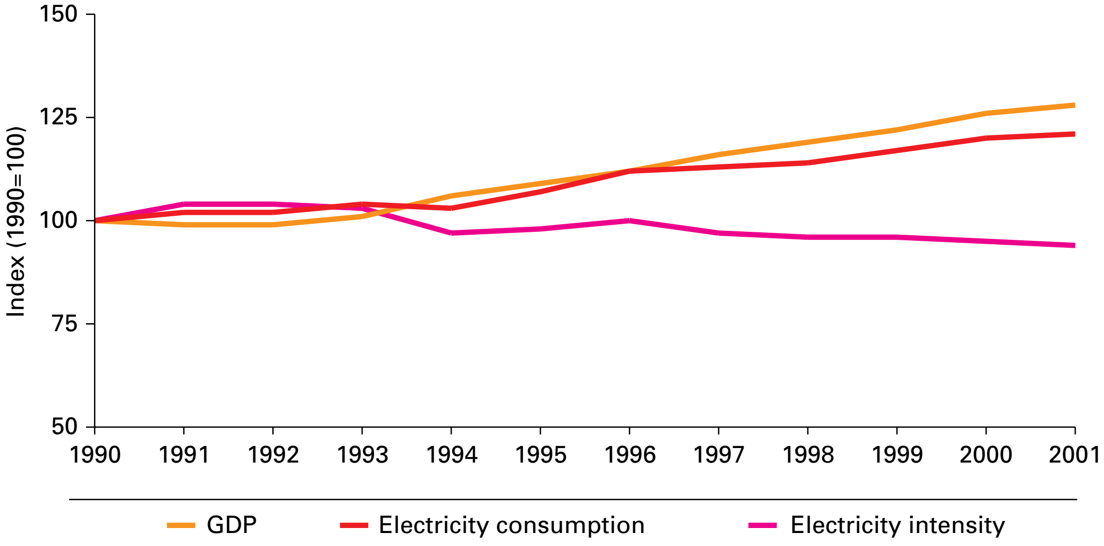
	1996	1997	1998	1999	2000	2001
Losses (GWh)	27,501	28,670	27,957	28,298	29,649	30,902
As a percentage of all electricity consumption	7.5	7.8	7.5	7.4	7.6	7.8

Consumption

2.52 Electricity is used for all sorts of purposes in everyday life, including heating, refrigeration and lighting in homes and workplaces, powering a wide range of appliances in hospitals, offices, schools and homes, as well as maintaining the flow of road, rail and air traffic. At the point of final consumption, electricity produces no emissions, but reducing consumption through energy efficiency can help reduce the negative impacts of generation. The section on electricity generation provides more information about the emissions that are created when electricity is generated.

2.53 Electricity consumption has increased by 21 per cent since 1990. Since GDP has increased by 28 per cent over the same period, the electricity intensity of the UK economy (the amount of electricity used per unit of output) has fallen by 6 per cent. This fall is due, at least in part, to a decline in the use of electricity for space heating, as gas has been used in its place. Energy efficiency improvements for lighting and appliances have also helped make it not as high as it would have otherwise been, given the increase in the use of electrical goods throughout the economy. Chapter 3 provides more information about the drivers for efficiency improvements for different types of electrical appliance by sector and the changing use of fuels for different end uses.

Chart 2.5 Electricity consumption, GDP growth and electricity intensity



Source: Department of Trade and Industry, Office for National Statistics

2.54 Electricity can kill and injure both those working with electricity and those who use it. The main hazards from electricity are contact with live parts causing shocks and burns, and faults which could cause fires. In the workplace, most fatalities arise from contact with overhead or underground power cables. In 2000/01, there were nine reported employee deaths as a result of contact with electricity or electrical discharge, four of which occurred in the construction industry, three in the service industries, one in manufacturing industry, one in agriculture, hunting, forestry and fishing and no deaths in the energy extractive and supply industries. There were three fewer deaths in 2000/2001 than in 1999/2000 and seven fewer than in 1998/99.

Further reading:

- Digest of UK Energy Statistics, DTI
  http://www.dti.gov.uk/energy/inform/dukes/
- Brown Book, DTI
  http://www.dbd-data.co.uk/bb2001/book.htm
- Review into the case for government support for cleaner coal technology demonstration plant: Final Report, December 2001, DTI
  http://www.dti.gov.uk/energy/
- The Energy Report 2001 – Market reforms and the environment, DTI
  http://www.dti.gov.uk/
- Nuclear power in the OECD, IEA
  http://www/iea.org
- Heath and Safety Statistics 2000/01, Health and Safety Commission, 2001, Stationery Office
  http://www.hse.gov.uk/statistics/index.htm
- Oil and gas in the environment, Environment Agency, 1998, Stationery Office
  http://www.environment-agency.gov.uk/
- Electricity Industry Review 6, Electricity Association, January 2002
  http://www.electricity.org.uk/
- The Government's Strategy for Combined Heat and Power to 2010 - Public Consultation Draft
  http://www.defra.gov.uk/environment/consult/chpstrat/index.htm

Useful websites

DTI:	http://www.dti.gov.uk/
DEFRA:	http://www.defra.gov.uk
UK Offshore Oil Operators:	http://www.ukooa.org.uk
Coal Authority:	http://www.coal.gov.uk
National Coalfields Programme:	http://www.englishpartnerships.co.uk/

Annex 2A
Decommissioning of offshore oil and gas installations

2A.1 The controversy over the decommissioning of Brent Spar drew to the public's attention the issue of what should happen to offshore oil and gas installations once they reached the end of their life. This Annex looks at the scale of the environmental and other challenges raised by the decommissioning of such installations.

2A.2 The Brent Spar was a very large floating oil storage and loading buoy owned by Shell and Esso. It had most of its bulk, including six huge storage tanks below the surface of the sea, and was 109 metres long, which is more than a football field floating on its end. Initially, the UK Government accepted a proposal that the Brent Spar should be disposed of by being sunk in deep water in the North Atlantic. However four months later, in June 1995, in response to widespread public concern, Shell, the operator of the Brent field, decided to halt the disposal in order to consider other options. Various options for disposal were then considered and, in January 1998, Shell announced that the Brent Spar would be re-used as a Norwegian roll-on, roll-off ferry quay. The project to achieve this was completed in July 1999. In the meantime, the Oslo and Paris Convention (OSPAR) passed a binding resolution in 1998, which ensured that the vast majority of offshore installations would be removed to shore for reuse or recycling.

2A.3 The decommissioning of oil platforms is important ecologically because of the residual substances that remain once the last of any oil stored has been removed. These oily residues are formed as a result of chemical reactions and include waxes and asphaltenes, in addition to materials formed when dissolved particles from seawater react. They also contain sand, mineral particles and remains of marine organisms. In some cases there may be Normally Occurring Radioactive Material (NORM) within the tanks. This is subject to strict regulated licence and disposal guidelines.

2A.4 The Scientific Group on Decommissioning Offshore Structures concluded that between 71.1 and 99.7 tonnes of hydrocarbons remained on board the Brent Spar, of which between 10.4 and 13.4 tonnes was sludge. The amount of NORM on board the Brent Spa was estimated at between 13.9 and 17.8 Giga Becquerel (GBeq), which is about the same as the amount emitted into the sea by a typical oil platform in a year. A conservative (high) estimate for NORM from the Maureen platform, which was decommissioned in 2001 (see below), is 30.4GBeq.

2A.5 There were 234 offshore oil and gas fields in production as at the end of February 2002. A Health and Safety Executive report in 2001 identified 232 UK Continental Shelf (UKCS) structures of various sizes ranging from small steel platforms to the Shell Brent D concrete gravity platform, which weighs 200,000 tonnes and was designed to hold the equivalent of one million barrels of oil. Figures showing the numbers of each type of platform are given in Table 2A.1, while Diagram 2A.1 gives diagrams of each type of installation. Over 85 per cent of North Sea platforms are steel structures (type 1, 3, 5 or 6 on the diagram) of which 17 per cent are large steel platforms. Steel platforms are now favoured over concrete platforms (type 2).

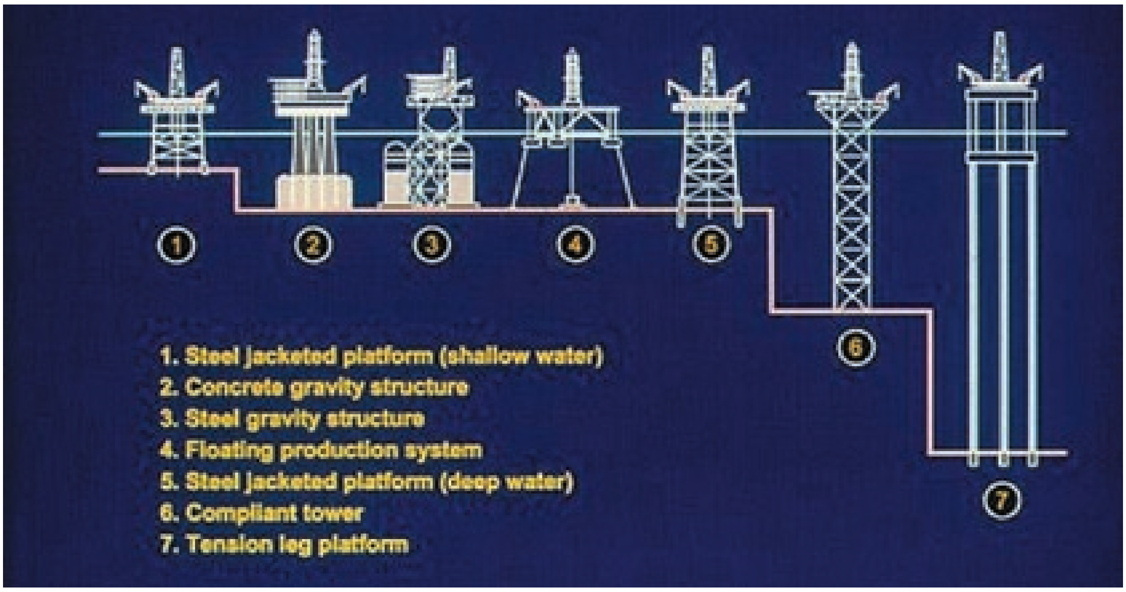
Table 2A.1: The number of each type of platform on the UKCS, 2001

Type of platform	Number
Steel	196
Large Steel	33
Concrete gravity based structure	11
Floating production facility	22
Steel self elevating production jack-up	1
Steel Tension Leg Platform	3
Total	**266**

Source: DTI Brown Book

2A.6 There are three main components to a typical installation. The topsides are basically the deck of the installation and all associated process equipment, whilst the jacket is the substructure supporting the topsides. The footings are either piles driven into the seabed to secure the platform or the concrete foundations weighing down the platform. The shape and size of the topside, jacket and footings depend on the type of platform, the depth of the sea at that point and the seabed conditions found there.

Diagram 2A.1 Types of oil platform installations



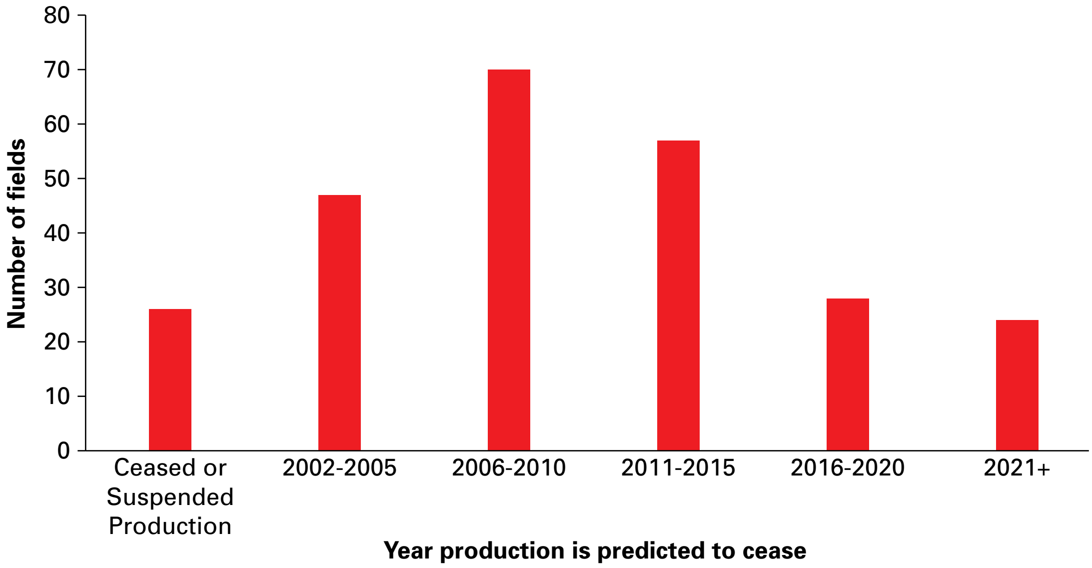
Source: UK Offshore Operators Association

2A.7 Twenty installations were decommissioned between 1988 and 2001. In all cases but one, these have been re-used or removed to shore for recycling. The exception is the Piper Alpha platform, the remains of which were toppled in situ, following the Piper Alpha disaster in which 167 people died following a gas explosion. In this case the fire resulting from the explosion destroyed most of the structure.

2A.8 The Maureen platform, which was decommissioned in 2001, was the first large steel gravity platform to be removed. The majority of other decommissioning projects were to remove or re-use fixed steel platforms, floating production facilities or floating production, storage and offloading vessels. With ballast, the Maureen platform weighed over 110,000 tonnes and was more than 200 metres in height. It was successfully refloated by injecting water under the bases to create upward force, while at the same time deballasting the seawater in the three tanks that form the base of the structure. As the water was pumped out of the tanks, an inert gas, nitrogen, was simultaneously introduced into them in order to maintain internal pressure. The platform is now being dismantled at Stord, Norway.

2A.9 Domestic UK legislation governing the decommissioning process was originally introduced in 1987. The UK's international obligations are governed principally by the 1992 Oslo and Paris (OSPAR) Convention for the Protection of the Marine Environment of the North East Atlantic, the decommissioning component of which was agreed by a binding Decision in 1998. Under this Decision, which entered into force on 9 February 1999, there is a prohibition on the dumping and leaving wholly or partly in place of offshore installations. The Decision recognises, however, that there may be difficulty in removing the 'footings' of large steel jackets weighing more than 10,000 tonnes and in removing concrete installations. As a result derogations may be granted for these categories of installations if the internationally agreed process of assessment and consultation shows that leaving the footings of a large steel installation or a concrete installation wholly or partly in place, is justifiable. All installations emplaced after 9 February 1999 must be totally removed.

Chart 2A.1 Existing oil fields predicted to have ceased production 2000-2020



Source: Department of Trade and Industry

2A.10 It is predicted that over the next 25 years it will be necessary to decommission 6,000 platforms worldwide over 53 countries. Chart 2A.1 gives the number of UK fields that are currently in production that are expected to cease production in each five year period until 2020. The number of fields that cease production will not necessarily equal the number of platforms it will be necessary to decommission. This is because some of the fields will contain more than one installation, so in some cases the cessation of production in a field may result in more than one unit being decommissioned. The number of fields predicted to have ceased production by year does however give a useful indication of the potential scale of future decommissioning.

2A.11 The chart shows that about 50 of the presently producing oil and gas fields per year will cease production by 2005, with more than 120 further ceasing of productions expected between 2006 and 2015. This can be compared to 28 installations decommissioned between 1988 and 2000. The decommissioning of installations used on these fields will prove a major engineering and environmental challenge.

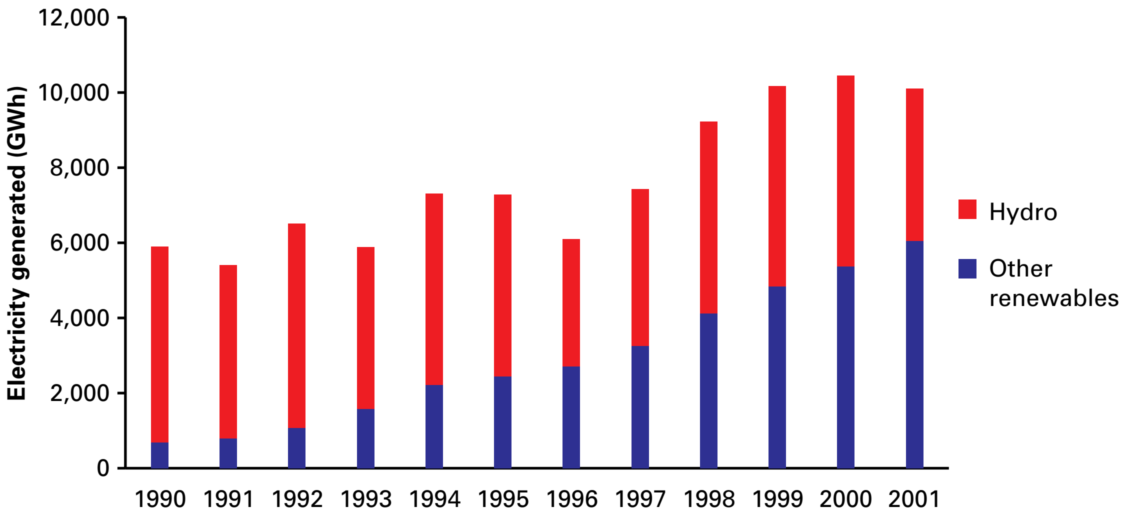
Annex 2B
Low carbon technologies

2B.1 Two technologies that are making a growing contribution towards reducing the carbon intensity of the UK economy are renewable energy sources and Combined Heat and Power (CHP). Renewable fuels are those that are continuously available and sustainable in our environment, such as wind and solar energy. In particular, they generally emit no greenhouse gas emissions or are emission neutral over their life cycle (e.g. energy crops). CHP is a low carbon technology that involves the simultaneous generation of usable heat and power in a single process. It is very efficient compared with separate electricity only generation and boilers to produce heat. The generation of electricity from nuclear sources also does not produce any greenhouse gases.

Renewables

2B.2 Renewable sources were used to generate 2.6 per cent of all UK electricity produced in 2001. As shown in Chart 2B.1, electricity generation from renewable sources went up by 70 per cent between 1990 and 2001, and electricity generated by non-hydro renewables increased by a factor of almost nine. This has resulted in substantial savings in carbon and other emissions that would have resulted from more conventional forms of generation. Estimates of this saving in carbon emissions depend on assumption about how the electricity would otherwise have been generated: the savings would be 0.7 million tonnes of carbon (MtC) per year in 2000 compared with the average mix of non-renewable generation or 0.9MtC compared with the average mix of fossil fuel generation. When the 2010 target of 10 per cent of all electricity being generated from renewable sources is met, the savings could be of the order of 2.5MtC per annum.

Chart 2B.1: Electricity generated by renewable sources, 1990 to 2001



Source: DTI

2B.3 This growth in the use of renewables to generate electricity has been encouraged by Government policies. The main instruments of encouragement have been the Non Fossil Fuel Obligation (NFFO) Orders for England and Wales and for Northern Ireland, and the Scottish Renewable Orders (SRO). There is now a target that 10 per cent of electricity supplied by 2010 should be from renewable sources that are eligible under the Renewables Obligation. The UK's renewables policy consists of four keys strands to support the target. Firstly, with effect from 1 April 2002, the new Renewables Obligation for England and Wales and the corresponding Obligation for Scotland place a requirement on all electricity suppliers to supply a specific and increasing proportion of their electricity from eligible renewable energy sources. Secondly, the electricity generated most from renewable sources is exempt from the Climate Change Levy, one exception being electricity from large -scale hydro schemes with a declared net capacity of over 10MW Thirdly,there is an expanded support programme for renewable energy projects, including capital grants and an expanded research and development programme and, fourthly, a strategic regional approach is being taken to planning and setting targets for renewables.

2B.4 Table 2B.1 shows how much electricity has been generated by each renewable source over the last 10 years. Up until 2000, hydroelectric plants generated the largest share of electricity from renewables. Hydropower is generated by direct action of water on turbines that drive electricity generators. The rivers and reservoirs that provide the head of water needed for hydro schemes are mainly located in Scotland and Wales. The amount of electricity generated from hydro sources varies each year according to the amount of water available. On average over the last ten years 4.7 GWh per year have been generated but in dry years this has fallen to 3.4 GWh while wet years have seen 5.3 GWh generated. Large-scale hydro schemes are defined as those belonging to companies with an aggregate hydro capacity of 5MWe or over.

Table 2B.1 Electricity generated from renewable sources, 1990 to 2001

GWh

Year	Wind[1]	Large-scale hydropower	Small-scale hydropower	Biofuels	Total amount of electricity generated
1990	9	5,080	127	678	5,894
1991	9	4,482	142	776	5,409
1992	33	5,282	149	1,038	6,502
1993	217	4,143	159	1,363	5,883
1994	344	4,935	159	1,870	7,307
1995	392	4,672	166	2,053	7,283
1996	488	3,275	118	2,221	6,101
1997	667	4,005	164	2,593	7,428
1998	877	4,911	206	3,237	9,231
1999	851	5,128	207	3,987	10,174
2000	947	4,871	214	4,422	10,494
2001	967	3,845	210	5,076	10,099

[1] includes 1 GWh of solar voltaics in 1999 and 2000 and 2GWh of solar voltaics in 2001

2B.5 There has been a large increase in the electricity generated by wind power from a very low level in 1990. At the end of 2001, 75 wind generation projects were operational under NFFO. As well as more wind turbines coming online, the efficiency of existing wind turbines has improved, as has their siting. The Blyth Offshore Wind Farm is the first offshore wind farm to be built in UK waters and became fully operational in November 2001. The turbines of the installation, which is capable of producing the annual electricity requirements of 3,000 average households, are the largest erected offshore anywhere in the world. A new capital grants programme is making available up to £74 million over three years to help the expansion of the offshore wind energy industry and this has attracted strong interest.

2B.6 Biofuels is a term that covers two categories of renewables: biomass and biogases. Biomass materials include trees and grass crops (such as willow and miscanthus) and forestry, agricultural and urban waste that can be burnt to produce energy. Grants are available to establish energy crops. The main biogas is methane produced from landfill sites and sewage plants. Burning the methane can generate energy from waste and at the same time reduce the amount of methane, a powerful greenhouse gas, in the atmosphere. Unlike other renewables, biofuel energy does release carbon dioxide into the atmosphere, but in the case of plant materials, it is only returning to the atmosphere carbon dioxide that was removed through photosynthesis during the plant's lifetime. Burning fossil fuels, by contrast, returns carbon dioxide to the atmosphere that has been locked away in the Earth's crust for millions of years.

Table 2B.2: Renewable energy sources used to generate heat, 1990 to 2001

Thousand tonnes of oil equivalent

	Biofuels					Other	Total
Year	Landfill gas	Sewage sludge digestion	Wood combustion	Municipal solid waste combustion	Other biofuels	Solar and geothermal	
1990	34.2	34.6	174.1	49.3	94.8	7.2	394.2
1991	36.3	43.5	174.1	53.2	95.1	7.6	409.8
1992	31.5	43.5	204.2	49.0	102.9	7.9	439.0
1993	15.0	34.0	441.0	44.8	108.9	8.2	651.9
1994	18.9	52.1	659.3	46.8	115.2	8.5	901.0
1995	15.1	58.5	702.3	48.5	122.3	8.9	955.6
1996	16.6	58.5	709.7	50.6	117.9	9.5	961.2
1997	15.5	58.2	710.3	14.3	122.7	9.7	926.9
1998	13.6	54.1	641.1	24.1	122.4	9.9	855.5
1999	13.6	54.2	571.9	32.0	119.7	10.2	791.6
2000	13.6	48.3	502.8	40.6	119.7	11.9	726.5
2001	13.6	49.4	468.8	46.5	119.7	14.0	701.5

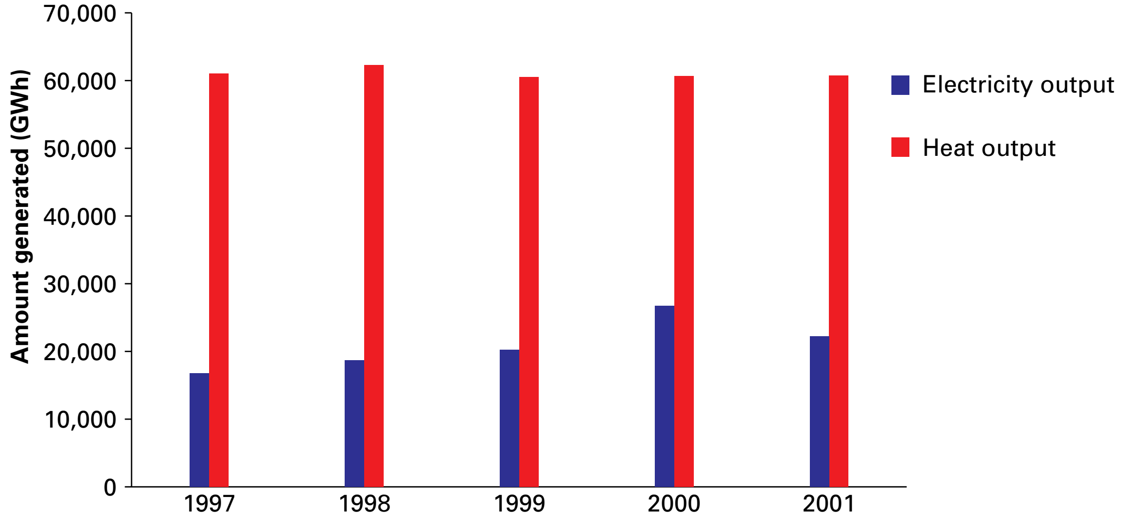
2B.7 As well as constituting more than a half of electricity generated from renewable sources, biofuels are also used to generate heat, as the table above shows. There are also small amounts of heat sourced from active solar heating and geothermal aquifers. Active solar heating can be used in the domestic sector as a water heating mechanism. It is also used to heat swimming pools and for some other applications. Passive solar energy is used in almost all buildings to save energy because windows or transparent roofs allow in natural light, which reduces use of energy for lighting. Geothermal aquifers contain hot water at depths of between 1,500 metres and 3,000 metres below the surface. If this water is pumped to the surface it can be used in community heating schemes.

Combined Heat and Power

2B.8 Combined heat and power (CHP) is the simultaneous generation of usable heat and power in a single process. Whereas an electricity-only plant is typically large, and connected at very high voltage to the grid transmission system, a CHP plant is typically much smaller, sized to make use of the available heat, and connected to a lower voltage distribution system. Not only is CHP more efficient through utilisation of heat that might otherwise be wasted, it also avoids significant transmission and distribution losses.

2B.9 CHP usually displaces boiler plant and electricity-only plant using a range of technologies. CHP typically achieves a 25 to 35 per cent reduction in primary energy usage compared with electricity-only generation and heat-only boilers. This can allow the host organisation to make substantial savings in costs and emissions where there is a suitable heat load.

Chart 2B.2: Electricity and heat output of CHP schemes, 1997 to 2001



Source: Department of Trade and Industry

2B.10 Chart 2B.2 shows the change in the electricity and heat output of CHP schemes between 1997 and 2001. Whereas the heat generated from CHP has remained approximately the same over the last five years, electricity output grew strongly up to 2000, but then fell back sharply in 2001. The rise up to 2000 reflected the liberalisation of the electricity markets, which gave a strong incentive to design schemes to maximise electricity generation for a given heat load. However, following the introduction of the New Electricity Trading Arrangements (NETA) in March 2001, the price of electricity fell, including the price of electricity exported from CHP plant. These exports fell by 30 per cent in total in 2001 compared with the previous year.

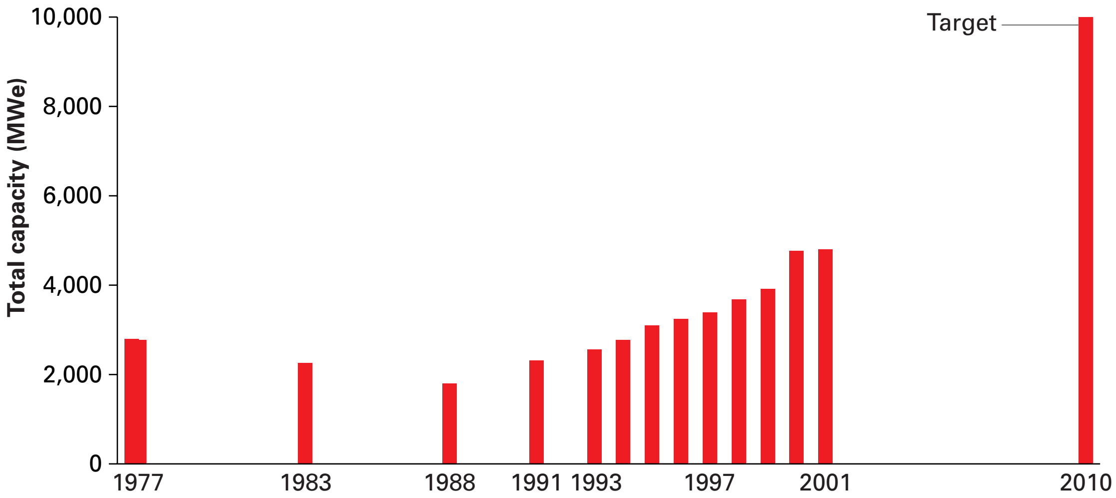
2B.11 Concerns have been raised that NETA is having an adverse impact on the development of CHP. The Office of Gas and Electricity Markets' (Ofgem) report on the initial impact of NETA on smaller generators found that, during the first two months of NETA, export prices achieved by smaller generators had reduced by 17 per cent. In addition, the level of electricity exports by the CHP plants that responded to the survey had fallen by up to 61 per cent compared to a year earlier. The level of output on-site remained constant. Ofgem suggested that lower prices were one factor but there was evidence that higher fuel costs had also contributed. The Government has identified a range of measures to improve the position of CHP within NETA and will keep the position under review.

2B.12 CHP accounted for 5.8 per cent of electricity generated in 2001 compared with 3.7 per cent in 1991. Over this period CHP electricity capacity more than doubled from 2,312MWe to 4,801MWe. Given the fuel efficiency of CHP plants, this expansion has delivered substantial savings in carbon emissions compared with what would have been emitted if electricity-only plant and boilers had been used to deliver the same amount of heat and electricity output that CHP plants produced.

2B.13 Estimates of these savings depend on assumption about the nature of electricity-only plant that has been displaced by CHP. It has been estimated that savings were running at 4.4 million tonnes of carbon per year at the end of 2001, when CHP capacity was 4,801MWe. This estimate was based on an assumption that the then current fossil fuel generation mix of electricity, and the then current mix of installed boilers were replaced. This represented a saving of 0.92 MtC per 1,000 MWe of installed capacity. The level of savings were, however, highly dependent on assumptions about what fuels would have been used if the CHP plants had not been operating. The least favourable assumptions put savings per 1,000 MWe of installed capacity at only half that level and the most favourable at 2½ times that level.

2B.14 Given the environmental benefits that CHP delivers, the Government has set a UK target of at least 10,000MWe of installed Good Quality CHP by 2010. Good Quality CHP capacity was 4,801MWe at the end of 2001. A major factor affecting the economics of CHP is the cost of fuel used in the plant (principally natural gas) and the value that can be realised for electricity. Recently the attractiveness of new investment in CHP plant has been reduced because of higher gas prices and lower electricity prices. To support CHP and help reach the target, the Government has introduced a range of policies to encourage its development and issued a draft strategy.

Chart 2B.3 Installed electricity capacity of Combined heat and power plants

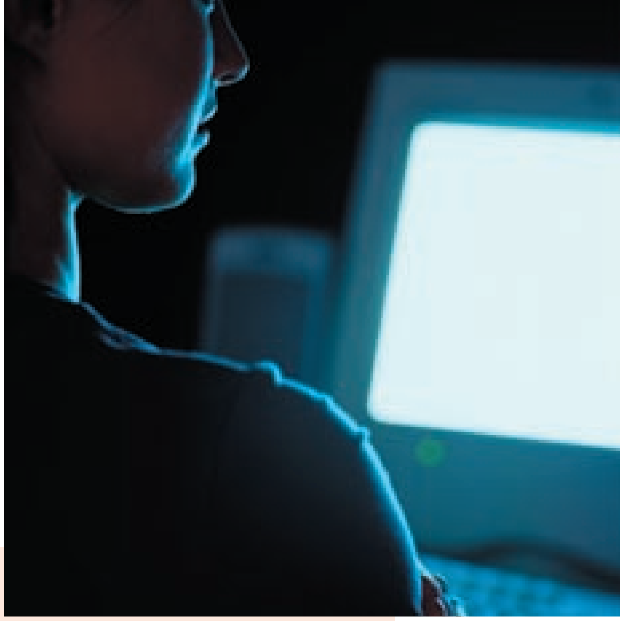


Source: Department of Trade and Industry

2B.15 The main measures in the draft strategy are:

- Climate Change Levy (CCL) exemption on fuel inputs to Good Quality CHP and on Good Quality CHP electricity outputs sold direct to end-users. In the 2002 Budget, an announcement was made that Good Quality CHP electricity sold via licensed suppliers will also be exempt from the CCL. This extension is subject to EU state aid approval;
- Climate Change Agreements established with 44 industry sectors to provide an incentive for emissions reductions through an 80 per cent reduction on the rate of the CCL;
- the emissions trading scheme. The Government has offered a financial incentive to encourage business and other organisations to take on voluntary emissions reductions targets. This incentive was allocated through an auction in March 2002;
- eligibility for Enhanced Capital Allowances (ECAs) to stimulate investment. Businesses are able to write-off the whole costs of investments in certain energy saving equipment (including CHP) against taxable profits during the period in which they make the investment;
- Business Rates exemption for CHP power generation plant and machinery;
- changes to the licensing regime for power plants, benefiting smaller generators;
- a £50m Community Energy programme to encourage the use of CHP in community heating schemes.

2B.16 The Government has commissioned modelling work from Cambridge Econometrics to provide an independent evaluation of the effect of a number of support measures on the growth of CHP installed capacity to 2010. By modelling various energy price scenarios, Cambridge Econometrics suggest that installed capacity will reach 9,300 - 10,300 MWe by 2010 under measures currently in place and recently announced.



3. Energy demand

- Energy consumption increased by 10 per cent between 1990 and 2001.
- Transport now accounts for more than one third of all UK final energy consumption.

Introduction

3.1 Energy plays a central role in each of our everyday lives. We use electricity for lighting our homes and offices, for powering our fridges, ovens, televisions and computers. We use petrol in our cars and gas for cooking and heating. For most of the time we don't even think about it, it is simply there to enable us to carry on with our normal activities. However, our use of energy impacts on our environment and contributes to global warming. These consequences were covered in the previous two chapters. The aim of this chapter is to look at the factors that influence energy demand and the policies that aim to restrain such demand. Each of the domestic, industrial, service and transport sectors are examined in turn.

Total energy consumption

3.2 More than one half of UK energy consumption is accounted by space heating and transport needs - as shown in Table 3.1. These sources of demand continue to increase with energy use in transport up 15 per cent between 1990 and 2000 and that used in space heating up 14 per cent on the same period as we kept our homes warmer. Energy demand for lighting and appliances was also up 14 per cent over the same period, mainly driven by increases in the service sector - in shops, offices and other non industrial business premises. Total energy consumption across all uses rose 8 per cent between 1990 and 2000.

3.3 This 8 per cent increase in energy consumption is much less than the 26 per cent growth in Gross Domestic Product (GDP) between 1990 and 2000. Thus the level of energy consumption per unit of output - which is often called the energy ratio of the economy - fell by 13 per cent between 1990 and 2000. Changes in the energy ratio - often also called energy intensity - can be a result of structural change in the nature of our economy, for example, the switch from manufacturing industries towards the service sector; changes in our behaviour, for example, how often we do the washing; fuel switching, since the impact of changing the fuel in a process that provides the same function will impact the amount of energy required; or changes in efficiency, for example, the change in the amount of energy required to power an electrical appliance.

Table 3.1 Total energy consumption by final use, 2000

Million tonnes of oil equivalent

	Energy consumption (tonnes of oil equivalent)	Percentage of the total
Transport	55.8	35
Space heating	41.4	26
Process use	15.3	10
Hot water	13.0	8
Lighting and appliances	9.3	6
Cooking/ catering	4.4	3
Drying/separation	3.1	2
Motors and drives	2.2	1
Agriculture	1.2	1
Other	13.1	8
Total	**158.7**	**100**

3.4 The decline in the energy ratio shows the extent to which growth in energy consumption has been de-coupled from economic growth which is key to the development of a more sustainable society. This chapter looks at trends in energy consumption in each of the main energy consuming sectors in turn. Table 3.2 shows a summary of those trends. During the 1990s, energy consumption grew fastest in the domestic sector, although the fastest growing sector since 1970 is transport.

