ENERGY CONSUMPTION IN THE UNITED KINGDOM

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Introduction

Energy forms a key part of our everyday lives. We need energy to switch on our lights, drive our cars, make the products we use and keep warm in winter in our homes and workplaces. As our economy grows, demand for energy increases as the number of appliances we own increases and we demand more functionality from new products. We need good quality statistics to understand the underlying trends in energy consumption since our energy use has a big impact on our environment.

This publication looks at energy consumption and how it has changed over the last 30 years, with a focus on changes over the last ten years. It considers some of the drivers that have influenced energy consumption, updating some of the data that were published in Energy Paper 66, 'Energy Consumption in the United Kingdom' in 1997. This booklet provides an overview of the key trends and factors affecting energy consumption in five short chapters. Chapter 1 looks at overall energy consumption, while Chapters 2 to 5 look at each of the transport, domestic, industrial and service sectors respectively. Detailed tables containing more information about energy consumption can be found on the DTI website.

The main purpose of this publication is to provide data on energy consumption patterns. It contains data that are published in the annual Digest of UK Energy Statistics alongside information from other organisations that help us to understand some of the more detailed trends within the totals. Some of the data contained in this publication are analyses that have been carried out by the DTI and methodological notes detailing how these calculations were made can be found in the methodological annex at the end of this publication.

It is intended that the data that appears on the internet will be updated on an annual basis, while the paper publication will appear every few years.

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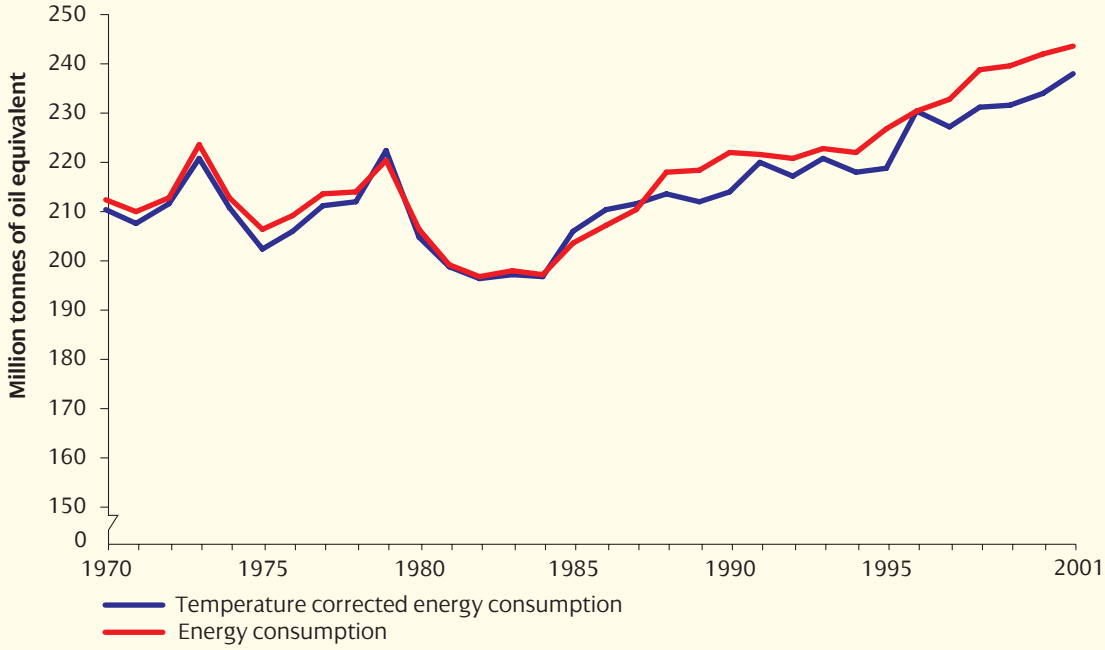
Chapter 1: Overall energy consumption

Overall energy consumption

1.1 Energy consumption in 2001 was higher than in any other year over the last thirty years. Overall energy consumption for energy use in the UK has increased by 13 per cent since 1970 and by 11 per cent since 1990. Since energy consumption is partly dependent on the weather, in a cold year more energy is consumed to maintain a consistent internal temperature than in a warmer year, energy consumption is adjusted for temperature to identify the underlying trend. On this basis, energy consumption increased by 15 per cent between 1970 and 2001 and by 10 per cent between 1990 and 2001. Chart 1.1 shows how energy consumption has changed over the last thirty years on both unadjusted and temperature corrected bases.

Chart 1.1
Total primary energy consumption, 1970 to 2001

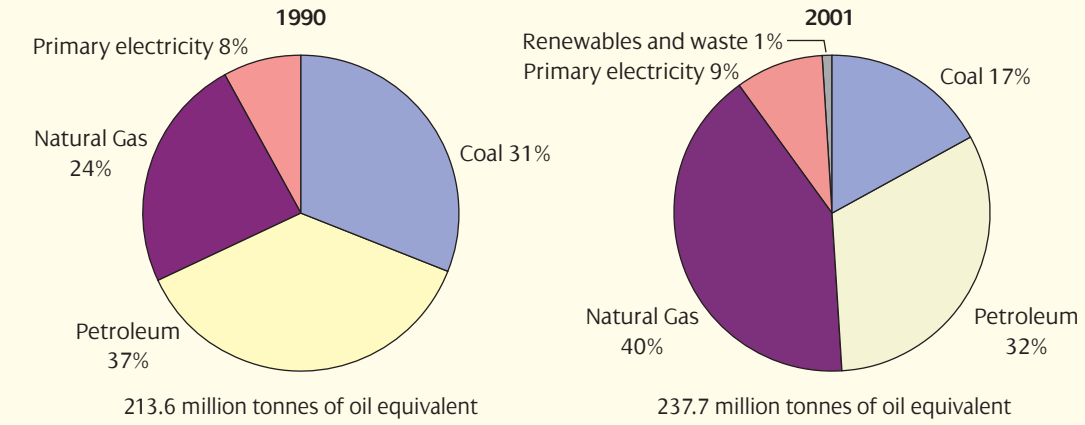


Source: DTI

- Primary energy consumption increased by 13 per cent between 1970 and 2001 and by 11 per cent between 1990 and 2001.
- On a temperature corrected basis, energy consumption increased by 15 per cent between 1970 and 2000 and by 10 per cent between 1990 and 2001. Over the last 20 years it has been steadily increasing at about 1 per cent a year.

1.2 Chart 1.2 shows how much fuel was consumed in 1990 and 2001. In 2001 natural gas made up two-fifths of all energy consumption in the UK. Since 1990, while use of natural gas has increased by 86 per cent, solid fuel consumption fell by 38 per cent and accounted for 17 per cent of all fuel consumed in 2001. The increase in natural gas consumption is due to its use in generating electricity, Combined Cycle Gas Turbine power stations were introduced in 1992.

Chart 1.2
Primary energy consumption by fuel, 1990 and 2001

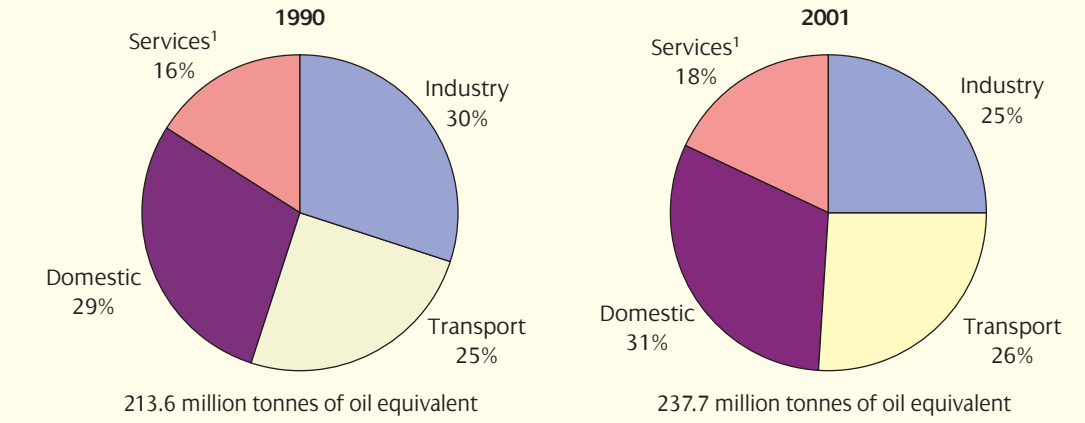


Source: DTI

- Natural gas contributed towards 40 per cent of total primary energy consumption in 2001.
- Petroleum contributed towards 32 per cent of total primary energy consumption in 2001.

1.3 The total amounts of energy consumed by sector in 1990 and 2001 (in primary energy equivalents) are shown in Chart 1.3. Industrial energy consumption fell by 5 per cent between 1990 and 2001 while energy consumption in the transport, domestic and service sectors increased by 18 per cent, 17 per cent and 19 per cent respectively. In primary energy equivalents in 1990 industry was the largest sub-sector, followed by the domestic sector. A decade later the domestic sector was the largest, with transport second. Paragraph 1.6 provides more information about the contribution that each sector makes in final energy terms.

Chart 1.3
Final energy consumption, by sector, in primary energy equivalents, 1990 and 2001



Source: DTI

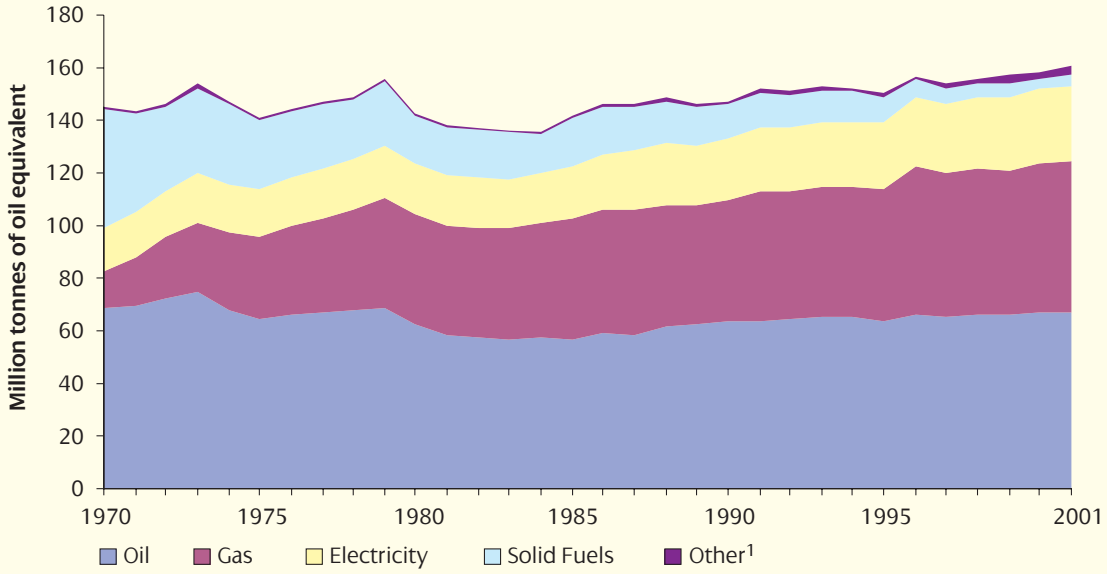
1. Includes agriculture.

- The domestic sector contributed towards 31 per cent of final energy consumption, in primary energy equivalents in 2001.
- The transport sector contributed towards 26 per cent of final energy consumption, in primary energy equivalents in 2001.

1.4 Some of the fuel consumed in the UK is transformed into electricity and other manufactured fuels, which result in energy losses. On average for every 2½ energy units of fuel that goes into power stations, approximately 1 energy unit of electricity is produced. Since electricity is used for a wide range of uses and trends in electricity consumption determine the levels of energy required to generate it, the rest of this chapter focuses on final energy consumption. Final energy consumption covers the final fuels that are consumed by users so the final amounts of electricity and manufactured solid fuels are measured rather than the amount of fuel used to generate or manufacture them.

1.5 Final energy consumption in the UK in 2001, shown in Chart 1.4, was at a higher level than any in other year over the last thirty years. Overall energy consumption has increased by 10 per cent since 1970 and by 9 per cent since 1990. The fuel mix has changed significantly since 1970 as natural gas consumption has replaced coal. In 1970 natural gas accounted for 3 per cent of total overall final energy consumption and in 2001 for 36 per cent. Electricity consumption has increased by 74 per cent over the period. Over the last 20 years it has grown steadily at 2 per cent a year.

Chart 1.4:
Final energy consumption by fuel, 1970 to 2001



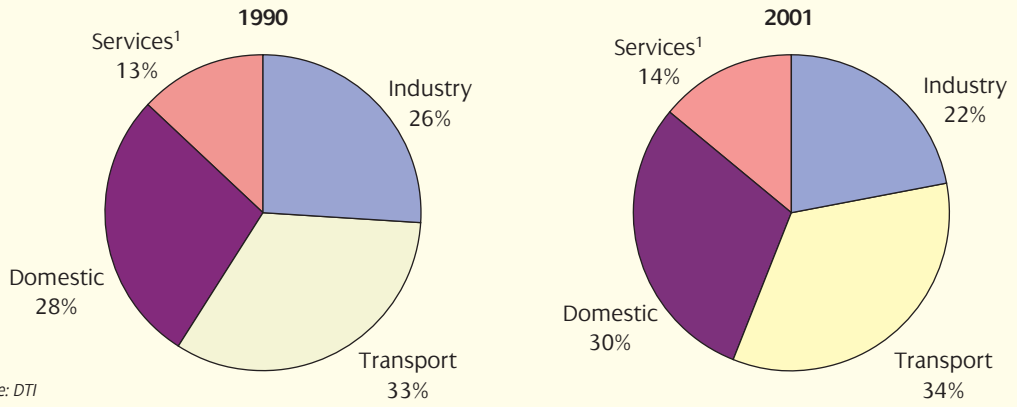
Source: DTI
1. Includes coke oven gas, heat, renewables and waste.

- Gas energy consumption (including town gas in 1970) increased by 300 per cent between 1970 and 2001
- Consumption of solid fuels has fallen by 90 per cent between 1970 and 2001.

1.6 In final energy terms by sector (rather than primary energy equivalents which were discussed in paragraph 1.3), the transport sector was the largest single consumer of energy in 2001, accounting for 34 per cent of the total. The domestic sector was responsible for a further 30 per cent and industry for another 22 per cent. The remaining 14 per cent was consumed by the service sector (13 per cent) and the agriculture sector (1 per cent). Chart 1.5 shows that since 1990, the contribution that each of these sectors has made to overall energy consumption has not changed greatly, although

there have been more major changes since 1970, reflecting the shift from energy-intensive industry to the service sector and growth in the transport sector.

Chart 1.5
Percentage sector shares in total energy consumption, 1990 and 2001

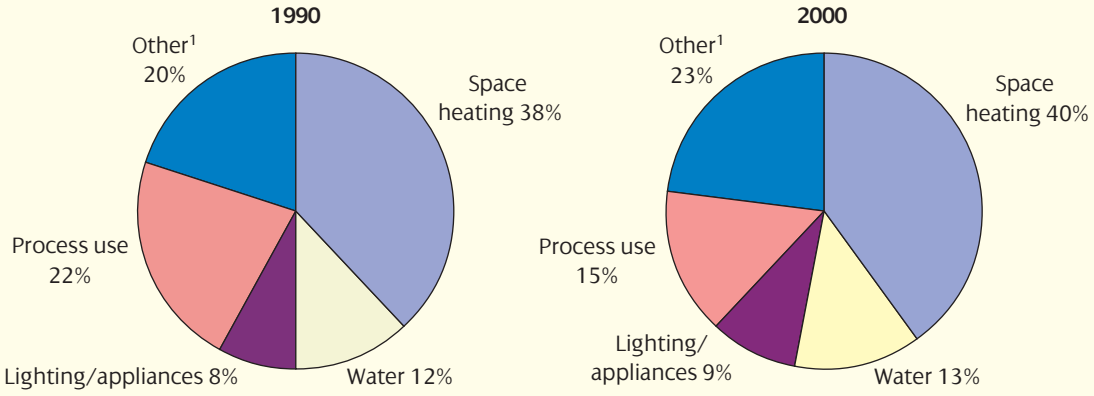


Source: DTI
1. Includes agriculture.

