Environmental accounts on energy use QMI

Quality and Methodology Information for energy use in the UK Environmental Accounts, detailing the strengths and limitations of the data, methods used, and data uses and users.

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1 . Methodology background

- National Statistic: Yes
- Frequency: Annual
- How compiled: Various sources
- Last revised: 13 July 2023

2 . About this Quality and Methodology Information report

This quality and methodology report contains information on the quality characteristics of the data (including the European Statistical System five dimensions of quality (PDF, 3MB)) as well as the methods used to create it. The information in this report will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and users of the data
- understand the methods used to create the data
- decide suitable uses for the data
- reduce the risk of misusing data

3 . Important points

This report aims to provide users of the energy use statistics with information on the usability and fitness for purpose of these estimates.

The energy use statistics form part of the Office for National Statistics (ONS) UK Environmental Accounts. This is part of a set of reports covering the UK Environmental Accounts estimates.

There is quality and methodology information available for other UK Environmental Accounts estimates, including:

- Air emissions
- Material flows
- Environmental Protection Expenditure
- Environmental Goods and Services
- Environmental taxes

4 . Quality summary

Overview

A range of statistics is published in the UK Environmental Accounts on energy use. They show the levels of energy being used by different areas of the economy - for example, how much energy used by UK households in a particular year was generated from renewable sources, or how much energy was used by the manufacturing industry. The main tables cover:

- energy use by industry, source and fuel
- direct use of energy and reallocated energy use (see Annex 5)
- energy from renewable and waste sources and for generation of heat
- energy intensity (see Annex 4)

These are all made available for download as Microsoft Excel files from the Environmental Accounts page.

The main source of information for this reporting is the National Atmospheric Emissions Inventory (NAEI). The NAEI is maintained by Ricardo Energy and Environment on behalf of the Department for Energy Security and Net Zero (DESNZ), formerly known as the Department for Business, Energy and Industrial Strategy (BEIS).

The UN System of Environmental-Economic Accounting (SEEA), together with the UN System of National Accounts (SNA) (and the European System of Accounts), provides a framework for producing internationally comparable statistics on the environment and its relationship with the economy. Since the UK's departure from the EU, there is no longer a mandatory requirement to supply data to Eurostat. However, the Office for National Statistics (ONS) now supplies data to the Organisation for Economic Co-operation and Development (OECD) instead.

Uses and users

(Who is using the data and for what purposes.)

Energy statistics deal with collecting and compiling information on production, imports, exports and domestic use of energy products. Energy balances are published by the Department for Energy Security and Net Zero (DESNZ), formerly known as the Department for Business, Energy and Industrial Strategy (BEIS), in the Digest of UK Energy Statistics (DUKES) publication. These are then adjusted to the UK National Accounts basis, including the conversion from a territory to a residence basis (see Quality characteristics and Annex 2). The ONS publishes a bridging table to make the reconciliation between the energy balances and energy accounts transparent.

Because estimates are produced on a comparable basis with the SNA, it is possible to derive figures for energy intensity using the series on energy use and economic output. When the energy intensity lowers, it means that more economic output is being produced for each unit of energy consumed.

Since the UK's departure from the EU, there is no longer a mandatory requirement to supply data to Eurostat. However, the ONS now supplies data to the OECD instead. The potential uses of energy accounts data come from:

- a variety of international organisations
- the UK and other governments
- the research community

For example, the energy accounts are relevant for the Data Gaps Initative-3 project led by the International Monetary Fund (IMF).

5 . Quality characteristics of the energy use data

Geography

Estimates are available at UK level and not further disaggregated by geography. “UK level”, in this context, is on a “residence” basis – that is, including energy consumption by UK households and UK registered businesses in their transport and travel abroad, excluding energy consumed through travel and transport in the UK of non-UK residents and UK-based businesses who are registered abroad (see Annex 2).

Coherence and comparability

The “residence” basis, required under the UN System of Environmental–Economic Accounting (SEEA), is one of the reasons why these estimates differ from other energy use statistics. Energy balances are prepared by Ricardo Energy and Environment on a “territory basis” for the Department for Business, Energy and Industrial Strategy (BEIS) and published in the Digest of UK Energy Statistics (DUKES). They provide the starting point to which the residence adjustments are applied.

In addition to the residence versus territory issue, the various reporting requirements also differ for other reasons. These differences are explained in the bridging tables (see also Annex 3).

The energy use statistics are presented in tonnes of oil equivalent (toe) (although some are also shown in other units of measurement). This enables different fuels to be compared and aggregated. It is a measure of energy content rather than a physical quantity. Standard conversion factors for each type of fuel are given in the Digest of UK Energy Statistics (DUKES).