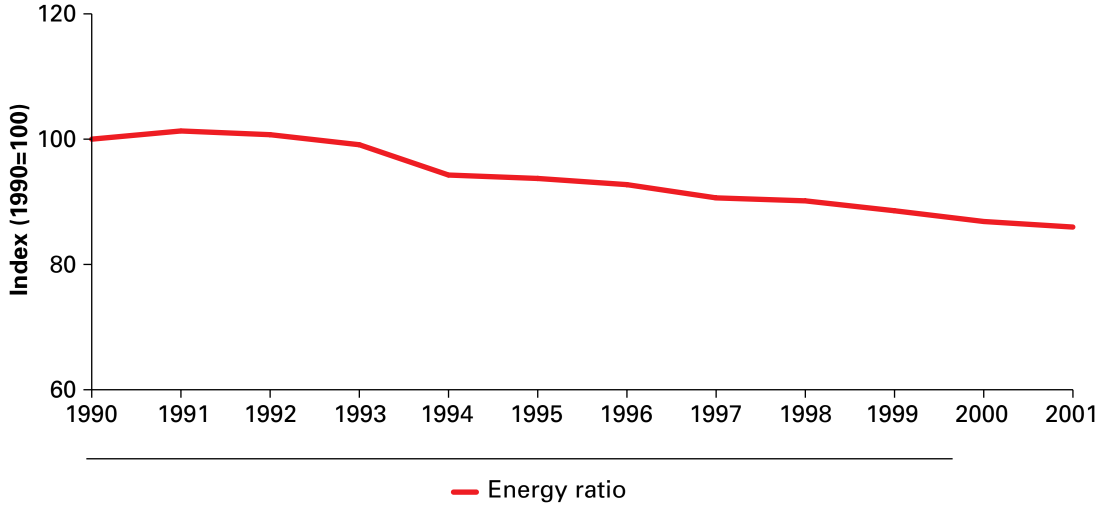
Table 3.2 Changes in levels of energy consumption, by sector

	Percentage change between 1970 and 2001	Percentage change between 1990 and 2001	2001 levels (million tonnes of oil equivalent)
Overall	+10	+9	160.8
Domestic	+32	+19	48.6
Industry	-44	-9	35.2
Services [1]	+19	+15	22.1
Transport	+95	+13	54.9

[1] Includes agriculture.

3.5 The UK's Climate Change Programme aims to ensure that the UK is secure in the delivery of its international target to reduce emissions of the basket of six greenhouse gases to 12½ per cent below 1990 levels over the commitment period, 2008-2012, and to move towards the domestic goal of a 20 per cent reduction in carbon dioxide emissions below 1990 levels by 2010. Most of the measures in the Programme aim to increase the efficiency with which energy is used across all sectors of the economy - in homes, industry, commerce, the public services and transport. Other measures encourage the development of renewables sources of energy.

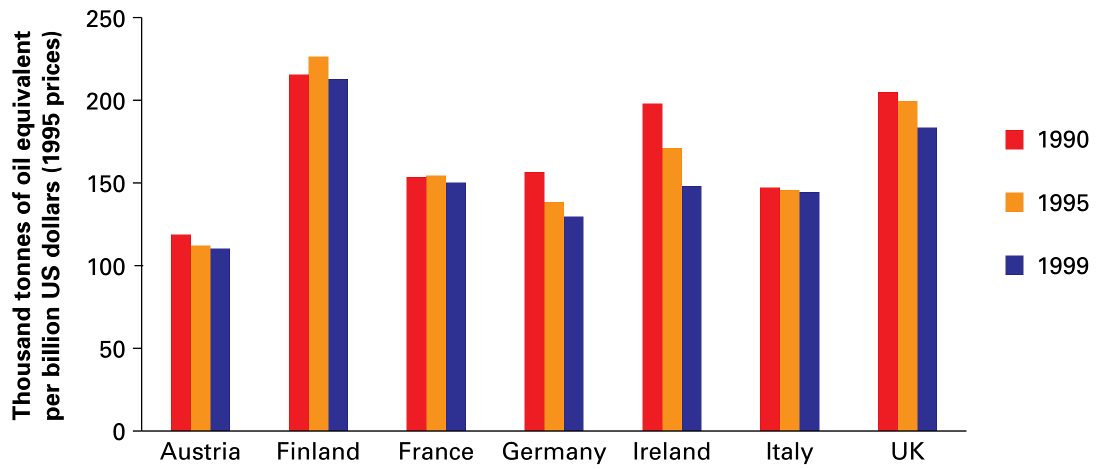
Chart 3.1 Changes in energy ratio between 1990 and 2001



Source: Department of Trade and Industry

3.6 At a European level, the EU wide SAVE programme aims to improve energy efficiency in all sectors. It invests in projects and other measures to improve energy efficiency in the EU. Chart 3.2 shows how the energy ratio, energy consumption per unit of GDP, has changed since 1990 in each of the countries shown. As noted earlier, the energy ratio measures how energy consumption has changed in relation to the economy and will reflect changes in the structure of the economy, changes in behaviours, changes in the mix of fuels used, as well as changes in energy efficiency.

Chart 3.2 Energy ratio for selected EU countries



Source: International Energy Agency

Domestic sector

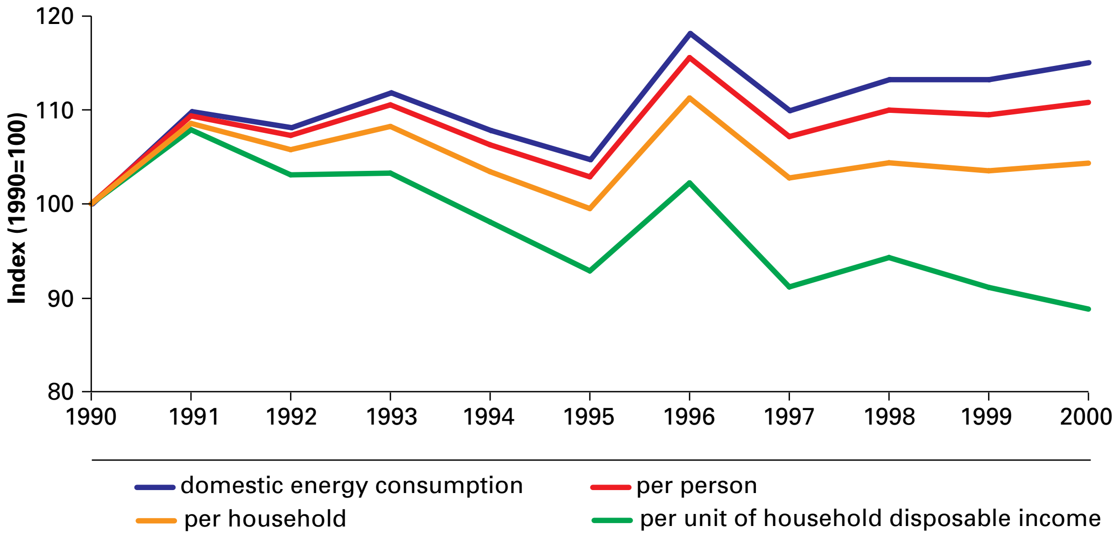
- Energy consumption in the domestic sector rose 19 per cent between 1990 and 2001.
- Improvements in insulation and heating efficiencies between 1990 and 2000 mean energy use for space heating was 26 per cent lower than it would have been without the improvements.
- This has helped people keep their houses warmer. Average temperatures inside domestic dwelling increased from 16½ degrees in 1991 to 18 degrees in 2000.
- Increasing household incomes have led to increased purchases of appliances causing a 9 per cent increase in electricity demand from this source.

3.7 Domestic energy consumption increased by 19 per cent between 1990 and 2001 to 48.6 million tonnes of oil equivalent and accounted for 30 per cent of all final energy consumption for energy purposes in 2001. This increase has been driven by a range of factors. First, household incomes have risen steadily and this has resulted in the purchase of more and bigger appliances in homes. Secondly, we keep our homes warmer in winter than we used to. Thirdly, there has been an increase in the number of households, as more people live alone. The increase in energy consumption from these factors has been offset significantly by increases in thermal insulation of the housing stock and improvement in the efficiency of some appliances. Without these, the increase in energy consumption would have been greater.

3.8 Chart 3.3 shows the evolution of domestic energy consumption and alternative measures of the intensity of energy use in the domestic sector: it looks at domestic consumption per person in order to take account of the growth in the UK population; it shows consumption per household reflecting the increase in the number of households as more people live alone or in smaller households; it shows consumption per unit of household income in order to take account of average households' increasing wealth. Between 1990 and 2000, energy consumption per person increased by 11 per cent; energy consumption per household increased by 4 per cent, whereas energy consumption fell by 11 per cent relative to household income. The variation in consumption seen in some years reflects variations in demand for space heating depending on the coldness of winters.

3.9 The causes of the increase in domestic energy consumption can be more closely identified when this consumption is broken down into its end uses of space heating, hot water, lighting and appliances and cooking. Table 3.3 shows how energy consumption for each of these end uses has changed since 1990. Between 1990 and 2000, the biggest increase in energy use was for space and water heating, though this largely reflected the fact that the winter months of 1990 were exceptionally warm, with the result that energy demand for space heating purposes was lower than usual in 1990. Compared with 1991, a more normal year in terms of winter temperatures, energy use for space heating per household was 6 per cent lower in 2000.

Chart 3.3 Domestic energy consumption and intensities



Source: Department of Trade and Industry, Office for National Statistics, Building Research Establishment

Table 3.3 Domestic energy consumption by final use per household

Tonnes of oil equivalent

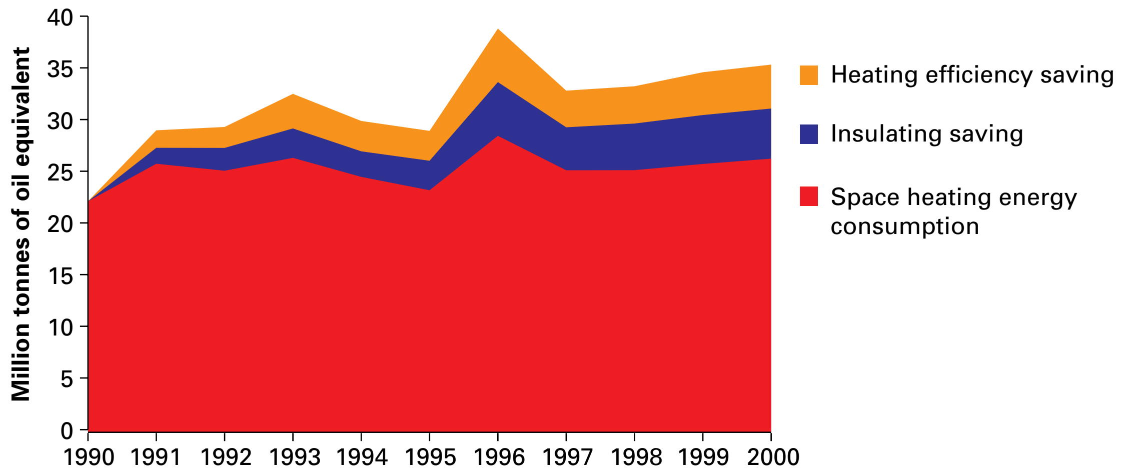
	1990	2000	Percentage change between 1990 and 2000
Space heating	1,018	1,095	+8%
Hot water	457	444	-3%
Lighting and appliances	230	243	+6%
Cooking	92	93	+1%

3.10 Average temperatures inside domestic dwellings are estimated by the Building Research Establishment to have increased from 16½ degrees in 1991 to 18 degrees in 2000. People have been helped in keeping themselves warmer by the increased prevalence of central heating - central heating ownership increased from 79 per cent of households in 1990 to 89 per cent in 2000 - and greater use of insulation in their dwellings.

3.11 By the end of 2000, only 11 per cent of all homes in Great Britain had no insulation. Of all the households that could install each insulation measure, 91 per cent had loft insulation, 82 per cent had draught proofing, 72 per cent had double-glazing and 94 per cent of homes with hot water tanks had them insulated. In each case these figures include homes where the measures are present but not installed to the full extent (for example, homes with double glazing may only have some rather than all of their windows double-glazed), so there is still substantial scope for improvement for each of these measures. Big reductions in the loss of energy through walls can be obtained through the installation of cavity wall insulation. However, at the end of 2000, only 28 per cent of homes with cavity walls had them insulated.

3.12 The installation of insulation measures and more efficient heating systems between 1990 and 2000 has led to increased energy efficiency. Consequently, the energy use of the housing stock for heating purposes in 2000 was about 26 per cent less than it would otherwise have been in the absence of these improvements. Chart 3.4 shows the contribution that both heating efficiency and insulation have made in reducing space heating energy consumption since 1990.

Chart 3.4 Domestic energy savings, 1990 to 2000



Source: Building Research Establishment

3.13 The energy efficiency improvement may also be characterised by the mean Standard Assessment Procedure (SAP) rating within the stock, which has been rising at an average rate of about 0.5 points per year, ending the period at a value approaching 45. The SAP, which is the government standard for home energy rating, was introduced in 1993. SAP ratings are based on estimates of space and water heating costs and provide a comprehensive measure of the energy efficiency of a dwelling. Under the revised building regulations, it is necessary to calculate a SAP rating for all new dwellings and conversions in England and Wales and a minimum standard has been set.

3.14 A substantial proportion of existing dwellings still have low SAP ratings and these dwellings can be expensive to keep warm which is especially difficult for those on low incomes. Those on benefits are treated as priority consumers under the Energy Efficiency Commitment 2002-2005 (EEC), introduced in April 2002, replacing the Energy

Efficiency Standards of Performance that were introduced in 1994. The EEC requires electricity and gas suppliers to achieve an energy saving target by encouraging consumers to make energy savings, through, for example, loft or cavity wall insulation, central heating or more efficient gas boilers.

3.15 It is estimated that the average financial benefit for lower income customers benefiting from measures under the schemes will be around £15.50 a year by 2005 in lower energy bills or increased comfort. The environmental impact of the EEC is estimated to be a cut in greenhouse gas emissions of around 0.4 million tonnes of carbon a year by 2005. Further information on Energy Efficiency Standards of Performance and Commitment is shown at Annex 3.B. The Home Energy Efficiency Scheme, marketed as Warm Front, is aimed at tackling fuel poverty in the private sector. Managed by Eaga Partnership and TXU Warm Front Ltd on behalf of DEFRA, Warm Front offers a range of insulation and heating measures to the homes of those most vulnerable to cold related ill-health who are in receipt of a qualifying benefit. More information on Warm Front can be found in Chapter 6 on fuel poverty.

3.16 The amount of energy used by appliances has increased by 9 per cent since 1990, which has been a result of increases in the total number of appliances bought and used by households. Net national disposable income in the UK has increased by 30 per cent since 1990. The higher the income, the higher the level of appliances owned by households. In 2000, 45 per cent of households with a gross weekly income of over £500 owned a dishwasher, compared with only 12 per cent of households with an income of £100 or less.

3.17 The largest growth in the number of households owning selected appliances has been in the number of households owning VCRs, from 59 per cent of households in 1990 to 84 per cent in 2000, and fridge-freezers, from 51 per cent of households in 1990 to 63 per cent in 2000. There are 59 per cent of households now owning two or more televisions and 14 per cent owning two or more VCRs. As technology advances, new products that use energy emerge; for example, DVD players, which were introduced in 1997, were owned by 13 per cent of the households in Great Britain in 2000. Changes in technology can also result in energy being used in a different way, such as the increased use of mobile telephones, which require electricity to charge them, and in the development of standby, which accounted for 1 per cent of domestic energy consumption in 2000.

3.18 Energy consumption for lighting increased by 11 per cent between 1990 and 2000, as the shift away from rooms lit by single ceiling bulbs towards multi-source lighting continued. The increase in consumption would have been greater if energy efficient lightbulbs had not made inroads into the lighting market. Campaigns such as DEFRA's 'Are you doing your bit' aim to help young people understand how their use of energy causes global warming and draw attention to simple actions that can be taken to protect their local and global environment. In Scotland the 'Do a little, change a lot' campaign shows how the small actions we all take can have a big impact on our environment, and encourages people to walk short distances instead of taking the car and to be more energy efficient through, for example, the use of energy efficient lightbulbs and switching off electrical equipment rather than leaving them on standby.

3.19 The Market Transformation Programme, which is jointly sponsored by DEFRA and DTI aims to 'bring forward products, systems and services which do less harm to the environment, using less energy, water and other resources'. It supports a number of policy measures including the provision of reliable product information via mandatory energy labels and seeks to raise minimum standards through measures which include the removal of inefficient boilers and refrigeration appliances from the market.

3.20 Energy labelling covers fridges, freezers, fridge-freezers, washing machines, electric tumble dryers, combined washer-dryers, dishwashers, lamps and air conditioners. The labels provide clear and easily recognisable information about the energy consumption and performance of products on a 7-point scale ranging from 'A' (most efficient) to 'G' (the least efficient), so that consumers can make a considered choice when buying.

3.21 The European Commission is developing negotiated agreements with European manufacturers on a voluntary basis to improve the efficiency of consumer products. Agreements have already been established to reduce the stand-by power of televisions, videocassette recorders and digital TV decoders, to remove inefficient washing machines and to phase out magnetic ballasts for energy efficiency light bulbs.

3.22 With DEFRA funding, the Energy Saving Trust (EST) runs a number of initiatives to help deliver energy savings. Its raising awareness activities, such as the promotion of the 'Energy Efficiency' logo, and the provision of advice through a national network of 52 Energy Efficiency Advice Centres, helps stimulate demand for energy efficient goods and services. At the same time, EST works with the energy efficiency industry to develop the infrastructure and capacity to meet the increased demand with quality products.

Industrial sector

- The chemical sector accounted for one fifth of all energy consumed in the industrial sector in 2001.
- The next biggest consuming sectors are food, drink and tobacco and iron and steel.
- Industrial energy consumption fell by 11 per cent between 1990 and 2000, compared with an increase of 13 per cent in industrial output.

3.23 Industrial energy consumption makes up more than a fifth of overall energy consumption in the UK and accounts for a quarter of all carbon dioxide emissions. Of the total, the chemicals sector consumed a fifth of all energy consumed in the industrial sector in 2001. The next two largest energy-consuming sectors are food, drink and tobacco (12 per cent) and iron and steel (10 per cent). Sugar manufacture accounts for a fifth of all food, drink and tobacco energy consumption, while beverages account for a further 13 per cent and meat and meat products for a further 10 per cent. The greatest use of energy in the iron and steel sector is in the high temperature processes needed for making basic iron and steel.

Table 3.4 Industrial energy consumption by type of use, 1999

Million tonnes of oil equivalent

	High temperature processes	Low temperature processes	Drying/ separation	Motors	Space heating	Total[1]
Chemicals	0.6	2.1	1.2	0.7	0.2	6.4
Metal products, machinery and equipment	0.2	1.6	-	-	1.4	3.8
Food, beverages and tobacco	-	2.5	0.3	0.2	-	3.9
Paper, printing and publishing	-	0.5	0.8	0.2	0.1	2.2
Other industries	6.1	1.9	0.7	1.0	1.1	11.9
All industry[2]	6.9	8.7	3.1	2.2	2.8	28.2

[1] Includes compressed air, refrigeration and lighting.
[2] Excludes the energy industries, mineral products, construction and unclassified industries.

3.24 The very varied pattern of fuel use within industry reflects the varied end uses to which industrial energy is put. Table 3.4 shows the end uses of energy in the industrial sector. The main high temperature process uses of energy are coke ovens, blast furnaces and other furnaces in the iron and steel sector and kilns and glass tanks in the chemicals sector. Low temperature process uses include process heating and distillation in the chemicals sector; baking and separation processes in the food and drink sector; pressing and drying processes in paper manufacture; and washing, scouring, dyeing and drying in the textiles sector. Motive power is used for pumping, fans (mainly in the high temperature industries and chemicals), machinery drives, compressors (for both compressed air supply and for refrigeration) and conveyor systems. Most energy in the industrial sector is used in high and low temperature processes.

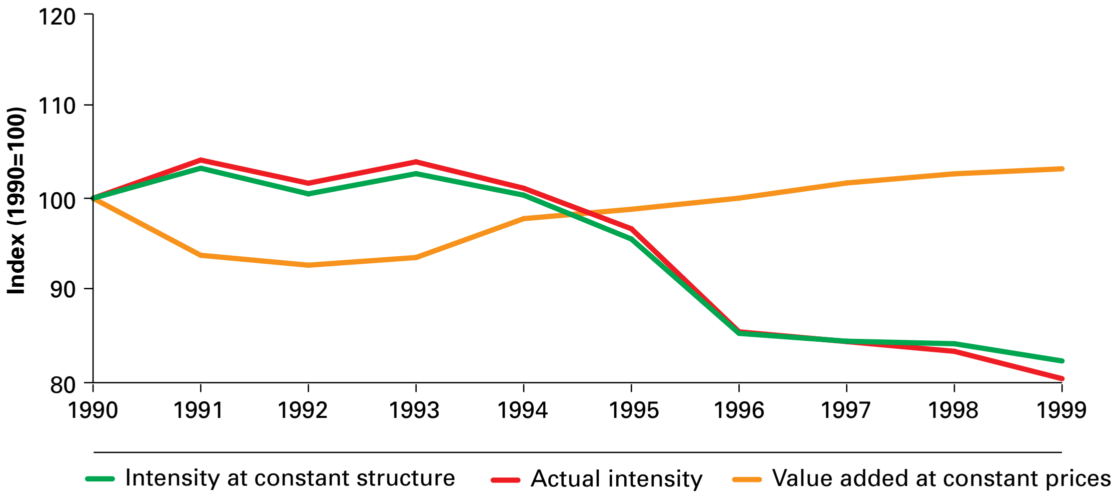
3.25 Overall industrial energy intensity, measured as energy consumption per unit of output, fell by 15 per cent between 1990 and 2000. Reasons for the fall include a change in the structure of industry, with a relative or absolute decline in the output of the most energy intensive industries (for example, output has fallen in the iron and steel sector as shown in the table above), fuel switching and an increase in the efficiency with which industry uses energy. Fuel switching can be undertaken in order to reduce energy costs per unit of output (though because of differences in the prices of different fuels this may not always reduce the volume of energy per unit of output).

Table 3.5 Changes in industrial energy consumption, output and energy intensity between 1990 and 2000

	Percentage Change between 1990 and 2000		
	Energy consumption	**Output**	**Energy intensity**
Iron and steel and non-ferrous metals	-41	-14	-31
Chemicals	+28	+34	-4
Metal products, machinery and equipment	-17	+12	-26
Food, beverages and tobacco	-6	+2	-8
Paper, printing and publishing	-17	+3	-20
Total industries	-11	+5	-15

3.26 Chart 3.5 shows how energy intensity has changed between 1990 and 1999, separating out the structural effects from the rest of energy intensity (the difference between intensity at constant structure and actual intensity). While energy intensity fell by 20 per cent between 1990 and 1999, 18 per cent was due to changes in the energy intensity of the component sectors of manufacturing industry and 2 per cent was due to changes in structure. The construction and mining industries have been excluded from this definition of industry.

Chart 3.5 Industrial output and intensity[1]



[1] Excluding construction and the mining industries.
Source: Department of Trade and Industry

3.27 Industrial energy consumption fell by 4.2 million tonnes of oil equivalent between 1990 and 2000. If the energy required to produce a unit of output was the same

[1] Energy data excludes energy used for transformation activities from 1996 (for example, electricity generation and coke manufacture) wheras they are included in the output figure.

in 2000 as in 1990, then energy consumption would have been 5.5 million tonnes of oil equivalent higher than it was in 2000.

3.28 Between 1990 and 1999, energy consumption fell by 8 per cent in the ceramics industry, rose by 27 per cent in the chemicals industry, fell by 21 per cent in the paper and board industry, fell by 7 per cent in food and drink, increased by 4 per cent in the textile industry and fell by 26 per cent in the plastics industry. The ENVIROWISE programme (formerly the Environmental Technology Best Practice Programme) seeks to improve environmental performance in these sub-sectors, among others, whilst increasing the competitiveness of UK industry by encouraging the take-up of good practice technology and techniques. The main themes of the Programme are the promotion of waste minimisation and the adoption of cost-effective cleaner technology.

3.29 A range of regulatory and fiscal policies have been advanced to encourage more sustainable use of energy by industry including the Climate Change Levy, the creation of the Carbon Trust, to deliver an integrated programme of support to accelerate the take up of low carbon technologies, and Enhanced Capital Allowances for energy saving technologies.

3.30 The Climate Change Levy was introduced in April 2001 and is a tax levied on the use of energy in industry, commerce and the public sector, which is offset by cuts in employers' National Insurance Contributions and additional support for energy efficiency schemes and renewables sources of energy. Fuels used by combined heat and power schemes are also excluded to encourage their take up. The levy forms part of the government's overall Climate Change Programme. It entails no increase in the tax burden on industry as a whole and no net gain for the public finances.

3.31 Energy intensive sectors can obtain an 80 per cent discount in Climate Change Levy rates if they agree to meet targets for improving energy efficiency or reducing carbon emissions. These climate change agreements are negotiated through trade associations and include the brewing, cement, steel, printing, chemical and ceramics sectors. In the UK, the Climate Change Levy as a whole - including the influence of the tax on energy consumption, the use of revenues to encourage energy efficiency, and the impact of the negotiated agreements - is expected to save at least 5 million tonnes of carbon per year by 2010.

3.32 Enhanced Capital Allowances were introduced as part of the Climate Change Levy package and are tax incentives to encourage firms to make investments in energy efficient technologies. The scheme currently covers CHP, motors, variable speed drives, lighting, refrigeration, boilers, pipe insulation materials and thermal screens which meet the relevant energy efficiency criteria. A further five sub-technologies were announced in Budget 2002 which will be added to the scheme subject to State Aid approval. Table 3.4 shows how energy is consumed for some of these final uses. The Carbon Trust administers and promotes the scheme in addition to managing the non-domestic Energy Efficient

Best Practice Programme and developing a programme that will support and develop new and emerging technologies.

3.33 A UK wide voluntary emissions trading scheme began trading in April 2002 that is estimated to deliver annual emission savings of at least two million tonnes of carbon per year by 2010. The scheme enables organisations to take on voluntary targets to reduce emissions and incentive payments from the Government that were set at the April 2002 auction through a competitive bidding process.

3.34 The Integrated Pollution Prevention and Control Directive provides a regulatory basis for improving the energy efficiency of most of the energy intensive sectors of industry throughout the European Union. Sectors covered by the Directive must obtain a permit from the Environment Agency or their Local Authorities, based on their use of Best Available Technologies to reduce emissions and waste. It currently applies to any new or substantially changed installation and will be phased in for existing installations by 2007.

Service sector

- The service sector consumes 13 per cent of all final energy consumed in the UK.
- A fifth of all service sector energy consumption is from the retail sector.

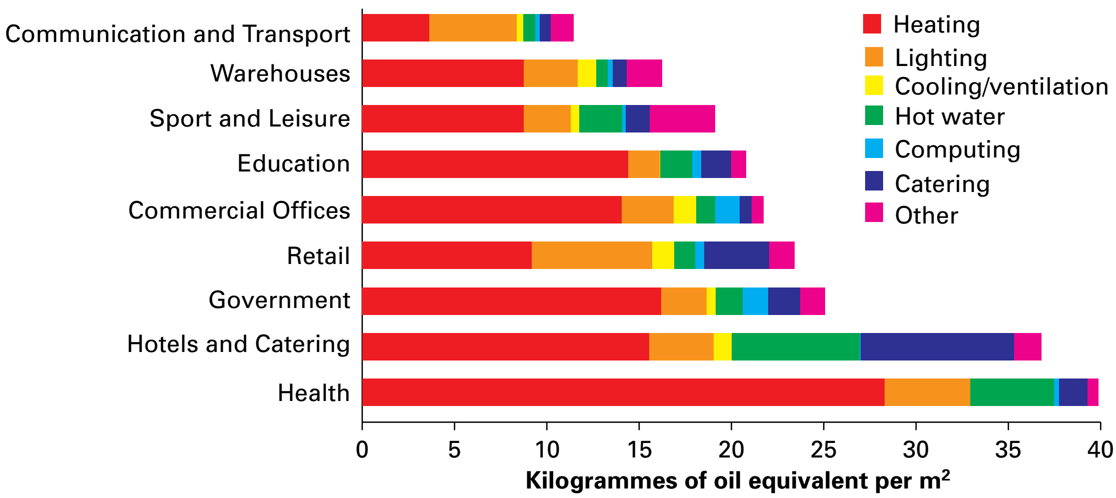
3.35 The service sector was responsible for 13 per cent of all energy consumed in the UK in 2001. The service sector also accounted for 28 per cent of all electricity consumption. The amount of energy consumed by each of the service sector sub-sectors is shown in Table 3.6. The largest single energy consuming sub-sectors in services are retail, hotels and catering and education. A fifth of all service sector electricity consumption is from the retail sector which uses electricity mainly for lighting, although shops vary considerably in their electricity needs with certain types such as hairdressers and dry cleaners having high requirements. A further 14 per cent of all service sector electricity consumption is from hotels and catering where electricity is mainly used for catering and lighting.

3.36 Each sub-sector uses energy differently, reflecting the different activities that they undertake. The amount of energy consumed for space heating purposes accounts for 55 per cent of all service sector energy consumption, with the education, commercial offices, hotel and catering and retail sub-sectors accounting for the largest part. Lighting accounts for a further 15 per cent of total service sector energy consumption and catering makes up another 10 per cent. Chart 3.6 shows how each sub-sector uses energy for different purposes.

Table 3.6 Service sector energy consumption by final use, 2000

	Final energy consumption (thousand tonnes of oil equivalent)	Average energy consumption per unit floor area (kilograms of oil equivalent per m^2)
Commercial offices	2,376	21.7
Communication and transport	305	11.5
Education	2,826	20.8
Government	1,211	25.1
Health	1,079	39.9
Hotels and catering	3,568	36.8
Retail	3,814	23.4
Sports and entertainment	833	19.1
Warehouses	1,845	16.2
Other	3,155	23.2
Total	21,012	23.9

Chart 3.6 Average energy consumption per unit floor area for service sector buildings, 2000



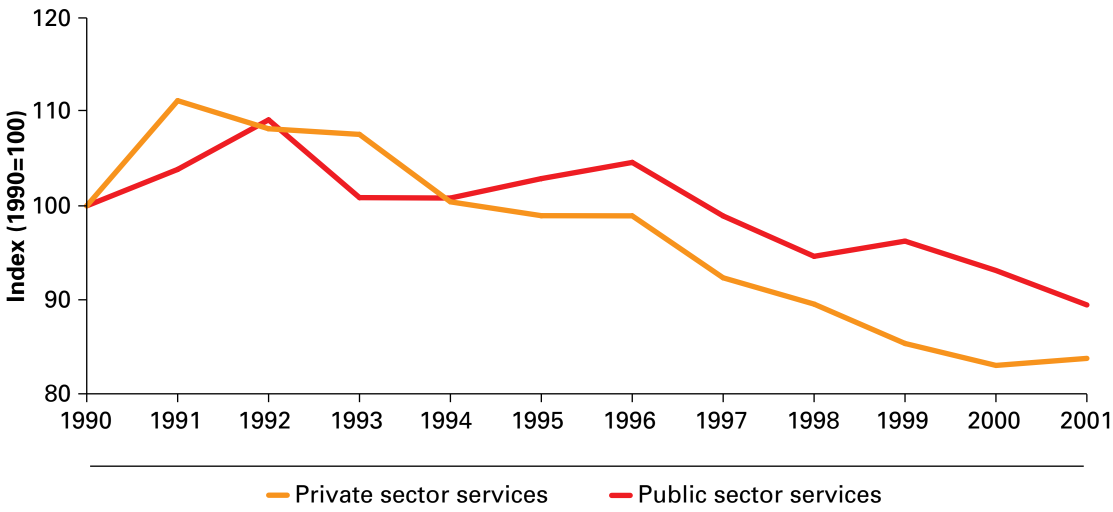
Source: Building Research Establishment

3.37 Targeting just one of the areas where energy is consumed in the service sector, the European Green Light Programme is a voluntary EC programme where private and public organisations agree to upgrade their existing lighting and to use energy efficient lighting systems where the energy savings justify the investment and the lighting quality is maintained or improved. The Green Light programme will run for five years, from 2000 until 2004.

3.38 Energy demand in the service sector (excluding agriculture) has grown by 17 per cent between 1990 and 2001. Splitting this into two broad areas of public administration, which includes government activities, education and health, and private commercial, which includes retail, hotels, financial, real estate and computer activities, energy consumption increased by 7 per cent in the public administration sub-sector and by 23 per cent in private commercial over the same time period.

3.39 These rates of growth in energy consumption are well below the growth in service sector output. In the eleven years to 2001, the private commercial sector's output grew 49 per cent and the public administration sector's output by 19 per cent. Thus energy intensity (energy consumption per unit of output) declined significantly in both sectors as shown in Chart 3.7. A key cause of these declines may be the benefits of more efficient heating systems, better insulation, greater efficiency of lighting and electrical equipment, improved energy management leading to appliances being switched off when not in use and improved awareness of energy efficiency issues through schemes such as the Energy Efficiency Best Practice Programme.

Chart 3.7 Energy intensity in the public administration and private commercial sub-sectors[2]



[2] Energy data exclude energy used for road transport services whereas they are included in the output figure.
Source: Department of Trade and Industry

3.40 Other factors will also have influenced trends in energy intensity, including the change in the composition of the service sector, for example the growth in the telecommunications industry. The rise in the use of air conditioning is one of the main contributory factors to the increased use of electricity in the service sector. Another is the growing use of electrical equipment such as IT equipment, which may tend to increase energy intensity but also increases labour productivity.

3.41 Energy Star is a joint European Union and USA initiative to identify and promote energy efficient office equipment. It is a voluntary scheme which will cover PCs, monitors, fax machines, scanners, photocopiers and printers in the EU, focusing on the electrical consumption of different appliances in stand-by mode. Manufacturers who meet the criteria under the scheme can display the Energy Star logo on their products.

3.42 In recognition of the changing energy requirements of the service sector, balanced against the potential impact on the environment, the government has worked to raise awareness of climate change through the Climate Change Levy (which is covered in paragraph 3.30) and setting energy efficiency targets for local authorities, schools and hospitals. Some information on the potential for reductions in energy consumption and carbon emissions from the service sector are shown in Annex 3A.

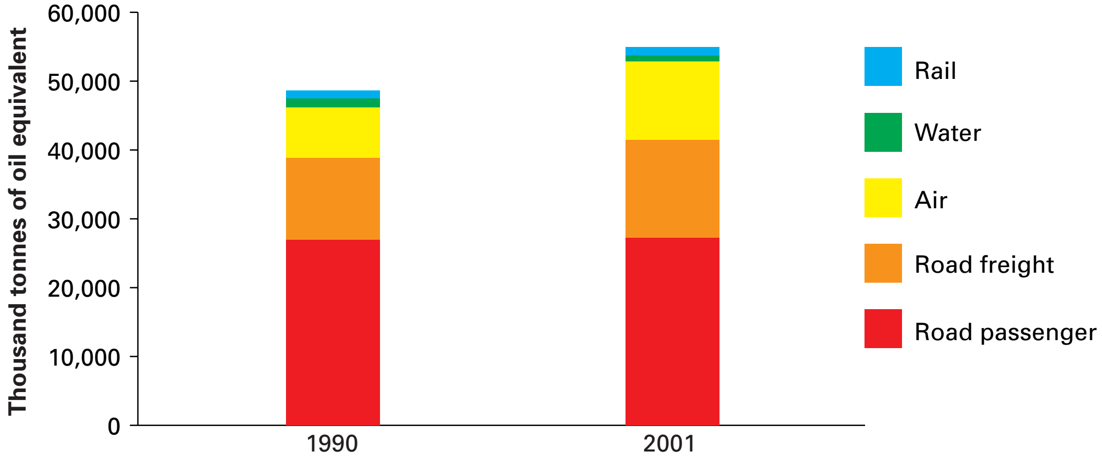
Transport sector

- Energy consumption for transport increased 13 per cent between 1990 and 2001.
- Passenger road transport accounted for around half of this energy consumption in 2001.
- Car travel increased but the increased fuel efficiency of cars meant that the total amount of fuel they used increased by only 1 per cent between 1990 and 2000.
- Increased demand for air travel led to an increase of 56 per cent in energy demand for this purpose between 1990 and 2001.

3.43 Transport is a fundamental part of our lives and our demand for it has increased continuously for decades. It has two key components, personal transport whether by car, bus, coach, train, boat or plane, and freight transport whether by small goods vehicle or large articulated lorries. Together, these transport demands now account for more than one third of all UK final energy consumption. Since 1990, energy consumption for transport has increased by 13 per cent.

3.44 Chart 3.8 shows how energy consumption has changed since 1990. The largest increase was for air transport where energy consumption increased by more than 60 per cent. Energy consumption for road passenger transport was at the same level in 2001 as in 1990, while road freight energy consumption increased by a fifth. Some of the reasons for these changes are discussed in the rest of this section.

