Electricity statistics: Technical information & methodologies

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1 Overview of the UK electricity system

The UK electricity system broadly consists of the following distinct areas: electricity supply, transmission, distribution, and consumption. The Department for Energy Security and Net Zero (DESNZ)'s electricity statistics cover all of these areas.

1.1 History of the UK electricity system

The following paragraphs describe developments in the UK electricity system from the 1990s to present day.

The electricity market was privatised in 1990, at a time when seven generating companies in England and Wales and 12 Regional Electricity Companies distributed and supplied electricity to customers. Over the next decade, competition was re-introduced to the markets in three phases. First, the upper tier of the non-domestic market (customers with a maximum demand of over 1 MW, comprising 30 per cent of the market) was opened to competition in March 1990. Next, the 100 kW to 1 MW tier (15 per cent of the market) was opened to competition in April 1994. Full competition for the remaining 55 per cent of the market was introduced in stages between September 1998 and June 1999. The breakup of the nationalised companies immediately increased market competitiveness, leading to an early peak in the number of market participants in 2004. However, the number of companies then fell until 2010 as companies either took over competitors or bought additional power stations to add to their portfolios. Since 2010, the market has continued to become increasingly competitive.

Before 2005, the electricity industries of Scotland, Northern Ireland and England and Wales operated independently, with interconnectors joining the grid systems together. In England and Wales, NESO (formerly National Grid), owns and operates the high-voltage transmission networks. Initially the National Grid Company was owned by the 12 privatised regional electricity companies but was floated on the Stock Exchange in 1995. In March 2001, the means of trading electricity changed with the introduction of the New Electricity Trading Arrangements (NETA). These arrangements were based on bi-lateral trading between generators, suppliers, traders, and customers, and were designed to provide greater choice for market participants whilst maintaining the operation of a secure and reliable electricity system. The system included forwards and futures markets, a balancing mechanism to balance generation and supply, and a settlement process.

In Scotland before 2005, two main companies (Scottish Power and Scottish and Southern Energy) covered the full range of electricity provision - operating generation, transmission, distribution, and supply businesses. There were also several small independent hydro stations and generators operating fossil-fuelled stations, which sold their output to Scottish Power and Scottish and Southern Energy. From April 2005, the electricity system in Scotland was integrated with that in England and Wales under the British Electricity Trading and Transmission Arrangements (BETTA), introduced in the Energy Act 2004. This allowed the extension of NETA to Scotland and created a single GB transmission network operated by the National Grid.

In April 2019, the National Grid legally split into the network operator, and the National Grid Electricity Systems Operator (ESO) which is responsible for operating the GB balancing mechanism.

In Northern Ireland, power procurement, transmission, distribution, and supply has been in the private ownership of Northern Ireland Electricity plc (NIE) since 1993. Generation is provided by three private sector companies who own the four major power stations. In December 2001, a link for the transfer of electricity between Northern Ireland and Scotland's grids was inaugurated. A link for the import and export of electricity between the grids of Northern Ireland and the Republic of Ireland was re-established in 1996. The two grids were fully integrated on 1 November 2007, with a joint body SEMO (Single Electricity Market Operator) set up by SONI (System Operator for Northern Ireland) and EirGrid from the Republic of Ireland to oversee the new single market. In July 2012, an interconnector between the Republic of Ireland and Wales began operations.

1.2 Electricity supply

Electricity supply (or electricity available) is equal to electricity generated (or produced) and net trade. DESNZ statistics report generation as that produced by Major Power Producers plus transfers (or purchases) from other generators. The definitions of different sources of generation in DESNZ statistics are as follows:

Major Power Producers (MPPs) are companies whose prime purpose is the generation of electricity. Some renewable generators, with a smaller capacity portfolio, are excluded from this list. For a detailed description of the inclusion criteria for MPPs in DESNZ statistics, see the MPP data collection section of this document. A list of current MPPs can be found in the Digest of UK Energy Statistics (DUKES) Table 5.11.

Autogenerators are companies who produce electricity as part of their industrial or commercial activities, but whose main business is not electricity generation. Most of the electricity produced by these schemes is consumed on site, but some producers also transfer electricity to the public distribution system.

Other generators refer to autogenerators, domestic generation, and smaller renewable electricity generators (e.g., small wind farms) who are not included as MPPs due to their comparatively small size.

1.2.1 Key terms and categories

The following categories are used to classify generation within DESNZ statistics:

Electricity vs energy. In common English usage, these two words are often used interchangeably. Within electricity statistics, only the term electricity is used and relates only to that specific form of energy. The energy statistics in Chapter 1 of DUKES and Energy Trends refer to a wider category of energy sources, including the use of coal or gas for heating and the use of oil for transport.

Generated and supplied make a distinction between the total amount generated by a plant and the amount supplied to the grid. The difference between these is the plants' **own use** i.e. the electricity needed in the process of generation (also called 'used on works'). 'Supplied' in this context is different from the overall supply referred to in the balances (which includes all generation and imports).

Fuels refer to substances which are consumed (typically burnt) to release energy.

Fossil fuels refer to fuels formed by natural processes, such as the decomposition of plant and animal biomass, which cannot be replenished. They include coal, oil, and gas.

Renewable refers to any form of generation that either does not use fuel to generate, such as solar, wind or tidal generation, or generation that uses fuels that can be replenished. Renewable fuels include plant biomass, animal biomass, biogas and renewable waste.

Low carbon includes all forms of renewable generation, plus nuclear generation.

Thermal generation is any generation where a fuel is burnt during the process of generation. This could be fossil fuel such as coal or gas, or a renewable fuel such as plant biomass.

Non-thermal generation is any generation that does not use fuel to generate, such as solar, wind or tidal generation.

1.2.2 Generation technologies

Within DESNZ statistics, generation is also broken down by type of technology used to produce electricity. The types of technology referred to are as follows:

Conventional steam stations burn fuel to convert water into steam, which then turns steam turbines and powers a connected electrical generator.

Nuclear stations are also steam stations, but nuclear fission is used to produce the heat needed for steam.

Gas turbines use pressurised combustion gases from fuel burned in one or more combustion chambers to turn a series of bladed fan wheels and rotate the shaft on which they are mounted.

Combined cycle gas turbine (CCGT) stations combine in the same plant gas turbines and steam turbines, enabling electricity to be produced at higher efficiencies. The gas turbine (usually fuelled by natural gas or oil) produces mechanical power (to drive the generator) and waste heat. The hot exhaust gases (waste heat) are fed to a boiler, where steam is raised at pressure to drive a conventional steam turbine.

Natural flow hydro-electric stations use natural water flows to turn turbines.

Pumped storage hydro-electric stations use electricity to pump water into a high-level reservoir. This water is then released to generate electricity at peak times. Where the reservoir is open, the stations also generate some natural flow electricity; this is included with natural flow generation. The amount of electricity used in pumping the water uphill is greater than that generated as the water flows downhill through the turbines. Therefore, net supply from pumped storage schemes across the year is negative.

Solar generators use photovoltaic cells and modules to directly convert solar energy into electricity, using both direct and diffuse radiation.

Wind farms use wind flows to turn turbines.

Other stations include stations burning fuels such as landfill gas, sewage sludge, biomass, and waste.

1.2.3 Combined Heat and Power (CHP)

Combined Heat and Power generation is a form of thermal generation where useable heat and power (usually electricity) is generated in a simultaneous process. CHP can use a variety of fuels and generation technologies but include a way for the heat generated in the process to be captured and put to further productive use, such as for industrial processes, hot water or space heating.

Chapter 7 of DUKES covers CHP in more detail but is treated slightly differently. For Chapter 5 and within the electricity balance, any electricity generated will be counted, but Chapter 7 focuses on ‘good quality’ CHP as defined in the CHP Quality Assurance scheme. DUKES Table 5.15 shows the difference in generation and capacity measured by both chapters.

1.2.4 Generator capacity

Generation technologies are described by their capacity, which is the maximum output a generator can produce. Different measures of capacity are used for different generator technologies, and more information about these can be found in the capacity methodology.

1.2.5 Types of fuel

Electricity generation is also broken down by fuel use, and the fuels reported by DESNZ can be described using broad categories.

Fossil fuels refer to fuels formed by natural processes, such as the decomposition of plant and animal biomass, which cannot be replenished. They include coal, oil, and gas, which are burnt to create heat which produces steam to power turbines for electricity generation.

Nuclear refers to the release of energy from splitting atoms into smaller atoms (nuclear fission).

Bioenergy (also called thermal renewables) refer to any fuel used in generation that can be replenished. This includes plant biomass (e.g., wood, straw, husks from nut production), animal biomass (e.g., bones from meat production), biogas (e.g., gas from sewage or anaerobic digestion) and renewable waste.

Other fuels include the burning of non-renewable waste and industrial waste products (e.g. waste gases).

