Department for
Business, Energy
& Industrial Strategy

DIGEST OF UNITED KINGDOM ENERGY STATISTICS 2018

July 2018

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Digest of United Kingdom Energy Statistics

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Designation can be broadly interpreted to mean that the statistics:

- meet identified user needs
- are well explained and readily accessible
- are produced according to sound methods, and
- are managed impartially and objectively in the public interest

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed

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Monthly and quarterly data are also available for Energy, Solid fuels and derived gases, Petroleum, Gas, Electricity and Renewables at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Information on Energy Prices is also available at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

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Introduction

I This issue of the Digest of United Kingdom Energy Statistics (DUKES) continues a series which commenced with the Ministry of Fuel and Power Statistical Digest for the years 1948 and 1949, published in 1950. The Ministry of Fuel and Power Statistical Digest was previously published as a Command Paper, the first being that for the years 1938 to 1943, published in July 1944 (Cmd. 6538). A publication tracing the history of energy production and use over the past 60 years was produced in 2009 to mark the 60th anniversary of DUKES. The publication is available at: www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-60th-anniversary

II The current issue updates the figures given in the Department for Business, Energy and Industrial Strategy's (BEIS) *Digest of United Kingdom Energy Statistics 2017*, published in July 2017.

III This publication consists of seven chapters and four annexes. The first chapter deals with overall energy. The other chapters cover the specific fuels, renewable sources of energy and combined heat and power. The annexes cover conversion factors and calorific values, a glossary of terms, further sources of information and major events in the energy industries.

IV Some additional information appears on the internet. The tables on the internet are provided in Microsoft Excel format. Most internet versions of the tables include data for earlier years, which are not provided in this publication. For example commodity and energy balances (see VII and VIII, below) for 1998 to 2014 are included on the internet, and tables that show five years in this publication show twenty years in their internet form because page sizes are not a limiting factor. In addition, the following appear on the internet:

Long term trends tables
Major events from 1990 to 2018 - Annex D
(only Major events for 2016 to 2018 appear in this publication)
Energy and the environment – Annex E
UK oil and gas resources - Annex F
Foreign trade – Annex G
Flow charts – Annex H
Energy balance: net calorific values – Annex I
Heat reconciliation – Annex J

V Annual information on prices is included in the publication *Energy Prices*. The data are also available on the Department for Business, Energy and Industrial Strategy (BEIS) section of the GOV.UK website. Further information on these publications can be found in Annex C.

VI Where necessary, data have been converted or adjusted to provide consistent series. However, in some cases changes in methods of data collection have affected the continuity of the series. The presence of remaining discontinuities is indicated in the chapter text or in footnotes to the tables.

VII Chapters 2, 3, 4, 5 and 6 contain production and consumption of individual fuels and are presented using *commodity balances*. A commodity balance illustrates the flows of an individual fuel through from production to final consumption, showing its use in transformation (including heat generation) and energy industry own use. Further details of commodity balances and their use are given in Annex A, paragraphs A.7 to A.42.

VIII The individual commodity balances are combined in an *energy balance,* presented in Chapter 1, *Energy*. The energy balance differs from a commodity balance in that it shows the interactions between different fuels in addition to illustrating their consumption. The energy balance thus gives a fuller picture of the production, transformation and use of energy showing all the flows. Expenditure on energy is also presented in energy balance format in Chapter 1. Further details of the energy balance and its use, including the methodology introduced in the 2003 Digest for heat, are given in Annex A, paragraphs A.43 to A.58.

IX Chapter 1 also covers general energy statistics and includes tables showing energy consumption by final users and an analysis of energy consumption by main industrial groups. Fuel production and consumption statistics are derived mainly from the records of fuel producers and suppliers.

X Chapters 6 and 7 summarise the results of surveys conducted by Ricardo Energy & Environment on behalf of BEIS which complement work undertaken by BEIS. These chapters estimate the contribution made

by renewable energy sources to energy and combined heat and power (CHP) production and consumption in the United Kingdom.

XI Some of the data shown in this Digest may contain previously unpublished revisions and estimates of trade from HM Revenue and Customs and the Office for National Statistics. These data are included in Annex G.

Definitions

XII The text at the beginning of each chapter explains the main features of the tables. Technical notes and definitions, given at the end of this text, provide detailed explanations of the figures in the tables and how they are derived. Further information on methodologies are also provided on the BEIS section of the GOV.UK website for each fuel

XIII Most chapters contain some information on 'oil' or 'petroleum'; these terms are used in a general sense and vary according to usage in the field examined. In their widest sense they are used to include all mineral oil and related hydrocarbons (except methane) and any derived products.

XIV An explanation of the terms used to describe electricity generating companies is given in Chapter 5, paragraphs 5.72 to 5.79.

XV Data in this issue have been prepared on the basis of the Standard Industrial Classification (SIC 2007) as far as is practicable. For further details of classification of consumers see Chapter 1, paragraphs 1.57 to 1.61.

XVI Where appropriate, further explanations and qualifications are given in footnotes to the tables.

Proposed change to use net calorific values when producing energy statistics

XVII A consultation was launched in the 2005 edition of the Digest seeking views of users as to whether Net Calorific Values (NCVs) should be used in place of Gross Calorific Values (GCVs). As a result of this consultation, it was recognised that there are good arguments both for and against moving from GCV to NCV. However it was concluded that there would be no demonstrable advantage to changing the method of presenting UK Energy statistics, and so GCVs continue to be used in this edition and will be used in future editions of the Digest. The fuel specific NCVs will continue to be published, and are shown in Annex A. The total energy balances on a net calorifc basis are now produced as part of the additional internet content of the Digest, Annex I.

Geographical coverage

XVIII The geographical coverage of the statistics is the United Kingdom. However, within UK trade statistics, shipments to the Channel Islands and the Isle of Man from the United Kingdom are not classed as exports. Supplies of solid fuel and petroleum to these islands, from the UK, are therefore included as part of United Kingdom inland consumption or deliveries.

Periods

XIX Data in this Digest are for calendar years or periods of 52 weeks, depending on the reporting procedures within the fuel industry concerned. Actual periods covered are given in the notes to the individual fuel chapters

Revisions

XX The tables contain revisions to some of the previously published figures, and where practicable the revised data have been indicated by an 'r'. The 'r' marker is used whenever the figure has been revised from that published in the 2017 Digest, even though some figures may have been amended on the internet version of the tables. A table showing the size of revisions to key aggregates is available (Chapter 1, table 1J). Statistics on energy in this Digest are classified as National Statistics. This means that they are produced to high professional standards as set out in the UK Statistics Authority's Code of Practice for Official Statistics. The Code of Practice requires that all the public bodies that produce official statistics "Publish a revisions policy for those outputs that are subject to scheduled revisions, and provide a statement explaining the nature and extent of revisions at the same time that they are released". The following statement outlines the policy on revisions for energy statistics.

Revisions to data published in the *Digest of UK Energy Statistics*.

It is intended that any revisions should be made to previous years' data only at the time of the publication of the Digest (i.e. in July 2018 when this Digest is published, revisions can be made to 2016 and earlier years). In exceptional circumstances previous years' data can be amended between Digest publication dates, but

this will only take place when quarterly *Energy Trends* is published. The reasons for substantial revisions will be explained in the 'Highlights' sheet of the internet version of the table concerned. Valid reasons for revisions of Digest data include:

- revised and validated data received from a data supplier;
- the figure in the Digest was wrong because of a typographical or similar error.

In addition, when provisional annual data for a new calendar year (e.g. 2018) are published in *Energy Trends* in March of the following year (e.g. March 2019), percentage growth rates are liable to be distorted if the prior year (i.e. 2017) data are constrained to the Digest total, when revisions are known to be required. In these circumstances the prior year (i.e. 2017) data will be amended for all affected tables in *Energy Trends* and all affected Digest tables will be clearly annotated to show that the data has been up-dated in *Energy Trends*.

Revisions to 2018 data published in *Energy Trends* prior to publication in the 2019 edition of the *Digest of UK Energy Statistics.*

- All validated amendments from data suppliers will be updated when received and published in the next statistical release.
- All errors will be amended as soon as identified and published in the next statistical release.
- Data in energy and commodity balances format will be revised on a quarterly basis, to coincide with the publication of *Energy Trends*.

Further details on the UK Statistics Authority's Code of Practice for Official Statistics can be found at: www.statisticsauthority.gov.uk/monitoring-and-assessment/code-of-practice/. BEIS's statements of compliance with the Code are available at: www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics. The UK Statistics Authority undertake regular assessments of BEIS's energy statistics and their reports can be accessed at: www.statisticsauthority.gov.uk/publications-list/?keyword=&type=assessment-report.
The authority's recommendations have been incorporated into this publication and other BEIS energy statistical publications and outputs.

Energy data on the internet

XXI Energy data are held on the BEIS section of the GOV.UK website, under "statistics". The Digest is available at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes. Information on further BEIS energy publications is given in Annex C.

XXII The Department for Business, Energy and Industrial Strategy was created on 14 July 2016. This Department took over energy policy from the former Department of Energy and Climate Change. Within this publication references to BEIS's predecessor Department refer to DECC.

XXIII Short term statistics are published:

- monthly, by BEIS;
- quarterly, by BEIS in *Energy Trends,* and *Energy Prices;*
- quarterly, by BEIS in a Statistical Press Release which provides a summary of information published in *Energy Trends* and *Energy Prices*;

Table numbering

XXIV Page 10 contains a list showing the tables in the order in which they appear in this issue, and their corresponding numbers in previous issues.

Symbols used

XXV The following symbols are used in this Digest:

..	not available
-	nil or not separately available
r	revised since the previous edition

Rounding convention

XXVI Individual entries in the tables are rounded independently and this can result in totals, which are different from the sum of their constituent items.

Acknowledgements

XXVII Acknowledgement is made to the main coal producing companies, the electricity companies, the oil companies, the gas pipeline operators, the gas suppliers, National Grid, the Institute of Petroleum, the Coal

Authority, the United Kingdom International Steel Statistics Bureau, Ricardo Energy & Environment, the Department for Environment, Food and Rural Affairs, the Department for Transport, OFGEM, Building Research Establishment, HM Revenue and Customs, the Office for National Statistics, and other contributors to the enquiries used in producing this publication.

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XXIX For enquiries concerning particular data series or chapters contact those named on page 9 or at the end of the relevant chapter.

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Tables as they appear in this issue and their corresponding numbers in the previous three issues

Chapter	2015	2016	2017	2018	Chapter	2015	2016	2017	2018
ENERGY	-	-	-	1.1	**ELECTRICITY**	5.1	5.1	5.1	5.1
	-	-	1.1	1.2		5.2	5.2	5.2	5.2
	-	1.1	1.2	1.3		5.3	5.3	5.3	5.3
	1.1	1.2	1.3	-		1.9	1.9	5.4	5.4
	1.2	1.3	-	-		5.4	5.4	5.5	5.5
	1.3	-	-	-		5.5	5.5	5.6	5.6
	-	-	-	1.4		5.6	5.6	5.7	5.7
	-	-	1.4	1.5		5.7	5.7	5.8	5.8
	-	1.4	1.5	1.6		5.8	5.8	5.9	5.9
	1.4	1.5	1.6	-		5.9	5.9	5.10	5.10
	1.5	1.6	-	-		5.10	5.10	5.11	5.11
	1.6	-	-	-		5.11	5.11	7.10	7.10
	1.7	1.7	1.7	1.7		-	5.12	5.12	5.12
	1.8	1.8	-	-					
	1.9	1.9	5.4	5.4	**RENEWABLE**	-	-	-	6.1
					SOURCES OF	-	-	6.1	6.2
SOLID FUELS	-	-	-	2.1	**ENERGY**	-	6.1	6.2	6.3
& DERIVED	-	-	2.1	2.2		6.1	6.2	6.3	-
GASES	-	2.1	2.2	2.3		6.2	6.3	-	-
	2.1	2.2	2.3	-		6.3	-	-	-
	2.2	2.3	-	-		6.4	6.4	6.4	6.4
	2.3	-	-	-		6.5	6.5	6.5	6.5
	2.4	2.4	2.4	2.4		6.6	6.6	6.6	6.6
	2.5	2.5	2.5	2.5		6.7	6.7	6.7	6.7
	2.6	2.6	2.6	2.6					
	2.7	2.7	2.7	2.7	**COMBINED**	7.1	7.1	7.1	7.1
					HEAT AND	7.2	7.2	7.2	7.2
PETROLEUM	3.1	3.1	3.1	3.1	**POWER**	7.3	7.3	7.3	7.3
	-	-	-	3.2		7.4	7.4	7.4	7.4
	-	-	3.2	3.3		7.5	7.5	7.5	7.5
	-	3.2	3.3	3.4		7.6	7.6	7.6	7.6
	3.2	3.3	3.4	-		7.7	7.7	7.7	7.7
	3.3	3.4	-	-		7.8	7.8	7.8	7.8
	3.4	-	-	-		7.9	7.9	7.9	7.9
	3.5	3.5	3.5	3.5		5.11	5.11	7.10	7.10
	3.6	3.6	3.6	3.6					
	3.7	3.7	3.7	3.7	**ANNEX A**	A.1	A.1	A.1	A.1
	3.8	3.8	3.8	3.8	**CALORIFIC**	A.2	A.2	A.2	A.2
					VALUES	A.3	A.3	A.3	A.3
NATURAL GAS	4.1	4.1	4.1	4.1					
	4.2	4.2	4.2	4.2					
	4.3	4.3	4.3	4.3					
	4.4	4.4	4.4	4.4					
	4.5	4.5	4.5	4.5					
	4.6	4.6	4.6	4.6					

Chapter 1
Energy

Key points

- **In 2017, UK energy production was up 0.4 per cent on a year earlier**. The rise was driven by **growth from wind, solar and hydro and bioenergy and waste**. Overall fossil fuel production contracted with coal reaching a record low. (Tables 1.1 and 1.2).

- Imports and exports in 2017 were both up; **overall net imports decreased though they still accounted for 36 per cent of energy used in the UK**.

- **Primary energy consumption was down 1.2 per cent; and on a temperature adjusted basis primary energy consumption was down 0.3 per cent** continuing the downward trend of the last ten years. UK temperatures were above normal with a decrease in heating degree days compared to 2016. (Table 1.1.7).

- **Final energy consumption fell by 0.7 per cent** as demand for heating decreased with temperature adjusted final energy consumption up by 0.9 per cent on 2016 levels, mainly due to increased energy use in transport. (More details are available in Energy Consumption in the UK www.gov.uk/government/collections/energy-consumption-in-the-uk)

- **Fossil fuels remain the dominant source of energy supply, but now accounts for 80.1 per cent,** a record low level. Supply from renewables increased, with their contribution accounting for 10.2 per cent of final consumption on the EU agreed basis (see Chapter 6).

- In 2017, there was a switch in the main sources of electricity generation away from coal and gas to renewables. Generation from coal fell by 27 per cent, gas fell by 4.6 per cent, whilst renewables rose by 19.5 per cent**. Renewables' share of generation was at a record high level of 29.3 per cent in 2017,** up from 24.5 per cent in 2016, due to increased renewables generation capacity (wind and solar) and more favourable weather conditions for wind generation (see chapters 5 and 6).

- Provisional BEIS estimates suggest that **overall emissions fell by 12 million tonnes of carbon dioxide ($MtCO_2$) (3.2 per cent) to 366.9 $MtCO_2$** between 2016 and 2017, driven by the changes in electricity generation.

Introduction

1.1 This chapter presents figures on overall energy production and consumption. Figures showing the flow of energy from production, transformation and energy industry use through to final consumption are presented in the format of an energy balance based on the individual commodity balances in Chapters 2 to 6.

1.2 The chapter begins with aggregate energy balances covering the last three years (Tables 1.1 to 1.3) starting with the latest year, 2017, compiled using Gross Calorific Values (see paragraph 1.29). Energy value balances then follow this for the same years (Tables 1.4 to 1.6) and Table 1.7 shows sales of electricity and gas by sector in value terms. The explanation of the principles behind the energy balance and commodity balance presentations, and how this links with the figures presented in other chapters, is set out in Annex A. Information on long term trends (Tables 1.1.1 to 1.1.9) are available on BEIS's energy statistics website at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

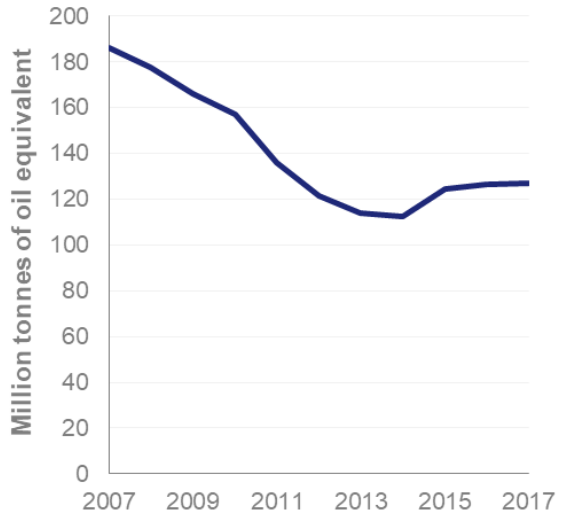
Aggregate energy balance (Tables 1.1, 1.2 and 1.3)

1.3 These tables show the flows of energy in the United Kingdom from production to final consumption through conversion into secondary fuels such as coke, petroleum products, secondary electricity and heat sold. The figures are presented on an energy supplied basis, in tonnes of oil equivalent (toe), a unit of energy where 1 toe = 41.868 GJ, see also paragraph 1.28 for other energy units. The basic principles of energy balances and guidance on what is included in each row is detailed in Annex A of this publication.

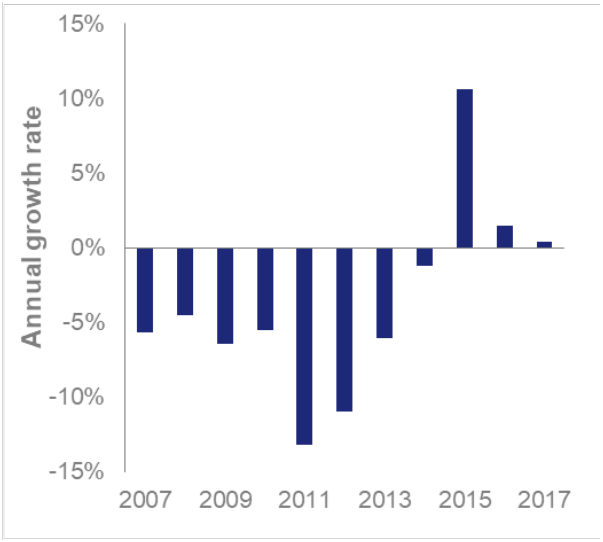
Energy production and supply

1.4 Indigenous **production in 2017 was 0.4 per cent higher than in 2016** (Chart 1.1). This small increase is the third consecutive rise since UK energy production peaked in 1999 and is now 57 per cent below that peak with production falling in each of the years between 2000 and 2014 due to declines in output from the UK Continental Shelf (UKCS). **The rise in 2017 was due to an increase in renewable fuel production.** The combined output of wind, hydro and solar photovoltaics rose by 27 per cent, as wind and solar capacity increased and weather conditions (primarily wind speeds) improved. This was matched with strong growth in bioenergy production, up 9.4 per cent on last year. Although gas production was up slightly (0.3 per cent) **overall fossil fuel production contracted** with coal posting a new record low.

Chart 1.1: UK energy production level



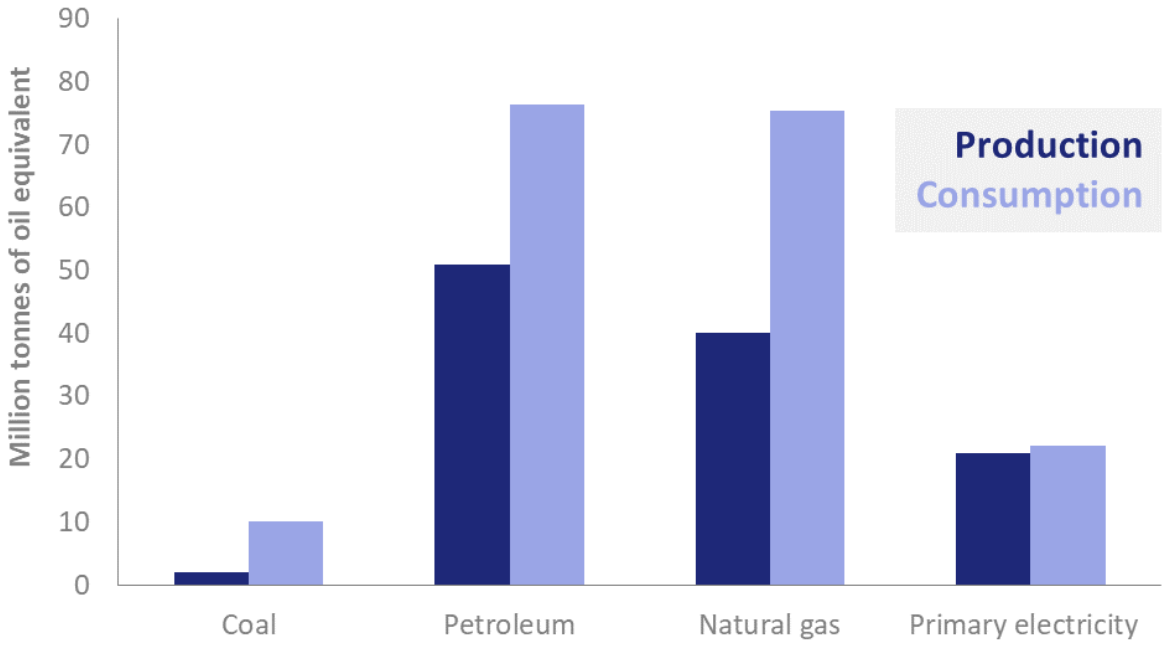
Annual growth rate



1.5 The reduction in coal output, down 27 per cent to a record low level, is due to the last large deep mines closing in 2015 and a continued reduction in demand from electricity generators. Crude oil production was down 1.9 per cent with the unexpected closure of the Forties Pipeline System for repair affecting output at the end of the year. Nuclear output was down 1.9 per cent due to outages, however primary electricity (nuclear plus wind, solar and hydro) output was up 4.7 per cent. More details on these changes are given in the later fuel specific chapters.

1.6 **In 2017, the primary supply of fuels was 200.1 million tonnes of oil equivalent (mtoe), a 1.2 per cent decrease compared to 2016**. Chart 1.2 illustrates the figures for the production and consumption of individual primary fuels in 2017. In 2017, aggregate primary fuel consumption was not met by indigenous production; this continues the trend since 2004 when the UK became a net importer of fuel. The differences between production and consumption are met mainly by trade but stock changes and the use of fuel in international shipping (marine bunkers) are also factors.

Chart 1.2: Production and consumption of primary fuels 2017



1.7 As explained in subsequent chapters, the UK has traded fuels such as oil and gas regardless of whether it has been a net exporter or importer. Imports in 2017 at 151.9 million toe rose by 1.2 per cent from 2016 but are down 16 per cent from their peak in 2013. Imports of petroleum products and gas fell, but these were more than offset by the rise in imports of primary oil which were up by 9.4 per cent to meet UK refinery demand. Exports at 79.3 million toe were up 4.7 per cent, as a result of OPEC production cuts making it cheaper for Asian refineries to use UK supplies resulting in an increase of 10.1 per cent in crude oil exports. The UK remained a net importer of all main fuel types in 2017. In 2017 the UK net import gap fell back to 72.6 million toe from the 2013 peak of 104 million toe. **Net imports accounted for 36 per cent of energy used in the UK in 2017, down from their share of 48 per cent in 2013.**

Energy demand and final consumption

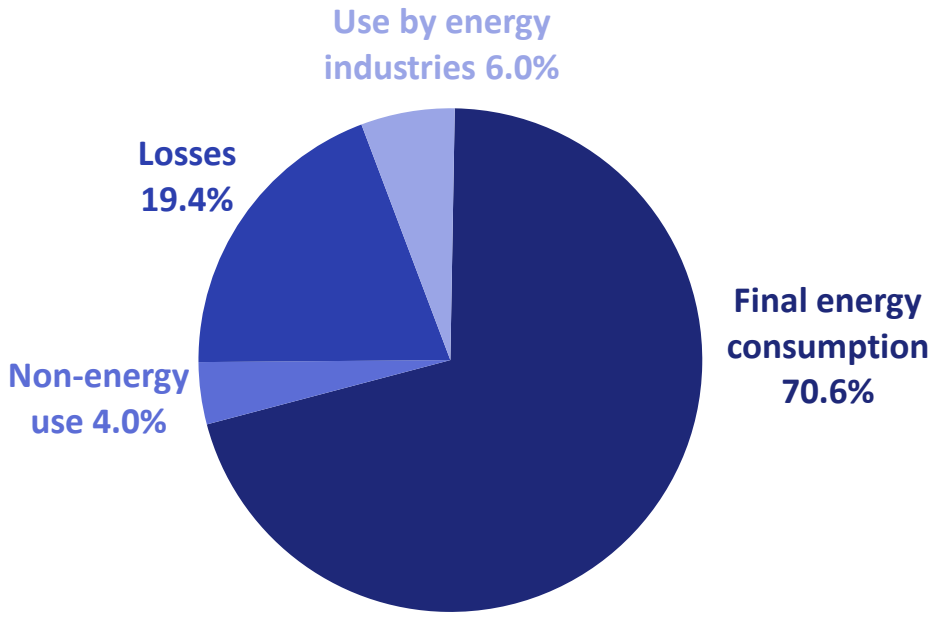
1.8 **Total primary energy demand was 1.4 per cent lower in 2017 than in 2016 at 199.9 mtoe**. The fall in demand compared to a year earlier was mainly due to reduced losses in transformation, as renewables displaced coal in generation. Average temperatures overall in 2017 were 0.3 degrees warmer than in 2016 and the average number of heating degree days down from 5.5 to 5.2.

1.9 Primary energy consumption (primary supply less non-energy use) was down by 1.2 per cent in 2017**. On a temperature corrected basis, primary energy consumption was estimated to have fallen by 0.3 per cent.** A table showing temperature corrected demand is shown in Table 1.1.4 in the annex on long term trends, while Chart 1.3, shows the continued fall in primary energy consumption.

Chart 1.3: Primary energy consumption

1.10 In 2017, gas accounted for 40 per cent of UK generation down from 42 per cent in 2016. Coal's share declined further, accounting for only 6.7 per cent in 2017. Nuclear accounted for 21 per cent of generation, down marginally from 2016, with thermal renewables accounting for a record 9.4 per cent share**. Generation from wind, hydro and solar photovoltaics rose by 27 per cent, to a record high level, due to increased wind and solar capacity as well as better weather conditions and accounted for a record 20 per cent of generation. Overall renewables' share of generation was at a record high of 29.3 per cent in 2017.** More details on electricity are available in Chapter 5, with further information on renewable generation available in Chapter 6.

Chart 1.4: Primary demand 2017

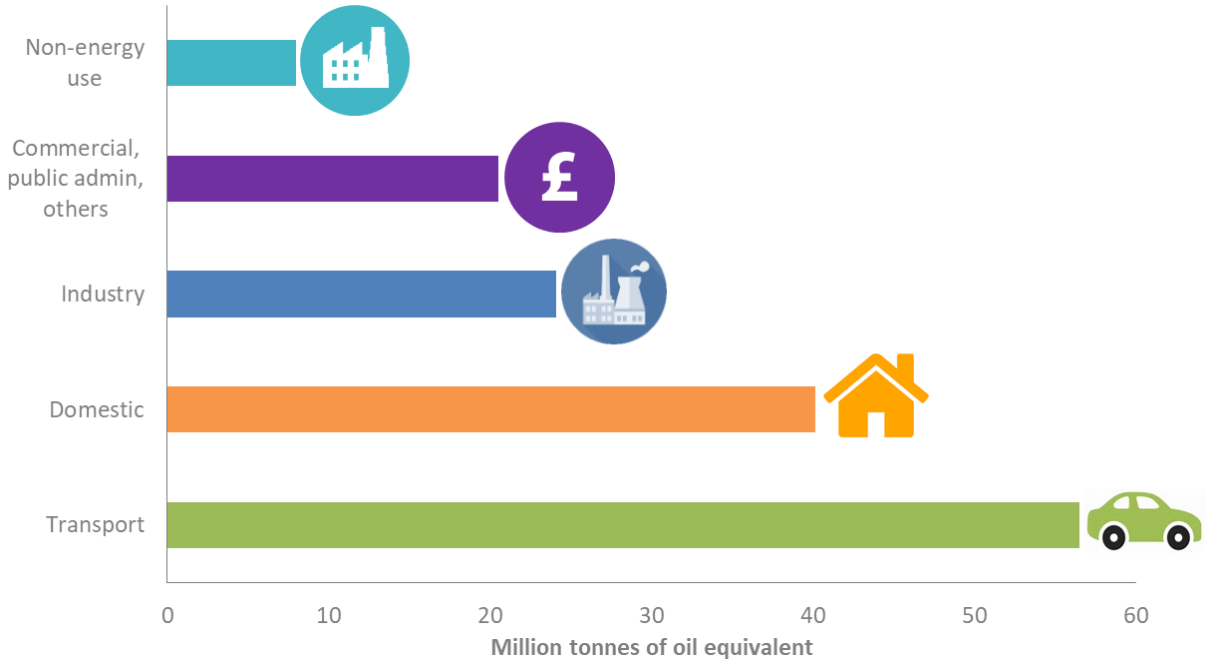


Primary demand: 199.9 million tonnes of oil equivalent

1.11 This switch from coal to renewables for generation has resulted in a **sharp decrease in carbon dioxide emissions between 2016 and 2017**. Provisional BEIS estimates suggest that overall emissions fell by 12.0 million tonnes of carbon dioxide ($MtCO_2$) (3.2 per cent) to 366.9 $MtCO_2$ between 2016 and 2017. More details of carbon dioxide emissions are available in a Statistical Release, published in March, which is available on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/provisional-uk-greenhouse-gas-emissions-national-statistics#2018

1.12 Total **final consumption**, which includes non-energy use of fuels, was 149.1 million tonnes of oil equivalent in 2017. Chart 1.5 shows consumption by category, with transport and domestic use accounting for nearly two thirds of final consumption.

Chart 1.5: Final consumption 2017



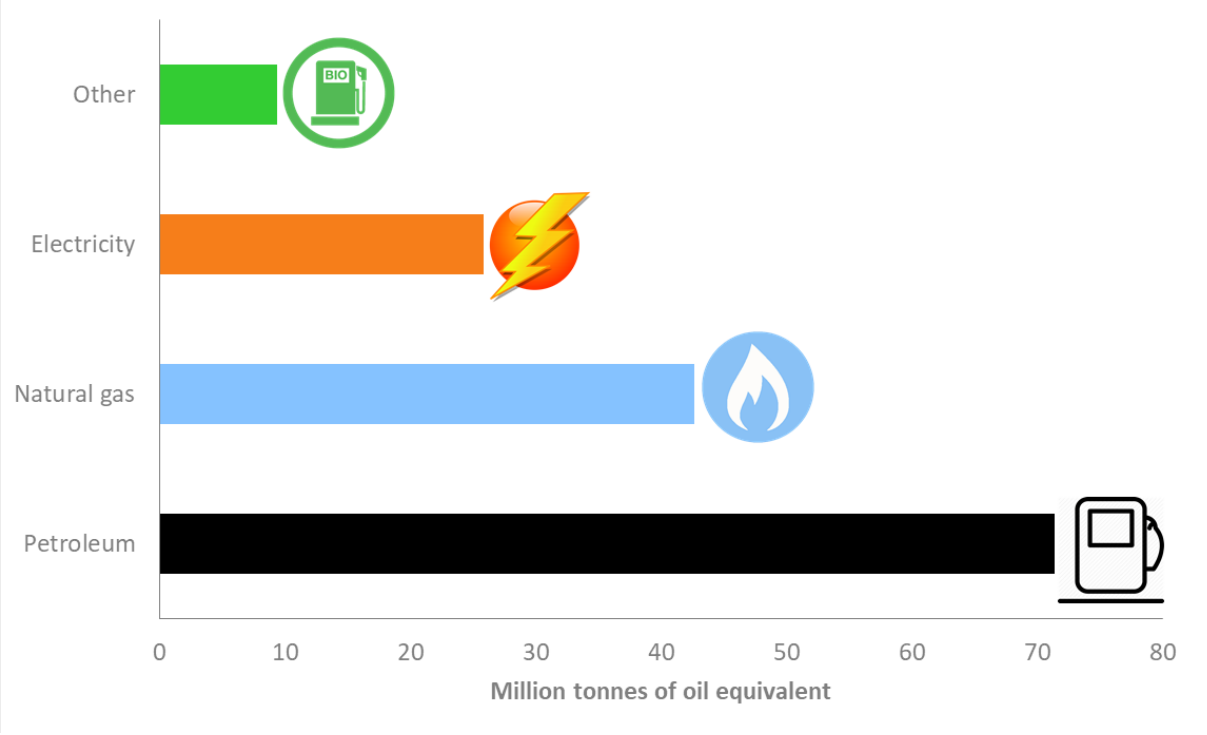
1.13 Final consumption (including Non Energy Use) decreased by 1.1 million tonnes of oil equivalent, **0.7 per cent down, on the consumption in 2016.** The decrease comes mainly from the domestic sector, which fell by 3.7 per cent. The domestic fall in consumption was mainly due to the warmer winter weather in 2017 compared to 2016. On a temperature adjusted basis domestic consumption is estimated to have increased by 0.3 per cent in 2017, though it is down 12 per cent over the last 10 years.

1.14 **Consumption in the transport sector rose by 0.9 per cent; this rise taking consumption to its highest level since 2008, with increased demand in air transport consumption.** Consumption in the service sector fell by 1.4 per cent on decreased heating demand, whilst consumption in the industrial sector rose by 1.6 per cent. There was a slight fall in non-energy use.

1.15 **Final energy consumption (where non-energy use is excluded) was down by 0.7 per cent on the year**. On a temperature corrected basis final energy consumption was estimated to be up 0.9 per cent in 2017 compared to 2016 but is down by an average of 0.9 per cent per annum over the last 10 years.

1.16 The main fuels used by final consumers in 2017 were petroleum products (47.8 per cent), natural gas (28.6 per cent) and electricity (17.3 per cent). Biofuels accounted for 4.1 per cent of final consumption. The amount of heat that was bought for final consumption accounted for 0.9 per cent of the total final consumption.

Chart 1.6: Final consumption by fuel 2017



1.17 Of the petroleum products consumed by final users 10 per cent was for non-energy purposes; for natural gas 1.0 per cent was consumed for non-energy purposes. Non-energy use of fuels includes use as chemical feedstocks and other uses such as lubricants. Non-energy use of fuels for 2017 is shown in Table 1A. Further details of non-energy use are given in Chapter 2 paragraph 2.29, Chapter 3, paragraph 3.20 and Chapter 4, paragraph 4.27.

Table 1A: Non-energy use of fuels 2017

Thousand tonnes of oil equivalent

	Petroleum	Natural gas	Manufactured fuel
Petrochemical feedstocks	4,893	426	48
Other	2,597	-	-
Total	**7,490**	**426**	**48**

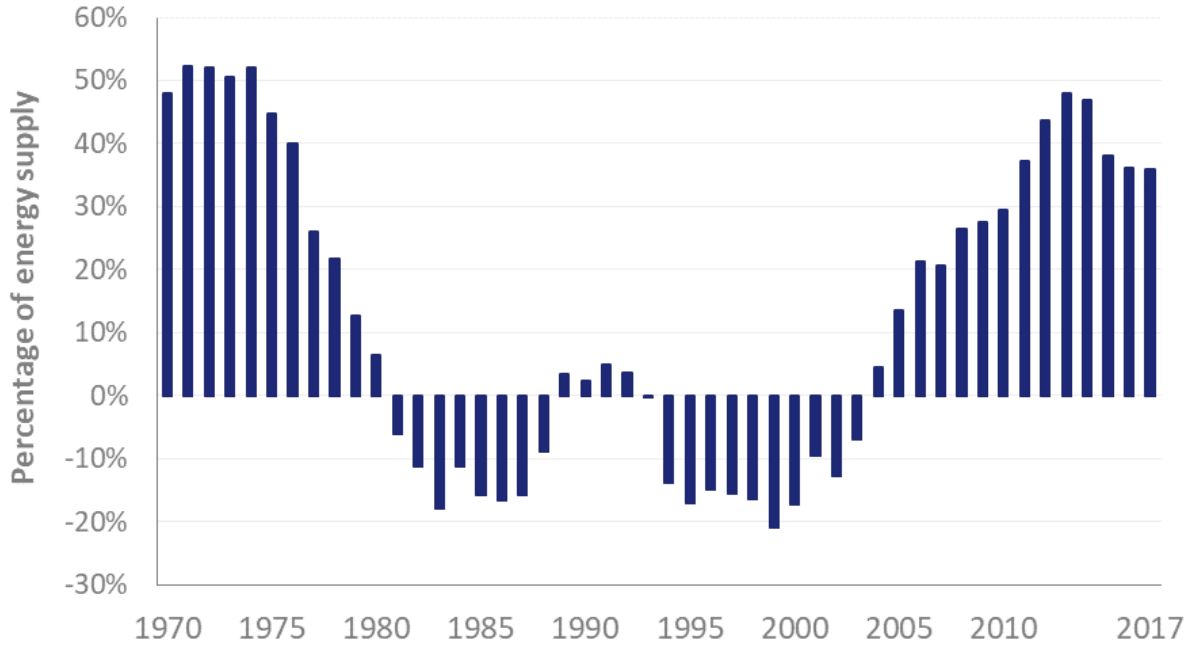
1.18 The data in the energy balances (Table 1.1) can be viewed in a number of ways, with a number of other statistics derived to produce different descriptions of the UK energy market. Recently greater focus has been given to looking at import dependency and also at fossil fuel dependency. Import dependency (Table 1B) is calculated by dividing net imports by primary supply, including an addition for the energy supplied to marine bunkers. Chart 1.7 shows this on a longer time frame.

Table 1B: Net import dependency 2015 to 2017

Thousand tonnes of oil equivalent

	2015	2016	2017
Net imports	78,669	74,304	72,568
Primary energy supply + bunkers	207,061	205,397	202,686
Net import dependency	38.0%	36.2%	35.8%

Chart 1.7: Net import dependency



1.19 The energy used in the UK can also be classified by whether its source was from fossil fuels, low-carbon sources or other (Table 1C). The main fossil fuel sources in the UK are coal, gas and oil. The low carbon sources include nuclear and renewables such as wind; hydro; solar photovoltaics (pv) and biofuels. **In 2017, the share of energy from fossil fuels decreased further to a record low of 80.1 per cent**, whilst that from low-carbon sources increased from having a 17.4 per cent to a 18.4 per cent share.

1.20 The largest component of this series is currently nuclear; its share of energy supplied remained broadly unchanged at 7.9 per cent in 2017. There was a rise in the share from renewables; with an increase in bioenergy use. The 'other' category, shown for completeness, includes net imports of electricity, as imports and exports could come from either of the previous categories, and non-biodegradable wastes. Headline data, taken from Table 6.7 later in this publication, show that renewables had a "normalised" 10.2 per cent share of final energy consumption in 2017 (the normalisation process takes out weather effects from this statistic; see paragraph 6.49). There are other ways to measure renewables contribution to energy, and these are discussed in more detail in Chapter 6.

Table 1C: Fossil fuel and low carbon dependencies 2015 to 2017

Per cent

	2015	2016	2017
Fossil fuel	81.7%	81.1%	80.1%
Low-carbon	16.8%	17.4%	18.4%
Other	1.5%	1.4%	1.4%

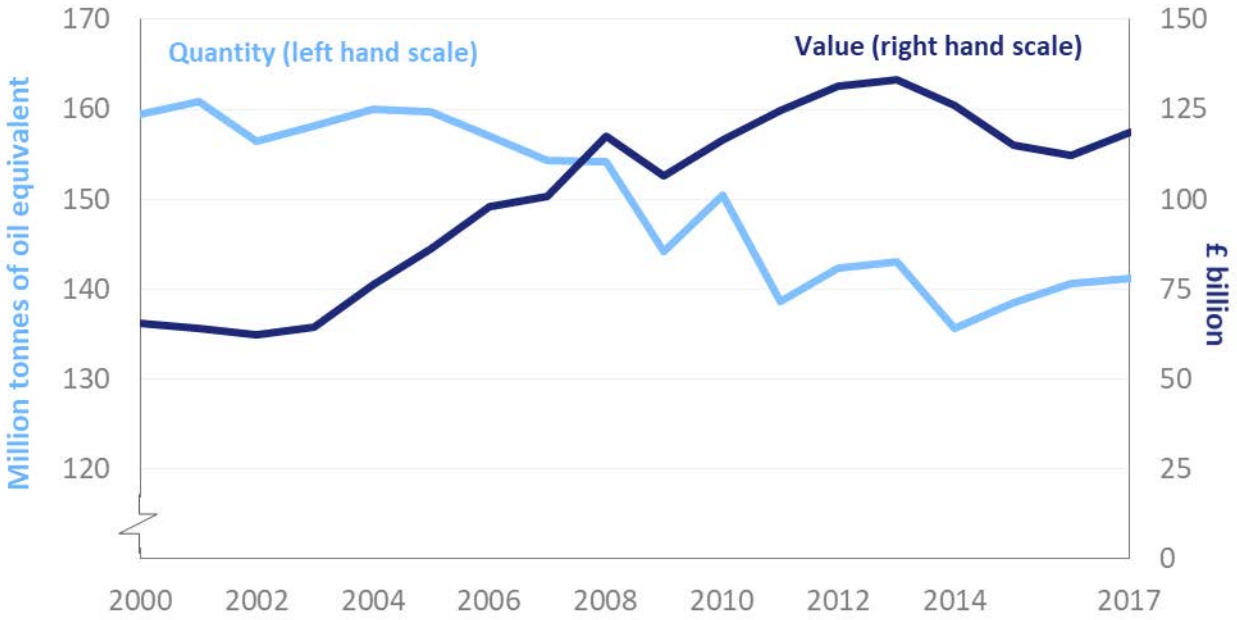
Value balance of traded energy (Tables 1.4, 1.5 and 1.6)

1.21 Tables 1.4 to 1.6 present the value of traded energy in a similar format to the energy balances. The balance shows how the value of inland energy supply is made up from the value of indigenous production, trade, tax and margins (profit and distribution costs). The lower half of the tables show how this value is generated from the final expenditure on energy (from the industrial and domestic sectors) through transformation processes and other energy sector users. The balances only contain values of energy which are traded, i.e. where a transparent market price is applicable. Further technical notes are given in paragraphs 1.39 to 1.45.

1.22 **Total expenditure by final consumers** in 2017 is estimated at £118,545 million, (£118,270 million shown as actual final consumption and £275 million of coal consumed by the iron and steel sector in producing coke for their own consumption), **up by 5.8 per cent on the 2016 level.**

1.23 **Expenditure though is down by 11 per cent (down 16 per cent in real terms when adjusted for inflation) from the peak in 2013**, with the most significant changes from then being the reduced prices for crude and petroleum products. In 2017, crude oil prices averaged around $54 per barrel, up from $44 per barrel in 2016 and much lower compared to the average price of just under $109 per barrel in 2013. Chart 1.8 shows energy consumption and expenditure by final users.

Chart 1.8: Energy consumption and estimated expenditure on energy by final users



1.24 Of the total final expenditure on energy in 2017 (£119 billion), the biggest share, 51 per cent, fell to the transport sector. Industry purchased 10 per cent (£12 billion), the domestic sector purchased 27 per cent (£32 billion), with the remaining 12 per cent (£14 billion) purchased by the service sector.

Sales of electricity and gas by sector (Table 1.7)

1.25 Table 1.7 shows broad estimates for the total value of electricity and gas to final consumption. Net selling values provide some indication of typical prices paid in broad sectors and can be of use to supplement more detailed and accurate information contained in the rest of this chapter. More detailed information on energy prices is available in *Energy Prices*, available on BEIS's energy statistics website at: www.gov.uk/government/collections/quarterly-energy-prices

The energy industries

1.26 **The energy industries in the UK play a central role in the economy by producing, transforming and supplying energy in its various forms to all sectors.** They are also major contributors to the UK's Balance of Payments through the exports of crude oil and oil products. The box below summarises the energy industries' contribution to the economy in 2017, based on the latest available data from the Office for National Statistics (ONS):

- 2.9 per cent of GDP;
- 9.8 per cent of total investment;
- 33.6 per cent of industrial investment;
- 181,000 people directly employed (6.3 per cent of industrial employment);
- Many others indirectly employed (e.g. an estimated 142,000 in support of UK Continental Shelf production).

1.27 The share of GDP at 2.9 per cent compares to a peak level of 10.4 per cent in 1982. **The share fell to below 4 per cent in most years since 2000, with energy's share of the UK economy falling to a low of 2.8 per cent in 2016 before rising marginally in 2017**. The rise between 2016 and 2017 is largely due to the increase in the price of oil; which rose by around 23 per cent in 2017[1]. In 2017 investment in the energy industries rose lightly with increased spending for electricity. Employment has remained broadly unchanged in the last eight years, but up from 10 years ago.

[1] www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/oil/oil-prices.html

Technical notes and definitions

I Units and measurement of energy

Units of measurement

1.28 The original units of measurement appropriate to each fuel are used in the individual fuel chapters. A common unit of measurement, the tonne of oil equivalent (toe), which enables different fuels to be compared and aggregated, is used in Chapter 1. In common with the International Energy Agency and with the Statistical Office of the European Communities, the tonne of oil equivalent is defined as follows:

1 tonne of oil equivalent = 10^7 kilocalories
= 396.83 therms
= 41.868 Gigajoules (GJ)
= 11,630 Kilowatt hours (kWh)

This unit should be regarded as a measure of energy content rather than a physical quantity. One tonne of oil is not equal to one tonne of oil equivalent.

Calorific values when producing energy statistics

1.29 In this publication Gross Calorific Values (GCVs) are used to convert fuel from their original units to tonnes of oil equivalent (toe). An alternative is to use Net Calorific Values (NCVs) as detailed in paragraph XVII of the introduction. The fuel specific GCVs and NCVs are shown at Annex A. However, as some EU targets are calculated on data converted using net calorific values, aggregate energy balances for the most recent years have been calculated using NCVs; these are used in Table 6.7, and are available on the internet version, Annex I, of this publication at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

Thermal content - energy supplied basis of measurement

1.30 Tables 1.1 to 1.3 and 1.1.1 to 1.1.5 (available on the BEIS section of GOV.UK at: www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes are compiled on an energy-supplied basis. Detailed data for individual fuels are converted from original units to tonnes of oil equivalent using gross calorific values and conversion factors appropriate to each category of fuel. The results are then aggregated according to the categories used in the tables. Gross calorific values represent the total energy content of the fuel, including the energy needed to evaporate the water present in the fuel (see also paragraph 1.55).

1.31 Estimated gross and net calorific values for 2017 are given in Table A.1 in Annex A. Calorific values are reviewed each year in collaboration with the fuel industries, and figures for earlier years can be found in Tables A.2 and A.3. To construct energy balances on an energy supplied basis calorific values are required for production, trade, and stocks, as follows:

Coal The weighted average gross calorific value of all indigenous coal consumed is used to derive the thermal content of coal production and undistributed stocks. Thermal contents of imports and exports allow for the quality of coal. Thermal contents of changes in coal stocks at secondary fuel producers are the average calorific values of indigenous coal consumed.

Petroleum Work carried out in 1997 to revise calorific values for petroleum products did not find any recent work on the subject. In the absence of such work, the gross calorific values, included in Annex A and used in the construction of these energy balances from 1990 onwards, have been calculated using a formula derived by the US Bureau of Standards. This formula estimates the gross calorific value of products according to their density as follows:

$GJ = 51.83 - 8.78 \times d^2$, where *d* is the density of the product in terms of kilograms per litre.

For crude petroleum and refinery losses, the weighted average calorific value for all petroleum products from UK refineries is used. A notional figure of 43.0 GJ per tonne is used for non-energy petroleum products (industrial and white spirits, lubricants, bitumen, petroleum coke, waxes and miscellaneous products).

Gases Although the original unit for gases is the cubic metre, figures for gases are generally presented in the fuel sections of this Digest in gigawatt hours (GWh), having been converted from cubic metres using gross calorific values provided by the industries concerned. Conversion factors between units of energy are given on the flap inside the back cover and in Annex A.

Electricity and heat Unlike other fuels, the original unit used to measure electricity and heat is a measure of energy. The figures for electricity and heat can therefore be converted directly to toe using the conversion factors on the flap inside the back cover and in Annex A.

Primary electricity Hydro electricity and net imports of electricity are presented in terms of the energy content of the electricity produced (the energy supplied basis). This is consistent with international practice. Primary inputs for nuclear electricity assume the thermal efficiencies at nuclear stations given in Chapter 5, Table 5.10 (40.0 per cent in 2017). (See Chapter 5, paragraphs 5.71 and 5.79).

Non-energy uses of fuel

1.32 Energy use of fuel mainly comprises use for lighting, heating, motive power and power for appliances. Non-energy use includes use as chemical feedstocks, solvents, lubricants and road making material. It should be noted that the amounts of non-energy use of natural gas included in the Digest are approximate. Further discussion of non-energy uses of lubricating oils and petroleum coke appears in Chapter 3, paragraph 3.20.

Autogeneration of electricity

1.33 Autogeneration is defined as the generation of electricity by companies whose main business is not electricity generation, the electricity being produced mainly for that company's own use. Estimated amounts of fuel used for thermal generation of electricity by such companies, the output of electricity and the thermal losses incurred in generation are included within the Transformation section in the energy balances shown in Tables 1.1 to 1.3. Electricity used in the power generation process by autogenerators is shown within the Energy Industry Use section. Electricity consumed by industry and commerce from its own generation is included as part of final consumption. This treatment is in line with the practice in international energy statistics.

1.34 Figures on total amount of fuel used and electricity generated by autogenerators, and the amount of electricity for own consumption is shown in Tables 5.1 to 5.6. Table 5.4 summarises the figures by broad industrial groups. Much of the power generated is from combined heat and power (CHP) plants and data from Chapter 7 are included within Table 5.4. Differences will occur where CHP plants are classified to major power producers, and this mainly affects the chemicals sector. The method of allocating fuel used in CHP plants between electricity production and heat production is described in Chapter 7 paragraphs 7.36 to 7.41. This method can give rise to high implied conversion efficiencies in some sectors, most notably in the iron and steel sector.

Final consumption, deliveries, stock changes

1.35 Figures for final consumption relate to deliveries, if fuels can be stored by users and data on actual consumption are not available. Final consumption of petroleum and solid fuels is on a deliveries basis throughout, except for the use of solid fuels by the iron and steel industry. Figures for domestic use of coal are based on deliveries to merchants. Figures for stock changes in Tables 1.1 to 1.3 cover stocks held by primary and secondary fuel producers, major distributors of petroleum products, and stocks of coke and breeze held by the iron and steel industry; for coal they also include an estimate of volumes in transit. Figures for stock changes in natural gas represent the net amount put into storage by gas companies operating pipelines.

1.36 Figures for final consumption of electricity include sales by the public distribution system and consumption of electricity produced by generators other than the major electricity producing companies. Thus electricity consumption includes that produced by industry and figures for deliveries of other fuels to industry exclude amounts used to generate electricity (except for years prior to 1987, shown in tables giving long term trends).

Heat sold

1.37 Heat sold is defined as heat that is produced and sold under the provision of a contract. The heat sold figures have been derived from two sources covering CHP plants and community heating schemes without CHP plants. Data for heat sold were supplied by CHP plants to the Combined Heat and Power Quality Assurance Programme and were processed by Ricardo-AEA. Data for heat consumption from community heating schemes were derived from the Building Research Establishment's (BRE) 'Nationwide Survey of Community Heating' that was carried out in 1997, a database of community heating schemes in social housing in 2000, and Community Heating Sales Surveys undertaken between 2003 and 2005. The estimates from these sources have been used to derive heat sold figures since 1999. When information about where the heat was generated was not available from the BRE sources, it was assumed that domestic sector heat consumption was provided by the commercial sector, public sector heat consumption was provided by the public administration and industrial sectors (using proportions derived from CHP statistics) and that industrial sector heat consumption was provided by the industrial sector. The introduction of heat sold into the energy balances has not affected the individual fuel totals, since the energy used to generate the heat has been deducted from the final consumption section of the energy balance and transferred to the transformation section. The figures that are included in the balances should be treated as indicative of the amount of heat sold. Annex J of the Digest, at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes shows the quantity of fuel by consuming sector used to produce heat that is subsequently sold.

II Energy balances (Tables 1.1, 1.2 and 1.3)

1.38 Tables 1.1, 1.2 and 1.3 show the energy flows as the primary fuels are processed (or used) and as the consequent secondary fuels are used. The net inputs to transformation are shown in the transformation rows and hence outputs from transformation processes into which primary fuels are input (such as electricity generation, heat generation or petroleum refining) appear as positive figures under the secondary product's heading in the tables. Similarly the net inputs are shown as negative figures under the primary fuel headings.

III Value balances (Tables 1.4, 1.5 and 1.6)

Valuation of energy purchases

1.39 In common with the rest of the chapter, these tables covering energy expenditure follow a balance format. While a user may derive data on a similar basis as that previously published, the balance tables allow for more varied use and interpretation of traded energy value data. That said, the tables continue to only show values for energy that has to be purchased and therefore do not include estimated values of a sector's internal consumption, such as coal used in the process of coal extraction.

The value balance

1.40 The tables balances around **market value of inland consumption**, with the lower half of the tables showing the total value of consumption by end users, sub divided into energy sector users and final users both for energy and non-energy use. The top half of the tables show the supply components that go to make up the final market value of inland consumption, namely upstream cost of production, imports, taxes and the margins and costs of delivering and packaging the fuel for the final consumer. The total final consumers' value of energy consumption is represented by the lines 'total non-energy sector use' and iron and steel sectors' purchases of coal for use in solid fuel manufacture. All figures are estimates and have been rounded to the nearest £5 million.

1.41 In keeping with the energy balances, the value balances, since 2000, have included data on heat generation and heat sold. Additionally, an estimate of the amount of Climate Change Levy (CCL) and the Carbon Price Support (CPS) paid is included in Tables 1.4, 1.5 and 1.6. The CCL was introduced in April 2001 and is payable by non-domestic final consumers of gas, electricity, coal, coke and LPG, with the Carbon Price Support (CPS), a tax on fossil fuel used to generate electricity, introduced in April 2013.

1.42 The value balance demonstrates how the value chain works in the production and consumption of energy. For example, in 2017, £15,545 million of crude oil was indigenously produced, of which £12,835 million was exported; and £16,165 million of crude oil was imported. Allowing for stock changes, this provides a total value of UK inland crude oil supply of £18,985 million. This fuel was then completely consumed within the petroleum industry in the process of producing £27,295 million of petroleum products. Again, some external trade and stock changes took place before arriving at a basic value of petroleum products of £29,590 million. In supplying the fuel to final consumers, distribution costs were incurred, and some profit was made amounting to £2,315 million, whilst duty and tax meant a further £34,165 million was added to the basic price to arrive at the final market value of £66,150 million. This was the value of petroleum products purchased, of which industry purchased £1,845 million, domestic consumers for heating purposes purchased £1,105 million, with the vast majority £58,260 million, purchased by the transport sector.

Fuel definitions in value balances

1.43 **Crude oil** includes Natural Gas Liquids (NGLs) and refinery feedstocks. **Natural gas** does not include colliery methane. **Electricity** only includes electricity delivered via the public distribution system and therefore does not value electricity produced and consumed by autogenerators; however the fuels used by autogenerators are included under Transformation. **Manufactured solid fuels** include coke, breeze and other solid manufactured fuels, mainly products from patent fuel and carbonisation plants. **Other fuels** include all other fuels not separately listed, where they can be clearly considered as traded and some reasonable valuation can be made. Fuels mainly contributing to this year's values are wood, coke oven and colliery methane gases sold on to other industrial users and some use of waste products such as poultry litter.

Energy end use

1.44 Values represent the cost to the final user including transportation of the fuel. They are derived, except where actual values are available, from the traded element of the volumes presented in aggregate energy balance and end user prices collected from information supplied by users or energy suppliers. The **energy sector** consists of those industries engaged in the production and sale of energy products, but values are not given for consumption of self-generated fuels e.g. coke oven gas used by coke producers. Many of the processes in the **iron and steel** industry are considered to be part of the energy sector in the energy balances, but for the purposes of this economic balance their genuine purchases are treated as those of final consumers, except for purchases of coal directly used in coke manufacture, which is shown separately as part of manufacture of solid fuel. Coal used directly in or to heat blast furnaces is shown as iron and steel final use. **Transformation** includes those fuels used directly in producing other fuels e.g. crude oil in petroleum products. **Electricity generators** keep and use significant stocks of coal, and the stocks used in consumption each year are shown separately. The value and margins for these being assumed to be the same as other coal purchased in the year. **Road transport** includes all motor spirit and DERV (diesel-engined road vehicle) use. **Commercial and other users** include public administration and miscellaneous uses not classified to the industrial sector.

Supply

1.45 The supply side money chain is derived using various methods. **Indigenous production** represents the estimated basic value of in-year sales by the upstream producers. This value is gross of any taxes or cost they must meet. The valuation problems in attributing network losses in gas and electricity between upstream and downstream within this value chain means any costs borne are included in the production value. **Imports and exports** are valued in accordance with data published by HM Revenue and Customs, contained in Annex G (which can be found on the Internet at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes). However, crude oil is treated differently, where the value is formed from price data taken from a census survey of refiners and volume data taken from Table 3.1. These values are considered to reflect the complete money chain more accurately than Tables G.1 to G.7. **Stock changes** are those for undistributed stocks except for coal where coke oven and generators' stocks are included. A stock increase takes money out of the money chain and is therefore represented as a negative. **Distribution costs** are arrived at by removing an estimate of producers' value along with any taxes from the end user values shown. For most fuels, the estimate of producer value is derived from the consumption used for end use and the producer price taken from survey of producers. No sector breakdown is given for gas and

electricity margins because it is not possible to accurately measure delivery costs for each sector. **Taxes** include VAT where not refundable and duties paid on downstream sales. Excluded are the gas and fossil fuel levies, petroleum revenue tax and production royalties and licence fees. The proceeds from the fossil fuel levy are redistributed across the electricity industry, whilst the rest are treated as part of the production costs.

Sales of electricity and gas by sector (Table 1.7)

1.46 This table provides data on the total value of gas and electricity sold to final consumers. The data are collected from the energy supply companies. The data are useful in indicating relative total expenditure between sectors, but the quality of data provided in terms of industrial classification has been worsening in recent years. Net selling values provide an indication of typical prices paid in broad sectors.

IV Measurement of energy consumption

Primary fuel input basis

1.47 Energy consumption is usually measured in one of three different ways. The first, known as the primary fuel input basis, assesses the total input of primary fuels and their equivalents. This measure includes energy used or lost in the conversion of primary fuels to secondary fuels (for example in power stations and oil refineries), energy lost in the distribution of fuels (for example in transmission lines) and energy conversion losses by final users. Primary demands as in Table 1.1, 1.2 and 1.3 are on this basis.

Final consumption - energy supplied basis

1.48 The second method, known as the energy supplied basis, measures the energy content of the fuels, both primary and secondary, supplied to final users. Thus it is net of fuel industry own use and conversion, transmission and distribution losses, but it includes conversion losses by final users. Table 1D presents shares of final consumption on this basis. The final consumption figures are presented on this basis throughout Chapter 1.

1.49 Although this is the usual and most direct way to measure final energy consumption, it is also possible to present final consumption on a primary fuel input basis. This can be done by allocating the conversion losses, distribution losses and energy industry use to final users. This approach can be used to compare the total primary fuel use which each sector of the economy accounts for. Table 1E presents shares of final consumption on this basis.

Final consumption - useful energy basis

1.50 Thirdly, final consumption may be expressed in the form of useful energy available after deduction of the losses incurred when final users convert energy supplied into space or process heat, motive power or light. Such losses depend on the type and quality of fuel and the equipment used and on the purpose, conditions, duration and intensity of use. Statistics on useful energy are not sufficiently reliable to be given in this Digest; there is a lack of data on utilisation efficiencies and on the purposes for which fuels are used.

Shares of each fuel in energy supply and demand

1.51 The relative importance of the energy consumption of each sector of the economy depends on the method used to measure consumption. Shares of final consumption on an energy supplied basis (that is in terms of the primary and secondary fuels directly consumed) in 2017 are presented in Table 1D. For comparison, Table 1E presents shares of final consumption on a primary fuel input basis.

Table 1D: Primary and secondary fuels consumed by final users in 2017 – energy supplied basis

	Percentage of each fuel						Percentage of each sector					
	Industry	Transport	Domestic	Others	Total		Solid fuels	Petr-oleum	Gas	Electricity	Bio-energy	Total
Solid fuels	68	1	30	1	100	Industry	5	18	37	34	5	100
Petroleum	7	86	4	3	100	Transport	0	97	-	1	2	100
Gas	21	-	61	19	100	Domestic	1	6	64	23	6	100
Electricity	31	2	35	33	100	Others	0	10	39	42	9	100
Bioenergy	19	16	36	29	100							
All fuels	**17**	**40**	**28**	**14**	**100**	**All users**	**1**	**46**	**30**	**18**	**4**	**100**

Table 1E: Total primary fuel consumption by final users in 2017 - primary input basis

	Percentage of each fuel						Percentage of each sector					
	Industry	Transport	Domestic	Others	Total		Coal	Petr-oleum	Gas	Primary electricity	Bio-energy	Total
Coal	40	1	34	25	100	Industry	11	12	48	17	11	100
Petroleum	7	85	4	3	100	Transport	0	97	1	1	2	100
Gas	25	1	50	24	100	Domestic	7	5	65	14	10	100
Primary electricity	31	2	35	33	100	Others	8	7	51	21	14	100
Bioenergy	26	7	35	31	100							
All fuels	**20**	**32**	**30**	**18**	**100**	**All users**	**6**	**36**	**39**	**12**	**8**	**100**

1.52 In 2017, every 1 toe of secondary electricity consumed by final users required, on average, 0.2 toe of coal, 1.1 toe of natural gas, 0.7 toe of primary electricity (nuclear) and 0.4 toe of oil and bioenergy combined. The extent of this primary consumption is hidden in Table 1D, which presents final consumption only in terms of the fuels directly consumed. When all such primary consumption is allocated to final users, as in Table 1E, the relative importance of fuels and sectors changes; the transport sector, which uses very little electricity, declines in importance, whilst the true cost of final consumption in terms of coal use can now be seen.

1.53 Another view comes from shares of users' expenditure on each fuel (Table 1F based on Table 1.4). In this case the importance of fuels which require most handling by the user (solids and liquid fuels) is slightly understated, and the importance of uses taxed at higher rates (transport) is overstated in the "All users" line.

Table 1F: Value of fuels purchased by final users in 2017

	Percentage of each sector						
	Solid fuels	Petroleum	Gas	Secondary electricity	Heat	Biofuels	Total
Industry	6	15	15	59	4	1	100
Transport	-	96	-	1	-	3	100
Domestic	1	3	40	52	1	3	100
Others	-	8	15	75	1	-	100
All users	**1**	**53**	**14**	**29**	**1**	**2**	**100**

Systems of measurement - international statistics

1.54 The systems of energy measurement used in various international statistics differ slightly from the methods of the Digest. The key difference is the conversion factors used in BEIS's headline data that change the units for fuels for a volume or weight measure to an energy basis, as discussed in the paragraph below. However, in line with the International Recommendations for Energy Statistics (IRES) the UK does make data available on both bases. Other differences are that both the

International Energy Agency (IEA) as well as the United Nations' IRES have International Aviation Bunkers as well as International Marine Bunkers shown together and not included in the country's energy supply. The UK in its energy balances continues to show fuel used for international marine bunkers in this manner but has maintained its practice of showing fuel for international aviation as part of final consumption - this practice is also followed by Eurostat.

Net calorific values

1.55 Calorific values (thermal contents) used internationally are net rather than gross. The difference between the net and gross thermal content is the amount of energy necessary to evaporate the water present in the fuel or formed during the combustion process. The differences between gross and net values are generally taken to be 5 per cent for liquid and solid fuels (except for coke and coke breeze where there is no difference), 10 per cent for gases (except for blast furnace gas, 1 per cent), 15 per cent for straw, and 16 per cent for poultry litter. The calorific value of wood is highly dependent on its moisture content. In Annex A, the gross calorific value is given as 16.3 GJ at 20 per cent moisture content and 20.3 GJ for dry wood. Both gross and net calorific values are shown in Annex A. Energy balances on a net calorific basis are published in an annex to DUKES available at:
www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes

V Definitions of fuels

1.56 The following paragraphs explain what is covered under the terms "primary" and "secondary" fuels.

Primary fuels

Coal - Production comprises all grades of coal, including slurry.
Primary oils - This includes crude oil, natural gas liquids (NGLs) and feedstock.
Natural gas liquids - Natural gas liquids (NGLs) consist of condensates (C5 or heavier) and petroleum gases other than methane C1, that is ethane C2, propane C3 and butane C4, obtained from the onshore processing of associated and non-associated gas. These are treated as primary fuels when looking at primary supply but in the consumption data presented in this chapter these fuels are treated as secondary fuels, being transferred from the primary oils column in Tables 1.1, 1.2 and 1.3.
Natural gas - Production relates to associated or non-associated methane C1 from land and the United Kingdom sector of the Continental Shelf. It includes that used for drilling production and pumping operations, but excludes gas flared or re-injected. It also includes colliery methane piped to the surface and consumed by collieries or others.
Nuclear electricity - Electricity generated by nuclear power stations belonging to the major power producers. See Chapter 5, paragraphs 5.62 to 5.69.
Natural flow hydro-electricity - Electricity generated by natural flow hydroelectric power stations, whether they belong to major power producers or other generators. Pumped storage stations are not included (see under secondary electricity below).
Renewable energy sources - In this chapter figures are presented for renewables and waste in total. Further details, including a detailed breakdown of the commodities and technologies covered are in Chapter 6.

Secondary fuels

Manufactured fuel - This heading includes manufactured solid fuels such as coke and breeze, other manufactured solid fuels, liquids such as benzole and tars and gases such as coke oven gas and blast furnace gas. Further details are given in Chapter 2, Tables 2.5 and 2.6.
Coke and breeze – Coke, oven coke and hard coke breeze. Further details are given in Chapter 2, Table 2.5.
Other manufactured solid fuels – Manufactured solid fuels produced at low temperature carbonisation plants and other manufactured fuel and briquetting plants. Further details are given in Chapter 2, Table 2.5.
Coke oven gas - Gas produced at coke ovens, excluding low temperature carbonisation plants. Gas bled or burnt to waste is included in production and losses. Further details are given in Chapter 2, Table 2.6.
Blast furnace gas - Blast furnace gas is mainly produced and consumed within the iron and steel industry. Further details are given in Chapter 2, Table 2.6.

Petroleum products - Petroleum products produced mainly at refineries, together with inland deliveries of natural gas liquids.
Secondary electricity - Secondary electricity is that generated by the combustion of another fuel, usually coal, natural gas, biofuels or oil. The figure for outputs from transformation in the electricity column of Tables 1.1, 1.2 and 1.3 is the total of primary and secondary electricity, and the subsequent analysis of consumption is based on this total.
Heat sold – Heat sold is heat that is produced and sold under the provision of a contract.

VI Classification of consumers

1.57 The Digest has been prepared, as far as is practicable, on the basis of the *Standard Industrial Classification (SIC) 2007,* details of which are available at: www.ons.gov.uk/methodology/classificationsandstandards/ukstandardindustrialclassificationofeconomicactivities/uksic2007). Table 1G shows the categories of consumers together with their codes in SIC 2007. SIC(2007) replaced SIC(2003) on 1 January 2008, with energy statistics being compiled on the new basis from 2010. SIC(2003) was introduced at the start of 2003; the previous classification SIC(1992) was used from 1995. Between 1986 and 1994 data in the Digest were prepared on the basis of SIC(1980). The changes in classification between SIC(1992), SIC(2003) and SIC(2007) are mainly in the very detailed classifications at the four or five digit level. As such the classifications used for energy statistics are unaffected by these changes.

1.58 The coverage varies between tables (e.g. in some instances the 'other' category is split into major constituents, whereas elsewhere it may include transport). This is because the coverage is dictated by what data suppliers can provide. The table also shows the disaggregation available within industry. This disaggregation forms the basis of virtually all the tables that show a disaggregated industrial breakdown.

1.59 There is also an 'unclassified' category in the industry sector (see Table 1G). In cases where the data supplier has been unable to allocate an amount between categories, but the Department for Business, Energy and Industrial Strategy has additional information, from other data sources, with which to allocate between categories, then this has been done. Where such additional information is not available the data are included in the 'unclassified' category, enabling the reader to decide whether to accept a residual, pro-rate, or otherwise adjust the figures. The 'miscellaneous' category also contains some unallocated figures for the services sector.

Table 1G: SIC 2007 classifications

Fuel producers	05-07, 09, 19, 24.46, 35
Final consumers:	
Industrial	
Unclassified	See paragraph 1.59
Iron and steel	24, (*excluding* 24.4, 24.53, 24.54)
Non-ferrous metals	24.4, (*excluding* 24.46), 24.53, 24.54
Mineral products	08, 23
Chemicals	20-21
Mechanical engineering and metal products	25, 28
Electrical and instrument engineering	26-27
Vehicles	29-30
Food, beverages & tobacco	10-12
Textiles, clothing, leather, & footwear	13-15
Paper, printing & publishing	17-18
Other industries	16, 22, 31-33, 36-39
Construction	41-43
Transport	49-51 (part*)
Other final users	
Domestic	Not covered by SIC 2007
Public administration	84-88
Commercial	45-47, 49-51 (part*), 52-53, 55-56, 58-66, 68-75, 77-82
Agriculture	01-03
Miscellaneous	90-99

* Note – transport sector includes only energy used for motion/traction purposes. Other energy used by transport companies is classified to the commercial sector.

1.60 In Tables 7.8 and 7.9 of Chapter 7 the following abbreviated grouping of industries (Table 1H), based on SIC 2007, is used in order to prevent disclosure of information about individual companies.

Table 1H: Abbreviated grouping of Industry

Iron and steel and non-ferrous metal	24
Chemicals	20-21
Oil refineries	19.2
Paper, printing and publishing	17-18
Food, beverages and tobacco	10-12
Metal products, machinery and equipment	25, 26, 27, 28, 29, 30
Mineral products, extraction, mining and agglomeration of solid fuels	05, 06, 08, 23
Sewage Treatment	(parts of 36 and 37)
Electricity supply	35.1
Other industrial branches	07, 13, 14, 15,16, 19.1, 24.46, 22, 31, 32, 33, 35.2, 36 & 37 (remainder) 41, 42, 43
Transport, commerce, and administration	1, 2, 3, 45 to 99 (except 93)
Other	35.3, 93

1.61 In Table 5.4 the list above is further condensed and includes only manufacturing industry and construction as follows in Table 1I.

Table 1I: Abbreviated grouping of Industry for Table 5.4

Iron and steel and non-ferrous metals	24
Chemicals	20-21
Paper, printing and publishing	17-18
Food, beverages and tobacco	10-12
Metal products, machinery and equipment	25-30
Other (including construction)	08, 13-16, 19, 22-23, 31-33, 36-39, 41-43

VII Monthly and quarterly data

1.62 Monthly and quarterly data on energy production and consumption (including on a seasonally adjusted and temperature corrected basis) split by fuel type are provided on the BEIS section of the GOV.UK website at: www.gov.uk/government/statistics/total-energy-section-1-energy-trends. Quarterly figures are also published in BEIS's quarterly statistical bulletins *Energy Trends* and *Energy Prices*. See Annex C for more information about these bulletins.

VIII Statistical differences

1.63 Tables 1.1 to 1.3 each contain a statistical difference term covering the difference between recorded supply and recorded demand. These statistical differences arise for a number of reasons. The data within each table are taken from varied sources, as described above and in later chapters; for example producers, intermediate consumers (such as electricity generators), final consumers and HM Revenue and Customs. Also, some of the figures are estimated either because data in the required detail are not readily available within the industry or because the methods of collecting the data do not cover the smallest members of the industry. Typically, the supply of fuels is easier to measure than demand, and thus greater reliance can be made of these numbers.

IX Revisions

1.64 Table 1J below shows a summary of the revisions made to the major energy aggregates between this year's edition of DUKES and the immediately preceding version. This year, the revisions window for DUKES has been opened back to 2015. Next year revisions for earlier years are likely to again be restricted to two years only, though this is subject to change. A key data change this year is the inclusion of renewable energy from heat pumps, following a BEIS led study to estimate the amount of heat generated by reversible air to air heat pumps. This data had not previously been included in the renewable heat statistics.

Table 1J: Revisions since DUKES 2017

Thousand tonnes of oil equivalent

	2015	2016	Percentage revisions to 2016 data
Production	808	1121	0.9%
Primary supply	991	1432	0.7%
Primary demand	1104	1591	0.8%
Transformation	-96	-19	0.1%
Energy industry use	-7	177	1.5%
Final consumption	858	1264	0.8%
Industry	-299	-31	-0.1%
Transport	264	227	0.4%
Other	894	1310	2.1%
Non energy use	-1	-242	-2.9%

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1.1 Aggregate energy balance 2017
Gross calorific values

Thousand tonnes of oil equivalent

	Coal	Manufactured fuel*(1)*	Primary oils	Petroleum products	Natural gas*(2)*	Bioenergy & waste*(3)*	Primary electricity	Electricity	Heat sold	Total
Supply										
Production	1,934	-	50,944	-	40,019	12,924	20,924	-	-	126,745
Imports	5,807	712	58,480	36,722	45,132	3,475	-	1,562	-	151,891
Exports	-369	-14	-42,040	-25,374	-10,802	-431	-	-293	-	-79,323
Marine bunkers	-	-	-	-2,596	-	-	-	-	-	-2,596
Stock change*(4)*	+2,098	-2	+361	-113	+1,028	-	-	-	-	+3,373
Primary supply	**9,470**	**696**	**67,746**	**8,639**	**75,377**	**15,969**	**20,924**	**1,269**	**-**	**200,090**
Statistical difference*(5)*	-65	+1	-66	-10	+337	-	-	-35	-	+163
Primary demand	**9,535**	**694**	**67,811**	**8,649**	**75,040**	**15,969**	**20,924**	**1,304**	**-**	**199,927**
Transfers	-	+10	-2,476	+2,483	+224	-237	-5,801	+5,801	-	+4
Transformation	**-8,134**	**379**	**-65,335**	**64,539**	**-27,182**	**-9,587**	**-15,124**	**23,071**	**1,592**	**-35,779**
Electricity generation	-5,559	-518	-	-533	-24,594	-9,387	-15,124	23,071	-	-32,645
Major power producers	-5,545	-	-	-146	-22,150	-4,404	-15,124	20,358	-	-27,011
Autogenerators	-14	-518	-	-387	-2,445	-4,983	-	2,713	-	-5,634
Heat generation	-4	-1	-	-52	-2,587	-200	-	-	1,592	-1,252
Petroleum refineries	-	-	-65,795	65,691	-	-	-	-	-	-104
Coke manufacture	-1,435	1,351	-	-	-	-	-	-	-	-84
Blast furnaces	-989	-596	-	-	-	-	-	-	-	-1,585
Patent fuel manufacture	-146	143	-	-66	-	-	-	-	-	-69
Other(7)	-	-	460	-501	-	-	-	-	-	-40
Energy industry use	**-**	**458**	**-**	**4,315**	**4,903**	**-**	**-**	**2,041**	**322**	**12,040**
Electricity generation	-	-	-	-	-	-	-	1,332	-	1,332
Oil and gas extraction	-	-	-	715	4,244	-	-	51	-	5,010
Petroleum refineries	-	-	-	3,600	92	-	-	375	322	4,390
Coal extraction	-	-	-	-	6	-	-	39	-	45
Coke manufacture	-	182	-	-	-	-	-	1	-	183
Blast furnaces	-	276	-	-	25	-	-	18	-	319
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	85	-	85
Other	-	-	-	-	536	-	-	139	-	675
Losses	**-**	**109**	**-**	**-**	**580**	**-**	**-**	**2,283**	**-**	**2,972**
Final consumption	**1,401**	**516**	**-**	**71,356**	**42,599**	**6,145**	**-**	**25,851**	**1,270**	**149,139**
Industry	**972**	**296**	**-**	**4,308**	**8,677**	**1,162**	**-**	**7,964**	**692**	**24,071**
Unclassified	-	-	-	3,380	1	135	-	-	-	3,515
Iron and steel	23	296	-	5	331	-	-	230	-	885
Non-ferrous metals	19	-	-	8	261	-	-	370	-	659
Mineral products	439	-	-	174	1,222	203	-	524	-	2,562
Chemicals	43	-	-	115	1,748	5	-	1,336	277	3,524
Mechanical engineering etc	8	-	-	0	975	2	-	556	-	1,540
Electrical engineering etc	3	-	-	1	275	-	-	512	-	791
Vehicles	38	-	-	208	595	-	-	405	-	1,246
Food, beverages etc	54	-	-	110	1,624	47	-	945	3	2,783
Textiles, leather etc	44	-	-	43	243	-	-	231	-	561
Paper, printing etc	64	-	-	31	391	611	-	930	-	2,027
Other industries	232	-	-	38	609	159	-	1,801	412	3,251
Construction	4	-	-	195	401	-	-	125	-	725
Transport *(6)*	**11**	**-**	**-**	**55,051**	**-**	**997**	-	**411**	**-**	**56,470**
Air	-	**-**	**-**	12,995	**-**	**-**	**-**	**-**	**-**	12,995
Rail	11	**-**	**-**	661	**-**	**-**	**-**	396	**-**	1,069
Road	-	**-**	**-**	40,468	**-**	997	**-**	15	**-**	41,480
National navigation	-	**-**	**-**	926	**-**	**-**	**-**	**-**	**-**	926
Pipelines	-	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	-
Other	**419**	**172**	-	**4,507**	**33,496**	**3,986**	**-**	**17,476**	**578**	**60,634**
Domestic	392	172	-	2,472	25,540	2,216	**-**	9,062	260	40,116
Public administration	18	-	-	369	3,111	72	**-**	1,696	97	5,364
Commercial	4	-	-	883	3,868	1,173	**-**	6,344	220	12,493
Agriculture	-	-	-	474	110	525	**-**	373	-	1,482
Miscellaneous	5	-	-	308	866	-	-	-	-	1,179
Non energy use	-	**48**	-	**7,490**	**426**	-	-	-	-	**7,964**

(1) Includes all manufactured solid fuels, benzole, tars, coke oven gas and blast furnace gas.
(2) Includes colliery methane.
(3) Includes geothermal and solar heat.
(4) Stock fall (+), stock rise (-).
(5) Primary supply minus primary demand.
(6) See paragraphs 5.42 regarding electricity use in transport and 6.66 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.2 Aggregate energy balance 2016
Gross calorific values

Thousand tonnes of oil equivalent

	Coal	Manufactured fuel*(1)*	Primary oils	Petroleum products	Natural gas*(2)*	Bioenergy & waste*(3)*	Primary electricity	Electricity	Heat sold	Total
Supply										
Production	2,633	-	51,952	-	39,880r	11,815r	19,976r	-	-	126,256r
Imports	5,812r	890	53,479r	38,452r	45,979	3,743	-	1,721r	-	150,077r
Exports	-333	-16	-38,180	-26,663	-10,048	-338	-	-195r	-	-75,774r
Marine bunkers	-	-	-	-2,840	-	-	-	-	-	-2,840
Stock change*(4)*	3,588r	-89	-135	77	1,397	-	-	-	-	4,837r
Primary supply	**11,700r**	**785**	**67,115r**	**9,026r**	**77,208r**	**15,220r**	**19,976r**	**1,526r**	**-**	**202,557r**
Statistical difference*(5)*	34r	1r	-20r	35r	-222r	-	-	45r	-	-127r
Primary demand	**11,666r**	**784r**	**67,135r**	**8,991r**	**77,429r**	**15,220r**	**19,976r**	**1,481r**	**-**	**202,684r**
Transfers	-	27	-1,640	1,629	135	-165	-4,563r	4,563r	-	-14
Transformation	**-10,113r**	**281r**	**-65,495r**	**64,661r**	**-28,158r**	**-9,099r**	**-15,414**	**24,358r**	**1,556r**	**-37,423r**
Electricity generation	-7,531r	-540	-	-559	-25,630	-8,903r	-15,414	24,358r	-	-34,219r
Major power producers	-7,521	-	-	-194	-23,350	-4,233	-15,414	21,779r	-	-28,934r
Autogenerators	-10r	-540	-	-365	-2,280	-4,670r	-	2,579r	-	-5,285r
Heat generation	-4r	-1r	-	-45r	-2,528r	-195r	-	-	1,556r	-1,218r
Petroleum refineries	-	-	-65,964r	65,861r	-	-	-	-	-	-103r
Coke manufacture	-1,384r	1,303	-	-	-	-	-	-	-	-81r
Blast furnaces	-1,037	-656	-	-	-	-	-	-	-	-1,692
Patent fuel manufacture	-157r	174r	-	-81	-	-	-	-	-	-64r
Other(7)	-	-	469	-515	-	-	-	-	-	-46
Energy industry use	**-**	**468r**	**-**	**4,286r**	**4,952r**	**-**	**-**	**2,036r**	**316r**	**12,058r**
Electricity generation	-	-	-	-	-	-	-	1,313r	-	1,313r
Oil and gas extraction	-	-	-	715	4,306r	-	-	51	-	5,072r
Petroleum refineries	-	-	-	3,571r	76r	-	-	379	316r	4,342r
Coal extraction	-	-	-	-	6r	-	-	40	-	47r
Coke manufacture	-	189r	-	-	-	-	-	1	-	191r
Blast furnaces	-	279r	-	-	25	-	-	18	-	322r
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	91	-	91
Other	-	-	-	-	539	-	-	142	-	680
Losses	**-**	**96**	**-**	**-**	**614r**	**-**	**-**	**2,244r**	**-**	**2,954r**
Final consumption	**1,553r**	**528r**	**-**	**70,996r**	**43,841r**	**5,957r**	**-**	**26,122**	**1,239r**	**150,235r**
Industry	**1,107r**	**314r**	**-**	**4,288r**	**8,405r**	**1,099r**	**-**	**7,894**	**592r**	**23,700r**
Unclassified	-	-	-	3,385r	1	120r	-	-	-	3,506r
Iron and steel	25r	314r	-	5r	351r	-	-	245	-	939r
Non-ferrous metals	20r	-	-	8r	256r	-	-	370	-	654r
Mineral products	542	-	-	173r	1,225r	203r	-	517	-	2,661r
Chemicals	55r	-	-	110r	1,612r	10r	-	1,328	177r	3,292r
Mechanical engineering etc	8r	-	-	0r	936r	2	-	536	-	1,482r
Electrical engineering etc	4r	-	-	1r	266r	-	-	502	-	772r
Vehicles	42r	-	-	202r	566r	-	-	402	-	1,212r
Food, beverages etc	47r	-	-	109r	1,585r	25r	-	923	0r	2,689r
Textiles, leather etc	50r	-	-	42r	244r	-	-	227	-	563r
Paper, printing etc	79r	-	-	31r	387r	594r	-	911	-	2,001r
Other industries	230r	-	-	36r	597r	147r	-	1,818	415r	3,243r
Construction	4	-	-	185r	381r	-	-	115	-	685r
Transport *(6)*	**11**	**-**	**-**	**54,571r**	**-**	**1,010**	-	**403r**	**-**	**55,994r**
Air	-	**-**	**-**	12,560r	**-**	**-**	**-**	**-**	**-**	12,560r
Rail	11	**-**	**-**	666r	**-**	**-**	**-**	392r	**-**	1,069r
Road	-	**-**	**-**	40,429	**-**	1,010	**-**	11	**-**	41,450
National navigation	-	**-**	**-**	915r	**-**	**-**	**-**	**-**	**-**	915r
Pipelines	-	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	-
Other	**436r**	**168**	-	**4,561r**	**34,996r**	**3,848r**	**-**	**17,825r**	**647r**	**62,480r**
Domestic	404r	168	-	2,556r	26,773	2,215r	**-**	9,284	260r	41,661r
Public administration	23r	-	-	375r	3,256r	51r	**-**	1,705	164r	5,574r
Commercial	4	-	-	866r	4,005r	1,097r	**-**	6,456r	222r	12,650r
Agriculture	-	-	-	469r	99r	485r	**-**	380	-	1,433r
Miscellaneous	5	-	-	294r	863r	-	-	-	-	1,162r
Non energy use	-	**46**	-	**7,576r**	**439**	-	-	-	-	**8,061r**

(1) Includes all manufactured solid fuels, benzole, tars, coke oven gas and blast furnace gas.
(2) Includes colliery methane.
(3) Includes geothermal and solar heat.
(4) Stock fall (+), stock rise (-).
(5) Primary supply minus primary demand.
(6) See paragraphs 5.42 regarding electricity use in transport and 6.66 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.3 Aggregate energy balance 2015
Gross calorific values

Thousand tonnes of oil equivalent

	Coal	Manufactured fuel*(1)*	Primary oils	Petroleum products	Natural gas*(2)*	Bioenergy & waste*(3)*	Primary electricity	Electricity	Heat sold	Total
Supply										
Production	5,384r	-	49,544	-	38,847	10,575r	20,132r	-	-	124,481r
Imports	14,885	806	55,407r	35,408r	43,127	3,712	-	1,974r	-	155,319r
Exports	-290	-79	-36,867	-25,173	-13,716	-366	-	-160r	-	-76,650r
Marine bunkers	-	-	-	-2,684	-	-	-	-	-	-2,684
Stock change*(4)*	4,467r	46	-105	-800	302	-	-	-	-	3,911r
Primary supply	**24,447r**	**772**	**67,979r**	**6,752r**	**68,560**	**13,921r**	**20,132r**	**1,815r**	**-**	**204,378r**
Statistical difference*(5)*	158r	1r	-80r	28r	-223r	-	-	115r	-	0r
Primary demand	**24,288r**	**771r**	**68,059**	**6,724r**	**68,783r**	**13,921r**	**20,132r**	**1,699r**	**-**	**204,378r**
Transfers	-	34	-1,477	1,511	48	-84	-4,652r	4,652r	-	32
Transformation	**-22,455r**	**913r**	**-66,582**	**65,674r**	**-20,740r**	**-8,513r**	**-15,479**	**24,250r**	**1,507r**	**-41,425r**
Electricity generation	-18,328	-783	-	-593r	-18,283	-8,318r	-15,479	24,250r	-	-37,535r
Major power producers	-18,316	-	-	-213	-15,989	-4,060	-15,479	21,813	-	-32,245
Autogenerators	-12	-783	-	-380r	-2,294	-4,258r	-	2,437r	-	-5,290r
Heat generation	-4r	-1r	-	-47r	-2,457r	-195r	-	-	1,507r	-1,197r
Petroleum refineries	-	-	-67,032	66,880	-	-	-	-	-	-152
Coke manufacture	-2,788r	2,636	-	-	-	-	-	-	-	-152r
Blast furnaces	-1,174	-1,103	-	-	-	-	-	-	-	-2,277
Patent fuel manufacture	-161	164	-	-71	-	-	-	-	-	-68
Other(7)	-	-	450	-494	-	-	-	-	-	-44
Energy industry use	**-**	**716**	**-**	**4,302r**	**5,026r**	**-**	**-**	**2,163r**	**270**	**12,477r**
Electricity generation	-	-	-	-	-	-	-	1,432r	-	1,432r
Oil and gas extraction	-	-	-	756	4,387	-	-	52	-	5,196
Petroleum refineries	-	-	-	3,546r	87r	-	-	390	270	4,293r
Coal extraction	-	-	-	-	7	-	-	43	-	50
Coke manufacture	-	329	-	-	-	-	-	4	-	333
Blast furnaces	-	387	-	-	28	-	-	30	-	445
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	84	-	84
Other	-	-	-	-	517	-	-	129	-	646
Losses	**-**	**228**	**-**	**-**	**716r**	**-**	**-**	**2,347r**	**-**	**3,291r**
Final consumption	**1,834r**	**775r**	**-**	**69,607r**	**42,349r**	**5,324r**	**-**	**26,092**	**1,236r**	**147,217r**
Industry	**1,380r**	**510r**	**-**	**4,212r**	**8,418r**	**875r**	**-**	**7,989**	**678r**	**24,063r**
Unclassified	-	12	-	3,319r	1	91r	-	-	-	3,422r
Iron and steel	31	498r	-	6	456r	-	-	317	-	1,309r
Non-ferrous metals	22r	-	-	7r	262r	-	-	380	-	672r
Mineral products	698	-	-	170r	1,220r	220r	-	524	-	2,833r
Chemicals	60r	-	-	120r	1,551r	1r	-	1,342	256r	3,329r
Mechanical engineering etc	9r	-	-	0r	946r	2	-	536	-	1,492r
Electrical engineering etc	4r	-	-	1r	265r	-	-	515	-	785r
Vehicles	47r	-	-	197r	537r	-	-	419	-	1,200r
Food, beverages etc	54r	-	-	103r	1,562r	15r	-	926	0r	2,661r
Textiles, leather etc	49r	-	-	43r	253r	-	-	231	-	576r
Paper, printing etc	81r	-	-	31r	394r	407r	-	911	-	1,824r
Other industries	320r	-	-	34r	596r	140r	-	1,768	422r	3,281r
Construction	5	-	-	181r	376r	-	-	117	-	679r
Transport *(6)*	**9**	**-**	**-**	**53,617r**	**-**	**998**	-	**388r**	**-**	**55,013r**
Air	-	**-**	**-**	12,528r	**-**	**-**	**-**	**-**	**-**	12,528r
Rail	9	**-**	**-**	674r	**-**	**-**	**-**	380r	**-**	1,063r
Road	-	**-**	**-**	39,510	**-**	998	**-**	8	**-**	40,516
National navigation	-	**-**	**-**	906r	**-**	**-**	**-**	**-**	**-**	906r
Pipelines	-	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	-
Other	**444r**	**167**	-	**4,470r**	**33,478r**	**3,451r**	**-**	**17,715r**	**558r**	**60,284r**
Domestic	418	167	-	2,518r	25,587	2,080r	**-**	9,266	260r	40,297r
Public administration	18r	-	-	360r	3,175r	49r	**-**	1,666	78r	5,346r
Commercial	4	-	-	837r	3,779r	986r	**-**	6,429r	220r	12,254r
Agriculture	-	-	-	473r	84	336r	**-**	354	-	1,248r
Miscellaneous	5	-	-	282r	852r	-	-	-	-	1,140r
Non energy use	-	**98**	-	**7,308r**	**453**	-	-	-	-	**7,858r**

(1) Includes all manufactured solid fuels, benzole, tars, coke oven gas and blast furnace gas.
(2) Includes colliery methane.
(3) Includes geothermal and solar heat.
(4) Stock fall (+), stock rise (-).
(5) Primary supply minus primary demand.
(6) See paragraphs 5.42 regarding electricity use in transport and 6.66 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.4 Value balance of traded energy in 2017[(1)]

£million

	Coal	Manufactured fuels	Crude oil	Petroleum products	Natural gas	Electricity	Heat sold	Other fuels	Total
Supply									
Indigenous production	195	65	15,545	27,295	6,260	17,605	1,010	3,100	71,075
Imports	710	75	16,165	13,855	7,565	870	-	390	39,635
Exports	-60	-5	-12,835	-10,545	-1,830	-175	-	-	-25,440
Marine bunkers	-	-	-	-985	-	-	-	-	-985
Stock change	240	35	110	-25	180	-	-	-	545
Basic value of inland consumption	**1,095**	**170**	**18,985**	**29,590**	**12,180**	**18,300**	**1,010**	**3,490**	**84,825**
Tax and margins									
Distribution costs and margins	**280**	**15**	**-**	**2,315**	**8,745**	**16,370**	**-**	**85**	**27,815**
Electricity generation	50	-	-	-	-	-	-	-	55
Solid fuel manufacture	75	-	-	-	-	-	-	-	75
of which iron & steel sector	65	-	-	-	-	-	-	-	65
Iron & steel final use	45	5	-	-	-	-	-	-	50
Other industry	10	-	-	375	-	-	-	-	385
Air transport	-	-	-	130	-	-	-	-	130
Rail and national navigation	-	-	-	30	-	-	-	-	30
Road transport	-	-	-	1,050	-	-	-	85	1,135
Domestic	95	10	-	205	-	-	-	-	315
Agriculture	-	-	-	35	-	-	-	-	35
Commercial and other services	5	-	-	105	-	-	-	-	110
Non energy use	-	-	-	385	90	-	-	-	475
VAT and duties	**10**	**5**	**-**	**34,165**	**610**	**790**	**-**	**1,170**	**36,745**
Electricity generation	-	-	-	25	-	-	-	-	25
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	250	-	-	-	-	250
Air transport	-	-	-	5	-	-	-	-	5
Rail and national navigation	-	-	-	190	-	-	-	-	190
Road transport	-	-	-	33,445	-	-	-	1,125	34,570
Domestic	10	5	-	70	610	790	-	40	1,525
Agriculture	-	-	-	45	-	-	-	-	45
Commercial and other services	-	-	-	135	-	-	-	-	135
Climate Change Levy/Carbon Price Support	**135**	**-**	**-**	**80**	**975**	**655**	**-**	**-**	**1,845**
Total tax and margins	**425**	**20**	**-**	**36,560**	**10,325**	**17,815**	**-**	**1,255**	**66,405**
Market value of inland consumption	**1,520**	**195**	**18,985**	**66,150**	**22,510**	**36,115**	**1,010**	**4,745**	**151,230**
Energy end use									
Total energy sector	**965**	**-**	**18,985**	**1,070**	**5,675**	**1,200**	**205**	**1,970**	**30,070**
Transformation	965	-	18,985	145	4,810	850	-	1,970	27,730
Electricity generation	645	-	-	130	4,350	850	-	1,970	7,945
of which from stocks	25	-	-	-	-	-	-	-	25
Heat Generation	-	-	-	15	460	-	-	-	475
Petroleum refineries	-	-	18,985	-	-	-	-	-	18,985
Solid fuel manufacture	320	-	-	-	-	-	-	-	320
of which iron & steel sector	275	-	-	-	-	-	-	-	275
Other energy sector use	**-**	**-**	**-**	**925**	**865**	**350**	**205**	**-**	**2,345**
Oil & gas extraction	-	-	-	240	750	55	-	-	1,050
Petroleum refineries	-	-	-	685	15	250	205	-	1,160
Coal extraction	-	-	-	-	-	40	-	-	40
Other energy sector	-	-	-	-	95	-	-	-	95
Total non energy sector use	**555**	**175**	**-**	**62,305**	**16,745**	**34,915**	**805**	**2,775**	**118,270**
Industry	**335**	**70**	**-**	**1,845**	**1,845**	**7,145**	**440**	**100**	**11,785**
Iron & steel final use	205	70	-	-	70	170	-	20	540
Other industry	130	-	-	1,845	1,775	6,975	440	80	11,245
Transport	**5**	**-**	**-**	**58,260**	**-**	**500**	**-**	**1,720**	**60,480**
Air	-	-	-	4,865	-	-	-	-	4,865
Rail and national navigation	5	-	-	825	-	480	-	-	1,310
Road	-	-	-	52,570	-	20	-	1,720	54,310
Other final users	**215**	**105**	**-**	**2,205**	**14,895**	**27,270**	**365**	**950**	**46,005**
Domestic	205	105	-	1,105	12,765	16,610	165	915	31,870
Agriculture	-	-	-	260	35	545	-	25	870
Commercial and other services	10	-	-	840	2,095	10,110	200	15	13,265
Total value of energy end use	**1,520**	**175**	**18,985**	**63,375**	**22,420**	**36,115**	**1,010**	**4,745**	**148,345**
Value of non energy end use	**-**	**20**	**-**	**2,775**	**90**	**-**	**-**	**-**	**2,885**
Market value of inland consumption	**1,520**	**195**	**18,985**	**66,150**	**22,510**	**36,115**	**1,010**	**4,745**	**151,230**

(1) For further information see paragraphs 1.39 to 1.45.

