Office for National Statistics

Statistical bulletin

UK Environmental Accounts: 2015

Satellite accounts to the main UK National Accounts measuring the contribution of the environment to the economy, the impact of economic activity on the environment, and society's response to environmental issues.

Contact:
Matthew Steel
environment.accounts@ons.gsi.gov.uk

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1. Main points

- Renewable and waste sources accounted for 5.6% of total energy consumed in 2013, compared with 1.2% in 2000
- Emissions of greenhouse gases have fallen 23.6% between 1990 and 2013
- In 2013, 9.2 tonnes of material resources were consumed per capita, down from 12.6 tonnes in 2000
- Environmental tax revenue (in current prices) was 2.5 times greater in 2014 (£44.6 billion
- UK government spent an estimated £14.4 billion on environmental protection in 2013

2. Overview

Environmental accounts show how the environment contributes to the economy (for example, through the extraction of raw materials), the impacts that the economy has on the environment (for example, energy consumption and air emissions), and how society responds to environmental issues (for example, through taxation and expenditure on environmental protection).

Environmental accounts are ‘satellite accounts’ to the main National Accounts and they are compiled in accordance with the System of Environmental Economic Accounting (SEEA), which closely follows the UN System of National Accounts (SNA). This means that they are comparable with economic indicators such as Gross Domestic Product (GDP).

Environmental accounts are used nationally and internationally, primarily by governments, development organisations and researchers, to inform sustainable development policy, to evaluate the environmental impacts of different sectors of the economy, and to model impacts of fiscal or monetary measures.

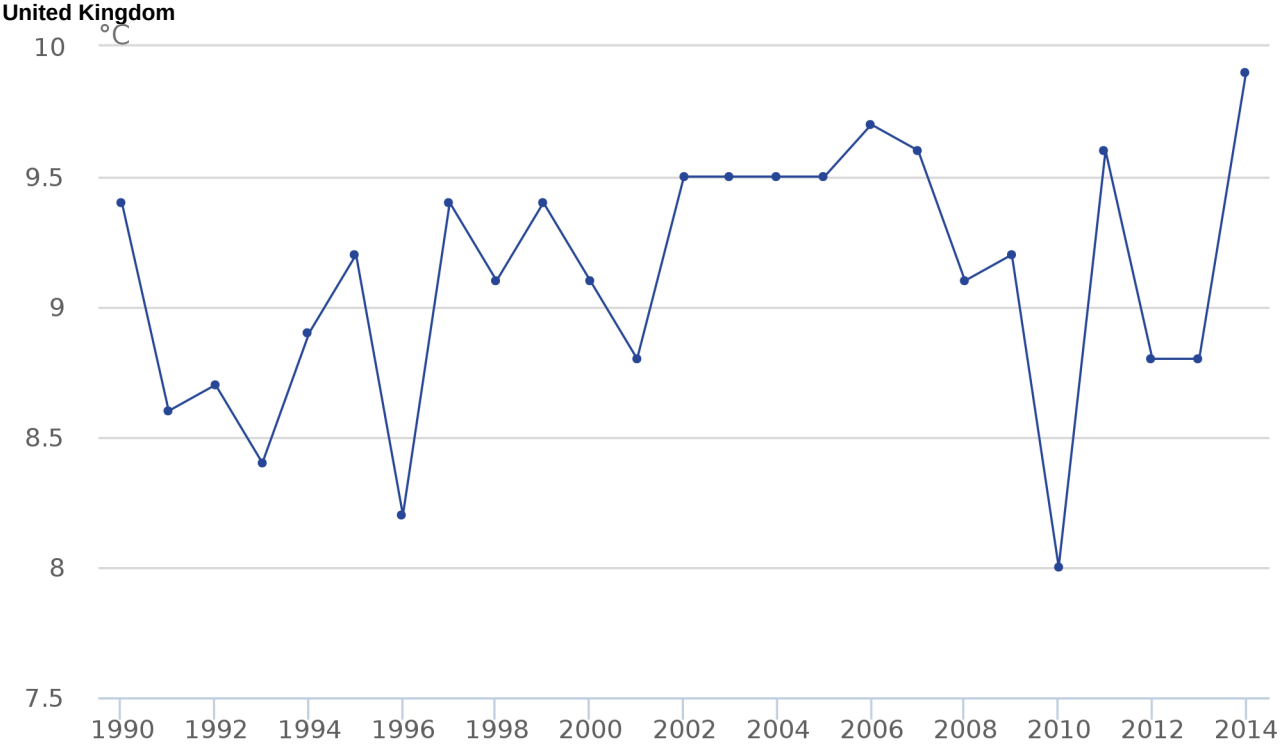
3. Changes in environmental and economic measures

Figures 1.1 and 1.2 show changes in mean air temperature and gross domestic product (GDP) between 1990 and 2014. These measures help to contextualise some of the changes observed across the environmental accounts. For example, the average temperature fell in 2010 to 8.0 degrees Celsius, from 9.2 degrees Celsius in 2009, which contributed to the increases in energy consumption and greenhouse gas emissions observed during that year. At the same time, GDP started to recover following the economic downturn, which may also explain the increases in consumption and emissions.

The relationships between the environment and the economy are explored further throughout this bulletin.

Figure 1.1: Mean air temperature, 1990 to 2014

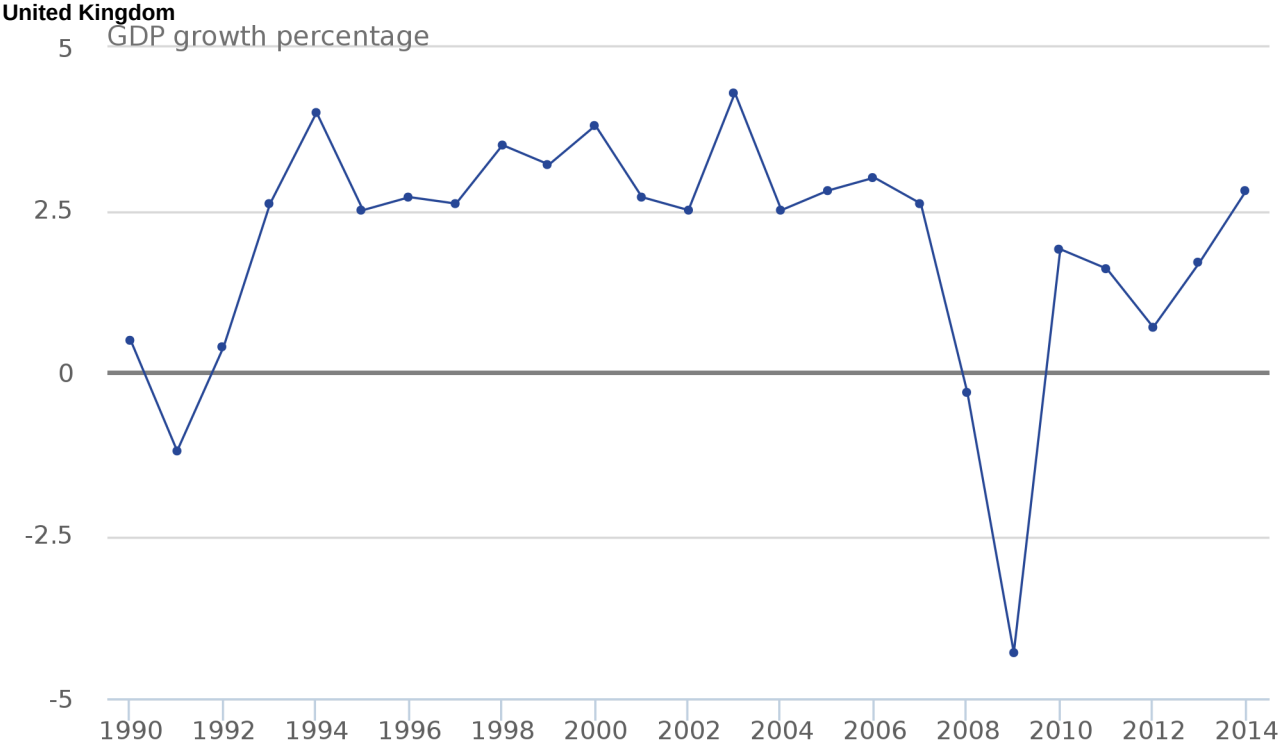
United Kingdom



Source: Met Office

Figure 1.2: Gross Domestic Product (GDP)[1], 1990 to 2014

United Kingdom



Source: Office for National Statistics

Notes:

1. GDP: Year on Year Growth: Chained Volume Measure, in constant prices (2011-based)

4. Fuel use

Main points

- Fuel use fell 2.0% between 2012 and 2013, largely as a result of a decrease in power stations' coal combustion and electricity production from fossil fuel combustion
- Fuel use was 10.9% lower in 2013 than when the series began in 1990
- Since 1993, natural gas has been the dominant fuel used. In 2013, it accounted for 38.0% of total fuel used
- The trend of road-transport fuel switching from petrol to diesel continued. Between 2012 and 2013, diesel use increased by 1.7%, whereas petrol use decreased by 4.9%
- Road diesel made up 12.8% of total fuel used in 2013, compared to only 5.5% in 1990

Introduction

A fuel is a material which can store and release energy, usually as heat from combustion. Within the environmental accounts, "fuel use" refers to the consumption of combustible fuels, and differs from "energy consumption", which excludes fuels consumed for non-energy purposes, such as to produce chemicals or other fuels. In addition, energy consumption includes other sources of energy that are not from combustible fuels; as a result these are not included here within fuel use. For the purposes of this publication, "fuel use" is defined also to exclude combustible renewable and waste fuels; these are not associated with a net loss of energy from the environment in the same way as fossil fuels.

Fuel use at its lowest point since series began

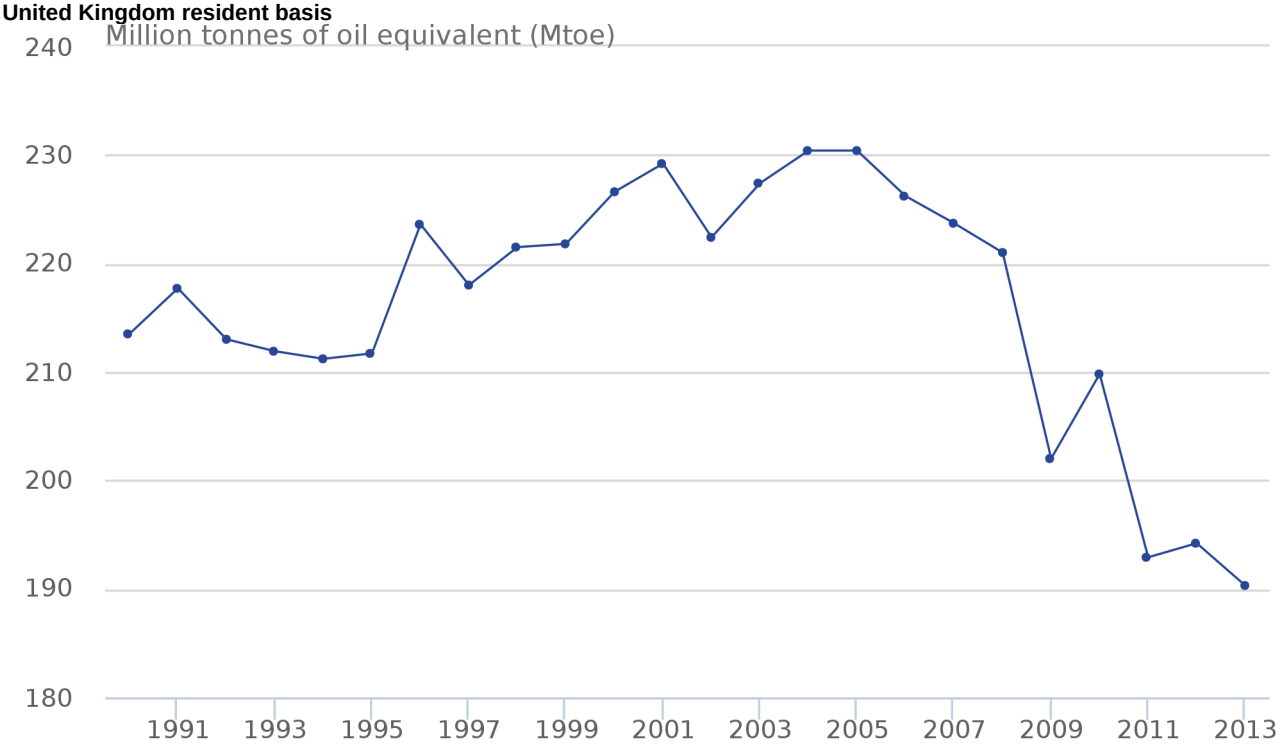
Total fuel use fell between 2012 and 2013 by 2.0% to 190.3 Million tonnes of oil equivalent (Mtoe) (Figure 2.1). Fuel use in 2013 was at the lowest point in the series, 10.9% lower than 1990.

In 2005, fuel use peaked at 230.4 Mtoe, and has since been following a downward trend. This is in part as a result of a move towards more efficient use of fuel and also because of increases in the use of renewable and sustainable sources of energy.

Since 2005 there have been increases in fuel use of 3.9% between 2009 and 2010, and 0.7% between 2011 and 2012, mainly due to cooler temperatures, resulting in greater fuel demand. The former increase, between 2009 and 2010, was also partly as a result of a return to economic activity following the downturn.

Figure 2.1 Total fuel use, 1990 to 2013

United Kingdom resident basis



Source: Ricardo-AEA, Office for National Statistics

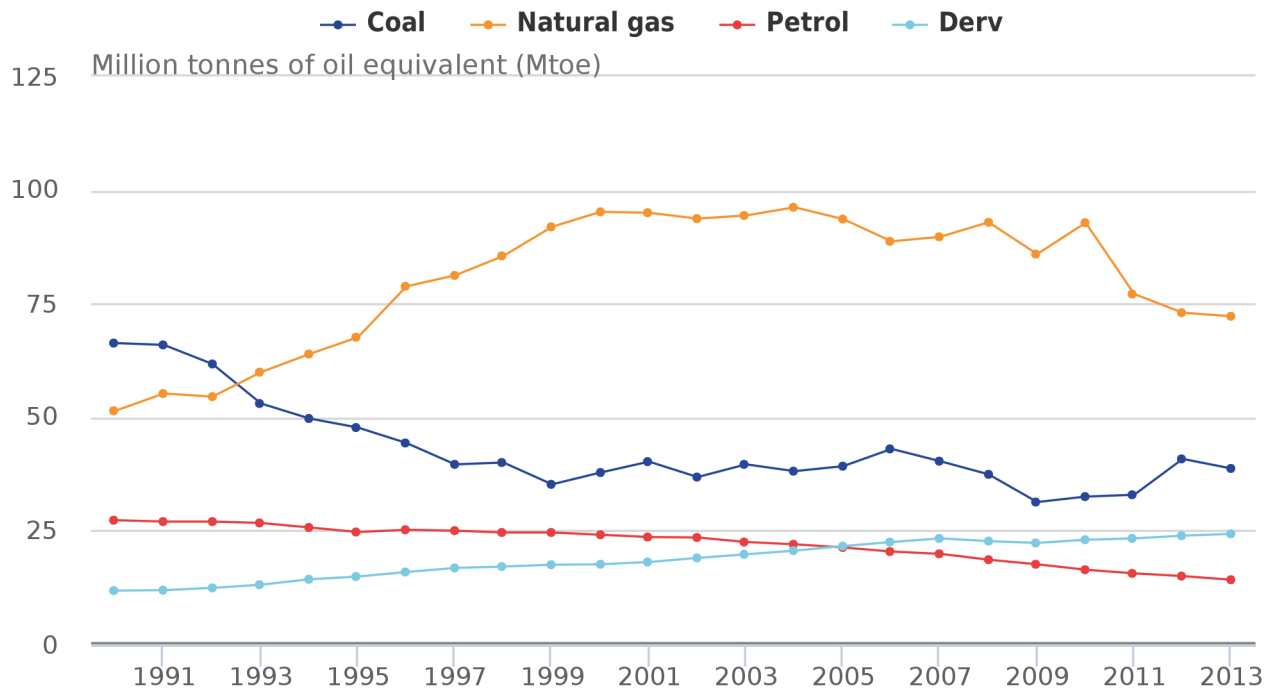
Natural gas has been the dominant fuel used since 1993

Since 1993, natural gas has been the most used fuel (Figure 2.2). In 2013, 72.2 Mtoe of natural gas was used, falling 1.1% since 2012. Natural gas use peaked in 2004 at 96.2 Mtoe, when it made up 41.8% of total fuel used. In comparison, natural gas made up 38.0% of total fuels used in 2013.

Coal use has declined since 1990, with 66.3 Mtoe used in 1990 compared to 38.7 Mtoe in 2013. The largest annual increase in coal use was 24.0% between 2011 and 2012, partly because of a switch in the electricity generation sector from natural gas towards cheaper coal. However, between 2012 and 2013 coal use fell 5.1%, partly as a result of a fall in power station use.

Figure 2.2 Fuel use: by type, 1990 to 2013

United Kingdom resident basis



Source: Ricardo-AEA, Office for National Statistics

Petrol use has been declining since 1990, falling from 27.3 Mtoe in 1990 to 14.2 Mtoe in 2013, the lowest point in the series. This may indicate a switch to more efficient fuels for road use. The downward trend continued between 2012 and 2013, with petrol use falling 4.9%. In 1990, petrol use represented 12.8% of total fuel used. In comparison, it made up 7.5% of total fuel used in 2013.

In contrast, use of road diesel or DERV (Diesel-Engine Road Vehicle) has been gradually increasing. In 2013, 24.3 Mtoe of DERV was used, compared to 11.8 Mtoe in 1990. DERV use fell slightly between 2007 and 2009, but has since been increasing. Between 2012 and 2013, DERV was the only main fuel to have increased in use, rising 1.7%. DERV made up 12.8% of total fuel used in 2013, compared to only 5.5% in 1990.

More detailed fuel use data is available in the fuel use by type (71 Kb Excel sheet) and fuel use by industry source and fuel type (584 Kb Excel sheet) datasets.

5. Energy consumption

Main points

- Total energy consumption fell 0.9% between 2012 and 2013
- The vast majority of energy consumed came from fossil fuels (86.6%). However, energy consumption from fossil fuels in 2013 was at its lowest level since the time series began
- Energy consumption from renewable and waste sources in 2013 was 8.2 times greater than in 1990. These sources contributed 5.6% of total energy consumption

Introduction

Energy consumption is defined here as the use of energy for power generation, heating and transport. This is essential to most economic activities, for example, as input for production processes and as a consumer commodity.

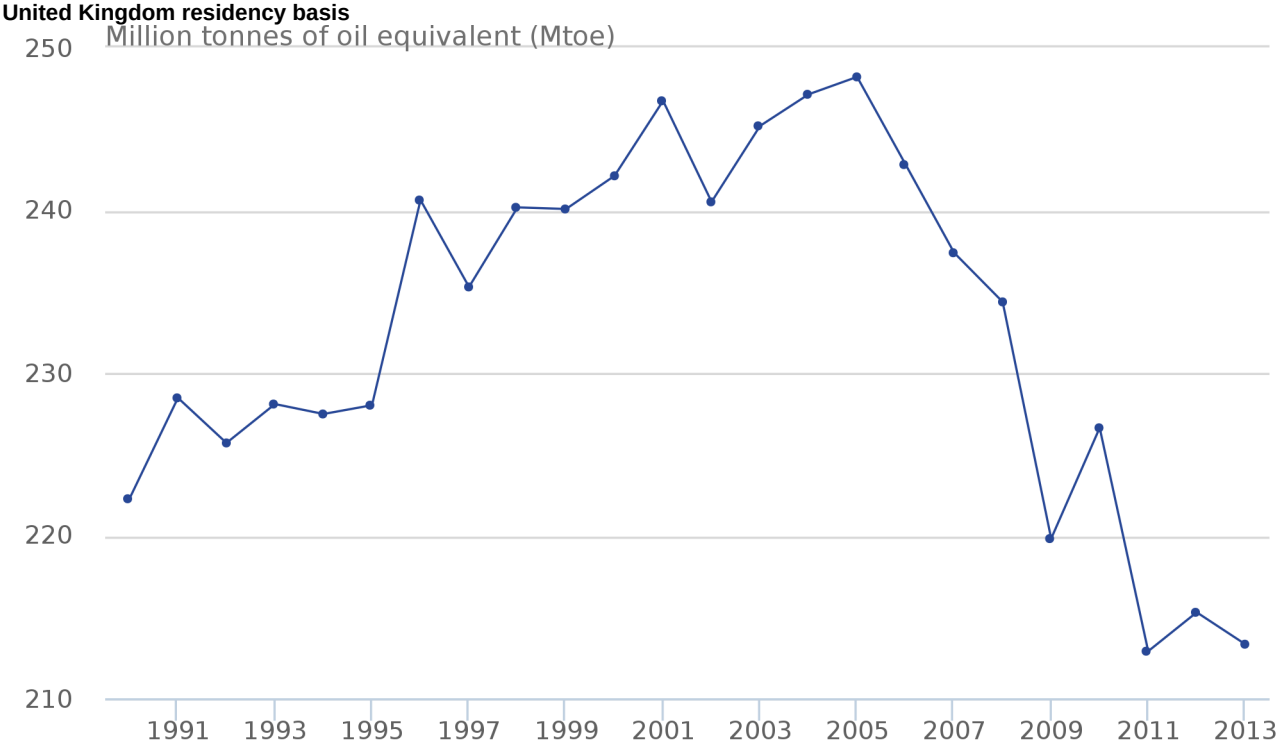
In this release, “direct use of energy” refers to the energy content of fuel for energy at the point of use, allocated to the original purchasers and consumers of fuels. Whereas, for “reallocated use of energy”, the losses incurred during transformation1 and distribution2 are allocated to the final consumer of the energy rather than incorporating it all in the electricity generation sector.

Total energy consumption

Total energy consumption of primary fuels and equivalent fell 0.9% between 2012 and 2013 to 213.3 Million tonnes of oil equivalent (Mtoe) (Figure 3.1). The fall is in line with the overall downward trend since 2005, which has seen total energy consumption falling 14.0%. Despite the fall, energy consumption in 2013 was still 0.4 Mtoe higher than in 2011, the lowest point in the series. In 2011 however, average annual air temperature was at its highest level since 2006, and 0.9 degrees Celsius warmer than 2013.

Figure 3.1: Energy consumption of primary fuels and equivalents, 1990 to 2013

United Kingdom residency basis



Source: Ricardo-AEA, Office for National Statistics

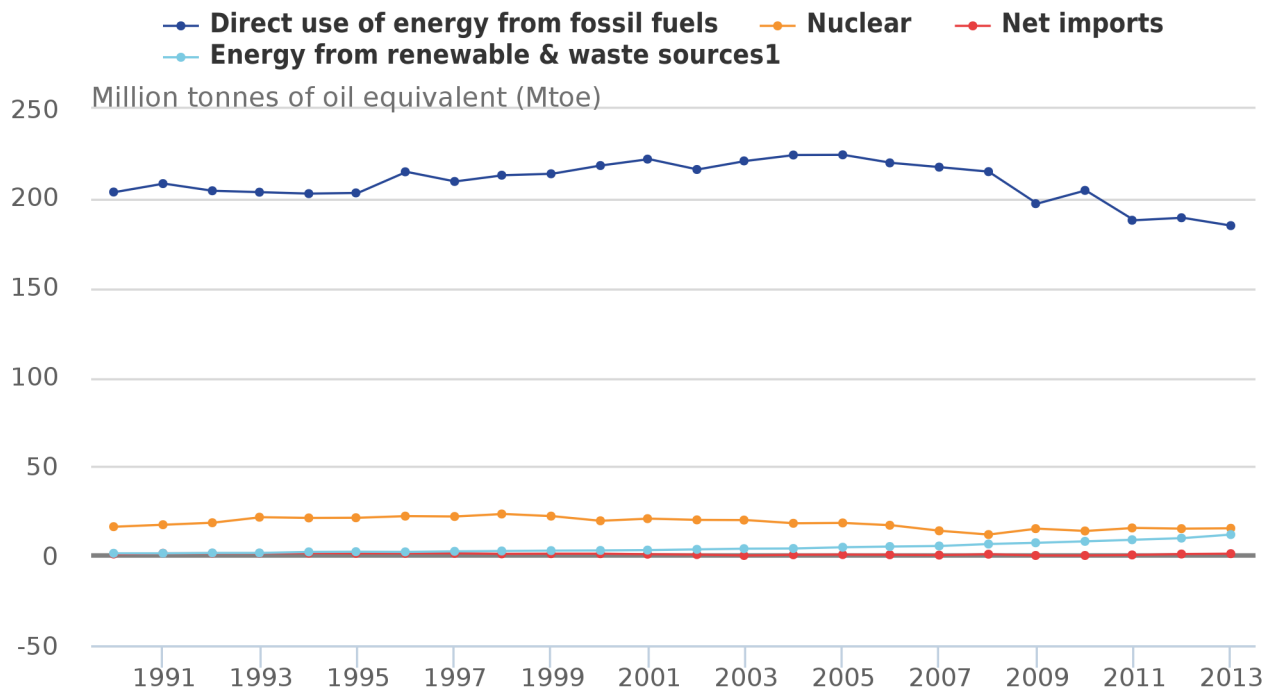
Fossil fuels remained the dominant source of energy supply in 2013; however, less primary fuel was consumed than in previous years (Figure 3.2). Energy consumption from fossil fuels in 2013 was at the lowest level since the time series began, at 184.7 Mtoe. This represented 86.6% of total energy consumption. Fossil fuel use as a percentage of total energy consumption peaked in 2008, contributing 91.7% of total energy consumption.

The direct use of energy from fossil fuels fell 2.3% between 2012 and 2013, to 184.7 Mtoe. This fall was driven by a reduction in coal use in power stations. Within the Energy supply, water and waste sector for example, direct use of fossil fuels fell 6.8%. Also contributing to the decline, direct use of fossil fuels fell 3.9% in the Transport, storage, information and communication sector. This was largely the result of a reduction in international shipping fuel use.

Although fossil fuels remained the main source of energy for consumption, other sources (including nuclear, net imports and renewable and waste) became increasingly important. Total energy consumption from other sources increased between 2012 and 2013 by 9.3% to 28.6 Mtoe. Nuclear remained the second largest source of energy in 2013, increasing marginally by 1.6% to 15.4 Mtoe between 2012 and 2013. Energy consumption from imports also increased, from 1.0 Mtoe to 1.2 Mtoe. Consumption from renewable and waste sources increased 19.9% to 11.9 Mtoe between 2012 and 2013.