Waste as a fuel uses waste from households and industry to power generators. The fuel use and generation from waste is split between the renewable 'bioenergy' category and the non-renewable 'other fuels' category. The split assumes that half of household waste counts as renewable. Other waste products will be split differently, as detailed in the notes to Chapter 6.

Non-thermal renewables are forms of generation where no fuels are burnt in generation. This includes natural water flows (hydro natural flow), solar, tidal, offshore and onshore wind. Non-thermal renewables do not burn fuel, but for comparison purposes we assume their fuel use is equal to their electricity output.

1.2.6 Imports and exports

The final component of UK electricity supply is net imports (imports minus exports). Trade of electricity occurs along interconnectors with France, Ireland, Netherlands, Belgium, Norway and Denmark. Electricity can also be transferred between the separate electricity grids of England & Wales, Scotland, and Northern Ireland.

1.3 Transmission and distribution

Once electricity is made available, it then is carried to final consumers through grid networks. DESNZ statistics split this into supply via the Public Distribution System, and supply from other generators.

Public Distribution System (PDS) is the separate grid systems in England and Wales, Scotland and Northern Ireland which carries electricity from generators to final users. It consists of (1) transmission networks: high voltage electricity wires which extend across GB and offshore waters, and (2) distribution networks: lower voltage electricity networks which carry electricity from the transmission grid to final users.

1.3.1 Losses

Losses refer to electricity lost through the process of either transmission or distribution. They are reported as electricity lost within the system as a percentage of electricity entering the system. Losses also include theft of electricity from the distribution network, which is reported as a fixed percentage of electricity entering the distribution network. Further information can be found in the losses methodology.

1.4 Electricity consumption

Electricity consumption measures the amount of electricity that is consumed by users. It is also called electricity demand, which must balance with supply. It includes electricity consumed in the process of generation and electricity sold to industrial, commercial, domestic, and other users. Actual consumption data is not immediately available as it is dependent on electricity meters being read and reported back to the suppliers. Therefore, DESNZ final consumption data is continuously revised over the course of a year, to reflect the increased number of meter readings and availability of accurate data from electricity suppliers. Key consumption terms are:

Major electricity suppliers are companies who supply electricity to consumers through the PDS and have a market share of above 0.1%. Further information about electricity suppliers can be found in the electricity suppliers data collection. Electricity can also be consumed by autogenerators, which use the electricity they produce on site.

Total demand refers to electricity use by consumers across different sectors such as: industry, commercial, transport, agriculture, and public administration, as well as by the energy industry in the process of generation.

Final consumption refers to consumption by end users, including all the categories above except for energy industry use. Electricity final consumption data is reliant on estimates provided by electricity suppliers each month.

1.4.1 Electricity sales sectors

The classification of consumers into sectors according to their main business follows, as far as practicable, the Standard Industrial Classification (SIC 2007). Definitions for which sales are included within each sector definition can be found below, and full definitions can be found in the Energy Balance methodology note (section 1.3).

Industrial sector use includes electricity used for transformation and final consumption activities in the iron and steel, non-ferrous metals, chemical and mineral products industries. It also incorporates electricity used for mechanical or electrical engineering, construction, printing and publishing, and the manufacture of vehicles, textiles and clothing, food, drink, and tobacco. In some DESNZ electricity tables, industrial consumption includes energy industry use.

Energy industry use includes electricity used on works by generators (e.g., the consumption of electricity in power plants for lighting, compressors, cooling systems), as well as that consumed by pumped storage stations in pumping water to the reservoir.

Commercial sector use includes electricity consumed by shops, offices, hotels, restaurants, as well as that consumed by telecommunications and public administration services. In some DESNZ electricity tables, commercial consumption also includes transport sector use.

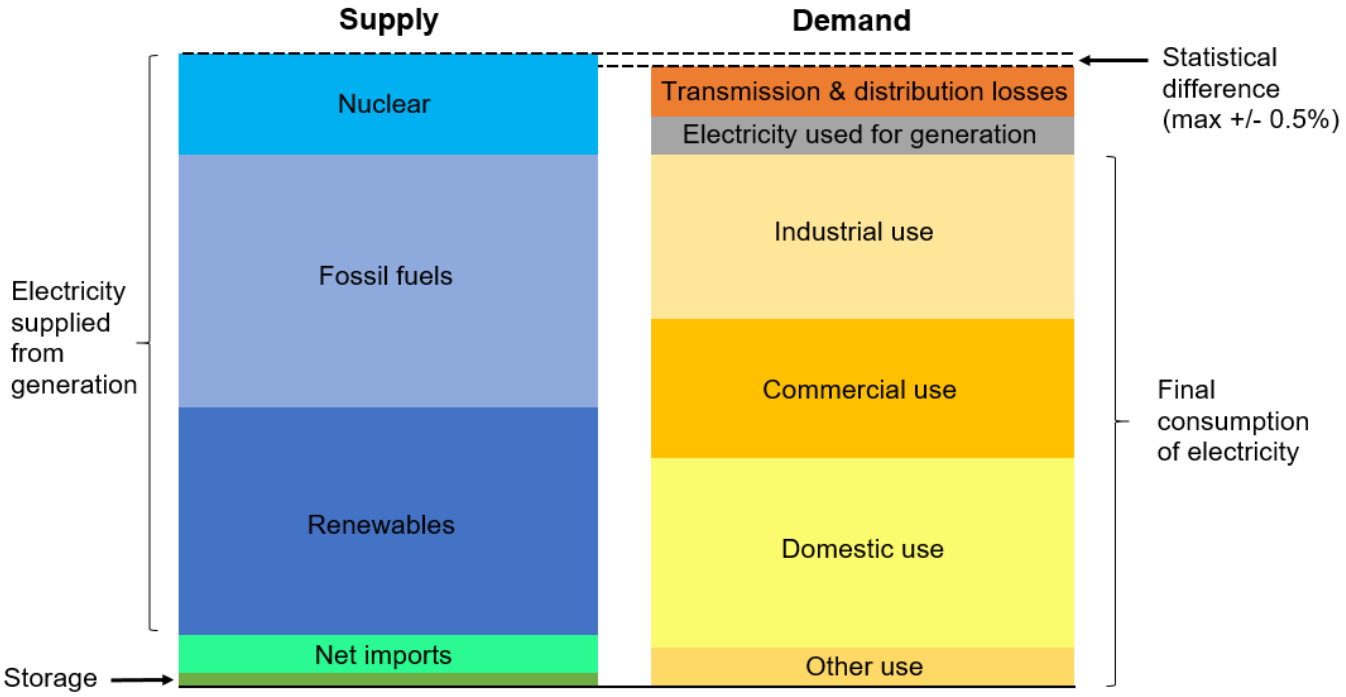
Transport sector use includes electricity used by rail and light rail companies (both over and underground) for traction purposes, and electricity used by electric road vehicles.

Domestic sector use includes electricity consumed by households, covering final consumption across prepayment and credit meters, and peak and off-peak tariff rates. Domestic sector consumption of electricity shows seasonal variation across the year, with colder weather leading to an increase in electricity use due to higher demand for heating, and vice versa.

Other sectors' use includes all remaining electricity consumed, which does not fall into the preceding sector classifications. What is included in this category is variable across DESNZ electricity tables, but includes electricity use for agriculture and public lighting.

1.5 Electricity balance

An electricity balance presents the components of electricity supply and demand using a common unit, and places them alongside one another in a manner that shows the dependence of one on the other. DESNZ quarterly and annual publications include electricity balances, and it is based on these balances that other statistics are compiled. The components of an electricity balance are displayed in the diagram below.



In the electricity system, the level of supply is dependent on current demand as electricity cannot be stored economically on a large-scale. Electricity suppliers forecast future demand and then agree contracts to buy an amount of electricity from a specific generator at a specific future time. However, as forecasts can differ from actual demand, the balance between supply and demand is ensured through the operation of a centralised balancing mechanism. This allows electricity generators and suppliers to be contracted to change their supply or demand to match the current demand level.

The UK's energy balances are compiled in line with international reporting standards, most notably those issued by the International Energy Agency (IEA). Energy balances aim to cover all energy products entering, exiting and used within the national territory of a given country during a reference period. In these conventions, primary production of energy is defined as any extraction of energy products in a useable form from natural sources, such as mined coal or electricity generated by a wind turbine. It excludes energy not in a useful form, for example the wind that blows across the UK. Under the IEA's conventions, for hydro, wind and tidal the equivalent fuel input is simply the gross electricity generated. Solar PV is treated similarly as a measure of simple gross output rather than the solar radiation input into the panels. For nuclear, an estimate of the heat content of the steam leaving the reactor for the turbine is used as the primary energy form (equivalent fuel input).