Chart 3.8 Transport energy consumption in 1990 and 2001



Source: Department of Trade and Industry

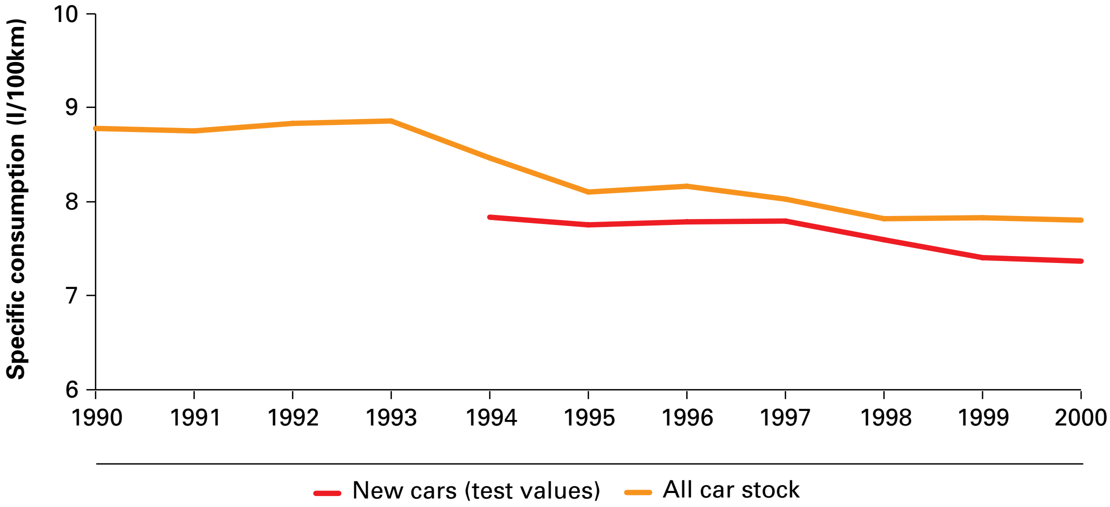
3.45 Personal transport - often called passenger transport - reflects lifestyle choices by individuals and families. It is influenced by where people live and work and how they choose to spend their leisure time. The average person travelled 6,843 miles per year in 1998-2000 in Great Britain, including a distance of 1,419 miles travelled to visit friends and a distance of 1,350 miles travelled through commuting to work.

3.46 Four-fifths of the total distance travelled was by car. Public transport was used for travelling 12½ per cent of the total distance travelled per year in 1998-2000 and was mainly used for commuting, shopping and visiting friends. Travel by public transport fell by 5 per cent between 1990 and 2000 whilst walking and cycling declined by 17 per cent. Investment in the public transport system has been identified as a key way of reducing energy consumption and forms a key part of the Government's Ten Year Plan for transport, which was published in 2000. The plan sets out a long term strategy for delivering a quicker, safer, more reliable transport system that has less of an impact on the environment.

3.47 Energy consumption for passenger road transport, which accounted for half of all energy consumption in the transport sector in 2001, was at about the same level in 2001 as eleven years earlier. This reflected increases in levels of personal travel and the switch from public transport to cars, tending to increase energy consumption, offset by reductions in the average fuel consumption of cars. As Chart 3.8 shows, the average fuel consumption of the UK car stock declined from 8.8 litres per hundred kilometres in 1990 to 7.8 litres per hundred kilometres ten years later.

3.48 The average fuel consumption of cars can be affected by a range of factors, including car design, changes in driving behaviour, including speed, and congestion. Changes in technology are an important factor and the increased fuel efficiency of engines, together with the increased use of diesel cars, explains the reductions that have been seen in recent years in the average fuel consumption of the UK car stock. However, efficiency gains that have resulted from the introduction of improved technologies have, to some extent, been offset by increased demand for higher specification vehicles, power steering, air conditioning and new features to meet crash safety requirements, which have resulted in heavier vehicles that require more fuel.

Chart 3.9 Specific consumption of the UK car stock and new cars (average fleet test values)



Source: Department for Transport, National Environmental Technology Centre

3.49 For the future, the use of lightweight materials such as aluminium, plastics, magnesium, carbon fibre and metal matrix composites should enable manufacturers to build more fuel-efficient vehicles in the future, without sacrificing safety, durability and comfort. For every 10 per cent of weight eliminated from a vehicle's total weight, fuel economy improves by 7 per cent.

3.50 The EU target for an average carbon dioxide emissions level of 120 grams of carbon dioxide per kilometre for new cars by 2010 at the latest, compares with an average of 185 grams for new cars sold in the UK in 2000. This is expected to be achieved through voluntary agreements between the European Commission and car manufacturers to make use of improved vehicle technology, a fuel economy labelling scheme for new cars and through market oriented measures to influence motorists' choice towards more fuel efficient cars. From January 2001, labels have been attached to new cars giving information about fuel consumption and carbon dioxide emissions in order to help consumers to make an informed environmental choice about the cars that they buy.

3.51 Vehicle excise duty is now lower for car buyers who choose vehicles with lower carbon dioxide emissions. This scheme was introduced in 2001 for new cars, while the rate is dependent on the size of the car engine for older cars. UK consumers are also being encouraged, through targeted reductions in fuel duties, to make greater use of environmentally friendly fuels such as bio-diesel and road fuel gases.

3.52 The company car tax regime has also been changed to encourage the purchase of smaller more efficient cars. Another measure directed at businesses is Motorvate which is a greener fleet certification scheme that is designed to help companies cut their fleet travel costs and help the environment. It sets simple targets for improving fuel efficiency and reducing fleet mileage in order to reduce the fleet's total carbon dioxide emissions over a three year period, 3 per cent of which must be achieved through reduced business mileage.

3.53 All these measures should help increase the adoption of energy efficient vehicle technologies. One of these is hybrid electric vehicles where an electric motor supplements a small conventional internal combustion engine. Hybrid vehicles offer up to twice the energy efficiency of conventional vehicles. There are already two models on the UK market, though as yet they are more expensive than vehicles of the same size, however the cost disadvantage is likely to decline as the market grows. In any case, buyers of these vehicles benefit from substantial fuel savings over the lifetime of the vehicle.

3.54 'Powering Future Vehicles' is a Government strategy to support the shift to low carbon vehicles and fuels for both passenger and freight transport. It promotes the development, introduction and take-up of new vehicle technologies and fuels, and aims to ensure the full involvement of the UK automotive industry in the new technologies and fuels. This includes setting technical standards, facilitating the quick and smooth development of any new fuel distribution infrastructure that may be needed, setting the right fiscal regime for such projects and encouraging customer take-up of new vehicles and fuels.

3.55 The growth in the air transport sector over the last thirty years has been driven by greater demand for travel to a wide variety of destinations. Between 1990 and 2000, the numbers of passengers using UK airports for international flights increased by 84 per cent. Two thirds were travelling within Western Europe, the most popular destination being Spain and the Canary Islands. Air travel between the UK and the USA nearly doubled between 1990 and 2000 accounting for 13½ per cent of all passenger movements through the UK in 2000. These trends led to an increase of 63 per cent in energy consumption for air transport between 1990 and 2000.

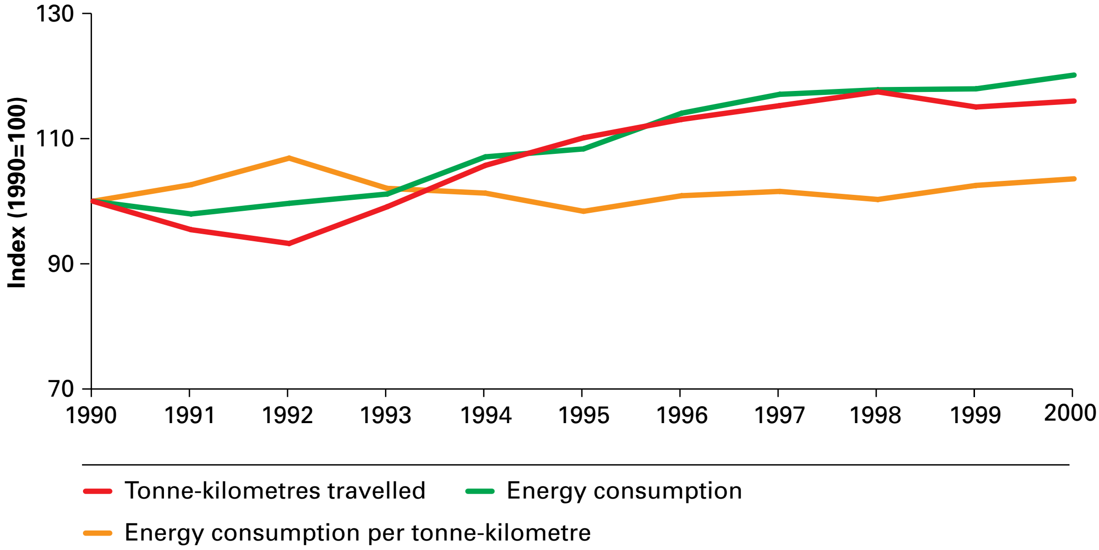
3.56 Like personal travel, freight transport has also continued to grow for a very long time, and lorries are the second most important source of carbon dioxide emissions from road transport after cars. Its growth has been driven by economic expansion and increases in production, consumption and trade.

3.57 Energy use for freight transport is dependent on the weight carried as well as distance travelled, together with the mix of sizes of vehicles used and their fuel efficiency. The energy intensity of freight transport is usually calculated as the total consumption of petrol and diesel by trucks and light goods vehicles divided by total freight transport in tonne-kilometres (each tonne transported over one kilometre counts as one tonne-kilometre). This energy intensity is shown in index form in Chart 3.10. This shows that, except for a rise in 1990-92, the energy intensity of freight transport has fluctuated about a constant level. This is a reflection of improved vehicle efficiency and a move towards larger trucks that carry more freight with a less than proportionate increase in the use of fuel. For example, the number of articulated trucks over 33 tonnes rose from 63,000 in 1991 to 91,000 in 2001.

3.58 The increase in intensity between 1990 and 1992 is likely to have been due to less efficient use of vehicles during the recession, that is, less freight being carried per journey, rather than to changes in vehicle performance. Between 1990 and 2000, energy consumption for road freight transport increased by 20 per cent because total freight transported (in terms of tonne-kilometres) increased 16 per cent, driven by economic growth of 25 per cent over the same period.

3.59 As with cars, technological progress can help reduce the energy consumption of freight vehicles. Hybrid electric vehicle technology, for example, could be eventually employed in light vans, small trucks and urban buses. Their use in these markets could provide substantial air quality benefits, as well as fuel savings, given such vehicles could potentially run on electricity in congested pollution hotspots. There are already several demonstration projects involving hybrid electric buses worldwide. Powershift is an Energy Saving Trust programme to help to establish a sustainable market for alternative, clean fuel vehicles in the UK through the provision of grants to help offset the extra costs of purchasing an alternative fuel vehicle or converting an existing vehicle to run on an alternative fuel. The programme includes a register of vehicles that are suitable to run on alternative clean fuels such as LPG and natural gas

Chart 3.10 Road freight energy consumption, tonne-kilometres and energy intensity, 1990 to 2000



Source: Department of Trade and Industry, Department for Transport

3.60 The Government is also promoting greater fuel efficiency in the road haulage and bus industries through its Energy Efficiency Best Practice Programme and through its

Haulage Forum subgroup. The Programme also provides free advice to hauliers and logistics companies on energy saving measures and the costs, implementation and benchmarking of these measures.

3.61 Potentially significant reductions in energy consumption from road transport (both passenger and freight) can be realised through reducing vehicle speeds, especially on motorways, with the added benefit of substantial reductions in emissions of nitrogen oxides. There is a range of potential ways of achieving this and one is Intelligent Speed Adaptation (ISA), a system designed to limit or advise on the speed of a road vehicle. The system is currently operational only in Formula One racing, but a pilot programme is under way in Sweden, primarily to improve road safety, and it could generate useful carbon savings.

Further reading

- Climate Change - The UK Programme, DETR (now DEFRA), November 2000
  http://www.defra.gov.uk/environment/climatechange/cm4913/index.htm
- Energy Sector Indicators, DTI
  http://www.dti.gov.uk/energy/inform/energy_indicators/
- Digest of UK Energy Statistics, DTI
  http://www.dti.gov.uk/energy/inform/dukes/
- Energy Balances of OECD Countries
  http://www.iea.org
- Domestic Energy Fact File, Building Research Establishment
  http://www.bre.co.uk
- Transport Statistics Great Britain, DfT
  http://www.transtat.dft.gov.uk/tables/tsgb01/text/tsgb.htm
- Energy Consumption in the United Kingdom, DTI
  http://www.dti.gov.uk/energy/inform/energy_consumption/

Useful websites

Are You Doing Your Bit: http://www.doingyourbit.org.uk/

Carbon Trust: http://www.thecarbontrust.co.uk/

Do A Little Change A Lot:
http://www.scotland.gov.uk/environment/dochange/pages/html/home.html

Energy Saving Trust: http://www.est.org.uk/

Envirowise: http://www.envirowise.gov.uk/

European Greenlight Programme: http://www.eu-greenlight.org/

Market Transformation Programme: http://www.mtprog.com/introfram.html

Motovate: http://www.greenerfleet.org.uk/index.html

Powershift: http://www.est-powershift.org.uk/

Warm Front:
http://www.eaga.co.uk/grants/warm_front_grant.html

Annex 3A
The potential for reducing energy consumption and carbon emissions in commercial and public buildings

3A.1 Technologies already in use could reduce carbon dioxide emissions by 7.4 million tonnes of carbon (MtC) per year if used more extensively in commercial and public sector buildings throughout the UK, according to the Building Research Establishment in their report 'Carbon dioxide emissions from non-domestic buildings: 2000 and beyond'. This compares with total carbon emissions in the sector of 21.2 MtC in 2000, making up 15 per cent of all emissions in 2000. This 7.4MtC is said to be technically feasible, which means that it can be achieved through adopting current, fully developed technologies that reduce energy use and hence carbon dioxide emissions.

3A.2 Well over half of the carbon saved through technically feasible measures could be saved through measures that also save businesses cash - they are cost effective for businesses to do now because the average annual monetary saving through reduced energy consumption exceeds the equivalent annual cost of the measure. This is calculated taking into account the cost of investing capital in energy measures instead of elsewhere. If businesses in the commercial and public sector introduced all the energy saving technologies that saved them money, this would reduce carbon emissions by 4.6 million tonnes of carbon per year.

3A.3 In practice, however, businesses often ignore these potential savings. There are a number of reasons for this. Most businesses will have to decide carefully where they want to invest any capital, and it may be necessary to delay undertaking energy saving measures because of more urgent investments. The time senior management have to put into place energy saving projects is also likely to be limited. There may also be a lack of information about the types of energy saving measures possible for a business and the cost-effectiveness of these measures.

3A.4 Service sector businesses could save money and reduce carbon emissions by saving energy used in a variety of purposes: heating, lighting, computing, etc. These potential savings are summarised in Table 3B.1, based on BRE's report, which shows the carbon savings that would have been achieved in 2000 if all cost effective or technically feasible measures had been undertaken. The amount of energy consumed for each end use is included to put these savings into context.

3A.5 In 2000, according to figures from the Building Research Establishment, 64 per cent of all service sector energy use was for heating, including water heating. Table 3A.1 shows that there is significant scope for reducing the amount of energy used and hence carbon emitted through heating in the service sector. Whilst heating measures do offer the greatest technical potential for carbon savings in 2000, only 40 per cent of these savings can be made cost effectively, because many retrofit measures to improve the fabric of the building, such as double glazing and insulation are generally not cost effective on energy grounds alone. However, where non-energy benefits are included, such measures often become cost-effective.

Table 3A.1 Energy consumption and maximum potential carbon savings achievable from the simultaneous application of all energy efficiency measures in 2000[3]

Service sector end-use	Energy consumption (ktoe)	Carbon emissions (MtC)	Cost effective saving (MtC)	Technical potential (MtC)
Lighting	3,060	4.8	2.08	2.37
Heating	13,544	10.4	1.49	3.88
Computing	477	0.8	0.44	0.45
Cooling	626	1.0	0.23	0.23
Catering	2,135	2.5	0.15	0.16
Other	1,171	1.6	0.21	0.35
Total	21,014	21.2	4.60	7.43

[3] A discount rate of six per cent has been used to calculate the cost effectiveness.

3A.6 Energy use for lighting purposes accounted for 14½ per cent of all energy used in the service sector in 2000. Lighting, however, offers the greatest scope for cost effective savings to be made. This is because the marginal cost of replacing a standard light with a more energy efficient model is frequently quite low relative to the cost of energy saved. The types of measures considered consist of the replacement of one type of light with another that is more energy efficient or more effective lighting management, i.e. by ensuring that rooms are only lit when occupied.

3A.7 Possible carbon savings from reduced energy consumption by computers, cooling systems and refrigeration units are also shown. Energy savings from computing cover a range of office equipment from computers to photocopiers and monitors and mainly consist of the units either being put in standby or turned off instead of being left on when not in use or being turned off instead of being left on standby. Cooling involves the adoption of more energy efficient systems and refrigeration involves choosing more energy efficient units. Most computing or cooling measures are either low cost, by for instance choosing a more efficient cooling system over a standard system, or involve no cost, for instance by switching off computers when not in use instead of leaving them on standby, and are thus mostly cost effective. Appropriate controls and the increased use of passive cooling techniques would lead to additional savings in cooling energy

3A.8 Table 3A.2 below shows the savings possible from the twelve measures that are most cost effective, both in terms of a carbon saving per year and monetary savings through reduced energy consumption in the service sector as a whole. The Building Research Establishment modelled a total of almost fifty measures. The figures in the table show the amount of saving possible from a single measure pursued in isolation. If two or more measures are undertaken at the same time then the carbon savings through the two measures combined is likely to be less than the sum of the savings from the each individual measure shown in the table. This is because there will be overlaps between some of the various actions, for instance when more efficient lamps are installed in a room with an occupancy sensor. There may also be thermal interactions between two or more installed measures. These overlaps and interactions are taken into account in the figures shown in Table 3A.2.

Table 3A.2 The annual monetary and carbon savings in 2000 from measures with the greatest total potential cost effective carbon savings in the commercial and public sector[4]

Measure	Savings from reduced energy use (£millions/year) - across all service sector	Carbon saved (tonnes/year) across all service sector
Fit fixed period timers on stairwell lights	£ 249.4	650,900
Replace tungsten lamps with compact fluorescent lamps (with electronic control gear)	£ 200.1	522,200
Turn off lights when not in use	£ 188.9	492,900
Reduce thermostat temperature by 1oC	£ 182.9	812,500
Energy management of office equipment	£ 153.7	401,200
Replace 38mm fluorescent tubes with 16mm	£ 118.0	307,900
Install energy efficient air conditioning	£ 88.9	232,000
Replace 26mm fluorescent tubes with 16mm	£ 82.6	215,600
Install most energy efficient boiler	£ 75.8	578,200
Fit thermostatic radiator valves (TRV's) to all radiators	£ 69.1	527,100
Basic timer for lighting	£ 63.2	164,900

The table above is ranked by monetary savings, it should be noted that carbon savings do not necessarily follow the same ranking due to differences in the emission factors and costs of the different fuel types displaced.

[4] A discount rate of six per cent has been used to calculate the cost effectiveness.

3A.9 Lighting measures constitute the top three measures in terms of total cost effective monetary savings. The greatest total monetary savings are from the installation of timers on stairwells, which provide light only when needed. BRE estimate that such timers would reduce energy consumption by stairwell lights by 20 per cent. Replacing tungsten filament lamps with CFL's (Compact Fluorescent Lamps) also produce high monetary savings, with energy savings of over 80 per cent. The third greatest monetary savings are from turning off lights when they are not in use. It was assumed that lights could be turned off for an extra hour every day, thus reducing lighting energy consumption by 10 per cent. The remaining lighting measures involve the replacement of one type of fluorescent tube with a more energy efficient model.

3A.10 Four of the measures with the greatest total cost effective carbon savings reduce the amount of energy used to heat or cool the building. Reducing the thermostat temperature by 1°C shows the greatest total monetary savings, and is estimated to reduce space heating and cooling energy consumption by 10 per cent. In terms of heating and cooling measures, the next greatest total monetary savings come from installing the most energy efficient air conditioning unit, with savings estimated to be 20 per cent. The final two heating and cooling measures involve installing the most energy efficient boiler and fitting TRV's (Thermostatic Radiator Valves) to radiators where they are not already installed. Energy management of office equipment also results in significant total monetary savings. Here, all office equipment is considered including computers, monitors, printers and photocopiers. Savings range from 35 per cent to 60 per cent.

3A.11 Table 3A.3 shows the amount of cost effective carbon savings for four of the main service sub-sectors. These four sub-sectors account for just over half of current service sector energy use in the UK. Of the four sectors it is clear that retail offers the greatest potential for cost effective carbon savings, followed by the commercial offices and the hotels and catering sub-sectors. In the retail sector there is, in particular, scope to reduce carbon emissions by reducing lighting energy use, because of the amount of display lighting. Lighting also accounts for a high proportion of potential savings in the hotel and catering sub-sector.

Table 3A.3 Energy consumption and cost effective measures for commercial offices, retail, hotels and catering, and sport and leisure sectors[5]

Sector	Energy consumed by sector	Cost effective potential carbon savings (MtC)
Retail	3,814	1.23
Hotels and Catering	3,568	0.53
Commercial Offices	2,376	0.47
Sport and Leisure	833	0.23

[5] A discount rate of six per cent has been used to calculate the cost effectiveness.

3A.12 The latest Building Regulations, introduced in April 2002, encourage architects to design new non-domestic buildings with energy efficiency in mind. These include standards for both lighting and heating appliances, and require that both lighting and heating appliances should be "reasonably" efficient. For general office or storage buildings, the lighting requirement implies an efficiency of not less than 40 luminaires-lumens/watt when averaged across the whole building. There are various ways of ensuring compliance with heating standards, with targets based on fuel used for heating, and on an associated carbon emission factor or carbon emitted per unit energy. The Market Transformation Programme also supports policies to improve the energy efficiency of air conditioning, refrigeration, motors, lighting and office equipment.

Annex 3B

Energy efficiency standards of performance and commitments

3B.1 A large increase in the level of energy efficiency investment in the domestic sector is expected following the introduction of the Energy Efficiency Commitment for 2002-2005 (EEC), in April 2002. Substantial investments have already been made under the Energy Efficiency Standards of Performance (EESoP) scheme that operated from April 1994 through to March 2002. This Annex looks at the scope of investments made under EESoPs over this eight-year period.

3B.2 Overall, energy efficiency measures resulting from the EESoP programmes will provide consumers with savings of more than £1 billion over the lifetime of the measures, which is equivalent to over £40 per household in the UK. The first programme began in 1994 with the Energy Efficiency Standards of Performance (EESoP) scheme for England and Wales for electricity suppliers, which was extended to Scotland in 1995 and Northern Ireland separately under the Energy Efficiency Incentive Scheme in 1997. The scheme was extended to gas suppliers in April 2000. Under the schemes, energy suppliers were obliged to help their domestic customers to save energy. The companies were encouraged to direct much of their efforts towards lower income or disadvantaged customers and, so far, over half the benefits have been directed towards these groups.

3B.3 There were three separate EESoP schemes, the first of which ran from April 1994 to March 1998 and aimed to save 6,103GWh[6] over this period. The second scheme ran from April 1998 to March 2000, with a target of 2,713GWh. The Office of Electricity Regulation (OFFER) set these targets. The third EESoP scheme ran from April 2000 to March 2002 and had a target of 4,981GWh for electricity and 6,144GWh for gas. The Office of Gas and Electricity Markets (Ofgem) set the targets for this scheme. Projects designed to achieve these targets were funded by a levy on customers of £1 per year for the first two schemes and a nominal expenditure[7] of £1.20 per year for the third scheme. Following the Utilities Act 2000, the Government has been responsible for setting the Energy Efficiency Commitment (EEC) for April 2002 to March 2005.

3B.4 The total expenditure on the measures in the EESoP schemes over the period 1994/1995 to 2000/2001 has totalled approximately £284 million of which 72 per cent has been borne by the energy supply companies, with customers and social landlords funding the remainder. For the Energy Efficiency Commitment the energy saving target is expected to lead to energy supplier expenditure amounting to £450 million over the three years, equivalent to £3.60 per customer per fuel. It should also result in a reduction of greenhouse gas emissions of approximately 0.4 million tonnes of carbon per year by 2005.

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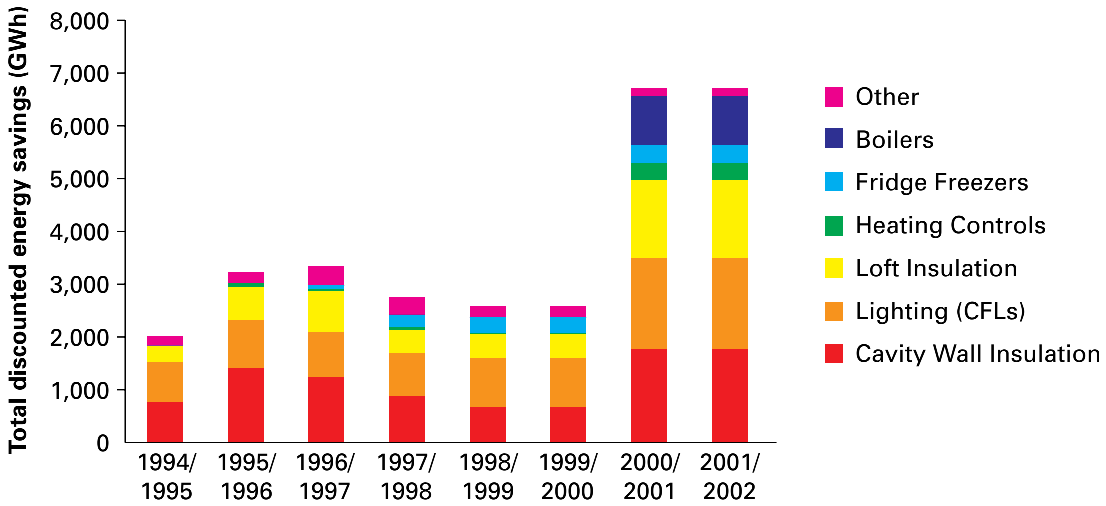
[6] All EESoP energy savings quoted are on the basis of the targets set by OFFER, which are calculated on the basis of discounted lifetime savings. The amount of savings accredited to suppliers is dependent on their share of funding.
[7] By 2000, when EESoP 3 was set, the energy supply market was fully competitive and hence there was no ability to set a levy.

3B.5 Results of the EESoP schemes are shown in Chart 3B.1. The chart shows the energy savings resulting from each measure under the three EESoP schemes. Values for the second EESoP scheme, which ran from April 1998 to March 2000 and the third EESoP scheme, which ran from April 2000 to March 2002 are estimates until the figures are finalised.

Chart 3B.1 Energy savings per year under the EESoP schemes, 1994/1995 until 2001/2002[8]



[8] Savings for 1998/1999 and 1999/2000 are based on estimated values averaged over the two years. 2000/2001 and 2001/2002 are based on measures as submitted by electricity and gas supply companies under EESoP 3 averaged over the two years that the programme was in operation.
Source: Energy Saving Trust

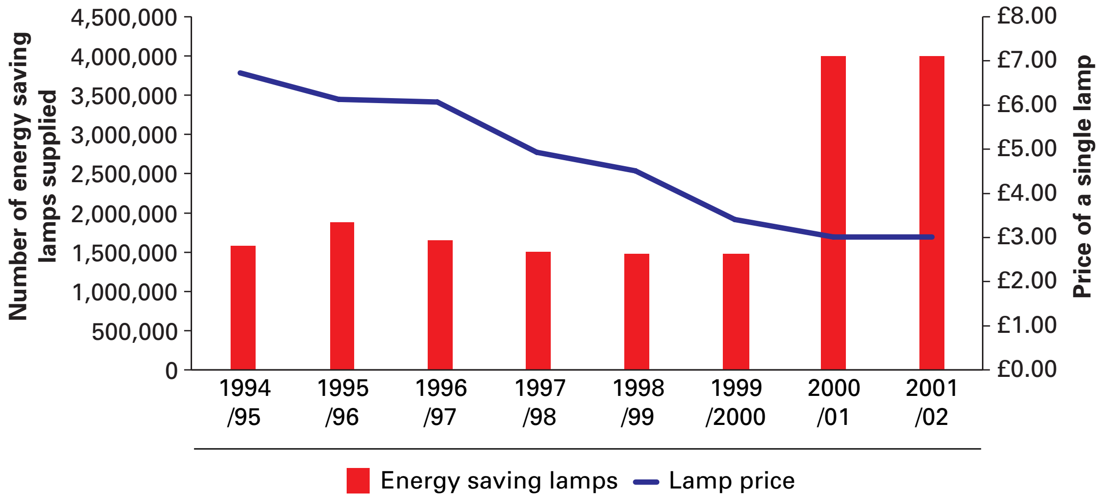
3B.6 The above chart shows that the majority of savings, particularly for the first two EESoP schemes, were a result of actions in three areas; the installation of cavity wall insulation, the supply of Compact Fluorescent Lamps (CFLs) and the installation of loft insulation. Since 1997, there have also been significant energy savings from the supply of energy efficient refrigeration appliances. In the third EESoP scheme, large energy savings are also expected to result from the installation of heating controls and more energy efficient boilers.

3B.7 Cavity wall insulation can cost up to £400, but delivers a large energy saving, and could pay for itself through reduced energy use over a four or five year period. Over the eight-year period from 1994/1995 to 2001/2002, it is expected that over 260,000 houses will have had cavity wall insulation installed under the EESoP schemes and it is predicted that this will deliver savings over the lifetime of the insulation of over 9000GWh of energy, or about 35MWh per cavity wall insulated. Cavity wall insulation involves injecting the wall cavity with insulating material from outside. Suitable materials include urea formaldehyde foam, mineral wool (glass or rock) and polystyrene beads or granules. Figures from the GfK Home Audit show that just over a quarter of households in Great Britain that could install cavity wall installation have done so, thus there remains scope for considerable further energy savings in this area.

3B.8 The EESoP scheme has resulted in large numbers of conventional light bulbs being replaced with Compact Fluorescent Lamps (CFLs). The installation of CFLs is one of the most cost effective measures in terms of the energy saved relative to expenditure and is the easiest measure to supply in large volumes. It is estimated that approximately 17.5 million energy saving lamps were supplied under the three EESoP schemes and it is expected under the EEC scheme on average almost 9 million CFLs per year will be supplied. Lamps supplied under the EESoP schemes are expected to save over 8,500GWh over their lifetime.

3B.9 The cost of each light to energy suppliers has decreased, from around £6.70 in 1994 to £3.00 today. Retail prices have also fallen: approved lights cost around £15 in 1994, but are now available for as little as £5. These lamps only consume 20-25 per cent of the electricity consumed by filament light bulbs for a similar amount of light. The lifetime of a CFL is about 12 times that of a conventional lightbulb and after about 900 hours of use, the cost savings through reduced energy use will have offset the extra amount paid for the bulb. The savings on a consumers' energy bill over the lifetime of a single CFL could be as much as £35.

Chart 3B.2 Energy Saving Lamp installations under EESoP schemes, 1994/1995 until 2001/2002[9]



[9] Savings for 1998/1999 and 1999/2000 are based on estimated values averaged over the two years. 2000/2001 and 2001/2002 are based on measures as submitted by electricity and gas supply companies under EESoP 3 averaged over the two years that the programme was in operation.
Source: Energy Saving Trust

3B.10 Another important domestic energy saving measure has been loft insulation. Approximately 200,000 households will have installed loft insulation as a result of the EESoP schemes. This will deliver lifetime savings of about 6,000GWh, or 30MWh per loft insulated. The thickness of any loft insulation is important and all new houses built between had to have loft insulation of a thickness of 150mm. Regulations that came into force on 1 April 2002 have increased the thickness of the loft insulation that new houses should have to 250mm.

3B.11 It is expected that 360,000 energy efficient refrigeration appliances will have been provided between 1994 and 2002 under the EESoP schemes, with a typical lifetime energy saving of 5MWh per fridge supplied. Specifically, the Energy Saving Trust ran the FridgeSavers scheme from 1996 to 2002, which aimed to replace old or damaged fridges and fridge freezers in disadvantaged households with new appliances that use only a quarter of the energy. This was initially a pilot scheme for the first EESoP scheme through London Electricity and ScottishPower and was then rolled out nationally under the second EESoP scheme. The Energy Saving Trust has continued to operate the scheme for five electricity companies over the third scheme, and it is expected that the FridgeSavers scheme alone will have resulted in the replacement of over 150,000 fridges and fridge freezers.

3B.12 Two measures that were introduced through the final EESoP scheme, which ran from April 2000 to March 2002, are energy efficient condensing boilers and heating controls. These two measures were undertaken primarily by gas supplier companies to reduce energy consumption from gas. It is estimated that approximately 65,000 boilers were replaced under the final EESoP scheme and 42,000 heating controls were installed to reduce energy consumed by boilers. Such heating controls might react to changes in the outside temperature, provide different levels of temperature in different rooms, and switch heating and hot water on and off at specified times, depending on the complexity of the system.

3B.13 The EESoP schemes have provided benefits, both in terms of carbon dioxide savings and in terms of reduced electricity bills, where the focus has been on those customers with the lowest incomes. The new Energy Efficiency Commitment, will do the same, demonstrating that environmental and economic benefits can be achieved simultaneously, through improvements in energy efficiency.

Annex 3C

A comparison of final energy consumption across the European Union[10]

3C.1 There are significant differences in the pattern of energy use across the nations forming the European Union. Some of these differences may be due to differing climates, some due to differences in the industrial structures of national economies and some due to differences in lifestyle. This analysis looks at the patterns of energy use in the fifteen countries that make up the EU.

Table 3C.1 Energy consumption of EU countries 1990 and 1999

Country	Energy consumption in 1999 (Thousand tonnes of oil equivalent)	Percentage change in energy consumption between 1990 and 1999	Percentage change in GDP between 1990 and 1999	Percentage change in the energy ratio between 1990 and 1999	Sector(s) with biggest increase in energy consumption in absolute terms
Austria	24,201	+16.0	+21.5	-4.5	Service
Belgium	41,262	+25.3	+18.6	+5.7	Industry
Denmark	15,641	+11.3	+22.1	-8.9	Transport and Agriculture
Finland	25,221	+11.7	+17.3	-4.8	Industry
France	169,741	+16.0	+15.2	+0.7	Transport
Germany	239,742	-2.8	+14.7	-15.2	N/A
Greece	18,994	+26.2	+20.1	+5.1	Transport and Domestic
Ireland	10,590	+37.0	+78.5	-23.3	Transport
Italy	131,780	+12.1	+13.7	-1.4	Transport
Luxembourg	3,434	+16.1	+62.4	-28.5	Transport
Netherlands	57,895	+11.4	+27.4	-12.6	Transport
Portugal	17,806	+40.5	+25.3	+12.1	Transport
Spain	83,184	+35.6	+23.5	+9.8	Transport
Sweden	35,423	+10.2	+14.5	-3.8	Domestic
United Kingdom	159,785	+10.0	+20.7	-8.8	Transport and Domestic
European Union	1,034,700	+11.3	+18.1	-5.8	Transport

3C.2 Total final energy consumption across the EU was 1,035 million tonnes of oil equivalent (Mtoe) in 1999, an increase of 11 per cent on 1990 levels. The amount of energy consumed in every state of the EU except Germany increased by at least 10 per cent between 1990 and 1999. The small fall in German energy consumption was primarily due to restructuring in the energy intensive industries in the former East Germany. Increases of more than 25 per cent were reported in Belgium, Greece, Ireland,

[10] This analysis is based on IEA figures. The IEA include feedstocks for petroleum products and gas with the 'industry sector' consumption figures, whereas the UK figures include petroleum feedstocks with the 'non-energy use' figures.

Portugal and Spain. Table 3C.1 shows total final energy consumption in the European Union's countries. Germany, France, United Kingdom and Italy account for over two thirds of energy consumption in the European Union.

3C.3 There are also notable differences in trends in the energy ratio - the amount of energy consumed relative to GDP at constant prices - across the nations of the European Union. In ten of the fifteen nations and across the European Union as a whole the energy ratio decreased, but there were increases in the energy ratio in five nations. Of the four main EU consumers of energy, Germany and the UK had the largest declines in the energy ratio, Italy has shown a smaller reduction, whilst France has had a slight rise in the energy ratio. In absolute terms, France, Germany and the UK now have energy ratios that are approximately the same at about 130ktoe per billion dollars of GDP at 1995 prices. Italy has the lowest energy ratio of the EU nations at 107ktoe per billion dollars of GDP at 1995 prices.

