national STATISTICS

Environmental Accounts

Spring 2004

Contact points

For enquiries about this publication, contact;

Perry Francis
Head of Environmental Accounts

Tel: **020 7533 5916**

E-mail: **environment.accounts@ons.gov.uk**

For general enquiries, contact the National Statistics Customer Contact Centre on **0845 601 3034**
(minicom: 01633 812399)

E-mail: **info@statistics.gov.uk**

Fax: 01633 652747

Letters: Customer Contact Centre, Room 1.015,

Government Buildings, Cardiff Road,

Newport NP10 8XG

You can also find National Statistics on the Internet at **www.nationalstatistics.gov.uk**

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The Office for National Statistics (ONS) is the government agency responsible for compiling, analysing and disseminating many of the United Kingdom's economic, social and demographic statistics, including the retail prices index, trade figures and labour market data, as well as the periodic census of the population and health statistics. The Director of ONS is also the National Statistician and the Registrar General for England and Wales, and the agency that administers the registration of births, marriages and deaths there.

A National Statistics Publication

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Contents

List of tables

List of graphs

What's new

Publication date: 20.05.2004

This edition of *Environmental Accounts* presents updates of data for environmental protection expenditure, environmental taxes, air and energy accounts and the material flow accounts. There has also been a revision to oil and gas monetary valuations data.

Full details of the revisions are listed in annex 2 while further information on the updates can be found using links to the relevant sections below:-

Oil and Gas
Energy consumption
Atmospheric emissions
Material Flows
Environmental taxes
Environmental protection expenditure

The next edition of *Environmental Accounts* will be published on 18 November 2004.

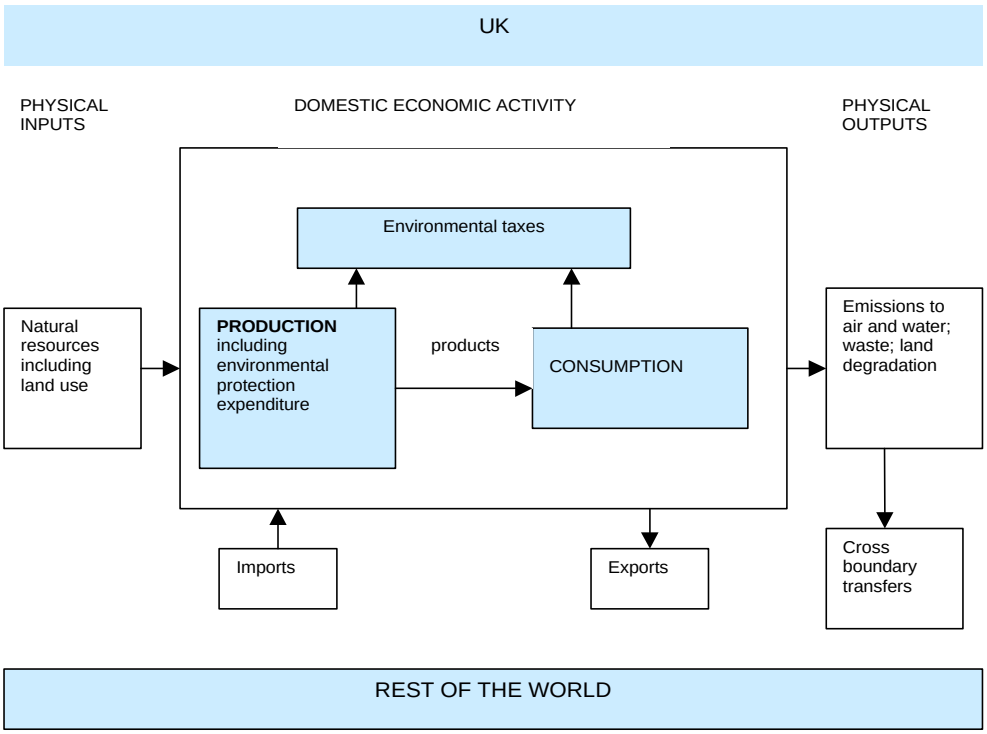
Introduction to environmental accounting

The Environment

“The effect of mankind’s activity upon the environment has been an important policy issue throughout the last part of the twentieth century. On the one hand there has been growing concern about the impact of each country’s economic activity upon the global and local environment. On the other hand there has been increasing recognition that continuing economic growth and human welfare are dependent upon the services provided by the environment. These services include the provision of raw materials and energy used to produce goods and services, the absorption of waste from human activities, and the basic roles in life support and the provision of other amenities such as landscape.”

Source: The United Nations Handbook of National Accounting - Integrated Environmental and Economic Accounting

Economic activity and environmental impact



Source: ONS

UK Environmental accounts

UK Environmental Accounts look to provide information on the demands that UK economic activity places on the environment (in particular in the form of emissions of pollutants) and on the importance of natural resources to the economy. The information has been separated into three dimensions:

Natural resources

- Oil and gas extraction and reserves - providing information in physical and monetary terms
- Land cover - reporting on the amount and condition of habitats and landscapes in Great Britain
- Forestry - providing information on tree diversity in Great Britain
- Fishing - giving information on selected catches and stocks in three sea regions

Physical flows

- Fossil fuel and energy consumption - a breakdown of fossil fuel use and energy consumption by sector
- Atmospheric emissions - a breakdown of greenhouse gas and acid rain precursor emissions by sector
- Material flows - presents information on the total mass of natural resources and products that are used by the economy
- Waste - estimating the total waste arising in the UK, including information on radioactive waste
- Water - showing amounts of ground water and non-tidal surface water used by UK industry

Monetary

- Environmental taxes - information on government revenue from environmental taxes
- Environmental protection expenditure - a breakdown of environmental protection expenditure by general government and UK industry

UK environmental accounts are used to inform sustainable development policy, to model impacts of fiscal or monetary measures and to evaluate the environmental impacts of different sectors of the economy. Most data are provided in units of physical measurement (mass or volume), although some are in monetary units, where this is the most relevant or the only data available.

Satellite Accounts

Environmental Accounts are “satellite accounts” to the main National Accounts. (Satellite accounts are extensions to National Accounts, which facilitate analysis of the wider impact of economic change.) The Environmental Accounts use similar concepts and classifications of industry to those employed in the National Accounts and they reflect the recommended European Union and United Nations frameworks for developing such accounts.

Other publications

Office for National Statistics

United Kingdom National Accounts Blue Book:
www.statistics.gov.uk/downloads/theme_economy/BB_2003.pdf

Department for Environment, Food and Rural Affairs

The Environment in your Pocket 2003: *http://www.defra.gov.uk/environment/statistics/eiyp/index.htm*
Digest of Environmental Statistics: *http://www.defra.gov.uk/environment/statistics/index.htm*

Sustainable development

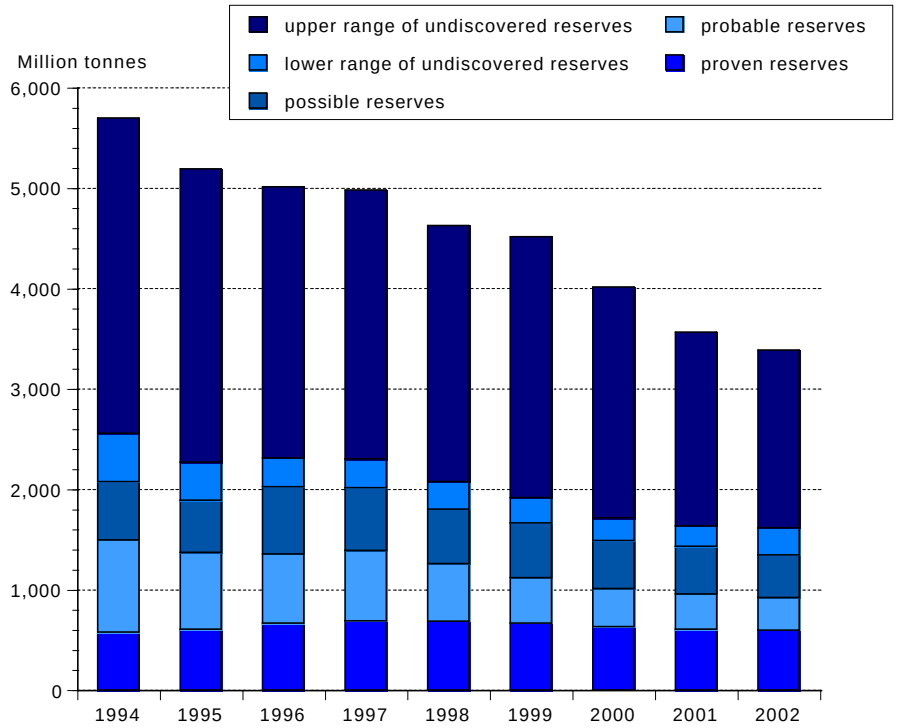
A better quality of life, a strategy for sustainable development for the UK:
www.sustainable-development.gov.uk/uk_strategy/index.htm
Indicators of Sustainable Development:
http://www.sustainable-development.gov.uk/indicators/index.htm

Eurostat

Measuring progress towards a more sustainable Europe:
www.eu-datashop.de/veroeffe/EN/thema8/entwickl.htm

Natural resource accounts

Estimated remaining recoverable oil reserves at end of year, 1994-2002 (million tonnes)



- *Proven reserves are known reserves which have a better than 90 per cent chance of being produced.*
- *Probable reserves are known reserves which are not yet proven but which are estimated to have a greater than 50 per cent chance of being technically and economically producible.*
- *Possible reserves are those reserves which, at present cannot be regarded as 'probable', but are estimated to have significant but less than 50 per cent chance of being technically and economically producible.*

Source: ONS

Only a small proportion of the estimated remaining recoverable reserves of oil and gas is known with any degree of certainty. Reserves of oil were estimated to total up to 3.1 billion tonnes at the end of 2002, but of these only 0.6 billion tonnes were proven.

The total includes an estimate of between 0.2 and 1.8 billion tonnes of reserves which have yet to be discovered, but which may exist in areas of the UK continental shelf. Estimates of the life expectancy of remaining UK oil reserves are therefore uncertain, but they do show an overall decline between 1994 and 2002 (as would be expected given the extraction of reserves over the period).

Estimates of gas reserves are made on the same basis as oil and are similarly uncertain, totalling up to 2.7 billion cubic metres at the end of 2002, of which only 0.6 billion cubic metres were proven reserves. The life expectancy of gas reserves also shows an overall decline over the period, down to approximately 12 years at current rates of extraction by the end of 2002.

1.1 Estimates of remaining recoverable oil and gas reserves

Million tonnes

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Oil											
Discovered reserves											
Proven	**JKOV**	605	575	605	665	690	685	665	630	605	595
Probable	**JKOW**	800	920	765	690	700	575	455	380	350	325
Proven plus Probable	**JKOX**	1 405	1 495	1 370	1 355	1 390	1 260	1 120	1 010	955	920
Possible	**JKOY**	690	580	520	670	625	540	545	480	475	425
Maximum	**JKOZ**	2 095	2 075	1 890	2 025	2 015	1 800	1 665	1 490	1 430	1 345
Range of undiscovered reserves											
Lower	**JKNY**	560	480	380	285	285	275	250	225	205	270
Upper	**JKNZ**	3 355	3 140	2 920	2 700	2 680	2 550	2 600	2 300	1 930	1 770
Range of total reserves											
Lower[1]	**JKOA**	1 165	1 055	985	950	975	960	915	855	810	865
Upper[2]	**JKOB**	5 450	5 215	4 810	4 725	4 695	4 350	4 265	3 790	3 360	3 115
Expected level of reserves[3]											
Opening stocks	**JKOC**	1 895	1 965	1 975	1 750	1 640	1 675	1 535	1 370	1 235	1 160
Extraction	**JKOD**	–100	–127	–130	–130	–128	–132	–137	–126	–117	–117
Other volume changes	**JKOE**	170	137	–95	20	163	–8	–28	–9	42	147
Closing stocks	**JKOF**	1 965	1 975	1 750	1 640	1 675	1 535	1 370	1 235	1 160	1 190
Life expectancy[4] (years)	**JKOG**	20	16	13	13	13	12	10	10	10	10
Gas (billion cubic metres)											
Discovered reserves											
Proven	**JKOH**	630	660	700	760	765	755	760	735	655	630
Probable	**JKOI**	805	855	780	660	620	585	500	460	445	370
Proven plus Probable	**JKOJ**	1 435	1 515	1 480	1 420	1 385	1 340	1 260	1 195	1 100	1 000
Possible	**JKOK**	480	400	435	540	600	455	490	430	395	330
Maximum	**JKOL**	1 915	1 915	1 915	1 960	1 985	1 795	1 750	1 625	1 495	1 330
Range of undiscovered reserves											
Lower	**JKOM**	300	430	395	440	500	440	355	325	290	235
Upper	**JKON**	1 297	1 602	1 412	1 585	1 700	1 595	1 465	1 440	1 680	1 390
Range of total reserves											
Lower[1]	**JKOO**	930	1 090	1 095	1 200	1 265	1 195	1 115	1 060	945	865
Upper[2]	**JKOP**	3 212	3 517	3 327	3 545	3 685	3 390	3 215	3 065	3 175	2 720
Expected level of reserves[3]											
Opening stocks	**JKOQ**	1 620	1 735	1 945	1 875	1 860	1 885	1 780	1 615	1 520	1 390
Extraction	**JKOR**	–61	–65	–70	–84	–86	–89	–99	–108	–107	–101
Other volume changes	**JKOS**	176	275	–	69	111	–16	–66	13	–23	–54
Closing stocks	**JKOT**	1 735	1 945	1 875	1 860	1 885	1 780	1 615	1 520	1 390	1 235
Life expectancy[4] (years)	**JKOU**	28	30	27	22	22	20	16	14	13	12

1 The lower end of the range of total reserves has been calculated as the sum of proven reserves and the lower end of the range of undiscovered reserves.
2 The upper end of the range of total reserves is the sum of proven, probable and possible reserves and the upper end of the range of undiscovered reserves.
3 Expected reserves are the sum of proven reserves, probable reserves and the lower end of the range of undiscovered reserves.
4 Based on expected level of reserves at year end and current extraction rates (source: ONS).

Source: ONS and Department of Trade and Industry

Oil and Gas reserves

Oil reserves include both oil and the liquids and liquefied products obtained from gas fields, gas-condensate fields and from the associated gas in oil fields. Gas reserves are the quantity of gas expected to be available for sale from dry gas fields, gas-condensate fields and oil fields with associated gas. Gas which is expected to be flared or used offshore is not included.

Recoverable reserves are classified into two main categories: discovered and undiscovered. The discovered reserves are subdivided into proven, probable and possible.

Simulation models using Monte Carlo techniques are used each year by the Department for Trade and Industry (DTI) to assess the likely existence and size of undiscovered oil and gas fields on the UK continental shelf (UKCS). The assessments are presented as a range, but the limits of the range should not be regarded as maxima or minima. Estimates of the volume of undiscovered reserves have fluctuated considerably in recent years as new areas of UKCS have been subjected to statistical analysis and older areas have been reassessed. Estimates are published annually by the DTI and are taken from the DTI Brown Book[1].

The lower end of the range of total reserves shown in the table is the sum of estimated proven reserves and the lower end of the range of undiscovered reserves for that year, net of cumulative production.

The upper end of the range of total reserves is the sum of estimated proven, possible and probable reserves, plus the upper end range of undiscovered reserves, for that year, net of cumulative production.

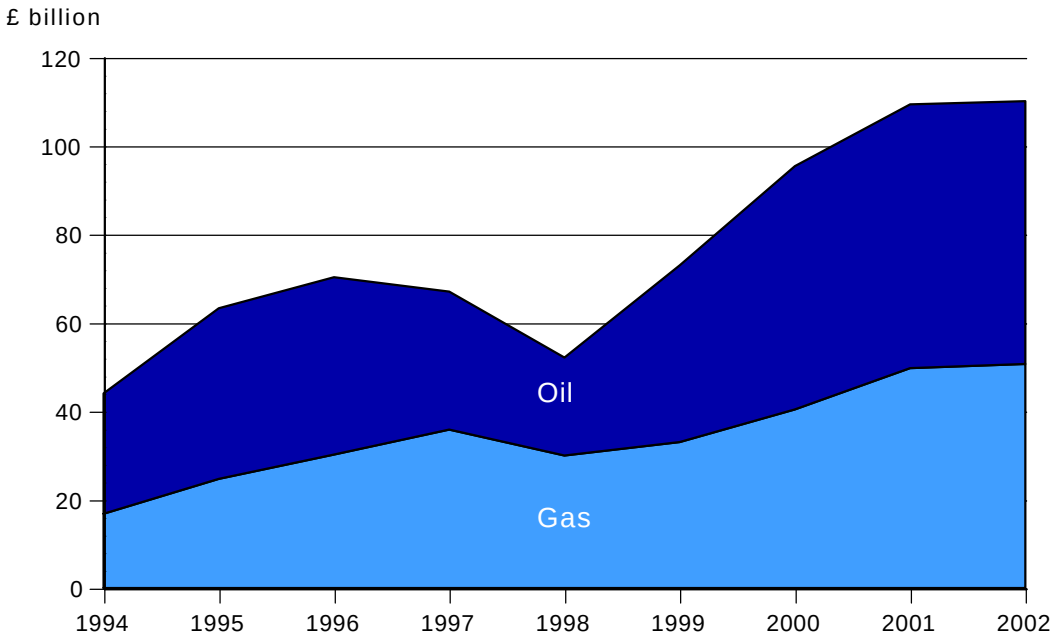
The expected level of reserves is calculated as the sum of proven and probable reserves and the lower end of the range of undiscovered reserves.