1.5 Value balance of traded energy in 2016[(1)]

£million

	Coal	Manufactured fuels	Crude oil	Petroleum products	Natural gas	Electricity	Heat sold	Other fuels	Total
Supply									
Indigenous production	120r	95	12,385r	21,970r	5,315r	16,320r	885r	2,880r	59,970r
Imports	565	80	11,200r	11,335	6,150r	780	-	310	30,420r
Exports	-50	-5	-9,200r	-8,050	-1,350	-105	-	-	-18,755
Marine bunkers	-	-	-	-835	-	-	-	-	-835
Stock change	270r	-5	-25r	-	205	-	-	-	445r
Basic value of inland consumption	**905r**	**165**	**14,360r**	**24,420r**	**10,320r**	**17,000r**	**885r**	**3,195r**	**71,245r**
Tax and margins									
Distribution costs and margins	**270r**	**15r**	**-**	**2,055r**	**10,540r**	**16,655r**	**-**	**80**	**29,615r**
Electricity generation	50r	-	-	5	-	-	-	-	50r
Solid fuel manufacture	50	-	-	-	-	-	-	-	50
of which iron & steel sector	40	-	-	-	-	-	-	-	40
Iron & steel final use	30	5r	-	-	-	-	-	-	35r
Other industry	35	-	-	340r	-	-	-	-	375r
Air transport	-	-	-	105	-	-	-	-	105
Rail and national navigation	-	-	-	25r	-	-	-	-	25r
Road transport	-	-	-	965	-	-	-	80	1,045
Domestic	100	10	-	85	-	-	-	-	195
Agriculture	-	-	-	35r	-	-	-	-	35r
Commercial and other services	5	-	-	110r	-	-	-	-	120
Non energy use	-	-	-	385r	85	-	-	-	465r
VAT and duties	**10**	**5**	**-**	**33,620r**	**650**	**765r**	**-**	**1,155**	**36,210r**
Electricity generation	-	-	-	30	-	-	-	-	30
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	240r	-	-	-	-	240r
Air transport	-	-	-	5	-	-	-	-	5
Rail and national navigation	-	-	-	190r	-	-	-	-	190r
Road transport	-	-	-	32,915r	-	-	-	1,115	34,035r
Domestic	10	5	-	65r	650	765r	-	40r	1,535r
Agriculture	-	-	-	45	-	-	-	-	45
Commercial and other services	-	-	-	135	-	-	-	-	135
Climate Change Levy/Carbon Price Support	**180**	**-**	**-**	**105**	**1,030**	**585**	**-**	**-**	**1,895**
Total tax and margins	**455r**	**20r**	**-**	**35,775r**	**12,220r**	**18,005r**	**-**	**1,235**	**67,720r**
Market value of inland consumption	**1,360r**	**185r**	**14,360r**	**60,195r**	**22,540r**	**35,005r**	**885r**	**4,430r**	**138,965r**
Energy end use									
Total energy sector	**865r**	**-**	**14,360r**	**1,010r**	**4,905r**	**1,170**	**180r**	**1,855**	**24,340r**
Transformation	865r	-	14,360r	150	**4,175r**	840	-	1,855	22,235r
Electricity generation	655	-	-	135	3,800	840	-	1,855	7,280
of which from stocks	35	-	-	-	-	-	-	-	35
Heat Generation	-	-	-	15r	375r	-	-	-	390r
Petroleum refineries	-	-	14,360r	-	-	-	-	-	14,360r
Solid fuel manufacture	210	-	-	-	-	-	-	-	210
of which iron & steel sector	175	-	-	-	-	-	-	-	175
Other energy sector use	**-**	**-**	**-**	**865r**	**730r**	**330**	**180r**	**-**	**2,105r**
Oil & gas extraction	-	-	-	200r	640	50	-	-	890r
Petroleum refineries	-	-	-	665r	10r	235	180r	-	1,095r
Coal extraction	-	-	-	-	-	40	-	-	40
Other energy sector	-	-	-	-	80	-	-	-	80
Total non energy sector use	**495r**	**165r**	**-**	**56,535r**	**17,550r**	**33,840r**	**705r**	**2,575r**	**111,870r**
Industry	**280r**	**65r**	**-**	**1,610r**	**1,610**	**6,595**	**335r**	**95r**	**10,590r**
Iron & steel final use	145	65r	-	-	65	170	-	15	470r
Other industry	135r	-	-	1,610r	1,540r	6,420	335r	80r	10,120r
Transport	**5**	**-**	**-**	**53,020r**	**-**	**460**	**-**	**1,605**	**55,085r**
Air	-	-	-	3,940r	-	-	-	-	3,940r
Rail and national navigation	5	-	-	695r	-	450	-	-	1,145r
Road	-	-	-	48,385r	-	15r	-	1,605	50,000r
Other final users	**215r**	**100**	**-**	**1,905**	**15,945r**	**26,785r**	**370r**	**875r**	**46,190r**
Domestic	205	100	-	920r	13,700r	16,100r	150r	845r	32,020r
Agriculture	-	-	-	235r	30r	535	-	20	820r
Commercial and other services	10r	-	-	750r	2,210r	10,145r	220r	10r	13,350r
Total value of energy end use	**1,360r**	**165r**	**14,360r**	**57,545r**	**22,455r**	**35,005r**	**885r**	**4,430r**	**136,210r**
Value of non energy end use	**-**	**20**	**-**	**2,650r**	**85**	**-**	**-**	**-**	**2,755r**
Market value of inland consumption	**1,360r**	**185r**	**14,360r**	**60,195r**	**22,540r**	**35,005r**	**885r**	**4,430r**	**138,965r**

(1) For further information see paragraphs 1.39 to 1.45.

1.6 Value balance of traded energy in 2015[(1)]

£million

	Coal	Manufactured fuels	Crude oil	Petroleum products	Natural gas	Electricity	Heat sold	Other fuels	Total
Supply									
Indigenous production	245r	215r	12,985	23,205r	7,035r	16,850r	1,040r	2,680r	64,255r
Imports	985	70	12,645	12,505r	6,990	950	-	340	34,485r
Exports	-45	-20	-9,915	-8,755r	-2,310	-80	-	-	-21,125r
Marine bunkers	-	-	-	-855	-	-	-	-	-855
Stock change	320r	-20r	-15	-250	55	-	-	-	90
Basic value of inland consumption	**1,505**	**240**	**15,695**	**25,855r**	**11,770r**	**17,720r**	**1,040r**	**3,020r**	**76,845r**
Tax and margins									
Distribution costs and margins	**380r**	**15r**	**-**	**2,030r**	**10,465r**	**16,835r**	**-**	**85**	**29,810r**
Electricity generation	105	-	-	5	-	-	-	-	105
Solid fuel manufacture	85	-	-	-	-	-	-	-	85
of which iron & steel sector	75	-	-	-	-	-	-	-	75
Iron & steel final use	35	**5r**	-	-	-	-	-	-	40
Other industry	70r	-	-	340r	-	-	-	-	410r
Air transport	-	-	-	110	-	-	-	-	110
Rail and national navigation	-	-	-	25r	-	-	-	-	25r
Road transport	-	-	-	975	-	-	-	85	1,060
Domestic	85	10	-	100	-	-	-	-	200r
Agriculture	-	-	-	30	-	-	-	-	30
Commercial and other services	5r	-	-	85	-	-	-	-	90r
Non energy use	-	-	-	360	105	-	-	-	465
VAT and duties	**10**	**5**	**-**	**33,025r**	**685**	**780r**	**-**	**1,160**	**35,660r**
Electricity generation	-	-	-	30	-	-	-	-	30
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	240r	-	-	-	-	240r
Air transport	-	-	-	5	-	-	-	-	5
Rail and national navigation	-	-	-	190r	-	-	-	-	190r
Road transport	-	-	-	32,320r	-	-	-	1,125	33,445r
Domestic	10	5	-	65	685	780r	-	35	1,580r
Agriculture	-	-	-	45	-	-	-	-	45
Commercial and other services	-	-	-	125r	-	-	-	-	125r
Climate Change Levy/Carbon Price Support	**465**	**-**	**-**	**270**	**700**	**325**	**-**	**-**	**1,760**
Total tax and margins	**855r**	**20r**	**-**	**35,325r**	**11,850r**	**17,940r**	**-**	**1,240**	**67,230r**
Market value of inland consumption	**2,360r**	**265r**	**15,695**	**61,180r**	**23,625r**	**35,660r**	**1,040r**	**4,260r**	**144,080r**
Energy end use									
Total energy sector	**1,800r**	**-**	**15,695**	**1,065r**	**4,740r**	**1,245**	**185r**	**1,770r**	**26,500r**
Transformation	1,800r	-	15,695	170r	3,820r	915	-	1,770r	24,165r
Electricity generation	1,430	-	-	155	3,365	915	-	1,770r	7,630r
of which from stocks	25	-	-	-	-	-	-	-	25
Heat Generation	-	-	-	15r	455r	-	-	-	470r
Petroleum refineries	-	-	15,695	-	-	-	-	-	15,695
Solid fuel manufacture	370	-	-	-	-	-	-	-	370
of which iron & steel sector	335	-	-	-	-	-	-	-	335
Other energy sector use	**-**	**-**	**-**	**895r**	**920r**	**335**	**185r**	**-**	**2,335r**
Oil & gas extraction	-	-	-	235r	810	50	-	-	1,095r
Petroleum refineries	-	-	-	660	15r	235	185r	-	1,095r
Coal extraction	-	-	-	-	-	45	-	-	45
Other energy sector	-	-	-	-	95	5	-	-	100
Total non energy sector use	**565r**	**220r**	**-**	**57,510r**	**18,775r**	**34,410r**	**855r**	**2,490r**	**114,830r**
Industry	**345**	**125r**	**-**	**1,705r**	**1,955r**	**6,895**	**470r**	**90r**	**11,580r**
Iron & steel final use	150	120r	-	-	105	240	-	**25r**	**645r**
Other industry	195	5	-	1,700r	1,850r	6,655	470r	60r	10,935r
Transport	**5**	**-**	**-**	**53,835r**	**-**	**440**	**-**	**1,655**	**55,935r**
Air	-	-	-	4,215	-	-	-	-	4,215
Rail and national navigation	5	-	-	750r	-	430	-	-	1,185r
Road	-	-	-	48,870r	-	10r	-	1,655	50,535r
Other final users	**215r**	**95**	**-**	1,970r	**16,825r**	**27,075r**	**385r**	**750r**	**47,315r**
Domestic	205	95	-	1,000r	14,425r	16,340r	180r	730r	32,980r
Agriculture	-	-	-	240r	30	505	-	10r	785
Commercial and other services	10r	-	-	730r	2,370r	10,235r	205r	10r	13,555r
Total value of energy end use	**2,360r**	**220r**	**15,695**	**58,575r**	**23,520r**	**35,660r**	**1,040r**	**4,260r**	**141,330r**
Value of non energy end use	**-**	**40**	**-**	**2,605**	**105**	**-**	**-**	**-**	**2,750**
Market value of inland consumption	**2,360r**	**265r**	**15,695**	**61,180r**	**23,625r**	**35,660r**	**1,040r**	**4,260r**	**144,080r**

(1) For further information see paragraphs 1.39 to 1.45.

1.7 Sales of electricity and gas by sector

United Kingdom

	2013	2014	2015	2016	2017
Total selling value (£ million)[1]					
Electricity generation - Gas	4,722	4,109	3,366	3,798	4,352
Industrial - Gas[2]	2,457	2,325	1,948	1,604	1,843
- Electricity	7,462	7,143	7,227	6,924	7,497
of which:					
Fuel industries	334	320	333	330	350
Industrial sector	7,129	6,823	6,894	6,594	7,147
Domestic sector - Gas	15,822	13,833	13,737	13,049	12,159
- Electricity	15,809	15,720	15,562	15,336	15,820
Other - Gas	3,488	2,583	2,501	2,339	2,217
- Electricity	10,918	10,867	11,178	11,142	11,156
of which:					
Agricultural sector	437	455	503	534	547
Commercial sector	8,613	8,504	8,664	8,598	8,576
Transport sector	398	431	442	461	499
Public lighting	170	178	190	194	201
Public admin. and other services	1,300	1,299	1,378	1,355	1,334
Total, all consumers	**60,678**	**56,580**	**55,519**	**54,190**	**55,044**
of which gas	**26,489**	**22,850**	**21,552**	**20,789**	**20,571**
of which electricity	**34,189**	**33,730**	**33,966**	**33,401**	**34,473**
Average net selling value per kWh sold (pence)[1]					
Electricity generation - Gas	2.299	1.890	1.586	1.276	1.524
Industrial - Gas	2.616	2.310	1.990	1.641	1.826
- Electricity	7.992	8.073	8.191	8.074	8.631
of which:					
Fuel industries	8.219	8.645	8.652	8.648	9.130
Industrial sector	7.981	8.048	8.170	8.047	8.608
Domestic sector - Gas	4.606	4.876	4.616	4.191	4.093
- Electricity	14.017	14.666	14.594	14.384	15.215
Other - Gas	3.023	3.009	2.726	2.446	2.397
- Electricity	10.854	11.380	11.747	11.635	12.151
of which:					
Agricultural sector	11.284	11.846	12.221	12.079	12.600
Commercial sector	11.284	11.846	12.221	12.079	12.600
Transport sector	9.142	9.558	9.779	9.829	10.441
Public lighting	9.166	9.622	10.041	10.012	10.485
Public admin. and other services	9.166	9.622	10.041	10.012	10.485
Average, all consumers	**5.698**	**5.781**	**5.611**	**4.969**	**5.199**
of which gas	**3.494**	**3.323**	**3.081**	**2.591**	**2.651**
of which electricity	**11.146**	**11.585**	**11.712**	**11.592**	**12.196**

(1) Excludes VAT where payable - see paragraph 1.46 for a definition of average net selling value.

(2) Excludes Fuel Industry use

Chapter 2
Solid fuels and derived gases

Key points

- **Coal production fell by 27 per cent compared to last year**, down to an all-time low of 3 million tonnes, just under a tenth of the production recorded at the start of the century (Table 2.4). This decrease was mainly due to one of the large surface mines not producing since April 2017 (it is under “care and maintenance”).

- **Demand for coal fell by 20 per cent** from 17.7 million tonnes in 2016 to 14.2 million tonnes in 2017 (Table 2.4), with a 28 per cent decrease in the use of coal for electricity generation. Overall demand last year was less than a quarter of that seen at the start of the century.

- In 2017 **around 62 per cent of demand for coal was for electricity generation** with around a further 13 per cent used for the manufacture of coke (Table 2.4).

- In 2017 **imports of coal at 8.5 million tonnes were near identical to 2016.** Imports in 2016 were at their lowest in 34 years due to lower demand from electricity generators.

- In 2017 **Russia was the UK’s largest supplier of coal imports** with a share of 46 per cent. The other main suppliers were the USA with a 28 per cent share and Australia and Colombia both with a 9 per cent share (Table 2B).

- **Total stock levels decreased** in 2017 to 5.2 million tonnes, which was 3.2 million tonnes lower than in 2016, due to generators reducing stocks held due to closures and lower coal-fired demand. (Table 2.4).

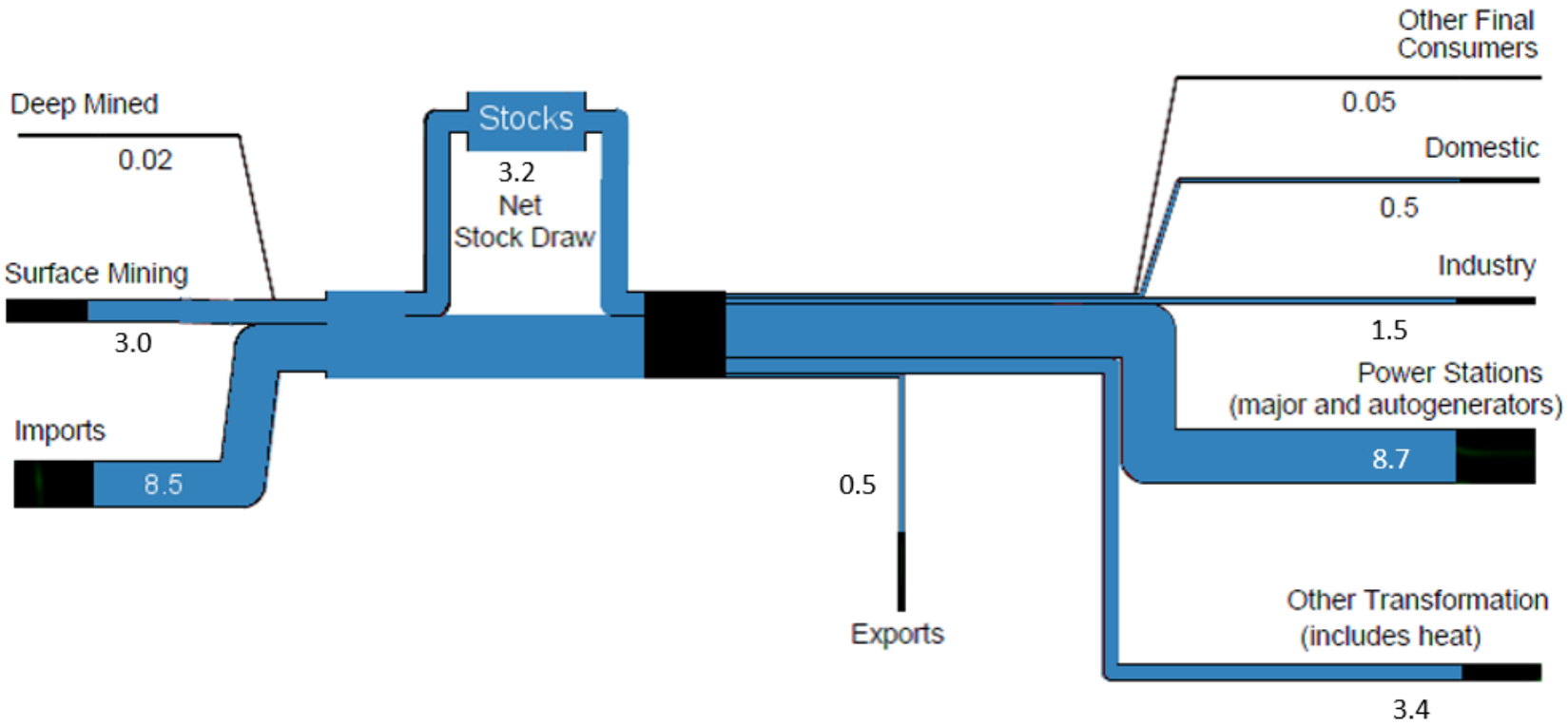
Introduction

2.1 This chapter presents statistics on supply and demand for coal (tables 2.1 - 2.4) and manufactured solid fuels, including coke oven coke, coke breeze, patent fuel, coke oven gas, blast furnace gas, benzole and tar (tables 2.5 and 2.6). A full list of tables is available at the end of the chapter.

2.2 **In 2017, coal comprised 4.8 per cent of UK primary energy demand, down from 5.8 per cent the previous year** and about a quarter of its recent peak of 19 per cent in 2012. Most coal is used for electricity generation, coke manufacture, or in blast furnaces in the steel industry.

2.3 Overleaf, an energy flow chart for 2017 shows the flows of coal from production and imports through to consumption. It is a way of simplifying the figures that can be found in the commodity balance for coal in Table 2.4. The chart illustrates the flow of coal from the point of supply (on the left) to its eventual final use (on the right).

Coal flow chart 2017 (million tonnes of coal)

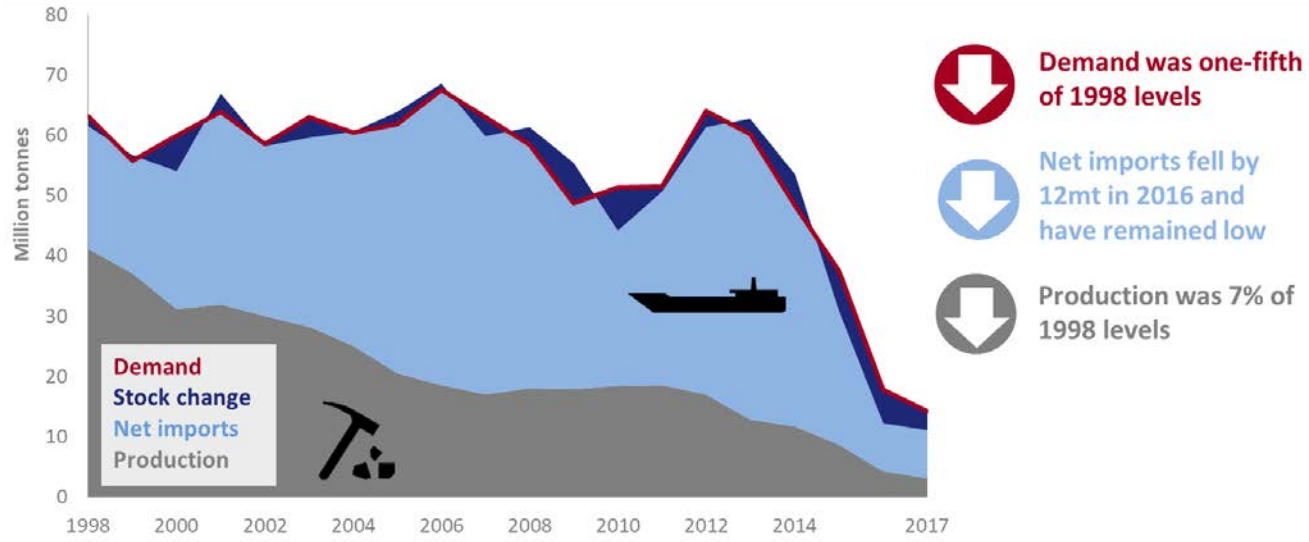


Notes: This flow chart is based on the data that appear in Tables 2.1 and 2.4.

Coal supply and demand (Table 2.1)

2.4 **In 2017, coal production fell 27 per cent compared to 2016 to an all-time low of 3 million tonnes.** Net imports fell 0.6 per cent to 8 million tonnes (Chart 2.1).

Chart 2.1: UK coal supply and demand to 2017



2.5 **Deep mined** production fell to just 0.02 million tonnes in 2017. Following closure of the last three deep mines in 2015 (Hatfield, Thoresby and Kellingley, production remains a fraction of the values seen two years ago. Similarly, **surface mine** production decreased by 27 per cent to a new record low of 3.0 million tonnes. This was mainly due to one of the large surface mines not producing since April 2017 (it is under "care and maintenance"). Production from deep mines and surface mines accounted for 21 per cent of UK coal supply, with 56 per cent from net imports and the remaining 23 per cent drawn from stocks held by coal power plants and coke ovens.

2.6 **Steam coal**, mainly used by power stations, accounted for 88 per cent of total coal production in 2017, with 11 per cent **anthracite** and the remainder **coking coal** (Table 2.1). No coal slurry has been produced since the last UK sites closed in 2013.

2.7 Table 2A shows how production of coal is divided between England, Wales and Scotland. In 2017, 41 per cent of coal output was in Wales, 33 per cent in England and 27 per cent in Scotland. Wales overtook England as the main producer of coal as the last remaining large deep mines, which were in England, closed in 2015. There is no longer any deep mining of coal in Scotland (Map 2A).

Table 2A: Output from UK coal mines and employment in UK coal mines [1, 2]

Million tonnes **Number**

		Output			Employment		
		2015	2016	2017	2015	2016	2017
Deep mined	England	2.8	0.02	0.02	427	42	48
	Wales	0.03	0.01	0.00	50	6	4
	Total	2.8	0.02	0.02	477	48	52
Surface mining	England	2.2	0.9	1.0	388	192	115
	Scotland	1.3	0.8	0.8	421	176	159
	Wales	2.3	2.4	1.2	689	415	294
	Total	5.8	4.2	3.0	1,498	783	568
Total	England	4.9	0.9	1.0	815	234	163
	Scotland	1.3	0.8	0.8	421	176	159
	Wales	2.3	2.5	1.2	739	421	298
	Total	8.6	4.2	3.0	1,975	831	620

Source: The Coal Authority

1. *Output is the tonnage declared by operators to the Coal Authority, including estimated tonnages. It excludes estimates of slurry recovered from dumps, ponds, rivers, etc.*
2. *Employment includes contractors and is as declared by licensees to the Coal Authority at 31 December each year.*

2.8 Employment in the coal industry has followed a similar pattern to UK production levels. Table 2A also shows how numbers employed in the production of coal have changed over the last three years. **During 2017 total employment, including contractors, was 25 per cent lower than in 2016.** At 31 December 2017, 48 per cent of the 620 people employed in UK coal mining worked in Wales, while 26 per cent were employed in England and 26 per cent in Scotland.

2.9 **In 2017 UK imports at 8.5 million tonnes were near identical to the value of imports in 2016**

2.10 The majority of UK coal imports came from just three countries, as shown by the map below. In 2017, 46 per cent of the UK's total coal imports came from Russia (3.9 million tonnes), 28 per cent (2.4 million tonnes) came from the USA and 9 per cent (0.8 million tonnes) came from Australia and 9 per cent (0.7 million tonnes) came Colombia.

Chart 2.2: UK Coal Imports in 2017 (thousand tonnes)

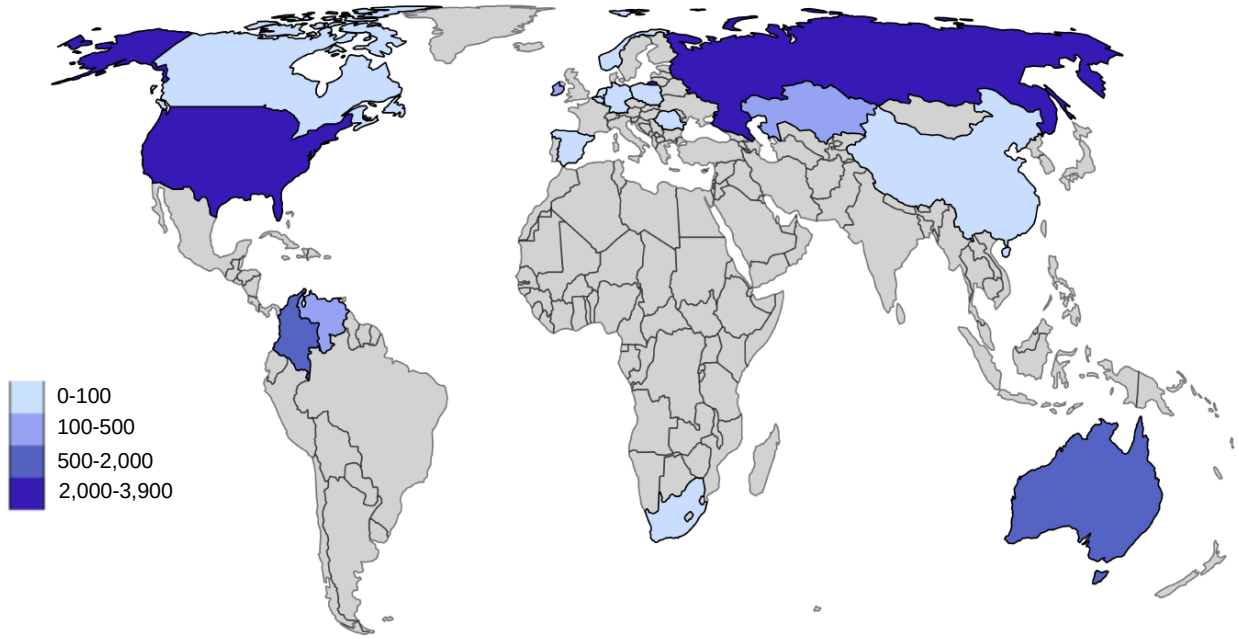


Table 2B: Imports of coal in 2017[1]

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Russia	2,919	915	50	3,883
United States of America	1,452	899	1	2,352
Australia	-	749	-	749
Colombia	731	-	-	731
European Union[2]	293	29	33	356
Republic of South Africa	50	-	-	50
Other countries	244	100	33	378
Total all countries	5,689	2,692	116	8,498

Source: HM Revenue and Customs, ISSB

1. *Country of origin basis.*
2. *Includes non-EU coal routed through the Netherlands.*

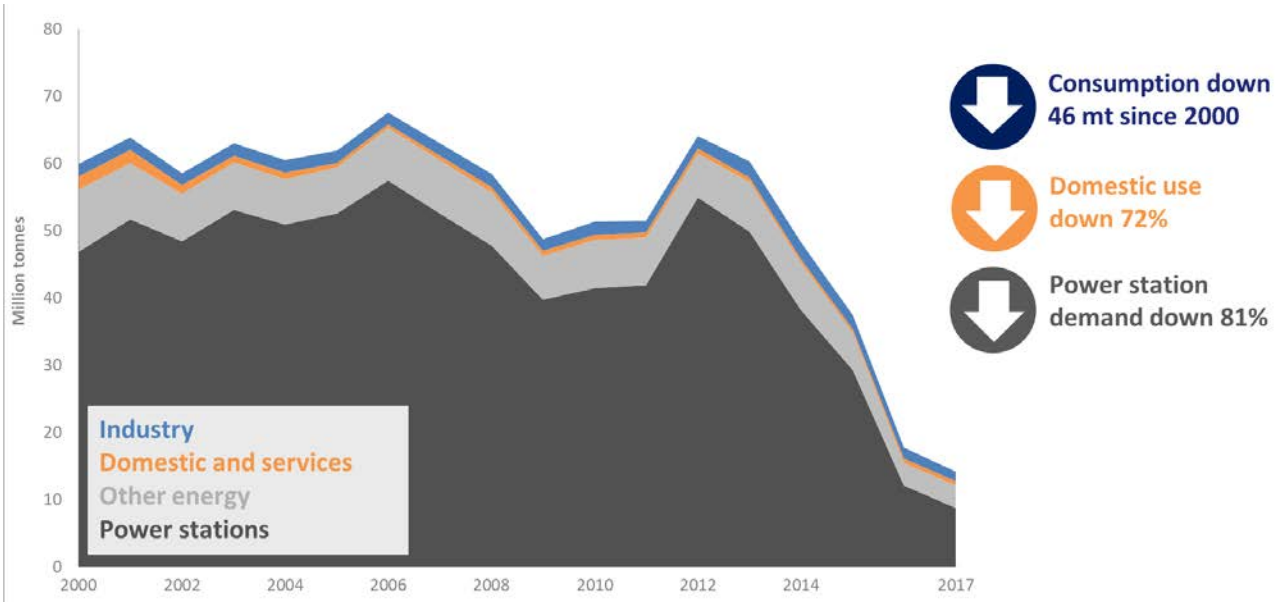
2.11 Steam coal accounted for 67 per cent of the total imports, of the rest, 32 per cent was coking coal, with anthracite accounting for the remainder. Imports from Colombia decreased by 22 per cent in 2017 compared to 2016, from 3 million tonnes to 1 million tonnes. In 2017, Russia accounted for 51 per cent of total steam coal imports. A further 26 per cent came from the USA. The UK imported 34 per cent of coking coal from Russia with a further 33 per cent from the USA and 28 per cent from Australia. The small volume of imported anthracite was mainly from Russia (43 per cent) and the European Union (29 per cent).

2.12 In 2016, the latest year for which data is available, the UK fell from the third largest importing country in the EU to seventh due to lower demand and accounted for 4 per cent of total EU imports (202 million tonnes). From 1999 to 2013 UK had been in the top two largest importers with Germany. In 2016, Germany was the top importing country in the EU accounting for 29 per cent, followed by Netherlands with a 24 per cent share and Italy with an 8 per cent share of the total.

Coal Consumption

2.13 **The main development this year was yet another significant fall in demand, as coal for electricity generation continued to fall sharply** (Chart 2.3). Consumption by electricity generators was down by 28 per cent to 9 million tonnes (a new record low). The decline was due to reduced capacity, with the closure of Longannet and Ferrybridge C in 2016. In addition to that production favoured gas over coal, partly due to the carbon price per GWh being higher for coal. The price of gas relative to coal was also a key reason for the decline; the price of coal purchased by major power producers rose by 36 per cent in 2016, while the increase in the price of gas was smaller, rising by 19 per cent.[1] Seventy-three per cent (10 million tonnes) of demand for all coal was for steam coal, 22 per cent (3.2 million tonnes) was for coking coal and the remaining 4 per cent (0.6 million tonnes) was for anthracite. The proportion of steam coal fell from 78 per cent in 2016, and coking coal rose from 18 per cent as use by the iron and steel industry fell less steeply than for electricity generation.

Chart 2.3: Coal consumption, 2000 to 2017



2.14 **The transformation sector represented 85 per cent (12 million tonnes) of overall demand for coal in 2017.** Electricity generation accounted for 62 per cent of demand for all types of coal and 84 per cent of demand for steam coal. Most coking coal was used in coke ovens (59 per cent) and the rest in blast furnaces (41 per cent) in the UK iron and steel industry. Coking coal used in blast furnaces decreased by 4.5 per cent from 1.4 million tonnes in 2016 to 1.3 million tonnes in 2017. An energy balance flow chart for manufactured fuel, similar to that at the start of this chapter, is included in annex H.

2.15 Electricity generation use of coal by major power producers fell by 28 per cent from 12 million tonnes in 2016 to 9 million tonnes (a new record low) in 2017. Coal use by autogenerators rose by 38 per cent from 16 thousand tonnes in 2016 to 22 thousand tonnes in 2017.

2.16 **Coal consumption by final consumers fell 9.6 per cent compared to 2016, to 2.1 million tonnes. This comprised 15 per cent of total demand.** Final consumption mainly covers steam raising, space or hot water heating, or heat for processing. Steam coal accounted for 79 per cent of this final consumption (down 2.4 per cent from 2016).

2.17 The industrial sector is the largest final consumer (accounting for 71 per cent of total final consumption in 2017). Eighty four per cent of the coal used in the industrial sector was steam coal and

[1] *Quarterly Energy Prices – table 3.2.1, which can be accessed at www.gov.uk/government/collections/industrial-energy-prices*

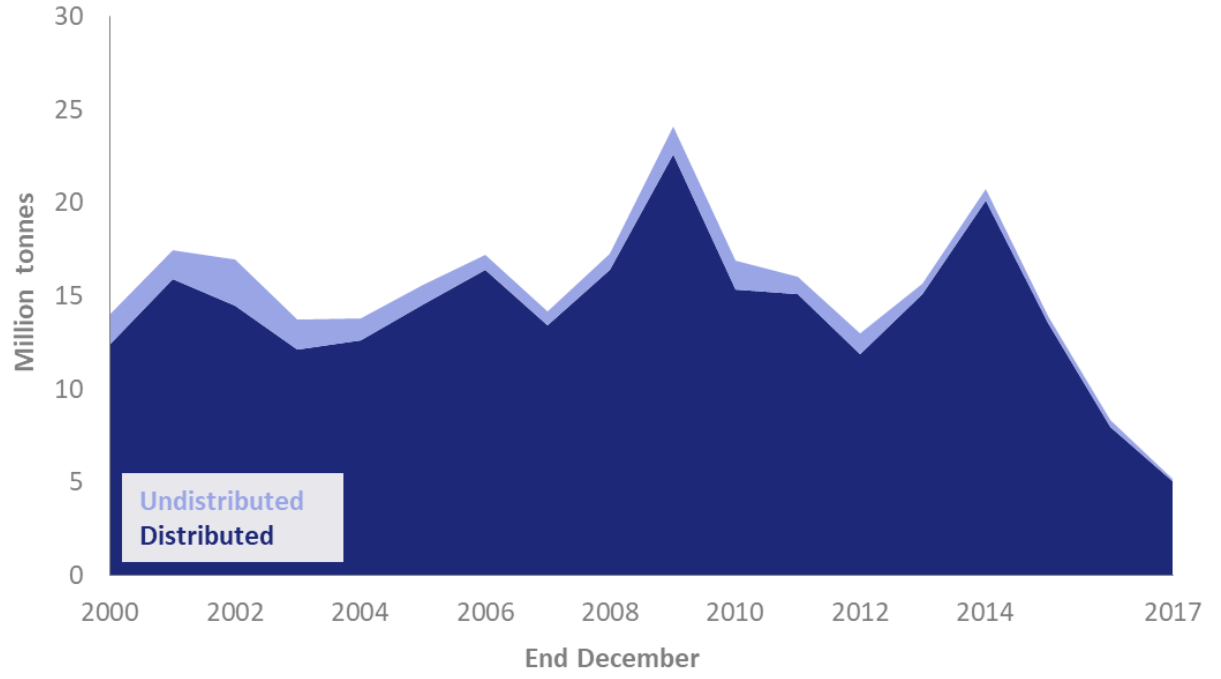
manufacturers of mineral products (e.g. cement, glass and brick) were the largest users. The domestic sector accounted for 26 per cent of the final consumption of coal, with 64 per cent of this demand being for steam coal and the remainder for anthracite. Domestic consumption fell slightly, by 2.6 per cent in 2017 compared with 2016.

2.18 **In 2016, the UK was the fourth largest consumer of coal among the EU countries**, accounting for 7 per cent of total coal consumption in the EU. The top consumer was Poland accounting for 26 per cent of total EU consumption, while Germany was second accounting for 24 per cent.

Coal Stocks

2.19 Coal stocks fell 38 per cent in 2017 to 5.2 million tonnes, compared to 8.4 million tonnes in 2016. (Chart 2.4). The fall was due to closing power stations using up their stocks. Stocks at major power stations fell 39 per cent from 7.0 million tonnes to 4.3 million tonnes. Stocks held by coke ovens decreased 46 per cent to 0.3 million tonnes. Undistributed stocks (stocks held at collieries and surface mine sites) of 0.1 million tonnes at the end of 2017 fell 64 per cent from the previous year.

Chart 2.4: Coal stocks in the UK 2000 to 2017



Coal Resources

2.20 **The Coal Authority estimates that overall there are 3,862 million tonnes of coal resources, including prospects** (Table 2C), up from 3,365 million tonnes assessed in June 2017. Of the economically recoverable and minable coal resource in current operations (including those in the planning or pre-planning process) 967 million tonnes is in underground mines and 67 million tonnes in surface mines. Overall England had an 81 per cent share of UK current mines and licenced resources, followed by Scotland with 16 per cent and Wales 3 per cent.

2.21 In prospects, there were 2,050 million tonnes suitable for underground mining and 778 million tonnes suitable for surface mining. Table 2C gives details of the resource assessment by England, Scotland and Wales as at 22 June 2018.

Table 2C: Identified GB coal resource assessment at 22 June 2018

UNDERGROUND MINING

Million tonnes

	England	Scotland	Wales	Total
Operational mines	1	0	24	25
Planning granted	5	0	0	5
In planning process	340	0	0	340
Pre-planning	480	117	0	597
Prospects	2,000	0	50	2,050
Closed mines still in licence	0	0	0	0
Total	**2,826**	**117**	**74**	**3,017**

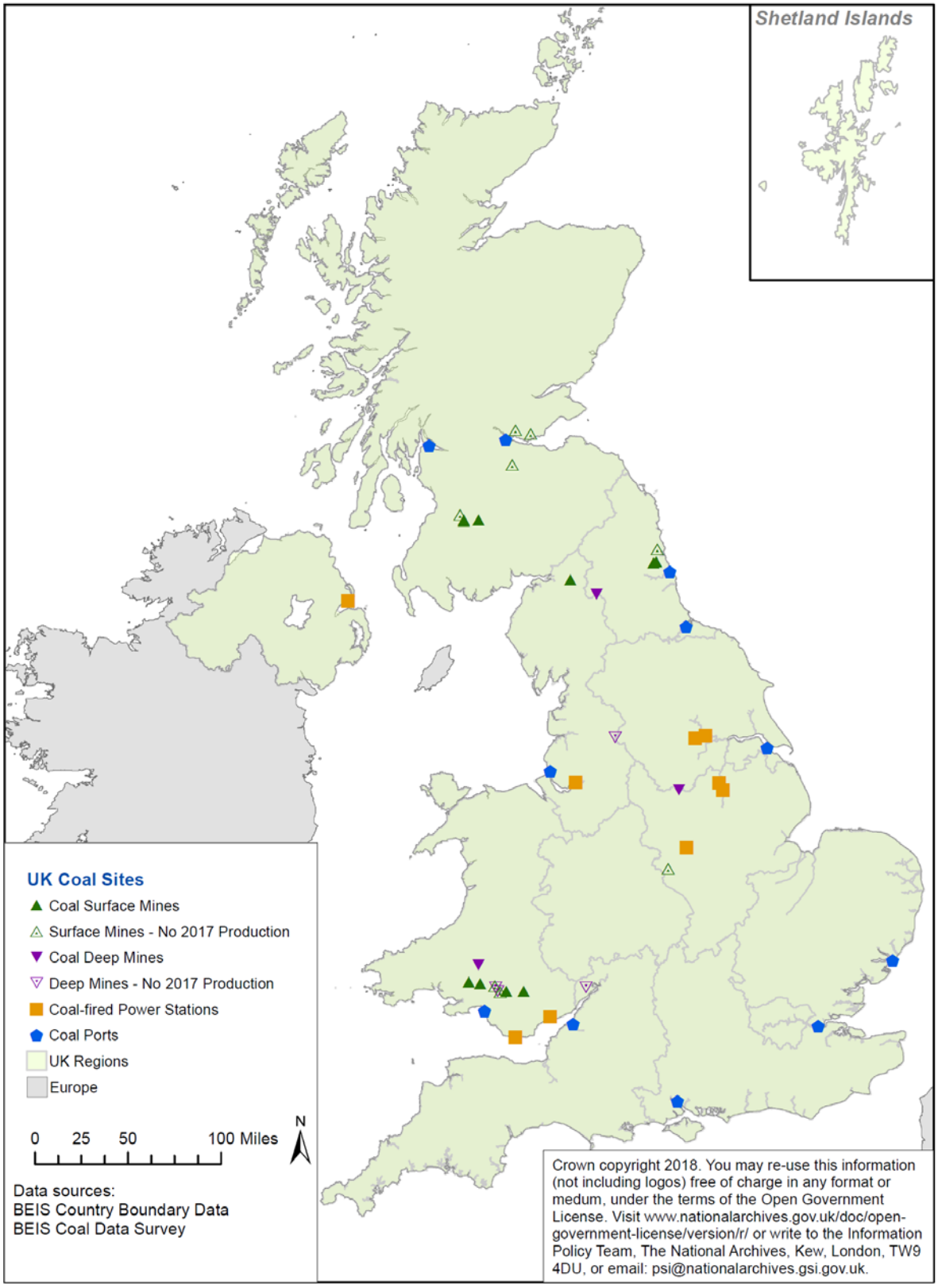
SURFACE MINING

Million tonnes

	England	Scotland	Wales	Total
Operational mines	7	1	5	13
Planning granted	3	5	1	9
In planning process	3	1	1	5
Pre-planning	0	40	0	40
Prospects	516	115	147	778
Total	**529**	**162**	**154**	**845**

Source: Coal Authority

Map 2A: UK coal production sites and ports as at the end of December 2017[2]



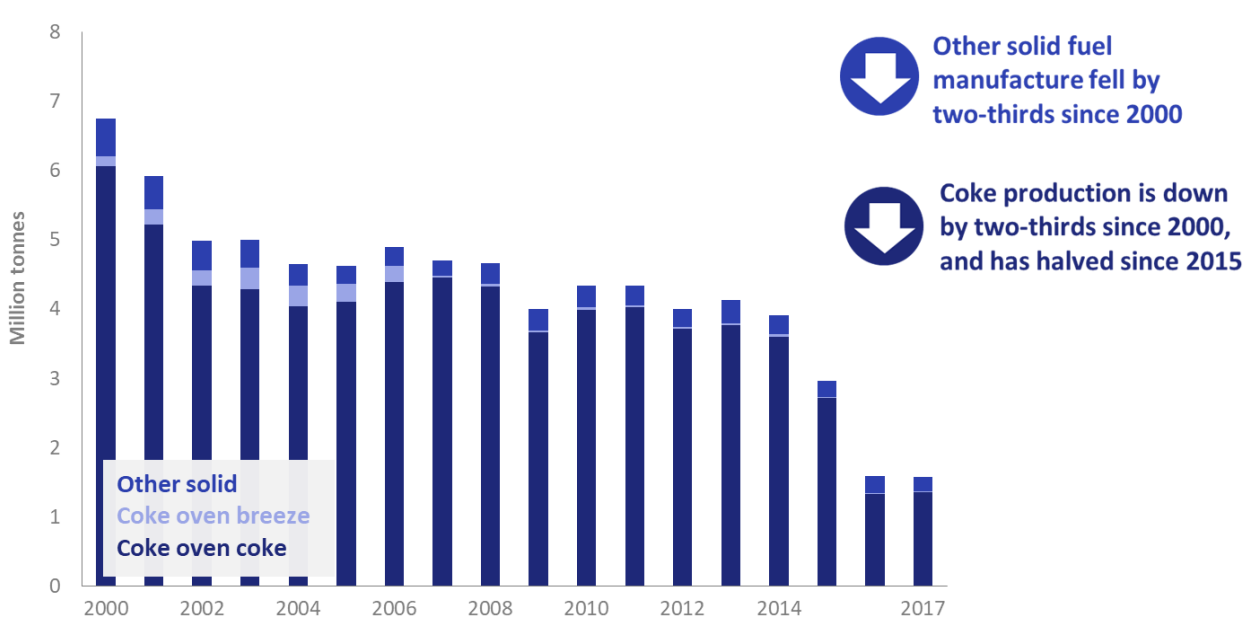
[2] *Includes non-coastal ports: Immingham (River Humber), Avonmouth (River Avon) and Tilbury (River Thames)*

Manufactured Solid Fuels (Tables 2.5 and 2.6)

Production, Trade and Consumption

2.22 In 2017, home produced coke oven coke increased by 2.2 per cent compared to 2016 to 1.4 million tonnes (Chart 2.5). However, between 2014 and 2017 production fell by 62 per cent. Monckton Coke and Chemicals, the only dedicated coke plant in the UK closed in December 2014. However, coke is still being produced and used at steelworks, mainly Port Talbot and Scunthorpe. In 2017, 77 per cent of the UK's supply of coke oven coke was home produced, with the remainder being imported.

Chart 2.5: Total manufactured solid fuels production in the UK 2000 to 2017



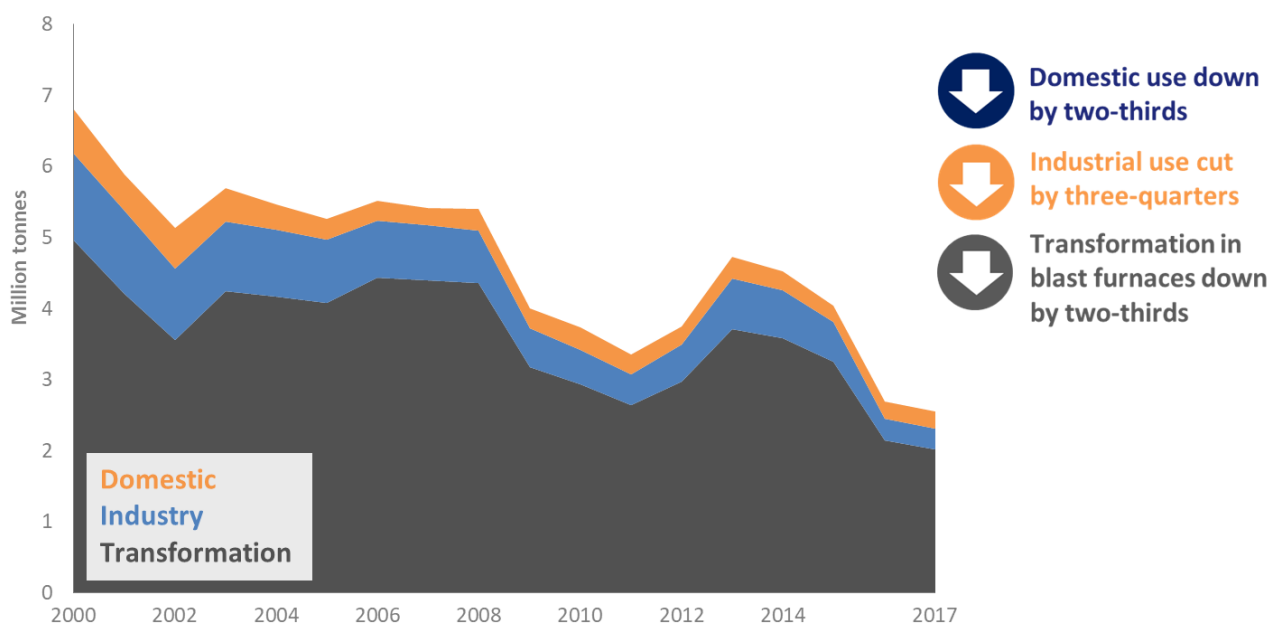
2.23 The main purpose of coke oven coke is for use in blast furnaces in the UK iron and steel industry. In 2017, blast furnace use had fallen to 1.8 million tonnes, down 5.6 per cent from 2016. The fall from 2015 to 2016 was larger at 34 per cent. This due to reduced steel production in the UK. Notably, SSI steelworks at Redcar ceased production in mid-September 2015 (with the subsequent closure in October).

2.24 Most of the supply of **coke breeze** is from re-screened coke oven coke, with direct production accounting for only 3.3 per cent of total supply in 2017. In that year, 47 per cent of coke breeze was used in blast furnaces (0.3 million tonnes) for transformation and 53 per cent used for final consumption (Chart 2.5).

2.25 Other manufactured solid fuels (patent fuels) are manufactured smokeless fuels, produced mainly for the domestic market. A small amount of these fuels (only 24 per cent of total supply in 2017) was imported.

2.26 The carbonisation and gasification of solid fuels in coke ovens produces coke oven gas as a by-product. In 2017, production of coke oven gas was 3.7 TWh, 8.0 per cent higher than in 2016 (3.5 TWh). Some of this (40 per cent) was used to fuel the coke ovens themselves. Another 26 per cent was used for electricity generation, 19 per cent for iron and steel and other industrial processes (including heat production), 10 per cent in blast furnaces and 5 per cent was lost.

Chart 2.6: Total manufactured solid fuels consumption in the UK 2000 to 2017



2.27 Blast furnace gas is a by-product of iron smelting in a blast furnace. A similar product is obtained when steel is made in basic oxygen steel (BOS) converters and "BOS" gas is included in this category. Most of these gases are used in other parts of integrated steel works. Production decreased by 3.2 per cent in 2017 compared with 2016. The generation of electricity in 2017 used 52 per cent of total blast furnace gas and BOS gas, while 35 per cent was used in coke ovens and blast furnaces themselves, 11 per cent was lost or burned as waste and a further 2 per cent was used in the iron and steel industry.

2.28 Demand for benzole and tars increased by 4.7 per cent from 531 GWh in 2016 to 556 GWh in 2017, all of which was met by domestic production. From 2009, based on information from the EU-ETS, all consumption of these products has been allocated to non-energy use – see also paragraph 2.50 (d) and (e).

List of DUKES coal tables

Table	Description	Period
2.1-2.3	Commodity balances for coal – supply, demand & final consumption	1998-2017
2.4	Supply and consumption of coal	1996-2017
2.5	Supply and consumption of coke oven coke, coke breeze and other manufactured solid fuels	1996-2017
2.6	Supply and consumption of coke oven gas, blast furnace gas, benzole and tars	1996-2017
2.7	Deep mines and surface mines in production, December 2017.	2017

2.1.1	Coal production and stocks	1970-2017
2.1.2	Inland consumption of solid fuels	1970-2017

2A	Output from UK coal mines and employment in UK coal mines	2015-2017
2B	Imports of coal in 2017, by grade and origin	2017
2C	Identified GB coal resource assessment at 22 June 2018	22nd June 2018

Technical notes and definitions

2.29 These notes and definitions are in addition to the technical notes and definitions covering all fuels and energy as a whole in Chapter 1. Additional guidance on the compilation of the solid fuels and derived gases statistics can be found in the document 'Data Sources and Methodologies', available on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/coal-statistics. For notes on the commodity balances and definitions of the terms used in the row headings see Annex A. While the data in the printed and bound copy of this Digest cover only the most recent 5 years, these notes also cover data for earlier years that are available on the BEIS website.

Coal production

2.30 **Deep mined**: The statistics cover saleable output from deep mines including coal obtained from working on both revenue and capital accounts. All licensed collieries (and British Coal collieries prior to 1995) are included, even where coal is only a subsidiary product.

2.31 **Surface** mines: The figures cover saleable output and include the output of sites worked by operators under agency agreements and licences, as well as the output of sites licensed for the production of coal as a subsidiary to the production of other minerals. The term 'surface mining' has now replaced opencast production as defined in DUKES pre-2011. Opencast production is a particular type of surface mining technique.

2.32 **Other sources/Slurry**: Estimates of slurry etc recovered and disposed of from dumps, ponds, rivers, etc.

Steam coal, coking coal and anthracite

2.33 **Steam coal** is coal classified as such by UK coal producers and by importers of coal. It tends to have calorific values at the lower end of the range.

2.34 **Coking coal** is coal sold by producers for use in coke ovens and similar carbonising processes. The definition is not therefore determined by the calorific value or caking qualities of each batch of coal sold, although calorific values tend to be higher than for steam coal.

2.35 **Anthracite** is coal classified as such by UK coal producers and importers of coal. Typically it has a high heat content making it particularly suitable for certain industrial processes and for use as a domestic fuel. Some UK anthracite producers have found a market for their lower calorific value output at power stations.

Allocation of imported coal

2.36 Although data are available on consumption of home produced coal, and also on consumption of imported coal by secondary fuel producers, there is only very limited direct information on consumption of imported coal by final users. Guidance on how BEIS allocate imports to final users is outlined in paragraph 3.2.5 of the 'Data Sources and Methodologies' document. This guidance can be found on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/coal-statistics.

Coal consumption

2.37 Figures for actual consumption of coal are available for all fuels and power producers and for final use by the iron and steel industry. The remaining final users' consumption figures are based on information on disposals to consumers by producers and on imports.

2.38 Annex A of this Digest outlines the principles of energy and commodity balances and defines the activities that fall within these parts of the balances. However, the following additional notes relevant to solid fuels are given below:

Transformation: Blast furnaces: Coking coal injected into blast furnaces is shown separately within the balance tables.

Transformation: Low temperature carbonisation plants and patent fuel plants: Coal used at these plants for the manufacture of domestic coke such as Coalite and of briquetted fuels such as Phurnacite and Homefire.

Consumption: Industry: The statistics comprise sales of coal by the six main coal producers and a few small producers to the iron and steel industry (excluding those used at coke ovens and blast furnaces) and to other industrial sectors, estimated proportions of anthracite and steam coal imports, and submission made to the EU Emissions Trading Scheme. The figures exclude coal used for industries' own generation of electricity, which appear separately under transformation.

Consumption: Domestic: Some coal is supplied free of charge to retired miners and other retired eligible employees through the National Concessionary Fuel Scheme (NCFS). The concessionary fuel provided in 2017 is estimated at 30.5 thousand tonnes. This estimate is included in the domestic steam coal and domestic anthracite figures.

Stocks of coal

2.39 Undistributed stocks are those held at collieries and surface mine sites. It is not possible to distinguish these two locations in the stock figures. Distributed stocks are those held at power stations and stocking grounds of the major power producing companies (as defined in Chapter 5, paragraphs 5.62 and 5.63), coke ovens, low temperature carbonisation plants and patent fuel plants.

Coke oven coke (hard coke), hard coke breeze and other manufactured fuels

2.40 The statistics cover coke produced at coke ovens owned by Corus plc, Coal Products Ltd and other producers. Low temperature carbonisation plants are not included (see paragraph 2.38). Breeze (as defined in paragraph 2.41) is excluded from the figures for coke oven coke.

2.41 Breeze can generally be described as coke screened below 19 mm (¾ inch) with no fines removed, but the screen size may vary in different areas and to meet the requirements of particular markets. Coke that has been transported from one location to another is usually re-screened before use to remove smaller sizes, giving rise to further breeze.

2.42 The coke screened out by producers as breeze and fines appears as transfers in the coke breeze column of the balances. Transfers out of coke oven coke have not always been equal to transfers into coke oven breeze. This was due to differences arising from the timing, location of measurement and the practice adopted by the iron and steel works. Since 2000, however, the Iron

and Steel Statistics Bureau have been able to reconcile these data. Since 2007, most of the supply of coke breeze was reclassified to coke oven coke following better information received by the Iron and Steel Statistics Bureau.

2.43 Figures are derived from returns made to HM Revenue and Customs and are broken down in greater detail in Annex G on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

2.44 In Table 2.5, the export figures used for hard coke, coke breeze and other manufactured solid fuels for the years before 1998 (as reported on the BEIS web site) are quantities of fuel exported as reported to BEIS or its predecessor Departments by the companies concerned, rather than quantities recorded by HM Revenue and Customs in their Trade Statistics. A long-term trend commentary and tables on exports are on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

2.45 In 1998, an assessment using industry data showed that on average over the previous five years 91 per cent of imports had been coke and 9 per cent breeze and it is these proportions that have been used for 1998 and subsequent years in Table 2.5.

2.46 The calorific value for coke breeze has been set the same as for coke oven coke. This is following information from the iron and steel industry on the similarities between the two types of manufactured fuels.

2.47 Imports and exports of manufactured smokeless fuels can contain small quantities of non-smokeless fuels.

2.48 Other manufactured solid fuels are mainly solid smokeless fuels for the domestic market for use in both open fires and in boilers. A smaller quantity is exported (although exports are largely offset by similar quantities of imports in most years). Manufacture takes place in patented fuel plants and low-temperature carbonisation plants. The brand names used for these fuels include Homefire, Phurnacite, Ancit and Coalite.

2.49 Consumption of coke and other manufactured solid fuels: These are disposals from coke ovens to merchants. The figures also include estimated proportions of coke imports.

Blast furnace gas, coke oven gas, benzole and tars

2.50 The following definitions are used in the tables that include these fuels:

(a) Blast furnace gas: includes Basic Oxygen Steel furnace (BOS) gas. Blast furnace gas is the gas produced during iron ore smelting when hot air passes over coke within the blast ovens. It contains carbon monoxide, carbon dioxide, hydrogen and nitrogen. In a BOS furnace the aim is not to introduce nitrogen or hydrogen into the steel making process, so pure oxygen gas and suitable fluxes are used to remove the carbon and phosphorous from the molten pig iron and steel scrap. A similar fuel gas is thus produced.

(b) Coke oven gas: is a gas produced during the carbonisation of coal to form coke at coke ovens. In 2009, some coke oven gas was produced using a combination of gases other than natural gas and blast furnace gas. This total has been added to the production of coke oven gas rather than transfers because it is specifically defined as the mixture of natural gas, blast furnace gas and BOS gas. See the paragraph below on synthetic coke oven gas for a complete definition of this.

(c) Synthetic coke oven gas: is mainly natural gas that is mixed with smaller amounts of blast furnace and BOS gas to produce a gas with almost the same qualities as coke oven gas. The transfers row of Table 2.6 shows the quantities of blast furnace gas used for this purpose and the total input of gases to the synthetic coke oven gas process. There is a corresponding outward transfer from natural gas in Chapter 4, Table 4.1.

(d) Benzole: a colourless, liquid, flammable, aromatic hydrocarbon by-product of the iron and steel making process. It is used in the UK as a solvent in the manufacture of styrenes and phenols. All consumption of benzole has been allocated to non-energy use from 2009 onwards.

(e) Tars: viscous materials usually derived from the destructive distillation of coal, which are by-products of the coke and iron making processes. All consumption of tars has been allocated to non-energy use from 2009 onwards.

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2.1 Commodity balances 2017

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	2,667	39	335	3,041
Other sources	-	-	-	-
Imports	5,689	2,692	116	8,498
Exports	-403	-2	-90	-495
Marine bunkers	-	-	-	-
Stock change *(1)*	+2,769	+281	109	+3,159
Transfers	-	-	-	-
Total supply	**10,723**	**3,010**	**470**	**14,203**
Statistical difference *(2)*	+364	-179	-165	+19
Total demand	**10,359**	**3,189**	**635**	**14,183**
Transformation	**8,730**	**3,189**	**207**	**12,126**
Electricity generation	8,725	-	-	8,725
Major power producers	8,702	-	-	8,702
Autogenerators	22	-	-	22
Heat generation	6	-	-	6
Petroleum refineries	-	-	-	-
Coke manufacture	-	1,888	-	1,888
Blast furnaces	-	1,301	-	1,301
Patent fuel manufacture and low temperature carbonisation	-	-	207	207
Energy industry use	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-
Oil and gas extraction	-	-	-	-
Petroleum refineries	-	-	-	-
Coal extraction	-	-	-	-
Coke manufacture	-	-	-	-
Blast furnaces	-	-	-	-
Patent fuel manufacture	-	-	-	-
Pumped storage	-	-	-	-
Other	-	-	-	-
Losses	-	-	-	-
Final consumption	**1,629**	**-**	**428**	**2,057**
Industry	**1,233**	**-**	**235**	**1,468**
Unclassified	-	-	-	-
Iron and steel	1	-	32	33
Non-ferrous metals	32	-	-	32
Mineral products	666	-	0	666
Chemicals	68	-	-	68
Mechanical engineering etc.	11	-	-	11
Electrical engineering etc.	5	-	-	5
Vehicles	54	-	-	54
Food, beverages etc	59	-	18	77
Textiles, leather etc.	63	-	-	63
Paper, printing etc.	111	-	-	111
Other industries	158	-	185	343
Construction	5	-	-	5
Transport	**15**	**-**	**-**	**15**
Air	-	-	-	-
Rail *(3)*	15	-	-	15
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**380**	-	**193**	**574**
Domestic	342	-	193	535
Public administration	26	-	-	26
Commercial	5	-	-	5
Agriculture	-	-	-	-
Miscellaneous	7	-	-	7
Non energy use	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).

(2) Total supply minus total demand.

(3) Estimate revised following research carried out into heritage railways.

2.2 Commodity balances 2016

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	3,664	53	461	4,178
Other sources	-	-	-	-
Imports	5,619	2,781	94	8,494
Exports	-356	-1	-86	-443
Marine bunkers	-	-	-	-
Stock change *(1)*	5,699r	-58r	-93r	5,547r
Transfers	-	-	-	-
Total supply	**14,625r**	**2,775r**	**375r**	**17,775r**
Statistical difference *(2)*	839r	-409	-399r	30r
Total demand	**13,786r**	**3,184r**	**775r**	**17,745r**
Transformation	**11,929r**	**3,184r**	**355r**	**15,468r**
Electricity generation	11,924r	-	132	12,056r
Major power producers	11,908	-	132	12,040
Autogenerators	16r	-	-	16r
Heat generation	6r	-	-	6r
Petroleum refineries	-	-	-	-
Coke manufacture	-	1,821r	-	1,821r
Blast furnaces	-	1,364	-	1,364
Patent fuel manufacture and low temperature carbonisation	-	-	223r	223r
Energy industry use	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-
Oil and gas extraction	-	-	-	-
Petroleum refineries	-	-	-	-
Coal extraction	-	-	-	-
Coke manufacture	-	-	-	-
Blast furnaces	-	-	-	-
Patent fuel manufacture	-	-	-	-
Pumped storage	-	-	-	-
Other	-	-	-	-
Losses	-	-	-	-
Final consumption	**1,857r**	**-**	**420r**	**2,277r**
Industry	**1,435r**	**-**	**232**	**1,667r**
Unclassified	-	-	-	-
Iron and steel	2r	-	33	35r
Non-ferrous metals	34r	-	-	34r
Mineral products	813	-	0	813
Chemicals	87r	-	-	87r
Mechanical engineering etc.	12r	-	-	12r
Electrical engineering etc.	5r	-	-	5r
Vehicles	59r	-	-	59r
Food, beverages etc	53r	-	14	67r
Textiles, leather etc.	71r	-	-	71r
Paper, printing etc.	137r	-	-	137r
Other industries	156r	-	185	341r
Construction	5	-	-	5
Transport	**15**	**-**	**-**	**15**
Air	-	-	-	-
Rail *(3)*	15	-	-	15
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**407r**	-	**188r**	**595r**
Domestic	362r	-	188r	550r
Public administration	33r	-	-	33r
Commercial	5	-	-	5
Agriculture	-	-	-	-
Miscellaneous	7	-	-	7
Non energy use	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).

(2) Total supply minus total demand.

(3) Estimate revised following research carried out into heritage railways.

2.3 Commodity balances 2015

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	7,667r	72	858r	8,598r
Other sources	-	-	-	-
Imports	17,665	4,750	102	22,518
Exports	-303	-1	-81	-385
Marine bunkers	-	-	-	-
Stock change *(1)*	6,603r	242r	25	6,869r
Transfers	-	-	-	-
Total supply	**31,632r**	**5,063r**	**904r**	**37,600r**
Statistical difference *(2)*	634r	-148	-337r	149r
Total demand	**30,998r**	**5,211r**	**1,242**	**37,451r**
Transformation	**28,863r**	**5,211r**	**701**	**34,775r**
Electricity generation	28,857	-	473	29,330
Major power producers	28,838	-	473	29,310
Autogenerators	19	-	-	19
Heat generation	6r	-	-	6r
Petroleum refineries	-	-	-	-
Coke manufacture	-	3,667r	-	3,667r
Blast furnaces	-	1,544	-	1,544
Patent fuel manufacture and low temperature carbonisation	-	-	228	228
Energy industry use	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-
Oil and gas extraction	-	-	-	-
Petroleum refineries	-	-	-	-
Coal extraction	-	-	-	-
Coke manufacture	-	-	-	-
Blast furnaces	-	-	-	-
Patent fuel manufacture	-	-	-	-
Pumped storage	-	-	-	-
Other	-	-	-	-
Losses	-	-	-	-
Final consumption	**2,136r**	**-**	**541**	**2,676r**
Industry	**1,738r**	**-**	**336**	**2,073r**
Unclassified	-	-	-	-
Iron and steel	1	-	43	44
Non-ferrous metals	38r	-	-	38r
Mineral products	1,048	-	0	1,048
Chemicals	94r	-	-	94r
Mechanical engineering etc.	13r	-	-	13r
Electrical engineering etc.	6r	-	-	6r
Vehicles	67r	-	-	67r
Food, beverages etc.	57r	-	21	77r
Textiles, leather etc.	69r	-	-	69r
Paper, printing etc.	140r	-	-	140r
Other industries	200r	-	272	472r
Construction	6	-	-	6
Transport	**13**	**-**	**-**	**13**
Air	-	-	-	-
Rail *(3)*	13	-	-	13
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**385r**	-	**205**	**590r**
Domestic	347	-	205	552
Public administration	26r	-	-	26r
Commercial	5	-	-	5
Agriculture	-	-	-	-
Miscellaneous	7	-	-	7
Non energy use	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).

(2) Total supply minus total demand.

(3) Estimate revised following research carried out into heritage railways.

2.4 Supply and consumption of coal

Thousand tonnes

	2013	2014	2015	2016	2017
Supply					
Production	12,673	11,648	8,598	4,178	3,041
Deep-mined	4,089	3,685	2,784	22	20
Surface mining *(1)*	8,584	7,962	5,814	4,156	3,021
Other sources *(2)*	95	-	-	-	-
Imports	50,611	42,225	22,518	8,494	8,498
Exports	-595	-425	-385	-443	-495
Stock change *(3)*	-2,641	-5,131	+6,869	+5,547	+3,159
Total supply	**60,143**	**48,316**	**37,600**	**17,775**	**14,203**
Statistical difference *(4)*	-62	+21	+149	+30	+19
Total demand	**60,206**	**48,295**	**37,451**	**17,745**	**14,183**
Transformation	**57,192**	**45,255**	**34,775**	**15,468**	**12,126**
Electricity generation	49,873	38,234	29,330	12,056	8,724
Major power producers	49,840	38,215	29,310	12,039	8,702
Autogenerators	33	19	19	16	22
Heat generation	362	272	6	6	6
Coke manufacture	5,288	4,977	3,667	1,821	1,888
Blast furnaces	1,411	1,513	1,544	1,364	1,301
Patent fuel manufacture and l	259	259	228	223	207
Energy industry use	**3**	**1**	**-**	**-**	**-**
Coal extraction	3	1	-	-	-
Final consumption	**3,011**	**3,040**	**2,676**	**2,277**	**2,057**
Industry	**2,323**	**2,442**	**2,073**	**1,667**	**1,468**
Unclassified	-	-			
Iron and steel	53	54	44	35	33
Non-ferrous metals	21	25	38	34	32
Mineral products	1,338	1,239	1,048	813	666
Chemicals	84	108	94	87	68
Mechanical engineering, etc	11	14	13	12	11
Electrical engineering, etc	5	7	6	5	5
Vehicles	60	70	67	59	54
Food, beverages, etc	55	62	77	67	77
Textiles, leather, etc	66	74	69	71	63
Paper, printing, etc	143	166	140	137	111
Other industries	480	615	472	341	343
Construction	6	7	6	5	5
Transport	**14**	**13**	**13**	**15**	**15**
Other	**675**	**585**	**590**	**595**	**574**
Domestic	640	549	552	550	535
Public administration	24	24	26	33	26
Commercial	5	5	5	5	5
Agriculture	-	-	-	-	-
Miscellaneous	7	7	7	7	7
Non energy use					
Stocks at end of year *(5)*					
Distributed stocks	15,114	20,142	13,546	7,953	5,067
Of which:					
Major power producers	11,871	17,091	12,595	6,962	4,257
Coke ovens	518	795	553	611	331
Undistributed stocks	530	633	360	406	134
Total stocks *(6)*	**15,644**	**20,775**	**13,906**	**8,359**	**5,200**

(1) The term 'surface mining' has now replaced opencast production. Opencast production is a surface mining technique.
(2) Estimates of slurry etc. recovered from ponds, dumps, rivers, etc.
(3) Stock fall (+), stock rise (-).
(4) Total supply minus total demand.
(5) Excludes distributed stocks held in merchants' yards, etc., mainly for the domestic market, and stocks held by the industrial sector.
(6) For some years, closing stocks may not be consistent with stock changes, due to additional stock adjustments.

2.5 Supply and consumption of coke oven coke, coke breeze and other manufactured solid fuels

Thousand tonnes

	2013	2014	2015	2016	2017
Coke oven coke					
Supply					
Production	3,769	3,601	2,716	1,332	1,361
Imports	764	823	1,006	1,110	849
Exports	-75	-85	-83	-	-
Stock change *(1)*	+178	-64	+184	-110	-232
Transfers	-1,277	-1,075	-970	-459	-215
Total supply	**3,358**	**3,199**	**2,853**	**1,872**	**1,764**
Statistical difference *(2)*	**-**	**-**	**-**	**-**	**-**
Total demand	**3,358**	**3,199**	**2,853**	**1,872**	**1,764**
Transformation	**3,271**	**3,144**	**2,823**	**1,860**	**1,757**
Blast furnaces	3,271	3,144	2,823	1,860	1,757
Energy industry use	**-**	**-**	**-**	**-**	**-**
Final consumption	**87**	**55**	**30**	**12**	**7**
Industry	**82**	**49**	**27**	**12**	**7**
Unclassified	69	35	13	0	0
Iron and steel	13	14	15	12	7
Non-ferrous metals	**-**	**-**	**-**	**-**	**-**
Other	**6**	**6**	**3**	**0**	**-**
Domestic	6	6	3	0	-
Stocks at end of year *(3)*	**215**	**280**	**95**	**206**	**437**
Coke breeze					
Supply					
Production *(4)*	32	31	18	16	18
Imports	55	103	107	112	94
Exports	-11	-3	-7	-	-
Stock change *(1)*	-283	-132	-123	+1	+226
Transfers	1,277	1,071	967	455	211
Total supply	**1,069**	**1,070**	**962**	**584**	**549**
Statistical difference *(2)*	**-**	**-**	**-**	**-**	**-**
Total demand	**1,069**	**1,070**	**962**	**584**	**549**
Transformation	**442**	**440**	**433**	**280**	**260**
Coke manufacture	**-**	**-**	**-**	**-**	**-**
Blast furnaces	442	440	433	280	260
Energy industry use	**-**	**-**	**-**	**-**	**-**
Final consumption	**627**	**629**	**528**	**304**	**289**
Industry	**627**	**629**	**528**	**304**	**289**
Unclassified	14	9	4	-	-
Iron and steel	613	620	525	304	289
Stocks at end of year *(3)*	**720**	**852**	**975**	**974**	**748**
Other manufactured solid fuels					
Supply					
Production	336	274	231	245	201
Imports	15	14	20	29	57
Exports	-30	-24	-22	-22	-20
Stock change *(1)*	-17	-15	+3	-16	+3
Total supply	**303**	**249**	**232**	**236**	**242**
Statistical difference *(2)*	-1	-1	+0	+0	-1
Total demand	**304**	**250**	**232**	**236**	**242**
Transformation	**-**	**-**	**-**	**-**	**-**
Energy industry use	**-**	**-**	**-**	**-**	**-**
Patent fuel manufacture	**-**	**-**	**-**	**-**	**-**
Final consumption	**304**	**250**	**232**	**236**	**242**
Industry	**-**	**-**	**-**	**-**	**-**
Unclassified	**-**	**-**	**-**	**-**	**-**
Other	**304**	**250**	**232**	**236**	**242**
Domestic	304	250	232	236	242
Stocks at end of year *(3)*	**42**	**57**	**54**	**70**	**67**

(1) Stock fall (+), stock rise (-).
(2) Total supply minus total demand.
(3) Producers stocks and distributed stocks.
(4) See paragraph 2.25.