3C.4 In terms of fuel use, 51 per cent of the energy consumed in the EU was in the form of petroleum products, with 22 per cent being natural gas and 18 per cent being electricity. The main change over the period 1990 to 1999 has been the reduction in the use of coal in favour of gas and electricity. Coal made up 8 per cent of all final consumption of energy in 1990, but only 3 per cent in 1999, whereas between 1990 and 1999 the proportion of final energy made up by gas increased from 19 per cent to 22 per cent and the proportion made up by electricity increased from 17 per cent to 18 per cent.

3C.5 There are large differences in the fuel mix of EU nations. Natural gas makes up less than 10 per cent of energy used in Portugal, Greece, Sweden and Finland because of limited gas distribution infrastructures in these countries. Greece and Ireland are more heavily dependent on oil, which constitutes over 70 per cent of the fuel they use. In terms of the four major consumers of energy, the share of oil in the fuel mix is lower in the UK than in Germany, Italy and France. The share of natural gas in the fuel mix is higher in the UK and Italy than in France and Germany.

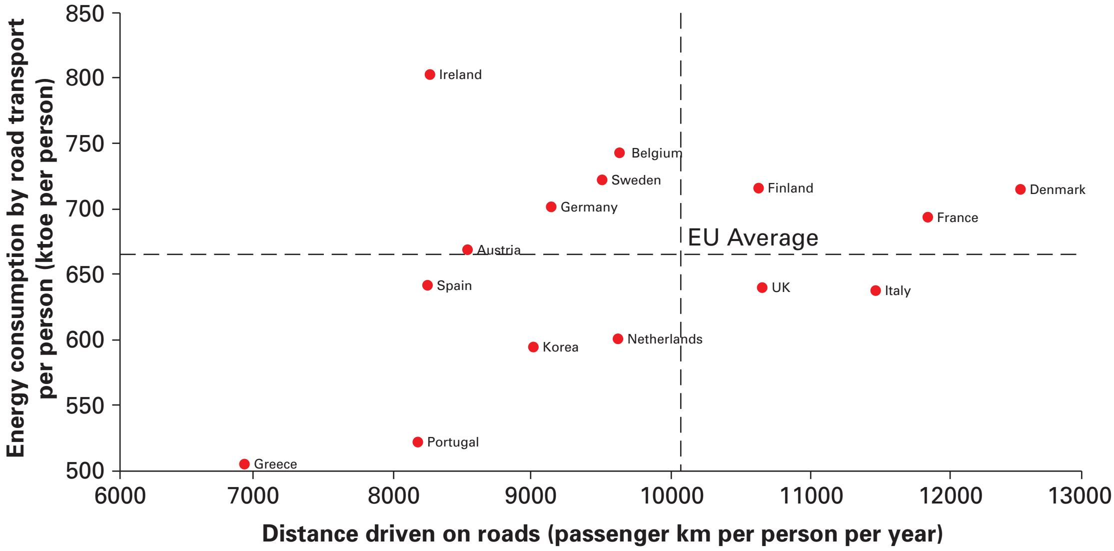
3C.6 Table 3C.1 also shows, for each country, the sectors that were the biggest driver of increased energy consumption in each country. Whilst it can be seen that transport was the main driver of the overall EU increase and was the main increasing factors in ten of the fourteen EU states with increased energy usage, there are some significant differences between countries, with each of the final use sectors driving up energy consumption in at least one country.

3C.7 The transport and industrial sectors in the EU are the biggest consumers of energy with 30 per cent of the total each. The domestic sector is the next largest, accounting for 24 per cent of the total, with the service sector accounting for a further 11 per cent. The remaining 5 per cent is accounted for by the agricultural and non-energy use of energy fuels, for instance for lubricants or chemical feedstock.

Transport sector

3C.8 The transport sector accounted for the highest proportion of energy use in the EU in 1999, overtaking industry as the largest sector for the first time. This increase was driven primarily by an increase in road passenger transport, which has grown more rapidly than the EU's GDP. The relative proportions of rail and buses have declined in favour of passenger cars and air transport. There have also been large increases in road freight traffic, partly as a result of the 'just-in-time' industrial organisation, through which, by the efficient delivery of products exactly when needed, stocks and working capital have been reduced, but this has necessitated more delivery journeys. The growth in energy used for transport was one of the main factors in increasing energy use in ten of the fourteen EU states with increased energy use over the last decade.

Chart 3C.1 Transport energy per capita, ownership of cars and the distance travelled by car by country compared to the EU average, 1999



Source: European Commission, Directorate-General for Energy and Transport

3C.9 Chart 3C.1 compares the amount of energy consumed by road vehicles per person with the distance travelled by road per person in each EU nation. Generally the shorter the distance travelled per person the lower the amount of energy used by road vehicles. There are differences between nations, which can be explained by differences in the occupancy rates of cars and by differences in the types of cars owned across the EU. People in the UK travel longer distances by road but use less energy on road transport than the EU average.

3C.10 Additionally, the rate of car ownership is steadily increasing and larger, more powerful cars have increased their share of new registrations at the expense of smaller cars. There are large differences, however, between different EU states with Greece having just

275 cars per 1,000 inhabitants and Luxembourg the highest with 610 cars per 1,000 inhabitants. The UK has 414 cars per 1,000 inhabitants, which is below the EU average.

Industrial sector

3C.11 Energy use in the industrial sector in the EU fell by about 2 per cent per annum between 1990 and 1993, as a result of energy savings and depressed industrial production. It has, however, been rising since 1994, although at less than the rate of industrial production. Between 1993 and 1999, energy consumption in the industrial sector increased by 10 per cent, whilst production increased by 20 per cent, meaning energy intensity has improved by 8 per cent since 1993, because of technical improvements including conversion of some nation's iron and steel sectors to electric arc furnaces, as well as the decline in manufacturing industries. There were also changes in the fuel mix of the industrial sector, with a decline in the importance of solid fuels in favour of gas and electricity.

3C.12 Different Members States had very different industrial energy trends over the last decade. As an example, Ireland's industrial energy intensity fell by 58 per cent between 1990 and 1999, because of that nation's concentration on high technology, less energy intensive industries. All of the major EU energy consuming countries showed improvements in energy intensity over the period 1990 to 1999.

Domestic sector

3C.13 Energy use in the domestic sector in the EU increased by 11 per cent over the period 1990 to 1999. Whilst domestic energy use is heavily influenced by demand for space heating which is dependent on climate, the continued increase in the use of electrical appliances and increasing living standards also drove up energy consumption. The Mediterranean countries of Portugal, Spain, Greece and Italy have the lowest domestic energy consumption per person, reflecting their warmer weather, reducing demand for heating purposes.

3C.14 There are also large differences in the fuel mix between nations and between the four main EU consumers of energy nations. The UK and Italian domestic sectors are much more heavily dependent on gas than Germany and France, with more than 60 per cent of all domestic consumption being met through gas in the UK and Italy. French, Italian and German consumers are much more dependent on oil than UK consumers.

Service Sector

3C.15 Energy consumption in the service sector, excluding agriculture, increased by 17 per cent over the period 1990 to 1999. If Germany, where energy consumption in this sector fell by 17 per cent because of the changes in this sector since reunification, is excluded, the increase rises to 34 per cent. Indeed, all other nations in the EU had increases in energy consumption in this sector, with only Sweden, Denmark and France reporting increases of less than 30 per cent.

3C.16 The growth in service sector energy consumption has been driven, primarily, by the rapid growth of the service sector across most EU nations. In addition, there is increased demand for air conditioning in the sector and an increased use of IT equipment.

4. Competition and prices for domestic customers

- By the end of 2001, about a third of all gas and electricity customers in Great Britain were no longer with their home supplier[1].
- Overall, domestic customers have seen prices fall for all fuel and light by 23 per cent in real terms in the ten years to 2001.
- There are significant savings available to most customers by changing gas and electricity suppliers.

Introduction

4.1 Evidence from other markets suggested that the best way for customers to be able to benefit from lower prices and better levels of service was by introducing competition to the gas and electricity market.

4.2 Competition has been introduced throughout Great Britain in the domestic gas and electricity supply markets. In Northern Ireland, domestic electricity is not yet open to competition. Mains gas is being rolled out throughout much of the region over nine years from 1997.

4.3 In Great Britain, competition in the domestic gas market began in April 1996 in the South West of England and was then rolled out through the whole of Great Britain by May 1998. In the domestic electricity market competition began in September 1998 in four areas and was rolled out throughout the whole of Great Britain over eight months up to May 1999. With competition came the freedom of choice for consumers that was not available under the former monopoly businesses. Customers throughout the country could now choose from a range of suppliers offering cheaper prices and innovative payment methods.

[1] Throughout this chapter the term home supplier will be used to describe electricity suppliers working within the boundaries of their historic Public Electricity Supply region and will be used to describe British Gas in the domestic gas market. The term non-home supplier will be used to describe electricity suppliers working outside of the boundaries of their historic Public Electricity Supply region as well as new entrant electricity suppliers. In the domestic gas supply market, non-home supplier will be used to describe all suppliers other than British Gas.

4.4 In April 2002, the industry regulator, Ofgem lifted the remaining supply price controls on providers of gas and electricity. These price controls had been introduced prior to competition to ensure better prices for customers, who were at the time still supplied by monopoly businesses. Ofgem still regulates, through price controls, the monopoly companies who operate the pipes and wires, i.e. Transco, National Grid Company (NGC), the two Scottish transmission businesses and the 14 electricity distribution companies.

4.5 Together with price controls and other developments in the energy industry, competition has helped to bring lower prices to domestic customers. The first part of this chapter looks at the development of competition in the domestic supply market for gas and electricity and the extent to which different groups of domestic customers have chosen to change supplier. As the markets for heating oils and coal are already open to supply competition, these fuels are not considered in the first part of the chapter.

4.6 The chapter then goes on to look at the benefits competition has brought for customers in terms of savings and explores some of the problems customers have faced and what is being done to address these issues. It goes on to look at the changes in fuel prices for all domestic fuels and concludes with a more detailed look at average bills for domestic gas and electricity customers.

Competition

- At the end of 2001, just over 8.0 million (33 per cent) domestic electricity customers were no longer with their home supplier; at the same time, about 6.8 million (34 per cent) gas customers were no longer with their home supplier.

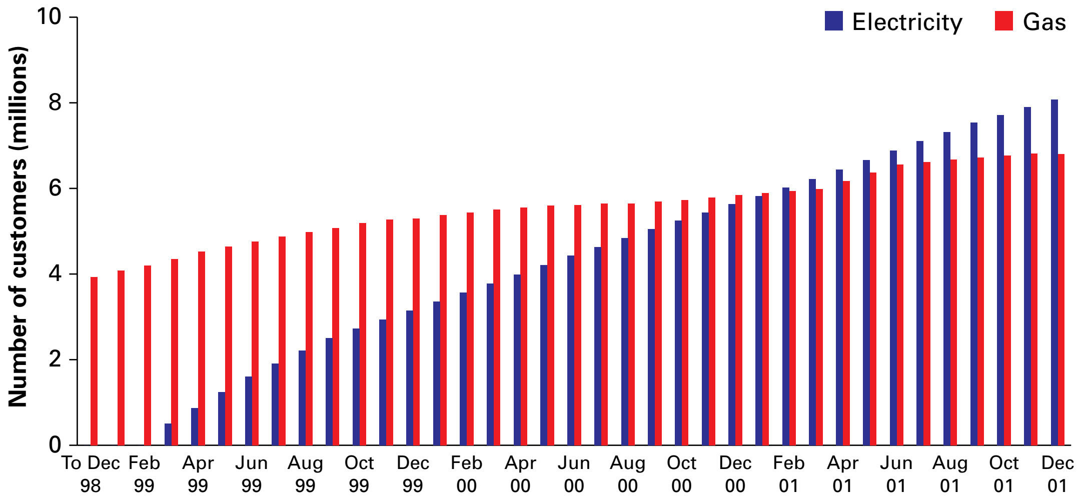
- The overall rates of transfer for both fuels continues at very high rate, averaging over half a million each month during 2001 for electricity and over 300,000 each month for gas, although not all transfers result in an increase of customers no longer with their home supplier.

- The proportion of customers no longer with their home supplier varies by payment method; customers using prepayment meters are less likely to be with a non-home supplier than credit and direct debit customers.

4.7 A key indicator of the level of competition is the extent to which customers switch suppliers. Competition itself drives down prices and poorer people benefit from falling prices. Competition also gives customers the ability to change their supplier if dissatisfied with their treatment. Competition has led to social innovation from the energy companies. The Government has set out the importance it attaches to helping the poor and has used a partnership approach, with the regulator, to encourage companies to develop programmes to help poorer consumers (which bring commercial advantages of their own through increasing the customer base and enhancing corporate image). Companies have responded creatively with a range of special payment schemes, debt management and energy efficiency advice, insulation and central heating packages, and signposting to other sources of help and benefits. Although this is still a developing area, many of these schemes are starting to have a real impact by reaching consumers who most need help and supplying them with practical assistance.

4.8 In Great Britain, at the end of 2001 just over 8.0 million domestic electricity customers were no longer with their home supplier. At the same time, around 6.8 million gas customers were no longer with their home supplier. This represents about a third of all domestic gas and electricity customers.

Chart 4.1 Cumulative number of customers no longer with their home supplier



Source: DTI, Transco, Ofgem

4.9 Chart 4.1 shows that the absolute number of electricity customers no longer with their home supplier first exceeded the number of gas customers no longer with British Gas in early 2001. However, the proportion of gas customers who are no longer with British Gas remains above that for electricity (34 per cent against 33 per cent). This is because there are over 4½ million domestic customers in the UK who do not have access to mains gas.

4.10 The continued growth of the non-home supplier market for both gas and electricity is an encouraging sign for competition, given the savings on offer to most customers who have changed supplier. In addition, the overall rates of transfer for both fuels continues at very high rates, averaging over 600,000 a month in the last quarter of

2001 for electricity and about 340,000 a month in the same period for gas. However, not all of this transfer activity results in a growth in the number of customers no longer with their home supplier. Many of these transfers will be as a result of customers transferring between two non-home suppliers or as a result of customers transferring back to the home supplier for their region. Table 4.1 below shows the balance of the three main transfer types for gas and electricity up to the middle of 2001.

4.11 From Table 4.1 it can be seen that the proportion of customers who have transferred away from their home supplier is much higher in the electricity market than in the gas market, highlighting the faster growth in the number of customers with non-home suppliers in the electricity market. In comparison, there is more transfer activity between non-home suppliers and back to British Gas in the gas market than the comparable activity in the electricity market.

Table 4.1 Overall transfers by transfer type

Type of transfer	Gas transfers: from October 2000 to September 2001	Electricity transfers: from July 2000 to June 2001
Transfers away from home supplier	46 per cent	74 per cent
Transfers between non-home suppliers	28 per cent	9 per cent
Transfers from non-home suppliers back to home suppliers	26 per cent	16 per cent

Source: Ofgem, Review of domestic gas and electricity competition and supply price regulation, November 2001

4.12 In the "Review of domestic gas and electricity competition and supply price regulation" published in November 2001, Ofgem use net transfer rates to analyse competition. The net transfer rate looks at the rate of customers transferring away from their home supplier net of those transferring back and gives an idea of how the market for non-home suppliers is growing. Ofgem found that for gas in the year to September 2001, the net transfer rate was about 14,000 compared with the 70,000 weekly average of all gas transfers. Similarly with electricity in the year to June 2001, the net transfer rate away from home suppliers was 55,000 customers per week compared with about 100,000 transfers per week overall.

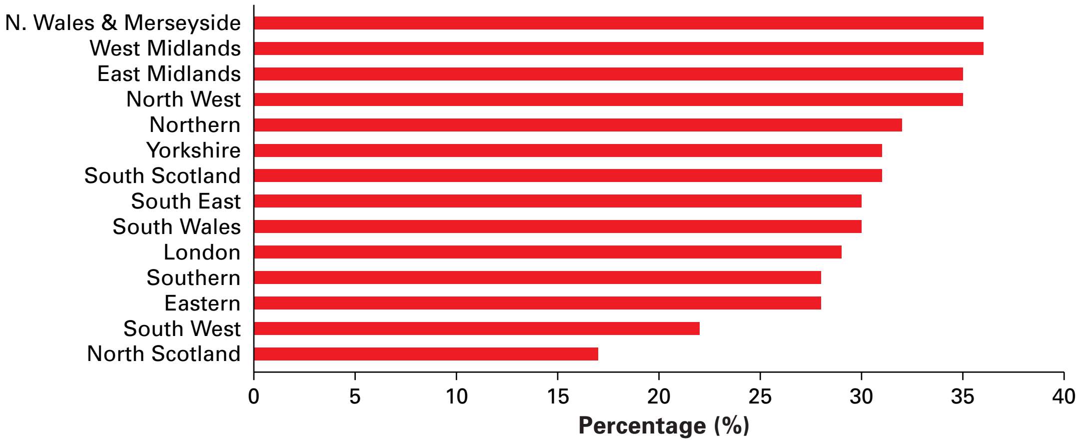
Competition by region

4.13 This rest of this section on competition focuses on the number of customers no longer with their home supplier and examines differences amongst these customers in terms of payment type and looks at regional and social factors.

4.14 Since the introduction of competition some regional differences have emerged in the number of customers no longer with their home suppliers. These differences for standard credit customers are highlighted in Charts 4.2 and 4.3 below.

4.15 For standard credit electricity customers, it is the North Wales and Merseyside and Midlands regions where non-home suppliers have had the most success in attracting customers. Conversely, standard credit customers in the South West and North Scotland have remained with their home suppliers, as they are the least likely consumers to change suppliers. Throughout Great Britain, on average 31 per cent of standard credit customers were no longer with their home supplier by December 2001.

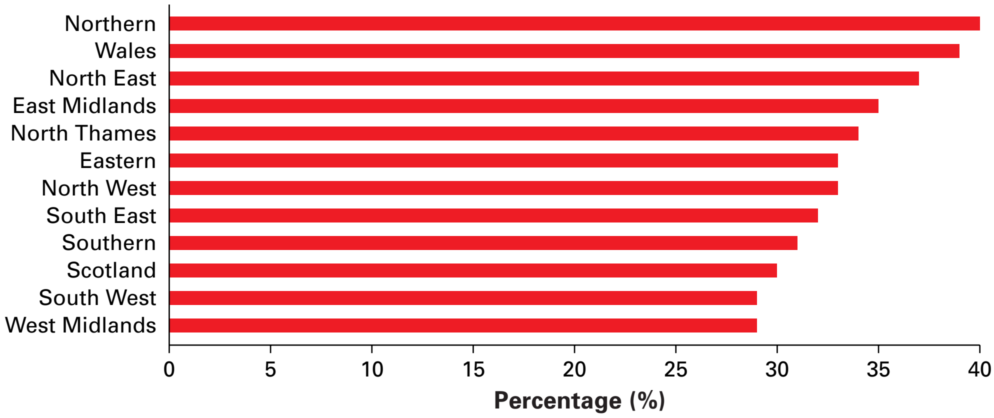
Chart 4.2 Percentage of domestic standard credit electricity customers no longer with their home supplier by region, December 2001



Source: DTI Domestic Fuels Inquiry, December 2001

4.16 As in the electricity market, there are regional differences in the percentages of standard credit gas customers who are no longer with their home supplier. Non-home suppliers have had more success in attracting standard credit customers in the Northern region and in Wales and it is the South West and West Midlands where their success has been limited. Throughout Great Britain, on average 33 per cent of standard credit gas customers were no longer with their home supplier in December 2001.

Chart 4.3 Percentage of domestic standard credit gas customers no longer with their home supplier by region, December 2001



Source: DTI Domestic Fuels Inquiry, December 2001

4.17 Regional variances are difficult to understand and the proportion of domestic standard customers no longer with their home supplier varies from 40 per cent in the Northern Region to 29 per cent in the West Midlands. The success or interest of the local Electricity Companies in attracting the gas customers within their own catchment area is likely to be a contributory factor.

Competition by payment type

4.18 In addition to regional differences, there exist differences in the proportion of customers with home or non-home suppliers by payment type. There are three main payment types which exist for domestic gas and electricity customers: standard credit, direct debit and prepayment. The differences in the proportion of customers opting for each payment method by supplier type are shown in Table 4.2.

Table 4.2 Percentage of customers by payment type for domestic gas and electricity markets by payment type, December 2001

		Gas	Electricity	Overall[1]
Home supplier	Credit	67	69	68
	Direct Debit	62	63	63
	Prepayment	82	72	75
Non-home supplier	Credit	33	31	32
	Direct Debit	38	37	37
	Prepayment	18	28	25

Source: DTI Domestic Fuels Inquiry, December 2001

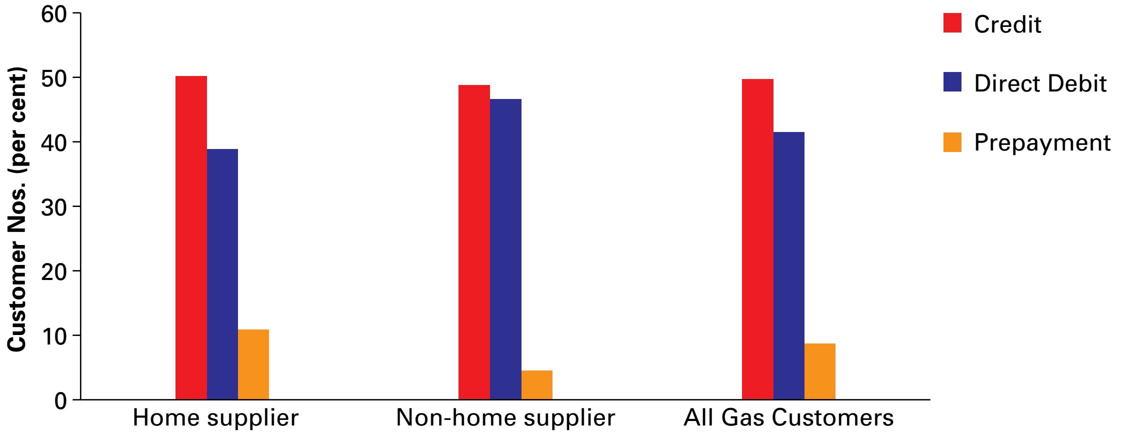
[1] The overall figure relates to number of accounts rather than number of households. The majority of households have both gas and electricity and thus have two accounts, but there are over 4½ million households in Great Britain who do not have mains gas.

The gas market

4.19 In the gas market at the end of 2001, 38 per cent of direct debit customers had chosen a non-home supplier. This compares with 33 per cent of standard credit customers and 18 per cent of prepayment meter customers. The apparent lagging of prepayment meter customers behind other types of customer could be linked to the fact that British Gas' prices have historically been on average lower than those charged by competing companies. The prices paid by home and non-home gas customers are considered in more detail in paragraphs 4.40 - 4.44 whilst the development of competitive prepayment prices by other suppliers is summarised in the Annex to this chapter.

4.20 Data from Ofgem's MORI survey into switching carried out in August and September 2001, suggested that 28 per cent of gas prepayment meter customers had switched supplier by that time, compared with 42 per cent of direct debit customers and 32 per cent of standard credit customers. Ofgem's research looked at all customers who had switched, and so included customers who had returned to their home supplier, but the overall picture is the same - direct debit customers have embraced the competitive market more than standard credit customers and prepayment meter customers.

Chart 4.4 Gas customers by supplier and payment type, December 2001



Source: DTI Domestic Fuels Inquiry, December 2001

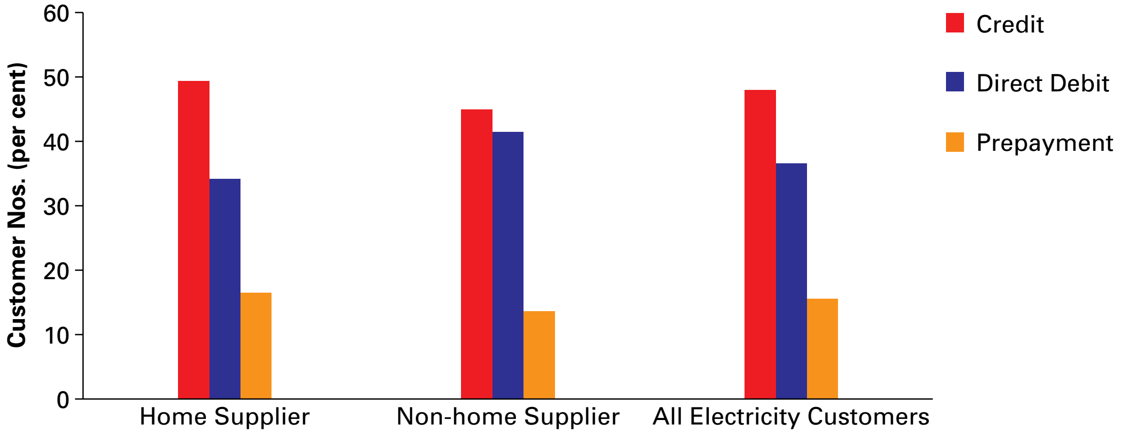
4.21 By the end of 2001, the number of prepayment customers not with their home supplier had risen by 23 per cent since the end of 2000, with the number of direct debit customers who are not with their home supplier increasing by 18 per cent in the same time period. Within the non-home supplier market the most popular payment method is standard credit which makes up 49 per cent of that market followed by direct debit which makes up 47 per cent of the market. Prepayment meter customers make up 5 per cent of the non-home supplier market compared with 9 per cent of the whole gas market.

The electricity market

4.22 At the end of 2001, 37 per cent of electricity direct debit customers had chosen a non-home supplier, compared with 31 per cent of standard credit customers and 28 per cent of prepayment meter customers. Again, it is the direct debit customers who are taking full advantage of the competitive nature of the market. The proportion of prepayment customers who have switched supplier is much closer to the proportion of credit customers in the electricity market than in the gas market. This is likely to be linked to the more favourable offers that have historically been available from non-home suppliers in the electricity prepayment market. Prices in the electricity market are discussed further in the Annex to this chapter.

4.23 Again, looking at Ofgem's research, the percentage of customer switching supplier stood at 44 per cent for the direct debit market, 32 per cent for the standard credit market, and 31 per cent for the prepayment meter market. The pattern for both of the domestic fuel markets is the same, with direct debit customers making the most use of switching.

Chart 4.5 Electricity customers by supplier and payment type, December 2001



Source: DTI Domestic Fuels Inquiry, December 2001

4.24 There have been some shifts in the last three years in the method of payment chosen by customers; for instance the number of direct debit customers has increased by 11 per cent overall, with the number of prepayment meter customers also increasing (by 3 per cent) . Over the last three years, the number of credit customers have fallen by 6 per cent.

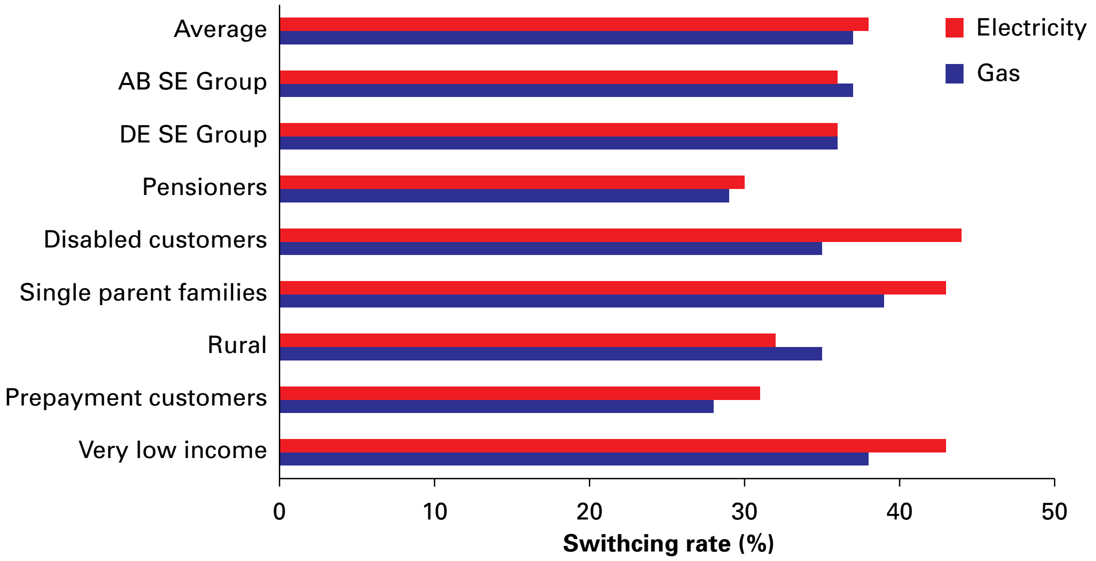
4.25 The rate of transfer in the electricity industry continues at a substantial rate, averaging 530,000 transfers a month during 2001. The continued high transfer rate may reflect increased customer awareness about competition. The growth of competition is also leading to expansion and innovation in the methods available to pay for electricity and gas. Companies are introducing tariffs with no standing charges and are linking up with other non-energy companies to offer deals linked to air miles or points on shop's loyalty schemes.

4.26 Chart 4.6 presents information collected through a survey conducted by MORI on behalf of Ofgem and shows that a lower proportion of pensioners have switched suppliers than the average proportion overall. Only 30 per cent of pensioners have switched gas suppliers and only 29 per cent have switched electricity suppliers. To address this, Ofgem, together with Age Concern, are working on a campaign that will target this group and highlight the simplicity and benefits of switching domestic supplier. The campaign will be launched in Autumn 2002.

Competition by social group

4.27 Single parent households are more likely than average to switch either gas or electricity supplier. According to the MORI survey, 39 per cent of all single parent households have switched gas supplier, compared to 37 per cent of the population as a whole, and 43 per cent have switched electricity supplier, compared with 38 per cent of the population as a whole. This makes them the most likely group to switch suppliers out of all who were surveyed. Those classified under the low income group also have switching rates above the average with rates of 43 per cent for electricity and 38 per cent for gas.

Chart 4.6 Switching rates in percentages by customer social group for gas and electricity



Source: Ofgem

4.28 Prepayment meters appear to be most favoured by those in social groups E. (defined as those at the lowest levels of subsistence, eg those with no earnings, state pensioners, etc). More than a third (36 per cent) of customers in this social group use this method of payment for electricity and approximately a quarter (24 per cent) as a means for paying for their gas consumption. In contrast, only 2 per cent of those in social groups AB (defined as higher and intermediate managerial, administrative or professional) use prepayment meters for electricity payment and only 1 per cent use prepayment meters for gas. Lower income households are also more likely to use prepayment meters (37 per cent of very low income household use prepayment meters to pay for electricity, compared to only 7 per cent of high income households).

4.29 Options such as monthly direct debit are not a viable means of payment for customers without a bank or building society account. Hence 52 per cent of those without a bank account pay for their electricity by prepayment meters. Even so, about three quarters of electricity and gas prepayment meter customers have bank or building society accounts. It is also unsurprising that 88 per cent of customers who pay for their gas by prepayment meters also pay for their electricity by prepayment meters. However, prepayment meters are not the exclusive domain to low income groups, with 2 per cent of those in social groups AB and 8 per cent of those in social group C1 (supervisor or clerical and junior managerial, administrative or professional) paying in this way.

Prices

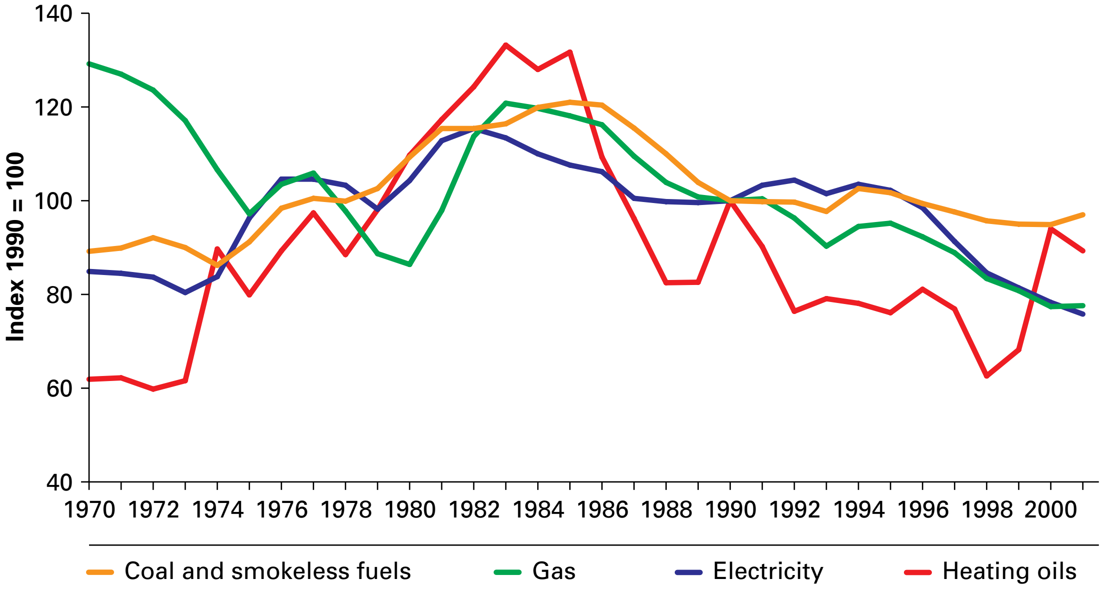
- In real terms, average annual domestic electricity prices in 2001, including VAT, were 24.2 per cent lower in real terms than in 1990, the year of privatisation.
- For gas, average annual prices in 2001 were 33.2 per cent lower in real terms than those at privatisation in 1986 and 22.3 per cent lower than prices in 1990.
- Since 1990, in real terms, prices for coal and smokeless fuels have fallen by 2.9 per cent and prices for heating oils have fallen by 10.7 per cent in real terms.

4.30 In real terms, gas and electricity prices in 2001 were 39.9 per cent and 10.7 per cent lower respectively than in 1970. These falls are in part offset by an increase in the price of heating oils of 44.4 per cent and an increase of 8.8 per cent in the price of coal and smokeless fuels over the same period. Overall, in 2001, domestic customers saw prices for all fuel and light which were 14.3 per cent lower than in 1970 in real terms.

4.31 In real terms, average annual domestic electricity prices in 2001, including VAT, were 25.8 per cent lower than in 1995 and 24.2 per cent lower than in 1990, the year of privatisation. Average annual domestic gas prices in 2001 in real terms, including VAT, were 18.4 per cent down on 1995 and 33.2 per cent down on 1986, the year of privatisation.

4.32 Between 1989 and 1992, domestic electricity prices rose each year, resulting in a 6 per cent rise for the whole period (although prior to 1988 prices had fallen each year since 1982). Since 1992, prices have fallen, with the exception of 1994 when VAT was introduced at 8 per cent in April of that year. The fall accelerated in 1996 when measures such as price regulation on distribution charges and the first round of the reduction in the Fossil Fuel Levy (reduced from 10 per cent to 3.7 per cent in November 1996) were major factors in lowering prices by 3.5 per cent compared with 1995. Subsequent reductions in 1997 and 1998 in both the Levy and VAT (reduced from 8 per cent to 5 per cent from 1 September 1997) resulted in a 7 per cent fall in prices in both years. Full competition in the domestic electricity supply market was introduced in May 1999, and has helped to reduce prices by a further 7 per cent between 1999 and 2001.

Chart 4.7 Fuel price indices in the domestic sector in real terms, 1970 to 2001



Source: ONS, Retail Prices Index

4.33 Domestic gas prices moved broadly in line with oil prices until 1983, when a general de-coupling began between UK fuel prices. Gas prices then fell fairly steadily over the next 10 years, until by 1993 they were about 25 per cent lower than in 1983, in real terms. The trend was broken in 1994 and 1995 when the introduction of VAT and tariff changes caused prices to rise by around 5 per cent. However, between 1995 and 2000 there were falls in prices in every year, mainly due to the advent of competition (see paragraphs 4.2 and 4.3 for more details), the reduction in VAT and reductions in British Gas standard tariffs. Upward pressure on gas prices during 2000 and increases in wholesale gas prices began to feed through to most gas customers from the second quarter of 2001, meaning prices in 2001 were very slightly higher in real terms than in 2000. Despite these increases, real terms prices for domestic gas customers have fallen by 7 per cent since full supply competition was introduced in 1998.

4.34 Heating oil prices typically follow crude oil prices, e.g. rising rapidly in 1990 due to the Gulf crisis, before falling back to a post 1973 low in 1995. During 1996, prices rose by 7 per cent, as crude oil prices climbed and international demand was generally higher, before falling back by 5 per cent in 1997 as the oil prices began to weaken. In 1998, there was a sharp reduction in crude prices to levels not seen since the early 1970s. As such, heating oil prices also fell in real terms to prices not seen for 20 years. Following the agreement of key oil producers to meet production targets, crude oil prices began to rise again early in 1999, but have since reduced. Overall average heating oil prices rose by 50.2 per cent between 1998 and 2000 but have since fallen by 4.9 per cent and in 2001 were 10.7 per cent lower than in 1990.