- The transport sector contributed towards 34 per cent of overall energy in 2001.
- The domestic sector contributed towards 30 per cent of overall energy in 2001.

1.7 The amount of energy consumed by each sector can be analysed by how it is used. In 2000, 40 per cent was used for space heating, and 15 per cent for process use. Space heating and hot water accounted for 82 per cent of domestic use of energy and 64 per cent of commercial use of energy in 2000. Chart 1.6 shows how energy consumption by end use changed between 1990 and 2000.

Chart 1.6
Final energy consumption by end use, 1990 and 2000



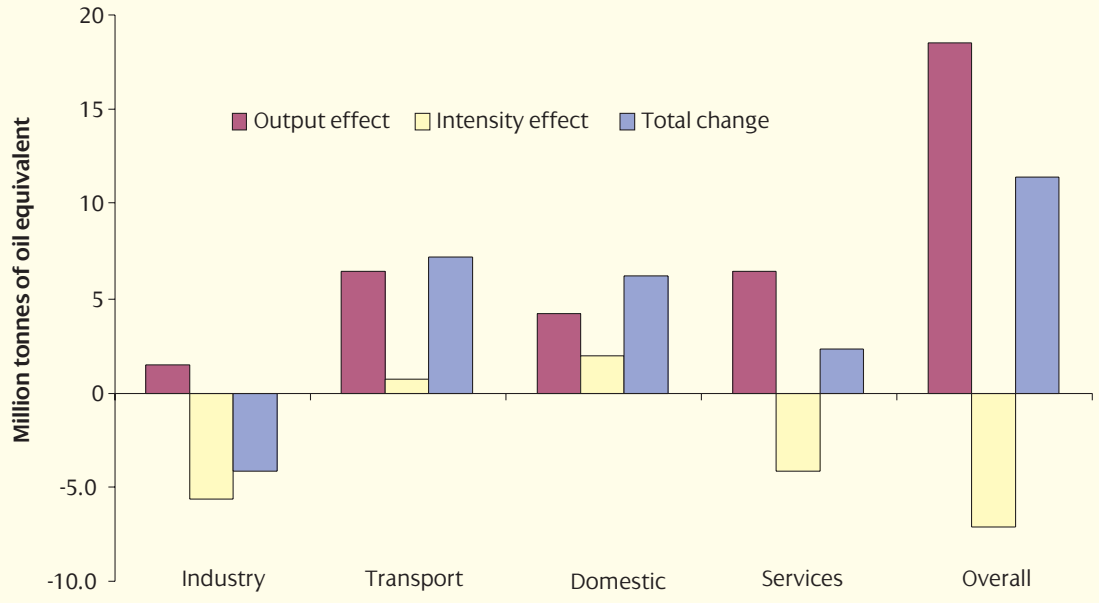
Source: DTI estimates derived from data provided by FES and BRE
1. Includes cooking, catering, motors, drivers, drying and separation.

- Space heating contributed 40 per cent of all non-transport energy consumption in 2000.
- Process use contributed 15 per cent of all non-transport energy consumption in 2000.

Factors affecting overall energy consumption

1.8 Overall energy consumption increased by 11.4 million tonnes of oil equivalent between 1990 and 2000. If the energy required to produce a unit of output was the same in 2000 as in 1990, then it is estimated that energy consumption would have risen by an additional 7.1 million tonnes of oil equivalent. This 7.1 million tonnes of oil equivalent is due to a combination of structural change and changes in efficiency (called an intensity effect). The difference between the intensity effect and the actual value, an increase of 18.5 million tonnes of oil equivalent, can be attributed to changes due to output. The largest fall in intensity, of 5.6 million tonnes of oil equivalent, occurred in the industrial sector. The service sector also experienced a fall in intensity of 4.1 million tonnes of oil equivalent. Increases in output in both the transport and domestic sectors resulted in increased energy consumption of 6.4 and 4.2 million tonnes of oil equivalent respectively. The next section describes the change in intensity in more detail.

Chart 1.7
Factors affecting changes in final delivered energy by sector between 1990 and 2000



Source: DTI estimates

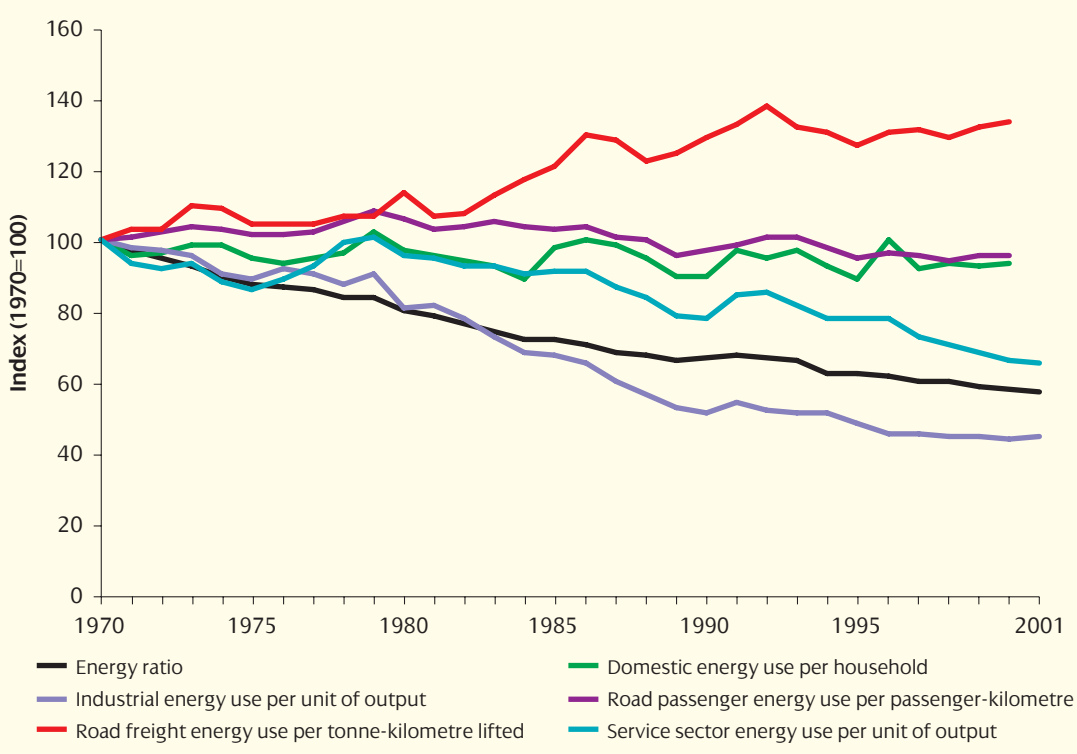
- Of the overall increase in energy consumption between 1990 and 2000 of 11.4 million tonnes of oil equivalent, it is estimated that changes due to output resulted in an increase of 18.5 million tonnes of oil equivalent which was partly offset by a fall in intensity of 7.1 million tonnes of equivalent.

Energy intensity

1.9 As the economy grows and activity increases within the economy it is usually associated with rises in the production, transportation and consumption of goods and services all of which require energy. Output from the economy is measured using a constant measure of Gross Domestic Product (GDP) to remove any inflation effects. Between 1970 and 2001, GDP in the UK more than doubled. The energy ratio measures the relationship between GDP and energy consumption and has fallen steadily over the period, at approximately 2 per cent each year since 1970, and by 2001 it was 57 per cent of its

1970 value. This downward trend in energy intensity can be explained by a variety of factors: improvements in energy efficiency; fuel switching; a decline in the relative importance of energy intensive industries; and the fact that some industrial uses, such as space heating, do not increase in line with output. The energy ratio is shown in Chart 1.8.

Chart 1.8
Sectoral energy intensity indicators, 1970 to 2001



Source: DTI, ONS, DFT

- Industrial energy consumption per unit of output has fallen by 55 per cent between 1970 and 2001.
- Road freight energy consumption per tonne-kilometre lifted increased by 33 per cent between 1970 and 2000.

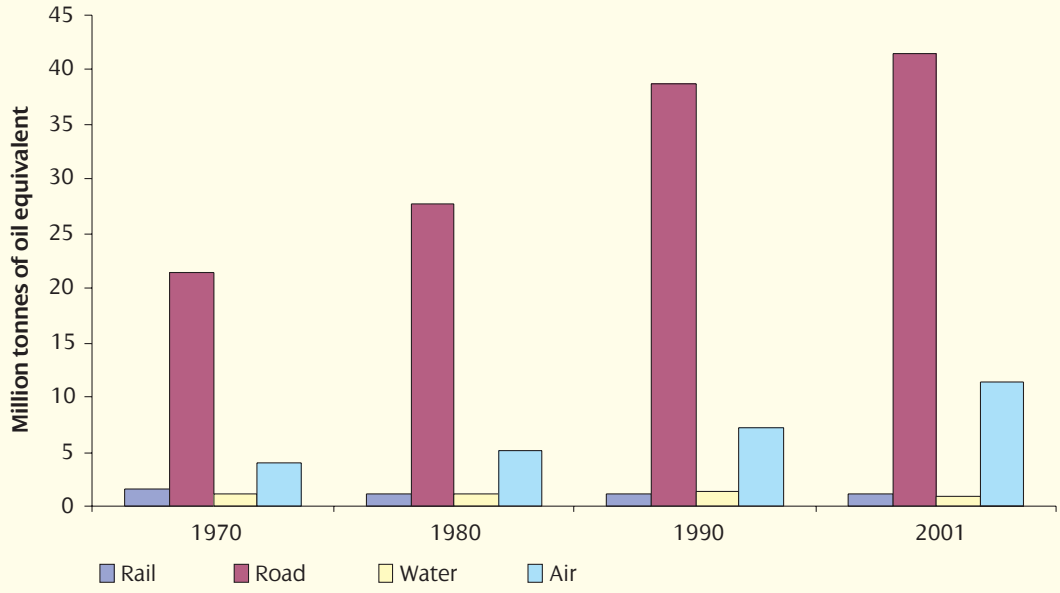
1.10 Measures of energy intensity by sector can be calculated using Gross Value Added (which contributes to the overall measure of Gross Domestic Product) for the industrial and service sectors, by the number of households for the domestic sector (population and household income are alternative measures), by the distance travelled for the road passenger transport sector and by the distance travelled and weight carried for the road freight transport sector. These intensities are also presented in Chart 1.8. Industrial energy intensity has fallen more quickly than the intensities in the other sectors between 1970 and 2001, mainly due to structural change within the sector as more energy-intensive industries have been replaced with less energy-intensive industries. Energy intensity in the domestic sector (measured in terms of households here) has remained fairly steady over the period, despite some fluctuations. More information on the trends behind these figures and drivers of energy consumption can be found in each of the chapters that follow, taking each sector in turn.

Chapter 2: Transport energy consumption

Transport energy consumption

2.1 Transport forms a key part of our everyday lives, the products that we buy are often transported over long distances and the use of transport provides greater opportunity for personal travel than would exist in its absence. Transport energy consumption has increased by 95 per cent since 1970 and by 13 per cent since 1990. In 2001 54,932 thousand tonnes of oil equivalent were consumed in the transport sector, three quarters of which was consumed for road transport. Chart 2.1 shows the increases in energy consumption by the transport sector over time and shows the increasing amount consumed for air transport, accounting for 21 per cent of all energy consumed in the transport sector in 2001. Between 1990 and 2001, energy consumption increased by 56 per cent in the air transport sector, by 8 per cent in the rail transport sector and by 7 per cent in the road transport sector.

Chart 2.1
Transport energy consumption by type of transport, 1970, 1980, 1990 and 2001



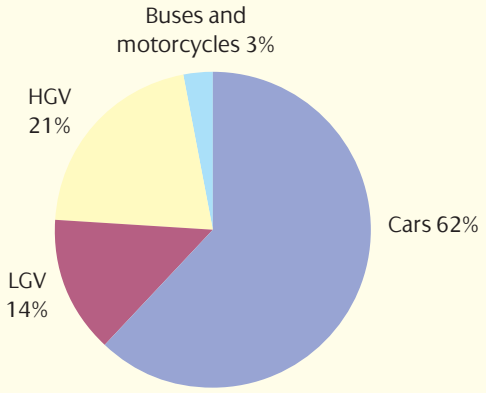
Source: DTI

- Transport energy consumption has almost doubled since 1970.
- The largest increase has been from air transport, which has nearly tripled since 1970.
- Energy consumption from rail and water transport has fallen over the last 30 years by 25 per cent and 34 per cent respectively, whereas consumption from road transport has almost doubled.

2.2 Transport can be considered in two ways, in terms of people (passengers) and in terms of goods (freight). While it is difficult to split rail, water and air transport into clear breakdowns of passenger and freight, it is more straightforward to calculate a breakdown for road transport. Of the 41,451 thousand tonnes of oil equivalent consumed for road transport in 2001, it is estimated that 66 per cent was from road passengers and 34 per cent from road freight. Since 1990, road freight energy consumption has increased by 17 per cent whereas road passenger energy consumption has increased by just 1 per cent.

2.3 Chart 2.2 shows road transport energy consumption by different types of road vehicle in 2000. Between 1990 and 2000, energy consumption increased by 1 per cent for cars, by 26 per cent for light goods vehicles and by 14 per cent for heavy goods vehicles.

Chart 2.2
Road transport energy consumption by type of road vehicle, 2000



Source: NETCEN

- Cars accounted for nearly two thirds of all road transport energy consumption.
- Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs) accounted for a further 36 per cent of the total.

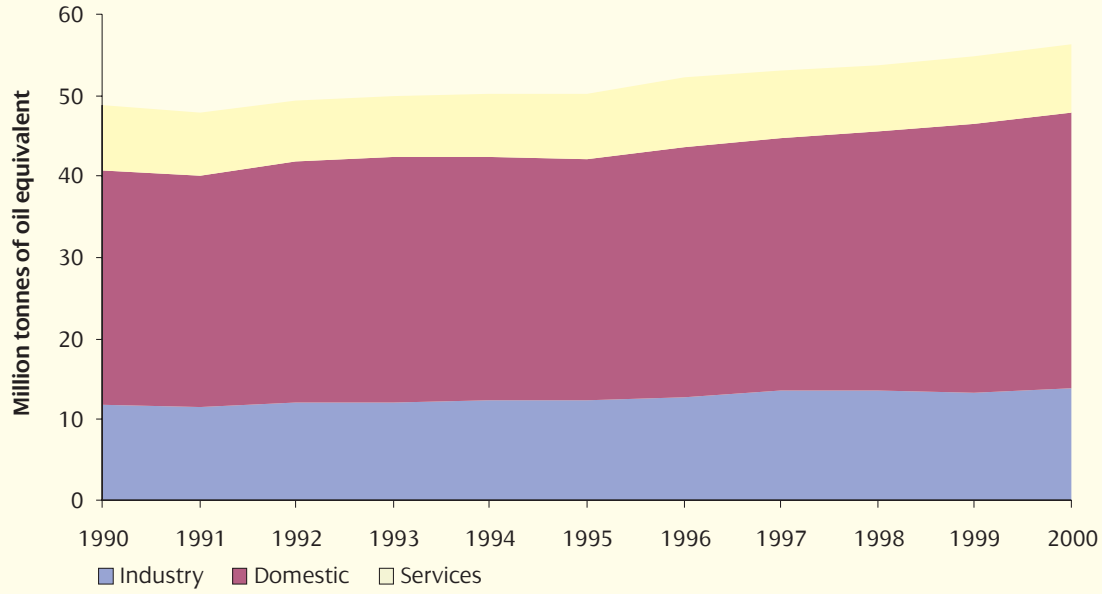
2.4 The transport sector is fundamentally different to the other sectors covered in this publication since demand for transport does not come from the transport sector itself. Transport is used to support activities in the industrial, service and domestic sectors. To show which sectors are responsible for consuming energy for transport use, an analysis to re-allocate transport energy consumption to the individual sectors has been carried out and the details of the methodology used can be found in the methodological annex. Chart 2.3 shows that in 2000 60 per cent of all transport energy demand was from the domestic sector, 24 per cent from the industrial sector, and 15 per cent from the service sector.