Timeliness and punctuality

Physical Environment Flow Accounts (PEFA, see Annex 1) data are supplied and published on our website annually. We keep our physical energy flow accounts database comparable with other European countries, so we follow Eurostat guidance closely.

Ricardo Energy and Environment deliver two sets of energy use statistics to the ONS for a particular time series (for example, 1990 to 2020), the first forms the basis of the estimates published in the Environmental Accounts, the second is used to provide data for the PEFA publication. Data are at industry section (21 categories) and group (around 130 categories) level. The industry splits are based on the Standard Industrial Classification (SIC) 2007.

The energy use figures are annual estimates starting from 1990. Ricardo Energy and Environment continuously take on methodological improvements, changes to reporting requirements, data revisions from suppliers and so on[1]. This means that while the whole time series is always open to being revised, the data are comparable over time.

We publish these estimates on our website as soon as possible following receipt from Ricardo Energy and Environment. For example, in 2019, data for 1990 to 2017 were received in April and May and published in June. The release, and any articles associated with the estimates, are pre-announced on our website. Previously released datasets are also on our website.

Concepts and definitions

The UN System of Environmental–Economic Accounting (SEEA – see also Annex 1), together with the UN System of National Accounts (SNA) and the European System of Accounts, provides a framework for producing internationally comparable statistics on the environment and its relationship with the economy. The Office for National Statistics (ONS) is responsible for reporting the information on an annual basis. Ricardo Energy and Environment are contracted to deliver estimates that are consistent with the UN SEEA framework.

Notes for: Quality characteristics of the energy use data

1. Detailed summaries of all recalculations can be found in the Informative Inventory Report and the National Inventory Report.

6 . Methods used to produce the energy use data

Ricardo Energy and Environment maintains the National Atmospheric Emissions Inventory (NAEI) on behalf of the Department for Energy Security and Net Zero (DESNZ), formerly known as the Department for Business, Energy and Industrial Strategy (BEIS), and supplies emissions estimates that are partly calculated from fuel consumption and emissions factors corresponding to emission source. This fuel consumption forms the basis for the energy accounts, and there is a strong link between the energy and emissions accounts.

The NAEI data are used to identify the main processes and industries responsible for energy consumption leading to atmospheric emissions. These are then allocated to individual industries using information from a variety of sources. For example, diesel consumption by heavy goods vehicles is allocated to industries using vehicle mileage information from the Department for Transport.

While the Digest of UK Energy Statistics (DUKES) is a key source of energy data, the classification of industrial sectors used in environmental accounts differs from that used in DUKES. In particular, the transport sector in the accounts is defined to include only enterprises that provide transport services to other consumers (for example, public transport operators and freight haulage companies). The energy consumed by households' use of private cars is allocated to the domestic sector. The allocation of energy use to particular industries is primarily based on Digest of UK Energy Statistics (DUKES) data. However, for certain industries more detailed estimates are used, for more information see DESNZ Energy trends.

Annex 4 explains direct and reallocated use of energy.

Annex 5 includes detail on methods for energy use from specific sources.

7 . Acknowledgement

We would like to thank Ricardo Energy and Environment for their significant contribution towards this work.

8 . Other information

- UK Environmental Accounts
- UK gross domestic product (GDP) (National Accounts)
- UK supply and use tables
- Adjustments to the UK's atmospheric emissions and energy accounts to bring them on to a national accounts "residents" basis – Methodology and analysis report
- Digest of UK Energy Statistics (DUKES)
- UN System of Environmental–Economic Accounting (SEEA)
- SEEA-Energy
- European regulation on environmental economic accounts
- National Atmospheric Emissions Inventory (NAEI)
- UK greenhouse gas inventory – Methods and compilation

9 . Annex 1: Regulations

UN SEEA

The UN System of Environmental–Economic Accounting (SEEA) was adopted by the UN Statistical Commission as the first international standard for environmental–economic accounting in 2012, following a comprehensive global consultation process. The UN SEEA sits alongside the UN System of National Accounts (SNA) to provide a framework for producing internationally comparable statistics on the environment and its relationship with the economy.

The UN SEEA framework follows a similar accounting structure to the SNA and uses consistent concepts, definitions and classifications in order to facilitate the integration of environmental and economic statistics.