Other volume changes are calculated as the difference between the expected level of reserves at the start of the year less production within that year, and the estimated level of reserves at the start of the following year.

Life expectancy is calculated as the expected level of reserves at the end of the year divided by the current rate of annual extraction. This calculation gives an indication of the theoretical number of years for which extraction could be sustained at current levels. In practice, towards the end of the period, the rate of extraction is likely to decrease as individual oil and gas fields are exhausted, so the period of extraction will be longer than that implied by the life expectancy calculation.

1. *Department of Trade and Industry. The Energy Report, vol 2 – Oil and gas resources of the United Kingdom. Various issues. HMSO/TSO*

Value of oil and gas reserves 1994 to 2002



Source: ONS

The value of the UK's recoverable oil and gas reserves mainly depends upon the estimated physical amounts remaining, the rate of extraction and the assumed future price per unit of oil or gas, net of the cost of extraction.

These factors show that since 1994, the estimated remaining physical stock of reserves has fallen as a result of extraction, but the value of the reserves has generally risen, with increases in the price of oil and gas being significant. As at the end of 2002 (the latest date for which estimates are currently available), oil reserves were valued at £59 billion while gas reserves were estimated to be worth £51billion.

Data from 1997 have been revised since their previous publication in October 2003 to incorporate a change in methodology used in the calculation of the unit resource rent moving average that had previously been applied only to pre-1997 data.

Expressing UK oil and gas reserves in monetary terms allows these subsoil assets to be compared with other economic entities. This provides a means for the commercial depletion of subsoil assets to be set against national income.

1.2 Oil and gas monetary balance sheet

£ million

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Oil											
Opening stocks[1]	**JKPA**	6 993	17 912	27 203	38 593	40 136	31 176	22 124	39 989	54 974	59 629
Extraction	**JKPB**	–1 335	–2 381	–3 761	–4 107	–3 111	–2 496	–5 047	–7 053	–7 571	–7 394
Revaluation due to time passing	**JKPC**	699	1 084	1 689	1 687	1 227	1 120	2 059	2 805	2 943	2 727
Other volume changes	**JKPD**	1 066	1 396	–1 569	374	2 385	–80	–626	–303	1 688	5 826
Change in extraction	**JKPE**	353	1 872	275	–12	–82	218	381	–1 171	–1 106	–
Change in rent	**JKPF**	4 726	7 045	14 028	2 288	–10 524	–8 678	20 594	20 138	7 437	–3 322
Closing stocks	**JKPG**	17 912	27 203	38 593	40 136	31 176	22 124	39 989	54 974	59 629	59 390
GAS											
Opening stocks[2]	**JKPH**	906	8 455	16 781	24 696	30 171	35 852	30 011	32 989	40 384	49 757
Extraction	**JKPI**	–505	–969	–1 525	–2 085	–2 484	–2 349	–2 926	–3 964	–5 166	–5 498
Revaluation due to time passing	**JKPJ**	325	631	1 008	1 213	1 422	1 487	1 682	2 012	2 528	2 630
Other volume changes	**JKPK**	497	1 351	3	720	1 363	–159	–869	241	–584	–1 592
Change in extraction	**JKPL**	582	355	972	2 123	222	483	1 395	1 252	–157	–945
Change in rent	**JKPM**	5 948	6 830	7 006	2 664	4 298	–6 296	3 010	7 386	11 823	4 743
Closing stocks	**JKPN**	8 455	16 781	24 696	30 171	35 852	30 011	32 989	40 384	49 757	50 699

1 The estimated opening and closing stock values are based on the present value method -see *Environmental Accounts* on the National Statistics web-site for more detailed descriptions of the methodology used. The estimates are extremely sensitive to the estimated return to capital and to assumptions about future unit resource rents.

Source: ONS

Monetary valuation of oil and gas reserves

Expressing UK oil and gas reserves in monetary terms allows these subsoil assets to be compared with other economic entities. This provides a means for the commercial depletion of subsoil assets to be set against national income. The results for 1994 to 2002 are presented in the form of a balance sheet.

Since observed market values for transactions *in situ* in their original state are not widely available, the present value method is used to put a monetary value on the physical stocks of assets. This is an indirect valuation method measuring the current value of the asset's future streams of income by discounting the expected future rent, often referred to as the economic rent or resource rent. The method relies on information about the size of resource rent, the number of years for which the rent is to be received and the social discount rate to be applied.

The resource rent is the net income from extraction defined as total revenue from sales less all costs incurred in the extraction process i.e. operating costs, depreciation of capital and an allowance for the return on capital. Decommissioning costs have not been included in these accounts. The rate of return on capital is estimated to be 8 per cent in real terms in line with Eurostat recommendations[1], but it is worth noting that the resulting valuations are very sensitive to variations in this estimate. A three point centred moving average has been introduced for the calculation of the unit resource rent. This has resulted in some large revisions to previously published estimates.

The time span until the complete exhaustion of the reserves is the period over which resource rents are discounted, using the Eurostat recommended social discount rate of 4 per cent. Using these assumptions it is possible to calculate a present value of the stocks of oil and gas reserves at the start and end of each year. The accumulation account then breaks down the change between the start-of-year balance and the end-of-year balance. While physical stocks may change only as a result of extraction and other volume changes such as reassessments, monetary stocks can change for a number of other reasons.

Extraction is equal to the total resource rent for the year, effectively reducing the present value of the stocks by that amount. Positive values for extraction are a result of estimated negative resource rents. Revaluation due to time passing takes account of the fact that, as we move forward in time, the period over which the future rents are discounted is one year less, thereby reducing the effect of discounting future incomes. Other volume changes are reassessments which change the estimated stock of recoverable reserves.

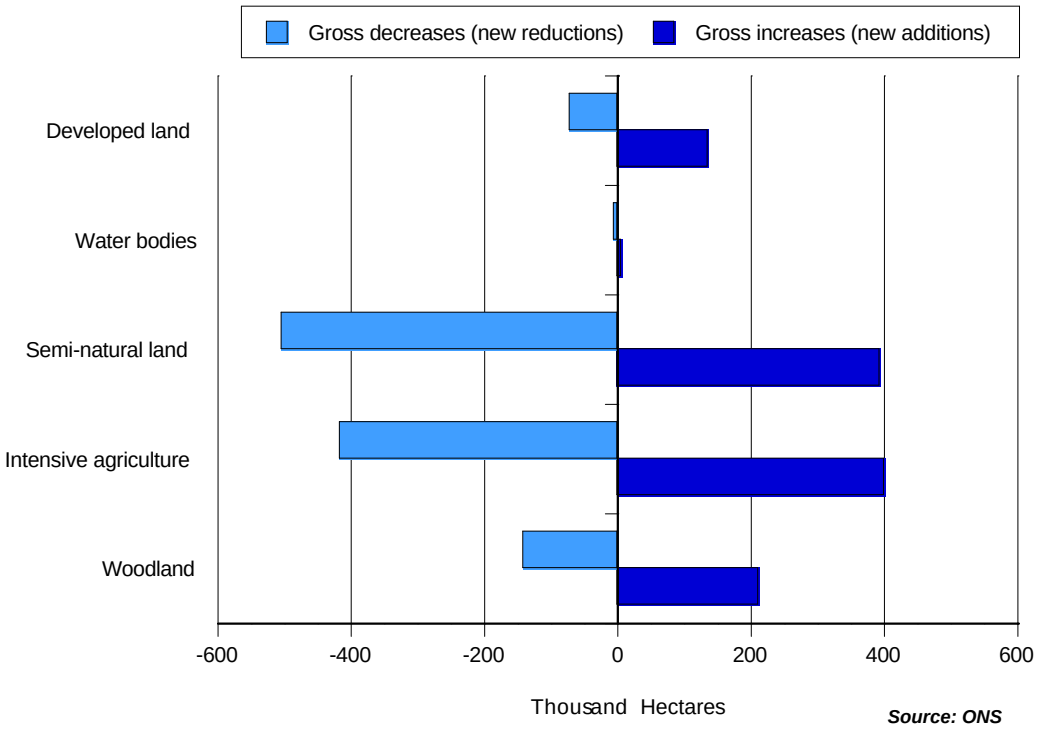
The change in the extraction path sets out in monetary terms the addition or subtraction to the present value arising from a change in the amounts assumed to be extracted each year.

The change in unit rent gives the change in the future stream of income resulting from a change in the estimated unit resource rent. Any negative stock values result from estimated negative resource rents and have been left in the table in order to show the results of the assumptions made in the calculations.

1. European Commission (2000). Accounts for subsoil assets: Results of pilot studies in European countries, 2000. Office for Official Publication of the European Communities, Luxemberg

Land cover

Gross changes of land cover in Great Britain, between 1990 and 1998



Source: ONS

Total land cover for Great Britain is 23.5 million hectares. Different types of landcover give distinctive qualities to an area and can have important climatic effects. For instance the urban “heat island” effect raises temperatures in urban areas compared with the surrounding countryside.

The most recent data shows that developed land accounts for 1.8 million hectares, water bodies 0.3 million hectares, semi-natural land 7 million hectares, intensive agricultural land 10.8 million hectares and woodland 2.8 million hectares. The chart shows how these different types of land cover changed between 1990 and 1998. Most notably there is a net increase in the area of woodland of 200 thousand hectares, an increase of 2.1 per cent and a net decrease in the area of semi-natural land of 90 thousand hectares a fall of 1.5 per cent .

1.3 Land cover account, Great Britain Changes between 1990 and 1998

Area measured in thousand hectares

		Types of changes in stock							
	1990 stock	Woodland creation/ rotation	Agricultural intensifica- tion/rotation	Semi- natural creation	Semi- natural rotation	Water body creation	Develop- ment	Loss to unknown	1998 stock
Broadleaved and mixed woodland	1 371.2	145.9	–22.2	–42.1	..	–0.8	–12.9	–0.4	1 438.7
Coniferous woodland	1 369.3	53.7	–9.0	–48.3	..	–0.6	–5.0	–	1 360.2
Woodland sub-total	**2 740.5**	**199.6**	**–31.2**	**–90.4**	..	**–1.4**	**–17.8**	**–0.4**	**2 798.9**
Arable and horticultural	5 246.1	–28.8	177.4	–41.4	..	–1.0	–19.3	–0.2	5 332.9
Improved grassland	5 538.6	–34.1	222.8	–232.0	..	–0.5	–53.9	–5.3	5 435.5
Intensive agriculture sub-total	**10 784.7**	**–62.8**	**400.2**	**–273.4**	..	**–1.5**	**–73.2**	**–5.5**	**10 768.4**
Neutral grassland	569.5	–24.4	–153.6	238.9	–18.2	–0.5	–33.2	–0.1	578.3
Calcareous grassland	81.4	–1.1	–13.3	3.7	–3.8	–	–0.2	–	66.7
Acid grassland	1 470.9	–24.0	–133.7	43.3	–34.7	–	–4.6	–0.7	1 316.5
Bracken	456.9	–21.8	–8.7	20.4	38.9	–	–0.5	–	485.1
Dwarf shrub heath	1 487.1	–24.5	–1.2	13.1	–41.4	–	–3.3	–	1 429.7
Fen, marsh, and swamp	456.4	–6.1	–25.1	61.0	71.3	–0.7	–1.2	–0.6	554.9
Bog	2 297.3	–17.9	–0.7	10.5	–10.1	–0.3	–0.2	–0.1	2 278.5
Montane	49.8	–	–	–	–	–	–	–	49.8
Coastal habitats	274.1	–0.3	–0.8	2.6	–2.0	–0.3	–	–	273.3
Semi-natural sub-total	**7 143.3**	**–120.1**	**–337.2**	**393.5**	**–**	**–1.8**	**–43.2**	**–1.5**	**7 032.9**
Standing open water and canals	208.4	–0.2	–1.0	–0.9	..	5.2	–1.2	–	210.3
Rivers and streams	66.7	–0.2	–0.1	–1.4	..	0.3	–0.1	–	65.2
Water bodies sub-total	**275.1**	**–0.4**	**–1.1**	**–2.3**	..	**5.5**	**–1.2**	**–0.1**	**275.5**
Inland rock	53.6	–0.6	–2.2	–7.6	..	–	17.0	–	60.2
Built up areas and gardens	1 230.4	–14.2	–12.3	–9.4	..	–0.7	98.3	–1.2	1 291.0
Boundary and linear features	495.0	–1.0	–14.5	–7.8	..	–0.1	20.2	–0.1	491.7
Developed sub-total	**1 779.0**	**–15.9**	**–28.9**	**–24.8**	..	**–0.8**	**135.5**	**–1.3**	**1 842.9**
Sea	298.5	–	–	–0.7	..	–	–	–	297.8
Unknown	73.9	–0.3	–1.8	–2.0	..	–	–	8.8	78.6
Unsurveyed urban land	463.0	..	..	..	..	..	..	..	463.0
Total	**23 557.9**	..	..	..	..	..	..	..	**23 558.0**

Areas that are more than 75% built up were not covered by the Countryside 2000 survey

Source: Defra

Land cover

These estimates made within the account are based on the Countryside Survey 2000 (CS2000), which is a stratified sample survey that used detailed field recording and mapping to provide information on the stock and condition of habitats and landscapes in Great Britain in 1998. The survey covered both terrestrial and freshwater habitats but did not cover areas more than 75 per cent built up. A similar Northern Ireland Countryside survey (NICS2000) was also completed, but since comparable estimates for 1990 are not readily available, our data only covers Great Britain.

Using the results of the 1990 survey and CS2000, it is possible to estimate changes in the stock of land cover types between 1990 and 1998. Our data sets out a summary of the main changes in land cover over the period, broken down by the type of change in the stock of land. There are various land cover types:

Woodland is dominated by trees which are more than 5 metres high when mature and which provide a canopy with a cover of greater than 25 per cent. It is divided between broad-leaved and mixed woodland (including yew woodland) and coniferous woodland.

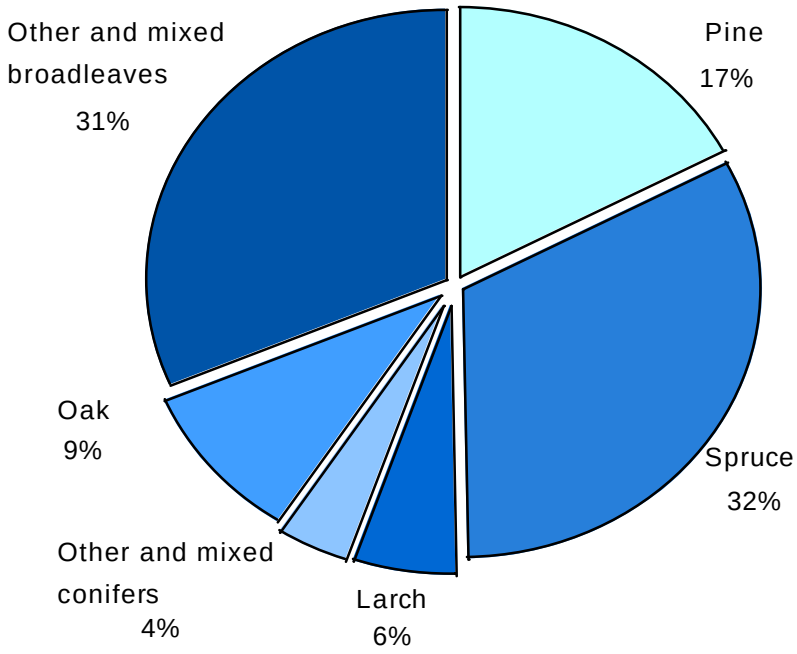
Intensive agricultural land is divided into arable and horticultural land and improved grassland. Arable and horticultural land includes orchards and more specialist operations such as market gardening and commercial flower growing.