1.5.1 Statistical difference

In electricity statistics production, data collected on generation/supply do not match exactly with data collected on consumption and losses. This results in a statistical difference between the total generation and demand, which is within +/- 0.5%. This difference exists as data for each industry is collected from different sources, with varying restrictions on when accurate data becomes available.

2 Publications

DESNZ publishes monthly, quarterly, and annual electricity statistics, within three statistical publications: Energy Trends, the Digest of UK Energy Statistics (DUKES) and UK Energy in Brief (UKEiB).

2.1 List of publications

Energy Trends is published each month, and Chapter 5 contains monthly (published two months in arrears) electricity statistics and quarterly (published one quarter in arrears) statistics and balances. The tables published within Energy Trends are described below.

Table number	Content	Type of data
5.1	Fuel used in electricity generation and electricity supplied	Quarterly
5.2	Supply and consumption of electricity	Quarterly
5.3	Fuel used in electricity generation by major producers	Monthly
5.4	Electricity production and availability from the public supply system	Monthly
5.5	Availability and consumption of electricity	Monthly
5.6	Imports, exports, and transfers of electricity	Quarterly

Digest of UK Energy Statistics (DUKES) is published in July, and Chapter 5 contains a detailed breakdown of annual electricity statistics and time-series data back to 1970. The annual statistics are published one year in arrears, but revisions are typically carried out to the previous two years. The tables published within DUKES are described below.

Table number	Content	Type of data
5.1	Electricity commodity balances	Annual
5.2	Commodity balances, public distribution system and other generators	Annual
5.3	Fuel used in generation	Annual
5.4	Fuels consumed for electricity generation (autogeneration) by main industrial groups	Annual
5.5	Electricity supply, electricity supplied (net), electricity available, electricity consumption and electricity sales	Annual
5.6	Electricity fuel use, generation, and supply	Annual
5.7	UK plant capacity	Annual
5.8	Major Power Producers plant capacity: England and Wales, Scotland, and Northern Ireland	Annual
5.9	Capacity of other generators	Annual

5.10	Plant loads, demand, and efficiency	Annual
5.11	Power stations in the UK	Annual
5.12	Plant installed capacity, by connection	Annual
5.13	Capacity, net imports and utilisation of interconnectors	Annual
5.14	Estimated carbon dioxide emissions from electricity supplied	Annual
5.15	Combined Heat and Power generation and capacity overview	Annual
5.16	Energy storage overview	Annual
5.1.1	Fuel input for electricity generation (1970 – current year)	Annual
5.1.2	Electricity supply, availability, and consumption (1970 – current year)	Annual
5.1.3	Electricity generated and supplied (1970 – current year)	Annual

UK Energy in Brief (UKEiB) is also published in July, with sections on electricity and renewables since 1990. It is designed to provide a concise overview of energy production, consumption, prices and climate change in the UK using figures primarily taken from the DUKES edition released in the same July. These statistics are also published one year in arrears and will take into account revisions made to DUKES statistics. The tables relating to electricity published in UKEiB are described below.

Content	Type of data
Electricity generated by fuel type	Annual
Electricity supplied by fuel type	Annual
Electricity capacity	Annual
Small scale renewable capacity (GB)	Annual
Electricity generation from renewable sources since 2000	Annual
UK Onshore and Offshore wind capacity	Annual
Renewable proportion of gross final consumption	Annual
Combined heat and power (capacity and generation)	Annual

2.2 Revisions policy

Published statistics in DUKES or Energy Trends can be revised to reflect updated information. Energy Trends data for the current year is considered provisional (allowing data revisions to occur) until the publication of DUKES which covers that year. Data revisions for monthly publications can occur back to the end of the previous quarter. Data revisions for quarterly data can occur to the end of the previous provisional year. Following the publication of DUKES covering the current year, changes to quarterly data would only usually occur at the time of future DUKES publications. Figures in UKEiB align with DUKES.

The revisions timetable and further information can be found in the DESNZ statistical revisions policy.

3 Data collection and sources

Three monthly electricity surveys are electronically carried out by DESNZ: a survey of the Major Power Producers (MPPs), a survey of the major electricity suppliers, and a survey of electricity distributors. These involve a monthly survey, collected every month for data two months in arrears, and a more detailed annual survey covering the previous calendar year. Respondents can revise past data submissions within each new survey return, to reflect the availability of new information. These data sources are supplemented with a quarterly survey with electricity autogenerators as well as additional information from various external data sources and internal analysis.

3.1 Major Power Producers (MPPs)

Major Power Producers (MPPs) are companies whose prime purpose is the generation of electricity. They represent around 80 per cent of generation. The current list of MPPs and the sites they own is included in DUKES Table 5.11. For thermal generation, there is no minimum size but solar and wind farms are only included where a company owns more than 50 MW of capacity, which can be across multiple sites. Solar and wind sites owned by companies which do not meet this minimum are reported in the 'other generators' category. Some smaller thermal generators are also counted as 'other generators' even though their main activity is electricity generation.

Major wind farm companies were added to the MPP survey in 2007 and solar companies in 2015. Prior to this, these sites were all included in the 'other generators' category.

The companies included in the MPP survey are reviewed each January. Companies that no longer meet the criteria are removed and new companies are added. If an MPP site is sold, it will be kept in the survey (with estimated data if necessary) until the end of the calendar year. Similarly, new sites or companies will be counted in the 'other generators' category until they can be added in the next calendar year. This minimises the effects of changes in the MPP survey sample.

3.1.1 MPP monthly survey

The monthly MPP survey is sent to all MPPs. There is a response rate of around 95 per cent, with estimates used for any missing data. For each site owned by an MPP, they are asked for the total generation, own use, fuel used and total coal or oil stocks. The return also records site data including location, grid connection and capacity and MPPs can record any changes to the capacity. Generation and own use are also recorded for storage sites, along with the amount of electricity consumed in pumping. As well as completing the survey for each month, MPPs are also able to revise data from any previous month and to record comments about anything that may have affected generation.

3.1.2 MPP annual survey

The annual survey for MPPs is a consolidation exercise as no additional data are collected annually. MPPs are asked to check that their annual totals for fuel use, generation and own use are correct and that the site capacity and connection data are correct. They are also asked to reconcile the annual totals with the monthly submissions.

3.1.3 MPP estimation process

Where an MPP does not supply data for a particular month, the data will be estimated by DESNZ. Generation and own use are calculated using the annual rate of change for a particular fuel/technology, applied to that site's generation from the previous month. Fuel use is estimated using efficiency factors based on the site's estimated generation (or actual generation if available). No estimates are made for the annual survey.

3.2 Autogenerators and Other generators

3.2.1 Autogenerators survey

The term 'Autogenerators' refers to companies who produce electricity as part of their manufacturing or other commercial activities, but whose main business is not electricity generation. DESNZ conducts a quarterly survey with a panel of autogenerators which is used alongside the sources below. The autogenerators' survey asks companies for total fuel used, covering coal, oil, gas, and other fuels, as well as total generation, consumption on site and electricity sold off site or onto the grid. Data on the company is used to classify this by industrial or commercial sector. If a company does not provide data for a particular quarter, their most recently provided data will be used as an estimate.

3.2.2 Other generators data sources

Data for the 'Other generators' category is collated from a range of sources to supplement the autogenerators survey data.

CHP Quality Assurance (CHPQA) scheme data is published annually. The quality assurance programme is used to assess all types and sizes of Combined Heat and Power (CHP) schemes throughout the UK. The dataset covers fuel used, electricity and heat generated and consumption of electricity and heat, with classification of the data by industrial or commercial sector. It also includes capacity data.

RESTATS refers to the UK's Renewable Energy Statistics Database. This collates data from a range of sources covering all forms of renewable energy, including the CHP Quality Assurance database, Feed in Tariffs data and Renewables Obligation data. It covers generation and capacity. A full list is included in the methodology for DUKES Chapter 6. RESTATS is collated and processed by Ricardo Energy and Environment for DESNZ, including data checking and deduplicating between the various data sources.

Iron and Steel Statistics Bureau (ISSB) supply DESNZ with electricity and generation data relating to the iron and steel industries.

London Underground supply data on electricity generated from gas for London Underground use.

3.3 Electricity suppliers

Major electricity suppliers are companies who supply electricity to consumers and have a market share of above 0.1%. Major electricity suppliers are recruited to the DESNZ electricity suppliers' surveys, to cover the greatest proportion of market sales possible. This includes the 'Big Six' suppliers who supply most of the electricity in the market: Centrica (parent company of British Gas), E.ON UK, Scottish and Southern Energy, RWE npower, EDF Energy and Scottish Power. The market share of the top suppliers has steadily fallen since 2010 as smaller companies bought customers from the Big Six, and new entrants led to the market becoming increasingly fragmented.

Data from electricity suppliers are collected on a monthly and annual basis. Information on how this data is used can be found in the electricity consumption methodology section.