4.35 The prices paid by domestic customers for all fuel and light fell by 2 per cent in real terms between 2000 and 2001. Domestic electricity prices, including VAT, fell by 3 per cent in real terms between 2000 and 2001. Domestic gas prices, including VAT, rose slightly (0.3 per cent) in real terms in the same period. Prices for domestic coal and smokeless fuels rose by 2 per cent in real terms between 2000 and 2001.

4.36 Overall domestic prices for fuel and light rose slightly in cash terms but fell in real terms between 2000 and 2001, driven chiefly by falls in electricity prices. The fall in the prices of domestic electricity and gas in real terms are mainly attributable to downward pressures in the period from price controls set by the regulator Ofgem, the introduction of full competition into the domestic market and the introduction of the New Electricity Trading Arrangements.

4.37 The rise in the price of heating oils between 2000 and 2001 has resulted from the link between these fuels and the price of oil. In addition, shortages in world stocks of heating oils in the early winter period of 2000/2001 placed additional upward pressure on the price. The price has since fallen by 26.9 per cent in real terms from a peak in the fourth quarter of 2000.

Electricity and gas bills

- In 2001, the typical standard credit gas customer could have made an estimated annual saving of £47 (15 per cent), compared with £49 (16 per cent) in 2000, on changing supplier from British Gas. The average saving for direct debit customers who changed supplier was £27 (10 per cent) compared with £26 (9 per cent) in 2000.

- For electricity customers in 2001, bills for credit or direct debit customers switching suppliers were, on average, around £18 (7 per cent) less compared to those who remained with the incumbent supplier. The difference was £19 (7 per cent) in 2000.

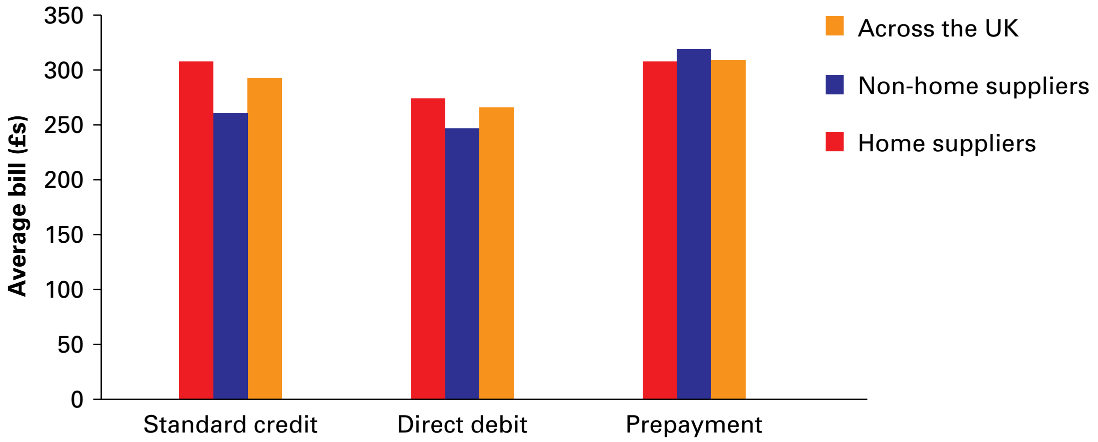
4.38 All remaining price controls for domestic customers were lifted from 1 April 2002, following a period of consultation. Ofgem's view was that competition was developed enough in the domestic market to allow them to lift the price controls, although there were concerns raised by others, including energywatch, in response to the consultation about the effects this may have on the prices on offer to consumers, especially those using the prepayment method.

4.39 Energywatch took over responsibility from Ofgem for producing price comparison factsheets in October 2001. These factsheets assist customers in choosing gas and electricity suppliers and are easily accessible through their website. Five companies signed up to energywatch's voluntary code aimed at companies providing internet-based pricing comparisons. Customers without personal internet access will be able to access these sites via libraries and advice centres around the country.

Gas bills

4.40 In 2001, the typical standard credit gas customer could have made an estimated annual saving of £47 (15 per cent), compared with £49 (16 per cent) in 2000, on changing supplier from British Gas. The average saving for direct debit customers who changed supplier was £27 (10 per cent) compared with £26 (9 per cent) in 2000. Individual customers were able to make larger savings by shopping around for the best deal.

Chart 4.8 Average gas bills in 2001 including VAT



Source: DTI

4.41 The price controls on British Gas's combined tariff for prepayment customers and credit "LatePay" customers (i.e. customers who do not pay their quarterly bill within 10 days) were lifted on 1 April 2002. Gas prices increased for the majority of gas customers in April 2001 when British Gas increased their prices in response to earlier increases in gas wholesale prices. A further price increase by British Gas came into force on 3 January 2002.

4.42 British Gas' pricing structure means that a credit "LatePay" and a prepayment customer pay the same for their gas if they are averaging the same level of consumption a year. The current average is 18,000 kWh per year. This means that, in 2001, an average British Gas prepayment customer pays £12 less than prepayment customers who are not with British Gas. After the lifting of price controls on 1 April 2002, it will be for British Gas to decide whether it is beneficial to retain this pricing structure or not.

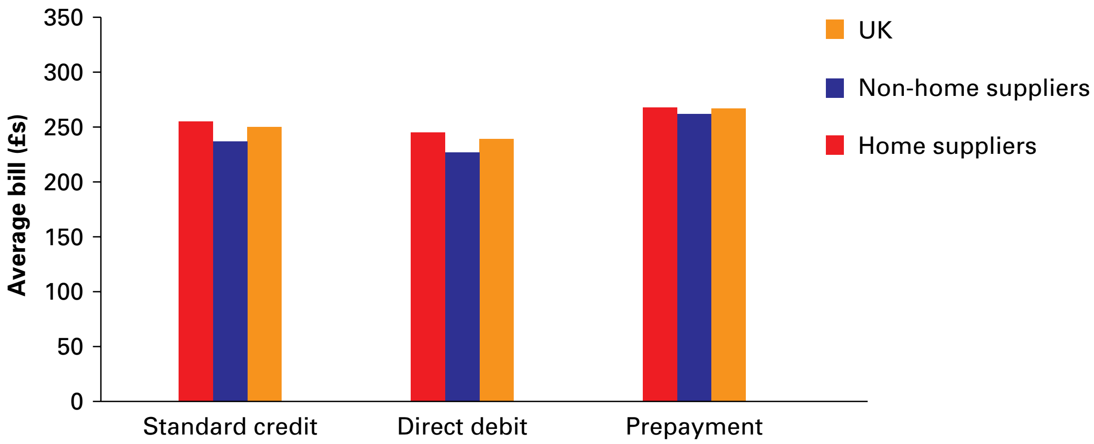
4.43 On average new suppliers charged standard credit customers £13 more than direct debit customers for their domestic bills (the same differential as in 2000), while those using prepayment meters paid on average £59 more than those on standard credit, which is down slightly from a difference of £63 in 2000. On the other hand a customer switching from British Gas credit to direct debit terms from a new supplier could have saved around £60 (20 per cent) a year in 2001, which probably accounts for the major growth that has taken place in that sector of the market.

4.44 Bills for 2001 show an average prepayment meter customer paid £15 more for their gas supply than a standard credit customer over the year, down from £16 in 2000. The difference in bills for a prepayment meter customer compared to a direct debit customer has narrowed from £47 on average in 2000 to £42 in 2001. In other words, the difference between the most and least expensive average bills has narrowed slightly and the position of a standard credit bill (the "middle" in terms of cost) has moved slightly closer to that of the direct debit bill.

Electricity bills

4.45 Bills for credit or direct debit customers were, on average, around £18 (7 per cent) less for customers switching supplier compared to those who remained with the incumbent supplier, which is a fall of £1 from the year 2000. Individual customers may be able to make larger savings by shopping around for the best deal. All the price controls covering electricity customers who have remained with their local public electricity company were lifted on 1 April 2002.

Chart 4.9 Average electricity bills in 2001 including VAT



Source: DTI

4.46 On average, in 2001, a prepayment meter customer was paying £17 more for a year's supply of electricity than a standard credit customer which is down slightly from £18 in 2000. Standard credit customers were paying £11 more than their direct debit counterparts which is a fall of £1 from 2000. In 2001, new suppliers were charging prepayment meter customers, on average, £6 a year less than the incumbent supplier, compared with a £2 saving in 2000.

Further Reading

- Quarterly Energy Prices, DTI
  http://www.dti.gov.uk/energy/inform/energy_prices
- Experience of the competitive domestic electricity and gas markets Research study conducted for Ofgem by MORI, November 2001
  http://www.ofgem.gov.uk/docs2001/72_mori.pdf
- Review of domestic gas and electricity competition and supply price regulation Evidence and Initial Proposals November 2001, Ofgem
  http://www.ofgem.gov.uk/docs2001/71_supply_price.pdf
- Domestic customer price comparisons, energywatch.
  http://www.energywatch.org.uk/supplier_information/comparisons_of_price/index.asp
- Household Utilities Price Indices. DTI, 2001. Also available at
  http://www.dti.gov.uk/energy/hupiworkingpaper/hupi.htm
- Consumer price indices, ONS:
  http://www.statistics.gov.uk/statbase/Product.asp?vlnk=868&More=N

Useful Websites

Ofgem:	http://www.ofgem.gov.uk
energywatch:	http://www.energywatch.org.uk/
DTI:	http://www.dti.gov.uk
Office of National Statistics:	http://www.statistics.gov.uk

Annex 4A

Gas and Electricity Bills[2]

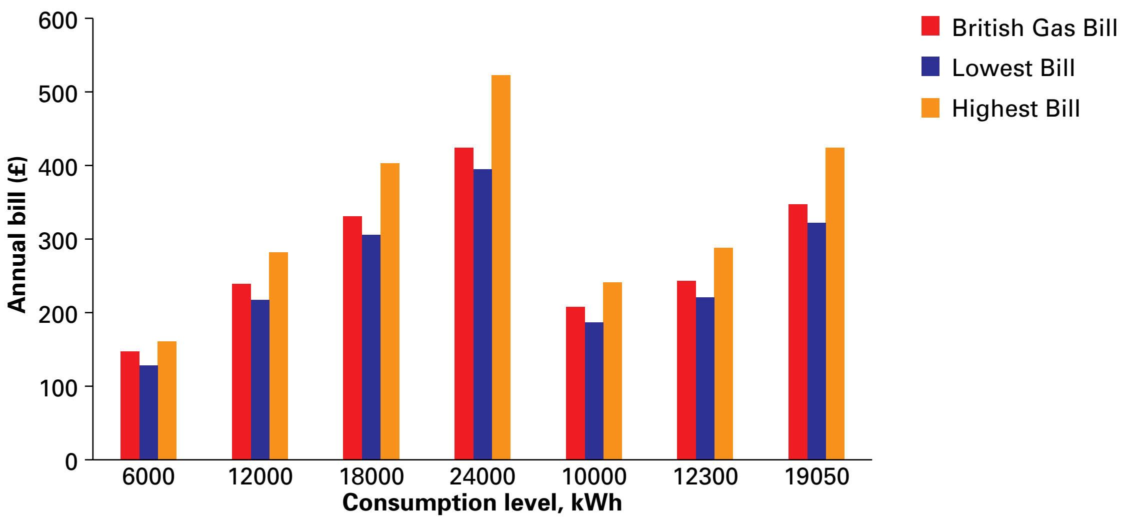
4A.1 The purpose of this Annex is to explore in more depth the effect that competition has had on domestic gas and electricity fuel bills and it considers the savings that are available to the consumer if they switch to the cheapest supplier in a region.

Gas bills

Prepayment bills

4A.2 There are three suppliers; British Gas, Cambridge Gas and North Wales Gas that do not have separate standing charges in their domestic tariffs. The other 12 suppliers apply annual standing charges ranging from £14.75 to £42.00. Countrywide Gas has the highest prices at all levels of consumption and Northern Electric the lowest. Chart 4A.1 below shows the prepayment bills for British Gas, and the highest and lower bills at various levels of consumption.

Chart 4A.1 Lowest and highest non-British Gas prepayment bills compared with British Gas, April 2002



Source: energywatch

4A.3 As the chart above shows, the highest bills range from £161 for 6,000 kWh to £523 for 24,000 kWh worth of consumption. The lowest gas bills range from £128 for 6,000 kWh to £395 for 24,000 kWh. The savings that can be made by customers transferring to the cheapest supplier from British Gas range from £19 to £29 depending on consumption. The largest bills range are between £14 and £99 higher than British Gas over a year.

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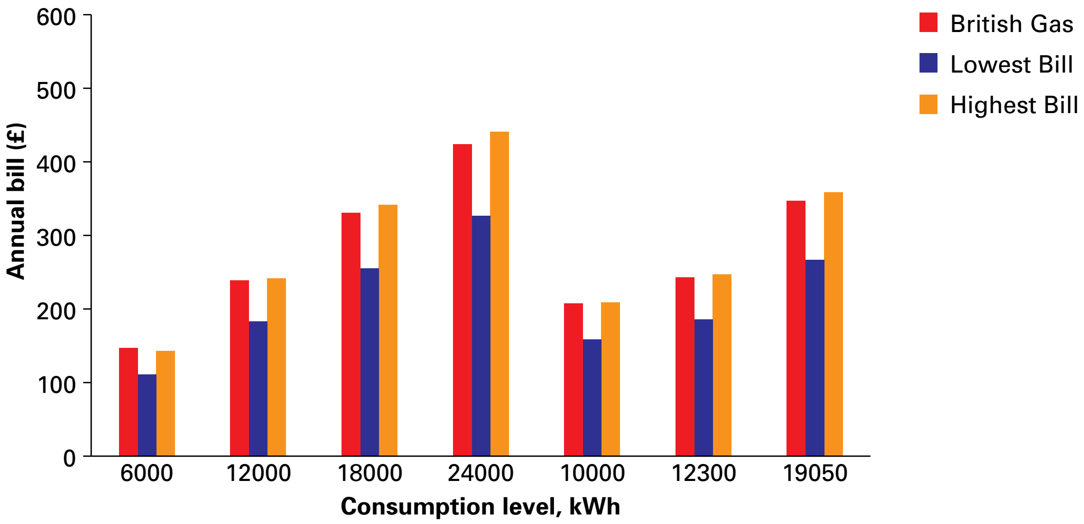
[2] Much of the information in this annex has been derived from information published by energywatch in April 2002 in its regularly updated "Price Comparisons" series.

Credit customers' bills

4A.4 Beacon Gas, British Gas, TXU, North Wales Gas and Northern Electric do not have separate standing charges for their credit customers. The other ten non-home suppliers all apply annual standing charges ranging from £38.33 to £42.00.

4A.5 The lowest prices within the gas credit market at all but the lowest levels of consumption are offered by the on line company amerada.co.uk. At the lowest consumption level, TXU and Scottish Power offer the lowest prices. The highest prices are those from Countrywide Gas except for at the lowest level of consumption. At the lowest level of consumption, British Gas has the highest prices by £4 per year. Chart 4A.2 compares credit bills for British Gas and the lowest and highest prices offered elsewhere.

Chart 4A.2 Lowest and highest non-British Gas credit bills, compared with British Gas, April 2002



Source: energywatch

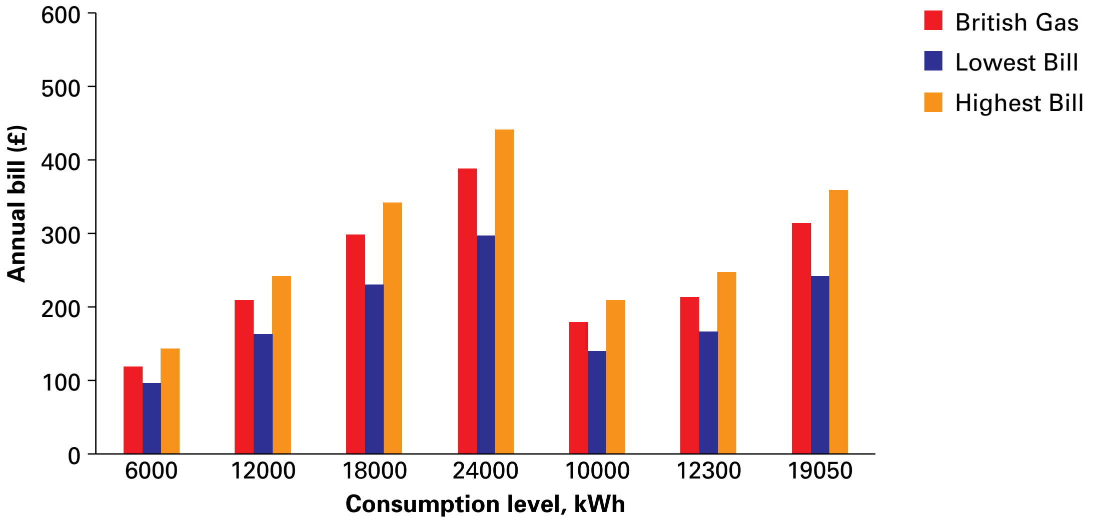
4A.6 There are more savings to be made by changing supplier in the credit market than in the prepayment market. Largest savings range from £36 to £97 in comparison with British Gas. The largest annual credit bills are between £1 and £17 higher than annual credit bills for British Gas depending on consumption.

Direct debit bills

4A.7 There are five suppliers that do not apply standing charges to the bills of their customers; these are Beacon Gas, British Gas, North Wales Gas, TXU and Northern Electric The other eight suppliers all have annual standing charges ranging from £28.36 to £42.00. The on-line firm, amerada.co.uk offers the lowest prices at all levels of consumption on the direct debit tariffs with Countrywide Gas offering the highest prices.

The largest savings that are available within the market range from £23 to £91 per year depending on consumption. Chart 4A.3 illustrates the difference between the most expensive bill prices and the cheapest bill prices at the various levels of consumption.

Chart 4A.3 Lowest and highest non-British Gas direct debit bills compared with British Gas, April 2002



Source: energywatch

4A.8 The cheapest bills range from £96 at a consumption level of 6,000 kWh to £297 for a consumption of 24,000 kWh. The most expensive bills are up to £53 more than British Gas. British Gas has remained within the middle of the market at the lowest consumption level with most of the savings over British Gas being around £5 per year. As consumption increases, British Gas prices get comparatively higher and at the 24,000 kWh they offer the third highest prices in the market.

Standing charges

4A.9 The table below shows the annual standing charge by supplier for each payment method. In most cases the charges do not vary but for some supplier the charges used depends on the payment method used. The most expensive standing charge is on the Credit tariff from Countrywide Gas and is £44.11.

Table 4A.1 Annual standing charge by supplier for each payment method, April 2002

Supplier	Prepayment	Credit	Direct Debit
Amerada Hess	£16.10	£40.25	£28.36
Amerada.Co.Uk	No tariff	£38.86	£28.36
Atlantic Gas	£42.00	£42.00	£42.00
Beacon Gas	£15.37	£0.00	£0.00
British Gas	£0.00	£0.00	£0.00
Cambridge Gas	£0.00	£39.98	£30.09
Countrywide Gas	£39.63	£44.11	£34.65
TXU	£34.13	£0.00	£0.00
London Electricity	£34.09	£41.10	£38.98
North Wales Gas	£0.00	£0.00	£0.00
Northern Electric	£38.33	£0.00	£0.00
Npower	£40.13	£38.33	£38.33
Powergen	£40.00	£40.00	£40.00
Scottish Power	£38.33	£39.27	£38.29
Southern Electric	£14.75	£28.74	£28.74

Electricity market

4A.10 Unlike in the gas market where the prices offered by suppliers tend to apply throughout Great Britain, electricity prices differ throughout the country. In most cases the home supplier for the region does not offer the lowest prices. In the Yorkshire and Northern Regions, London Electricity offers the lowest credit and direct debit markets at all consumption levels. In the low user market, British Gas has the lowest prices in five out of the 14 regions for prepayment meter customers. For the medium and high user prepayment markets they have the lowest prices in six and two of the regions respectively. In the credit and direct debit markets, the supplier who offers the cheapest price in the most regions is shown in the table below.

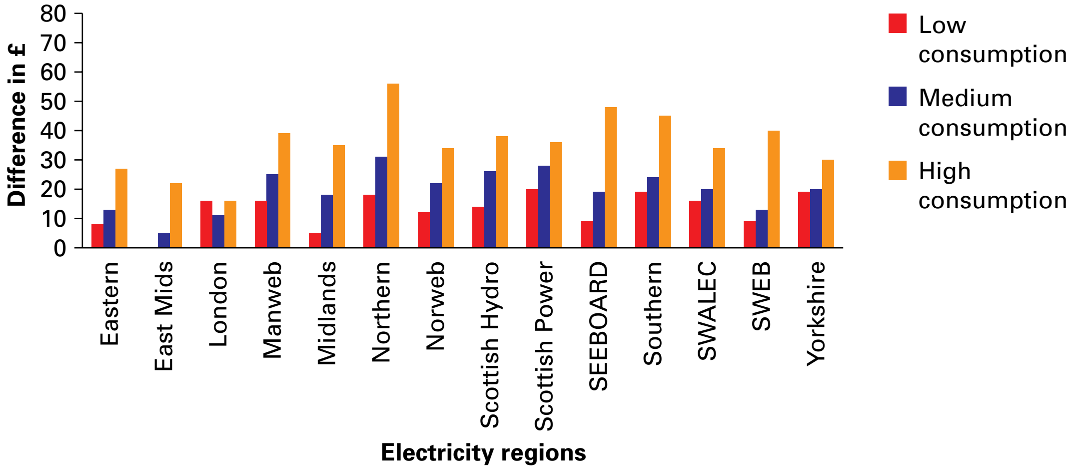
Table 4A.2 Suppliers that are cheapest in the most regions by market and user type, April 2002

Market	User Type	Supplier	No. of regions where cheapest bill offered out of 14
Credit	Low	Southern Electric	6
	Medium	Npower	7
	High	Npower	6
Direct debit	Low	London Electricity	6
	Medium	Atlantic Electric	12
	High	Atlantic Electric	10

4A.11 The analysis below considers the savings that can be made in each region by customers at low, medium and high consumption levels switching switching from their home supplier.

Prepayment market

Chart 4A.4 Difference in annual prepayment bills between the home supplier and cheapest supplier at different consumption levels, April 2002



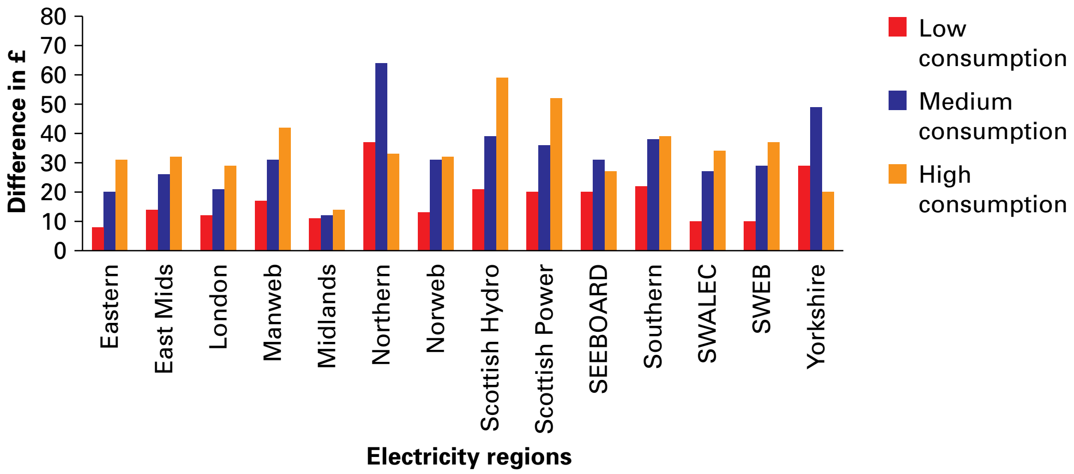
Source: energywatch

4A.12 For the low users, the savings that are to be made by changing from the home supplier range from no savings in the East Midlands region to a saving of £20 in the Scottish Power region. Competition seems to be more effective at higher consumption levels. At the medium consumption level, the savings that the consumers can make range from £5 in the East Midlands to £31 in the Northern region annually. At the high consumption level, customers can make annual savings ranging from £16 in London to £56 in the Northern region by switching from their home supplier depending on their region.

Credit market

4A.13 At the low levels of consumption, the savings that a customer can make by switching from their home supplier range from £8 in the Eastern Electricity region to £37 in the Northern electricity region. At medium consumption, the savings that consumers can make by transferring to a non-home supplier range from £12 in the Midlands region to £64 in Northern region. At high consumption, savings range from £14 in the Midlands to £59 in the Scottish Hydro area.

Chart 4A.5 Difference in annual credit bills between the home supplier and the cheapest supplier in a region at different consumption levels, April 2002

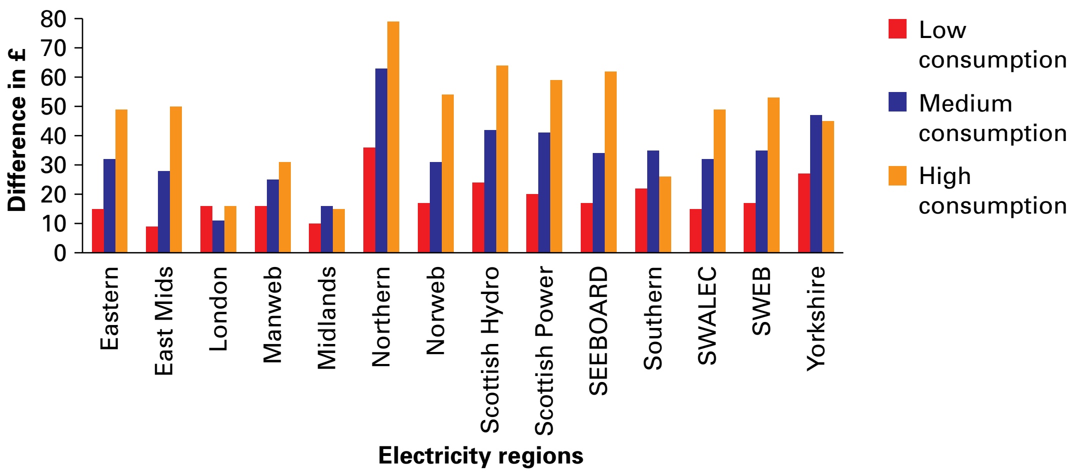


Source: energywatch

Direct debit market

4A.14 For the low consumption market, customers can make savings by switching from their home electricity supplier of between £9 (in the East Midlands area) to £36 (in the Northern area). For the medium consumption market, the highest savings (of £63) can be achieved by switching from the home supplier in the Northern region, while the smallest saving (of £11) would be made in the London area. At the high consumption level, savings from switching from the home supplier to the cheapest non-home supplier range from £15 in the Midlands to £79 in the Northern area.

Chart 4A.6 Direct debit bills



Source: energywatch

5. Service quality

- Transfers to other suppliers and selling practices are the causes of about one half of all complaints by consumers about their energy supply.
- There were an average of 84 interruptions to consumers' electricity supply per 100 customers per year over the last 5 years in Great Britain.
- Winter storms are the cause of a large majority of payments by electricity suppliers to customers for failure to meet Guaranteed Standards.

Introduction

5.1 The energy sector impacts on the private and working lives of every individual in the country and the quality of the service delivered by the energy industry can determine very important issues for individuals. For instance, the reliability of the electricity supply is crucial to both businesses, which run machines as part of their work, and to households, who need to be able to cook and keep warm. Domestic customers in the United Kingdom are protected by a series of standards to which gas and electricity suppliers and distributors subscribe. These standards are set by and monitored by the industry regulators, Ofgem in Great Britain and Ofreg in Northern Ireland.

5.2 This chapter focuses on gas and electricity customers, and examines the standards that apply to the service these customers receive. It looks at how they help to promote a better quality of service for domestic customers generally and, in particular, for the worst served and most vulnerable customers in society. The chapter also looks at the complaints made by domestic customers about the service they have received and investigates how market developments have influenced the numbers and nature of complaints. It looks at what is being done to address these problems by energywatch in Great Britain and Ofreg in Northern Ireland.

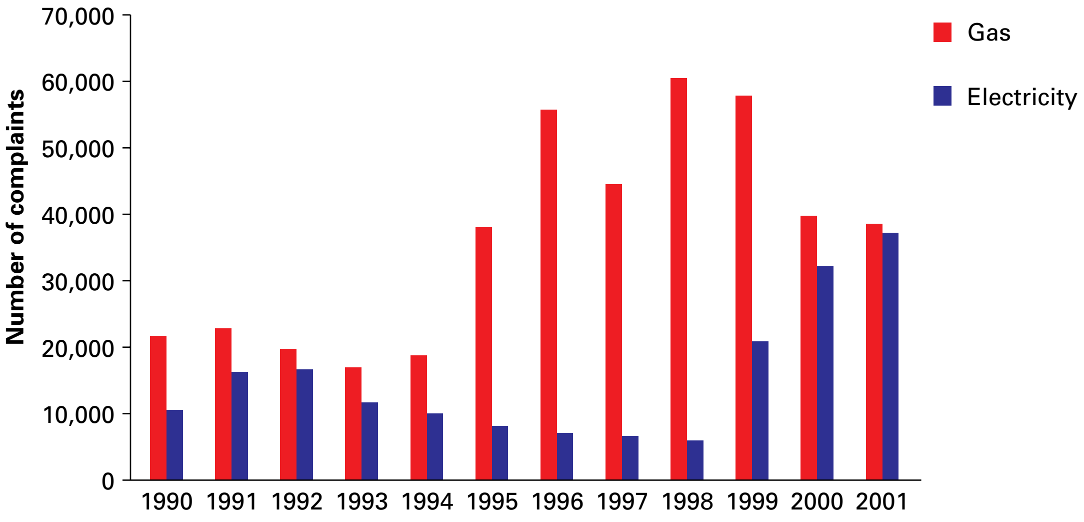
5.3 The chapter goes on to look at issues surrounding the quality of supply electricity customers experience and what is being done to try to improve this further. Finally, the chapter looks at the social obligations placed on suppliers to provide additional services for the most vulnerable in society.

Customer service

- The number of gas complaints has risen by 77 per cent since 1990.
- Since full competition was introduced into the gas supply market in 1998, 48 per cent of complaints have related to transfers and to selling.
- The number of electricity complaints has risen 252 per cent since 1990.
- Since full competition was introduced into the electricity supply market in May 1999, 54 per cent of complaints have related to transfers and to selling.

5.4 The number and type of complaints made by customers about their gas and electricity supply give a good idea of the problems customers are experiencing, and can be used to determine policy decisions about the standards and regulations which apply to the companies. Chart 5.1 sets out the total number of complaints received by OFFER, the Gas Consumer Council (GCC), Ofgem and energywatch.

Chart 5.1 Number of gas and electricity complaints received by the industry regulators and energywatch



Source: Ofgem (figures for GCC and OFFER), energywatch

5.5 The opening of the domestic market to competition resulted in an increase in the number of complaints made by customers. In May 1999, the electricity supply market fully opened to competition. This led to an increase in complaints to Ofgem of 248 per cent from the previous year to a total of 20,869. In the same year complaints about gas fell relative to the previous year. In 2000, complaints about direct selling rose to a peak in June reflecting the increased marketing of dual fuel tariffs from companies offering contracts for both gas and electricity.

5.6 Complaints about electricity suppliers have increased in both 2000 and 2001, with 37,205 complaints received by energywatch during 2001, a 24 per cent increase over the number received in 2000. The areas causing most problems for electricity customers were billing and account problems (39 per cent of all complaints in 2001), erroneous transfers (21 per cent) and doorstep sales (7 per cent). In the gas industry, figures for 2001 show a slight decrease in the overall number of complaints dealt with by energywatch from 38,963 in 2000 to 38,540 in 2001. Switching supplier still presents problems, with 43 per cent of all gas complaints in 2001 relating to transfers according to energywatch data. Unauthorised transfer of supply to a different supplier (17 per cent of all complaints in 2001), consumption disputes (8 per cent) and sales techniques (7 per cent) remain problem areas for customers.

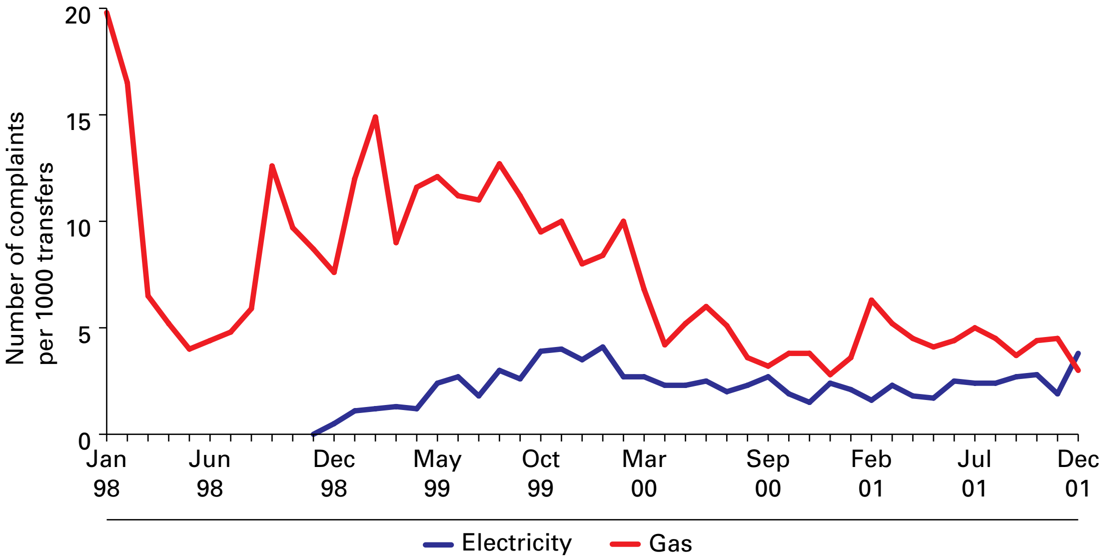
Table 5.1 Number of gas and electricity complaints received by the industry regulators and energywatch

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Gas	21,721	22,816	19,714	19,946	18,778	38,019	55,774	44,482	60,479	57,827	39,774	38,540
Electricity	10,567	16,257	16,677	11,684	10,007	8,153	7,081	6,622	5,996	20,869	32,216	37,205

5.7 Ofgem continues to work with suppliers to improve the transfer process for customers, introducing a voluntary Transfer Charter October 2001 which all suppliers of domestic gas and electricity have signed up to. The Charter is designed to enable customers transferred in error to return to their chosen supplier as rapidly as possible, with the minimum of inconvenience, and without the companies concerned passing the problem between them. The ideal is that the process should be largely invisible to the consumer. Ofgem will carry out a full review of the Charter in Autumn 2002 to see whether the charter has been effective or whether further regulatory action is required.

5.8 The marketing techniques used by gas and electricity companies remain an area of concern; there have been instances of sales agents giving misleading information to potential customers or acting fraudulently. Ofgem has recently consulted on proposals to extend the current marketing licence condition on suppliers for a further two years to March 2004. The present conditions require suppliers to implement procedures for: staff selection and training; sales agent identification; audit of doorstep and telephone sales, and sales in public places; cancelling contracts when requested by the customer; maintaining contact if there is a delay; and dealing with complaints.

Chart 5.2 Transfer complaints per 1,000 transfers



Source: Ofgem, energywatch

5.9 The conditions also require suppliers to ensure individuals understand that they have entered into a contract to send out terms and conditions following telephone sales, to provide appropriately for on-going management of sales agents, and to provide the same safeguards and audit procedures for sales conducted in public places as those for doorstep and telephone sales.

5.10 A recent campaign launched by energywatch is aimed at improving sales techniques used by gas and electricity companies in England, Scotland and Wales. The "Stop Now!" campaign is focussed on keeping and strengthening the current licence, and suggests a register of sales agencies and individuals who fail to meet acceptable standards, along with a standard format for energy supply contracts so consumers are able to understand their contract.

Security and availability of electricity supply

- The average number of minutes lost per electricity customer has fallen by 16 per cent since 1991/92.
- The average number of interruptions per electricity customer has fallen by 5 per cent since 1991/92.

5.11 Security and quality of supply are two distinct and important issues that can affect customers. Electricity companies have a duty to ensure that there is adequate generation capacity to meet overall level of demand, but there are occasions when customers lose supply for whatever reason. In addition, companies have a duty to ensure that electricity supplies meet the technical standards that are in force; currently supply must be delivered within +6 per cent and -10 per cent of 240V.

5.12 Ofgem monitors the distribution system performance of each public electricity and gas supplier. All licensees who operate transmission or distribution systems are required to report annually on their performance in maintaining system security, availability of service and quality of service. This provides a picture of the continuity and quality of supply experienced by final customers.