2.6 Supply and consumption of coke oven gas, blast furnace gas, benzole and tars

GWh

	2013	2014	2015	2016	2017
Coke oven gas					
Supply					
Production	8,479	8,473	6,890	3,468	3,745
Imports	-	-	-	-	-
Exports	-	-	-	-	-
Transfers *(1)*	+64	+146	+439	+360	+156
Total supply	**8,544**	**8,620**	**7,329**	**3,828**	**3,901**
Statistical difference *(2)*	-1	-3	-3	0	-0
Total demand	**8,545**	**8,622**	**7,332**	**3,828**	**3,901**
Transformation	**2,741**	**2,538**	**1,659**	**913**	**1,024**
Electricity generation	2,322	2,119	1,649	903	1,014
Heat generation	418	418	9	9	9
Other	-	-	-	-	-
Energy industry use	**4,525**	**4,599**	**3,879**	**1,937**	**1,940**
Coke manufacture	3,643	3,725	3,185	1,569	1,546
Blast furnaces	882	874	694	369	395
Other	-	-	-	-	-
Losses	**389**	**682**	**768**	**203**	**181**
Final consumption	**890**	**804**	**1,026**	**775**	**756**
Industry	**890**	**804**	**1,026**	**775**	**756**
Unclassified	174	165	-	-	-
Iron and steel	716	639	1,026	775	756
Blast furnace gas					
Supply					
Production	15,576	15,386	14,131	10,090	9,763
Imports	-	-	-	-	-
Exports	-	-	-	-	-
Transfers *(1)*	-4	-7	-19	-16	-7
Total supply	**15,572**	**15,380**	**14,111**	**10,074**	**9,756**
Statistical difference *(2)*	+17	-34	+13	+8	+21
Total demand	**15,555**	**15,414**	**14,099**	**10,066**	**9,735**
Transformation	**8,782**	**8,686**	**7,461**	**5,378**	**5,019**
Electricity generation	8,602	8,507	7,457	5,374	5,015
Heat generation	179	179	4	4	4
Other	-	-	-	-	-
Energy industry use	**4,516**	**4,732**	**4,451**	**3,509**	**3,384**
Coke manufacture	751	711	641	632	569
Blast furnaces	3,765	4,021	3,810	2,877	2,815
Other	-	-	-	-	-
Losses	**2,111**	**1,835**	**1,878**	**912**	**1,091**
Final consumption	**146**	**160**	**308**	**267**	**240**
Industry	**146**	**160**	**308**	**267**	**240**
Unclassified	-	-	-	-	-
Iron and steel	146	160	308	267	240
Benzole and tars *(3)*					
Supply					
Production	1,630	1,582	1,136	531	556
Final consumption *(4)*	**1,630**	**1,582**	**1,136**	**531**	**556**
Unclassified	-	-	-	-	-
Iron and steel	-	-	-	-	-
Non energy use	1,630	1,582	1,136	531	556

(1) To and from synthetic coke oven gas, see paragraph 2.51.
(2) Total supply minus total demand.
(3) Because of the small number of benzole suppliers, figures for benzole and tars cannot be given separately.
(4) From 2009, unclassified final consumption has been recorded under non energy use

2.7 Deep mines and surface mines in production 31 December 2017

Deep mines[1]

Licensee	Site Name	Location
Ayle Colliery Company Ltd	Ayle Colliery	Northumberland
Packaged Water Limited	Eckington Colliery	Derbyshire
Three D's Mining Ltd	Dan-y-Graig No.4 Colliery	Neath Port Talbot

Surface mines[2]

Licensee	Site Name	Location
Bryn Bach Coal Ltd	Glan Lash	Carmarthenshire
Celtic Energy Ltd	East Pit	Neath Port Talbot
Glenmuckloch Restoration Ltd	Glenmuckloch Site	Dumfries & Galloway
H J Banks & Company Ltd	Brenkley Lane	Newcastle upon Tyne
	Rusha Site	West Lothian
	Shotton	Northumberland
Hargreaves Surface Mining Ltd	Muir Dean Site	Fife
H M Project Developments Ltd	Halton Lea Gate Remediation Scheme	Northumberland
Kier Minerals Ltd	Greenburn Project	East Ayrshire
Land Engineering Services Ltd	Comrie Colliery Site	Fife
Miller Argent (South Wales) Ltd	Ffos-y-Fran Land Reclamation Scheme	Merthyr Tydfil
OCCW (Broken Cross) Ltd	Broken Cross Site	South Lanarkshire
OCCW (House of Water) Ltd	House of Water Site	East Ayrshire
OCCW (Netherton) Ltd	Netherton	East Ayrshire
PB Restoration Ltd	Potland Burn	Northumberland
Tower Regeneration Ltd	Tower Colliery Surface Mining Site	Rhondda Cynon Taff
UKCSMR Ltd	Minorca	Leicestershire

(1) In addition, there were 5 underground mines on care & maintenance :-

Aberpergwm Colliery in Neath Port Talbot licensed to Energybuild Mining Ltd

Hill Top in Lancashire licensed to Grimebridge Colliery Company Ltd

Monument Colliery in the Forest of Dean licensed to Messrs Ashly, Daniels and Jones

Nant Hir No 2 Colliery in Neath Port Talbot licensed to NH Colliery Ltd

Redding's Level No.2 Mine in the Forest of Dean licensed to Mr A J Warren

(2) In addition, there were 2 surface mines on care & maintenance :-

Nant Helen Remainder in Powys licensed to Celtic Energy Ltd

Selar site in Neath Port Talbot licensed to Celtic Energy Ltd

Source: The Coal Authority

Chapter 3
Petroleum

Key points

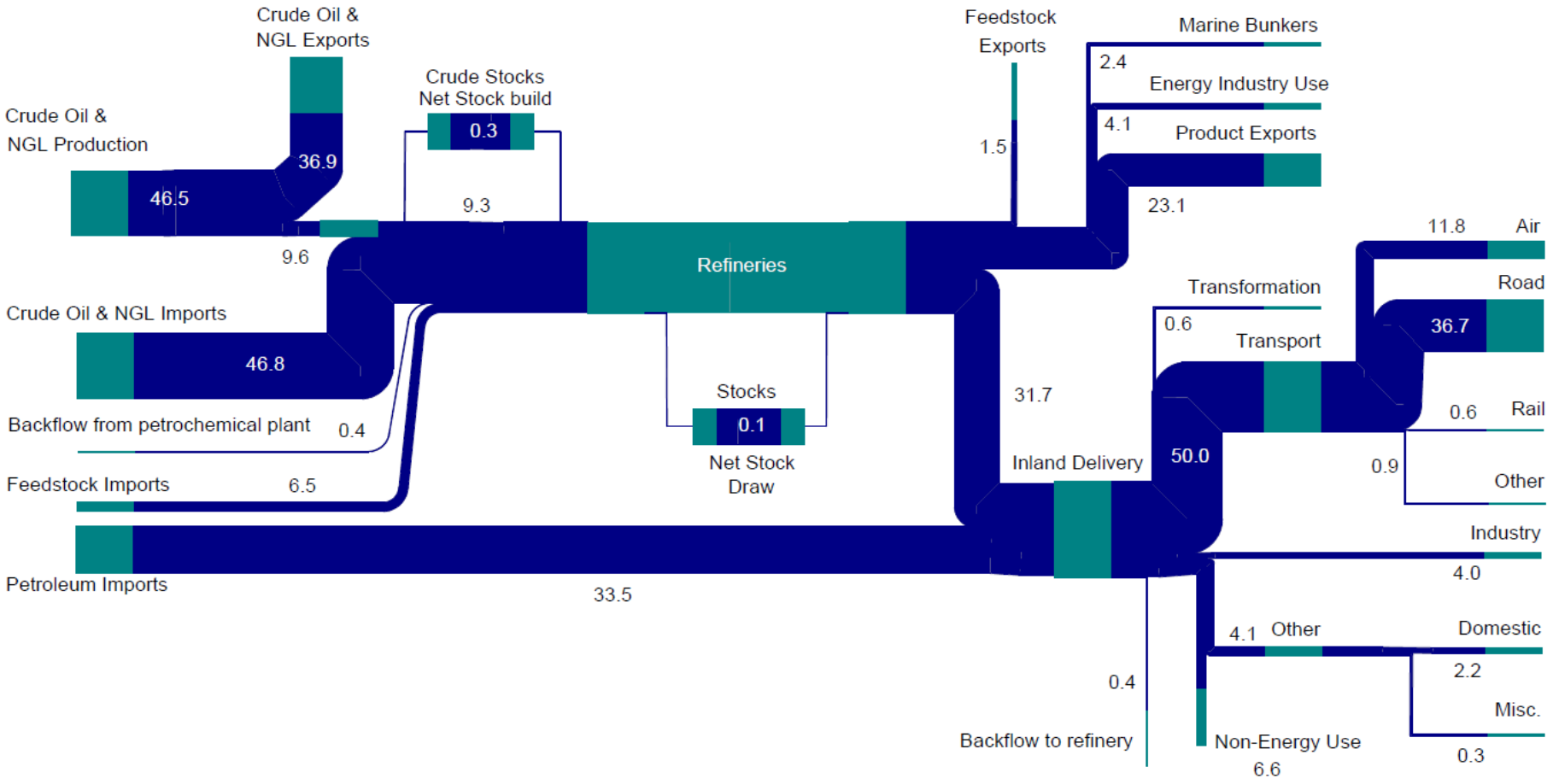
- **Production of crude oil and Natural Gas Liquids from the UK's North Sea decreased by 2.0 per cent in 2017**. Production is around a third of the UK's peak of 1999 (Table 3.1, Chart 3.1).
- **Net imports of primary oils increased in 2017.** Exports during the year were high, up 10 per cent (3.5 million tonnes) on last year, due to price spreads increasing demand for Brent crude in Asia. Stable refinery throughput and strong exports meant indigenous use of crude fell to a record low of 7.2 million tonnes. Refinery demand was met with a 9.4 per cent (4.6 million tonnes) increase in imports. (Table 3.1, Chart 3.1).
- **UK refinery production was stable at 59.8 million tonnes in 2017.** Production has bucked the long term of trend of decline since 2015, however many refineries have reduced their distillation capacity in recent years and UK production was still around one-third lower than the peak at the turn of the century (Table 3.2, Chart 3.2).
- **The UK was a net importer of petroleum products in 2017 by more than 10 million tonnes,** although this was a decrease of 3.0 per cent on the year before as a result of a larger fall in exports compared to imports. Product imports were down 4.4 per cent whereas exports were down 4.9 per cent on 2016. (Table 3.2, Chart 3.2).
- **Refinery production does not meet demand for every product.** Around half of the UK's demand for diesel is produced in the UK and around 40 per cent of jet fuel, whereas refineries continue to produce more than sufficient petrol (Table 3.2).
- **The increase in final consumption in 2017 of 0.6 per cent was lower than the 2.0 per cent seen in 2016.** In each year these increases were largely driven by the use of oil for transport, which forms around three-quarters of UK refined oil demand (Table 3.2 to 3.4, Chart 3.2).

Introduction

3.1 Petroleum forms a key part of the UK's energy mix. Around 40 percent of the UK's total energy production is from crude oils extracted from the UK's Continental Shelf, and UK refineries produce around 60 million tonnes of oil products. Consumer demand for transport fuels, heating fuels and for feedstocks to produce plastics and other products is around 65 million tonnes, over a third of the UK's energy consumption.

3.2 The flow chart on the following page shows the movement of primary oils and petroleum products, illustrating how crude oils are supplied, transformed in refineries, and then consumed in the various sectors of the UK's economy. The widths of the bands are proportional to the size of the flow they represent.

Petroleum Flow Chart 2017 (million tonnes)



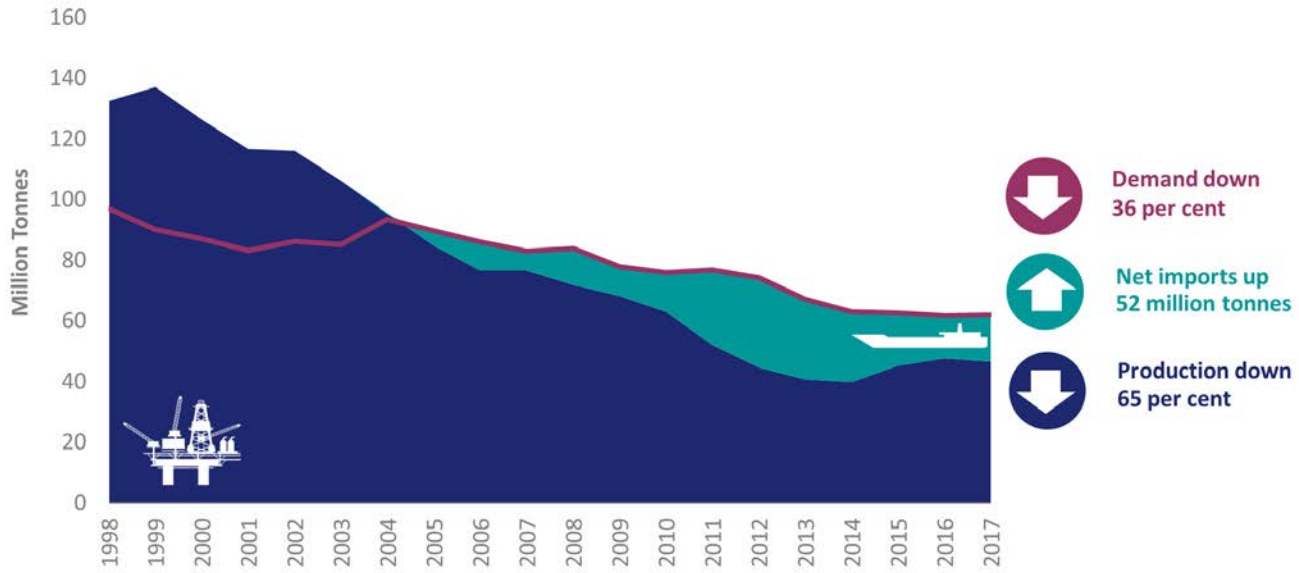
Note:
This flow chart is based on the data that appear in Tables 3.1 and 3.2.
The numbers on either side of the flow chart will not match due to losses in transformation.
Biofuels are not included.

Supply and demand for primary oil (Table 3.1)

3.3 Chart 3.1 summarises how production, trade and demand of crude oils have changed since 1998. Overall demand from refiners has dropped by more than a third since the late part of the last century but there has been a far steeper decline in oil production from the United Kingdom Continental Shelf (UKCS). **From its peak of 137 million tonnes in 1999 UKCS production of all primary oils (including feedstocks) has dropped nearly two-thirds to 47 million tonnes**, with the UK becoming a net importer in 2005. Production fell 2.0 per cent in 2017, although disruption to the Forties Pipeline System in December contributed to this. Without the disruption it is expected that production would have been stable. While recent declines in production have been shallower, imports will continue to become increasingly important in meeting the UK's needs.

3.4 Exports of primary oils were up 10 per cent on 2016, driven by an increase in exports of crude and NGLs because of favourable price spreads and strong demand for Brent crude from Asia. As a result of these high exports and stable refinery demand, indigenous use of crude reached a record low of 7.2 million tonnes, down more than a third on both 2016 and the previous five year average. To meet this shortfall in refinery demand, imports of primary oils increased by 9.4 per cent. The UK was a net importer of primary oils by 15.0 million tonnes in 2017, compared to 13.9 million tonnes in 2016.

Chart 3.1: Primary oil supply and demand 1998-2017

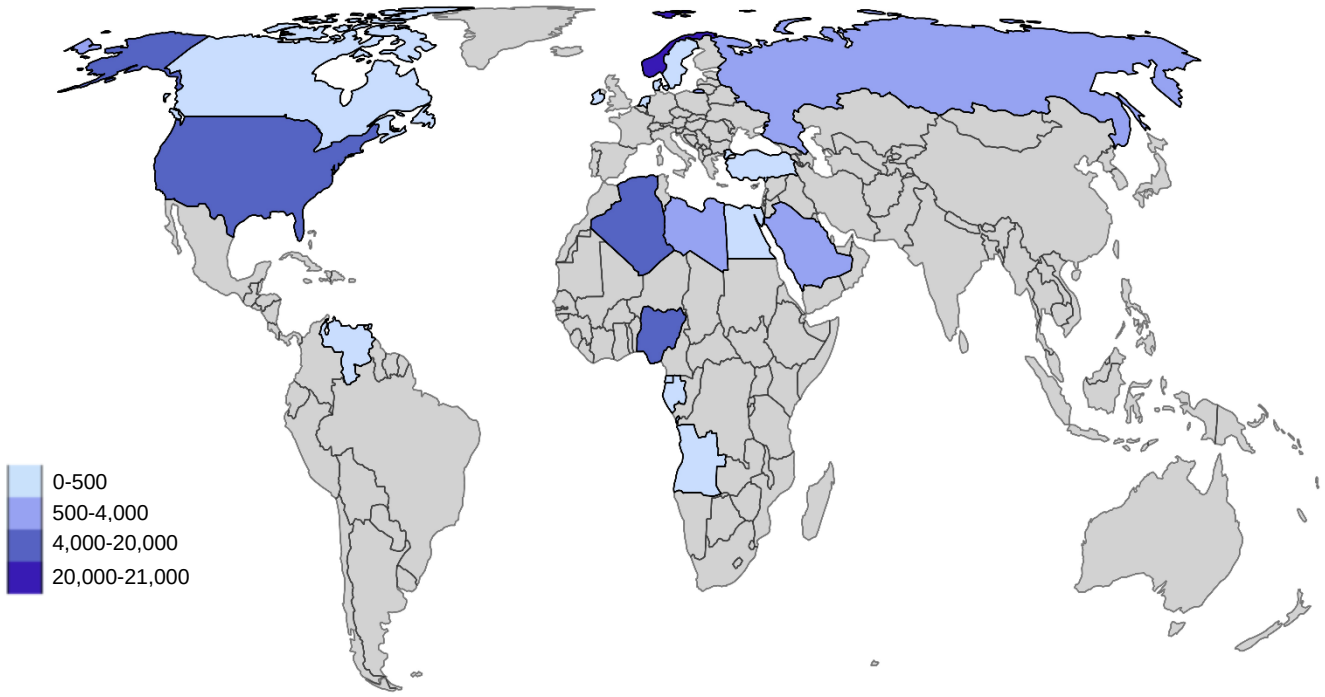


3.5 The sources of crude oil imports from other countries are shown in Map 3A. **The principal source of the UK's imports has consistently been Norway** given not only its proximity to the UK but also the similarity in its crude types. In 2015 Norway provided 50 per cent of UK crude, rising to 62 per cent in 2016. In 2017 the proportion of crude oil sourced from Norway stood at 48 per cent.

3.6 **Imports from OPEC countries accounted for 31 per cent of the UK's crude imports in 2017.** Principally imports from OPEC countries come from Algeria (10 per cent of total imports) and Nigeria (10 per cent). Combined volumes from OPEC countries increased by 2.9 million tonnes in 2017. This, combined with a 3.7 million tonne increase in imports from the USA, contributed to a total increase in UK imports of 4.7 million tonnes despite a 3.3 million tonne decrease from Norway.

3.7 Imports from Russia increased by 1.2 million tonnes in 2017 to comprise 6.7 per cent of UK crude imports. This made Russia the fifth largest source of imports after Norway, Algeria, Nigeria and the USA.

Map 3A: Source of UK crude oil imports 2017 (thousand tonnes)



3.8 **The UK is a significant exporter of crude oils as well as an importer. Crude oil exports increased in 2017 to reach over 34 million tonnes.** Crude oil has historically been principally exported to the Netherlands, Germany, France and the US, which together comprised 60 per cent of total crude exports in 2017. Exports to South Korea increased by 2.1 million tonnes and exports to China increased by 1.0 million tonnes, making China the second largest recipient of UK crude exports after the Netherlands in 2017.

UK refineries

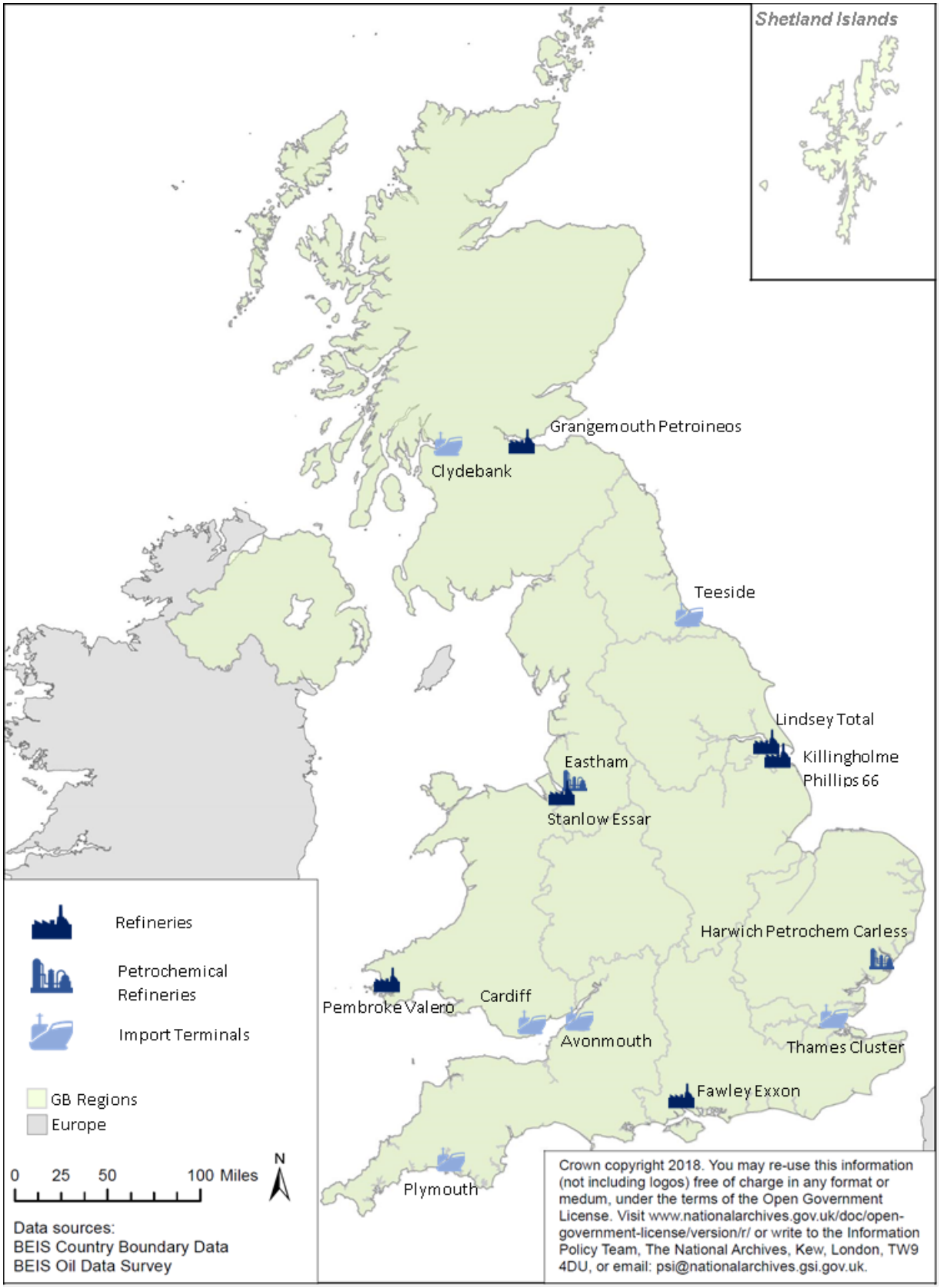
3.9 A significant proportion of the UK's primary oil is processed into petroleum products at the UK's six refineries. Data for refinery capacity as at the end of 2017 are presented in Table 3A, with the location of these refineries illustrated in Map 3B. The location of the UK's petrochemical refineries and major import terminals are also marked on the map.

Table 3A: UK refinery processing capacity as at end 2017

Refinery	Atmospheric Distillation	Reforming	Cracking and Conversion
Fawley Exxon	13.3	4.4	5.0
Stanlow Essar	9.8	1.5	4.0
Pembroke Valero	10.9	2.1	6.3
Grangemouth PetroIneos	10.2	1.9	3.5
Killingholme Phillips 66	11.9	2.6	10.7
Lindsey Total	5.0	0.7	3.8
Petrochemical plant			
Harwich Petrochem Carless	< 1.0	-	-
Eastham Refinery	1.2	-	-
Total	**62.3**	**13.2**	**33.3**

Million tonnes per annum

Map 3B: Distribution of GB refineries and import terminal clusters as at end 2017



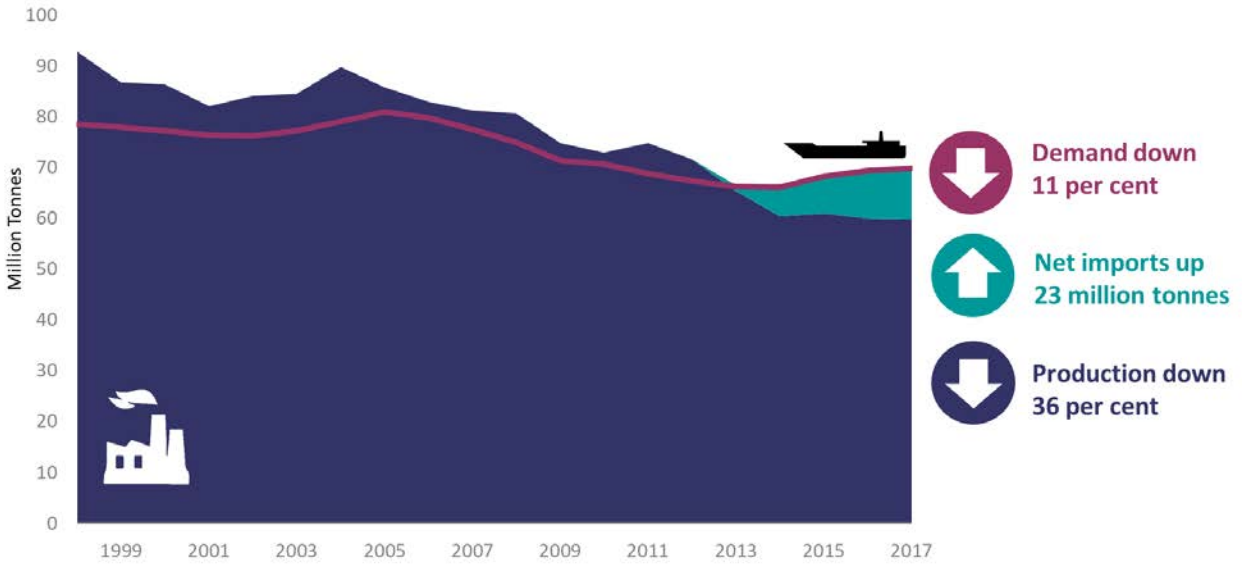
3.10 **Refinery capacity has decreased because of closures in recent years** including Murco at Milford Haven in 2014, as well as the Petroplus Teeside refinery in 2009, and the Petroplus Coryton refinery in 2012. In addition, there has been some rationalisation of capacity at other UK refineries in recent years and refining capacity is down nearly one-third on its 2008 total.

Supply and demand for petroleum products (Tables 3.2 to 3.4)

3.11 Chart 3.2 shows refinery production of petroleum products since 1998. **Despite recent rationalisation in the sector the UK's refineries produced nearly 60 million tonnes of product in 2017,** down just 0.3 per cent on 2016. Production increases in recent years have been at least partially due to higher margins for refinery operators following a fall in crude prices in 2016.

3.12 While the UK's refinery capacity remains substantial at the 6th highest in Europe, with Germany, Italy, Spain, the Netherlands and France having greater capacity than the UK, in the long term 2017 UK refinery production levels were down more than one-third from the turn of the century.

Chart 3.2: Production and trade in petroleum products 1998- 2017



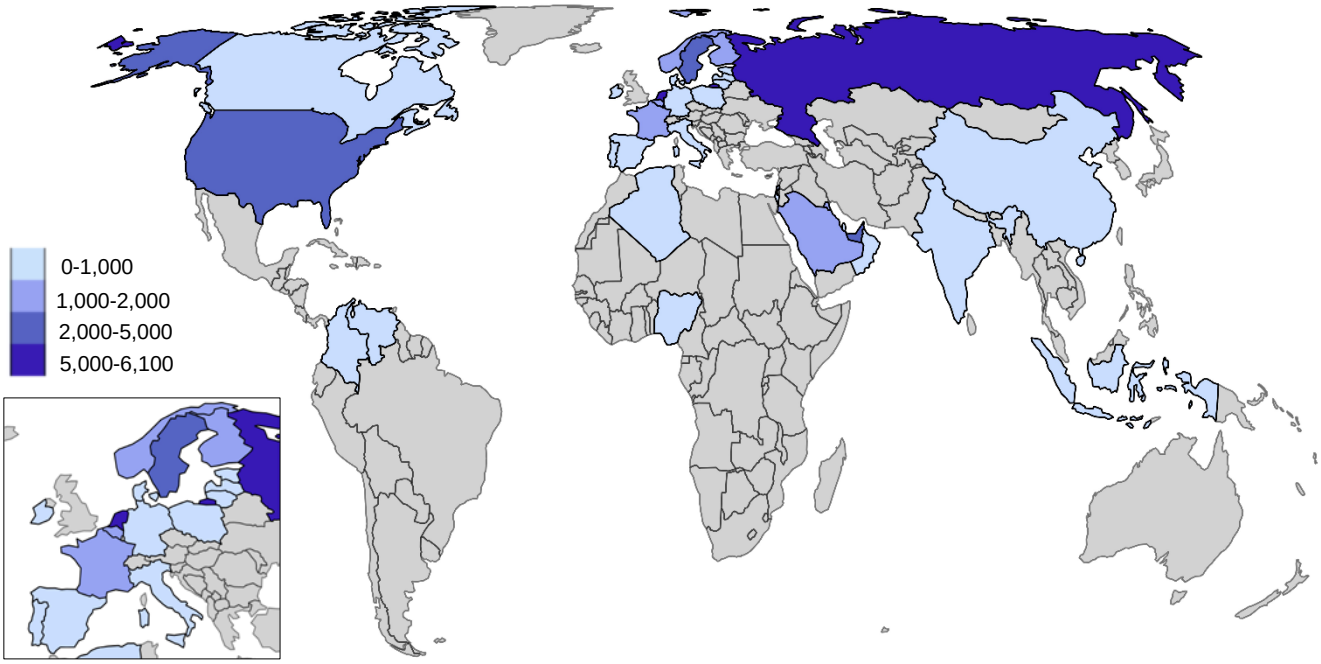
3.13 In 2017 the UK remained a net importer of petroleum products, by 10.4 million tonnes, down from 10.7 million tonnes in 2016. This is one of the largest total net import figures since 1984 when industrial action in the coal industry led to greater imports of petroleum products (particularly fuel oil) for power generation. With increasing demand for diesel and jet fuel as production of these key fuels declines, the UK has been a net importer of petroleum since 2013, reversing the trend of previous decades as a net exporter.

3.14 **As with crude oil, imports are critically important for the UK's domestic demand**. In common with many other countries, domestic supply and demand is not matched on a product-by-product basis. The UK's refineries were developed to produce petrol for domestic cars and fuel oil for electricity generation. With the increasing dieselisation of the UK's car fleet, and the switch from fuel oil to other fuels for electricity generation, UK production of key petroleum products is no longer aligned with market demand. To balance demand the UK trades widely and is one of the largest importers of jet fuel and road diesel in the OECD and one of the largest exporters of petrol.

3.15 Map 3C shows the principal product trading partners with the UK. Ten countries account for around 80 per cent of the total volume of imports[1]. Historically the bulk of products have come via the Netherlands, which acts as a major trading hub (the fuel might have been refined from elsewhere in Europe or beyond). Russia and Sweden were also larger sources of transport fuels in 2017, being especially big suppliers of diesel. Including the Netherlands, these three countries supplied 44 per cent of UK transport fuel imports in 2017.

[1] Diversity of supply for oil and oil products in OECD countries, 2015: https://www.gov.uk/government/publications/energy-trends-september-2016-special-feature-article-diversity-of-supply-for-oil-and-oil-products-in-oecd-countries-in-2015

Map 3C: Map of imports of petroleum products 2017 (thousand tonnes)



3.16 **The diversity of supply is increasing as demand for key transport fuels increases.** There is a clear split between imports from European countries (which are mainly diesel) and imports from the Middle East (where the bulk of jet fuel is sourced from generally more modern refinery operations than seen in Europe). The top three suppliers of jet fuel were Kuwait, the United Arab Emirates and Saudi Arabia in 2017, comprising over half of jet fuel imports that year.

3.17 The misalignment between UK refinery production and domestic demand means that the UK exports 23 million tonnes of petroleum products. Almost half of all exports is petrol (much of which goes to the US), while fuel oil accounts for around 13 per cent.

Consumption of petroleum products (Tables 3.2. to 3.4)

3.18 More than two-thirds of oil is consumed for transport purposes - for planes and road vehicles, including goods vehicles. Oil is critical to transport requirements and will likely remain so because while cars may be adapted to electrification and alternative fuels, planes and large goods vehicles are less amenable to these adaptations.

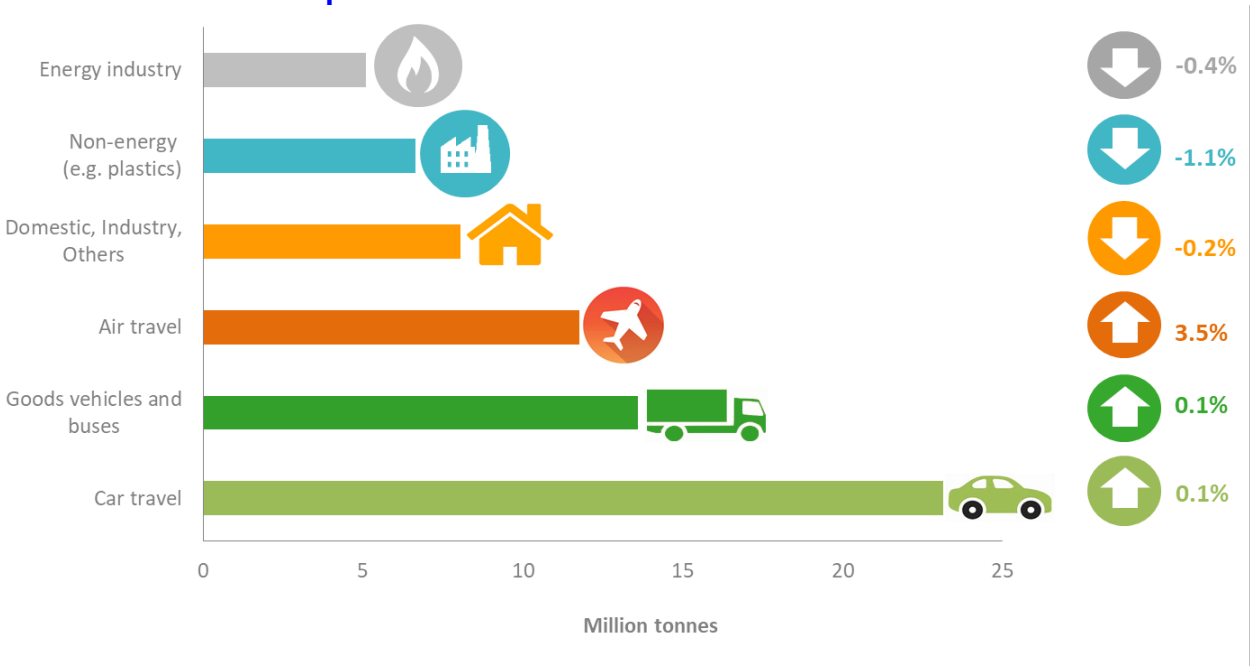
3.19 Final consumption of petroleum products has increased since 2014 following a period of decline (as illustrated in Chart 3.2). A relatively large (2.0 per cent) increase in 2016 was likely due to the same lower oil prices that have boosted refinery production. By 2017 the increase was less than one per cent as prices began to increase; in December 2017 road fuel prices were around five per cent higher than in 2016[2]. Chart 3.3 shows that consumption in 2017 was primarily for road transport fuels and aviation fuel, and that these increased by 0.2 per cent and 3.5 per cent in 2017.

3.20 Outside of transport, 'non-energy' use of oil is the single most significant sector. Here oil is not burnt but instead used as a feedstock to produce plastics and vinyls within the petrochemical industry. Non-energy use of oil has been growing in recent years and has now stabilised at around 10 per cent of total demand for oil. Non-energy use was down 1.1 per cent on 2016.

3.21 Oil products are also used by refineries to fuel the refining process, and very small amounts are used for electricity generation. Use of oil products in the energy industry, which includes electricity generation and petroleum refineries, was 0.4 per cent lower in 2017. More significant volumes are used by industry and to heat homes and businesses that are 'off-grid' and not connected to the gas transmission network. Use in these other sectors was down by 0.2 per cent in 2017.

[2] BEIS Quarterly Energy Prices, December 2017: www.gov.uk/government/statistics/quarterly-energy-prices-december-2017

Chart 3.3: Oil consumption in the UK 2017



3.22 The prevalent trend since 1998 has related to how petrol has been displaced by diesel in the UK's road transport market. The crossing point where diesel displaced petrol occurred in 2004, even though to date the size of the petrol car stock remains higher than that of diesel cars. Contributing to increased demand for diesel has been the considerable expansion of the number of miles driven by light good vehicles, which tend to use diesel.

3.23 The increase in diesel sales reflects in part the changing pattern of fuel consumption within the UK. Table 3B shows that the volume of diesel being consumed by cars and taxis quadrupled between 1995 and 2017. However following a period of growth in registrations of new diesel cars, in recent years there have instead been increasingly more new registrations of petrol rather than diesel cars. The increasing popularity of petrol cars will lead to changes in patterns of consumption.

Table 3B: Estimated consumption of road transport fuels by vehicle class

	1995	2000	2005	2010	2017[a]
					million tonnes
Petrol:					
Cars and taxis	19.9	20.2	18.1	14.1	11.4
Light goods vehicles	1.6	1.0	0.5	0.3	0.2
Motor cycles etc.	0.2	0.2	0.2	0.2	0.2
Total	**21.7**	**21.4**	**18.9**	**14.6**	**11.7**
Diesel:					
Cars and taxis	2.8	4.1	6.6	8.6	11.3
Light goods vehicles	2.5	3.5	4.6	4.8	6.0
Heavy goods vehicles	6.2	6.1	6.7	5.9	6.5
Buses and coaches	1.7	1.5	1.5	1.4	1.1
Total	**13.2**	**15.3**	**19.4**	**20.7**	**24.9**

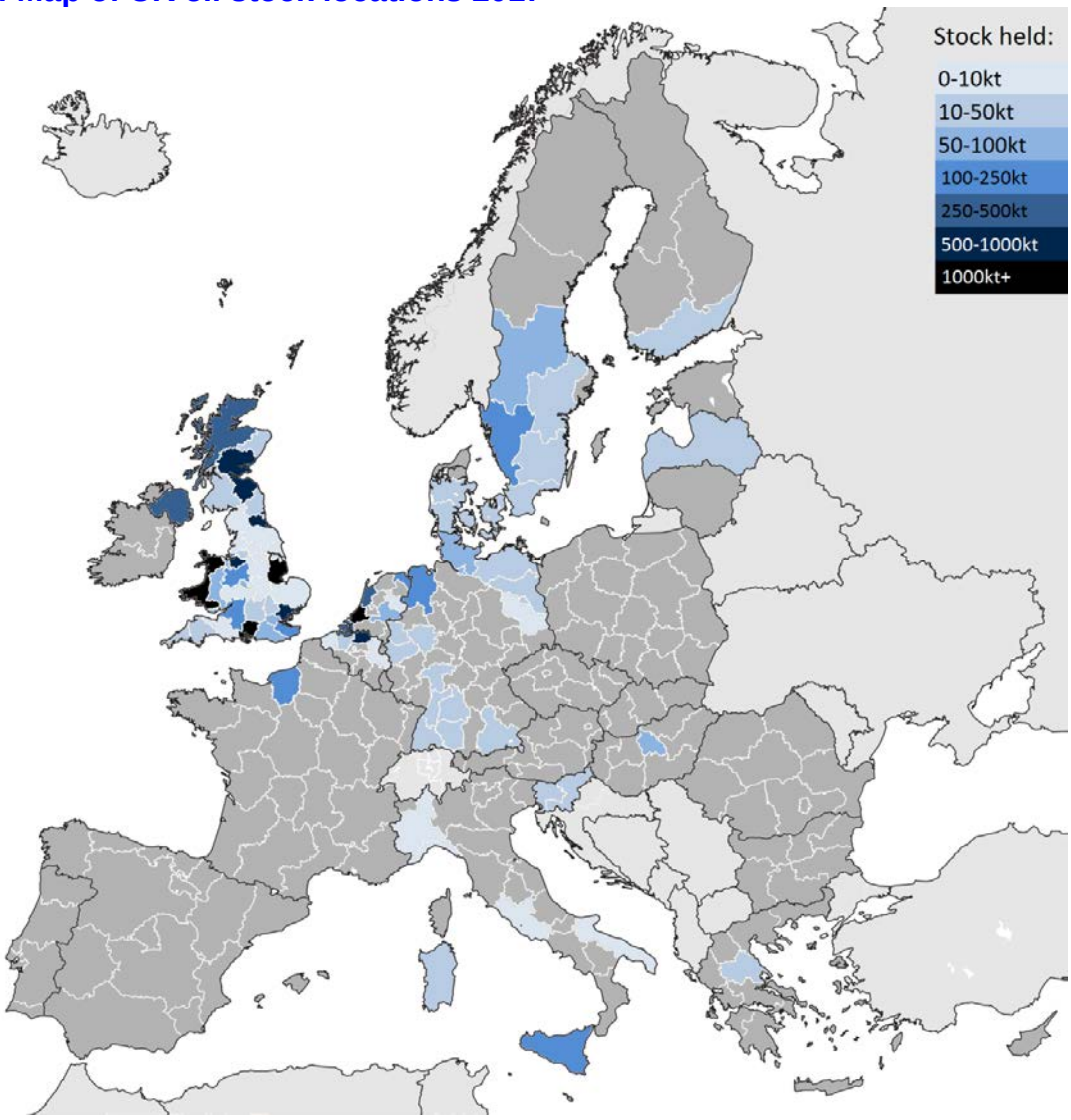
[a] *Data for 2017 have been estimated using 2016 percentage splits.*

Stocks of oil (Table 3.7)

3.24 Under international commitments to both the European Union and the International Energy Agency, the UK is obliged to hold oil stocks to offset the impact of significant disruptions to the global oil market. Such disruptions are relatively rare, but since the Arab-Israeli war of 1974 there have been three globally co-ordinated releases of oil in response to the Gulf War (1990–1991), Hurricane Rita (2005), and the civil war in Libya (2011).

3.25 **In total, the UK holds around 12 million tonnes of stock for emergency purposes, broadly equivalent to around 61 days of consumption.** The stock is held both within the UK, but significant volumes are held overseas under contractual arrangements that allow stocks to be repatriated to the UK if necessary. The map below shows the volume of stocks held in the UK and across the EU[3]. The UK also holds further stocks in the UK (not shown here) under contractual arrangement for other countries.

Map 3D: Map of UK oil stock locations 2017



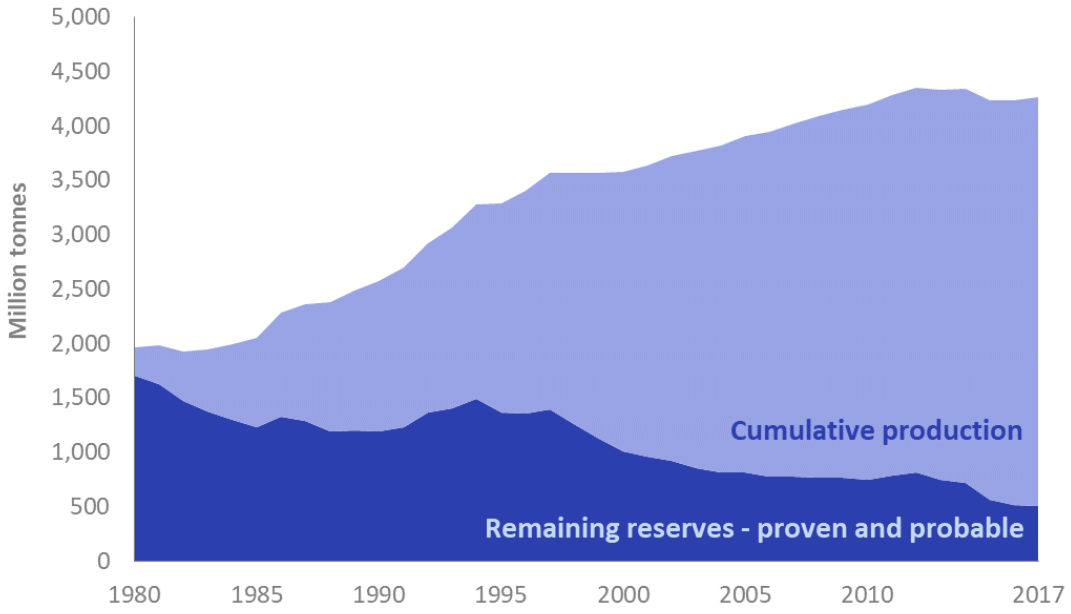
3.26 In addition to the information in this chapter, there is considerable data on BEIS's website. Information on long-term trends (Tables 3.1.1 and 3.1.2) and the annex on the oil and gas resources in the UK (Annex F) provide a more complete picture of the UK oil and gas production sector. These tables are at www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

[3] Mapping the UK's oil stocks: www.gov.uk/government/publications/energy-trends-march-2017-special-feature-article-mapping-the-uks-oil-stocks

Oil resources

3.27 The Oil and Gas Authority estimates that there are 501 million tonnes of proven and probable (2P) oil reserves at the end of 2017, of which 330 million tonnes are proven reserves. The volume produced plus 2P reserves have grown substantially since 1980, increasing by 116%. The increases reflect new discoveries, new technology allowing exploitation of resources that were previously regarded as uncommercial, and the inclusion of already-known fields as they entered production or moved from 'prospective' to 'probable' status. Replenishment of sanctioned oil and gas reserves through exploration and maturation of contingent resources has recently flattened, and in 2016 the reserves replacement ratio was just 13 per cent. The apparent decline in reserves in 2015 was due to re-classification of some reserves that had not yet been sanctioned - these will be included in future as and when sanctioned.

Chart 3.4: Oil reserves



List of DUKES oil tables

Table	Description	Period
3.1	Primary oil commodity balances	1998-2017
3.1au	Primary oil commodity balances – alternative units (barrels and litres)	1998-2017
3.2-3.4	Petroleum products commodity balances	1998-2017
3.2-3.4au	Petroleum products commodity balances – alternative units (barrels and litres)	1998-2017
3.5	Supply and disposal of petroleum	2012-2017
3.6	Additional information on inland deliveries of selected products	2012-2017
3.7	Stocks of crude oil and petroleum products at end of year	2012-2017
3.8	Additional information on inland deliveries for non-energy uses	2012-2017
3.9	Imports of crude oil and petroleum products by country of origin	2012-2017
3.1.1	Crude oil and petroleum products: production, imports and exports	1970-2017
3.1.2	Inland deliveries of petroleum	1970-2017
F.1	Crude oil and natural gas liquids production	1998-2017
F.3	Natural gas liquids net production	1999-2017
F.4	Disposals of crude oil	1998-2017

Technical notes and definitions

3.28 These notes and definitions are in addition to the technical notes and definitions covering all fuels and energy as a whole in Chapter 1.

Sources of data

3.29 The majority of the data included in the text and tables of this chapter are derived from BEIS's Downstream Oil Reporting System (DORS), which replaced the UK Petroleum Industry Association (UKPIA) reporting system in 2005. Data relating to the inland operations of the UK oil industry (i.e. information on the supply, refining and distribution of oil in the UK) are collected from companies. The data format and coverage have been designed to meet most of the needs of both Government and the industry itself. Each member of UKPIA and a number of other contributing companies provides returns on its refining activities and deliveries of various products to the internal UK market. This information is supplemented whenever necessary to allow for complete coverage within the statistics, with separate exercises carried out on special topics (for example, supermarket shares) or with the use of additional data (such as trade data from HM Revenue and Customs (HMRC) to cover import activity by non-reporting companies). In addition to these data sources, BEIS make use of the Emissions data from the EU's Emissions Trading Scheme provided on major energy users. In particular ensuring the consistency of data published on fuel used within the refineries (refinery gases and petroleum coke) and the sectoral usage of Gas oil and Fuel oil.

3.30 In 2014 BEIS introduced a new reporting form to major oil importers. The new form indicated the need for more detailed surveys of large importers within the UK and from January 2015 all major importers were obliged to complete the more detailed DORS form used by refiners. The DORS survey now offers substantially greater insight (particularly with respect to trade and blending activities).

Statistical differences

3.31 The upper half of the balance tables represents the supply side and calculates overall availability of the various products in the UK by combining production at refineries with trade (imports and exports), stock changes, product transfers and deliveries to international marine bunkers (fuel used by ships travelling to a foreign destination).

3.32 The lower half of the table reports the demand side and covers the uses made of the different products, including the use made within the refining process, and details of the amounts reported by oil companies within the UK as delivered for final consumption.

3.33 In Tables 3.1 to 3.5, there are headings titled "statistical differences". These are differences between the separately observed figures for production and delivery of crude oil and products during the path of their movement from the point of production to the point of consumption.

3.34 The statistical differences headings listed in the primary oil commodity balances (Table 3.1) are differences between the separately observed and reported figures for production from onshore or offshore fields and supply to the UK market that cannot be accounted for by any specific factors. Primarily they result from inaccuracies in the meters at various points along offshore pipelines. These meters vary slightly in their accuracy within accepted tolerances, giving rise to both losses and gains when the volumes of oil flowing are measured. Errors may also occur when non-standard conditions are used to meter the oil flow.

3.35 The statistical difference for primary oils in the table includes own use in onshore terminals and gas separation plants, losses, platform and other field stock changes. Another factor is the time lag that can exist between production and loading onto tankers being reported at an offshore field and the arrival of these tankers at onshore refineries and oil terminals. This gap is usually minimal and works such that any effect of this at the start of a month is balanced by a similar counterpart effect at the end of a month. However, there can be instances where the length of this interval is considerable and, if it happens at the end of a year, there can be significant effects on the statistical differences seen for the years involved.

3.36 Another technical factor that can contribute to the statistical differences relates to the recording of quantities at the producing field (which is the input for the production data) and at oil terminals and refineries, since they are in effect measuring different types of oil. Terminals and refineries are able to measure a standardised, stabilised crude oil, that is, with its water content and content of Natural Gas

Liquids (NGLs) at a standard level and with the amounts being measured at standard conditions. However, at the producing field they are dealing with a “live” crude oil that can have a varying level of water and NGLs within it. While offshore companies report live crude at field, the disposals from oil terminals and offshore loading fields are reported as stabilised crude oil. This effectively assumes that terminal disposals are stabilised crude production figures. These changes were introduced in the 2002 edition of this Digest.

3.37 Part of the overall statistical difference may also be due to problems with the correct reporting of individual NGLs at the production site and at terminals and refineries. It is known that there is some mixing of condensate and other NGLs in with what might otherwise be stabilised crude oil before it enters the pipeline. This mixing occurs as it removes the need for separate pipeline systems for transporting the NGLs and it also allows the viscosity of the oil passing down the pipeline to be varied as necessary. While the quantity figures recorded by terminals are in terms of stabilised crude oil, with the NGL component removed, there may be situations where what is being reported does not comply with this requirement.

3.38 With the downstream sector, the statistical differences can similarly be used to assess the validity and consistency of the data. From the tables, these differences are generally a very small proportion of the totals involved.

3.39 Refinery data are collated from details of individual shipments received and made by each refinery and terminal operating company. Each year there are thousands of such shipments, which may be reported separately by two or three different companies involved in the movement. While intensive work is carried out to check these returns, it is possible that some double counting of receipts may occur.

3.40 Temperature, pressure and natural leakage also contribute to the statistical differences. In addition, small discrepancies can occur between the estimated calorific values used at the field and the more accurate values measured at the onshore terminal where data are shown on an energy basis. The statistical differences can also be affected by rounding, clerical errors or unrecorded losses, such as leakage. Other contributory factors are inaccuracies in the reporting of the amounts being disposed of to the various activities listed, including differences between the quantities reported as going to refineries and the actual amounts passing through refineries.

3.41 Similarly, the data under the statistical difference headings in Tables 3.2 to 3.4 are the differences between the deliveries of petroleum products to the inland UK market reported by the supplying companies and estimates for such deliveries. These estimates are calculated by taking the output of products reported by refineries and then adjusting it by the relevant factors (such as imports and exports of the products, changes in the levels of stocks etc.).

3.42 It may be thought that such differences should not exist as the data underlying both the observed deliveries into the UK market and the individual components of the estimates (i.e. production, imports, exports, stocks) come from the same source (the oil companies). While it is true that each oil company provides data on its own activities in each area, there are separate areas of operation within the companies that report their own part of the overall data. Table 3C illustrates this.

Table 3C: Sources of data within oil companies

Area covered	Source
Refinery production	Refinery
Imports and exports	Refinery, logistics departments, oil traders
Stocks	Refinery, crude and product terminals, major storage and distribution sites
Final deliveries	Sales, marketing and accounts departments

3.43 Each individual reporting source will have direct knowledge of its own data. For example, refineries will know what they produce and how much leaves the refinery gate as part of routine monitoring of the refinery operations. Similarly other data such as sales to final consumers or imports and exports will be closely monitored. Companies will ensure that each component set of data reported is as accurate as possible but their reporting systems may not be integrated, meaning that internal consistency checks

across all reported data cannot be made. Each part of a company may also work to different timings as well, which may further add to the degree of differences seen.

3.44 The main area where there is known to be a problem is with the “Transfers” heading in the commodity balances. The data reported under this heading have two components. Firstly, there is an allowance for reclassification of products within the refining process. For example, butane can be added to motor spirit to improve the octane rating, aviation turbine fuel could be reclassified as domestic kerosene if its quality deteriorates, and much of the fuel oil imported into the UK is further refined into other petroleum products. Issues can arise with product flows between different reporting companies, for example when company A delivers fuel oil to company B who report a receipt of a feedstock. Secondly, and in addition to these inter-product transfers, the data also include an allowance to cover the receipt of backflows of products from petrochemical plants that are often very closely integrated with refineries. A deduction for these backflows thus needs to be included under the "Transfers" heading so that calculated estimates reflect net output and are thus more comparable with the basis of the observed deliveries data.

3.45 There is scope for error in the recording of these two components of transfers. With inter-product transfers, the data are recorded within the refinery during the refining and blending processes where the usual units used to record the changes are volumes rather than masses. Different factors apply for each product when converting from a volume to mass basis, as shown by the conversion factors given in Annex A of this Digest. Thus, a balanced transfer in volume terms may not be equivalent when converted to a mass basis. This is thought to be the main source of error within the individual product balances.

Revisions to published data

3.46 Following a review of trade data, exports of propane and butane (LPG) and fuel oil have been revised using HMRC data to capture exports by companies that do not report data to BEIS to provide a more complete picture of UK oil trade.

3.47 Minor revisions have been made following the re-introduction of checks on trade between reporting companies, which affects import and consumption data. Other revisions have been made following updates received from data suppliers.

Indigenous production

3.48 The term indigenous is used throughout this chapter and includes oil from the UK Continental Shelf, both offshore and onshore. Production of feedstocks at petrochemical plants that are delivered to refineries as backflows have not been included in production figures in the text or charts in this chapter.

Deliveries

3.49 These are deliveries into consumption, as opposed to being estimates of actual consumption or use. They are split between inland deliveries and deliveries to marine bunkers. Inland deliveries will not necessarily be consumed in the UK (e.g. aviation fuels).

Imports and exports

3.50 The information given under the headings "imports" and "exports" in this chapter are the figures recorded by importers and exporters of oil. They can differ in some cases from the import and export figures provided by HMRC that are given in Annex G on BEIS’s energy statistics website. Such differences arise from timing differences between actual and declared movements but also result from the Customs figures including re-exports. These are products that may have originally entered the UK as imports from another country and been stored in the UK prior to being exported back out of the UK, as opposed to having been actually produced in the UK.

Marine bunkers

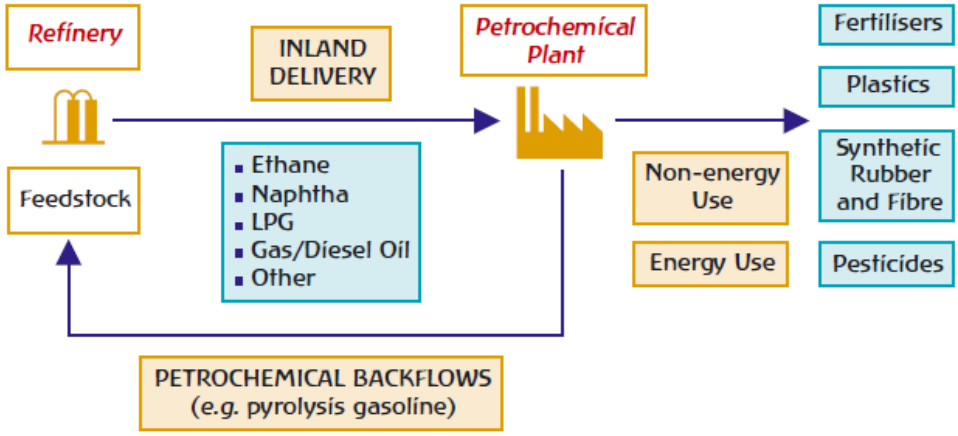
3.51 This covers deliveries to be used by ocean going and coastal vessels under international bunker contracts. Other deliveries to fishing, coastal and inland vessels are excluded. As part of BEIS’s audit programme, UK refinery contacts reviewed the provision of fuel to marine bunkers in 2009. Whilst a number of companies have reviewed their methodology there are still issues with determining the final destination of fuel when these are supplied to third parties that are not part of BEIS’s monitoring programme. This issue impacts on both the volumes delivered directly to marine vessels, and whether those vessels are engaged in domestic or international navigation.

Whilst BEIS will continue to work closely with reporting companies to improve the estimation of marine fuel use. We have aligned energy demand for shipping in line with the estimates of marine fuel use in the UK's National Atmospheric Emissions Inventory (NAEI). The NAEI figures use BEIS's estimate of marine fuels and derive the split between international and domestic use based on an activity based study of the UK's marine fuel use.

Backflows from the petrochemical sector

3.52 BEIS and Industry have also worked to better understand product flows between refiners and petrochemical plants. Whilst most petroleum products are used for energy purposes, substantial volumes are delivered to the petrochemical industry as a feedstock for the manufacturing of plastics, synthetic fibres and other products. These products are used, but they are not combusted. The refining and petrochemical industries are often closely related as shown in Figure 3.1 below. Refineries deliver product to a petrochemical plant for the production of a range of products, but these plants also return some petroleum products back to refineries for further processing.

Figure 3.1: Deliveries to the Petrochemical Sector (Source: IEA)



3.53 Since the 2015 edition of this Digest BEIS have separately identified deliveries of backflows from petrochemical plants under both the upstream side of the balance (in Table 3.1 they are included as part of the 'feedstocks' column) and the downstream part of the balance (in Table 3.2 to 3.4 the volumes are shown on the 'other' row in the transformation section).

Crude and process oils

3.54 These are all feedstocks, other than distillation benzene, for refining at refinery plants. Gasoline feedstock is any process oil whether clean or dirty which is used as a refinery feedstock for the manufacture of gasoline or naphtha. Other refinery feedstock is any process oil used for the manufacture of any other petroleum products.

Refineries

3.55 Refineries distil crude and process oils to obtain petroleum products. This excludes petrochemical plants, plants only engaged in re-distilling products to obtain better grades, crude oil stabilisation plants and gas separation plants.

Products used as fuel (energy use)

3.56 The following paragraphs define the product headings used in the text and tables of this chapter. The products are used for energy, either directly as a fuel or as an input into electricity generation.

Refinery fuel - Petroleum products used as fuel at refineries.

Ethane - A naturally gaseous straight-chain hydrocarbon (C2H6) in natural gas and refinery gas streams. Primarily used, or intended to be used, as a chemical feedstock.

Propane - Hydrocarbon containing three carbon atoms (C3H8), gaseous at normal temperature

but generally stored and transported under pressure as a liquid. Used mainly for industrial purposes, but also as transport, Liquid Petroleum Gas (LPG), and some domestic heating and cooking.

Butane - Hydrocarbon containing four carbon atoms (C_4H_{10}), otherwise as for propane. Additionally used as a constituent of motor spirit to increase vapour pressure and as a chemical feedstock.

Naphtha (Light distillate feedstock) - Petroleum distillate boiling predominantly below 200°C.

Aviation spirit - All light hydrocarbon oils intended for use in aviation piston-engine power units, including bench testing of aircraft engines.

Motor spirit - Blended light petroleum components used as fuel for spark-ignition internal-combustion engines other than aircraft engines:

(i) Premium unleaded grade - all finished motor spirit, with an octane number (research method) not less than 95.

(ii) Lead Replacement petrol / Super premium unleaded grade - finished motor spirit, with an octane number (research method) not less than 97.

Aviation turbine fuel (ATF) - All other turbine fuel intended for use in aviation gas-turbine power units and including bench testing of aircraft engines.

Burning oil (kerosene or “paraffin”) - Refined petroleum fuel, intermediate in volatility between motor spirit and gas oil, used primarily for heating. White spirit and kerosene used for lubricant blends are excluded.

Gas/diesel oil - Petroleum fuel having a distillation range immediately between kerosene and light-lubricating oil:

(i) **DERV (Diesel Engined Road Vehicle) fuel** - automotive diesel fuel for use in high speed, compression ignition engines in vehicles subject to Vehicle Excise Duty.

(ii) **Gas oil** - used as a burner fuel in heating installations, for industrial gas turbines and as for DERV (but in vehicles not subject to Vehicle Excise Duty e.g. agricultural vehicles, fishing vessels, construction equipment used off road and usually coloured with a red marker dye). Gas oil used for oil and gas extraction is included from 2005 onwards.

(iii) **Marine diesel oil** - heavier type of gas oil suitable for heavy industrial and marine compression-ignition engines.

Fuel oil - Heavy petroleum residue blends used in atomising burners and for heavy-duty marine engines (marine bunkers, etc.) with heavier grades requiring pre-heating before combustion. Excludes fuel oil for grease making or lubricating oil and fuel oil sold as such for road making.

Products not used as fuel (non-energy use)

3.57 The following paragraphs define the product headings used in the text and tables of this chapter, which are used for non-energy purposes.

Feedstock for petroleum chemical plants - All petroleum products intended for use in the manufacture of petroleum chemicals. This includes middle distillate feedstock of which there are several grades depending on viscosity. The boiling point ranges between 200°C and 400°C. (A deduction has been made from these figures equal to the quantity of feedstock used in making the conventional petroleum products that are produced during the processing of the feedstock. The output and deliveries of these conventional petroleum products are included elsewhere as appropriate.)

White spirit and specific boiling point (SBP) spirits - These are refined distillate intermediates with a distillation in the naphtha / kerosene range. **White spirit** has a boiling range of about 150°C to 200°C and is used as a paint or commercial solvent. **SBP spirit** is also known as **Industrial spirit** and has a wider boiling range that varies up to 200°C dependent upon its eventual use. It has a variety of uses that vary from use in seed extraction, rubber solvents and perfume.

Lubricating oils (and grease) - Refined heavy distillates obtained from the vacuum distillation of petroleum residues. Includes liquid and solid hydrocarbons sold by the lubricating oil trade, either alone or blended with fixed oils, metallic soaps and other organic and/or inorganic bodies. A certain percentage of inland deliveries are re-used as a fuel, but all inland deliveries of lubricating oils have been classified as non-energy use only. Some deliveries are used for energy purposes, but it is difficult to estimate energy use figures with any degree of accuracy, hence no such estimates appear in the commodity balance tables. DUKES Table 3.8 (prior to 2010, table 3D, within the main text) provides limited information on the use of lubricants and grease. The information which was published under the heading of "Motors" has been amended to now include "Gear Oils and Transmission" to give a full picture of the lubricants used by vehicles.

Bitumen - The residue left after the production of lubricating oil distillates and vacuum gas oil for upgrading plant feedstock. Used mainly for road making and building construction purposes. Includes other petroleum products such as creosote and tar mixed with bitumen for these purposes and fuel oil sold specifically for road making.

Petroleum wax - Includes paraffin wax, which is a white crystalline hydrocarbon material of low oil content normally obtained during the refining of lubricating oil distillate, paraffin scale, slack wax, microcrystalline wax and wax emulsions. Used for candle manufacture, polishes, food containers, wrappings etc.

Petroleum cokes - Carbonaceous material derived from hydrocarbon oils, uses for which include metallurgical electrode manufacture. Quantities of imports of this product are used as a fuel as it has a higher energy content than coal, though a lower energy content than fuel oils.

Miscellaneous products - Includes aromatic extracts, defoament solvents and other minor miscellaneous products.

Main classes of consumer

3.58 The following are definitions of the main groupings of users of petroleum products used in the text and tables of this chapter.

Electricity generators - Petroleum products delivered for use by major power producers and other companies for electricity generation including those deliveries to the other industries listed below which are used for autogeneration of electricity (Tables 3.2 to 3.4). This includes petroleum products used to generate electricity at oil refineries and is recorded in the Transformation section, as opposed to other uses of refinery fuels that are recorded in the Energy Industry Use section. From the 2009 chapter of the Digest, data in Chapter 3 (Table 3.2 to 3.4) has been aligned with Chapter 5 (Table 5.4). The data on oil used for electricity generation collected from major power producers and autogenerators is judged to be at least as accurate as the data from refiners on deliveries, and has the advantage of consistency.

Agriculture - Deliveries of fuel oil and gas oil/diesel for use in agricultural power units, dryers and heaters. Burning oil for farm use.

Iron and steel - Deliveries of petroleum products to steel works and iron foundries. This is now based on information from the Iron and Steel Statistics Bureau.

Other industries - The industries covered correspond to the industrial groups shown in Table 1G of Chapter 1, excluding Iron and Steel.

National navigation - Fuel oil and gas/diesel oil delivered, other than under international bunker contracts, for fishing vessels, UK oil and gas exploration and production, coastal and inland shipping and for use in ports and harbours.

Railways - Deliveries of fuel oil, gas/diesel oil and burning oil to railways now based on estimates produced by Ricardo Energy and Environment as part of their work to compile the UK National Atmospheric Emissions Inventory (NAEI).

Air transport - Total inland deliveries of aviation turbine fuel and aviation spirit. The figures cover deliveries of aviation fuels in the UK to international and other airlines, British and foreign Governments (including armed services) and for private flying. In order to compile the NAEI, Ricardo Energy and Environment need to estimate how aviation fuel usage splits between domestic and international consumption. Information from Ricardo Energy and Environment suggests that virtually all aviation spirit is used domestically while just 5 per cent of aviation turbine fuel use is for domestic consumption. A further 5 per cent is estimated to be consumed by the military.

Road transport - Deliveries of motor spirit and DERV fuel for use in road vehicles of all kinds.

Domestic - Fuel oil and gas oil delivered for central heating of private houses and other dwellings and deliveries of kerosene (burning oil) and liquefied petroleum gases for domestic purposes (see Tables 3.2 to 3.4).

Public services - Deliveries to national and local Government premises (including educational, medical and welfare establishments and British and foreign armed forces) of fuel oil and gas oil for central heating and of kerosene (burning oil).

Miscellaneous - Deliveries of fuel oil and gas oil for central heating in premises other than those classified as domestic or public.

Biofuels in transport

3.59 The quantity of biofuels blended into motor spirit and DERV are shown in Table 3.6 of this chapter. Total consumption of biofuels and road fuels are shown in Table 3D, this is based on the volume of fuel for which excise duty has been paid to HM Revenue and Customs (HMRC). As a percentage of road fuels biofuels have increased significantly from 2007 until 2010, but have been relatively flat since. At 3.1 per cent of total road fuels, they are down marginally on last year. Further details on biofuel consumption can be found in Chapter 6. Biofuels are also included in the overall energy balances in Chapter 1.

Table 3D: Consumption of Biodiesel and Bioethanol in the UK 2007 to 2017

Year	Biodiesel	All diesel including biodiesel	Biodiesel as % diesel	Bioethanol	All petrol including bioethanol	Bioethanol as % petrol	Biofuels as % total
2007	347	25,501	1.4%	153	24,019	0.6%	1.0%
2008	886	25,686	3.4%	206	22,709	0.9%	2.3%
2009	1,044	25,089	4.2%	320	22,029	1.5%	2.9%
2010	1,049	25,773	4.1%	631	20,650	3.1%	3.6%
2011	925	25,926	3.6%	652	19,548	3.3%	3.5%
2012	634	26,348	2.4%	775	18,792	4.1%	3.1%
2013	766	26,969	2.8%	820	18,020	4.6%	3.5%
2014	954	27,985	3.4%	814	17,672	4.6%	3.9%
2015	669	28,884	2.3%	795	17,319	4.6%	3.2%
2016	708	30,106	2.4%	759	17,101	4.4%	3.1%
2017	697	30,409	2.3%	753	16,786	4.5%	3.1%

Source: HM Revenue and Customs *Million litres*

Monthly and quarterly data

3.60 Monthly or quarterly aggregate data for certain series presented in this chapter are available. This information can be obtained free of charge by following the links given in the Energy Statistics section of the BEIS website on GOV.UK at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

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3.1 Commodity balances 2015 - 2017[(1)]

Primary oil

Thousand tonnes

	Crude oil	Ethane	Propane	Butane	Condensate	Total NGL	edstock (2)	Total primary oil
2015								
Supply								
Production	42,826	345	744	642	730	2,462	410	45,698
Imports	42,803	678	669	684r	446	2,477r	5,318	50,599r
Exports	-30,054	-11	-540	-577	-638	-1,766	-1,890	-33,709
Stock change (3)	-199	-	-	-	-	28	73	-98
Transfers (4)	-	-995	-743	-350	-265	-2,353	1,202	-1,152
Total supply	**55,376**	-	-	-	-	**848r**	**5,114**	**61,338r**
Statistical differe	-	-	-	-	-	1r	-54	-53r
Total demand (5	**55,376**	-	-	-	-	**847**	**5,168**	**61,391**
Transformation (	55,376	-	-	-	-	847	5,168	61,391
Energy industry ı	-	-	-	-	-	-	-	-
2016								
Supply								
Production	44,306	525	990	807	818	3,139	428	47,872
Imports	39,438	724	778	857	618	2,977	6,383r	48,798r
Exports	-30,651	-7	-1,023	-847	-718	-2,596	-1,609	-34,856
Stock change (3)	-31	-	-	-	-	19	-113	-125
Transfers (4)	-	-1,184	-714	-354	-298	-2,550	1,268	-1,282
Total supply	**53,061**	-	-	-	-	**989**	**6,357r**	**60,407r**
Statistical differe	-	-	-	-	-	11	4r	15r
Total demand (5	**53,061**	-	-	-	-	**978**	**6,353r**	**60,393r**
Transformation (	53,061	-	-	-	-	978	6,323	60,363
Energy industry ı	-	-	-	-	-	-	-	-
2017								
Supply								
Production	43,050	634	1,049	906	857	3,446	420	46,916
Imports	44,173	899	694	693	379	2,664	6,547	53,384
Exports	-34,342	-6	-1,043	-822	-728	-2,599	-1,456	-38,397
Stock change (3)	+340	-	-	-	-	+26	-36	+330
Transfers (4)	-	-1,234	-722	-424	-290	-2,670	+635	-2,035
Total supply	**53,221**	-	-	-	-	**868**	**6,109**	**60,198**
Statistical differe	-	-	-	-	-	+1	-48	-47
Total demand (5	**53,221**	-	-	-	-	**867**	**6,158**	**60,245**
Transformation (	53,221	-	-	-	-	867	6,158	60,245
Energy industry ı	-	-	-	-	-	-	-	-

(1) As there is no use made of primary oils and feedstocks by industries other than the oil and gas extraction and petroleum refining industries, other industry headings have not been included in this table. As such, this table is a summary of the activity of what is known as the Upstream oil industry.

(2) Production of feedstock indicates volume received from petrochemical plant as a backflow. See paragraphs 3.52

(3) Stock fall (+), stock rise (-).

(4) Transfers direct from the source to the petrochemical sector.

(5) Total supply minus total demand.

(6) Figures for total demand for the individual NGLs (and thus for the statistical differences as well) are not available

3.2 Commodity balances 2017

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit and SBP	Aviation turbine fuel
Supply									
Production	-	1,400	778	2,444	2,280	-	17,416	7	5,031
Other sources	1,234	722	424	-	290	-	-	-	-
Imports	-	560	224	-	1,502	16	3,455	138	8,671
Exports	-	-466	-576	-	-609	-	-10,961	-10	-1,258
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	-2	-17	-	-20	-2	-50	21	-15
Transfers	-	-	-83	-	-2,123	-	1,897	4	-639
Total supply	**1,234**	**2,213**	**751**	**2,444**	**1,321**	**14**	**11,757**	**159**	**11,791**
Statistical difference *(3)*	**-**	**-53**	**6**	**-15**	**11**	**2**	**12**	**1**	**33**
Total demand	**1,234**	**2,266**	**745**	**2,459**	**1,310**	**12**	**11,746**	**158**	**11,758**
Transformation	**-**	**15**	**262**	**405**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	264	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	264	-	-	-	-	-
Heat generation	-	14	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	1	262	141	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**2,019**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	2,019	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**1,234**	**2,251**	**483**	**34**	**1,310**	**12**	**11,746**	**158**	**11,758**
Industry	**-**	**285**	**80**	**-**	**93**	**-**	**-**	**-**	**-**
Unclassified	-	254	80	-	93	-	-	-	-
Iron and steel	-	1	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering etc	-	-	-	-	-	-	-	-	-
Electrical engineering etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages etc	-	30	-	-	-	-	-	-	-
Textiles, leather etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**68**	**-**	**-**	**-**	**12**	**11,746**	**-**	**11,758**
Air	-	-	-	-	-	12	-	-	11,758
Rail	-	-	-	-	-	-	-	-	-
Road	-	68	-	-	-	-	11,746	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**644**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	199	1	-	-	-	-	-	-
Public administration	-	16	-	-	-	-	-	-	-
Commercial	-	344	2	-	-	-	-	-	-
Agriculture	-	85	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**1,234**	**1,255**	**400**	**34**	**1,217**	**-**	**-**	**158**	**-**

(1) Includes marine diesel oil.
(2) Stock fall (+), stock rise (-).
(3) Total supply minus total demand.
(4) Backflows delivered from petrochemical plants to refineries for re-processing. See paragraphs 3.52 and 3.53 for further details.
(5) For further details on non-energy usage see paragraphs 3.57

3.2 Commodity balances 2017 (continued)

Petroleum products

Thousand tonnes

Burning oil	DERV	Gas Oil(1)	Fuel oils	Lubri -cants	Bitu -men	etroleum coke	Misc. products	Total Products	
									Supply
2,047	13,425	6,878	3,893	443	817	1,910	1,058	59,824	Production
-	-	-	-	-	-	-	-	2,670	Other sources
562	13,597	1,943	999	420	877	418	140	33,521	Imports
-102	-1,554	-2,320	-3,060	-454	-96	-642	-1,002	-23,110	Exports
-	-	-1,653	-777	-	-	-	-	-2,430	Marine bunkers
59	53	-49	-13	11	18	-102	-14	-122	Stock change *(2)*
607	-652	566	-285	-	-206	-	300	-612	Transfers
3,172	**24,869**	**5,365**	**758**	**420**	**1,410**	**1,583**	**481**	**69,742**	**Total supply**
14	**-42**	**32**	**12**	**-1**	**-25**	**-20**	**25**	**-11**	**Statistical difference *(3)***
3,157	**24,911**	**5,334**	**746**	**421**	**1,435**	**1,603**	**457**	**69,753**	**Total demand**
-	**-**	**98**	**146**	**-**	**-**	**77**	**24**	**1,029**	**Transformation**
-	-	95	116	-	-	-	-	475	Electricity generation
-	-	39	101	-	-	-	-	139	Major power producers
-	-	56	15	-	-	-	-	335	Autogenerators
-	-	4	30	-	-	-	-	48	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	77	-	77	Patent fuel manufacture
-	-	-	-	-	-	-	24	429	Other (4)
-	**-**	**599**	**271**	**-**	**-**	**1,180**	**-**	**4,070**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	599	64	-	-	-	-	662	Oil and gas extraction
-	-	-	208	-	-	1,180	-	3,407	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,157	**24,911**	**4,637**	**328**	**421**	**1,435**	**345**	**433**	**64,654**	**Final consumption**
1,272	**-**	**1,737**	**210**	**-**	**-**	**285**	**21**	**3,983**	**Industry**
1,244	-	1,039	110	-	-	285	21	3,126	Unclassified
-	-	-	4	-	-	-	-	4	Iron and steel
-	-	7	0	-	-	-	-	7	Non-ferrous metals
-	-	154	6	-	-	-	-	161	Mineral products
-	-	81	26	-	-	-	-	107	Chemicals
-	-	0	-	-	-	-	-	0	Mechanical engineering etc
-	-	1	0	-	-	-	-	1	Electrical engineering etc
24	-	161	6	-	-	-	-	192	Vehicles
4	-	16	51	-	-	-	-	101	Food, beverages etc
-	-	40	-	-	-	-	-	40	Textiles, leather etc
-	-	29	-	-	-	-	-	29	Paper, printing etc
-	-	35	0	-	-	-	-	35	Other industries
-	-	173	7	-	-	-	-	180	Construction
-	**24,911**	**1,463**	**0**	**-**	**-**	**-**	**-**	**49,957**	**Transport**
-	-	-	-	-	-	-	-	11,770	Air
-	-	610	-	-	-	-	-	610	Rail
-	24,911	-	-	-	-	-	-	36,724	Road
-	-	853	0	-	-	-	-	853	National navigation
-	-	-	-	-	-	-	-	-	Pipelines
1,886	**-**	**1,420**	**118**	**-**	**-**	**-**	**-**	**4,070**	**Other**
1,886	-	144	-	-	-	-	-	2,230	Domestic
-	-	299	25	-	-	-	-	340	Public administration
-	-	378	62	-	-	-	-	786	Commercial
-	-	328	17	-	-	-	-	430	Agriculture
-	-	271	13	-	-	-	-	285	Miscellaneous
-	**-**	**18**	**-**	**421**	**1,435**	**61**	**412**	**6,644**	**Non energy use *(5)***

3.3 Commodity balances 2016

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit and SBP	Aviation turbine fuel
Supply									
Production	-	1,416r	812r	2,444r	2,306	-	17,343r	95	4,392
Other sources	1,184	714	354	-	298	-	-	-	-
Imports	-	729r	113r	-	1,409r	11r	3,927r	57r	8,782r
Exports	-	-460	-513	-	-526	-	-11,128	-41	-1,226
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	15	-6	-	13	-1	5	-1	45
Transfers	-	-	-23	-	-2,234	-	1,850	-0	-631
Total supply	**1,184**	**2,414r**	**737r**	**2,444r**	**1,266r**	**10r**	**11,997r**	**111r**	**11,363r**
Statistical difference *(3)*	**-**	**-7r**	**-22r**	**-8**	**-16r**	**-2**	**46r**	**1**	**2**
Total demand	**1,184**	**2,421r**	**758r**	**2,453r**	**1,282**	**12r**	**11,951**	**110r**	**11,361r**
Transformation	**-**	**17**	**266**	**398**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	251	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	251	-	-	-	-	-
Heat generation	-	8	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	9	266	147	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**1,991r**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	1,991r	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**1,184**	**2,404**	**492r**	**63**	**1,282**	**12r**	**11,951**	**110r**	**11,361r**
Industry	**-**	**307r**	**78**	**-**	**94r**	**-**	**-**	**-**	**-**
Unclassified	-	277	78	-	94r	-	-	-	-
Iron and steel	-	1	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering etc	-	-	-	-	-	-	-	-	-
Electrical engineering etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages etc	-	30r	-	-	-	-	-	-	-
Textiles, leather etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**71**	**-**	**-**	**-**	**12r**	**11,951**	**-**	**11,361r**
Air	-	-	-	-	-	12r	-	-	11,361r
Rail	-	-	-	-	-	-	-	-	-
Road	-	71	-	-	-	-	11,951	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**654**	**4**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	214	1	-	-	-	-	-	-
Public administration	-	16	-	-	-	-	-	-	-
Commercial	-	335	3	-	-	-	-	-	-
Agriculture	-	89	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**1,184**	**1,372**	**411r**	**63**	**1,188r**	**-**	**-**	**110r**	**-**

(1) Includes marine diesel oil.
(2) Stock fall (+), stock rise (-).
(3) Total supply minus total demand.
(4) Backflows delivered from petrochemical plants to refineries for re-processing. See paragraphs 3.52 and 3.53 for further details.
(5) For further details on non-energy usage see paragraph 3.57

3.3 Commodity balances 2016 (continued)

Petroleum products

Thousand tonnes

Burning oil	DERV	Gas Oil(1)	Fuel oils	Lubri -cants	Bitu -men	etroleum coke	Misc. products	Total Products	
									Supply
2,015	13,541r	6,982	4,329	350	968	1,882r	1,111	59,986r	Production
-	-	-	-	-	-	-	-	2,550	Other sources
790r	14,194r	2,533r	1,259r	395r	442r	315r	91r	35,047r	Imports
-126	-2,421	-2,505	-3,360	-319	-107	-711	-870	-24,312	Exports
-	-	-1,770	-889	-	-	-	-	-2,659	Marine bunkers
38	-208	35	70	-11	-15	85	26	89	Stock change *(2)*
593	-419	-29	-631	-	15	1	239	-1,268	Transfers
3,310r	**24,686r**	**5,246r**	**778r**	**415r**	**1,303r**	**1,572r**	**597r**	**69,433r**	**Total supply**
21r	**38r**	**-2r**	**-9r**	**8**	**-36**	**-46r**	**52**	**20r**	**Statistical difference *(3)***
3,288r	**24,648**	**5,248r**	**787r**	**408r**	**1,338r**	**1,618r**	**545r**	**69,413r**	**Total demand**
-	**-**	**93r**	**191r**	**-**	**-**	**95**	**18**	**1,078r**	**Transformation**
-	-	89	161	-	-	-	-	501	Electricity generation
-	-	45	141	-	-	-	-	185	Major power producers
-	-	44	20	-	-	-	-	316	Autogenerators
-	-	4r	30r	-	-	-	-	42r	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	95	-	95	Patent fuel manufacture
-	-	-	-	-	-	-	18	440	Other (4)
-	**-**	**599**	**296**	**-**	**-**	**1,154r**	**-**	**4,040r**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	599	64	-	-	-	-	662	Oil and gas extraction
-	-	-	232	-	-	1,154r	-	3,377r	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,288r	**24,648**	**4,557r**	**300r**	**408r**	**1,338r**	**370r**	**527r**	**64,295r**	**Final consumption**
1,350r	**-**	**1,680r**	**180r**	**-**	**-**	**266r**	**-**	**3,956r**	**Industry**
1,322r	-	1,002r	84r	-	-	266r	-	3,122r	Unclassified
-	-	-	4r	-	-	-	-	4	Iron and steel
-	-	7r	0	-	-	-	-	7r	Non-ferrous metals
-	-	154r	6	-	-	-	-	160r	Mineral products
-	-	79r	24r	-	-	-	-	103r	Chemicals
-	-	0	-	-	-	-	-	0	Mechanical engineering etc
-	-	1	0	-	-	-	-	1	Electrical engineering etc
24	-	156r	6	-	-	-	-	186r	Vehicles
4r	-	16r	50r	-	-	-	-	100r	Food, beverages etc
-	-	39r	-	-	-	-	-	39r	Textiles, leather etc
-	-	28r	-	-	-	-	-	28r	Paper, printing etc
-	-	33r	0	-	-	-	-	33r	Other industries
-	-	164r	7	-	-	-	-	171r	Construction
-	**24,648**	**1,457r**	**0**	**-**	**-**	**-**	**-**	**49,501r**	**Transport**
-	-	-	-	-	-	-	-	11,373r	Air
-	-	614r	-	-	-	-	-	614r	Rail
-	24,648	-	-	-	-	-	-	36,671	Road
-	-	843r	0	-	-	-	-	843r	National navigation
-	-	-	-	-	-	-	-	-	Pipelines
1,938r	**-**	**1,401r**	**120r**	**-**	**-**	**-**	**-**	**4,117r**	**Other**
1,938r	-	151r	-	-	-	-	-	2,303r	Domestic
-	-	302r	28r	-	-	-	-	346r	Public administration
-	-	372r	60	-	-	-	-	771r	Commercial
-	-	319r	18r	-	-	-	-	426r	Agriculture
-	-	258r	14	-	-	-	-	272r	Miscellaneous
-	**-**	**18r**	**-**	**408r**	**1,338r**	**104r**	**527r**	**6,721r**	**Non energy use *(5)***

3.4 Commodity balances 2015

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit and SBP	Aviation turbine fuel
Supply									
Production	-	1,357	850	2,343	2,368	-	16,894	151	4,973
Other sources	995	743	350	-	265	-	-	-	-
Imports	-	580	103	-	983	13	3,905r	98	8,236
Exports	-	-293	-559	-	-436	-	-10,340	-76	-1,201
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	4	10	-	-8	-0	-137	-7	-201
Transfers	-	-	-	-	-1,986	-	1,754	-6	-483
Total supply	**995**	**2,392**	**755**	**2,343**	**1,185**	**13**	**12,075r**	**160**	**11,324**
Statistical difference *(3)*	**-**	**7r**	**30**	**-12**	**-9**	**1**	**-7r**	**-0**	**-8**
Total demand	**995**	**2,385r**	**725**	**2,356**	**1,195**	**11**	**12,082**	**160**	**11,331r**
Transformation	**-**	**12**	**282**	**371r**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	245r	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	245r	-	-	-	-	-
Heat generation	-	9	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	3	282	126	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**1,950r**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	1,950r	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**995**	**2,373r**	**443**	**35**	**1,195**	**11**	**12,082**	**160**	**11,331r**
Industry	**-**	**293r**	**72**	**-**	**122**	**-**	**-**	**-**	**-**
Unclassified	-	282	72	-	122	-	-	-	-
Iron and steel	-	2	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering etc	-	-	-	-	-	-	-	-	-
Electrical engineering etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages etc	-	10r	-	-	-	-	-	-	-
Textiles, leather etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**82**	**-**	**-**	**-**	**11**	**12,082**	**-**	**11,331r**
Air	-	-	-	-	-	11	-	-	11,331r
Rail	-	-	-	-	-	-	-	-	-
Road	-	82	-	-	-	-	12,082	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**637**	**5**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	204	1	-	-	-	-	-	-
Public administration	-	16	-	-	-	-	-	-	-
Commercial	-	327	4	-	-	-	-	-	-
Agriculture	-	90	0	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**995**	**1,361**	**366**	**35**	**1,072**	**-**	**-**	**160**	**-**

(1) Includes marine diesel oil.
(2) Stock fall (+), stock rise (-).
(3) Total supply minus total demand.
(4) Backflows delivered from petrochemical plants to refineries for re-processing. See paragraphs 3.52 and 3.53 for further details.
(5) For further details on non-energy usage see paragraph 3.57

3.4 Commodity balances 2015 (continued)

Petroleum products

Thousand tonnes

Burning oil	DERV	Gas Oil [1]	Fuel oils	Lubri -cants	Bitu -men	Petroleum coke	Misc. products	Total Products	
									Supply
2,031	13,483	7,204	5,094	350	990	1,737	1,104	60,929	Production
-	-	-	-	-	-	-	-	2,353	Other sources
890	12,474r	2,403r	1,062	444	509	339	249	32,290r	Imports
-151	-1,792	-2,806	-3,431	-365	-61	-455	-958	-22,926	Exports
-	-	-1,674	-835	-	-	-	-	-2,509	Marine bunkers
-46	-94	-105	-83	-19	7	-58	-3	-743	Stock change *(2)*
467	-422	297	-1,013	-0	14	-	190	-1,190	Transfers
3,191	**23,648r**	**5,317r**	**794**	**409**	**1,458**	**1,562**	**581**	**68,203r**	**Total supply**
3r	**-8r**	**43r**	**-16r**	**-1**	**-6**	**-8**	**8**	**16r**	**Statistical difference *(3)***
3,189r	**23,656**	**5,274r**	**809r**	**411**	**1,464**	**1,571**	**573**	**68,187r**	**Total demand**
-	**-**	**101r**	**197r**	**-**	**-**	**122**	**12**	**1,097r**	**Transformation**
-	-	98r	166	-	-	39	-	547r	Electricity generation
-	-	42	136	-	-	39	-	217	Major power producers
-	-	55r	30	-	-	-	-	330r	Autogenerators
-	-	4r	31r	-	-	-	-	44r	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	84	-	84	Patent fuel manufacture
-	-	-	-	-	-	-	12	423	Other (4)
-	**-**	**634**	**341r**	**-**	**-**	**1,127**	**-**	**4,051r**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	634	66	-	-	-	-	699	Oil and gas extraction
-	-	-	276	-	-	1,127	-	3,352r	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,189r	**23,656**	**4,540r**	**271r**	**411**	**1,464**	**322**	**561**	**63,039r**	**Final consumption**
1,268r	**-**	**1,719r**	**150r**	**-**	**-**	**184**	**56**	**3,865r**	**Industry**
1,239	-	1,053r	31r	-	-	184	56	3,038r	Unclassified
-	-	-	3	-	-	-	-	6	Iron and steel
-	-	7r	0	-	-	-	-	7r	Non-ferrous metals
-	-	151r	6	-	-	-	-	157r	Mineral products
-	-	84r	27r	-	-	-	-	111	Chemicals
-	-	0	-	-	-	-	-	0	Mechanical engineering etc
-	-	1	0	-	-	-	-	1	Electrical engineering etc
24	-	151r	6	-	-	-	-	181	Vehicles
5r	-	13r	70r	-	-	-	-	97r	Food, beverages etc
-	-	40r	-	-	-	-	-	40r	Textiles, leather etc
-	-	28r	-	-	-	-	-	28r	Paper, printing etc
-	-	32r	-	-	-	-	-	32r	Other industries
-	-	160r	7r	-	-	-	-	167r	Construction
-	**23,656**	**1,454r**	**-**	**-**	**-**	**-**	**-**	**48,617r**	**Transport**
-	-	-	-	-	-	-	-	11,343r	Air
-	-	620r	-	-	-	-	-	620r	Rail
-	23,656	-	-	-	-	-	-	35,820	Road
-	-	834r	-	-	-	-	-	834r	National navigation
-	-	-	-	-	-	-	-	-	Pipelines
1,921r	**-**	**1,350r**	**121r**	**-**	**-**	**-**	**-**	**4,033r**	**Other**
1,921r	-	143r	-	-	-	-	-	2,269r	Domestic
-	-	288r	28	-	-	-	-	332r	Public administration
-	-	352r	61r	-	-	-	-	743r	Commercial
-	-	321r	17	-	-	-	-	428r	Agriculture
-	-	246r	14	-	-	-	-	261r	Miscellaneous
-	**-**	**16r**	**-**	**411**	**1,464**	**138**	**505**	**6,525**	**Non energy use *(5)***

3.5 Supply and disposal of petroleum[(1)]

Thousand tonnes

	2013	2014	2015	2016	2017
Primary oils (Crude oil, NGLs and feedstocks)					
Indigenous production *(2)*	41,101	40,328	45,698	47,872	46,916
Imports	58,967	53,638	50,599r	48,798r	53,384
Exports *(3)*	-33,105	-30,869	-33,709	-34,856	-38,397
Transfers - Transfers to products *(4)*	-2,221	-2,255	-2,353	-2,550	-2,670
Product rebrands (5)	463	817	1,202	1,268	+635
Stock change *(6)*	724	-592	-98	-125	+330
Use during production *(7)*	-	-	-	-	-
Calculated refinery throughput *(8)*	65,928	61,066	61,338r	60,407r	60,198
Overall statistical difference *(9)*	-44	4	-53r	15r	-47
Actual refinery throughput	**65,972**	**61,063**	**61,391**	**60,393r**	**60,245**
Petroleum products					
Losses in refining process *(10)*	575	671	462	407r	421
Refinery gross production *(11)*	65,397	60,392	60,929	59,986r	59,824
Transfers - Transfers to products *(4)*	2,221	2,255	2,353	2,550	2,670
Product rebrands *(5)*	-463	-730	-1,190	-1,268	-612
Imports	28,418	29,384	32,290r	35,047r	33,521
Exports *(12)*	-26,910	-22,748	-22,926	-24,312	-23,110
Marine bunkers	-2,720	-2,824	-2,509	-2,659	-2,430
Stock changes *(6)* - Refineries	79	266	-769	63	-148
Power generators	26	26	26	26	26
Calculated total supply	66,049	66,022	68,203r	69,433r	69,742
Statistical difference *(9)*	-107	-29	16r	20r	-11
Total demand *(4)*	**66,156**	**66,051**	**68,187r**	**69,413r**	**69,753**
Of which:					
Energy use	60,226	60,178	61,662r	62,692r	63,108
Of which, for electricity generation *(13)*	541	490	547r	501	475
total refinery fuels *(13)*	3,759	3,198	3,352r	3,377r	3,407
Non-energy use	5,930	5,873	6,525	6,721r	6,644

(1) Aggregate monthly data on oil production, trade, refinery throughput and inland deliveries are available - see paragraph 3.60 and Annex C.
(2) Crude oil plus condensates and petroleum gases derived at onshore treatment plants.
(3) Includes NGLs, process oils and re-exports.
(4) Disposals of NGLs by direct sale (excluding exports) or for blending.
(5) Product rebrands (inter-product blends or transfers) represent petroleum products received at refineries/ plants and used as feedstock for refinery or cracking unit operations.
(6) Impact of stock changes on supplies. A stock fall is shown as (+) as it increases supplies, and vice-versa for a stock rise (-).
(7) Own use in onshore terminals and gas separation plants. These figures ceased to be available from January 2001.
(8) Equivalent to the total supplies reported against the upstream transformation sector in Table 3.1.
(9) Supply greater than (+) or less than (-) recorded throughput or disposals.
(10) Calculated as the difference between actual refinery throughput and gross refinery production.
(11) Includes refinery fuels.
(12) Excludes NGLs.
(13) Figures cover petroleum used to generate electricity by all major power producers and by all other generators, including petroleum used to generate electricity at refineries.