3.3.1 Electricity suppliers monthly survey

The monthly suppliers survey is sent to major electricity suppliers covering approximately 96 per cent of market sales. They are completed and electronically returned to DESNZ, with a response rate of approximately 90 per cent each month. Suppliers can use subsequent data collections to retrospectively submit missing data and retrospectively revise their monthly data submissions as they receive additional meter reading data. The survey collects:

- The quantity of electricity sold to direct customers by sector (MWh): industrial, services, domestic, other, and unclassified non-domestic.

- The quantity of electricity sold to direct customers by UK region (MWh): England & Wales, Scotland, and Northern Ireland.
- The value of sales by sector (£ thousand).
- Climate change levy collected by sector (£ thousand).

The classification of consumers into sectors according to their main business follows, as far as practicable, the Standard Industrial Classification (SIC2007). Full definitions for which sales are included within each sector can be found in the Energy Balance methodology note. Prices data is used for energy prices calculations, published by DESNZ in the Quarterly Energy Prices publication.

3.3.2 Electricity suppliers annual survey

The annual suppliers survey collects a breakdown of annual sales for sub-sectors within the industrial, commercial, domestic, and other sectors. It details:

- Quantity of electricity sold to direct customers by sub-sector (MWh).
- Number of customers within each sub-sector.

Suppliers are given the opportunity to revise their monthly data for the corresponding year and asked to ensure that monthly and annual sectoral totals reconcile.

3.3.3 UREGNI Quarterly Transparency Report

The UREGNI Quarterly Transparency report provides quarterly domestic and non-domestic sales volumes for smaller Northern Ireland suppliers missed by the DESNZ Electricity Suppliers survey.

3.4 Energy industry use

The balances measure energy industry use to account for the electricity that is needed in the process of generation and in fuel production. Data used in the process of generation are collected alongside generation and supply, as is the electricity used for pumping at pumped storage plants. Electricity used in fuel production is collected in the electricity suppliers' annual survey and estimated across the year, supplemented with data from autogenerators who operate in fuel production industries.

3.5 Transmission and distribution losses

3.5.1 Transmission losses

Elexon manages the electricity system settlement process and provides DESNZ with detailed data on transmission losses. DESNZ then collates this information to produce monthly aggregate transmission losses data.

3.5.2 Electricity distributors

Distribution network operators (DNOs) are the owners of regional distribution networks. All 15 DNOs who operate in the UK are electronically surveyed by DESNZ, with a response rate of just under 100 per cent. The monthly electricity distributors survey collects:

- Electricity received at grid supply points (MWh)
- Electricity received from elsewhere, e.g., embedded generators (MWh)
- Distribution losses incurred in your company's authorised area (MWh)
- Total electricity distributed in your company's authorised area (MWh)

DNOs can retrospectively revise their monthly submissions to reflect the availability of increased information as the electricity settlement process progresses. Space is provided for DNOs to indicate whether data has been revised and to note any events that have affected the month's data.

The annual electricity distributors survey is a consolidation exercise, as no additional information is collected. DNOs can revise their monthly data to reflect updated information, and to ensure that monthly and annual totals reconcile.

3.6 Imports and exports

3.6.1 NESO (formerly National Grid)

Data from NESO covers the interconnectors with France, the Netherlands, Ireland, Belgium, Norway and Denmark. Data for these are collated from NESO's published demand data files which show half hourly electricity flows and totalled to give the quarterly and annual values.

NESO also supply DESNZ with quarterly data on transfers between Scotland and England. The total quarterly transfers are published in Energy Trends table 5.6 and Dukes table 5.13, but NESO do not publish the half hourly transfer data.

3.6.2 EirGrid

EirGrid operate the electricity grid in Ireland and Northern Ireland, which is separate to the Great Britain grid covered by NESO. They supply monthly data on the interconnector between Ireland and Northern Ireland.

3.7 Other consumers

3.7.1 Electricity used in transport

Data published by other government departments is collated to calculate the electricity use in transport. This includes electricity used for electric road vehicles and electricity used for rail and light rail. Where full years' data are not available at the time that DUKES is published, the previous year is used as an estimate, with adjustments to take account of unusual patterns in the data, for example the effect of Covid restrictions.

Electricity used for electric road vehicles is based on data and models from the Department for Transport (DfT). The total vehicle miles for cars and light commercial vehicles are taken from table TRA0101 and multiplied by assumptions from DfT's TAG data book for the proportion of vehicle miles that were electric and the consumption of electricity per vehicle mile.

The estimated electricity consumption from electric vehicles is reported in the transport row of the tables and is deducted from the domestic and commercial rows to avoid double counting. Proportions are currently assumed to be 90 per cent domestic and 10 per cent commercial.

Electricity used for rail includes passenger and freight electricity use from the Office of Rail and Road (table 6105) plus modelled data for light rail. DfT data on vehicle kilometres by light rail and trams is published in LRT 0105 and multiplied by an estimated value for KWh per Km. This is added to data supplied by Transport for London about electricity consumption on London Underground.

4 Methodologies and table calculations

4.1 Fuel use

4.1.1 MPP fuel use

Fuel use by MPPs is collated from the monthly and annual survey data. Data are recorded in the original units supplied by MPPs and converted by DESNZ into Million Tonnes of Oil Equivalent (MTOE). Coal, diesel oil and gas oil are recorded in tonnes, natural gas and sour gas in thousand therms. Conversion of these fuels is done using the calorific values published in Annex A of DUKES, with the amount used multiplied by the calorific values, then converted using standard unit conversions. For bioenergy, MPPs are asked to detail the category (virgin wood, wood chips from processors, recycled wood, manufactured biofuel products, plant biomass, municipal solid waste, anaerobic digestion, animal biomass, plant biomass or other biomass) and to provide the calorific value. This is then multiplied by the amount used and converted using standard unit conversions.

MPPs using other fossil fuels can record the quantity used in therms, tonnes or TOE and are asked to provide a calorific value for conversion. Again, this is multiplied by the amount used and converted using standard unit conversions.

Fuel use data from MPPs is checked against historical trends for that site and for that fuel and any anomalies are queried with the site owner. The efficiency of the site (fuel use compared to generation) is also checked for any anomalies or large changes.

Where fuel use data is missing, this is estimated by taking the site's efficiency value from the previous month and setting the fuel use to match this efficiency based on their generation (if generation is also missing, this will be estimated first using the method below).

Total fuel used in each month is calculated and published in Energy Trends 5.3 and quarterly in Energy Trends 5.1. This shows the total fuel in original units for coal, oil and gas and the total of all fuels used in MTOE. Fuel input is set to match electricity output for non-thermal renewables.

4.1.2 Autogenerators fuel use

Annual data on fuel used by autogenerators comes from the CHPQA dataset, supplemented by renewable data from RESTATS and data from the quarterly autogenerators survey. Data from these sources are collated and converted to MTOE and then cross referenced to avoid double-counting. This includes removing data from MPPs who are counted in the CHP data.

The quarterly fuel used data from the autogenerators survey is collated and converted to MTOE using standard conversion factors. The data is checked and clarified with data providers if there are any issues. Some plants only know the total amount of fuel used, so it is necessary to estimate the split between fuel used for heat and for electricity generation. This is split using standard ratios for each fuel: gas 1:1, oil 1.5:1 and coal 3:1 and site-specific ratios for other fuels. The total fuel used for each quarter is then scaled based on the difference between the previous year's survey data and the full year's published data, to account for the autogenerators' data being from a sample of the full dataset.

4.1.3 Other generators fuel use

On a quarterly basis, bioenergy fuel use is estimated based on the generation. Efficiencies are calculated for each type of bioenergy and this efficiency is used to estimate fuel use. A small number of companies in the autogenerators survey report bioenergy fuel use and this is subtracted from the quarterly estimate to avoid double counting. The total bioenergy use is scaled in the same way as the other fuels collected in the autogenerator data. Fuel input is set to match electricity output for non-thermal renewables.

Similarly, quarterly data on gas use in transport and fuel used for electricity generation in the iron and steel industries is included in the total.

4.1.4 Basis for table figures on fuel used

Figures on fuel use for electricity generation can be compared in two ways. Energy Trends Table 5.3 illustrates one way by using the volumes of fuel input to power stations (after conversion of inputs to an oil equivalent basis), but this takes no account of how efficiently that fuel is converted into electricity. The fuel input basis is the most appropriate to use for analysis of the quantities of particular fuels used in electricity generation (e.g. to determine the additional amount of gas or other fuels required as coal use declines under tighter emissions restrictions). A second way uses the amount of electricity generated and supplied by each fuel, as in Energy Trends Table 5.4. This output basis is appropriate for comparing how much, and what percentage, of electricity generation comes from a particular fuel. It is the most appropriate method to use to examine the dominance of any fuel and for diversity issues. Percentage shares based on fuel outputs reduce the contribution of coal and nuclear and increase the contribution of gas compared with the fuel input basis. This is because of the higher conversion efficiency of gas.