Figure 3.2. Energy consumption from other sources: by source, 1990 to 2013

United Kingdom resident basis



Source: Ricardo-AEA, Office for National Statistics

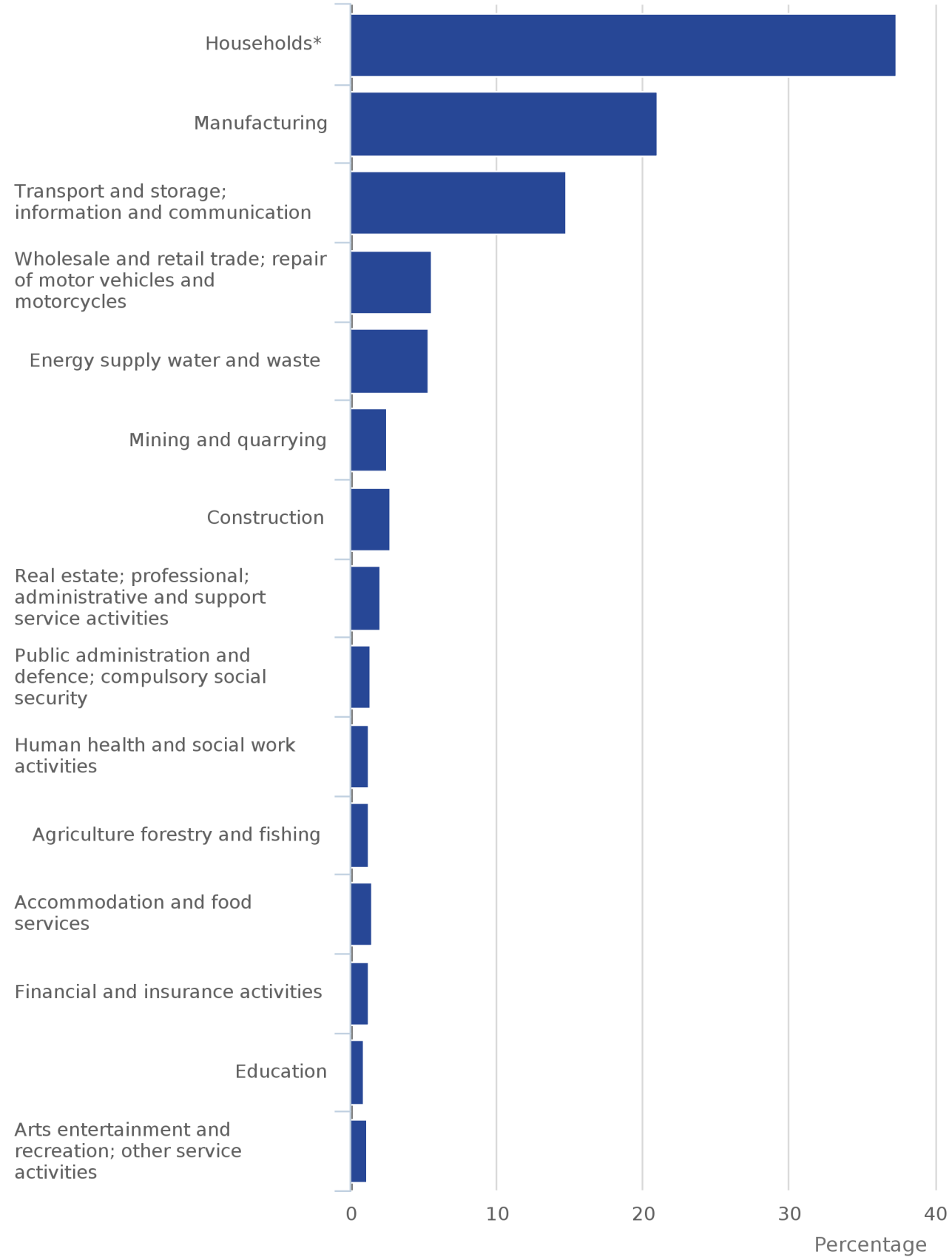
Notes:

1. Renewable and waste sources includes hydroelectric power, solar photovoltaic, geothermal aquifers, energy from wind, wave and tide, wood, charcoal, straw, liquid biofuels, biogas from anaerobic digestion, bioethanol and biodiesel, biomass combustion, sewage gas, landfill gas, poultry litter and municipal solid waste

When considering reallocated use of energy3, Households4 consumed the most energy in 2013, using 79.8 Mtoe. This represented 37.4% of total energy consumed (Figure 3.3). This was followed by the Manufacturing sector, which used 44.8 Mtoe (21.0%), and the Transport, storage, information and communication sector, which consumed 31.5 Mtoe (14.8%). These 3 sectors have been the largest consumers of energy since the series began.

Figure 3.3 Reallocated energy consumption: by industrial sector, 2013

United Kingdom resident basis



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. These industry aggregations are based on the Standard Industrial Classification (SIC) 2007 2.* The household category includes consumer expenditure and activities of households as employers; undifferentiated goods and services-producing activities of households for own use

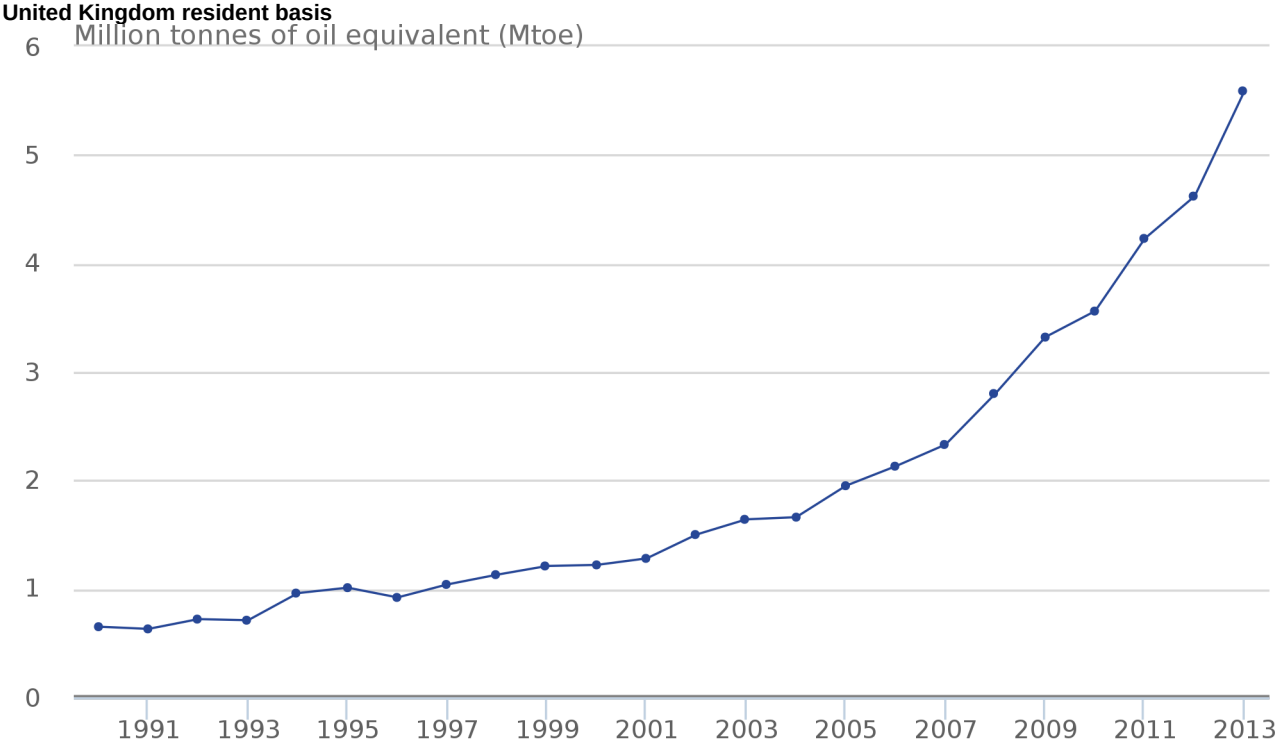
More detailed energy data can be found in the Total Energy Consumption by Industry (186 Kb Excel sheet) and Energy Use by Industry, Source and Fuel tables (1.01 Mb Excel sheet) available on our website.

Energy consumption from renewable and waste sources

In 2013, 11.9 Mtoes of energy was consumed from renewable and waste sources. This was 8.2 times greater than in 1990. The 19.9% increase reported between 2012 and 2013, is the greatest proportional increase since between 1993 and 1994. The increase brought the proportion of energy from renewable and waste sources to a new record high of 5.6% (Figure 3.4).

Figure 3.4 Energy consumption of renewable and waste sources, 1990-2013

United Kingdom resident basis



Source: Source: Ricardo-AEA, Office for National Statistics

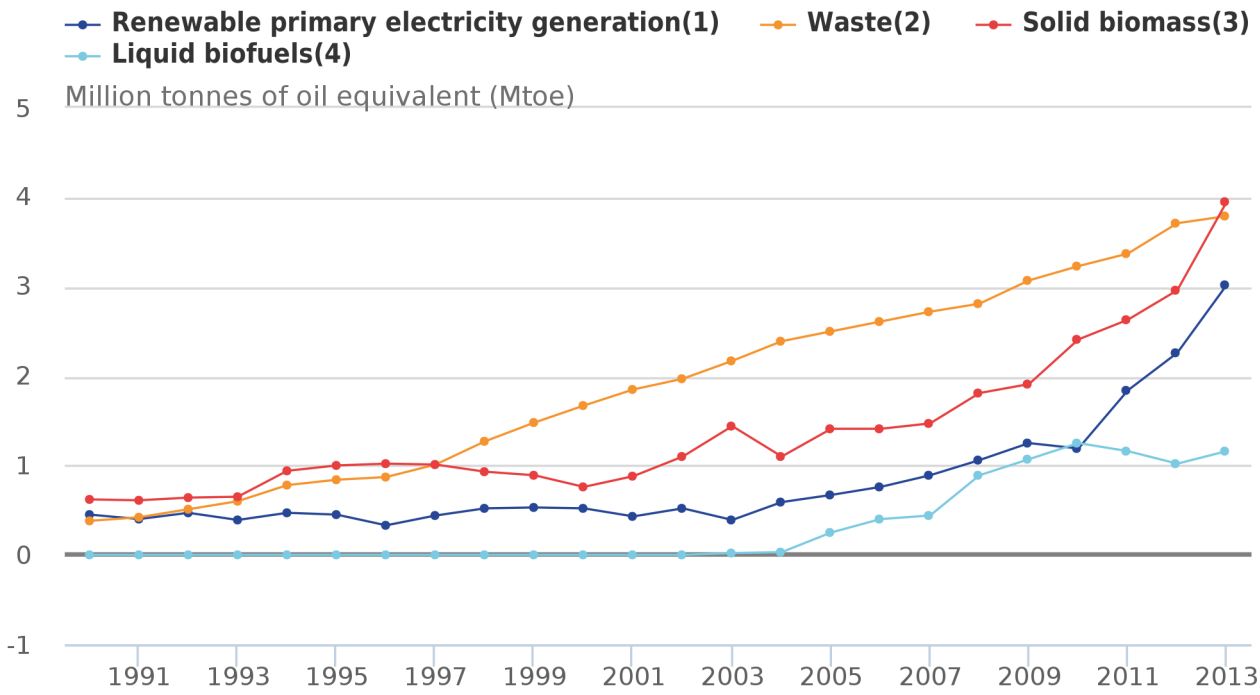
Notes:

1. Renewable and waste sources includes hydroelectric power, solar photovoltaic, geothermal aquifers, energy from wind, wave and tide, wood, charcoal, straw, liquid biofuels, biogas from anaerobic digestion, bioethanol and biodiesel, biomass combustion, sewage gas, landfill gas, poultry litter and municipal solid waste

In 2013, 31.8% of energy consumed from renewable and waste sources came from waste, 33.1% from solid biomass, 25.4% from renewable primary electricity generation, and 9.7% from liquid biofuels (Figure 3.5).

Figure 3.5: Energy consumption from renewable and waste sources, 1990 to 2013

United Kingdom resident basis



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. Renewable primary electricity generation includes hydroelectric power, wind, wave and tidal, solar photovoltaic, and geothermal aquifers

2. Waste includes landfill gas, sewage gas and municipal solid waste (MSW), poultry litter and biogas from anaerobic digestion used in autogeneration

3. Solid biomass includes wood, straw, charcoal and biomass

4. Liquid biofuels includes liquid biofuels used in power stations, bioethanol and biodiesel used in transport. The cross boundary adjustment is also included here

Energy consumed from these 4 collective renewable and waste sources were at their highest levels in 2013 since the time series began. Some sources however, have increased substantially in recent years. For example, energy consumption from solid biomass grew from 3.0 Mtoe in 2012 to 3.9 Mtoe in 2013 as biogas from autogeneration and wood combustion increased. This resulted in solid biomass becoming the most consumed of these 4 renewable and waste categories.

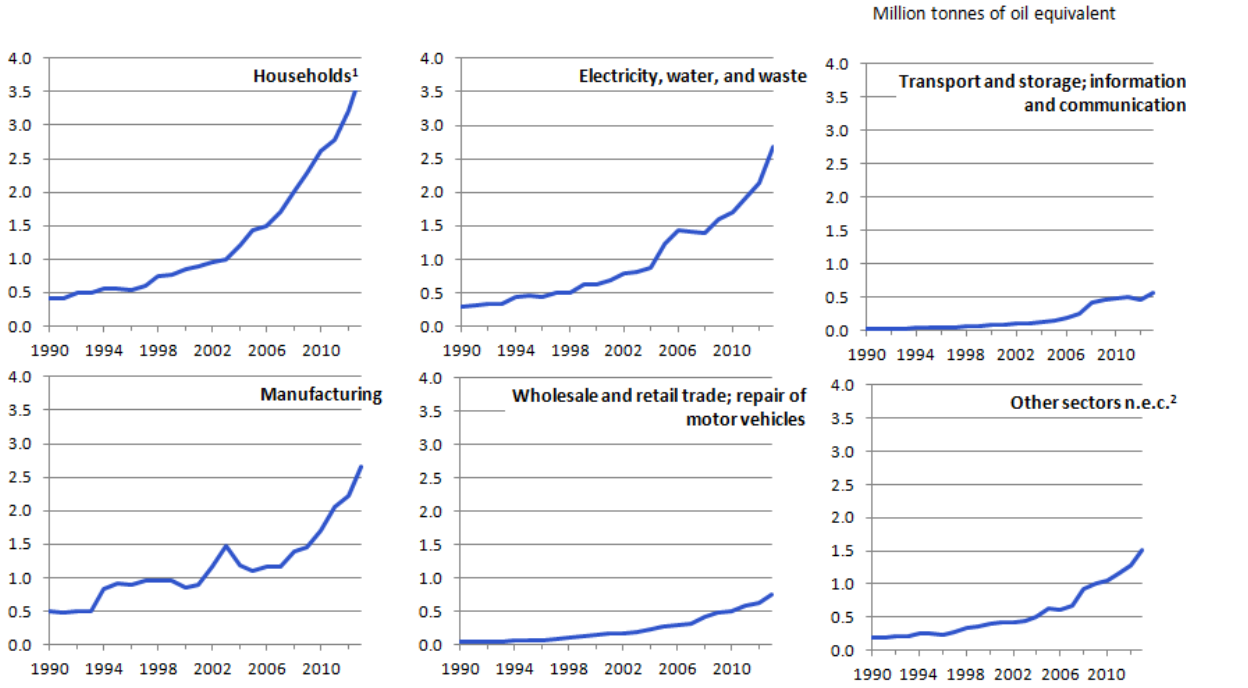
Waste was the most consumed energy source of these categories between 1998 and 2012. In recent years, energy consumption from other renewable sources has been increasing at a faster rate. In 2001, waste accounted for 58.6% of all energy consumed from renewable and waste sources, compared to 31.8% in 2013. This resulted in waste no longer being the most consumed category of renewable and waste sources as energy from solid biomass increased in importance.

There was a large increase in consumption of energy from renewable primary electricity generation sources from 2.3 Mtoe in 2012 to 3.0 Mtoe in 2013. This was partly due to an increase in energy generation from wind sources due to both greater capacity and higher wind speeds in 20135. This was however, partly offset by a fall in energy from hydroelectric power, due to lower rainfall where the main UK hydro stations are located. Energy consumed from liquid biofuels grew from 1.0 Mtoe to 1.2 Mtoe in 2013, largely as a result of increased use of biodiesel.

Since the time series began in 1990, the largest consumers of renewable and waste energy sources have been households, energy suppliers, water and waste industries, and the manufacturing sector (Figure 3.6).

Figure 3.6: Reallocated energy consumption from renewable and waste sources; by industry group, 1990 to 2013

United Kingdom residency basis



Source: Ricardo-AEA, Office for National Statistics

Households have been the largest consumers since 2004, with 31.7% of all energy produced from renewable and waste sources in 2013 consumed by households. In 2013, households consumed 3.8 Mtoe from renewable and waste sources, following a 17.2% increase between 2012 and 2013. This increase was mainly due to the rise in renewable primary electricity generation by onshore and offshore wind. The Energy supply, water and waste sector was the second largest consumer of energy from renewable and waste sources, consuming 2.7 Mtoe in 2013. This accounted for 22.5% of all energy consumed from these sources. The 26.1% increase between 2012 and 2013 in this industry was partly due to an increase in wood combustion in power stations. The amount of energy consumed from renewable and waste sources has also increased rapidly in the manufacturing industry in recent years. The 19.6% increase in renewable energy consumed in this sector between 2012 and 2013 was partly due to an increase in solid biomass combustion in industrial plants.

Large increases in renewable and waste energy consumption were also seen in the Transport (18.4%) and Wholesale (20.0%) industries between 2012 and 2013. In both sectors, the growth can be explained by the rise in renewable primary electricity generation driven by onshore and offshore wind.

More data can be found in the Energy Consumption from Renewable and Waste Sources (134 Kb Excel sheet) and the Energy Consumption used to Generate Heat (81 Kb Excel sheet) tables.

Reconciling environmental accounts estimates with Department of Energy & Climate Change (DECC) estimates

Environmental Accounts estimates follow the UN System of Environmental Economic Accounts (SEEA) framework which is an internationally agreed standard. They are not reported on the same basis as published by the Department of Energy & Climate Change (DECC) in the Digest of UK Energy Statistics (DUKES) which follow Eurostat, and IEA guidelines and the United Nations International Recommendations for Energy Statistics. The national accounts measure includes energy consumed by UK companies and households abroad and excludes energy consumption by foreign residents in the UK as well as further differences in definition. As a result of this and other differences the DUKES measure for UK energy consumption is 0.2 Mtoe higher than the environmental accounts measure in 2013.

The Energy bridging table showing relationship of national accounts measures to Digest of UK Energy Statistics (81 Kb Excel sheet) table shows the differences between the two estimates. Further information about the relationship between environmental accounts measures and those released by DECC is available in an energy bridging table and methodology article.

Notes for Energy consumption

1. Transformation losses are the differences between the energy content of the input and output product arising from the transformation of one energy product to another

2. Distribution losses are losses of energy product during transmission (for example, losses of electricity in the grid) between the supplier and the user of the energy

3. Energy consumption includes energy used during the process of transformation into electricity and the energy lost in distributing the electricity to end users, either directly allocated to the electricity generation sector, or indirectly to the consumers of the energy. “Direct use of energy including electricity” allocates the consumption of energy directly to the immediate consumer of the energy, while “reallocated energy” allocates these “electricity overheads” to the end user of the electricity

4. The “Household” category includes “Consumer expenditure” and “Activities of households as employers; undifferentiated goods and services – producing activities of households for own use”

5. Digest of UK Energy Statistics (DUKES), p.160, paragraph 6.9

6. Energy intensity

Energy intensity[1] can be interpreted as an indicator of energy efficiency in the economy. A reduction in energy intensity may indicate greater efficiencies in the production process, systematic changes in the economy or variations in temperature. All data in this section are presented in current prices.

Main points

- Energy intensity fell by 2.3% to 3.8 terajoules per million pounds (TJ/£m) between 2012 and 2013. This continues the general downward trend across the time series

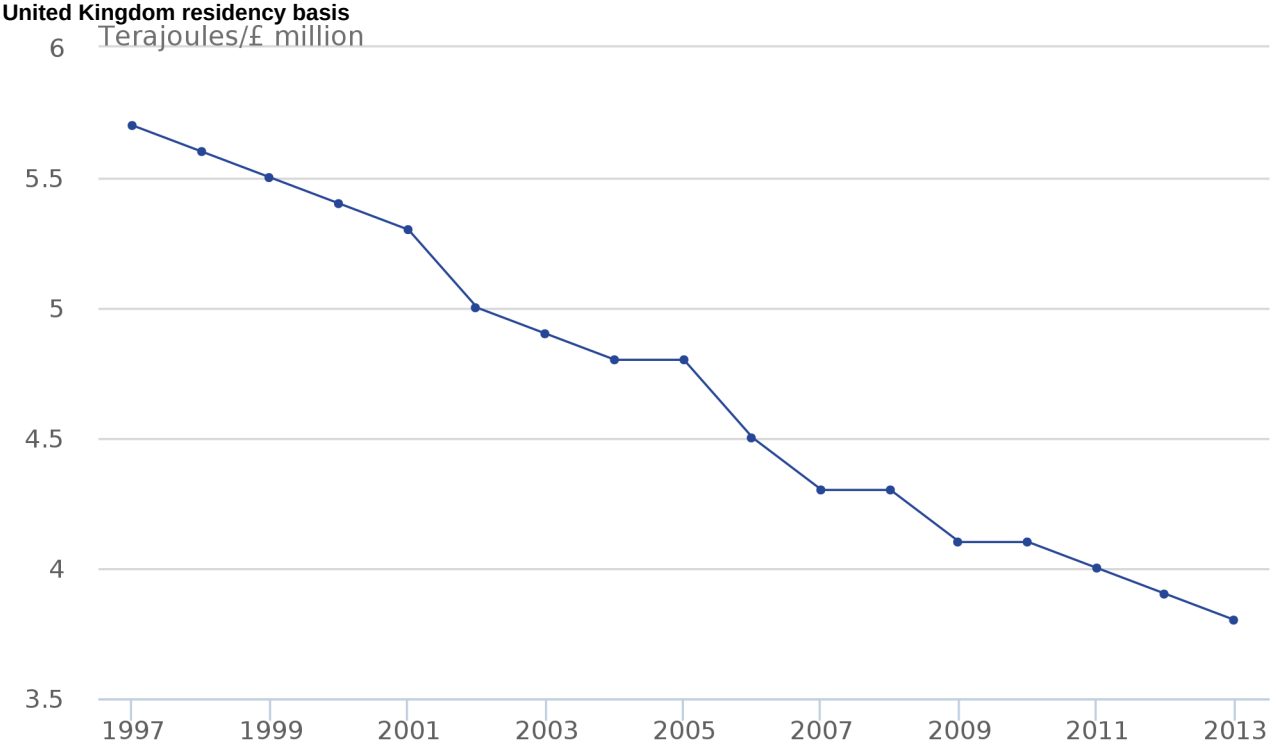
- Since 1997, energy intensity has fallen by 33.8% from 5.6 TJ/£m to 3.8 TJ/£m

- Energy supply, water, and waste remained broadly stable between 2012 and 2013, observing a fall of 0.4% and remain the industry with the highest levels of energy intensity

Energy intensity in the economy has been declining since the series began in 1997 where it stood at 5.7 terajoules per million pounds (TJ/£m). Since then, energy intensity has fallen approximately by a third. Between 2012 and 2013, energy intensity fell 2.3% from 3.9 TJ/£m to 3.8TJ/£m. Figure 4.1 illustrates the year-on-year decline in intensity, with the exception of 2010, when intensity rose by 0.6%.

Figure 4.1: Energy intensity, 1997 to 2013

United Kingdom residency basis



Source: Ricardo-AEA, Office for National Statistics

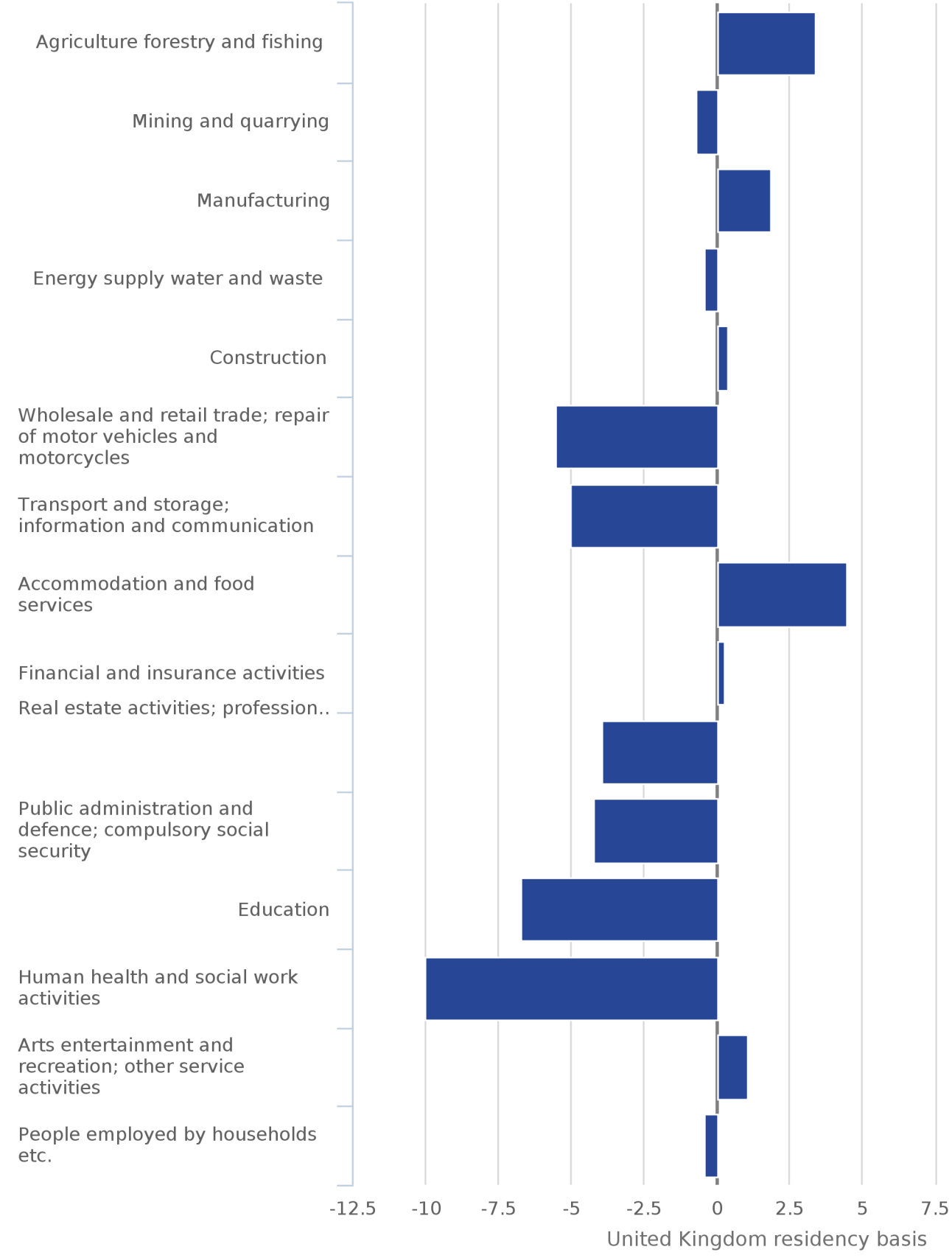
Notes:

1. Figure 4.1 has been corrected on 10 July 2015 at 13:00

Energy intensity can be broken down by industry. Between 1997 (beginning of the time series) and 2013, human health and social work activities observed a decline of 62.5% in energy intensity. Whereas mining and quarrying has observed a rise of 68.2% from 4.9 TJ/£m to 8.2 TJ/£m between the same time period. Energy supply, water, and waste, the most energy intensive industry of 2012, remained broadly stable in 2013 observing a fall in intensity of 0.4%. It remains the most energy intensive industry of 2013 with intensity recording 14.9 TJ/£m. Manufacturing observed a rise of 1.9% between 2012 and 2013. Despite this, energy intensity within the manufacturing sector has been declining since the beginning of the time series.

Figure 4.2 shows the percentage change between 2012 and 2013, the sectors which observed the largest increases in energy intensity were accommodation and food services at 4.5% and agriculture, forestry and fishing at 3.4%. Since the start of the time series, these industries have observed a fall in intensity of 20.3% and 14.7% respectively. The industries which observed the largest fall in intensity between 2012 and 2013 were human health and social work activities, which observed a fall of 10.0% and education with 6.7%. In both instances, energy consumption observed falls whereas gross value added (GVA) saw slight rises. The falls in energy intensity can be attributed to GVA falling faster than the rate of energy consumption.

Figure 4.2: Percentage change in energy intensity by: industry between 2012 and 2013



Source: Ricardo-AEA, Office for National Statistics

Notes for Energy intensity

1. Energy intensity is calculated by dividing reallocated energy consumption by gross value added (GVA). GVA is the difference between output and intermediate consumption for any given sector/industry. That is, the difference between the value of goods and services produced (the output) and the cost of raw materials and other inputs which are used up in production (the intermediate consumption). Data are in constant prices with 2010 defined as the base year. Energy intensity calculations include reallocated energy from wood and straw, renewable generation, biofuels and waste sources. Energy use per unit of value added is in the United Nations (UN) energy intensity indicators as defined in the UN sustainable development indicators, although consumer expenditure is included by the UN. The Organisation for Economic Co-operation and Development (OECD) Green Growth indicators include the inverse, energy productivity, that is, GDP per unit of energy supply. All energy intensity figures exclude consumer expenditure."