3.6 Additional information on inland deliveries of selected products[1]

Thousand Tonnes

	2013	2014	2015	2016	2017
Motor spirit					
of which, Hydrocarbon (2)	12,574	12,326	12,082	11,951	11,746
of which, Bio-ethanol (3)	650	645	631	603	598
Total Motor Spirit including Bio-ethanol	**13,224**	**12,971**	**12,713**	**12,554**	**12,344**
of which, sold through Supermarkets (4)	5,974	5,755	5,794	5,885	5,794
Diesel Road Fuel					
of which, Hydrocarbon (2)	21,926	22,675	23,656	24,648	24,911
of which, Bio-diesel (3)	682	850	595	630	620
Total Diesel Road Fuel including Bio-diesel	**22,607**	**23,525**	**24,251**	**25,279**	**25,531**
of which, sold through Supermarkets (4)	6,217	6,394	6,644	7,267	7,383

1. Monthly data for inland deliveries of oil products are available - See BEIS website at https://www.gov.uk/government/collections/oil-statistics
2. Demand excluding bioethanol. Based on HMRC data.
3. Bioethanol based on HMRC data and excludes other renewables
4. Data for sales by supermarkets collected by a monthly reporting system. Includes Asda, Morrisons, Sainsburys and Tesco only.

3.7 Stocks of crude oil and petroleum products at end of year[(1)]

Thousand to

	2013	2014	2015	2016	2017
Crude and process oils					
Refineries *(2)*	3,592	3,876	3,156	3,088	3,244
Terminals (3)	1,102	1,147	1,629	1,795	1,235
Offshore (4)	513	460	499	526	600
Net bilateral stocks (5)	1,469	1,728	2,289	2,006	2,121
Total crude and process oils *(6)*	**6,677**	**7,211**	**7,574**	**7,415**	**7,200**
Petroleum products					
Ethane	-	-	-	-	-
Propane	19	46	37	22	24
Butane	29	35	27	31	47
Other petroleum gases	-	-	-	-r	-
Naphtha	112	140	94	81	101
Aviation spirit	4	5	5	5	7
Motor spirit	1,287	1,141	1,246	1,293	1,246
White spirit and SBP	18	24	31	31	11
Aviation turbine fuel	1,162	999	1,232	1,117	1,111
Burning oil	287	231	281	244	185
Gas/Diesel oil (7)	2,482	2,399	2,842	2,976	3,130
of which, DERV	1,662	1,592	1,622	2,139	2,197
Fuel oils	1,340	1,060	891	1,013r	840
Lubricating oils	186	67	122	138	138
Bitumen	127	101	88	104	97
Petroleum wax	10	3	8	9	9
Petroleum coke	236	318	343	232	366
Miscellaneous products	228	302	249	127	217
Total all products	**7,528**	**6,871**	**7,497**	**7,422r**	**7,530**
Of which: net bilateral stocks (5)	2,432	2,064	2,022	2,082	2,126

(1) Aggregate monthly data on the level of stocks of crude oil and oil products are available - see paragraph 3.60 and Annex C.

(2) Stocks of crude oil, NGLs and process oils at UK refineries.

(3) Stocks of crude oil and NGLs at UKCS (UK continental shelf) pipeline terminals.

(4) Stocks of crude oil in tanks and partially loaded tankers at offshore fields.

(5) The difference between stocks held abroad for UK use under approved bilateral agreements and the equivalent stocks held in the UK for foreign use.

(6) Includes process oils held abroad for UK use approved by bilateral agreements.

(7) Includes marine diesel oil.

3.8 Additional information on inland deliveries for non-energy uses[(1)(2)]

Thousand tonnes

	2013	2014	2015	2016	2017
Feedstock for petroleum chemical plants:					
Propane	1,218	1,111	1,361	1,372	1,255
Butane	372	340	366	411r	400
Other gases	884	944	1,031	1,247	1,268
Total gases	2,474	2,395	2,757	3,029r	2,923
Naphtha (LDF)	909	817	1,072	1,188r	1,217
Middle Distillate Feedstock (MDF)	16	15	16r	18r	18
Other products	-	-	-	-	1
Total feedstock	3,400	3,226	3,846r	4,235r	4,157
Lubricating oils and grease:					
Aviation	5	1	1	2	3
Industrial	221	297	269	267r	279
Marine	17	21	18	21	21
Other motors, Gear oils and Transmissions	191	114	120	115	115
Agricultural	3	3	3	3	3
Fuel oil sold as lubricant	-	-	-	-	-
Total lubricating oils and grease	437	436	411	408r	421
Other non-energy products:					
Industrial spirit/white spirit	279	126	160	110r	158
Bitumen	1,358	1,410	1,464	1,338r	1,435
Petroleum coke	101	149	138	104r	61
Miscellaneous products	358	526	505	527r	412
Total other non-energy products	2,096	2,210	2,268	2,078r	2,066
Total non-energy use	**5,930**	**5,873**	**6,525r**	**6,721r**	**6,644**

(1) Aggregate monthly data on the total non energy use of oil products are available - see paragraph 3.61 and Annex C.
(2) For further details on non-energy usage see paragraph 3.57

Chapter 4
Natural Gas

Key points

- **UK natural gas production in 2017 was relatively stable on 2016 at 465 TWh, up just 0.3 per cent.** However, this small increase includes production of cushion gas from the Rough storage facility as it is prepared for closure, without which production would have fallen 1.5 per cent. Although recent years have seen modest increases in production, the long-term pattern is one of decline and 2017 production levels stood at under 40 per cent of the peak in 2000 (Table 4.1, Chart 4.1).

- **Net imports were 4.5 per cent lower in 2017 compared to 2016** (Table 4.1), driven by a 7.5 per cent increase in exports. Volumes exported to Belgium were up by nearly a third, increasing the share of UK exports to Belgium to more than 70 per cent. Imports fell by 1.8 per cent.

- **Imports of Liquefied Natural Gas (LNG) decreased by over a third to 80 TWh in 2017,** with imports of LNG from Qatar dropping by 40 per cent**.** In contrast pipeline imports increased by 8.2 per cent, with increased imports from Belgium and Norway more than compensating for a halving of imports from the Netherlands. (Table 4.5, Chart 4.3).

- **Total gas demand (natural gas plus colliery methane) decreased by 3.0 per cent in 2017 to 875 TWh.** Notably gas used for electricity generation fell by 4.0 per cent a result of an uptake in low carbon electricity sources such as renewables and nuclear. (Table 4.1, Chart 4.5).

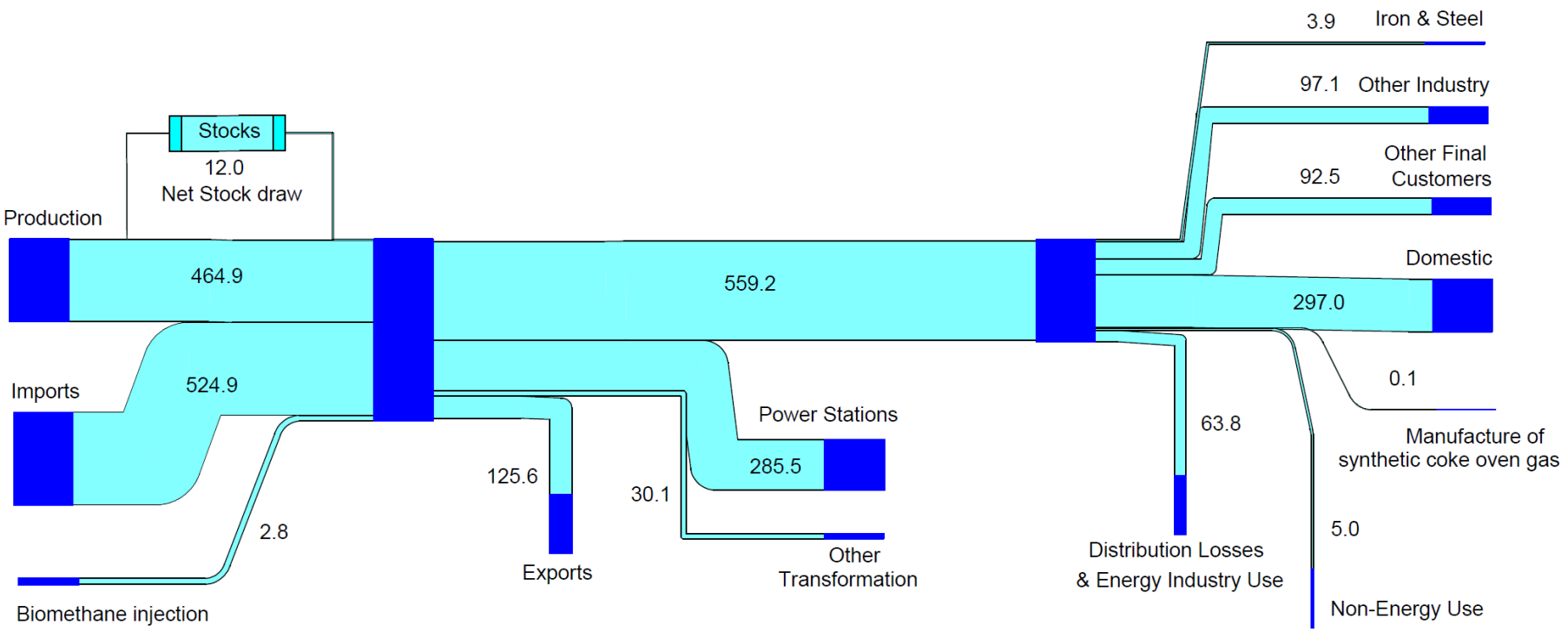
- **Final consumption decreased by 2.8 per cent in 2017 to 495 TWh,** with warmer temperatures in 2017 leading to decreases in the domestic (4.6 per cent), public administration (4.4 per cent) and commercial (3.4 per cent) sectors. In contrast industrial usage increased by 3.2 per cent, the principal reason being an 8.4 per cent increase in gas used in the chemicals sector. Excluding chemicals, industrial usage rose just 2.0 per cent.

Introduction

4.1 Gas is one of the key pillars of the UK's energy mix, accounting for over 30 per cent of the UK's energy production and second only to oil. Gas production from the UK's Continental Shelf (UKCS) would be sufficient to meet nearly 60 per cent of energy demand. Gas is particularly important for electricity generation where it meets around 40 per cent of the fuel required in power stations, a figure substantially up since 2015 due to the decline of coal in power generation. It is also critical for space heating, domestically and in offices, hotels and restaurants. In 2017 gas met nearly two thirds of total domestic energy demand.

4.2 An energy flow chart for 2017, showing the flows of natural gas from production and imports through to consumption, is included overleaf as a way of simplifying the figures that can be found in the commodity balance tables. It illustrates the flow of gas from the point at which it becomes available from indigenous production or imports (on the left) to the eventual final use of gas (on the right), as well as volumes transformed into other forms of energy or exported.

Natural gas flow chart 2017 (TWh)



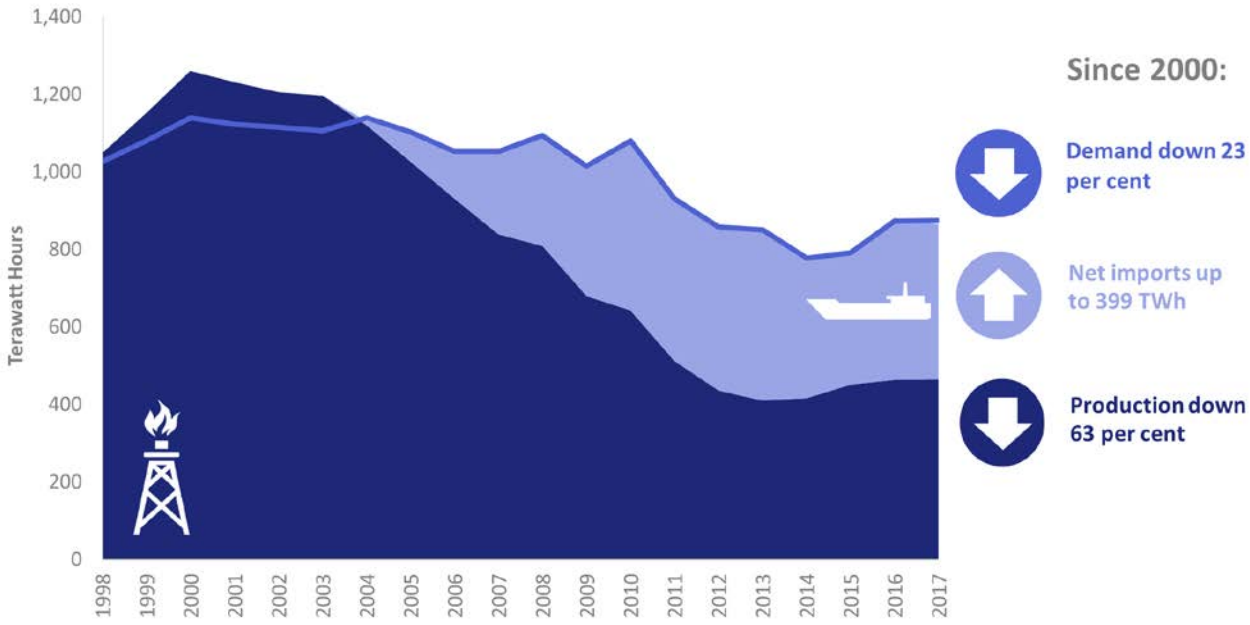
Note:
This flow chart is based on data that appear in Table 4.1, excluding colliery methane.

Supply of gas

4.3 The pattern of gas production since the turn of the century has generally been one of decline, with production falling by an average 8 per cent per year since production peaked in 2000. **Whilst production has increased year-on-year since 2014 it stands at less than 40 per cent of the peak recorded in 2000.** Despite this the UK, along with the Netherlands, is one of the two major gas-producing nations within the EU.

4.4 At 465 TWh production was flat on last year, up just 0.3 per cent. While recent years have seen modest increases, the small rise in 2017 includes just under 9 TWh of gas from the Rough facility. This former long-term storage site has been drawing down on last available reserves in preparation for closure, and production of cushion gas has been included in 2017 production figures. Not including this volume, gross production would have fallen by 1.5 per cent this year.

Chart 4.1: Changes over time in gas production and demand

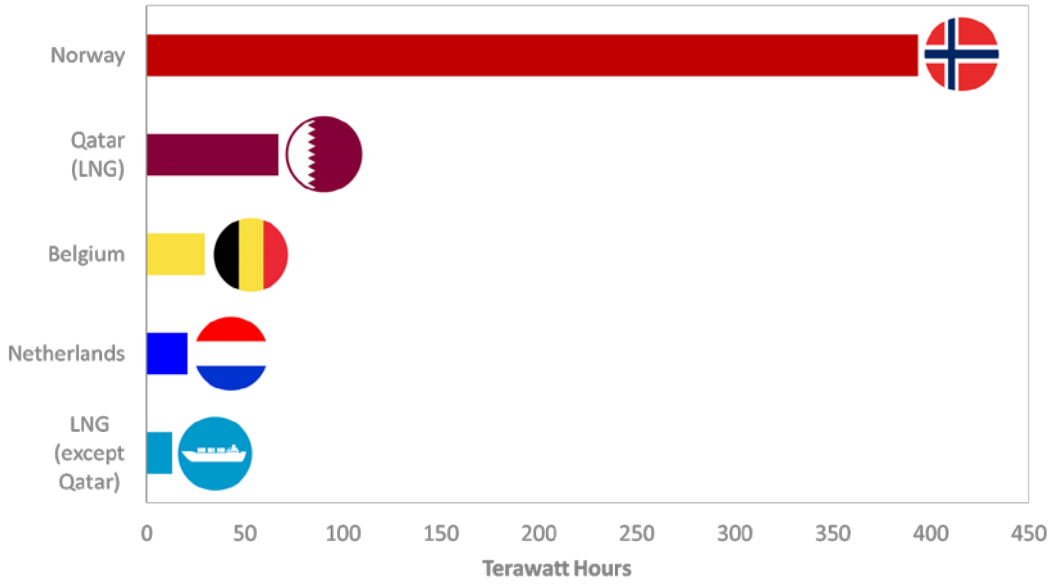


4.5 Chart 4.1 illustrates the growth in net imports despite a decrease in demand since the mid-2000s. The UK imports natural gas via pipeline from Norway, the Netherlands and Belgium and by ship in the form of Liquefied Natural Gas (LNG), to terminals at Milford Haven (South Hook and Dragon), the Isle of Grain and Teesside Gasport. Much of this infrastructure development has been recent and includes the completion of the interconnector from the Netherlands at the end of 2006 and completion of two new LNG terminals in 2009. The latter is a significant development and the LNG share of total gas imports had risen substantially, peaking at 47 per cent in 2011.

4.6 **However, in recent years LNG imports have contracted, and are now down by more than a third to comprise just 15 per cent of the total in 2017.** LNG imports had fallen by 20 per cent in 2016, and the further reduction this year continues to be the result of strong demand in Asia affecting volumes supplied into Europe and the UK. For the second year running the UK has filled the shortfall with an increase in pipeline imports, which were up 8.2 per cent. While pipeline imports from the Netherlands more than halved, volumes from Norway and Belgium met demand. Total imports in 2017 fell by 1.8 per cent and overall net imports were down 4.5 per cent because of the strong 7.5 per cent increase in export volumes.

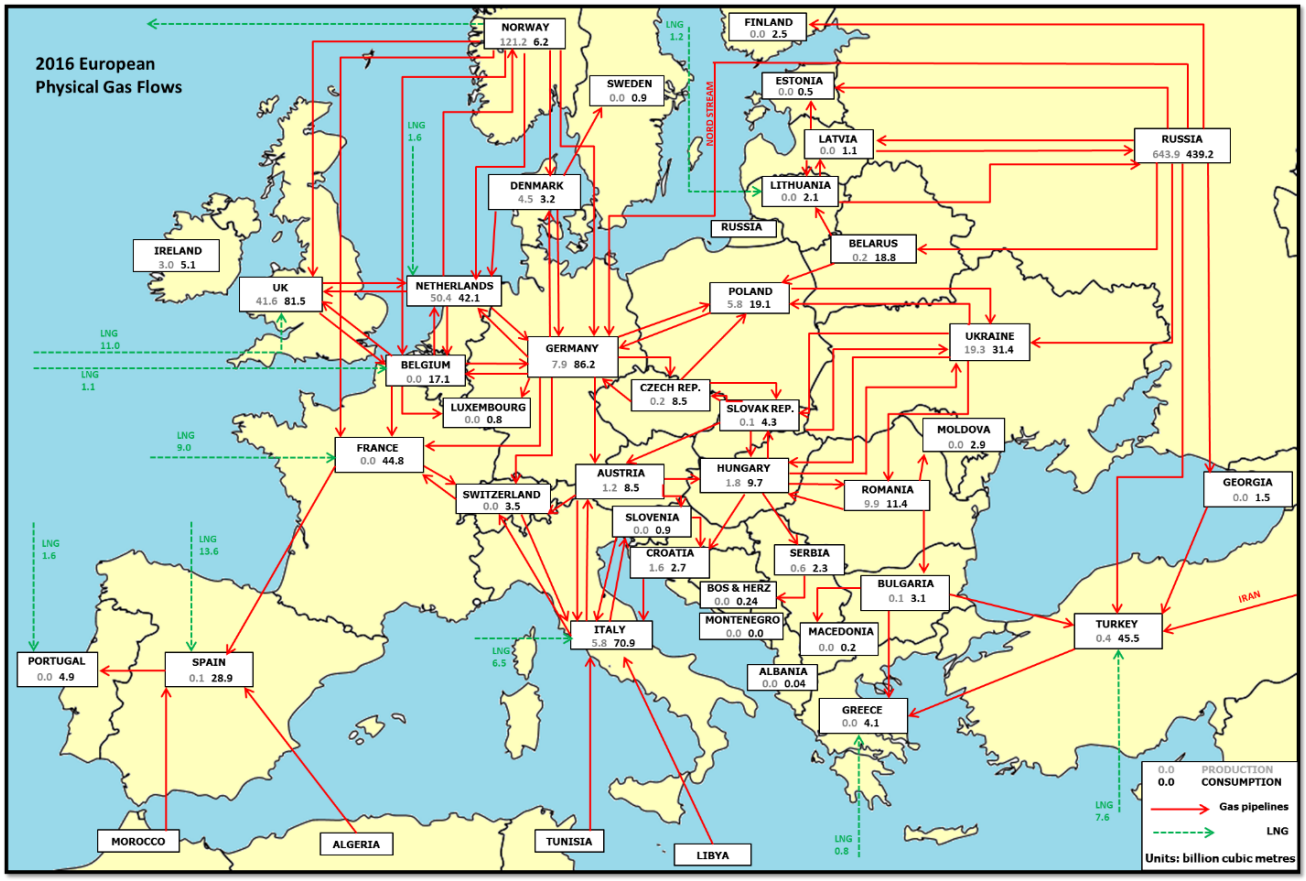
4.7 Chart 4.2 shows imports by source. LNG arrivals by ship cover a variety of countries but the vast bulk arrive from Qatar. Table 4.5 in DUKES shows imports and exports for all countries.

Chart 4.2: Gas imports by country 2017



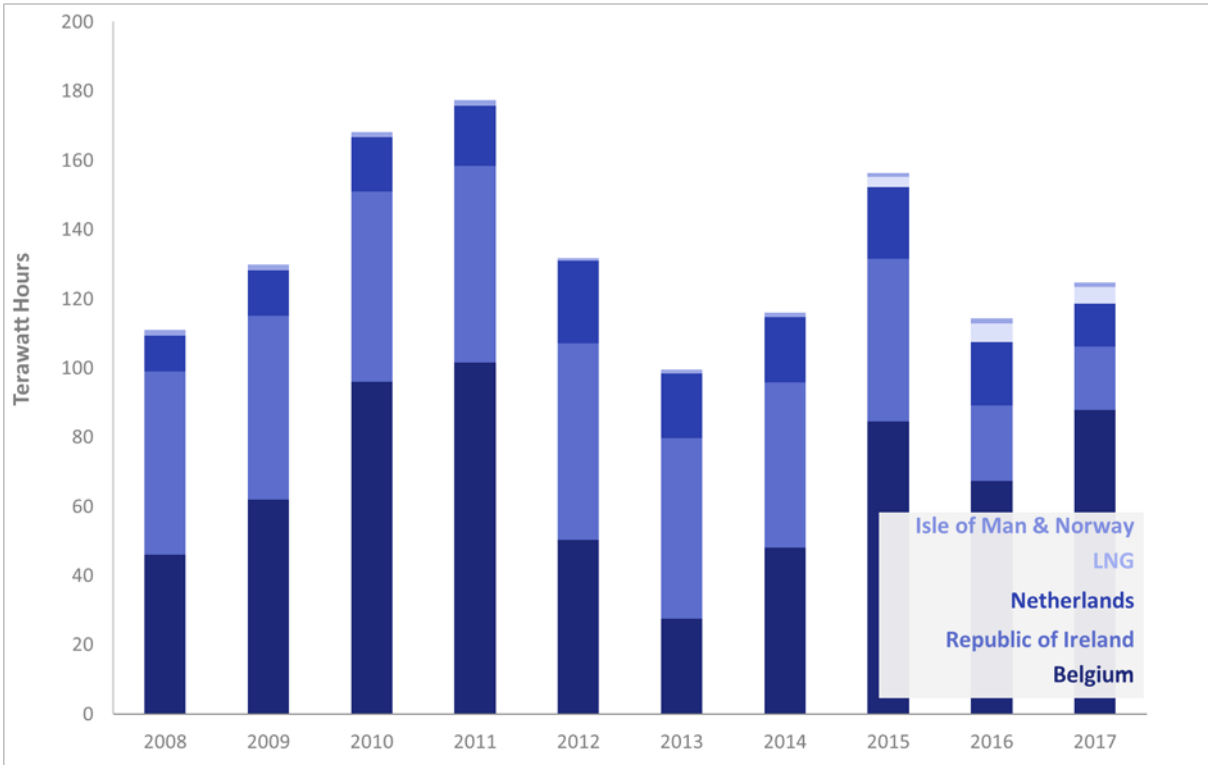
4.8 The European transit system for gas is complex, with multiple connectors giving a high degree of interconnectivity. Map 4A is illustrative of this and shows how gas flows into the EU (from Russia, Norway and by ship principally) and onto the UK (principally from Norway and by ship, with little or no direct reliance on Russian gas). A larger version of the map is available at www.gov.uk/government/publications/energy-trends-december-2017-special-feature-article-physical-gas-flows-across-europe-and-diversity-of-gas-supply-in-2016. The UK National Gas Transmission System is similarly complex a map, which can be found in Map 4B.

Map 4A: The European gas transit system



4.9 With demand outstripping supply from the UK's continental shelf it is perhaps surprising to note that the UK is a large exporter of gas, with exports in several recent years outstripping export volumes at the peak of the UK's indigenous production. Chart 4.3 shows that export volumes have been considerable but somewhat erratic in recent years, as well as illustrating the 7.5 per cent increase in export volumes in 2017 when compared with 2016.

Chart 4.3: Export volumes by year and country



4.10 **UK exports were up 7.5 per cent in 2017, driven by an increase of nearly a third in exports to Belgium.** Exports to all other countries were substantially reduced – in particular, exports to the Republic of Ireland and the Netherlands were down 17 and 31 per cent respectively – meaning that volumes to Belgium comprised more than 70 per cent of all UK exports.

Demand for gas

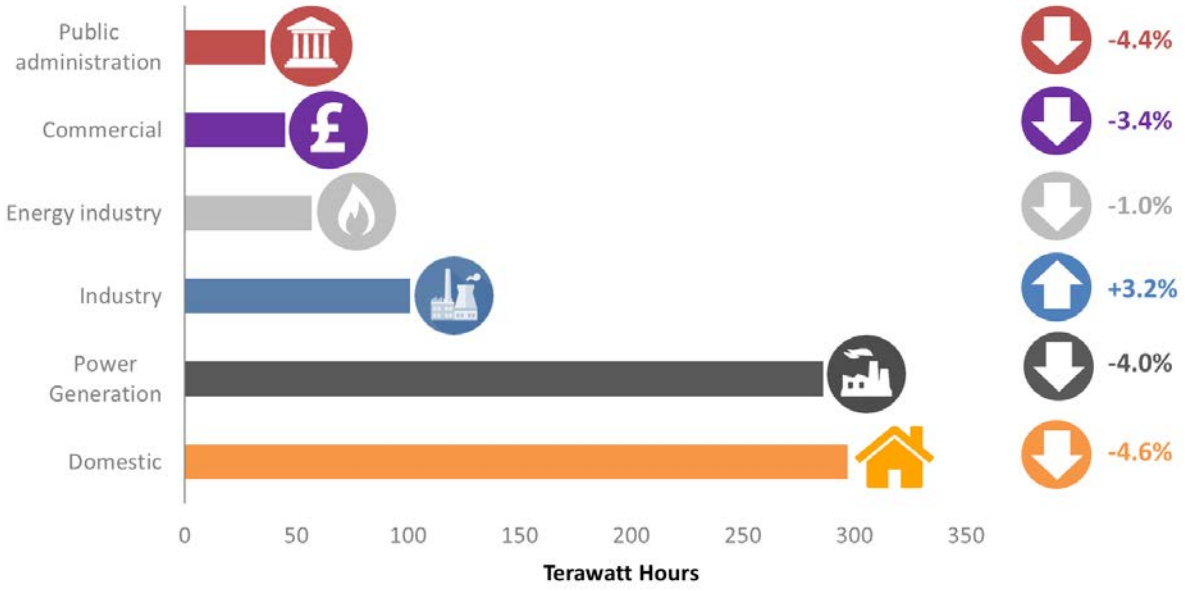
4.11 **In recent history, gas demand can be broadly broken down into two main sectors of very substantial size; domestic consumption and gas for electricity generation**, with demand for industry, commercial, public administration and other sectors making up the rest (see Chart 4.4).

4.12 Whilst gas is a critical part of the UK's energy demand, **in 2017 demand was down by more than a fifth compared with 2000** (see Chart 4.5). Most notably, it is industry demand that has shrunk over this period, down to just over a half of what it was in 2000. However, demand for power generation was also down (just over a tenth) and domestic demand has shrunk by around 20 per cent in the context of both a rising population and a rising number of homes. Increased efficiencies in heat use, including greater levels of home insulation, are a factor.

4.13 **Compared to last year demand has remained relatively stable at 875 TWh, down 3.0 per cent**. Notably, including colliery methane, power generation fell by 4.0 per cent as a result of an uptake in low carbon electricity sources such as renewables and nuclear. In 2016 demand here had increased by more than a third because of the drop off in coal power generation.

4.14 Generally warmer temperatures in 2017 meant that final consumption decreased by 2.8 per cent, **with domestic consumption down 4.6 per cent**. In contrast industrial usage increased by 3.2 per cent, the principal reason being an 8.4 per cent increase in gas used in the chemicals sector. Excluding chemicals, industrial usage rose just 2.0 per cent.

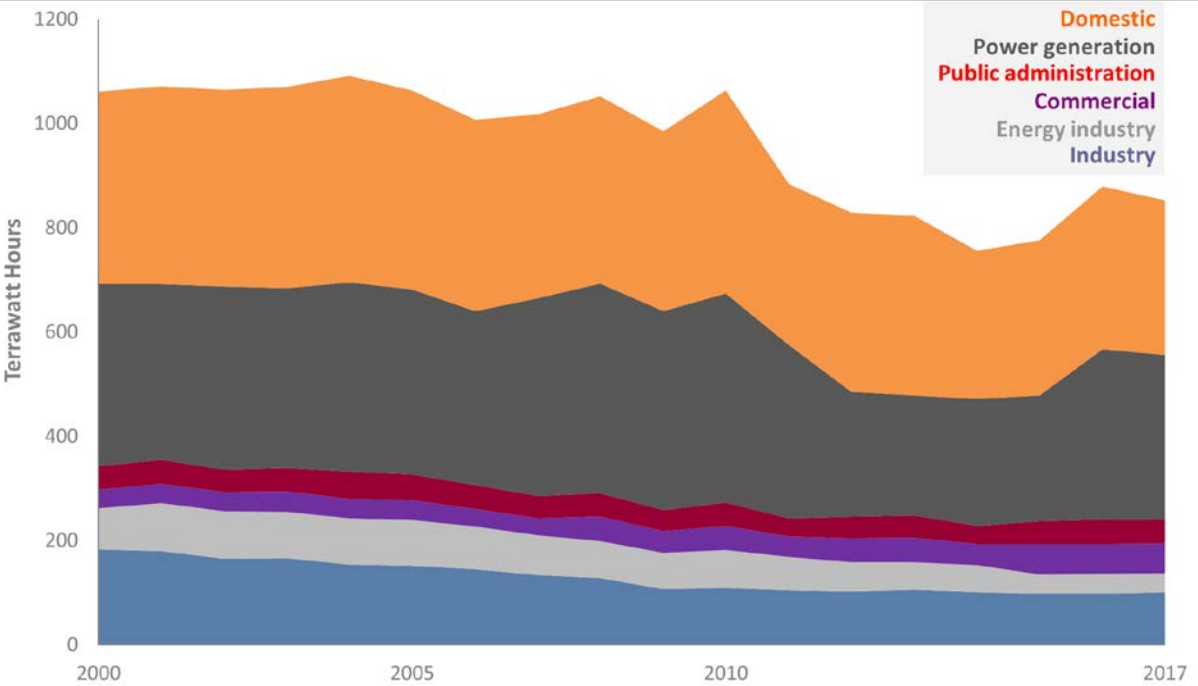
Chart 4.4: Gas demand in 2017



Note: Power generation includes colliery methane

4.15 Chart 4.5 shows the pattern of changes over time. As noted above, the direction of travel has been downwards since the mid-2000s but there are notable peaks that correspond with weather variations, which generate a greater demand for space heating in homes and offices.

Chart 4.5: Changes in gas demand over time

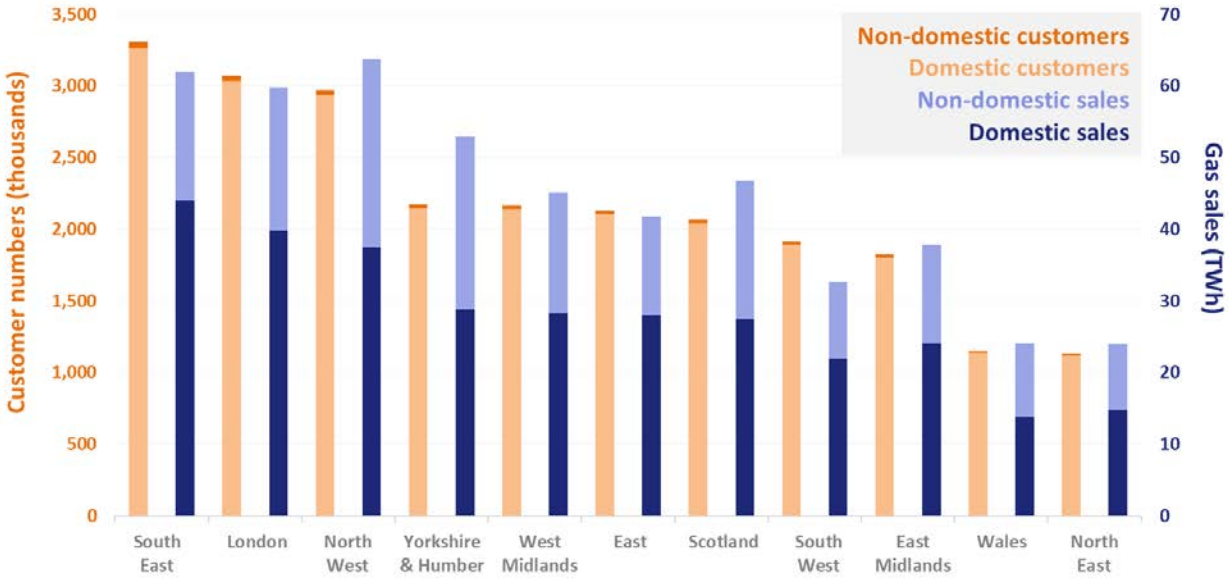


4.16 More detailed analysis of gas consumption in the domestic sector is available in the National Energy Efficiency Data-Framework (NEED): www.gov.uk/government/collections/national-energy-efficiency-data-need-framework. For definitions of the various sectors used for sales and consumption analyses see Chapter 1 paragraphs 1.55 to 1.60 and Annex A, paragraphs A.31 to A.42.

Sub-national gas data

4.17 In January 2018, BEIS published sub-national energy statistics data on its website: www.gov.uk/government/collections/sub-national-gas-consumption-data, including consumption data at both regional (NUTS1) and local (LAU1) level. Data for earlier years are presented on the website.

Chart 4.6: Domestic and non-domestic gas customer numbers and sales by region, 2016



Domestic customers (with an annual consumption of 73,200 kWh or lower) will include some small industrial and commercial consumers. Data excludes approximately 78,000 customers (0.3 per cent) for whom regional allocation was not possible.

4.18 The total number of customers in 2016 remains fairly similar to 2015, with all areas seeing a small rise in the total number of customers. Within this the South East and London have the largest numbers of consumers, whilst there are fewest in the North East. Total sales were up in four regions last year, with largest increases in Yorkshire, the North West and Wales. In Great Britain there was an increase in consumption of 0.7 per cent. A more detailed summary of this data can be found at: www.gov.uk/government/statistics/sub-national-electricity-and-gas-consumption-summary-report-2016.

4.19 In March 2018, BEIS published percentage of domestic gas customers by region and supplier type data on its website: www.gov.uk/government/collections/quarterly-energy-prices.

Table 4A: Domestic gas market penetration (in terms of percentage of customers supplied[1]) by region, Quarter 4 2017

	All Payment Types	
Region/Country[2]	Home supplier	Other large supplier
South Wales	24	76
North East	26	74
East Midlands	28	72
North Scotland	29	71
South East	29	71
Southern	30	70
Yorkshire	31	69
Eastern	32	68
South Scotland	33	67
South West	33	67
West Midlands	33	67
North West	33	67
Merseyside & N Wales	35	65
London	38	62
Great Britain	**32**	**68**

[1] Table is not adjusted to account for survey coverage. The Domestic Fuels Inquiry survey coverage is estimated at around 88%. All those not surveyed are with non-home suppliers.

[2] The regions used in this table are the distribution areas of the former public electricity suppliers. This marks a change from previous years, where regions were based on Transco local distribution zones (LDZs).

4.20 **At the end of December 2017, BEIS estimates that 68 per cent of domestic gas customers in Great Britain were no longer with their home supplier, British Gas.** The data in Table 4A are based on the BEIS domestic prices survey, which does not include the majority of small suppliers and therefore underestimates the proportion of customers not with their home supplier. By the end of December 2017, of the companies surveyed, around 32 per cent of customers were supplied by British Gas. For all types of domestic customers, it is in the markets in North Scotland, South Wales and the North East of England that new suppliers have had most success.

4.21 Competition in the domestic market has continued to increase in 2017 as the concentration of sales by the largest three and largest six suppliers for each relevant sector have continued to dilute compared to past years. **Competition remained broadly unchanged between 2008 and 2013, but from 2014 onwards the competition has gradually increased.** In 2017, the largest six domestic suppliers accounted for around 82 per cent of sales, down from 85 per cent of sales in 2016 and 97 per cent of sales in 2013.

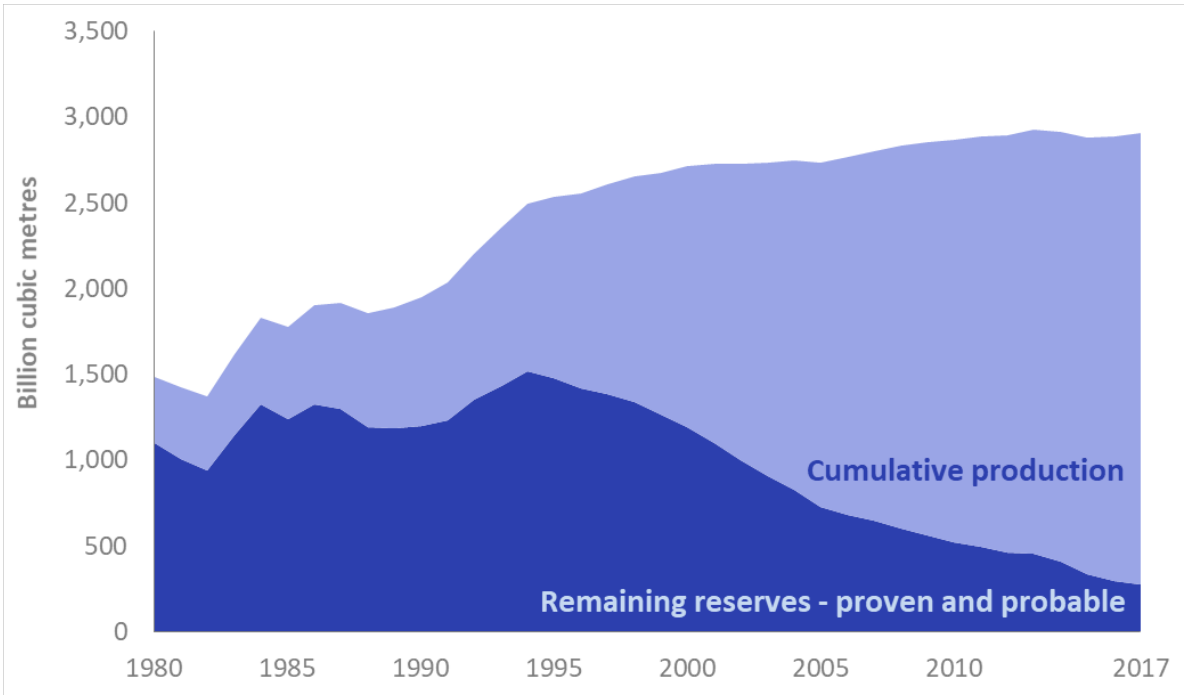
Map 4B: The National Gas Transmission System

Source: International Energy Agency and BEIS

Gas resources

4.22 The Oil and Gas Authority estimates that there are 275 billion cubic metres of proven and probable (2P) gas reserves, of which 180 billion cubic metres are proven reserves. There has been a steady decline in 2P reserves since 1994 (as shown in Chart 4.6), initially associated with a higher rate of production. At the end of 2017 cumulative production plus 2P reserves was 2,910 billion cubic metres. The apparent decline in reserves in 2015 was due to re-classification of some reserves that had not yet been sanctioned - these will be included in future as and when sanctioned.

Chart 4.7: Gas reserves



List of DUKES gas tables

Table	Description	Period
4.1	Natural gas commodity balances	1998-2017
4.2	Supply and consumption of natural gas and colliery methane	1996-2017
4.3	UK continental shelf and onshore natural gas production and supply	2008-2017
4.4	Gas storage sites and import/export facilities in the United Kingdom	May 2017
4.5	Natural gas imports and exports	2000-2017
4.6	Liquefied natural gas imports by terminal	2006-2017
4.1.1	Natural gas and colliery methane production and consumption	1970-2017
F.2	Gas production	1998-2017

Technical notes and definitions

These notes and definitions are in addition to the technical notes and definitions covering all fuels and energy as a whole in Chapter 1, paragraphs 1.29 to 1.63. For notes on the commodity balances and definitions of the terms used in the row headings see Annex A, paragraphs A.7 to A.42. While the data in the pdf copy of this Digest cover only the most recent five years, these notes also cover data for earlier years that are available on the BEIS energy statistics website.

Definitions used for production and consumption

4.23 **Natural gas** production in Tables 4.1 and 4.2 relates to the output of indigenous methane at land terminals and gas separation plants (includes producers' and processors' own use). For further explanation, see Annex F on BEIS's energy statistics web site under 'Production of gas' - www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes. Output of the Norwegian share of the Frigg and Murchison fields is included under imports. A small quantity of onshore produced methane (other than colliery methane) is also included.

4.24 **Colliery methane** production is colliery methane piped to the surface and consumed at collieries or transmitted by pipeline to consumers. As the output of deep-mined coal declines so does the production of colliery methane, unless a use can be found for gas that was previously vented. The supply of methane from coal measures that are no longer being worked or from drilling into coal measures is licensed under the same legislation as used for offshore gas production.

4.25 **Transfers** of natural gas include natural gas use within the iron and steel industry for mixing with blast furnace gas to form a synthetic coke oven gas. For further details see paragraph 2.54 in Chapter 2.

4.26 **Non-energy gas**: Non-energy use is gas used as feedstock for petrochemical plants in the chemical industry as raw material for the production of ammonia (an essential intermediate chemical in the production of nitrogen fertilisers) and methanol. The contribution of liquefied petroleum gases (propane and butane) and other petroleum gases is shown in Tables 3.2 to 3.4 of Chapter 3. Firm data for natural gas are not available, but estimates for 2011 to 2015 are shown in Table 4.2 and estimates for 2013 to 2015 in Table 4.1. The estimates for the years up to 2011 have been obtained from AEA's work for the National Atmospheric Emissions Inventory; 2012-13 data are BEIS extrapolations. For DUKES 2016, we will be exploring non-energy use in more detail to improve the accuracy of these data.

Sectors used for sales/consumption

4.27 For definitions of the various sectors used for sales and consumption analyses see Chapter 1 paragraphs 1.55 to 1.60 and Annex A, paragraphs A.31 to A.42.

Data collection

4.28 Production figures are generally obtained from returns made under OGA's Petroleum Production Reporting System (PPRS). BEIS also obtain data on the transmission of natural gas from National Grid (who operate the National Transmission System) and from other pipeline operators. Data on consumption are based on returns from gas suppliers and UK Continental Shelf (UKCS) producers who supply gas directly to customers, (see paragraph 4.31).

4.29 The production data are for the UK (including natural gas from the UKCS - offshore and onshore). The restoration of a public gas supply to parts of Northern Ireland in 1997 means that all tables in this chapter, except Tables 4A and 4B, cover the UK.

4.30 BEIS carry out an annual survey of gas suppliers to obtain details of gas sales to the various categories of consumer. The larger gas suppliers (defined as those with more than about a 0.5 per cent share of the UK market up to 1997 and those known to supply more than 1,750 GWh per year for 1998 onwards) provide a detailed breakdown of sales for final consumption to BEIS on an annual basis. This provides the main data source for the UK's gas demand. Prior to 2013 data, companies supplying less than 1,750 GWh provided gas sales as a single sum which was then apportioned across sectors using the same proportional split as seen in the data from the large suppliers. From 2013 onwards, data from smaller suppliers were provided broken down by broad sector (e.g. domestic, other industry etc.) to allow more accurate apportioning of these data.

4.31 Data on sectoral gas use are primarily derived from surveys of large and small gas suppliers. Beyond this, data for electricity generation by major power producers are adjusted, such that the data agree with a separate data set collected via the Major Power Producers' (MPP) survey. Data for autogenerators are similarly adjusted to match CHP data (see Chapter 7) provided to BEIS, with the appropriate amount of gas used for autogeneration being subtracted from each sector and added to the autogeneration figure. The same methodology is applied for heat sold, which makes up the heat generation figure. For 2000 and subsequent years, gas consumption for the iron and steel sector is based on data provided by the Iron and Steel Statistics Bureau (ISSB) rather than gas suppliers since gas suppliers were over estimating their sales to this sector. The difference between the ISSB and gas suppliers'' figures has been re-allocated to other sectors.

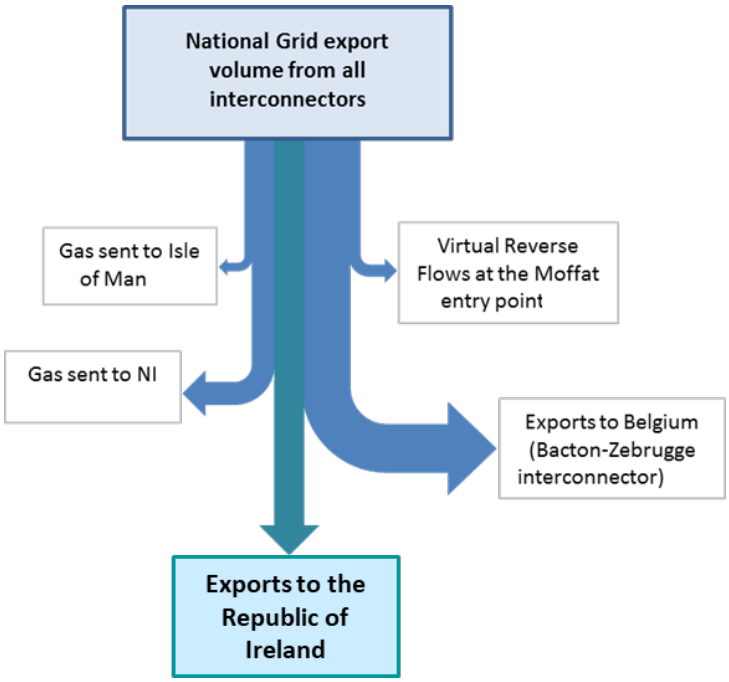
Methodology updates

4.32 Biomethane has been injected into the National Grid from certified Renewable Heat Incentive (RHI) installations since 2014. These volumes have been small, but increasing, with biomethane accounting for 0.3 per cent of supply in 2017. This gas is included in the transfers row in Tables 4.1, 4.2 and 4.3 in this chapter and separately identified in the monthly Energy Trends tables (see Energy Trends June 2017 special feature for details: www.gov.uk/government/uploads/system/uploads/attachment_data/file/622863/Enhancements_to_Energy_Trends_gas_tables.pdf.

4.33 In 2016 BEIS updated the methodology to calculate gas exports to the Republic of Ireland to remove virtual reverse flows, which ensures that only physical flows are reported in line with international reporting standards (see Energy Trends June 2017 special feature for details: www.gov.uk/government/uploads/system/uploads/attachment_data/file/622863/Enhancements_to_Energy_Trends_gas_tables.pdf. Along with this we have used two new data sources, one to identify gas sent to Northern Ireland to improve data capture and another to separately identify gas exports to the Isle of Man. The methodology to calculate exports to the Republic of Ireland is outlined below and illustrated in Figure 4.1:

1. National Grid provide BEIS with data for gas input into the transmission system, stock changes, operator's own use, exports through all interconnectors and gas output from the transmission system in the form of a GM10 report. The exports through all interconnectors are calculated by removing offtakes from Local Distribution Networks (LDZ) from gas transported through companies' pipelines.
2. The export data provided by National Grid is the combined amount of gas sent through the Bacton and Moffat interconnectors along with the Scotland-Northern Ireland Pipeline (SNIP) and therefore is the gas sent out from Great Britain.
3. BEIS then remove gas exports to Belgium through the Bacton interconnector to leave a figure for the amount of gas sent through the Moffat Interconnector to the Republic of Ireland and the Isle of Man along with gas sent to Northern Ireland through the SNIP.
4. BEIS then remove the amount of gas sent to Northern Ireland from Moffat via the SNIP from shipping allocation data from Gas Networks Ireland (GNI).
5. This figure for the Moffat Interconnector from National Grid is currently the nominated flow to Ireland. Therefore, BEIS remove the Virtual Reverse Flow (VRF) from Ireland to the UK to gain a physical flow to ensure that reporting is consistent with methodology from the International Energy Agency (IEA) and Eurostat.
6. The gas taken off on the interconnector to the Isle of Man (data provided by Manx Utilities) is then removed to obtain a figure for the amount of gas exported to the Republic of Ireland.

Figure 4.1: Methodology to calculate exports of gas to Northern Ireland



4.34 BEIS updated our gas data collection methodology and analysis in 2014 (see Energy Trends June 2014 special feature for details: www.gov.uk/government/statistics/energy-trends-june-2014. This change in methodology resulted in shifts in sectoral gas use going back to 2008. In particular, gas use shifted out of the industrial sector, with a subsequent increase in the services sector.

Period covered

4.35 Figures generally relate to years ended 31 December. However, before 2004, data for natural gas for electricity generation relate to periods of 52 weeks as set out in Chapter 5, paragraphs 5.83 and 5.84.

Monthly and quarterly data

4.36 Monthly data on natural gas production and supply are available from BEIS's energy statistics website: www.gov.uk/government/collections/gas-statistics in monthly Table 4.2. A quarterly commodity balance for natural gas (which includes consumption data) is published in BEIS's quarterly statistical bulletin *Energy Trends* and is also available from quarterly Table 4.1 on BEIS's energy statistics website.

Statistical and metering differences

4.37 Table 4.3 shows production, transmission and consumption figures for UK continental shelf and onshore natural gas. This table departs from the standard balance methodology and definitions to maintain the link with historical data and with monthly data given on BEIS's energy statistics website. This section of the technical notes illustrates how total gas consumption shown in Table 4.3 and Table 4.1.are mapped across. Production includes waste and own use for drilling, production and pumping operations, but excludes gas flared. Gas available in the UK excludes waste, own use for drilling etc., stock change, and includes imports net of exports. Gas transmitted (input into inland transmission systems) is after stock change, own use, and losses at inland terminals. The amount consumed in the UK differs from the total gas transmitted by the gas supply industry because of losses in transmission, differences in temperature and pressure between the points at which the gas is measured, delays in reading meters and consumption in the works, offices, shops, etc. of the undertakings. The figures include an adjustment to the quantities billed to consumers to allow for the estimated consumption remaining unread at the end of the year.

4.38 In Table 4.3 there are several headings that refer to statistical or metering differences. These arise because measurement of gas flows, in volume and energy terms, takes place at several points along the supply chain. The main sub-headings in the table represent the instances in the supply

chain where accurate reports are made of the gas flows at that particular key point in the supply process. It is possible to derive alternative estimates of the flow of gas at any particular point by taking the estimate for the previous point in the supply chain and then applying the known losses and gains in the subsequent part of the supply chain. The differences seen when the actual reported flow of gas at any point and the derived estimate are compared are separately identified in the table wherever possible, under the headings statistical or metering differences.

4.39 The relationship between total UK gas consumption shown in this Table 4.3 and total demand for natural gas given in the balance Table 4.1 is illustrated for 2017 as follows:

	GWh
Total UK consumption (Table 4.3)	814,756
Plus producers' own use	+49,357
Plus operators' own use	+3,973
Consumption of natural gas	**868,086**
Plus upstream losses and metering differences	+0
Plus downstream losses – leakage assessment	+2,684
Plus downstream losses – own gas use	+116
Plus downstream losses – theft	+164
Plus downstream losses – iron and steel losses	+3
Plus downstream metering differences	+3,776
Total demand for natural gas (Table 4.1)	**874,829**

4.40 The statistical difference row in Table 4.1 is made up of the following components in 2017:

	GWh
Statistical difference between gas available at terminals and gas input to downstream (Table 4.3)	211
Plus Downstream gas industry: Distribution losses and metering differences	+3,707
Statistical difference for natural gas (Table 4.1)	**3.918**

4.41 Losses and metering differences attributable to the information provided on the upstream gas industry are zero from 2001 onwards because these data are no longer reported in the revised PPRS System. This simplified system for reporting the production of crude oil, NGLs and natural gas in the UK was implemented from 1 January 2001; it reduced the burden on the respondents and improved the quality of data reported on gas production.

4.42 The differences in the natural gas commodity balances arise from several factors:-

- Limitations in the accuracy of meters used at various points of the supply chain. While standards are in place on the accuracy of meters, there is a degree of error allowed which, when large flows of gas are being recorded, can become significant.
- Differences in the methods used to calculate the flow of gas in energy terms. For example, at the production end, rougher estimates of the calorific value of the gas produced are used which may be revised only periodically, rather than the more accurate and more frequent analyses carried out further down the supply chain. At the supply end, although the calorific value of gas shows day-to-day variations, for the purposes of recording the gas supplied to customers a single calorific value is used. Until 1997 this was the lowest of the range of calorific values for the actual gas being supplied within each LDZ, resulting in a "loss" of gas in energy terms. In 1997 there was a change to a "capped flow-weighted average" algorithm for calculating calorific values resulting in a reduction in the losses shown in the penultimate row of Table 4.3. This change in algorithm, along with improved meter validation and auditing procedures, also reduced the level of the "metering differences" row within the downstream part of Table 4.3.

- Differences in temperature and pressure between the various points at which gas is measured. Until February 1997 British Gas used “uncorrected therms” on their billing system for tariff customers when converting from a volume measure of the gas used to an energy measure. This made their supply figure too small by a factor of 2.2 per cent, equivalent to about 1 per cent of the wholesale market.
- Differences in the timing of reading meters. While National Transmission System meters are read daily, customers’ meters are read less frequently (perhaps only annually for some domestic customers) and profiling is used to estimate consumption. Profiling will tend to underestimate consumption in a strongly rising market.
- Other losses from the system, for example theft through meter tampering by consumers.

4.43 The headings in Table 4.3 show where, in the various stages of the supply process, it has been possible to identify these metering differences as having an effect. Usually they are aggregated with other net losses as the two factors cannot be separated. Whilst the factors listed above can give rise to either losses or gains, losses are more common. However, the negative downstream gas metering difference within the transmission system in 2003 was an anomaly that was investigated by National Grid during 2004. They concluded that this unaccounted for element of National Transmission System shrinkage was due to an exceptional run of monthly negative figures between February and June 2003 within what is usually a variable but mainly positive series. However, after a comprehensive investigation of this exceptional period no causal factors were identified. It is probable that the meter error or errors that caused this issue were corrected during the validation of metering.

4.44 Care should be exercised in interpreting the figures for individual industries in these commodity balance tables. As companies switch contracts between gas suppliers, it has not been possible to ensure consistent classification between and within industry sectors and across years. The breakdown of final consumption includes a substantial amount of estimated data prior to 2013.

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4.1 Commodity balances

Natural gas

GWh

	2015			2016			2017		
	Natural gas	Colliery methane	Total Natural gas	Natural gas	Colliery methane	Total Natural gas	Natural gas	Colliery methane	Total Natural gas
Supply									
Production	451,437	354	451,791	463,364r	443	463,807r	464,929	490	465,418
Other sources	-	-	-	-	-	-	-	-	-
Imports	501,563	-	501,563	534,740	-	534,740	524,890	-	524,890
Exports	-159,517	-	-159,517	-116,862	-	-116,862	-125,629	-	-125,629
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(1)*	3,515	-	3,515	16,242	-	16,242	11,955	-	11,955
Transfers *(2)*	559	-	559	1,575	-	1,575	2,603	-	2,603
Total supply	**797,558**	**354**	**797,912**	**899,058r**	**443**	**899,502r**	**878,747**	**490**	**879,237**
Statistical difference *(3)*	-2,593r	-	-2,593r	-2,576r	-	-2,576r	3,918	-	3,918
Total demand	**800,151r**	**354**	**800,505r**	**901,635r**	**443**	**902,078r**	**874,829**	**490**	**875,319**
Transformation	**240,865r**	**343**	**241,208r**	**327,047r**	**434**	**327,481r**	**315,640**	**482**	**316,122**
Electricity generation	212,289	343	212,632	297,643	434	298,077	285,549	482	286,031
Major power producers	185,955	-	185,955	271,563	-	271,563	257,599	-	257,599
Autogenerators	26,335	343	26,678	26,080	434	26,514	27,950	482	28,432
Heat generation *(4)*	28,576r	-	28,576r	29,404r	-	29,404r	30,090	-	30,090
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Energy industry use	**58,456r**	**-**	**58,456r**	**57,589r**	**-**	**57,589r**	**57,024**	**-**	**57,024**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil and gas extraction	51,024	-	51,024	50,080r	-	50,080r	49,357	-	49,357
Petroleum refineries	1,012r	-	1,012r	881r	-	881r	1,072	-	1,072
Coal extraction	79	-	79	74r	-	74r	72	-	72
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	323	-	323	291	-	291	294	-	294
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	6,018	-	6,018	6,263	-	6,263	6,229	-	6,229
Losses *(5)*	**8,327r**	-	**8,327r**	**7,139r**	-	**7,139r**	**6,743**	-	**6,743**
Final consumption	**492,503r**	**11**	**492,514r**	**509,860r**	**9**	**509,870r**	**495,422**	**8**	**495,430**
Industry	**97,891r**	**11**	**97,902r**	**97,745r**	**9**	**97,755r**	**100,909**	**8**	**100,917**
Unclassified	-	11	11	-	9	9	-	8	8
Iron and steel	5,303r	-	5,303r	4,084r	-	4,084r	3,854	-	3,854
Non-ferrous metals	3,046r	-	3,046r	2,973r	-	2,973r	3,040	-	3,040
Mineral products	14,190r	-	14,190r	14,251r	-	14,251r	14,216	-	14,216
Chemicals	18,034r	-	18,034r	18,752r	-	18,752r	20,329	-	20,329
Mechanical Engineering etc	11,002r	-	11,002r	10,880r	-	10,880r	11,343	-	11,343
Electrical engineering etc	3,081r	-	3,081r	3,090r	-	3,090r	3,199	-	3,199
Vehicles	6,243r	-	6,243r	6,578r	-	6,578r	6,921	-	6,921
Food, beverages etc	18,167r	-	18,167r	18,431r	-	18,431r	18,889	-	18,889
Textiles, leather etc	2,938r	-	2,938r	2,836r	-	2,836r	2,820	-	2,820
Paper, printing etc	4,583r	-	4,583r	4,497r	-	4,497r	4,545	-	4,545
Other industries	6,927r	-	6,927r	6,944r	-	6,944r	7,085	-	7,085
Construction	4,376r	-	4,376r	4,429r	-	4,429r	4,668	-	4,668
Transport	-	-	-	-	-	-	-	-	-
Air	-	-	-	-	-	-	-	-	-
Rail	-	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	-	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**389,345r**	-	**389,345r**	**407,006r**	-	**407,006r**	**389,557**	-	**389,557**
Domestic	297,582	-	297,582	311,375	-	311,375	297,035	-	297,035
Public administration	36,924r	-	36,924r	37,867r	-	37,867r	36,184	-	36,184
Commercial	43,947r	-	43,947r	46,577r	-	46,577r	44,990	-	44,990
Agriculture	983	-	983	1,146r	-	1,146r	1,278	-	1,278
Miscellaneous	9,910r	-	9,910r	10,041r	-	10,041r	10,070	-	10,070
Non energy use	**5,267**	-	**5,267**	**5,109**	-	**5,109**	**4,956**	-	**4,956**

(1) Stock fall (+), stock rise (-).

(2) Natural gas used in the manufacture of synthetic coke oven gas and biomethane injections into the grid from installations certified under the Renewable He

(3) Total supply minus total demand.

(4) Heat sold to third parties. Heat generation data are not available before 1999. For earlier years gas used to generate heat for sale is allocated to final consumption by sector.

(5) Refers to downstream losses. For an explanation of what is included under these losses, see paragraph 4.39.

4.2 Supply and consumption of natural gas and colliery methane[(1)]

GWh

	2013	2014	2015	2016	2017
Supply					
Production	410,893	415,906	451,791	463,807r	465,418
Imports	548,223	488,937	501,563	534,740	524,890
Exports	-109,664	-127,907	-159,517	-116,862	-125,629
Stock change *(2)*	+621	-2,383	3,515	16,242	+11,955
Transfers *(3)*	-61	-4	559	1,575	+2,603
Total supply	**850,013**	**774,549**	**797,912**	**899,502r**	**879,237**
Statistical difference *(4)*	+1,949	-3,846	-2,593r	-2,576r	+3,918
Total demand	**848,064**	**778,395**	**800,505r**	**902,078r**	**875,319**
Transformation	**230,170**	**243,468**	**241,208r**	**327,481r**	**316,122**
Electricity generation	205,869	217,837	212,632	298,077	286,031
Major power producers	175,210	189,919	185,955	271,563	257,599
Autogenerators	30,659	27,918	26,678	26,514	28,432
Heat generation	24,302	25,631	28,576r	29,404r	30,090
Other	-	-	-	-	-
Energy industry use	**53,219**	**52,470**	**58,456r**	**57,589r**	**57,024**
Electricity generation	-	-	-	-	-
Oil and gas extraction	46,000	45,391	51,024	50,080r	49,357
Petroleum refineries	1,151	1,201	1,012r	881r	1,072
Coal extraction	60	100	79	74r	72
Coke manufacture	-	-	-	-	-
Blast furnaces	363	338	323	291	294
Other	5,645	5,440	6,018	6,263	6,229
Losses *(5)*	**7,473**	**6,856**	**8,327r**	**7,139r**	**6,743**
Final consumption	**557,201**	**475,601**	**492,514r**	**509,870r**	**495,430**
Industry	**105,015**	**100,636**	**97,902r**	**97,755r**	**100,917**
Unclassified	15	13	11	9	8
Iron and steel	5,338	5,454	5,303r	4,084r	3,854
Non-ferrous metals	2,180	2,073	3,046r	2,973r	3,040
Mineral products	11,125	11,105	14,190r	14,251r	14,216
Chemicals	21,676	19,558	18,034r	18,752r	20,329
Mechanical engineering etc	6,194	5,938	11,002r	10,880r	11,343
Electrical engineering etc	2,812	2,779	3,081r	3,090r	3,199
Vehicles	8,480	8,321	6,243r	6,578r	6,921
Food, beverages etc	21,096	20,395	18,167r	18,431r	18,889
Textiles, leather etc	4,757	4,579	2,938r	2,836r	2,820
Paper, printing etc	11,134	10,441	4,583r	4,497r	4,545
Other industries	7,171	7,022	6,927r	6,944r	7,085
Construction	3,037	2,957	4,376r	4,429r	4,668
Transport	-	-	-	-	-
Road *(6)*	-	-	-	-	-
Other	**446,589**	**369,535**	**389,345r**	**407,006r**	**389,557**
Domestic	344,501	283,691	297,582	311,375	297,035
Public administration	42,251	34,972	36,924r	37,867r	36,184
Commercial	47,276	40,189	43,947r	46,577r	44,990
Agriculture	1,096	1,073	983	1,146r	1,278
Miscellaneous	11,465	9,609	9,910r	10,041r	10,070
Non energy use	**5,598**	**5,430**	**5,267**	**5,109**	**4,956**

(1) Colliery methane figures included within these totals are as follows:

	2013	2014	2,015	2,016	2016
Total production	**433**	**391**	**354**	**443**	**490**
Electricity generation	418	378	343	434	482
Coal extraction	-	-	-	-	-
Other industries	15	13	11	9	8
Total consumption	**433**	**391**	**354**	**443**	**490**

(2) Stock fall (+), stock rise (-).

(3) Natural gas used in the manufacture of synthetic coke oven gas and biomethane injections into the grid from installations certified under the Renewable Heat Incentive (RHI).

(4) Total supply minus total demand.

(5) Refers to downstream losses. For an explanation of what is included under these losses, see paragraph 4.39.

(6) A small amount of natural gas is consumed by road transport, but gas use in this sector is predominantly of petroleum gas, hence road use of gas is reported in the petroleum products balances in Chapter 3.

4.3 UK continental shelf and onshore natural gas production and supply[(1)]

GWh

	2013	2014	2015	2016	2017
Upstream gas industry:					
Gross production *(2)*	410,460	415,515	451,437	463,364r	464,929
Minus Producers' own use *(3)*	46,000	45,391	51,024	50,080r	49,357
Exports	109,664	127,907	159,517	116,862	125,629
Plus Imports of gas	548,223	488,937	501,563	534,740	524,890
Gas available at terminals *(4)*	803,019	731,153	742,459	831,162r	814,832
Minus Statistical difference *(5)*	-459	-984	921	196r	211r
Downstream gas industry:					
Gas input into the national transmission system *(6)*	803,478	732,137	741,539	830,966	814,621
Minus Operators' own use (7)	3,534	3,331	4,009	4,177	3,973
Stock change (storage sites) *(8)*	-621	2,383	-3,515	-16,242	-11,955
Metering differences *(5)*	5,697	5,302	5,219	4,065	3,776
Gas output from the national transmission system *(9)*	794,869	721,121	735,826	838,966	818,828
Minus Leakage assessment *(10)*	1,537	1,370	2,846r	2,763r	2,684
Own use gas *(11)*	34	30	112r	140r	116
Theft *(12)*	203	153	148	168r	164
Transfers *(13)*	61	4	-559	-1,575	-2,603
Losses *(14)*	2	1	2	3	3
Statistical difference and metering differences *(5)*	2,407	-2,862	-3,514r	-2,772r	3,707
Total UK consumption *(15)*	**790,624**	**722,425**	**736,791r**	**840,240r**	**814,756**
Stocks of gas (at end year) *(16)*	45,801	48,184	42,333r	26,091r	14,136
Storage capacity *(17)*	51,059	50,728	50,949	52,294	15,902

(1) For details of where to find monthly updates of natural gas production and supply see paragraph 4.36.
(2) Includes waste and producers' own use, but excludes gas flared.
(3) Gas used for drilling, production and pumping operations.
(4) The volume of gas available at terminals for consumption in the UK as recorded by the terminal operators.
(5) Measurement of gas flows, in volume and energy terms, occurs at several points along the supply chain. As such, differences are seen between the actual recorded flow through any one point and estimates calculated for the flow of gas at that point. More detail on the reasons for these differences is given in the technical notes and definitions section of this chapter, paragraphs 4.38 to 4.43.
(6) Gas received as reported by the pipeline operators. The pipeline operators include National Grid, who run the national pipeline network, and other pipelines that take North Sea gas supplies direct to consumers.
(7) Gas consumed by pipeline operators in pumping operations and on their own sites.
(8) Stocks of gas held in specific storage sites, either as liquefied natural gas, pumped into salt cavities or stored by pumping the gas back into an offshore field. Stock rise (+), stock fall (-).
(9) Including public gas supply, direct supplies by North Sea producers, third party supplies and stock changes.
(10) This is a National Grid assessment of leakage through the local distribution system based on the National Leakage Reduction Monitoring Model.
(11) Currently quivalent to about 0.0113 per cent of LDZ throughput, this is an assessment of the energy used to counter the effects of gas cooling on pressure reduction.
(12) Calculated by National Grid as 0.02 per cent of LDZ throughput, this is theft before the gas reaches customer meters.
(13) Transfers are the use within the iron and steel industry for the manufacture of synthetic coke oven gas and biomethane injections into the grid from installations certified under the Renewable Heat Incentive (RHI).
(14) Data for losses from the Iron and Steel Statistics Bureau Survey, converted from gigajoules to GWh assuming 0.2778 terajoules per GWh
(15) See paragraph 4.39 for an explanation of the relationship between these "Total UK consumption" figures and "Total demand" shown within the balance tables.
(16) Due to storage reconciliations, own use and metering differences, over a long period of years the stock levels based on gas put into storage and gas taken out of storage no longer reconciled with storage levels reported by National Grid. For 2011 action was taken to rectify this.
(17) Data compiled by BEIS from individual storage site information. Converted from billion cubic metres to GWh assuming 11.02 kWh per cubic metre.

4.4 Gas storage sites and import/export facilities in the United Kingdom at 1 November 2017 (1)

Owner	Site	Location	Space (Billion m^3)	Approximate maximum delivery (Million m^3/day)	Type	Status *(2)*
Operational storage						
Centrica Storage Ltd	Rough	Southern North Sea	-	-	Depleted field	Long
Scottish and Southern Energy & Statoil	Aldbrough	East Yorkshire	0.30	40	Salt cavern	Medium
E.ON	Holford	Cheshire	0.20	22	Salt cavern	Medium
Scottish and Southern Energy	Hornsea	East Yorkshire	0.30	18	Salt cavern	Medium
EDF Trading	Holehouse Farm	Cheshire	0.02	5	Salt cavern	Medium
Humbly Grove Energy	Humbly Grove	Hampshire	0.30	7	Depleted field	Medium
Scottish Power	Hatfield Moor	South Yorkshire	0.07	1.8	Depleted field	Medium
EDF Energy	Hill Top Farm	Cheshire	0.05	12	Salt cavern	Medium
Storenergy	Stublach	Cheshire	0.20	15	Salt cavern	Medium

Facilities	Owner	Between / Location	Max flow rate (Million m3/day)
Imports			
Operational pipelines			
Bacton-Zeebrugge Interconnector	Interconnector (UK) Limited	Zeebrugge and Bacton	74
Langeled Pipeline	Gassco	Nyhamna and Easington	72
BBL Pipeline	BBL Company	Balgzand and Bacton	45
Vesterled Pipeline	Gassco	Heimdal Riser Platform	39
Tampen Link	Gassco	Links Statfjord to FLAGS (terminating at St Fergus)	27
Gjøa Pipeline	Gassco	Links Gjøa/Vega to FLAGS and St Fergus (terminating at St Fergus)	17
SAGE Pipeline	Gassco	Links Alvheim to SAGE (terminating at St Fergus)	7
CATS Pipeline	Gassco	Links Rev and Gaupe to CATS (terminating at Teesside)	1
Liquefied Natural Gas (LNG) terminals			
South Hook	Qatar Petroleum and ExxonMobil	Milford Haven	58
Isle of Grain	National Grid Grain LNG	Kent	56
Dragon	BG Group and Petronas	Milford Haven	21
Teesside GasPort	Excelerate	Teesside	11
Exports			
Bacton-Zeebrugge Interconnector	Interconnector (UK) Limited	Bacton and Zeebrugge	55
UK- Irish Gas Interconnector	Bord Gais	Moffat and Ireland	30

(1) Information on gas storage as detailed in the National Grid Gas Ten Year Statement 2017

(2) Long range, medium range or short range storage. Status is determined both by capacity size and injection, deliverability and storage re-cycling rates.

4.5 Natural gas imports and exports (1)

GWh

	2013	2014	2015	2016	2017
Imports					
by pipelines from:					
Belgium *(2)*	35,367	3,949	2,116	15,414	29,428
The Netherlands *(3)*	81,519	70,293	35,933	47,444	20,766
Norway *(4)*	318,634	278,818	307,943	347,005	393,417
Liquefied Natural Gas (5)	102,620	123,910	152,406	122,310	80,144
of which:	-	-	-	-	-
Algeria	4,492	5,774	*4,807*	*4,776*	*3,630*
Australia	-	-	-		
Belgium				*1,117*	-
Dominican Republic					*680*
Egypt	755	-	-	*120*	-
Nigeria	-	534	*436*	*434*	*734*
Norway	1,068	-	*601*	*2,649*	*1,509*
Peru					*1,493*
Qatar	95,204	113,597	*141,549*	*112,012*	*67,285*
Russia	-	-	-	-	*1,016*
Trinidad & Tobago	1,101	4,004	*5,013*	*1,202*	*2,124*
USA	-	-	-	-	*1,672*
Yemen	-	-	-	-	-
Total Imports	**538,140**	**476,969**	**498,398**	**532,173**	**523,755**
Exports to:	-	-	- -	- -	-
Belgium (2)	27,458	48,074	84,465	67,189	87,873
The Netherlands (6)	18,597	18,852	20,789	18,302	12,574
Norway (7)	20	9	4r	1	2
Republic of Ireland (8)	52,257	47,737	46,898	21,943	18,224
Isle of Man (9)	1,251	1,267	1,192	1,349	1,302
Liquefied Natural Gas (10)	-	-	3,005	5,511	4,519
Total Exports	**99,582**	**115,938**	**156,353**	**114,294**	**124,494**
	-	-	-	-	-
Net Imports *(11)*	**438,558**	**361,030**	**342,045**	**417,879**	**399,261**

(1) This table is also shown as Table G.5 of the Internet Annex G to the Digest.

(2) Physical flows of gas through the Bacton-Zeebrugge Interconnector. In tables 4.1 to 4.3 the commercial flows of gas through the pipeline are used. Commercial flows are the amounts of gas that companies requested be supplied through the pipeline. Net imports are the same whichever measurement is used.

(3) Physical flows via the Bacton-Balgzand (BBL) pipeline. Commissioned in November 2006.

(4) Currently via the Langeled and Vesterled pipelines, the Tampen Link (from Statfjord to FLAGS), Gjoa/Vega (to FLAGS), SAGE pipline to St Fergus and CATS pipeline to Teesside.

(5) From various sources to the Isle of Grain, Milford Haven and Teesside. Includes LNG cargoes that were re-exported.

(6) Direct exports from the Grove, Kew, Chiswick, Markham, Minke, Stamford, Windermere and Wingate offshore gas fields using the Dutch offshore gas pipeline infrastructure.

(7) With effect from September 2007, UK gas from the Blane field to the Norwegian Ula field for injection into the Ula reservoir.

(8) Includes gas to the Isle of Man up until 2004 and then seperately identified.

(9) Gas to Isle of Man seperately identified from exports to the Republic of Ireland from 2005 onwards.

(10) To various sources such as Brazil, United Arab Emirates and Pakistan.

(11) A negative figure means the UK was a net exporter of gas.

4.6 Liquefied Natural Gas imports by terminal

GWh

	2013	2014	2015	2016	2017
LNG Imports via:					
Dragon (*Milford Haven) (1)*	968	3,326	8,015r	4,282r	5,140
Isle of Grain (*Isle of Grain*) *(2)*	15,664	13,808	14,224	21,949r	22,146
South Hook (*Milford Haven*) *(3)*	85,989	106,776	130,167r	96,079	52,858
Teesside GasPort (*Teesside*) *(4)*	-	-	-	-	-
	102,620	**123,910**	**152,406**	**122,310**	**80,144**

(1) Dragon began importing LNG to the UK in August 2009.

(2) LNG imports at Canvey Island commenced in 1965 but ceased in the early 1980's when, with increasing supplies from the North Sea, imports were no longer required. UK natural gas production peaked in 2000 and as a result of falling production LNG imports recommenced at the Isle of Grain in 2005.