Fuel input data in DUKES and Energy Trends generally report the energy content of the fuel, converted using published calorific values (CVs). Some tables also report quantities such as tonnes of coal or oil. For nuclear and non-thermal renewable technologies, the fuel input is reported in line with international reporting standards, most notably those issued by the International Energy Agency (IEA). Under the IEA's conventions, for hydro, wind and tidal, the equivalent fuel input is simply the gross electricity generated. Solar PV is treated similarly as a measure of simple gross output rather than the solar radiation input into the panels. For nuclear, an estimate of the heat content of the steam leaving the reactor for the turbine is used as the primary energy form (equivalent fuel input).

4.2 Electricity generation and supply

4.2.1 MPP Generation, own use and supply

Generation, own use and supply is recorded in the MPP return and is collated directly from the survey data. Generation data are checked against historical trends for that site and for that technology and any anomalies are queried with the site owner. The efficiency of the site (fuel use compared to generation) is also checked for any anomalies or large changes.

In the return, MPPs are asked for each site's generation and own use, with amount supplied being automatically calculated for them as generation minus own use. It is the calculated 'amount supplied' figure that is used to produce published tables.

The MPP's total electricity supplied is imported from the MPP and split between the different fuels that they consumed, once the fuels have all been converted to MTOEs. For example, if an MPP reported using 90 MTOE of gas and 10 MTOE of oil, their electricity supplied would be split 90 per cent to gas and 10 per cent to oil. Some site-level adjustments are also made to reflect specific operating practices.

If available, data on own use is reported directly from MPP returns for all fuels and technologies.

Each month, data on generation and own use are used to calculate scaling factors, and these are applied to MPP sites who have not provided this data. MPP sites are included in the calculation if they have generation and own use data and have supplied electricity to the grid in that month. A separate factor is calculated for each fuel/technology and each year (e.g. solar in 2023) and then applied to all sites of that type in that year who have only reported supply data. The factors are revised every month when the MPP process is run to take account of any revisions to the data, but the factor from the most recent complete year is used to prevent variability in the early parts of the year where there is not as much data. The only exception to this is pumped storage sites, where own use is taken from MPP's returns, to accurately report on the amount of electricity used in pumping. This methodology ensures that own use for solar and wind sites is reported. It also results in more accurate calculations for other fuels and technologies. For more information about the current methodology, see Methodology changes: Oil, Gas and Electricity.

4.2.2 Co-firing adjustments

Some power stations will burn small amounts of fuels alongside their main fuel, called co-firing. Adjustments are therefore made to the total electricity supplied to account for this co-firing. These adjustments are calculated by Ricardo Energy and Environment as part of their renewables work and are applied to the MPP data on an annual basis, with monthly values calculated using the latest annual figure apportioned across the months according to the months' shares in total supply.

4.2.3 Autogenerators and other generators generation

Annual data on generation by autogenerators comes from the CHPQA dataset, supplemented by renewable data from RESTATS and data from the quarterly autogenerators survey. Data from these sources is collated and cross referenced to avoid double-counting. This includes removing data from MPPs who are counted in the CHP data.

Quarterly autogenerator generation comes from the autogenerators survey data. It is calculated based on the total fuel use in MTOE multiplied by efficiency factors for each fuel, with adjustments to match the electricity generation and consumption data supplied by the autogenerator. Additional generation is also counted as part of this calculation, including renewable generation from RESTATS and generation from London Underground and the iron and steel industries data. The total generation for a quarter is then scaled based on the difference between the previous year's survey data and the full year's published data.

4.2.4 Autogenerators and other generators supply and own use

Annual calculations for supply from autogenerators and other generators are made based on a standard scaling factor by fuel. The factors used are 95.2 per cent for coal generation, 92.6 per cent for oil, 96.6 per cent for gas, 95.4 per cent for other fuels and 95 per cent for hydro and thermal renewable generation. Own use is the difference between generation and supply.

Quarterly autogenerator supply is calculated from the total generation and total own use reported by each company. Supply is the generation minus the own use figure. The total generation for a quarter is then scaled based on the difference between the previous year's survey data and the full year's published data.

4.2.5 Autogenerators and other generators electricity available

Monthly data on electricity available from autogenerators and other generators is included in Energy Trends Table 5.5. This is estimated using the quarterly figure, which is split between the months of the quarter based on the proportion of MPP generation that occurred in that month of the quarter. Where the quarter figure is not yet available, this is estimated from the value for the same month in the previous year multiplied by the rate of change between that month and the one before, in the previous year. It is then adjusted to reflect situational changes, for example unusual weather.

4.3 Purchases and transfers

This refers to electricity produced by autogenerators and other generators that is then sold or transferred to the grid.

The annual data for transfers combines the renewable data from RESTATS with the total transfers measured in the CHPQA data. The data is compared to ensure that there is no double counting between these sources and to account for data covered in the MPP survey. The data is also adjusted to ensure that generation and consumption balance for both the MPP public distribution side and for the autogenerators and other generators.

Quarterly data combines the quarterly renewable data from RESTATS with the transfers data from the autogenerators' survey. For the autogenerators' data, this is calculated from their generation minus any electricity used in the process of generation, minus the amount used on site. The total transfers for a quarter then scaled based on the difference between the previous year's survey data and the full year's published

data. The data is also adjusted to ensure that generation and consumption balance for both the MPP public distribution side and for the autogenerators and other generators.

Monthly estimates of the purchases figure are made and included in the total electricity available in Tables 5.4 and 5.5. Where the quarterly data is available, the monthly split is estimated based on the MPP generation proportion. Where the quarterly data has not yet been collected, the estimate is calculated from the value for the same month in the previous year multiplied by the rate of change between that month and the one before, in the previous year. It is then adjusted to reflect situational changes, for example unusual weather or consumption patterns.

4.4 Storage

4.4.1 Pumped storage

Data on hydro pumped storage are collected as part of the MPPs survey. There are no pumped storage plants within the autogenerators or other generators data. Plants are asked for total generation, own use and for electricity used in the process of pumping. This gives total supply and net supply, which is usually negative.

Because there is no information on the fuel or technology used to generate the electricity initially used to pump the water, pumped storage generation is reported separately and cannot be classed as renewable.

4.4.2 Battery storage: input and output electricity and capacity

Over the last decade the UK battery market has grown rapidly. Figures on grid-scale battery storage were published in DUKES from 2024 with data going back to 2017. Data is still under development and will be subject to revision as the methodology and data sources improve.

Data on the electricity input to and output from batteries comes from Elexon's BM Unit Aggregation Report, which quantifies the volume of electricity input/output to Great Britain's Balancing Mechanism by all Balancing Mechanism Units (BMUs). A list of the Balancing Mechanism Unit IDs of batteries has been produced using data provided to DESNZ by Elexon on the primary fuel type of each unit, alongside supplementary research. Batteries co-located with generation sites were excluded from this list to prevent double counting of generation. Using this list of IDs, data referring solely to batteries is extracted from the BM Unit Aggregation Report. The data are then aggregated by year, giving the total electricity input from and output to the balancing mechanism to/from batteries in each year. Where multiple settlement runs were available for a given day, the most recently published run is used.

The total electricity output to the GB balancing mechanism from batteries is used to estimate the total electricity input to and output from batteries to all markets in the UK. This is then used to estimate the relative size of total UK battery input and output electricity compared to the total battery input and output electricity from/to the balancing mechanism. Work is ongoing to identify suitable sources of data for volumes provided to/from each of the other markets. This will improve the current methodology.

Batteries have two forms of capacity: power capacity and energy capacity. Power capacity measures the rate of electricity input/output and is commonly measured in units of MW. Energy capacity measures the amount of electricity stored by a battery and is commonly measured in units of MWh.

Data on the power capacity of batteries are sourced from Elexon's list of registered BM units, available daily via their data portal. Batteries are identified in this file using the same list of IDs compiled for the input/output of electricity. The power capacity of a battery is taken to be the generation capacity in this file. Since most battery sites are registered with the balancing mechanism, capacity data is not scaled up to account for the other markets. No suitable data source has yet been identified for energy capacity figures. Work is ongoing to address this.

4.5 Imports and exports

4.5.1 Net imports

Net imports are calculated as total imports of electricity for an interconnector or time period minus the total exports for the same interconnector or time period. Net imports contribute to total electricity available but do not have any associated information on how the electricity was generated.

4.5.2 Utilisation (Table 5.13)

Utilisation measures the use of the interconnector over the year. It is calculated by summing the imports and exports (which are not counted as negative for this purpose) in MWh and dividing by the potential MWh of interconnector capacity available, i.e. the interconnector's capacity in MW multiplied by the number of hours in the year.