Factors affecting Transport energy consumption

2.5 Changes in transport energy consumption can occur for efficiency, technological or economic reasons. Chart 2.4 shows how changes between 1990 and 2000 can be attributed to increased transport use (the output effect which measures how much energy consumption changed as a result of increased demand for transport) and to changes in structure and efficiency (called the intensity effect). Of the overall change in the transport sector between 1990 and 2000, it is estimated that 90 per cent was due to changes in output while the remaining 10 per cent was due to intensity changes. The greatest output effect was from air transport, while the largest fall in intensity was from road passenger transport.

Chart 2.3

Transport energy consumption reallocated to the domestic, industrial and service sectors

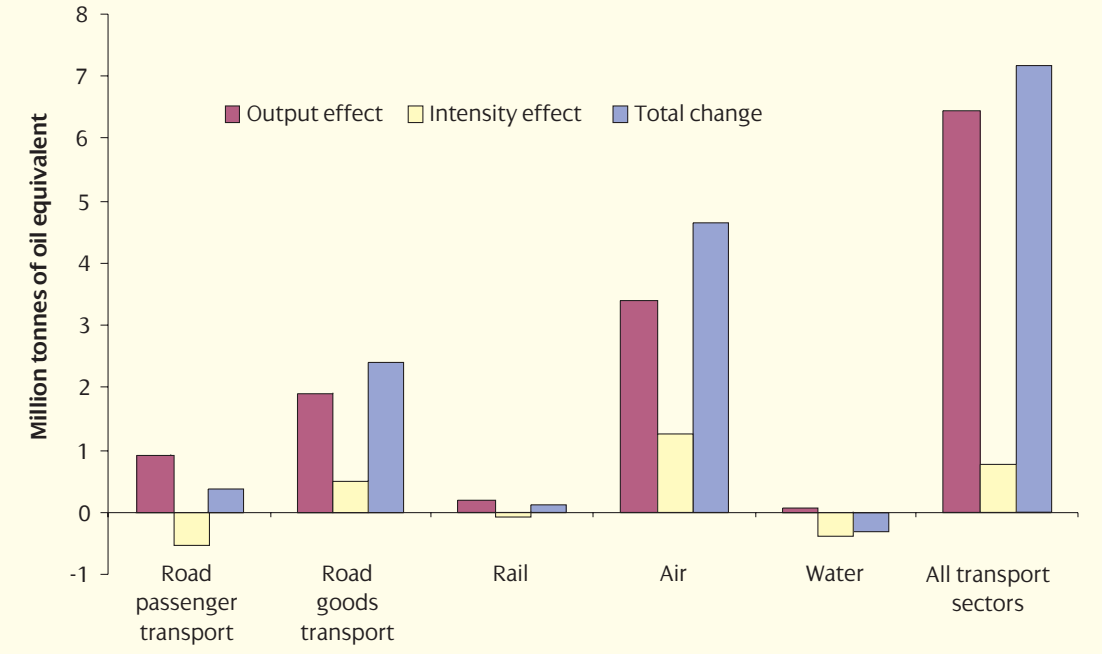


Source: DTI estimates

- In 2000, 60 per cent of all energy consumed for transport was driven by demand from the domestic sector.
- Since 1990, domestic sector energy demand for transport has increased by 17 per cent.

Chart 2.4

Factors affecting changes in transport energy use between 1990 and 2000



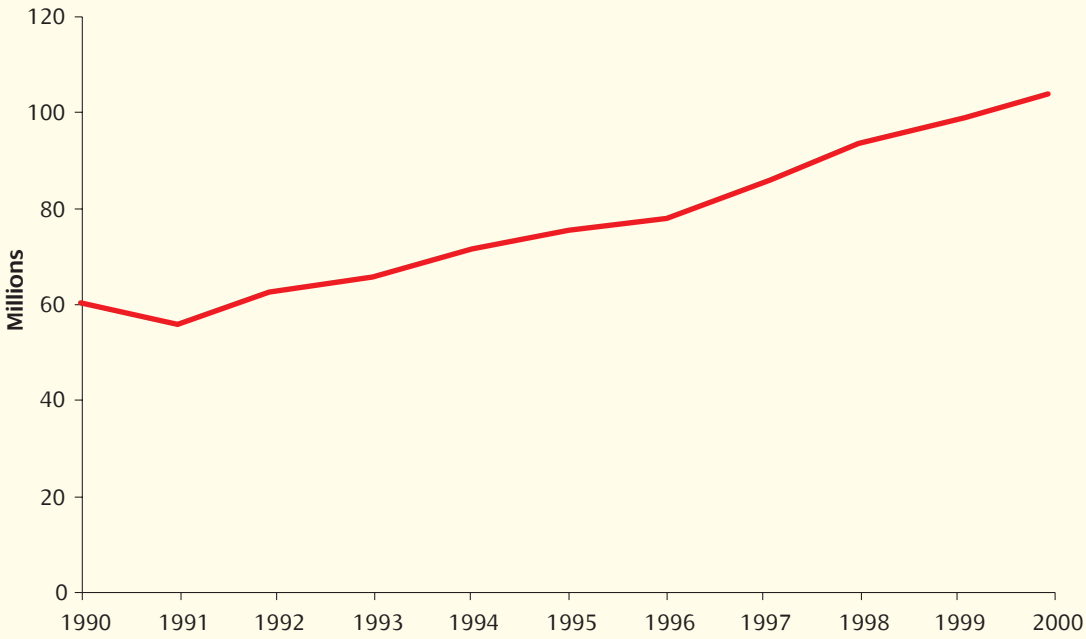
Source: DTI estimates

- Of the overall change in transport energy consumption between 1990 and 2000 of 7.2 mtoe, it is estimated that 6.4 mtoe was due to changes in output while the difference was due to an increase in energy intensity.

Increased demand for travel

2.6 Energy consumption by air transport has increased due to improvements in airline design and technology, the continued growth of trade, and the rise in leisure travel over the last thirty years, as shown in Chart 2.5. There has been a 73 per cent growth between 1990 and 2000 in total passengers lifted by United Kingdom airlines, while total air transport movements, combining take-offs and landings, by United Kingdom airlines have increased by 40 per cent. The average distance travelled on UK airlines on international flights was 2,564 kilometres per air traveller in 1990 and 2,959 kilometres per air traveller in 2000, a rise of 15 per cent. Although larger, more efficient aircraft are now used, occupancy rates have remained between 74 and 79 per cent since 1990.

Chart 2.5
Passenger numbers between the UK and abroad



Source: DFT

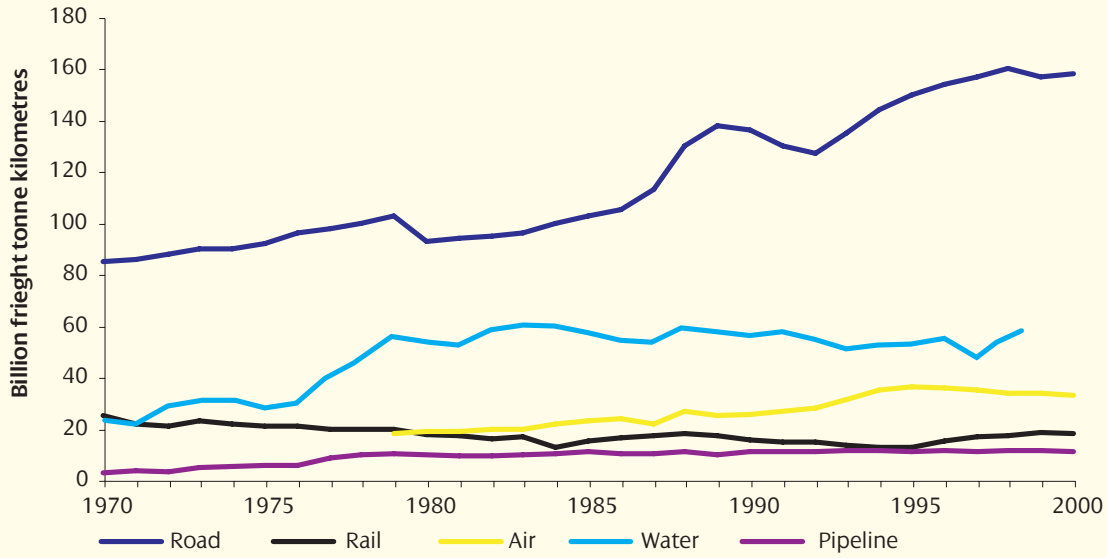
- Passenger numbers increased by 73 per cent between 1990 and 2000.

2.7 The change in the amount of freight moved, measured in tonne-kilometres, is shown in Chart 2.6. A total of 220 billion tonne-kilometres of freight were moved by road, rail, air and pipeline in 2000, half of which were met by road. Between 1970 and 2000 the amount of freight moved by road rose by 86 per cent. The increase has been driven by increased economic activity (GDP rose by 98 per cent between 1970 and 2000), and has been enabled by an improved road network that can accommodate larger and heavier vehicles. The number of articulated trucks over 33 tonnes rose from 63,000 in 1991 to 91,000 in 2001.

2.8 Chart 2.7 shows passenger kilometres by different types of transport. In 2000, 721 billion passenger kilometres were travelled in Great Britain. This corresponds to 12 thousand kilometres per person. Passenger kilometres from air and rail have increased since 1970, whereas passenger kilometres from buses have fallen over the same time period.

Chart 2.6

Freight transport by mode

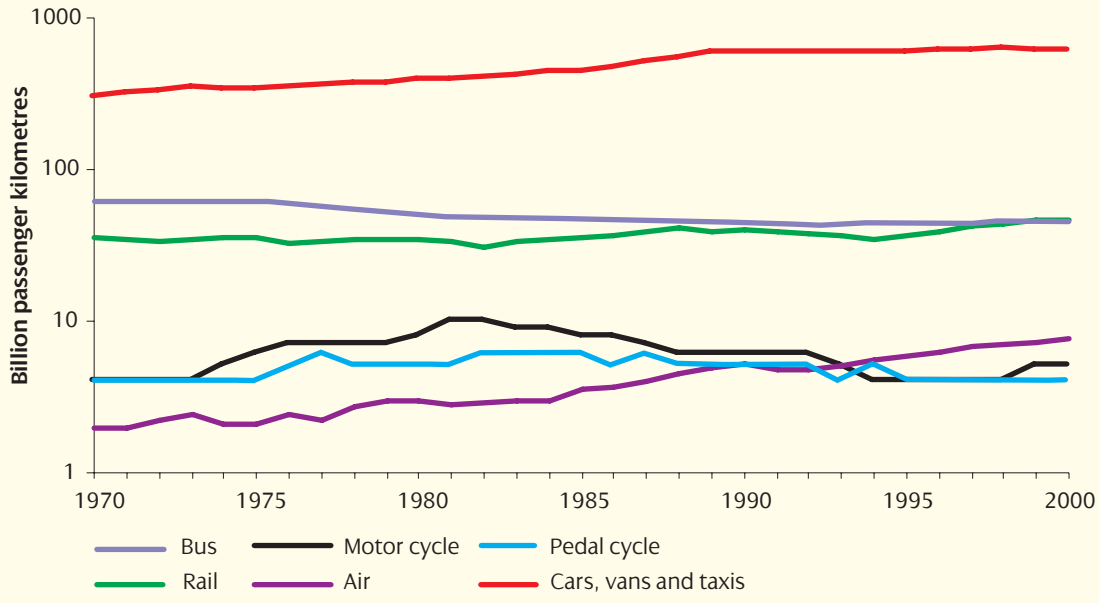


Source: DTI, DFT

- The amount of freight moved by road, measured in tonne-kilometres, increased by 86 per cent between 1970 and 2000.
- Since 1979 the amount of freight moved by air has increased by 83 per cent.
- Freight moved by rail has decreased by 39 per cent since 1970.

Chart 2.7

Passenger kilometres by bus, motorcycle, cycle, rail and air (logarithmic scale)

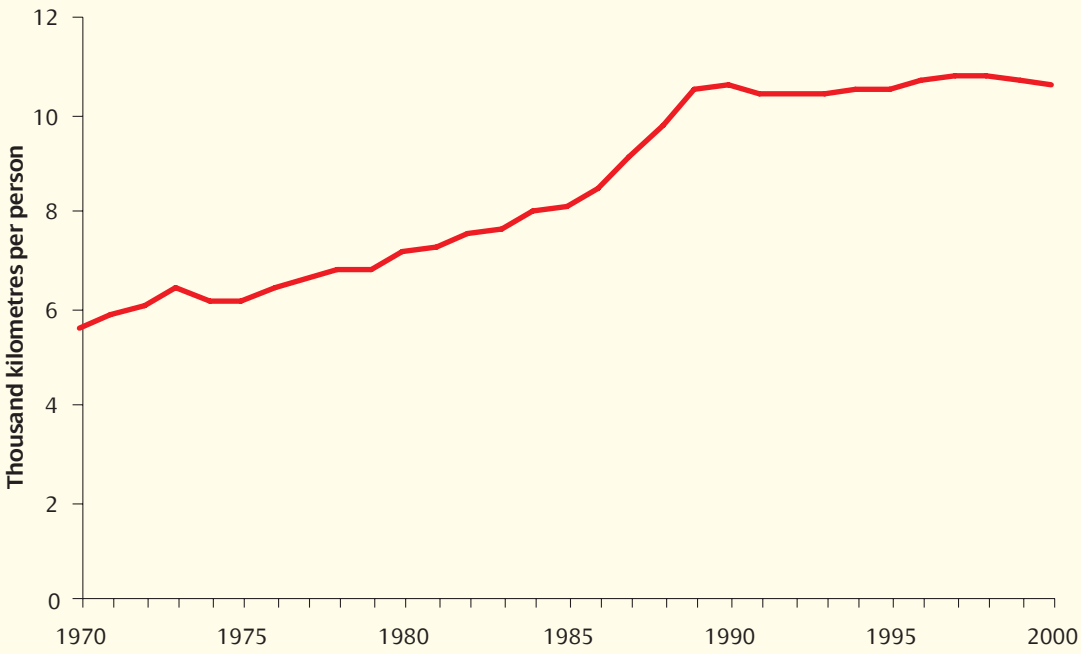


Source: DFT

- Overall passenger kilometres from air transport have almost quadrupled over the last 30 years while passenger kilometres from cars, vans and taxis have more than doubled.
- The distance travelled by bus fell by 25 per cent between 1970 and 2000.
- Passenger kilometres from motorcycles and pedal cycles are at levels similar to 1970 levels. Rail passenger kilometres increased by 31 per cent between 1970 and 2000.