Semi-natural land includes neutral, calcareous and acid grassland (the classification of which depends upon the type of soil and the resulting types of vegetation communities); bracken and dwarf shrub heath (which are lands dominated by bracken, dwarf gorse or heath family species); wetlands such as fen, marsh, swamp and bog; and montane and coastal habitats.

The remaining land covered by the survey is classified as developed land and water bodies. Developed land consists principally of built up areas and gardens, but also includes inland rock (such as quarries and excavations as well as cliffs, screes, etc) and boundary and linear features such as hedgerows, walls and ditches as well as roads, tracks and railways.

Unsurveyed urban land is shown separately, in addition to sea and a small unclassified category.

Forest diversity in the United Kingdom, 1999



Source: Forestry Comission

The amount of woodland in the UK is increasing. This increase is driven by a number of factors. The commercial popularity of conifer plantations the first of which were set up in the 1950's. The Forestry Commission's tax incentives and expansion objectives including the Land Regeneration Unit and the Woodlands by the Motorway programme. In the 1990s the Kyoto Protocol to the UN Framework Convention on Climate Change recognised the place of forestry in reducing concentrations of greenhouse gases and the Convention on Biological Diversity affirmed the role of forests in the promotion of greater variety of life[1].

These factors have seen woodland cover more than double during the twentieth century, from 5 per cent of United Kingdom land cover in 1900 to the current 11 per cent[2] and new woodland is being established at the rate of 15-20 thousand hectares per year. Within the UK the number of trees per hectare varies, however in 1999 there were a total of 3911 million trees in the UK, representing 67 trees for every man, women and child in the country.

In order for woodland to be a sustainable resource, its management must be sustainable. One measure of sustainability is the certification of woodland, under which woodlands are monitored to ensure that good management is continually in practice. The Forest Stewardship Council (FSC) began a scheme for certifying woodland in 1996 and, by December 2001, more than one third of the UK's total woodland area had been certified. In addition, there may be sustainable management of woodlands that are not certified.

1. *Convention on Biological Diversity,* Sustaining life on Earth: How the Convention on Biological Diversity promotes nature and human well being*, pp 6, downloaded 20/3/2003 www.biodiv.org/doc/publications/guide.asp*
2. *Forestry Commission report,* UK indicators of sustainable forestry, *October 2002, pp11*

Woodlands are managed for a variety of purposes, including bio-diversity and recreation, in addition to timber production. If timber production is to be sustainable in the long term, the volume of growing stock must be maintained so that the increase in growing stock (from new planting and from natural growth) exceeds the volume of timber harvested. The annual volume of conifer (softwood) harvested is around 60 per cent of the gross annual increment in conifer growing stock. For broadleaves (hardwood), the annual volume harvested is currently around 20 per cent of the gross annual increment in broadleaved growing stock.

UK woodlands have been providing an increasing volume of timber, which has permitted the development of wood processing industries using homegrown logs and small roundwood. In 2001 the amount of softwood harvested in Great Britain was 9.6 million m^3. The softwood forecast shows that the current woodland area can provide more raw materials to these industries in the future.

Plants absorb carbon dioxide (CO_2) and store the carbon, so they can help to reduce the CO_2 concentration in the atmosphere. Processes that lock up carbon are known as carbon sequestration. The value of offsetting emissions by sequestration is controversial, but there is widespread international agreement that the store of carbon represented by forest ecosystems should be protected and enhanced. The amount of carbon in tree wood varies with the volume of growing stock and tree species; the rate of carbon take-up by woodland depends upon the species and age of trees. There is currently around 140 million tonnes of carbon stored in UK woodland, with a net addition of 2 million tonnes of carbon each year.

Ancient semi-natural woodland (ASNW) and native woodland are the two most important woodland habitats for maintaining bio-diversity. Currently ASNW accounts for 10 per cent of woodland coverage in the United Kingdom and with the introduction of conservation policies its depletion has largely halted. The Woodland Grant Scheme has, since 1997, added approximately 1,500 hectares of new native woodland each year[3] . Broadleaved species such as Oak, Beech and Ash are important for the expansion of the UK's area of native woodland. Broadleaved planting has increased from around 600 hectares in the 1970s to 10,000 in the late 1990s. The majority of this increase has taken place in England where the climate is more suited to their growth. In Scotland the woodland remains dominated by conifers although here too the area covered by broadleaved species has increased by 9 per cent since 1990[4] .

In recreational terms woodland is an important resource with 350 million leisure day trips to woodland each year. Woodland also makes less quantifiable improvements to quality of life such as enhancing the appearance of the landscape and retaining cultural heritage.

3. *Forestry Commission report,* UK indicators of sustainable forestry, *October 2002, pp28-30*
4. *Countryside survey 2000 pp24*

Fish Stocks

UK catches of the selected stocks, 2001

Fishing area	Species	Total catch in 2001 (tonnes)[1]	UK catch in 2001 (tonnes)[2]	UK catch as % of total catch	Total value of UK catch in 2001[2] (£ million)
North Sea and Eastern English Channel	cod	49,693	19,931	40.1	28.19
	haddock	167,000	32,544	19.5	26.20
	whiting	46,640	19,168	41.1	8.38
Western English Channel	sole	965	384	39.8	7.66
	plaice	967	784	81.1	2.66
Irish Sea	cod	3,875	917	23.7	1.43
	whiting	1,745	531	30.4	0.30
	sole	1,473	618	42.0	0.50
	plaice	1,053	198	18.8	1.17
Total of selected stocks		**273,411**	**75,075**	**27.5**	**76.49**
Total UK catch		**737,802**	**-**	**574.38**	

Source: ICES Working Groups[2]; UK Sea Fisheries Statistics 2001

An ONS report published in May 2003 looked to construct physical and economic accounts for UK fisheries. The report looked at three sea regions of the UK:

- The North Sea and Eastern English Channel
- Western English Channel
- Irish Sea

and a combination of five species of fish

- Cod
- Plaice
- Sole
- Whiting
- Haddock

The results for each selected stock are summarised below, with all physical accounts dating from 1981 to 2000 and economic accounts dating from 1991 to 2001 and using individually estimated stock costs.

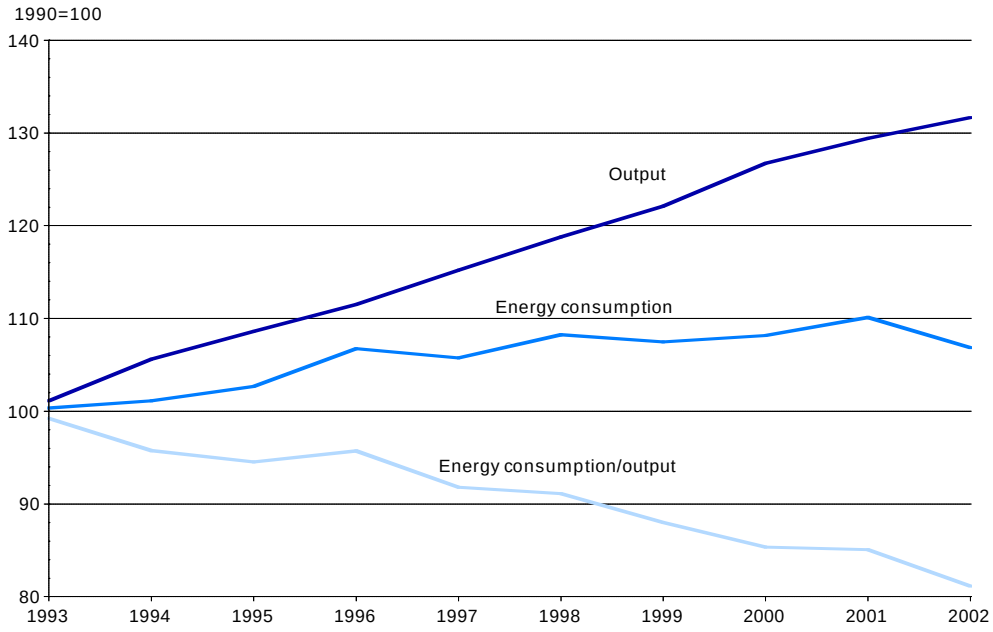
- In the North Sea and Eastern English Channel, stocks of cod and whiting in 2000 were only 33 and 44 per cent of the level that they were in 1981, respectively, while haddock stocks in 2000 were two and a half times higher compared to levels in 1981;
- In the English Channel, the stocks of sole and plaice have both significantly declined from 1981 to 2000, by 44 and 41 per cent, respectively;
- In the Irish Sea, the stocks of cod, plaice and sole all peaked in the 1980s before declining throughout the 1990s. Between 1981 and 1999, the levels of cod and whiting have fallen by 79 and 84 per cent, respectively, while the levels of plaice and sole have fallen by a much smaller 8 and 19 per cent, respectively.

The full UK fisheries report can be found on the National Statistics website at: http://www.nationalstatistics.gov.uk/downloads/theme_environment/UKfisheries_accounts.pdf

Physical flows

Energy consumption

Non-domestic energy consumption and output (Gross Domestic Product, CVM) 1993 to 2002



Source:ONS

Referring to table 2.1 Energy consumption (top section):

Energy consumption by non-domestic sectors of the UK economy increased by 7 per cent between 1993 and 2002, while output (Gross Domestic Product) rose by 30 per cent in real terms. Hence energy intensity (energy consumed per unit of output) decreased by 18 per cent over the same period.

- Total non-domestic use of energy from fossil fuels has increased from 145.4 million tonnes of oil equivalent (mtoes) in 1993 to 158.8 mtoes in 2002 representing a rise of 9 per cent.
- As a percentage of total energy consumption of primary fuels and equivalents, total non-domestic energy from fossil fuels has increased from 64 per cent in 1993 to 66 per cent in 2002.
- Energy consumption is highest in the Energy, gas and water and Transport and communication sectors which account for 27 per cent and 14 per cent respectively of all energy derived from fossil fuels.

Referring to table 2.1 Energy Consumption (bottom section):

- In 2002, the domestic sector accounted for 35 per cent of energy use once electricity transformation and distribution losses are allocated to the final consumer.

2.1 Energy Consumption

Million tonnes of oil equivalent

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Direct use of energy from fossil fuels											
Agriculture	**JKPO**	1.9	1.8	1.8	1.9	1.9	1.9	1.8	1.7	1.7	1.6
Mining and quarrying	**JKPP**	4.1	4.7	4.7	5.4	5.7	6.2	6.1	6.4	7.5	7.5
Manufacturing	**JKPQ**	41.8	42.7	42.4	43.6	43.4	42.4	42.6	41.3	41.2	38.5
Energy, gas and water supply	**JKPR**	51.8	51.7	53.2	54.1	51.7	53.8	53.4	57.1	59.8	59.0
Construction	**JKPS**	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.6	1.2
Wholesale and retail trade	**JKPT**	6.3	6.3	6.3	6.6	6.2	6.6	6.8	7.0	6.6	5.7
Transport and communication	**JKPU**	22.7	23.1	24.4	26.6	28.0	29.7	29.9	31.2	30.4	30.8
Financial intermediation	**JKPV**	4.4	4.4	4.4	4.5	4.2	4.4	4.4	4.5	4.4	4.3
Public administration	**JKPW**	4.7	4.7	4.9	5.0	4.8	4.3	4.3	4.2	4.2	4.0
Education, health and social work	**JKPX**	4.6	4.5	4.6	4.9	5.0	4.9	5.0	4.9	4.8	4.5
Other services	**JKPY**	1.9	1.7	1.7	1.7	1.4	1.4	1.4	1.3	1.5	1.7
Domestic	**JKPZ**	57.8	55.7	54.0	59.9	57.2	57.9	58.3	58.9	60.3	59.0
Total use of energy from fossil fuels	**JKQA**	**203.2**	**202.5**	**203.5**	**215.6**	**210.9**	**214.9**	**215.4**	**219.8**	**223.8**	**217.8**
Energy from other sources[1]	**JKQB**	23.4	23.1	23.1	24.0	23.8	25.0	24.0	21.4	22.0	21.6
Total energy consumption of primary fuels and equivalents	**JKQC**	**226.6**	**225.7**	**226.6**	**239.5**	**234.7**	**239.9**	**239.4**	**241.1**	**245.9**	**239.4**
Direct use of energy including electricity											
Agriculture	**JKQD**	2.2	2.2	2.1	2.3	2.2	2.2	2.1	2.0	2.1	1.9
Mining and quarrying	**JKQE**	4.6	5.0	5.0	5.8	6.0	6.5	6.4	6.7	7.8	7.7
Manufacturing	**JKQF**	49.1	49.6	49.6	51.0	51.0	49.9	50.2	49.4	48.8	47.8
Electricity, gas and water supply	**JKQG**	51.1	51.1	52.0	52.9	50.2	53.4	51.5	51.8	55.0	52.2
of which - transformation losses by major producers	**JKQH**	45.1	44.5	45.1	45.3	44.0	45.3	43.7	44.0	46.3	45.1
distribution losses of electricity supply	**JKQI**	2.0	2.6	2.5	2.4	2.5	2.4	2.4	2.5	2.7	2.6
Construction	**JKQJ**	1.4	1.5	1.5	1.5	1.5	1.4	1.5	1.4	1.7	1.3
Wholesale and retail trade	**JKQK**	8.4	8.4	8.4	8.9	8.9	9.1	9.4	9.7	9.4	8.6
Transport and communication	**JKQL**	23.6	24.0	25.3	27.5	29.1	30.7	30.9	32.3	31.5	31.8
Financial intermediation	**JKQM**	6.2	6.2	6.2	6.5	6.3	6.5	6.7	6.9	6.8	6.8
Public administration	**JKQN**	5.4	5.4	5.7	5.7	5.5	5.0	5.0	4.8	4.7	4.6
Education, health and social work	**JKQO**	5.7	5.7	5.7	6.2	6.1	6.1	6.2	6.1	6.0	5.8
Other services	**JKQP**	2.4	2.2	2.2	2.2	1.8	1.7	1.6	1.5	1.8	2.0
Domestic	**JKQQ**	66.5	64.3	62.8	69.2	66.2	67.3	67.8	68.5	70.3	68.9
Total energy consumption of primary fuels and equivalents	**JKQR**	**226.6**	**225.7**	**226.6**	**239.5**	**234.7**	**239.9**	**239.4**	**241.1**	**245.9**	**239.4**
Reallocated use of energy											
Energy industry electricity tranformation losses and distribution losses and allocated to final consumer											
Agriculture	**JKQS**	2.7	2.7	2.7	2.8	2.7	2.7	2.6	2.6	2.6	2.4
Mining and quarying	**JKQT**	5.3	5.4	5.6	6.3	6.4	7.0	6.8	7.2	8.2	8.1
Manufacturing	**JKQU**	60.6	60.9	61.3	62.7	62.1	61.2	61.0	60.3	60.1	58.7
Electricity, gas and water supply	**JKQV**	12.4	12.6	13.4	14.2	12.8	15.1	14.7	14.9	15.9	14.3
Construction	**JKQW**	1.6	1.7	1.7	1.7	1.6	1.6	1.7	1.6	1.9	1.5
Wholesale and retail trade	**JKQX**	11.9	11.9	11.9	12.4	12.7	12.9	13.1	13.4	13.6	12.7
Transport and communication	**JKQY**	25.1	25.5	26.8	29.0	30.6	32.3	32.4	33.8	33.2	33.3
Financial intermediation	**JKQZ**	9.2	9.2	9.2	9.4	9.4	9.7	9.9	10.3	10.3	10.3
Public administration	**JKRA**	6.5	6.7	6.9	6.8	6.5	5.9	5.9	5.6	5.5	5.3
Education, health and social work	**JKRB**	7.6	7.7	7.6	8.1	7.9	8.0	8.1	7.8	7.8	7.6
Other services	**JKRC**	3.2	3.1	3.0	2.8	2.4	2.2	1.9	1.8	2.2	2.4
Domestic	**JKRD**	80.4	78.4	76.6	83.3	79.4	81.4	81.3	82.0	84.7	82.8
Total energy consumption of primary fuels and equivalents	**JKRE**	**226.6**	**225.7**	**226.6**	**239.5**	**234.7**	**239.9**	**239.4**	**241.1**	**245.9**	**239.4**
Energy from renewable sources[2]	**JKRF**	1.9	2.2	2.3	2.1	2.3	2.6	2.8	2.8	3.0	3.2
Percentage from renewable sources	**JKRG**	0.8	1.0	1.0	0.9	1.0	1.1	1.2	1.2	1.2	1.3

1 Nuclear power, hydroelectric power and imports of electricty.

2 Renewable sources include solar power and energy from wind, wave and tide, hydroelectricty, wood, straw and sewage gas. Landfill gas and municipal solid waste combustion have also been included within this definition.