4.6 Transmission and distribution losses

Transmission losses are defined as electricity lost in transmission as a percentage of electricity entering the transmission system. Data for transmission losses within the GB network are provided by Elexon, then collated by DESNZ to produce a percentage which is applied to the UK electricity available figure in DUKES 5.5 and Energy Trends 5.5.

Distribution losses are defined as electricity lost in distribution as a percentage of electricity entering the transmission system. Distribution Network Operators report monthly distribution losses for their region in the DESNZ Electricity Distributors survey. This data is then checked against additional data reported by Elexon and scaled accordingly. The resulting percentage is applied to electricity available less transmission losses.

A further percentage of electricity is assumed to be lost due to theft. These were estimated to account for 0.3% of electricity supply in a 2004 Ofgem consultation document. This is applied to electricity available less transmission losses.

4.7 Electricity consumption

Electricity consumption through the Public Distribution System (PDS), and consumption by other generators are calculated separately.

4.7.1 PDS sales data aggregation

PDS sales data is primarily sourced from the monthly and annual electricity suppliers' survey. The monthly survey collects data split across five sector headings (industry, services, domestic, other, and unclassified non-domestic) and across UK regions. The data is initially checked against that provided the previous month, the corresponding month in the previous year, and against external trends e.g., seasonal variation in sales. When quarterly statistics are compiled, data from the UREGNI Quarterly Transparency Report are used to provide monthly estimates for domestic and unclassified non-domestic sales from smaller Northern Ireland suppliers who are not included in the DESNZ monthly suppliers survey.

Suppliers submit revisions to sales data throughout the year, as more electricity meter readings occur and provide more accurate consumption data. These revisions are incorporated into DESNZ statistics following the revisions policy for the relevant publication.

If a supplier is unable to submit data for a new month, their data is provisionally estimated. To estimate sector sales, the supplier's previous month's data is scaled by the month-on-month change reported by other suppliers. To estimate regional sales, the split between UK regions reported in the previous month is used to split total estimated sales for the new month. Estimates are replaced with actual data when they are provided in the next month's data collection of the electricity suppliers survey.

PDS annual sales data is provided from the annual electricity suppliers survey, which collects a more detailed breakdown of sub-sectoral sales categories. The data is initially checked against the monthly sectoral data collection for the corresponding year, the annual data submitted the previous year, and against external trends. No estimates are used for the annual survey data.

4.7.2 PDS sales table calculations

The survey includes lines for 'unclassified' and the data in these categories is reassigned based on the sectoral splits from other companies. As the electricity suppliers' survey does not cover one hundred per cent of the market, additional adjustments are then added to the monthly aggregate sector totals, and annual aggregate sub-sector totals to balance electricity consumption with electricity generation. These adjustments are carried out with consideration of the current economic and energy climate, trends reported by relevant data sources (e.g., the Index of Production, Heating Degree Days, Labour Productivity) and past trends of the individual time-series. When considering the past time-series, it may be necessary to redistribute consumption from one category to another. The finalised monthly sectoral consumption statistics are then published in Energy Trends 5.5, and the annual sub-sectoral consumption statistics are published in DUKES 5.1, 5.2, 5.5 and 5.1.2.

The quarterly electricity consumption table (Energy Trends 5.2) provides a more detailed sectoral breakdown than is provided in the monthly electricity suppliers' survey. The additional breakdown of consumption data is gained from the latest annual data collection, MPP or autogenerators surveys. Demand from the transport sector is estimated as the latest years' annual figure divided by four. Iron and steel consumption is estimated as the latest years' figure divided by twelve, and energy industry use of electricity is estimated as the latest years' figure divided by four. As iron and steel consumption and energy industry use fall within the industrial sector, they are then deducted from the overall industry figure gathered from the monthly electricity suppliers' survey. Data for electricity generation consumption are provided by the monthly MPPs survey and quarterly autogenerators survey.

4.7.3 Other generators' consumption

Annual data for consumption by autogenerators and other generators are compiled from the CHPQA data, the quarterly autogenerators' survey and renewable data from the Feed in Tariff (FITS) scheme. Data from these sources are compared to ensure that consumption is not double counted and is then split into the sectors published in DUKES. The CHPQA data and the autogenerators' survey records the specific sector of consumption, with the FITS data counted as 'other industrial', 'other commercial' or domestic depending on the installation. Gas consumption by London Underground is also added in separately.

Electricity consumption for the iron and steel sector is based on data provided by the Iron and Steel Statistics Bureau (ISSB) as electricity suppliers tend to over-estimate their sales to this sector by including some companies that use steel rather than manufacture it. The difference between the ISSB and electricity suppliers' figures is re-allocated to other sectors.

Quarterly data on autogenerators and other generators' consumption comes from the autogenerators' survey data. The total consumption reported by survey respondents for their own power and processing is combined with the total they have sold directly to other consumers (but not electricity sold to the grid) and is then scaled based on the annual CHPQA dataset. The consumption for each quarter is scaled based on the difference between the previous year's survey data and the full year's published data. It is then manually adjusted to balance with generation and to reflect differences in consumption patterns between the two years.

A monthly estimate of consumption by autogenerators and other generators' is included in Energy Trends 5.5. Where the quarterly consumption data are available, it is split across the months based on the proportion of the MPP's quarterly generation that happened in that month. Where the quarterly data have not yet been collected, the estimate is calculated as the same month last year multiplied by the rate of change between that month and the one before, in the previous year.

4.7.4 Electricity used in transport

Electricity used in transport is calculated annually as detailed above. For Energy Trends the quarterly values published are the annual value divided into four equal parts. The exception to this was for 2020 when the quarters had very different consumption patterns as a result of Covid-19 restrictions.

4.8 Energy industry use

The balances measure energy industry use to account for the electricity that is needed in the process of generation and in fuel production.

4.8.1 Fuel production

Annual data for fuel production are collated from the detailed breakdown of sectors given in the annual sales survey. They are checked and adjusted in line with consideration of the current economic and energy climate, trends reported by relevant data sources (e.g., the Index of Production, Heating Degree Days, Labour Productivity) and past trends of the individual time-series in the same way as the other sectors' data. This includes coke manufacture and blast furnace data from the ISSB.

Quarterly data are taken from the autogenerators survey for companies that work in this sector. They are then scaled in the same way as other consumption data in this survey. The consumption for each quarter is scaled based on the difference between the previous year's survey data and the full year's published data. The ISSB data are only published annually so are divided by four to give a quarterly value.

4.8.2 Electricity used in generation

Electricity used in generation, including energy used for pumped storage, is sourced from the MPP's monthly survey, the quarterly autogenerators' survey and the data on other generators, including RESTATS. The processes for calculating own use are detailed in the sections for each of these surveys and is then totalled quarterly or annually.

4.9 Electricity balance

An electricity balance presents the components of electricity supply and demand using a common unit, and places them alongside one another in a manner that shows the dependence of one on the other. Balancing of total supply and total demand is carried out on a quarterly basis, with a more detailed balance produced annually.

For both quarterly and annual balances, supply data are generally considered to be more accurate, so if necessary, the demand data will be adjusted to balance with supply. Adjustments are carried out with consideration of the current economic and energy climate, and past trends of the individual time-series, rather than using a statistical methodology. When considering the past time-series, it may also be necessary to redistribute consumption from one category to another. Balancing adjustments are typically within a range of 5 to 7 per cent of the original figure from the survey data.

Data are reconciled so that the annual balance matches the sum of the four quarters and so that monthly data sums to the quarterly balance. This is done by revising the data as needed and republishing previous monthly and quarterly data so that it matches the annual balances published within DUKES.

4.9.1 Statistical difference

In electricity statistics production, data collected on generation/supply do not match exactly with data collected on consumption and losses. This results in a statistical difference between the total generation and demand, which is within +/- 0.5%. This difference exists as data for each industry are collected from different sources, with varying restrictions on when accurate data becomes available.

4.10 Capacity

Generation capacity measures the maximum electricity output of MPPs, autogenerators and other generators. It is published annually, with renewable capacity published quarterly in Energy Trends 6.1.

4.10.1 Capacity methodology

Capacity data for MPPs are collected on a rolling basis as part of the monthly survey. They are collated annually into a database which is the source for all the DUKES tables. Tables 5.7, 5.8 and 5.12 report MPP capacity at the end of December prior to publication. Table 5.11 and the MPP capacity map report MPP capacity at the end of May for the same year DUKES is published.

Capacity for autogenerators and other generators is collated from the CHPQA survey and from RESTATS. It is checked for duplication between the data sources and collated into the DUKES tables. All tables for autogenerators and other generators report capacity at the end of December prior to publication.