2.9 Journey length and frequency of car use affect energy consumption. In 1970 nearly half of all households in Great Britain did not own a car, whereas in 2000, less than a third were without a car. Chart 2.8 shows how much car use per person increased between 1970 and 2000. Since 1990 car use per person has remained fairly constant.

Chart 2.8
Car use per person, 1970 to 2000



Source:DTI estimates derived from data provided by DFT and ONS

- Car use per person increased by 91 per cent between 1970 and 1990.
- Between 1990 and 2000, the distance travelled by car per person has increased by 1 per cent.

2.10 In 2000 the average distance travelled per person by car in Great Britain was 8,900 kilometres. The number of trips per person per year made by car has increased by 25 per cent since 1985/1986, from 517 (10 per week) to 640 (12 per week) in 1998/2000. For distances of more than one mile, the car is most commonly used. The average length of a car trip has also gone up from 7.8 miles on average in 1985/1986 to 8.7 miles in 1998/2000, although a quarter of all car journeys were less than two miles in length in 1998/2000.

2.11 In 1998/2000, the three main reasons for a car trip were for shopping (20 per cent), commuting (18 per cent), and visiting friends at home (15 per cent). The average person made 210 trips per year for shopping purposes in 1985/1986, compared with 216 in 1998/2000 by car. The total distance travelled for shopping increased from 611 to 898 miles per year over the same period, and the average shopping trip length increased from 2.9 miles to 4.2 miles (5.9 miles in 1998/2000 for shopping trips made by car).

2.12 In autumn 2001, around 17 million people (70 per cent of those working) usually travelled to work by car, compared with around 14 million people (68 per cent of those working) in autumn 1992. The average distance between home and work increased, from 7.2 miles in 1989/1991 to 8.4 miles in 1998/2000. Car commuting averaged 9.4 miles per trip in 1998/2000, compared with 5.1 miles for bus and 19.5 miles for rail. Car occupancy rates for commuting and business related journeys are low, at an average of between 1.1 and 1.2 people per car. Average occupancy rates in 1998/2000 for family holidays were 2.2 people per car, for education 2.1, and 1.9 for leisure.

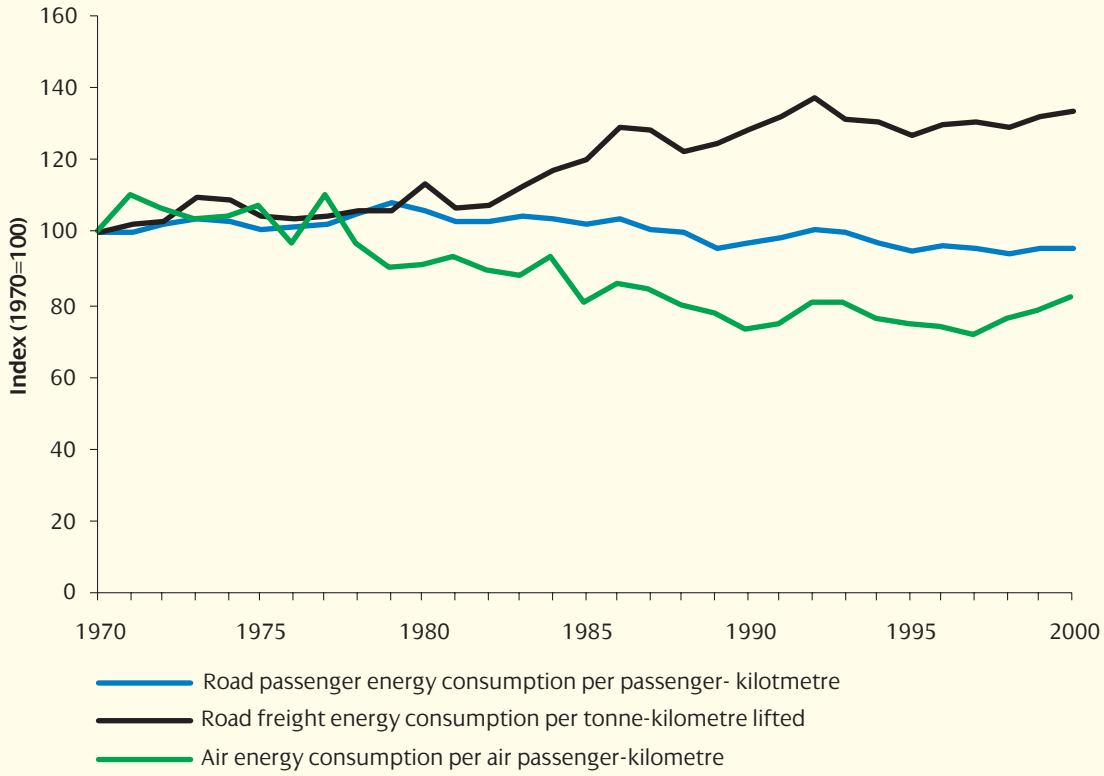
2.13 A change in the way that transport is used is for the school run, accompanying children to and from schools and after-school activities on a regular basis. In 1985/1986, 59 per cent of children aged between 5 and 16 walked to school, compared with 49 per cent in 1998/2000, whereas the proportion travelling by car increased from 16 per cent to 27 per cent over the same period. For primary school children 56 per cent walked to school in 1998/2000 while 36 per cent were driven by car whereas for secondary school children, 43 per cent walked while 19 per cent travelled by car. After taking children to school in the morning, over three quarters of 'escorts' return straight home. Between 8am and 9am during term time, about one car in ten on the road in urban areas was on the school run in 1998/2000.

2.14 Congestion arises when the volume of traffic exceeds road capacity, although the actual causes are complex. The capacity of the road network has increased at a lower rate than actual traffic; lane kilometres have increased by about a third since 1960, while traffic has roughly quadrupled. Congestion has proved not to be a deterrent for people choosing to travel by car.

Changes in energy intensity

2.15 Energy consumption can be measured in relation to distance travelled and load carried to provide a measure of energy intensity. For road transport this would be measured as energy consumption per passenger-kilometre or freight tonne-kilometre. Road freight needs to be treated differently to road passenger travel since the weight carried will have an impact on the amount of energy consumed. Since it is difficult to weight the two measures together they are considered separately. Air transport energy intensity can be measured as energy consumption per air passenger-kilometre. Chart 2.9 shows how road passenger, road freight and air transport energy intensities have changed since 1970. While the largest increase has been for road freight, most of the increase mainly occurred during the 1980s when energy consumption increased at a higher rate than the number of freight-tonne kilometres travelled. Road freight energy intensity has increased by 4 per cent since 1990. Energy intensity in the road passenger sub-sector has fallen by 2 per cent since 1990, as energy consumption has not increased in line with distances travelled due to improvements in fuel efficiencies and vehicle technology, despite demand for improved safety features, power steering and air conditioning that have resulted in heavier vehicles.

Chart 2.9
Energy intensities for road passenger, road freight and air transport



Source: DTI, DFT

- Road freight energy consumption per tonne-kilometre lifted has increased by 33 per cent since 1970 and by 4 per cent since 1990.
- Road passenger energy consumption per passenger kilometre has fallen by 5 per cent since 1970 and by 2 per cent since 1990.
- Air transport energy consumption per air passenger-kilometre has fallen by 19 per cent since 1970 and increased by 12 per cent since 1990.

2.16 The average fuel efficiency of the UK vehicle stock has been improved by the increasing penetration of more efficient diesel-engined vehicles. In 1990 6 per cent of new cars registrations were diesel-engined, this had increased to 14 per cent by 1999. Derv (diesel) energy consumption for road transport increased by 47 per cent between 1990 and 2000. While it made up 31 per cent of all fuel consumed in 1990, this proportion had increased to 42 per cent by 2000.

2.17 The air transport sector in the ten years after 1990 has seen an increase in energy intensity, although not at the same rate as the increase in the distance travelled due to improvements in aircraft technology (some of which are described in paragraph 2.6) and the increased number of long-distance flights. Longer flights require less energy per kilometre than shorter flights since most energy is consumed during take-off and landing. However, the figures should be treated with some caution since the fuel consumption figures relate to fuel that is bought in the UK rather than the fuel consumed to travel these distances. Therefore the figures will be affected by the airlines' choice about where to load fuel.

Gross Domestic Product and Income

2.18 As the economy grows and activity increases within the economy, there is increased demand for transport as higher disposable incomes enable more people to travel over longer distances and demand for products increases requiring a higher level of freight transportation. Between 1970 and 2001, Gross Domestic Product (GDP) in the UK rose by 102 per cent, and between 1990 and 2001 by 28 per cent.

2.19 Income also has an impact on how transport is used. Net national disposable income has increased by 30 per cent between 1990 and 2000. However, those in low-income groups are less likely to own a car, and are more likely to travel in larger groups. In Great Britain in 1998/2000 65 per cent of households in the lowest income quintile did not have a car, and only 4 per cent had two or more. Average car occupancy for this income quintile was 2.1 people compared with 1.4 people in the highest household income quintile. The higher the level of occupancy, the less energy consumed per person.

2.20 Car travel increases with income. Those in low-income groups make fewer trips than those in high-income groups. On average, people living in households in the lowest income quintile made 317 car trips a year in 1998/2000 while the average individual made 640 trips. People living in households in the highest income quintile group make the highest use of cars, at 850 trips a year. The majority of trips by those with low incomes are made as passengers whereas the majority of trips made by those with high incomes are made as drivers. In addition, the average length of car trips also varies by income, from 7.0 miles for trips made by people in the lowest income quintile group, to 10.6 miles for those in the highest group.

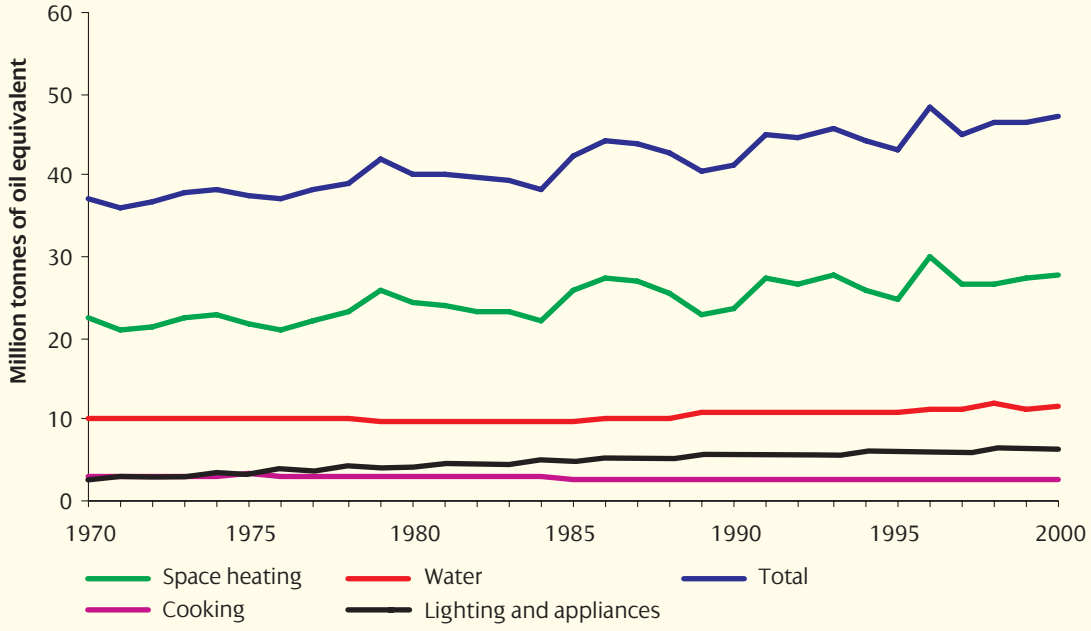
Charter 3: Domestic energy consumption

Domestic energy consumption

3.1 Domestic energy consumption has increased by 32 per cent since 1970 and by 19 per cent since 1990. Since 1990 the number of households has increased by 10 per cent, population has increased by 4 per cent and household disposable income has increased by 30 per cent. Energy efficiency improvements, such as increased levels of insulation and the introduction of more efficient electrical appliances, have meant that domestic energy consumption has not increased at a greater rate. This chapter will look at the purposes for which energy is used in the domestic sector and the drivers of domestic energy consumption which can potentially lead to more or less energy being consumed.

3.2 The majority of energy consumed in the domestic sector is for space heating, which accounted for 58 per cent of all delivered energy consumed in 2000 (see Chart 3.1). Space heating in any year is largely dependent on outside temperatures which explains the year-to-year fluctuations, although increases in internal temperatures, the growth in central heating and the increased number of households have all contributed to the increase over the period 1970 to 2000, despite the increased presence of insulation. These factors are covered in more detail in paragraphs 3.7 to 3.20. The other major areas of energy consumption in the domestic sector are for heating water, for lighting and appliances and for cooking. Between 1970 and 2000, energy consumption in lighting and appliances increased by 157 per cent, while energy use in cooking has fallen by 16 per cent.

Chart 3.1
Domestic final energy consumption by end use, 1970 to 2000

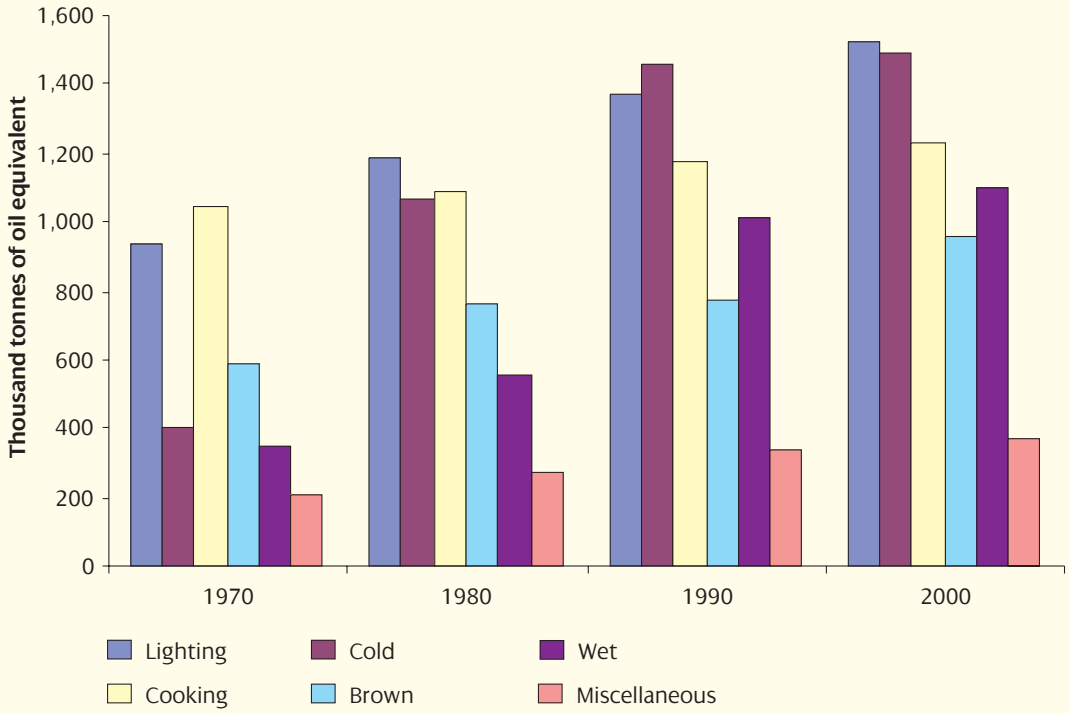


Source: Derived from BRE

- 82 per cent of energy used in households is for space or water heating. Such uses are susceptible to weather conditions and, in particular, temperature variations.
- Since 1970 energy use for space heating has risen by 24 per cent, for water heating by 15 per cent, and for lighting and appliances by 157 per cent. In contrast, energy use for cooking has fallen by 16 per cent.