(3) South Hook began importing LNG to the UK in April 2009.

(4) Teesside GasPort was commissioned in February 2007.

Chapter 5
Electricity

Key points

- **Electricity generation in the UK in 2017 was broadly stable** compared to the previous two years at 336 TWh, with a continuation of the **shift in fuel mix away from coal.** Unlike previous years, this shift has tended towards a growth in renewable generation aided by the increase in renewable capacity (Table 5.1).

- In 2017, **the share of renewables' generation increased to 29.3 per cent** from 24.5 per cent in 2016. (Table 5.6). This increase resulted from an 12.8 per cent increase in renewables' generation capacity in 2017, reaching 18.3 GW (derated to reflect intermittency), accounting for 22 per cent of generating capacity. (Table 5.7).

- **Low carbon electricity's share of generation increased from 45.6 per cent to a record 50.1 per cent.** This increase was driven by the increase in renewables generation, as nuclear generation decreased by 1.9 per cent compared to 2016. (Table 5.6).

- In contrast, **coal's share of generation fell to 6.7 per cent in 2017 from 9.0 per cent in 2016**. This continued the decline observed in 2016, with generation from coal falling from 31 TWh in 2016 to 23 TWh in 2017. Unlike in 2016 when the gap was filled by gas generation, this also fell in 2017. Gas generation reduced from 143 TWh in 2016 to 137 TWh in 2017, resulting in its share of generation falling to 40.4 per cent. (Table 5.6).

- **Total electricity supply fell by 1.0 per cent to 353 TWh**, as net imports decreased by 16.8 per cent to 14.8 TWh. (Tables 5.6 and 5.1). The **UK remained a net importer of electricity in 2017**, with net imports contributing 4.2 per cent of electricity supply – this was slightly lower than the 5.0 per cent of supply in 2016. (Table 5.1).

- **Final consumption decreased by 1.0 per cent to 301 TWh in 2017**, largely as a result of decreases in the domestic and commercial sectors due to warmer weather.

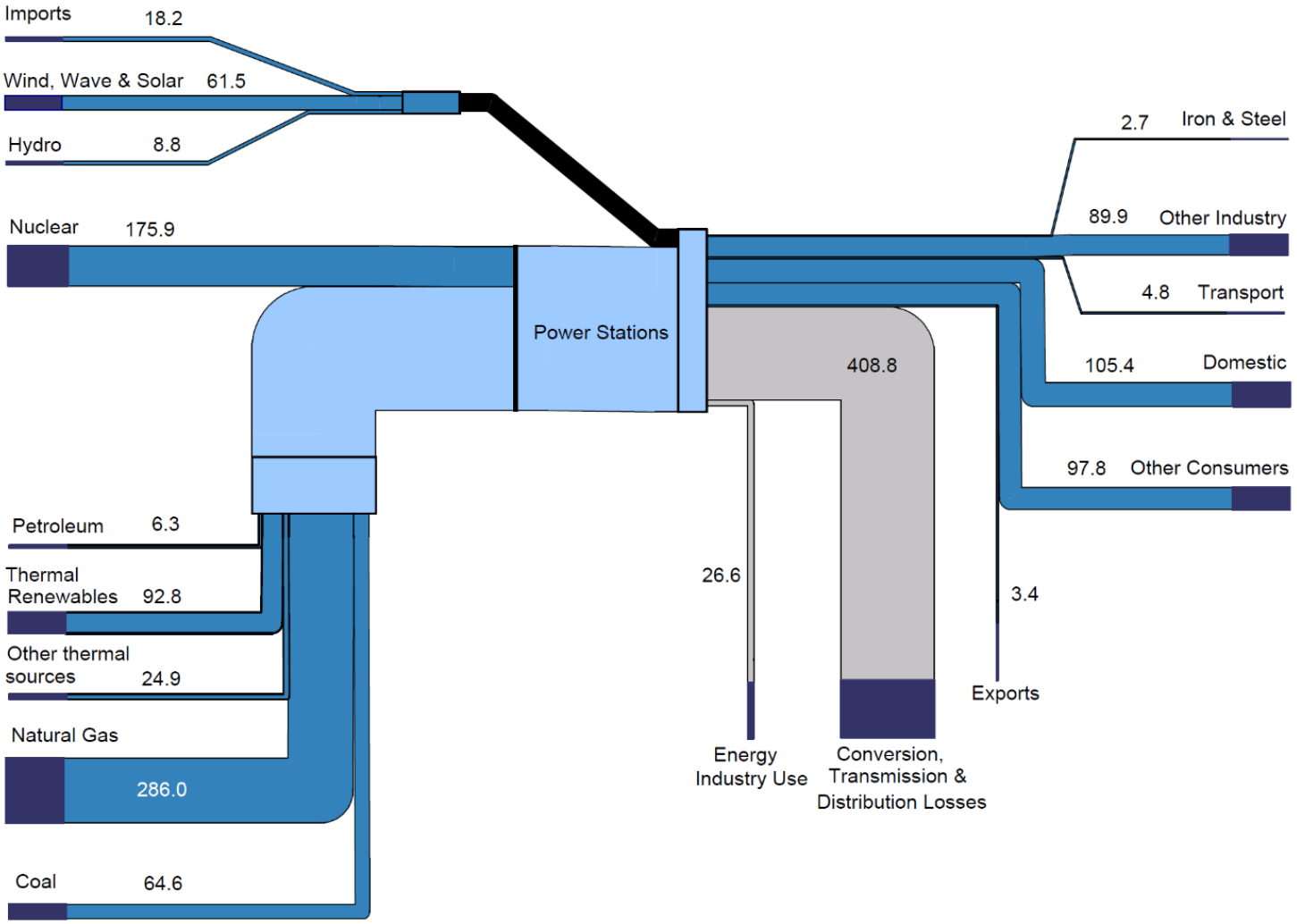
Introduction

5.1 This chapter presents statistics on electricity from generation through to sales, and includes statistics on generating capacity, fuel used for generation, load factors and efficiencies. It also includes a map showing the electricity network in the United Kingdom and the location of the main power stations as at the end of May 2018. A **full list** of tables is available at the end of the chapter.

5.2 **In 2017, electricity consumption accounted for 17.3 per cent of the UK's final consumption.** This proportion has been relatively stable in recent years.

5.3 Overleaf is an energy flow chart for 2017, showing the flows of electricity from fuel inputs through to consumption. It illustrates the flow of primary fuels used for the production of electricity through to the final use of the electricity produced or imported as well as the energy lost in conversion, transmission and distribution. The widths of the bands are proportional to the size of the flows they represent.

Electricity flow chart 2017 (TWh)

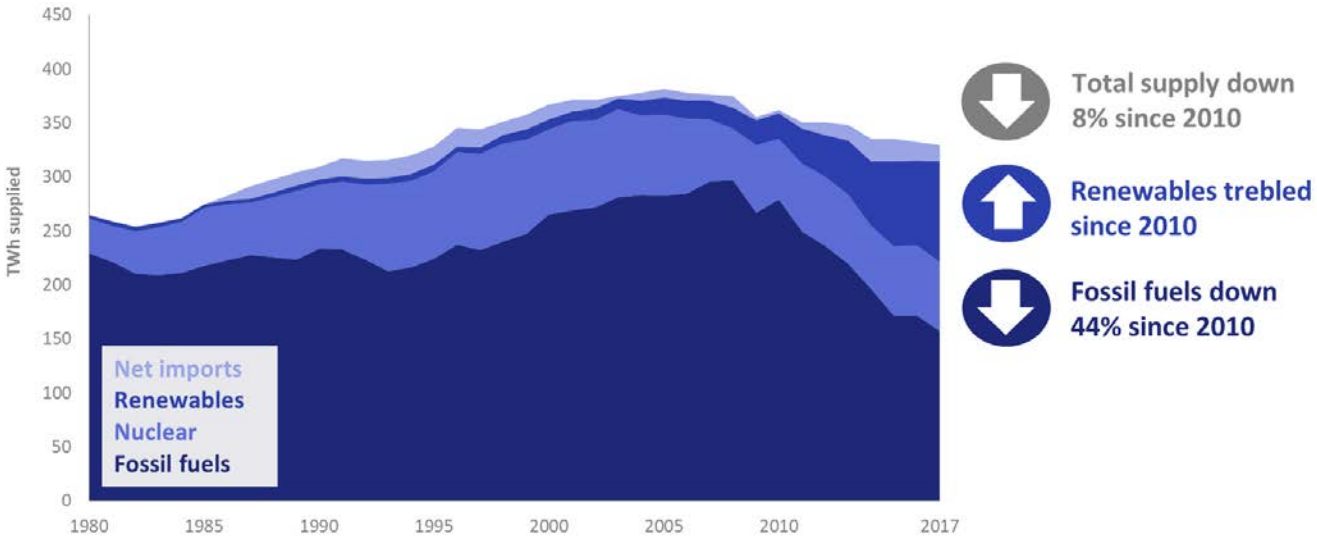


This flow chart is based on the data in Tables 5.1 (for imports, exports, use, losses and consumption) and 5.6 (fuel used).
1. Hydro includes generation from pumped storage while electricity used in pumping is included under Energy Industry Use.
2. Conversion, Transmission and Distribution Losses is calculated as fuel used (Table 5.6) minus generation (Table 5.6) plus losses (Table 5.1).

Electricity supply (Table 5.1)

5.4 **Total UK electricity supply decreased in 2017 to 353 TWh, a reduction of 3.6 TWh compared to 2016.** The total supply from UK generation was 339 TWh (95.8 per cent), with net imports (imports minus exports) accounting for 4.2 per cent of total supply. The proportion of supply from the UK increased in 2017 compared to 2016 as a result of a reduction in imports and increased exports. For electricity, supply is totally driven by demand – the impacts of improving energy efficiency and overall warmer temperatures have seen demand drop since 2005, with final consumption broadly stable since 2014 and at its lowest level in a series since 1995 (see paragraph 5.45). Final consumption fell slightly further in 2017 to 301 TWh.

Chart 5.1: Electricity supply



5.5 As electricity supply is driven by demand, UK generation fell by 0.2 per cent in 2017 compared to 2016, reflecting the demand reduction. The total electricity generated from all generating companies was 336 TWh[1]. Major power producers accounted for 84.9 per cent of generation and 15.1 per cent from other generators. The share of electricity from primary sources (including nuclear, wind, solar and hydro) increased to 41.0 per cent in 2017 compared to 37.1 per cent in 2016, while 59.0 per cent of 2017 generation was from secondary sources (including coal, gas, oil, bioenergy and non-bio waste).

5.6 **Net imports in 2017 were down by 16.8 per cent to 14.8 TWh compared to 17.7 TWh in 2016. These accounted for 4.2 per cent of electricity supplied in 2017**. The UK has four interconnectors allowing trade with Europe: England-France (2 GW capacity), England-Netherlands (1 GW), Northern Ireland-Ireland (0.6 GW) and Wales-Ireland (0.5 GW). Table 5A below shows the UK's net imports via interconnectors during the past three years.

Table 5A: Net Imports via interconnectors 2015 to 2017

GWh

	France – UK[a]	Ireland – N. Ireland[b]	Netherlands – UK[a]	Ireland – Wales[a]	Total
2015	13,838	334	7,999	-1,065	21,106
2016	9,728	399	7,306	313	17,745
2017	7,181	-110	6,858	831	14,760

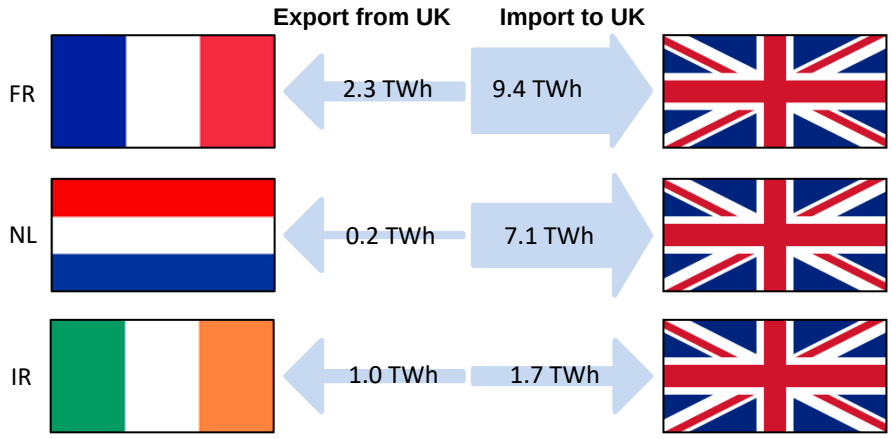
a. Figures taken from the demand data available on the National Grid website at www2.nationalgrid.com/UK/Industry-information/Electricity-transmission-operational-data/Data-Explorer/.

b. Figures taken from data available on the SEMO website at www.semo.com/marketdata/pages/energysettlement.aspx.

[1] Excluding pumped storage production

5.7 **Imports fell by 9.2 per cent whilst exports increased 49.9 per cent, resulting in the 16.8 per cent reduction to net imports.** This trend was a result of repairs to the UK-France interconnector in quarter 1 of 2017, required after damage by a ship's anchor in November 2016. Additionally, in quarter 4 2017 French nuclear outages resulted in increased French electricity prices and increased UK exports. The trend for decreasing utilisation of the French interconnector continued in 2017 falling to 67 per cent from 72 per cent in 2016.

Chart 5.2: Electricity imports and exports in 2017



5.8 Net imports from the Netherlands were down 6.1 per cent, with utilisation of the interconnector down slightly from 88 per cent in 2016 to 83 per cent in 2017. From the two interconnectors with the Republic of Ireland, the UK was a net importer, with net imports of 0.8 TWh from the Ireland-Wales interconnector but a net exporter for the Ireland-Northern Ireland interconnector (-0.1 TWh).

Electricity distributed via the public distribution system and for other generators (Table 5.2)

5.9 The majority of electricity in the United Kingdom is supplied by the public distribution system (PDS), the interconnected high voltage transmission network and lower voltage distribution network. **In 2017, 91.8 per cent of UK electricity was supplied by the PDS, down from 92.8 per cent in 2016.** The remainder was provided by other generators (largely autogeneration and generation from renewable sources). Major power producers[2] (MPPs) provide the majority of power to the PDS, with the remainder made up of transfers from other generators which can sell surplus electricity into the PDS, as well as net imports.

5.10 In 2017, total supply decreased by 1.0 per cent compared to 2016. This decrease was comprised of a 1.7 per cent decrease in electricity from MPPs, a 9.2 per cent decrease in imports and a 49.9 per cent increase in exports. However, electricity supplied from other generators increased by 9.7 per cent to 50.9 TWh of which 21.9 TWh were transferred to the PDS.

5.11 As autogeneration and local generation increased since 2009 (assisted by small scale renewable schemes such as the Feed-in Tariff Scheme in 2010), the proportion of electricity supplied by the PDS has slowly declined. **Since 2009, the share of electricity from the PDS has decreased from 95.2 per cent to 91.8 per cent** (3.4 percentage points (pp)). Other generators sell excess electricity to the PDS, with this amount increasing from 5.7 TWh in 1998 to 21.9 TWh in 2017. In 2017, the proportion of other generator supply sold to the PDS was 43.0 per cent. However, this proportion was lower than in 2015 and 2016, due to the larger increase in total other generator supply compared to the increase in transfers to the PDS.

2 *Further information on the definitions of other generators and MPPs can be found in paragraph 5.72.*

5.12 While total energy industry use in 2017 was very similar to that in 2016 at 26.6 TWh, the proportion used by other generators increased from 24.2 per cent in 2016 to 27.1 per cent in 2017. For some energy industry sectors the proportion of self-generation is much higher, particularly for petroleum refineries where 72.7 per cent of electricity consumption was from self-generation.

5.13 The proportion of final electricity consumption by other generators continued to increase in 2017, to 7.3 per cent. This was up from 6.4 per cent in 2016 and 5.7 per cent in 2015, and continues the trend of increased share of consumption since 2009.

5.14 Other generators and autogenerators produce electricity as part of their manufacturing or other commercial activities, principally for their own use. **Similar to 2016, 10.4 per cent of industrial demand for electricity was met by autogeneration in 2017.** Table 5.4 shows the fuels used by autogenerators to generate this electricity within each major sector and also the quantities of electricity generated and consumed.

5.15 Domestic electricity generation by households with micro-generation units (such as solar photovoltaic panels) increased sharply since the Feed in Tariff (FiT) scheme was launched in April 2010 in Great Britain (see paragraph 6.61 for further information on FiTs uptake). **The trend of increased consumption of self-produced electricity by the domestic sector continued in 2017, to reach 1,420 GWh an increase of 4.7 per cent on 2016**. This is a considerable increase on the 23 GWh when the scheme started in 2010. However, **self-produced electricity still accounts for only 1.3 per cent of domestic consumption**.

5.16 For electricity consumption in the domestic sector, 19.0 per cent was reported as being purchased under some form of off-peak pricing structure (e.g. Economy 7) in 2017, broadly the same as in 2016 (19.1 per cent). Domestic purchases through prepayment systems remained stable at 16.2 per cent of domestic consumption in 2017, stable since 2011.

Combined Heat and Power (CHP) plants

5.17 Combined Heat and Power (CHP) is the simultaneous generation of useable heat and power in a single process, and is frequently referred to as cogeneration. A large proportion of CHP schemes in the UK are covered by the CHPQA programme and are covered in detail in Chapter 7, along with background information. Table 5B shows how much CHP capacity and generation is covered in Chapter 7 using statistics sourced from the CHPQA programme compared to other CHP plants not covered by the scheme.

Table 5B: Combined Heat and Power (CHP) electricity generation and capacity in 2017, compared to UK generation and capacity

		Generation (GWh)	Capacity (MW)
Major Power Producers (Thermal)	CHPQA (ch 7)	5,939	1,990
	CHP (not included in ch 7)	15,480	2,333
	Other thermal generation	215,343	66,631
	Total MPP thermal generation	236,761	70,954
Autogenerators (Thermal)	CHPQA (ch 7)	15,709	3,845
	CHP (not included in ch7)	5,459	448
	Other thermal generation	10,387	6,047
	Total thermal autogeneration	31,554	10,339
Wind, solar & hydro (MPP and autogenerators)		67,461	13,348
Total		**335,776**	**81,294**

5.18 In 2017, CHP comprised 9.0 per cent of MPP's thermal electricity generation, and 67 per cent of thermal autogeneration.

Electricity fuel use, generation and supply (Tables 5.3 & 5.6)

5.19 **With the small decrease in generation, fuel used by all generating companies in 2017 fell 4.5 per cent.** This trend was largely a result of the generation mix shifting to more low carbon alternatives. Coal use was 26.3 per cent lower in 2017 than in 2016, and typically covered peak demand over the winter season. Gas use decreased by 4.0 per cent from 25.6 mtoe to 24.6 mtoe in 2017. For other generators, gas use increased by 7.2 per cent between 2016 and 2017 to 2.4 mtoe, but decreased by 5.1 per cent to 22.2 mtoe for MPPs over the same period (Table 5.3).

5.20 The **United Kingdom generated 338.6 TWh of electricity in 2017**, this includes 2.9 TWh of pumped storage generation. This total generation was very similar to the amount generated in 2016 (0.2 per cent lower). Including pumped storage, major power producers (MPPs, companies whose main business is generating electricity as defined in paragraph 5.73) accounted for 85.0 per cent of generation, with the remaining 15.0 per cent supplied by other generators. MPP generation was 287.8 TWh in 2017 (1.8 per cent lower than in 2016), while other generators produced 50.9 TWh of electricity, an increase of 9.7 per cent on 2016 (Table 5.6).

5.21 While 2016 saw large shifts in the mix of fuels for electricity generation, the trend continued at a slower rate in 2017. The largest change was again in coal; **generation from coal decreased by 26.5 per cent** compared to 2016, and in comparison to 2015 decreased by 70.3 per cent. In 2017, gas generation decreased to 136.7 TWh (-4.6 per cent compared to 2016); this was in contrast to the large increase in gas generation in 2016. The generation from gas in 2017 is still higher than that in 2015. The main driver for the shift in generation between coal and gas was an increase in the carbon price floor in April 2015, from £9 per tonne of CO_2 to £18 per tonne of CO_2. Since coal generation produces more than double the carbon dioxide per GWh of electricity supplied compared to gas, this made generation from coal more expensive than gas. Therefore the coal-fired plants tended to reserve generation for periods of highest demand. Additionally, two large coal power plants closed in March 2016, reducing coal-fired capacity.

5.22 Nuclear generation fell 1.9 per cent from 71.7 TWh to 70.3 TWh in 2017, which is very similar to the level of generation in 2015. This reduction in nuclear generation was due to a slight increase in outages in 2017 compared to 2016.

5.23 The growth in renewable generation was a major trend in 2017. Renewable generation[3] increased by 19.5 per cent in 2017 compared to the previous year. This trend is a result of weather conditions and capacity. In 2017, the average wind speed across the year was 0.4 knots higher than in 2016, while the average daily hours of sun was broadly the same, but the level of rainfall decreased slightly. Over 2017, renewable generators capacity increased by 12.8 per cent (see Table 5.7 for more detail).

5.24 **Generation from wind and solar[4] sources increased to 61.5 TWh in 2017** from 47.7 TWh in 2016 (+29.1 per cent). This large increase was largely a result of a 22.6 per cent increase in wind capacity and a 7.3 per cent increase in solar capacity. A capacity increase of 1.0 per cent helped to **increase natural hydro generation by 10.0 per cent to 5.9 TWh**. Additionally, **generation from bio-energy (including biodegradable wastes) increased to 31.9 TWh, an increase of 6.0 per cent** compared to 2016[5]. More information on renewable electricity can be found in Chapter 6.

5.25 Not all electricity produced by generators is available for use as plants require a portion for their own works. Deducting stations' own use, in 2017 gross electricity supplied was 323.2 TWh, 0.3 per cent lower than in 2016 (Table 5.6).

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[3] Renewables include wind, natural flow hydro, solar, wave, tidal and bioenergy (including co-firing).

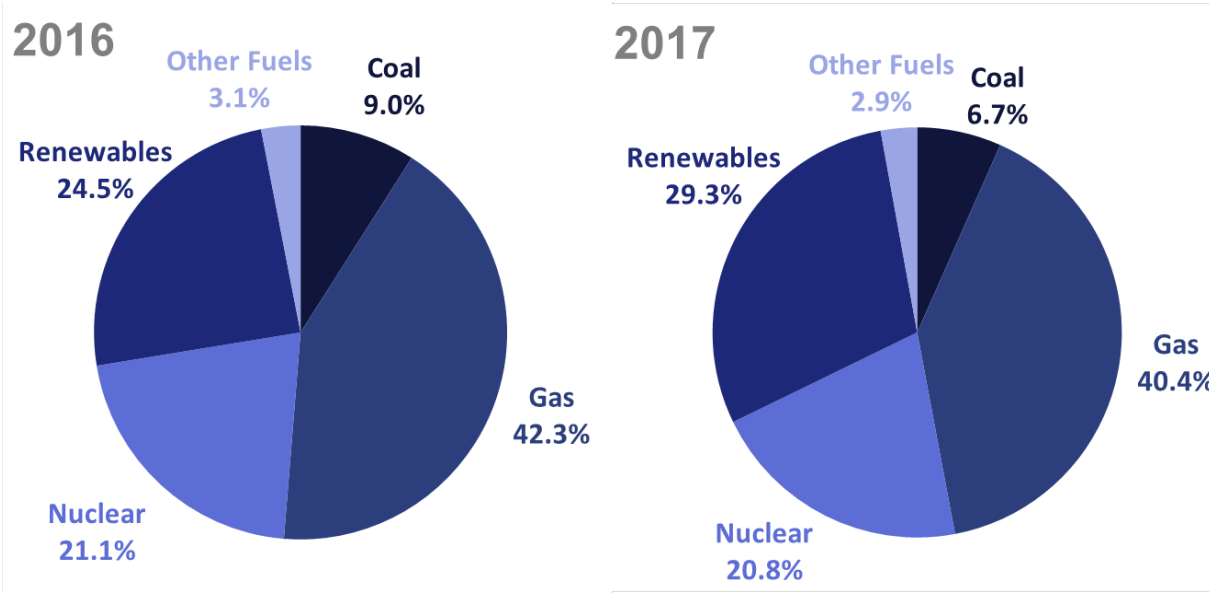
[4] Including generation from wave and tidal

[5] For consistency with the Renewables Chapter (Chapter 6), non-biodegradable wastes (previously included in thermal renewables / bio-energy) have been moved to the 'other fuels' category for 2007 onwards for autogeneration and for 2013 onwards for MPPs. Prior to this, they have remained in thermal renewables.

5.26 Chart 5.3 shows the share of 2017 generation by fuel, on an output basis (i.e. the percentage of electricity generated by the fuel), compared with 2016. Further information on this and the alternative input basis of comparing fuel use can be found in paragraph 5.81.

5.27 Following the significant shift in generation in 2016 from coal to gas, the trend away from coal continued in 2017. Coal's share fell by 2.4 percentage points from 9.0 per cent in 2016 to 6.7 per cent in 2017. Gas's share of generation reduced by 1.9 percentage points to 40.4 per cent. Most notably the share from renewables increased by 4.8 percentage points in 2017 to 29.3 per cent, from 24.5 per cent in 2016, with the renewable's share stable in 2016 compared to 2015. Renewable's share of generation was a record high in 2017. Nuclear generation accounted for 20.8 per cent of generation, broadly stable on 2016 (21.1 per cent).

Chart 5.3: Shares of electricity generation, by fuel



5.28 A historical series of fuel used in generation on a consistent, energy supplied, fuel input basis is available at Table 5.1.1 on the BEIS section of the GOV.UK website and accessible from the Digest of UK Energy Statistics home page: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Plant capacity (Tables 5.7, 5.8 and 5.9)

5.29 Electricity generation capacity is the maximum power available to the UK at any one time. Capacity is provided by Major Power Producers[6] (MPPs, companies whose main business is the generation of electricity) and other generators including non-MPP renewables. In this section, wind, small scale hydro and solar PV capacity is de-rated to account for intermittency, to enable direct comparison with conventional fuels which are less dependent on the weather (Table 5.7).

5.30 **Total capacity of all generators increased to 81,294 MW in 2017**; an increase of 4.0 per cent on the 78,188 MW capacity in 2016. Of this total capacity, MPPs accounted for 70,954 MW (87.3 per cent), a 4.0 per cent increase on the 68,203 MW MPP capacity in 2016. Similarly, other generator capacity increased by 3.5 per cent compared to 2016 to 10,339 MW. The share of capacity between MPPs and other generators was broadly similar in 2017 as in the previous year.

5.31 The notable **increases in capacity were for renewable generation capacity, which increased by 12.8 per cent to 18,288 MW in 2017** from 16,211 MW in 2016. **Wind capacity increased by 22.6 per cent** from 6,955 MW in 2016 to 8,529 MW in 2017, increasing wind's share of all capacity to 10.5 per cent (a 1.6 percentage point increase). The increase in wind capacity was evidenced for both MPPs and other generators, up 25.5 per cent and 12.6 per cent, respectively.

5.32 For all generators, **solar capacity increased by 7.3 per cent** in 2017 to 2,172 MW from 2,025 MW in 2016, though its share of capacity remained stable at 2.7 per cent. Notably the increase in solar capacity was driven by MPPs, where capacity increased by 43.5 per cent to 574 MW in 2017 compared to 400 MW in 2016. For other generators, solar capacity decreased slightly (-1.7 per cent).

5.33 For other renewables (excluding hydro, wind and solar) capacity increased to 5,964 MW from 5,624 MW in 2016 (+6.0 per cent). This increase was largely driven by the increased other generator capacity, up to 3,379 MW in 2017. The past seven years have seen the closure, capacity reduction, full/partial mothballing or conversion to biomass of several large power stations. These are summarised in Table 5C overleaf.

5.34 The capacity of gas turbines and oil engines increased significantly in 2017. This was due to a reclassification of the Killingholme plant from CCGT to OCGT.

[6] *From 2006 onwards, MPP capacities are measured in Transmission Entry Capacity (TEC) terms, rather than Declared Net Capacity (DNC). The effect of this change has been to increase the capacity of MPPs by about 2,000 MW in total. A full definition of TEC and DNC is given in paragraph 5.86. Wind, small scale hydro, and solar photovoltaic DNC is de-rated to take into account intermittency. Renewables installed capacity figures are given in table 6.4.*

Table 5C: Major Power Producers capacity closed, converted or reduced (as at end of May 2018), since end-2010

Site	Fuel	Status	Previous Capacity (MW)	New Capacity (MW)	Year of closure, capacity reduction or conversion
Fife	CCGT	Closed	123	0	2011
Derwent	CCGT-CHP	Closed	228	0	2012
Shotton	CCGT-CHP	Closed	210	0	2012
Kingsnorth A	Coal/Oil	Closed	1,940	0	2012
Grain A	Oil	Closed	1,300	0	2012
Oldbury	Nuclear [1]	Closed	434	0	2012
Wylfa (Reactor 2)	Nuclear [2]	Partially Closed	980	490	2012
Keadby	CCGT	Mothballed	749	0	2013
Kings Lynn	CCGT	Mothballed	340	0	2013
Roosecote	CCGT	Mothballed	229	0	2013
Cockenzie	Coal	Closed	1,152	0	2013
Drax	Coal [3]	Partially Converted	3,870	3,225	2013
Drax	Biomass	Partially Converted	0	645	2013
Ironbridge	Coal [4]	Converted	940	370	2013
Tilbury B	Biomass [5]	Closed	750	0	2013
Didcot A	Coal/Gas	Closed	1,958	0	2013
Fawley	Oil	Closed	1,036	0	2013
Teeside	OCGT [6]	Closed	45	0	2013
Ferrybridge C	Coal	Partially Closed	1,960	980	2014
Drax	Coal [3]	Partially Converted	3,225	2,580	2014
Drax	Biomass	Partially Converted	645	1,290	2014
Barking	CCGT	Closed	1,000	0	2014
Littlebrook D	Oil	Closed	1,370	0	2015
Drax	Coal [3]	Partially Converted	2,580	1,935	2015
Drax	Biomass	Partially Converted	1,290	1,935	2015
Ironbridge	Biomass	Closed	370	0	2015
Lynemouth	Coal	Mothballed	420	0	2015
Wylfa (Reactor 1)	Nuclear [2]	Closed	490	0	2015
Ferrybridge C	Coal	Closed	980	0	2016
Killingholme A&B	CCGT	Converted	900	0	2016
Killingholme A&B	OCGT	Converted	0	600	2016
Longannet	Coal	Closed	2,260	0	2016

1. Reactor 2 with capacity of 217 MW closed on 30 June 2011, reactor 1 with capacity of 217 MW closed on 29 February 2012.

2. Reactor 2 closed on 30 April 2012, reactor 1 closed on 31 December 2015 (both with a capacity of 490 MW).

3. Partly converted to biomass. One unit (645 MW) converted to biomass in 2013, a second unit (also 645 MW) converted to biomass in 2014 and a third unit (also 645 MW) converted to high-range co-firing (85% to <100% biomass) in 2015. Overall capacity remains at 3,870 MW (coal 1,935 MW, biomass 1,935 MW).

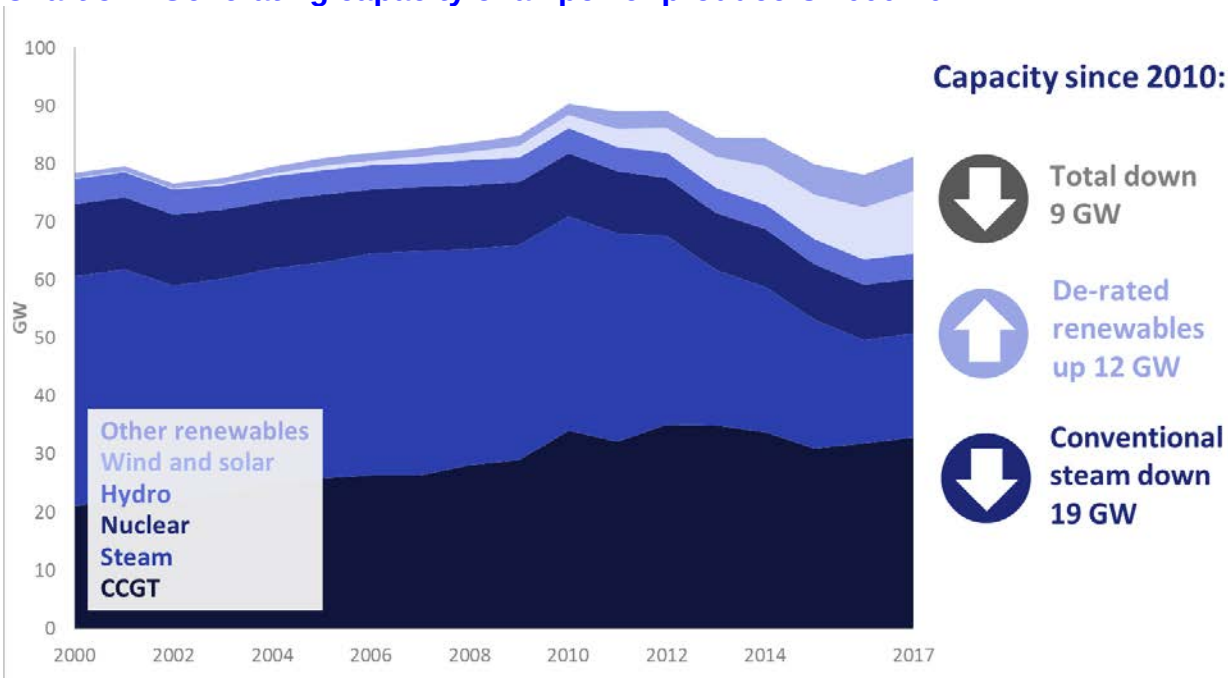
4. Converted from coal to dedicated biomass in 2013 (at 740 MW), before reducing to 370 MW in April 2014.

5. Converted from coal at 1,063 MW capacity to dedicated biomass at 750 MW capacity in 2011 before closing in 2013.

6. Reduced capacity from 1,875 MW (CCGT 1,830 MW / OCGT 45 MW) to 45 MW (OCGT) in 2011 before closing in 2013.

5.35 Since 2010, MPP plant closures and an increase in small-scale renewable capacity saw the **MPP's proportion of total generating capacity steadily fall from 92 per cent in 2010 to 87.3 per cent in 2017**. The capacity of other generators increased correspondingly, from 8 per cent to 12.7 per cent over the same period. Between 2016 and 2017, the capacity of other generators increased by 354 MW (3.5 per cent). The capacity of renewables from other generators increased by 484 MW. This increase came from wind (+191 MW) and other renewables (excluding hydro, wind and solar; +307 MW); however, solar[7] capacity decreased by 27 MW. Non-renewable power station capacity decreased by 74 MW for conventional steam stations and 56 MW for Combined Cycle Gas Turbine (CCGT) stations. A breakdown of the capacity of all generating plants at the end of December each year from 2000 to 2017 is shown in Chart 5.4.

Chart 5.4: Generating capacity of all power producers 2000-2017



1. 'Conventional steam' includes a small proportion of non-CCGT plants, gas turbines and plants that can be fuelled by a combination of gas, coal and oil.
2. 'Hydro' includes natural flow and pumped storage.
3. 'Other renewables' includes biofuels.
4. Wind included from 2007

5.36 In 2017, 84.7 per cent of the generating capacity in the UK owned by MPPs was in England and Wales, 11.9 per cent was in Scotland and 3.3 per cent in Northern Ireland. Of the net increase in UK MPP capacity of 2,751 MW between 2016 and 2017, there was a 2,140 MW increase in England and Wales and a 540 MW increase in Scotland, while for Northern Ireland capacity increased by 71 MW (Table 5.8).

5.37 Non-MPP generators include autogenerators, businesses that generate their own electricity and may export surplus to the grid, and microgeneration by the domestic and commercial sectors. In 2017, 71.5 per cent of capacity was in the commercial and domestic sectors, stable on a year earlier[8]. By industry, the oil and gas sector had the largest share of capacity at 8.5 per cent, followed by chemicals (6.5 per cent of capacity), food, drink and tobacco (4.8 per cent) and paper industries (4.0 per cent).

[7] *Includes solar photovoltaic capacity installed under the Feed in Tariff (FiT) scheme. For further information on FiTs, see Chapter 6.*

[8] *The total capacity of 'Other Generators' fell in 2007 as, from this point, the capacity of major wind farm operators are included under MPPs (see paragraph 5.73). In 2008, Shotton CHP plant was re-classified as a MPP as the electricity generated is now exported to the grid rather than for use in the nearby paper mill. This change in classification led to a fall in capacity in the paper, printing and publishing sector.*

The shares were broadly similar for all industries in 2017 compared to 2016, as capacity increased by only 1.5 per cent in 2017 compared to 2016 (Table 5.9).

5.38 In Table 5.9, data for the generating capacity for generators other than MPPs are shown according to the industrial classification of the generator. For CHP, schemes are classified according to the sector that receives the majority of the heat (as opposed to the sector in which the CHP operator was considered to operate).

Plant loads, demand and efficiency (Table 5.10)

5.39 The maximum load (demand) in the UK during the winter of 2017/2018[9] was 52,279 MW, which occurred on 1st March 2018, in the half-hour ending 18:30; this was 1.2 per cent lower than the previous winter's maximum (on 26 January 2017). This occurred at the time of maximum demand in Great Britain (50,700 MW)[10]; at this time, Northern Ireland had a load of 1,579 MW. The timing of this maximum load reflects the extremely cold period experienced by the UK in late-February and early-March 2018. In Northern Ireland, the maximum load occurred on 27 November 2017 at the period ending 17:30 (1,715 MW), which was 1.5 per cent below that of the previous winter.

5.40 **Maximum demand in 2017/2018 was 73.7 per cent of the UK capacity of major power producers** (as shown in Table 5.7) as measured at the end of December 2017, a 3.9 percentage point decrease on 2016/2017.

5.41 In Great Britain, maximum demand in 2017/2018 was 73.7 per cent of the England, Wales and Scotland capacity of MPPs (Table 5.8). For Northern Ireland, the proportion was 66.7 per cent (75.7 per cent in 2016/17). These percentages do not include the capacities available via the interconnectors with neighbouring grid systems nor demand for electricity via these interconnectors.

5.42 Plant load factors measure how intensively each type of plant has been used, with a higher value demonstrating a higher intensity of use. For all plants in 2017, the load factor was 46.1 per cent, a decrease of 1.2 percentage points on 2016. Nuclear stations had the highest plant load factor at 77.4 per cent, which was 0.8 percentage points lower than that in 2016 due to more maintenance outages. CCGT station load factors decreased the most (-4.3 percentage points) to 45.3 per cent, as a result of increased capacity but reduced supply as renewables generation displaced generation from fossil fuels. Reflecting the transition away from coal with reduced capacity and generation demand, the coal fired power station load factor decreased to 17.3 per cent (-3.9 percentage points).

5.43 Load factors for natural flow hydro and wind (as well as other renewables) can be found in table 6.5[11], with a summary of the trends on an unchanged configuration basis provided here. Weather conditions affected the load factors of renewable generators, with higher wind speeds but reduced sun hours and rainfall. **The overall wind load factor was 31.6 per cent, an increase of 2.8 percentage points on 2016.** This value was slightly lower (-1.7 percentage points) than the record in 2015. For onshore wind, the load factor increased from 24.2 per cent in 2016 to 27.3 per cent in 2017 (+3.1 percentage points), with offshore wind also increasing from 36.7 per cent to 40.0 per cent in 2017 (+3.3 percentage points). While rainfall levels were lower in 2017 than 2016 (-3.6 per cent), the hydro load factor increased to 35.8 per cent (+1.8 percentage points) [12], reflecting the increased supply from hydro generation. Based on the data in table 5.10, the pumped storage load factor in 2017 was slightly lower than in 2016 at 11.9 per cent (-0.3 percentage points).

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9 Maximum demand figures cover the winter period ending the following March. With the advent of the British Electricity Trading and Transmission Arrangements (BETTA) (see paragraph 5.63), England, Wales and Scotland are covered by a single network and a single maximum load is shown for Great Britain for 2006 to 2016.

10 In Great Britain the highest ever load met was 60,118 MW on 10 December 2002.

11 The load factors presented in table 5.10 use transmission entry capacity (as presented in table 5.7). For hydro and wind, this has been de-rated for intermittency, so is not suitable for calculating load factors. The installed capacity measure used in Chapter 6 has not been de-rated.

12 For renewables load factors, including the unchanged configuration and standard (average beginning and end of year) measures, see table 6.5

5.44 Thermal efficiency measures the efficiency with which the heat energy in fuel is converted into electrical energy. Generally, nuclear efficiency has remained between 38 and 40 per cent over the last decade, with it remaining at 40 per cent in 2017. The efficiencies presented here are calculated using **gross** calorific values to obtain the energy content of the fuel inputs[13]. The largest change in thermal efficiency was for CCGT stations, with a 5.3 percentage point decrease to 50.0 per cent.

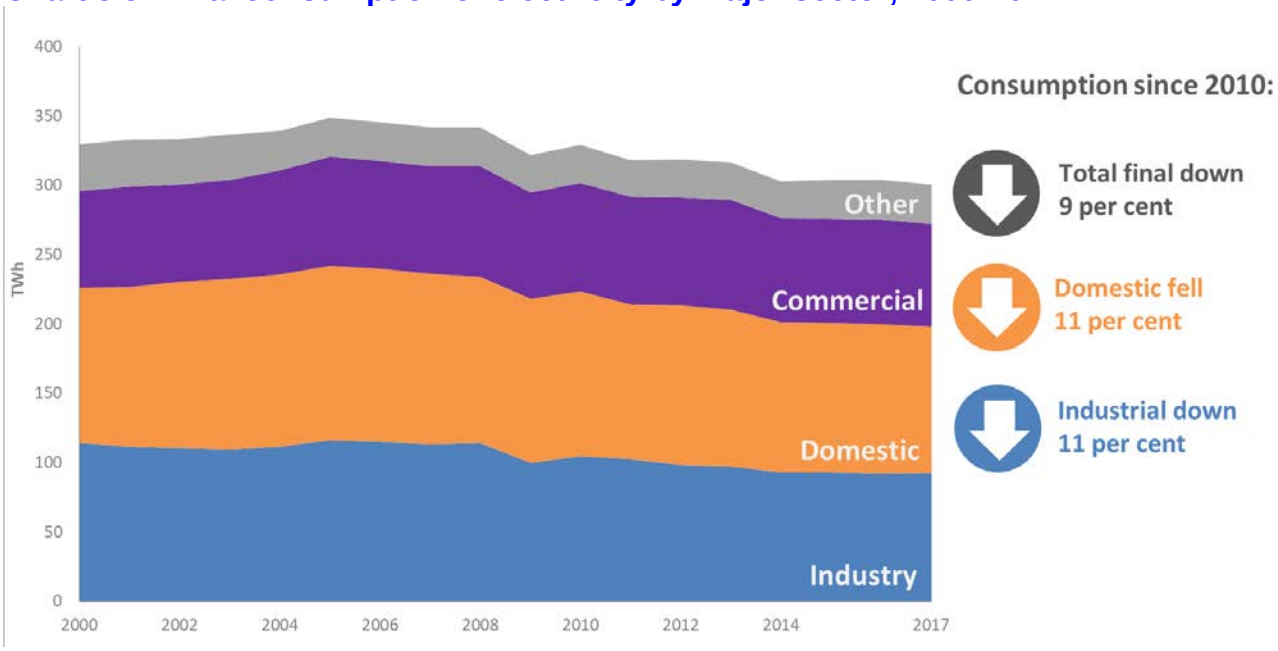
Electricity demand and consumption (Table 5.1)

5.45 **Total electricity demand fell by 0.8 per cent in 2017** to 353.8 TWh compared to 356.5 TWh in 2016. This total demand was divided into the following key components; 26.6 TWh (7.5 per cent) was used within the energy industry; losses accounted for 26.5 TWh (7.5 per cent); and the largest component was final consumption at 300.7 TWh (85.0 per cent). The proportion of demand accounted for by final consumption was broadly similar to that in 2015 and 2016, as demand and final consumption reduced by similar amounts. Final consumption was at its lowest level since 1995 in 2017. Electricity demand broadly equals supply, although for a number of reasons there is a small difference which is termed the statistical difference[14].

5.46 Temperatures influence the actual level of consumption, especially in the winter months, as customers adjust heating levels in their homes and businesses. The average temperature for the winter months (covering December to February) in 2016-17 was 1.1 degrees colder than the same period a year earlier, as December 2016 and January 2017 were colder than the preceding year. In 2017, the daily average temperature was 0.3 degrees Celsius warmer than in 2016. For the first six months of 2017, the average temperature was 0.9 degrees Celsius warmer than in 2016, while the second six months was 0.4 degrees Celsius colder than in 2016.

5.47 **The average temperature in 2017 was slightly warmer than the previous year reflected in the 2.6 TWh decrease in domestic consumption to 105.4 TWh** (-2.4 per cent decrease). Domestic consumption has generally declined each year from its peak of 126 TWh in 2005, on account of milder winters and continuing energy efficiency improvements. Similar to the 2017 trend for domestic consumption, commercial consumption decreased by 1.7 per cent to 73.8 TWh. Agriculture consumption also decreased by 1.9 per cent, while a smaller decrease occurred in public administration consumption (-0.5 per cent).

Chart 5.5: Final consumption of electricity by major sector, 2000-2017



13 *For more information on gross and net calorific values, see paragraph 5.89.*

14 *Further explanations of the statistical difference can be found in paragraph 5.97 and in paragraph A.19 of DUKES annex A.*

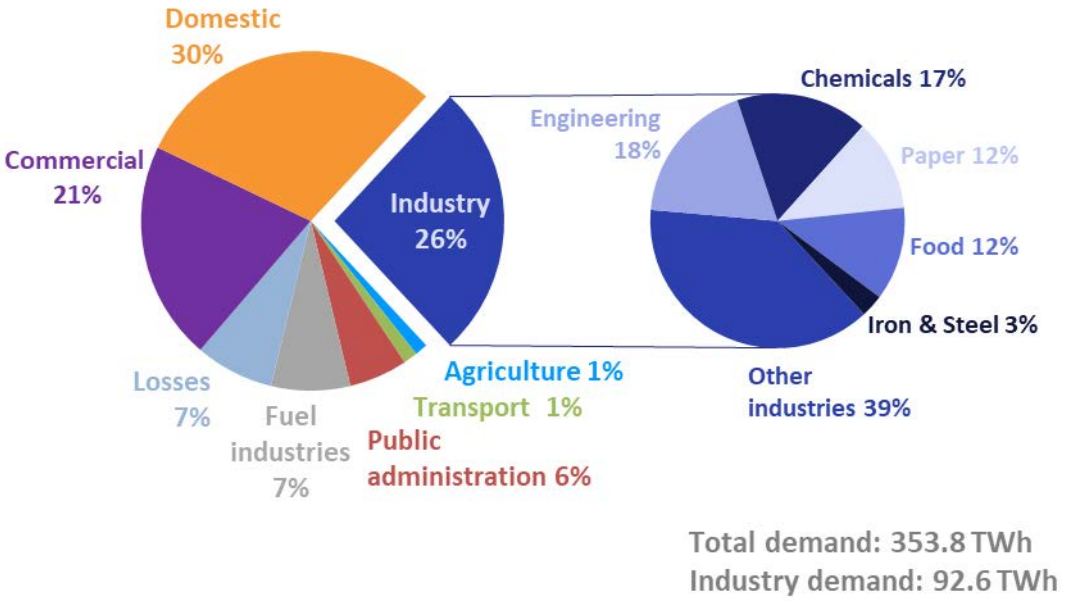
5.48 I**ndustrial consumption has fallen 11.4 per cent since 2010. However, in 2017 industrial consumption increased slightly (+0.9 per cent) compared to 2016, from 91.8 TWh to 92.6 TWh.** The largest decrease was in Iron and Steel, down 6.0 per cent to 2.7 TWh. The largest increase was in the Construction sector, up 8.4 per cent to 1.4 TWh, largely due increase activity in the sector[15].

5.49 **Transport consumption increased to its highest level since 2004, reaching 4.8 TWh** – an increase of 2.1 per cent on 2016**.** Rail accounted for 96.4 per cent of electricity consumption in the transport sector, with the rest (3.6 per cent) from road. Road consumption increased by 33.4 per cent in 2017 compared to 2016 to reach 172 GWh; this reflected the growth in electric vehicles rising from 39,000 to 52,000[16]. The number of electric vehicles has more than doubled since 2014.

5.50 From the total electricity demand of 353.8 TWh, 26.2 per cent was consumed by the industrial sector. Domestic consumption accounted for 29.8 per cent of total demand. The services sector, covering transport, public administration, commercial and agriculture) accounted for a further 29.0 per cent.

5.51 Within industrial consumption (92.6 TWh), the largest specified consumers were chemicals, food and paper, together accounting for 40.3 per cent of industrial consumption. The two engineering consumers and vehicles accounted for a further 18.5 per cent of industrial consumption. The iron and steel sector was also a substantial user of electricity but part of its consumption is included against blast furnaces and coke ovens under energy industry uses. A note on the estimates included within these figures can be found in paragraphs 5.93 to 5.96. Chart 5.6 shows the total demand for electricity in 2016, by final consumer.

Chart 5.6: Electricity demand by sector 2017



5.52 **Energy industry consumption was broadly stable in 2017 compared to 2016 – down 0.1 per cent to 26.6 TWh.** While the amount of electricity used in electricity generation and oil and gas extraction both increased by 1.4 per cent to 15.5 TWh and 0.6 TWh respectively, pumped storage, coke manufacture, petroleum refineries and other uses each decreased. Consumption for electricity

[15] *Office for National Statistics produces the Construction Index (CVM) available here: www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/l2n8/qna, which shows a 7.1 per cent increase for 2017 compared to 2016.*

[16] *Road use is based on data from the Department for Transport on the number of electric cars (table VEH0203, available at www.gov.uk/government/statistical-data-sets/veh02-licensed-cars) and the number of light goods vehicles (table VEH0403, available at www.gov.uk/government/statistical-data-sets/veh04-licensed-light-goods-vehicles).*

generation accounted for 58.2 per cent of energy industry use. The proportion of total demand used by the energy industry remained the same in 2017 as in 2016 at 7.5 per cent.

5.53 Similar to energy industry use, **losses accounted for 7.5 per cent of total electricity demand in 2017**. Losses increased by 1.8 per cent to 26.5 TWh in 2017, resulting in a small increase in the proportion of demand in accounted for (+0.2 percentage points from 7.3 per cent in 2016). Losses comprise three components[17]:

- transmission losses (6.5 TWh) from the high voltage transmission system, which represented about 24.5 per cent of the losses figure in 2017;
- distribution losses (19.1 TWh), which occur between the gateways to the public supply system's network and the customers' meters, and accounted for about 71.8 per cent of losses; and
- theft or meter fraud (just under 1.0 TWh, around 3.7 per cent).

Power stations in the United Kingdom (Tables 5.11 and 5.12)

5.54 **The total installed capacity of major UK power stations was 79,354 MW**[18] at the end of May 2018. Table 5.11 is a database of UK capacity with details of these Major Power Producers (MPPs) as well as the four interconnectors allowing trade with Europe, and an aggregate of other generating stations using renewable sources and smaller (<1 MW) Combined Heat and Power (CHP) plants.

5.55 Table 7.10 shows CHP schemes of 1 MW and over for which the information is publicly available. Total power output of these stations is given (electricity plus heat), not just that which is classed as good quality CHP under the CHP Quality Assurance programme (CHPQA, see Chapter 7), since CHPQA information for individual sites is not publicly available.

5.56 Table 5.12 shows capacity of the transmission and distribution networks for Great Britain, Northern Ireland and the UK as a whole. Transmission network connected capacity for the UK as a whole reduced each year from 2012 to 2015 due to closures and conversions of coal, oil and gas plants. In 2016 these closures were offset by the increase in renewables capacity. In 2017 transmission capacity increased as there were no major closures and increased capacity from onshore wind (+18 per cent) and offshore wind (+32 per cent). Some thermal power stations also reported increased capacity as units came back online following maintenance.

5.57 The trend for increasing quantities of embedded solar and wind generation resulted in the **distribution network capacity increasing each year since 2011** for Great Britain and Northern Ireland. In 2017, the distribution network capacity for the UK was 32,389 MW, an increase of 11 per cent on 2016 and two and a half times 2011's capacity. In 2017, an additional 0.9 GW of solar capacity and 1.8 GW of wind capacity was added compared to 2016.

5.58 **Over 2017 the total installed capacity (for both transmission and distribution networks) for the UK was 106 GW, an increase of 6 per cent on 2016.** From this total UK capacity, 96 per cent was connected in Great Britain and 4 per cent in Northern Ireland. For Great Britain, it is estimated that 71 GW was connected to the transmission network, which accounts for 70 per cent of the Great Britain total capacity. This was slightly lower than the 71 per cent in 2016, due to increases in distribution connected renewables capacity. From the Northern Ireland total capacity (4 GW), 61 per cent was estimated as connected to the transmission network, which was lower than the 68 per cent in 2016. The change in Northern Ireland is attributable to increases in distribution connected wind and solar capacity.

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17 *See paragraph 5.85 for further information on the calculation of losses.*

18 *The total installed capacity for stations listed in table 5.11 differs from the total in table 5.7, as the latter is on a Transmission Entry Capacity basis, and taken as at the end of 2017. See paragraph 5.86 for more information on the measures of capacity.*

Carbon dioxide emissions from power stations

5.59 **It is estimated that carbon dioxide emissions from power stations accounted for 19.6 per cent of the UK's total carbon dioxide emissions in 2017**. Emissions vary by type of fuel used to generate the electricity and emissions estimates for all electricity generation for 2015 to 2017 are shown in Table 5D below.

Table 5D: Estimated carbon dioxide emissions from electricity supplied 2015 to 2017 [1,2]

Fuel	Emissions (tonnes of carbon dioxide per GWh electricity supplied)		
	2015	2016	2017[3]
Coal	909	931	918
Gas	382	378	357
All fossil fuels	625	497	460
All fuels (including nuclear and renewables)	335	265	225

1. The carbon intensity figures presented in Table 5D are different to those produced for the Greenhouse Gas Inventory (GHGI). The differences arise due to slightly differing methodologies, including geographical coverage and treatment of autogenerators but principally because the GHGI presents figures based on a 5-year rolling average whereas those in Table 5D are presented as single year figures.

2. The numerator includes emissions from power stations, with an estimate added for auto-generation. The denominator (electricity supplied by all generators) used in these calculations can be found in table 5.6, with the figure for All fuels in 2017 being 319,218 GWh.

3. The 2017 emissions figures are provisional.

5.60 The emissions per GWh electricity supplied from coal and gas decreased in 2017 due to the drop in coal and gas generation.

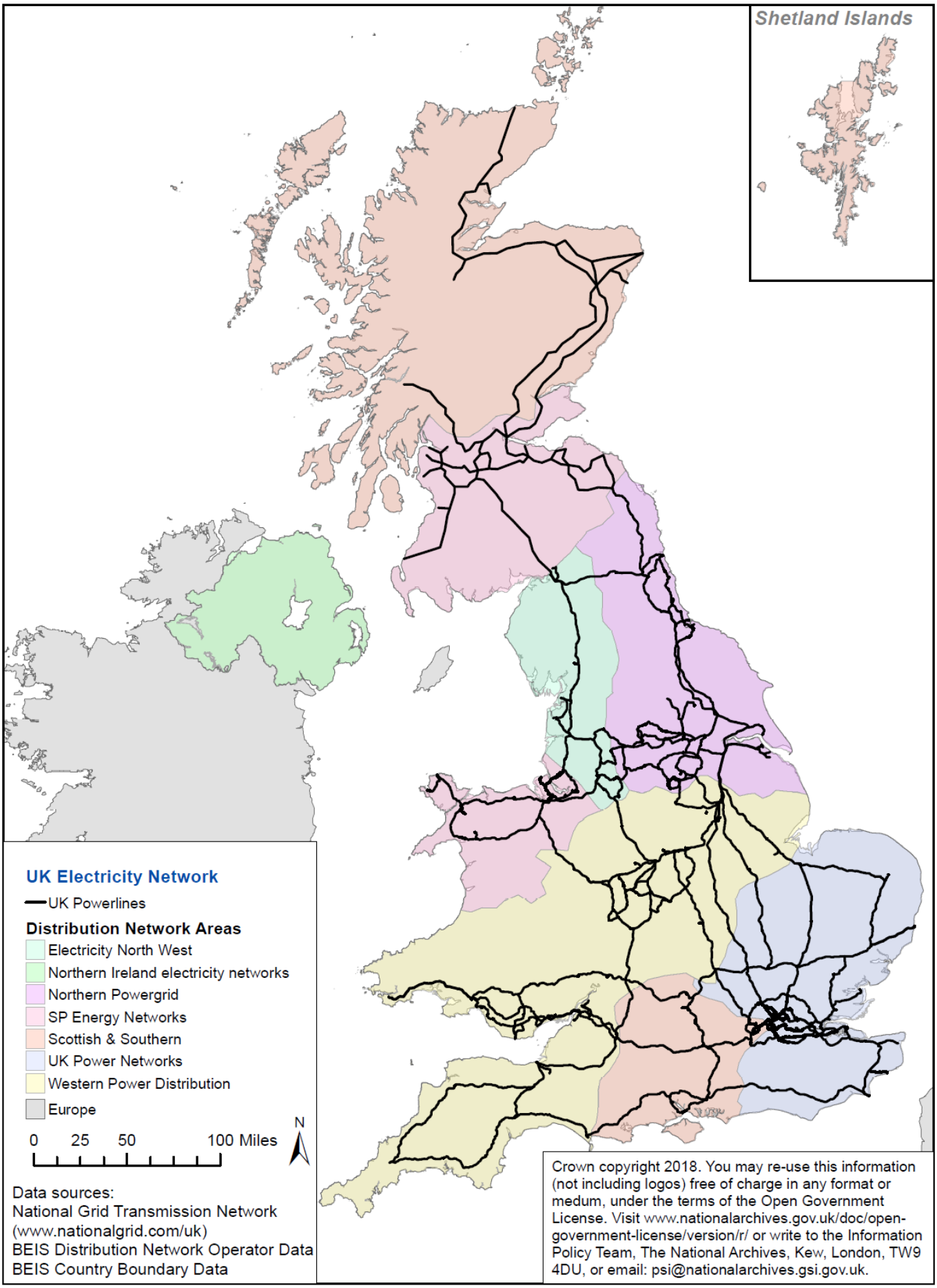
Sub-national electricity data

5.61 The collection of data relating to regional and local consumption of electricity began in 2004. For details of the availability of local level electricity (and gas) data see Chapter 4, paragraph 4.17 and the sub-national electricity statistics pages on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/sub-national-electricity-consumption-data. Data repeated here in previous editions of this publication as Table 5E are available via that link. The regional data will not sum exactly to the figures given in table 5.4 as the regional data are not based exactly on a calendar year and are obtained via different data sources.

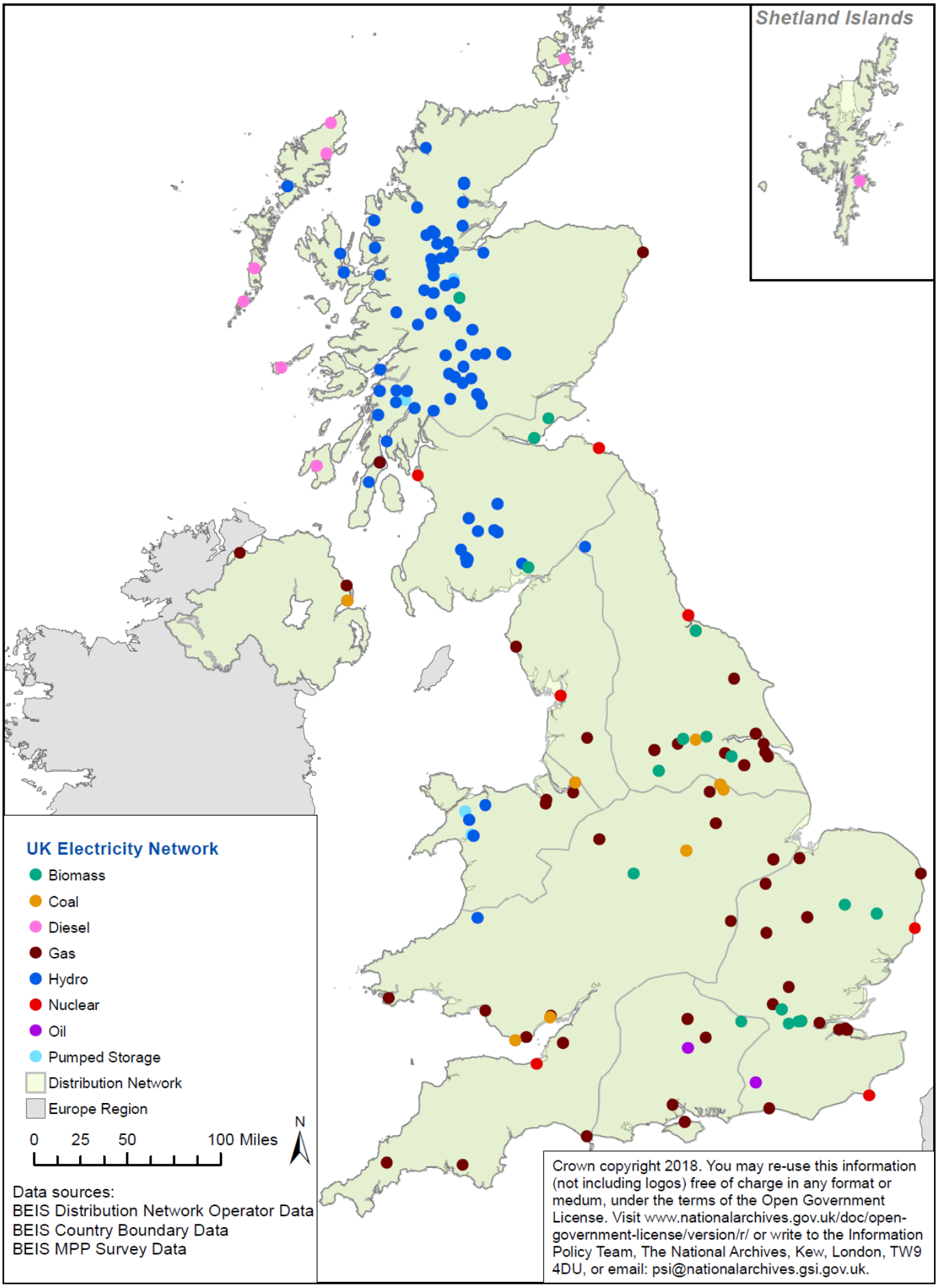
Electricity price and market penetration

5.62 Electricity price and market penetration data are published by BEIS in the Quarterly Energy Prices publication, available at: www.gov.uk/government/statistical-data-sets/quarterly-domestic-energy-price-statistics. Data on Domestic electricity market penetration, repeated here in previous editions of this publication as Table 5F, are available in table 2.4.1 of Quarterly Energy Prices.

UK Distribution Network Operating Areas and GB Power Lines Map



Major Power Producers in the UK (operational May 2018)



List of DUKES electricity tables

Table	Description	Period
5.1	Commodity balances for UK electricity	1998-2017
5.2	Commodity balances for electricity (separates out the *public* distribution system for electricity from the electricity generated and consumed by *autogenerators*)	1998-2017
5.3	Fuels used to generate electricity in the UK (by MPP/other and fuel)	1996-2017
5.4	Fuels consumed for electricity generation (autogeneration) by main industrial groups	1996-2017
5.5	Electricity supply, consumption and sales (links between DUKES tables and long term trends data)	1996-2017
5.6	Electricity fuel use, generation and supply (by MPP/other and fuel type)	1996-2017
5.7	Plant capacity (MPPs, other and all, by type)	1996-2017
5.8	Major Power Producers Plant capacity (by region & type)	1999-2017
5.9	Capacity of other generators (by sector)	1996-2017
5.10	Plant loads, demand and efficiency	1996-2017
5.11	List of major power producers (power stations) in operation	May 2018
5.12	Plant installed capacity, by connection (GB, NI, by plant type)	2011-2017
5A	Net imports via interconnectors	2015-2017
5B	Combined Heat & Power (CHP) generation & capacity (see chapter 7 for more)	2017
5C	Major Power Producers Capacity closed, converted or reduced	May 2018
5D	Estimated carbon dioxide emissions by electricity supplied	2015-2017
	Long term trends commentary and tables on fuel use, generation, supply and consumption back to 1970 can be found on BEIS section of the GOV.UK website, at: www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes	1970-2017

Structure of the UK electricity industry

5.63 Up to March 2005 the electricity industries of Scotland, Northern Ireland and England and Wales operated independently although interconnectors joined all three grid systems together. From April 2005, under the British Electricity Trading and Transmission Arrangements (BETTA) introduced in the Energy Act 2004, the electricity systems of England and Wales and Scotland have been integrated. The paragraphs below describe the position up to March 2005 but indicate the further changes that have been made under BETTA.

5.64 From the period immediately after privatisation of the industry in 1990, when there were seven generating companies in England and Wales and 12 Regional Electricity Companies distributing and supplying electricity to customers in their designated area, there were many structural and business changes and residual flotations. Competition developed in mainland Britain as follows:

(a) From 1 April 1990, customers with peak loads of more than 1 MW (about 45 per cent of the non-domestic market) were able to choose their supplier;

(b) From 1 April 1994, customers with peak loads of more than 100 kW were able to choose their supplier;

(c) Between September 1998 and May 1999, the remaining part of the electricity market (i.e. below 100 kW peak load) was opened up to competition. Paragraph 5.62 and Table 5E give more details of the opening up of the domestic gas and electricity markets to competition.

5.65 Since the late 1990s, there have been commercial moves toward vertical re-integration between generating, electricity distribution and/or electricity supply businesses. Those mergers that have taken place were approved by the relevant competition authority. Initially the National Grid Company was owned by the 12 privatised regional electricity companies, but was floated on the Stock Exchange in 1995. National Grid (and its predecessors since 1990) has owned and operated the high voltage

transmission system in England and Wales linking generators to distributors and some large customers. The transmission system is linked to continental Europe via an interconnector to France under the English Channel, and since 1 April 2011, to the Netherlands under the North Sea (see Table 5.10). Up to March 2005, the Scottish transmission system was regarded as being linked to that in England and Wales by two interconnectors but under BETTA National Grid also took on responsibility for operating the system in Scotland, to form a single Great Britain transmission network.

5.66 In Scotland, until the end of March 2005, the two main companies, Scottish Power and Scottish and Southern Energy, covered the full range of electricity provision. They operated generation, transmission, distribution and supply businesses. In addition, there were a number of small independent hydro stations and some independent generators operating fossil-fuelled stations, which sold their output to Scottish Power and Scottish and Southern Energy.

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

5.68 In March 2001, the means of trading electricity changed with the introduction in England and Wales of the New Electricity Trading Arrangements (NETA). This replaced the Electricity Pool of England and Wales. These arrangements were based on bi-lateral trading between generators, suppliers, traders and customers. They were designed to be more efficient and 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 enable National Grid, as system operator, to balance the system, and a settlement process. In April 2005 this system was extended to Scotland under BETTA.

Technical notes and definitions

5.69 These notes and definitions are in addition to the technical notes and definitions covering all fuels and energy as a whole in Chapter 1. For notes on the commodity balances and definitions of the terms used in the row headings see Annex A, paragraphs A.7 to A.42. While the data in the PDF copy of this Digest cover only the most recent five years, these notes also cover data for earlier years that are available on the BEIS energy statistics website.

Electricity generation from renewable sources

5.70 Figures on electricity generation from renewable energy sources are included in the tables in this section. Further detailed information on renewable energy sources is included in Chapter 6.

Combined heat and power

5.71 Electricity generated from combined heat and power (CHP) schemes, CHP generating capacities and fuel used for electricity generation are included in the tables in this chapter. However, more detailed analyses of CHP schemes are set out in Chapter 7.

Generating companies

5.72 Following the restructuring of the electricity supply industry in 1990, the term "Major generating companies" was introduced into the electricity tables to describe the activities of the former nationalised industries and distinguish them from those of autogenerators and new independent companies set up to generate electricity. The activities of the autogenerators and the independent companies were classified under the heading "Other generating companies". In the 1994 Digest, a new terminology was adopted to encompass the new independent producers, who were then

beginning to make a significant contribution to electricity supply. Under this terminology, all companies whose prime purpose is the generation of electricity are included under the heading "Major power producers" (or MPPs). The term "Other generators" (“Autogenerators” in the balance tables) is restricted to companies who produce electricity as part of their manufacturing or other commercial activities, but whose main business is not electricity generation. “Other generators” also covers generation by energy services companies at power stations on an industrial or commercial site where the main purpose is the supply of electricity to that site, even if the energy service company is a subsidiary of a MPP. Additionally (and particularly since 2010), this category includes generation from the domestic sector.

5.73 The definition of MPPs was amended in 2008 to include major wind farm companies, but this change only applies to data for 2007 onwards. Most generators of electricity from renewable sources (apart from large scale hydro, large scale wind, large scale solar and some biofuels) are also included as “Other generators” because of their comparatively small size, even though their main activity is electricity generation.

5.74 Major wind farm operators have been included under MPPs, for 2007 onwards, in the monthly, quarterly, and annual tables of electricity statistics produced by BEIS. Until then, all generation using wind turbines was excluded from the MPP classification. This was because originally such generation was by small independent companies and collecting data on a monthly basis was prohibitively costly and unnecessarily burdensome on such companies. Similarly, major solar site operators have been included under MPPs for the first time in 2015.

5.75 Generation from wind has now become more concentrated in the hands of larger companies and BEIS has extended its system of monthly data collection to cover the largest wind power companies and, from 2015, solar. The intention is that, in future, any company whose wind generation capacity increases to above 50 MW will be asked to provide monthly data for generation from wind and thus be included in the list of MPPs.

5.76 The inclusion of major wind farm and solar site operators under MPPs affects the majority of the electricity tables in DUKES, with figures for MPPs and the public distribution system increased, and other generators reduced for 2007 onwards due to wind and from 2015 onwards due to solar.

5.77 **Major power producers at the end of 2017 were:**

AES Electric Ltd, Calon Energy (formerly MPF Operations Ltd),Centrica, Corby Power Ltd, Drax Power Ltd, E.On UK, EDF Energy, Eggborough Power Ltd, Energy Power Resources, ENGIE, EPUKi, ESB Ltd, Ferrybridge Multifuel Energy Limited, Innogy Renewables UK Ltd, Intergen, LondonWaste Ltd, Magnox Ltd, Marchwood Power Ltd, Riverside Resources Recovery Ltd, RWE Generation SE, Scottish and Southern Energy, Scottish Power, Seabank Power Ltd, SELCHP Ltd, Semcorp Utilities (UK) Ltd, SIMEC, Sellafield Ltd, Statkraft Energy Ltd, Suez recycling and recovery, Third Energy Trading Ltd, Uniper UK Ltd, Viridor Waste Management, VPI Immingham LLP.

5.78 **Major wind farm companies were added to the list of MPPs in 2007. At the end of 2017 these comprised:**
Black Hill Wind, Blue Energy, CEP Wind 2 Ltd, E.On UK, Ecotricity, EDF Renewables, Eneco Wind UK Limited, Engie, Falck Renewables Wind Ltd, Fred Olsen, Greencoat UK Wind, Infinis, Orsted (formerly Dong Energy), Peel Energy Ltd, REG Windpower Ltd, Renewable Energy Systems Ltd, Innogy Renewables (formerly RWE Innogy UK Ltd), Scottish and Southern Energy, Scottish Power, Statkraft Wind UK Ltd, Temporis capital, WPO (formerly Wind Prospect), Vattenfall Wind Power, XceCo Ltd.

5.79 **Major solar farm companies were added to the list of MPPs in 2016. At the end of 2017 these comprised:**
Anesco, British Solar Renewables, Cubico Sustainable Investments Limited, Ecotricity, Foresight Group, Greencoat Solar, LightsourceBP, Octopus Energy, REG Blackrock, Rockfire Capital, Vattenfall Wind Power.

Types of station

5.80 The various types of station identified in the tables of this chapter are as follows:

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

Nuclear stations are also steam stations but the heat needed to produce the steam comes from nuclear fission.

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. This then drives the generator. The fuel burnt is usually natural gas or gas oil.

Combined cycle gas turbine (CCGT) stations combine in the same plant gas turbines and steam turbines connected to one or more electrical generators. This enables electricity to be produced at higher efficiencies than is otherwise possible when either gas or steam turbines are used in isolation. 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 that is also connected to an electrical generator.

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. As electricity is used in the pumping process, pumped storage stations are net consumers of electricity.

Wind farms use wind flows to turn turbines.

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

Electricity supplied – input and output basis

5.81 The energy supplied basis defines the primary input (in million tonnes of oil equivalent, Mtoe) needed to produce 1 TWh of hydro, wind, or imported electricity as:

$$\text{Electricity generated (TWh)} \times 0.085985$$

The primary input (in Mtoe) needed to produce 1 TWh of nuclear electricity is similarly

$$\frac{\text{Electricity generated (TWh)} \times 0.085985}{\text{Thermal efficiency of nuclear stations}}$$

5.82 Figures on fuel use for electricity generation can be compared in two ways. 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. 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 (by one percentage point in 2017) compared with the fuel input basis. This is because of the higher conversion efficiency of gas. Fuel input is set to match electricity output for non-thermal renewables.

Public distribution system

5.83 This comprises the grid systems in England and Wales, Scotland and Northern Ireland. In April 2005 the Scotland and England and Wales systems were combined into a single grid.

Sectors used for sales/consumption

5.84 The various sectors used for sales and consumption analyses are standardised across all chapters of the 2016 Digest. For definitions of the sectors see Chapter 1 paragraphs 1.57 to 1.61 and Annex A paragraphs A.31 to A.42.

Losses

5.85 The losses component of electricity demand are calculated as follows:

Transmission losses: electricity lost as a percentage of electricity entering the GB transmission system (as reported by National Grid); this is applied to the electricity available figure in DUKES 5.5 (334,058 GWh in 2017).

Distribution losses: electricity lost in distribution as a percentage of electricity entering the distribution system (as reported by the distribution network operators); this is applied to electricity available less transmission losses.

Theft: a fixed percentage of 0.3 per cent is assumed to be stolen from the distribution network. This is applied to electricity available less transmission losses.

Transmission Entry Capacity, Declared Net Capacity and Installed Capacity

5.86 Transmission Entry Capacity (TEC) is a Connection and Use of System Code term that defines a generator's maximum allowed export capacity onto the transmission system. In the generating capacity statistics of the 2007 Digest, it replaced Declared Net Capacity (DNC) as the basis of measurement of the capacity of Major Power Producers from 2006. DNC is 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. It represents the nominal maximum capability of a generating set to supply electricity to consumers. The maximum rated output of a generator (usually under specific conditions designated by the manufacturer) is referred to as its Installed Capacity. For the nuclear industry, the World Association of Nuclear Operators (WANO) recommends that capacity of its reactors is measured in terms of Reference Unit Power (RUP) and it is the RUP figure that is given as the installed capacity of nuclear stations.

5.87 DNC is used to measure the maximum power available from generating stations that use renewable resources. For wind and wave and small scale hydro a factor is applied to declared net capability to take account of the intermittent nature of the energy source (e.g. 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?view=plain

Load factors

5.88 The following definitions are used in Table 5.10:

Maximum load – This is twice the largest number of units supplied in any consecutive thirty minutes commencing or terminating at the hour.

Simultaneous maximum load met – The maximum load on the transmission network at any one time, net of demand met by generation connected to the distribution network. From 2005 (following the introduction of BETTA – see paragraph 5.63) 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.

Plant load factor – The average hourly quantity of electricity supplied during the year, expressed as a percentage of the average output capability at the beginning and the end of year.

System load factor – The average hourly quantity of electricity available during the year expressed as a percentage of the maximum demand nearest the end of the year or early the following year.

Thermal efficiency

5.89 Thermal efficiency 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 as a result of fission of the nuclear fuel inside the reactor. The efficiency of CHP systems is illustrated in Chapter 7, Table 7D. Efficiencies based on gross calorific value of the fuel (sometimes referred to as higher heating values or HHV) are lower than the efficiencies based on net calorific value (or lower heating value LHV). The difference between HHV and LHV is due to the energy associated with the latent heat of the evaporation of water products from the steam cycle which cannot be recovered and put to economic use.

Period covered

5.90 Until 2004, figures for the MPPs relate to periods of 52 weeks as listed below (although some data provided by electricity supply companies related to calendar months and were adjusted to the statistical calendar). In 2004, a change was made to a calendar year basis. This change was made in the middle of the year and the data are largely based on information collected monthly. The January to May 2004 data are therefore based on the 21 weeks ended 29 May 2004 and the calendar months June to December 2004, making a total of 361 days. In terms of days, 2004 is therefore 1.1 per cent shorter than 2005:

Year	**52 weeks ended**
2003	28 December 2003
2004	21 weeks ended 29 May 2004 and 7 months ended 31 December 2004
2005 – 2017:	12 months ended 31 December

5.91 Figures for industrial, commercial and transport undertakings relate to calendar years ending on 31 December, except for the iron and steel industry where figures relate to the following 52 or 53 week periods:

Year	**53 weeks ended**
2003	3 January 2004
	52 weeks ended
2004	1 January 2005
2005	31 December 2005
2006	30 December 2006
2007	29 December 2007
2008	27 December 2008
	53 weeks ended
2009	2 January 2010
	52 weeks ended
2010	1 January 2011
2011	31 December 2011
2012	29 December 2012
2013	28 December 2013
2014	27 December 2014
	53 weeks ended
2015	2 January 2016
	52 weeks ended
2016	31 December 2016
2017	30 December 2017

Monthly and quarterly data

5.92 Monthly and quarterly data on fuel use, electricity generation and supply and electricity availability and consumption are available on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/electricity-statistics. Monthly data on fuel used in electricity generation by MPPs are given in Monthly Table 5.3 and monthly data on supplies by type of plant and

type of fuel are given in Monthly Table 5.4. Monthly data on availability and consumption of electricity by the main sectors of the economy are given in Monthly Table 5.5. A quarterly commodity balance for electricity is published in BEIS's quarterly statistical bulletin *Energy Trends* (Quarterly Table 5.2) along with a quarterly table of fuel use for generation, electricity generated, and electricity supplied by all generators (Quarterly Table 5.1). Both these quarterly tables are also available from BEIS's energy statistics web site. See Annex C for more information about *Energy Trends*.

Data collection

5.93 For MPPs, as defined in paragraphs 5.72 to **Error! Reference source not found.**, the data for the tables in this Digest are obtained from the results of an annual BEIS inquiry, sent to each company, covering generating capacity, fuel use, generation and sales of electricity (where a generator also supplies electricity).

5.94 Similarly, an annual inquiry is sent to licensed suppliers of electricity to establish electricity sales by these companies. Electricity consumption for the iron and steel sector is based on data provided by the Iron and Steel Statistics Bureau (ISSB) rather than electricity suppliers since 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 has been re-allocated to other sectors. A further means of checking electricity consumption data is now being employed on data for 2006 and subsequent years. A monthly inquiry is sent to electricity distributors, as well as the National Grid, to establish electricity distribution and transmission losses. Copies of the survey questionnaires are available in *electricity statistics: data sources and methodologies*, at: www.gov.uk/government/collections/electricity-statistics.

5.95 A sample of companies that generate electricity mainly for their own use (known as autogenerators or autoproducers – see paragraph 5.72, above) is covered by a quarterly inquiry commissioned by BEIS but carried out by the Office for National Statistics (ONS). Where autogenerators operate a combined heat and power (CHP) plant, this survey is supplemented (on an annual basis) by information from the CHP Quality Assessment scheme (for autogenerators who have registered under the scheme – see Chapter 7 on CHP). There are two areas of autogeneration that are covered by direct data collection by BEIS, mainly because the return contains additional energy information needed by the Department. These are the Iron and Steel industry, and generation on behalf of London Underground.

5.96 In addition to the above sources, some administrative data is used for renewable generation and capacity in the hands of non-major power producers - this includes data from the Renewables Obligation and Feed in Tariff schemes.

Statistical differences

5.97 Statistical differences are included in Tables 5.1 and 5.2. These arise because data collected on production and supply do not match exactly with data collected on sales or consumption. One of the reasons for this is that some of the data are based on different calendars as described in paragraphs 5.90 and 5.91, above. Sales data based on calendar years will always have included more electricity consumption than the slightly shorter statistical year of exactly 52 weeks.

5.98 Care should be exercised in interpreting the figures for individual industries in the commodity balance tables. Where companies have moved between suppliers, it has not been possible to ensure consistent classification between and within industry sectors and across years. The breakdown of final consumption includes some estimated data. In 2014, for about five per cent of consumption of electricity supplied by the public distribution system, the sector figures are partially estimated.

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5.1 Commodity balances

Electricity

GWh

	2013	2014	2015	2016	2017
Total electricity					
Supply					
Production	355,379	335,213	336,136r	336,342r	335,776
Other sources *(1)*	2,904	2,883	2,739	2,959	2,872
Imports	17,533	23,243	22,961r	20,018r	18,167
Exports	-3,102	-2,723	-1,855r	-2,273r	-3,407
Marine bunkers	-	-	-	-	-
Stock change	-	-	-	-	-
Transfers	-	-	-	-	-
Total supply	**372,714**	**358,616**	**359,981r**	**357,046r**	**353,408**
Statistical difference *(2)*	-1,116	-1,066	1,342r	522r	-410
Total demand	**373,831**	**359,682**	**358,639r**	**356,524r**	**353,819**
Transformation	-	-	-	-	-
Energy industry use	**29,893**	**28,382**	**27,894r**	**26,633r**	**26,613**
Electricity generation	17,850	16,479	16,652r	15,275r	15,491
Oil and gas extraction	570	536	606	589	597
Petroleum refineries	4,681	4,873	4,532	4,412	4,367
Coal extraction and coke manufacture	873	741	549	485	473
Blast furnaces	438	440	344	209	209
Patent fuel manufacture	-	-	-	-	-
Pumped storage	3,930	3,884	3,711	4,014	3,859
Other	1,551	1,429	1,500	1,648	1,617
Losses	**27,667**	**28,514**	**27,297r**	**26,096r**	**26,554**
Final consumption	**316,271**	**302,786**	**303,448**	**303,795**	**300,651**
Industry	**96,981**	**93,005**	**92,907**	**91,808**	**92,627**
Unclassified	-	-	-	-	-
Iron and steel	3,799	3,787	3,688	2,847	2,677
Non-ferrous metals	4,430	4,475	4,423	4,303	4,306
Mineral products	6,726	6,267	6,099	6,018	6,097
Chemicals	16,525	15,476	15,610	15,445	15,541
Mechanical engineering etc	7,064	6,912	6,228	6,237	6,461
Electrical engineering etc	6,172	5,714	5,992	5,839	5,952
Vehicles	5,067	4,831	4,874	4,676	4,709
Food, beverages etc	11,083	10,644	10,774	10,733	10,993
Textiles, leather etc	2,894	2,721	2,692	2,638	2,687
Paper, printing etc	10,806	10,725	10,599	10,595	10,813
Other industries	20,952	20,060	20,567	21,140	20,941
Construction	1,464	1,393	1,362	1,337	1,449
Transport *(3)*	**4,352**	**4,504**	**4,517r**	**4,686r**	**4,783**
Air	-	-	-	-	-
Rail *(4)*	4,319	4,437	4,419	4,557r	4,611
Road *(5)*	33	68	97	129	172
National navigation	-	-	-	-	-
Pipelines	-	-	-	-	-
Other	**214,938**	**205,277**	**206,025r**	**207,302r**	**203,242**
Domestic	113,412	108,076	107,764	107,971	105,396
Public administration	18,802	18,502	19,371	19,827	19,726
Commercial	78,849	74,854	74,773	75,081r	73,782
Agriculture	3,874	3,844	4,117	4,423	4,338
Miscellaneous	-	-	-	-	-
Non energy use	-	-	-	-	-

5.1 Commodity balances (continued)

Electricity

GWh

	2013	2014	2015	2016	2017
Electricity production					
Total production *(6)*	**355,379**	**335,213**	**336,136r**	**336,342r**	**335,776**
Primary electricity					
Major power producers	**98,174**	**95,145**	**109,913**	**108,425r**	**118,499**
Nuclear	70,607	63,748	70,345	71,726	70,336
Large scale hydro *(6)*	3,349	4,333	4,578	3,682	3,876
Small scale hydro	260	301	328	269	303
Wind *(7)(8)*	23,958	26,762	34,662	32,748r	43,984
Other generators	**7,546**	**10,507**	**14,539r**	**16,364r**	**19,298**
Nuclear	-	-	-	-	-
Large scale hydro	678	720	736	697	730
Small scale hydro	415	533	655r	742r	1,020
Wind, wave and solar photovoltaics *(7)(8)*	6,454	9,253	13,148r	14,926r	17,549
Secondary electricity					
Major power producers	**223,545**	**202,794**	**183,338**	**181,559r**	**166,425**
Coal	130,175	100,167	75,812	30,613r	22,481
Oil	745	530	683	606r	390
Gas	82,891	88,871	88,461	131,972r	124,512
Renewables	9,212	12,698	17,694	17,400r	17,766
Other	522	528	689	968	1,276
Other generators	**26,115**	**26,768**	**28,346r**	**29,993r**	**31,554**
Coal	83	72	66	56	49
Oil	1,321	1,390	1,354	1,285	1,225
Gas	12,952	12,021	11,415	11,384	12,233
Renewables	8,888	9,921	11,563r	12,664r	14,103
Other	2,870	3,363	3,948r	4,605r	3,944
Primary and secondary production *(9)*					
Nuclear	70,607	63,748	70,345	71,726	70,336
Hydro	4,701	5,888	6,297r	5,390r	5,928
Wind, wave and solar photovoltaics	30,412	36,016	47,810r	47,674r	61,533
Coal	130,258	100,239	75,878	30,669r	22,530
Oil	2,066	1,920	2,037	1,890r	1,615
Gas	95,843	100,892	99,875	143,356r	136,746
Other renewables	18,100	22,619	29,257r	30,064r	31,869
Other	3,392	3,891	4,636r	5,573r	5,219
Total production	**355,379**	**335,213**	**336,136r**	**336,342r**	**335,776**

(1) Pumped storage production.
(2) Total supply minus total demand.
(3) From 2004, non-traction Transport sector consumption is included under 'Transport Services'.
(4) From 2004, this includes light rail and metro systems (eg. London Underground).
(5) Included from 2004.
(6) Excludes pumped storage production.
(7) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.74.
(8) From 2015, major solar companies are included under Major Power Producers, see paragraph 5.74.
(9) These figures are the same as the electricity generated figures in Table 5.6 except that they exclude pumped storage production. Table 5.6 shows that electricity used on works is deducted to obtain electricity supplied. It is electricity supplied that is used to produce Chart 5.2 showing each fuel's share of electricity output (see paragraph 5.25).