Source: NETCEN, Department of Trade and Industry, ONS

Energy consumption

The Energy Consumption dataset gives estimates of total energy used by each industrial sector and the proportion of total energy used from renewable resources, for the years 1990 to 2002. Detailed estimates of consumption of different fuel types by each sub-sector are given in Fossil Fuel Use by 93 economic sector 1990-2002 dataset.

Unit of measurement

The unit of measurement is tonne of oil equivalent (toe), which enables different fuels to be compared and aggregated. It should be regarded as a measure of energy content rather than a physical quantity. Standard conversion factors for each type of fuel are given in the "*Digest of UK Energy Statistics*" (DUKES).

Consumption of fossil fuels, energy used in transformation processes and losses in distribution

The consumption of fossil fuels, and the related consumption of energy, can be analysed from a number of different perspectives. In terms of atmospheric emissions, it may be helpful to identify which industrial sectors are actually consuming the fossil fuels that give rise to emissions.

From this perspective, fuels used by the electricity generation sector are attributed entirely to that sector, even though some of the energy is transformed into electricity. This analysis is shown in Part 1 of the table showing Energy Consumption.

In terms of energy consumption, it is possible to attribute energy used during the process of transformation into electricity, and the energy lost in distributing electricity to end users, either directly to the electricity generation sector, or indirectly to the consumers of energy. Parts 2 and 3 of the table in Energy Consumption consider energy consumption from both points of view. Part 2 allocates the consumption of energy directly to the immediate consumer of the energy, while Part 3 allocates these "electricity overheads" to the end user of the electricity.

Non-energy uses of fuels

Non-energy use of fuels includes, for example, chemical feedstocks, solvents, lubricants and road-making material. These uses have been excluded from the data.

Renewable energy sources

Renewable energy is defined to include solar power, energy from wind, wave and tide, hydroelectricity, and energy from wood, straw and sewage gas.
Landfill gas and municipal solid waste combustion have been included within renewable energy for the purposes of defining energy sources in the context of sustainable development policy.

Sources and methods for estimating consumption of energy by industrial sector

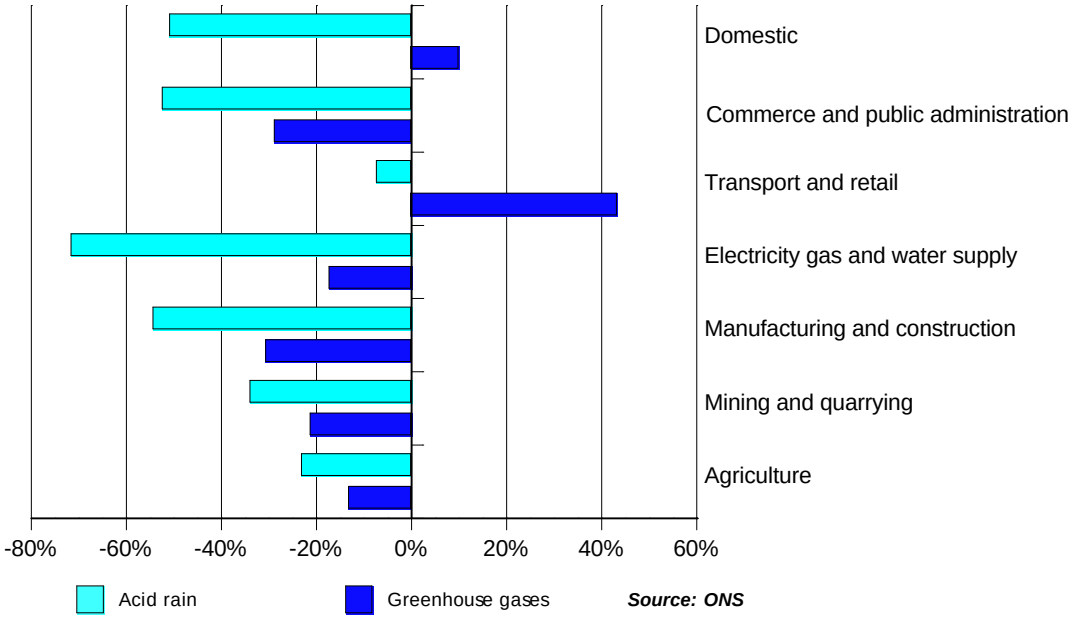
Data for estimating fuel consumption by industrial sectors are collected by the DTI and underlie the figures given in the "*Digest of UK Energy Statistics*"[1]. However, the figures shown in Energy Consumption differ from those given in the "*Digest of UK Energy Statistics*" (DUKES) in that:

- Fuels used by the UK fishing fleet, UK international shipping and aircraft operators, and ships and aircraft used for UK military purposes, are included, whether or not they were purchased in the UK, whereas fuels purchased in the UK by non-resident operators are excluded;
- Purchases of petrol and DERV abroad by UK motorists and road hauliers are included;
- Non-energy uses of fuels for example, chemical feedstocks, solvents, lubricants and road-making material, are excluded. However, energy lost through gas leakage etc is included;
- The classification of industrial sectors used in environmental accounts differ from that used in DUKES. In particular, the transport sector is defined to include only enterprises that provide transport services to other consumers (i.e. public transport operators, freight haulage companies, etc.). The energy consumed by households' use of private cars is allocated to the domestic sector.

Reference

1. Department of Trade and Industry. Digest of United Kingdom Energy Statistics. Various issues. HMSO/TSO

Atmospheric emissions of greenhouse gases and acid rain precursors, percentage change from 1990 to 2002



Greenhouse gas emissions

In 2002 emissions of greenhouse gases in the United Kingdom were 696470 (thousand tonnes) compared with 718454 (thousand tonnes) in 2001, constituting a fall of 3 per cent. Non-domestic sectors have fallen 3.3 per cent over the same period while emissions from the domestic sector have decreased by 2.2 per cent.

Within the non-domestic sector most industries show falls in emissions compared with 2001. In particular emissions from manufacturing have fallen by 7.7 per cent reflecting lower output in this industry. Emissions from the transport and communication industry have increased year on year by 1.3 per cent from 88684 thousand tonnes in 2001 to 89822 thousand tonnes in 2002.

The greenhouse gases included in this analysis are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perflourocarbons and sulphur hexafluoride.

Acid rain precursors

Between 2001 and 2002, emissions of acid rain precursors have fallen 5.4 per cent from 3227 (thousand tonnes) to 3053 (thousand tonnes). This decrease in emissions mainly reflects the decline in the use of coal for power generation in favour of natural gas. Emissions from the non-domestic sector have fallen 4.9 per cent while emissions from the domestic sector have fallen 9 per cent.

Within the non-domestic sector transport and communication shows a slight year on year rise from 581 thousand tonnes in 2001 to 585 thousand tonnes in 2002.

Acid rain precursors are sulphur dioxide, nitrogen oxides and ammonia.

2.2 Atmospheric emissions 2002

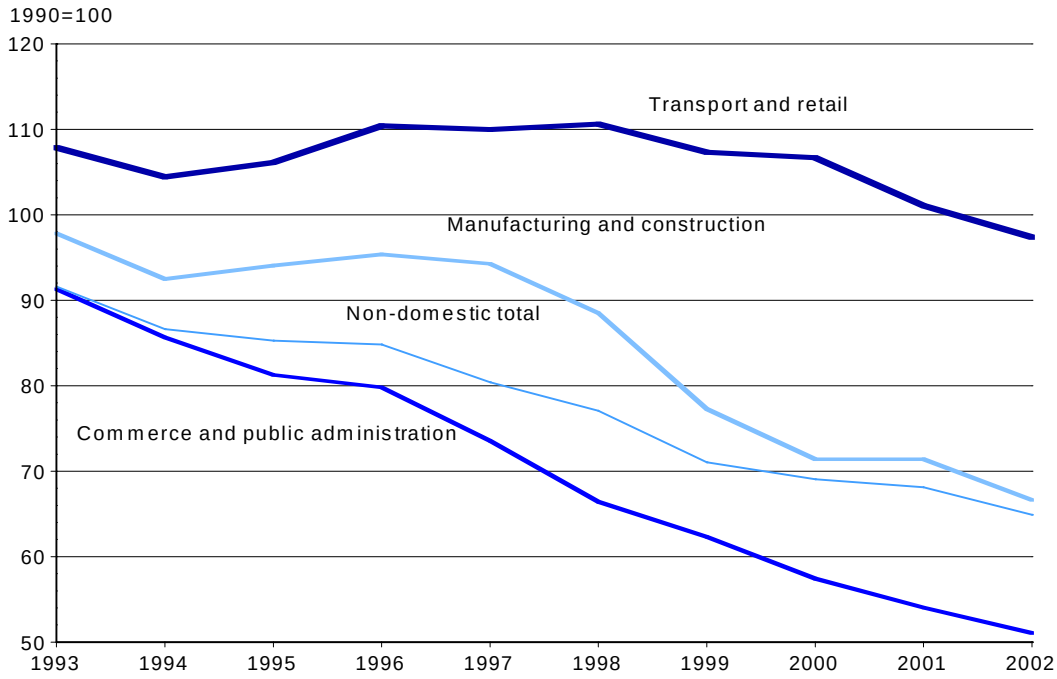
Thousand tonnes

	Greenhouse gases[1]	Acid rain precursers[2]	Emissions affecting air quality							
			PM10[3]	CO[4]	NMVOC[5]	Benzene	Butadiene	Lead (tonnes)	Cadmium (tonnes)	Mercury (tonnes)
Agriculture	51 515	504	19.1	50.4	144.8	0.141	0.106	0.16	0.009	0.003
Mining and quarrying	31 795	66	22.8	50.8	199.9	0.318	0.030	0.25	0.012	0.010
Manufacturing	122 002	438	34.9	815.2	363.0	2.820	0.648	113.61	3.051	3.832
Electricity, gas and water supply	175 903	937	10.4	102.4	75.7	0.849	0.046	24.20	0.558	1.501
Construction	3 492	14	5.9	46.9	55.3	0.147	0.081	5.60	0.032	0.013
Wholesale and retail trade	17 987	49	6.6	92.1	77.2	0.308	0.201	0.21	0.015	0.005
Transport and communication	89 822	585	18.7	194.3	51.3	2.205	1.041	2.60	0.110	0.033
Financial intermediation	11 616	27	4.5	91.9	10.3	0.230	0.094	0.15	0.011	0.001
Public administration	10 692	54	1.5	22.6	3.4	0.276	0.032	0.44	0.007	0.038
Education, health and social work	10 903	16	1.7	12.7	2.6	0.065	0.012	0.53	0.009	0.048
Other services	16 033	43	1.7	24.3	13.7	0.936	0.048	3.28	0.357	2.086
Domestic	154 710	320	38.9	1 798.5	338.4	7.266	1.442	13.46	0.347	0.483
Total	**696 470**	**3 053**	**166.7**	**3 302.1**	**1 335.6**	**15.6**	**3.8**	**164.5**	**4.50**	**8.10**
of which, emissions from road transport	125 259	538	39.9	1 940.7	214.7	4.5	2.8	1.5	0.17	0.001

Source: NETCEN

1 Carbon dioxide, methane, nitrous oxide, hydro-fluorocarbons, perfluorocarbons and sulphur hexafluoride expressed as thousand tonnes of carbon dioxide equivalent.
2 Sulphur dioxide, nitrogen oxides and ammonia expressed as thousand tonnes of sulphur dioxide equivalent.
3 PM10's are carbon particles in air arising from incomplete combustion.
4 Carbon monoxide.
5 Non-methane Volatile Compounds, including benzene and 1,3-butadiene.

Greenhouse gas emissions per unit of output, 1993-2002



Source: ONS

Most sectors of the economy show substantial improvements in emissions intensity, as measured by the ratio of greenhouse gas emissions per unit of output (Gross Value Added, Chained Volume Measure) between 1993 and 2002.

The exception is the transport and retail sector where greenhouse gases per unit of output broadly increased during the 1990s and only fell below the 1990 level in 2002. The largest fall in energy intensity is in the commerce and public administration sector where emissions per unit of output have fallen by approximately half.

Overview to Atmospheric Pollutants

The UK is required to report emissions under different international agreements for key air pollutants covered by the National Atmospheric Emissions Inventory (NAEI) and greenhouse gases (GHG) covered by the UK GHG inventory. The National Environmental Technology Centre (NETCEN) maintains the National Atmospheric Emissions Inventory.

There are a wide range of pollutants that contribute emissions to the atmosphere. They include greenhouse gases, regional pollutants and substances that are directly toxic such as heavy metals. These pollutants can be grouped according to their contribution to environmental themes such as climate change and acid rain.

2.3 Greenhouse gas and acid rain precursor emissions

Thousand tonnes

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Greenhouse gases - CO2,CH4,N2O,HFC,PFCs and SF6[1]											
Agriculture	**JKRH**	56 506	57 426	57 248	57 959	58 453	57 727	56 768	54 515	51 529	51 515
Mining and quarrying	**JKRJ**	36 940	35 007	35 048	36 554	34 970	34 750	32 216	31 499	31 503	31 795
Manufacturing	**JKRK**	162 324	168 540	164 929	169 321	170 805	161 480	141 363	133 447	132 228	122 002
Electricity, gas and water supply	**JKRL**	181 149	177 809	176 954	175 037	160 426	165 159	158 361	170 674	180 955	175 903
Construction	**JKRM**	3 706	3 814	3 808	3 863	3 778	3 715	3 794	3 568	4 481	3 492
Wholesale and retail trade	**JKRN**	16 210	16 572	16 803	17 948	17 684	18 923	19 732	20 586	19 772	17 987
Transport and communication	**JKRO**	66 349	67 577	71 463	77 814	82 208	86 781	87 092	91 001	88 684	89 822
Financial intermediation	**JKRP**	11 701	11 599	11 536	11 932	11 294	11 608	11 737	12 007	11 644	11 616
Public administration	**JKRQ**	13 140	12 938	13 139	13 378	12 966	11 482	11 619	11 192	11 113	10 692
Education, health and social work	**JKRR**	11 930	11 549	11 390	12 123	12 299	11 992	12 096	11 774	11 431	10 903
Other services	**JKRS**	28 327	27 442	26 326	25 563	23 561	21 831	19 511	17 775	16 883	16 033
Domestic	**JKRT**	150 972	145 141	139 840	154 728	149 188	151 581	152 952	153 988	158 232	154 710
Total greenhouse gas emissions	**JKRU**	**739 254**	**735 413**	**728 484**	**756 219**	**737 633**	**737 029**	**707 240**	**712 027**	**718 454**	**696 470**
of which, emissions from road transport	**JKRV**	113 527	114 626	114 115	119 083	121 307	121 594	123 267	123 776	124 919	125 259
Acid rain precursor emissions - SO2,NOx,NH3[2]											
Agriculture	**JKRW**	612	611	588	587	594	582	577	539	525	504
Mining and quarrying	**JKRX**	94	95	71	80	81	75	76	73	66	66
Manufacturing	**JKRY**	974	890	800	772	713	632	561	483	481	438
Electricity, gas and water supply	**JKRZ**	2 490	2 143	1 947	1 644	1 294	1 336	997	1 059	999	937
Construction	**JKSA**	23	22	20	19	18	17	16	14	16	14
Wholesale and retail trade	**JKSB**	80	78	73	71	67	67	62	60	52	49
Transport and communication	**JKSC**	572	563	597	664	715	704	625	591	581	585
Financial intermediation	**JKSD**	52	49	46	44	39	38	35	33	29	27
Public administration	**JKSE**	88	82	76	80	80	59	67	67	62	54
Education, health and social work	**JKSF**	64	55	41	40	38	31	26	21	19	16
Other services	**JKSG**	70	68	65	62	58	53	47	45	47	43
Domestic	**JKUK**	610	567	516	528	494	454	427	377	352	320
Total acid rain precursor emissions	**JKUL**	**5 729**	**5 224**	**4 840**	**4 591**	**4 191**	**4 048**	**3 518**	**3 361**	**3 227**	**3 053**
of which, emissions from road transport	**JKUM**	879	859	828	821	777	740	688	624	577	538

1 Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perflurocarbon and sulphur hexafluoride expressed as thousand tonnes of carbon dioxide equivalent.

2 Sulphur dioxide, nitrogen oxides and ammonia expressed as thousand tonnes of sulphur dioxide equivalent.

Source: NETCEN, ONS

Each year we produce estimates of pollutants directly emitted to the atmosphere by each industrial sector. The figures are on a National Accounts basis and differ from the basis used to monitor progress against the Kyoto protocol in that they include estimated emissions from fuels purchased abroad by UK residents, including those used by international shipping and aircraft on international flights. They exclude emissions from fuels purchased in the UK by non-UK residents. For a comparison of the different measures see table 2.4.

The Greenhouse effect (Climate change)

Greenhouses gases are transparent to visible light from the sun but relatively opaque to infra-red radiation from the Earth.

