

Compendium

UK Environmental Accounts

Estimates of oil and gas reserves, energy consumption, atmospheric emissions and material flows.



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1 . Environmental accounts

Environmental accounts are:

- “satellite accounts” to the main national accounts
- compiled in accordance with the [System of Environmental-Economic Accounting \(SEEA\)](#), which closely follows the [United Nations System of National Accounts \(SNA\)](#).

Environmental accounts measure:

- the impact the economy has on the environment
- how the environment contributes to the economy
- how society responds to environmental issues by using the accounting framework and concepts of the national accounts

Environmental accounts are used to:

- inform sustainable development policy
- model impacts of fiscal or monetary measures
- evaluate the environmental impacts of different sectors of the economy

Environmental accounts data:

- are mostly provided in units of physical measurement (mass or volume)
- can be provided in monetary units, where this is the most relevant or only data available

[Tables 12.1 to 12.5](#) show estimates of oil and gas reserves, energy consumption, atmospheric emissions and material flows. More data, information and other environmental accounts (including fuel use, environmental goods and services sector, environmental taxes and environmental protection expenditure) can be found on the [UK Environmental Accounts release page](#).

2 . Temperature

Figure 12.1 shows the change in mean air temperature between 1990 and 2016. This measure provides a useful context for some of the changes observed across the environmental accounts. For example, the average temperature in the UK fell to 8.0 degrees Celsius (°C) in 2010 from 9.2°C in 2009, which contributed to the increases in energy consumption and greenhouse gas emissions observed during that period.

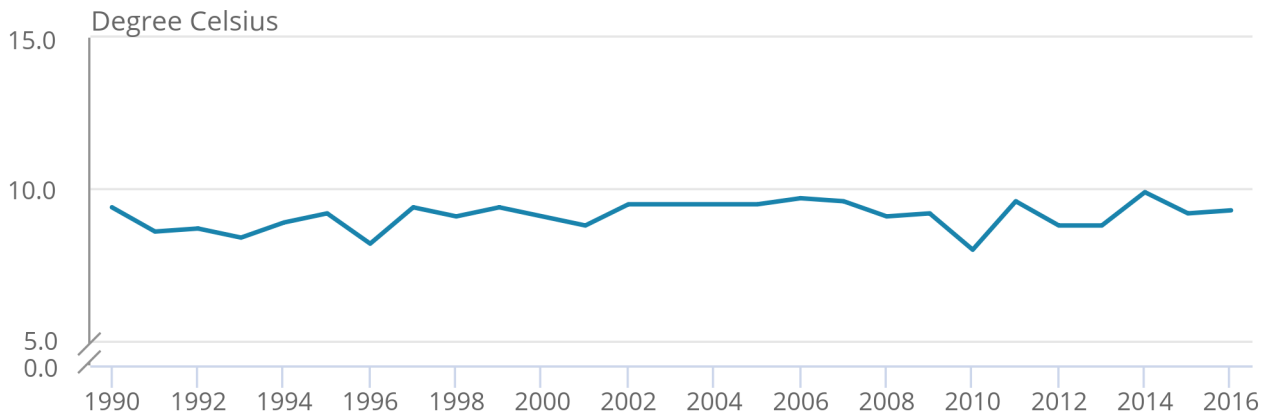
At the same time, UK gross domestic product (GDP) started to recover after the economic downturn, which may also explain the increases in consumption and emissions. The average air temperature in 2016 was slightly higher than in 2015, up to 9.3°C from 9.2°C. This was still below the record high of 9.9°C in 2014.

Figure 12.1: Mean air temperature

UK, 1990 to 2016

Figure 12.1: Mean air temperature

UK, 1990 to 2016



Source: Met Office

3 . Oil and gas reserves

[Table 12.1](#) presents non-monetary estimates of the oil and gas reserves and resources in the UK. “Resources” are minerals that are potentially valuable and could eventually be extracted, whereas “reserves” refer to discovered minerals that 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 but have a more than 50% chance of being produced
- possible reserves cannot be regarded as probable at present, but are estimated to have a significant (but less than 50%) chance of being technically and commercially producible

Last year the Oil and Gas Authority developed a new category of oil and gas reserves, known as “contingent resources”. Contingent resources are defined as “significant discoveries where development plans are under discussion”. In the past these would have been included as “probable reserves”.

Oil is defined as both oil and the liquids that can be obtained from gas fields. Shale oil is not included in the estimates. Total (discovered; proven and probable, plus possible reserve, contingent resources and undiscovered) oil reserves and resources for 2016 were estimated to be between 1,059 million tonnes and 1,658 million tonnes. Both upper range and lower range for total oil reserves have decreased due to a new reporting method for the years 2013 to 2016.

Gas includes gas expected to be available for sale from dry gas fields, gas condensate fields, oil fields associated with 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 589 billion cubic metres (bcm) and 1,050 bcm in 2016. Both upper range and lower range for total oil reserves have decreased due to a new reporting method for the years 2013 to 2016.