5.13 The regulatory framework places an obligation on distributors to connect any customer to an electricity or gas supply on request and allows the distributor to make requests in exchange, for example, for information and payment. It also effectively imposes a universal service obligation on supply companies that requires them to provide high levels of service. The standards required are set out in the licenses that supply companies must hold in order to operate. Broadly, obligations fall as follows:

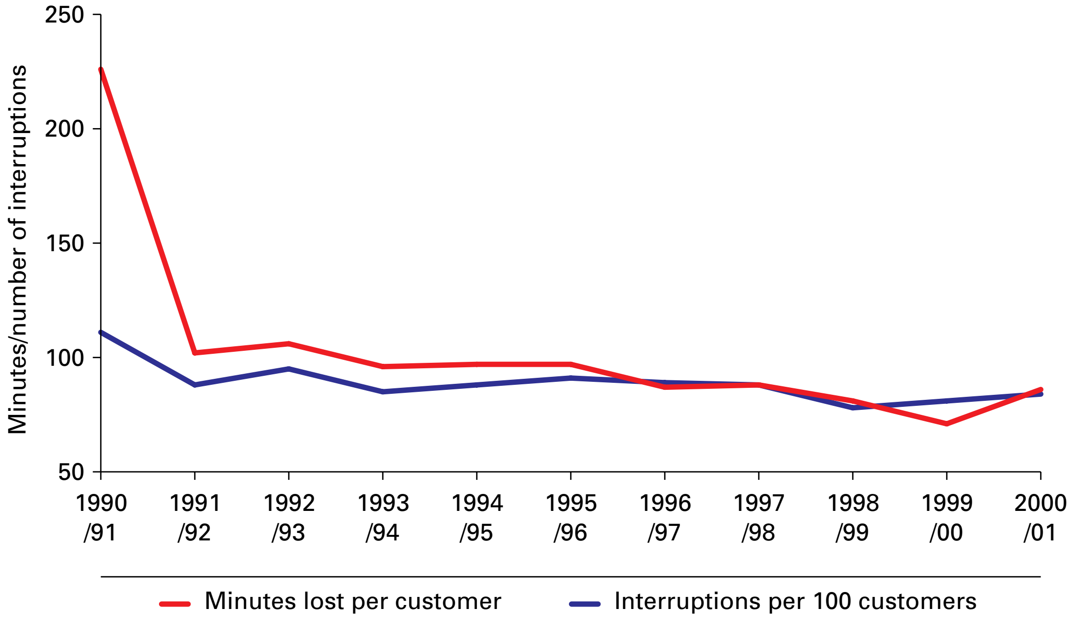
- Suppliers are obliged to ensure that they can fulfil customer demand for energy (where the demand is reasonable and cost is economic);
- Electricity generators are required to fulfil the terms of their own licence in contributing to secure, high quality supply, particularly in co-operating with transmission system operators. They are also obliged to comply with the relevant grid distribution and fuel security codes. Generators can also be required to hold certain levels of fuel stocks.

Transmission system operators must report annually to the Regulatory Authority on their performance in terms of the availability, security and quality of supply. They have statutory duties to develop and maintain an efficient, co-ordinated and economical system of transmission and to offer non-discriminatory terms for connection to or use of the system by licensed suppliers or operators.

5.14 The quality of supply experienced by customers is influenced by the performance at all stages of electricity supply, from generation to transmission and finally distribution. However, the number of interruptions to supply caused by failure or lack of generation has usually been extremely small, and the contribution from transmission system failures has also been minor. Distribution systems are by far the most significant determinant of the supply experienced by final customers.

5.15 During 2000/01, there were 84 interruptions per 100 customers, slightly worse than the average of 81 interruptions per 100 customers in 1999/00. The average length of time without supply of 86 minutes per customer in 2000/01 represents a 21 per cent deterioration on the previous year. The number of minutes and number of interruptions depend heavily on the weather and other disturbances to the electricity supply.

Chart 5.3 Security and availability of electricity supply for the average domestic customer



Source: Ofgem

Table 5.2 Security and availability of electricity supply for the average domestic customer

	1990 /91	1991 /92	1992 /93	1993 /94	1994 /95	1995 /96	1996 /97	1997 /98	1998 /99	1999 /00	2000 /01
Minutes lost per customer	226	102	106	96	97	97	87	88	81	71	86
Interruptions per 100 customers	111	88	95	85	88	91	89	88	78	81	84

5.16 In December 2001, Ofgem issued final proposals on its “Information and incentives project”. This project started in December 1999 and looked to strengthen incentives on electricity distribution companies to deliver a good quality of service to customers.

5.17 Ofgem proposes to penalise companies that do not meet their quality of supply targets (covering both the number and duration of supply interruptions) and reward those who exceed their targets. Ofgem introduced a new Guaranteed Standard in April 2002, which will give customers who experience four or more power interruptions of more than three hours per year a compensation payment of £50. In addition, a new Overall Standard will be set to measure the individual distribution companies’ overall performance in minimising the number of multiple interruptions on their networks.

Social obligations

Social Action Plan

5.18 In April 2000, Ofgem published its Social Action Plan. This set out a programme of work which Ofgem would take forward in its role as energy regulator which would contribute to tackling fuel poverty. The plan is based around four main strands of activity:

- enhanced licence obligations,
- improvements in monitoring and reporting,
- a research programme,
- a number of broader structural changes.

5.19 Ofgem have since published two annual reviews of the Action Plan that have reported on progress against 12 key indicators which included debt repayment levels, tariff choice and payment choice and disconnection and self-disconnection by pre-payment customers not recharging their meter. These indicators have been complemented by three detailed research projects, which included projects on self-disconnection and rationing, energy efficiency advice and debt prevention and management.

5.20 One of the findings to emerge from the research was that the majority of prepayment meter customers were content with this payment method, despite the fact that it is generally a more expensive way of paying for fuel. Part of the reason for this is because of the budgetary control it gives to customers, particularly those on a limited income. One of the challenges facing the industry is to encourage alternative methods of payment which will appeal to customers on tight budgets without increasing the risk of customers getting into debt.

5.21 In February 2002, Ofreg published proposals aimed at improving Social Obligations to benefit customers in Northern Ireland. These proposals, entitled "Social Action Plans for Electricity and Gas Customers", aim to improve provision of services to disadvantages customers in Northern Ireland, including those who are disabled, are on low income or need to spend more than ten per cent of their income to keep warm, i.e. the fuel poor.

Priority Service Register (PSR)

5.22 Ofgem monitors company performance against several Codes of Practice, one of which is aimed specifically at people who are of pensionable age, disabled or chronically sick. This Code requires electricity and gas companies to offer additional services to some of the more vulnerable members of society.

5.23 For instance, each company must operate and promote a Priority Service Register (PSR) for these customers. Customers who are on the PSR are eligible for additional services such as the ability to have their bills redirected to a third party and a guarantee that their meter is read once a quarter. Customers will also be given information and advice on supply interruptions when possible. This is particularly important for those customers who rely on medical equipment at home.

5.24 Licensees should recognise that customers, who are of pensionable age or are disabled or chronically sick may be more dependent on a reliable supply of electricity than some other groups of customers, particularly where the use of special electrically operated equipment is essential. Reasonable steps should be taken to provide customers on the Register with information and advice about supply interruptions.

Utilities Act 2000

energywatch

5.25 The Utilities Act 2000 created a new consumer on a reliable supply of electricity, body to look after the interests of gas and electricity customers in Great Britain. This organisation, energywatch, took over this responsibility from the Gas Consumers Council for gas customers and from Ofgem for electricity customers. Among the statutory duties given to energywatch in the Act were functions to represent the view of consumers and to investigate and seek to resolve complaints against companies about regulated matters. Additionally, the Act requires energywatch to publish information relating to those complaints.

Services for vulnerable customers

5.26 The Act also set a duty on the Secretary of State, Ofgem and energywatch to have regard to the interests of individuals who are disabled or chronically sick, individuals of pensionable age, individuals with low incomes and individuals living in rural areas.

Overall and Guaranteed Standards of Peformance

- For electricity, the number of payments for failure to meet Guaranteed Standards has fallen by 38 per cent since 1991/92.
- Winter storms were associated with 95 per cent of payments for failure to meet Guaranteed Standards in 1998/99.

5.27 The Electricity Act 1989 gave Ofgem (then OFFER) the powers to set Guaranteed Standards of Performance to cover a wide range of services relating to the supply, distribution, and metering of electricity. These standards were set to maintain and improve service levels following the privatisation of the electricity industry, and were set to guarantee a level of service for customers. If a supplier or distributor fails a Guaranteed Standard then it is required to make a fixed payment to the customer concerned. Subsequent revisions to the original Guaranteed Standards in 1993, 1995, 1998 and 2000 have tightened the requirements to promote a better service for customers.

5.28 One Guaranteed Standard applies to the length of time a customer can be expected to put up with no electricity supply before the company must pay them a fixed fee. At present, a customer who is without a supply for longer than 18 hours will receive a payment of £50 with a further £25 for each subsequent 12 hours without supply. Table 5B.1 in Annex 5B shows all 11 service areas of the guaranteed standards of performance currently applying in electricity distribution and supply.

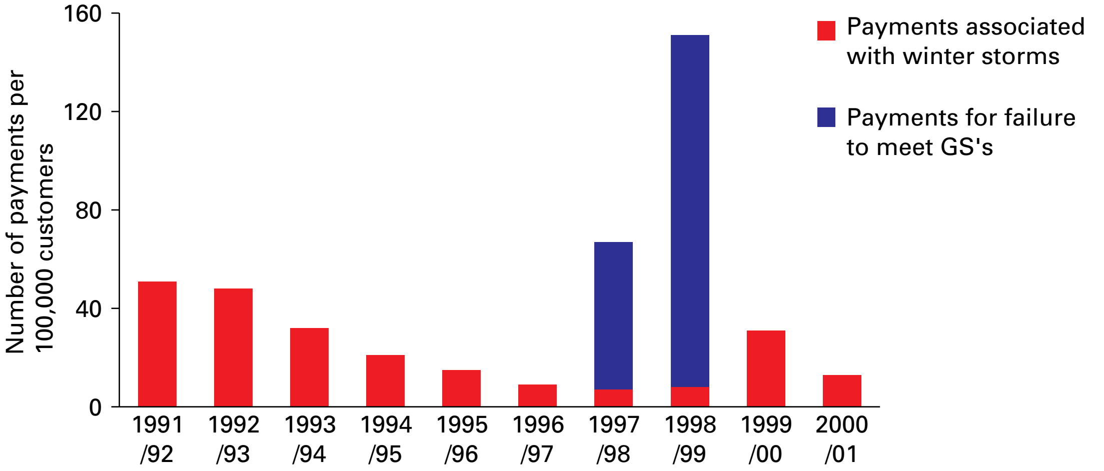
5.29 Overall Standards of Performance cover areas of service where it is not appropriate to give individual guarantees, but where companies are expected to deliver predetermined, minimum levels of service. For instance, there are Overall Standards that cover the time a company has to respond to customer correspondence and which specify that a meter reading must be obtained for all business and domestic customers at least once a year. A description of the current electricity Overall Standards is shown in Table 5B.2 in Annex 5B to this Chapter. The Overall Standards set minimum levels of performance, which the former Public Electricity Suppliers are required to achieve over a 12 month period in specific service areas. Although individual customer do not get a fixed payment, these standards are extremely important in improving overall service standards for all customers.

5.30 British Gas has had agreed standards of service with Ofgem (previously OFGAS) since 1992. Further standards of service, relating to transportation and storage, were introduced in 1994. In the two years prior to 1996, there were around 38 standards and in 1993 and 1992 there were 30 standards, which covered all aspects of the supply of gas to consumers.

5.31 Since 1996, separate standards have been set for British Gas Trading (BGT, the domestic supply business of Centrica plc) and Transco (part of British Gas plc). The standards for BGT are set out in Annex 5B, and are split between overall standards concerning the whole business, and individual standards relating to individual customers who may be entitled to compensation if failures occur. Some standards are both overall and individual. Overall, both BGT and Transco met all published targets in 2000.

5.32 The perfomance of electricity companies against the Guaranteed and Overall Standards has generally improved throughout the 1990s, although in 1999/2000 there was an increase in underlying payments for failure to meet standards. For the 12 Guaranteed Standards, payments decreased steadily from 12,255 payments in 1992/93 to 2,251 in 1996/7. Winter storms affected the number of payments considerably in 1997/8 and 1998/9, when the number of payments increased to 17,308 and 39,085 respectively, mainly due to payments made to customers who were off supply for more than 24 hours during winter storms in each of these years.

Chart 5.4 Number of Electricity Guaranteed Standards Payments per 100,000 customers for Great Britain



Source: Ofgem

Table 5.3 Number of Electricity Guaranteed Standards Payments per 100,000 customers, GB

	1991 /92	1992 /93	1993 /94	1994 /95	1995 /96	1996 /97	1997 /98	1998 /99	1999 /00	2000 /01
Payments for failure to meet Guaranteed Standards	51	48	32	21	15	9	7	8	31.5	13
Payments associated with winter storms							60	143		

5.33 Without the winter storm payments, there would have been 1,953 payments for failure to meet standards in 1997/8 and 2,059 in 1998/9. In 1999/00 there were 6,714 payments with no significant winter storm payments, which is more than a threefold increase in the underlying payments from the previous year. In 2000/01 figures for the number of payments resulting from failure to meet Guaranteed Standards were presented against either distribution or supply businesses for the first time, following the requirement in the Utilities Act 2000, relating the former public electricity suppliers separate these components of their businesses. In 2000/01 there was a decline of 50 per cent in the number of payments made over the previous year.

5.34 This was in part due to decreases from 2,923 payments in 1999/00 to 953 payments in 2000/01 for failure to restore electricity supplies after faults and from 1,228 payments to 518 payments for failing to respond to customers queries within five working days.

5.35 The Overall Standards cover eight key areas, such as reconnection following faults, meter reading and responding to correspondence. Many companies failed to improve on their 1999/00 performance in 2000/01. Of the total of 140 targets 36 were missed by more than one per cent. Ofgem will continue to monitor the performance against the Overall Standards and will consider what further action needs to be taken if performance does not improve.

5.36 Customers in Northern Ireland also benefit from service standards set by the Director General of Electricity Supply for Northern Ireland. The Guaranteed and Overall Standards cover the same areas as those set by Ofgem in Great Britain.

Further Reading

- Utilities Act 2000, The Stationary Office, ISBN 0-10-542700-4
  http://www.hmso.gov.uk/acts/acts2000/20000027.htm
- The Social Action Plan, Ofgem, March 2000
  http://www.ofgem.gov.uk/docs/sapmarch.pdf
- Social action plan: Annual Review, Ofgem, March 2001
  http://www.ofgem.gov.uk/projects/sap_index.htm
- Information and Incentives project, Incentive schemes: Final proposals, Ofgem, December 2001
  http://www.ofgem.gov.uk/projects/iip_index.htm
- Gas and Electricity Codes of Practice, Guidance for Domestic Suppliers, Ofgem, October 2001
  http://www.ofgem.gov.uk/docs2001/61_suppliers.pdf
- Distribution and Transmission System Performance 2000/2001, Ofgem, January 2002
  http://www.ofgem.gov.uk/docs2002/01datsjan.pdf
- Marketing gas and electricity, Ofgem, February 2002
  http://www.ofgem.gov.uk/docs2002/mkting_gas_elec.pdf
- Report on Services for Electricity Customers 2001/2002, Ofgem, March 2002
  http://www.ofgem.gov.uk/docs2002/28_service_report.pdf
- What We Plan To Do Year 2, 2002-2003, energywatch, December 2001
  http://www.energywatch.org.uk/uploads/documents/upl_15.pdf
- Supplier of last resort – Guidance on current arrangements
  http://www.ofgem.gov.uk/docs2001/27_supplier.pdf

Useful Websites

Ofgem:	http://www.ofgem.gov.uk
energywatch:	http://www.energywatch.org.uk/
DTI:	http://www.dti.gov.uk
Ofreg:	http://www.ofreg.nics.gov.uk

Annex 5A
Provisions for maintaining supply in the event of supplier failure

Introduction

5A.1 From time to time, companies in competitive markets fail. Although when companies fail investors can lose money, jobs can be lost and inconvenience can be caused to consumers, failure can be a sign that competition is working effectively in the market. In many cases it is the degree of rivalry between companies and the extent to which customers exercise choice that inevitably leads to success for some companies and failure for others.

5A.2 This logic applies as much in relation to the gas and electricity supply markets as it does to other markets. It is inevitable that from time to time gas and electricity suppliers will fail. However, the difference between the gas and electricity supply markets and many other sectors is that gas and electricity are services that are regarded as essential. It is therefore important that Ofgem, and other bodies where appropriate, take all reasonable steps to address the consequences of gas or electricity suppliers failing.

5A.3 This Annex explains Ofgem's powers to appoint a Supplier of Last Resort (SoLR) to ensure continuity of supply for a failed supplier's customers. It also describes what happened when Independent Energy and Enron Direct failed.

Supplier of Last Resort

5A.4 Ofgem's priority is to ensure that all customers continue to receive supplies of gas and/or electricity when a supplier fails. When a supplier has gone into administration or receivership, Ofgem has the power to revoke the supplier's licence and appoint a 'Supplier of Last Resort' (SoLR) to take over responsibility for supplying its customers. Ofgem has the power to do this for all groups of gas and electricity customers, both domestic and non-domestic.

5A.5 In general, Ofgem believes that a trade sale is more likely to achieve the best deal for customers than the appointment of a SoLR. A trade sale should ensure that the right to supply the customers of a failed company is purchased by the supplier that values them the most (i.e. is prepared to pay the highest price for them). It is possible that customers would pay higher charges to a SoLR (because the SoLR might have to buy gas and electricity at short notice) than if a trade sale took place and another supplier charged the customers its normal contract prices. A trade sale may also reduce regulatory involvement in the operation of the market.

5A.6 However if a receiver does not agree to pay for the gas and electricity that customers continue to use or a trade sale does not take place very quickly, other industry parties (and perhaps other customers) could end up paying for the energy used. The failed supplier's customers may also face the threat of disconnection. In this situation, it is likely that Ofgem will revoke the failed supplier's licence(s) and appoint a SoLR to take over responsibility for supplying customers. Appointing a SoLR ensures that the failed supplier's customers continue to receive gas and electricity, and no longer face the risk of being disconnected. It also ensures that other market participants (and other customers) are not exposed to very large costs.

Failures of Independent Energy and Enron Direct

5A.7 In the cases of the failures of Independent Energy and Enron Direct other suppliers were keen to purchase the customer base and Ofgem did not have to appoint a SoLR.

Independent Energy

5A.8 Independent Energy UK Limited was the holder of licences to supply both gas and electricity customers. At the time of its failure, it supplied approximately 80,000 gas customers and 240,000 electricity customers and employed over 200 staff. Its customer base comprised both domestic and business customers. Independent Energy became active in the market for the supply of electricity to business premises in 1998. Between October 1998 and April 1999 the company continued to expand. The company also expanded into the competitive gas market, and acquired York Gas Limited, a domestic gas supplier.

5A.9 During 2000, Independent Energy experienced problems billing customers and recovering debt. On 8 September 2000, KPMG were appointed as administrative receivers to the company. On 14 September 2000, Innogy holdings plc acquired the major supply business assets of Independent Energy for £10 million.

Enron Direct

5A.10 Enron Direct Limited was a subsidiary company of Enron Europe Ltd, which was itself the European subsidiary of Enron Corporation, the US based ultimate holding company of the Enron group of companies. Enron Direct held licences for the supply of both gas and electricity. At the time of its failure in December 2001, Enron Direct supplied gas to approximately 12,000 non-domestic sites and electricity to approximately 149,000 non-domestic sites and 34,000 domestic sites.

5A.11 On 29 November 2001, following events in the US, PriceWaterhouseCoopers were appointed administrators to Enron Europe Limited. On 4 December 2001, PriceWaterhouseCoopers were appointed administrators to Enron Direct Limited. On the same day, Centrica plc purchased certain assets and liabilities of Enron Direct Limited for £96.4 million.

Further information

5A.12 In March 2001 Ofgem published 'Supplier of last resort - Guidance on current arrangements', which explains in more detail the process for appointing and selecting a SoLR.

Annex 5B
Electricity and Gas Standards of Performance

5B.1 Standards of Performance are an important element in the regulatory framework and serve to protect the interests of customers in key service areas. This report explains the background to the setting of the Standards and examines the performance of electricity companies against them. It also looks at other important customer service issues.

5B.2 Until November 2001 the 12 regional electricity companies in England and Wales and the two Scottish companies were regulated as Public Electricity Suppliers (PES)[1]. The PESs were required to report to Ofgem on their performance against the standards, which were set under sections 39 and 40 of the Electricity Act 1989. The standards covered the provision of services to customers in the distribution, supply and metering of electricity. They have been set after consultation with companies, the Electricity Consumers' Committees and other customer representatives. Standards were first introduced in July 1991, and were successively revised and tightened in April and July 1993, April 1995, April and July 1998 and April 2000.

5B.3 There are two types of standards:

- Guaranteed Standards (GS) set service levels which must be met in each individual case and are established by a series of Statutory Instruments. If the PES fails to provide the level of service required, it must make a payment to the customer affected.

- Overall Standards (OS) cover areas of service where it is not appropriate to give individual guarantees, but where customers in general have a right to expect an acceptable level of service.

5B.4 The Utilities Act 2000 has triggered the introduction of a revised series of performance standards[2], which were subject to extensive consultation. These will form the basis of any future reports on electricity services provided from 1 October 2001 onwards.

5B.5 In electricity distribution -
- Existing standards are largely unaffected.
- However, Guaranteed Standard 5, notification of planned interruption, now features a two day notice period, reduced from five days.

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[1] Since the commencement of the Utilities Act on 1 October 2001 the concept of PES and Second Tier Suppliers has been abolished. Businesses are now recognised and report as either a distribution or supply company, but are still subject to Standards of Performance.
[2] The Electricity (Standards of Performance) Regulations 2001
The Electricity (Standards of Performance) (Amendment) Regulations 2001
The Gas (Standards of Performance) Regulations 2001
There are also new standards for gas suppliers introduced with effect from 1 April 2002.

- Also, Overall Standard 1a, restoration of supply following a supply outage, now excludes interruptions of less than 3 minutes.

5B.6 In electricity supply -

- Existing standards will remain in place in the first instance. However, Ofgem recognises that where retail markets are fully competitive the policy rationale for regulating standards of customer service disappears. Some time ago Ofgem announced its intention to disapply the supply standards once supply price controls were lifted[3].
- A new series of metering standards is to be introduced from 1 April 2002.

Table 5B.1 Electricity Guaranteed Standards[1] of Performance in June 2001

Service	Performance Level	Penalty Payment
Respond to a failure of a suppliers fuse	All PESs to respond within three hours of on weekdays between (at least) 7am to 7pm, and within four hours at weekends between (at least) 9 am to 5 pm	£20
Restoring electricity supplies after faults	Must be restored within 18 hours.	£50 (domestic) £100 (other), £25 for each subsequent 12 hours after
Providing supply and meter	Arrange appointment within two working days for domestic customers (and four working days for non-domestic customers).	£20 -£100
Estimating charges	Within five working days for simple jobs and 15 for most others.	£40
Notice of supply interruption	Customers must be given at least five days notice.	£20 (domestic) £40 (other)
Investigation of voltage complaints	Visit within seven days or substantive reply within five working days.	£20
Responding to meter problems	Visit within seven working days or substantive reply within five working days.	£20
Responding to customers queries about charges and payment queries	A substantive reply and agreed refunds to be paid within five working days.	£20
Making and keeping appointments	Companies must offer and keep a morning or afternoon appointment, or a timed appointment if requested by the customer.	£20
Notifying customers of payments owed under standards	Payment to be made within ten working days.	£20
Responding to prepayment meter faults	Within three hours on weekdays and four hours at weekends.	£20

[3] "Guaranteed and Overall Standards of Performance - Further Consultation" June 2001

Table 5B.2 Electricity Overall Standards[1] of Performance in June 2001

No.	Service Required	Target (percentage)	Results from electricity companies (percentage)
1a	Minimum percentage of supplies to be connected, following faults, within three hours.	85 to 95	83.4 to 92.7
1b	All supplies to be reconnected, following faults within 18 hours	99.5	97.8 to 99.9
2	All voltage faults to be corrected within six months	100	79.6 to 100
3	Connecting new tariff premises to the electricity distribution system within 30 working days for domestic customers	100	99.9 to 100
4	All consumers who have been disconnected for non-payment to be reconnected before the end of the working day after they have paid the bill, or made arrangements to pay.	100	93.4 to 100
5	Visiting to move the meter, when asked to do so by the customer within 15 working days	100	100
6	Changing meters when necessary on change of tariff within ten working days of request	100	99.6 to 100
7	Obtaining a firm meter reading for all domestic and business consumers at least once a year	100	95.4 to 99.3
8	Responding to all customer letters within ten days	100	92.8 to 100

Table 5B.3 British Gas Trading standards of service and performance July 2001

No	Performance standard	Target (percentage)	Actual British Gas performance (percentage)
1	Customer telephone calls to be answered within 30 seconds.	90	95
2	Replies to customer correspondence within five working days.	90	100
3	Keep a record of all written customer complaints.	99	100
4	For correspondence, which require a visit within five days, contact will be made within two days.	93	100
5	Request for new gas supply passed to Public Gas Transporter within 48 hours.	99	100
6	Appointments will be made and kept.	95	100
7a	Submit gas bills on actual meter readings at least once a year, may be a customer read or a gas company read.	90	95
7b	Submit gas bills on an actual meter reads at least once every two years, must be a gas company read.	99	99
8	Attempt meter reads within six months of the last attempt/read.	98	100
9	Appointments agreed for final meter reading or meter clearance, with at least two days' notice where requested.	99	100
10	Requested meter reads or special meter clearance within three days of request.	99	100
11	Difference between actual and estimated gas use within +/- 4 %.	90	94
12	Take action to prevent debt build-up from an unpaid gas bill within three months.	99	100
13	Provide helpline packs for customers with unpaid bill and with whom no contact has been made.	99	100
14	Customers visited within 13 weeks to discus arrangements to pay.	95	99
15	Regular payment scheme offered to customers with payment difficulties	100	100
16	Prepayment meter/Fuel Direct offered if above option not suitable.	100	100
17a	Regular payment scheme: six monthly monitoring of payment level.	100	100
17b	Refunds of Regular Payment Scheme credit balances made on request	100	100
18	Refunds despatched to customers within five working days.	95	98
19	Respond to "No Gas" defective/full meters within four hours	95	97
20	BGT to maintain Gas Care Register for Older, disabled or chronically sick consumers.	BGT Internal Analysis	
21	Requested free gas safety check made within 28 days of joining GasCare register	95	99
24	Energy efficiency advice given to customers with debt problems in last 12 months	100	100

Standards 7, 17a 20 and 23 require a numerical record to be kept of complaints/advice given.

6. Fuel poverty

- Fuel poverty occurs when households are unable to heat their homes adequately without spending a disproportionate amount of income on fuel.

- It has been estimated that about 4 million households in the UK were in fuel poverty in the year 2000.

- Between 1998 and 2000 it is estimated that half a million households were removed from fuel poverty in England as a result of changes in income and fuel prices alone.

- Provisional analyses indicate that the number in fuel poverty may have fallen by a further half a million in England as a result of income policies in the period 2000-2002.

- Fuel poverty damages people's quality of life and affects the health of people living in cold homes. Although these risks apply to all people, older people, children, and those who are disabled or have a long-term illness are especially vulnerable.

- Fuel poverty is a multi-dimensional problem. Low incomes, poor housing energy efficiency and fuel prices can all contribute to the problem.

- The Government will seek an end to fuel poverty by 2010 amongst vulnerable households, that is, older households, families with children and householders who are disabled or who have a long-term illness.

Introduction

6.1 Fuel Poverty in the UK is caused by a combination of factors including:
- poor energy efficiency of the home;
- the cost of fuel;
- low household income.

6.2 The likelihood of ill health is increased by cold homes, with illnesses such as influenza, heart disease and strokes all exacerbated by the cold. Cold homes can also promote the growth of fungi. The need to spend a large portion of income on fuel means that fuel poor households may have to make difficult decisions about other household essentials. This can lead to poor diets and reduced opportunities to participate in the community.

6.3 Although the risks from fuel poverty and cold-related ill health apply to all people, older householders, families with children and householders who are disabled or suffering from a long-term illness are especially vulnerable. People in these higher risk groups are found in over 80 per cent of fuel poor households in England. They are also likely to be at home for more of the day, possibly all of the time, so heating is needed for more of the time than in other households.

6.4 Fuel poverty is a term used to describe those households who need to spend more than 10 per cent of their income on fuel in order to keep warm. Provisional estimates show that there were about 2.8 million fuel poor households in England in 2000, with the figure for the whole of the UK being about 4 million households.

6.5 The number of vulnerable households in fuel poverty in England in 2000 has been estimated at around 2.3 million households, about 83 per cent of the total number of fuel poor households for England.

The definition of fuel poverty

6.6 The Ministerial Group on Fuel Poverty has considered carefully how to define fuel poverty. For the purposes of the strategy for England, it has decided that no worthwhile distinction can be made between fuel used for heating and hot water, and that for other, equally essential purposes. The definition of fuel poverty for England is therefore currently based upon all fuel that a household needs to use and is calculated on the basis of two definitions of income as follows:

i. A household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (including Housing Benefit or Income Support for Mortgage Interest) on all household fuel use. This definition is being focussed on for target setting.

ii. A household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (excluding Housing Benefit and ISMI) on all household fuel use. Data is being collected under this definition to allow comparison with earlier data.

6.7 There remain differences in the definition of fuel poverty between the various countries of the UK and it is hoped that it will be possible to work towards an agreed single definition. The definition is a contentious issue and many organisations commented on it in the UK Fuel Poverty Strategy consultation. Some more information on possible definitions is included in Annex 6A to this chapter.

The causes of fuel poverty

- The lower the energy efficiency rating of a property, the higher the associated costs of keeping it warm. It is then increasingly likely that those living there will be in fuel poverty.
- In 1998, 0.6 million households in fuel poverty in England had homes with a very low standard of energy efficiency (a SAP rating of less than 20). This means over 40 per cent of households in this lowest energy efficiency rating category were fuel poor.
- The fuel poor have lower incomes and higher fuel costs, compared with other households. The average income of households in England in 1998 in severe fuel poverty (spending more than 20 per cent of income on fuel) was £5,574, whilst their required expenditure on fuel was an average of £1,500.
- In the six years from 1994/95, the proportion of income spent on fuel in the 30 per cent of households with the lowest income fell from 9.4 per cent to 7.0 per cent, compared with a fall across all households from 4.3 per cent to 2.9 per cent.

6.8 As already mentioned, fuel poverty damages people's quality of life and imposes wider costs on the community. The most direct effects are in relation to the health of people living in cold homes. Although these risks apply to all people, older people, children and those who are disabled or have a long-term illness are especially vulnerable.

6.9 Fuel poverty is not the result of a single factor; it is the result of a combination of factors such as low income, poor energy efficiency, higher fuel bills and, in some cases, underoccupancy.

Poor energy efficiency

6.10 Table 6.1 shows how the energy efficiency rating of a property is linked to the incidence of fuel poverty. SAP is a rating scale used to measure the energy efficiency of a property. It is a logarithmic scale running from 1 to 100, with 1 being a very poor standard of energy efficiency and 100 being excellent. In 1998 over 40 per cent of those households with a SAP rating below 20 (i.e. poor energy efficiency) were in fuel poverty. The majority of those who were considered to be in fuel poverty were in homes with SAP ratings of less than 50. However, 20 per cent of fuel poor households had SAP ratings of 50 or more, demonstrating that poor energy efficiency is not the only cause of fuel poverty.

Table 6.1 Fuel poverty in England in 1998, by energy efficiency rating

SAP rating	Number of households in fuel poverty (millions)	Percentage of SAP rating group in fuel poverty
Under 20	0.6	41.5
20-30	0.4	33.4
30-40	0.9	21.5
40-50	0.8	13.9
50 plus	0.7	8.7
All	3.3	16.4

Source: 1998 Energy Follow Up Survey (EFUS), DEFRA and ODPM

Low income

6.11 Low income has an obvious effect on the ability of households to spend enough on keeping warm. It is the combination of this with poor energy efficiency that results in fuel poverty. Table 6.2 illustrates clearly how the income of a household is linked to fuel poverty; the lower the household income the more likely that household is to be suffering from fuel poverty. This table also indicates that those on the lowest incomes are often those who need to spend the highest amounts on fuel.

Table 6.2 Mean income, required fuel expenditure and floor space by level of fuel poverty, England 1998

Percentage of income[1] required to maintain a satisfactory heating regime	Median floor area of dwelling, m^2	Mean Income £ per annum	Mean required fuel costs[2] £ per annum
5% or less	82	23,085	693
5-10%	82	11,679	778
10-15%	80	7,115	849
15-20%	82	5,649	961
Over 20%	104	5,574	1,529
All households	82	16328	772

[1] Including Housing Benefit and Income Support for Mortgage Interest as income
[2] Expenditure on fuel required to maintain a satisfactory heating regime
Source: 1998 Energy Follow Up Survey, DEFRA, ODPM

6.12 Recent Government analysis on the links between income and fuel poverty has shown that pensioners with an income at Minimum Income Guarantee (MIG) level and families not in paid employment will not be fuel poor if their bills are somewhere around £500 a year (an approximate bill for a household with good insulation and an efficient gas central heating system).

Underoccupancy

6.13 The size of the property in relation to the number of people living there will also affect the ability of a household to afford to pay heating bills. For example, where a single elderly person is living in what was once the family home, it may be difficult for them to afford to heat it adequately. Table 6.2 illustrates that on average those in the most extreme fuel poverty live in larger than average homes.

6.14 In 1998, about $1^1/_4$ million fuel poor households were defined as underoccupying. Of those underoccupying and in fuel poverty, 67 per cent were in single person households and 70 per cent were households containing pensioners. Underoccupation is a complex issue; often there are good social reasons for not moving to a smaller property. Older people in particular tend to rely on strong local community networks, and these links can have real health and other benefits.

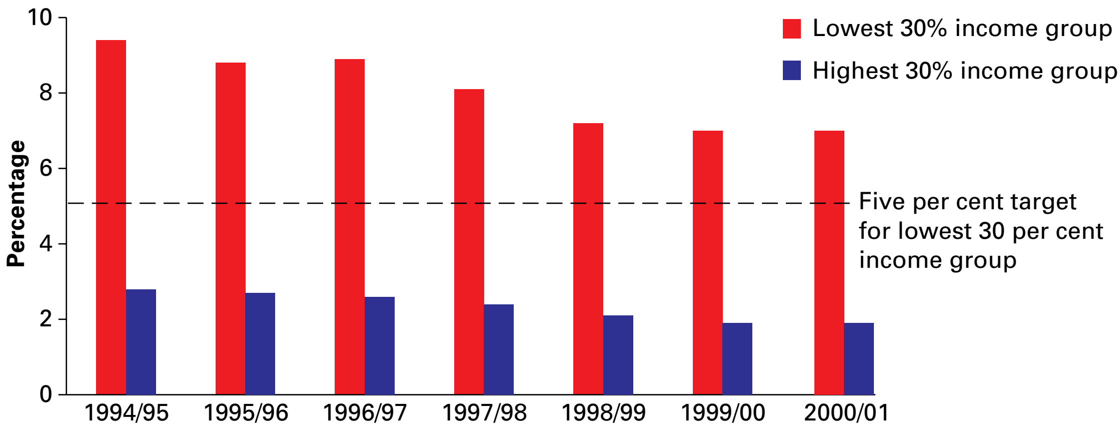
Expenditure on fuel

6.15 As well as having the lowest mean income, the fuel poor also have the highest mean required fuel costs as Table 6.2 illustrates. This may be a reflection not only of poor energy efficiency and possibly higher fuel needs, as mentioned above, but also of the type of heating systems in place or the availability of the fuels themselves - many smaller towns and villages, particularly in rural areas, do not have access to the gas network (mains gas is currently the cheapest fuel widely available for heating). As an indication of the kind of cost differentials, it is estimated that in 1998, a typical household would have spent about 40 per cent more on their total energy use to maintain the same level of comfort if they used an electric storage heating system rather than a gas system. It should also be borne in mind that, generally speaking, the price of other fuels such as heating oil and bottled gases fluctuate considerably.

6.16 Chart 6.1 shows the percentage of total income spent on fuel for the poorest households throughout the UK. In the six years from 1994/95, the proportion of income spent on fuel by the 30 per cent of households with the lowest incomes fell from 9.4 per cent to 7.0 per cent compared with a fall across all households from 4.3 per cent to 2.9 per cent. So, over this period, the 30 per cent of households with the lowest incomes spent over twice the proportion of their income on fuel than the average for all households and over three times that of the 30 per cent of households with the highest income.

6.17 The 30 per cent of households with the lowest incomes have been focussed on because the definition of fuel poverty has its roots based on those in this group. Not all households that fall within the technical definition of fuel poverty actually spend more than 10 per cent of their income on fuel. Many cannot and choose to use less fuel. But many do, and may have to substitute expenditure on other items for expenditure on fuel.