7. Atmospheric emissions

Main points

- Emissions of greenhouse gases on a UK residency basis were estimated to be 643.1 million tonnes carbon dioxide equivalent (Mt CO_2e) in 2013. This was 2.0% lower than the 2012 figure of 656.5 Mt CO_2e, and 23.6% lower than the 1990 figure of 842.0 Mt CO_2e
- Carbon dioxide was the dominant greenhouse gas, accounting for 84.4% of total emissions in 2013
- Over the period 1990 to 2013, carbon dioxide emissions decreased by 14.1%, methane emissions decreased by 59.0% and nitrous oxide emissions decreased by 51.4%
- The “energy supply, water and waste” sector emitted the largest amount of greenhouse gas in 2013 (189.8 Mt CO2e). This represented 29.5% of all greenhouse gas emissions

Greenhouse gas emissions

Atmospheric emissions of greenhouse gases are widely believed to contribute to global warming and climate change. The Environmental Accounts covers the most significant of these as specified in the IPCC Fourth Assessment report, namely:

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- and the fluorinated gases: Hydro-fluorocarbons (HFCs); Perfluorocarbons (PFCs); Sulphur hexafluoride (SF_6) and Nitrogen trifluoride (NF_3)

The potential of each greenhouse gas to cause global warming is assessed in relation to a given mass of carbon dioxide and accordingly weighted. Consequently, all greenhouse gas emissions are measured as carbon dioxide equivalents (CO_2e).

This publication provides estimates of 2013 greenhouse gas emissions on a UK residency basis. This approach focuses on responsibility for emissions instead of the physical location (or territory) in which these took place. This means they include emissions which UK residents and UK-registered businesses are directly responsible for, whether in the UK or overseas, but exclude emissions resultant from foreign visitors and businesses in the UK. These estimates also include emissions associated with international aviation and shipping by UK operators.

The residency approach adopts UK national accounting principles, allowing environmental impacts to be compared on a consistent basis with economic indicators such as GDP. These estimates are also consistent with the System of Environmental-Economic Accounting – Central Framework, adopted by the United Nations Statistical Commission. The residency principle therefore provides an important indicator for the environmental pressure caused by the UK's economic activities.

Two other approaches for estimating greenhouse gas emissions are published by the UK Government. Emissions based on the UK greenhouse gas inventory are published by the Department of Energy and Climate Change (DECC). The inventory measures emissions on a territorial basis, as opposed to a residency basis, so only includes emissions which occur within the borders of the UK, Crown Dependencies and Overseas Territories. They provide the basis for assessing progress towards UK emissions reduction targets including Kyoto Protocol, EU Effort Sharing Decision and UK Carbon Budgets.

Embedded emissions, published by the Department for Environment, Food and Rural Affairs (Defra), take account of emissions associated with the consumption spending of UK residents on goods and services, irrespective of where in the world these emissions arise. This approach also incorporates emissions directly generated through households' private motoring and heating.

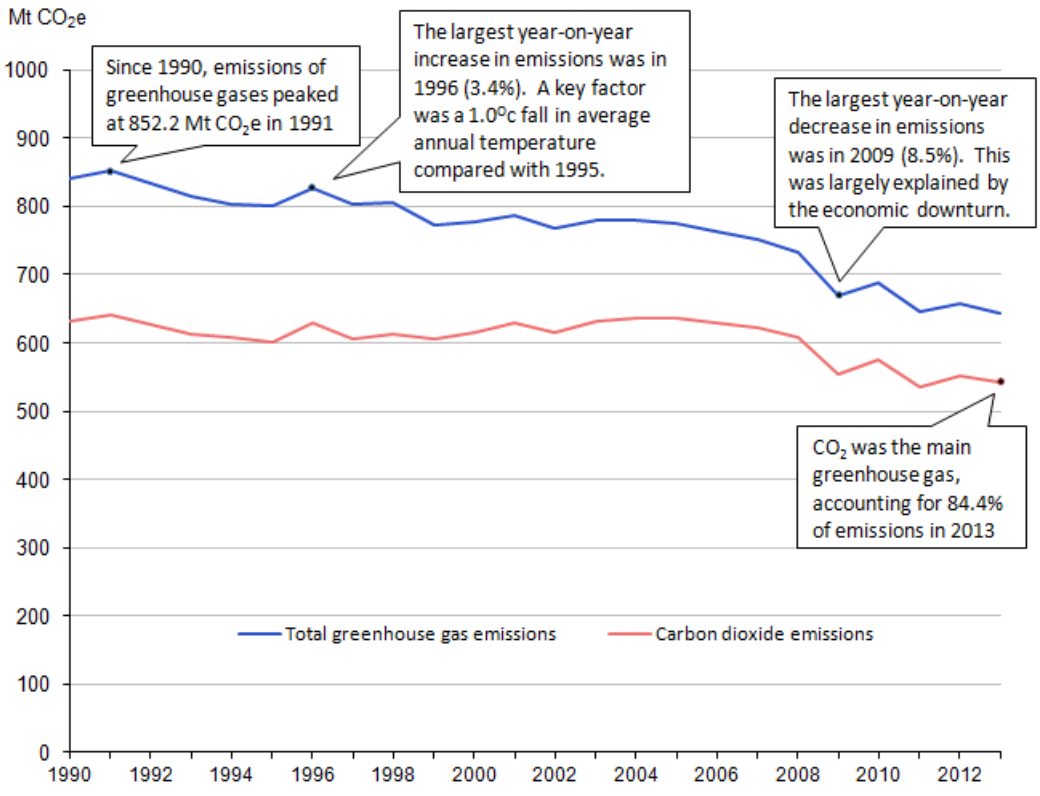
Emissions of greenhouse gases have fallen 23.6% since 1990

Emissions of greenhouse gases in 2013 were estimated to be 643.1 million tonnes carbon dioxide equivalent (Mt CO2e), the lowest level since 1990 (Figure 5.1). This was 23.6% lower than the 1990 figure of 842.0 Mt CO2e. The decrease has been driven by reductions in emissions from the "manufacturing" and "energy supply, water and waste" sectors, which together account for 94.9% of the total reduction.

Across the time series, the largest annual fall in emissions of greenhouse gases occurred in 2009 following the onset of the economic downturn in 2008, when emissions decreased by 8.5%. Between 2012 and 2013, emissions decreased by 13.5 Mt CO2e (2.0%). Factors underpinning this particular fall include a reduction in coal use by power stations and a fall in emissions from landfill.

Figure 5.1: Greenhouse gas emissions, 1990 to 2013

United Kingdom, residency basis



Source: Ricardo-AEA, Office for National Statistics

Despite an overall downward trend in emissions, there were 8 years between 1990 and 2013 when annual emissions increased. The largest of these rises was between the years 1995 and 1996. A likely factor behind this rise was the 1.0 degree Celsius drop in mean average air temperature in 1996 compared with 1995. Between 2009 and 2010 there was a 2.6% rise in emissions of greenhouse gases. This rise was driven by the recovery of economic activity following the recession coupled with particularly cold weather at the beginning and end of 2010. The rise of 1.8% in greenhouse gas emissions between 2011 and 2012 was the result both of an increase in the proportion of electricity generated from coal, and increased fuel consumption for heating due to a fall in average air temperature.

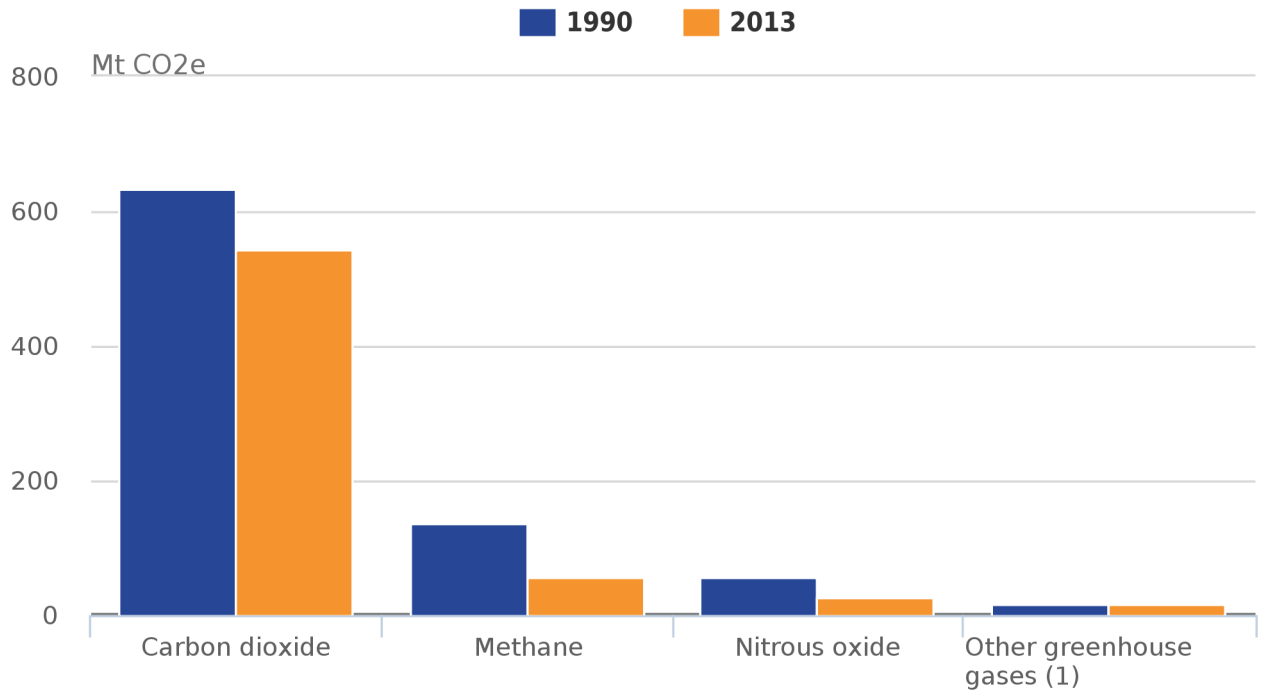
Carbon dioxide emissions accounted for 84.4% of all greenhouse gas emissions in 2013

Carbon dioxide was the dominant greenhouse gas, and in 2013 accounted for 84.4% of the UK's greenhouse gas emissions. Methane accounted for a further 8.7% of emissions, nitrous oxide for 4.2% and fluorinated gases comprised the remaining 2.6%.

The share of total greenhouse gas emissions represented by emissions of carbon dioxide has increased over the time series. In 1990, carbon dioxide accounted for three-quarters (75.0%) of greenhouse gas emissions. By 2013, this share had risen to 84.4%. The increased importance of carbon dioxide, relative to the other greenhouse gases, was driven by larger falls in the emissions of methane and nitrous oxide. When we compare 1990 and 2013, emissions of carbon dioxide fell 14.1% from 631.7 Mt CO_2e to 542.8 Mt CO_2e (Figure 5.2). Over the same period, emissions of methane fell 59.0% from 136.6 Mt CO2e to 56.0 Mt CO2e and emissions of nitrous oxide fell 51.4% from 56.2 Mt CO_2e to 27.3 Mt CO_2e.

Figure 5.2. Greenhouse gas emissions: by type of gas, 1990 and 2013

United Kingdom



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. Other greenhouse gases includes: Hydro-fluorocarbons; Perfluorocarbons; Sulphur hexafluoride and Nitrogen trifluoride

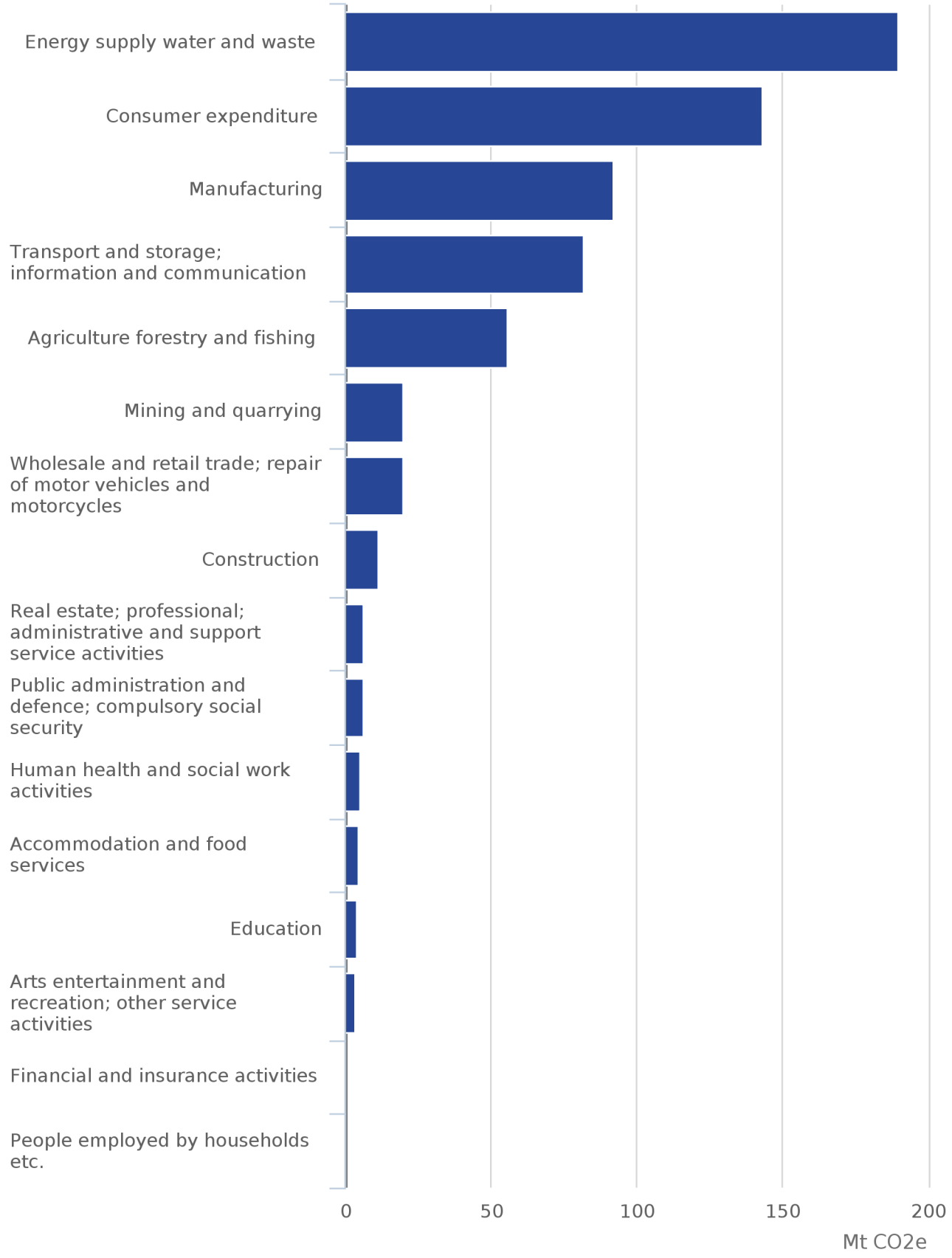
The manufacturing sector played an important role in driving the decline in emissions of carbon dioxide observed over the time series. Carbon dioxide emissions from this sector fell by 36.2% between 1990 and 2013 - the result of a decrease in emissions from industrial fuel combustion. One of the main drivers behind the fall in methane emissions was the "energy supply, water and waste" sector. Between 1990 and 2013, there was a reduction of 67.9% in the emissions of methane from this sector, driven largely by a fall in emissions from landfill. The fall in emissions of nitrous oxide is due in large part to a 97.8% fall in emissions from the manufacturing sector. A major factor here was the fitting of abatement equipment in the UK's only adipic acid factory in 1998, followed by its closure and the termination of industrial adipic acid production in the UK in 2009.

Energy supply, water and waste sector emitted the largest amount of greenhouse gases in 2013

The 189.8 Mt CO_2e emitted from the "energy supply, water and waste" sector was equivalent to 29.5% of the total greenhouse gas emissions in 2013 (Figure 5.3). Compared with 2012, emissions from this particular sector fell 6.6%. This was driven by a change in the mix of electricity generation, namely a decrease in fossil fuel combustion at power stations, primarily coal and natural gas, offset by increased combustion of renewable fuels and generation from wind. A fall in emissions of methane from landfill also contributed to the reduction of emissions from this sector. Consumer expenditure, which includes emissions caused by household fuel consumption, accounted for the second greatest amount of greenhouse gas emissions in 2013 (22.3%). Nearly all of the emissions resultant from consumer expenditure were of carbon dioxide (95.5%).

Figure 5.3: Greenhouse gas emissions, by economic sector*, 2013

United Kingdom



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. *Industry aggregations are based on the Standard Industrial Classification (SIC) 2007

Greenhouse gas emissions data by economic sector (421 Kb Excel sheet) are available on our website.

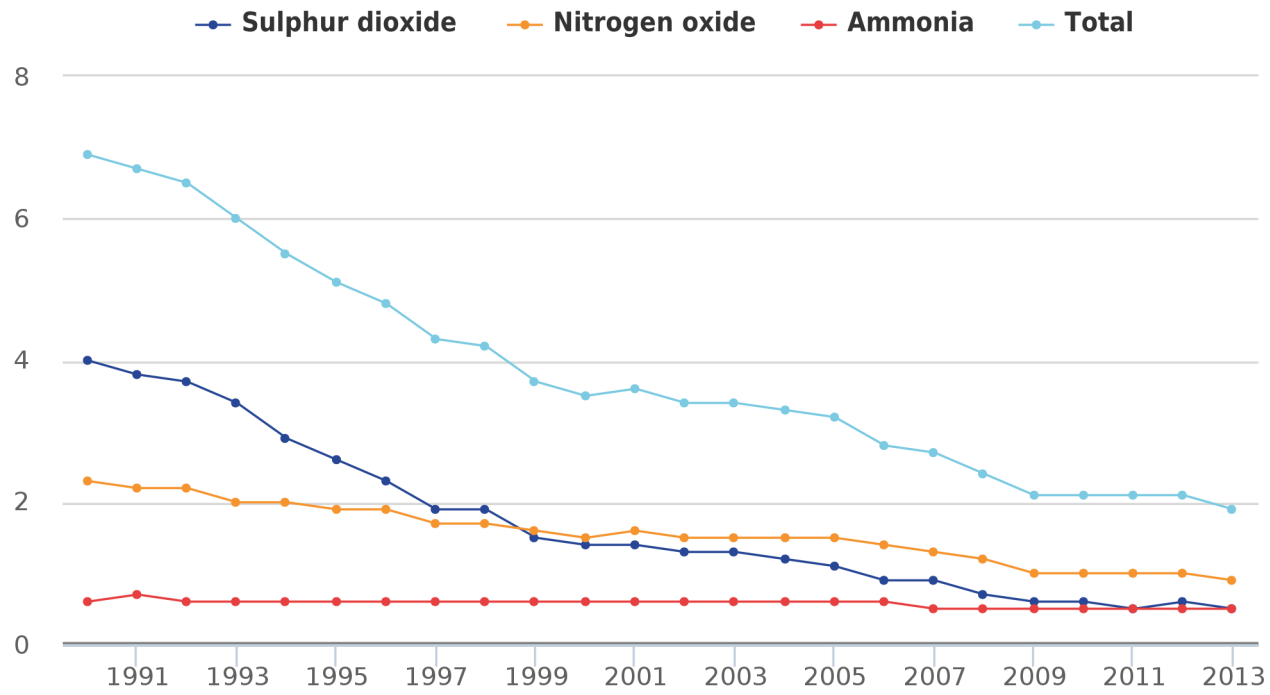
Acid rain precursor emissions have fallen 72.5% since 1990

Acid rain can have harmful effects on the environment and is caused primarily by emissions of sulphur dioxide (SO_2), nitrogen oxide (NOX) and ammonia (NH_3). For comparability, all figures are weighted according to their acidifying potential, and presented as sulphur dioxide equivalents (SO_2e).

Since 1990, acid rain precursor (ARP) emissions (excluding natural world) have decreased sharply, falling by 72.5% from 6.9 million tonnes of sulphur dioxide equivalent (Mt SO_2e) in 1990 to 1.9 Mt SO_2e in 2013. Between 2012 and 2013, ARP emissions were estimated to have fallen by 8.2%.

Figure 5.4. Acid rain precursor emissions: by type of gas, 1990 to 2013

United Kingdom



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. Excluding natural world

Throughout the 1990s sulphur dioxide was the dominant ARP. However, the sharp fall of 87.9% in sulphur dioxide emissions between 1990 and 2013 resulted in its emissions falling below those of ammonia in 2013. The fall was largely driven by decreases in emissions from coal use in power stations within the 'energy supply, water and waste' sectors. Between 2012 and 2013 sulphur dioxide emissions decreased by 15.0%.

Nitrogen oxide emissions (excluding natural world) declined by 60.6% between 1990 and 2013, primarily due to a large decrease in emissions from petrol use in cars. Emissions of nitrogen oxide were 8.0% lower in 2013 compared with 2012. This fall was primarily driven by a reduction in emissions from fuel oil use in international shipping.

Ammonia emissions (excluding natural world) fell by 20.2% between 1990 and 2013, which was due in part to a decrease in emissions from agricultural soils in the "agriculture, forestry and fishing" sector. Emissions of ammonia were 1.0% lower in 2013 compared with 2012.

Acid rain precursor emissions data by economic sector (245 Kb Excel sheet) are available on our website.

Heavy metal pollutants – emissions of lead down 97.8% since 1990

Emissions of heavy metal pollutants can affect air quality and health. Table 5.1 shows emissions of heavy metal pollutants in the years 1990, 2012 and 2013.

Table 5.1. Emissions of heavy metal pollutants, 1990 and 2013

United Kingdom

			Tonnes
Heavy metal	1990	2012	2013
Arsenic	51.3	17.4	18.4
Cadmium	23.8	3.1	3
Chromium	162.2	29.9	31.1
Copper	147.8	58.4	57.9
Lead	2,897.10	62.7	64.4
Mercury	37.5	5.8	6.2
Nickel	395.6	167.7	193.5
Selenium	77.5	33.2	28
Vanadium	1,225.50	745.3	814.5
Zinc	1,063.40	381.7	410.1

Source: Ricardo-AEA, Office for National Statistics

Emissions of all heavy metal pollutants declined between 1990 and 2013. The most notable reduction was in emissions of lead, which fell by 97.8% from 2,897.1 tonnes in 1990 to 64.4 tonnes in 2013. This was mostly due to the decrease in the use of leaded petrol, the marketing of which was prohibited within the EU from 2000.

Despite the long term downward trend, emissions of 7 out of the 10 heavy metal pollutants increased between 2012 and 2013. The largest year on year rise was in emissions of nickel, rising by 15.4%. These increases are mostly due to the increase in petroleum coke use in industrial combustion plants between 2012 and 2013.

Emissions of heavy metal pollutants data by economic sector (807.5 Kb Excel sheet) are available on our website.

Other pollutants

There are a number of other pollutants that affect air quality. Table 5.2 shows emissions of these in the years 1990, 2012 and 2013.

Carbon monoxide (CO) emissions (excluding natural world) were 77.7% lower in 2013 compared with 1990. During the same period, non-methane volatile organic compound (NMVOC) emissions (excluding natural world) fell by 68.6%. These decreases were mainly due to reductions in road transport emissions, which fell by 91.1% for CO and 96.4% for NMVOC over the period. This is a result of stricter emission standards for road vehicles driving significant reductions in exhaust emissions, and a large switch from petrol to diesel cars, as petrol engines emit more CO and NMVOC than diesel engines.

Airborne particulate matter (PM) consists of solid and/or liquid materials that are generated from both manmade and natural sources. PM10 and PM2.5 emissions both decreased by 53.2% between 1990 and 2013. Residential and industrial coal combustion had been a major source of PM emissions in the UK. However, the Clean Air Act 1993 restricted coal combustion and this accounts for reductions in emissions across many sectors.

Table 5.2. Emissions of other pollutants: 1990, 2012 and 2013

United Kingdom

Thousand tonnes

Pollutant	1990	2012	2013
PM10[1,2]	305	149.9	142.6
PM2.5[1,2]	210.4	104	98.5
Carbon monoxide[2]	9,036.20	1,990.60	2,013.60
Non-methane volatile organic compound[2]	2,811.40	904.5	881.6
Benzene	39.3	9.6	8.8
1,3-Butadiene	14.6	1.4	1.2

Source: Ricardo-AEA, Office for National Statistics

Notes:

1. PM – Particulate matter. PM is classified according to its size. For example, PM10 broadly represents the concentration of particles that are less than 10 µm in diameter

2. Figures exclude emissions from natural world

Only emissions of carbon monoxide increased between 2012 and 2013. The rise of 1.2% from 1,990.6 tonnes in 2012 to 2,013.6 tonnes in 2013 was largely the result of increases in emissions from the iron and steel industry, following increased production at UK major steelworks.

Emissions of other pollutants data by economic sector (807.5 Kb Excel sheet) are available on our website.

Road transport emissions

Various pollutants are emitted from road transport into the atmosphere. Figure 5.5 shows greenhouse gas emissions generated from combustion by road vehicles from 1990 to 2013.

Greenhouse gas emissions related to road transport generally increased from the early 1990s until 2007. However, since 2008 emissions have declined, which in part reflects both the economic downturn and the continuation of the trend toward more energy efficient vehicles.

In 2013, road transport emissions accounted for 17.5% (112.3 Mt CO2e) of total greenhouse gas emissions (643.1 million tonnes of CO2e). This consisted of:

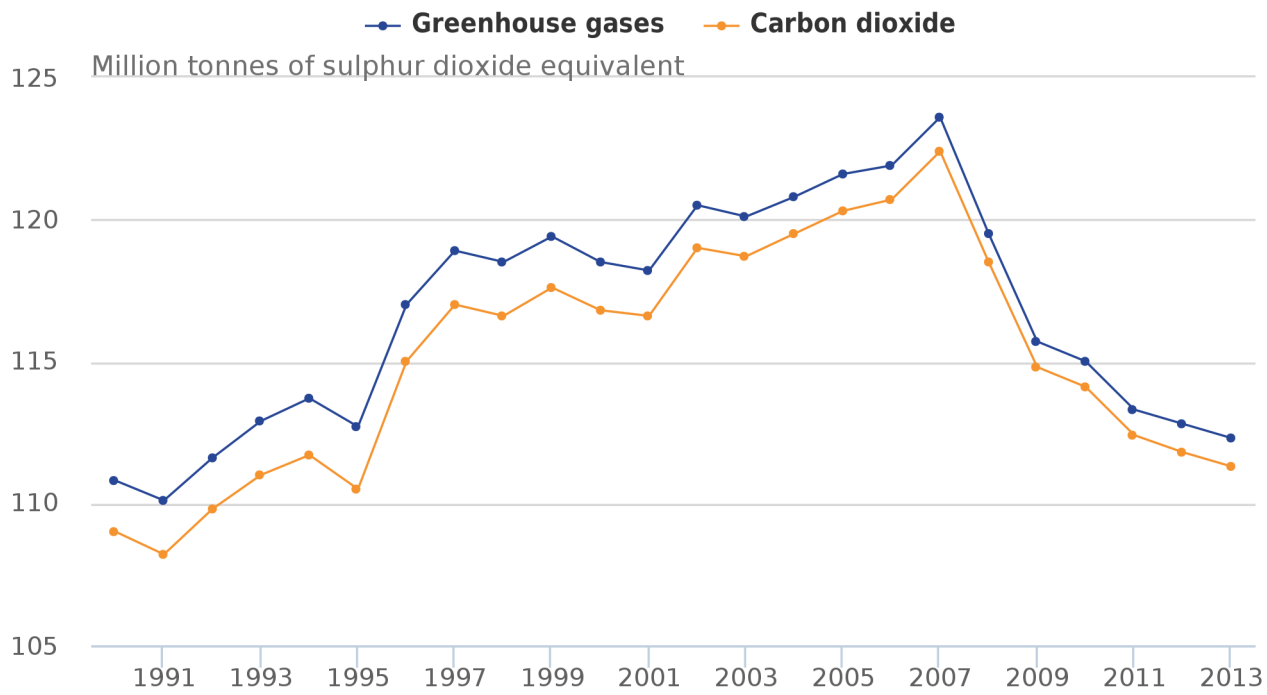
- 111.3 Mt of carbon dioxide
- 0.05 Mt CO2e of methane
- 1.0 Mt CO2e of nitrous oxide

Road transport emissions of acid rain precursors decreased by 74.1% between 1990 and 2013 from 932.6 to 242.0 thousand tonnes of SO2e respectively.