4.10.2 Capacity definitions

There are different definitions of capacity used within the published tables:

Transmission Entry Capacity (TEC) describes a generator's maximum allowed export capacity onto the transmission system and is used to measure the capacity of MPPs. Prior to 2007, Declared Net Capacity was used for MPPs.

Installed capacity represents the maximum rated output of a generator (usually under specific conditions designated by the manufacturer), and one such measure, **Reference Unit Power (RUP)**, is applied to nuclear stations.

Declared Net Capacity (DNC) describes the maximum power available for export from a power station on a continuous basis, minus any power generated or imported by the station from the network to run its own plant.

4.10.3 Capacity derating

Derating of capacity reduces the reported capacity figure for types of generation that require particular conditions, particularly wind, hydro and solar generation which are reliant on wind, rainfall and sun. It is done in order to make comparisons with forms of generation that do not have these restrictions. Capacity is derated by applying a scaling factor to the declared net capacity of the generator. These factors are 0.43 for wind, 0.365 for small scale hydro and 0.17 for solar photovoltaics. Further information on this can be found at: www.legislation.gov.uk/uksi/1990/264/made.

4.10.4 Grid connections (Table 5.12)

Table 5.12 separates capacity based on whether it is connected to the transmission (higher voltage) or distribution (lower voltage) networks. For MPPs, this is collected on a rolling basis as part of the monthly survey and then collated into a database to produce the table. All autogenerators and other generators are assumed to be connected to the distribution network.

4.11 Other DUKES calculations

4.11.1 Efficiency (Table 5.10)

Thermal efficiency is the efficiency with which heat energy contained in fuel is converted into electrical energy. It is calculated by expressing electricity generated as a percentage of the total energy content of the fuel used in generation. The efficiency of coal generators, CCGT gas generators and nuclear generators is reported in Table 5.10. It is calculated on a Gross Calorific Value basis.

4.11.2 Maximum load met (Table 5.10)

The maximum load met is obtained from NESO for Great Britain and SONI Ltd, the system operator for Northern Ireland. The maximum load met is the sum of the NESO's peak plus the Northern Ireland demand at the same time. Maximum demand is measured across a 12-month period from April to March the following year rather than calendar years, so that each year only contains one winter peak. This means that the maximum load value in DUKES for a particular year will be for the winter prior to publication.

The maximum load met is divided by the total capacity of MPPs from Table 5.8 (with renewables derated for intermittency) to show the maximum load as a percentage of the available capacity. This does not include any capacity available from other generators nor that available via the interconnectors.

The time series data reflect the changes in the electricity system. From 2005, it is measured by the sum of the maximum load met in Great Britain and the load met at the same time in Northern Ireland. Prior to 2005 it was measured by the sum of the maximum load met in England and Wales and the loads met at the same time by companies in other parts of the United Kingdom.

4.11.3 System load factor (Table 5.10)

The system load factor shows the average hourly quantity of electricity available during the year (electricity available divided by hours in the year) expressed as a percentage of the maximum demand in the winter prior to the publication of DUKES.

4.11.4 Plant load factor (Table 5.10),

Plant load factors are an indication of how well utilised plant have been across the year, expressed as a percentage of the maximum possible generation. These are calculated for six categories of generation, as well as an overall load factor for all plants. The calculation uses the average hourly quantity of electricity supplied by that category divided by the average capacity at the beginning and the end of year. This shows the percentage of available capacity that was used. Hydro, wind and solar capacities are derated to account for intermittency in the load factor calculations. Chapter 6 includes load factors for renewable capacities without derating.

4.11.5 Carbon dioxide emissions per GWh supplied (Table 5.14)

Table 5.14 reports the carbon dioxide emissions per GWh of electricity supplied, for coal, oil, fossil fuels and all generation. The total carbon dioxide emissions are taken from the underlying data for the DESNZ Greenhouse Gas Emissions publication and are divided by the GWh supplied data from Table 5.6.

The carbon intensity figures presented in Table 5.14 are different to those produced for the Conversion Factors for Company Reporting. The differences arise because of methodology differences, including geographical coverage and treatment of autogenerators and interconnectors, but are principally because the conversion factors have a two-year lag between the data used to report and publication (i.e., 2020 Conversion Factors report 2018 grid average carbon intensity).

5 Glossary

Autogeneration refers to the generation of electricity as a by-product of another process, which is usually used by the producer.

Autogenerators are companies who produce electricity as part of their industrial or commercial activities, but whose main business is not electricity generation.

Bioenergy (also called thermal renewables) refer to any fuel used in generation that can be replenished. This includes plant biomass, animal biomass, biogas and renewable waste.

Blast furnace gas refers to residual gas from blast furnaces (used for steel production), used to generate electricity onsite.

Calorific values (CVs) refer to the amount of energy stored by a mass of fuel, measured in joules per tonne (or joules per cubic metre for Natural Gas). The energy content can be expressed as an upper (or gross) value and a lower (or net) value. The difference between is due to the release of energy from the condensation of water in the products of combustion. Gross calorific values are used throughout this publication.

Capacity is a measure of power stations' ability to generate, usually measured in megawatts.

Carbon Emission Reduction Target (CERT) requires gas and electricity suppliers to achieve targets to reduce carbon emissions from the domestic sector.

Carbon Reduction Commitment (CRC) is a mandatory scheme to improve energy efficiency and cut emissions in the public and private sector.

Climate Change Agreement (CCA) states that energy intensive businesses can receive a 65 per cent discount on the Climate Change Levy in return for meeting energy efficiency or carbon saving targets.

Climate Change Levy is a tax on the use of energy in industry, commercial, and the public sector, with offsetting cuts in employers' National Insurance Contributions and additional support for energy efficiency and renewable energy. The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.

Co-firing refers to the inclusion of other thermal fuels alongside a main fuel, in the generation of electricity, typically Biomass and Oil.

Coke oven gas refers to residual gas from coke ovens (used to create coke, for iron smelting), used to generate electricity by onsite.

Colliery Methane refers to methane found in coal seams and beds. It is usually used on the coal mine site or nearby, either for heating or for electricity generation

Combined Cycle Gas Turbine (CCGT) refers to the combination of gas turbines and steam turbines connected to electrical generators in the same plant.

Combined Heat and Power (CHP) refers to the simultaneous generation of usable heat and power (usually electricity) in a single process. Synonymous with cogeneration and total energy. Steam or hot water generated in a process is utilised via heat recovery equipment for use either in industrial processes or in community and space heating. **CHPQA** refers to the Combined Heat and Power Quality Assessment Scheme which assesses those CHP schemes qualifying as 'Good Quality' (i.e., those where a certain proportion of the waste heat is utilised).

Commercial sector use includes electricity consumed by shops, offices, hotels, restaurants, as well as that consumed by telecommunications and public administration services.

Conventional thermal power stations generate electricity by burning fossil fuels to convert water into steam, which then powers steam turbines.

Declared Net Capacity (DNC) is used to measure the capacity of generating stations which use renewable resources and describes the maximum power available for export from a power station on a continuous basis, minus any power generated or imported by the station from the network to run its own plant.

Derating is a scaling factor applied to renewable capacity that requires particular conditions to generate, for example solar plants being unable to generate at night. It is done to make comparisons with other forms of generation that do not have these restrictions.

Distribution Network Operator (DNO) refers to an operator of one of the 15 United Kingdom regional electricity distribution networks.

Distribution networks are lower voltage electricity networks which carry electricity from the transmission grid to final users.

Domestic sector use includes electricity consumed by households, covering final consumption across prepayment and credit meters, and peak and off-peak tariff rates.

Electricity demand refers to the total amount of electricity needed in a given time period, including consumption by users and electricity used in the process of generation and losses.

Electricity supply refers to the total amount of electricity available in a given time period, including electricity supplied to the grid by generators or imported from other countries. Electricity demand and supply need to balance.

Electricity vs energy. In common English usage, these two words are often used interchangeably. Within electricity statistics, only the term electricity is used and relates only to that specific form of energy. The energy statistics in Chapter 1 of DUKES and Energy Trends refer to a wider category of energy sources, including the use of coal or gas for heating and the use of oil for transport.

Energy industry use in the electricity balance covers all electricity used in the process of generation. This includes electricity used for fuel processing, electricity used by generators and electricity used in pumping water for pumped storage.

Embedded Generation refers to electricity generation by plant that has been connected to the distribution networks of public electricity distributors rather than directly to NESO transmission systems. Typically, they are smaller stations and include domestic generators who have electric solar panels.

Energy capacity measures the amount of electricity stored by a battery, commonly measured in units of MWh.

European Union Emissions Trading Scheme (EU-ETS) operated from 2005 and involved trading of emissions allowances as means of reducing emissions by a fixed amount.

Exports refers to the movement of commodities that have been produced in the UK for use abroad. Figures can be reported by companies or are available from the monitoring of trade in all types of products by HM Revenue and Customs.