3.3 Electricity consumption by household domestic appliances is shown in Chart 3.2. By 2000, energy consumption by cold appliances had increased by 274 per cent on 1970 levels and was the second largest consuming group, after lighting. Lighting accounted for 23 per cent of the total amount of electricity consumed for lighting and appliances in the domestic sector while cold appliances accounted for 22 per cent. The factors affecting electricity consumption by household appliances are covered in paragraphs 3.12 to 3.17.

Chart 3.2
Electricity consumption by household domestic appliance, by broad type



Source: ECI

- The total amount of electricity consumed for domestic household lighting increased by 63 per cent between 1970 and 2000.

3.4 In 1970 gas (including town gas) accounted for 24 per cent of total domestic energy consumption and for 67 per cent by 2001, whereas coal accounted for 39 per cent in 1970 and just 4 per cent by 2001. Electricity consumption has increased by 50 per cent over the period, mainly due to the increased use of electricity for lighting and appliances in the home. The individual countries within the UK have wide disparities in the mix of fuels used in the domestic sector. Northern Ireland uses more coal and oil per household, since gas has only recently been introduced, while Scotland consumes more electricity. This is predominately down to the higher proportion of flats in urban Scotland, which often use electrical heating rather than gas or oil based systems.

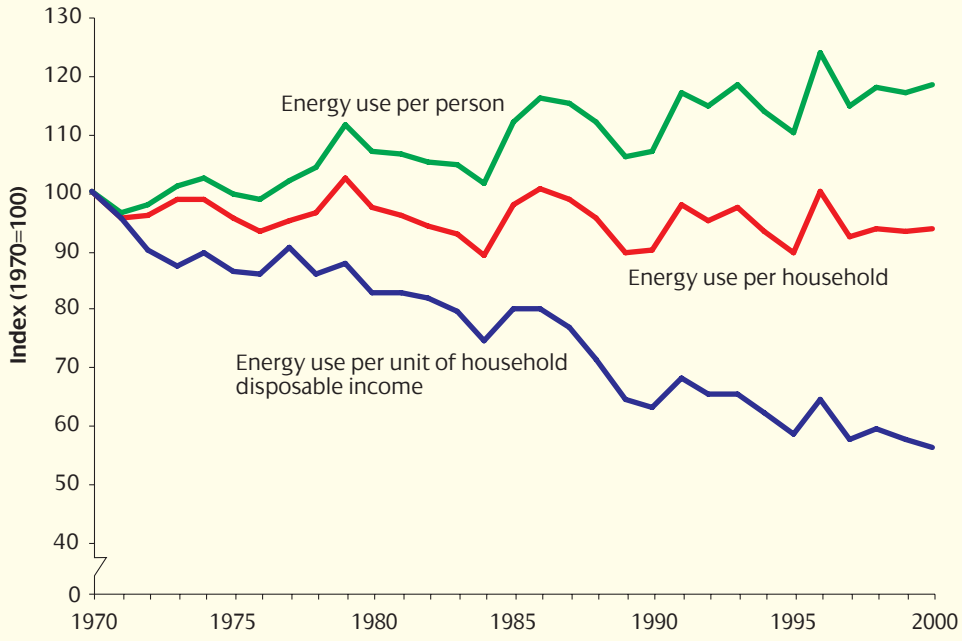
3.5 The fuel mix in the domestic sector for space heating has changed significantly over the last three decades. In 1970 10 per cent of households in Great Britain were centrally heated by gas and 9 per cent used solid fuels. In 2000 71 per cent used gas for central heating and just 3 per cent used solid fuels. Electrical storage heating accounted for 6 per cent of the total in 1970 and 9 per cent in 2000. Less than a third of all housing stock in Great Britain had central heating in 1970. Thirty years later the proportion had risen to 89 per cent.

Factors affecting domestic energy consumption

The number of households, population and income

3.7 Energy intensity in the domestic sector can be measured by the number of households, by population or household incomes. These three measures are shown in Chart 3.3. While overall domestic energy consumption has gone up by a third, energy consumption per household has fallen by 6 per cent, energy consumption per person has increased by 18 per cent and energy consumption per unit of income has fallen by 44 per cent.

Chart 3.3
Domestic energy consumption per person, per household and per unit of household income



Source: DTI, BRE, ONS

- Energy consumption per person has increased by 18 per cent since 1970.
- Energy consumption per household was 6 per cent below 1970 levels by 2000.
- Energy consumption per unit of household disposable income fell by 44 per cent between 1970 and 2000.

3.8 The proportion of one-person households has almost doubled from 17 per cent in 1971 to 32 per cent in 2000. Part of this increase has been driven by the rise in life expectancy since the early 1970s, 50 per cent of those aged 75 and over live alone, compared with just 12 per cent of 25 to 44 year olds. The amount of energy required by two people living in two households is greater than the amount of energy required by two people living in the same household.

3.9 Type of housing can also have an impact on energy consumption. Flats have the lowest heat loss while bungalows and detached houses have higher heat-loss levels as there is a larger surface to volume ratio. In 1996 only 19 per cent of dwellings in England were flats, this was higher than the proportion in Wales and Northern Ireland, but less than in Scotland. Dwellings that are occupied by their owners use more energy than rented dwellings, up to 60 per cent more according to figures from the Building Research Establishment. Owner-occupation has increased by 14 per cent since

1979. However, much of the difference between buildings is due to differences between dwelling types and ages in the different tenures.

3.10 In Great Britain 40 per cent of the housing stock was built before 1945, 46 per cent between 1945 and 1984, and 14 per cent after 1984. Newer houses have to conform to much higher energy efficiency standards than previous building stock. However, considerable improvements in insulation standards in existing homes have offset some of the energy losses that would have otherwise been incurred.

Temperature

3.11 When it is cold outside, more energy is used in the domestic sector for space heating. While the average external temperature was 5.8°C in 1970, it had risen to 7.2°C by 2000. Households are also kept warmer than they were in 1970 and more households have central heating which has made internal temperatures easier to manage. In 1970 5.6 million homes were centrally heated, this had increased to 21.7 million by 2000, accounting for nearly 90 per cent of all households in Great Britain. Average internal temperatures increased from 13°C in 1970 to 18°C in 2000.

Growth in number of appliances

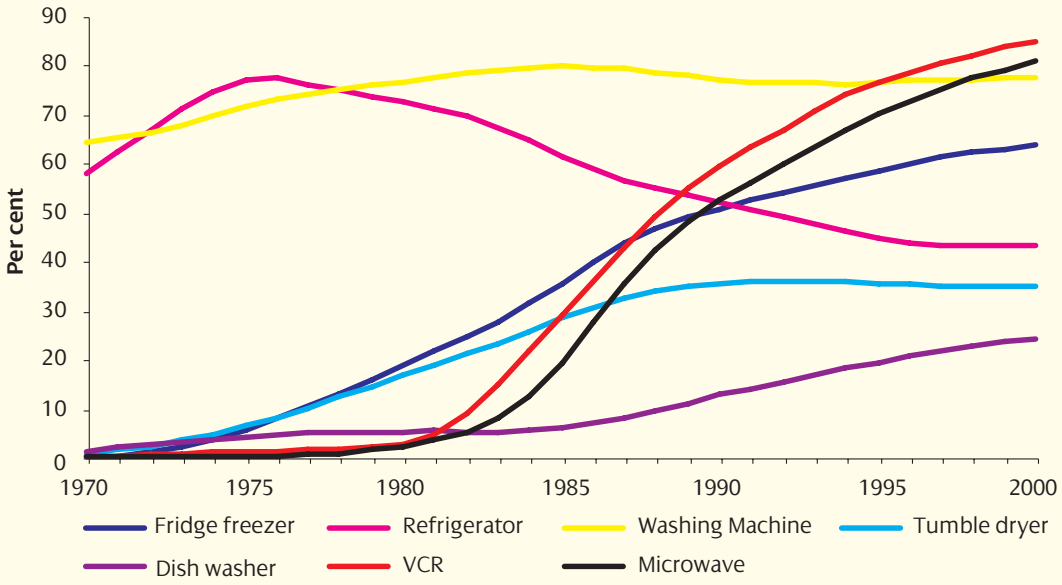
3.12 The amount of energy used by appliances has increased by 9 per cent since 1990, which has been a result of increases in the total number of appliances bought and used by households as well as the increase in the number of households. Net national disposable income in the UK has increased by 30 per 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.

3.13 Chart 3.4 shows how the percentage of households with selected appliances has increased since 1970. The largest growth has been in the number of households owning VCRs, from a small number of households in 1970 to 84 per cent in 2000, and fridge-freezers, from no households in 1970 to 63 per cent in 2000. The chart does not show multiple ownership. 59 per cent of households now own 2 or more televisions and 14 per cent own 2 or more VCRs. As technologies change, ownership levels change. Chart 3.4 shows how the number of refrigerators has fallen, although the number of other types of cold appliances have increased. DVD players were introduced in 1997 and are now owned by 13 per cent of the households in Great Britain.

3.14 Ownership of home computers reached 45 per cent of households in 2000. Nearly a third of all households had access to the Internet at home, most of which accessed the Internet from their home computer.

3.15 Energy consumption for lighting has increased by 63 per cent between 1970 and 2000 and by 11 per cent between 1990 and 2000. The increase has been mainly due to the shift away from rooms lit by single ceiling bulbs towards multi-source lighting from wall and table lamps as well as multi-ceiling lights. The introduction of energy efficient light bulbs in the early 1980s has led to some energy savings and from this relatively recent beginning sales rose to over 4 million in 1999.

Chart 3.4
Percentage of households that own household domestic appliances



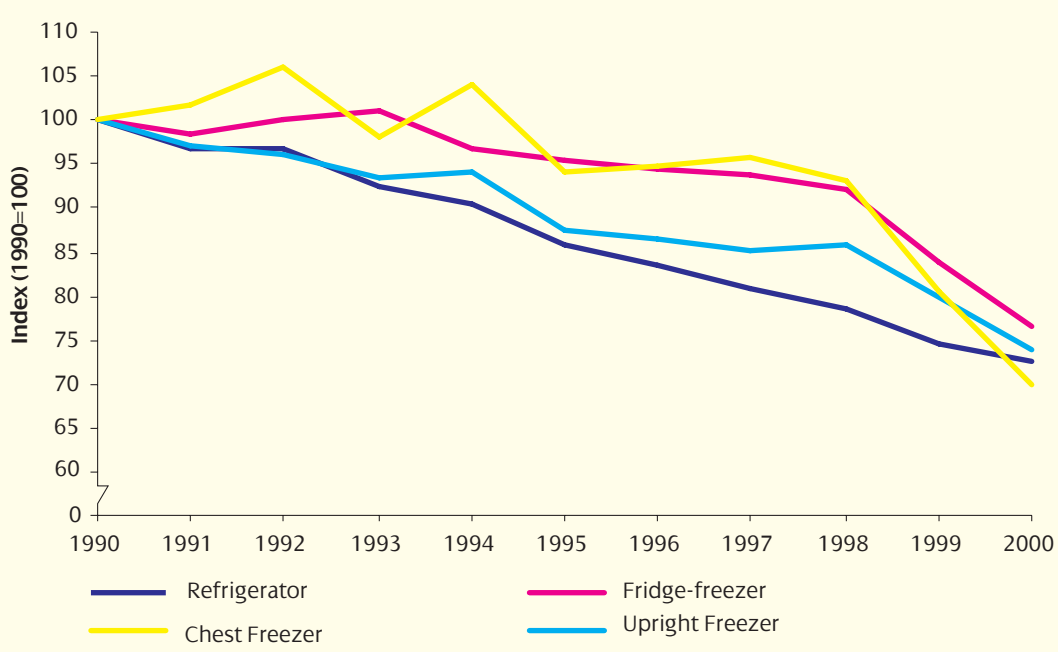
Source: ECI

- Ownership of at least one VCR had risen to 84 per cent of households by 2000.
- In 2000 92 per cent of households could wash their clothes with automatic machines.
- Just over 70 per cent of households owned a microwave oven in 2000.

3.16 The introduction of the standby facility on some electronic goods has also affected energy consumption and is responsible for an estimated 1 per cent of the UK's total domestic energy consumption, equivalent to 6 per cent of domestic electricity consumption.

3.17 Energy efficiency improvements have gone some way to reducing overall energy consumption from the levels that would have been experienced in their absence. Chart 3.5 shows changes in the energy consumption of cold appliances since 1990. Improvements have been more marked since 1994 when energy labelling was introduced and the figures take into account the larger appliances with additional features that consume more energy, such as the introduction of frost-free appliances.

Chart 3.5
Energy consumption of new cold appliances, 1990 to 2000



Source: ECI

- Energy efficiency for new cold appliances improved most for refrigerators which consumed 27 per cent less electricity in 2000 than they did in 1990.

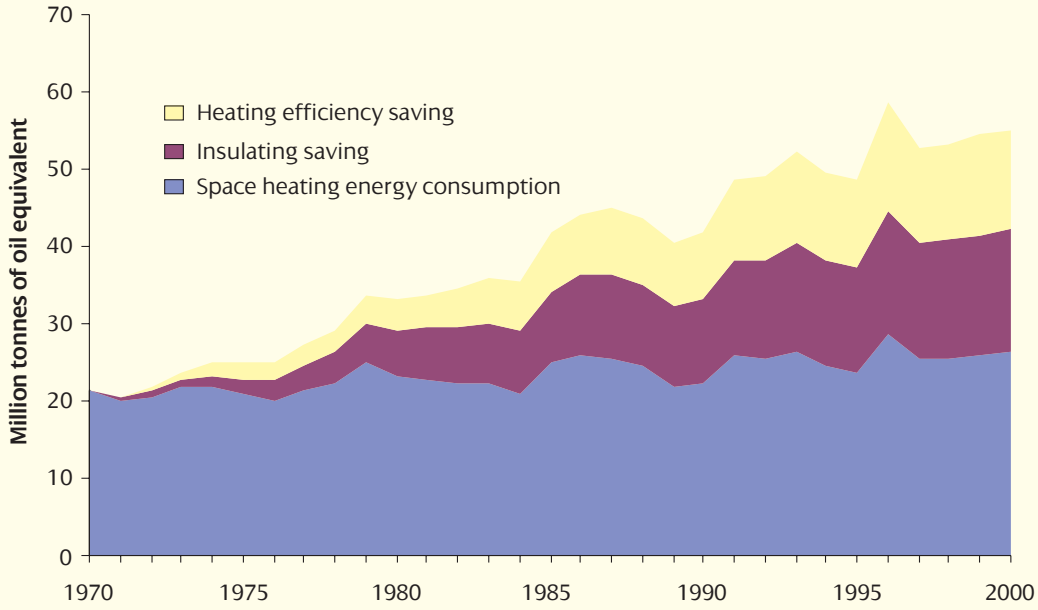
Cooking

3.18 The fall in energy consumption in cooking is partly explained by a change in lifestyle. More convenience foods are now consumed and people eat out more frequently than in the past. The average person in 2000 spent £7.36 per person per week on food and drink consumed out of the house. Excluding alcoholic drink, expenditure on eating out increased by 13 per cent in real terms since 1994, whilst household food and non-alcoholic drink purchases fell by 2 per cent. However, small cooking appliances such as toasters and kettles are excluded from the definition of cooking used in Chart 3.1.