PM emissions related to road transport peaked in 1996 and then decreased to their lowest levels in 2013, at 21.6 thousand tonnes of PM10 and 15.1 thousand tonnes of PM2.5. Diesel engine vehicles emit a greater mass of PM per kilometre than petrol engine vehicles. Since 1992, diesel vehicles have had to meet tighter PM emission regulations. This has led to reductions in PM emissions, despite the use of diesel vehicles increasing.

Figure 5.5: Greenhouse gas emissions produced by fuel sources used by road vehicles, 1990 to 2013

United Kingdom



Source: Ricardo-AEA, Office for National Statistics

More detailed road transport emissions data (518 Kb Excel sheet) are available on our website.

Reconciling environmental accounts with UNECE and UNFCCC estimates

Estimates within environmental accounts are produced in accordance with the UN System of Environmental-Economic Accounting (SEEA) which is an internationally agreed standard. UK environmental accounts are reported on a UK "residency" basis, which include emissions that UK resident persons and businesses are directly responsible for in other countries (dominated by travel and transport overseas), but exclude emissions caused by visiting foreign persons and businesses in the UK. This is consistent with UK national accounts and enables comparison with economic indicators such as gross domestic product (GDP).

UK air emissions estimates that are reported internationally to the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Economic Commission for Europe (UNECE) are reported on a '"territory" basis, which only include emissions that occur within the UK's territorial boundaries.

Tables that illustrates the differences between UK Environmental Accounts estimates and UNFCCC and UNECE estimates can be found in the Atmospheric Emissions: Bridging Tables (280 Kb Excel sheet)

Notes for Atmospheric emissions

1. Information on alternative approaches to reporting UK greenhouse gas emissions is available on the Department of Energy & Climate Change's website

2. Figures exclude emissions arising from the natural world

8. Greenhouse gas emissions intensity

Main points

- Greenhouse gas emissions intensity was 44.0% lower in 2013 compared with 1997
- Emissions intensity was greatest in the "agriculture, forestry and fishing" and "energy supply, water and waste" sectors

Introduction

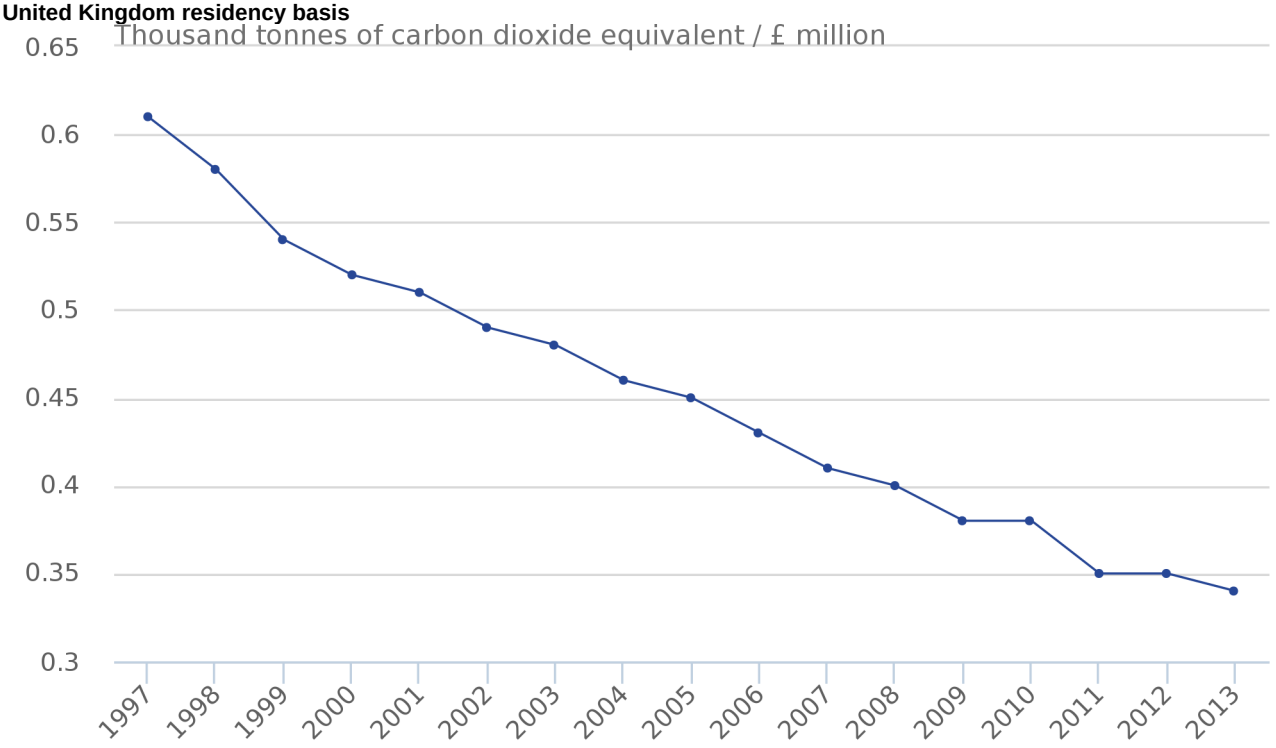
Greenhouse gas emissions intensity measures the level of emissions per unit of economic output (constant price level)[1]. It can be used to examine the relationship between economic growth and greenhouse gas emissions. For example, a reduction in greenhouse gas emissions intensity may indicate the UK is moving towards a greener and more sustainable economy. At the same time, it may also reflect changes to the structure of the economy - for example, a change from manufacturing industries to services.

Emissions intensity declined by 44.0% between 1997 and 2013

Since 1997 when the time series began, greenhouse gas emissions intensity of the UK economy, excluding consumer expenditure, has fallen by an average of 3.6% per year. It has declined from 0.61 thousand tonnes of carbon dioxide (CO2e) per £ million value added in 1997 to 0.34 thousand tonnes of CO2e per £ million value added in 2013; a fall of 44.0% (Figure 6.1). Although economic output considered here in terms of Gross Value Added (GVA) has generally increased, greenhouse gas emissions have generally decreased, helping to explain the falls in emissions intensity.

Figure 6.1. Greenhouse gas emissions intensity, 1997 to 2013

United Kingdom residency basis



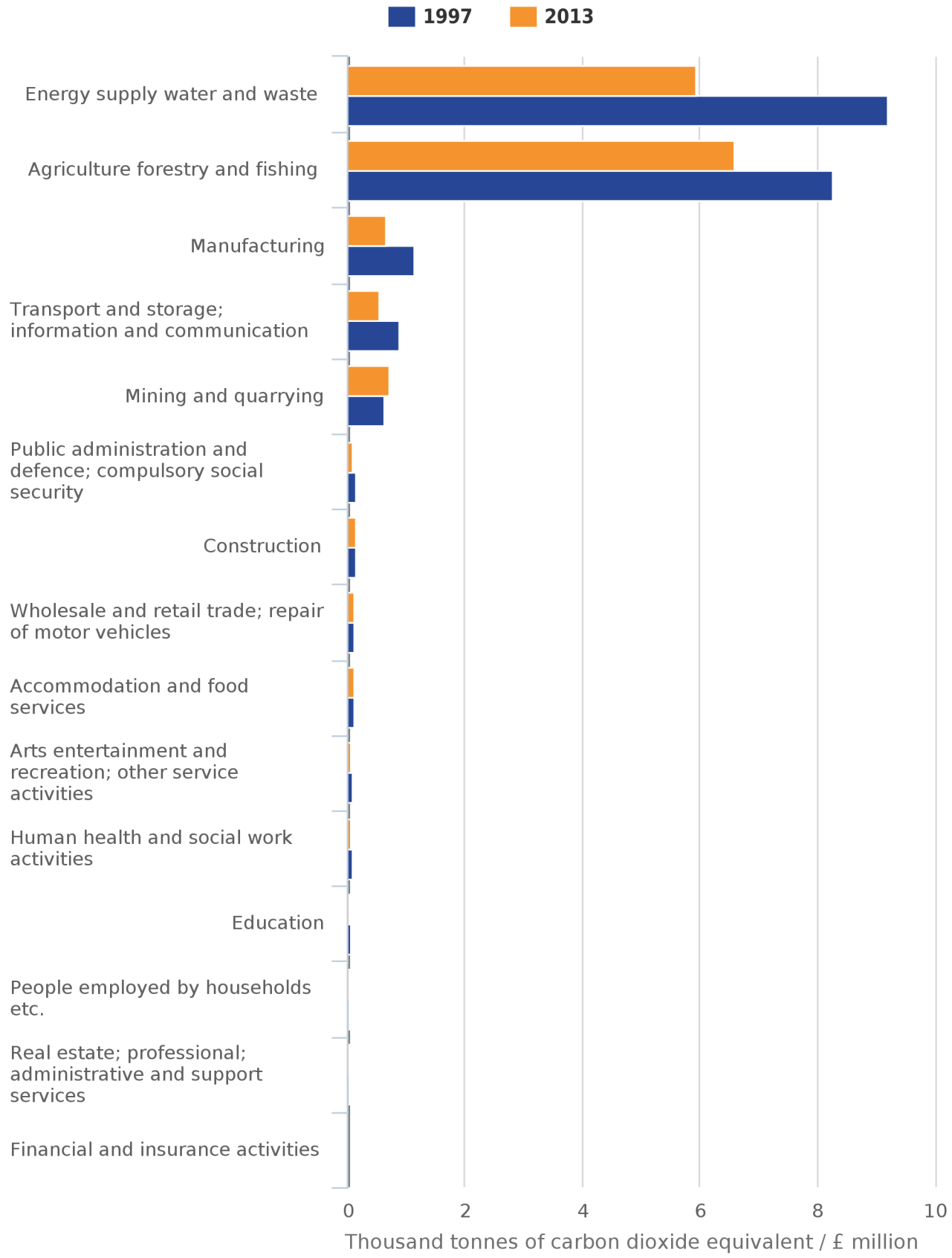
Source: Ricardo-AEA, Office for National Statistics

The largest annual decrease in greenhouse gas emissions intensity was 7.9% in 1999. This was due to a larger than average fall of 4.8% in GHG emissions in this year relative to GVA. A notable fall of 5.7% in emissions intensity also occurred in 2009, and is thought to reflect the impact of the economic downturn.

Greenhouse gas emissions intensity was greatest within the ‘agriculture, forestry and fishing’ and ‘energy supply, water and waste’ sectors in 2013 (Figure 6.2). The emissions intensity levels in these sectors were lower in 2013 compared with 1997, reducing by 35.1% for the ‘energy supply, water and waste’ sector and by 20.3% for the ‘agriculture, forestry and fishing’ sector.

Figure 6.2 Greenhouse gas emissions intensity: by industry, 1997 and 2013

United Kingdom residency basis



Source: Ricardo-AEA, Office for National Statistics

Notes:

1. These industry aggregations are based on the Standard Industrial Classification (SIC) 2007

Compared with 1997, greenhouse gas emissions intensity was higher in 2013 in only three sectors. These were: mining and quarrying (0.62 to 0.70 thousand tonnes CO2e per £million), 'Wholesale and retail trade; repair of motor vehicles and motorcycles' (0.11 to 0.12 thousand tonnes CO2e per £million); and 'Households as employers' (0.03 to 0.04 thousand tonnes CO2e per £million).

More detailed greenhouse gas emissions intensity data are available in the Atmospheric emissions: Greenhouse gas emissions intensity (170.5 Kb Excel sheet) dataset.

Notes for Greenhouse gas emissions intensity

1. Greenhouse gas emissions intensity is calculated by dividing the level of greenhouse gas emissions by Gross Value Added (GVA) in constant prices. This is the difference between output and intermediate consumption for any given industry/sector. This means the difference between the value of goods and services produced (output) and the cost of raw materials and other inputs which are used up in production (intermediate consumption). Data are in constant prices with 2010 defined as the base year. All emissions intensity figures exclude consumer expenditure

9. Material flows

Main points

- The amount of material resources consumed by the UK economy has declined. In 2013, 9.2 tonnes of material resources were consumed per capita, down from 12.6 tonnes in 2000
- Between 2000 and 2013, levels of raw material extraction fell by 38.0%
- The decline in extraction has been partly offset in recent years by a rise in physical imports (to 293.5 million tonnes in 2013) and a fall in exports (to 154.3 million tonnes in 2013)
- Resource productivity (the total amount of materials used by an economy in relation to economic activity) increased by over 50% during the period 2000 to 2013

Introduction

Economy-wide material flow accounts estimate the physical flow of materials through our economy. As well as providing an aggregate overview of the annual extraction of raw materials, they also measure the physical amounts of imports and exports. This information is important in attempting to understand resource productivity. For example, they shed light on the depletion of natural resources and seek to promote a sustainable and more resource-efficient economy.

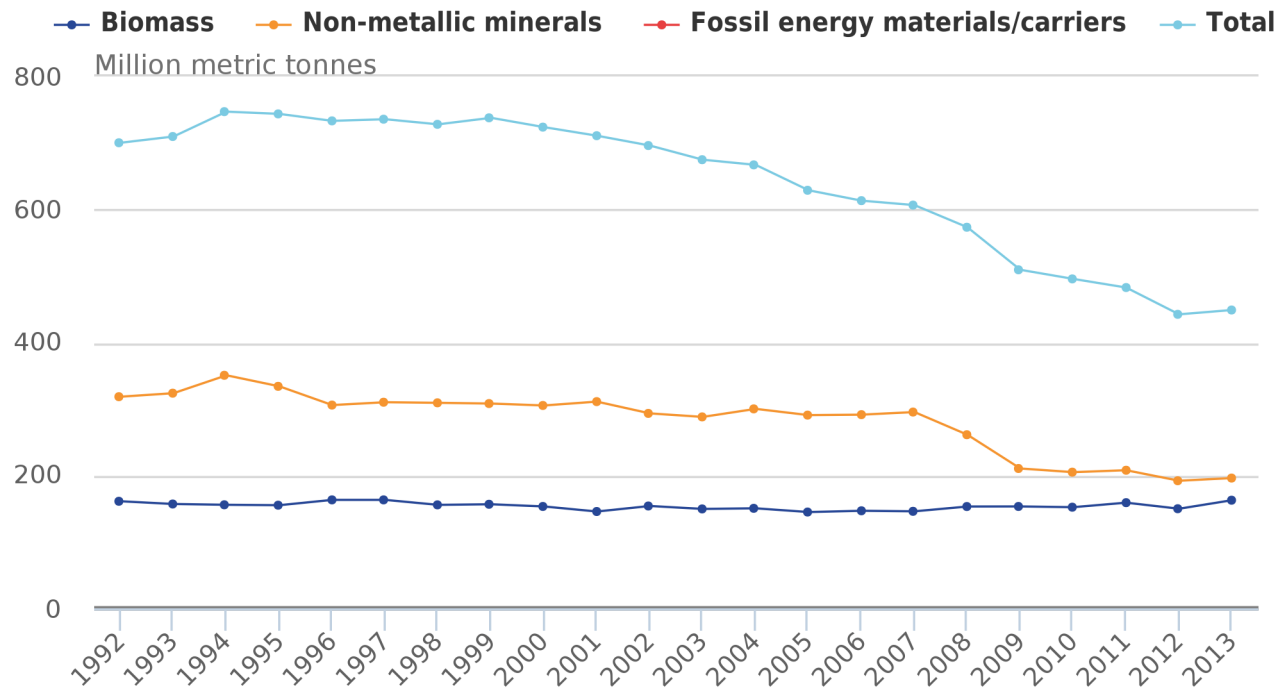
Domestic extraction levels down 64.1% between 1992 and 2013

Since 1992, when the time series began, the extraction of raw materials [1] (for example, crops and fossil fuels) within the UK reached a peak of 747.1 million metric tonnes in 1994 (Figure 7.1). After remaining broadly stable between 1994 and 2000, the quantity of materials extracted gradually declined and fell to 442.2 million metric tonnes in 2012, the lowest point in the time series. Between 2012 and 2013, total domestic extraction levels increased by 1.5%, driven by increases in the extraction of biomass.

In 1992, 12.2 metric tonnes of materials were extracted per capita (per person). Domestic extraction levels per capita fell to 7.0 metric tonnes in 2013.

Figure 7.1: Quantity of raw materials extracted, 1992 to 2013

United Kingdom



Source: Department for Environment, Food and Rural Affairs; Food and Agriculture Organization of the United Nations; Eurostat; European Forest Institute; Kentish Cobnuts Association; British Geological Survey

Notes:

1. Metal ores are not included on the chart as the quantity extracted is small

Biomass includes material of biological origin that is not from fossil and includes crops, wood and wild fish catch. Since 1992, the quantity of biomass extracted in the UK has remained fairly stable. In 2013, 162.6 million tonnes were extracted, 9.0% higher than in 2012 (149.8 million tonnes). Of this, crop residues, fodder crops and grazed biomass accounted for 70.9% (115.2 million tonnes)[2].

Non-metallic minerals consist mainly of construction and industrial minerals, including sand and gravel, limestone and gypsum, and clays. The extraction of non-metallic minerals has considerably declined over the time series. In 2013, 195.9 million tonnes were extracted in comparison with 318.3 million tonnes in 1992. The majority of this fall is a result of falling demand for aggregates (granular material formed from natural rock substances). This is the result of a combination of factors including a decline in infrastructure projects, increased use of non-aggregate materials in buildings, less waste, and increased use of recycled aggregates in construction. The rapid decline observed from 2007 is related to the global economic downturn, which greatly reduced construction and demand for aggregates in the UK.

Fossil energy materials/carriers include coal, peat, crude oil and natural gas. During the 1990s, extraction of fossil energy materials/carriers increased and peaked at 273.2 million tonnes in 1999. Since then, production has continually fallen and fell to 90.3 million tonnes in 2013, 10.1% lower than in 2012 (100.5 million tonnes). The decline in extraction of fossil energy materials is due primarily to a drop in North Sea oil and gas production, as major producing fields begin to decline and exploration of new fields is focused on smaller resources that are more difficult to exploit. The economic downturn has also had an effect.

Metal ores include iron and non-ferrous metals. Each year, small quantities of metal ores are extracted in the UK, although this has notably decreased since 1992. The main metal extracted during the 1990s was tin, but this is currently only produced in minor quantities. Iron was extracted until 2008, but is now no longer produced. In 2013, just 1.1 thousand tonnes of metal ores were extracted in the UK, a fall of 99.5% from 230.4 thousand tonnes in 1992.

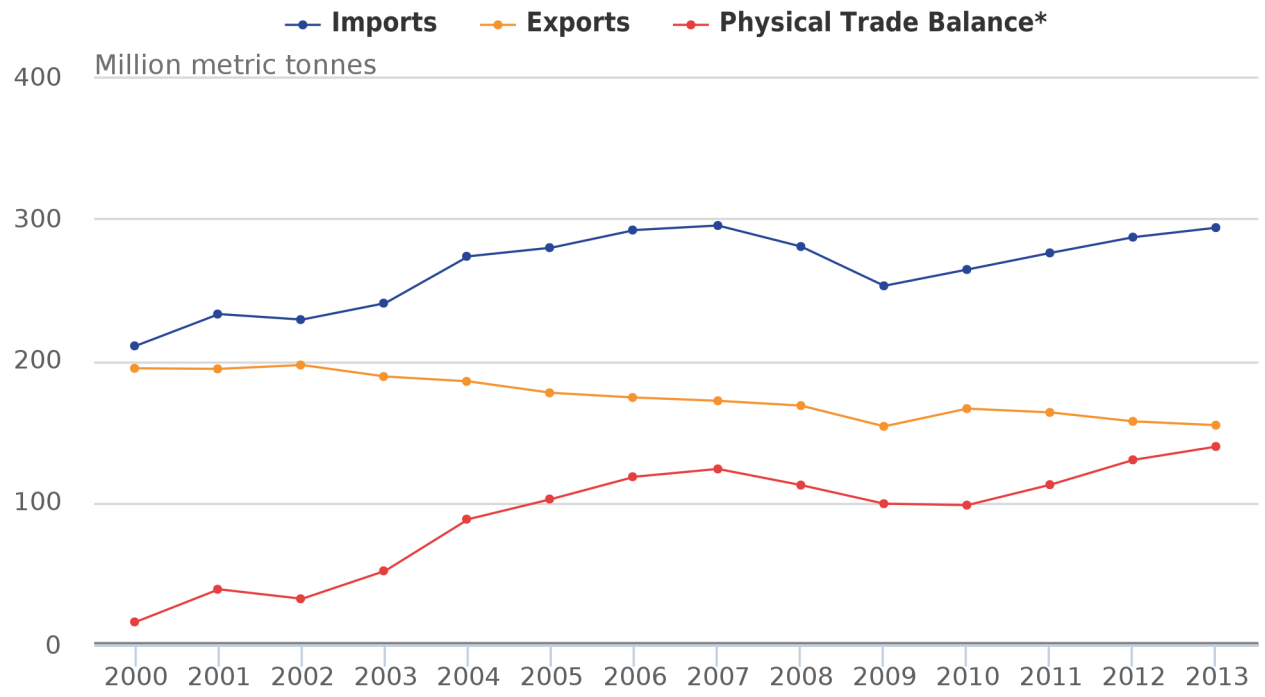
Gap widening between physical imports and exports

Figure 7.2 shows the total quantity of materials imported to, and exported from the UK. While physical imports have largely increased over the period (rising from 210.2 million tonnes in 2000 to a peak of 295.0 million tonnes in 2007, before falling and then rising again to 293.5 million tonnes in 2013), physical exports have gradually decreased (peaking at 196.7 million tonnes in 2002 and falling to 153.5 million tonnes in 2009 – the lowest point in the time series). The rise in imports partly offsets the decline in domestic extraction.

The amount of material imported per capita has been rising. In 2000, 3.6 tonnes of material were imported per capita in the UK. In 2013, an extra tonne (4.6 tonnes) of material was imported per capita. In contrast, exports of material per capita have fallen. In 2000, 3.3 tonnes of goods were exported per capita. This fell to 2.4 tonnes per capita in 2013.

Figure 7.2: Total quantity of materials imported and exported, and the Physical Trade Balance, 2000 to 2013

United Kingdom



Source: HM Revenue and Customs; Office for National Statistics

Notes:

1. *The Physical Trade Balance (Imports – Exports) is defined in reverse to the Monetary Trade Balance (Exports – Imports) Data are only available for 2000 onwards

Across the 2000 to 2013 period, fossil energy materials/carriers were the largest component of UK imports and exports. Trade in other materials remained fairly stable over the series, apart from a sharp drop in the trade of metal ores and concentrates in 2009, where, compared with 2008, imports fell by 36.7% and exports fell by 23.8%. This is likely to be due to the economic downturn.

The Physical Trade Balance (PTB) shows the relationship between imports and exports and is calculated by subtracting the weight of exports from the weight of imports [3]. The UK has a positive PTB, meaning that more materials and products are imported than are exported.

In 2000, the PTB was relatively small at 15.7 million tonnes. It generally increased until 2007, but then fell in 2008, 2009 and 2010 during the economic downturn. However, the PTB has since increased and peaked at 139.3 million tonnes in 2013. In 2013, the total mass of imports (293.5 million tonnes) was almost double the total mass of exports (154.3 million tonnes). The widening gap between physical imports and exports suggests that the UK is becoming more reliant on the production of materials in other countries.

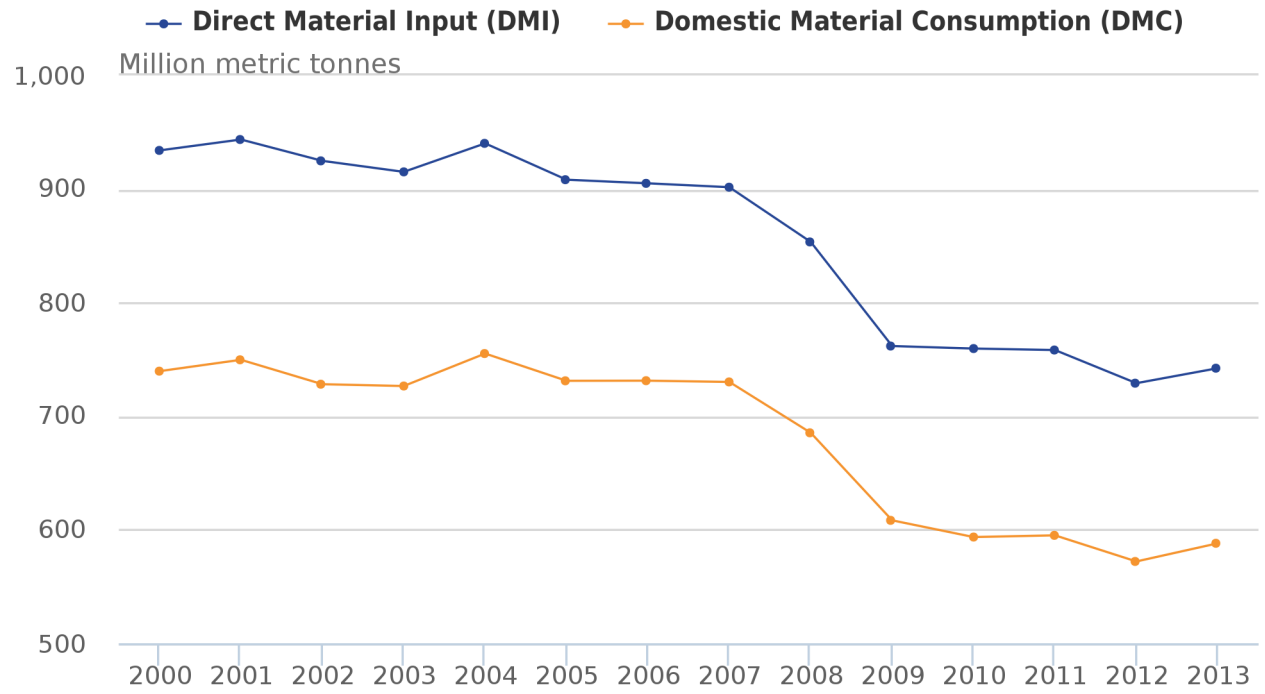
Consumption of materials falls by over a fifth since 2000

Direct Material Input (DMI) (Domestic extraction + Imports) measures the total amount of materials that are available for use in the economy. **Domestic Material Consumption (DMC)** (Domestic extraction + Imports – Exports) measures the amount of materials used in the economy, and is calculated by subtracting exports from DMI.

Figure 7.3 shows that DMI and DMC were fairly stable between 2000 and 2007 but then gradually declined from 2008 at the start of the economic downturn. This indicates that fewer material resources were being used and consumed in the UK economy during this period. DMI and DMC fell most sharply in 2009, by 10.7% and 11.3% respectively. Since then they have remained at a more consistent level, although they increased slightly in 2013 compared with 2012, to 742.2 million tonnes for DMI and 588.0 million tonnes for DMC.

Figure 7.3: Direct Material Input (DMI) and Domestic Material Consumption (DMC) indicators, 2000 to 2013

United Kingdom



Source: Office for National Statistics

Across most of the time series, non-metallic minerals were the largest component of DMC. However, in 2013, biomass became the largest component, accounting for 34.0% of all materials used within the economy. Non-metallic minerals accounted for 33.2% and fossil fuels for 29.2% of DMC. The remaining 3.5% consisted of metal ores and other products.

Both DMI and DMC on a per capita basis have fallen between 2000 and 2013. DMI represented 15.9 tonnes per capita in 2000 but declined to 11.6 tonnes in 2013. DMC decreased from 12.6 tonnes per capita in 2000 to 9.2 tonnes per capita in 2013.