There is a growing consensus that the rise of greenhouse gases in the atmosphere has led to changes in the global climate system. The greenhouse gases included in the atmospheric emissions accounts are those covered by the Kyoto Protocol:

Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

To aggregate the greenhouse gases covered in the accounts, a weighting based on the relative global warming potential (GWP) of each of the gases is applied, using the effect of carbon dioxide over a 100 year period as a reference. This gives methane a weight of 21 relative to carbon dioxide and nitrous oxide a weight of 310 relative to carbon dioxide. Sulphur hexafluoride has a GWP of 23,900 relative to carbon dioxide. The GWP of the other fluorinated compounds varies according to the individual gas.

Greenhouse gas emissions are sometimes shown in terms of carbon equivalent rather than carbon dioxide equivalent. To convert from carbon dioxide equivalent to carbon equivalent it is necessary to multiply by 12/44.

Acid Rain Precursors

The term ‘acid rain’ describes the various chemical reactions acidic gases and particles undergo in the atmosphere and may be transported long distances before being deposited as wet or dry deposition. When deposited the hydrogen ions may be released causing acidification. These dilute acids damage ecosystems and buildings. The gases covered are sulphur dioxide, nitrogen oxides and ammonia.

Attributing emissions to industrial sectors

The emissions are weighted together using their relative acidifying effects. The weights, given relative to sulphur dioxide, are 0.7 for nitrogen oxides and 1.9 for ammonia. This is a simplification of the chemistry involved, and there are a number of factors which can affect the eventual deposition and effect of acid rain. There may be an upward bias on the weights of the nitrogen-based compounds in terms of damage to ecosystems.

National Atmospheric Emissions Inventory (NAEI) projections of future emissions are an increasingly important requirement for UK government policy-making. National estimates of emissions are calculated across all economic sectors, e.g. industry, domestic use. The disaggregation of national estimates of emissions to industrial sectors is based upon an initial disaggregation provided by the National Environmental Technology Centre (NETCEN).

Emissions were estimated by multiplying fuel consumption by emissions factors and adding releases unrelated to fuel use such as methane arising from landfill.

The NAEI data is used to identify the main processes and industries responsible for the emissions. These are then allocated to individual sectors on the basis of information from a variety of sources. For example, emissions from DERV use by HGVs is allocated to sectors using vehicle mileage data from the Department of the Environment, Food and Rural Affairs (Defra). Expenditure information is also used, for example emissions arising from the use of various industrial coatings (e.g. general industrial, heavy duty and vehicle refinishing) are allocated to relevant sectors in proportion to each sector's expenditure on paints, varnishes and similar coatings, printing ink and mastics, using National Accounts Input-Output supply and use tables as the main source.

Notes on available data

This kind of analysis is based on linking the environmental accounts data with the economic data generated by the National Accounts. Two datasets are available:

- A series of annual spreadsheets, for 1990 to 2002, each including three tables covering economic use tables, atmospheric emissions, electricity use and fossil fuel use across 76 industrial sectors. The use table shows the value of the consumption of these products and services by each industry and by final consumers.

- A set of tables covering estimates for 1993 (produced in 1997). The use table shows products and services used by each economic sector. The environmental input-output tables provide information about the direct and indirect emissions of atmospheric pollutants for 91 industrial sectors. Also, specialised analytical tables can be used to model different policy scenarios and to investigate the impact of changes in demand for products.

Differences between National Accounts air emission measure and other published measures

There are a number of formats for the reporting and recording of atmospheric emissions data. These include the IPCC and UNECE measures both published by Defra and the National Accounts consistent measure published by ONS.

Differences exist in the coverage of these alternative measures and are shown in table 2.4.

The National Accounts measure puts emissions on an UK resident's basis including emissions related to UK resident's abroad and look to exclude emissions by non-residents. This allows for a more consistent comparison to be made against key national account indicators such as gross domestic product and gross value added. The National Accounts measure also includes emissions of CO_2 from bio-mass.

The Kyoto measure records total emissions of CO_2 on a country basis. It therefore includes emissions from within an individual country but excludes emissions from international transport. The Kyoto measure is Defra's headline climate change indicator.

UNFCCC/IPCC records net emissions on a country basis. Net emissions take the total of all emissions then net off CO_2 removals from biomass growth and changes in land use. These are the "net" emissions published by Defra in more detailed tables.

Eurostat publishes emissions from countries of the EU in the National Accounting Matrix including Environmental Accounts (NAEMA). Like the National Accounts measure these treat emissions on a resident's basis. However, in addition they included treatment of CO_2 removals from biomass and changes in land use.

2.4 Atmospheric emissions bridging table National Accounts measure to IPCC measure

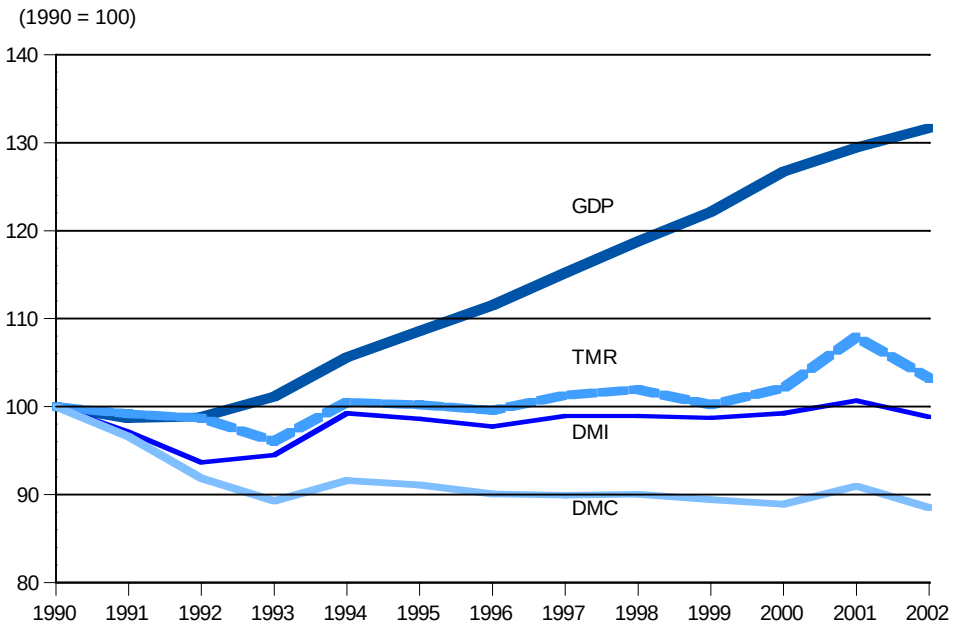
Thousand tonnes

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Greenhouse gases - CO2,CH4,N2O,HFC,PFCs and SF6[1]											
National Accounts measure	**JKRU**	739 254	735 413	728 484	756 219	737 633	737 029	707 240	712 027	718 454	696 470
less											
Bunker emissions[2]	**A43J**	24 186	24 450	26 074	27 938	30 146	33 492	33 330	35 506	34 392	34 388
CO2 from biomass[3]	**A43K**	3 705	4 833	5 223	5 477	5 761	5 823	6 409	6 871	7 210	7 496
Cross boundary adjustment[4]	**A43L**	10 614	9 782	11 095	15 046	17 349	18 341	19 577	21 968	20 669	19 754
plus											
Landuse change / forestry [5]	**A43M**	17 969	16 956	16 501	16 867	16 616	16 841	16 585	15 318	15 117	13 612
IPCC (Reported)	**A43N**	718 718	713 304	702 593	724 625	700 993	696 214	664 509	663 001	671 299	648 444

1 Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perflurocarbon and sulphur hexafluoride expressed as thousand tonnes of carbon dioxide equivalent.
2 Aviation and marine emissions.
3 Emissions arising from wood, straw, biogases and poultry litter combustion for energy production
4 Emissions made by UK residents abroad and excludes emissions made by foreign residents in the UK.
5 Emissions from deforestation, soils and changes in forest and other woody biomass.

Source: NETCEN, ONS

Material flows, 1990 to 2002



- *Direct Material Input (DMI) - used domestic extraction plus imports.*
- *Domestic Material Consumption (DMC) = DMI minus exports.*
- *Total Material Requirement (TMR) = DMI plus indirect flows associated with imports plus indirect flows from domestic extraction.*

Source: ONS

The mass of resources and products used by the economy has fallen by 12 per cent since 1990, while GDP has risen by 32 per cent in real terms, suggesting that economic growth in the UK is becoming decoupled from total use of materials. In 2002 this trend continued following a slight narrowing in the previous year. Changes in resource use are based on the movement of three different indicators which are derived from the material flows account (for further information see p36-37): Data in 2001 has been revised following receipt of new information on levels of mineral extraction.

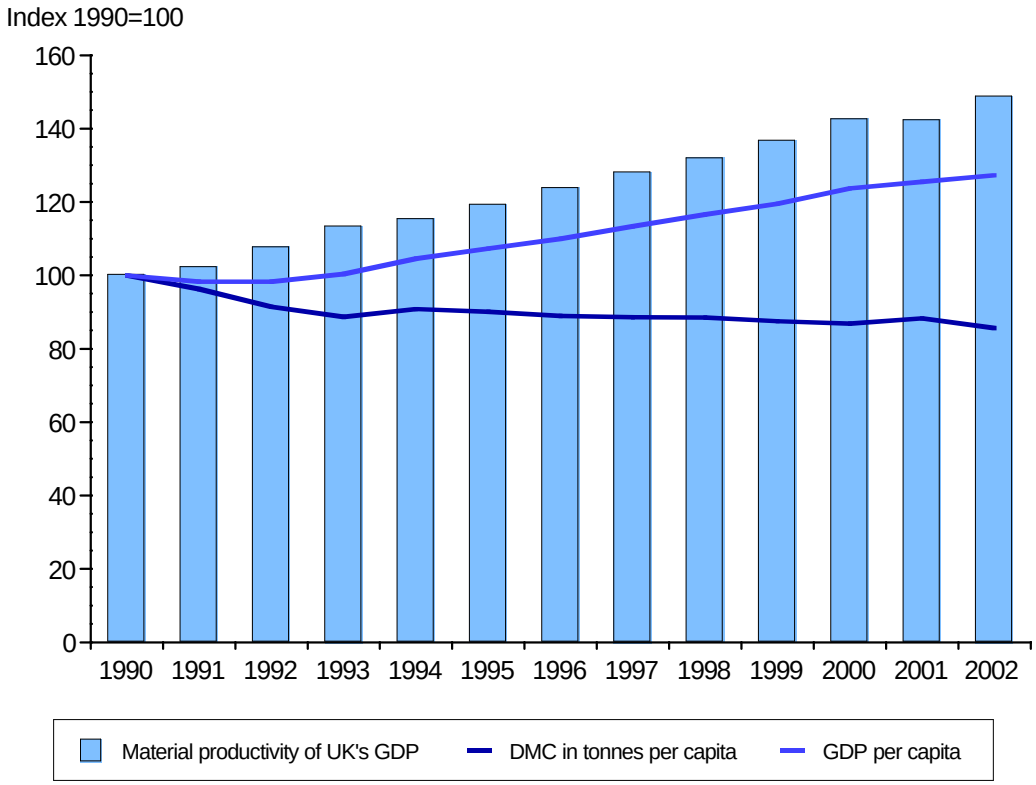
Direct Material Input (DMI) is the sum of the total amounts of primary resources extracted from the UK environment and the amount of imports into the UK. Total domestic extraction fell by 1.8 per cent to 652 million tonnes in 2002 compared with 2001. Within this total biomass rose by 5.2 per cent driven by a recovery in cereal production following the severe weather conditions of autumn 2001. Extraction of minerals fell by 3.5 per cent to 300 million tonnes and extraction of fossil fuels fell by 2.7 per cent.

In 2002 the mass of imports remained high compared to the long term average. This was caused by large increases in coal imports during 2001 and 2002 following a switch to coal by energy producers in reaction to high gas prices.

Domestic Material Consumption (DMC) is equal to DMI less the amount of extraction associated with goods exported from the UK. Total DMC fell by 2.7 per cent to 682 million tonnes in 2002. Although exports rose slightly in 2002, this was off set by reductions in the levels of imports and domestic extraction.

Total Material Requirement (TMR) is equal to DMI plus the indirect flows associated with the extraction of materials from the UK environment plus the indirect flows associated with the production of goods imported into the UK. TMR decreased by 4.4 per cent between 2001 and 2002, but remains at historically high levels due to domestic extraction and imports of fossil fuels driven by higher energy demand for coal and imports of coal.

Material productivity, 1990 to 2002



Source:ONS

Material productivity is per capita GDP at real prices divided by per capita Domestic Material Consumption (extraction + imports – exports). Latest data shows an increase in material productivity of 48 per cent between 1990 and 2002. This trend supports evidence that material use and economic growth have decoupled since 1990. It indicates that material use per head is falling in relation to the of level economic activity per head of population in the United Kingdom.

2.5 Material Flows

Million tonnes

		1970	1975	1980	1985	1990	1995	1997	1998	1999	2000	2001	2002
Domestic extraction													
Biomass													
Agricultural harvest	**JKUN**	42	38	47	47	46	47	53	51	52	51	45	50
Timber	**JKUO**	3	3	4	5	6	8	7	7	7	7	8	8
Animal grazing	**JKUP**	49	49	49	48	46	45	45	44	43	43	43	43
Fish	**JKUQ**	1	1	1	1	1	1	1	1	1	1	1	1
Total biomass	**JKUR**	96	92	101	100	100	101	106	103	104	102	97	102
Minerals													
Ores	**JKUS**	12	5	1	1	–	–	–	–	–	–	–	–
Clay	**JKUT**	38	33	25	23	21	18	15	16	15	15	14	14
Other industrial minerals	**JKUU**	14	11	11	11	11	10	10	8	8	8	9	9
Sand and gravel	**JKUV**	122	131	110	112	128	106	103	103	105	106	105	101
Crushed stone	**JKUW**	156	169	150	160	212	200	182	181	179	176	183	177
Total minerals	**JKUX**	342	349	298	307	373	334	310	309	308	305	311	300
Fossil fuels													
Coal	**JKUY**	149	129	130	94	94	53	48	41	37	31	32	30
Natural gas	**JKUZ**	11	37	39	37	43	71	86	90	99	109	106	103
Crude oil	**JKVA**	–	2	80	128	92	130	128	132	138	126	118	116
Total fossil fuels	**JKVB**	161	168	249	259	229	254	262	264	274	266	256	249
Total domestic extraction	**JKVC**	**598**	**609**	**648**	**666**	**701**	**688**	**679**	**676**	**686**	**673**	**664**	**652**
Imports													
Biomass	**JKVD**	38	33	30	31	38	40	41	42	42	42	46	46
Minerals	**JKVE**	30	32	24	34	41	51	51	54	50	49	52	53
Fossil fuels	**JKVF**	123	111	74	76	89	73	79	76	70	83	99	95
Other products	**JKVG**	5	6	13	14	19	23	28	31	29	34	34	32
Total imports	**JKVH**	**197**	**183**	**140**	**156**	**187**	**187**	**200**	**203**	**191**	**208**	**230**	**226**
Exports													
Biomass	**JKVI**	3	5	8	11	13	15	18	17	16	17	13	15
Minerals	**JKVJ**	17	20	26	22	25	39	43	46	45	44	42	41
Fossil fuels	**JKVK**	23	19	60	102	67	103	106	103	108	115	118	119
Other products	**JKVL**	5	7	8	11	12	17	19	19	19	20	20	20
Total exports	**JKVM**	**47**	**51**	**101**	**146**	**117**	**174**	**185**	**185**	**187**	**196**	**193**	**195**
Indirect flows													
-From domestic extraction[1] (excl soil erosion)	**JKVN**	574	593	660	648	713	660	665	623	637	606	616	599
Of which;													
unused biomass	**JKVO**	16	16	22	25	27	27	31	29	30	30	26	30
fossil fuels	**JKVP**	188	228	326	312	355	317	323	281	297	264	276	258
Minerals and ores	**JKVQ**	177	158	121	115	135	117	110	112	110	112	113	108
soil excavation and dredging	**JKVR**	193	191	191	195	197	199	201	200	200	201	202	204
-From production of imports	**JKVS**	394	395	368	423	457	527	541	597	549	614	711	648
Key indicators													
Direct Material Input (domestic extraction + imports)	**JKVT**	795	792	788	821	888	876	879	879	877	882	894	878
Domestic Material Consumption (domestic extraction + imports - exports)	**JKVU**	748	741	687	676	771	702	693	694	689	685	701	682
Total Material Requirement (direct material input + indirect flows)	**JKVV**	1 763	1 779	1 817	1 892	2 058	2 063	2 085	2 098	2 063	2 102	2 222	2 125

1 Indirect flows from domestic extraction relate to unused material which is moved during extraction, such as overburden from mining and quarrying.
2 Components may not sum to totals due to rounding.