Insulation

3.19 The main types of insulation in the UK are loft insulation, cavity wall insulation, double glazing and hot water tank insulation. In 2000, 72 per cent of all houses in Great Britain had loft insulation, 19 per cent had some form of cavity wall insulation installed (cavity wall dwellings account for 69 per cent of the housing stock with the remainder being largely accounted for by solid wall dwellings), 39 per cent of houses in Great Britain had more than 80 per cent of their windows treated with double glazing and most houses with hot water tanks have hot water tank insulation since it is a low cost, easy maintenance form of insulation.

Chart 3.6
Savings due to better insulation and heating efficiency, 1970 to 2000



Source: BRE

- The combined savings from insulation and heating efficiency improvements reduced domestic space heating energy consumption in 2000 to about 48 per cent of what it could otherwise have been in the absence of those improvements.

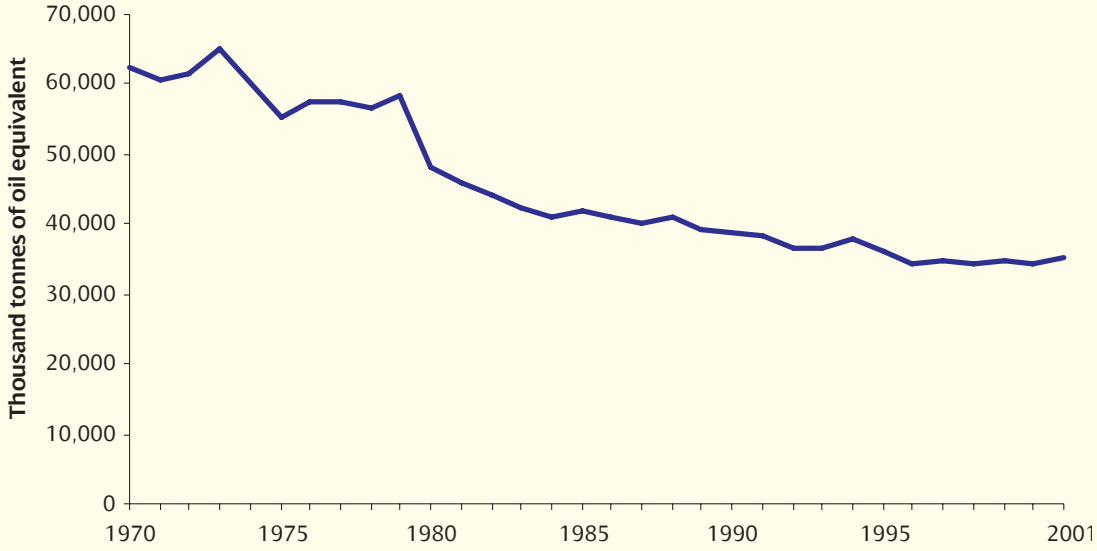
3.20 During the 1970s and 1980s, many homes were insulated in order to make more efficient use of energy. Chart 3.6 shows how insulation and improved heating efficiency saved energy for space heating in the domestic sector over the period 1970 to 2000. Without insulation energy consumption would have been 59 per cent higher by 2000. New homes are constructed using insulated material which will lead to even further energy savings in the future. The Standard Assessment Procedure (SAP) provides a means of rating the energy efficiency of a dwelling and is based on estimates of space and water heating costs, with a rating of 100 to 120 indicating an extremely efficient house. Based on this system, the energy efficiency of the country's housing stock has risen from a SAP rating of about 12 in 1970 to approaching 45 or so in 2000.

Chapter 4: Industrial energy consumption

Industrial energy consumption

4.1 Industrial energy consumption accounted for more than a fifth of all UK energy consumption in 2001, consuming 35,152 thousand tonnes of oil equivalent. In 2001 the largest sub-sector was the chemicals industry, accounting for 22 per cent of all industrial energy consumption (mainly for the manufacture of basic chemcials), while the food, drink and tobacco industry consumed a further 12 per cent. A fifth of all energy consumed in the food, drink and tobacco industry was for sugar manufacture, while a further 13 per cent was used for making beverages and another 10 per cent for the production, processing and preserving of meat and meat products.

Chart 4.1
Total industrial energy consumption[1], 1970 to 2001



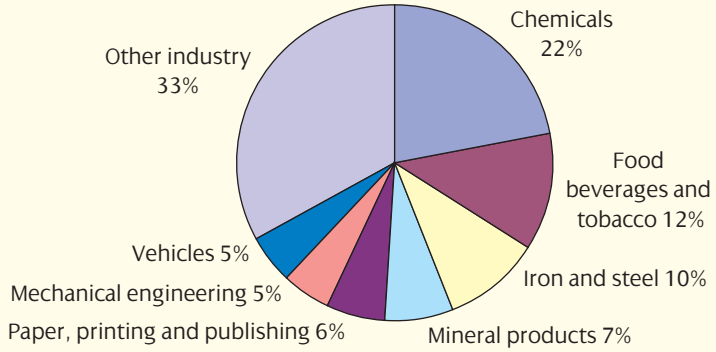
Source: DTI

1. Energy use by the industrial sector for transformation activities, for example, energy used to generate electricity, is included up to 1995 and excluded from 1996 onwards.

- Industrial energy consumption has fallen by 44 per cent since 1970 and by 9 per cent since 1990.
- Industrial energy consumption has increased by 2 per cent since 1996.

4.2 Energy use in the industrial sector has changed as the structure and way that energy is used has changed. Chart 4.1 shows how energy consumption has fallen, by 44 per cent since 1970 and by 9 per cent since 1990, although there was a change in definition used to classify the industrial sector between 1995 and 1996 - energy used in transformation activities, for example, manufacturing coke or generating electricity, is excluded from the total from 1996 onwards. Since 1996, industrial energy consumption has increased by 2 per cent. Within the rise between 1996 and 2001 energy consumption in the chemicals industry increased by 24 per cent, by 11 per cent in the textiles, leather and clothing industry, by 5 per cent in the electrical engineering industry and by 3 per cent in both the vehicles industry and the mechanical engineering and metal products industry. These increases were partly offset by falls in energy consumption between 1996 and 2001 for the iron and steel industry of 16 per cent, for the mineral products industry of 15 per cent, for the construction industry of 11 per cent, for the paper printing and publishing industry of 8 per cent and for the food, drink and tobacco industry of 2 per cent. Chart 4.2 shows energy consumption by sub-sector in 2001.

Chart 4.2
Industrial energy consumption by sub-sector, 2001

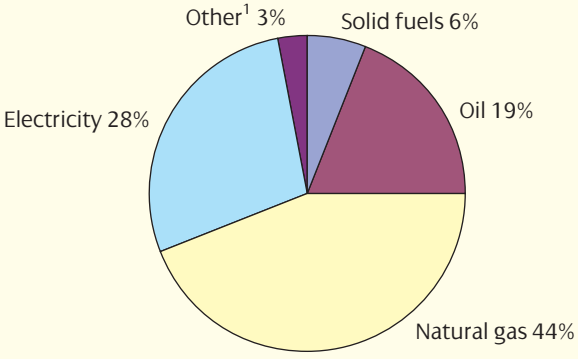


Source: DTI

- The chemicals industry consumed 22 per cent of all industrial energy consumption in 2001.
- The iron and steel industry consumed 10 per cent of all industrial energy consumption in 2001.

4.3 The use of different fuels within the industrial sector has also changed over time reflecting changes in the way that energy is used in different processes and industries. Since 1996, coal and oil consumption have fallen by 40 per cent and 7 per cent respectively. Chart 4.3 shows fuel use in the industrial sector in 2001. The share of natural gas consumed has increased from 41 per cent of all energy consumed in 1996 in the industrial sector to 44 per cent in 2001, replacing solid fuels which fell from 9 per cent to 6 per cent as technological changes have enabled alternative fuels to be used. Electricity consumption rose in the industrial sector from 26 per cent in 1996 to 28 per cent in 2001.

Chart 4.3
Industrial energy consumption by fuel, 2001



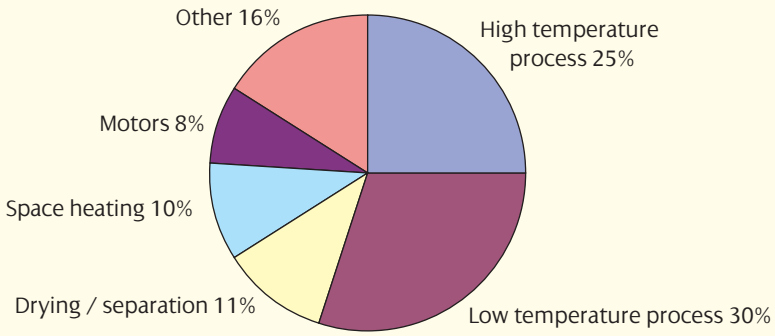
Source: DTI

1. Renewables, waste and heat.

- Natural gas contributed towards 44 per cent of total industrial energy consumption in 2001.
- Electricity contributed towards 28 per cent of total industrial energy consumption in 2001.

4.4 The relatively varied pattern of fuel use within the industrial sector reflects the varied end uses to which energy is put. Chart 4.4 shows how energy was used in the industrial sector in 1999. In 1999 energy consumed for high and low temperature processes accounted for 25 per cent and 30 per cent respectively of the total. A further 11 per cent was consumed for drying and separation and an additional 10 per cent for space heating.

Chart 4.4
Industrial energy consumption by type of use, 1999



Source: DTI, FES

- Low temperature processes contributed towards 30 per cent of total industrial energy consumption in 1999.

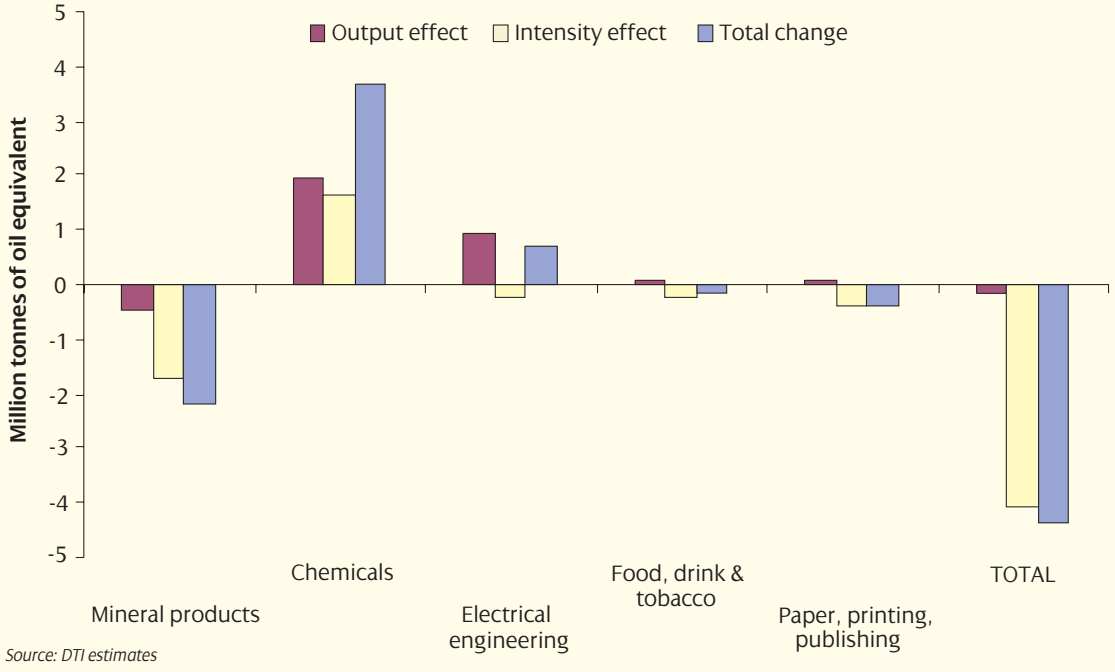
4.5 The main high temperature process uses of energy are coke ovens, blast furnaces and other furnaces, kilns and glass tanks. Low temperature process uses include process heating and distillation in the chemicals sector; baking and separation processes in food and drink; pressing and drying processes in paper manufacture; and washing, scouring, dyeing and drying in the textiles industry. Motive power is used for pumping, fans, machinery drives, compressors (for both compressed air supply and for refrigeration) and conveyor systems.

4.6 High temperature processing dominates energy consumption in the iron and steel, non-ferrous metal, bricks, cement, glass and potteries. Low temperature processes are the largest end use of energy for the food, drink and tobacco industry. Space heating and lighting are the main end uses in engineering (mechanical and electrical engineering and vehicles). Drying and separation is important in paper-making while motor processes are used more in the manufacture of chemicals and chemical products than in any other individual industry. Compressed air processes are mainly used in the publishing, printing and reproduction of recorded media sub-sector. Refrigeration processes are mainly used in the chemicals and food and drink industries.

Factors affecting industrial energy consumption

4.7 Industrial energy consumption fell by 4.4 million tonnes of oil equivalent between 1990 and 2000. If the energy required to produce a unit of output was the same in 2000 as in 1990, then it is estimated that energy consumption would have fallen by 4.2 million tonnes of oil equivalent. This 4.2 million tonnes of oil equivalent can be thought of as an intensity effect which includes changes due to changes in structure and in energy efficiency. The difference between the intensity effect and the actual value, a fall of 0.2 million tonnes of oil equivalent, can be attributed to changes due to output. The methodological annex provides details of the calculation. These changes in output and intensity are shown in Chart 4.5.

Chart 4.5
Output and intensity effects on industrial energy consumption between 1990 and 2000



Source: DTI estimates

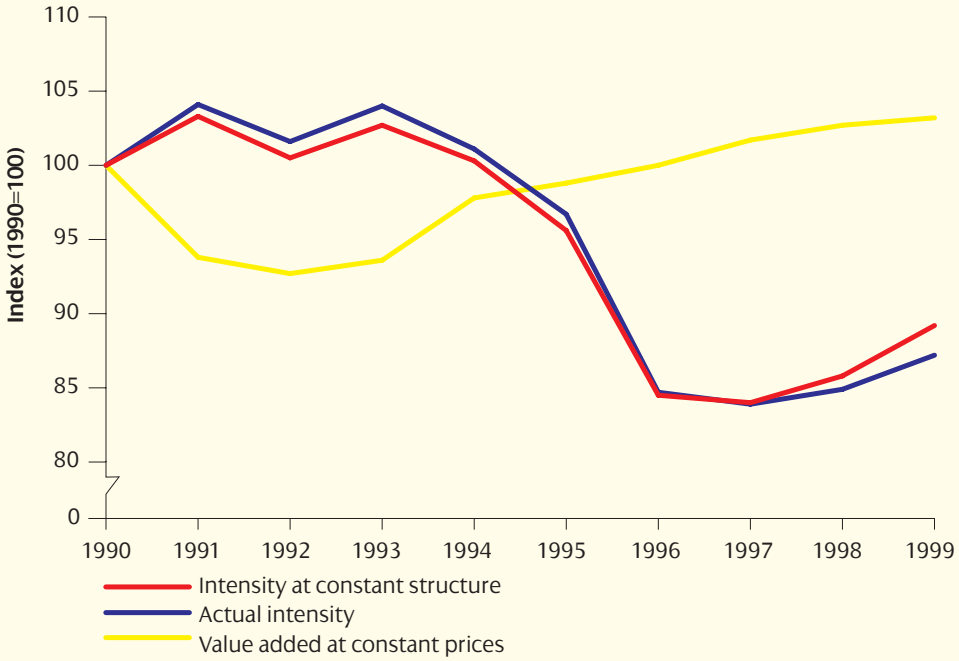
- It is estimated that changes due to intensity led to a fall in industrial energy consumption of 4.2 million tonnes of oil equivalent between 1990 and 2000 and a fall in output led to a fall in industrial energy consumption of 0.2 million tonnes of oil equivalent.