Resource productivity has increased between 2000 and 2013

Resource productivity can be thought of as the total quantity of materials consumed by the economy in relation to its economic activity. One might expect that as an economy grows, its demand for resources (for example, construction materials for building new homes or fuels to power industrial plants) also rises. Estimates of resource productivity provide insights into whether the opposite is occurring, and whether there is a decoupling of economic growth and use of natural resources. A move in this direction might indicate a greener and more sustainable economy.

Apart from during the most recent economic downturn, the UK's economy has followed a broadly upward trend. DMC in contrast, and particularly since 2007, has been falling. This provides evidence of a decoupling between resource use and economic growth. This is highlighted by the estimate of resource productivity derived by dividing GDP by DMC. Over the entire time series 2000 to 2013, resource productivity was estimated to have increased by 55.3%.

Experimental estimates of Raw Material Consumption using Raw Material Equivalents

A limitation of the DMC indicator is its 'asymmetry': it measures the domestic extraction of material resources in tonnes of gross harvest and ore, whereas the imports are measured according to the weight of goods crossing the boundary independent of how far the imported products have been processed (Eurostat, 2012) [4].

The Raw Material Consumption (RMC) indicator is designed to overcome this asymmetry. In addition to domestic extraction, RMC includes imports expressed or converted into their raw material equivalents (RME) (into equivalents of domestic extractions from the rest of the world to produce the respective good).

ONS, in coordination with Defra, are currently reviewing the methodology for estimating RMC. A report will be published later in the summer. Estimates of indirect flows are also under development.

Notes for Material flows

1. In Eurostat's Economy-Wide Material Flow Accounts Compilation Guide 2012 a distinction is made between 'used' and 'unused' domestic extraction. 'Used' refers to an input for use in any economy (for example, where a material acquires the status of a product) and 'unused' flows refer to materials that are extracted from the environment without the intention of using them. Only domestically extracted items that are 'used' are included within the UK's material flow accounts

2. The residual biomass from primary crop harvest, such as straw and leaves, is often subject to further economic use. A large fraction of crop residues is used as bedding material in livestock husbandry, but may also be used as animal feed, for energy production, or as industrial raw material. Fodder crops consist of beets, cabbage, maize and turnips for fodder, as well as hay and silage from grass. The quantity of grazed biomass used is estimated according to demand for animal feed that cannot be met by fodder crops, and the area of grazing land available

3. The Physical Trade Balance (Imports – Exports) is defined in reverse to the Monetary Trade Balance (Exports – Imports). Physical estimates can differ quite significantly to monetary estimates

4. Eurostat (2012) 'Project: Estimates for Raw Material Consumption (RMC) and Raw Material Equivalents (RME) conversion factors'

10. Environmental Goods and Services Sector (EGSS)

Main point

- In 2012, the EGSS contributed £26.3 billion to the economy in terms of value added, £55.4 billion to the economy on a production output basis and 357,200 full-time equivalent jobs

Introduction

There is increasing demand in the UK and internationally to measure the progress towards a green economy. There is particular interest in establishing how the economy is moving towards improving and protecting the environment from further deterioration (sustainable development) and the amount of green jobs being created. Furthermore, information on green growth is required to assist in the development and monitoring of environmental and economic policies and initiatives.

The environmental goods and services sector (EGSS) statistics provide information on:

- how much of the UK economy is engaged in producing goods, services and technologies for environmental protection purposes and resource management activities
- the contribution of the EGSS production to the wider economy
- the number of jobs created in this sector; and how the EGSS is changing through time

The main variables are output[1] value added[2] and employment[3] to give an indication of the relative economic size and contribution of the EGSS to the whole economy.

Main results

The EGSS contributed £26.3 billion (current prices) to the economy in terms of value added in 2012 (Table 8.1), equating to 1.6% of gross domestic product (GDP)[4]. A small growth in the value added occurred between 2010 and 2012 of 1.5% from £25.9 billion to £26.3 billion; slower than the growth of the total economy (GDP grew by 6.2% during the same period). In contrast, output of the EGSS grew quickly from £50.8 billion in 2010 to £55.4 billion in 2012, increasing by 9.1% (Figure 8.1). Likewise, employment in the EGSS grew by 5.3% between 2010 and 2012 to 357,200 full-time equivalent (FTE) jobs.

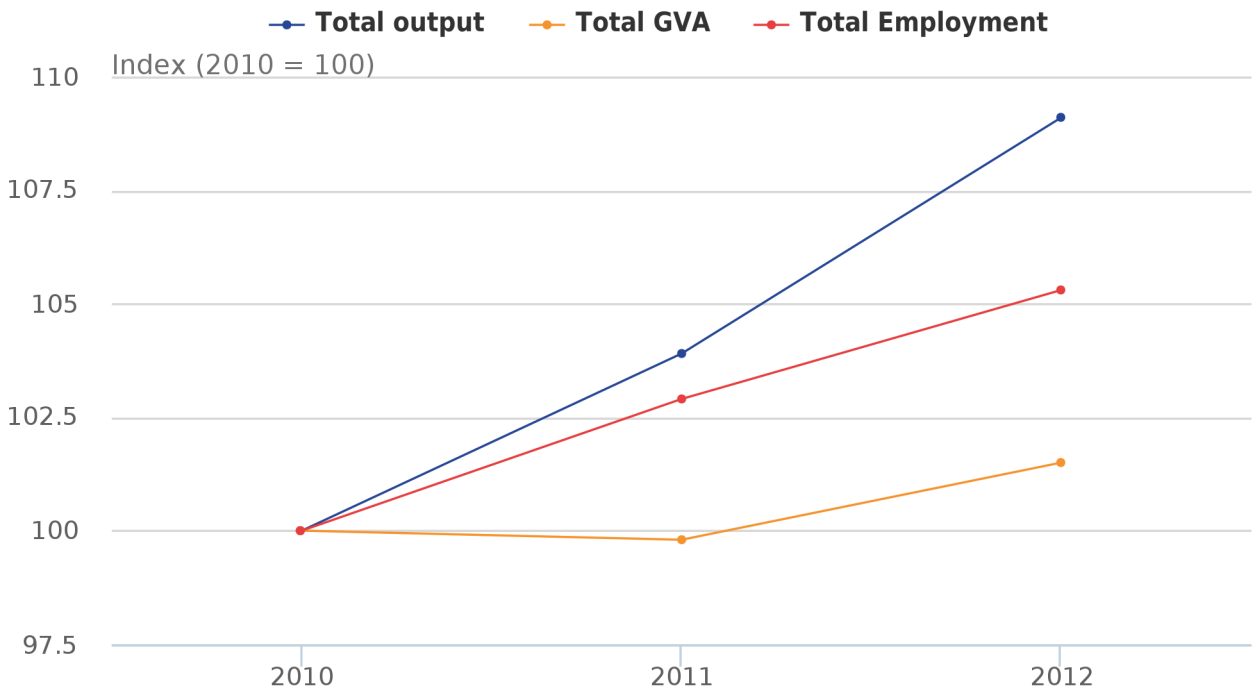
Table 8.1: Estimated output, value added and employment for the EGSS, 2010 to 2012

	Total output (£ billion)	Total GVA (£ billion)	Total Employment (FTE)
2010	50.8	25.9	339,200
2011	52.7	25.8	348,900
2012	55.4	26.3	357,200

Source: Office for National Statistics

Figure 8.1: Changes in output, value added and employment of the EGSS, 2010 and 2012

United Kingdom



Source: Office for National Statistics

A detailed publication on the EGSS was published in April 2015, which fully describes the scope and composition of the EGSS estimates, provides additional statistics relating to the EGSS and presents the methodology used to derive the estimates. This publication can be found on our website.

Notes for Environmental Goods and Services Sector (EGSS)

1. Output (measured in current prices) is the value of goods and services produced

2. Gross Value Added (measured in current prices) is the total value of output of goods and services produced less the intermediate consumption (goods and services used up in the production process in order to produce the output). It represents the contribution made by these activities towards gross domestic product (GDP)

3. Employment: the employment in environmental protection and resource management activities is measured by the full-time equivalent (FTE) employment engaged in the production of the environmental output as defined above. The full-time equivalent is the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs

4. Gross domestic product (GDP) is used to measure the total economic activity of the UK. Gross value added (GVA) differs slightly to GDP in that GVA doesn't include taxes on products and imports and less subsidies on products. The Eurostat EGSS Handbook (2009) and other EU member states use GVA as a percentage of GDP to assess the EGSS contribution to the economy

5. The methodology used to develop the EGSS estimates remains under development, the estimates reported here and in the detailed publication are experimental and should be interpreted in this context. A full description of experimental statistics can be found on our website

11. Waste

Waste is defined by the European statistical office (Eurostat) as "any substance or object which the holder disposes of or is required to dispose of". Each year a large amount of resources are lost to waste, both in terms of materials and energy.

The following section presents a selection of statistics on UK waste generation and recycling. Further information is available in the UK Digest of waste and resource statistics publication.

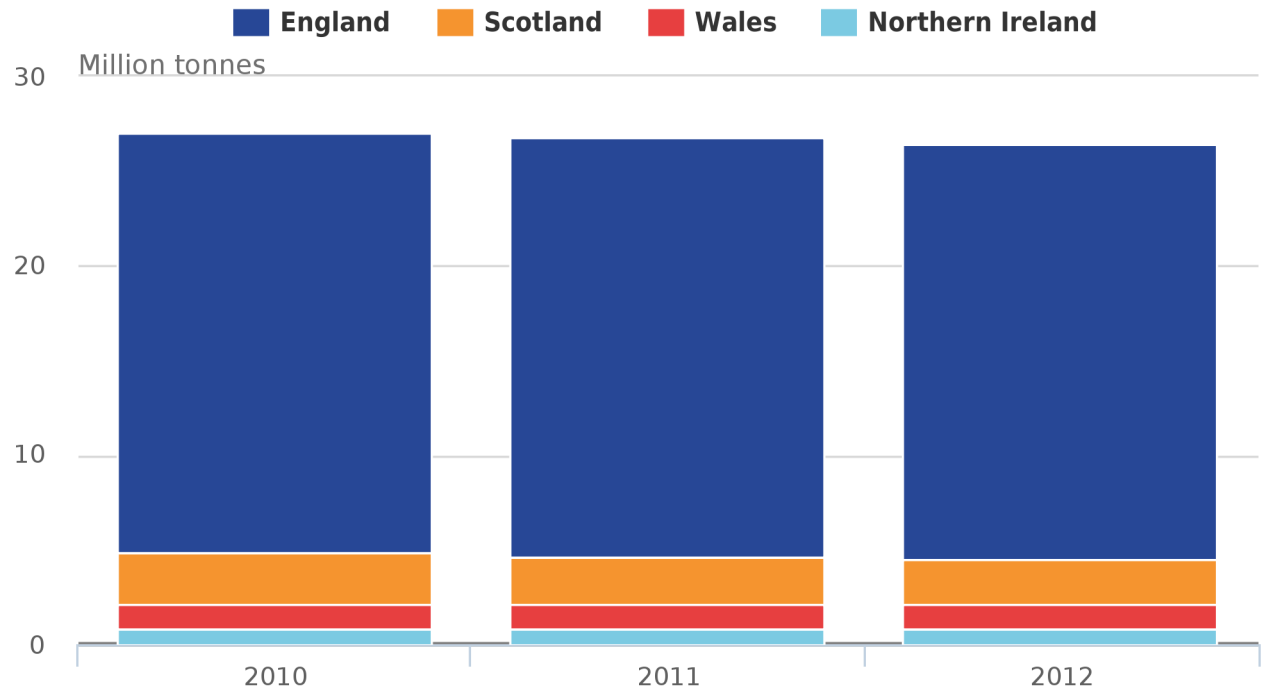
The "waste from households" indicator, published by Defra, was introduced for statistical purposes to enable comparability across the 4 nations of the United Kingdom. It also enabled a consistent reporting of recycling rates to the EU under the waste framework directive.

In 2012, waste from households was 26.5 million tonnes (Figure 9.1). England was responsible for the vast majority of UK waste generated from households (22.0 million tonnes in 2012).

Waste from households fell by 2.2% between 2010 and 2012.

Figure 9.1: Waste from households, 2010 to 2012

United Kingdom

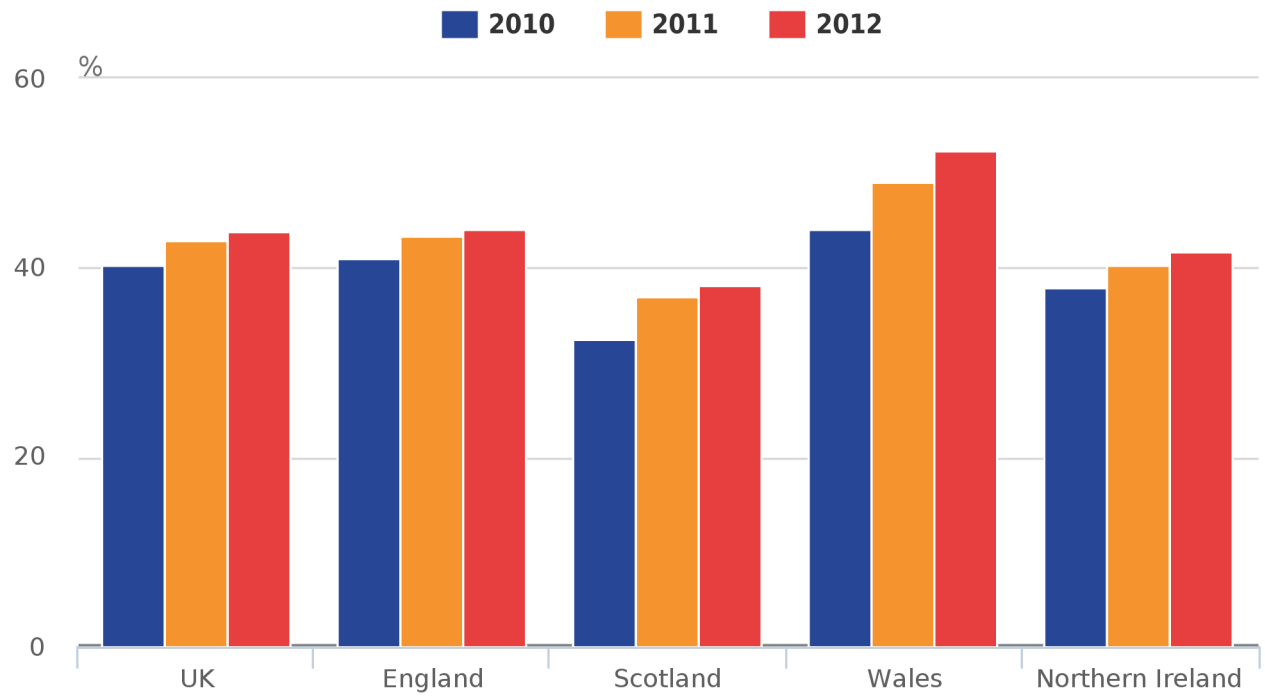


Source: Environment, Food and Rural Affairs

The recycling rate in each country of the UK increased between 2010 and 2012 (Figure 9.2). In each of the three years, Wales had the highest recycling rate (52.5% in 2012). Overall, the UK achieved a recycling rate of 43.9% in 2012, increasing by 3.6 percentage points from 2010. There is an EU target for the UK to recycle at least 50 per cent by 2020.

Figure 9.2. Waste from households recycling rate, 2010 to 2012

United Kingdom



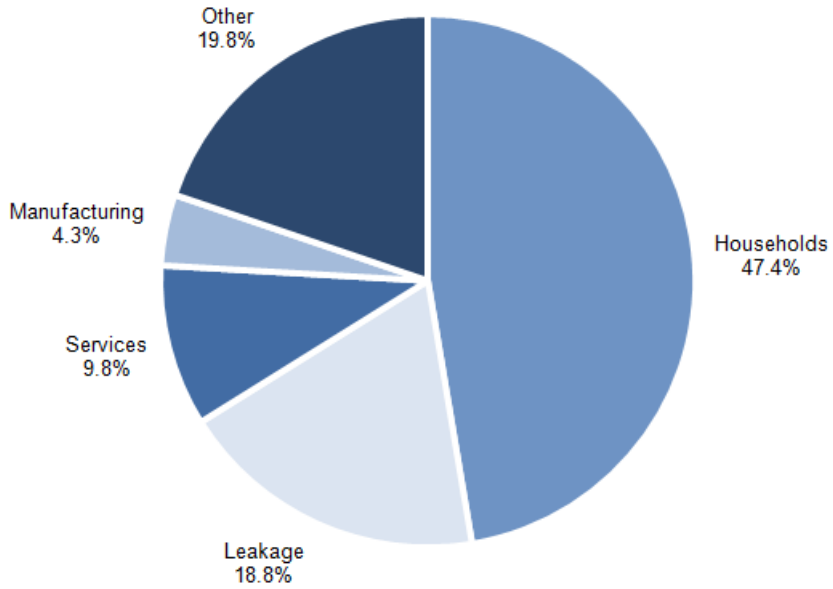
Source: Defra

12. Water use

Water use is the physical amount of water removed (abstracted) from any source for consumption and production activities. In 2011, total water abstraction from freshwater (non-tidal) sources in England and Wales was 10,463 million cubic metres. Of this, 58.1% was for public water supply, while 41.9% was directly abstracted by different sectors of the economy.

Figure 10.1: Use of public water supply, 2011

England and Wales



Source: Source: Department for Environment, Food and Rural Affairs; WRc; Environment Agency; WaterUK

Notes:

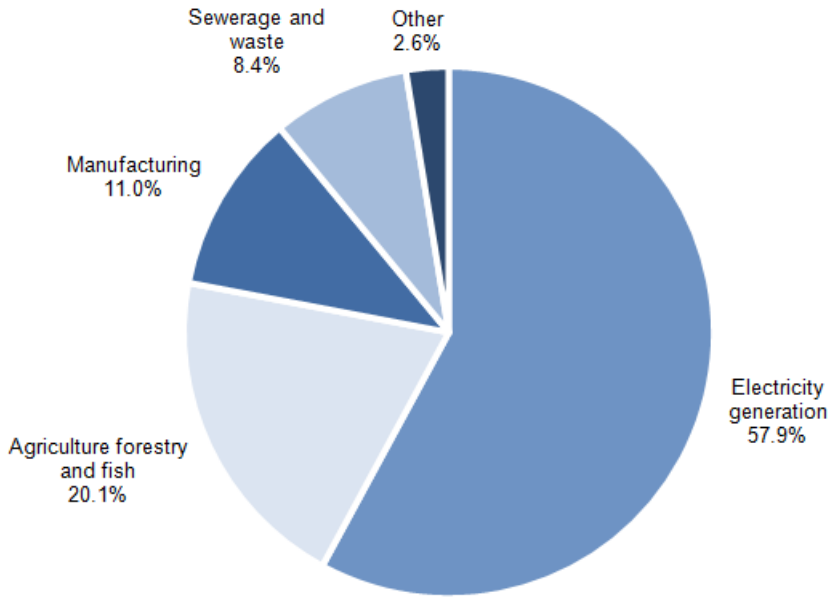
1. The estimate of Private households' use of public water supply has been revised and is now based on information supplied by water companies (source: Environment Agency)

Public water supply is the use of mains water supplied by water companies to various sectors of the economy, including households, the manufacturing sector, and services.

Of all public water supply, 47.4% was used by households, while non-domestic sectors accounted for 33.9% of public water use, with the remaining 18.8% lost through leakage. The services sector used 9.8% and the manufacturing sector used 4.3%. Significant non-domestic users of the public water supply were the chemicals and chemical products sector (165.9 million cubic metres), and accommodation and food services sector (127.0 million cubic metres).

Figure 10.2: Direct abstractions from freshwater (non-tidal) waters, 2011

England and Wales



Source: Source: Department for Environment, Food and Rural Affairs; WRc

Notes:

1. Estimates exclude abstractions for Public Water Supply and abstractions below the licensing threshold

In 2011, direct abstraction accounted for 41.9% of freshwater (non-tidal) abstraction in England and Wales.

The sector that directly abstracted the largest amount of water was electricity generation, directly abstracting 2,537.6 million cubic metres (57.9% of total direct abstraction). The agriculture, forestry and fishing sector was also a major user, with 878.7 million cubic metres directly abstracted (20.1% of total direct abstraction) in addition to the 120.5 million cubic metres taken from the public water supply. The manufacturing sector directly abstracted 11.0% of total direct abstraction, while also using 4.3% of the public water supply.

13. Environmental taxes

Main points

- Environmental taxes raised £44.6 billion in the UK in 2014
- Despite rising by an average of 5.0% per year since 1993 (in current prices), environmental tax revenue has remained broadly stable as a percentage of GDP (2.5% in 2014)
- Environmental taxes provided 7.5% of all revenue from taxes and social contributions in 2014
- Hydrocarbon oil duties (including transport fuels) accounted for 60.8% of all environmental taxes in 2014

Introduction

Our environmental taxes data are based on the definition outlined in Regulation (EU) No 691/2011 on European environmental economic accounts. The European Statistical Office (Eurostat) define an environmental tax as a tax whose base is a physical unit (for example, a litre of petrol or a passenger flight) that has a proven negative impact on the environment. These taxes are designed to promote environmentally positive behaviour, reduce damaging effects on the environment and generate revenue that can potentially be used to promote further environmental protection. Data on UK environmental tax revenue are available for the years 1993 through to 2014.

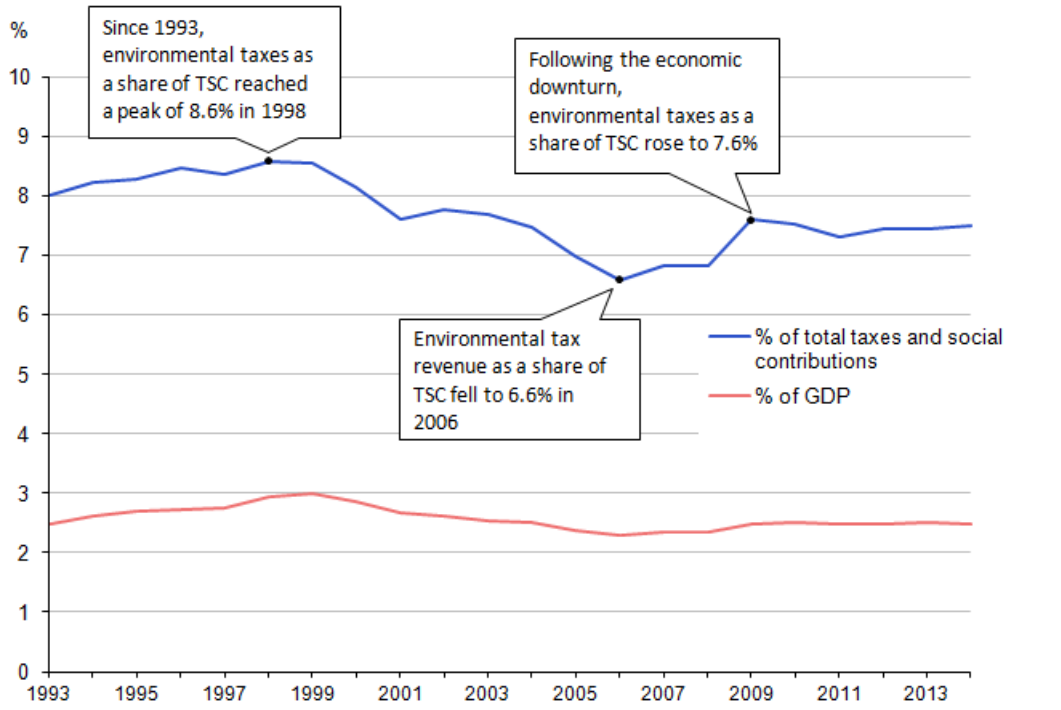
The analysis presented below formed part of a larger article on environmental taxes published in June 2015.

Environmental tax revenue broadly stable as a percentage of GDP

In 2014, revenue from environmentally related taxes stood at £44.6 billion. This corresponded to 2.5% of the UK's gross domestic product (GDP). Looking over the time series as a whole, environmental taxes as a share of GDP has remained at a broadly consistent level of between 2% and 3% (Figure 11.1).

Environmental tax revenue as a percentage of total taxes and social contributions (TSC) has been more volatile across the time series. After peaking at 8.6% of TSC in 1998, the trend of environmental taxes was downward and fell to 6.6% of TSC in 2006. In 2009, as a possible result of the fall in other government revenue following the most recent economic downturn, the share of TSC-comprised environmental taxes rose to 7.6%. Since then, the importance of environmental taxes has remained broadly consistent and in 2014 stood at 7.5% of TSC.

Figure 11.1: Environmental tax revenue, as a percentage of GDP and total taxes and social contributions, 1993 to 2014



Source: Office for National Statistics

Notes:

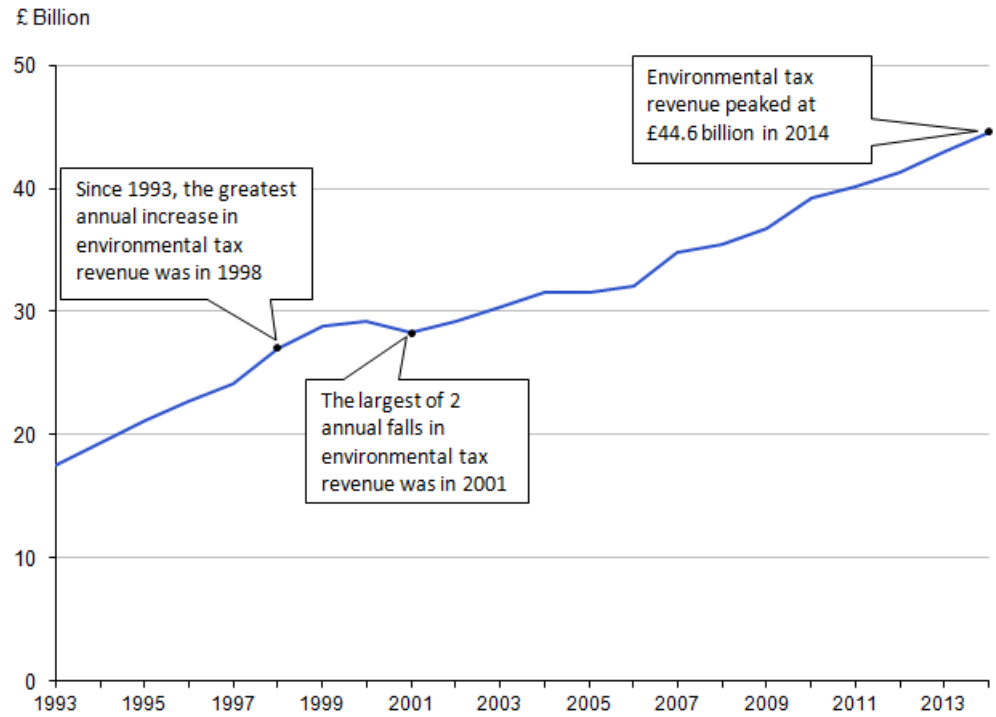
1. Data are presented in current prices and have not been adjusted for inflation

Revenue from environmental taxes has more than doubled between 1993 and 2014

UK government revenue from environmentally-related taxes has increased by, on average, 5.0% (in current prices) per year since 1993 (Figure 11.2). Total revenue in 2014 (£44.6 billion) was 2.5 times greater than revenue in 1993 (£17.6 billion).

The largest annual increase in environmental tax revenue was 12.1% in 1998. An increase of £2.6 billion in revenue from hydrocarbon oil duty (which include taxes on transport fuels) explained much of this rise. The fuel price escalator, which set the rate for year-on-year increases in this particular duty, rose from 5% in 1997 to 6% in 1998. The larger than average increase in income from environmental taxes was also partly explained by a rise of £0.4 billion in revenue from air passenger duty. The duty was doubled to £10 for flights to most European countries and £20 for other flights from 1 November 1997.

Figure 11.2: Environmental tax revenue, 1993 to 2014



Source: Office for National Statistics

Notes:

1. Data are presented in current prices and have not been adjusted for inflation

Of the two periods (2001 and 2005) with falls in environmental tax revenue, the largest was in 2001 – a 3.0% decrease. A series of national protests against the rising costs of petrol and diesel fuel prices for road vehicle use in the autumn of 2000 had a considerable impact, and led to a £1.0 billion fall in revenue from taxes on hydrocarbon oils. A fall of £0.6 billion was also observed in revenue generated from motor vehicle tax paid by businesses. This followed a change in the base for the tax from engine size (for cars and light goods vehicles registered before 1 March 2001) to fuel type and CO2 emissions (for cars and light goods vehicles registered on or after 1 March 2001).