5.2 Commodity balances

Public distribution system and other generators

GWh

	2015			2016			2017		
	Public distribution system	**Other gener-ators**	**Total**	**Public distribution system**	**Other gener-ators**	**Total**	**Public distribution system**	**Other gener-ators**	**Total**
Supply									
Major power producers	293,251	-	293,251	289,984r	-	289,984r	284,924	-	284,924
Other generators	-	42,885r	42,885r	-	46,358r	46,358r	-	50,853	50,853
Other sources *(1)*	2,739	-	2,739	2,959	-	2,959	2,872	-	2,872
Imports	22,961r	-	22,961r	20,018r	-	20,018r	18,167	-	18,167
Exports	-1,855r	-	-1,855r	-2,273r	-	-2,273r	-3,407	-	-3,407
Transfers	19,057r	-19,057r	-	20,501r	-20,501r	-	21,861	-21,861	-
Total supply	**336,154r**	**23,827r**	**359,981r**	**331,189r**	**25,857r**	**357,046r**	**324,417**	**28,991**	**353,408**
Statistical difference *(2)*	1,325r	16r	1,342r	604r	-83r	522r	-339	-72	-410
Total demand	**334,829r**	**23,811r**	**358,639r**	**330,585r**	**25,939r**	**356,524r**	**324,756**	**29,063**	**353,819**
Transformation	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy industry use	**21,374**	**6,520r**	**27,894r**	**20,177r**	**6,456r**	**26,633r**	**19,400**	**7,214**	**26,613**
Electricity generation	13,818	2,834r	16,652r	12,347r	2,928r	15,275r	11,712	3,779	15,491
Oil and gas extraction	606	-	606	589	-	589	597	-	597
Petroleum refineries	1,345	3,187	4,532	1,219	3,194	4,412	1,191	3,176	4,367
Coal extraction and coke manufacture	501	49	549	468	17	485	455	17	473
Blast furnaces	-	344	344	-	209	209	-	209	209
Pumped storage	3,711	-	3,711	4,014	-	4,014	3,859	-	3,859
Other fuel industries	1,394	106	1,500	1,540	107	1,648	1,585	32	1,617
Losses	**27,293r**	**4**	**27,297r**	**26,095r**	**1**	**26,096r**	**26,534**	**20**	**26,554**
Transmission losses	**7,394r**	**-**	**7,394r**	**6,235r**	**-**	**6,235r**	**6,506**	**-**	**6,506**
Distribution losses	**18,902r**	**4**	**18,906r**	**18,865r**	**1**	**18,866r**	**19,045**	**20**	**19,065**
Theft	**997r**	**-**	**997r**	**995r**	**-**	**995r**	**983**	**-**	**983**
Final consumption	**286,161r**	**17,287r**	**303,448r**	**284,313r**	**19,482r**	**303,795r**	**278,822**	**21,829**	**300,651**
Industry	**84,382r**	**8,524r**	**92,907r**	**81,935r**	**9,873r**	**91,808r**	**83,033**	**9,594**	**92,627**
Iron and steel	2,974r	714r	3,688r	2,263r	584r	2,847r	2,140	538	2,677
Non-ferrous metals	3,642r	781r	4,423r	3,564r	738r	4,303r	3,560	746	4,306
Mineral products	5,986r	113r	6,099r	5,922r	96r	6,018r	6,000	97	6,097
Chemicals	13,919r	1,690r	15,610r	13,372r	2,073r	15,445r	13,326	2,216	15,541
Mechanical engineering, etc	6,225r	4r	6,228r	6,230r	7r	6,237r	6,347	113	6,460
Electrical engineering, etc	5,986r	6r	5,992r	5,832r	6r	5,839r	5,946	6	5,952
Vehicles	4,693r	180r	4,874r	4,495r	182r	4,676r	4,529	180	4,709
Food, beverages, etc	9,401r	1,373r	10,774r	9,456r	1,277r	10,733r	9,623	1,370	10,993
Textiles, leather, etc	2,685r	7r	2,692r	2,634	4r	2,638r	2,686	1	2,687
Paper, printing, etc	8,797r	1,802r	10,599r	8,576r	2,019r	10,595r	8,739	2,074	10,813
Other industries	18,727r	1,840r	20,567r	18,270r	2,871r	21,140r	18,703	2,239	20,941
Construction	1,347r	15	1,362r	1,322r	15	1,337r	1,434	15	1,449
Transport *(3)*	**4,517r**	**-**	**4,517**	**4,686r**	**-r**	**4,686r**	**4,783**	**-**	**4,783**
Rail *(4)*	4419.49	-	4,419	4,557r	-	4,557r	4,611	-	4,611
Road *(5)*	97.12	-	97	129r	-	129r	172	-	172
Other	**197,262r**	**8,763**	**206,025r**	**197,692r**	**9,609**	**207,302r**	**191,006**	**12,235**	**203,242**
Domestic *(6)*	106,630	1,134	107,764	106,615	1,356	107,971	103,976	1,420	105,396
Standard	72,313	-	72,313	72,378	-	72,378	70,476	-	70,476
Economy 7 and other off-peak *(7)*	17,130	-	17,130	16,883	-	16,883	16,426	-	16,426
Prepayment (standard)	13,197	-	13,197	13,539	-	13,539	13,405	-	13,405
Prepayment (off-peak) *(7)*	3,953	-	3,953	3,768	-	3,768	3,621	-	3,621
Sales under any other arrangement	37	-	37	47	-	47	49	-	49
Public administration	15,619	3,752	19,371	15,468	4,359	19,827	14,631	5,095	19,726
Public lighting *(8)*	1,897	-	1,897	1,939	-	1,939	1,913	-	1,913
Other public sector	13,723	3,752	17,475	13,530	4,359	17,889	12,719	5,095	17,813
Commercial	70,896r	3,876	74,773	71,186r	3,895	75,081r	68,062	5,721	73,782
Shops	27,858	-	27,858	28,176	-	28,176	27,712	-	27,712
Offices	23,249	-	23,249	23,213	-	23,213	21,389	-	21,389
Hotels	8,155	-	8,155	7,990	-	7,990	7,822	-	7,822
Combined domestic/commercial premises	2,349	-	2,349	2,344	-	2,344	2,264	-	2,264
Post and telecommunications	5,605	-	5,605	5,790	-	5,790	5,379	-	5,379
Unclassified	-	-	-	-	-	-	-	-	-
Transport services	3,681r	-	3,681r	3,673r	-	3,673r	3,495	-	3,495
Agriculture	4,117	-	4,117	4,423	-	4,423	4,338	-	4,338

(1) Pumped storage production.
(2) Total supply minus total demand.
(3) From 2004, non-traction Transport sector consumption is included under 'Transport Services'.
(4) From 2004, this includes light rail and metro systems (eg. London Underground).
(5) Included from 2004.
(6) From 2011, this includes consumption by domestic generators. See paragraph 5.14.
(7) Electricity consumed under an off-peak tariff.
(8) Sales for public lighting purposes are increasingly covered by wider contracts that cannot distinguish the public lighting element.

5.3 Fuel used in generation[(1)]

	Unit	2013	2014	2015	2016	2017
						Original units of measurement
Major power producers *(2)*						
Coal	M tonnes	49.84	38.22	29.31r	12.04	8.70
Oil *(3)*	"	0.19	0.17	0.17	0.19	0.14
Gas *(4)*	GWh	174,070	189,695	185,955	271,563	257,599
Other generators *(2)*						
Transport undertakings:						
Gas	GWh	10.28	9.65	7.17	13.78	11.15
Undertakings in industrial and commercial sectors:						
Coal *(5)*	M tonnes	0.03	0.02	0.02	0.02	0.01
Oil *(4)*	"	0.30	0.32	0.33	0.32	0.34
Gas *(6)*	GWh	30,659	27,918	26,678	26,514	28,432
Major power producers *(2)*						**Millions of tonnes of oil equivalent**
Coal		31.31	24.00	18.33	7.53r	5.55
Oil *(3)*		0.24	0.18	0.23	0.22r	0.16
Gas		15.07	16.33	15.99	23.35r	22.15
Nuclear		15.44	13.85	15.48	15.41r	15.12
Hydro (natural flow) *(7)*		0.31	0.40	0.42	0.34r	0.36
Wind		2.06	2.30	2.86	2.64r	3.53
Solar		-	-	0.12	0.18r	0.26
Other renewables *(7)*		2.22	2.97	3.59	3.44r	3.51
Other fuels *(8) (10)*		0.18	0.19	0.47	0.79r	0.90
Net imports		1.24	1.76	1.81r	1.53r	1.27
Total major power producers *(2)*		**68.07**	**61.98**	**59.30r**	**55.43r**	**52.79**
Of which: conventional thermal and other stations *(9)*		36.19	29.88	25.87r	15.08r	14.18
combined cycle gas turbine stations		**14.89**	**16.09**	**15.72r**	**23.07r**	**21.86**
Other generators *(2)*						
Transport undertakings:						
Gas (6)		-	-	-	-	-
Undertakings in industrial and commercial sectors:						
Coal (5)		0.02	0.01	0.01	0.01	0.01
Oil (4)		0.35	0.37	0.38	0.37	0.39
Gas		2.64	2.40	2.29	2.28	2.44
Hydro (natural flow) *(7)*		0.09	0.11	0.12	0.12	0.15
Wind, wave and solar photovoltaics		0.55	0.80	1.13r	1.28r	0.77
Other renewables *(7)*		2.81	3.14	3.58r	3.83r	4.02
Other fuels *(8)*		1.41	1.62	1.71	1.90	1.69
Total other generators *(2)*		**7.88**	**8.45**	**9.23**	**9.79**	**9.48**
All generating companies						
Coal *(5)*		31.33	24.01	18.34r	7.54r	5.55
Oil *(3)(4)*		0.59	0.55	0.61r	0.58	0.54
Gas *(6)*		17.70	18.73	18.28r	25.63r	24.60
Nuclear		15.44	13.85	15.48r	15.41	15.12
Hydro (natural flow) *(7)*		0.40	0.51	0.54r	0.46	0.51
Wind, wave and solar photovoltaics		2.61	3.10	4.11r	4.10r	4.56
Other renewables *(7)*		5.04	6.11	7.17r	7.27r	7.53
Other fuels *(8)*		1.41	1.62	2.18r	2.69r	2.59
Net imports		1.24	1.76	1.81r	1.53r	1.27
Total all generating companies		**75.77**	**70.24**	**68.53r**	**65.21r**	**62.27**

(1) A monthly update of fuel used in electricity generation by major power producers is given in Table 5.3 of Energy Trends, and a quarterly update of fuel used in electricity generation by all generating companies is given in Table 5.1 of Energy Trends.
(2) See paragraphs 5.72 to 5.79 for information on companies covered.
(3) Includes orimulsion, oil used in gas turbine and diesel plant, and oil used for lighting up coal fired boilers.
(4) Includes refinery gas.
(5) Includes coke oven coke.
(6) Includes colliery methane.
(7) More detailed information on renewables can be found in Chapter 6, with Table 6.5 showing generation, and Table 6.6 showing fuel use.
(8) For MPPs this is municipal solid waste (MSW), for other generators main fuels included are coke oven gas, blast furnace gas, and waste products from chemical processes.
(9) Includes gas turbines, oil engines, coal and plants producing electricity from renewable sources other than hydro. Excludes nuclear.
(10)For generation and supply a proportion of MPP other fuels is taken to be renewable; this is not done for fuel use

5.4 Fuels consumed for electricity generation (autogeneration) by main industrial groups[(1)]

Thousand tonnes of oil equivalent
(except where shown otherwise)

	2013	2014	2015	2016	2017
Iron and steel and non-ferrous metals					
Coal (2)	-	-	-	-	-
Blast furnace gas	740	731	641	462	431
Coke oven gas	172	154	137	72	82
Natural gas	39	34	43	42	24
Petroleum	7	7	16	6	6
Other (including renewables) (3)	58	62	63	60	63
Total fuel input (4)	**1,016**	**989**	**901**	**643**	**606**
Electricity generated by iron & steel and non-ferrous metals (5)	**185**	**335**	**166**	**132**	**131**
(in GWh)	2,147	3,896	1,928	1,538	1,524
Electricity consumed by iron and steel and non-ferrous metals from own generation (6)	**166**	**181**	**163**	**133**	**130**
(in GWh)	1,931	2,106	1,892	1,551	1,511
Chemicals					
Coal	7	7	7	6	5
Natural gas	627	454	419	424	481
Petroleum	0	0	0	0	0
Other (including renewables) (3)	34	29	38	137	150
Total fuel input (4)	**668**	**491**	**464**	**567**	**637**
Electricity generated by chemicals (5)	**301**	**211**	**190**	**233**	**241**
(in GWh)	3,501	2,450	2,214	2,715	2,805
Electricity consumed by chemicals from own generation (6)	**161**	**139**	**145**	**178**	**191**
(in GWh)	1,875	1,614	1,690	2,073	2,222
Metal products, machinery and equipment					
Coal	-	-	-	-	-
Natural gas	40	27	30	30	31
Petroleum	6	6	6	6	6
Other (including renewables) (3)	49	63	63	67	66
Total fuel input (4)	**94**	**96**	**99**	**102**	**102**
Electricity generated by metal products, machinery and equipment (5)	**24**	**25**	**26**	**27**	**27**
(in GWh)	279	286	301	310	312
Electricity consumed by metal products, machinery and equipment from own generation (6)	**23**	**24**	**16**	**17**	**26**
(in GWh)	267	275	190	195	299
Food, beverages and tobacco					
Coal	4	5	5	3	4
Natural gas	345	360	365	358	372
Petroleum	3	2	2	2	1
Other (including renewables) (3)	25	31	31	31	62
Total fuel input (4)	**377**	**397**	**403**	**394**	**438**
Electricity generated by food, beverages and tobacco (5)	**187**	**198**	**199**	**191**	**209**
(in GWh)	2,177	2,300	2,310	2,227	2,432
Electricity consumed by food, beverages and tobacco from own generation (6)	**112**	**116**	**118**	**110**	**118**
(in GWh)	1,301	1,343	1,373	1,277	1,370

(1) Industrial categories used are described in Table 1I.
(2) The power plant in this category was reclassified as a Major Power Producer in 2013 so no longer appears in the autogeneration figures
(3) Includes hydro electricity, solid and gaseous renewables and waste.
(4) Total fuels used for generation of electricity. Published on the same basis as figures for fuels used by other generators in Table 5.6.

5.4 Fuels consumed for electricity generation (autogeneration) by main industrial groups[(1)] (continued)

Thousand tonnes of oil equivalent
(except where shown otherwise)

	2013	2014	2015	2016	2017
Paper, printing and publishing					
Coal	10	-	-	-	-
Natural gas	301	272	247	271	271
Petroleum	0	0	0	0	0
Other (including renewables) (3)	145	240	270	315	366
Total fuel input (4)	**456**	**512**	**517**	**586**	**637**
Electricity generated by paper, printing and publishing (5)	**187**	**207**	**194**	**214**	**228**
(in GWh)	2,180	2,402	2,257r	2,492	2,646
Electricity consumed by paper, printing and publishing	**137**	**161**	**155**	**174**	**179**
from own generation (6) (in GWh)	1,590	1,868	1,802	2,019	2,080
Other industries					
Coal	-	-	-	-	-
Coke oven gas	28	28	5	5	5
Natural gas	59	60	64	66	80
Petroleum	2	3	3	3	2
Other (including renewables) (3)	1,948	1,926	1,892	1,856	1,725
Total fuel input (4)	**2,038**	**2,017**	**1,964**	**1,929**	**1,813**
Electricity generated by other industries (5)	**129**	**155**	**191**	**341**	**235**
(in GWh)	1,501	1,807	2,220	3,963	2,728
Electricity consumed by other industries from own	**119**	**146**	**179**	**266**	**206**
generation (6) (in GWh)	1,390	1,700	2,080	3,093	2,390
Total					
Coal	20	12	12	10	9
Blast furnace gas	740	731	641	462	431
Coke oven gas	200	182	142	78	87
Natural gas	1,411	1,208	1,168	1,189	1,259
Petroleum	19	18	28	17	15
Other (including renewables) (3)	2,259	2,351	2,356	2,466	2,432
Total fuel input (4)	**4,648**	**4,502**	**4,347**	**4,222**	**4,233**
Electricity generated (5)	**1,013**	**1,130**	**966**	**1,139**	**1,070**
(in GWh)	11,784	13,142	11,229	13,245	12,448
Electricity consumed from own generation (6)	**718**	**766**	**776**	**878**	**849**
(in GWh)	8,354	8,907	9,027	10,208	9,872

(5) Combined heat and power (CHP) generation (i.e. electrical output from Table 7.8) plus non-chp generation, so that the total electricity generated is consistent with the "other generators" figures in Table 5.6.

(6) This is the electricity consumed by the industrial sector from its own generation and is consistent with the other generators final users figures used within the electricity balances (Tables 5.1 and 5.2). These figures are less than the total generated because some of the electricity is sold to the public distribution system and other users.

(7) The figures presented here are consistent with other figures presented elsewhere in this publication as detailed at (4), (5), and (6) above but are further dissaggregated. Overall totals covering all autogenerators can be derived by adding in figures for transport, services and the fuel industries. These can be summarised as follows:

Thousand tonnes of oil equivalent

Fuel input	**2013**	**2014**	**2015**	**2016**	**2017**
All industry	4,561	4,502	4,347	4,222	4,233
Fuel industries	1,799	2,043	2,299r	2,487r	2,798
Transport, Commerce and Administration	379	409	406	456	529
Services	1,143	1,492	2,179r	2,620r	2,655r
Total fuel input	**7,882**	**8,445**	**9,232r**	**9,785r**	**10,215r**
Electricity generated	**2,893**	**3,205**	**3,687r**	**3,986r**	**4,367r**
Electricity consumed	**1,503**	**1,691**	**1,805r**	**1,972r**	**2,168r**
				GWh	**GWh**
Electricity generated	**33,647**	**37,274**	**42,885r**	**46,358r**	**50,782**
Electricity consumed	**17,484**	**19,668**	**20,993r**	**22,929r**	**25,212**

5.5 Electricity supply, electricity supplied (net), electricity available, electricity consumption and electricity sales

GWh

	2013	2014	2015	2016	2017
Total supply					
(as given in Tables 5.1 and 5.2)	372,714	358,616	359,981r	357,046r	353,408
less imports of electricity	-17,533	-23,243	-22,961r	-20,018r	-18,167
plus exports of electricity	3,102	2,723	1,855r	2,273r	3,407
less electricity used in pumped storage	-3,930	-3,884	-3,711	-4,014	-3,859
less electricity used on works	-17,850	-16,479	-16,652r	-15,275r	-15,491
equals					
Electricity supplied (net)	336,504	317,733	318,513r	320,012r	319,298
(as given in Tables 5.5, 5.1.2 and 5.1.3)					
Total supply					
(as given in Tables 5.1 and 5.2)	372,714	358,616	359,981r	357,046r	353,408
less electricity used in pumped storage	-3,930	-3,884	-3,711	-4,014	-3,859
less electricity used on works	-17,850	-16,479	-16,652r	-15,275r	-15,491
equals					
Electricity available	350,935	338,253	339,618r	337,757r	334,058
(as given in Table 5.1.2)					
Final consumption					
(as given in Tables 5.1 and 5.2)	316,271	302,786	303,448	303,795	300,651
plus Iron and steel consumption counted as energy industry use	572	561	411	242	261
equals					
Final users	316,844	303,347	303,860	304,038	300,913
(as given in Table 5.1.2)					
Final consumption					
Public distribution system					
(as given in Table 5.2)	302,690	287,456	286,161	284,313	278,822
plus Oil and gas extraction use	570	536	606	589	597
plus Petroleum refineries use	1,291	1,218	1,345	1,219	1,191
plus Coal and coke use	796	665	501	468	455
plus Other fuel industries use	1,402	1,280	1,394	1,540	1,585
equals					
UK Electricity sales *(1)*	306,748	291,153	290,007	288,129	282,651

(1) A calendar year estimate of the Renewables Obligation percentage can be calculated using the "total generation from sources eligible for the Renewable Obligation" figure from Table 6.4 as the numerator, and this figure as the denominator. Separate electricity sales data for public electricity suppliers are given for England and Wales, Scotland and Northern Ireland in Table 5.5 of Energy Trends on the BEIS website at:
www.gov.uk/government/statistics/electricity-section-5-energy-trends

5.6 Electricity fuel use, generation and supply

GWh

	Thermal sources							Non-thermal sources			
	Coal	Oil	Gas	Nuclear	Renew-ables *(1)*	Other *(3)*	Total	Hydro-natural flow	Hydro-pumped storage	Wind and solar *(4)*	Total All sources
2013											
Major power producers *(2) (5)*											
Fuel used	364,141	2,775	175,210	179,601	25,832	2,119	749,678	3,609	2,904	23,958	780,149
Generation	130,175	745	82,891	70,607	9,212	522	294,152	3,609	2,904	23,958	324,623
Used on works	6,678	97	1,409	6,474	925	52	15,636	13	10	-	15,658
Supplied (gross)	123,497	648	81,482	64,133	8,287	470	278,516	3,596	2,894	23,958	308,964
Used in pumping											3,930
Supplied (net)											305,034
Other generators *(2) (5)*											
Fuel used	239	4,066	30,659	-	32,728	16,440	84,132	1,092	-	6,454	91,678
Generation	83	1,321	12,952	-	8,888	2,870	26,115	1,092	-	6,454	33,661
Used on works	4	97	402	-	1,501	166	2,169	22	-	-	2,191
Supplied	79	1,224	12,550	-	7,388	2,705	23,945	1,071	-	6,454	31,470
All generating companies											
Fuel used	364,380	6,841	205,869	179,601	58,560	18,559	833,810	4,701	2,904	30,412	871,827
Generation	130,258	2,066	95,843	70,607	18,100	3,392	320,266	4,701	2,904	30,412	358,283
Used on works	6,682	195	1,810	6,474	2,426	218	17,805	35	10	-	17,850
Supplied (gross)	123,576	1,872	94,033	64,133	15,674	3,174	302,461	4,667	2,894	30,412	340,434
Used in pumping											3,930
Supplied (net)											336,504
2014											
Major power producers *(2) (5)*											
Fuel used	279,117	2,112	189,919	161,079	34,503	2,204	668,934	4,635	2,883	26,762	703,214
Generation	100,167	530	88,871	63,748	12,698	528	266,542	4,635	2,883	26,762	300,822
Used on works	5,154	72	1,519	5,845	1,275	53	13,919	29	10	-	13,958
Supplied (gross)	95,013	458	87,352	57,903	11,423	475	252,623	4,606	2,873	26,762	286,864
Used in pumping											3,884
Supplied (net)											282,980
Other generators *(2) (5)*											
Fuel used	135	4,311	27,918	-	36,517	18,829	87,711	1,253	-	9,253	98,218
Generation	72	1,390	12,021	-	9,921	3,363	26,768	1,253	-	9,253	37,274
Used on works	3	102	373	-	1,812	204	2,495	28	-	-	2,522
Supplied	69	1,288	11,648	-	8,109	3,159	24,273	1,226	-	9,253	34,752
All generating companies											
Fuel used	279,252	6,423	217,837	161,079	71,020	21,033	756,645	5,888	2,883	36,016	801,432
Generation	100,239	1,920	100,892	63,748	22,619	3,891	293,309	5,888	2,883	36,016	338,096
Used on works	5,157	174	1,892	5,845	3,087	257	16,413	57	10	-	16,480
Supplied (gross)	95,082	1,746	99,000	57,903	19,532	3,634	276,896	5,831	2,873	36,016	321,616
Used in pumping											3,884
Supplied (net)											317,732
2015											
Major power producers *(2) (5)*											
Fuel used	213,158	2,626	185,955	180,025	44,483	2,738	628,984	4,907	2,739	34,662	671,292
Generation	75,812	683	88,461	70,345	17,694	689	253,683	4,907	2,739	34,662	295,991
Used on works	3,890	88	1,517	6,450	1,777	69	13,791	17	10	-	13,818
Supplied (gross)	71,922	595	86,943	63,895	15,917	620	239,892	4,889	2,730	34,662	282,173
Used in pumping											3,711
Supplied (net)											278,462
Other generators *(2) (5)*											
Fuel used	137	4,422	26,678	-	41,656r	19,932	92,825r	1,391r	-	13,148r	107,364r
Generation	66	1,354	11,415	-	11,563r	3,948r	28,346r	1,391r	-	13,148r	42,885r
Used on works	3	99	354	-	2,077r	268	2,800r	34	-	-	2,834r
Supplied	63	1,255	11,061	-	9,487r	3,680r	25,546r	1,357r	-	13,148r	40,051r
All generating companies											
Fuel used	213,296r	7,048	212,632	180,025	86,139r	22,670	721,809r	6,297r	2,739	47,810r	778,656r
Generation	75,878	2,037	99,875	70,345	29,257r	4,636r	282,029r	6,297r	2,739	47,810r	338,875r
Used on works	3,893	187	1,871	6,450	3,853r	337	16,591r	51	10	-	16,652r
Supplied (gross)	71,985	1,850	98,005	63,895	25,404r	4,300r	265,438r	6,246r	2,730	47,810r	322,224r
Used in pumping											3,711
Supplied (net)											318,513r

5.6 Electricity fuel use, generation and supply (continued)

GWh

	Thermal sources							Non-thermal sources			
	Coal	Oil	Gas	Nuclear	Renew-ables *(1)*	Other *(3)*	Total	Hydro-natural flow	Hydro-pumped storage	Wind and solar *(4)*	Total All sources
2016											
Major power producers *(2) (5)*											
Fuel used	87,557	2,545	271,563	179,263	44,644r	4,596r	590,168r	3,951	2,959	32,748r	629,826r
Generation	30,613r	606r	131,972r	71,726	17,400r	968	253,285r	3,951	2,959	32,748r	292,943r
Used on works	1,569r	85r	2,248	6,577	1,747	97	12,323r	14	10	-	12,347r
Supplied (gross)	29,044r	521r	129,725r	65,149	15,653r	871	240,963r	3,937	2,949	32,748r	280,597r
Used in pumping											4,014
Supplied (net)											276,582r
Other generators *(2) (5)*											
Fuel used	113	4,245	26,514	-	44,499r	22,060	97,431r	1,439r	-	14,926r	113,796r
Generation	56	1,285	11,384	-	12,664r	4,605r	29,993r	1,439r	-	14,926r	46,358r
Used on works	3	95	352	-	2,140r	301	2,890r	38	-	-	2,928r
Supplied	53	1,190	11,032	-	10,524r	4,304r	27,104r	1,400r	-	14,926r	43,430r
All generating companies											
Fuel used	87,669	6,790	298,077	179,263	89,143r	26,656r	687,599r	5,390r	2,959	47,674r	743,622r
Generation	30,669r	1,890r	143,356r	71,726	30,064r	5,573r	283,279r	5,390r	2,959	47,674r	339,301r
Used on works	1,571r	180r	2,599r	6,577	3,887r	398	15,212r	52	10	-	15,275r
Supplied (gross)	29,097r	1,711r	140,757r	65,149	26,177r	5,175r	268,066r	5,338r	2,949	47,674r	324,026r
Used in pumping											4,014
Supplied (net)											320,012r
2017											
Major power producers *(2) (5)*											
Fuel used	64,495	1,812	257,599	175,890	45,993	5,225	551,014	4,179	2,872	43,984	602,048
Generation	22,481	390	124,512	70,336	17,766	1,276	236,761	4,179	2,872	43,984	287,796
Used on works	1,154	48	2,124	6,450	1,784	128	11,687	15	10	-	11,712
Supplied (gross)	21,327	342	122,388	63,887	15,982	1,148	225,074	4,164	2,862	43,984	276,084
Used in pumping											3,859
Supplied (net)											272,225
Other generators *(2) (5)*											
Fuel used	102	4,512	28,432	-	46,796	19,658	99,500	1,750	-	17,549	118,798
Generation	49	1,225	12,233	-	14,103	3,944	31,554	1,750	-	17,549	50,853
Used on works	2	90	378	-	2,949	307	3,727	52	-	-	3,779
Supplied	47	1,134	11,855	-	11,154	3,637	27,827	1,697	-	17,549	47,073
All generating companies											
Fuel used	64,597	6,324	286,031	175,890	92,789	24,882	650,513	5,928	2,872	61,533	720,846
Generation	22,530	1,615	136,746	70,336	31,869	5,219	268,316	5,928	2,872	61,533	338,649
Used on works	1,156	138	2,503	6,450	4,733	435	15,415	67	10	-	15,491
Supplied (gross)	21,375	1,476	134,243	63,887	27,136	4,784	252,901	5,861	2,862	61,533	323,157
Used in pumping											3,859
Supplied (net)											319,298

	2013		2014		2015		2016		2017	
	Conv-entional thermal *(6)*	CCGT	Conv-entional thermal *(6)*	CCGT	Conv-entional thermal *(6)*	CCGT	Conv-entional thermal *(6)*	CCGT	Conv-entional thermal *(6)*	CCGT
Major power producers *(2)*										
Generated	141,011	82,533	114,534	88,259	95,606r	87,732r	50,283r	131,276	42,662	123,763
Supplied (gross)	133,238	81,145	107,945	86,775	89,741r	86,256r	46,745r	129,069	39,505	121,682
Other generators										
Generated	15,162	10,953	18,794	7,974	21,679r	6,667r	23,641r	6,353r	24,744	6,811
Supplied (gross)	13,539	10,406	16,697	7,576	19,212r	6,334r	21,068r	6,036r	21,356	6,471
All generating companies										
Generated	156,173	93,486	133,328	96,233	117,285r	94,399r	73,923r	137,629r	67,406	130,574
Supplied (gross)	146,777	91,552	124,642	94,351	108,952r	92,591r	67,812r	135,105r	60,861	128,153

(1) Thermal renewable sources are those included under bioenergy in Chapter 6. Prior to 2007, non-biodegradable wastes are also included.

(2) See paragraphs 5.72 to 5.79 on companies covered.

(3) Other thermal sources include coke oven gas, blast furnace gas and waste products from chemical processes. From 2007, non-biodegradable wastes are also included.

(4) For Major Power Producers before 2015, this is wind only; for Major Power Producers from 2015 and for other generators, this includes solar photovoltaics as well as wave and tidal.

(5) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.74.

(6) Includes gas turbines, oil engines and plants producing electricity from thermal renewable sources; also stations with some CCGT capacity but mainly operate in conventional thermal mode.

5.7 Plant capacity - United Kingdom

MW

	end December				
	2013	2014	2015	2016	2017
Major power producers *(1)*					
Total transmission entry capacity	**77,167**	**75,694**	**70,798r**	**68,203r**	**70,954**
Of which:	-	-	-	-	-
Conventional steam stations:	23,141	21,282	18,714	14,607r	14,311
Coal fired	20,591	18,732	17,534	13,677r	13,341
Oil fired	1,370	1,370	-	-	-
Mixed or dual fired *(3)*	1,180	1,180	1,180	930r	970
Combined cycle gas turbine station	32,967	31,994	29,434r	29,805r	31,482
Nuclear stations	9,906	9,937	9,487	9,497	9,361
Gas turbines and oil engines (11)	1,639	1,643	1,287r	1,766r	1,680
Hydro-electric stations:	-	-	-	-	-
Natural flow *(4)*	1,399	1,400	1,400	1,401	1,404
Pumped storage	2,744	2,744	2,744	2,744	2,744
Wind *(4) (5)*	3,947	4,528	4,917	5,431r	6,814
Solar *(4)*	-	-	288	400	574
Renewables other than hydro, wind	1,424	2,166	2,526r	2,552r	2,585
Other generators *(1)*	-	-	-	-	-
Total capacity of own generating p	**7,430**	**8,718**	**9,119r**	**9,985r**	**10,339**
Of which:	-	-	-	-	-
Conventional steam stations *(8)*	2,045	2,108	2,171	2,097r	2,023
Combined cycle gas turbine station	1,905	1,813	1,616	1,461r	1,405
Hydro-electric stations (natural flow)	163	169	186	206	219
Wind *(4) (9)*	905	1,094	1,234r	1,524r	1,716
Solar *(4)*	499	940	1,344r	1,625r	1,598
Renewables other than hydro, wind	1,914	2,594	2,568r	3,072r	3,379
All generating companies	-	-	-	-	-
Total capacity	**84,596**	**84,412**	**79,917r**	**78,188r**	**81,294**
Of which:	-	-	-	-	-
Conventional steam stations *(8)*	25,186	23,390	20,885	16,704r	16,334
Combined cycle gas turbine station	34,872	33,807	31,050r	31,266r	32,887
Nuclear stations	9,906	9,937	9,487	9,497	9,361
Gas turbines and oil engines	1,639	1,643	1,287r	1,766r	1,680
Hydro-electric stations:	-	-	-	-	-
Natural flow *(4)*	1,561	1,569	1,586	1,608r	1,623
Pumped storage	2,744	2,744	2,744	2,744	2,744
Wind *(4)*	4,851	5,622	6,151r	6,955r	8,529
Solar *(4)*	499	940	1,632r	2,025r	2,172
Renewables other than hydro, wind	3,338	4,760	5,094r	5,624r	5,964

(1) See paragraphs 5.72 to 5.79 for information on companies covered.
(2) See paragraph 5.86 for definition. Data before 2006 are based on declared net capacity.
(3) Includes gas fired stations that are not Combined Cycle Gas Turbines, or have some CCGT capability but mainly operate as conventional thermal stations.
(4) Small-scale hydro, wind and solar photovoltaics capacity are shown on declared net capability basis, and are de-rated to account for intermittency, by factors of 0.365, 0.43 and 0.17 respectively. See paragraph 5.87.
(5) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.74
(6) For Major Power Producers, this includes bioenergy; for other generators, this includes bioenergy, wave and tidal.
(7) "Other generators" capacities are given in declared net capacity terms, see paragraph 5.77.
(8) For other generators, conventional steam stations include combined heat and power plants (electrical capacity only) but exclude combined cycle gas turbine plants, hydro-electric stations and plants using renewable sources.
(9) Falls in capacity in 2007, 2010 and 2012 due to re-classification of capacity to Major Power Producers.
(10) Stations on Supplemental Balancing Reserve, ie. those that are closed but available for times of high demand such as winter, are classed as having zero capacity. SBR ended in 2017.
(11) Significant revision to gas turbine capacity as a plant was converted in 2016 from CCGT and this was not reflected in the previous publication.

5.8 Major Power Producers Plant capacity - England and Wales, Scotland, and Northern Ireland

MW

	end December				
	2013	2014	2015	2016	2017
Major power producers in England and Wales *(1)*					
Total transmission entry capacity *(2)*	**65,019**	**63,348**	**58,306r**	**57,984r**	**60,124**
Of which:	-	-	-	-	-
Conventional steam stations:	19,821	17,962	15,394	13,797r	13,461
Coal fired	18,331	16,472	15,274	13,677r	13,341
Oil fired	1,370	1,370	-	-	-
Mixed or dual fired *(3)*	120	120	120	120	120
Combined cycle gas turbine stations	30,765	29,792	27,230r	27,601r	29,278
Nuclear stations	7,617	7,648	7,198	7,208	7,037
Gas turbines and oil engines	1,191	1,195	839r	1,318r	1,232
Hydro-electric stations:	-	-	-	-	-
Natural flow	141	141	141	141	141
Pumped storage	2,004	2,004	2,004	2,004	2,004
Wind *(4)*	2,110	2,526	2,795	3,019r	3,948
Solar	-	-	288r	398r	553
Renewables other than hydro and wind *(5)*	1,370	2,080	2,417r	2,498r	2,471
Major power producers in Scotland *(1)*	-	-	-	-	-
Total transmission entry capacity *(2)*	**9,630**	**9,827**	**9,970r**	**7,921r**	**8,461**
Of which:	-	-	-	-	-
Conventional steam and combined cycle gas turbine stations	3,442	3,442	3,440	1,180	1,180
	-	-	-	-	-
Nuclear stations	2,289	2,289	2,289	2,289	2,324
Gas turbines and oil engines	131	131	131	131	137
Hydro-electric stations:	-	-			
Natural flow	1,258	1,259	1,259	1,260	1,263
Pumped storage	740	740	740	740	740
Wind *(4)*	1,716	1,881	2,001	2,266	2,702
Solar	-	-	1r	2r	2
Renewables other than hydro and wind *(5)*	54	86	109	54	114
Major power producers in Northern Ireland *(1)*	-	-	-	-	-
Total transmission entry capacity *(2)*	**2,518**	**2,518**	**2,522r**	**2,298r**	**2,369**

(1) See paragraphs 5.72 to 5.79 for information on companies covered.
(2) See paragraph 5.86 for definition. Data before 2006 are based on declared net capacity.
(3) Includes gas fired stations that are not Combined Cycle Gas Turbines, or have some CCGT capability but mainly operate as conventional thermal stations.
(4) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.64.
(5) Bioenergy only.

5.9 Capacity of other generators

	2013	2014	2015	2016	2017
Capacity of own generating plant *(1) (2)*					
Undertakings in industrial and commercial sector:					
Oil and gas terminals and oil refineries	1,019	917	874	863	864
Iron and steel	314	314	314	206	206
Chemicals	815	767	678r	661	661
Engineering and other metal trades	199	199	171	171	171
Food, drink and tobacco	438	457	469r	469	485
Paper, printing and publishing	470	508	498r	397	400
Other *(3)*	4,072	4,581	6,011r	7,115r	7,240
Total industrial, commercial and domestic sector	7,327	7,744	9,016r	9,882r	10,027
Undertakings in transport sector	103	103	103	103	103
Total other generators	**7,430**	**7,847**	**9,119r**	**9,985r**	**10,130**

(1) For combined heat and power plants the electrical capacity only is included. Further CHP capacity is included under major power producers in Table 5.7. A detailed analysis of CHP capacity is given in the tables of Chapter 7. Figures may not sum to 5.7 due to rounding.
(2) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.74.
(3) Includes companies in the commercial sector, and domestic installations.

5.10 Plant loads, demand and efficiency

Major power producers [1]

	Unit	2013	2014	2015	2016	2017
Simultaneous maximum load met *(2) (3*	MW	53,420	53,858	52,753	52,909	52,279
of which England and Wales	MW	..	..	..	..	..
Scotland	MW	..	..	..	..	..
Great Britain	MW	51,811	52,516	51,100	51,169	50,700
Northern Ireland	MW	1,609	1,342	1,653	1,740	1,579
Maximum demand as a percentage of UK Major Power Producers' capacity	Per cent	69.2	71.2	74.5r	77.6r	73.7
Plant load factor *(2) (4)*						
Combined cycle gas turbine stations	Per cent	28.0	30.5	32.1r	49.6r	45.3
Nuclear stations	"	73.8	66.6	75.1	78.1r	77.4
Pumped storage hydro	"	12.0	12.0	11.4	12.2r	11.9
		-	-	-	-r	-
Conventional thermal and other stations *(5)*	"	61.0	57.2	52.2r	37.3r	37.1
of which coal-fired stations *(6) (7)*	"	58.1	50.7	44.0r	21.2r	17.3
		-	-	-r	-r	-
All plant *(8) (9)*	"	**46.1**	**44.8**	**45.4r**	**47.3r**	**46.1**
System load factor *(10)*	"	**70.7**	**67.0**	**68.3**	**67.1r**	**66.6**
Thermal efficiency *(11)*						
(gross calorific value basis)						
Combined cycle gas turbine stations	"	47.7	47.2	48.0	48.9r	48.7
Coal fired stations	"	35.8	35.9	35.6	35.0	34.9
Nuclear stations	"	39.3	39.6	39.1	40.0	40.0

(1) See paragraphs 5.72 to 5.79 for information on companies covered.
(2) Load met by transmission network, net of demand met by embedded generation. See paragraph 5.88 for definitions.
(3) Data cover the 12 months ending March of the following year, e.g. 2017 data are for the year ending March 2018.
(4) Load factors for renewable sources, including wind and hydro, can be found in Table 6.5.
(5) Conventional steam plants, gas turbines and oil engines and plants producing electricity from thermal renewable sources; supply from all generators, with capacity just from MPPs.
(6) Includes both coal-fired stations, and dual/mixed fired stations that mainly use coal.
(7)Coal in 2016 was revised to correct an error
(8) Includes wind (from 2008), solar (from 2015) and natural flow hydro, using capacity that has not been de-rated for intermittency.
(9)Uses electricity supplied by all generators, with the capacity of MPP sites for all fuels
(10) Average electricity available as percentage of maximum demand. See paragraph 5.88.
(11) See paragraph 5.89 for definition of thermal efficiency.

5.11 Power Stations in the United Kingdom

(operational at the end of May 2018)[1]

Company Name	Station Name	Fuel	Installed Capacity (MW)	Year of commission or year generation began	Location Scotland, Wales, Northern Ireland or English region	
AES	Ballylumford B	Gas	540	1968	Northern Ireland	
	Ballylumford B OCGT	Gas oil	116	1968	Northern Ireland	
	Ballylumford C	CCGT	616	2003	Northern Ireland	
	Kilroot OCGT	Gas oil	142	1981	Northern Ireland	
	Kilroot	Coal/oil	560	1981	Northern Ireland	
Blue energy	Beinneun Wind Farm	Wind	109	2017	Scotland	
	Cour Wind Farm	Wind	21	2016	Scotland	
British Solar Renewables	Bradenstoke Solar Park	Solar	70	2015	South West	
Calon energy (formerly MPF operations)	Sutton Bridge	CCGT	819.0	1999	East Midlands	
	Baglan Bay CCGT	CCGT	520.0	2002	Wales	
	Severn Power	CCGT	850.0	2010	Wales	
	Baglan Bay OCGT	OCGT	32.3	2002	Wales	
Centrica	Peterborough	CCGT	360.0	1993	East England	*(2)*
	Glanford Brigg	CCGT	150.0	1993	Yorkshire & Humber	*(2)*
	Barry	CCGT	235.0	1998	Wales	*(2)*
Corby Power Ltd	Corby	CCGT	401	1993	East Midlands	
Cubico Sustainable Investments Limited	Broxted Solar Park	Solar	32	2014	Eastern	
	Owl's Hatch Solar Park	Solar	51.9	2015	South East	
Drax Power Ltd	Drax - coal units	Coal	1,980	1974	Yorkshire and the Humber	
	Drax - biomass units	Biomass	1,980	1974	Yorkshire and the Humber	
	Drax GT	Gas oil	75	1971	Yorkshire and the Humber	
E.On UK	Blackburn meadows *	Biomass	33.0	2015	Yorkshire & Humber	
	Castleford	CCGT	56.0	2002	Yorkshire & Humber	
	Sandbach	CCGT	56.0	1999	North West	
	Steven's Croft *	Biomass	50.0	2007	Scotland	
	Thornhill	CCGT	50.0	1998	Yorkshire & Humber	
	Camster	Wind	50.0	2013	Scotland	
	Humber Gateway	Wind (offshore)	219.0	2015	Yorkshire and Humber	
	London Array	Wind (offshore)	630.0	2013	South East	
	Robin Rigg East	Wind (offshore)	90.0	2010	Scotland	
	Robin Rigg West	Wind (offshore)	90.0	2010	Scotland	
	Rosehall	Wind	25.0	2013	Scotland	
	Scroby Sands	Wind (offshore)	60.0	2004	Eastern	
	Tween Bridge	Wind	44.0	2012	Yorkshire and Humber	
	Rampion	Wind (offshore)	182.9	2018	South East	
EDF Energy	Dungeness B	Nuclear	1,120.0	1983	South East	
	Hartlepool	Nuclear	1,207.0	1984	North East	
	Heysham 1	Nuclear	1,179.0	1984	North West	
	Heysham 2	Nuclear	1,254.0	1988	North West	
	Hinkley Point B	Nuclear	1,061.0	1976	South West	
	Sizewell B	Nuclear	1,216.0	1995	East England	
	Hunterston B	Nuclear	1,074.0	1976	Scotland	
	Torness	Nuclear	1,250.0	1988	Scotland	
	Cottam	Coal	2,008.0	1969	West Midlands	
	West Burton	Coal	2,012.0	1967	West Midlands	
	West Burton CCGT	CCGT	1,332.0	2012	West Midlands	
	Barkantine Heat & Power Company *	Gas	1.0	2000	London	
	London Heat & Power Company *	Gas	9.0	2000	London	
	West Burton GT	Gas oil	40.0	1967	East Midlands	
EDF renewables	Beckburn	Wind	31.1	2017	North West	
	Bicker Fen	Wind	26.0	2008	East Midlands	
	Blyth	Wind (offshore)	40.0	2017	North East	
	Burnfoot	Wind	30.1	2010	Scotland	
	Burnhead Moss	Wind	26.0	2015	Scotland	
	Corriemoillie	Wind	47.5	2017	Scotland	
	Fallago Rig	Wind	144.0	2013	Scotland	
	Green Rigg	Wind	36.0	2012	North East	
	Longpark	Wind	38.0	2009	Scotland	
	Red Tile	Wind	24.0	2006	Eastern	
	Rusholme	Wind	24.0	2010	Yorkshire and Humber	
	Teesside (offshore)	Wind (offshore)	62.0	2013	North East	
Eggborough Power Ltd	Eggborough	Coal	1,960.0	1967	Yorkshire & Humber	
Eneco	Burn of Whilk	Wind	22.5	2015	Scotland	
	Lochluichart	Wind	69.0	2014	Scotland	
	Moy	Wind	60.0	2016	Scotland	
	Twinshiels	Wind	25.0	2015	Scotland	
ENGIE	Dinorwig	Pumped storage	1,800.0	1983	Wales	
	Ffestiniog	Pumped storage	360.0	1961	Wales	
EPR	Eye Suffolk	Biomass	14.3	1992	East England	
	Glanford	Meat & bone meal	14.0	1993	Yorkshire & Humber	
	Thetford	Biomass	41.5	1998	East England	
	Westfield	Biomass	12.5	2000	Scotland	
	EPR Ely Ltd	Straw	38.0	2001	East England	*(4)*
EPUKi	South Humber Bank	CCGT	1,365.0	1996	Yorkshire & Humber	
	Langage	CCGT	905.0	2010	South West	
ESB	Coolkeeragh	CCGT	408.0	2005	Northern Ireland	
	Coolkeeragh OCGT	Gas oil	53.0	2005	Northern Ireland	
	Carrington	CCGT	910.0	2016	North West	

For footnotes see end of section

5.11 Power Stations in the United Kingdom
(operational at the end of May 2018)[1] (continued)

Company Name	Station Name	Fuel	Installed Capacity (MW)	Year of commission or year generation began	Location Scotland, Wales, Northern Ireland or English region
Falck renewables LTD	Assel Valley	Wind	25.0	2016	Scotland
	Auchrobert	Wind	38.8	2017	Scotland
	Ben Aketil	Wind	27.6	2007	Scotland
	Cambrian	Wind	58.5	2016	Wales
	Earlsburn	Wind	37.5	2006	Scotland
	Kilbraur	Wind	67.5	2008	Scotland
	Kingsburn	Wind	22.5	2016	Scotland
	Millennium	Wind	65.0	2007	Scotland
	West Browncastle	Wind	30.0	2014	Scotland
Foresight Group	Shotwick	Solar	72	2017	Wales
Fred Olsen	Brockloch Rig	Wind	61.5	2017	Scotland
	Crystal Rig	Wind	62.5	2003	Scotland
	Crystal Rig II	Wind	138.0	2003	Scotland
	Mid Hill	Wind	75.9	2013	Scotland
	Pauls Hill	Wind	64.4	2005	Scotland
	Rothes	Wind	50.6	2004	Scotland
	Rothes II	Wind	41.4	2013	Scotland
Greencoat	Braes of Doune Wind Farm	Wind	72.0	2006	Scotland
	Drone Hill	Wind	28.6	2012	Scotland
	Maerdy	Wind	24.0	2012	Wales
	North Rhins	Wind	22.0	2010	Scotland
	Sixpenny Wood	Wind	20.5	2013	Yorkshire and Humber
	Stroupster	Wind	29.9	2015	Scotland
	Tappaghan Wind Farm	Wind	28.5	2004	Northern Ireland
	Slieve Divena	Wind	30.0	2009	Northern Ireland
	Bann Road	Solar	45.8	2017	Northern Ireland
	Coltishall 1	Solar	33.7	2015	Eastern
	Eveley	Solar	49.3	2016	South East
Indian Queens Power Ltd	Indian Queens	Gas oil / kerosene	140.0	1996	South West
Infinis	Ardrossan	Wind	30.0	2004	Scotland
	A'Chruach	Wind	42.6	2016	Scotland
	Dalswinton	Wind	30.0	2007	Scotland
	Galawhistle	Wind	55.2	2016	Scotland
	Lissett	Wind	30.0	2007	Yorkshire and Humber
	Minsca	Wind	36.8	2007	Scotland
	Carno	Wind	33.6	1997	Wales
	Causeymire wind farm	Wind	48.3	2004	Scotland
	Farr wind farm ltd	Wind	92.0	2005	Scotland
	Fynnon Oer	Wind	32.0	2006	Wales
	Llyn Alaw	Wind	20.4	1997	Wales
	Windy Standard	Wind	21.6	1996	Scotland
Innogy renewables	Bradwell	Wind	20.5	2013	Eastern
	Galloper	Wind (offshore)	33.0	2013	Yorkshire and Humber
	Goole Fields 2	Wind	34.9	2016	Yorkshire and Humber
	Gwynt-y-Mor	Wind (offshore)	576.0	2013	Wales
	Little Cheyne Court	Wind	59.8	2008	South East
	Middlemoor	Wind	54.0	2013	North East
	North Hoyle	Wind (offshore)	60.0	2003	Wales
	Novar2	Wind	36.8	2012	Scotland
	Rhyl Flats	Wind (offshore)	90.0	2009	Wales
	Galloper Wind Farm	Wind (offshore)	72.0	2017	Eastern
Intergen	Rocksavage	CCGT	810.0	1998	North West
	Coryton	CCGT	800.0	2001	East England
	Spalding	CCGT	880.0	2004	East Midlands
Lark	Nixey Farm - Chalgrove - Solar Farm	Solar	21.3	2015	South East
LightsourceBP	Bury Lane	Solar	22.2	2014	Eastern
	Crundale	Solar	43.7	2014	Wales
	Exning	Solar	30.3	2015	Eastern
	Fareham	Solar	20.5	2014	South East
	Hill House Farm	Solar	28.3	2015	South West
	South Creake	Solar	26.0	2016	Eastern
	Lough Road PV	Solar	32.1	2017	Northern Ireland
Londonwaste Limited	Edmonton	Waste	60.0	1970	London
Magnox Ltd	Maentwrog	Hydro	35.3	1928	Wales
Marchwood Power Limited	Marchwood	CCGT	920.0	2009	South East
Multifuel energy ltd	Ferrybridge Multi-fuel	Waste	79.0	2015	Yorkshire & Humber
Octopus energy	Abbots Ripton	Solar	24.7	2014	Eastern
	Ermine	Solar	32.4	2014	East Midlands
	Melborn Muncey	Solar	30.9	2015	Eastern
	Pitchford	Solar	21.0	2015	West Midlands
	Waterloo	Solar	28.7	2015	Eastern
Orsted	Barrow	Wind (offshore)	90.0	2006	North West
	Burbo Extension Offshore Windfarm	Wind (offshore)	259.0	2017	North West
	Burbo Offshore Windfarm	Wind (offshore)	90.0	2007	North West
	Gunfleet Sands 1 & 2 Ltd.	Wind (offshore)	172.8	2010	Eastern
	Lincs	Wind (offshore)	270.0	2013	East Midlands
	Race Bank	Wind (offshore)	548.1	2018	Eastern
	Walney 1 & 2	Wind (offshore)	368.0	2012	North West
	Walney 3	Wind (offshore)	330.0	2017	North West
	West of Duddon Sands	Wind (offshore)	388.8	2014	North West
	Westermost Rough	Wind (offshore)	210.0	2014	Yorkshire and Humber
Peel Energy Ltd	Frodsham Wind Farm Ltd	Wind	50.4	2016	North West
REG power	Glens of Foudland	Wind	26.0	2005	Scotland

For footnotes see end of section

5.11 Power Stations in the United Kingdom
(operational at the end of May 2018)[1] (continued)

Company Name	Station Name	Fuel	Installed	Year of commission	Location	
Renewable energy systems	Gruig Wind Farm Limited	Wind	25.0	2009	Northern Ireland	
	Altahullion Wind Farm (NI)	Wind	26.0	2003	Northern Ireland	
	Black Hill Wind Farm (GB)	Wind	28.6	2006	Scotland	
	Freasdail (GB)	Wind	22.5	2017	Scotland	
	Garreg Llwyd (GB)	Wind	30.4	2017	Wales	
	Glenchamber Wind Farm (GB)	Wind	27.5	2016	Scotland	
	Hill of Towie Wind Farm (GB)	Wind	48.3	2012	Scotland	
	Kelburn Wind Farm (GB)	Wind	28.0	2012	Scotland	
	Minnygap (GB)	Wind	25.0	2017	Scotland	
	Penmanshiel (GB)	Wind	28.7	2016	Scotland	
	Wadlow Farm (GB)	Wind	26.0	2012	Eastern	
	Wryde Croft Wind Farm (GB)	Wind	26.0	2016	Eastern	
	Parley	Solar	24.2	2014	South West	
Riverside Resource Recovery Limited	Riverside - Energy from Waste	Waste	80.0	2011	London	*(5)*
Rockfire capital	Swindon Solar Farm	Solar	60.9	2016	South West	
RWE Generation SE	Aberthaw B	Coal	1,610.0	1971	Wales	
	Aberthaw GT	Gas oil	51.0	1971	Wales	
	Cowes	Gas oil	140.0	1982	South East	
	Didcot B	CCGT	1,550.0	1998	South East	
	Didcot GT	Gas oil	100.0	1972	South East	
	Great Yarmouth	CCGT	420.0	2001	East England	
	Little Barford	CCGT	740.0	1995	East England	
	Little Barford GT	Gas oil	17.0	2006	East England	
	Markinch CHP *	Biomass	65.0	2014	Scotland	
	Pembroke	CCGT	2,199.0	2012	Wales	
	Staythorpe C	CCGT	1,772.0	2010	East Midlands	
Saltend Cogeneration Company Ltd	Saltend *	CCGT	1,200.0	2000	Yorkshire & Humber	
Scira Offshore Energy Ltd	Dudgeon BMU 1	Wind (offshore)	108.0	2017	Eastern	
	Dudgeon BMU 2	Wind (offshore)	90.0	2017	Eastern	
	Dudgeon BMU 3	Wind (offshore)	102.0	2017	Eastern	
	Dudgeon BMU 4	Wind (offshore)	102.0	2017	Eastern	
	Hywind BMU 1	Wind (offshore)	30.0	2017	Scotland	
	Sheringham Shoal BMU 1	Wind (offshore)	158.0	2012	Eastern	
	Sheringham Shoal BMU 2	Wind (offshore)	158.0	2017	Eastern	
Scottish power	Blackburn	CCGT	59.0	2011	North West	
	Damhead Creek	CCGT	805.0	2000	South East	
	Shoreham	CCGT	420.0	2000	South East	
	Rye House	CCGT	715.0	1993	East England	
	Arecleoch	Wind	120.0	2010	Scotland	
	Beinn an Tuirc I	Wind	29.7	2001	Scotland	
	Beinn an Tuirc II	Wind	43.7	2002	Scotland	
	Beinn Tharsuinn	Wind	29.8	2006	Scotland	
	Black Law	Wind	124.2	2005	Scotland	
	Black Law II	Wind	63.4	2017	Scotland	
	Cruach Mhor	Wind	29.8	2004	Scotland	
	Dersalloch	Wind	69.0	2016	Scotland	
	Dun Law II	Wind	29.8	2009	Scotland	
	Ewe Hill II	Wind	36.8	2017	Scotland	
	Glenapp	Wind	22.0	2016	Scotland	
	Green Knowes	Wind	27.0	2008	Scotland	
	Hagshaw Hill II	Wind	26.0	1995	Scotland	
	Hare Hill II	Wind	29.8	2016	Scotland	
	Harestanes	Wind	136.0	2013	Scotland	
	Kilgallioch	Wind	239.0	2017	Scotland	
	Lynemouth	Wind	26.0	2012	North East	
	Mark Hill	Wind	56.0	2011	Scotland	
	P&L	Wind	30.6	1993	Wales	
	Whitelee	Wind	322.0	2007	Scotland	
	Whitelee II	Wind	217.0	2013	Scotland	
	Glenlee	Hydro	24.0	1935	Scotland	
	Kendoon	Hydro	24.0	1936	Scotland	
	Tongland	Hydro	33.0	1935	Scotland	
	Cruachan	Pumped storage	440.0	1966	Scotland	
Seabank Power Limited	Seabank	CCGT	1,234.0	1998	South West	*(6)*
Sellafield Ltd	Fellside CHP *	CCGT	180.0	1995	North West	
Sembcorp Utilities (UK) Ltd	Wilton GT *	Gas	120.0	1952	North East	*(7)*
	Wilton 10 *	Biomass	38.0	2007	North East	
SIMEC	Uskmouth power	Coal	363.0	1966	Wales	
South East London Combined Heat & Power Ltd	SELCHP ERF *	Waste	35.0	1994	London	

For footnotes see end of section

5.11 Power Stations in the United Kingdom
(operational at the end of May 2018)[1] (continued)

Company Name	Station Name	Fuel	Installed	Year of commission	Location	
SSE	Deanie	Hydro	38.0	1963	Scotland	
	Fasnakyle	Hydro	69.0	1951	Scotland	
	Lochay	Hydro	46.0	1958	Scotland	
	Luichart	Hydro	34.0	1954	Scotland	
	Foyers	Hydro / pumped storage	300.0	1974	Scotland	
	Glendoe	Hydro	100.0	2008	Scotland	
	Glenmoriston	Hydro	37.0	1957	Scotland	
	Clachan	Hydro	40.0	1955	Scotland	
	Inverawe	Hydro	25.0	1963	Scotland	
	Sloy	Hydro	152.5	1950	Scotland	
	Clunie	Hydro	61.2	1950	Scotland	
	Errochty	Hydro	75.0	1955	Scotland	
	Rannoch	Hydro	45.0	1930	Scotland	
	Tummel	Hydro	34.0	1933	Scotland	
	Burghfield	Gas	50.0	1998	South East	
	Chickerell	Gas	50.0	1998	South West	
	Chippenham	Gas	10.0	2002	South West	
	Pilkington - Greengate *	Gas	10.0	1998	North West	
	Arnish	Diesel	10.2	2001	Scotland	
	Barra	Diesel	3.0	1990	Scotland	
	Bowmore	Diesel	6.2	1946	Scotland	
	Kirkwall	Diesel	16.0	1953	Scotland	
	Lerwick	Diesel	67.0	1953	Scotland	
	Loch Carnan, South Uist	Diesel	11.5	1971	Scotland	
	Tiree	Diesel	3.0	1945	Scotland	
	Peterhead	CCGT	1,180.0	1980	Scotland	(3)
	Stornoway	Diesel	24.0	1950	Scotland	
	Keadby	CCGT	735.0	1994	Yorkshire & Humber	
	Medway	CCGT	755.0	1995	South East	
	Fiddler's Ferry GT	Gas oil	35.0	1969	North West	
	Fiddler's Ferry	Coal	1,961.0	1971	North West	
	Slough *	Biomass	35.0	1918	South East	
	Keadby GT	Gas oil	25.0	1994	Yorkshire and the Humber	
	Achany Windfarm	Wind	38.0	2010	Scotland	
	Artfield Fell Windfarm - A,C	Wind	28.6	2005	Scotland	
	Bhlaraidh Wind Farm	Wind	110.4	2017	Scotland	
	Clyde Windfarm (Central)	Wind	112.7	2011	Scotland	
	Clyde Windfarm (North)	Wind	108.1	2012	Scotland	
	Clyde Windfarm (South)	Wind	128.8	2011	Scotland	
	Drumderg Windfarm	Wind	36.8	2008	Scotland	
	Dunmaglass Wind Farm	Wind	94.1	2016	Scotland	
	Fairburn Windfarm	Wind	40.0	2010	Scotland	
	Gordonbush Wind Farm	Wind	70.0	2012	Scotland	
	Greater Gabbard	Wind (offshore)	504.0	2012	Eastern	
	Griffin Wind Farm	Wind	188.6	2012	Scotland	
	Hadyard Hill Windfarm - A,C	Wind	119.8	2006	Scotland	
	Keadby Wind Farm	Wind	68.0	2013	Yorkshire and Humber	
	Slieve Kirk Windfarm	Wind	73.6	2012	Northern Ireland	
	Strathy North	Wind	66.0	2015	Scotland	
	Toddleburn Windfarm	Wind	27.6	2010	Scotland	
	Tievenameenta Wind Farm	Wind	34.5	2017	Northern Ireland	
	Barkip AD	Waste	2.7	2012	Scotland	
Statkraft Energy Ltd	Alltwalis Wind Farm	Wind	23.0	2009	Wales	
	Andershaw Wind Farm	Wind	35.0	2016	Scotland	
	Baillie Wind Farm	Wind	52.5	2013	Scotland	
	Berry Burn Wind farm	Wind	66.7	2014	Scotland	
	Rheidol	Hydro	56.0	1961	Wales	
Suez recycling and recovery	Wilton 11 EfW	Waste	49.0	2016	North East	
Third Energy Trading Ltd	Knapton	Gas	41.5	1994	Yorkshire & Humber	
Uniper UK Limited	Cottam Development Centre	CCGT	445.0	1999	East Midlands	
	Connahs Quay	CCGT	1,380.0	1996	Wales	
	Enfield	CCGT	408.0	1999	London	
	Grain CHP *	CCGT	1,517.0	2010	South East	
	Killingholme	OCGT	600.0	1994	East Midlands	
	Ratcliffe	Coal	2,021.0	1968	East Midlands	
	Taylor's Lane GT	Gas oil	144.0	1979	London	
	Grain GT	Gas oil	56.0	1978	South East	
	Ratcliffe GT	Gas oil	34.0	1966	East Midlands	
Vattenfall	Clashindarroch	Wind	36.9	2015	Scotland	
	Edinbane	Wind	41.4	2010	Scotland	
	Kentish	Wind (offshore)	90.0	2005	South East	
	Kentish Flats Extension	Wind (offshore)	49.5	2015	South East	
	Ormonde	Wind (offshore)	150.0	2012	North West	
	Pen y Cymoedd	Wind	228.0	2016	Wales	
	Ray	Wind	54.4	2017	North East	
	Swinford	Wind	22.0	2012	East Midlands	
	Thanet	Wind (offshore)	300.0	2010	South East	
Viridor Waste Management	Runcorn EfW	Waste	86.0	2014	North West	
	Bolton EfW	Waste	8.0	1971	North West	
	Exeter EfW	Waste	3.5	2014	South West	
	Peterborough EfW	Waste	7.3	2016	East Midlands	
	Ardley EfW	Waste	26.0	2014	South East	
	Cardiff EfW	Waste	30.0	2014	South Wales	
	Lakeside EfW	Waste	37.0	2010	South West	
VPI Immingham LLP	VPI Immingham *	CCGT	1,240.0	2004	Yorkshire & Humber	
WPO	Airies	Wind	39.9	2017	Scotland	
	Corriegarth	Wind	69.0	2016	Scotland	
	Dungavel	Wind	26.0	2015	Scotland	
	Middlewick	Wind	20.7	2014	Eastern	
	Scout Moor	Wind	65.0	2008	North West	
	Tir Mostyn & Foel Goch	Wind	21.3	2005	Wales	
Xceco	Inner Dowsing	Wind (offshore)	97.2	2009	East Midlands	
	Lynn	Wind (offshore)	97.2	2009	East Midlands	
Total			**79,354**			

For footnotes see end of section

5.11 Power Stations in the United Kingdom
(operational at the end of May 2018)[1] (continued)

Other power stations

Renewable sources and combustible wastes	Other MPP wind onshore	1,936
	Other MPP wind offshore	16
	Other generators wind	3,990
	Other generators landfill gas	1,066
	Other generators sewage gas	245
	Other generators biomass and waste	1,910
	Other MPP hydro	1,009
	Other generators hydro	413
	Other MPP Solar	2,557
	Other generators solar photovoltaics and wave/tidal	9,416

Interconnectors

	Capacity (MW)
England - France	2,000
England - Netherlands	1,000
Scotland - Northern Ireland	500
Wales - Irish Republic	500
Northern Ireland - Irish Republic	600

Footnotes

(1) This list covers stations owned or operated by Major Power Producers, apart from non-thermal renewable sites under 20MW capacity (which are included in the database tab); other power stations (including many renewable sites and auto-generators) are included in the sub table at the end of table 5.11

(2) Capacity reduced in 2013, with these stations typically now operating as Open Cycle Gas Turbines.

(3) Total capacity is 1,840 MW but because of transmission constraints only 1,180 MW can be used at any

(4) Previously called Elean

(5) Previously called Belvedere

(6) Previously split into Seabank 1 and 2

(7) Previously split into Wilton GT1 and GT2

* indicates CHP plant

5.12 Plant installed capacity, by connection - United Kingdom

MW

	end December				
	2013	2014	2015	2016	2017
Transmission Network - Great Britain					
Installed capacity (1)	**73,998**	**72,213**	**67,259r**	**67,682r**	**70,695**
Coal (2)	20,216	18,353	14,513r	13,737	13,915
CCGT	30,805	29,880	30,199r	29,964r	30,637
Oil	1,370	1,370	-	-	-
Nuclear - Magnox	490	490	-	-	-
Nuclear - PWR	1,198	1,198	1,198	1,198	1,216
Nuclear - AGR	7,685	7,720	7,720	7,720	8,145
OCGT	1,112	1,076	937	1,488r	1,489
Hydro	1,213	1,226	1,228	1,228	1,228
Onshore Wind	2,713	2,747	2,777	3,280r	3,873
Offshore Wind	2,721	3,507	3,716	3,862r	5,098
Bioenergy (3)	1,647	1,817	2,226	2,460	2,349
Pumped Storage	2,828	2,828	2,744r	2,744r	2,744
Distribution Network - Great Britain	-	-	-	-	-
Installed capacity (1)	**15,652**	**19,395**	**24,752r**	**28,197r**	**30,838**
Coal (2)	28	33	22	57r	22
CCGT	2,530	2,586	2,399r	2,258r	2,230
Oil	448	350	374	302	286
Diesel Engines	134	138	138	138r	141
OCGT	105	90	-r	-	-
Conventional Thermal Gas	833	883	925r	951r	1,015
Hydro	487	494	540r	598r	636
Onshore Wind	4,221	5,100	5,704r	6,715r	7,788
Offshore Wind	975	994	1,377r	1,431r	1,890
Bioenergy	2,344	2,693	2,982r	3,214r	3,597
PV	2,846	5,362	9,496r	11,775r	12,523
Wave/Tidal	6	7	8	13	18
Other Fuels (4)	695	664	788	746r	692
Transmission Network - Northern Ireland	-	-	-	-	-
Installed capacity (1)	**2,395**	**2,395**	**2,415r**	**2,395r**	**2,435**
Coal (2)	520	520	540r	520r	560
CCGT	1,024	1,024	1,024	1,024	1,024
OCGT	311	311	311	311	311
Conventional Thermal Gas	540	540	540	540	540
Distribution Network - Northern Ireland	-	-	-	-	-
Installed capacity (1)	**647**	**798**	**911r**	**1,113r**	**1,551**
Hydro	9	9	9	10	10
Onshore Wind	582	689	731	886	1,187
Bioenergy	28	37	64	81r	101
PV	27	62	105r	137r	253
Wave/Tidal	1	1	1	-	-
Transmission Network - Total UK	-	-	-	-	-
Installed capacity (1)	**76,393**	**74,608**	**70,058r**	**70,488r**	**73,605**
Coal (2)	20,736	18,873	15,053r	14,257	14,475
CCGT	31,829	30,904	31,223r	30,988r	31,661
Conventional Thermal Gas	540	540	925r	951r	1,015
Oil	1,370	1,370	-	-	-
Nuclear - Magnox	490	490	-	-	-
Nuclear - PWR	1,198	1,198	1,198	1,198	1,216
Nuclear - AGR	7,685	7,720	7,720	7,720	8,145
OCGT	1,423	1,387	1,248	1,799r	1,800
Hydro	1,213	1,226	1,228	1,228	1,228
Onshore Wind	2,713	2,747	2,777	3,280r	3,873
Offshore Wind	2,721	3,507	3,716	3,862r	5,098
Bioenergy	1,647	1,817	2,226	2,460	2,349
Pumped Storage	2,828	2,828	2,744r	2,744r	2,744
	-	-	-	-	-
of which, good quality CHP	2,113	2,141	1,976	1,976	1,976
Distribution Network - Total UK	-	-	-	-	-
Installed capacity (1)	**16,299**	**20,193**	**25,663r**	**29,310r**	**32,389**
Coal (2)	28	33	22	57r	22
CCGT	2,530	2,586	2,399r	2,258r	2,230
Oil	448	350	374	302	286
Diesel Engines	134	138	138	138r	141
OCGT	105	90	-r	-	-
Conventional Thermal Gas	833	883	925r	951r	1,015
Hydro	496	503	549r	607	647
Onshore Wind	4,803	5,789	6,435r	7,600r	8,974
Offshore Wind	975	994	1,377r	1,431r	1,890
Bioenergy	2,372	2,731	3,047r	3,295r	3,698
PV	2,873	5,424	9,601r	11,912r	12,776
Wave/Tidal	7	9	9	13	18
Other Fuels (4)	695	664	788	746r	692
	-	-	-	-	-
of which, good quality CHP	3,811	3,752	3,732r	3,649r	3,859

(1) See paragraph 5.86 for definition.

(2) Includes mixed fuel stations (coal/oil, coal/gas) and co-firing coal stations.

(3) Up to 2016 includes 48 MW of Slough Heat and Power's mixed fuel capacity (remaining 13 MW included under coal).

(4) For MPPs this is municipal solid waste (MSW), for other generators main fuels included are coke oven gas, blast furnace gas, and waste products from chemical processes.

Chapter 6
Renewable sources of energy

Key points

- **Electricity generation (table 6.4) in the UK from renewable sources increased by 19 per cent between 2016 and 2017, to 99.3 TWh.** High wind speeds in 2017, along with increased capacity resulted in a record year for wind generation.
- **Onshore wind was the leading technology in terms of capacity at 31.7 per cen**t. Although solar photovoltaics saw a further increase in capacity, it was insufficient to retain the leading technology status in 2017 with a 31.5 per cent share, (table 6.4).
- **Onshore wind generation increased by 39 per cent to 29.1 TWh with offshore increasing by 27 per cent to 20.9 TWh.** Higher wind speeds compared to 2016, combined with large increases in capacity (onshore 18 per cent, offshore 32 per cent) contributed to the large increases in generation (table 6.4).
- **Generation from hydro sources also increased, by 10 per cent to 5.9 TWh;** a slight increase in capacity more than offset lower rainfall compared to 2016.
- **Renewable heat increased by 3.6 per cent** due to increases in plant biomass and anaerobic digestion schemes supported by the Renewable Heat Incentive (RHI)

Progress against the Renewable Energy Directive

- **In 2017, 10.2 per cent of total energy consumption came from renewable sources (table 6.7);** up from 9.2 per cent in 2016 (revised). Renewable electricity represented 27.9 per cent of total generation; renewable heat 7.7 per cent of overall heat; and renewables in transport, 4.6 per cent.

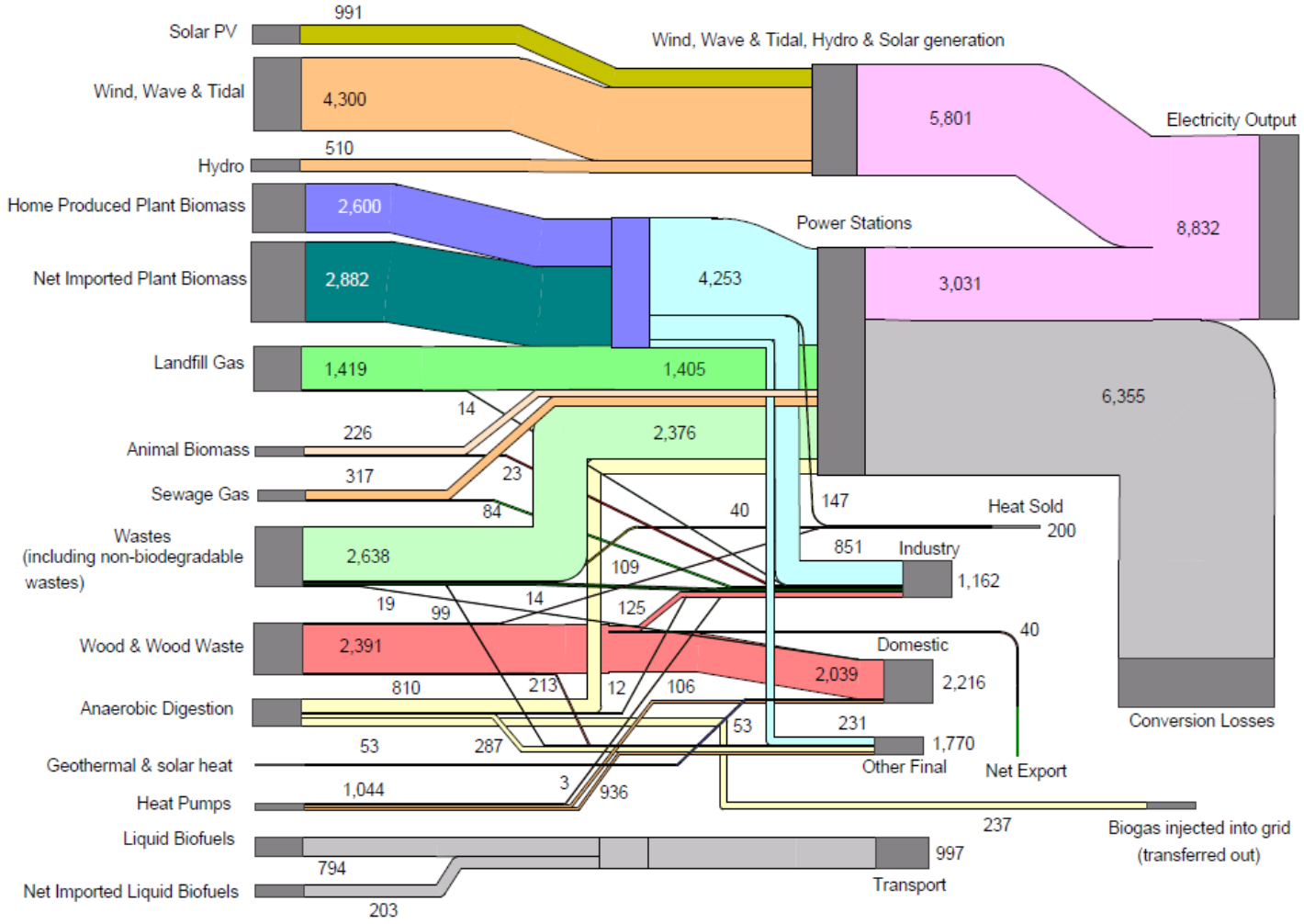
Introduction

6.1 This chapter presents statistics on supply, demand, and consumption for renewable sources of energy (tables 6.1 – 6.6) together with an update of the UK's progress against its renewable energy target for 2017. The UK has a varied mix of renewable technologies including biomass which is a key fuel source in both electricity generation and heat. Wind, solar photovoltaics, hydro and shoreline wave and tidal also contribute to electricity generation and active solar, heat pumps and deep geothermal are used in heat generation. A full list of tables is available at the end of the chapter (see the technical annex for descriptions of the sources of renewable energy).

6.2 Production and consumption of energy from renewable sources has been steadily increasing since 2000. The rise has been driven by national and international incentives including the EU Renewable Energy Directive which requires the EU as a whole to achieve 20 per cent of its energy from renewable sources by 2020 (the UK's target is set at 15 per cent, see the technical annex for a description of the policy context).

6.3 The renewable energy flow chart over the page summarises the flows of renewables from fuel inputs through to consumption for 2017 and includes energy lost in conversion; the data are sourced from the commodity balance table 6.1 and table 6.4 for electricity outputs.

Renewables flow chart 2017 (thousand tonnes of oil equivalent)



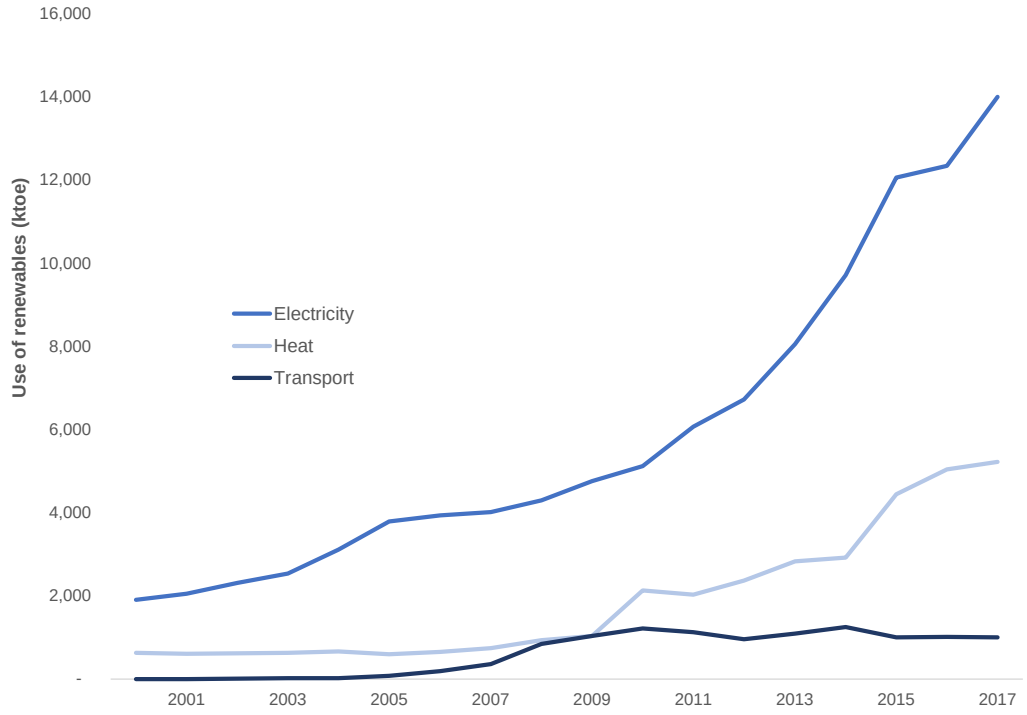
Note: This flow chart is based on data that appear in Tables 6.1 and 6.4

Renewable fuel demand (Tables 6.1 and 6.6)

6.4 The commodity balances tables for renewables (tables 6.1 to 6.3) show that a large proportion (87 per cent) of renewable fuel sources are produced domestically, largely due to the local nature of utilising natural resources such as wind, solar and hydro. However, bio energy fuels are transportable and a significant proportion is imported (24 per cent in 2017, including wood and liquid biofuels). Plant biomass showed the largest proportion of imports at 54 per cent, mainly wood pellets for electricity generation.

6.5 Chart 6.1 and table 6.6 show how renewable fuel demand (excluding non-biodegradable waste) by source (i.e. on an input basis[1]) is split between electricity generation, heat and as a fuel in transport. Excluding non-biodegradable energy from waste, total demand in 2017 increased by 9.9 per cent, to 20,216 ktoe. This growth was due to an increase in bio energy demand, particularly in plant biomass used for electricity generation and heating and also anaerobic digestion for generation. While the amount of renewable energy used for generating electricity and heat have been steadily climbing, the proportion of renewables used for electricity and heat has remained broadly stable in recent years (the proportion used for generating electricity has remained between 67 and 70 per cent since 2012).

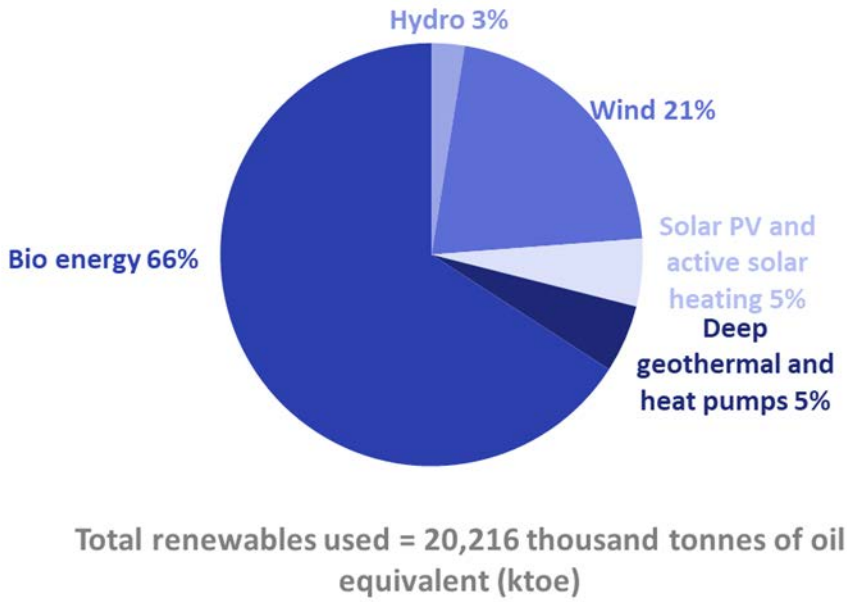
Chart 6.1: Demand for renewable energy by end use:



6.6 In 2017, 66 per cent of renewable energy demand was accounted for by bioenergy with wind accounting for 21 per cent. Chart 6.2 shows a comparison for the key renewables sources.

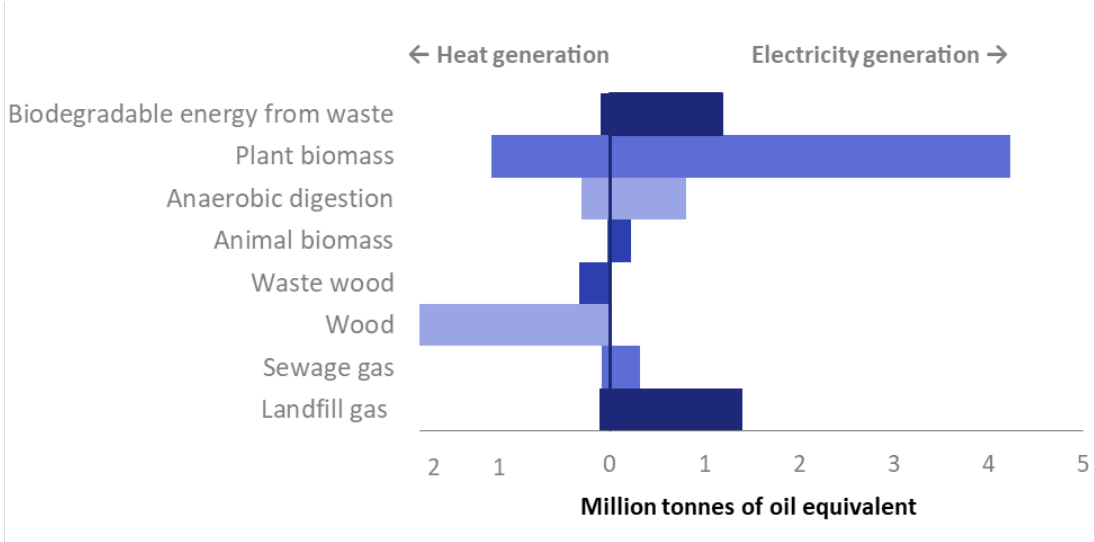
[1] For combustible fuels used to generate electricity, this refers to the energy value of the fuel source rather than the actual electricity generated. For heat generation and primary electricity sources (solar photovoltaics, wind, hydro, and wave and tidal), the output energy is deemed to be equal to the fuel inputs.