4 . Energy consumption

[Table 12.2](#) presents energy consumption by industry for the UK. Energy consumption is defined 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. The term “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. On the other hand, “reallocated use of energy” means that 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 of primary fuels and equivalent was 202.4 million tonnes of oil equivalent (Mtoe) in 2016, which was 1.1% lower than in 2015. Fossil fuels remained the dominant source of energy supply, although their use continued to fall. Energy consumption from fossil fuels in 2016 was at the lowest level since 1990 at 167.1 Mtoe. This represented 82.6% of total energy consumption.

Overall, direct use of energy from fossil fuels has dropped 18.9% since 1990, whereas total energy consumption has fallen 9.9% between 1990 and 2016. This fall in energy from fossil fuels is driven largely by the energy supply and manufacturing sectors. The energy supply sector continued its downward trend in 2016, with a 9.5% reduction on 2015 to 32.3 Mtoe, 42.5% below 1990 levels.

Although fossil fuels are the main source of energy for consumption, other sources (including nuclear, net imports, and renewable and waste sources) are becoming increasingly important. Total energy consumption from other sources was 35.3 Mtoe in 2016, which was 1.4% higher than in 2015. Approximately half of this (52.1 %) came from renewable and waste sources³. The largest annual increase in this category occurred between 2014 and 2015, when energy consumption from renewable and waste sources rose by 19.9%.

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. Renewable sources include: solar photovoltaic, geothermal and energy from wind, wave and tide, hydroelectricity, wood, charcoal, straw, liquid biofuels, biogas from anaerobic digestion and sewage gas. Landfill gas, poultry litter and municipal solid waste combustion have also been included within this definition.

5 . Atmospheric emissions

[Tables 12.3 and 12.4](#) show emissions of greenhouse gases, acid rain precursors (ARP) and other pollutants by industry for the UK.

Atmospheric emissions of greenhouse gases are widely believed to contribute to global warming and climate change. In 2016, emissions of greenhouse gases were estimated to be 576.3 million tonnes of carbon dioxide equivalent (Mt CO₂e), the lowest level since 1990. 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 8.1%. Between 2015 and 2016, emissions decreased by 23.2 Mt CO₂e (3.9%). This was due primarily to reductions in carbon dioxide emissions from the energy supply ¹ and manufacturing sectors.

Carbon dioxide (CO₂) was the dominant greenhouse gas, accounting for 84.7% of the UK's total greenhouse gas emissions in 2016. The remainder of greenhouse gas emissions comprised methane (8.9%), nitrogen oxide (3.6%) and fluorinated gases (2.6%).

Other important atmospheric emissions include acid rain precursors (ARPs). Acid rain is caused primarily by emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x) and ammonia (NH₃) and can have harmful effects on the environment. Table 12.4 shows ARP emissions. For comparability, all figures are weighted according to their acidifying potential and presented as sulphur dioxide equivalents (SO₂e).

Since 1990, total ARP emissions have decreased sharply, falling by 75.8%, from 7.1 million tonnes of sulphur dioxide equivalent (Mt SO₂e) to 1.7 Mt SO₂e in 2016. The reduction in ARPs was driven largely by a reduction in SO₂ emissions, which fell by 93% between 1990 and 2016. This reduction can be linked to policy initiatives ² to control sulphur and nitrogen oxides emission levels, discourage the use of high-sulphur fuels, control the sulphur content of those fuels and encourage the adoption of cleaner technologies. For example, electricity generation was switched from coal to gas, which generates fewer ARPs. As a result, ARP emissions from the energy supply sector fell 46.4% between 2015 and 2016, and 96.3% between 1990 and 2016.

NO_x have also seen a large decline (63.3%) between 1990 and 2016. Moreover, as internal combustion engines are an important emitter of NO_x, some of this reduction may be attributed to strict standards and policy initiatives, such as European emission standards for motor vehicles, regulating NO_x, particulate matter, and other emissions from road freight vehicles³. This is reflected in an 54.8% decline of emissions from the transport ⁴ sector between the peak of 2004 and 2013. Since then the trend reversed and between 2013 and 2016, NO_x emissions have risen by 16.6% to 363.6 thousand tonnes of SO₂e. In contrast, at the same period, total NO_x emissions have fallen by 6.6%.

Notes for: Atmospheric emissions

1. The “energy supply” sector comprises of electricity, gas, steam and air conditioning supply industries.
2. Policies include UK National Air Quality Strategy Directive on Integrated Pollution Prevention and Control (IPPC) (Directive 2008/1/EC); Directive on industrial emissions 2010/75/EU (IED); UK Pollution Prevention and Control (PPC) regulations; Large combustion plant directive (LCPD, 2001/80/EC); Limiting sulphur emissions from the combustion of certain liquid fuels by controlling the sulphur contents of certain liquid fuels (Directive 1999/32/EC); Annex VI of the MARPOL agreement for ship emissions, augmented by the Sulphur Content of Marine Fuels Directive 2005/33/EC and the introduction of Sulphur Emission Control Areas.
3. Euro1, Euro2, Euro3, Euro4, Euro5, and Euro6 is a family of European emission standards for motor vehicles, regulating NO_x, particulate matter, and other emissions. More can be found in this link: [EUR-Lex](#)
4. The transport sector refers to the standard industrial classification sector ‘transportation and storage’.