Source: Wuppertal Institute, ONS

Material flows

Material flow accounts record the total mass of natural resources and products that are used by the economy, either directly in the production and distribution of products and services, or indirectly through the movement of materials which are displaced in order for production to take place.

A material flow account balances the inputs (extraction of natural resources from the UK environment, and imports of goods) with the outputs (wastes, emissions to air and water, exports) and accumulation (in terms of new buildings etc) within the economy.

The direct inputs of materials into the economy derive primarily from domestic extraction, that is from biomass (agricultural harvest, timber, fish and animal grazing), fossil fuel extraction (such as coal, crude oil and natural gas) and mineral extraction (metal ores, industrial minerals such as pottery clay, and construction material such as crushed rock, sand and gravel).

The direct input of materials from domestic sources is supplemented by the imports of products, which may be of raw materials such as unprocessed agricultural products, but can also be semi-manufactured or finished products. In a similar way the UK exports raw materials, semi-manufactured and finished goods which can be viewed as inputs to the production and consumption of overseas economies.

Water is used so widely and in such quantities that its inclusion in the accounts tends to obscure other resource use. For this reason, the accounts only include the water that is contained in products (e.g. agricultural produce and imported beverages). Water for other consumptive uses (cleaning or irrigation) and in situ uses (such as hydroelectric power) is excluded from these accounts.

The accounts also provide a framework for recording the quantity of raw material that is translocated by the process of extraction, but not actually used in the production of goods and services. These movements are known as hidden flows. Hidden flows may be as a result of extraction activities within the UK economy, or associated with the extraction of raw materials in other countries which are then imported into the UK economy. Examples of hidden flows are unused extraction from mining and quarrying (also known as overburden), discarded material from harvesting (e.g. wood harvesting losses such as timber felled but left in the forests), and soil and rock moved as a result of construction and dredging.

Summary aggregates

There are a number of indicators which can be used to summarise the flows of materials into and out of the economy. Material Flows show three of the main indicators used to measure inputs.

The **Direct Material Input (DMI)** measures the input of materials directly used by the economy, that is all materials that form part of products or are used in production and consumption activities. DMI equals used extraction in the UK (including that which is used or contained in exports) plus imports.

Domestic material consumption (DMC) measures the total amount of material directly consumed by the economy i.e. it includes domestic extraction and imports

The **Total Material Requirement (TMR)** measures the total material basis of the economy, that is the total direct and indirect resource requirements of all the production and consumption activities. TMR includes the amount of used extraction in the UK, the imports into the UK and the resulting indirect or hidden flows associated with extraction in the UK and imports from other countries. Although TMR is widely favoured as a resource use indicator, the estimates of indirect flows are less reliable than those for materials directly used by the economy, and it can be argued that it double-counts trade flows, in that materials used both in the production of imports and in the production of exports are included. The indicator therefore needs to be considered alongside other indicators.

Sources and methods

Data on the yields of agriculture, forestry and fishing comes from the Food and Agriculture Organization (FAO)[1] .

Mineral extraction data has been taken from the *UK Minerals Yearbook*[2] and information on the mass of imports and exports has been taken from trade information compiled by HM Customs and Excise[3] .

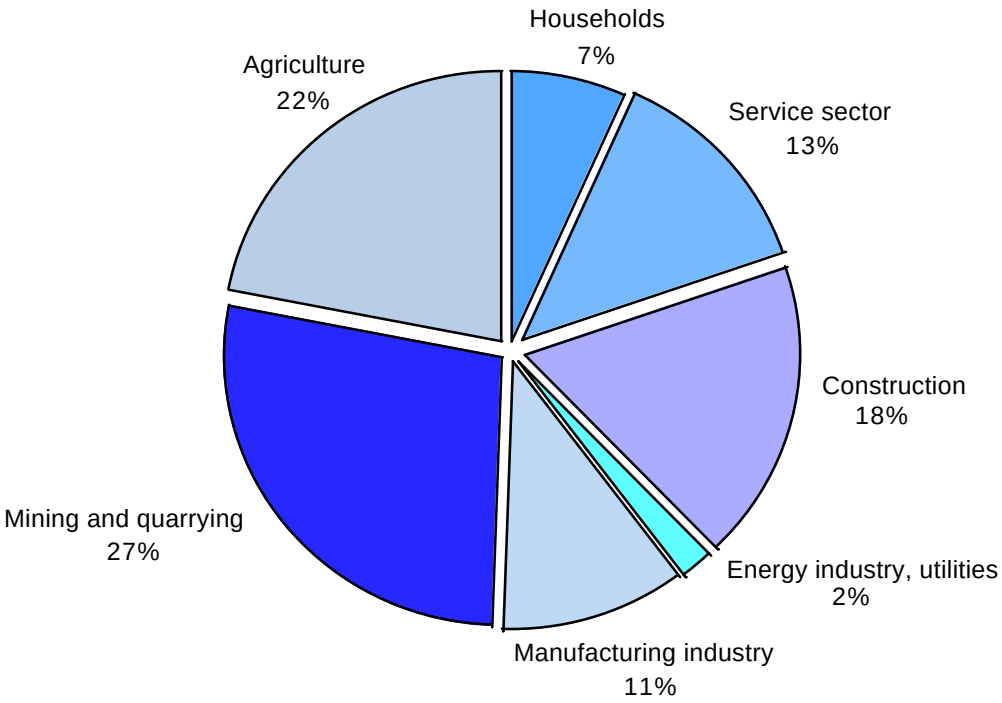
Factors applied to give estimates of the amounts of unused material moved for each tonne of used material have been taken from research carried out by the Wuppertal Institute on behalf of the Department for Environment, Food and Rural Affairs (Defra)[4] .

The methodology used to compile the account is also based upon the Wuppertal Institute's research.

1. *Food and Agricultural Organization (FAO), available at http://apps.fao.org*
2. *British Geological Survey (2003). UK Minerals Yearbook 2002*
3. *HM Customs and Excise trade data, available at: www.uktradeinfo.com*
4. *Wuppertal Institute for Climate, Environment and Energy (2002). Resource use and efficiency of the UK economy. See the Defra website at: http://www.defra.gov.uk/environment/statistics/waste/research/mfa/index.htm*

General waste

Total industrial waste arisings in the UK 1998/99



The total amount of waste arising in the UK in 1998/99 was approximately 430 million tonnes. Of this, mineral waste from the mining and quarrying sector accounted for 119 million tonnes, and inert construction waste accounted for 78 million tonnes. Other significant waste streams include animal and vegetable waste from agriculture of nearly 94 million tonnes, 22 million tonnes of dredged material, and 26 million tonnes of general household waste.

The types of waste we produce, all forms of waste management, and the transport of waste, have impacts on the environment. Waste is a potential resource and increased levels of reuse, recycling and energy recovery will contribute to sustainable development.

The figures for waste arisings are based on a variety of sources for the years 1997 to 2000, with the main source being the 1998/99 Environment Agency survey of commercial and industrial waste arisings in England and Wales. We have used this data to compile estimates of the total waste arisings in the UK in 1998/99 by industrial sector. The grouping of sectors reflects the variety of sources used to compile the estimates. We also have data on the stocks and disposals of radioactive waste from three specific sectors: nuclear, medicine and defence broken down into various types.

The government is committed to achieving targets derived from European legislation, such as the Landfill Directive and the Packaging Directive. The Landfill Directive, which requires substantial amounts of waste to be diverted from landfill, will require a step change in the management of municipal waste in the UK.

2.6 Total waste arisings in the United Kingdom 1998/9

Million tonnes

	Inert construction demolition	Paper, card	Animal and vegetable	General	Metal & scrap equipment	Mineral	Other waste	Total
Agriculture[1]	–	–	92.5	1.0	–	–	–	93.5
Mining and quarrying[2]	–	–	–	–	–	119.0	–	119.0
Food, drink and tobacco[3]	0.5	0.3	2.3	3.8	0.1	–	1.6	8.6
Textiles and clothing[3]	–	0.1	–	0.9	–	–	0.2	1.2
Pulp, paper, printing and publishing[3]	–	1.8	–	2.9	–	–	0.3	5.0
Chemicals[3]	0.3	0.1	–	1.3	0.5	0.2	3.0	5.3
Non-metallic mineral products[3]	1.2	0.2	–	1.8	0.1	0.5	0.4	4.3
Metal products[3]	0.2	0.1	–	1.2	2.3	7.5	1.8	13.1
Machinery and equipment[3]	0.1	0.1	–	1.4	1.0	–	0.4	3.1
Transport equipment	–	–	–	0.7	0.8	–	1.0	2.5
Other manufacturing [3]	–	0.1	–	2.3	0.1	–	0.3	2.8
Electricity, gas and water supply[4]	0.2	–	–	0.4	0.1	7.0	0.3	7.9
Construction[5]	78.0	–	–	–	–	–	–	78.0
Wholesale and retail[6]	–	1.7	0.3	7.7	0.4	–	0.8	10.9
Hotels and catering[6]	0.1	0.1	–	3.6	0.1	–	0.1	3.9
Transport and communications[6,7]	–	0.4	0.2	2.1	0.1	22.3	0.6	25.8
Finance and other services[6]	0.1	0.7	–	7.6	0.1	0.1	0.7	9.4
Public administration, health and education[6]	0.1	0.3	0.1	4.2	0.1	–	0.2	4.8
Waste water services[8]	–	–	1.0	–	–	–	–	1.0
Households[9]	–	0.9	0.6	26.1	0.3	0.4	–	28.4
Total waste arrings	80.8	6.9	97.1	69.0	6.0	157.1	11.7	428.6

Source: Source: see Notes 1 - 9

1 Based on estimate of 87 million tonnes for GB for 1999 (source Defra) Grossed to UK total on basis of agricultural GDP for 1997 (source ONS)
2 1997 figure used as the 1998 figure is still provisional (source Defra)
3 Industry figures based on Environment Agency estimates for 1998/99 for England and Wales, controlled to GB total and grossed to UK total on the basis of estimated manufacturing industry GDP for 1997 (source ONS).
4 Figures based on Environment Agency estimates for 1998/99 for England and Wales, controlled to GB total and grossed to UK total on the basis of electricity, gas and water supply industry for 1997 (source ONS).
5 Provisional figure based on Defra survey for 2000 for England and Wales. Grossed to UK total using 1997 share of construction industry GDP (source ONS).
6 Services sector figures based on Environment Agency estimates for 1998/99 for England and Wales, controlled to GB total and grossed to UK total on the basis of service sector GDP estimates for 1997 (source ONS).
7 Mineral waste estimate is for the amount of dredged material, based on Centre for Environment, Fisheries and Aquaculture Science Survey for 1997 for all UK waters.
8 Dry weight arisings for 1998/99 (source Water UK). Wet weight can be estimated on the basis of 4% solid content on average giving a total of 26 million tonnes.
9 Household muncipal waste 1998/99 for England and Wales (source DETR), grossed to UK total on the basis of population.

2.7 Stocks and disposals of solid radioactive waste by source

Cubic metres

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Stock of high level waste[2]														
Nuclear fuels														
as stored[3]	**JPOF**	–	1 686	..	..	1 639	..	..	..	1 804	..	..	1 766	..
when conditioned[4]	**JPOG**	–	681	..	..	653	..	..	..	717	..	..	765	..
Stock of intermediate level waste[5]														
As stored[3]														
Nuclear fuels	**JPOH**	–	49 232	..	..	58 459	..	..	..	67 262	..	..	70 826	..
Medical	**JPOI**	–	380	..	..	290	..	..	..	293	..	..	358	..
Defence	**JPOJ**	–	1 946	..	..	2 745	..	..	..	3 393	..	..	4 092	..
Total	**JPOK**	–	51 558	..	..	61 494	..	..	..	70 948	..	..	75 276	..
When conditioned														
Nuclear fuels	**JPOL**	–	75 931	..	..	63 020	..	..	..	71 133	..	..	71 141	..
Medical	**JPOM**	–	605	..	..	597	..	..	..	293	..	..	345	..
Defence	**JPON**	–	1 976	..	..	2 485	..	..	..	2 705	..	..	2 886	..
Total	**JPOO**	–	78 512	..	..	66 102	..	..	..	74 131	..	..	74 372	..
Disposals of low level waste[6]														
Nuclear fuels	**JPOP**	–	22 502	23 323	20 787	–	–	–	–	–	..	..	..	..
Medicinal	**JPOQ**	–	1 055	278	545	–	–	–	–	–	..	..	..	..
Defence	**JPOR**	–	1 543	1 799	1 868	–	–	–	–	–	..	..	..	..
Total disposals of low level waste	**JPOS**	32 500	25 100	25 400	23 200	26 300	12 700	10 300	9 200	12 600	8 000	8 400	..	..
Stock of low level waste[1,3]														
Nuclear fuels	**JPOT**	–	4 998	..	..	5 801	..	..	..	6 287	..	..	12 654	..
Medicinal	**JPOU**	–	55	..	..	5	..	..	..	–	..	..	–	..
Defence	**JPRA**	–	1 199	..	..	2 076	..	..	..	1 696	..	..	1 650	..
Total stock of low level waste	**JPRB**	–	6 252	..	..	7 882	..	..	..	7 983	..	..	14 304	..

1 Figures for stocks of waste only available from inventories for 1991, 1994, 1998 and 2001
2 High level waste comes from the reprocessing of irradiated nuclear fuel.
3 "As stored" is the form in which the waste is currently stored, except for low level waste, which is the estimated volume after supercompaction.
4 "When conditioned" is the estimated volume when waste is converted into a form in which it is placed into long term storage.
5 Intermediate level waste has a lower radioactivity content and heat output than high level waste, but a radioactivity content which exceeds the upper limits for low level waste.
6 Up to and including 1993 figures are net waste volumes, from 1994 they are packaged waste volumes. Supercompaction was introduced in 1995 for all wastes sent to Drigg. This has significantly reduced volumes of disposals. The breakdown by source is not available after 1993.

Source: Electrowatt - Ekono (UK) Ltd

Radioactive waste

Data shows that total stocks of high and intermediate level radioactive waste have remained broadly stable since 1991, while stocks of low level waste have doubled to facilitate the decommissioning process.

Solid radioactive wastes are not discharged into the environment but stored and conditioned by processes such as supercompaction, cementation and vitrification (turning into glass).

Figures for stocks of waste are only available from inventories for 1991, 1994, 1998 and 2001. These are classified:

- High level waste comes from the reprocessing of irradiated nuclear fuel. It accounts for over 95 per cent of all the radioactivity in waste.
- Intermediate level waste from sources such as nuclear reactor components, has a lower radioactivity content and heat output than high level waste, but a radioactivity content which exceeds the upper limits for low level waste.
- Low level waste such as discarded protective clothing, up to and including 1993, are net waste volumes and from 1994 are packaged waste volumes. A breakdown by source is not available after 1993.

Data are further classified by the condition in which the radioactive waste is stored:

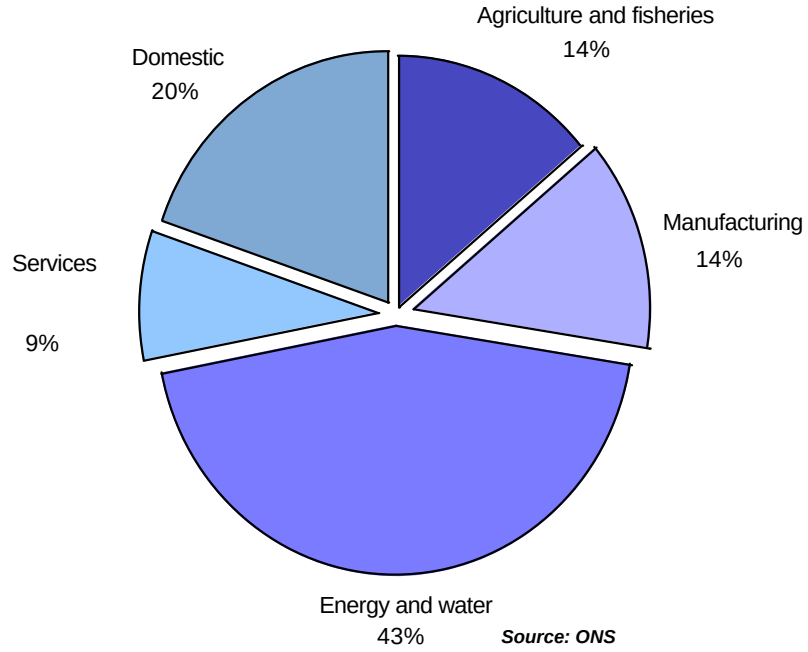
- 'As stored' refers to the form in which the waste is currently stored, except for low level waste, which is the estimated volume after supercompaction. Most low level waste is in short term storage prior to disposal.
- 'When conditioned' is the estimated volume when waste is converted into a form in which it is placed in long term storage. These estimates should be treated as indicative only.