Energy taxes contributed nearly three-quarters of all environmental tax revenue

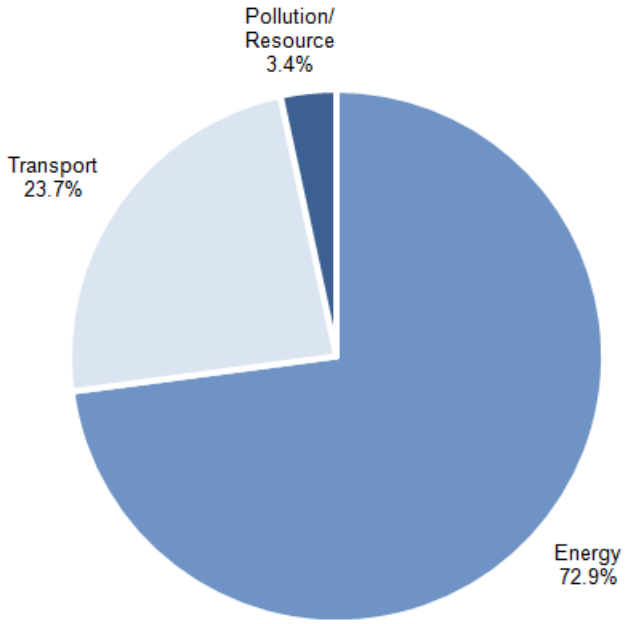
Environmental taxes can be of four types: energy, transport, pollution and resource. For ease of interpretation this articlecombines pollution and resource taxes together.

Energy taxes comprise taxes on energy production and on energy products (for example, coal, oil products, natural gas and electricity) used for both transport and stationary purposes. In 2014, nearly three-quarters (72.9%) of all income from environmental taxes were energy taxes (Figure 11.3). The largest contributor to energy taxes was tax on hydrocarbon oils (which include taxes on transport fuels). In 2014, this tax accounted for 83.4% of all income from energy taxes and 60.8% of total revenue from all environmental taxes.

Transport taxes consist mainly of taxes related to the ownership and use of motor vehicles, although taxes on other transport and related transport services are also included. In 2014, transport taxes contributed 23.7% of all environmental tax revenue. Motor vehicle taxes paid by households made the most important contribution, accounting for 47.6% of total transport tax revenue in 2014.

Figure 11.3: Environmental tax revenue, by tax type, 2014

United Kingdom



Source: Office for National Statistics

Pollution and resource taxes include taxes on the extraction of raw materials and on the management of waste. Only 3.4% of total environmental tax revenue comprised pollution and resource taxes in 2014. Landfill tax made the largest contribution to pollution and resource taxes. In 2014, this tax generated £1.1 billion in revenue, representing 75.8% of all income from pollution and resource taxes.

14. Environmental protection expenditure

Main points

- In 2013, UK government spent an estimated £14.4 billion on environmental protection
- Waste management activities accounted for a little over four-fifths (80.3%) of government EPE spend
- EPE as a percentage of gross domestic product (GDP) was 0.8% in 2013
- Electricity, gas and water industries had the greatest contribution of £824.1 million (23.6%) towards industry EPE in 2013

Introduction

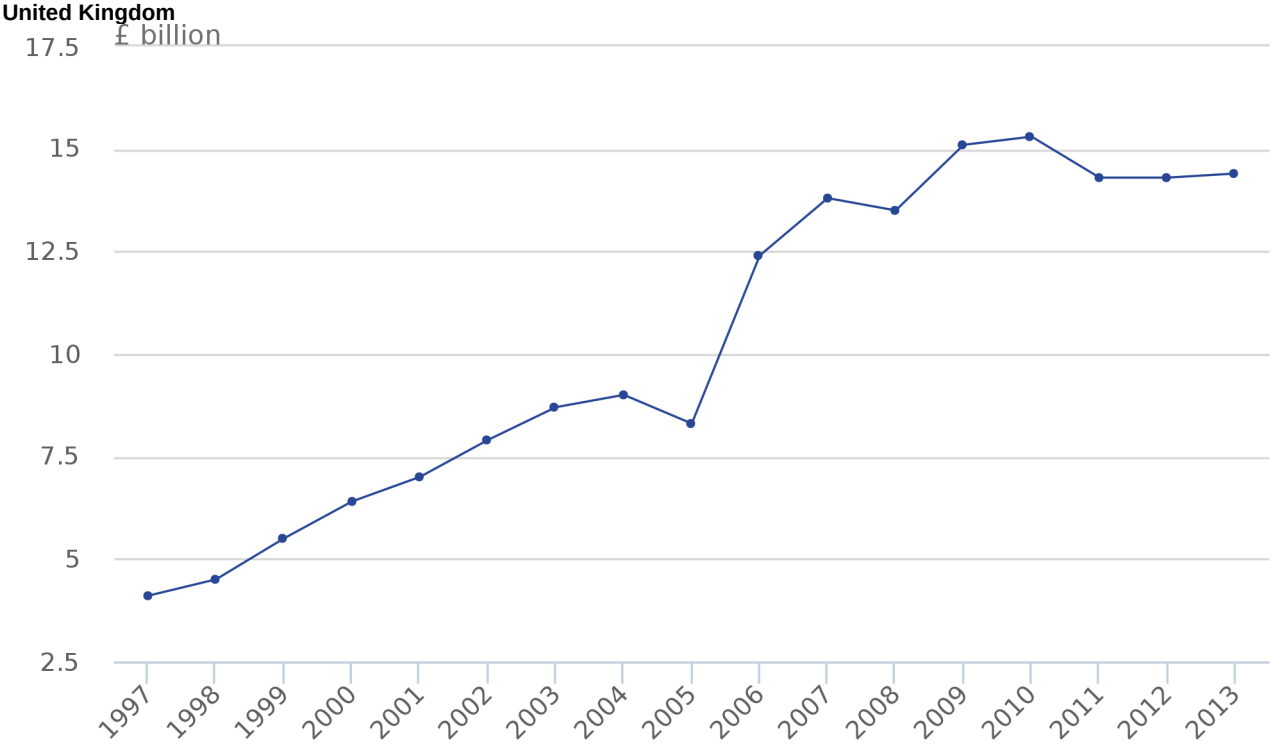
Environmental protection expenditure (EPE) includes all activities and actions which have as their main purpose the prevention, reduction and elimination of pollution or any other degradation of the environment. The purpose of reporting EPE is to enable identification and measurement of society's response to environmental concerns through the supply of and demand for environmental protection services and through the adoption of production and consumption behaviour aimed at preventing environmental degradation. All data in this section are presented in current prices.

Environmental protection expenditure by general government

UK government data for EPE are derived using annual expenditure data disaggregated by Classification of Functions of Government (COFOG)1. Figure 12.1 shows EPE by the UK government from 1997 to 2013. Between this period EPE increased by £10.3 billion. The general trend has been year-on-year increases, with a few notable exceptions. In 2005, EPE observed a fall of 7.1% from a year earlier as a result of the decommissioning of British Nuclear Fuels plc (BNFL). In April 2005, BNFL (classified as a public corporation) transferred some nuclear reactors to the Nuclear Decommissioning Authority (NDA) (classified as central government) .EPE by general government in 2013 observed a rise of 0.1% from a year earlier to £14.4 billion.

Figure 12.1: Environmental protection expenditure by government, 1997 to 2013

United Kingdom

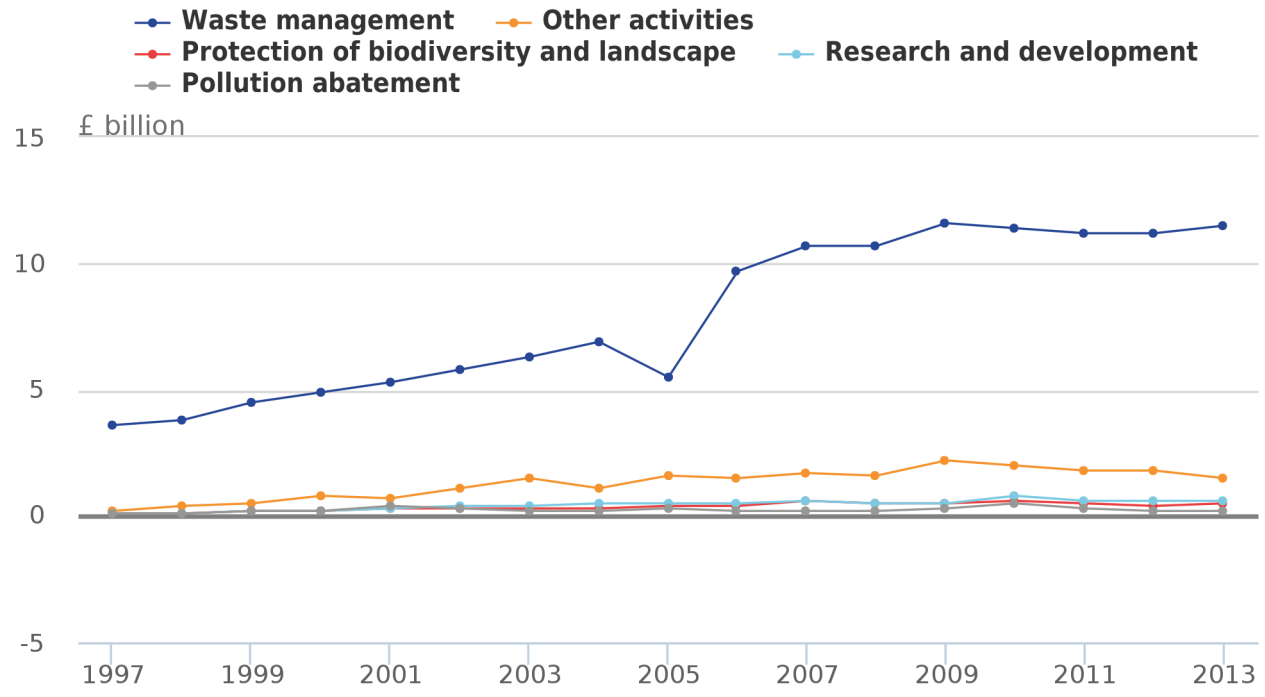


Source: ONS, HM Treasury

Figure 12.2 shows general government EPE, by activity. Between 2012 and 2013, expenditure on waste management – the activity accounting for the highest overall expenditure of all the EPE activities observed a rise of 2.5% to £11.5 billion. Expenditure on the protection of bio-diversity and landscape activity increased by 16.6% over the same period, reversing a 14.7% fall in EPE for this activity between 2011 and 2012.

Figure 12.2 Environmental protection expenditure by general government: by activity, United Kingdom, 1997 to 2012

United Kingdom

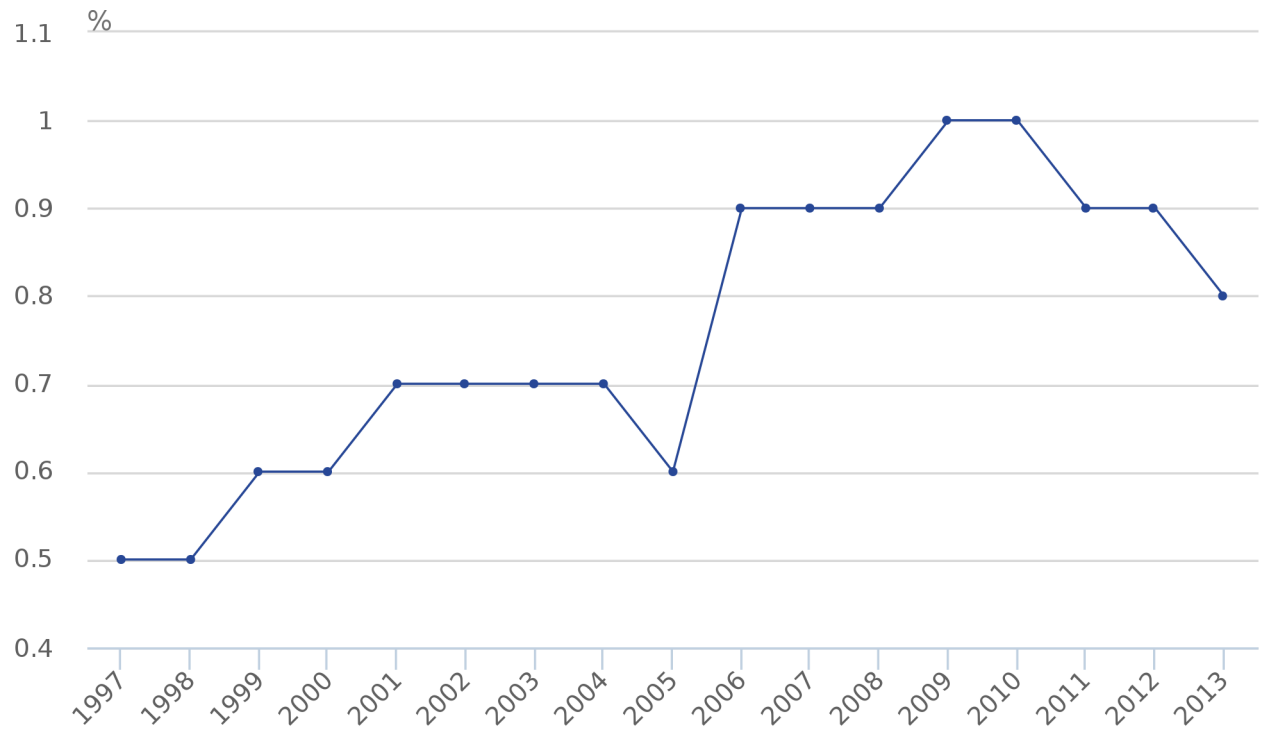


Source: ONS, HM Treasury

EPE as a percentage of GDP has observed a generally positive trend. Notable exceptions to this trend occurred during 2005 for the reasons outlined above. Between 2008 and 2009, EPE increased as GDP fell as a result of the economic downturn. The largest fall in EPE occurred between 2010 and 2011, with all activities contributing to a fall in EPE, particularly waste management. Since 2009, EPE as a percentage of GDP has fallen and in 2013 was 0.1 percentage points lower than 2012. The fall in EPE as a percentage of GDP was largely because GDP grew at a faster rate than EPE, 3.5% and 0.1%, respectively.

Figure 12.3. Environmental protection expenditure by general government as an equivalent of Gross Domestic Product (GDP), United Kingdom, 1997 to 2012

United Kingdom



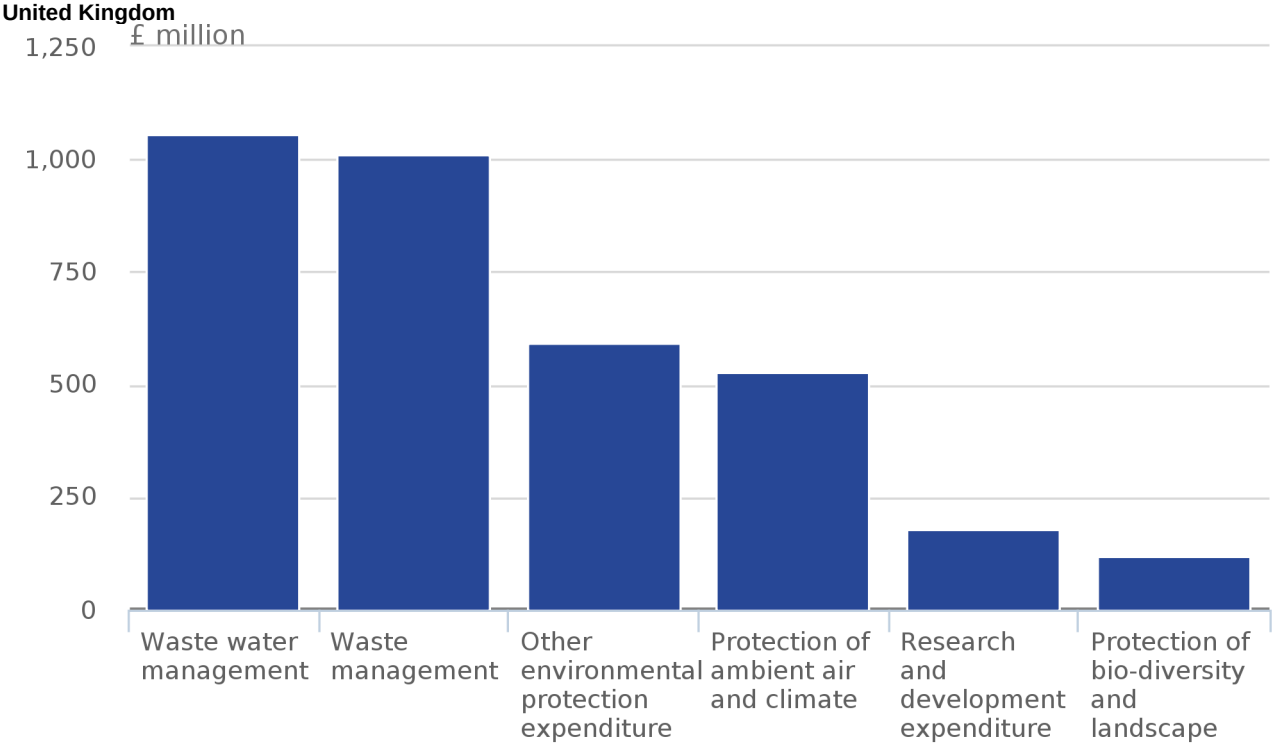
Environmental protection expenditure by industry

Data for EPE by industry are estimated from an annual EPE survey commissioned by the Department for Environment, Food and Rural Affairs (Defra). The survey response rate and methodology vary from year to year and so caution must be taken when comparing data.
In total, UK industries spent £3.5 billion on environmental protection activities in 2013. The electricity, gas and water supply industries spent the most at £824.1 million, representing 23.6% of total industry EPE, followed by the by the food products, beverages and tobacco industry which spent £447.6 million, equating to 12.8% of total industry EPE in 2013.

Figure 12.4 shows total EPE according to activity. In 2013, the largest expenditure came from waste water management at £1.1 billion (30.3%). This was followed by expenditure on waste management at £1.0 billion (28.9%).

Figure 12.4. Environmental protection expenditure by industry: by activity, 20131

United Kingdom



Source: Environment, Food and Rural Affairs

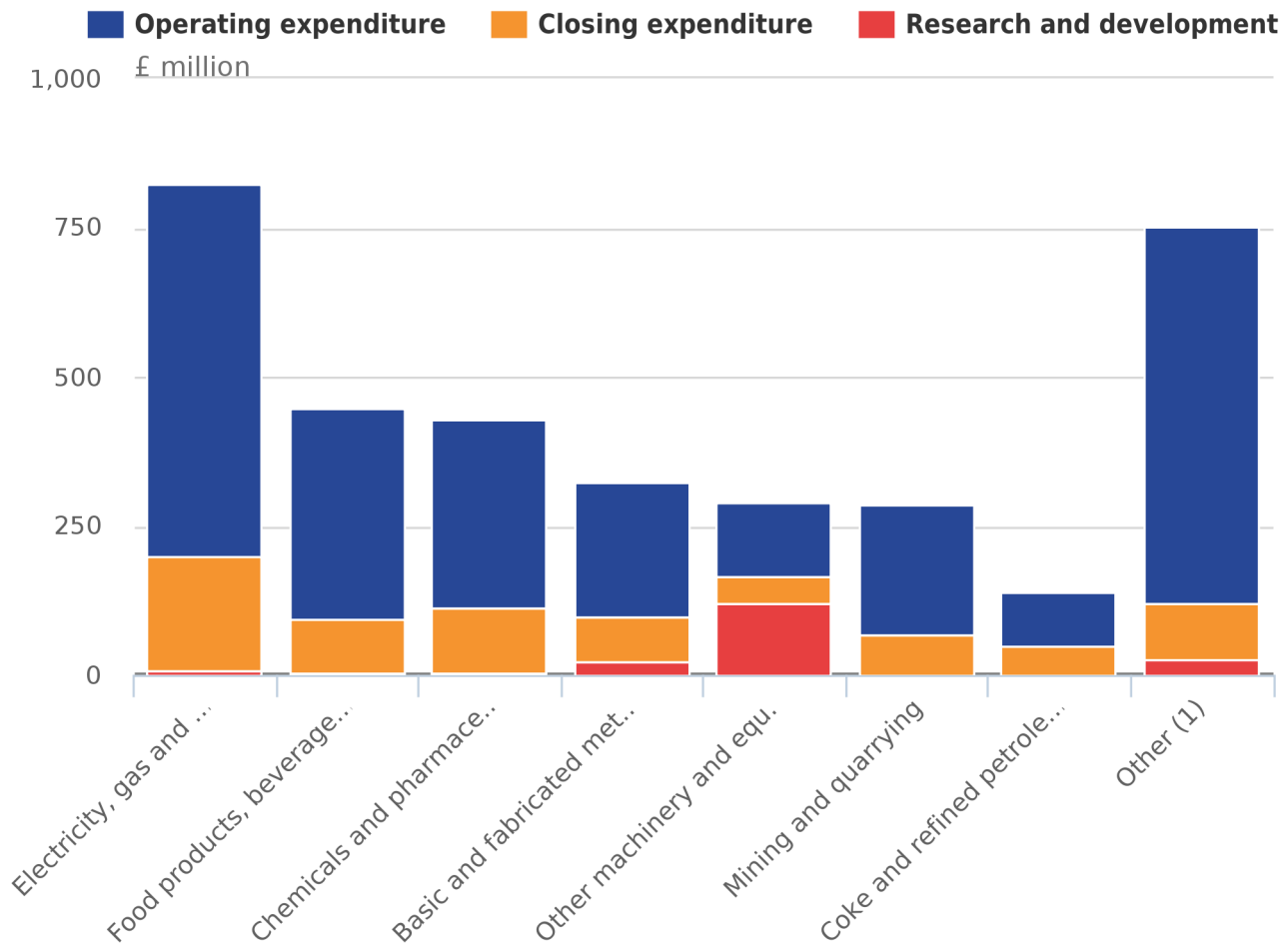
Environmental protection expenditure by selected industries

Figure 12.5 shows the amount spent on EPE by industry in 2013 split by

- operating expenditure (Opex) (operating costs of a company's own environmental protection activities)
- capital expenditure (Capex) (integrated and 'end of pipe' investments, for example the purchase of equipment to reduce or eliminate emissions as part of the production process)
- research and development

Figure 12.5: Environmental protection expenditure by selected industries, 2013

United Kingdom



Source: Environment, Food and Rural Affairs

Across all industries, Opex accounted for the greatest proportion of their EPE. The proportion of Opex was highest in the "Food products, beverages and tobacco products" industries at 78.7%, but lowest in the "Other machinery and equipment" industries at 43.0%. The proportion of Capex was greatest within the "Coke and refined petroleum" industry at 35.4% in 2013. The total EPE in this industry was lowest of all industries at £138.4 million.

Notes for Environmental protection expenditure

1. General government environmental protection activities are defined using COFOG category 05 Environmental Protection. This includes: 05.1 Waste management – includes the collection, treatment and disposal of waste. 05.2 Waste water management – includes sewage system operations and waste water treatment. 05.3 Pollution abatement – includes activities relating to ambient air and climate protection, soil, and groundwater. 05.4 Protection of biodiversity and landscape – includes activities relating to the protection of fauna and flora species, the protection of habitats, and the protection of landscapes for their aesthetic value. 05.5 Research and development – includes administration and operation of government agencies engaged in applied research and experimental development related to environmental protection; grants, loans or subsidies to support applied research and experimental development related to environmental protection undertaken by non-government bodies such as research institutes and universities. 05.6 Environmental protection not elsewhere classified – includes administration, management, regulation, supervision, operation and support of activities such as formulation, administration, coordination and monitoring of overall policies, plans, programs and budgets for the promotion of environmental protection; preparation and enforcement of legislation and standards for the provision of environmental protection services; production and dissemination of general information, technical documentation and statistics on environmental protection.

15. Introduction to natural capital

UK natural capital accounts

Natural capital can be thought of as the stock of our physical natural resources and the ecosystem services that they provide.

Our economy's gross domestic product (GDP) only tells part of our economic story. We need also to account nationally not just for market output, buildings and roads but also for our natural resources, the ecosystems, green spaces and landscapes that provide us with a range of non-economic benefits. This includes changes to the value of the physical environmental assets, such as fish stocks and forests, and also to the value of services provided by healthy ecosystems, such as timber, carbon sequestration, pollination and recreation. In doing so, we can end the current situation where gains and losses in the value of natural capital go unrecorded and unnoticed, with the risk that natural capital is degraded over time leading to unwanted impacts on the benefits it provides to people.

Natural capital accounting can help inform and improve decision-making surrounding the natural environment. It can provide an insight on the losses, gains and relative importance of services provided by natural assets; highlight links with economic activity and pressures on natural environment; and inform priorities for investment and management decisions for natural capital.

In 2011, the Government committed to working with us to incorporate natural capital into the UK environmental accounts by 2020 in order to better recognise the benefits provided by ecosystems.

Utilising both the United Nations System of Environmental-Economic Accounting Central Framework (SEEA-CF), an international standard, for valuing physical environmental assets and international guidance endorsed by the UN Statistical Commission on the System of Environmental-Economic Accounting–Experimental Ecosystem Accounting guidelines (SEEA-EEA) for valuing ecosystem services, we have applied the UN SEEA frameworks to the UK situation. In addition, since SEEA-EEA is still developing, we and the Department for Environment, Food and Rural Affairs published a principles paper in August 2014 that set out the basic principles to be followed when developing ecosystems accounts.The following section provides an overview of the work that we have carried-out so far to incorporate natural capital into the UK environmental accounts by 2020.

The section includes the following accounts:

- oil and gas asset accounts
- land cover non- monetary asset account
- freshwater ecosystem assets and services accounts
- timber asset accounts
- woodland ecosystem assets and services accounts

These accounts are experimental (apart from oil and gas non-monetary account which are National Statistics) and continuously under development and therefore should be interpreted in this way. We welcome comments on all aspects of the methodology used and feedback for further improvement and refinement.

Further information on our Natural Capital work and detailed methodological and technical papers available can be found on our website.

Notes for Introduction to natural capital

1. Experimental statistics are those statistics that are in the testing stage and are not fully developed. A full description of experimental statistics can be found on our website

16. Oil and gas asset accounts

Main points

- At the end of 2013, the expected level of discovered oil reserves were estimated to be 746 million tonnes (mt), 8.0% lower than in 2012
- Expected reserves of discovered gas resources at the end of 2013 were estimated to be 452 billion cubic metres (bcm), 2.0% lower than in 2012
- The value of remaining oil and gas at end-2013 were estimated at £63.2 billion, 3.5% higher than the revised estimate for 2012

Introduction

The following section present non-monetary estimates of the oil and gas reserves and resources in the UK (National Statistics), followed by a combined monetary estimate for oil and gas (experimental statistics).

In the context of oil and gas resources and reserves presented here, resource refers to minerals that are potentially valuable and for which reasonable prospects exist for eventual extraction, whereas reserves refer to discovered mineral reserves which are recoverable and commercially viable.

Reserves can be proven, probable or possible depending on the confidence level:

- proven reserves (based on the available evidence) are virtually certain to be technically and commercially producible, that is, have a better than 90% chance of being produced
- probable reserves are not yet proven and have a more than 50% chance of being produced
- possible reserves are those which, at present, cannot be regarded as probable, but which are estimated to have a significant – but less than 50% – chance of being technically and commercially producible

Oil reserves and resources

Oil is defined as both oil and the liquids that can be obtained from gas fields. Shale oil is not included in these estimates.

The total (discovered and undiscovered) oil reserves and resources for 2013 were estimated at between 857 million tonnes (mt) and 2,415 mt. The upper range for total oil reserves increased between 2012 and 2013 by 0.3%, whilst the lower range decreased by the same percentage.