4.8 In the mineral products sector, energy consumption fell by 2.2 million tonnes of oil equivalent, 1.7 million tonnes of oil equivalent of which was due to a fall in intensity and the rest due to falling output. The chemicals sector saw a rise in consumption of 3.6 million tonnes of oil equivalent. It is estimated that increased output accounted for a rise of 2.0 million tonnes of oil equivalent and a rise in intensity of 1.7 million tonnes of oil equivalent.

Changes in structure

4.9 Between 1990 and 1999 the overall decline in industrial energy intensity was 13 per cent. Of this overall decline, it is estimated that 11 per cent was due to changes in intensity of the component sectors of manufacturing industry. Changes in structure are identified as contributing 2 per cent. Chart 4.6 shows these trends in energy intensity. The large fall in intensity between 1995 and 1996 is explained by the change in definition used for the industrial sector in the energy statistics, paragraph 4.2 provides more details.

Chart 4.6
Energy intensity changes in manufacturing industry, 1990 to 1999



Source: DTI, ONS

- While energy intensity fell by 13 per cent, it is estimated that 11 per cent was due to changes in the intensity of the component sectors of manufacturing industry.

Changes in output

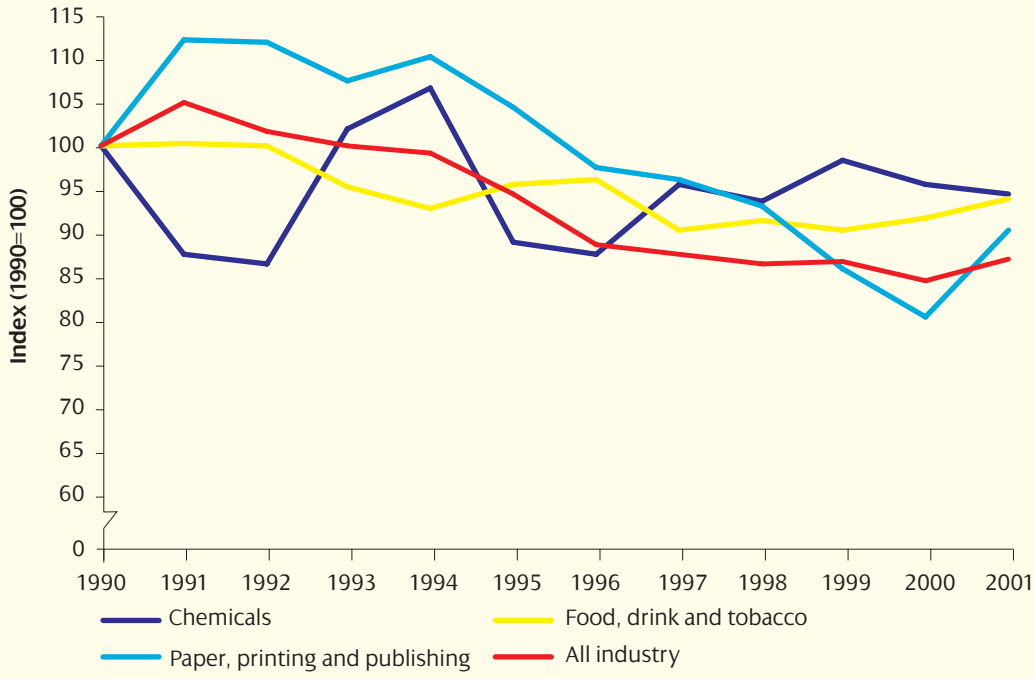
4.10 Between 1970 and 2001 overall energy consumption per unit of output, a measure of energy intensity, fell by 55 per cent while industrial output rose by 26 per cent. The reduction in overall industrial energy intensity since 1970 is partly due to the relative decline in the importance of energy-intensive industry in the economy as less energy-intensive industry and services have become more prominent. Energy intensity has also fallen due to improvements in energy efficiency and technologies used in production processes.

4.11 Chart 4.7 shows how energy intensities have changed since 1990 for selected industries within the industrial sector. Energy intensity in the paper, printing and publishing sector fell by 13 per cent, while energy intensity in the food, drink and tobacco sector fell by 6 per cent between 1990 and 2001. Energy intensity in the chemicals industry fell by 5 per cent over the same period. The mix and weighting of different sub-sectors, along with the rate of decline in their energy intensity all contribute to the overall picture of how energy use has changed in the industrial sector.

Changes in efficiency

4.12 The reasons for changes in energy consumption due to efficiency savings can be difficult to measure. Some data from the Energy Efficiency Best Practice Programme for the food and drink, chemicals and textiles industries are available that show the reasons for energy efficiency improvements over a two year period.

Chart 4.7
Industrial energy intensities for selected industrial groups, 1990 to 2001



Source: DTI, ONS

- Energy consumption per unit of output fell by 4 per cent in the iron and steel industry, by 4 per cent in the chemicals industry, and by 34 per cent in the minerals industry between 1990 and 2000.

4.13 Between 1997 and 1999 it is estimated that there was an overall energy efficiency improvement of 4 per cent in the food and drink industry. Of this 11/2 per cent was due to improved energy management, 1½ per cent to the fitting of new boilers, while the remaining 1 per cent was due to improvements made to steam and motors and drives processes. The largest saving within the food and drink sector was for the oils and fats sub-sector where an energy efficiency improvement of 11 per cent was recorded.

4.14 Energy efficiency improvements in the chemical sector between 1998 and 1999 have led to an estimated improvement of 6 per cent overall. More than half of this was due to the fitting of more efficient boilers, while improvements to steam distribution processes accounted for a further 1 per cent. The remainder was due to some process change and improved energy management. The sub-sector that made most energy efficiency improvements was inorganic basic chemicals which showed an improvement of 12½ per cent.

4.15 Between 1998 and 2000 there was an estimated 9 per cent energy efficiency improvement in the textiles industry, 4 per cent of which was due to improvements to compressed air processes, 2 per cent to energy management improvements and the rest to boiler improvements, specific improvements to steam distribution and motor processes and more general process improvements. The dyeing and finishing sub-sector made an estimated 13 per cent improvement over the period, while improvements in the cotton and man-made fibres, spinning and weaving sub-sector made an estimated improvement of 12 per cent.

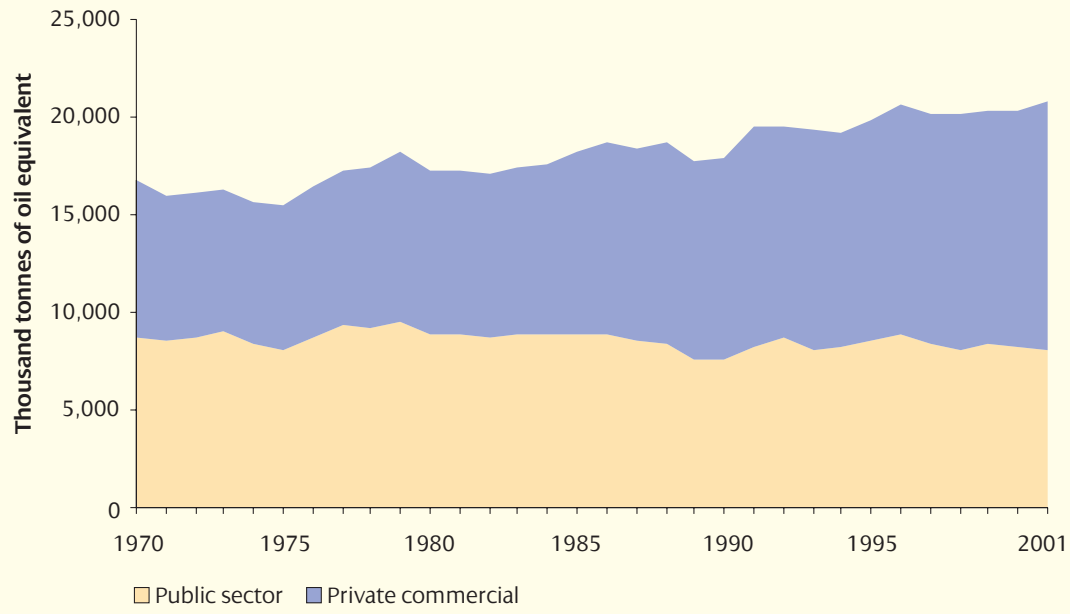
Chapter 5: Service sector energy consumption

Service sector energy consumption

5.1 Service sector energy consumption (excluding agriculture) accounted for 13 per cent of all final energy consumed for energy purposes in 2001. The service sector can be split into two main components: public administration which covers government activities, education and health and private commercial which covers retail, hotels, financial, real estate and computer activities. In 2001 energy consumed in the public administration sub-sector accounted for 39 per cent of all service sector energy consumption, while the private commercial sector accounted for the remaining 61 per cent.

5.2 Chart 5.1 shows how energy consumption in the service sector has changed since 1970. Consumption has increased by 25 per cent since 1970 and by 17 per cent since 1990. Energy consumption in the private sector increased by 59 per cent between 1970 and 2001 and energy consumption in the public sector fell by 7 per cent.

Chart 5.1
Service sector energy consumption, 1970 to 2001

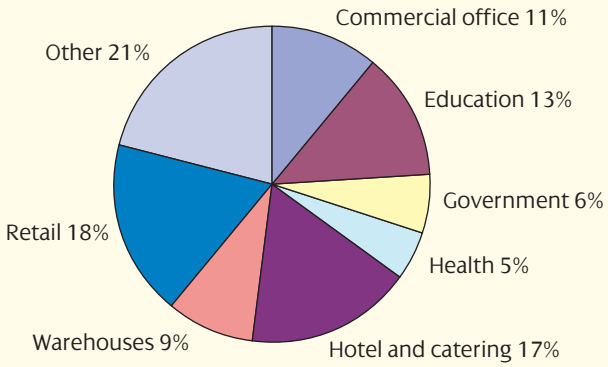


Source: DTI

- The level of service sector energy consumption has increased by 25 per cent since 1970 and by 17 per cent since 1990.

5.3 A more detailed breakdown of service sector energy consumption in 2000 is shown in Chart 5.2. The chart shows that the largest energy consuming sub-sectors are retail, hotels and catering and education.

Chart 5.2
Service sector energy consumption by sub-sector, 2000



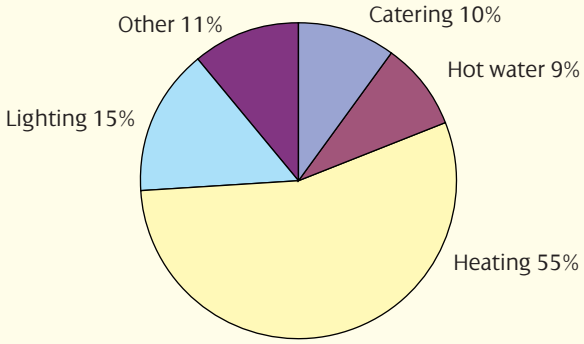
5.4 The way that the service sector uses energy has changed over time. As in other sectors, consumption of coal and oil has fallen over the last thirty years as natural gas usage has increased. Since 1990 electricity consumption has more than doubled, mainly due to the growth in electrical equipment supporting service sector activities, such as information technology, air conditioning, medical and leisure equipment. In 2000 one third of all service sector electricity consumption is from the retail sector where electricity is mainly used 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 hotel and catering where electricity is mainly used for catering. The greater importance of lighting and air conditioning in the private commercial sector means that electricity accounts for a larger share in the private sector than in public services.

5.5 This large growth in electricity consumption means that the energy requirements of the service sector have grown by 29 per cent since 1970 and by 12 per cent since 1990 in primary energy equivalents. This measure takes into account the amount of energy required to generate the electricity consumed as well as the other fuels that are used as a direct energy source.

5.6 More than half of all energy consumed in the service sector was for space heating in 2000. Hot water energy consumption accounted for a further 9 per cent, lighting for 14 per cent and catering for an additional 10 per cent of the total. The breakdowns for energy consumption by end use are shown in Chart 5.3. Most of the energy consumed for space heating is for commercial offices, schools and colleges, hotels, caterers and shops. The main consumer of energy used for lighting is the retail sector, as shown in Chart 5.4.

Chart 5.3

Service sector energy consumption by end use, 2000

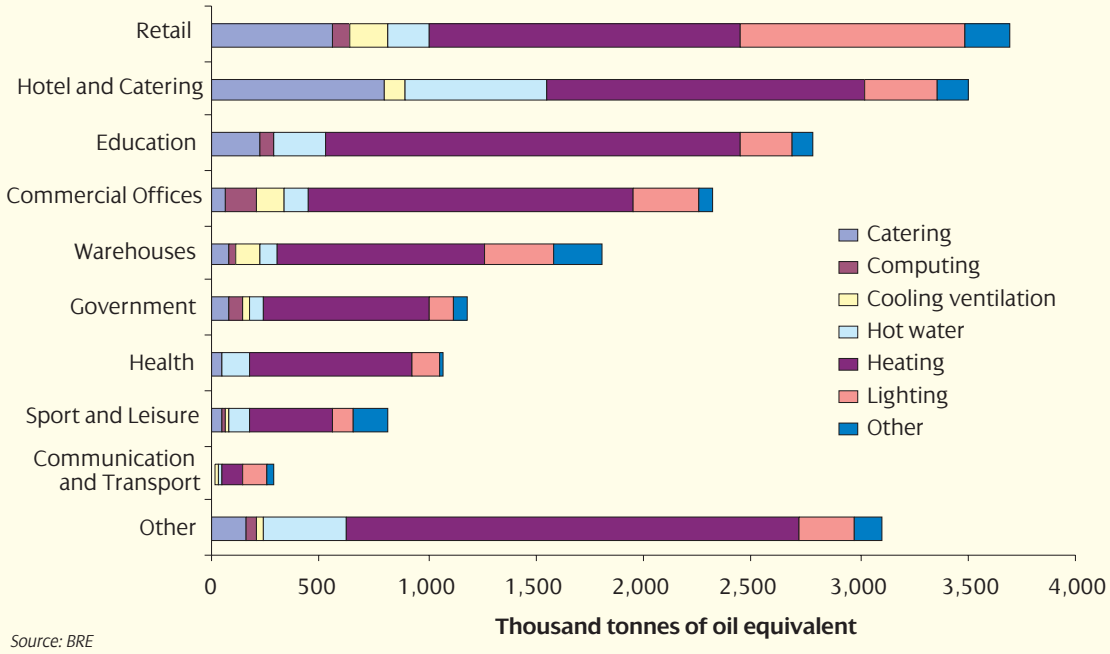


Source: BRE

- Space heating consumes 55 per cent of all energy consumed in the service sector.