Supercompaction was introduced in 1995 for all wastes sent to Drigg. This has significantly reduced volumes of disposals which no longer take place in trenches. Such waste is now immobilised in containers and placed in concrete vaults.

1. Notes based on information downloaded 4.2.2003 from DEFRA web site \ Environmental Protection statistics \ radioactivity: http://www.defra.gov.uk/environment/statistics/radioact/index.htm

Water

UK water resource use by industry, 1997/98



Source: ONS

In 1997/98, nearly 17 billion cubic metres of water were taken from groundwater and non-tidal waters in the UK. Of this total about 20 per cent, 3.2 billion cubic metres, was used by households through the public water supply network. A further 1.8 billion cubic metres were lost through leakage. Electricity generation and fisheries account for the bulk of the use of water removed directly by industries.

These estimates are taken from the UK water accounts for 1997/98, which shows water is an important resource for all aspects of the UK economy. The accounts cover the use of groundwater and non-tidal water only.

Most of the water consumed by agriculture and industry comes directly from rivers and lakes, although a significant amount of the water provided through the public water supply network (PWS) is also used by various industries, such as the food and drinks sector and the chemicals industry. The water accounts exclude use of tidal waters, whether freshwater or not, and the uses of water (such as for hydroelectric power) that do not result in it changing. However the accounts do include some uses where the water is returned to the same part of the environment in an unchanged state, such as where the water has been used for cooling purposes only.

The estimates for the water accounts are mainly based on research carried out by the Environment Agency on water consumption in England and Wales. For the use of the Public Water Supply (PWS) in 1997/98, the Agency asked the water companies to provide estimates of use by industrial sectors. Information on direct removals of groundwater and non-tidal waters by sector in 1997/98 was obtained from the Environment Agency's National Abstraction Licensing Database, using a combination of information on the purpose of the abstractions and estimates of the ratio of actual use to licensed use.

2.8 Consumption of water resources by industrial sector 1997/8

Million cubic metres

	Public water supply	Direct abstractions from groundwater and non-tidal waters	Total groundwater and non-tidal abstractions
Use of groundwater and non-tidal water by:			
Agriculture	10	360	370
Fisheries	–	2 060	2 060
Mining and extraction[1]	10	60	70
Food, drink and tobacco	190	110	300
Textiles	10	80	90
Pulp, paper, printing and publishing	20	190	210
Fuel processing	–	–	–
Chemicals	240	430	670
Rubbers and plastics	–	10	10
Mineral products	10	70	80
Metal manufacturing and products	90	240	330
Manufacture and machinery	100	10	110
Electrical equipment	30	–	30
Transport equipment	30	–	30
Other manufacturing including recycling	150	10	160
Unspecified industry[2]	120	160	280
Electricity and gas production	50	5 560	5 610
Water supply[3]	1 750	–	1 750
Construction	10	10	20
Wholesale, hotels and catering	140	–	140
Education and health	190	–	190
Other services	310	–	310
Domestic	3 180	70	3 250
Other abstractions[4]	–	160	160
Statistical discrepancies	600	–	600
Total use of groundwater and non-tidal waters	**7 240**	**9 590**	**16 830**

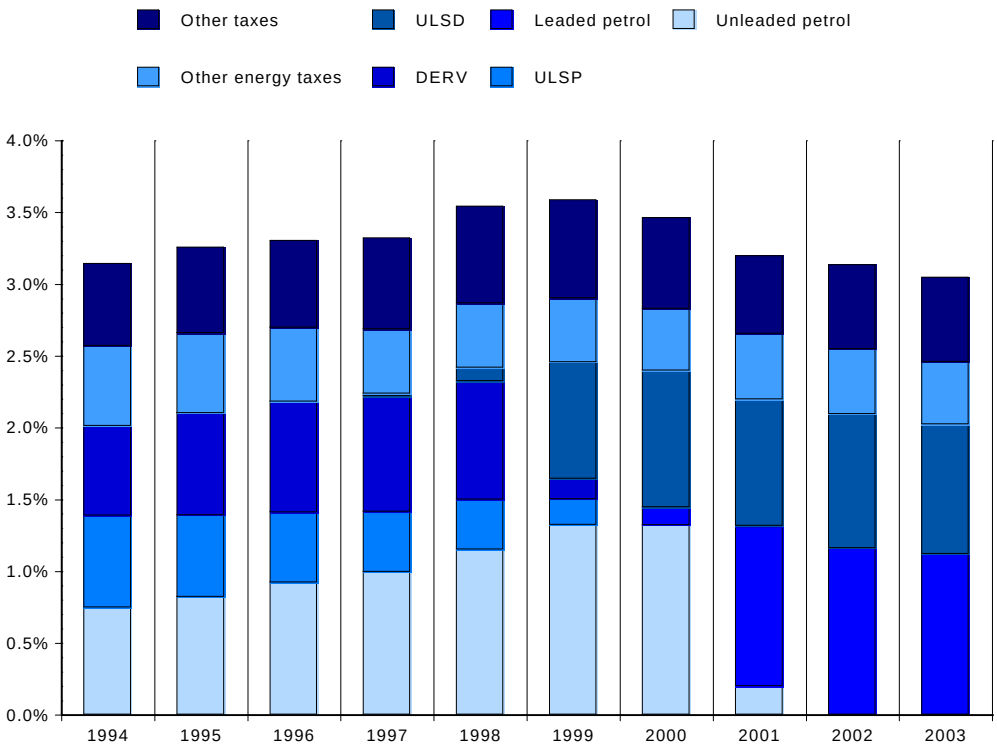
1 Excludes mineral washing
2 Includes mineral washing
3 Includes leakage
4 Includes some private domestic water supply, public water supply licences and frost protection use.

Source: Environment agency, Scottish executive, ONS

Monetary accounts

Environmental taxes

Environmental tax revenue as a percentage of GDP 1994 to 2003



Source:ONS

Total revenue received by the Government in 2003 from environmental taxation was £33.7 billion. Environmental taxes as a percentage of total taxes and social contributions followed a trend of small increases between 1994 and 1999. However since 1999 this trend has reversed and levels in 2003 have fallen to 3.1 per cent of GDP compared with 3.6 per cent in 1999 (see table over page).

The types of environmental taxation revenues received have changed significantly in recent years due, in part, to changes in the types of fuel available: leaded petrol has been withdrawn from sale and Ultra Low Sulphur Petrol and Diesel (ULSP/D) have been introduced. Following the October 2000 budget these fuels attracted lower rates of duty than regular unleaded petrol and diesel due to their reduced particulate emissions and producers have now switched production entirely to low sulphur varieties. Duty on hydrocarbon oils such as petrol and diesel accounted for 67 per cent of total environmental taxation in 2003.

Revenue from the Landfill tax rose by 13.5 per cent between 2002 and 2003 as a result of the policy to increase the tax rate by £1.00 per tonne each year until 2004.

Revenue from Vehicle Excise duty in 2003 rose by 4.5 per cent compared with 2002 data. A new environmental tax, the aggregates levy has been introduced. Revenues from this tax stood at £347 million in 2003 (for further details see p47).

Increased numbers of air passengers, up 40 per cent since 1995 according to the Civil Aviation Authority, have generated a steady increase in Air passenger duty since its introduction in 1994. Revenues show a year on year fall from £814 million in 2002 to £781 million in 2003. An increasing proportion of travel is within the EU, which attracts a lower rate of air passenger duty than travel outside the EU.

3.1 Government revenues from environmental taxes

£ million

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Energy											
Duty on hydrocarbon oils	**GTAP**	13 984	15 360	16 895	18 357	20 996	22 391	23 041	22 046	22 070	22 476
including											
Unleaded petrol[1]	**GBHE**	5 101	5 901	7 043	8 073	9 897	11 952	12 548	1 980	–	–
Leaded petrol/LRP[2]	**GBHL**	4 349	4 088	3 716	3 393	2 984	1 630	7	3	–	–
Ultra low sulphur petrol	**ZXTK**	–	–	–	–	–	–	1 162	11 042	12 097	12 314
Diesel[3]	**GBHH**	4 257	5 127	5 888	6 528	7 088	1 274	32	60	–	–
Ultra low sulphur diesel	**GBHI**	–	–	–	146	806	7 338	9 061	8 754	9 756	9 931
VAT on duty	**CMYA**	2 447	2 688	2 957	3 212	3 674	3 918	4 032	3 858	3 862	3 933
Fossil fuel levy	**CIQY**	1 355	1 306	978	418	181	104	56	86	32	–
Climate change levy	**LSNT**	–	–	–	–	–	–	–	585	825	828
Road vehicles											
Vehicle excise duty	**CMXZ**	3 848	3 954	4 149	4 334	4 631	4 873	4 606	4 061	4 519	4 724
Other environmental taxes											
Air passenger duty	**CWAA**	33	339	353	442	823	884	940	824	814	781
Landfill tax	**BKOF**	–	–	113	361	333	430	461	502	541	614
Aggregates levy	**MDUQ**	–	–	–	–	–	–	–	–	213	347
Total environmental taxes	**JKVW**	**21 667**	**23 647**	**25 445**	**27 124**	**30 638**	**32 600**	**33 136**	**31 962**	**32 876**	**33 703**
Environmental taxes as a % of:											
Total taxes and social contributions	**JKVX**	9.2	9.3	9.5	9.4	9.6	9.8	9.3	8.6	8.8	9.0
Gross domestic product	**JKVY**	3.2	3.3	3.3	3.3	3.6	3.6	3.5	3.2	3.2	3.1

1 Unleaded petrol includes superunleaded petrol.
2 Lead Replacement Petrol (the alternative to 4-Star leaded petrol introduced in 2000) is lead-free.
3 Duty incentives have concentrated production on ultra low sulphur varieties.

Source: ONS, DTI

Government revenues from environmental taxes

The Environmental taxes table shows the amounts raised in environmental taxes between 1994 and 2003.

Definition of an environmental tax

An environmental tax is defined as a tax whose base is a physical unit (or a proxy for it) that has a proven specific negative impact on the environment. By convention, in addition to pollution related taxes, all energy and transport taxes are classified as environmental taxes. This definition has been agreed by international experts and adopted by the Statistical Office of the European Communities (Eurostat) and Organisation for Economic Co-operation and Development (OECD). It enables analysis to be based on the effects of taxes rather than the aims behind their introduction, i.e. the aim of a tax for raising government revenue rather than reducing environmental degradation does not preclude it from being defined as an environmental tax.

Nevertheless, the interpretation and use of measures of environmental taxes need care. In particular, the levels of revenues from environmental taxes do not necessarily indicate the relative importance or the success of environmental policy. High environmental tax revenues can result either from high rates of taxes or from high levels of environmental problems (e.g. pollution) leading to a large tax base. The broad measure of revenues can also fail to capture the effect of the differential rates that encourage a shift away from higher impact behaviour (such as the use of leaded petrol).

Taxes on energy products include duties on hydrocarbon oils used in road vehicles, the main ones being ultra low sulphur petrol and ultra low sulphur diesel. Taxes on energy products also include those used for non-transport purposes (such as industrial gas turbines and heating installations, with a reduced rate for energy saving materials). The fossil fuel levy, which is levied on sales of electricity from fossil fuels and used to compensate companies producing electricity from non-fossil fuel sources such as nuclear or renewable energy.

The **climate change levy**, which is a tax on non-domestic use of energy, was introduced in April 2001. The levy applies to the suppliers of the following energy types: electricity, natural gas as supplied by a gas utility, petroleum and hydrocarbon gas in a liquid state, coal and lignite, coke and semi-coke of coal or lignite, and petroleum coke. The rates of the levy are based on the type and quantity of fuel supplied, with a range of relief and exemptions available.

VAT on duty is calculated as a fixed proportion (in most cases 17.5 per cent) of the duty paid on hydrocarbon oils. In practice much of this VAT will be reclaimed by business, but it could be argued that the total will eventually be paid when the final product or service is purchased.

Taxes on road vehicles include Vehicle Excise Duty, which owners of motor vehicles can pay on either a six monthly or annual basis. There have been various changes to this duty over recent years. Most recently, as from 1 May 2002, private cars, taxis and light goods vehicles registered before 1 March 2001 with an engine size up to and including 1549cc are subject to a lower tax than cars with engine sizes greater than 1549cc. The same vehicle types registered on or after 1 March

2001 are taxed according to the level of carbon dioxide emissions. Car tax was payable on purchases of new cars, up until 1993 when it was discontinued.

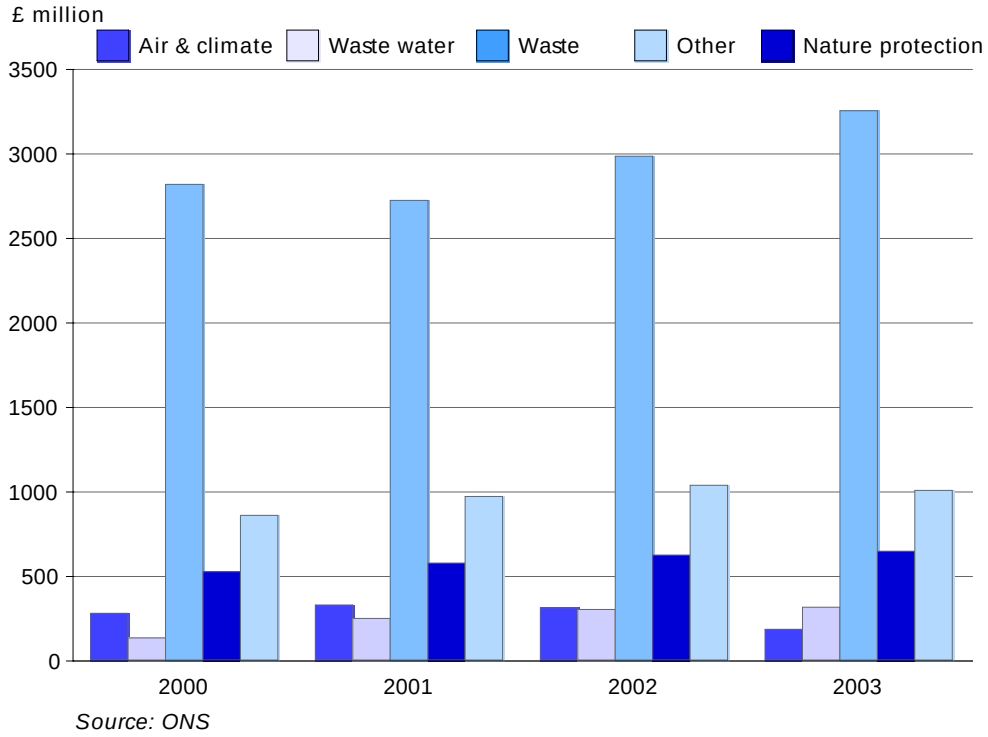
Air passenger duty was introduced on 1 November 1994. It applies to the carriage from a UK airport of chargeable passengers on chargeable aircraft at two different rates. The lower rate is charged where passengers are travelling to a UK destination or within the European Economic Area (EEA), and the higher rate applies in all other cases. On the year of introduction, the lower and higher rates of duty were £5 and £10 respectively. From 1 April 2001, standard rates of £10 for EEA destinations and £40 for other destinations have been applied. There are also reduced rates of duty for the lowest class of travel on any flights.

Landfill tax was introduced in October 1996 and aims to encourage waste producers to produce less waste, recover more value from waste e.g. through recycling or composting and to use more environmentally friendly methods of waste disposal. The tax applies to active and inactive (inert) waste disposed of at landfill sites. Generally when waste is committed to landfill it undergoes physical, chemical or biological transformations which then react with surrounding matter. Known as leaching, this process can give rise to environmental damage and harm human health. Waste classified as inactive has insignificant levels of leachability, pollutant content and ecotoxicity. Types of waste excluded from this tax include dredgings, disposals from mines and quarries and also waste resulting from the clearance of contaminated land. A standard rate of tax is levied on active waste, this was introduced at the rate of £7.00 per tonnes and has since risen to £14 per tonne in 2003-04. This rate will subsequently be increased by £3 to £18 per tonnes in 2005-06 and by at least £3 per tonne each year thereafter, until it reaches a medium to long term rate of £35 per tonne. A lower rate of tax is levied on inert waste, which has remained at £2.00 per tonne from the year of introduction.