Chart 6.2: Renewable fuel use 2017



6.7 Whilst several renewable technologies are specific to either electricity generation or heat production, combustible fuels are used for both purposes. In 2017, 68 per cent of biomass was used in electricity generation. Chart 6.3 below shows a further breakdown of biomass by source and also how its use is split between heating and electricity generation.

Chart 6.3: Biomass fuel use 2017



6.8 Where biofuels are used for generation, a comparison is made in the electricity generation section (paragraph 6.14) between the fuel input split and actual output generation.

Overall Renewable Electricity (table 6.4)

6.9 Total **renewable capacity** increased between 2016 and 2017 by 14 per cent. Most of the increase in both capacity is due to increased wind capacity, accounting for 75 per cent of the increase in capacity.

6.10 In 2017, onshore wind regained the highest share of **capacity** and it also held the highest share of generation (at 31.7 per cent and 29 per cent respectively).

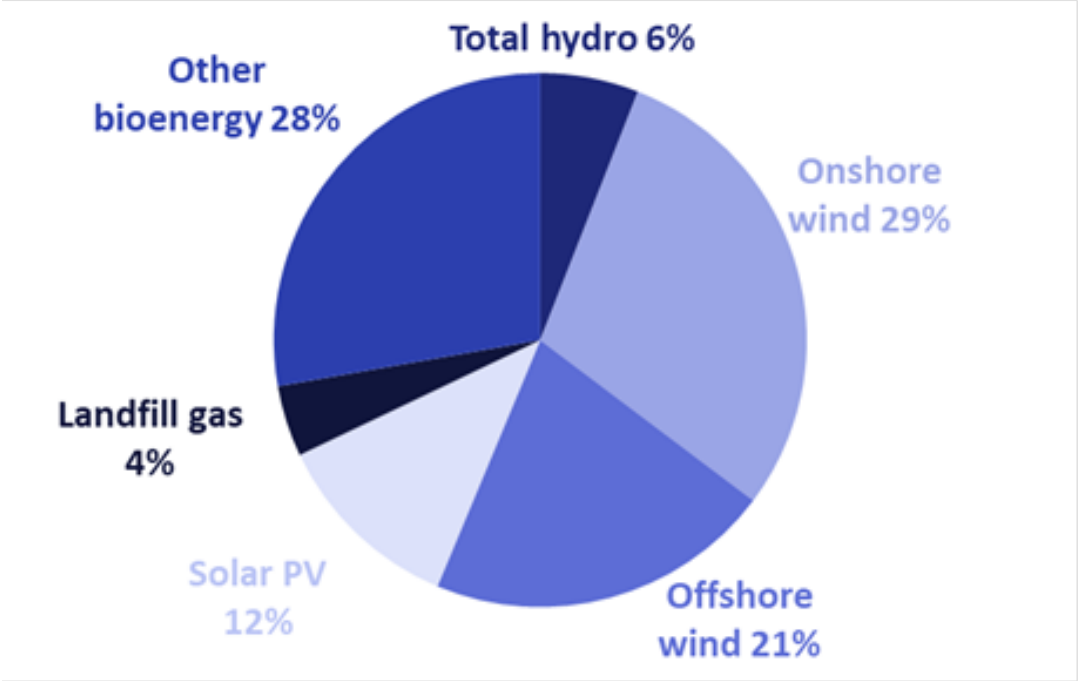
6.11 The main use of renewable energy is to generate electricity. In 2017, **electricity generated from renewables increased by 19 per cent** on 2016, from 83.1 TWh to 99.3 TWh.

6. 12 **Renewable sources provided 29.3 per cent of the electricity generated in the UK in 2017** compared to 24.5 per cent in 2016, an increase of 4.8 percentage points (measured using the "international basis", i.e. electricity generated from all renewables except non-biodegradable wastes as a percentage of all electricity generated in the UK).

6.13 Taken together, onshore and offshore wind represented 79 per cent of the total increase in **generation**; onshore wind increased by 8.2 TWh (39 per cent) and offshore by 4.5 TWh (27 per cent). This was due to a combination of increased capacity and unusually high wind speeds. The third and fourth largest increases in generation (in absolute terms) were plant biomass (1.2 TWh) and solar photovoltaic (1.1 TWh). Landfill gas generation fell by 0.4 TWh, (8.9 per cent) to 4.3 TWh and cofiring with fossil fuels also fell by 54 per cent.

6.14 While bioenergy dominates on a fuel input basis (chart 6.2), hydroelectricity, wind power and solar together provide a larger contribution when the **output** of electricity is being measured as chart 6.4 shows;

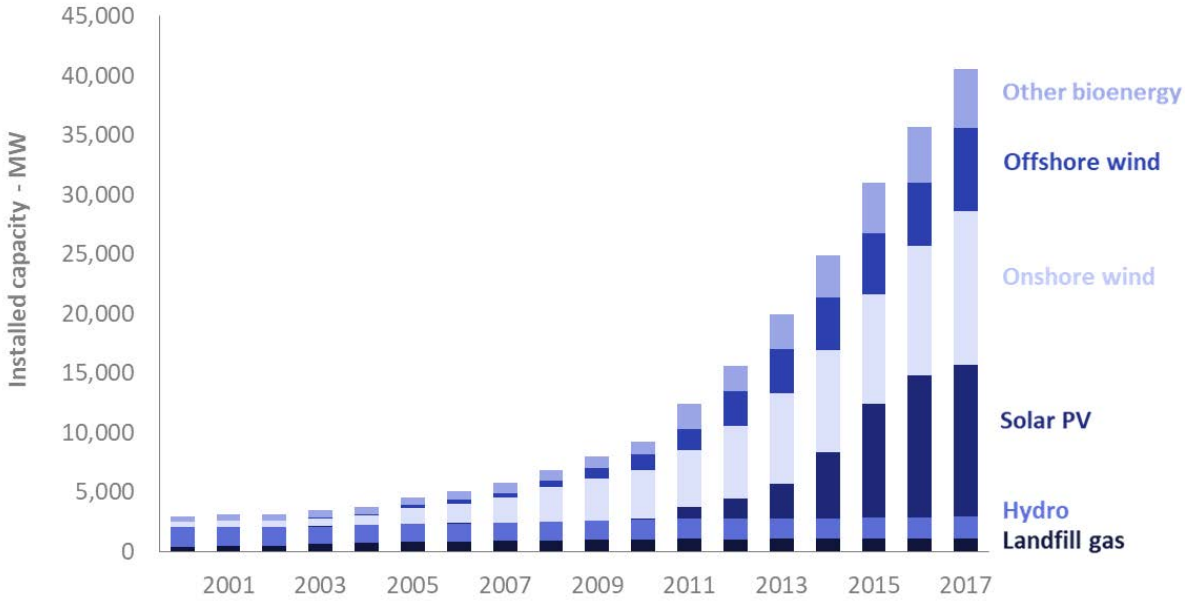
Chart 6.4: Electricity generation by fuel source 2017



This is because on an energy supplied basis the inputs are deemed to be equal to the electricity produced for hydro, wind, wave and solar, i.e. are deemed to be 100 per cent efficient. However, for landfill gas, sewage sludge, municipal solid waste and other bioenergy sources a substantial proportion of the energy content of the input is lost in the process of conversion to electricity (6,355 ktoe in 2017), as the renewables flow chart illustrates.

Charts 6.5 and 6.6 show the long term trends in capacity and generation.

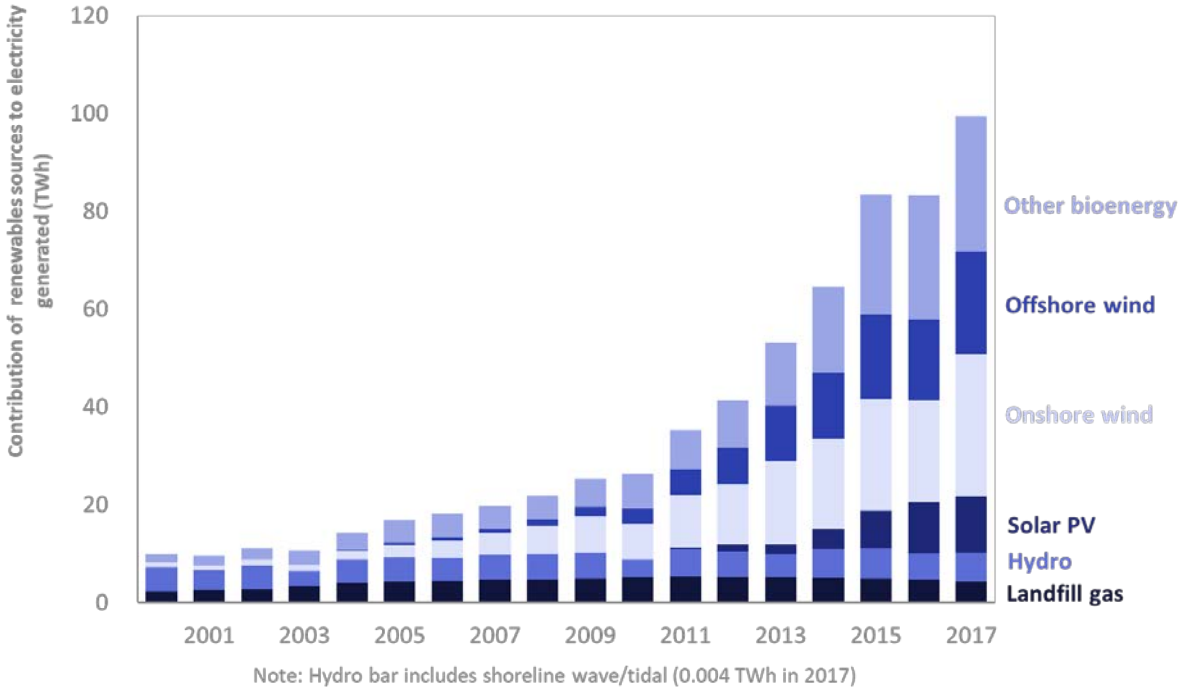
Chart 6.5: Electrical generating capacity of renewable energy plant



(1) All waste combustion plant is included because both biodegradable and non-biodegradable wastes are burned together in the same plant.

(2) Hydro includes both large scale and small scale, and shoreline wave (18.4 MW in 2017).

Chart 6.6: Electricity generation by main renewable sources



Load factors (table 6.5)

6.15 **Load factors** are the ratio of how much electricity was generated as a proportion of the total generating capacity. In 2015 and 2016, solar photovoltaics held the highest share of capacity and in 2017, represented the second highest share at 31.5 per cent. However, due to the low load factor for solar photovoltaics, its share of generation was just 12 per cent. Conversely, bioenergy showed the fourth lowest share of capacity (15 per cent) but the highest share of generation (32 per cent). The

load factor for bioenergy is correspondingly high. Table 6.B below shows the share of total generation and capacity and also their load factors for 2016;

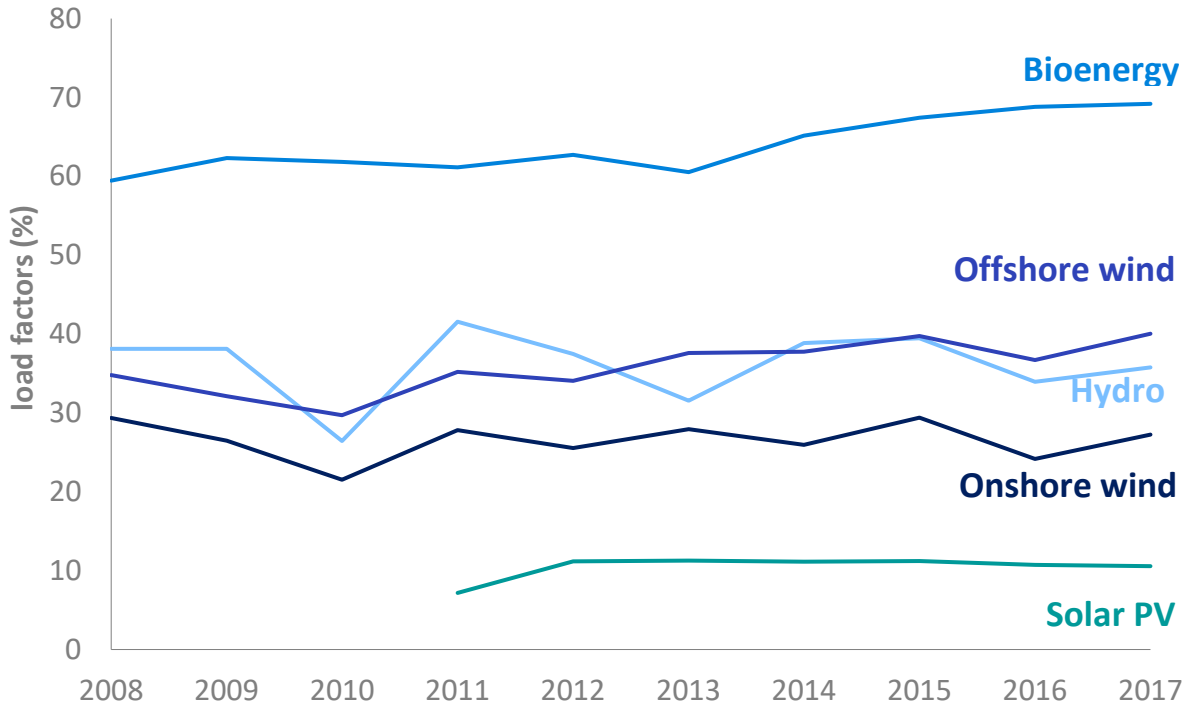
Table 6A Share of generation and capacity by leading technologies

	Share of total capacity	Share of total generation	Load factor
Onshore wind	31.7%	29.3%	28.0%
Solar photovoltaics	31.5%	11.6%	10.7%
Offshore wind	17.2%	21.1%	38.9%
Bioenergy	14.9%	32.1%	61.5%
Hydro	4.6%	6.0%	36.5%
Total	100%	100%	

6.16 The table shows that the technologies with highest capacity do not necessarily have the highest share of generation, since this depends on the load factor (a high load factor giving a relatively higher share of generation). Chart 6.7 shows how load factors have fluctuated since 2008.

6.17 Chart 6.7 below shows the load factors for the key renewable technologies since 2000. Although bioenergy has been grouped into one category, it is mostly influenced by plant biomass which represents 63 per cent of all generation from bioenergy. The chart shows that for weather dependent technologies, the load factors have fluctuated from year to year though there is no evidence of an underlying trend. However, for bioenergy, there has been a steady increase since 2011 representing an improvement in generation load factors, largely driven by the three Drax unit conversions, which tend to operate at high load factors, with a large share of bioenergy capacity.

Chart 6.7: Load factors[2] for renewable electricity generation since 2008



[2] On an unchanged configuration basis

Electricity Generation, Capacity, and Load Factors by technology (tables 6.4 and 6.5)

6.18 This section discusses trends in generation, capacity (table 6.4), and load factors (table 6.5), for the key technologies. Within renewables, load factors[3] can be heavily influenced by weather conditions; wind speeds affect the load factors for onshore and offshore wind, rainfall similarly impacts the load factor for hydro and, to a lesser extent, hours of sunshine impact the load factor for solar pv. The load factor calculation assumes that capacity is added evenly throughout the year which may not always be the case; for example, a large generator could add a high capacity installation towards the end of the year and only generate for a very short period. To remove this effect, the second part of table 6.5 shows load factors on an "unchanged configuration basis". This calculation includes only those generators who are producing at the start and end of the year providing a more reflective picture of the underlying trend.

6.19 In previous editions of The Digest, a description of the key technologies was included under the heading "Sources of Renewable Energy". This has now been moved to the methodology note to create a more comprehensive document relating to background information in renewables. It includes details of how renewable energy statistics are collected, estimated and ultimately summarised for inclusion in this chapter along with the renewables section of Energy Trends and other related publications. This document is available via the following link:
www.gov.uk/government/publications/renewable-energy-statistics-data-sources-and-methodologies

Wind[4]

6.20 **Total wind generation increased by 34 per cent to 50.0 TWh in 2017**. The high growth for both onshore and offshore wind was due to increased capacity (23 per cent), and also higher wind speeds compared to 2016. Wind speeds have fluctuated over the last three years, with record wind speeds in 2015 resulting in high levels of generation. In 2016, this reversed as wind speeds fell to the third lowest level since 2001, resulting in a slight decline in generation for that year. As wind speeds have reverted to being in line with the ten year mean in 2017, comparing generation with a year with unusually low wind speeds have contributed to the high levels of growth.

6.21 **Onshore wind saw the largest increase in generation, by 39 per cent to 29.1 TWh in 2017, a record**. Capacity also increased by more than offshore wind, by 2.0 GW (32 per cent) to 12.8 GW. New capacity includes Ray Wind Farm (54.4 MW), Bhlaraidh Wind Farm (110.4 MW), Brockloch Rig (Windy Standard 3) (61.5 MW), Brockaghboy Full (47.5 MW), Clyde Wind Farm Extension (Clyde 2) (172.8 MW) and Aikengall II, Wester Dod Community Wind Farm (60.8 MW). The higher wind speeds in 2017 are reflected in the load factors for onshore wind; the standard measure increased by 4.4 percentage points to 28.0 and on an unchanged configuration basis, by 3.1 percentage points to 27.3 per cent.

6.22 **Offshore wind generation increased by 4.5 GWh (27 per cent),** less than for onshore wind despite the higher percentage increase in capacity (32 per cent compared to 18 per cent for onshore). In absolute terms, offshore wind capacity increased by less than onshore; by 1.7 GW to 7.0 GW. New capacity includes Burbo Bank Extension (Burbo Bank 2, 259 MW), Dudgeon Offshore Wind Farm (402 MW), Race Bank (48.1 MW), Galloper Wind Farm (72 MW), Walney Offshore Wind Phase III (330 MW) and Rampion (182.85 MW). Using the standard measure for the load factor, this increased by 2.9 percentage points to 38.9 per cent, reflecting the higher wind speeds. This is lower than in 2015 which was a record high, in line with the exceptionally high wind speeds experienced that year. Interestingly, using the unchanged configuration measure, the load factor is the highest recorded (40.0 per cent) since the last highest value in 2015 (39.7 per cent). Wind speeds are much stronger off the coasts, and unlike wind over land, offshore breezes can be strong in the afternoon, matching the time when people are using the most electricity. This may have some bearing on these apparently odd results.

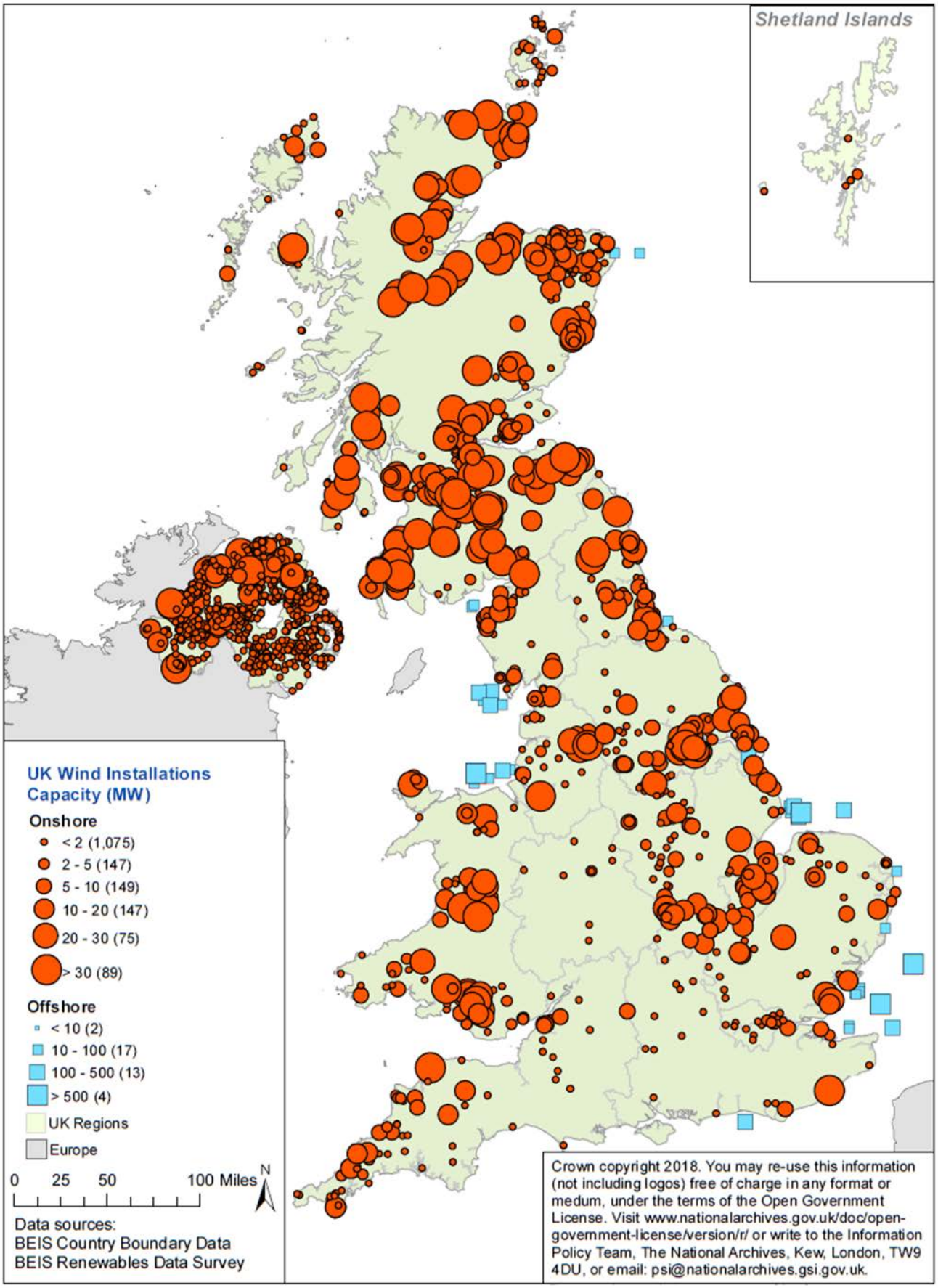
[3] For further details of how load factors are calculated, refer to the methodology note
[4] See paragraphs 6.76 to 6.6.82 for a description of onshore and offshore wind capacity and generation.

Table 6B: Number of operational wind turbines split by FiTs and non FiTs accredited sites, as at end of December 2017

	FiTs confirmed	Other sites	Total
Onshore Wind	7,511	2,106	9,617
Offshore Wind	-	38	38
Total	**7,511**	**2,144**	**9,655**

The map on the following page shows the location of wind farms operational at the end of 2017 along with an indication of capacity.

UK Onshore and Offshore Wind Capacity



Solar Photovoltaics

6.23 **Solar photovoltaic generation showed a more modest percentage growth in 2017 when compared to recent years; by 1.1 TWh (11 per cent) to 11.5 TWh.** This compares with a doubling of generation in 2014, 86 per cent growth in 2015, and 38 per cent in 2016. This is in line with a slowing in the growth of capacity which increased by just 7.3 per cent to 12.8 GW in 2017. New schemes include, Henley Hall (22 MW), Lough Road PV (32.13 MW) and Bann Road PV (includes second Bann record) (45.75 MW). Although solar photovoltaic capacity has not retained the largest share of total capacity, it still represents almost a third, and is only slightly less than onshore wind's share (31.5 per cent compared to 31.7 per cent).

6.24 The load factor for solar photovoltaics (on an unchanged configuration basis) decreased slightly in 2017, by 0.4 percentage points to 10.7, the lowest since 2011. This reflects the slightly lower hours of sunshine (4.1 hours compared to 4.2 for 2016). Compared to the ten year mean, hours of sunshine in 2017 were fewer for most months during the apart from January, November and December.

6.25 However, within months, fluctuations exist, and on Saturday 25 March 2017, demand on the National Transmission System was, for the first time ever, lower during the afternoon, than it was overnight. This was due to very high levels of PV generation, even in March. This will become common place in future summer days with implications for management of the grid and for operation of fossil fuelled plant.

Hydro generation

6.26 **Generation from hydro increased in 2017, by 10 per cent to 5.9 TWh**, due to an increase in capacity, mostly for small scale generation; rainfall (in the main catchment areas) was slightly down on 2016. Whilst large-scale hydro (>5 MW) saw a 1.9 MW increase in growth due to some small MPP amendments, the growth of 37 MW for small-scale hydro (<=5 MW) is about half the rate of increase for 2016 (10% in 2017 compared to 19% in 2016); most of this increase came from schemes supported by the Feed in Tariff scheme.

Wave and Tidal

6.27 **Generation from wave and tidal in 2017, although relatively small, increased to 4 GWh**. This is due to increases in capacity; 2017 saw several new rigs installed EMEC Berth 5 (2 MW), Tocardo EMEC Array (1.45 MW), S G E Tidal Array (0.5 MW) and Billia Croo Berth 5 (0.96 MW).

Bioenergy

6.28 **Generation from bioenergy and wastes increased by 6.0 per cent to 31.9 TWh, whilst capacity increased by 5.1 per cent to 6.0 GW**. Of this increase, 69 per cent was from plant biomass, with 36 per cent from energy from waste and 22 per cent from anaerobic digestion.

6.29 **Generation from plant biomass showed the highest growth in absolute terms for bioenergy, by 1.2 TWh (6.6 per cent) to 20.1 TWh in 2017.** This is due to additional capacity which increased by 7.1 per cent to 3.1 MW. New stations include, Mersey Bioenergy Widnes Biomass CHP (20.2 MW), Margam REP (40 MW), MEPALCHP (14.37 MW) and Liberty Steel Lochaber (17.32 MW). Increasing efficiencies continue to be seen and attributed to the deployment of large scale dedicated biomass plant with improved performance. The load factor in 2017, 79 per cent, together with the same value recorded in 2016 represent the highest to date.

6.30 **Anaerobic digestion generation increased by 19 per cent to 2.5 TWh. Capacity increased to a lesser extent; by 7.9 per cent to 0.5 GW, the result of** 93 new sites being identified. Load factors continue to vary as full plant output is not fully achieved for between three and six months following commissioning. Load factors for 2017 are the highest yet at 63.2 (on an unchanged configuration basis).

6.31 **Energy from waste generation increased by 24 per cent to 3.4 TWh.** Capacity increased to a lesser extent, by 6.1 per cent to 1.1 GW. The disproportionately higher growth in generation is due to new capacity installed previously coming on line and generating at full output in 2017. This is reflected

in the load factor which increased by 2.8 percentage points to 37.2. New sites included this year are EnviRecover (15.5 MW), European Metal Recycling Ltd (17.4 MW) and Derby and Derbyshire Waste Treatment Centre. (13.85 MW).

6.32 **Generation from landfill gas fell for the sixth year in a row**, with an accelerating rate of decline in 2017; generation fell by 8.9 per cent to 4.3 TWh. This could be the result of lower gas abstraction efficiencies. Landfill operators respond to reducing gas yields by a combination of operating at lower turndown, and then removing plant when it is no longer economic to run. More recently, microgeneration schemes are operating at such sites.

6.33 **Animal biomass generation and capacity remain largely unchanged in 2017**; generation fell by 0.2 per cent to 0.6 TWh, with capacity remaining the same at 0.1 GW. **Sewage gas generation increased by 1.8 per cent to 1.0 TWh despite capacity falling by 4.6 per cent to 0.2 GW,** due to the closure of several sites.

6.34 Generally growth in bioenergy fuels used in electricity generation will be similar to the growth in output generation unless there is a change in thermal efficiency (the amount of fuel required to produce a unit of electricity). Table 6C below shows the comparative growth rates between 2016 and 2017 for bioenergy fuel inputs and generation outputs;

Table 6C: Growth in fuel inputs versus generation for bioenergy

Growth between 2016 and 2017	Fuel use (table 6.6)	Generation (table 6.4)
Bioenergy:		
Landfill gas	-8.9%	-8.9%
Sewage sludge digestion	1.8%	1.8%
Biodegradable energy from waste *(8)*	6.0%	23.6%
Co-firing with fossil fuels	-25.5%	-54.1%
Animal Biomass *(3)*	-1.8%	-0.2%
Anaerobic digestion	18.6%	18.6%
Plant Biomass *(4)*	9.4%	6.6%
Total bioenergy	5.3%	6.0%

6.35 For most biofuels, growth in fuel use is similar to generation growth with the exception of energy from waste and co-firing. The high growth in generation from waste was due to high capacity increases in the preceding year coming on line. The lower growth in fuel input (5.3 per cent) could indicate a change in efficiencies or other factors.

Different measures of electricity generation (tables 6.4 and 6.7)

6.36 The share of renewable energy Generation from **renewable sources claiming Renewable Obligation Certificates (ROCs)** in 2017, at 71.3 TWh, was 8.6 per cent greater than in 2016 and a record. RO supported generation has increased by over 65 TWh since its introduction in 2002, an increase of a factor of twelve[5]. As a proportion of total electricity sales, RO supported generation increased (by 2.3 percentage points) to 25.1 per cent.

6.37 Renewable Energy Directive measure also increased; by 3.5 percentage points to 27.9 per cent. This growth is less than the share measured on the international basis due to the effect of the "normalisation" process for wind and hydro generation which effectively smooths the effects of particularly high or low wind speeds or rainfall. Table 6C and chart 6.7 show the three measures. Chart 6.8 shows how the low wind speeds in 2016 resulted in renewables' share of generation level between 2015 and 2016 on the international basis, before increasing again in 2017 along with wind speeds.

[5] A small amount is due to existing hydro stations being refurbished and thus becoming within the scope of the RO definition, as opposed to new capacity being installed.

Table 6D: Percentages of electricity derived from renewable sources

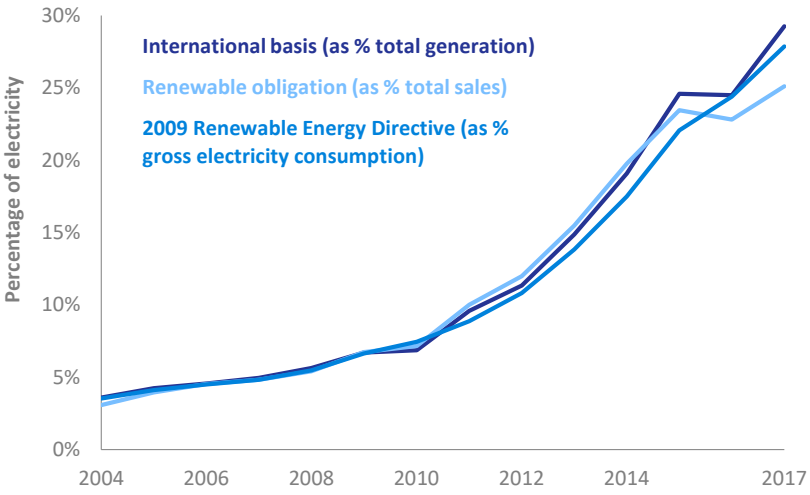
	2004	2010	2015	2016	2017
International Basis[1]	3.6%	6.9%	24.6%	24.5%	29.3%
Renewable Obligation[2]	3.1%	7.2%	23.5%	22.8%	25.1%
2009 Renewable Energy Directive[3]	3.5%	7.4%	22.1%	24.4%	27.9%

[1] All renewable electricity as a percentage of total UK electricity generation

[2] Measured as a percentage of UK electricity sales

[3] 2009 Renewable Energy Directive measured as a percentage of gross electricity consumption

Chart 6.8: Growth in electricity generation from renewable sources since 2004



Renewable heat (table 6.6)

6.38 **Renewable heat generation increased by 3.6 per cent in 2017 to 5,222 ktoe.** Of this increase 83 per cent was plant biomass (151 ktoe). The largest increase in percentage terms was **biodegradable energy from waste which increased by 53 per cent**, although this remains a relatively small share of overall renewable heat (1.8 per cent).

6.39 **Renewable energy from heat pumps has seen a sizeable revision** following a BEIS led study to estimate the amount of heat generated by reversible air to air heat pumps. This had not previously been included in renewable heat statistics as it was unknown the proportion of time they were being operated in heat mode (as opposed to cooling mode which is not included in renewable heat). An estimate was established for 2015, resulting in an upward revision from 156 ktoe to 1,007 ktoe. The full research paper is available via the following link:
www.gov.uk/government/publications/renewable-energy-from-reversible-air-to-air-heat-pumps[6]

Heat from heat pumps actually fell from 2016 to 2017, by 2.0 per cent due to lower sales in 2016. A time lag is factored into the estimates for each year to allow for the lag between installation and generation at full output, hence sales effects in one year can filter through into the following year.

6.40 **Around 14 per cent of renewable heat was supported by the Renewable Heat Incentive (RHI) or Renewable Heat Premium Payment (RHPP) in 2017, compared to 15 per cent in 2016**. The fall is due to the inclusion of reversible air to air heat pumps (see paragraph 6.39) which, although are included in overall renewable heat, are not supported by the RHI, thus increasing the denominator (total renewable heat) but not the numerator (RHI supported heat). Excluding reversible air to air heat pumps, the proportion of RHI supported heat would have increased to 17 per cent. Further information on the RHI and RHPP schemes can be found in paragraphs 6.75 to 6.77.

[6] The research focussed on reporting UK progress against the renewable energy directive. This excludes heat pumps not meeting the minimum seasonal performance factor of 2.5 (see paragraph 6.39). All heat pumps are included in table 6.6 and hence the upward revision is larger.

6.41 **Around 26 per cent of renewable sources were used to generate heat in 2017**, higher than the 23 per cent for 2016, as reported in DUKES 2017. This is due to the greater contribution of renewable heat from reversible air to air heat pumps.

6.42 **Domestic wood combustion retained the largest share of renewable heat at 40 per cent**, despite the upward revision for heat pumps, however, lower than the 50 per cent share as reported in DUKES 2017 for the year 2016. Plant biomass represented 24 per cent and heat pumps 20 per cent. Non-bioenergy renewable heat sources include solar thermal, deep geothermal and heat pumps, and combined these accounted for 21 per cent, compared to 5.9 per cent for 2016 (as reported in DUKES 2017).

Liquid biofuels for transport (tables 6.1 and 6.6)[7]

6.43 Biofuels are made from recently-living biological material[8] and can be waste products, residues, or sourced from crops. The biofuels added to petrol are bioethanol, biomethanol and MTBE (methyl tern-butyl ether), and those added to diesel are FAME (fatty acid methyl ester), HVO (hydrotreated vegetable oil), pure plant oil.

6.44 **In 2017, 697 million litres of biodiesel[9] were consumed, 1.4 per cent lower than in 2016.** It is estimated that 524 million litres of biodiesel were produced in the UK in 2017, 36 per cent higher than in 2016. Of this, about 53 million litres are known to have been used for non-transport applications or exported. Therefore, at least 226 million litres of biodiesel were imported in 2017. The total annual capacity for biodiesel production in the UK in 2017 is estimated to be around 684 million litres.

6.45 **Consumption of bioethanol fell in 2017, by 0.8 per cent to 752 million litres**. The UK capacity for bioethanol production at the end of 2017 remained unchanged from 2016 at around 910 million litres, although actual production was estimated to be 645 million litres. Of UK production, 431 million litres was known to be used for non-transport applications, or exported, so at least 539 million litres was imported.

6.46 During 2017, biodiesel accounted for 2.3 per cent of diesel, and bioethanol 4.5 per cent of motor spirit. The combined contribution of liquid biofuels for transport was 3.1 per cent, unchanged from 2016.

6.47 Volume data have been converted from litres to tonnes of oil equivalent and are shown in both the commodity balances (Tables 6.1 to 6.3) and in Table 6.6. In addition, these data are also included in the aggregate energy balances (Tables 1.1 to 1.3). The tables show the contribution that liquid biofuels are making towards total renewable sourced energy. Renewable biofuels used for transport fell by 1.2 per cent (to 997 ktoe) between 2016 and 2017 with the majority of the decrease being due to biodiesel. In 2017, liquid biofuels for transport comprised 4.9 per cent of total renewable sources, 0.6 percentage points less than 2016.

6.48 When measuring the contribution of transport biofuels for the Renewable Energy Directive, only those meeting sustainability criteria count. The data referred to above do not contain sustainability information, including which fuels carry a higher reward (mostly sourced from waste), and the table which does, is not yet a complete data set for 2017. This is due to the RTFO allowing suppliers to make claims for RTFCs up to August after the obligation period (in order to allow suppliers to optimise their supply chain verification processes), as well as, allowing sufficient time for the Department for Transport to make necessary compliance checks before applications are processed. Table 6.7 records progress against the directive and includes an estimate of the proportion of biofuels being compliant and also the proportion meeting the double credited criteria (mostly those from waste sources). Further information on the RTFO is given in paragraphs 6.71 to 6.74.

[7] See paragraphs 6.114 to 6.115 for a description of liquid biofuels.
[8] Department for Transport Renewable Transport Fuel Obligation statistics, notes and definitions; www.gov.uk/government/uploads/system/uploads/attachment_data/file/519910/notes-and-definitions.pdf
[9] The most usual way for biodiesel to be sold is for it to be blended with ultra-low sulphur diesel fuel.

Renewable sources data used to indicate progress under the 2009 EU Renewable Energy Directive (RED) (Table 6.7)

6.49 The 2009 Renewable Energy Directive (RED) has a target for the UK to obtain 15 per cent of its energy from renewable sources by 2020. The target uses a slightly different definition of renewable and total energy than is used in the rest of the Digest, including the use of 'normalised' wind and hydro generated electricity. Further details on the RED methodology can be found in the methodology document.

6.50 Table 6.7 brings together the relevant renewable energy and final energy consumption data to show progress towards the target of 15 per cent of UK energy consumption to be sourced from renewables by 2020[10], and shows the proportions of electricity, heat and transport energy coming from renewable sources. It is an update of the provisional figure published in the June 2018 edition of Energy Trends. D**uring 2017, 10.2 per cent of final energy consumption was from renewable sources, an increase of 0.9 percentage points on 2016**. The UK has exceeded its first three interim targets (the third was 7.5 averaged over 2015 and 2016, and the UK achieved 8.8 per cent). The fourth interim target is 10.2 per cent averaged across 2017 and 2018 and will be reported in early 2020.

6.51 Overall renewable sources, excluding non-biodegradable wastes, provided 10.7 per cent of the UK's total primary energy requirements in 2017 (excluding energy products used for non-energy purposes). This is a different measure to that reported in the RED. The primary energy demand basis typically produces higher percentages because thermal renewables are measured including the energy that is lost in transformation. The thermal renewables used in the UK are less efficient in transformation than fossil fuels, so as non-thermal renewables such as wind (which by convention are 100 per cent efficient in transformation) grow as a proportion of UK renewables use, then the gross final energy consumption percentage will overtake the primary energy demand percentage. Both these percentage measures are directly influenced by overall energy use: for instance, whilst the renewable energy component (the numerator in the RED calculation) increased by 9.4 per cent, the final consumption denominator increased by just 0.8 per cent. Table 6D shows both measures.

Table 6E: Percentages of energy derived from renewable sources since 2013

	2013	2014	2015	2016	2017
Eligible renewable energy sources as a percentage of capped gross final energy consumption (ie the basis for the Renewable Energy Directive)	5.7%	7.0%	8.4%	9.2%	10.2%
Renewable energy as a percentage of primary energy demand	5.9%	7.3%	9.1%	9.2%	10.7%

Revisions to published data and new reporting

6.52 Renewables data have been revised back to 2015, with the most recent years seeing the largest revisions; mostly the result of more up to date information. There were also some reclassifications and also new reporting. Where revisions have been made, the values in the excel versions of the tables have been suffixed with an "r" to indicate the value has been changed since last published.

6.53 Some revisions have also been made to installed generating capacities (table 6.4) following an exercise to replace previously estimated data points with actual data, for 2015, and including a reconciliation of different sources of survey and administrative data sources.

6.54 The most notable revision is for heat pumps which now include heat generated by reversible air to air heat pumps. The upward revision to table 6.6 is greater than for table 6.7 which is calculated on the basis specified in the Renewable Energy Directive which excludes those heat pumps not meeting

[10] This is an update of the first estimate of the UK progress published in the June 2017 edition of Energy Trends. It includes a member state comparison for 2015 and progress for the EU as a whole
www.gov.uk/government/statistics/energy-trends-june-2017-special-feature-article-renewable-energy-in-2016

the minimum seasonal performance factor of 2.5. A special feature article was published in the March 2018 edition of Energy Trends summarising the impact on directive reporting: www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-the-contribution-of-reversible-air-to-air-heat-pumps-towards-the-renewable-energy-directive

Paragraph 6.39 in this chapter of DUKES shows the impact on table 6.6.

6.55 Unlike other fuel sources, the renewables energy balances have zero statistical differences as the data are mostly taken from a single source where there is less likelihood of differences due to timing, measurement, or differences between supply and demand.

Technical Notes

European and UK Renewable Energy Policy Context

EU Renewable Energy Directive

6.56 In March 2007, the European Council agreed to a common strategy for energy security and tackling climate change. An element of this was establishing a target of 20 per cent of EU's energy to come from renewable sources. In 2009, a new Renewable Energy Directive (Directive 2009/29/EC) ('RED') was implemented on this basis and resulted in agreement of country "shares" of this target. For the UK, its share is that 15 per cent of final energy consumption - calculated on a net calorific value basis, and with a cap on fuel used for air transport - should be accounted for by energy from renewable sources by 2020. The RED included interim targets and required each Member State to produce a National Renewable Energy Action Plan (which contains a progress trajectory and identifies measures which will enable countries to meet their targets). The Directive also requires each Member State to submit a report to the Commission on progress in the promotion and use of energy sources every two years. The UK's action plan and the first three progress reports (covering performance during 2009-2010, 2011-12, and 2013-14) are available at:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf,

www.gov.uk/government/publications/first-progress-report-on-the-promotion-and-use-of-energy-from-renewable-sources-for-the-uk,

www.gov.uk/government/publications/second-progress-report-on-the-promotion-and-use-of-energy-from-renewable-sources-for-the-united-kingdom,

www.gov.uk/government/publications/third-progress-report-on-the-promotion-and-use-of-energy-from-renewable-sources-for-the-united-kingdom

UK Renewables Policy

6.57 The UK's low carbon policies have seen renewable electricity capacity increase by more than three times since 2010. In 2016, renewables provided nearly one quarter of the UK's electricity generation, and we are on track to comfortably exceed our ambition of delivering 30% of the UK's electricity from renewables in 2020-21.

Renewables Obligation (RO)

6.58 The Renewables Obligation (RO) came into effect in April 2002[11]. It places an obligation on UK electricity suppliers to present a certain number of Renewables Obligation Certificates (ROCs) to Ofgem, the administrator of the scheme, in respect of each megawatt hour of electricity supplied each year. The Obligation is intended to incentivise an increase in the level of renewable generating capacity and so contribute to our renewable energy and climate change targets. RO eligible sources include wind energy, bioenergy (including landfill gas, sewage gas, biomass, anaerobic digestion. advanced conversion technologies and energy from waste), hydro, photovoltaics, wave and tidal energy and deep geothermal. Ofgem issues ROCs to qualifying renewable generators. These certificates may be sold by generators directly to licensed electricity suppliers or to traders. Suppliers present ROCs to Ofgem to demonstrate their compliance with the obligation or make a payment into a buy-out fund.

6.59 When the Obligation was first introduced, 1 ROC was awarded for each MWh of renewable electricity generated. In 2009, 'banding' was introduced into the RO, meaning different technologies now receive different numbers of ROCs depending on their costs and potential for large scale

[11] The Renewables Obligation covering England and Wales and the analogous Renewables (Scotland) Obligation came into effect in April 2002. Northern Ireland introduced a similar Renewables Obligation in April 2005. Strictly speaking until 2005, the RO covers only Great Britain, but in these UK based statistics Northern Ireland renewable sources have been treated as if they were also part of the RO.

deployment; for example, new offshore wind in Great Britain receives 1.8 ROCs/MWh while onshore wind receives 0.9 ROCs/MWh. The more established renewable technologies such as sewage gas receive 0.5 ROCs/MWh. A review of the bands across the UK concluded in 2012 and set the level of support under the RO from 1 April 2013 – 31 March 2017. In 2018, following a public consultation, the Government announced its intention to introduce measures to control the cost of biomass conversions and co-firing under the RO. Full details are available at www.gov.uk/government/consultations/controlling-the-costs-of-biomass-conversion-and-co-firing-under-the-renewables-obligation

6.60 The RO scheme closed to new capacity on 31 March 2017 although various grace periods are available which extend the closure date in certain specified situations. Existing generating stations will continue to receive support for 20 years, up to 2037. Details of the grace periods are available on Ofgem's website at: www.ofgem.gov.uk/environmental-programmes/renewables-obligation-ro/information-generators/closure-renewables-obligation-ro .

A list of technologies eligible for the RO, and the level of ROCs received, is available on Ofgem's website at: www.ofgem.gov.uk/publications-and-updates/renewables-obligation-guidance-generators

6.61 Table 6.4 contains a row showing the total electricity eligible for the RO. Prior to 2002 the main instruments for pursuing the development of renewables capacity were the Non Fossil Fuel Obligation (NFFO) Orders.

Contracts for Difference (CfDs)

6.62 The Contracts for Difference (CfD) has replaced the RO for new low carbon electricity generating stations. The CfD scheme tackles the risks and uncertainties of the underlying economics of different forms of electricity generation by offering long term contracts for low carbon energy. Support is provided in the form of a private law contract between a generator and the Low Carbon Contracts Company (a government-owned company).

6.63 Generators must sell their electricity to the market as usual, but in addition generators receive a top-up payment to a fixed and secure price (known as a "strike price") for each unit of electricity they generate. This certainty allows investors to be confident about the returns of their capital in advance of investing billions into new infrastructure schemes. It also encourages banks to lend at cheaper rates because the projects are less risky. When market prices are higher than the strike price, generators must pay back the difference. This provides protection to consumers when electricity prices are high.

6.64 CfDs are awarded to the cheapest projects via a competitive auction mechanism. To date, two auctions have awarded support to over 9GW of new renewable electricity projects, with the next auction planned for spring 2019. Further details are available at: www.gov.uk/government/publications/contracts-for-difference/contract-for-difference

Feed-in Tariffs (FiTs)

6.65 The Feed-in Tariff (FIT) scheme is a policy mechanism designed to support investment in small scale renewable and low carbon electricity generation projects up to 5MW capacity. It offers long term support to projects and provides tariffs based on the costs of generation for each technology. The technologies supported are: solar PV, onshore wind power, hydropower, anaerobic digestion (AD), and micro (<2kW) combined heat and power (micro-CHP). Under the scheme, generators receive three sources of income/savings:

- A Generation tariff - a payment for every kWh generated, dependent on the technology and capacity of the installation, and date installed;
- An Export tariff - an additional payment for every kWh exported to the local electricity network; and
- Bill savings - additional benefit from usage of electricity "onsite" as opposed to paying the retail price for importing that energy from the grid.

6.66 Provisionally, overall FIT-scale deployment at the end of May 2017 was 6,091 MW (902,560 installations). This represented an 8% increase in total FIT installed capacity and a 4% increase in the number of installations compared to the same period in 2016. Around 99% are solar PV installations (82% of capacity). Statistical reports are available at:
www.gov.uk/government/statistics/monthly-small-scale-renewable-deployment

6.67 The scheme has been hugely successful in attracting investment. A review of the scheme took place in 2015 and new measures were introduced in early 2016 to ensure the scheme's costs are effectively controlled up to March 2019; providing value for money for the consumers that fund it through their electricity bills.

Feed in Tariff Supported Capacity

6.68 Much small scale (up to 5 MW capacity) renewable electricity in Great Britain is supported by and has increased as a result of, the Feed in Tariff (FiT) scheme. During the first nine months (April and December 2010) of the FiT scheme, a total of 71 MW of renewable capacity was installed and subsequently confirmed on it. During 2011, a further 977 MW of FiT supported renewable capacity was installed. For 2012, 892 MW of capacity was added and in 2013, 622 MW. In 2014, 999 MW of capacity was added, while in 2015, a further 1,738 MW of FiT capacity was installed, with 83 per cent of this new capacity coming from solar photovoltaics (PV). A further 724 MW of solar PV capacity was installed in 2016, of which 71 per cent of this new capacity came from PV. In 2017, 212 MW of new capacity was installed, with PV accounting for 68 per cent of this.

6.69 **The greatest increase in FiT capacity in percentage terms in 2017 was from solar photovoltaics**, from 4,893 MW at the end of 2016 to 5,038 MW at the end of 2017. Onshore wind increased from 702 MW at the end of 2016 to 732 MW at the end of 2017, while hydro capacity increased from 183 MW to 220 MW. There was no change in the capacity of anaerobic digestion remaining stable at 289 MW. At the end of 2017, solar PV represented 80 per cent of commissioned FiTs capacity (down from 81 per cent at the end of 2016), with onshore wind stable at 12 per cent, and anaerobic digestion 4.6 per cent (down from 4.8 per cent) and hydro increased from 3.0 to 3.5 per cent. It should be noted that, due to administrative lags of around three months, much capacity installed towards the end of 2016 was not confirmed until the first quarter of 2017 (so the amount of capacity installed under FiTs at the end of 2016 will not equal the amount actually confirmed on the Central FiTs Register).[12]

6.70 Table 6F shows the number of sites generating renewable electricity at the end of 2017. There were 936,273 sites, although this figure is dominated by small-scale solar PV installations confirmed on FiTs.

[12] At the end of 2017, 5,959 MW of renewable capacity was commissioned (and subsequently confirmed) on the Central FiTs Register. This includes 37 MW commissioned prior to the start of FiTs on 1 April 2010.

Table 6F: Number of sites generating renewable electricity, as at end of December 2017 (excluding co-firing)[13]

	FiTs confirmed	Other sites	Total
Onshore Wind	7,511	2,106	9,617
Offshore Wind	-	38	38
Marine energy	-	18	18
Solar PV	809,655	113,746	923,401
Hydro	1,140	346	1,486
Landfill gas	-	464	464
Sewage sludge digestion	-	194	194
Energy from waste	-	54	54
Animal biomass (non-AD)	-	6	6
Anaerobic digestion	429	194	623
Plant biomass	-	372	372
Total	**818,7353**	**117,538**	**936,273**

Renewable Transport Fuel Obligation (RTFO)

6.71 The Renewable Transport Fuel Obligation, introduced in April 2008, placed a legal requirement on road transport fuel suppliers (who supply more than 450,000 litres of fossil petrol, diesel or renewable fuel per annum to the UK market) to ensure that 4.75 per cent (by volume) of their overall fuel sales were from a renewable source by 2013/14 and in subsequent years. Under the RTFO all obligated companies are required to submit data to the RTFO administrator on volumes of fossil and renewable fuels they supply. Renewable Transport Fuel certificates are issued in proportion to the quantity of biofuels registered.

6.72 The RTFO (amendment) Order, made in 2011, introduced mandatory carbon and sustainability criteria for all renewable fuels and double rewards for some fuel types, including those made from waste and residue materials. From April 2013 the end uses covered by the RTFO were amended to include non-road mobile machinery, agriculture and forestry tractors and recreational craft when not at sea.

6.73 The Renewable Transport Fuels and Greenhouse Gas Emissions Regulations, made in 2018, have introduced an increase in the obligation to ensure that 7.25 per cent (by volume) of fuel comes from a renewable source in 2018, rising incrementally through 9.75% in 2020 to 12.4% in 2032. The Regulations also aim to increase the supply of the fuels of the greatest future strategic importance to the UK, through the introduction of an obligation to provide a proportion of 'development' fuels and by setting a maximum limit for supply of fuels made from crops.

6.74 Further information on the RTFO policy can be found at:
www.gov.uk/government/collections/renewable-transport-fuels-obligation-rtfo-orders#guidance

The verified RTFO biofuels statistics, including information on origin and sustainability from 2008 onwards can be found at: www.gov.uk/government/collections/biofuels-statistics.

[13] The number of sites (as with overall capacity) is subject to revision, due to lags in data sources. This particularly affects solar PV, where more sites may have come online since compiling this edition of DUKES.

Renewable Heat Incentive and Premium Payment

6.75 The Renewable Heat Incentive (RHI) scheme is a government financial incentive scheme introduced to encourage a switch to renewable heating systems in place of fossil fuels. The tariff based scheme is split into two parts:

- The non-domestic RHI scheme which has been open to commercial, industrial, public sector, not for profit and community generators of renewable heat since November 2011.
- The domestic RHI scheme which opened on 9 April 2014 and is available to homeowners, private and social landlords and people who build their own homes.

Further information on this scheme, including details of the technologies, can be found at: www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/renewable-heat-incentive-rhi.

6.76 The Renewable Heat Premium Payment (RHPP) voucher scheme, launched in August 2011, made one-off payments to householders to help them buy renewable heating technologies. This scheme closed on 31 March 2014 prior to the introduction of the domestic RHI scheme. Further information on the RHPP can be found at www.gov.uk/renewable-heat-premium-payment-scheme with further data available at www.gov.uk/government/collections/renewable-heat-incentive-renewable-heat-premium-payment-statistics.

6.77 Table 6G below shows the breakdown of technologies accredited to the domestic scheme, over the period 9 April 2014 (launch date) to 31 December 2017, with average installed capacity and heat paid out for under the scheme. In total there were 60,093 accreditations, with 2,289,573 MWh of heat generated and paid for. Further data and information relating to the RHI can be found at: www.gov.uk/government/collections/renewable-heat-incentive-statistics

Table 6G: Domestic Renewable Heat Incentive accreditations, average capacity installed and estimated heat generation to December 2017

Technology	Number of accreditations	Average (mean) capacity installed (kW)	Heat paid out under the scheme (MWh)
Air source heat pump	30,177	10.1	665,236
Ground source heat pump	8,820	13.5	358,459
Biomass systems	12,523	26.6	1,230,844
Solar thermal	8,573	-	35,032
Total	**60,093**	**-**	**2,289,573**

Sources of Renewable Energy

Since the 2017 edition of The Digest, the majority of the background on sources of renewable energy have been moved to the methodology note which can be accessed via the following link: www.gov.uk/government/collections/renewables-statistics#methodology

This now incorporates background information along with the data sources and methodology employed to produce renewable energy statistics.

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6.1 Commodity balances 2017

Renewables and waste

Thousand tonnes of oil equivalent

	Waste wood	Wood	Animal biomass and anaerobic digestion *(4)*	Plant biomass *(5)*	Sewage gas	Landfill gas
Supply						
Production	394	2,037	1,594	2,600	346	1,419
Other sources	-	-	-	-	-	-
Imports	29	22	-	2,935	-	-
Exports	-71	-20	-	-53	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-237	-	-	-
Total supply (2)	**352**	**2,039**	**1,358**	**5,482**	**346**	**1,419**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**352**	**2,039**	**1,358**	**5,482**	**346**	**1,419**
Transformation	**14**	**-**	**1,036**	**4,400**	**317**	**1,405**
Electricity generation	-	-	1,036	4,253	317	1,405
Major power producers	-	-	174	3,332	-	-
Autogenerators	-	-	862	921	317	1,405
Heat generation	14	-	-	147	-	-
Petroleum refineries	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Other	-	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-
Coal extraction	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-
Other	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**338**	**2,039**	**322**	**1,082**	**29**	**14**
Industry	**125**	**-**	**35**	**851**	**26**	**14**
Unclassified	-	-	12	43	-	-
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	40	-	11	139	-	14
Chemicals	-	-	-	5	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	9	38	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	3	609	-	-
Other industries	85	-	-	18	26	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**213**	**2,039**	**287**	**231**	**3**	**-**
Domestic	-	2,039	-	-	-	-
Public administration	-	-	-	-	3	-
Commercial	9	-	-	197	-	-
Agriculture	204	-	287	33	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).

(2) Including non-biodegradable wastes, which accounted for 1,359 ktoe.

(3) Total supply minus total demand.

(4) Includes poultry litter, meat and bone and farm waste

(5) Includes straw, short rotation coppice (SRC), and other plant based biomass

(6) Municipal solid waste, tyres, general industrial waste and hospital waste.

(7) The amount of marine energy was very small.

6.1 Commodity balances 2017 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(6)*	Solar photovoltaics, active solar heating, and deep geothermal	Heat pumps	Hydro	Wind and marine energy *(7)*	Liquid biofuels	Total renewables	
							Supply
2,642	1,044	1,044	510	4,300	794	18,725	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	490	3,475	Imports
-	-	-	-	-	-287	-431	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-237	Transfers
2,642	**1,044**	**1,044**	**510**	**4,300**	**997**	**21,532**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
2,642	**1,044**	**1,044**	**510**	**4,300**	**997**	**21,532**	**Total demand**
2,415	**991**	**-**	**510**	**4,300**	**-**	**15,388**	**Transformation**
2,376	991	-	510	4,300	-	15,187	Electricity generation
898	256	-	359	3,526	-	8,545	Major power producers
1,477	735	-	150	774	-	6,642	Autogenerators
40	-	-	-	-	-	200	Heat generation
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Energy industry use**
-	-	-	-	-	-	-	Electricity generation
-	-	-	-	-	-	-	Oil and gas extraction
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Losses**
227	**53**	**1,044**	**-**	**-**	**997**	**6,145**	**Final consumption**
109	**-**	**3**	**-**	**-**	**-**	**1,162**	**Industry**
77	-	3	-	-	-	135	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	203	Mineral products
-	-	-	-	-	-	5	Chemicals
2	-	-	-	-	-	2	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	47	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	611	Paper, printing, etc
31	-	-	-	-	-	159	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**997**	**997**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	997	997	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
118	**53**	**1,041**	**-**	**-**	**-**	**3,986**	**Other**
19	52	106	-	-	-	2,216	Domestic
68	0	-	-	-	-	72	Public administration
31	0	936	-	-	-	1,173	Commercial
-	-	-	-	-	-	525	Agriculture
-	-	-	-	-	-	-	Miscellaneous
-	**-**	**-**	**-**	**-**	**-**	-	

6.2 Commodity balances 2016

Renewables and waste

Thousand tonnes of oil equivalent

	Waste wood	Wood	Animal biomass and anaerobic digestion *(4)*	Plant biomass *(5)*	Sewage gas	Landfill gas
Supply						
Production	331r	2,121r	1,371r	1,948r	337r	1,556
Other sources	-	-	-	-	-	-
Imports	38	41	-	3,032	-	-
Exports	-17	-109	-	-9	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-165	-	-	-
Total supply (2)	**352r**	**2,054r**	**1,206r**	**4,971r**	**337r**	**1,556**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**352r**	**2,054r**	**1,206r**	**4,971r**	**337r**	**1,556**
Transformation	**14r**	**-**	**913r**	**4,030r**	**312**	**1,542**
Electricity generation	-	-	913r	3,895r	312	1,542
Major power producers	-	-	210	3,233	-	-
Autogenerators	-	-	703r	662r	312	1,542
Heat generation	14r	-	-	135r	-	-
Petroleum refineries	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Other	-	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-
Coal extraction	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-
Other	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**337r**	**2,054r**	**293r**	**941r**	**25r**	**14**
Industry	**125r**	**-**	**35r**	**807r**	**25r**	**14**
Unclassified	-	-	12	27r	-	-
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	40r	-	11	139r	-	14
Chemicals	-	-	-	10r	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	9r	16r	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	3	591r	-	-
Other industries	85r	-	-	24r	25r	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**213r**	**2,054r**	**258r**	**134r**	**0**	**-**
Domestic	-	2,054r	-	-	-	-
Public administration	-	-	-	-	0	-
Commercial	8r	-	-	112r	-	-
Agriculture	204r	-	258r	22r	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).
(2) Including non-biodegradable wastes, which accounted for 1,268 ktoe.
(3) Total supply minus total demand.
(4) Includes poultry litter, meat and bone and farm waste
(5) Includes straw, short rotation coppice (SRC), and other plant based biomass
(6) Municipal solid waste, tyres, general industrial waste and hospital waste.
(7) The amount of marine energy was very small.

6.2 Commodity balances 2016 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(6)*	Solar photovoltaics, active solar heating, and deep geothermal	Heat pumps	Hydro	Wind and marine energy *(7)*	Liquid biofuels	Total renewables	
							Supply
2,454	947r	1,066r	463r	3,204r	580	16,378r	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	631r	3,742r	Imports
-	-	-	-	-	-203	-338	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-165	Transfers
2,454	**947r**	**1,066r**	**463r**	**3,204r**	**1,008r**	**19,617r**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
2,454	**947r**	**1,066r**	**463r**	**3,204r**	**1,008r**	**19,617r**	**Total demand**
2,288r	**895r**	**-**	**463r**	**3,204r**	**-**	**13,661r**	**Transformation**
2,241	895r	-	463r	3,204r	-	13,466r	Electricity generation
790	175	-	340	2,641	-	7,389	Major power producers
1,451	720r	-	124	563r	-	6,077r	Autogenerators
46r	-	-	-	-	-	195r	Heat generation
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Energy industry use**
-	-	-	-	-	-	-	Electricity generation
-	-	-	-	-	-	-	Oil and gas extraction
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Losses**
166r	**52**	**1,066r**	**-**	**-**	**1,008r**	**5,955r**	**Final consumption**
90r	**-**	**4**	**-**	**-**	**-**	**1,099r**	**Industry**
76r	-	4	-	-	-	120r	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	203r	Mineral products
-	-	-	-	-	-	10r	Chemicals
2	-	-	-	-	-	2	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	25r	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	594r	Paper, printing, etc
12r	-	-	-	-	-	147r	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**1,008r**	**1,008r**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	1,008r	1,008r	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
76r	**52**	**1,061r**	**-**	**-**	**-**	**3,848r**	**Other**
14r	51r	97r	-	-	-	2,215r	Domestic
50r	0	-	-	-	-	51r	Public administration
13r	0r	964r	-	-	-	1,097r	Commercial
-	-	-	-	-	-	485r	Agriculture
-	-	-	-	-	-	-	Miscellaneous
-	**-**	**-**	**-**	**-**	**-**	**-**	

6.3 Commodity balances 2015

Renewables and waste

Thousand tonnes of oil equivalent

	Waste wood	Wood	Animal biomass and anaerobic digestion *(4)*	Plant biomass *(5)*	Sewage gas	Landfill gas
Supply						
Production	365r	2,021r	956r	1,899r	318r	1,612
Other sources	-	-	-	-	-	-
Imports	50	35	-	2,836	-	-
Exports	-73	-138	-	-37	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-84	-	-	-
Total supply (2)	**343r**	**1,918r**	**872r**	**4,698r**	**318r**	**1,612**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**343r**	**1,918r**	**872r**	**4,698r**	**318r**	**1,612**
Transformation	**14r**	**-**	**722r**	**4,021r**	**293**	**1,598**
Electricity generation	-	-	722r	3,888r	293	1,598
Major power producers	-	-	209	3,381	-	-
Autogenerators	-	-	513r	507r	293	1,598
Heat generation	14r	-	-	133r	-	-
Petroleum refineries	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Other	-	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-
Oil and gas extraction	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-
Coal extraction	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-
Other	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**328r**	**1,918r**	**150r**	**678r**	**25r**	**14**
Industry	**116r**	**-**	**39**	**599r**	**25r**	**14**
Unclassified	-	-	14	4r	-	-
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	40r	-	17	150r	-	14
Chemicals	-	-	-	1r	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	5	10r	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	3	403r	-	-
Other industries	76r	-	-	31r	25r	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**213r**	**1,918r**	**110r**	**79r**	**-**	**-**
Domestic	-	1,918r	-	-	-	-
Public administration	-	-	-	-	-	-
Commercial	8r	-	-	57r	-	-
Agriculture	204r	-	110r	22r	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).
(2) Including non-biodegradable wastes, which accounted for 1,049 ktoe.
(3) Total supply minus total demand.
(4) Includes poultry litter, meat and bone and farm waste
(5) Includes straw, short rotation coppice (SRC), and other plant based biomass
(6) Municipal solid waste, tyres, general industrial waste and hospital waste.
(7) Marine energy was 0.2 ktoe.

6.3 Commodity balances 2015 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(6)*	Solar photovoltaics, active solar heating, and deep geothermal	Heat pumps	Hydro	Wind and marine energy *(7)*	Liquid biofuels	Total renewables	
							Supply
2,020	699r	1,007r	541r	3,463r	325	15,227r	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	792r	3,714r	Imports
-	-	-	-	-	-117	-366	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-84	Transfers
2,020	**699r**	**1,007r**	**541r**	**3,463r**	**999r**	**18,491r**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
2,020	**699r**	**1,007r**	**541r**	**3,463r**	**999r**	**18,491r**	**Total demand**
1,865r	**648r**	**-**	**541r**	**3,463r**	**-**	**13,165r**	**Transformation**
1,817	648r	-	541r	3,463r	-	12,971r	Electricity generation
471	121	-	422	2,860	-	7,463	Major power producers
1,346	527r	-	120	604r	-	5,508r	Autogenerators
48r	-	-	-	-	-	195r	Heat generation
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Energy industry use**
-	-	-	-	-	-	-	Electricity generation
-	-	-	-	-	-	-	Oil and gas extraction
-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Losses**
156r	**52**	**1,007r**	**-**	**-**	**999r**	**5,326r**	**Final consumption**
79r	**-**	**4**	**-**	**-**	**-**	**875r**	**Industry**
69	-	4	-	-	-	91r	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	220r	Mineral products
-	-	-	-	-	-	1r	Chemicals
2	-	-	-	-	-	2	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	15r	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	407r	Paper, printing, etc
9r	-	-	-	-	-	140r	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**999r**	**999r**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	999r	999r	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
77r	**52**	**1,003r**	**-**	**-**	**-**	**3,451r**	**Other**
17r	51r	94r	-	-	-	2,080r	Domestic
48r	0	-	-	-	-	49r	Public administration
11r	0r	909r	-	-	-	986r	Commercial
-	-	-	-	-	-	336r	Agriculture
-	-	-	-	-	-	-	Miscellaneous
-	**-**	**-**	**-**	**-**	**-**	**-**	

6.4 Capacity of, and electricity generated from, renewable sources

	2013	2014	2015	2016	2017
Installed Capacity (MW) [1]					
Wind:					
Onshore	7,586	8,573	9,212r	10,880r	12,847
Offshore	3,696	4,501	5,093	5,293	6,988
Marine energy (wave and tidal stream)	8	9	9	13	18
Solar photovoltaics	2,937	5,528	9,601r	11,912r	12,776
Hydro:					
Small scale	232	253	300	359r	396
Large scale [2]	1,477	1,477	1,477	1,477	1,479
Bioenergy:					
Landfill gas	1,050	1,058	1,061	1,062	1,066
Sewage gas	201	230	231	257	245
Energy from waste [3]	545	680	930r	1,028r	1,091
Animal biomass [4]	111	111	111	129	129
Anaerobic digestion	163	243	336r	426r	460
Plant biomass[5]	1,955	2,258	2,604r	2,852r	3,055
Total bioenergy and wastes	4,025	4,579	5,273r	5,755r	6,047
Total	19,961	24,920	30,966r	35,690r	40,551
Co-firing [6]	39	14	21	13	6
Generation (GWh)					
Wind:					
Onshore [7]	16,925	18,555	22,852r	20,857r	29,088
Offshore	11,472	13,405	17,423	16,406	20,916
Marine energy (wave and tidal stream)[8]	5	2	2	0	4
Solarphotovoltaics	2,010	4,054	7,533r	10,411r	11,525
Hydro:					
Small scale[7]	675	835	983r	1,011r	1,322
Large scale[2]	4,026	5,053	5,314	4,379	4,606
Bioenergy:					
Landfill gas	5,175	5,033	4,872	4,703	4,284
Sewage gas	766	840	894	950	967
Biodegradable energy from waste[9]	1,648	1,900	2,582r	2,740r	3,386
Co-firing with fossil fuels	337	124	183	117	54
Animal biomass[4]	628	614	648	650	649
Anaerobic digestion	713	1,023	1,485r	2,082r	2,470
Plant biomass[5]	8,832	13,086	18,592r	18,822r	20,059
Total bioenergy	18,100	22,619	29,257r	30,064r	31,869
Total generation	53,213	64,522	83,364r	83,127r	99,330
Non-biodegradable wastes[10]	1,480	1,901	2,584r	2,741r	3,387
Total generation from sources eligible for the Renewable Obligation[11]	47,539	57,569	68,066r	65,680r	71,298

(1) Capacity on a DNC basis is shown in Long Term Trends Table 6.1.1 available on the BEIS website.
(2) Excluding pumped storage stations. Capacities are as at the end of December.
(3) Includes waste tyres and hospital waste.
(4) Includes the use of poultry litter and meat & bone.
(5) Includes the use of straw combustion and short rotation coppice energy crops.
(6) This is the proportion of fossil fuelled capacity used for co-firing of renewables based on the proportion of generation accounted for by the renewable source.
(7) Actual generation figures are given where available, but otherwise are estimated using a typical load factor or the design load factor, where known.
(8) Includes electricity from the EMEC test facility.
(9) Biodegradable part only.
(10) Non-biodegradable part of municipal solid waste plus waste tyres, hosptal waste and general industrial waste.
(11) See paragraphs 6.56 to 6.57 for definition and coverage.

6.5 Load factors for renewable electricity generation

Per cent

	2013	2014	2015	2016	2017
Load factors - based on average beginning and end of year capacity (1)					
Wind	31.9	30.0	33.6r	27.8r	31.7
Onshore	28.4	26.2	29.3r	23.6r	28.0
Offshore	39.1	37.3	41.5r	36.0r	38.9
Marine energy (wave and tidal stream)	6.5	3.0	2.6r	0.0r	3.0
Solar photovoltaics	9.8	10.9	11.4r	11.0r	10.7
Hydro	31.6	39.1	41.0r	34.0r	36.5
Small scale	34.4	39.3	40.6r	34.9r	40.0
Large scale	31.1	39.1	41.1r	33.8r	35.6
Bioenergy (excludes cofiring and non-biodegradable wastes)	56.4	59.7	67.4r	61.8r	61.5
Landfill gas	56.5	54.5	52.5r	50.4r	46.0
Sewage sludge digestion	42.3	44.4	44.2r	44.3r	43.9
Energy from waste (3)	35.6	35.4	36.6r	31.9r	36.5
Animal biomass (4)	64.9	63.4	66.9r	61.7r	57.3
Anaerobic digestion	57.5	57.6	58.6r	62.2r	63.6
Plant Biomass (5)	64.6	70.9	87.3r	78.5r	77.5
All renewable technologies (excluding cofiring and non-biodegradable wastes)	33.9	32.8	34.0r	28.4r	29.7
Load factors - for schemes operating on an unchanged configuration basis (2)					
Wind	31.0	29.8	33.3	28.8	31.6
Onshore	27.9	25.9	29.4	24.2	27.3
Offshore	37.6	37.8	39.7	36.7r	40.0
Solar photovoltaics	11.3	11.1	11.2	10.8r	10.6
Hydro	31.6	38.8	39.5	33.9	35.8
Small scale	36.1	39.7	41.9	34.7	37.9
Large scale	31.2	38.8	39.2	33.8	35.6
Bioenergy (excludes cofiring and non-biodegradable wastes)	60.5	65.1	67.4r	68.8r	69.2
Landfill gas	57.5	55.2	52.6	49.9	45.8
Sewage sludge digestion	49.8	48.0	48.2	43.1	46.1
Energy from waste (3)	35.3	35.5	35.7r	34.4r	37.2
Animal biomass (4)	70.4	63.4	66.9	57.2	57.3
Anaerobic digestion	61.5	57.5	55.4r	60.5r	63.2
Plant biomass (5)	60.6	70.5	74.4r	79.0r	79.0
All renewable technologies (excluding cofiring and non-biodegradable wastes)	36.1	37.8	38.2r	33.0r	33.5

(1) See methodology note for details of the calculation.

(2) See methodology note for details of the calculation.

(3) Calculation is based on biodegradable waste generation but all waste capacity; this reduces the load factor.

(4) Includes the use of poultry litter and meat & bone.

(5) Includes the use of straw combustion and short rotation coppice energy crops.

6.6 Renewable sources used to generate electricity and heat and for transport fuels*(1)(2)*

Thousand tonnes of oil equivalent

	2013	2014	2015	2016	2017
Used to generate electricity *(3)*					
Wind:					
Onshore	1,455.3	1,595.4	1,965r	1,793r	2,501.1
Offshore	986.4	1,152.6	1,498	1,411	1,798.5
Marine energy (4)	0.4	0.2	0	-	0.4
Solar photovoltaics	172.8	348.6	648r	895r	991.0
Hydro:					
Small scale	58.0	71.8	85	87	113.7
Large scale *(5)*	346.2	434.5	457	377	396.0
Bioenergy:					
Landfill gas	1,697.2	1,650.8	1,598	1,542	1,405.0
Sewage gas	251.2	275.5	293	312	317.3
Biodegradable energy from waste	564.7	682.1	905	1,117	1,184.6
Co-firing with fossil fuels	53.7	25.1	38	25	18.3
Animal biomass *(6)*	226.4	224.8	235	230	225.9
Anaerobic digestion	233.9	335.4	487r	683r	810.0
Plant biomass *(7)*	2,008.3	2,912.9	3,850r	3,871	4,234.6
Total bioenergy	5,035.3	6,106.6	7,407r	7,780r	8,195.7
Total	8,054.5	9,709.7	12,059r	12,342r	13,996.3
Non-biodegradable wastes *(8)*	513.1	688.4	912	1,124	1,190.9
Used to generate heat					
Active solar heating	47.9	49.6	51	51	52.1
Bioenergy:					
Landfill gas	13.6	13.6	14	14	13.6
Sewage gas	68.3	67.7	73	72	84.2
Wood	1,787.7	1,698.1	1,918r	2,054r	2,039.4
Waste wood	315.4	319.1	319	319	319.1
Animal biomass *(9)*	29.1	34.5	31	23	23.0
Anaerobic digestion	18.5	42.9	119r	270r	298.9
Plant biomass *(10)*	418.8	561.2	838	1,102	1,252.9
Biodegradable energy from waste *(6)*	29.7	22.4	67r	69r	93.8
Total bioenergy	2,681.1	2,759.6	3,378r	3,923r	4,124.9
Deep geothermal	0.8	0.8	1	1	0.8
Heat Pumps	96.5	106.7	1,007r	1,066r	1,044.4
Total	2,826.3	2,916.6	4,436r	5,040r	5,222.2
Non-biodegradable wastes *(8)*	154.7	158.4	137r	144r	168.5
Renewable sources used as transport fuels					
Bioethanol	462.2	458.8	448r	428	424.5
Biodiesel	629.4	783.8	550r	582	572.7
Total	1,091.6	1,242.7	998r	1,010	997.1
Total use of renewable sources and wastes					
Solar heating and photovoltaics	220.7	398.1	698r	946r	1,043.0
Onshore wind	1,455.3	1,595.4	1,965r	1,793r	2,501.1
Offshore wind	986.4	1,152.6	1,498	1,411	1,798.5
Marine energy (wave and tidal stream)	0.4	0.2	0	-	0.4
Hydro	404.3	506.3	541r	463r	509.7
Bioenergy	7,716.4	8,866.2	10,784r	11,702r	12,320.6
Deep geothermal	0.8	0.8	1	1	0.8
Heat pumps	96.5	106.7	1,007r	1,066r	1,044.4
Transport biofuels	1,091.6	1,242.7	998r	1,010	997.1
Total	11,972.4	13,869.0	17,493r	18,392r	20,215.6
Non-biodegradable wastes *(8)*	667.8	846.8	1,049r	1,268r	1,359.4
All renewables and wastes *(11)*	12,640.2	14,715.8	18,542r	19,660r	21,575.0

(1) Includes some waste of fossil fuel origin.
(2) See the Digest of UK Energy Statistics for technical notes and definitions of the categories used in this table.
(3) For wind, solar PV and hydro, the figures represent the energy content of the electricity supplied but for bioenergy the figures represent the energy content of the fuel used.
(4) Wave and tidal stream; Includes the EMEC test facility.
(5) Excluding pumped storage stations.
(6) Includes electricity from poultry litter combustion and meat & bone combustion.
(7) Includes electricity from straw and energy crops.
(8) Non-biodegradable part of municipal solid waste plus waste tyres, hospital waste, and general industrial waste.
(9) Includes heat from farm waste digestion, and meat and bone combustion.
(10) Includes heat from straw, energy crops, paper and packaging.
(11) The figures in this row correspond to the total demand and total supply figures in Tables 6.1, 6.2 and 6.3.

6.7 Renewable sources data used to indicate progress under the 2009 EU Renewable Energy Directive (measured using net calorific values)

Thousand tonnes of oil equivalent

	2013	2014	2015	2016	2017
Electricity generation component:					
Normalised hydro generation *(1) (2)*	445	448	383r	427r	470
Normalised wind generation *(3)*	2,228	2,714	3,222r	3,499r	4,199
Electricity generation from renewables other than wind, hydro, and compliant biofuels	1,730	2,295	3,174r	3,506r	3,732
Electricity generation from compliant biofuels	-	-	1	2	3
Total renewable generation from all compliant sources	4,402	5,457	6,779r	7,432r	8,401
Total Gross Electricity Consumption *(2)*	31,798	30,587	30,721r	30,454r	30,135
Percentage of electricity from renewable sources	13.8%	17.8%	22.1%	24.4%	27.9%
Heat component:					
Renewable energy for heating and cooling	2,387	2,468	3,469r	4,034r	4,254
Total Gross energy consumption for heating and cooling	59,180	52,997	55,243r	55,823r	54,979
Percentage of heating and cooling energy from renewable sources	4.0%	4.7%	6.3%	7.2%	7.7%
Transport component (excluding air transport):					
Road transport renewable electricity	1	1	2	3r	4
Non-road transport renewable electricity	81	90	-r	-r	0
Biofuels (restricted to those meeting sustainability criteria from 2011) *(4)*	1,045	1,176	943	993r	921
Total electricity consumption in transport	374	387	388r	403r	411
Total petrol and diesel consumption in transport	36,777	37,270	38,186r	39,101r	39,142
Total transport component numerator (including weighted components) *(5)*	1,824	2,090	1,780r	2,004r	1,906
Total transport component denominator (including weighted components) (5)	38,894	39,653	40,248r	41,386r	41,323
Percentage of transport energy from renewable sources *(5)*	4.7%	5.3%	4.4%	4.8%	4.6%
Overall directive target:					
Renewables used for:					
Electricity generation	4,321	5,366	6,777r	7,429r	8,397
Heating and Cooling	2,387	2,468	3,469r	4,034r	4,254
Transport biofuels (restricted to those meeting sustainability criteria from 2011)	1,127	1,267	945r	996r	925
Total Final Consumption of Renewable Energy ["Row A"]	7,835	9,101	11,191r	12,459r	13,575
Final Electricity Consumption *(6)*	26,820	25,648	25,703r	25,719r	25,463
Transport Final Energy Consumption (including air transport) *(7)*	50,107	50,720	51,507r	52,575r	52,950
Heating and Cooling Final Energy Consumption	59,170	52,988	55,234r	55,813r	54,969
Total Final Energy Consumption *(8)*	136,097	129,356	132,444r	134,107r	133,381
plus Distribution losses for electricity	2,283	2,360	2,466r	2,296r	2,212
plus Distribution losses for heat	0	0	-	-	1
plus Consumption of electricity in the electricity and heat generation sectors	1,535	1,417	1,432	1,314r	1,326
plus Consumption of heat in the electricity and heat generation sectors	0	0	-	-	1
Gross Final Energy Consumption (GFEC)	139,915	133,133	136,342r	137,717r	136,922
of which Air transport	11,812	11,798	11,188r	11,283r	11,659
Air transport as a proportion of GFEC	8.44%	8.86%	8.21%	8.19%	8.52%
Air transport cap specificed in Directive	6.18%	6.18%	6.18%	6.18%	6.18%
Capped air transport	8,647	8,228	8,426r	8,511r	8,462
Capped Gross Final Energy Consumption (CGFEC) ["Row B"] *(9)*	136,750	129,562	133,581r	134,945r	133,725
Headline Directive percentage : Renewable Energy Consumption as a percentage of Capped Gross Final Energy Consumption ["Row A" divided by "Row B"]	5.7%	7.0%	8.4%	9.2%	10.2%

(1) Based on a 15 year average hydro load factor.
(2) Excludes generation from pumped storage.
(3) Based on a 5 year average wind load factor.
(4) For the current year, an estimate has been made for the proportion of biofuels meeting the sustainability criteria
(5) Some sustainable biofuels are double weighted in the numerator of this calculation, as specified by the Directive.
(5) Final Electricity Consumption is Gross Electricity Consumption minus generators' own use of electricity and losses.
(7) Includes consumption of petrol and diesel, biofuels, other oil products, and coal.
(8) Total final consumption less non-energy use, as shown in Annex I, Table I.1, available on the BEIS website.
(9) This row includes adjustments for loses, and generators own use of electricity, combined with the capping mechanism for air transport as specified in the Directive.

Chapter 7
Combined heat and power

Key Points

- The Good Quality CHP capacity increased by 210 MWe between 2016 and 2017 from 5,625 MWe to 5,835 MWe. (Table 7A)
- The amount of good quality electricity produced in 2017 was 21.6 TWh (Table 7.4), which is 6.1 per cent higher than in 2016. The good quality electricity generated by CHP in 2017 corresponds to 6.4 per cent of all electricity generated in the UK.
- Sixty-nine percent of the fuel used in CHP schemes in 2017 was natural gas. This is 2.4 percentage points lower than in 2016. In 2017, the share of total fuel that was renewable was 16.5 per cent, a 3.3 percentage point increase between 2016 and 2017.
- The Oil and Gas sector has the largest Good Quality CHP capacity (38 per cent), followed by the Chemicals sector (19 per cent), Other sector (12 per cent) and then the Transport Commerce and Administration sector (9.1 per cent).
- The absolute CO_2 savings delivered by CHP in 2017 were lower than in 2016. This is due to the provisional values for CO_2 intensity of electricity displaced by CHP electricity being lower in 2017 than in 2016, rather than falls in the outputs of CHP or efficiency of operation.

Introduction

7.1 This chapter sets out the contribution made by Combined Heat and Power (CHP) to the United Kingdom's energy requirements. The data presented in this chapter have been derived from information submitted to the CHP Quality Assurance programme (CHPQA) or by following the CHPQA methodology in respect of data obtained from other sources. The CHPQA programme was introduced by the Government to provide the methods and procedures to assess and certify the quality of the full range of CHP schemes. It is a rigorous system for the Government to ensure that the incentives on offer are targeted fairly and benefit schemes in relation to their environmental performance.

7.2 CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process. The term CHP is synonymous with cogeneration, which is commonly used in other Member States of the European Community and the United States. CHP uses a variety of fuels and technologies across a wide range of sizes and applications. The basic elements of a CHP plant comprise one or more prime movers (a reciprocating engine, gas turbine, Rankine cycle turbine using steam or organic fluids and, more recently, steam screw expanders) driving electrical generators, with the heat generated in the process captured and put to further productive use, such as for industrial processes, hot water and space heating or cooling (via absorption chillers).

7.3 CHP is typically sized to make use of the available heat[1], and connected to the lower voltage distribution system (i.e. embedded). This means that, unlike conventional power stations, CHP can provide efficiency gains by avoiding significant transmission and distribution losses, which currently represent about 7.5 per cent of electricity demand in the UK. These gains are reflected in the calculation of CO_2 savings delivered by CHP (see paragraphs 7.29-7.30). CHP can also provide important network services such improvements to power quality, and some have the ability to operate in island mode if the grid goes down. There are six principal types of CHP system: steam turbine, gas turbine, combined cycle systems, reciprocating engines, Organic Rankine Cycle (ORC) and steam expander systems. Each of these is defined in paragraph 7.37 later in this chapter.

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1 *But not always, see paragraph 7.6. In such cases there is an impact upon the electrical capacity and electrical output classified as CHP.*

UK energy markets, and their effect on CHP

7.4 Two major factors affecting the economics of CHP are the relative cost of fuel (principally natural gas) and the value that can be realised for electricity both for own use and export. This is known as the spark spread (i.e. the difference between the price of electricity and the price of the gas required to generate that electricity). The larger the spark spread the more favourable are the economics of CHP operation. At the start of 2013 the spark spread started to increase and did so each quarter until the middle of 2016. Since that time, the spark gap has fluctuated in magnitude up and down. Over the last 10 years the spark spread peaked at 5.2 (Q3 of 2016) and was at a minimum of 3.0 (Q1 2013). In Q4 2017 it stood at 4.6.