Chart 5.4

Energy consumption for service sector buildings by end use, 2000



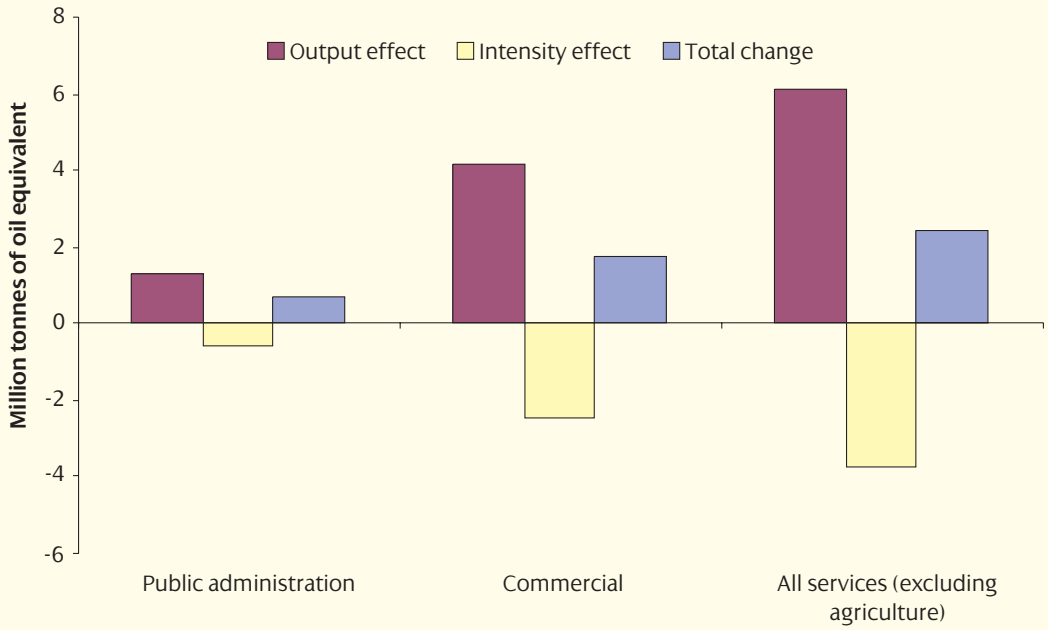
Source: BRE

- Space heating made up the largest share of all energy consumed by each of the service sub-sectors.
- The retail sub-sector was the largest consumer of energy for lighting, which accounted for 28 per cent of all of the energy that it consumed.
- Energy used for heating water was most important in the hotels and catering sub-sector, accounting for 19 per cent of all of the energy consumed by hotels and catering.

Factors affecting service sector consumption

5.7 The main drivers affecting service sector energy consumption over the last thirty years have been changes in output (measured as the service sector's contribution to the UK economy), floor area, levels of employment and changes in technological innovation. Chart 5.5 shows how structural change and changes in efficiency in the service sector (measured as energy intensity) have affected overall changes since 1990. Of the increase of 2.4 million tonnes of oil equivalent between 1990 and 2000, it is estimated that service sector energy consumption would have increased by 6.2 million tonnes of oil equivalent due to changes in output, although this was offset by a 3.8 million tonnes of oil equivalent improvement in energy intensity, which consists of energy efficiency and structural changes within the public administration and commercial sub-sectors. This rise in intensity is due to a combination of more efficient heating systems, insulation, greater efficiency of lighting and electrical equipment and improved energy management leading to appliances being switched off when not in use.

Chart 5.5
Factors affecting changes in service sector energy consumption between 1990 and 2000



Source: DTI estimates

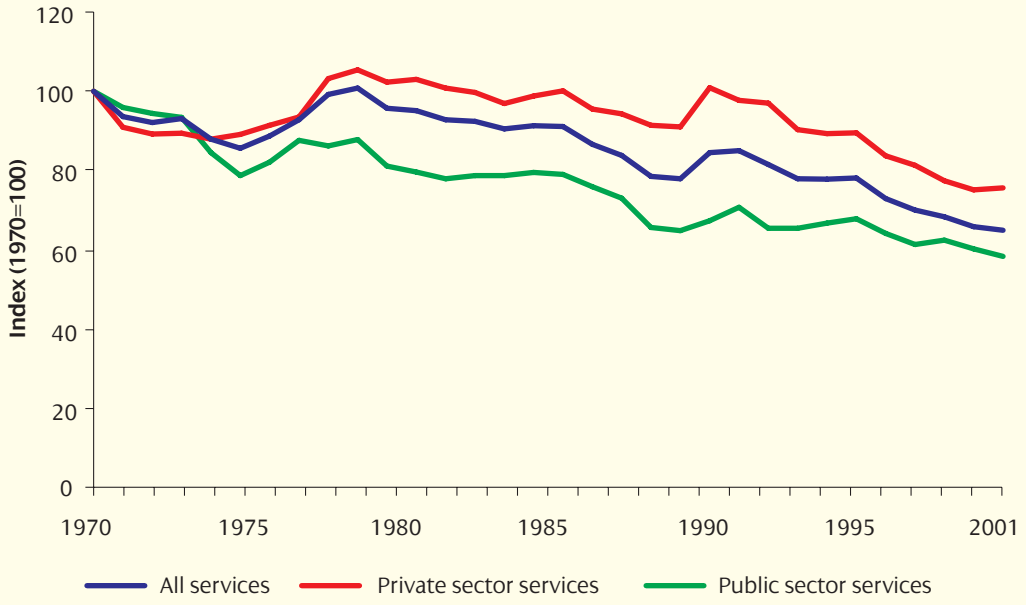
- Of the overall increase in energy consumption of 2.4 million tonnes of oil equivalent, it is estimated that the output effect resulted in an increase of 6.2 million tonnes of oil equivalent which was partly offset by a fall due to energy intensity of 3.8 million tonnes of oil equivalent.

Output

5.8 Service sector energy consumption has increased to meet increased demand for services. Output, measured as the contribution made to the UK economy (in terms of this total, Gross Value Added at constant prices), by the service sector increased by 40 per cent between 1990 and 2001, equivalent to an annual increase of 3 per cent. Private sector output increased by 49 per cent, while public sector output increased by 19 per cent.

5.9 Energy consumption per unit of output (energy intensity) fell by 17 per cent between 1990 and 2001 in the service sector as a whole. Energy intensity has fallen more quickly in the private commercial sub-sector than in the public administration sector; while energy intensity fell by 17 per cent in the private commercial sub-sector, it only fell by 10 per cent in the public administration sub-sector between 1990 and 2001.

Chart 5.6
Energy intensities for the whole service sector, private commercial and public sectors, 1970 to 2001



Source: DTI, ONS

- Energy intensity in the service sector fell by 35 per cent between 1970 and 2001 and by 17 per cent between 1990 and 2001.
- Intensity levels in the private commercial and public sectors have fallen by 24 and 42 per cent respectively between 1970 and 2001.

Floor space

5.10 The relative energy intensity of individual types of building in the service sector can also be measured by floor space. In 2000 77 per cent of the total working population were employed in the service sector, an increase of 4 per cent since 1994. The increased number of employees has resulted in an increase in floor area of 7 per cent over the same period, requiring more energy for space heating.

Annex

Sources and Methods

A.1 The purpose of this annex is to give further details of the methods used to calculate primary energy equivalents, factor analyses and other derived tables. The sources of data feeding into these calculations are outlined.

Main sources by sector

A.2 The Digest of United Kingdom Energy Statistics (DUKES) provides a detailed picture of energy production and use over the last five years with key series taken back to 1970. Other information sources are outlined below; these provide more detailed information for specific areas.

A.3 The end use estimates for the industrial sector have been provided by Future Energy Solutions, those for the domestic and service sectors by the Building Research Establishment (BRE) and those for the transport sector by the Department for Transport, Local Government and the Regions (DTLR) and the National Environmental Technology Centre (NETCEN). The Environmental Change Institute of Oxford University has provided energy consumption figures for appliances in the domestic sector. The BRE domestic end use figures are based on their BREHOMES model, whilst the service sector figures are based on the their N-DEEM model. The Environmental Change Institute figures are derived from their DECADE model. These figures are generally constrained to totals as shown in the Digest, however there will be some differences between these sources since they are derived from different data sources.

A.4 Additional information for the transport sector were provided by DTLR, including data from 'Transport Statistics Great Britain (2001)'. Output data (Gross Value Added) for the industrial and service sectors are from the Office for National Statistics (ONS).

Primary Energy Equivalents

A.5 The primary energy source of secondary energy used within a sector is reallocated to that sector and is added to the fuel consumed within the sector to provide primary energy equivalents for that fuel, for example the gas used to produce electricity consumed within a sector is added to the gas used in that sector to give primary energy equivalents for gas for that sector. Similarly the coal used in the manufacture of coke, which has been consumed in a sector is added to the amount of coal used in that sector to give primary energy equivalents for coal for that sector. This provides primary energy equivalents of each fuel by sector.

A.6 The reallocation to primary energy equivalents includes consideration of difficulties in data availability, for example some data for manufactured solid fuels were not available before 1990, electricity data are only available for major power producers before 1987, data for renewables have only been collected since 1988 and data for heat have only been included since 1999. The primary energy equivalent figures will include any losses that were incurred during the transformation process or energy used by the energy industry. In order that the total primary energy equivalents correspond with the primary energy totals it is necessary to estimate factors which apportion these losses and uses.

Conversion Losses and Primary Energy Savings

A.7 "Conversion losses" are defined as the difference between total inland consumption of primary fuels (and equivalents) for energy use and energy consumption by final users. Conversion losses can be decomposed into changes due to improvements in conversion efficiency, changes in the proportions of final fuels and changes in the total requirement for final energy.

Factor analyses

A.8 It is assumed throughout the report that a change in consumption at any level of aggregation can be broadly split into the change due to variation in the level of activity for which energy is required (the output effect) and the change due to a change in the energy required per unit output of that activity (the intensity effect). Aggregate output of all the sectors is assumed to be the aggregate of the individual sector output effects.

A.9 The intensity effect has been estimated by subtracting the output effect from the overall change in energy consumption for that sector or sub-sector. This measure of intensity also includes structural and efficiency changes. The aggregate measure of intensity has been derived from a weighted measure of sectoral intensities.

Output indicators used

A.10 For each of the industrial, transport, domestic and service sectors different indicators have been used as proxies for changes in output (see Charts 1.7, 2.4, 4.5 and 5.5). For each sector the output effect is defined as the change in delivered energy that would have occurred in that sector if the percentage change in energy demand over the period had been exactly the same as the percentage change in the indicator used to measure the output of that sector or sub-sector. The difference between the output effect and the total recorded change in that sector's demand for energy is then defined as the intensity effect, which measures the change in energy use per unit of output.

A.11 For the industrial sector, Gross Value Added (GVA) figures (from Table 2.4 of the 2001 edition of the ONS' National Accounts Blue Book) are used as proxies for output changes in the sector (except in the iron and steel sector where actual output in tonnes of steel has been used). The groups in which GVA at constant prices is published do not exactly correspond to the twelve DUKES industrial groups, so the factor analysis shown in Chart 4.5 is subject to some approximation. Figures in Chart 1.7 for industry are the headline figures from Chart 4.5.

A.12 For the services sector factor analysis, Chart 5.5, figures derived from Table 2.4 of the National Accounts are used to give measures of output in the public administration, commercial and agricultural sub-sectors. Figures in Chart 1.7 for the service sector are the headline figures from Chart 5.5.

A.13 Numbers of households have been used as the indicator for output in the domestic sector, while alternative measures are available, such as income, floor space of the housing stock or population, these are less reliable indicators of energy use, although over time the size and composition of households will also have changed slightly.

A.14 In the transport sector a variety of indicators have been used for each transport type, for example, road passenger transport, road freight transport, rail, air and water transport. The split between road passenger transport and road freight energy use is based on estimates provided by NETCEN.

A.15 Passenger kilometres are used as a proxy for changes in road passenger transport use, while freight tonne-kilometres are used as a proxy for changes in freight transport. Water borne passenger transport is assumed negligible relative to water-borne freight transport and changes in water-borne freight are used as a proxy. Air-borne freight is assumed to be small relative to air passenger transport, so air passenger kilometres is used as a proxy. The weighting of rail freight and passenger transport is based on data from a ratio derived from the ONS Input-Output tables for 1990.

Reallocation of transport energy between the industrial, domestic and service sectors

A.16 The reallocation of transport energy use between the industrial, domestic and service sectors has been based on a number of data sets of varying quality. The reallocation of road transport is rather more reliable than the other transport modes because more reliable data have been available for this sub-sector.

A.17 Lack of data has meant that it was not possible to separate transport energy used by the energy industries and that used by other industries.

The split between domestic and non-domestic transport energy use

A.18 The more straightforward split of transport energy is between the domestic and non-domestic sectors. All road freight transport energy has been allocated to the non-domestic sectors. For road passenger energy the split between domestic and non-domestic energy use has been achieved using the purposes of car journeys according to the National Travel Survey results. Commuting has been interpreted as transport energy use in the domestic sector, because getting to work by whatever means is not directly part of the work you do.

A.19 It is difficult to split rail energy usage between freight and passenger transport and a ratio derived from the ONS Input-Output tables for 1990 has been used. It is assumed that all intermediate demand for rail transport, that is, demand from other companies, is for goods transport, whilst demand for final consumers is for passenger transport. This is only an approximation and the same ratio has had to be applied to all years subsequent to 1990.

A.20 Air transport energy use has been split on the basis of results of the International Passenger Survey, 2001. This covers international flights into and out of the country, which make up over 85 per cent of flights. Air freight energy use is assumed to be negligible. This is supported by figures from the Civil Aviation Authority that show that passenger flights make up 98.7 per cent of all aircraft kilometres in 2000. Water transport energy has been allocated in its entirety to the non-domestic sector.

The split between industry and service sector transport energy use

A.21 For road passenger transport the proportion of the energy that was used for business purposes was split according to the proportions from the ONS Combined Use tables, for petrol driven and diesel driven cars. For road freight data from DTLR's Transport Statistics Great Britain (2001 edition) has been used to split transport energy use between services and industry.

A.22 For rail freight data from National Rail Trends 2001-2002 have been used. This gives data for domestic inter-modal freight, which is primarily parcels, and has been interpreted as corresponding to service sector energy consumption. These data only cover 1998-1999, 1999-2000 and 2000-2001, and data have been extrapolated for the years 1990 to 1997.

A.23 All water transport energy use has been allocated to the industrial sector. Support for this action is given by the detailed table of freight transport by water in DTLR's 'Waterborne Freight in the UK' publication, which shows that the vast majority of water transport is industrial in nature. For air business travel data from the Civil Aviation Authority annual passenger survey for 2000 has been used to derive a service and industrial sector split.

List of tables available on the Internet

Overall energy consumption

Transport energy consumption

Domestic energy consumption

Industrial energy consumption

Service sector energy consumption

ENERGY CONSUMPTION IN THE UNITED KINGDOM

ENERGY CONSUMPTION in the United Kingdom, brings together statistics from a variety of sources to produce a comprehensive review of energy consumption in the UK since the 1970s. This booklet describes the key trends in energy consumption in the UK since 1970 with a particular focus on trends since 1990. It includes an analysis of the factors driving the changes in energy consumption, the impact of increasing activity, increased efficiency, and structural change in the economy, while detailed tables can be found on the internet. The information is presented in five sections covering firstly overall energy consumption, then energy consumption in the transport, domestic, industrial and service sectors.

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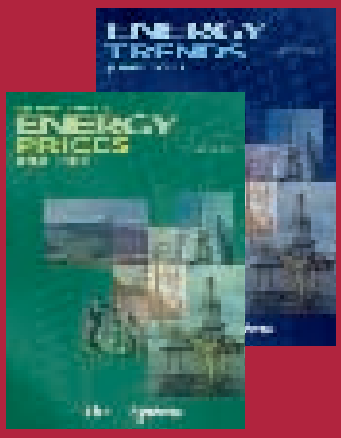
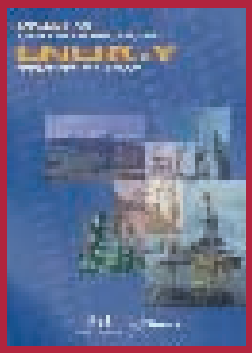


Quarterly Energy Prices and Energy Trends
Available from the DTI
(020 7215 2698)
Price - £35p/a UK
http://www.dti.gov.uk/energy/inform/energy_trends/
http://www.dti.gov.uk/energy/inform/energy_prices/



Digest of UK Energy Statistics 2002
Available from The Stationery Office (0870 600 5522)
http://www.dti.gov.uk/energy/inform/dukes/

UK Energy in Brief
Available free from the DTI
(020 7215 2698)
http://www.dti.gov.uk/energy/inform/energy_in_brief/

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