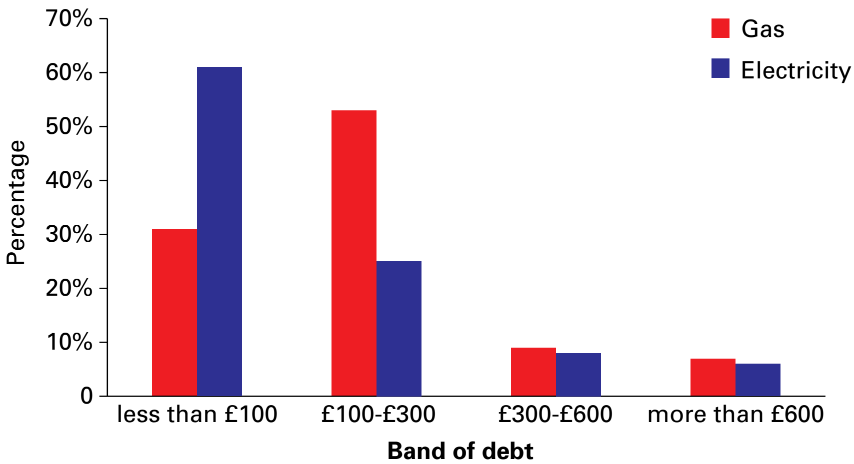
Chart 6.1 Percentage of income spent on fuel for households in the lowest and highest 30 per cent income groups



Source:Office for National Statistics, Family Expenditure Survey

6.18 Customers in fuel poverty may be more likely to fall into debt, as the expenditure on fuel necessary to keep their homes warm forms a high proportion of their income. This can lead to the use of (more expensive) prepayment meters or disconnection. The effectiveness of attempts to prevent and reduce debt therefore needs to be monitored. Chart 6.2 shows the level of customer debt for gas and electricity. At the end of 2001, there were 1.7 million customers repaying a gas debt and 1.0 million repaying an electricity debt in Great Britain.

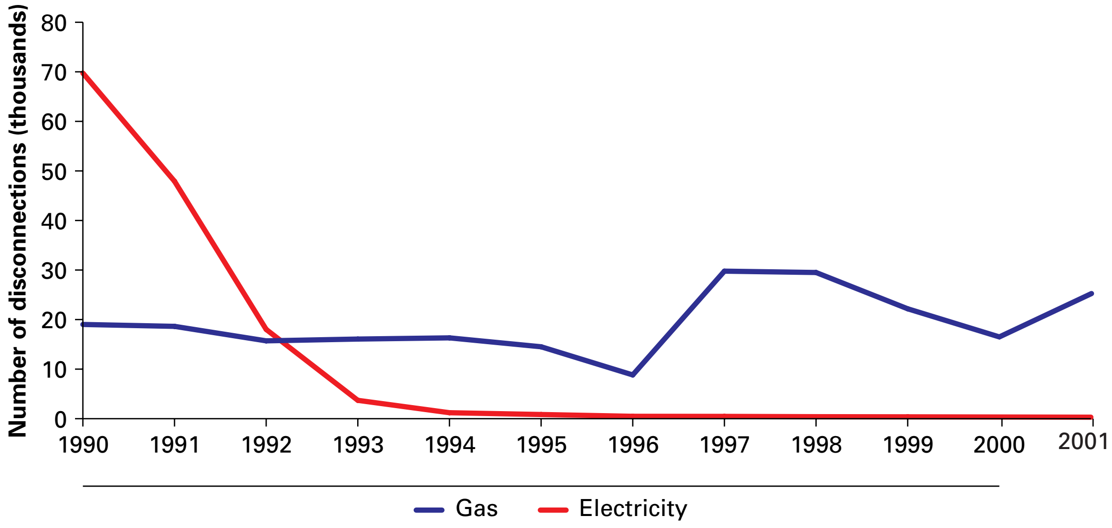
Chart 6.2 Average amounts owed by customers on a debt payment arrangement in 2001



Source: Ofgem

6.19 The number of people being disconnected for debt helps to illustrate the ability of customers to pay bills in a timely manner. The statistics also help to illustrate how companies are dealing with customers with debt problems. Chart 6.3 shows disconnections for debt in the electricity industry have all but disappeared in recent years, with companies preferring to install prepayment meters rather than disconnect customers. In Northern Ireland there were no electricity disconnections because of debt.

Chart 6.3 Number of customers disconnected for debt for gas and electricity 1990-2001



Source:Ofgem, Gas Consumer Council and Northern Ireland Assembly

6.20 Customers on prepayment meters can "self disconnect" by not recharging their meter. This can be deliberate or accidental. Recent research carried out for the Electricity Association Fuel Poverty Task Force suggests that around a quarter of customers who use prepayment meters self disconnect, most of whom were off supply for less than seven hours. The research also showed the main reason for self disconnection is forgetting to 're-charge' the meter, with less than 10 per cent self disconnecting for reasons of poverty.

6.21 The scale of reduction in disconnections for debt in the electricity industry has not been mirrored in the gas industry. Whilst in the electricity industry, a prepayment meter can usually be installed as an alternative to disconnection, this is not always possible in the gas industry for safety reasons; a gas customer must co-operate so safety checks can be undertaken at the time the meter is being exchanged.

The effects of fuel poverty

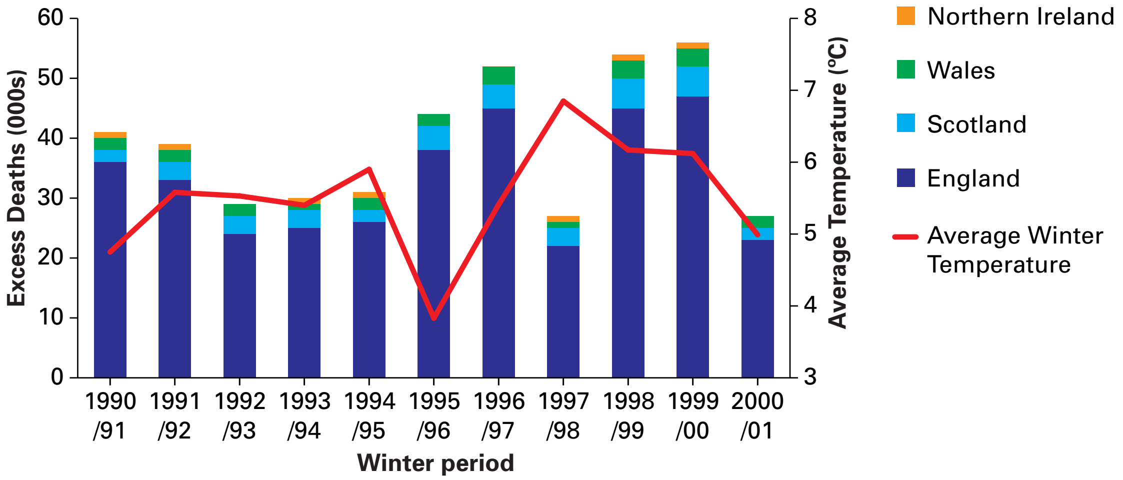
- More people die in the winter months in the UK than at other times of the year and cold homes contribute to this. In the UK from December to March, year on year, there are between 20,000 and 50,000 extra deaths compared to the rest of the year.
- Families with children account for 15 to 20 per cent of fuel poor households. Children are particularly vulnerable to respiratory conditions such as asthma, which have been linked to cold and damp homes.

6.22 Fuel poverty can affect any type of household, but three particular types of household have been identified as being most vulnerable to the effects of cold; these are older households, families with children and those with a member with a long-term illness or disability.

Older people

6.23 Householders aged 60 years or over make up a large proportion of the fuel poor (accounting for over half of the fuel poor households in England and Scotland). The physiological effects of cold are well documented. Resistance to respiratory disease falls when temperatures fall below 16°C (Collins KJ 1986). Temperatures below 12°C result in raised blood pressure (Collins et al 1985), caused by the narrowing of blood vessels, which also leads to an increase in the thickness of the blood, as fluid is lost from the circulation. This, with raised fibrinogen levels due to respiratory infections in winter, is associated with increased deaths from coronary thrombosis in cold weather. About half of excess winter deaths are circulatory in cause, due to the above factors.

Chart 6.4 Excess Winter Deaths



Source: Office for National Statistics, Scottish Executive, Northern Ireland Assembly

6.24 In the UK from December to March, year on year, there are between 20,000 and 50,000 extra deaths compared to the rest of the year. Older people spend a lot of this period in their homes. The relationship between indoor temperatures and ill health is a complex one, with other factors such as outside exposure and behavioural patterns involved. To study the impact of cold homes on health, a Government-funded study has begun and will look at the impact of the new Home Energy Efficiency Scheme (marketed as the Warm Front Team) on recipients' health.

6.25 In addition, cold causes other discomfort for older people, for example worsening arthritic pains or contributing to a general feeling of illness. Research indicates that domestic accidents, including fatalities, are more common in cold homes in winter. Periods of prolonged immobility can result from injuries, making it even more difficult for older people to keep warm. People may need to go into residential care because of their injuries, or because they can no longer live in their cold home.

6.26 Fuel poverty can also exacerbate the social isolation felt by many older households; they cannot afford to go out; or are fearful of going out knowing they will come in, already feeling cold, to a cold home; or are reluctant to invite friends into a cold house. These factors can diminish the social well-being and quality of life of older households.

Children

6.27 Families with children account for 15 to 20 per cent of fuel poor households. Children are particularly vulnerable to respiratory conditions such as asthma, which have been linked to cold and damp homes. Cold homes also increase the time taken to recover from other illnesses, so children may be absent from school longer, affecting their education and development. Homework can also suffer if the family is squeezed into a small part of their home, and there is nowhere for the children to study with out being disturbed. Fuel poverty therefore impairs the opportunities available for children.

People who are disabled or have a long-term illness

6.28 Fuel poverty may compound the ill health and suffering of those who are disabled or have a long-term illness. It is likely to exacerbate existing problems and lengthen recovery time. Cold homes may make it more difficult for carers to look after acutely or chronically sick people, more of whom will have to go into hospital needlessly - or go permanently into a nursing home. Thus the cost of cold-related ill health can be counted in more than the misery caused to the individuals affected. Increased illness adds to the pressures on health and social care services.

Characteristics and numbers of fuel poor households

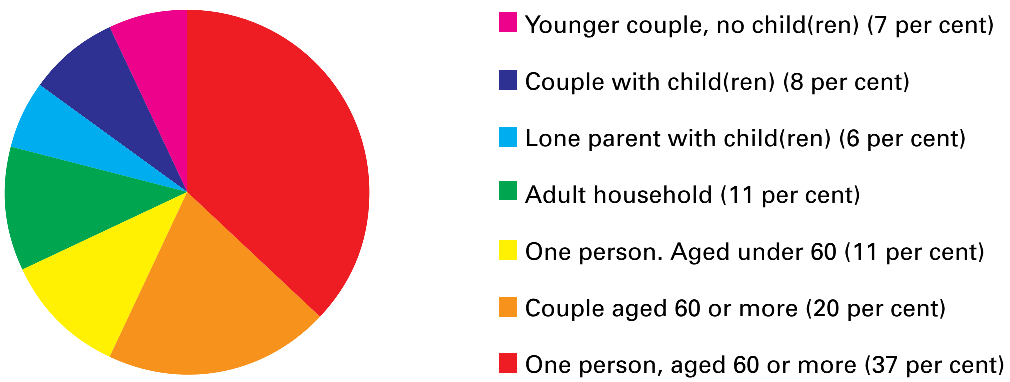
- In 1998, over half of households in fuel poverty in England were made up of single people over 60 or couples over 60. One in seven fuel poor households in 1998 contained children.

- From 1996 to 2000, it has been estimated that the number of households in fuel poverty in the UK fell from about 5½ million to about 4 million, of which about 3 million households were considered to be vulnerable.

6.29 Some 83 per cent of the fuel poor in England in 1998 were vulnerable householders: older people, families with children and those who are disabled or have a long-term illness. The remaining householders in fuel poverty were healthy adults. When compared with the figures for 1996, this shows a reduction in the proportion of healthy adult households in fuel poverty from 30 per cent to 17 per cent, whose position may have been improved through the falling unemployment rate. There is less of a reduction over this period in the number of vulnerable households in fuel poverty, as the main programmes for tackling fuel poverty did not begin until after 1998.

6.30 In England in 1998, over half (57 per cent) of all the fuel poor were aged 60 years or over, with one in seven fuel poor households containing children. Chart 6.5 provides a breakdown of the individual household types.

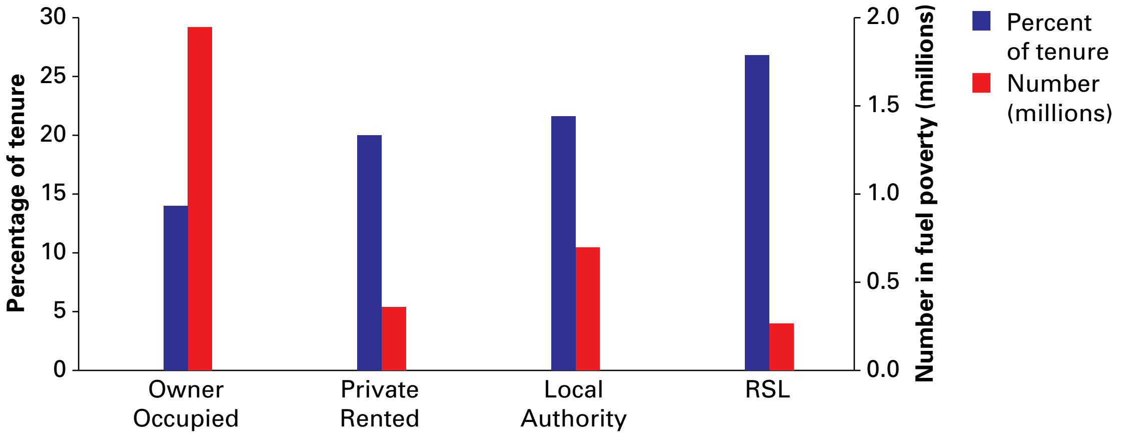
Chart 6.5 Percentage in fuel poverty by household type, England 1998



Source: 1998 Energy Follow Up Survey to the EHCS, DEFRA

6.31 About 60 per cent of the fuel poor are owner-occupiers, about one in nine are in the private rented sector and the remaining third are in local authority or Registered Social Landlord properties. The highest concentration of fuel poverty is found in the Registered Social Landlord (RSL) sector, where just over one in four households are fuel poor. The "Fuel Poverty in England 1998" report published by DTI and DEFRA provides more detailed breakdowns of the numbers of fuel poor in each sector.

Chart 6.6 Fuel poverty by household type, England 1998



Source: 1998 Energy Follow Up Survey to the EHCS, DEFRA

6.32 Since 1998, there have been a number of significant Government policy developments that have helped households in fuel poverty. These include:

- increases in household income due to the introduction of working families tax credit, the minimum wage and other changes to the benefit and tax systems;

- reduced fuel prices resulting from effective regulation and the liberalisation of the fuel supply market.

Table 6.3 The number of households in fuel poverty[1] and the number of vulnerable households in fuel poverty throughout the UK

millions

	Total number of households in fuel poverty				Vulnerable households in fuel poverty			
	1996	1998	1999	2000	1996	1998	1999	2000
England	4.3 (5.3)	3.3 (4.3)	3.1 (4.2)	2.8 (3.9)	3.0 (3.7)	2.7 (3.7)	2.6 (3.6)	2.2 (3.1)
Scotland	0.7 (-)	-	-	-	0.5 (-)	-	-	-
Wales	-	- (0.2)	-	-	-	- (0.2)	-	-
Northern Ireland	(0.2)	(0.2)	-	-	-	-	-	-
UK estimate	About 5½ (6½)	About 4½ (5½)	About 4 (5½)	About 4 (5)	About 4 (4½)	About 3½ (4½)	About 3½ (4½)	About 3 (4)

Figures in brackets do not include Housing Benefit/ISMI as part of income (definition 2 at paragraph 6.6)
Source:
England - 1996 EHCS, 1998 EFUS, 1999/2000 modelled estimates
Scotland - Scottish House Condition Survey, Scottish Executive
Wales - Welsh House Condition Survey, National Assembly for Wales
Northern Ireland - Northern Ireland FES
[1] Refer to Paragraph 6.6 for a definition of fuel poverty.

6.33 The resulting impact on the numbers in fuel poverty due to these two key changes has been modelled to produce broad estimates of the numbers in fuel poverty in 1999 and 2000, using information for 1998 as the starting point. Provisional estimates suggest that the number of fuel poor households in England has dropped to 3.1 million in 1999 and 2.8 million in 2000, from the 3.3 million figure in 1998. Excluding housing benefit and Income Support for Mortgage Interest (ISMI) from income, comparative figures are 4.2 million for 1999 and 3.9 million in 2000, compared with 4.3 million in 1998. Table 6.3 shows how the numbers of vulnerable and healthy adult fuel poor households have changed from 1996 to 1998, and also includes some possible ranges for these groups for 1999 and 2000.

6.34 Overall, between 1996 and 2000, the number of English households in fuel poverty fell by around 1½ million to about 2.8 million (to about 3.9 million excluding housing costs). These falls have largely been as a consequence of increased incomes and reduced fuel prices to roughly equal degrees.

Chart 6.7 The number of households in fuel poverty

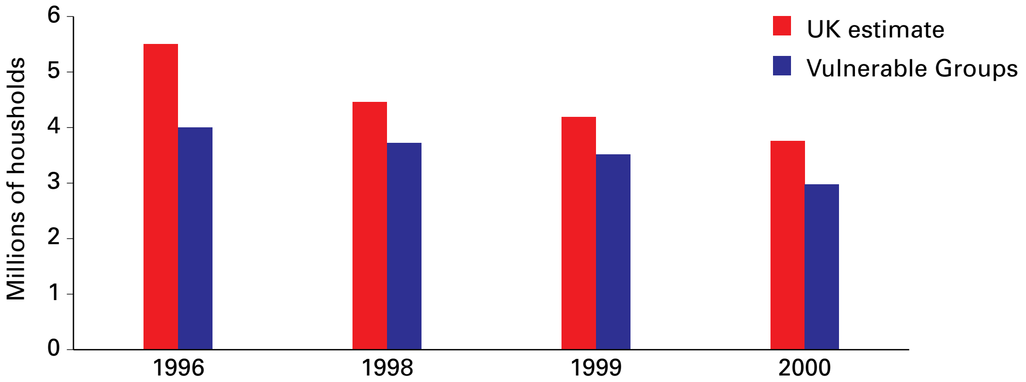


Chart based on the definition including Housing Benefit/ISMI as income
Source: 1998 Energy Follow Up Survey to the EHCS, DEFRA

6.35 Provisional analyses indicate that the number of households in fuel poverty may have fallen by a further half a million in England as a result of income policies in the period 2000-2002. In particular, the changes in income policies (such as the Minimum Income Guarantee, winter fuel payment etc), combined with changes in energy prices, could have resulted in the number of pensioner households in fuel poverty being almost halved. But this assumes that all those eligible for the Minimum Income Guarantee (MIG) claim this benefit.

The Way Forward

- The goal of the Government and the Devolved Administrations is to seek an end to the problem of fuel poverty. In particular they will seek an end to the blight of fuel poverty for vulnerable households by 2010. Fuel poverty in other households will also be tackled once progress is made on the priority vulnerable groups. For each country the specific interim targets are:

- England - By 2004, to have assisted 800,000 vulnerable households through the Home Energy Efficiency Scheme (HEES), now marketed as the Warm Front Team (WFT) and to reduce the number of non-decent social sector homes by one third (though not all of these will be occupied by fuel poor households).

- Scotland - By 2006, to ensure that all pensioner households and tenants in the social rented sector live in a centrally heated and well insulated home.

- Wales - By March 2004, to have assisted 38,000 households likely to be in fuel poverty through the Home Energy Efficiency Scheme for Wales.

- Northern Ireland - By 2006, to have assisted at least 40,000 households in fuel poverty through the new Warm Homes Scheme and partnership programmes.

6.36 The Government's UK Fuel Poverty Strategy was published in November 2001 and sets out the causes and effects of fuel poverty in the UK, and outlines the measures being implemented to tackle this problem. This section summarises the main points of the Strategy and focuses on some of the indicators of fuel poverty used in the Strategy document which relate to energy issues. The Strategy focuses primarily on measures to improve energy efficiency and to reduce the costs of fuel for fuel poor households; the income measures which form part of a long-term solution are being addressed in wider poverty and social exclusion policies.

6.37 The Inter-Ministerial Group on Fuel Poverty was set up in November 1999 to take a strategic overview of the relevant policies and initiatives with a bearing on fuel poverty, and to develop and publish a UK Fuel Poverty Strategy setting out fuel poverty objectives, targets, and the policies to deliver those objectives. The Strategy was published after wide consultation on the draft UK Fuel Poverty Strategy, published in February 2001.

6.38 Fuel poverty is a problem that each of the devolved administrations has a responsibility for, as housing and energy efficiency are devolved matters. The Scottish Executive has recently published its own Fuel Poverty Statement and the National Assembly for Wales will be issuing a draft Strategy for consultation within the next 12 months. Each of the three devolved administrations will be developing its own fuel poverty monitoring requirements alongside these Strategies.

6.39 Many of the figures in this section present the picture of fuel poverty in England only; this information has been taken from the 1996 English House Condition Survey (EHCS) and the 1998 Energy Follow Up Survey to the EHCS. Until now, the EHCS has only been run at five year intervals. The last five yearly survey was carried out in 2001, with data from this expected at the end of 2002. From 2002 the EHCS will be run on an annual basis, this should help ensure that up to date data is available to help inform important policy development.

Programmes in place to achieve the Government's targets

- The different targets for each country reflect the current understanding of the nature and scale of the problem. To achieve their targets, the Government and the Devolved Administrations believe that no single measure would be sufficient. Instead a range of programmes and measures have been put in place, addressing the main causes of fuel poverty.

- There are programmes to improve the energy efficiency of fuel poor households. These include the separate home energy efficiency schemes within each country, as well as efforts through local authorities and registered social landlords.

- Energy market measures include continuing action to maintain the downward pressure on fuel bills, ensuring fair treatment for the less well off, and supporting the development of energy industry initiatives to combat fuel poverty.

- There is continuing action to tackle poverty and social exclusion including income measures recognising that these are multi-dimensional problems.

- These measures will interact with and complement each other and will link with the activities of others such as the energy industry.

Energy efficiency measures

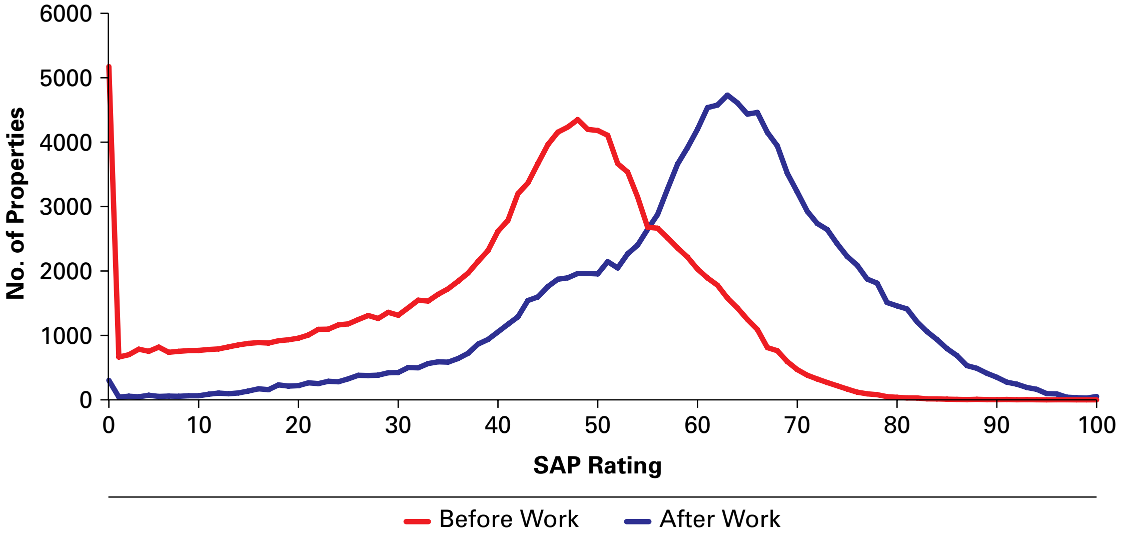
Home Energy Efficiency Schemes

6.40 The new Home Energy Efficiency Scheme (HEES) in England (marketed as the Warm Front Team - WFT), launched in June 2000, provides a package of insulation and heating measures to the homes of those most vulnerable to cold-related ill health - older householders, families with children and householders who are disabled or have a long-term illness - who are in receipt of a qualifying benefit. About 70 per cent of those in fuel poverty in England are in the private rented and owner occupier sectors. In England, HEES/WFT focuses on the private sector where need is greatest and where there is little recourse to other sources of assistance.

6.41 Each of the devolved administrations in the UK operates its own home energy efficiency scheme. In Northern Ireland this is known as the Domestic Energy Efficiency Scheme (Warm Homes) and in Wales as the Home Energy Efficiency Scheme. In Scotland, there are two separate schemes, the Warm Deal and the Central Heating scheme for pensioners and other vulnerable households.

6.42 Chart 6.8 shows the energy efficiency of homes in England before and after HEES/WFT measures based on a sample of just over 130,000 homes. Following improvements made under the scheme, homes are improved by some 19 SAP points on average to an energy rating of SAP 60 and many homes are improved to over SAP 80. This suggests that a large number of householders should no longer be at risk from fuel poverty. The homes that remain with a low SAP will include hard to heat homes.

Chart 6.8 The effects of HEES/WFT on energy efficiency rating

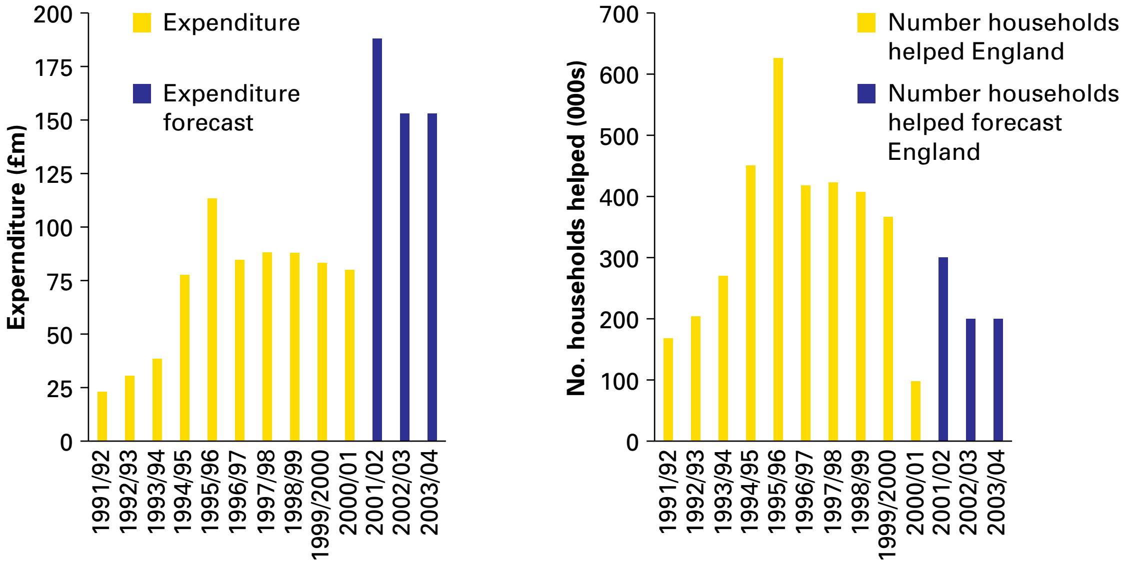


Source: Eaga Partnership

6.43 With a budget of over £600 million between 2000 and 2004, in England

HEES/WFT is expected to reach some 800,000 vulnerable households, 480,000 being those households with members over 60 years old. In Scotland around 70,000 households across all sectors of the stock will benefit from central heating programmes over 5 years from April 2001. In Wales by March 2004, 38,000 households likely to be in fuel poverty will be assisted through the Home Energy Efficiency Scheme. In Northern Ireland, the new Warm Homes scheme should assist at least 40,000 households by 2006.

Chart 6.9 Expenditure and number of households helped through home energy efficiency schemes, UK[1]



Source:DEFRA, National Assembly for Wales, Northern Ireland Assembly, Scottish Executive

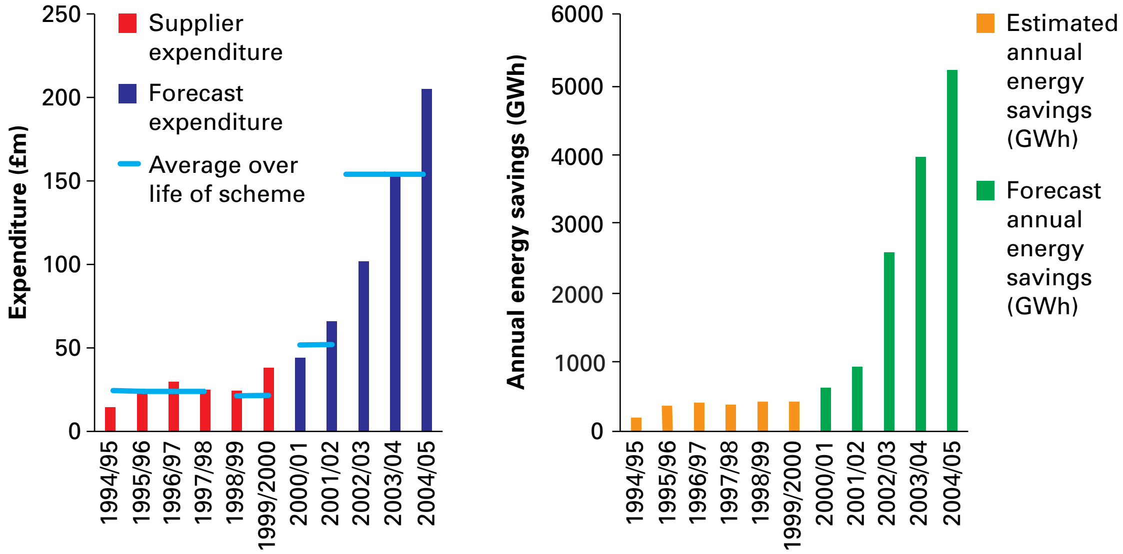
[1]Forecasts from 2001/02 for England only. New HEES introduced in June 2000 in England

Energy Efficiency Commitment (Formerly Energy Efficiency Standards of Performance)

6.44 The Energy Efficiency Standards of Performance were launched in 1994 in England and Wales as part of the electricity companies' price controls, and gave them specific obligations for funding of energy efficiency measures to deliver energy savings. The scheme was extended to gas suppliers in April 2000. This obligation on the energy supply companies shows a commitment both to disadvantaged customers and to the environment in reducing energy costs through more efficient energy consumption and lower bills. More details of energy savings from the schemes are given in Annex 3B of Chapter 3. It is estimated by EST that about 65 per cent of expenditure to date has gone to low-income or households with members over 60.The Electricity Levy and Gas Levies in Northern Ireland have helped 110,000 households with £2½million in expenditure since the electricity levy was first introduced three years ago.

6.45 The first two schemes ran over six years and the average expenditure per year for each scheme is shown as a line in the Chart 6.10. On top of the expenditure shown in the chart, additional "leveraged funds" have been released by other parties, as a result of the EESoP expenditure. For instance, as a result of cavity wall insulation put in under the EESoP schemes, a Local Authority may decide to install other measures. For the first scheme, this leveraged expenditure amounted to £22.5m on top of the £39m supplier expenditure, the second scheme resulted in a further £32.5m on top of the £105m expenditure. Also illustrated are the potential annual energy savings of the schemes introduced. Not all of these potential savings may be realised, since customers may prefer to enjoy improved comfort levels (i.e. a warmer home) rather than reductions in bills.

Chart 6.10 Expenditure and energy savings through EESOPs (now EEC)



Source: EST (historical figures), DEFRA (forecasts)

6.46 A new scheme takes the EESoP schemes into the future and is now referred to as the Energy Efficiency Commitment (EEC). Under the EEC for 2002 to 2005 electricity and gas suppliers are required to achieve targets for improvements in energy efficiency, through measures provided to domestic customers. The Government, for the first time, set the overall obligation on all suppliers. The EEC is expected to produce ongoing annual energy benefits worth £275 million. It will help lower income consumers - who spend a larger proportion of their incomes on energy - by requiring at least 50 per cent of energy savings to be focussed on the group. The new EEC specifies required carbon savings - it will be up to energy suppliers to meet their targets cost effectively - and there will not be a specified amount of money that a company must spend in doing so.

Decent homes

6.47 The Government has set a Public Service Agreement Target that all social housing will be of a 'decent' standard by 2010. The implementation plan setting out how this target will be delivered was published in March 2002. Amongst other things, to meet the decent home standard, a home must provide a reasonable degree of thermal comfort by having effective insulation and efficient heating. By ensuring that all social housing has effective insulation and efficient heating, the likelihood of tenants being in fuel poverty is reduced.

Hard to treat homes

6.48 The construction of some homes means that they can be particularly hard to keep warm. Unlike modern homes, they may not have cavity walls or roof spaces and so cannot benefit from cost-effective insulation measures. The Government recognises these problems. Renewable energy and micro-CHP pilots are being designed to assist our understanding of how these technologies may help us to tackle these issues. Complementing these pilots, the National Assembly for Wales has commissioned an examination of alternative fuels and insulation methods with potential for use in hard to heat properties. The project will be completed in 2002 and will seek to evaluate the use of alternative heating fuels or insulation methods.

Energy market measures

Energy Market Liberalisation

6.49 The liberalisation of the supply market for gas and electricity for domestic customers was completed in May 1999. This has led to reductions in prices for customers, particularly for the fuel poor for whom energy represents a higher proportion of household expenditure than it does for other customers. More details on prices and competition can be found in Chapter 4 of this booklet.

Energy Industry Initiatives

6.50 One of the benefits of liberalisation is that it has allowed energy companies to develop their own schemes aimed at tackling fuel poverty. These schemes are in addition to the energy efficiency schemes the companies are required to deliver under the Energy Efficiency Commitment, and focus more on other aspects of fuel poverty such as health and income. It is intended that information on the impact of these schemes on fuel poverty will be included in the Government's annual updates on the Fuel Poverty Strategy. For the moment a summary of the services the schemes offer is included at Annex 6B to this chapter.

Social Action Plan

6.51 Ofgem's Social Action Plan was launched in April 2000 and is aimed at ensuring that consumers have a range of tariff options and payment methods to suit their circumstances and that energy suppliers provide appropriate advice and help with debt management and energy efficiency. To date, there have been two annual updates of the Plan and more information on the Social Action Plan generally can be found in Annex 6C to this chapter.

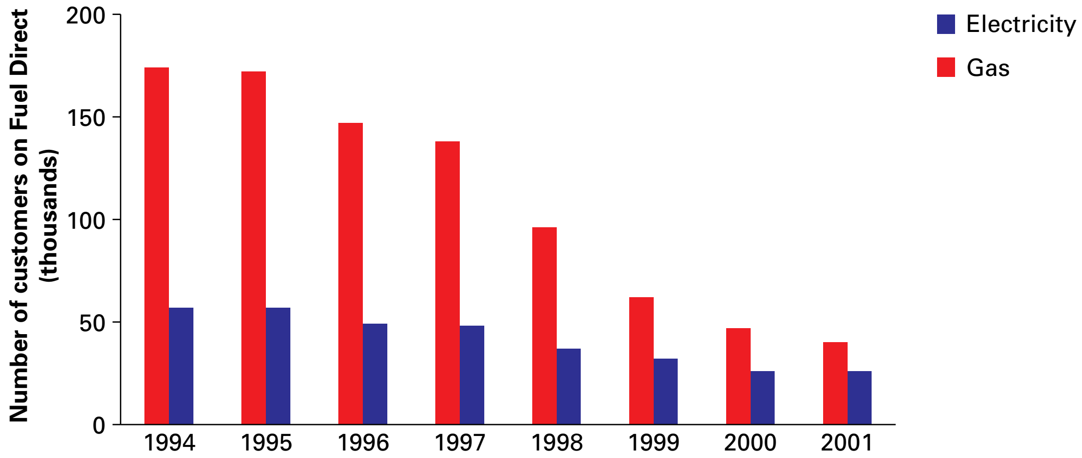
Extension of the gas network

6.52 There are around 4½ million households in Great Britain - some 20 per cent of the total - without a gas supply, and around 1.3 million of these are thought to be in fuel poverty. Not having access to a gas supply reduces the choice of fuels for customers, and may lead to their having to use less convenient, less energy efficient, or more costly methods of keeping their homes warm. The Government set up a working group to consider the issues surrounding extension of the gas network and the group has recommended that further work is needed to test the effectiveness of extending the gas network in addressing fuel poverty.