Feed-In Tariffs scheme (FITs) encouraged deployment of small-scale low-carbon electricity generation. Qualifying technologies received a guaranteed payment from an electricity supplier for the electricity they

generated and used, and a guaranteed payment for surplus electricity exported back to the grid. The scheme closed at the end of March 2019.

Final consumption refers to electricity use by end users. These are consumers across different sectors such as: industry, commercial, transport, agriculture, and public administration.

Fossil fuels refer to coal, natural gas, and fuels derived from crude oil (for example petrol and diesel) are called fossil fuels because they have been formed over long periods of time from ancient organic matter.

Fuels refer to substances which are consumed (typically burnt) to release energy.

Generated and supplied make a distinction between the total amount generated by a plant and the amount supplied to the grid. The difference between these is the plants' **own use** i.e. the electricity needed in the process of generation.

Gigawatt (GW) is a measure of the rate of energy consumption or production, in joules per second. 1 GW = 1000 MW.

Gigawatt-hour (GWh) is a measure of the quantity of energy consumed or produced in one hour. 1 GWh = 1000 MWh.

Green Deal is a scheme by which energy-saving improvements can be made to a home or business without having to pay all the costs up front. Includes insulation and renewable energy technologies (e.g., solar panels or wind turbines).

Heat pumps take heat from the ground or air and converts it into heating in the home (radiators, underfloor, or warm air heating systems and hot water). Heat pumps need electricity to run, but the heat is renewed naturally.

Heat sold refers to heat (or steam) that is produced and sold under the provision of a contract. Heat sold is derived from heat generated by Combined Heat and Power (CHP) plants and community heating schemes without CHP plants.

Hydro-electric (natural flow) stations generate electricity using natural water flows to turn turbines, usually downhill from a reservoir or dammed river. Where fuel use is reported for hydro electricity generation, this is equivalent to the gross electricity generated, in line with international reporting conventions.

Hydro-electric (pumped storage) stations use electricity to pump water into a high-level reservoir. This water is then released to generate electricity at peak times.

Imports refer to the movement of commodities into the UK from abroad. Figures can be reported by companies or are available from the monitoring of trade in all types of products by HM Revenue and Customs.

Indigenous production refers to the extraction or capture of primary fuels: for oil and gas this includes production from the UK Continental Shelf.

Industrial sector use includes electricity used for transformation and final consumption activities in industrial activities, including the production of iron and steel, non-ferrous metals, chemical and mineral products.

Installed capacity represents the maximum rated output of a generator (usually under specific conditions designated by the manufacturer), and one such measure, Reference Unit Power (RUP), is applied to nuclear stations.

Load factor is a measure of the utilisation of a power plant, given by the amount of electricity generated over a period of time divided by the maximum possible generation (given by the capacity multiplied by the number of hours in the period).

Losses refer to electricity lost through the process of either transmission or distribution. They are reported as electricity lost within the system as a percentage of electricity entering the system. Losses also include theft of electricity from the distribution network.

Major electricity suppliers are companies who supply electricity to consumers through the public distribution system and have a market share of above 0.1%. Further information about electricity suppliers can be found in the electricity suppliers data collection. Electricity can also be consumed by autogenerators, which use the electricity they produce onsite.

Major Power Producers (MPPs) are companies whose prime purpose is the generation of electricity. Some renewable generators, with a smaller capacity portfolio, are excluded from this list. For a detailed description of the inclusion criteria for MPPs in DESNZ statistics, see the MPP data collection section of this document.

Megawatt (MW) is a measure of the rate of energy consumption or production, in joules per second. 1 MW = 1000 kilowatts (kW)

Megawatt-hour (MWh) is a measure of the quantity of energy consumed or produced in one hour. 1 MWh = 1000 kilowatt-hours (kWh).

Natural gas refers to methane rich gas burned to drive turbines for electricity generation.

Net imports are calculated as imports of electricity minus exports. Trade of electricity occurs along interconnectors with France, Ireland, Netherlands, Belgium, Norway. Electricity can also be transferred between the separate electricity grids of England & Wales, Scotland, and Northern Ireland.

Non-Fossil Fuel Obligation (NFFO) refers to the obligation of Regional Electricity Companies in England and Wales to secure specified amounts of electricity from renewable sources, if ordered by the Secretary of State through the 1989 Electricity Act.

Nuclear refers to electricity generated from the heat produced from the nuclear fission of uranium. Nuclear generation uses nuclear fission to produce the heat needed for steam which is then used to turn turbines. Where fuel use is reported for nuclear electricity generation, this reports an estimate of the heat content of the steam leaving the reactor for the turbine, in line with international reporting conventions.

Other fuels refers to fossil fuels other than coal, oil or gas and to other non-renewable fuels, including the burning of non-renewable waste and industrial waste products (e.g. waste gases).

Other generators refers to any generator not counted as a Major Power Producer. It includes autogenerators, domestic generation, and smaller renewable electricity generators (e.g. small wind farms) who are not included as MPPs due to their comparatively small size.

Other sector use is any electricity consumption by end users which is not classified as industrial, commercial or domestic.

Other sources is used in the commodity balances to refer to electricity generated from pumped storage.

Power capacity measures the rate of electricity input or output to/from a battery and is commonly measured in units of MW.

Public Distribution System (PDS) is the separate grid systems in England and Wales, Scotland and Northern Ireland which carries electricity from generators to final users. It consists of (1) transmission networks: high voltage electricity wires which extend across GB and offshore waters, and (2) distribution networks: lower voltage electricity networks which carry electricity from the transmission grid to final users.

Primary electricity refers to electricity generated from a source that is immediately converted to usable electricity, e.g. nuclear or hydro-electric.

Pumped storage is a form of electricity storage, whereby electricity is used to pump water uphill to a reservoir when it is not required for consumption (i.e. at off-peak times), and electricity is generated (for consumption at peak times), by releasing the water to flow downhill through turbines (to another reservoir). This process is not 100 per cent efficient, so the electricity output is lower than the input for the same quantity of water moved.

Reference Unit Power (RUP) is a measure of installed capacity which is applied to nuclear stations.

Renewable refers to any form of generation that either does not use fuel to generate, such as solar, wind or tidal generation, or generation that uses fuels that can be replenished. Renewable fuels include plant biomass, animal biomass, biogas and renewable waste.

Renewables Directive encouraged EU Member States to adopt targets to meet 20 per cent of energy from renewables by 2020.

Renewable energy sources include solar, wind, wave and tide, and hydroelectricity. Solid renewable energy sources consist of wood, straw, short rotation coppice, other biomass, and the biodegradable fraction of wastes. Gaseous renewables consist of landfill gas and sewage gas. Non-biodegradable wastes are not counted as a renewables source but appear in the Renewable sources of energy chapter of this Digest for completeness.

Renewables Obligation refers to an obligation on all electricity suppliers to supply a proportion of electricity from eligible renewable sources.

Secondary electricity refers to electricity generated by utilising the heat obtained from burning natural primary sources of energy, e.g., coal, gas, or biomass.

Solar generators use photovoltaic cells and modules to directly convert solar energy into electricity. Where fuel use is reported for solar electricity generation, this is equivalent to the gross electricity generated, in line with international reporting conventions. It does not consider the radiation input to the solar panel.

Statistical difference (SD) refers to the difference between total demand and total supply.

Temperature correction indicates what annual consumption might have been if the average temperature during the year had been the same as the average for the years 1981 to 2010.

Therm is a unit of energy, typically used for natural gas.

Thermal efficiency of a power station is the efficiency with which heat energy contained in fuel is converted into electrical energy. It is calculated for fossil fuel burning stations by expressing electricity generated as a percentage of the total energy content of the fuel consumed (based on average gross calorific values). For nuclear stations it is calculated using the quantity of heat released from fission of the nuclear fuel inside the reactor.

Thermal sources of electricity include coal, oil, natural gas, nuclear, landfill gas, sewage gas, municipal solid waste, farm waste, tyres, poultry litter, short rotation coppice, straw, coke oven gas, blast furnace gas, and waste products from chemical processes.

Transmission Entry Capacity (TEC) is a measure of capacity which describes a generator’s maximum allowed export capacity onto the transmission system and is used to measure the capacity of Major Power Producers.

Transmission networks are the high voltage electricity wires which extend across GB and offshore waters.

Transport use includes electricity used by rail and light rail companies (both over and underground) for traction purposes, and electricity used by electric road vehicles.

Wave and tidal generation covers any generation from wave energy or tidal currents. Where fuel use is reported for wave and tidal electricity generation, this is equivalent to the gross electricity generated, in line with international reporting conventions.

Wind farms use wind flows to turn turbines. They can be either on-shore (located on land) or off-shore (located in water). Where fuel use is reported for wind electricity generation, this is equivalent to the gross electricity generated, in line with international reporting conventions.

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