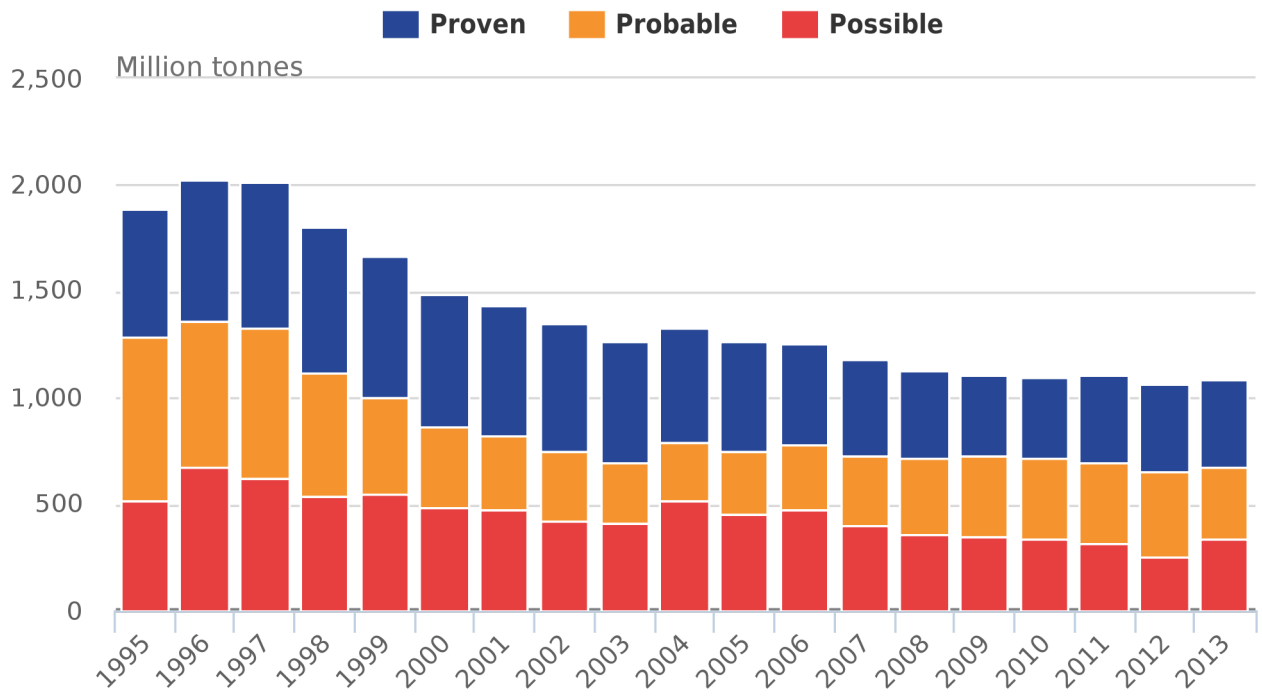
Discovered oil reserves

The expected level of discovered oil reserves is the sum of proven and probable reserves. In 2013, this was estimated at 746 mt, 8.0% lower than in 2012 (Figure 14.1). Proven levels of oil reserves were estimated to be 404 mt in 2013, representing 37.3% of maximum discovered reserves. Probable reserves represented 31.5% of maximum discovered resources in 2013, a smaller contribution compared with 2012. Revisions to oil reserves data in established oil fields, additions to reserves from new field developments and the rate of production during the year are the reasons for changes in oil reserves between 2012 and 2013 .

Total maximum discovered oil reserves and resources rose by 1.9% between 2012 and 2013. This was largely driven by rises in possible oil reserves, which rose 33.6% from 2012, countering falls in proven and probable reserves which fell 0.2% and 15.6% respectively.

Figure 14.1: Estimates of discovered oil reserves, 1995 to 2013

United Kingdom



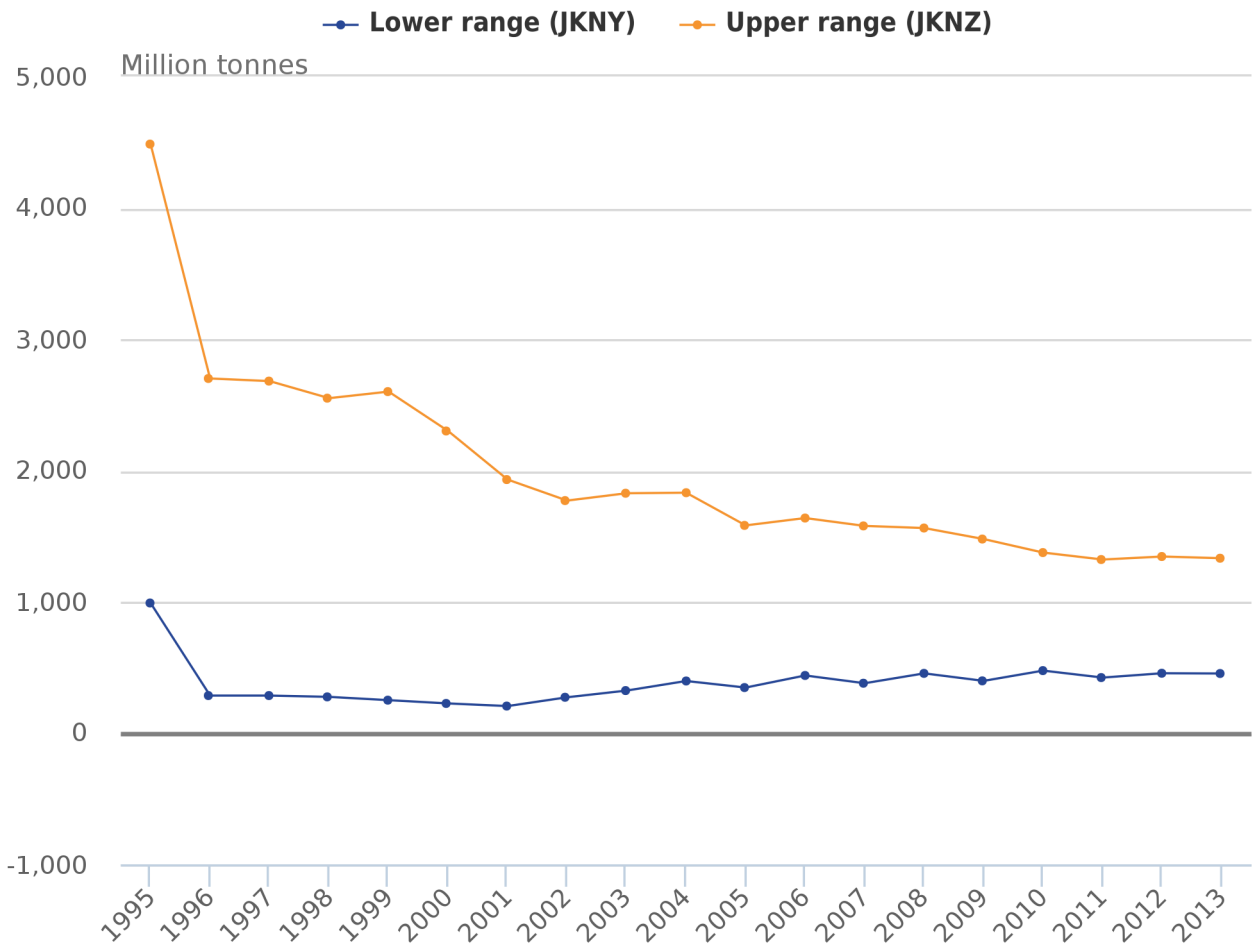
Source: Department of Energy and Climate Change (DECC)

Undiscovered oil reserves

Undiscovered oil resources provide a broad indication of the level of oil resources which are expected to exist, however are subject to higher levels of uncertainty than discovered reserves1. The lower range of undiscovered oil resources was 453 mt, changing little from the 455 mt estimated for the lower bound in 2012. The upper range was an estimated 1.0% lower in 2013 than in 2012, at 1,331 mt (Figure 14.2).

Figure 14.2: Estimates of undiscovered oil resources, 1995 to 2013

United Kingdom



Source: Department of Energy and Climate Change (DECC)

Gas reserves and resources

Gas includes gas expected to be available for sale from dry gas fields, gas condensate fields, oil fields with associated gas and a small amount from coal bed methane projects. Shale gas is not included in these estimates. These reserves include onshore and offshore discoveries but not flared gas or gas consumed in production operations.

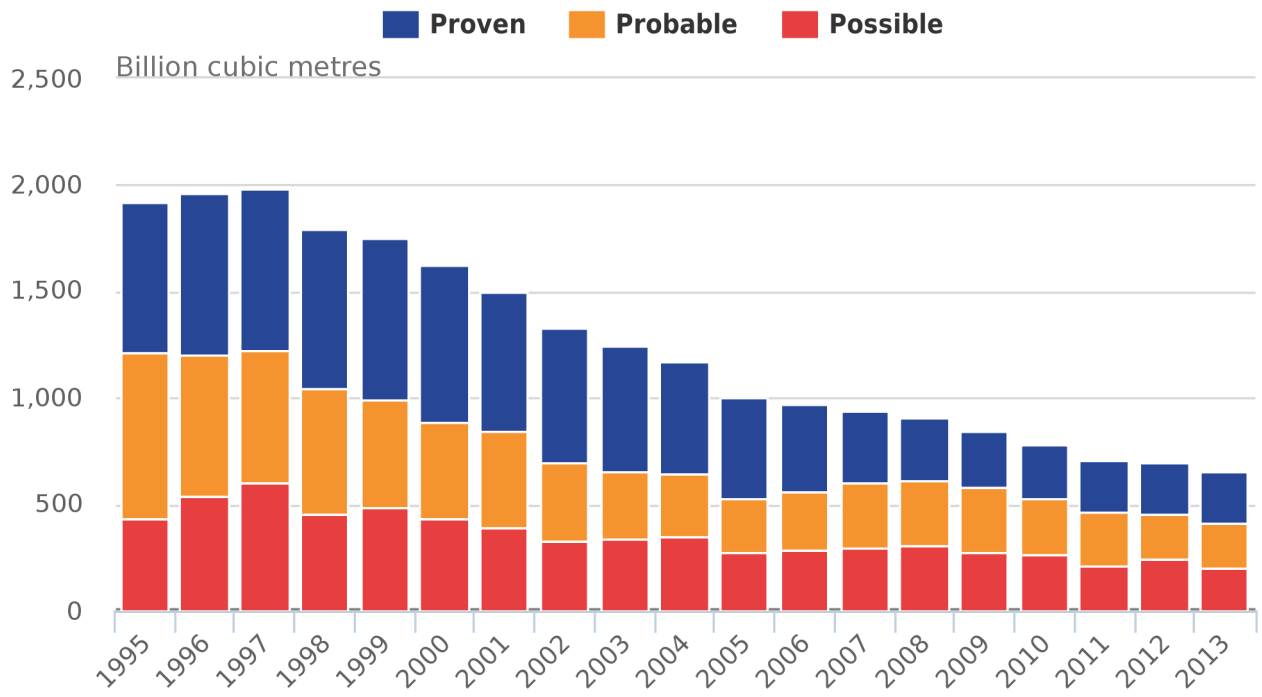
Total gas reserves and resources were estimated between 598 billion cubic metres (bcm) and 1,647 bcm in 2013. The upper range for total gas reserves and resources was 2.6% lower and the lower range 3.7% lower between 2012 and 2013.

Discovered gas reserves

The expected level of gas reserves in 2013 was estimated to be 452 bcm, 2.0% lower than in 2012. The fall in expected reserves was driven primarily by a fall in probable reserves. In 2013 proven gas reserves were 241 bcm, 1.2% lower than in 2012 where they were estimated to be 244 bcm. The estimates for probable reserves fell from 217 bcm to 211 bcm, representing a fall of 2.8%. The rate of annual gas production in 2013 was 34 bcm, 8.1% lower than in 2012. The change in gas reserves for 2013 was the result of revisions to reserves in established fields and new field developments as well as production during the year.

Figure 14.3: Estimates of discovered gas reserves, 1995 to 2013

United Kingdom



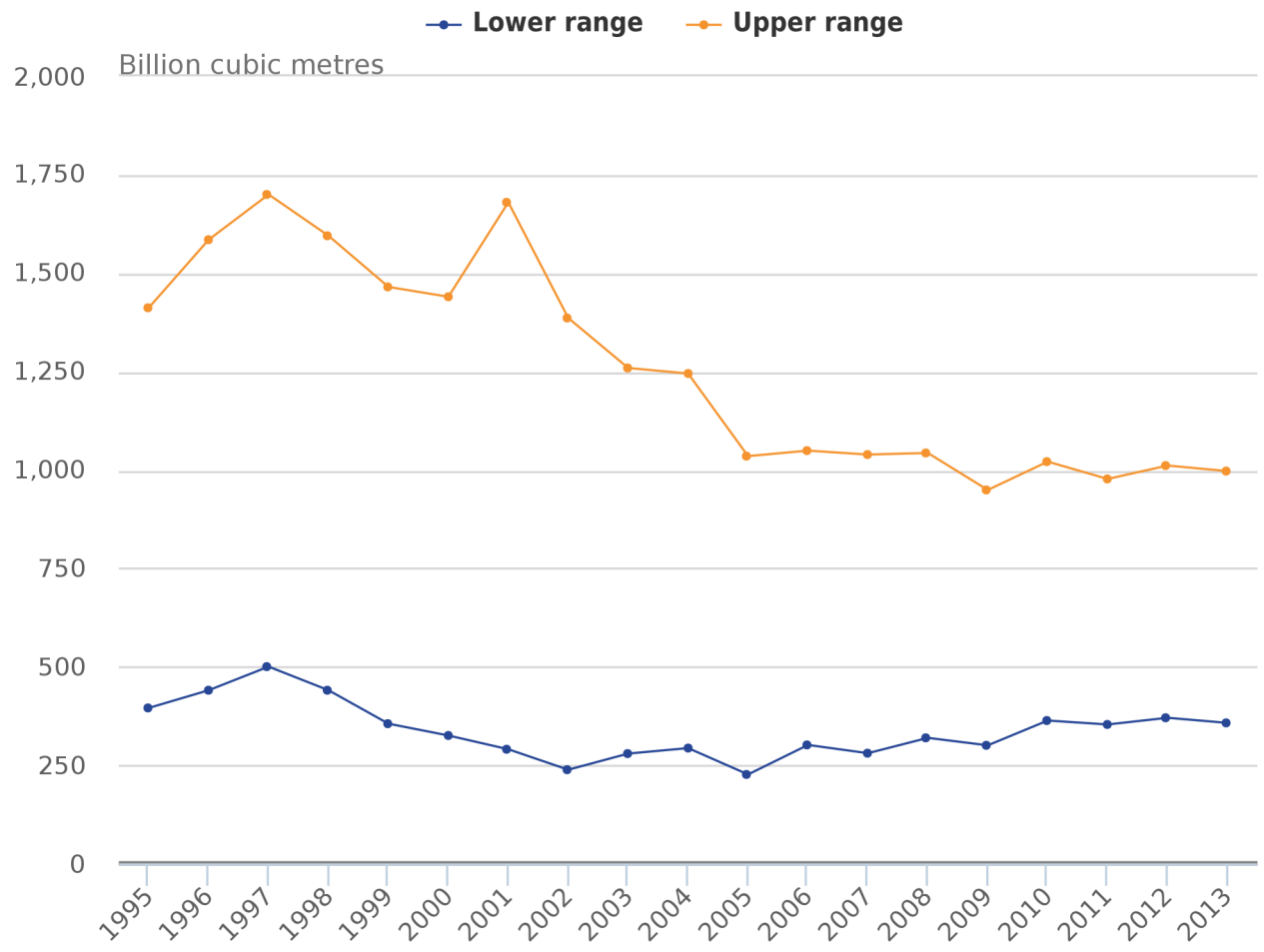
Source: Department of Energy and Climate Change (DECC)

Undiscovered gas resources

Undiscovered gas resources are estimated to have been 640 bcm in 2013, lying between the upper and lower limits of 997 and 357 bcm respectively (Figure 14.4). The lower range was 3.5% lower than in 2012 where the estimate stood at 370 bcm. The upper estimate for gas was estimated to be 1.4% lower than in 2012 where the estimate stood at 1,011 bcm.

Figure 14.4: Estimates of undiscovered gas resources, 1995 to 2013

United Kingdom



Source: Department of Energy and Climate Change

Monetary Valuation of Oil and Gas (experimental statistics)

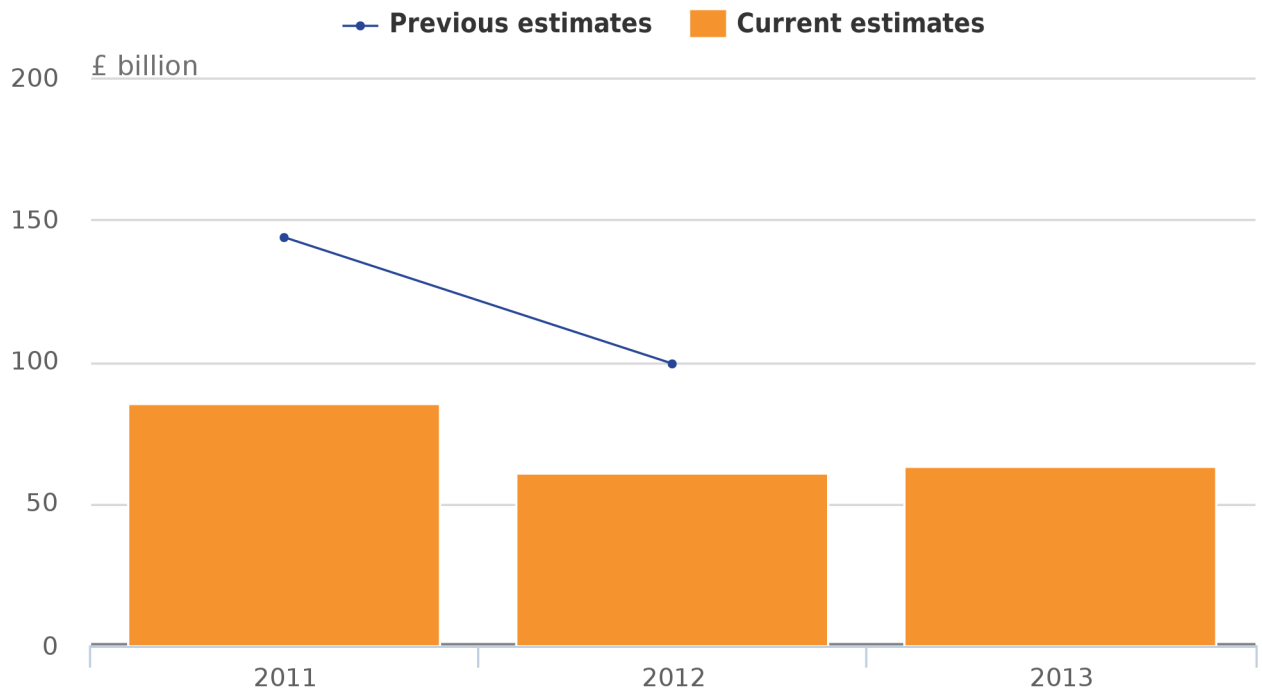
This section presents the monetary valuation for UK Continental Shelf oil and gas. It is estimated using the residual method in line with the System of Environmental-Economic Accounting (SEEA). A joint accounting structure has been adopted as oil and gas are often extracted jointly and so identifying extraction costs for each resource is not possible. The valuation methodology used follows that outlined by Khan, Greene and Hoo (2013) 2. A subsequent paper by Greene and Johnson (2014)3 recommended the use of a 3-year moving average to calculate the cost of capital to better reflect the decisions which would be made by investors. However, as the current bond yields (from which the cost of capital is calculated) are abnormally low and thus not reflective of future bond yields, a 10-year moving average has been adopted, as outlined in the methodology paper published by Khan, Greene and Hoo (2013).

The data used in valuing oil and gas in monetary terms are sourced from the Office for Budget Responsibility (OBR) 2014 Fiscal Sustainability Report. The OBR forecast figures are based on a number of components, one of which is the dollar price of oil – a volatile component. In light of this, we have revalued estimates for the monetary value for oil and gas previously presented in Monetary Valuation of UK Continental Shelf Oil and Gas Reserves. We are currently undertaking research to improve the methodology discussed in the work of Greene and Johnson (2014). We welcome any comments on future improvements of the methodology.

The value of remaining oil and gas in 2013 was estimated at £63.2 billion, 3.5% higher than the revalued figure for 2012, which stood at £61.1 billion. The revalued estimate for 2011 was £85.6 billion. Figure 14.5 illustrates the difference between the previous valuations for oil and gas in 2011 and 2012 and the current estimates for 2011 to 2013.The lower revaluations could be attributed to falls in oil and gas production through 2012 and 2013.

Figure 14.5: Current and previous monetary estimates for oil and gas, 2011 to 2013

United Kingdom



Source: Department of Energy and Climate Change (DECC)

Notes for Oil and gas asset accounts

1. For further information regarding undiscovered oil reserves please visit the GOV.UK website
2. Khan, Greene and Hoo (2013) Monetary Valuation of UK Continental Shelf Oil and Gas Reserves (256.3 Kb Pdf)
3. Greene and Johnson (2014 (73.8 Kb Pdf)

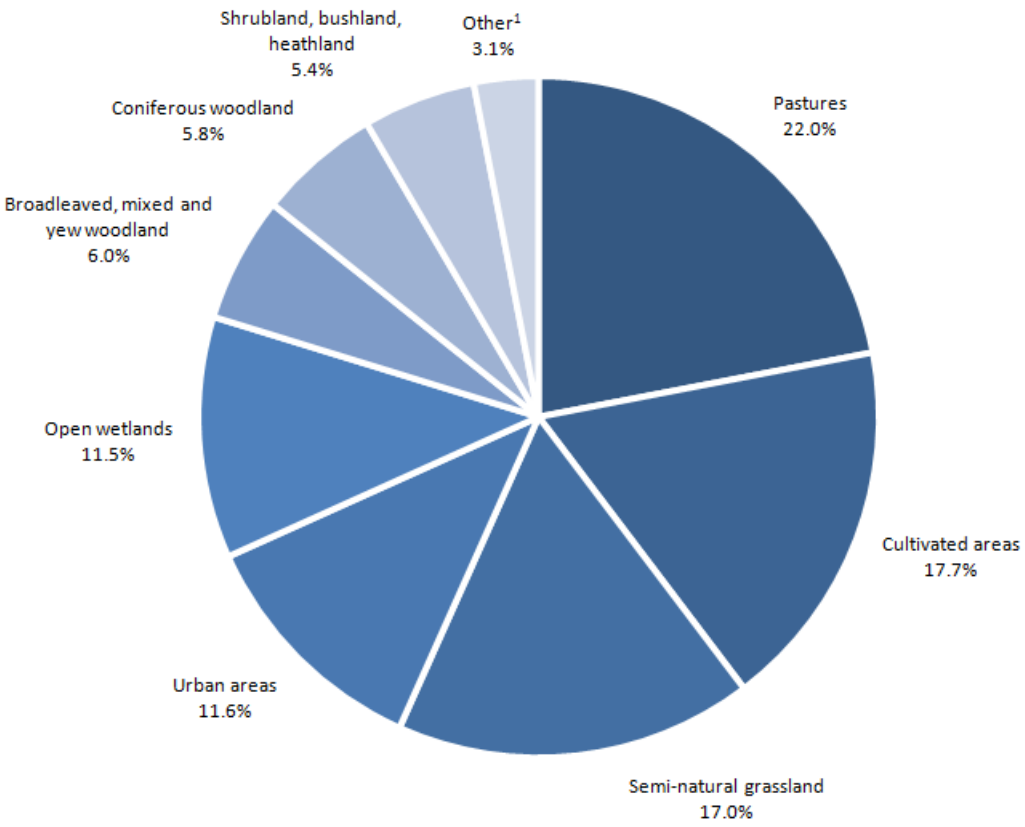
17. Land cover

Main points:

- Pastures and semi-natural grassland occupy close to 40% of the total area of the UK
- Urban and related developed areas make up 11.6% of the UK

Figure 15.1: Land cover, 2007

United Kingdom



Source: ONS, UK Natural Capital – Land Cover in the UK

Notes:

1. Other includes barren land and sparsely vegetated areas, inland water bodies, coastal margins and unknown

Following the System of Environmental-Economic Accounting Central Framework (SEEA CF), land cover can be defined as “the observed physical and biological cover of the Earth’s surface and includes natural vegetation and abiotic (non-living) surfaces”[1] . Although land commonly refers to only terrestrial areas, SEEA CF also applies this term to inland water resources and, in some cases, extends to include coastal waters up to the country’s Exclusive Economic Zone (EEZ).

The dominant habitat in the UK is grassland (Figure 15.1). Pastures and semi-natural grassland occupy 9.52 million hectares, which corresponds to 39.0% of the total area of the UK. Cultivated areas account for 17.7% of the area of the UK (4.33 million hectares) while urban and related developed areas make up 11.6% of the UK (2.83 million hectares), an area similar to that covered by, woodlands or open wetlands. Shrubland, bushland and heathland cover 5.4% of the UK area. Inland waters, barren land and coastal margins account for 3.1% of the area of the UK.

Between 1998 and 2007 the UK land cover has seen some changes. The area of pastures and semi-natural grassland increased by about 295,000 hectares (5.8%) and 155,000 hectares (3.9%) respectively. Correspondingly, the cultivated land area (herbaceous and permanent crops) decreased by over 560,000 hectares (11.5%), resulting in a reduction to cultivated land. The area of broadleaved woodland increased by approximately 94 thousand hectares (6.9%) over the period.

Further information on Land Cover in the UK can be found on our website.

18. Freshwater ecosystem asset and services accounts

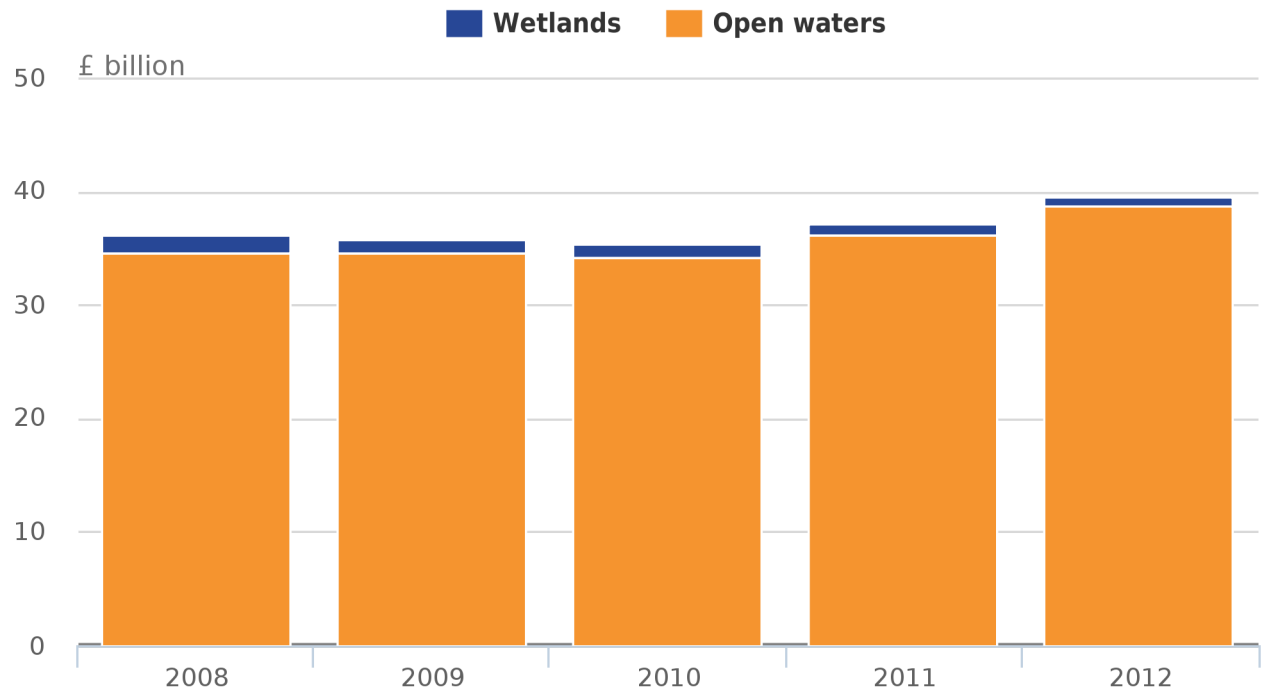
Freshwater ecosystems consist of wetlands, open waters and floodplains. The purpose of developing these accounts is to offer a consistent method of analysing the significance of freshwater ecosystems in the UK. Floodplains were excluded from the initial estimates for freshwater ecosystems due to data availability and the risk of double counting. The accounts have been developed on the basis of current data availability.