6.53 In the Fuel Poverty Strategy, the government announced proposals for pilot projects to assess the potential contribution of renewable sources of energy and other technologies to relieving fuel poverty, particularly in rural areas where there is no gas supply. This includes a proposed pilot to consider the use of "micro-CHP" in up to 6,000 homes. Micro-CHP uses a high-efficiency condensing gas boiler to provide households not only with gas-fired central heating but also with a baseload of electricity, thereby offering the potential for significant reductions in overall fuel bills. It has the potential of being an effective solution for many hard to heat homes and might even offer some solutions in rural areas, where the added efficiency of the CHP technology might make LPG-fired boilers economic.

Fuel Direct

Chart 6.11 Number of customers on the fuel direct scheme 1994-2001



Source: DWP

6.54 Fuel Direct is a scheme designed to act as a last resort measure for vulnerable households receiving Income Support or income-based Jobseekers Allowance who are threatened with the disconnection of an essential fuel supply. It allows for deductions to be made from benefit, towards repayment of the debt (currently £2.70 a week) and current consumption, to be paid by the DWP direct to the customers supplier. A working group convened by Ofgem with representatives of suppliers and relevant government departments has been examining the operation of Fuel Direct with a view to making improvements in the scheme, and considering its future once most benefits are paid via automated credit transfer.

Gas engineering skills shortage

6.55 In recent years, the number of registered gas installers in the UK has been falling and there has been a skill shortage in the sector, impacting both on those Government fuel poverty programmes which rely on installation of new heating systems and on the housing market generally. To address this problem, the Government and the Gas and Water Industry National Training Organisation (GWINTO) have jointly developed some 800 additional training places targeted at unskilled people or those with redundant skills, to increase the immediate supply of qualified installers.

6.56 These actions to improve the supply of installers are matched by similar action in other gas-related occupations, notably distribution. The overall programme of gas training is being overseen by the Gas Industry Skills Taskforce, a joint industry-Government group with capacity to measure and meet skills gaps across the whole industry.

Income measures

6.57 The Government and the Devolved Administrations have put in place strategies for tackling wider poverty and social exclusion. The strategies are founded on the principle that poverty and social exclusion are multi-dimensional. These are complex problems caused by a range of interlinked issues many of which may contribute towards fuel poverty (low incomes, poor housing or restricted access to low-cost direct debit bank payment services) or be exacerbated by it (poor health). The strategies aim to address these factors by tackling their root causes, as well as alleviating the symptoms. Amongst these programmes are two benefits that are specifically aimed at helping vulnerable households afford to keep warm in winter:

Winter Fuel Payments

6.58 Winter Fuel Payments were introduced in the winter of 1997. The Winter Fuel Payment scheme covers Great Britain only, with a mirroring scheme in place in Northern Ireland. They are paid to people aged 60 and over. The amount of the payment was increased from £150 to £200 for each eligible household for Winter 2000/01. The Government is committed to maintaining the payment at £200 for each year for the remainder of this Parliament. Everyone who qualifies for a Winter Fuel Payment and is in receipt of Income Support or income-based Jobseeker's Allowance will receive £200. For those not in receipt of Income Support or income-based Jobseeker's Allowance, where there is more than one eligible person living in the household then they should receive

£100 each.

Cold Weather Payments

6.59 Cold Weather Payments provide extra help towards heating costs for people on Income Support or income-based Jobseeker's Allowance whose benefit includes a pensioner or disability premium or who have a child under 5. Payment is made automatically when the average temperature at a specified weather station is recorded as, or forecast to be, 0°C or below, over seven consecutive days.

6.60 The payment is £8.50 and the number of payments made during any particular winter depends on air temperatures - forecast or recorded. Last winter there was a considerable increase in the number of spells of very cold weather when compared to the preceding 3 winters. This is reflected in the total expenditure for each of the last three winters varying from a low in 1998/99 of £0.2 million to £30 million in 2000/01.

Working together to deliver the UK Fuel Poverty Strategy

6.61 With half of fuel poor households living in their own homes, systematic identification of clients or client groups has always presented a problem. One approach to bringing greater coherence to delivery is Warm Zones, which aim to identify all fuel poor households within a defined area systematically and to treat 80 per cent of them within 3 years. Local authority partnership and strong support from energy suppliers, in terms of financial and staff resources, are a crucial element of the five Warm Zones currently being piloted.

6.62 In addition to Warm Zones, Local Authorities are uniquely placed to facilitate partnerships locally between a range of other organisations, including Health Authorities, utilities, voluntary groups, and businesses, to draw together funding, expertise, and other resources so as to deliver local solutions. "Tackling Fuel Poverty" was one of the themes for the 2001-02 Beacon Council Scheme with five local authorities being awarded Beacon status. Health Authorities, likewise, have an important part to play, particularly in identifying people who need help. Primary Care Trusts (PCTs) in the future will be the focus for partnership working with Local Authorities on a local basis.

6.63 The Government's Fuel Poverty Advisory Group will have as its focus the delivery of fuel poverty measures, including the co-ordination of effort and the removal of barriers. The Group is an advisory Non-Departmental Public Body and will report to Ministers annually. The Group will need to consider the role of both local and health authorities: and its activities will be reported as part of the regular progress reports on the Strategy itself.

Monitoring

6.64 To monitor progress, the Government intends to publish annual reports setting out the number of households in fuel poverty and presenting indicators on the factors that affect fuel poverty (income, fuel prices and housing). The intention is to produce a comprehensive picture of progress towards meeting the targets to enable the Government to assess whether any changes are required in policies to ensure the targets are met. More details on the approach proposed are given in the Fuel Poverty Strategy.

Further Reading

- The UK Fuel Poverty Strategy. DETR/DTI, February 2001. http://www.dti.gov.uk/energy/consumers/fuel_poverty/index.htm
- Opportunity for all - making progress Third Annual Report. DWP, September 2001. http://www.dwp.gov.uk/publications/dwp/2001/oppall_third/index.htm
- A better quality of life - A strategy for sustainable development for the UK. DETR, May 1999.
- Warm Homes and Energy Conservation Act 2000. The Stationary Office 2000. Also available at http://www.hmso.gov.uk/acts/acts2000/20000031.htm
- Low indoor temperatures and morbidity in the elderly. 1986, Collins KJ.
- Effects of age on body temperature and blood pressure in cold environments. 1985, Collins KJ, Easton JC, Belfield-Smith et al.
- Utilities Act 2000. The Stationary Office 2000 http://www.hmso.gov.uk/acts/acts2000/20000027.htm
- Social Action Plan. Ofgem, March 2000. http://www.ofgem.gov.uk/docs/sapmarch.pdf
- Overcoming Barriers, Older People and Income Support. DWP. Also available at http://www.dss.gov.uk/asd/asd5/100summ.html
- Access to Financial Services, Report of PAT14. HMT, November 1999
- English House Condition Survey 1996, DETR, Also available at http://www.housing.ODPM.gov.uk/research/ehcs96/
- Fuel poverty in England in 1998, DTI/DEFRA, August 2001. Also available at http://www2.dti.gov.uk/energy/fuelpoverty.htm/
- Saving Lives: Our Healthier Nation: White Paper
- Tackling Health Inequalities: Consultation Paper. DH
- Home Energy Conservation Act, 1995. The Stationary Office 1995. Also available at http://www.hmso.gov.uk/acts/acts1995/Ukpga_19950010_en_1.htm
- Quality and Choice: a decent home for all - the way forward for housing. DETR April 2000
- A decent Home - the revised definition and guidance for implementation (DLTR). Decent homes: Capturing the standard at the Local Level (ODPM). Decent social housing target implementation plan (ODPM) all of which are available http://www.housing.ODPM.gov.uk/information/dhg/index.htm
- Access to Financial Services, Report of PAT14. HMT, November 1999
- Household Utilities Price Indices. DTI, 2001. Also available at http://www.dti.gov.uk/energy/hupiworkingpaper/hupi.htm

Useful Websites

Ofgem:	http://www.ofgem.gov.uk
energywatch:	http://www.energywatch.org.uk
DTI:	http://www.dti.gov.uk
DEFRA:	http://www.defra.gov.uk
Northern Ireland Housing Executive:	http://www.nihe.gov.uk
Welsh Assembly:	http://www.wales.gov.uk
Scottish Executive:	http://www.scotland.gov.uk

Annex 6A

How to define Fuel Poverty

6A.1 Before the number of households in fuel poverty can be derived, it is essential that a definition of fuel poverty be set out in detailed terms. The definition of fuel poverty was one of the main issues raised by respondents to the consultation on the UK Fuel Poverty Strategy. One of the problems identified was that in the past different definitions have been used for the different countries, as this issue is dealt with on a devolved basis. The use of these differing definitions means that it is not easy to compile a UK figure for the number in fuel poverty. However, as the work to develop a UK Fuel Poverty Strategy to tackle fuel poverty has progressed most of the countries are in the process of reviewing the definitions used, the following text explains the definition used in each of the four countries of the UK and the development of the definition in England.

Definitions currently being used in England, Scotland, Wales and Northern Ireland

England

6A.2 The number of households in fuel poverty is to be displayed on two definitions. For the purposes of target setting the definition will be that a household is in fuel poverty if in order to maintain a satisfactory heating regime it would be required to spend more than 10 per cent of its income (net of income tax and national insurance and including Housing Benefit and Income Support for Mortgage Interest - ISMI) on all household fuel use. The second definition under which figures will be produced does not include Housing Benefit and ISMI as part of income. This second definition is the one which was used in the 1991 English House Condition Survey.

Scotland

6A.3 The Scottish Fuel Poverty Statement issued in March 2002 proposed a definition consistent with that used in England, i.e. that a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (including Housing Benefit or ISMI) on all household fuel use. This definition looks at expenditure on fuel before housing costs (that is, including Housing Benefit or ISMI). Whilst milestones and targets are based on this definition, the Scottish Executive also proposes to monitor changes in the numbers of people in fuel poverty using a definition of household income which excludes Housing Benefit and ISMI.

Wales

6A.4 The Welsh Assembly will be consulting on the definition of fuel poverty in Wales as part of the development of its fuel poverty strategy under the Warm Homes and Energy Conservation Act 2000, which came into force on 19th March 2002. It is expected that the favoured definition will be based on income excluding Housing Benefit and ISMI. In the meantime progress will be measured in terms of data on the Home Energy Efficiency Scheme eligibility & potential beneficiaries from HEES.

Northern Ireland

6A.5 The definition used in Northern Ireland is that a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (excluding Housing Benefit and ISMI) on fuel[2].

Data Sources used to calculate the numbers in fuel poverty

6A.6 The data sources currently used to produce estimates of the number of households in fuel poverty are generally house condition surveys which cover each of the countries within the UK individually. These surveys have generally been carried out at 5 yearly intervals, collecting detailed information on housing conditions.

6A.7 The responsibility for housing conditions (a key causal factor in fuel poverty) is devolved and the countries therefore have their own individual requirements for information from their house condition surveys. The text below sets out the current position and plans for the production of estimates of the numbers in fuel poverty for the different countries.

England

6A.8 Following extensive programming, the fuel poverty figures from the 1996 EHCS (based on a 12,500 achieved sample) were published in 2000. In parallel with this work, an Energy Follow Up Survey (EFUS) was run in 1998, using addresses from the 1991 and 1996 EHCS, to gather more information on the energy specifc aspects of homes. The fuel poverty analyses from this survey were published in August 2001. The 2001 EHCS (with

[2] Data are interpreted using the definition that includes housing benefit and ISMI to enable comparison across the devolved administrations. This is in line with the Scottish Executive approach.

an achieved sample of around 17,500) is currently being prepared for analysis with results expected by the end of 2002.

6A.9 Due to the long time lapse between the carrying out of the survey, the EHCS is undertaking a more continuous form of reporting from 2002. This will allow headline results to become available annually from 2003, with detailed results available from a larger (24,000 households), aggregate sample every three years. The first results from the aggregated sample will be published in 2005.

6A.10 At present broad estimates of fuel poverty in 1999 and 2000 have been modelled using the survey data for 1998 as a starting point, and taking into account changes in incomes and fuel prices. These figures and details of the methodology used are available on the DTI web site. It is proposed that a more sophisticated model will be developed in order to provide annual figures. This model will provide annual estimates of fuel poverty on a timely basis using information such as changes in fuel prices, changes in the benefits system and, where possible, changes to the energy efficiency of housing stock. These modelled estimates will be constrained to the estimates produced from the EHCS and any follow-up surveys similar to that carried out in 1998 as these become available.

Scotland

6A.11 Estimates of the number of households in fuel poverty in Scotland are produced from the five yearly Scottish House Condition Survey, the latest estimates relate to 1996. There are currently no plans to alter the method of collection or to produce more frequent estimates of the number of households in fuel poverty.

Wales

6A.12 The figures on the potential number of beneficiaries from HEES are produced from the latest Welsh House Condition Survey carried out in 1997/98. The National Assembly for Wales is currently reviewing the information required on fuel poverty, and a possible way forward includes the creation of a three yearly household interview survey allied to a smaller stock condition survey. It is proposed that annual estimates would then be modelled between surveys, similar to the proposed approach for England.

Northern Ireland

6A.13 The latest estimates of the number in fuel poverty in Northern Ireland are based on the aggregation of three years data from the Northern Ireland Family Expenditure Survey (NIFES). This source has been used in this instance because the 1996 Northern Ireland House Condition Survey (NIHCS) (again a five yearly survey) did not collect data on disposable income and fuel expenditure. However, the 2001 NIHCS will contain the data necessary to produce estimates of the number of households in fuel poverty and discussions are underway regarding the production of estimates for the mid point between the five yearly surveys. The results of the 2001 NIHCS are expected in Autumn 2002.

The development of the definition for England

6A.14 The Ministerial Group on Fuel Poverty considered the definition of fuel poverty for England, taking account of the feedback received from the consultation exercise carried out for new HEES/WFT and decided that the number of households in fuel poverty in England should be displayed on the basis of two definitions as follows:

i) Definition to be focussed on for target setting
A household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (including Housing Benefit or ISMI) on all household fuel use.

ii) Additional definition
A household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10 per cent of its income (not including Housing Benefit or ISMI) on all household fuel use.

6A.15 The definition(s) to be used will be considered further once the position on the definition to be used by the Devolved Administrations becomes clear, with the aim of agreeing a common UK wide definition. In coming to a definition three main issues were considered: -

- Fuel use to be included;
- Definition of household income;
- The 10 per cent cut off point.

Fuel use to be included

6A.16 As part of the consultation on the proposals for new HEES/WFT, views were sought as to whether fuel for non-heating purposes be considered when deciding whether a household is fuel poor. The consultation responses showed a strong view that other fuel use should be included in calculating the total amount of fuel needed as excluding other household fuel uses could have a marked effect on estimates of the number of fuel poor households. Fuel use for lighting and cooking purposes could also be considered as essential use. It was therefore decided that the definition of fuel poverty should be based on all household expenditure on fuel, including that used for non-heating purposes.

Definition of household income

6A.17 As part of the consultation on the proposals for new HEES/WFT, views were sought as to whether housing costs met by Housing Benefit (or ISMI), but not paid by the household directly, be excluded from income or included as income when calculating whether a household is fuel poor. The consultation responses on this issue were mixed suggesting that either approach was acceptable but that the percentage figure used to determine fuel poverty should reflect the latest figure from the Family Expenditure Survey (FES).

6A.18 The definition to be used for target setting has been selected so that housing costs met by Housing Benefit (or ISMI) are included as part of household income. This treats those in receipt of benefits in the same way as those without benefits and is the definition that received the most support in the new HEES/WFT consultation exercise. It is the definition which is broadly consistent with Government convention[3]. Excluding all housing costs from income would lead to those on higher incomes with more expensive (and often larger, harder to heat) properties being classed as fuel poor.

The 10 per cent cut off point

6A.19 The 10 per cent cut off point has been used for many years now. The 1988 FES showed that households in the lower three income deciles spent, on average, 10 per cent of their income (not including Housing Benefit or ISMI as part of income) on fuel for all household uses. It was assumed by researchers in the fuel poverty field that this could be taken as representing the amount that low-income households could reasonably be expected to spend on fuel.

6A.20 Some of those working in the fuel poverty field have suggested that the cut off point should be changed each year to be based on the latest FES expenditure for those in the lowest three income deciles. However, this would mean that each year the cut off point changed, and because it is based on the average expenditure in the lowest three income deciles it would be impossible ever to remove all households from fuel poverty. It would be impossible to define an achievable target using this approach or to monitor progress on a consistent basis over time. It has therefore been decided that the 10 per cent cut off point should be maintained as a reference point.

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[3] The Households Below Average Incomes (HBAI) series presents analysis using two definitions of income, namely before and after housing costs. These measures are adopted by the Government to monitor low income in its annual poverty and social exclusion report, Opportunity for all, and are also included as indicators of low income within the Fuel Poverty Strategy. The measure proposed here which includes all benefits received approximates to the before housing costs definition used in HBAI. The after housing costs definition of income used in HBAI is net of all housing costs i.e. the definition proposed here which excludes only those housing costs met by Housing Benefit or ISMI is not consistent with the approach taken for wider analysis of low income.

Annex 6B

Company Initiatives to tackle Fuel Poverty

6B.1 The Electricity Association Fuel Poverty Task Force was set up by the industry in May 1999 to consider energy-related actions to address fuel poverty that could be delivered through both the regulatory framework and the competitive market. The focus of the Task Force is on common issues requiring co-operation (e.g. sharing good practice), since - with competition being allowed to provide solutions wherever possible - suppliers are developing their own individual initiatives for commercial/social reasons (see below for some examples of this).

6B.2 The industry, through the Task Force, has funded a study of self-disconnection and rationing by prepayment meter customers, the findings of which were published in March 2001. This was followed in July 2001 by the publication of a booklet giving key facts on prepayment meters to encourage an informed debate about their use by low-income consumers. A guide for advice workers has also been produced, providing information on energy efficiency and payment advice services available from energy suppliers. The handbook also aims to demonstrate how a partnership approach can make these services more accessible to those most in need, such as the fuel poor.

6B.3 Following the publication in June 2001 of a major report (available electronically from www.electricity.org.uk), the Task Force's main role is to provide a convenient focus and resource for advice and assistance from the energy industry as required in helping the government to meet its fuel poverty targets. All the documents mentioned can all be downloaded from the Electricity Association's website at www.electricity.org.uk.

6B.4 The energy industry supports a wide range of social initiatives covering a variety of disadvantaged groups. Information on individual company initiatives can be found on their websites. The main schemes aimed directly at fuel poverty are set out below.

6B.5 **Warm Zones** bring together energy companies, local authorities, health authorities, local businesses and voluntary groups to target resources and expertise at specific areas over a three year period to tackle fuel poverty. Five zones have been launched and have attracted industry support in Stockton-on-Tees (supported by Transco), Northumberland (npower Electric), Hull (npower), Sandwell (npower) and the London Borough of Newham (London Electricity). Companies offer support to each zone through direct funding of the core management teams and by providing staff to the teams. Work in the zones will help to inform the future development of measures to tackle fuel poverty.

6B.6 **Transco's "Affordable Warmth Scheme"** programme uses an innovative application of lease finance to encourage the installation of high-efficiency gas central heating and energy efficiency measures. This new approach, which was developed by Transco, the national gas pipeline operator, required a change in the tax rules relating to the leasing of heating equipment, which was announced in the March 2000 Budget. The new rules mean that Affordable Warmth leases, which are targeted at local authorities and Registered Social Landlords, are available for fuel poverty and energy efficiency programmes that are financially attractive for both the landlord and tenant, because the installation is cheaper (owing to the lease basis and capital allowances) and can be financed more flexibly.

6B.7 As part of the programme Transco is also supporting training courses to meet the skills demand generated. To date, over 1,200 people have received training, and the company has pioneered three innovative gas sector schemes targeting people on benefits, on the New Deal programme, and those facing large-scale redundancy.

6B.8 **TXU** launched **Staywarm** in May 2000 and now has over 250,000 customers across the UK. The scheme offers pensioners a low fixed price for their energy, based only on the number of bedrooms in the household and occupancy. It does not relate to actual energy consumption. The price is guaranteed for 12 months, and there is no reconciliation at the end of the year and hence no build up of debt.

6B.9 **NESTMakers** is a joint **ScottishPower**/EAGA initiative which uses a neighbourhood approach, where trained advisers offer disadvantaged households the opportunity to heat their home more effectively through the provision of grants, competitive Gas & Electricity tariffs, flexible payment methods and a benefits health check.

6B.10 ScottishPower is also helping the HELPCo initiative via a package of energy services for domestic customers including energy efficiency measures, heating, energy monitoring & advice, and finance. Customers are able to take advantage of direct debit payment rates but keep their prefered payment method via this innovative ESCo arrangement. ScottishPower are also working in partnership with Transco in establishing the Lanarkshire Community Energy Partnership to deliver a broad range of energy efficiency and fuel poverty measures throughout the local authority areas of South and North Lanarkshire. The Partnership has been funded for a period of three years and is aimed at improving heating and insulation standards in housing using a variety of different funding sources."

6B.11 **British Gas** has a number of programmes with social objectives. Its link with Help the Aged, supports a range of activities to improve the quality of life for vulnerable older people, including the insulation and upgrade of day centres, provision of products and services to reduce bogus caller crime, and some installation of energy efficiency measures in particular hardship cases. The support is not tied to the supply of gas.

6B.12 British Gas has now extended its Warm-a-Life scheme to 2.4 million of its disadvantaged customers during 2002. The scheme helps households at risk from fuel poverty through referral to energy efficiency grant schemes (which could lead to a direct reduction in bills), a free benefits check, free in-home energy audit, Capped price electricity until January 2004 and two discounts of £5 off their gas account.

6B.13 With the Bank of Scotland, British Gas has introduced the 'Jigsaw' account to provide for its low income customers, who live by cash. These are special bank accounts which enable them to get cheaper fuel through access to direct debit terms without changing payment behaviour. British Gas has also established a national team of field-based Community Energy Advisers who are working in partnership with local charities, organisations and agencies in the development and delivery of new initiatives and schemes to tackle fuel poverty at a local level.

6B.14 **Powergen** has worked with **Age Concern** Energy Services, to develop an energy product for the elderly. Marketed through Age Concern's network of local groups it offers a comprehensive package including energy efficiency advice, free carbon monoxide detector and hypothermia thermometer, low energy light bulbs and to gas customers aged 60 and over, a cold weather payment equivalent to 2 hours free gas fire heating for every day that the temperature falls below zero in December, January and February.

6B.15 **London Electricity (LE)** and **SWEB** are piloting two **Powerkeyplus** schemes, in Newham and Plymouth, to eliminate the premium paid by prepayment customers. LE, together with other energy companies, has also funded Helpco, a finance operation which enables subscribers who do not have bank accounts to benefit from the discounts available to customers paying their bills by monthly direct debit. Low cost loans are also made available to customers with outstanding debts. LE is also working with Ofgem to consider a series of practical solutions for vulnerable customers such as the elderly, people with disability and those on low incomes. This involves working closely with local authorities and charities to help, particularly through the provision of low cost energy efficient light and electrical appliances

6B.16 The "**Health Through Warmth**" scheme is funded by **Innogy** and operated by its retail brand npower. This 10 million pound initiative is aimed at people suffering ill health caused by their living conditions. In partnership with the NHS,NEA ,Local authorities, Community groups and Charitable organisations. The scheme provides training for district nurses, health visitors, and key community workers and also includes voluntary sector workers. Training is designed to help workers identify people suffering ill health caused by their living conditions. A simple referral mechanism ensures that assistance goes to the people who need it most. A referrals team drawn from the partner organisations provides grants and monetary advice to the most vulnerable people, making their homes both more acceptable to live in and, at the same time, providing energy efficient measures, helping to lower their energy bills. This enables people to keep warmer throughout the winter periods. Following two successful pilot schemes in the West Midlands, Health Through Warmth launched the scheme into three additional areas in September 2001. This year (2002) an additional 10 schemes will be launched Nationally .The scheme will eventually be available in 20 NHS areas across England and Wales, with a target of training in excess of 20,000 health /key workers Nationally and assisting 300,000 homes .One of the aim of the Health Through Warmth programme is to achieve sustainability .

6B.17 **SEEBOARD** has developed two new fuel poverty initiatives. Firstly, it wholly funds the EnergyCare Network, a programme managed by the Energy Conservation and Solar Centre, which aims to make vulnerable householders aware of the grants they are entitled to and to help them make their homes more energy efficient. The Network will train key people such as Health Visitors and Social Workers (Networkers) to spot households in need of assistance and to refer clients to the Energy Care Network for further help. The programme is beginning in the Medway area and will spread through Kent, Sussex, and large parts of Surrey.

6B.18 Secondly, with the national fuel poverty organisation NEA (National Energy Action), SEEBOARD is running a project to evaluate the potential for linking energy efficiency improvements in fuel poor homes to an initiative to transfer customers from prepayment meters to credit meters. Other objectives include identification of energy efficiency options in fuel poor homes, provision of regular information about their energy consumption, provision of high bill warnings, and cash back incentives for those prepayment customers staying out of debt

6B.19 **Scottish and Southern Energy's Equigas** scheme charges all customers the same price for their gas (with no standing charge), regardless of their payment method: this means that in effect direct debit and quarterly credit customers pass some of their savings on to prepayment meter customers, whose charges are therefore cheaper than the normal prepayment meter tariff. The company has just launched an Equipower equivalent for electricity consumers. It also runs a Budget Warmth scheme which is designed to provide at least one warm room throughout the winter months via an electric storage heater in the main living room, with the cost spread evenly over the year.

Annex 6C
A Summary of Ofgem's Social Action Plan

6C.1 The Government asked the Regulator to develop a Social Action Plan for Great Britain. After extensive consultation the Regulator published a plan in March 2000. It is a framework for action across a wide range of activities to ensure that the economic benefits of liberalisation are spread fairly among vulnerable and disadvantaged customers. In order to tackle fuel poverty, and play its part, Ofgem is fully committed to taking forward this action plan.

6C.2 The Social Action Plan has four main strands of activity:

- Revision of gas and electricity licence conditions to provide enhanced protection for disadvantaged customers. As a result of these companies have to: offer their customers facilities to pay bills in cash fortnightly or more frequently; operate codes of practice which set out the services prepayment meter customers should expect; and improve the promotion of the help available e.g. energy efficiency advice, special services for vulnerable customers, and help to prevent disconnection for debt.

- Initiatives to drive down the cost of keeping warm for disadvantaged customers through price reductions and to ensure that wherever possible barriers to competitive market supply are removed and encouragement given to new initiatives. The new price controls introduced by Ofgem in April 2000 have meant price reductions for those customers paying by standard credit or prepayment methods. Ofgem's continuing support for the EEC (formerly Energy Efficiency Standards of Performance programme) will contribute towards provision of warmer homes for disadvantaged customers. Work is also ongoing on improving the provision of information on prices with particular regard to disadvantaged customers, and improving access to competitive markets for those customers in debt.

- Promoting research to explore issues and suggestions raised during consultation on the draft plan. This will encourage companies to understand the needs of disadvantaged customers. Research issues recently completed, or being investigated at present include payment patterns and preferences of customers, ways of helping vulnerable customers and participation in credit unions.

- Enhanced monitoring of progress of action taken under the plan with the establishment of a Review Group to help monitor activity.

Annex 6D

The effects of changes in income on the numbers in fuel poverty in England

Estimates for 2002

6D.1 Work is ongoing to measure the numbers in fuel poverty in England. It is hoped that the results from the 2001 English House Condition Survey will be available later this year to feed into the Government's first Annual Update of the UK Fuel Poverty Strategy. In the meantime, some figures have been modelled for 2002 which present broad estimates of the impact that key income policies implemented up to 2002 may have had on the number of households in fuel poverty.

6D.2 The broad estimates must be treated with some caution for a variety of reasons. The analyses are based on the 1998 Energy Follow Up Survey data and as such they do not take account of energy efficiency improvements made to the housing stock since 1998. The analyses assume that the household composition is as at 1998. No account has been taken of the aging of the population, i.e. there will be some householders who will have retired (or seen another change in their financial situation) since 1998 and this has not been taken into account. Even given these caveats, the estimates do help to focus on the main issues which need to be addressed to tackle fuel poverty. More information is needed, particularly on what the impacts of the various programmes in place are, and on how well they target the appropriate households.

6D.3 The broad estimates should be considered alongside earlier work done to estimate the numbers in fuel poverty in England in 2000. These 2000 estimates were also based on the 1998 Energy Follow Up Survey data and considered overall income changes in the period from 1998 to 2000 alongside changes in energy prices in that period. The overall income changes were provided from the Department of Work and Pensions Households Below Average Income Series and do need to be treated with some caution because of sampling constraints. More information on the 2000 estimates can be found at http://www2.dti.gov.uk/energy/consumers/fuel_poverty/9900estimates_england.pdf. The data for 2002 works from the same 1998 information and used the same prices information since more recent prices information was not available in time to feed into the modelling work. More recent data on overall income changes was also not available, so six key income benefits were used to estimate the impact of income policies up to 2002 on the numbers in fuel poverty.

6D.4 Reductions in energy prices and increases in incomes have together had a significant impact on the numbers in fuel poverty in recent years. The Fuel Poverty Strategy set out the estimated impact of these changes between 1996 and 2000. This Annex sets out the potential impact that key changes in income policies implemented between 1998 and 2002 may have had on the number in fuel poverty compared to the position in 1998. The figures are summarised in Table 6D.1. The table shows that over the period 1998 to 2002 it is estimated that 1 million households could have been taken out of fuel poverty, leaving 2.3 million households in England in fuel poverty in 2002. Given that the earlier analysis of fuel poverty in England in 2000 showed about 0.5 million households were removed by income changes and fuel prices from 1998 to 2000, this means that a further 0.5 million households could have been removed from fuel poverty by key income policies over the period from 2000 to 2002. The most significant impacts have been through the Minimum Income Guarantee and changes to the retirement pension, as Table 6D.1 illustrates.

Table 6D.1 Estimated impacts of key income policies over the period 1998 to 2002 and fuel price changes between 1998 and 2000[1] on the total number of households in England in fuel poverty (thousands)[2,5]

	All households	Pensioner households
Number of households in fuel poverty in 1998	3,280	1,850
Number of households removed from fuel poverty by income measures[3]	840	740
Of which would be removed by changes in:		
Winter fuel payment	80	80
TV licence for 75 years+	40	40
Minimum income guarantee for single pensioners/pensioner couples	460	460
Change in retirement pension for pensioners	340	340
WFTC impact (no change in wages)	20	-
National Minimum Wage	100	-
Number of households removed from fuel poverty by income measures and price changes[4] combined	1,020	880
Number of households remaining in fuel poverty despite these income measures and price changes	2,260	980

[1] Takes account of average changes in fuel prices between 1998 and 2000. More up to date figures are not currently available in the required format.
[2] Key income policies and energy price changes have been imposed upon data on the fuel poor in England in 1998 (from the Energy Follow Up Survey) These figure are based on the assumption that all of those eligible to benefit from the income policies implemented do so.
[3] Combined impacts of Winter Fuel Payment, free TV licence for those over 75, Minimum Income Guarantee, change in retirement pension, and National Minimum Wage.
[4] The total number of households taken out of fuel poverty as a result of the income policies listed takes account of the combined effects of these policies e.g. it includes households removed from fuel poverty by the combination of policies, and removes double counting of households taken out of fuel poverty by more than one of the policies alone.
[5] Where figures for the numbers taken out of fuel poverty have been less than 20,000; these have not been listed separately

6D.5 The position of pensioners is of particular interest and is set out separately in Table 6D.1. The changes in income policies (such as the Minimum Income Guarantee, winter fuel payment etc), combined with changes in energy prices, could have resulted in the number of pensioner households in fuel poverty being almost halved. But this assumes that all those eligible for the Minimum Income Guarantee (MIG) claim this benefit. Information available on other benefits indicates that there is significant underclaiming, particularly amongst pensioners (e.g. over a quarter of pensioners eligible for income support do not claim it). DWP have research in hand to examine the underclaiming of MIG.

Households in fuel poverty

6D.6 Many households, particularly elderly households, do not claim all the benefits to which they are entitled - for example, over a quarter of pensioners eligible for income support do not claim it. Such households have lower incomes than they should, and may also not be eligible for Warm Front grants, increasing the risk of them being in fuel poverty unnecessarily.

6D.7 The wider take up of benefits and of cheaper fuel tariffs therefore needs to be promoted in order to maximise on the impacts of these factors on tackling fuel poverty, and to ensure that all those who should benefit from schemes such as Warm Front and EEC are eligible to do so. But this will not necessarily do much to help those who have expensive heating systems or homes which cannot be insulated under these schemes as currently constituted.

6D.8 Various factors can determine whether low-income households are in fuel poverty. Table 6D.2 shows that, for some households, insulation measures and central heating cannot remove them from fuel poverty if they do not have cavity wall insulation or gas central heating. The method used to pay for their fuel can also have a significant impact: those paying for their fuel by direct debit with a non-home supplier can pay around £100 a year less than those on pre-payment meter terms with a home supplier.

6D.9 Based on the analysis in Table 6D.2, the following broad picture emerges:

- pensioner couples with income at Minimum Income Guarantee (MIG) level and families not in paid employment will not be fuel poor if their bills are somewhere around an average of £500-600 a year (which assumes good insulation and gas central heating), or even a bit more than this;

- single pensioners on MIG who get Housing Benefit should also not be fuel poor on average level bills;

- pensioners without Housing Benefit (i.e. who do not pay rent) are at risk of falling into fuel poverty, especially if they have higher-than average fuel bills (which is likely if they do not have cavity wall insulation and gas central heating);

- households on low incomes without gas central heating or in hard-to-heat homes have a more severe risk of fuel poverty.

Table 6D.2 Necessary fuel expenditure as a percentage of income for selected low income groups in properties with loft insulation but no cavity wall insulation[1,2,3,6]

	Gas central heating (high efficiency)[4]	Electric storage heating[5]
Not including housing benefit in income:		
Single pensioner at Minimum Income Guarantee level		
Pre-payment meter terms with incumbent suppliers	12%	18%
Direct debit terms with non-home supplier	10%	17%
Pensioner couple at Minimum Income Guarantee level		
Pre-payment meter terms with incumbent suppliers	8%	12%
Direct debit terms with non-home supplier	6%	11%
Family (2 adults & 2 children), not in paid employment		
Pre-payment meter terms with incumbent suppliers	7%	11%
Direct debit terms with non-home supplier	6%	10%
Including housing benefit in income[7]:		
Single pensioner at Minimum Income Guarantee level		
Pre-payment meter terms with incumbent suppliers	8%	13%
Direct debit terms with non-home supplier	7%	12%
Pensioner couple at Minimum Income Guarantee level		
Pre-payment meter terms with incumbent suppliers	6%	10%
Direct debit terms with non-home supplier	5%	9%
Family (2 adults & 2 children), not in paid employment		
Pre-payment meter terms with incumbent suppliers	6%	9%
Direct debit terms with non-home supplier	5%	8%

[1] Based on a heating pattern of 16 hours per day for a property that is semi detached with a floor area of 89m^2, whole house heating and living area temperature of 21ºC. Source: BRE. Assumes 3,842 kWh per annum for light and appliances.
[2] Uses average 2001 prepayment meter and direct debit bills information for home suppliers and non-home suppliers respectively.
[3] Assumes that 10% of the energy required for heating/hot water is consumed at the day rate and 90% at the night rate.
[4] Gas boiler efficiencies assumed at 90% (the starting rate for A rated boilers)
[5] The figures shown assume no cavity wall insulation. When cavity wall insulation is assumed, a pensioner couple using electricity central heating using a prepayment meter with their incumbent supplier could pay 10 per cent of their income on necessary fuel to keep warm, with pensioner couples on direct debit with a non-home supplier could pay 9 per cent. Comparable figures for a family (2 adults & 2 children), not in paid employment are 9 per cent and 8 per cent respectively.
[6] The data in this table is based on the following annual income assumptions:
- Single pensioner at MIG level: £5,304 (without housing benefit) and £7,488 (with housing benefit)
- pensioner couple at MIG level: £7,990 (without housing benefit) and £10,174 (with housing benefit). MIG level may be higher if the householder is disabled, a carer or receiving Child Benefit. Figure includes £200 for winter fuel payment.
- 2 parents plus 2 children, not in paid employment: £8,653 (without housing benefit) and £11,305 (with housing benefit) - both children assumed to be under 16 years of age.

[7] Average 2001 local Authority rent figures used for each family type presented, uprated to 2002. There are considerable regional variations in average Local Authority rent e.g £37 per week (£1,924 per annum) in Yorkshire and the Humber compared to £60 per week (£3,143 per annum) in London; a difference of £23 per week (£1,221 per annum).