The UN SEEA states that

“Physical energy flows recorded within the integrated framework of SEEA-Energy are coherent not only with monetary flow accounts of energy, but also with monetary and physical asset accounts. In such a system, a physical flow of energy (e.g., extraction of coal) can be directly linked to economic flows (e.g., resource rent generated by the coal extractor), physical assets (e.g., reduced coal resources) and economic assets (e.g., reduced market value of coal resources).”

According to the UN SEEA,

“Energy flow accounts describe energy flows, in physical units, from the initial extraction or capture of energy resources from the environment into the economy (natural inputs), to the flows within the economy in the form of supply and use by industries and households and finally, the flows of energy back to the environment (energy losses).”

Energy flow accounts are a sub-system within the general physical flow framework. Within the UN SEEA family, in addition to the central framework, specific attention has been given to energy with the development of SEEA-Energy.

SEEA-Energy, an SEEA “sub-system”, is under development to provide compilers and analysts with agreed concepts, definitions, classifications, tables, and accounts for energy and energy related air emission accounts. This is based on the principle that the total supply of each energy resource, energy product or energy loss is equal to the total use or loss of the same energy resource. Energy products are classified using the Standard International Energy Product Classification (SIEC).

PEFA

Physical energy flow accounts (PEFA) record the flows of energy (in terajoules) from the environment to the economy (natural inputs), within the economy (products) and from the economy back to the environment (residuals).

PEFA is conceptually embedded in environmental–economic accounts. PEFA provides information on energy flows arranged in a way fully compatible with concepts, principles and classifications of national accounts – thus enabling integrated analyses of environmental, energy and economic issues, for example, through environmental–economic modelling.

During 2011, the European Regulation on environmental–economic accounts was adopted by the European Parliament and European Council. A Module for Physical Energy Flow Accounts is set out in Annex VI of this Regulation, which defines the data to be collected, compiled, transmitted and evaluated for physical energy flow accounts by the member states. In 2017, provision of data to Eurostat became mandatory for EU countries. The UK continues to follow this regulation following the UK’s exit from the EU.

10 . Annex 2: The residence adjustment

Energy accounts are prepared on a residence basis. In practice, this means adjustments for UK and non-UK residents are made for the fuel use associated with cross-border travel by cars; coaches and lorries; and foreign and domestic international air, shipping and fishing activity.

Adjustments are not made for energy that foreign residents use within the UK or UK residents use outside of the UK in public transport use, electricity use or cars that do not cross the border such as those that are rented at their destination. Energy embedded in the import and export of goods is also not accounted for. This follows the methodology approach set out in the UN System of Environmental–Economic Accounting (SEEA) guidelines.

11 . Annex 3: Bridging tables

The bridging table is used to illustrate how the energy accounts reconcile with the Digest of UK Energy Statistics (DUKES) energy balances. In addition to the residence adjustment (see Annex 2), the main differences are in treatment of:

- marine bunker fuel use
- fuels such as gases used in the offshore industry, waste solvents, waste lubricants, orimulsion and petroleum coke
- calculating energy consumption from refinery petroleum coke estimates
- crown dependency fuel use
- transformed energy – energy from fuels that are created from another fuel
- energy in benzoles and tars created as a by-product of coke ovens
- energy products not used for energy purposes, for example, oil used in plastics
- some energy such as geothermal and solar
- losses of natural gas
- use of conversion factors for coke and coke breeze

12 . Annex 4: Direct and reallocated use of energy

The consumption of carbon fuels and the related consumption of energy can be analysed from several different perspectives. In terms of atmospheric emissions, it may be helpful to identify which industrial sectors are actually consuming the carbon fuels that give rise to emissions. From this perspective, fuels used by the electricity generation sector are attributed entirely to that sector, even though some of the energy is transformed into electricity.

Where fossil fuels used by industry are used to produce electricity (“autogenerated” electricity), some of this is then supplied to the grid. This energy is used by other sectors and would hence be double-counted if no adjustment were made. Therefore, direct use of energy is calculated as energy from fossil fuels plus electricity used excluding autogenerated electricity. Transformation and transmission losses of energy associated with the electricity supply industry are also shown.

In terms of energy consumption, it is possible to attribute energy used during the process of transformation into electricity and the energy lost in distributing electricity to end users, either directly to the electricity generation sector or indirectly to the consumers of energy. “Direct use of energy including electricity” allocates the consumption of energy directly to the immediate consumer of the energy; “reallocated energy” allocates these “electricity overheads” to the end user of the electricity.

13 . Annex 5: Specific methodology

Aviation energy consumption

For the UK Environmental Accounts, all energy use from take-off and landing and from aircraft in flight is included on a residence basis. To make this adjustment to a residence basis, there is an addition of aviation energy from UK flight operators running international flights to and from the UK less foreign operators running international flights to and from the UK.