By selecting a number of indicators, an initial non-monetary freshwater asset account provides a mixed picture of the conditions of UK freshwaters between 2008 and 2012. The initial accounts also provided a monetary value for UK freshwaters. The asset value of UK freshwaters is estimated at nearly £39.5 billion in 2012, 9.6% higher than in 2008. This is mainly due to an increase in the asset value of water abstraction. Freshwater ecosystems provide a range of services, of which the most important (in terms of monetary value) are the provision of water and the use of the ecosystem for recreational visits. For both of these services, the value of services provided by open waters was greater than those provided by wetlands.

The full publication on Freshwater ecosystem assets and services account was published in March 2015, which fully describes the scope, composition and methodology of the Freshwater estimates.

Figure 16.1: Monetary estimates of freshwaters, 2008 to 2012 (2012 prices)

United Kingdom



Source: Office for National Statistics

19. Timber asset accounts

- In 2014 the total stock of standing timber resource in the UK was estimated at 604.7 million cubic metres overbark
- Between 2013 and 2014 the total stock of standing timber resource increased by 5.7 million cubic metres overbark (1.0%), as natural growth exceeded removals and other losses
- The monetary value of all UK timber resources was estimated to be £7.5 billion in 2014, an increase of 3.3% compared to 2013

Introduction

These accounts have been developed in accordance with the System of Environmental Economic Accounting (SEEA) Central Framework , while showing some flexibility in its implementation due to UK specific context and needs.

The compilation of the non-monetary timber asset account can help to monitor changes in the physical extent of UK timber resources, whilst the monetary timber asset account allows the value of UK timber resources to be estimated.

This valuation is based upon the understanding that, in the UK all timber resources can theoretically be regarded as available for wood supply, although in practice harvesting of timber is not expected to reach these levels. This approach is an update of the earlier estimates by Khan, Greene and Hoo, 2013 . It differs to the approach adopted within the woodland ecosystem accounts, whereby the valuation only applies to the timber which is expected to be harvested as a woodland ecosystem service.

Non-monetary timber asset account

The total stock of standing timber resource was estimated at 604.7 million cubic metres overbark in 2014. Of the total stock of standing timber resources 348.9 million cubic metres overbark (57.7%) were coniferous timber (also known as softwood) and 256.2 million cubic metres overbark (42.3%) broadleaf timber (or hardwood).

The non-monetary asset account for UK timber resources for 2013 to 2014, which is based on the methodology we published in June 20133, is displayed in Table 17.1.

Table 17.1 shows that the majority of removals (harvesting) were coniferous timber (or softwood) - a total of 12.6 million cubic metres overbark of coniferous timber were removed compared to broadleaf (or hardwood) removals of 0.5 million cubic metres overbark (quoted figure in text has been corrected on 9 July 2015 at 14:30). Natural growth is estimated at 20.4 million cubic metres overbark and exceeded the reduction in standing timber resources, which amounted to 14.7 million cubic metres overbark.

Table 17.1 Non-monetary timber asset account, 2013-14

United Kingdom

Million cubic metres overbark

2013-2014	Type of timber resources				Total
Species Types	Conifers		Broadleaves		
Ownership Types	Public	Private	Public	Private	
Opening stock of timber resources as at 1 April 20131	130.5	217.6	13.3	237.8	599
Additions to stock					
Nautral growth	5.5	9.2	0.3	5.4	20.4
Reclassification	-	-	-	-	-
Total additions to stock	5.5	9.2	0.3	5.4	20.4
Reductions in stock					
Removals[2]	5.4	7.2	0.1	0.5	13.1
Fellings residues[2]	0.6	0.8	0	0.1	1.5
Natural losses	-	-	-	-	0.1
Catastrophic losses[3]	-	-	-	-	-
Reclassifications	-	-	-	-	-
Total reduction in stocks	6	8	0.1	0.5	14.7
Closing stock of timber resources as at 31 March 2014	130	218.9	13.6	242.6	604.7

Sources: National Forest Inventory (Forestry Commission, 2011); UK Wood Production and Trade: 2014 provisional figures (Forestry Commission, 2015); 50-year forecast of softwood timber availability (Forestry Commission, 2014); 50-year forecast of hardwood timber availability (Forestry Commission, 2014).

Notes:

1. Timber is defined as stemwood with a minimum top diameter of 7 cm. Therefore new planting and restocking are not captured in this account because the trees are too small to contain timber

2. The data for removals and fellings relate to calendar years. For simplicity, it is assumed that felling activity is similar throughout the year and that the figures for financial years are similar to those for calendar years.

3. No data are currently available on catastrophic losses, although such losses are expected to be very small.

4. Components may not sum to totals due to rounding.

Monetary timber asset account

The value of timber presented here is its value as standing timber before felling, extraction and processing, and represents the value accruing from the timber resource itself.

Table 17.2 shows the experimental monetary asset account for UK timber resources for 2011 to 2012, which is based on the methodology we published in June 2013 . It relies on the physical asset account outlined above.

This account is currently under development and includes a number of underlying assumptions:

- the stumpage price is the same across all timber resources - a moving 5 year average is used
- the stumpage price is received when the timber is harvested -the harvesting age is 50 years and discounted using HM Treasury (2003) discount rates
- all timber is available for wood supply
- as the timber grows until it is harvested, the expected volume of standing timber for each age class is fixed at harvesting age

Table 17.2: Timber resources monetary account, 2013-14

United Kingdom

	£ million (2014 prices)[3]
Opening Balance as at 31 March 2013	7,254
Additions to stock	
Natural growth	325
New planting & restocking (reclassification)	124
Total additions to stock	448
Reductions in stock	
Removals[1]	186
Fellings residues[1]	21
Natural losses	2
Catastrophic losses[2]	
Reclassifications	-
Total reduction in stocks	208
Revaluation	-
Closing balance as at 31 March 2014	7,494

Source: National Forest Inventory (Forestry Commission, 2011); UK Wood Production and Trade: 2014 provisional figures (Forestry Commission, 2015); Woodland Area, Planting & Restocking - 2015 edition (Forestry Commission, 2015); 50-year forecast of softwood timber availability (Forestry Commission, 2014); 50-year forecast of hardwood timber availability (Forestry Commission, 2014); Timber Price Indices: Data to March 2015 (Forestry Commission, 2015;. ONS calculations.

Notes:

1. The data for removals and fellings relate to calendar years. For simplicity, it is assumed that felling activity is similar throughout the year and that the figures for financial years are similar to those for calendar years.

2. No data are currently available on catastrophic losses, although such losses are expected to be very small.

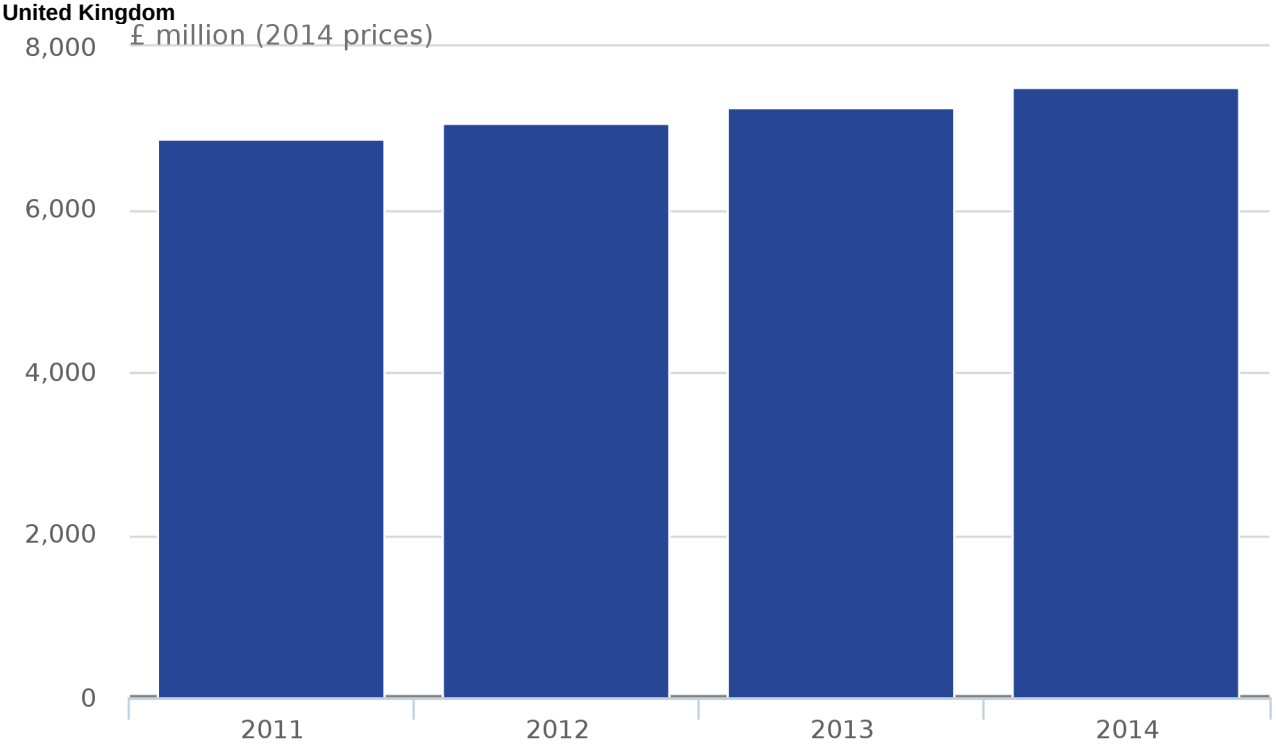
3. Components may not sum to totals due to rounding.

Table 17.2 shows that the experimental monetary value of UK timber resources at 2014 is estimated to be around £7.5 billion, up by 3.3% compared to 2013 to 2014, as natural growth and new planting exceeded removals and other losses.

Figure 17.1 shows how the monetary value of UK timber resources has changed in recent years. The monetary value of UK timber resources has been increasing steadily between 2011 and 2014, from £6.9 billion (2014 prices) in 2011 to £7.5 billion in 2014, with an annual growth rate of 3.3% between 20013 and 2014.

Figure 17.1: Monetary value of timber resources, 2011 to 2014

United Kingdom



Source: National Forest Inventory (Forestry Commission, 2011); UK Wood Production and Trade: 2014 provisional figures; Woodland Area, Planting & Restocking - 2015 edition (Forestry Commission, 2015); 50-year forecast of softwood timber availability (Forestry Commission, 2014); 50-year forecast of hardwood timber availability (Forestry Commission, 2014); Timber Price Indices: Data to March 2015 (Forestry Commission, 2015); ONS calculations.

Notes for Timber asset accounts

1. United National (2014): System of Environmental-Economic Accounting 2012 Central Framework
2. Khan, Greene, Hoo (2013) Monetary valuation of UK timber resources
3. Khan and Hoo: Measuring UK Woodland Area and Timber Resources

20. Woodland ecosystem asset and services accounts

Main points

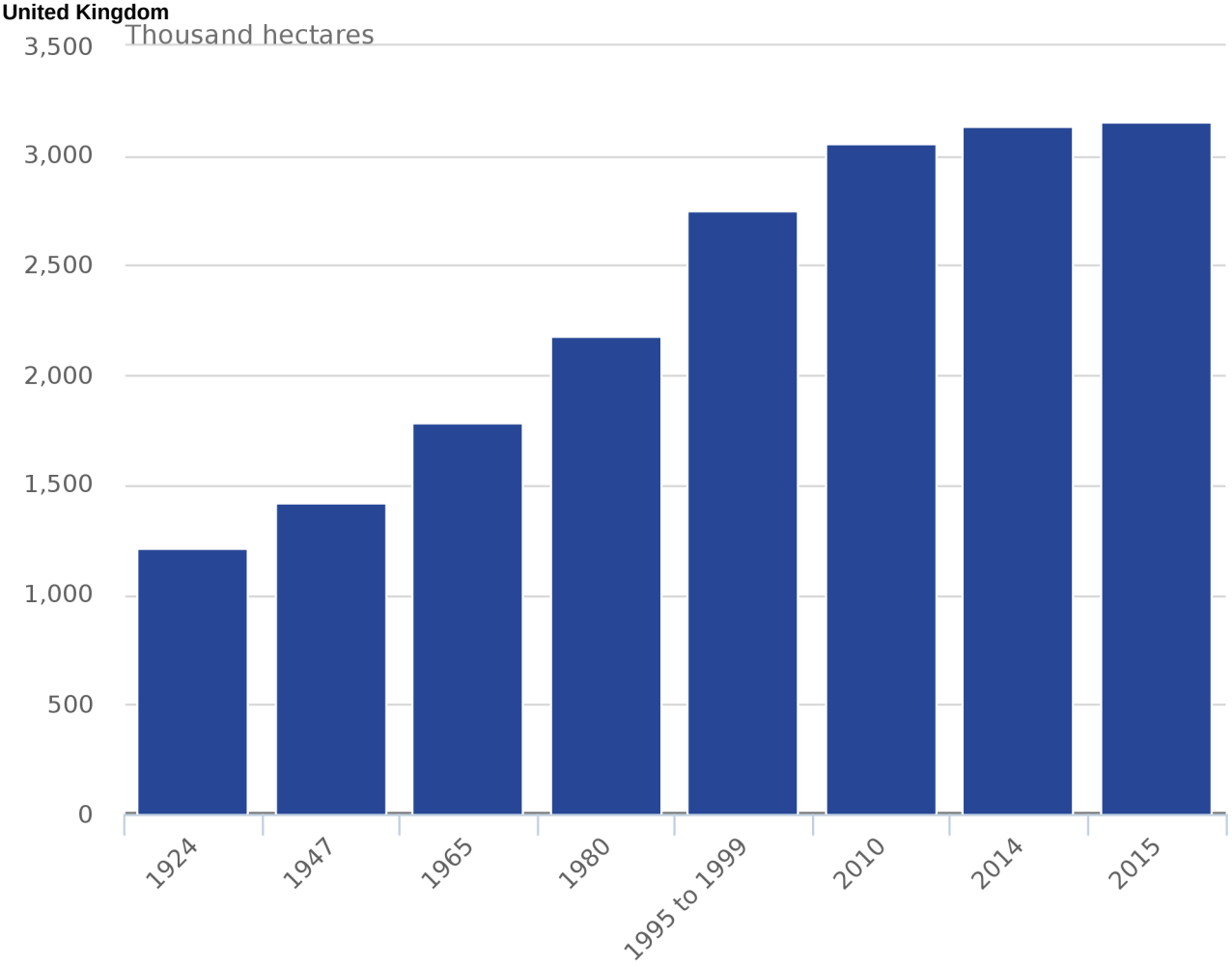
- Woodland area was 12.8% of total UK area in 2015; 3.16 million hectares
- The estimated net present value of these three woodland ecosystem services (timber, carbon sequestration and recreation) was £92 billion in 2013

Woodland non-monetary ecosystem asset account

Figure 18.1 shows that the area of woodland grew steadily over the past century in the UK. In 2015, woodland area amounts to 3.16 million hectares, 12.8% of total UK area. Much of the increase between 1924 and 2015 can be explained by new conifer plantations created between the 1950s and 1980s. Changes in the definitions and methodology used by each woodland survey may also explain part of the apparent changes in woodland area.

Figure 18.1: Woodland area, 1924 to 2015

United Kingdom



Source: Forestry Commission and NI Forest Service publications - GB Censuses of Woodland 1924 to 1980; National Inventory of Woodland and Trees 1995-99; Woodland grant schemes; Woodland area, Planting and Restocking: 2015 edition; UK Standard Area Measurements (ONS).

Notes:

1. Percentage of the total surface area excluding inland water.

Table 18.1 shows the UK woodland area account for 2014 to 2015, which is based on the methodology we published in June 2013[1]. This methodology paper explores the limitation of this approach and the need for a balancing item in more detail.

Table 18.1: Woodland area account, 2014 to 2015

Thousand hectare

Species type	Conifers		Broadleaves		Total
Ownership	Public	Private	Public	Private	
Opening stock as at 1 April 2014	742	866	129	1402	3,138
Additions to stock					
Total additions to stock	0.3	2.3	0.1	7.6	10.3
Reductions in stock					
Total reduction in stocks					
Balancing item	0.7	2.7	-0.1	2.4	6.7
Closing stock as at 31 March 2015	743	871	129	1412	3,155

Source: Forestry Commission

Of the UK woodland area in 2015, 27.6% was publicly owned or managed (by the Forestry commission in England and Scotland, by Natural Resources Wales and by the Forest Service in Wales and Northern Ireland). Coniferous woodland makes up 51.2% of the UK woodland area.

Between 2014 and 2015, woodland area increased by 17,000 hectares to 3,16 million hectares. Additions to stock relate to new planting, which amounted to 10,300 hectares, and do not include additions resulting from changes in ownership. The largest increase comes from new planting of broadleaves in privately owned woodland.

Reliable estimates of reduction in stock (or woodland loss) are not available. A balancing item has been included to record any differences between the opening and closing stocks resulting from changes in ownership or changes in assumptions about the conifer and broadleaf breakdown of woodland area.

Woodlands ecosystem services accounts

Ecosystem services are central to the ecosystem accounting framework since they provide the link between ecosystem assets on the one hand and the benefits received by society on the other. People benefit from both the materials that ecosystems provide (such as the harvesting of timber from woodland) and from the outcomes of natural processes (such as the benefits from clean air that has been filtered by an ecosystem).

Ecosystem services that contribute to human well-being are classified into:

- **provisioning services** – these are generally the material products that ecosystems provide, for example, food (crops, fish), materials (timber), or water
- **regulating services** – these are the benefits provided by ecosystems in the regulation of various aspects of the planet, for example, climate regulation (carbon sequestration), noise and air pollution reduction, and flood hazard reduction
- **cultural services** – non-material benefits, for example, through cultural heritage, recreation or aesthetic experience
- **supporting services** – such as biodiversity, soil function

For three of the most significant services listed in the methodology paper (273.5 Kb Pdf) we published in 2013, reasonably robust estimates can be generated on an annual basis: these are timber production, carbon sequestration and recreation. Timber quantities are estimated through surveys of removals by the industry, and are measured in terms of the felled volume of standing timber, including the bark, in cubic metres. Carbon sequestration estimates are generated through modelling for the Greenhouse Gas emissions inventory, taking account of the type and age profile of the trees in our forests. Recreation is measured in terms of the number of visits we make to woodlands in the UK.

Woodland non-monetary ecosystem services account

The main movements within the account for 2013 were:

- 14 million cubic metres of timber were removed from UK woodlands in 2013, of which 0.6 million was from broadleaved species, or hardwood
- UK woodlands removed 16.9 million tonnes of carbon dioxide equivalent (CO2e) from the atmosphere in 2013
- about 570 million visits were made to UK woodlands in 2013

Table 18.2 shows the non-monetary services accounts for UK woodland ecosystems for 2004 to 2013 for these 3 services (recreation only from 2009). Timber removals have increased in the last few years from 10.5 million cubic metres in 2008 to 14 million cubic metres in 2013. Carbon sequestration [2] has fallen over the same period from 17.8 million tonnes CO_2e in 2008 to 16.9 million tonnes CO_2e in 2013.

Table 18.2: Woodland non-monetary ecosystem services account, 2004 to 2013

United Kingdom

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Biomass for timber (million cubic metres overbark standing)										
Softwood removals	10	9.9	10.1	10.7	10.1	10.3	11.3	12.3	12.3	13.4
Hardwood removals	0.6	0.7	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
Total timber removals	10.5	10.5	10.6	11.2	10.5	10.9	11.9	12.9	12.9	14
Carbon sequestration (million tonnes carbon dioxide equivalent)	18.2	18.3	18.1	18	17.8	17.6	17.7	17.6	16.6	16.9
Recreation (million visits to woodland)						482	495	544	542	574

Source: Office for National Statistics

Woodland monetary ecosystem services account

These 3 services provided by woodland ecosystems in the UK can be valued in a variety of ways [3]. For timber, the value can be approximated by the stumpage price for coniferous wood, which is assumed to apply to all the timber that is harvested. For carbon sequestration, the value of carbon removed can be based upon the non-traded carbon price estimated by the Department of Energy and Climate Change (DECC) [4]. For recreation, the average value of each visit can be taken from a meta-analysis carried out by Sen et al. (2014) [1,2,5].

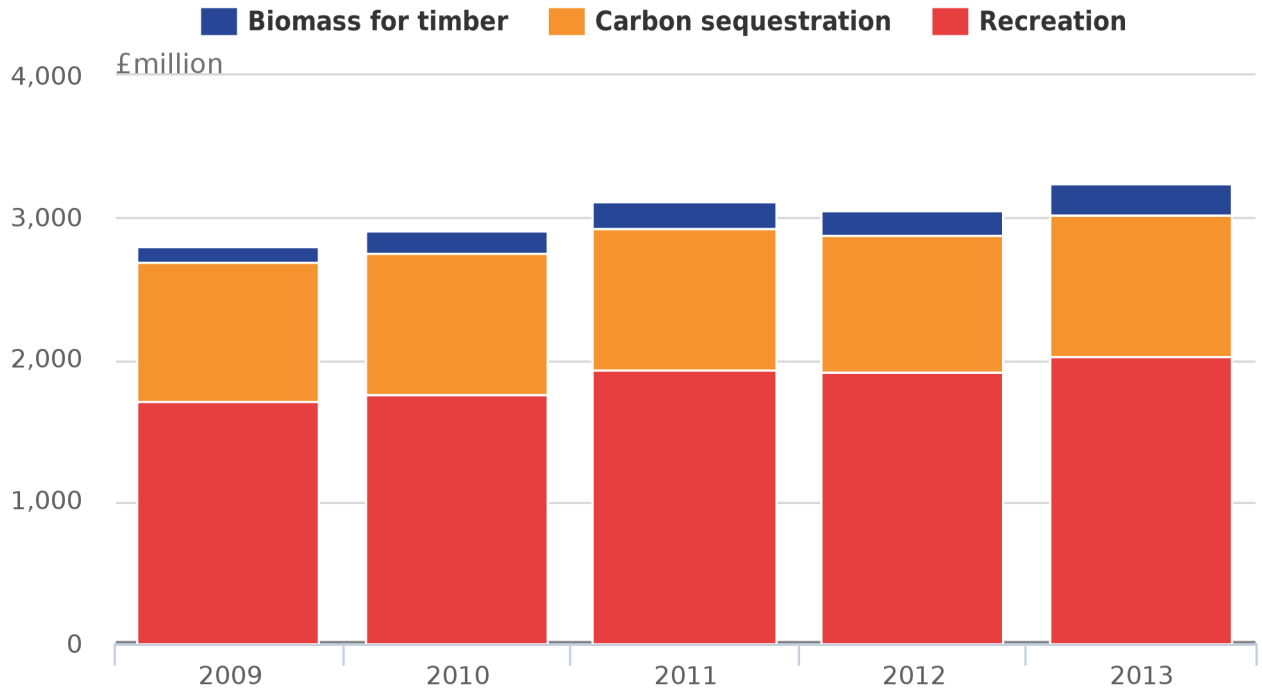
The monetary services account shows (Figure 18.2) that the value of the timber removed from UK woodlands is only a small part of the total value of these 3 ecosystem services provided by UK woodlands. Total value of all 3 services in 2013 was £3,239 million, up from £2,794 million in 2009 (in 2013 prices).

The split of total value between the 3 services is:

- timber removals were valued at £216 million in 2013, up from £79 million (in 2013 prices) in 2004. This increase is due mainly to an increase in the stumpage price over the period
- carbon removals were valued at £995 million in 2013, up from £911 million (in 2013 prices) in 2004. This increase is due to the increase in the value of carbon over the period, with a 7% fall in the volume of sequestrated gases
- recreation services were valued at £2,028 million in 2013, up from £1,701 million (in 2013 prices) in 2009. This increase is entirely due to the change in the number of visits made, as the value of each visit has been assumed to be constant over the period

Figure 18.2: Value of 3 woodland ecosystem services, 2009 to 2013

United Kingdom



Source: Office for National Statistics

Notes:

1. Prices are in 2013 constant prices

Table 18.3 shows the monetary services accounts for UK woodland ecosystems for 2004 to 2013 for these 3 services (recreation only from 2009).

Table 18.3: Value of 3 UK woodland ecosystem services, 2004 to 2013

United Kindom

£ million

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Biomass for timber	79	91	98	157	106	112	170	186	174	216
Carbon sequestration	911	940	948	960	970	981	997	1006	964	995
Recreation						1701	1749	1922	1915	2028
Total for the three services						2794	2916	3115	3053	3239

Source: Office for National Statistics

Notes:

1. Prices are in 2013 constant prices

Asset value of UK woodland ecosystem services

The total value of woodland ecosystems in the UK can be estimated by calculating the Net Present Value of each of the service flows over a prescribed period (in this case 50 years). More detail on this methodology, which has been revised from earlier work, can be found in Note 3 below.

A partial and experimental estimate of the total value of woodland ecosystems in the UK is £92 billion in 2013, based on the Net Present Value of three key services (timber, carbon sequestration and recreation) over a 50 year period. Table 18.4 provides estimates on a comparable basis for 2009 to 2013.

Table 18.4: Asset value of UK woodland ecosystem services, 2004 to 2013

£ billion

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Biomass for timber	1.9	2.2	2.8	2.9	3	3.1	3.5	4.1	4.4	5.1
Carbon sequestration	30.5	31.1	31.7	32.3	33	33.6	34.3	35	35.7	35.9
Recreation						43.8	45.4	47.1	48.9	50.7
Total for the three services						80.5	83.3	86.2	89.1	91.7

Source: Office for National Statistics

Notes:

1. Prices are in 2013 constant prices

2. Valuation is based on the Net Present Value of the three key services over a 50 year period (discounted)

Notes for Woodland ecosystem asset and services accounts

1. Khan and Hoo (2013): Measuring UK Woodland Area and Timber Resources (197.6 Kb Pdf)

2. National Atmospheric Emissions Inventory (2014): Projections of emissions and removals from Forest Land

3. The three services of woodland ecosystems covered in the accounts (timber production, carbon sequestration and recreation) do not include the value of the services to the wood products or tourism sectors and other sectors further down the economic production chain

4. Department of Energy and Climate Change (2014). Carbon Data tables 1-20: supporting the toolkit and guidance

5. Sen, A., Harwood, A. R., Bateman, I. J., Munday, P., Crowe, A., Brander, L., Raychaudhuri, J., Lovett, A.A. Foden J. and Provins, A. (2014). Economic assessment of the recreational value of ecosystems: Methodological development and national and local application. Environmental and Resource Economics, 57(2), 233-249

6. Sen, A., Harwood, A. R., Bateman, I. J., Munday, P., Crowe, A., Brander, L., Raychaudhuri, J., Lovett, A.A. Foden J. and Provins, A. (2014). Economic assessment of the recreational value of ecosystems: Methodological development and national and local application. Environmental and Resource Economics, 57(2), 233-249

7. Forestry Commission (2015). Timber Price Indices

8. Natural England (2015), Monitor of Engagement with the Natural Environment

9. Department of Energy and Climate Change (2014). Carbon Data tables 1-20: supporting the toolkit and guidance

10. National Atmospheric Emissions Inventory (2014). Projections of emissions and removals from the LULUCF sector

11. Office for National Statistics (2013). National Population Projections (no change variant)

12. HM Treasury (2003). The Green Book: Appraisal and Evaluation in Central Government

21. Background notes

1. Details of the policy governing the release of new data are available by visiting www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html or from the Media Relations Office email: media.relations@ons.gsi.gov.uk