6 . Material flows

[Table 12.5](#) presents economy-wide material flow accounts, which estimate the physical flow of materials through the UK economy. The quantity of materials extracted in the UK has been declining gradually and hit its lowest point in 2013 with 418 million tonnes extracted, a decrease of almost 41.8% from 2000. This trend reversed slightly between 2014 and 2015, rising to 452 million tonnes, before falling by 1.3% to 447 million tonnes in 2016.

Domestic extraction is divided into four categories: biomass, non-metallic minerals, fossil energy materials and carriers, and metal ores.

Biomass includes material of biological origin that is not from fossil, such as crops, wood and wild fish catch. In 2016, there were 132 million tonnes of biomass extracted, 7 million tonnes less than in 2015. Of this, crop residues, fodder crops and grazed biomass accounted for 65% (86 million tonnes).

Non-metallic minerals are mainly construction and industrial minerals, including limestone and gypsum, sand and gravel, and clays. There has been an overall fall in extraction of non-metallic minerals since 2000, a 26.5% fall by 2016. However, extraction of non-metallic minerals has been increasing again from the all-time low in 2012. In 2016, there was a 1.4% increase in the extraction of non-metallic minerals (from 221 million tonnes to 224 million tonnes).

Fossil energy materials and carriers include coal, peat¹, crude oil and natural gas. The extraction of these has decreased slightly since 2015 at 91 million tonnes, still 3.9% higher than 2014. However, 2015 was the first increase since 2000 and can be attributed to an increase in the production of crude oil and natural gas liquids from the North Sea due to the opening of new fields. Prior to this increase, extraction of fossil energy materials had fallen 67.1% between 2000 and 2014.

Physical trade balance

Physical imports increased by 27.3% between 2000 and 2016, rising from 221 million tonnes to 281 million tonnes. Contrary to this, physical exports have gradually decreased, peaking at 201 million tonnes in 2002 and falling to 158 million tonnes in 2016 – the lowest point since 2000 and a drop of 21.6%. The rise in imports partly offsets the decline in domestic extraction.

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 imports². 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 21 million tonnes. It generally increased until 2007, before falling between 2008 and 2010 during the economic downturn. Since 2010, the PTB increased, peaking at 151 million tonnes in 2013. However, the PTB has since decreased year-on-year with a 5.9% drop in 2016 from 2015 (to 123 million tonnes). Despite this, the amount of materials and products that were imported (281 million tonnes) was almost twice the amount of materials and products that were exported (158 million tonnes), suggesting that the UK may be becoming more reliant on the production of materials in other countries.

Material consumption

Direct material input (DMI) (domestic extraction plus imports) measures the total amount of materials that are available for use in the economy.

Domestic material consumption (DMC) (domestic extraction plus imports minus exports) measures the amount of materials used in the economy and is calculated by subtracting exports from DMI.

In 2016, the UK consumed 571 million tonnes of material, consisting of 237 million tonnes of non-metallic minerals (41.5%), 171 million tonnes of biomass (30%), 150 million tonnes of fossil fuels (26.4%) and 12 million tonnes of metal ores (2.2%).

Between 2000 and 2016, DMI and DMC decreased by 22.5% and 22.8% respectively. DMI and DMC have gradually declined since the start of the economic downturn in 2008. This indicates that fewer material resources were being used and consumed in the UK economy. DMI and DMC fell most sharply between 2008 and 2009 (decreasing by 11.6% and 12.3% respectively). Between 2015 and 2016, DMI decreased by 1.9%, from 742 million tonnes to 728 million tonnes and DMC decreased by 2.3%, from 584 million tonnes to 570 million tonnes.

Notes for: Material flows

1. For fossil energy materials and carriers (which include coal, crude oil, natural gas and peat) peat estimates were not available for 2016.
2. The physical trade balance (imports minus exports) is defined in reverse to the monetary trade balance (exports minus imports). Physical estimates can differ quite significantly from monetary estimates.

7 . More information

There is more information about environmental accounts on the [UK Environmental Accounts release page](#).

As of this year, we have revised the sector breakdown for the energy and air emissions sections. For example, the former sector “Transport, storage, information and communication” is now broken down to “Transport and storage” and “Information and communication”. This creates more categories where energy consumption and air emissions can be allocated, and therefore provides better granularity of data.

The residency adjustment is included as the UK Environmental Accounts are based on a UK-residency basis (as opposed to a territory basis). This is in line with national accounting principles, allowing environmental impacts to be compared on a consistent basis with economic indicators such as gross domestic product (GDP).

Percentages have been calculated using data rounded to thousand tonnes, so figures may not match those calculated using the linked dataset. Data rounded to thousand tonnes can be found on the [UK Environmental Accounts release page](#).