The **aggregates levy** was introduced on 1 April 2002. The objective of this tax is to address the environmental costs associated with quarrying operations (noise, dust, visual intrusion, loss of amenity and loss to biodiversity), by reducing the demand for aggregate and encouraging the use of alternative materials where possible e.g. the use waste glass and tyres in aggregate mixes. The tax applies to the commercial exploitation of sand, gravel and rock and includes aggregate dredged from the seabed within UK territorial waters. It is a specific tax, charged at £1.60 per tonne.

There is a wide range of exemptions for some quarried or mined products e.g. coal, metal ores, industrial minerals and for minerals used in the production of lime and cement and for exports of aggregates. Imports of aggregates will be taxed upon first sale or use in the UK.

Environmental protection expenditure by public sector, 2000 - 2003



Source: ONS

In 2003 general government environmental protection expenditure was £5.4 billion, representing 0.5 per cent of GDP. This is a rise of 2.8 per cent from 2002 when the level of spending stood at £5.2 billion. This expenditure included £3.2 billion on waste management, mainly through local authorities. Just over £0.6 billion was spent on nature conservation and only £0.3 billion was spent directly on wastewater management. In total, expenditure on waste and wastewater management accounted for 66 per cent of total government environmental protection expenditure. Expenditure on measures to protect the atmosphere and on climate change prevention fell to £0.2 billion compared with £0.3 billion in 2002 and 2001. Just over £1 billion was spent on other environmental protection activities, research and development, education and administration.

The majority of environmental protection expenditure is in the form of particular short-term programmes and as these become active and inactive there can be large movements in expenditure within the domains targeted by such programmes. However, overall environmental protection expenditure continues to increase year on year.

Estimates of public sector environmental protection expenditure are derived from the HMT Public Expenditure Statistics Analysis database.

3.2 Environmental protection expenditure by public sector 2002

£ million

	Protection of ambient air and climate	Waste water management	Waste management	Protection of bio-diversity and landscape	Other abatement activities[1]	Research and development education and adminstration	Total environmental expenditure
Staff costs	72	122	524	262	32	128	1 139
Other running costs[2]	43	72	2 255	201	26	279	2 876
less							
Current income	–	–1	–6	–	–	–1	–9
Net operating costs	**114**	**193**	**2 773**	**463**	**58**	**406**	**4 006**
Capital payments[3]	40	26	217	132	396	88	899
less							
Capital receipts	–	–	–11	–	–	–1	–12
Net capital expenditure	**40**	**26**	**206**	**132**	**396**	**87**	**887**
Current grants and subsidies							
to industry	20	–	2	25	–	20	67
to households	–	–	–	–	–	5	5
Capital grants and subsidies							
to public corporations	–	79	–	–	–	–	79
to industry	3	–	–	–	55	7	65
to households	132	–	–	–	1	–	133
Net transfers to the rest of the world	–	–	–	1	–	–	1
Net expenditure[2]	**308**	**299**	**2 980**	**621**	**510**	**524**	**5 242**

Source: ONS

3.3 Environmental protection expenditure by public sector 2003

£ million

	Protection of ambient air and climate	Waste water management	Waste management	Protection of bio-diversity and landscape	Other abatement activities[1]	Research and development education and adminstration	Total environmental expenditure
Staff costs	83	142	609	305	37	148	1 324
Other running costs[2]	47	78	2 450	219	28	303	3 125
less							
Current income	–1	–2	–11	–1	–	–1	–15
Net operating costs	**130**	**218**	**3 048**	**523**	**65**	**450**	**4 433**
Capital payments[3]	40	26	217	132	397	88	900
less							
Capital receipts	–	–	–15	–	–	–2	–17
Net capital expenditure	**40**	**26**	**202**	**132**	**397**	**86**	**883**
Current grants and subsidies							
to industry	–11	–	–1	–14	–	–11	–36
to households	–	–	–	–	–	6	6
Capital grants and subsidies							
to public corporations	–	68	–	–	–	–	68
to industry	–	–	–	–	9	1	10
to households	23	–	–	–	–	–	23
Net transfers to the rest of the world	–	–	–	3	–	–	3
Net expenditure[2]	**182**	**312**	**3 249**	**644**	**471**	**532**	**5 391**

1 Includes expenditure on the protection of soil and groundwater, on noise and vibration abatement, on protection against radiation and on other environmental protection activities.
2 Includes an allowance for the consumption of fixed capital.
3 Includes outlays on land.

Source: ONS

3.4 Environmental protection expenditure in specified industries 2001

£ million

	Protection of ambient air and climate	Waste water management	Waste management	Protection of bio-diversity and landscape	Other abatement activities	Research and development education and adminstration	Total environmental expenditure
Mining and quarrying	12	57	54	1	104	2	230
Food, beverages and tobacco	46	234	202	2	107	3	594
Textiles and leather products	3	84	30	–	11	2	130
Wood and wood products	6	11	33	1	9	1	61
Pulp and paper products, printing and publishing	19	45	90	1	18	4	177
Solid nuclear fuels, oil refining	23	23	31	2	7	8	94
Chemicals and man made fibres	169	284	155	4	65	33	710
Rubber and plastic products	44	49	66	2	29	2	192
Other non metallic mineral products	16	16	34	1	10	1	78
Basic metals and metal products	147	120	130	4	72	6	479
Machinery and equipment	10	30	32	2	25	7	106
Electrical and optical equipment	7	27	38	1	20	2	95
Transport equipment	53	44	64	4	52	5	222
Other manufacturing	9	7	41	–	4	1	62
Energy production and water	202	25	223	10	193	3	656
Total expenditure in extraction, manufacturing, energy and water supply industries	**766**	**1 056**	**1 223**	**34**	**726**	**80**	**3 886**

The figures in these tables fall outside the scope of National Statistics Components may not sum to totals due to rounding.

Source: Department for environment, food and rural affairs

Environmental protection expenditure

Estimates of environmental protection expenditure should be regarded as approximate orders of magnitude only. Because of this qualification, the estimates shown fall outside the scope of National Statistics.

Comparisons with previous surveys

The information on spending by industries in 2001, which is summarised in Environmental protection expenditure in specified industries, 2001 comes from the fourth of a regular series of surveys. The estimates from this survey and the earlier surveys in 1997, 1999 and 2000 should be regarded as very approximate and any comparisons between the results should be treated with care.

Definition of expenditure

Environmental protection expenditure is defined as capital and operational expenditure incurred because of, and which can be directly related to, the pursuit of an environmental objective. Spending on installations and processes which are environmentally beneficial, but which also produce revenue (or savings) exceeding expenditures, is excluded on the grounds that it is likely to have been carried out for commercial not environmental reasons. Also excluded are expenditures on natural resource management (e.g. fisheries and water resources), on the prevention of natural hazards (e.g. flood defence), on the provision of access and amenities to National Parks etc, and on the urban environment.

The spending has been classified by the following groups of environmental concerns:

Protection of ambient air and climate
Waste water management
Waste management
Protection of biodiversity and landscapes
Other abatement activities such as on the protection of soil and groundwater, protection against radiation, and noise and vibration abatement
Other environmental expenditure (on research and development, education and administration).

The spending by the general government sector shown in Environmental Protection Expenditure by the General Government Sector, 2002 - 2003 has also been classified by the following types of expenditure:

- Current costs, including staff costs (compensation of employees), other on-going expenditure on purchases of goods and services, and the estimated consumption of fixed capital
- Capital expenditure or investment including outlays on land and on the additions of new durable goods to the stock of fixed assets for environmental protection
- Income from sales, fees and charges for the provision of current or capital goods and services, such as fees for waste removal, but excluding taxes
- Current and capital transfers to other sectors of the economy
- Net transfers to and from the Rest of the World, in the form of aid or other grants, net of grants received from the EU. Data in Environmental Protection

Expenditure in specified industries, 2001 should not be added to data in Environmental Protection expenditure by the general government sector, 2002 - 2003.

There are five main categories of spending in Environmental protection expenditure in specified industries, 2001:

- End-of-pipe-investment is defined as add-on installations and equipment which treats or controls emissions or reduces waste materials generated by the plant, but which does not affect production processes.
- Integrated processes are adaptations or changes to production processes in order to generate fewer emissions or waste materials.
- In-house operating expenses cover operating costs necessary to run end-of-pipe or integrated facilities.
- Current payments made to others include all payments to third parties for environmental services, including payments for the treatment or removal of solid waste, water service company charges for sewage treatment, payments to contractors for the removal or treatment of waste waters, and payments made to environmental regulatory authorities.
- Research and development expenditure includes both in-house research and development and amounts paid to others such as trade associations and consultants.

Sources

Environmental protection expenditure in specified industries, 2001 gives figures for spending by the extraction, manufacturing, energy production and water supply industries. They are drawn from a survey for 2001 carried out on behalf of the Department for Environment, Food and Rural Affairs (Defra) by URS Corporation Ltd[1]

Environmental protection expenditure by the general government sector, 2002 - 2003 gives estimates for expenditures by the general government sector and is based on information obtained from a variety of sources such as the Public Expenditure Database and from various government departments, local authorities and the devolved administrations.

1. *URS Corporation LTD (2002).* Environmental Protection by Industry: 2000 UK Survey

Annex 1: Atmospheric pollutants

Greenhouse gases

There is a growing consensus that the rise in concentrations of greenhouse gases in the atmosphere has led to changes in the global climate system. The greenhouse gases included in the atmospheric emissions accounts are those covered by the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

The main source of **carbon dioxide (CO_2)** is from the combustion of fossil fuels, but it is also produced in some industrial processes such as the manufacture of cement. Carbon dioxide is a long-lived gas remaining in the atmosphere for between 50 and 200 years. It is the main anthropogenic greenhouse gas.

Methane (CH_4) is produced when organic matter is broken down in the absence of oxygen. Large quantities are produced by enteric fermentation in cattle and sheep, by the spreading of animal manure and from organic waste deposited in landfill sites. Methane is also emitted in coal mining, oil and gas extraction and gas distribution activities. Methane is a significant greenhouse gas.

Nitrous oxide (N_2O) is released in a few industrial processes and from the soil when nitrogenous fertilisers are applied in agriculture and horticulture. These are the main anthropogenic sources. It is a long-lived pollutant, lasting about 120 years in the atmosphere and is a potent greenhouse gas.

Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) are artificial fluids that contain chlorine and/or fluorine. Because of their low reactivity and non-toxicity they were widely used as refrigerants, foam blowing agents, aerosol propellants and solvents.

To aggregate the greenhouse gases covered in the accounts, a weighting based on the relative global warming potential (GWP) of each of the gases is applied, using the effect of CO_2 over a 100 year period as a reference. This gives methane a weight of 21 relative to relative to CO_2 and nitrous oxide a weight of 310 relative to CO_2. SF_6 has a GWP of 23,900 relative to CO_2. The GWP of the other fluorinated compounds varies according to the individual gas.

Greenhouse gas emissions are sometimes shown in terms of carbon equivalent rather than CO_2 equivalent. To convert from CO_2 equivalent to carbon equivalent it is necessary to multiply by 12/44.

The main sources of **mercury (Hg)** emissions are waste incineration, the manufacture of chlorine in mercury cells, non-ferrous metal production and coal combustion. Emissions of mercury have declined over recent years due to improved controls on mercury cells and their replacement by diaphragm cells and the decline of coal use. Due to the volatility of mercury, if levels are sufficiently high, compounds containing mercury attack and destroy various parts of the body, particularly teeth, lung tissues and intestines.

Acid rain precursors

The term 'acid rain' describes the various chemical reactions which acidic gases and particles undergo in the atmosphere. The gases may be transported long distances before being deposited as wet or dry deposition. When deposited, hydrogen ions may be released, forming dilute acids, which damage ecosystems and buildings. The gases covered are sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia (NH_3).

The emissions are weighted together using their relative acidifying effects. The weights, given relative to SO_2, are 0.7 for NO_x and 1.9 for NH_3. This is a simplification of the chemistry involved, and there are a number of factors which can affect the eventual deposition and effect of acid rain. There may be an upward bias on the weights of the nitrogen-based compounds in terms of damage to ecosystems.

Sulphur dioxide (SO_2) is produced when coal and some petroleum products containing sulphur impurities are burnt. Sulphur dioxide is an acid gas that can cause respiratory irritation. It can damage ecosystems and buildings directly and is a major contributor to acid rain.

Nitrogen oxides (NO_x) arise when fossil fuels are burnt under certain conditions. High concentrations are harmful to health and reduce plant growth. Like sulphur dioxide, nitrogen oxides contribute to acid rain; nitrogen dioxide (NO_2) also plays a part in the formation of ground ozone layer.

Ammonia (NH_3) is predominantly emitted from spreading animal manure and some fertilisers.

Other air pollutants

PM_{10}s are smoke particles whose diameter is less than 10 microns. They are regarded as responsible for some physiological damage and have been linked to premature mortality from respiratory diseases.

Carbon monoxide (CO) is produced in small quantities when fossil fuel is burnt with insufficient oxygen for complete combustion. At high concentrations carbon monoxide is toxic.

Non-methane volatile organic compounds (NMVOCs) cover a variety of chemicals, many of which are known carcinogens. Emissions of NMVOCs arise from the deliberate and incidental evaporation of solvents (e.g. in paints and cleaning products), from accidental spillage and from non-combustion of petroleum products. The environmental accounts include natural emissions of NMVOCs from managed forests. NMVOCs play a role in the formation of ground level ozone, which can have an adverse effect on health. The NMVOC emissions include benzene and 1,3-butadiene.

Benzene is released largely from the distribution and combustion of petrol. It is a carcinogen which has also been found to cause bone-marrow depression and consequent leukopenia (depressed white blood cell count) on prolonged exposure.

1,3-Butadiene is a colourless, gaseous hydrocarbon. It is produced by dehydrogenation of butene, or of mixtures of butene and butane; it may also be made from ethanol. 1,3-butadiene is believed to be a carcinogen, for which the safe level is not known. Emissions of 1,3-butadiene arise from combustion of petroleum products and in its manufacture of synthetic rubber, nylon and latex paints in the chemical industry. 1,3-butadiene is not present in petrol but is formed as a by-product of combustion. The increasing use of catalytic converters through the 1990's has caused a significant reduction in emissions from the road transport sector.

Heavy Metals

Lead (Pb) is a heavy metal that is emitted from the combustion of petrol, coal combustion and metal works. Emissions of lead continued to fall in 2000, mainly as a result of the ban on the sale of leaded petrol from 1 January 2000. Lead has been found to inhibit the development of children's intelligence. If the levels of lead are sufficient, lead can cause degenerative processes such as osteoporosis, inhibit many enzyme reactions in the body and cause reproductive disorders such as sterility and miscarriages.

Cadmium (Cd) is a normal constituent of soil and water at low concentrations. Industrially, cadmium is used as an anti-friction agent, in alloys, semi-conductors, control rods for nuclear reactors and PVC and battery manufacture. The main sources of cadmium emissions are from waste incineration, and iron and steel manufacture. Emissions of cadmium have declined over recent years; this is mainly attributable to the decline in coal combustion.

Environmentally, cadmium is dangerous because many plants and some animals absorb it easily and concentrate it in tissues. Cadmium competes with calcium in the body, and if levels are sufficient, it will displace calcium, causing embrittlement of bones and painful deformations of the skeleton. Cadmium also competes with zinc in the body, and if levels of cadmium are high enough, cadmium will also displace zinc from enzymes in the body.

Annex 2: Revisions since previous publication on 17 October 2003

Updates and revisions

The environmental accounts have been updated since the Autumn 2003 publication to incorporate more recent information and revisions to previously published estimates. The following accounts have been either updated or revised:

Oil and gas reserves
The monetary value of the UK's oil and gas reserves have been revised to correct a methodological error in the calculation of unit resource rent.

Energy consumption
The estimates for energy consumption in the UK have been revised to incorporate the latest estimates from the National Environmental Technology Centre (NETCEN). The latest data includes estimated energy consumption for 2002 as well as revisions to earlier periods.

Atmospheric emissions
Estimates of atmospheric emissions have been updated to include information for 2002 and to take on methodological improvements to the industry allocation of emissions from road transport.

Material flows
The material flow accounts have been updated to include estimates for 2002.

Environmental taxes
Estimates have been updated to include latest national accounts information for 2003.

Public sector environmental protection expenditure
Public sector environmental protection expenditure has been updated to include estimates for 2002 using information from HM Treasury's Public Expenditure Statistical Analysis (PESA) database.

The next publication of the Environmental Accounts is scheduled for 18 November 2004. Anticipated updates and revisions include:

Material flows
The incorporation of the results of the review of hidden flows.

Industry environmental protection expenditure
Incorporation of the results of Department for the Environment and Rural Affairs' environmental protection expenditure survey for 2002.

Environmental taxes
The incorporation of the results of work on environmental taxes and an analysis of payments by UK industries and households.

Index