Flight kilometre data is sourced from the Civil Aviation Authority. Information is available on the total amount of fuel that is used for domestic aviation, international aviation and for the military. Average fuel use per kilometre is calculated and then applied to calculate estimated fuel use by UK operators on international flights from abroad less fuel use by overseas operators on flights from the UK.

Shipping energy consumption

Adjustments for energy used in shipping follow a similar methodology to aviation. An adjustment is made based on the amount of fuel purchased overseas by UK operators less the amount of fuel purchased in the UK by foreign operators.

The volume of fuel purchased in the UK by overseas operators is calculated by subtracting UK purchases in the UK (estimated based on total UK operators’ expenditure in the UK from balance of payments divided by the unit price per tonne from the Quarterly Energy Prices) from the total purchases in the UK (supplied by Ricardo Energy and Environment based on the National Atmospheric Emissions Inventory, NAEI).

The volumes purchased overseas by UK resident operators are estimated based on the total bunker expenditure overseas by UK operators taken from the Balance of Payments divided by the average annual bunker price sourced from Bunker World.

Fishing energy consumption

EU regulations mean that fishing fleets from each member state can fish in the waters of other member states. Vessels can also fish in international waters. This means that fuel bought by fishing fleets within the UK can be bought by foreign vessels and UK vessels may purchase fuel in other countries.

The proxy that is used to estimate fuel usage and hence energy consumption is the fish catches. It is assumed that vessels landing catches in a country other than their own buy an amount of fuel at the place they make their catch, which is proportional to the size of the catch.

The UK Sea Fisheries Report provides statistics on what proportion of the UK catch was caught by foreign vessels. This proportion is then subtracted from the total amount of fuel bought by fishing vessels in the UK. A similar method is used to estimate the fuel usage by UK fishing vessels overseas on the catch of UK vessels overseas. The percentage by which the amount caught by the UK fishing fleet overseas would increase the catch in UK waters is added to the fuel purchased by fishing vessels in the UK.

This method assumes that boats from other countries do not have different energy consumption profiles from fishing vessels that are in the UK. It also does not take account of the fact that fishing vessels fishing further away from their home port will use more fuel as it will be a greater distance to get to their catching ground. As there are more UK fishing vessels fishing overseas than overseas vessels fishing in UK waters, it is possible that this methodology underestimates energy consumption from the UK fleet. However, it should be noted that fishing emissions make up a very small percentage of total emissions.

Private motor vehicle energy consumption

Private motor vehicles cover all vehicles not used for commercial goods or passenger transport. Purchases overseas by UK residents are calculated on the basis of total kilometres driven multiplied by average fuel use per kilometre. The distance driven is estimated based on the number of overseas visits by residents in cars divided by the average vehicle occupancy (from the International Passenger Survey) multiplied by average distance travelled (set at 620 kilometres since 2001). Purchases in the UK by overseas residents are calculated similarly.

An adjustment is then made for “tank tourism”, where drivers cross international borders to take advantage of lower fuel prices. Fuel prices reported by the AA are used to monitor price differentials.

Goods vehicle energy consumption

The Department for Transport calculates most of the statistics relating to goods vehicles and coaches, which are sourced from the Roll-on Roll-off Survey, the International Road Haulage Survey and the Foreign Vehicles Survey .

As different heavy goods vehicles have varying sizes and capacities, and hence different fuel consumption, splits are made by HGVs and LGVs. HGVs are also split between vehicles with rigid and articulated axles. Fuel consumption for each type of vehicle is combined with the distance driven by each type to provide an estimate of energy consumption from foreign vehicles inside the UK and UK vehicles overseas.

Coach energy consumption

The net adjustment is for total diesel purchased by UK coaches overseas less total diesel purchased in the UK by overseas coaches. As with cars, the International Passenger Survey provides estimates of number of residents or visitors travelling by coach and the numbers of coaches are calculated based on average vehicle occupancy. As a best proxy, the average distance travelled by coaches is based on the average travelled by HGVs.

Overseas territory energy consumption

Following national accounts conventions, overseas territories and crown dependencies are not included in the energy accounts. They are also treated as overseas territories for the purposes of estimating energy consumption from international aviation and shipping. This means that compiling the energy accounts for the UK involves removing all energy consumption from Guernsey, Jersey, Isle of Man, Gibraltar, Bermuda, Cayman Islands, Falkland Islands and Montserrat.