7.5 The effect of the introduction of a specific solid biomass CHP Renewable Heat Incentive (RHI) tariff for installations commissioned after May 2014 has encouraged the commissioning of a growing number of units based on Organic Rankine Cycle (ORC) and steam screw expander technologies. Statistics tables 7.3 to 7.7 now include a specific entry for schemes based on ORC technology, reflecting this development. These technologies are described in paragraph 7.37.

Use of CHPQA in producing CHP statistics

7.6 The CHPQA programme is the major source for CHP statistics. CHPQA schemes accounted for 92 per cent of the capacity reported in this chapter for 2017. The following factors need to be considered when using the statistics produced:

- Through CHPQA, scheme operators have been given guidance on how to determine the boundary of a CHP scheme (what is regarded as part of the CHP installation and what is not). A scheme can include multiple CHP prime movers[2], along with supplementary boilers and generating plant, subject to appropriate metering being installed to support the CHP scheme boundaries proposed, and subject to appropriate metering and threshold criteria. (See CHPQA Guidance Note 11 available at www.gov.uk/chpqa-guidance-notes). This point is relevant when considering the figures in Table 7D, where the power efficiencies, heat efficiencies and heat to power ratios stated in that table for 2017 are those of the scheme, which may not be just the prime mover.
- The output of a scheme is based on gross power output. This means that power consumed by parasitic plant such as pumps and fans is included in the power output of the scheme.
- The main purpose of a number of CHP schemes is the generation of electricity including export to other businesses and to the grid. There may not be demand for all of the available heat from such schemes. In such cases, the schemes' total electrical capacity and electrical output have been scaled back using the methodologies outlined in CHPQA (see www.gov.uk/chpqa-guidance-notes). Only the output from highly-efficient or "Good Quality" schemes is counted in this chapter. Chapter 5 includes all CHP capacity, fuel inputs and power outputs, for both highly-efficient, or "Good Quality", and less efficient schemes, under the categories "Other generators".
- For year of operation 2011 onwards, new scale back criteria came into force in order to be consistent with the EU Cogeneration Directive. This results in a more severe scale back than was previously the case. This has contributed to some of the decrease in Good Quality electricity output and associated fuel consumption seen after 2010.
- There are two load factors presented in Table 7A. Load Factor (CHPQA) is based on the Good Quality Power Output and Good Quality Power Capacity reported in this Chapter. Load Factor (Actual) is based on the Total Power Capacity and the Total Power Output. The Load Factor (CHPQA) is lower than the Load Factor (Actual) for schemes that have been scaled back on the power outputs. The load factor gives an indication of the degree to which the power generating capacity is utilized. Between 2007 and 2013 Load Factor (CHPQA) steadily declined but has undergone a modest increase since then. In 2016 there was an appreciable upturn in Load Factor (Actual), which was due to a number of large CHP generators in the Chemicals and Oil Refineries sectors increasing their production of electricity. Load Factor (Actual) in 2017 was lower than in 2016 but is still higher than at any time since 2011.

2 The CHP prime mover is the heart of a CHP system and is a mechanical machine which drives the electricity generator or develops mechanical power for direct use

Table 7A: A summary of the recent development of CHP *(1)*

	Unit	2013	2014	2015	2016	2017
Number of schemes		2,024	2,071	2,130	2,224	2,386
Net No. of schemes added during year (2)		84	47	59	94	162
Electrical capacity (CHP_{QPC})	MWe	5,919	5,888	5,708	5,625	5,835
Net capacity added during year		-45	-32	-179	-83	209
Capacity added in percentage terms	Per cent	-0.8	-0.5	-3.0	-1.5	3.7
Heat capacity	MWth	22,161	22,223	20,091	19,795	20,191
Heat to power ratio *(3)*		2.27	2.13	2.06	1.99	1.95
Fuel input *(4)*	GWh	88,403	86,184	82,576	85,123	90,279
Electricity generation (CHP_{QPO})	GWh	19,515	19,690	19,534	20,405	21,648
Heat generation (CHP_{QHO})	GWh	44,342	41,950	40,234	40,670	42,238
Overall efficiency *(5)*	Per cent	72.2	71.5	72.4	71.7	70.8
Load factor (CHPQA) *(6)*	Per cent	37.6	38.2	39.1	41.4	42.4
Load factor (Actual) *(7)*	Per cent	51.7	52.3	51.0	60.0	56.4

(1) Data in this table for 2013 and 2016 have been revised since last year's Digest as more up to date information on the performance and status of some CHP schemes has become available.
(2) Net number of schemes added = New schemes – Decommissioned existing schemes.
(3) Heat to power ratios are calculated from the qualifying heat output (QHO) and the qualifying power output (QPO).
(4) Fuel input is the fuel deemed to have generated the qualifying power output (QPO) and qualifying heat output (QHO).
(5) Overall efficiencies are calculated using qualifying power output (QPO), qualifying heat output (QHO) and fuel input. Fuel input is expressed in Gross Calorific Value (GCV) terms. When fuel input is expressed in Net Calorific Value (NCV) terms, efficiencies will be higher.
(6) The load factor (CHPQA) is based on the qualifying power output (QPO) and qualifying power capacity (QPC) and does not correspond exactly to the number of hours run by the prime movers in a year.
(7) The load factor (Actual) is based on the total power generated and total capacity.

Efficiency of CHP schemes

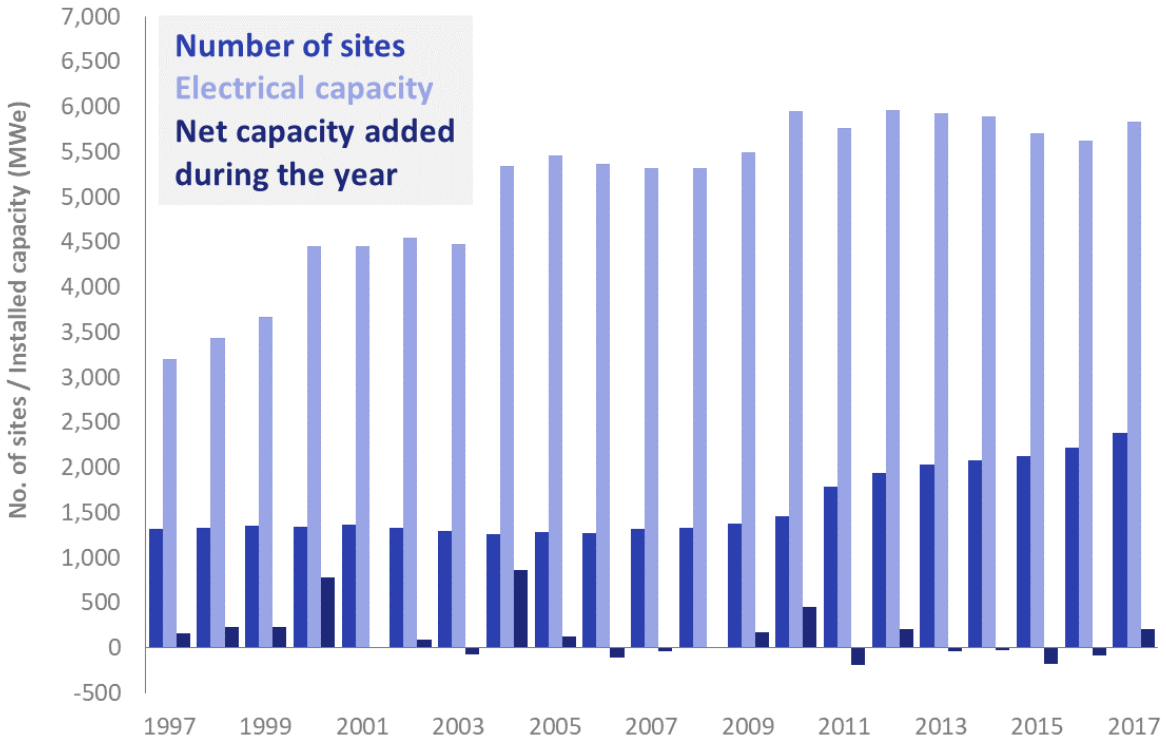
7.7 Good Quality CHP denotes schemes that have been certified as being highly efficient through the UK's CHP Quality Assurance (CHPQA) programme. The criteria used are in line with the requirements for high efficiency CHP set down in the Energy Efficiency Directive (2012/27/EU). A Good Quality CHP scheme, with installed capacity ≥1 MWe, must achieve 10 per cent primary energy savings compared with the EU reference values for separate generation of heat and power i.e. via a boiler and power station. Good Quality CHP schemes with installed capacity <1 MWe must achieve primary energy savings greater than zero per cent.

Changes in CHP capacity

7.8 Chart 7.1 shows the change in installed CHP capacity since 2001, when the CHPQA programme began. Installed capacity at the end of 2017 stood at 5,835 MWe, an increase of 209 MWe (3.7 per cent) compared to 2016. There was also a net increase of 162 (7.3 per cent) in the number of schemes between 2016 and 2017. Overall, between 2016 and 2017, there were 194 new schemes included in the database and a removal of 32 schemes. There have been revisions to the capacity figures for 2013 to 2016 shown in the previous edition of the Digest, as more up to date information on the performance and operational status of some schemes has become available.

7.9 For the first time it has been possible to include in the statistics a number of CHP schemes fuelled by biogas generated by anaerobic digesters which do not submit to CHPQA. These particular schemes are included on the basis that food waste makes up part of the composition of the feedstock and that, therefore, pasteurisation of the feedstock, or digestate, is required. As stated in paragraph 7.1, where data from sources other than CHPQA are used, the CHPQA methodology is nevertheless used to determine the qualifying capacities, fuel inputs, power and heat outputs, which are reported in this chapter. Under CHPQA, heat is only counted if it is deemed "useful heat". Useful heat from CHP is heat that is demonstrably utilised to displace heat that would otherwise be supplied from other sources. In the absence of CHP heat, heat to carry out the necessary pasteurisation of the feedstock or digestate, where the feedstock includes food waste, would have to come from another source. As such, at least some of the heat output from these particular CHP schemes is deemed useful heat, and so these schemes are included in the statistics. It is possible to include these schemes now because robust information has become available about the composition of the feedstock to the digesters. These schemes are included in the statistics just for year of operation 2017 and have not been added retrospectively.

Chart 7.1: Operating CHP capacity by year



7.10 Table 7A gives a summary of the overall CHP market. In 2017, CHP schemes generated 21,648 GWh of Good Quality electricity, 6.1 per cent higher than in 2016. This generated electricity represents 6.4 per cent of the total electricity generated in the UK. Virtually all of this increase in Good Quality outputs may be attributed to the inclusion in the statistics for the first time of a number of CHP schemes running on biogas generated by anaerobic digestion plant, as explained in paragraph 7.9. The quantity of Good Quality electricity generated in industry was more or less unchanged between 2016 and 2017. However, at the individual industrial sector level, there were more notable changes. For example, there was a 9.6 per cent increase in Good Quality power outputs in the Food and Drink sector, but a 5.2 per cent and 26 per cent decrease in the Iron and Steel and Non-ferrous sector. The Transport, Commerce and Administration (TCA) sector continued its more or less uninterrupted, gradual rise in Good Quality power outputs. In the Other sector, the output of Good Quality power outputs increased significantly between 2016 and 2017, and this is due to the inclusion of a number of CHP schemes based on food waste fed anaerobic digestion (see paragraph 7.9 for further information).

7.11 Table 7A shows that CHP schemes supplied a total of 42,238 GWh of heat in 2017. This was an increase of 3.9 per cent (1,568 GWh) compared to 2016. There were two notable components to this increase, one is the inclusion in the statistics for the first time of some CHP schemes fuelled by biogas from anaerobic digestion plant (contributing 421 GWh to the increase – see paragraph 7.9 for further information) and the other was a 777 GWh increase from industrial CHP. This increase in heat output from industrial CHP breaks a ten-year downward trend in industrial heat output from CHP. There were modest relative increases in the heat output from the Chemicals, Oil Refineries and Paper sectors, with a more significant increase (6.2 per cent) increase from the Food and Drink sector. The heat output from CHP in the Transport, Commerce and Administration (TCA) sector continued its long term upward trend, with an increase of 2.8 per cent between 2016 and 2017.

7.12 In terms of electrical capacity by size of scheme, schemes larger than 10 MWe represent 72 per cent of the total electrical capacity of CHP schemes as shown in Table 7B. Schemes less than 1 MWe constitute the majority of scheme numbers (79 per cent), but just 6.3 per cent of the total capacity. Table 7.5 provides data on electrical capacity for each type of CHP installation.

Table 7B: CHP schemes by capacity size ranges in 2017

Electrical capacity size range	Number of schemes	Share of total (per cent)	Total electricity capacity (MWe)	Share of total (per cent)
Less then100 kWe	605	25	36	0.6
100 kWe - 1 MWe	1,291	54	331	5.7
1 MWe - 2 MWe	183	7.7	259	4.4
2 MWe - 10 MWe	240	10	1,027	18
> 10 MWe +	67	2.8	4,181	72
Total	**2,386**	**100**	**5,835**	**100**

7.13 Table 7.5 shows that 58 per cent of total electrical capacity is in combined cycle gas turbine (CCGT) mode and 26 per cent is from reciprocating engines. In 2007 these proportions were 74 per cent and 12 per cent, respectively. These changes are explained by an absolute fall in the CCGT capacity and an absolute increase in reciprocating engine capacity. There were significant falls in CCGT capacity in the Chemicals and Paper sectors, while there was an increase in reciprocating engine capacity across all but one sector during this period. These changes in technology over time also explain changes in the distribution of capacity within capacity ranges, as shown in Table 7B across different editions of the Digest. As CCGT capacity has been lost, the proportion of total capacity in the size range >10 MWe has decreased from 82 percent in 2007 to 72 per cent in 2017. Over the long term there has been a fall in the proportion of overall capacity that is back pressure steam turbine, as this relatively inefficient and inflexible technology is phased out. In recent years there has been an increase in pass out condensing steam turbine capacity, as more biomass and waste fuelled CHP schemes have been brought on line.

7.14 Excluded from the statistics tables presented in this chapter are a number of very small CHP schemes (micro-CHP) installed since 2010 in response to the Feed-in Tariff (FiT) scheme. The overwhelming majority of these schemes are domestic. At the end of 2017 there were 517 such schemes registered with Ofgem for FiTs with a total installed capacity of 545 kWe. There are no data on electricity generation or fuel consumption for these schemes and, consequently, they have been left out of the statistics tables. However, if included, there would have a negligible impact upon the capacity and generation figures presented in the statistics tables.

7.15 Table 7.7 provides data on heat capacity for each type of CHP installation. Starting in the 2013 edition of the Digest, there has been a change implemented in how the heat capacity has been derived. Prior to this, for a number of schemes, the data held on heat capacity were either not complete or were not a true reflection of the capacity of the scheme to generate heat in CHP operating mode. To allow for this, a standard methodology was developed and applied for the first time in the 2013 edition of the Digest for the determination of the heat capacity. This is applied to new schemes and schemes undergoing a change in plant. Details of this methodology may be found in the CHP methodology note which is available from the following link:
www.gov.uk/government/publications/combined-heat-and-power-statistics-data-sources-and-methodologies

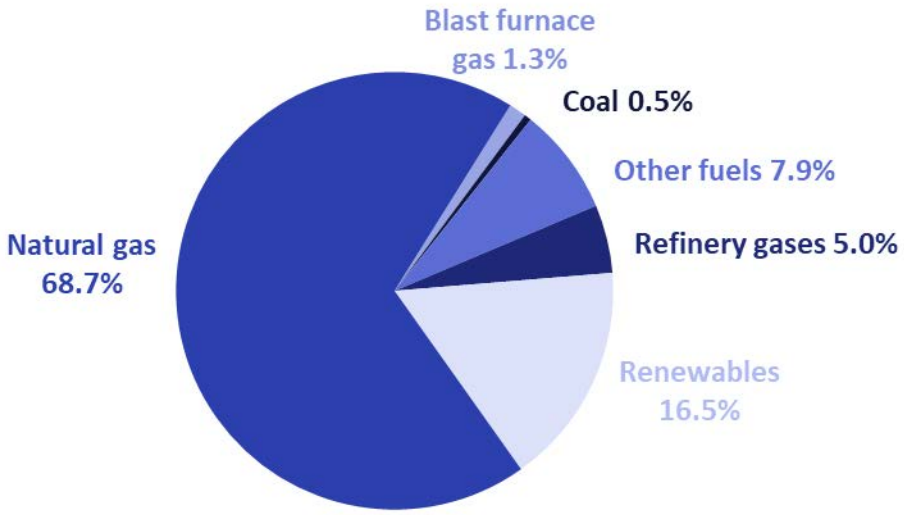
Fuel used by types of CHP installation

7.16 Table 7.2 shows the fuel used to generate electricity and heat in CHP schemes (see paragraphs 7.38 to 7.40 below for an explanation of the convention for dividing fuel between electricity and heat production). Table 7.3 gives the overall fuel used by types of CHP installation (which are explained in paragraph 7.37). Total fuel use is summarised in Chart 7.2. In 2017, 69 per cent of the total fuel use was natural gas. This is a decrease of 2.4 percentage points compared with 2016. CHP schemes accounted for 7.1 per cent of UK gas demand in 2017 (see Table 4.1). The use of coal and fuel oil is now less than 1 per cent of overall fuel use.

7.17 The proportion of total fuel consumption that was renewable increased between 2016 and 2017 from 13 per cent to 16 percent of the total. This increase is substantially due to the inclusion of a number of CHP schemes fuelled by biogas generated by anaerobic digestion fed with food waste (see paragraph 7.9 for detailed explanation). Gaseous renewable fuels constitute the single largest type of renewable fuel (45 per cent), followed by biomass fuels (34 per cent) and waste fuels (20 per cent), with the balance being liquid renewable fuels.

7.18 Fuels which are liquids, solids or gases that are by-products or waste products from industrial processes, or are renewable fuels, accounted for 30 per cent of all fuel used in CHP in 2017. This is 2.5 percentage points higher than in 2016, and this is mainly due to the increase in the consumption of renewable fuel included in this chapter, as discussed in paragraphs 7.9 and 7.17.

Chart 7.2: Types of fuel used by CHP schemes in 2017



CHP capacity, output and fuel use by sector

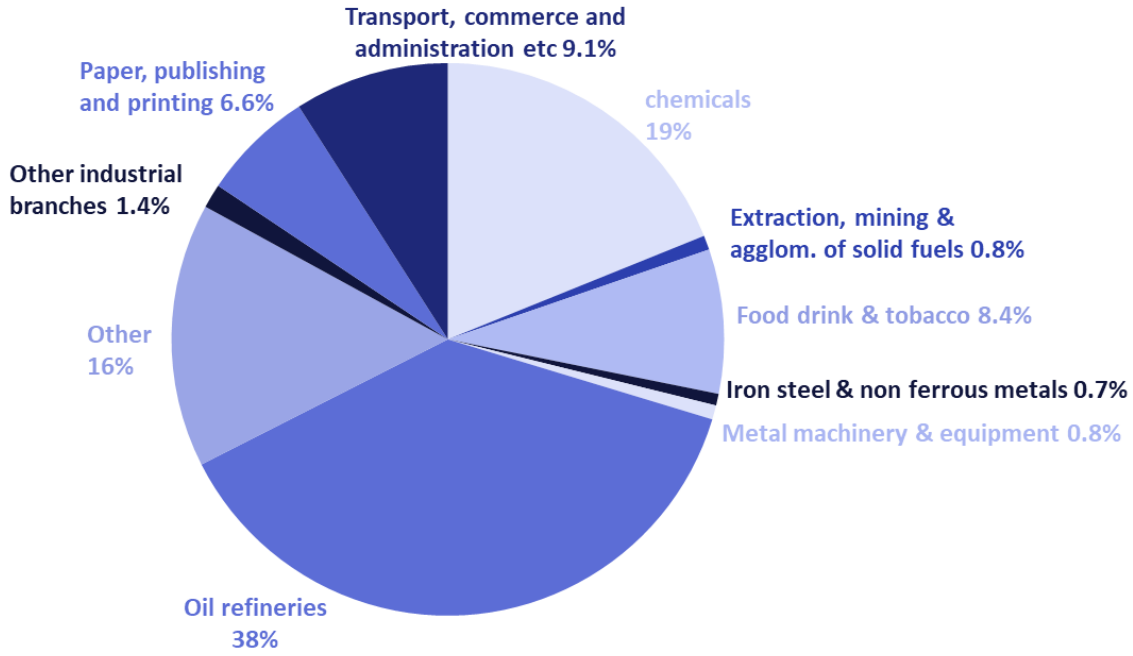
7.19 In this chapter of the Digest, CHP is analysed by the sector using the heat or, where the heat is used by more than one sector, by the sector using the majority of the heat. This method of assigning a CHP scheme to a sector was rigorously applied for the first time in the 2008 edition of the digest and resulted in the movement of CHP schemes between sectors. One consequence of this was the removal of all schemes once allocated to the "electricity supply" sector and their distribution to other sectors. Full details of this reassignment are provided in paragraph 6.33 and Table 6J of the 2008 edition of the digest.

7.20 Table 7.8 gives data on all operational schemes by economic sector. A definition of the sectors used in this table can be found in Chapter 1, paragraph 1.60 and Table 1H:

- 400 schemes (79 per cent of electrical capacity) are in the industrial sector and 1,986 schemes (21 per cent of capacity) are in the agricultural, commercial, public administration, residential and transport sectors. The share of capacity in the industrial sector was 3.8 percentage points lower in 2017 than in 2016. This continues a long-standing trend of a shrinking proportion of total CHP capacity being installed at industrial sites.
- The share of total installed Good Quality capacity taken up by each sector is shown in Chart 7.3. The Oil and gas terminals sector, which has been the largest sector since 2009, continues to have the largest share of total installed capacity, accounting for 38 per cent of all capacity. The Chemicals sector has the second highest share of total installed capacity (19 per cent) followed by the "Other" sector (12 per cent) and Transport, commerce and administration (TCA) at 9.1 per cent. The "Other" sector has overtaken TCA to occupy third position due to the inclusion for a number of anaerobic digestion CHP schemes (see paragraph 7.9 for detailed explanation).

Between 2016 and 2017 the following sectors saw a decrease in installed Good Quality capacity: Chemicals, Oil and gas terminals, Mineral products and Sewage treatment works. There were modest increases in the Paper, Food and drink and Metal products sectors.

Chart 7.3: CHP electrical capacity by sector in 2017



(1) Other sectors include agriculture, community heating, leisure, landfill and incineration
(2) Other industry includes textiles, clothing and footware and sewage treatment

7.21 Table 7C gives a summary of the 1,649 schemes installed in the commercial sector, public sector and residential buildings. These schemes form a major part of the "Transport, commerce and administration" and "Other" sectors in Tables 7.8 and 7.9. The vast majority of these schemes are based on spark ignition reciprocating engines fuelled with natural gas, though the larger schemes use compression ignition reciprocating engines or gas turbines. The largest proportion of the capacity is in the health sector (32 per cent), mainly hospitals. The leisure and hotel sectors remain the two sectors with the largest number of installed schemes. This is a reflection of the suitability of CHP for meeting the demand profiles for heating and hot water in these types of building. Of note is the large ratio of heat to power generating capacity in the health sector. This is a reflection of the especially acute need for security of heat supply required at hospitals, provided by back-up boilers, rather than the heat to power capacity ratios inherent in the prime mover used for power generation (see Definitions of schemes under Technical notes and definitions).

Table 7C: Number and capacity of CHP schemes installed in buildings by sector in 2017

	Number of schemes	Electrical capacity (MWe)	Heat capacity (MWth)
Leisure	545	71	121
Hotels	282	41	67
Health	231	188	1050
Residential Group Heating	122	96	420
Universities	99	102	521
Offices	43	17	29
Education	61	15	50
Government Estate	32	14	48
Retail	230	46	74
Other *(1)*	4	2.6	19
Total	**1,649**	**593**	**2,399**

(1) All schemes under Other are at airports

7.22 According to the Energy Performance in Buildings Directive, District Heating and Cooling (DHC) is the distribution of thermal energy in the form of steam, hot water or chilled products from a centralised place of production through a network to multiple buildings or sites for space or process heating or cooling. For statistical purposes, EUROSTAT further stipulates that, as well as more than one building or site having to be supplied, there must also be more than one customer for the heating or cooling supplied. Comprehensive data on Community Heating (CH) and District Heating (DH) schemes in the United Kingdom became available for the first time in 2017 when data submissions, made to the Office of Public Safety and Standards, as required under Article 3 of The Heat Network (Metering and Billing) Regulations 2014, were processed. Using these data and adopting the EUROSTAT definition of DH, in 2015 there were approximately 246 DH schemes using CHP in the UK, with a heat capacity of 5,619 MWth and supplying 7,099 GWh of heat to their associated DH networks[3].

CHP performance by main prime mover

7.23 Table 7D gives a summary of the performance of schemes in 2017 by main prime mover type. In 2017 the prime mover type with the highest average operating hours was gas turbines followed by reciprocating engines.

7.24 In 2017, the average operating hours were 3,710 hours. The average operating hours in 2016 (revised) was 3,627 hours, indicating a slight increase in the utilisation of good quality capacity between the two years. These are the highest average operating hours since 2012.

7.25 In 2017, the average electrical efficiency was 24 per cent and the heat efficiency 47 per cent, giving an overall average of 71 per cent. This is 1.0 percentage points lower than the revised figure for 2016. Overall efficiency is simply the sum of the individual electrical and heat efficiencies.

Table 7D: A summary of scheme performance in 2017

	Average operating hours per annum (Full load equivalent)	Average electrical efficiency (% GCV)	Average heat efficiency (% GCV)	Average overall efficiency (% GCV)	Average heat to power ratio
Main prime mover in CHP plant					
Back pressure steam turbine	2,141	8.5	75	84	8.9
Pass out condensing steam turbine	3,682	15	38	53	2.5
Gas turbine	5,210	23	50	72	2.2
Combined cycle	3,545	25	49	74	2.0
Reciprocating engine	3,870	31	37	67	1.2
Organic Rankine Cycle	3,213	9.0	55	64	6.1
All schemes	**3,710**	**24**	**47**	**71**	**2.0**

CHP schemes which export and schemes with mechanical power output

7.26 Table 7E shows the electrical exports from CHP schemes between 2015 and 2017. In the 2015 edition of the Digest, for the first time we presented rigorous values for both total power exported and the Qualifying Power Output (QPO) exported. In previous editions of the Digest, power export figures have been based upon information voluntarily supplied by scheme operators. From the 2015 edition of the Digest, power export figures are based upon export meter data. The total power exported given below is therefore the value registered on the power export meter, with one adjustment made for some schemes. Where the value registered on a scheme's power export meter is greater than the Total Power Output (TPO) for the scheme, the total power exported is capped at the TPO of the scheme. This adjustment is necessary in some situations where schemes import power from another place and onward supply this power, with the onward supplied power passing through the power export meter. Mathematically, this is shown as:

TPO Exported = Value registered on power export meter

[3] When comparing these statistics with other sources, care is required to ensure that the same definition of District Heating (DH) is being used.

If Value registered on power export meter > TPO, then TPO Exported is set to equal TPO.

The QPO exported is the TPO exported that is deemed good quality. This is calculated by assuming that any power consumed by the scheme is good quality power (QPO). This means that only if the scheme's consumption of power is less than the QPO will QPO become available for export. Mathematically, the QPO exported is:

QPO Exported = QPO for the scheme – Electricity consumed by the scheme, where

Electricity consumed by the scheme = Total Power Output – TPO Exported

If QPO for the scheme < Electricity consumed by the scheme, then QPO Exported is set to zero.

Table 7E also sets out the recipients of exported power. In the 2015 edition of the Digest for the first time we rigorously followed up with Schemes to obtain data on recipients of exported power. This means that this follow-up was possible for years of operation 2015, 2016 and 2017, as shown below.

Table 7E: Electrical exports from CHP (TPO)

GWh

	2015	2016	2017
To part of same qualifying group *(1)*	582	775	1,129
To a firm NOT part of same qualifying group	9,365	10,040(r)	9,675
To an electricity supplier	12,596(r)	17,931(r)	15,725
Total	**22,544(r)**	**28,747(r)**	**26,528**

(1) A qualifying group is a group of two or more corporate consumers that are connected or related to each other, for example, as a subsidiary, or via a parent or holding company, or in terms of share capital.

Table 7F: Electrical exports from CHP (QPO)

GWh

	2015	2016	2017
To part of same qualifying group *(1)*	343	267	262
To a firm NOT part of same qualifying group	3,908	4,536(r)	4,446
To an electricity supplier	3,482	3,900(r)	3,918
Total	**7,733**	**8,703(r)**	**8,626**

There was a significant increase in the power exports in 2016 relative to 2015, both for total power exports (TPO) and Good Quality (QPO) power exports. Although there was a drop off in 2017, both the TPO and QPO exported is appreciably higher in 2017 than it was in 2015. This is consistent with the step up in Load Factor (Actual) and Load Factor (CHPQA) between 2015 and 2016, which has only dropped off slightly in 2017, caused by some large power exporting CHP schemes generating more power post 2015.

7.27 In 2017, 54 large schemes exported heat, with some exporting to more than one customer. In 2016 there were 52 schemes exporting heat. As Table 7G shows, these schemes supplied 9,802 GWh of heat in 2017, which is a 6.6 per cent increase on the revised 2016 figure.

Table 7G: Heat exports from CHP

GWh

	2015	2016	2017
To part of same qualifying group *(1)*	760	961	949
To a firm NOT part of same qualifying group	7,670(r)	8,207(r)	8,783
To an electricity supplier	4(r)	25(r)	70
Total	**8,333(r)**	**9,193(r)**	**9,802**

(1) A qualifying group is a group of two or more corporate consumers that are connected or related to each other, for example, as a subsidiary, or via a parent or holding company, or in terms of share capital.

7.28 There are an estimated 10 schemes with mechanical power output. For those schemes, mechanical power accounts for 9 per cent of their total power capacity (Table 7H). These schemes are predominantly on petro-chemicals or steel sites, using by-product fuels in boilers to drive steam turbines. The steam turbine is used to provide mechanical rather than electrical power, driving compressors, blowers or fans, rather than an alternator. The statistics on schemes with mechanical power are substantially unchanged from those for 2016, published in the previous edition of the Digest.

Table 7H: CHP schemes with mechanical power output in 2017

	Unit	
Number of schemes		10
Total Power Capacity of these schemes (CHP_{TPC})	MWe	2,157
Mechanical power capacity of these schemes	MWe	203

7.29 The calculation of carbon emissions savings from CHP is complex because CHP displaces a variety of fuels, technologies and sizes of plant. The methodology and assumptions used for calculating carbon emission savings are outlined in Energy Trends June 2003[4] (www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx). The figures compare CHP with the UK fossil fuel basket carbon intensity and the UK total basket carbon intensity, which includes nuclear and renewable generation. The carbon emission savings from CHP in 2017 as compared to the fossil fuel basket were 10.70 $MtCO_2$, which equates to 1.83 Mt CO_2 per 1,000 MWe installed capacity. Against the total basket, CHP saved 4.91 Mt CO_2 which equates to 0.84 Mt CO_2 per 1,000 MWe installed capacity.

7.30 Corresponding figures for 2015 and 2016 are shown in Table 7I. The 2015 and 2016 CO_2 savings are revised based on revisions to the relevant data for these years in Tables 7.1, 7.4, 7.6 and 7.9 and revisions to the CO_2 intensity of grid electricity. Absolute savings ($MtCO_2$) are sensitive to both the levels of CHP heat and power output and the CO_2 factor attributed to grid electricity that CHP electricity displaces. When measured against the total basket of grid electricity (i.e. including nuclear

4 http://webarchive.nationalarchives.gov.uk/20060213234600/http:/www.dti.gov.uk/energy/inform/energy_trends/index.shtml

and renewables) both the absolute and relative CO_2 savings delivered by CHP fell each year between 2015-2017. This is in spite of an increase in CHP power and heat outputs over this period and is explained by a 30 per cent decrease in the carbon intensity of all grid electricity over this relatively short period. Over the longer term, this downward trend in absolute and relative savings (when measured against the total basket) has been unbroken since 2012, when the CO_2 intensity of the total basket was more than double what it was in 2017. There has been a similar downward (though not unbroken) trend in savings since 2012 (when measured against the fossil fuel basket) when the CO_2 intensity of fossil fuel generated electricity was 45 per cent higher than it was in 2017, owing to an increasing proportion of fossil fuel generated electricity coming from natural gas.

Table 7I: Carbon dioxide savings due to CHP, absolute and per 1,000 MWe of installed good quality CHP capacity

	2015		2016		2017	
	$MtCO_2$	$MtCO_2$/1000 MWe	$MtCO_2$	$MtCO_2$/1000 MWe	$MtCO_2$	$MtCO_2$/1000 MWe
Carbon savings against all fossil fuels	12.59	2.21	10.20	1.81	10.70	1.83
Carbon savings against all fuels (including nuclear and renewables)	6.47	1.13	5.09	0.90	4.91	0.84

Note: (1) The CO_2 savings in Table 7I assume that CHP generated electricity avoids the transmission and distribution losses associated with its conventionally generated equivalent. These losses are assumed to be 1.5% in the case of transmission losses and 6.0% in the case of distribution losses.

(2) The CO_2 savings quoted above for 2017 are based on preliminary CO_2 intensities, for that year, for the fossil fuel basket and the total fuel basket of conventional electricity generation. As such, they are subject to revision at a later date. The CO_2 savings quoted above for 2015 and 2016 have also been revised in response to changes in the CO_2 intensity factors for electricity for these years since reporting in DUKES 2017.The figures have also been revised to reflect revisions to CHP electricity and heat output and fuel consumption.

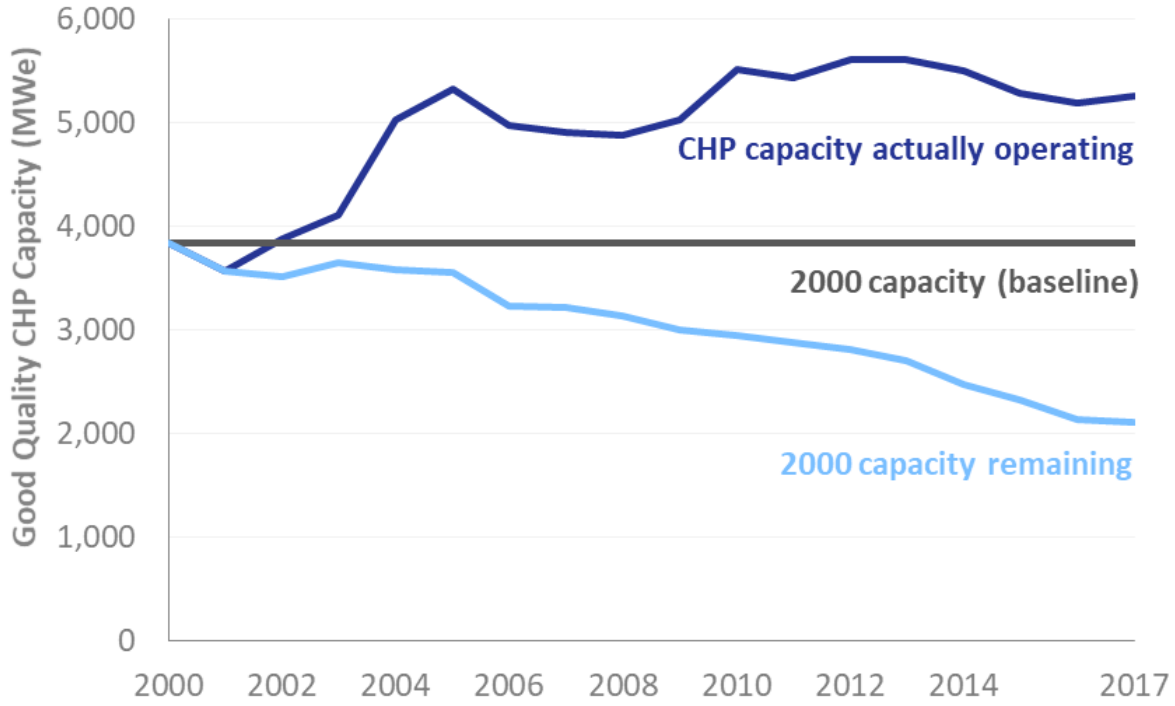
Government policy towards CHP

7.31 There are a range of support measures to incentivise the growth of Good Quality CHP in the UK. These include:

- Exemption from the Climate Change Levy (CCL) of all fuel inputs to, and electricity outputs from, Good Quality CHP. This exemption has been in place since the introduction of the CCL in 2001.
- From April 2013, exemption from Carbon Price Support (CPS) on fuel to CHP consumed for the generation of heat
- From April 2015, exemption from Carbon Price Support (CPS) on fuel to CHP consumed for the generation of Good Quality CHP electricity which is consumed on site
- Eligibility to Enhanced Capital Allowances for Good Quality CHP plant and machinery.
- Business Rates exemption for CHP power generation plant and machinery.
- Reduction of VAT (from 20 to 5 per cent) on domestic micro-CHP installations.
- Extension of the eligibility for Renewable Obligation Certificates (ROCs) to energy from waste plants that utilise CHP.
- Specific Renewable Heat Incentive (RHI) for biomass fuelled Good Quality CHP certified under CHPQA.
- Contract for Difference (CFD) for biomass fuelled CHP
- The zero-rating of heat under the Carbon Reduction Commitment Energy Efficiency Scheme (CRC), this means that allowances do not have to be purchased by a site covered by CRC for heat that it imports. This incentivises the use of CHP heat outputs.

7.32 Table 7.1 shows the installed Good Quality CHP capacity in each year. However, this table hides the underlying market activity that replaces older capacity as it is taken out of service over time. Chart 7.4 gives an idea of the scale of this activity since 2000 for CHP schemes certified under CHPQA. The dotted line shows how much of the Good Quality CHPQA capacity that was in place in 2000 remained in place in subsequent years, while the upper line shows the actual Good Quality CHPQA capacity in place in each year. For any year since 2000, the gap between these two lines represents the new Good Quality CHPQA capacity installed between 2000 and that year. By 2017 there had been just over 3.1 GWe of new Good Quality CHPQA capacity installed since 2000.

Chart 7.4: Underlying market activity – operating Good Quality CHP versus retained Good Quality CHP



International context

7.33 Phase III of EU ETS runs from 2013 until 2020. Under this phase there is no allocation made in respect of CO_2 emissions associated with the generation of electricity, including electricity generated by CHP. However, there is an allocation made in respect of EU ETS CO_2 emissions associated with measurable CHP heat consumption. The allocation is based upon harmonised benchmarks for heat production. In 2013 an EU ETS installation consuming CHP generated heat (not deemed at risk of carbon leakage) will have received a preliminary free allocation which is 80% of the allocation determined using this benchmark, declining linearly to 30% by 2020. Where the installation consuming the heat is deemed at significant risk of carbon leakage, then it will receive a preliminary free allocation which is 100% of the allocation determined using the benchmark for the duration of Phase III of EU ETS[5]. If the consumer of the heat is not an EU ETS installation, then the allocation is given to the heat producer. The benchmark for heat adopted by the European Commission is based on the use of natural gas with a conversion efficiency of 90% (N.C.V.). This means that the benchmark allocation made for each MWh of heat generated by a CHP scheme which is subsequently is 0.224 tCO2[6].

5 In determining the final free allocation received by the installation, the preliminary free allocation is multiplied by a factor known as the cross-sectoral correction factor. The cross-sectoral correction factor is applied to ensure that the total amount of free allocation does not exceed a certain cap. For EU ETS Phase III, the cross-sectoral correction factor is a factor that is less than 1 and declines linearly from 0.94 to 0.82 between 2013 and 2020. This means that the final free allocation is always less than the preliminary free allocation.

6 Where the CHP supplies heat to an EU ETS Phase III sub-installation or installation and the sub-installation or installation produces a product that is product benchmarked, then an allocation is not made in respect of the heat supplied but in respect of the product produced.

Technical notes and definitions

7.34 These notes and definitions are in addition to the technical notes and definitions covering all fuels and energy as a whole in Chapter 1, paragraphs 1.28 to 1.64.

Data for 2017

7.35 The data are summarised from the results of a long-term project undertaken by Ricardo Energy & Environment on behalf of the Department of Business, Energy and Industrial Strategy (BEIS). Data are included for CHP schemes installed in all sectors of the UK economy.

7.36 Data for 2017 were based on data supplied to the CHPQA programme, information from the Iron and Steel Statistics Bureau (ISSB), information from Ofgem in respect of "Renewables Obligation Certificates" (ROCs), information from the CHP Sales database maintained by the CHPA and from a survey of anaerobic digestion (AD) sites. Ninety-two per cent of the total capacity is from schemes that have been certified under the CHPQA programme. Sewage Treatment Works and other AD schemes that do not provide returns to CHPQA have been included based on ROCs and FITs information from Ofgem returns. The data from these sources accounts for approximately 6.0 per cent of total electrical capacity. The contribution from this source to the overall CHP statistics is higher than in previous years. The reason for this is explained in paragraph 7.9. The balance of the capacity is for schemes covered by ISSB sources (<1 per cent), CHPA Sales Database (<1 per cent) and for schemes not covered by the above sources which were interpolated from historical data (<1 per cent).

Definitions of schemes

7.37 There are four principal types of CHP system:

- **Steam turbine,** where steam at high pressure is generated in a boiler. In **back pressure steam turbine systems**, the steam is wholly or partly used in a turbine before being exhausted from the turbine at the required pressure for the site. In **pass-out condensing steam turbine systems**, a proportion of the steam used by the turbine is extracted at an intermediate pressure from the turbine with the remainder being fully condensed before it is exhausted at the exit. (Condensing steam turbines without pass out and which do not utilise steam are not included in these statistics as they are not CHP). The boilers used in such schemes can burn a wide variety of fuels including coal, gas, oil, and waste-derived fuels. With the exception of waste-fired schemes, a steam turbine plant has often been in service for several decades. Steam turbine schemes capable of supplying useful steam have electrical efficiencies of between 10 and 20 per cent, depending on size, and thus between 70 per cent and 30 per cent of the fuel input is available as useful heat. Steam turbines used in CHP applications typically range in size from a few MWe to over 100 MWe.

- **Gas turbine systems**, often aero-engine derivatives, where fuel (gas or gas-oil) is combusted in the gas turbine and the exhaust gases are normally used in a waste heat boiler to produce usable steam, though the exhaust gases may be used directly in some process applications. Gas turbines range from 30 kWe upwards, achieving electrical efficiency of 23 to 30 per cent (depending on size) and with the potential to recover up to 50 per cent of the fuel input as useful heat. They have been common in CHP since the mid-1980s. The waste heat boiler can include supplementary or auxiliary firing using a wide range of fuels, and thus the heat to power ratio of the scheme can vary.

- **Combined cycle systems**, where the plant comprises more than one prime mover. These are usually gas turbines where the exhaust gases are utilised in a steam generator, the steam from which is passed wholly or in part into one or more steam turbines. In rare cases reciprocating engines may be linked with steam turbines. Combined cycle is suited to larger installations of 7 MWe and over. They achieve higher electrical efficiency and a lower heat to power ratio than steam turbines or gas turbines. Recently installed combined cycle gas turbine (CCGT) schemes have achieved an electrical efficiency approaching 50 per cent, with 20 per cent heat recovery, and a heat to power ratio of less than 1:1.

- **Reciprocating engine systems** range from less than 100 kWe up to around 5 MWe and are found in applications where production of hot water (rather than steam) is the main requirement, for example, on smaller industrial sites as well as in buildings. They are based on auto engine or

marine engine derivatives converted to run on gas. Both compression ignition and spark ignition firing is used. Reciprocating engines operate at around 28 to 33 per cent electrical efficiency with around 50 per cent to 33 per cent of the fuel input available as useful heat. Reciprocating engines produce two grades of waste heat: high grade heat from the engine exhaust and low-grade heat from the engine cooling circuits.

- **Organic Rankine Cycle systems** operate on the same principle as steam turbines but, instead of using water steam as the working fluid, use organic substances with a lower boiling point and higher vapour pressure than water. This allows heat of a lower temperature to be converted into power via evaporation of the organic working fluid and expansion through a turbine. Low and medium temperature heat sources in the temperature range 80 to 350°C are exploited by ORC systems. The accessibility of low grade heat means that geothermal, industrial waste heat, biomass and solar heat sources can be exploited by ORC systems for the generation of power.

- **Steam screw expander systems** are based upon rotary screw expanders, rather than the turbine blades used in conventional steam turbine systems (see above). This allows power to be generated from wet steam, rather than the superheated dry steam that must be utilised in conventional steam turbines if turbine blade damage is to be avoided. Such systems can, for example, be installed in the place of pressure reduction valves in steam distribution systems, allowing the recovery of energy in the form of mechanical power and the onward supply of steam at the conditions desired downstream.

Determining fuel consumption for heat and electricity

7.38 In order to provide a comprehensive picture of electricity generation in the United Kingdom and the fuels used to generate that electricity, the energy input to CHP schemes has to be allocated between heat and electricity production. This allocation is notional and is not determinate.

7.39 The convention used to allocate the fuels to heat and electricity relates the split of fuels to the relative efficiency of heat and electricity supply. The efficiency of utility plant varies widely: electricity generation from as little as 25 per cent to more than 50 per cent and boilers from 50 per cent to more than 90 per cent. Thus, it is around twice as hard to generate a unit of electricity as it is to generate a unit of heat. Accordingly, a simple convention can be implemented whereby twice as many units of fuel are allocated to each unit of electricity generated, as to each unit of heat supplied. This approach is consistent with the Defra Guidelines for Company Reporting on greenhouse gas emissions and for Negotiated Agreements on energy efficiency agreed between Government and industry as part of the Climate Change Levy (CCL) package. It recognises that, in developing a CHP scheme, both the heat customer(s) and the electricity generator share in the savings.

7.40 The assumption in this convention that it is twice as hard to generate a unit of electricity as heat, is appropriate for the majority of CHP schemes. However, for some types of scheme (for example in the iron and steel sector) this allocation is less appropriate and can result in very high apparent heat efficiencies. These, however, are only notional efficiencies.

The effects on the statistics of using CHPQA

7.41 Paragraph 7.5 described how schemes were scaled back so that only CHP_{QPC} and CHP_{QPO} are included in the CHP statistics presented in this Chapter. This is illustrated in Table 7J where it is seen that 419 schemes were scaled back for year of operation 2017. For information, in 2016, 380 schemes (revised) were scaled back.

7.42 In 2017, the power output from these schemes was scaled back from a total of 33,120 GWh to 12,181 GWh. The total fuel input to these schemes was 111,568 GWh of which 55,328 GWh was regarded as being for power only. For 2016, the total power output was scaled back from 35,822 GWh to 12,189 GWh. The scale back of power was greater in 2016 than in 2017 as a number of large schemes generated more power for export in 2016 than in 2017, without a corresponding increase in the useful consumption of heat. This is consistent with the peak in Load Factor (Actual) in 2016 (60.0 per cent).

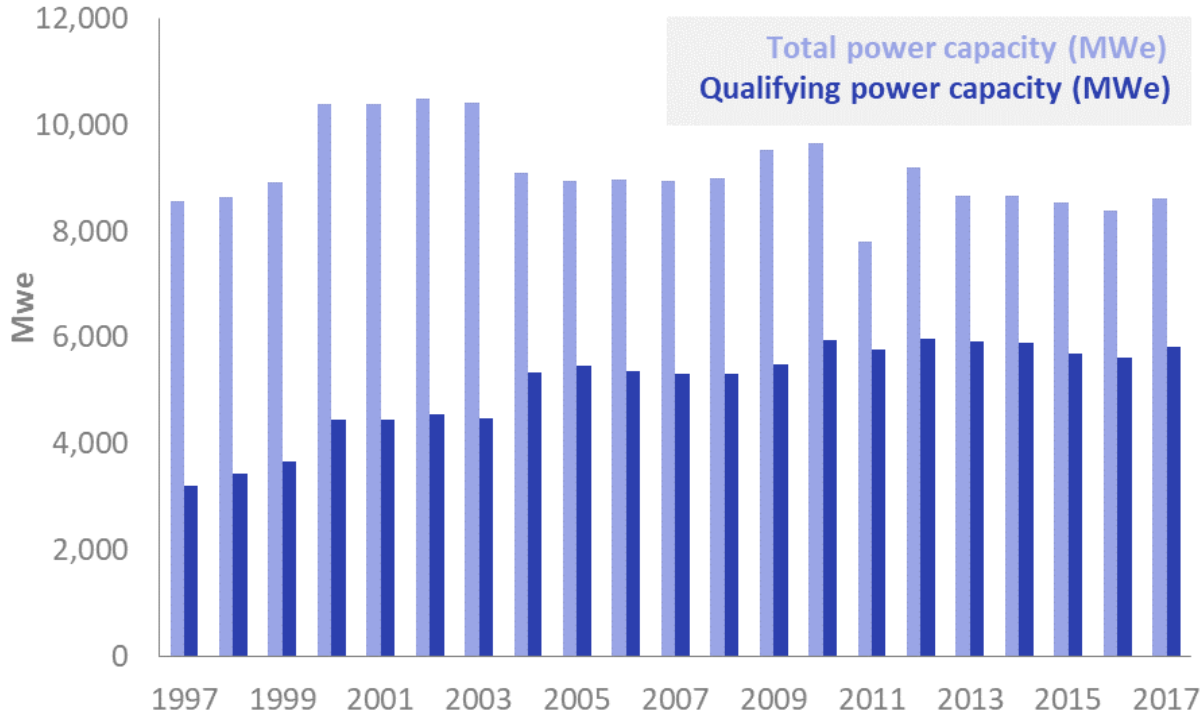
Table 7J: CHP capacity, output and fuel use which has been scaled back in 2017

	Units	
Number of schemes requiring scaling back		419
Total Power Capacity of these schemes (CHP_{TPC})	MWe	6,599
Qualifying Power Capacity of these schemes (CHP_{QPC})	MWe	3,818
Total power output of these schemes (CHP_{TPO})	GWh	33,120
Qualifying Power Output of these schemes (CHP_{QPO})	GWh	12,181
Electricity regarded as "Power only" not from CHP (CHP_{TPO} - CHP_{QPO})	GWh	20,939
Total Fuel Input of these schemes (CHP_{TFI})	GWh	111,568
Fuel input regarded as being for "Power only" use i.e. not for CHP	GWh	55,328

**This figure includes generation from major power producers*

7.43 The evolution of Total Power Capacity (TPC) and Qualifying Power Capacity (QPC) over time is shown in Chart 7.5.

Chart 7.5: Installed CHP capacity by year



Typical Power and Heat Efficiencies and Heat to Power Ratios of Prime Movers

7.44 The figures quoted above in Table 6D are for CHP schemes. These schemes may contain supplementary boilers, supplementary firing and auxiliary firing. The figures are, therefore, not reflective of the power and heat efficiencies and the heat to power ratios of the prime mover when it is considered in isolation.

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7.1 CHP installations by capacity and size range

	2013	2014	2015	2016	2017
Number of Schemes	**2,029**	**2,076**	**2,130r**	**2,224r**	**2,386**
<= 100 kWe	602	608	615r	642r	669
> 100 kWe to 1 MWe	1,083	1,102	1,129r	1,183r	1,239
>1 MWe to 2 MWe	114	132	141r	151	183
> 2 MWe to 10 MWe	165	169	179r	180	228
> 10 MWe +	65	65	66r	68r	67
Total Capacity	**5,924**	**5,892**	**5,708r**	**5,625r**	**5,835**
<= 100 kWe	39	39	40r	41r	43
> 100 kWe to 1 MWe	273	280	296r	309r	337
>1 MWe to 2 MWe	164	190	206r	218r	271
> 2 MWe to 10 MWe	759	781	818r	824r	1,003
> 10 MWe +	4,689	4,601	4,348r	4,232r	4,181

(1) A site may contain more than one CHP scheme; the capacity categories have changed since publication in the 2013 Digest.
(2) MicroCHP schemes installed under FIT are not included in these figures (or any subsequent figures in chapter 7). At the end of 2017 515 such schemes were registered on Ofgems Central FIT Register totalling 0.54MWe

7.2 Fuel used to generate electricity and heat in CHP installations

GWh

	2013	2014	2015	2016	2017
Fuel used to generate electricity *(1)*					
Coal *(2)*	420	386	137	113	102
Fuel oil	145	120	122r	133r	93
Natural gas	31,314	30,615	30,435r	31,496r	31,797
Renewable fuels *(3)*	4,428	5,374	4,829r	6,393r	9,222
Other fuels *(4)*	4,735	4,773	4,180	3,877r	4,078
Total all fuels	**41,042**	**41,268**	**39,704r**	**42,011r**	**45,291**
Fuel used to generate heat					
Coal *(2)*	1,592	863	439	371	379
Fuel oil	205	140	164r	147r	69
Natural gas	32,038	29,781	27,743r	28,960r	30,127
Renewable fuels *(3)*	3,429	3,924	4,187r	4,799r	5,636
Other fuels *(4)*	10,124	10,230	10,339	8,835r	8,777
Total all fuels	**47,388**	**44,939**	**42,872r**	**43,111r**	**44,988**
Overall fuel use					
Coal *(2)*	2,012	1,249	577	484	480
Fuel oil	350	260	287r	279r	161
Natural gas	63,352	60,397	58,178r	60,456r	61,924
Renewable Fuel o/w;	7,856	9,298	9,016r	11,192r	14,858
Bioliquid	*70*	*62*	*60r*	*82r*	*103*
Biomass	*3,363*	*4,042*	*3,179*	*4,233r*	*5,103*
Waste	*1,205*	*1,691*	*2,011*	*3,039r*	*3,027*
Biogas/Syngas	*3,218*	*3,504*	*3,766r*	*3,837r*	*6,625*
Other Fuels (3)	14,859	15,003	14,519	12,712r	12,855
Total all fuels	**88,430**	**86,207**	**82,576r**	**85,123r**	**90,279**

(1) See paragraphs 7.38 to 7.39 and the CHP methodology note on the BEIS website for an explanation of the method used to allocate fuel use between heat generation and electricity generation.
(2) Includes coke.
(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas.

7.3 Fuel used by types of CHP installation

GWh

	2013	2014	2015	2016	2017
Coal					
Back pressure steam turbine	550	572	577	484	480
Gas turbine	-	-	-	-	-
Combined cycle	1,358	674	-	-	-
Reciprocating engine	1	1	-	-	-
Pass out condensing steam turbine	102	2	-	-	-
Organic Rankine Cycle[1]	-	-	-	-	-
	2,012	**1,249**	**577**	**484**	**480**
Fuel Oil					
Back pressure steam turbine	145	100	95	77	17
Gas turbine	5	3	1	3	1
Combined cycle	56	16	25	65	14
Reciprocating engine	123	122	113r	116r	113
Pass out condensing steam turbine	21	20	52	18r	16
Organic Rankine Cycle[1]	-	-	-	-	-
	350	**260**	**287r**	**279r**	**161**
Natural Gas					
Back pressure steam turbine	2,544	2,079	1,466r	1,118r	1,340
Gas turbine	8,683	8,492	8,555	9,145r	9,468
Combined cycle	42,164	39,617	36,956	37,963r	38,671
Reciprocating engine	9,574	9,988	10,897r	11,986r	12,243
Pass out condensing steam turbine	388	221	305r	245r	201
Organic Rankine Cycle[1]	-	-	-	-	-
	63,352	**60,397**	**58,178r**	**60,456r**	**61,924**
Renewable Fuels *(2)*					
Back pressure steam turbine	1,484	1,081	1,037r	852r	1,099
Gas turbine	12	12	12	12	13
Combined cycle	87	60	67	191r	213
Reciprocating engine	3,226	3,492	3,747r	3,846r	6,657
Pass out condensing steam turbine	3,049	4,654	4,153	6,051r	6,469
Organic Rankine Cycle[1]	-	-	….	241r	407
	7,856	**9,298**	**9,016r**	**11,192r**	**14,858**
Other Fuels *(3)*					
Back pressure steam turbine	1,581	1,634	1,737r	1,678r	1,795
Gas turbine	155	153	212	245	152
Combined cycle	10,306	9,915	9,782	9,153r	9,452
Reciprocating engine	47	68	91	96r	47
Pass out condensing steam turbine	2,771	3,234	2,697r	1,540r	1,410
Organic Rankine Cycle[1]	-	-	-	-	0
	14,859	**15,003**	**14,519r**	**12,712r**	**12,855**
Total - all fuels					
Back pressure steam turbine	6,303	5,466	4,913r	4,209r	4,732
Gas turbine	8,854	8,659	8,779	9,405r	9,634
Combined cycle	53,972	50,281	46,830	47,372r	48,350
Reciprocating engine	12,971	13,670	14,848r	16,043r	19,060
Pass out condensing steam turbine	6,331	8,131	7,207r	7,854r	8,096
Organic Rankine Cycle[1]	-	-	….	241r	407
	88,430	**86,207**	**82,576r**	**85,123r**	**90,279**

(1) From 2015, Organic Rankine Cycle CHP schemes are included in the statistics
For 2015, where there is a "…." entered against this category, the data are merged with the back pressure steam turbine technology category, in order to avoid disclosure. In 2017's publication, 2016 was also disclosive but since publication, sufficient data have been received to enable splitting out for that year.

(2) Renewable fuels include: Biomass, sewage gas, other biogases, municipal solid waste and refuse derived fuels
(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas

7.4 CHP - electricity generated by fuel and type of installation

GWh

	2013	2014	2015	2016	2017
Coal					
Back pressure steam turbine	63	67	66	56	49
Gas turbine	-	-	-	-	-
Combined cycle gas turbine	101	113	-	-	-
Reciprocating engine	0	0	-	-	-
Pass-out condensing steam turbine	9	0	-	-	-
Organic Rankine Cycle[1]	-	-	-	-	-
	173	**179**	**66**	**56**	**49**
Fuel oil					
Back pressure steam turbine	17	13	12	10	2
Gas turbine	1	0	0	1	0
Combined cycle gas turbine	12	3	6	14	3
Reciprocating engine	42	42	40r	40r	40
Pass-out condensing steam turbine	1	1	2	1r	0
Organic Rankine Cycle[1]	-	-	-	-	-
	72	**59**	**60r**	**65r**	**46**
Natural gas					
Back pressure steam turbine	168	172	118r	85r	97
Gas turbine	2,034	1,953	1,966	2,034r	2,146
Combined cycle gas turbine	10,467	10,097	10,210	10,357r	10,084
Reciprocating engine	2,628	2,795	3,084r	3,447r	3,549
Pass-out condensing steam turbine	34	27	35r	21r	20
Organic Rankine Cycle[1]	-	-	-	-	-
	15,331	**15,045**	**15,412r**	**15,945r**	**15,895**
Renewable Fuel					
Back pressure steam turbine	213	168	170r	161r	206
Gas turbine	2	2	2	2	3
Combined cycle gas turbine	15	16	18	53r	61
Reciprocating engine	971	1,056	1,132r	1,177r	2,241
Pass-out condensing steam turbine	599	885	608	1,018r	1,138
Organic Rankine Cycle[1]	-	-	....	25r	37
	1,801	**2,128**	**1,930r**	**2,437r**	**3,685**
Other Fuels					
Back pressure steam turbine	82	106	95r	59r	47
Gas turbine	29	21	35	38r	21
Combined cycle gas turbine	1,967	1,935	1,785	1,722r	1,836
Reciprocating engine	11	16	19	25r	13
Pass-out condensing steam turbine	127	206	132r	59r	56
Organic Rankine Cycle[1]	-	-	-	-r	-
	2,215	**2,284**	**2,066**	**1,903r**	**1,973**
Total - All Fuels					
Back pressure steam turbine	543	526	461r	371r	401
Gas turbine	2,066	1,977	2,003	2,075r	2,169
Combined cycle gas turbine	12,561	12,164	12,019	12,146r	11,984
Reciprocating engine	3,652	3,909	4,276r	4,689r	5,842
Pass-out condensing steam turbine	770	1,119	776r	1,099r	1,214
Organic Rankine Cycle[1]	-	-	....	25r	37
Total	**19,592**	**19,695**	**19,534r**	**20,405r**	**21,648**

(1) From 2015, Organic Rankine Cycle CHP schemes are included in the statistics For 2015, where there is a "...." entered against this category, the data are merged with the back pressure steam turbine technology category, in order to avoid disclosure. In 2017's publication,
(2) Renewable fuels include: Biomass, sewage gas, other biogases, municipal solid waste and refuse derived fuels
(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas

7.5 CHP - electrical capacity by fuel and type of installation

MWe

	2013	2014	2015	2016	2017
Coal					
Back pressure steam turbine	20	21	22	22	22
Gas turbine	-	-	-	-	-
Combined cycle gas turbine	197	128	-	-	-
Reciprocating engine	0	0	-	-	-
Pass-out condensing steam turbine	2	0	-	-	-
Organic Rankine Cycle[1]	-	-	-	-	-
	220	**150**	**22**	**22**	**22**
Fuel oil					
Back pressure steam turbine	6	5	4	5	1
Gas turbine	0	0	0	0	0
Combined cycle gas turbine	3	1	1	3	1
Reciprocating engine	7	6	6r	6r	6
Pass-out condensing steam turbine	1	1	2	2r	0
Organic Rankine Cycle[1]	-	-	-	-	-
	17	**13**	**13r**	**16r**	**8**
Natural gas					
Back pressure steam turbine	79	71	50r	42r	48
Gas turbine	422	360	401	401r	412
Combined cycle gas turbine	3,114	3,220	3,005	2,885r	2,806
Reciprocating engine	763	825	857r	933r	987
Pass-out condensing steam turbine	9	9	13r	7r	7
Organic Rankine Cycle[1]	-	-	-	-	-
	4,387	**4,485**	**4,325r**	**4,269r**	**4,260**
Renewable Fuel *(2)*					
Back pressure steam turbine	37	28	28r	28r	30
Gas turbine	1	1	1	1	1
Combined cycle gas turbine	2	3	3	8r	8
Reciprocating engine	230	236	299r	315r	502
Pass-out condensing steam turbine	162	180	226	274r	293
Organic Rankine Cycle[1]	-	-	....	8r	11
	432	**447**	**556r**	**634r**	**845**
Other Fuels *(3)*					
Back pressure steam turbine	67	67	80r	89r	86
Gas turbine	9	4	10	6r	4
Combined cycle gas turbine	700	602	583	540r	565
Reciprocating engine	15	18	19	20r	15
Pass-out condensing steam turbine	77	107	100r	29r	30
Organic Rankine Cycle[1]	-	-	-r	-r	-
	868	**798**	**792**	**685r**	**699**
Total - All Fuels					
Back pressure steam turbine	210	192	184r	185r	187
Gas turbine	431	364	411	409r	416
Combined cycle gas turbine	4,018	3,954	3,592	3,437r	3,380
Reciprocating engine	1,014	1,085	1,181r	1,275r	1,510
Pass-out condensing steam turbine	251	297	340r	312r	330
Organic Rankine Cycle[1]	-	-	....	8r	11
Total	**5,924**	**5,892**	**5,708r**	**5,625r**	**5,835**

(1) From 2015, Organic Rankine Cycle CHP schemes are included in the statistics
For 2015, where there is a "...." entered against this category, the data are merged with the back pressure steam turbine technology category, in order to avoid disclosure. In 2017's publication, 2016 was also disclosive. However, since publication, sufficient data have been received to enable splitting out for that year.
(2) Renewable fuels include: Biomass, sewage gas, other biogases, municipal solid waste and refuse derived fuels
(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas

7.6 CHP - heat generated by fuel and type of installation

GWh

	2013	2014	2015	2016	2017
Coal					
Back pressure steam turbine	434	432	423	366	366
Gas turbine	-	-	-	-	-
Combined cycle gas turbine	776	381	-	-	-
Reciprocating engine	1	0	-	-	-
Pass-out condensing steam turbine	92	1	-	-	-
Organic Rankine Cycle[1]	-	-	-	-	-
	1,302	**813**	**423**	**366**	**366**
Fuel oil					
Back pressure steam turbine	121	78	71	60	13
Gas turbine	3	2	1	2	1
Combined cycle gas turbine	31	8	13	37	8
Reciprocating engine	36	35	32r	34r	32
Pass-out condensing steam turbine	13	13	32	11r	10
Organic Rankine Cycle[1]	-	-	-	-	-
	204	**136**	**149r**	**143r**	**63**
Natural gas					
Back pressure steam turbine	2,082	1,716	1,242r	931r	1,116
Gas turbine	4,506	4,365	4,265	4,634r	4,737
Combined cycle gas turbine	19,961	18,540	17,200	17,791r	18,378
Reciprocating engine	4,443	4,424	4,864r	5,358r	5,467
Pass-out condensing steam turbine	291	121	153r	119r	101
Organic Rankine Cycle[1]	-	-	-	-	-
	31,283	**29,164**	**27,724r**	**28,833r**	**29,800**
Renewable Fuel *(2)*					
Back pressure steam turbine	758	554	408r	300r	349
Gas turbine	2	2	2	2	3
Combined cycle gas turbine	34	30	34	95r	110
Reciprocating engine	873	961	991r	1,013r	1,509
Pass-out condensing steam turbine	1,113	1,423	1,634	1,944r	2,028
Organic Rankine Cycle[1]	-	-	….	120r	223
	2,780	**2,970**	**3,068**	**3,474**	**4,222**
Other Fuels *(3)*					
Back pressure steam turbine	1,458	1,519	1,665r	1,659r	1,724
Gas turbine	83	62	91	115	61
Combined cycle gas turbine	5,564	5,243	5,528	5,110r	5,090
Reciprocating engine	15	20	26	33r	14
Pass-out condensing steam turbine	1,660	2,030	1,560r	938r	900
Organic Rankine Cycle[1]	-	-	-r	-r	-
	8,781	**8,874**	**8,870**	**7,855r**	**7,788**
Total - All Fuels					
Back pressure steam turbine	4,853	4,298	3,809r	3,316r	3,568
Gas turbine	4,595	4,430	4,359	4,753r	4,801
Combined cycle gas turbine	26,366	24,201	22,775	23,033r	23,585
Reciprocating engine	5,369	5,441	5,913r	6,438r	7,022
Pass-out condensing steam turbine	3,168	3,587	3,379r	3,011r	3,038
Organic Rankine Cycle[1]	-	-	….	120r	223
Total	**44,350**	**41,957**	**40,234r**	**40,670r**	**42,238**

(1) From 2015, Organic Rankine Cycle CHP schemes are included in the statistics
For 2015, where there is a "…." entered against this category, the data are merged with the back pressure steam turbine technology category, in order to avoid disclosure. In 2017's publication, 2016 was also disclosive, however, since publication, sufficient data have been received to enable splitting out for that year.
(2) Renewable fuels include: Biomass, sewage gas, other biogases, municipal solid waste and refuse derived fuels
(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas

7.7 CHP - heat capacity by fuel and type of installation

MWth

	2013	2014	2015	2016	2017
Coal					
Back pressure steam turbine	124	134	137	134	141
Gas turbine	-	-	-	-	-
Combined cycle gas turbine	301	169	-	-	-
Reciprocating engine	2	1	-	-	-
Pass-out condensing steam turbine	48	20	-	-	-
Organic Rankine Cycle[1]	-	-	-	-	-
	474	**324**	**137**	**134**	**141**
Fuel oil					
Back pressure steam turbine	42	32	31	34	7
Gas turbine	1	1	1	2	0
Combined cycle gas turbine	14	6	5	12	3
Reciprocating engine	8	7	5r	7r	5
Pass-out condensing steam turbine	5	5	15	9r	7
Organic Rankine Cycle[1]	-	-	-	-	-
	70	**51**	**56r**	**64r**	**22**
Natural gas					
Back pressure steam turbine	829	751	470r	393r	439
Gas turbine	1,781	1,662	1,785	1,807r	1,833
Combined cycle gas turbine	9,750	9,836	8,946	8,680r	8,566
Reciprocating engine	2,758	2,991	3,153r	3,312r	3,495
Pass-out condensing steam turbine	145	241	72r	51r	44
Organic Rankine Cycle[1]	-	-	-	-	-
	15,263	**15,481**	**14,426r**	**14,243r**	**14,377**
Renewable Fuel *(2)*					
Back pressure steam turbine	155	129	128r	111r	118
Gas turbine	4	4	4	4	4
Combined cycle gas turbine	258	12	14	39r	41
Reciprocating engine	303	313	420r	433r	673
Pass-out condensing steam turbine	737	905	1,232	1,644r	1,690
Organic Rankine Cycle[1]	-	-	....	78r	111
	1,456	**1,363**	**1,797r**	**2,310r**	**2,637**
Other Fuels *(3)*					
Back pressure steam turbine	586	593	706r	784r	758
Gas turbine	32	7	20	18r	7
Combined cycle gas turbine	3,578	1,991	1,946	1,818r	1,828
Reciprocating engine	15	18	20	21r	13
Pass-out condensing steam turbine	694	2,401	983r	404r	410
Organic Rankine Cycle[1]	-	-	-	-	-
	4,904	**5,010**	**3,675**	**3,045**	**3,015**
Total - All Fuels					
Back pressure steam turbine	1,735	1,638	1,471r	1,456r	1,462
Gas turbine	1,818	1,674	1,810	1,830r	1,843
Combined cycle gas turbine	13,900	12,014	10,911	10,549	10,438
Reciprocating engine	3,085	3,330	3,597r	3,773r	4,186
Pass-out condensing steam turbine	1,628	3,573	2,303r	2,109r	2,151
Organic Rankine Cycle[1]	-	-	....	78r	111
Total	**22,167**	**22,228**	**20,091r**	**19,795r**	**20,191**

(1) From 2015, Organic Rankine Cycle CHP schemes are included in the statistics
For 2015, where there is a "...." entered against this category, the data are merged with the back pressure steam turbine technology category, in order to avoid disclosure. In 2017's publication, 2016 was also disclosive; however, since publication, sufficient data have been received so that 2016 is no longer disclosive.

(2) Renewable fuels include: Biomass, sewage gas, other biogases, municipal solid waste and refuse derived fuels

(3) Other fuels include: process by-products, coke oven gas, blast furnace gas, gas oil and refinery gas

7.8 CHP capacity, output and total fuel use[(1)] by sector

	Unit	2013	2014	2015	2016	2017
Iron and steel and non ferrous metals						
Number of sites		6	6	6	5	5
Electrical capacity	MWe	81	81	81	40	40
Heat capacity	MWth	674	674	674	435	435
Electrical output	GWh	163	158	118	98r	73
Heat output	GWh	1,701	1,776	1,506	1,024r	949
Fuel use	GWh	2,885	2,743	2,720	1,739r	1,503
of which : for electricity	GWh	435	395	316	255r	188
for heat	GWh	2,450	2,348	2,404	1,484r	1,315
Chemicals						
Number of sites		52	52	52	52	51
Electrical capacity	MWe	1,461	1,437	1,183	1,137	1,102
Heat capacity	MWth	4,828	4,878	4,458	4,363	4,252
Electrical output	GWh	5,212	4,574	4,977	4,792r	4,542
Heat output	GWh	12,282	11,010	10,487	10,396r	10,554
Fuel use	GWh	25,189	22,685	22,110	22,156r	21,970
of which : for electricity	GWh	11,543	10,214	10,458	10,487r	10,034
for heat	GWh	13,646	12,470	11,652	11,668r	11,936
Oil and gas terminals and oil refineries						
Number of sites		11	10	9	9	9
Electrical capacity	MWe	2,380	2,278	2,235	2,226r	2,208
Heat capacity	MWth	7,600	7,255	6,825	6,825	6,825
Electrical output	GWh	6,184	6,391	6,151	6,590r	6,576
Heat output	GWh	14,446	13,615	13,060	13,864r	14,222
Fuel use	GWh	26,634	25,759	24,164	25,346r	26,501
of which : for electricity	GWh	12,218	12,362	11,533	12,006r	12,479
for heat	GWh	14,416	13,397	12,631	13,340r	14,022
Paper, publishing and printing						
Number of sites		22	21	21	20	22
Electrical capacity	MWe	451	477	463	367r	383
Heat capacity	MWth	1,776	1,764	1,771	1,537	1,582
Electrical output	GWh	1,948	2,025	1,639	1,689r	1,751
Heat output	GWh	4,849	4,389	3,844	3,768r	3,863
Fuel use	GWh	9,221	8,831	7,349	7,723r	8,091
of which : for electricity	GWh	4,138	4,295	3,410	3,718r	3,925
for heat	GWh	5,082	4,536	3,939	4,005r	4,165
Food, beverages and tobacco						
Number of sites		54	59	61	63r	67
Electrical capacity	MWe	436	455	469	485r	492
Heat capacity	MWth	1,743	1,787	1,808	1,880r	1,895
Electrical output	GWh	2,117	2,266	2,257	2,149r	2,356
Heat output	GWh	4,277	4,291	4,119	3,896r	4,137
Fuel use	GWh	8,362	8,717	8,563	8,187r	8,900
of which : for electricity	GWh	4,172	4,487	4,471	4,277r	4,758
for heat	GWh	4,190	4,230	4,092	3,909r	4,142
Metal products, machinery and equipment						
Number of sites		19	20	21	21	22
Electrical capacity	MWe	43	43	46	46	48
Heat capacity	MWth	254	254	257	257	259
Electrical output	GWh	119	139	153	164r	166
Heat output	GWh	193	190	192	232r	225
Fuel use	GWh	462	625	654	729r	738
of which : for electricity	GWh	250	301	329	342r	357
for heat	GWh	212	324	325	387r	381

For footnotes see page 213

7.8 CHP capacity, output and total fuel use[1] by sector (continued)

	Unit	2013	2014	2,015	2,016	2017
Mineral products, extraction, mining and agglomeration of solid fuels						
Number of sites		8	8	8	8	8
Electrical capacity	MWe	54	54	52	52	49
Heat capacity	MWth	183	183	165	165	165
Electrical output	GWh	104	109	131	120	125
Heat output	GWh	526	530	550	498	457
Fuel use	GWh	836	881	889	827	793
of which : for electricity	GWh	230	253	289	269	282
for heat	GWh	605	628	600	558	511
Sewage treatment						
Number of sites		197	200	200r	207r	204
Electrical capacity	MWe	164	165	202r	212r	197
Heat capacity	MWth	240	245	343r	353r	329
Electrical output	GWh	657	719	749r	769r	793
Heat output	GWh	740	822	851r	884r	934
Fuel use	GWh	2,391	2,601	2,766r	2,775r	2,901
of which : for electricity	GWh	1,540	1,660	1,753r	1,766r	1,825
for heat	GWh	851	941	1,013r	1,010r	1,077
Other industrial branches *(2)*						
Number of sites		12	12	11r	12r	12
Electrical capacity	MWe	50	50	53r	82r	82
Heat capacity	MWth	274	274	166r	198r	198
Electrical output	GWh	225	243	217r	313r	269
Heat output	GWh	409	422	369r	411r	409
Fuel use	GWh	812	845	748r	912r	902
of which : for electricity	GWh	423	452	409r	556r	529
for heat	GWh	389	393	340r	356r	373
Total industry						
Number of sites		381	388	389r	397r	400
Electrical capacity	MWe	5,119	5,039	4,784r	4,648r	4,602
Heat capacity	MWth	17,571	17,312	16,466r	16,013r	15,940
Electrical output	GWh	16,729	16,625	16,392r	16,686r	16,653
Heat output	GWh	39,423	37,046	34,979r	34,973r	35,749
Fuel use	GWh	76,792	73,685	69,965r	70,394r	72,300
of which : for electricity	GWh	34,950	34,419	32,969r	33,677r	34,377
for heat	GWh	41,842	39,266	36,996r	36,718r	37,922
Transport, commerce and administration						
Number of sites		956	974	1,002r	1,027r	1,048
Electrical capacity	MWe	419	445	499r	506r	529
Heat capacity	MWth	1,729	1,823	1,999r	2,049r	2,148
Electrical output	GWh	1,742	1,867	1,875r	2,212r	2,247
Heat output	GWh	3,134	3,028	3,288r	3,437r	3,534
Fuel use	GWh	6,956	7,377	7,476r	8,749r	8,903
of which : for electricity	GWh	3,567	4,106	3,927r	5,033r	5,084
for heat	GWh	3,389	3,272	3,549r	3,716r	3,819
Other *(3)*						
Number of sites		692	714	739r	800r	938
Electrical capacity	MWe	386	408	426r	471r	705
Heat capacity	MWth	2,866	3,093	1,626r	1,733r	2,103
Electrical output	GWh	1,121	1,203	1,268r	1,506r	2,748
Heat output	GWh	1,793	1,884	1,967r	2,260r	2,955
Fuel use	GWh	4,683	5,144	5,135r	5,980r	9,077
of which : for electricity	GWh	2,525	2,744	2,809r	3,302r	5,830
for heat	GWh	2,158	2,401	2,327r	2,678r	3,247
Total CHP usage by all sectors						
Number of sites		2,029	2,076	2,130r	2,224r	2,386
Electrical capacity	MWe	5,924	5,892	5,708r	5,625r	5,835
Heat capacity	MWth	22,167	22,228	20,091r	19,795r	20,191
Electrical output	GWh	19,592	19,695	19,534r	20,405r	21,648
Heat output	GWh	44,350	41,957	40,234r	40,670r	42,238
Fuel use	GWh	88,430	86,207	82,576r	85,123r	90,279
of which : for electricity	GWh	41,042	41,268	39,704r	42,011r	45,291
for heat	GWh	47,388	44,939	42,872r	43,111r	44,988

(1) The allocation of fuel use between electricity and heat is largely notional and the methodology is outlined in the methodology note

(2) Other industry includes Textiles, clothing and footwear sector.

(3) Sectors included under Other are agriculture, community heating, leisure, landfill and incineration.

7.9 CHP - use of fuels by sector

GWh

	2013	2014	2015	2016	2017
Iron and steel and non ferrous metals					
Coal	-	-	-	-	-
Fuel oil	21	20	51	15r	16
Natural gas	204	169	237	218r	109
Blast furnace gas	2,169	2,114	2,001	1,291r	1,152
Coke oven gas	489	440	431	214r	227
Other fuels *(1)*	2	0	-	-r	0
Total iron and steel and non ferrous metals	**2,885**	**2,743**	**2,720**	**1,739r**	**1,503**
Chemicals					
Coal	1,697	1,033	359	331	306
Fuel oil	10	12	3	4	2
Gas oil	4	6	4	5r	15
Natural gas	20,118	18,169	17,444	17,788r	17,692
Refinery gas	646	653	648	614	630
Renewable fuels *(2)*	90	92	663	891r	910
Other fuels *(1)*	2,623	2,720	2,990	2,522r	2,415
Total chemicals	**25,189**	**22,685**	**22,110**	**22,156r**	**21,970**
Oil and gas terminals and oil refineries					
Fuel oil	48	7	25	65	14
Gas oil	763	906	798	766r	902
Natural gas	18,484	17,847	16,380	17,549r	18,360
Refinery gas	3,872	3,996	4,264	3,722r	3,912
Other fuels *(1)*	3,466	3,003	2,698	3,244	3,312
Total oil and gas terminals and oil refineries	**26,634**	**25,759**	**24,164**	**25,346r**	**26,501**
Paper, publishing and printing					
Coal	102	-	-	-	-
Fuel oil	-	-	-	-	-
Gas oil	7	2	1	0r	2
Natural gas	6,298	5,402	4,917	5,199r	5,238
Renewable fuels *(2)*	2,516	2,786	2,189	2,472r	2,800
Other fuels *(1)*	298	641	241	52r	52
Total paper, publishing and printing	**9,221**	**8,831**	**7,349**	**7,723r**	**8,091**
Food, beverages and tobacco					
Coal	205	214	218	152	174
Fuel oil	148	100	94	80r	17
Gas oil	3	4	3	15	12
Natural gas	7,653	7,885	7,812	7,441r	7,759
Renewable fuels *(2)*	354	515	436	499r	938
Other fuels *(1)*	-	-	-	-	-
Total food, beverages and tobacco	**8,362**	**8,717**	**8,563**	**8,187r**	**8,900**
Metal products, machinery and equipment					
Coal	-	-	-	-	-
Fuel oil	89	89	89	89	89
Gas oil	0.3	0.3	0	0	0.3
Natural gas	332	364	399	440r	442
Renewable fuels *(2)*	41	172	166	199	207
Other fuels *(1)*	-	-	-	-	-
Total metal products, machinery and equipment	**462**	**625**	**654**	**729r**	**738**

For footnotes see page 215

7.9 CHP - use of fuels by sector (continued)

GWh

	2013	2014	2,015	2,016	2017
Mineral products, extraction, mining and agglomeration of solid fuels					
Coal	-	-	-	-	-
Fuel oil	-	-	-	-	-
Gas oil	-	-	-	-	-
Natural gas	606	651	739	677	643
Coke oven gas	230	230	150	150	150
Total mineral products, extraction, mining and agglomeration of solid fuels	**836**	**881**	**889**	**827**	**793**
Sewage treatment			-	-	0
Fuel oil	32	33	24r	24r	24
Gas oil	17	26	37	22r	12
Natural gas	36	50	71	125r	140
Renewable fuels *(2)*	2,305	2,491	2,634r	2,604r	2,726
Total sewage treatment	**2,391**	**2,601**	**2,766r**	**2,775r**	**2,901**
Other industrial branches					
Fuel oil	-	-	-	-	-
Gas oil	0	0	-r	-r	-
Natural gas	803	837	733r	884r	852
Renewable fuels *(2)*	9	7	15r	28r	49
Total other industrial branches	**812**	**845**	**748r**	**912r**	**902**
Transport, commerce and administration					
Coal	-	-			
Fuel oil	-	-	-	0	1
Gas oil	12	34	41r	53r	24
Natural gas	6,287	6,255	6,652r	6,819r	6,939
Refinery gas	-	-	-	-	-
Renewable fuels *(2)*	657	1,088	782r	1,876r	1,940
Other fuels *(1)*	-	0	0	0r	0
Total transport, commerce and administration	**6,956**	**7,377**	**7,476r**	**8,749r**	**8,903**
Other *(3)*					
Coal	7	3	-	-	-
Fuel oil	2	-	0	2r	0.3
Gas oil	14	13	10	14r	10
Natural gas	2,530	2,768	2,794r	3,315r	3,751
Renewable fuels *(2)*	1,886	2,148	2,130r	2,622r	5,288
Other fuels *(1)*	244	213	201	27r	27
Total other	**4,683**	**5,144**	**5,135r**	**5,980r**	**9,077**
Total - all sectors					
Coal	**2,012**	**1,249**	**577**	**484**	**480**
Fuel oil	**350**	**287**	**287r**	**279r**	**161**
Gas oil	**820**	**992**	**895**	**874r**	**977**
Natural gas	**63,352**	**58,178**	**58,178r**	**60,456r**	**61,924**
Blast furnace gas	**2,169**	**2,114**	**2,001**	**1,291r**	**1,152**
Coke oven gas	**719**	**670**	**581**	**364r**	**377**
Refinery gas	**4,519**	**4,650**	**4,911**	**4,337r**	**4,542**
Renewable fuels *(2)*	**7,856**	**9,298**	**9,016r**	**11,192r**	**14,858**
Other fuels *(1)*	**6,633**	**6,577**	**6,130**	**5,845r**	**5,807**
Total CHP fuel use	**88,430**	**86,207**	**82,576r**	**85,123r**	**90,279**

(1) Other fuels include: process by-products.
(2) Renewable fuels include: sewage gas, other biogases, municipal solid waste and refuse derived fuels.
(3) Sectors included under Other are agriculture, community heating, leisure, landfill and incineration.

7.10 Large scale CHP schemes in the United Kingdom
(operational at the end of December 2017)[1]

Company Name	Scheme Location	Installed Capacity (MWe) (2)
Aberdeen Heat & Power	Stockethill CHP2	1
Aberdeen Heat & Power	SEATON ENERGY CENTRE, ABERDEEN HEAT & POWER	2
Aberdeen Heat & Power	Tillydrone CHP	1
Adam Wilson & Sons Ltd	Glennon Brothers Troon Limited	2
ADM Erith Ltd	ERITH OIL WORKS	14
Agrivert Ltd	Wallingford AD	2
Agrivert Ltd	Cassington AD	2
ATKINS POWER	HEDON SALADS - BURSTWICK	7
ATKINS POWER	HEDON SALADS - NEWPORT	4
BALCAS LIMITED	Laragh	3
Balcas Timber Ltd	BALCAS INVERGORDON	9
BARKANTINE HEAT & POWER COMPANY	BARKANTINE, BARKANTINE HEAT & POWER COMPANY	1
BASF Bradford	BASF PLC	16
Boortmalt	Boortmalt - Bury St Edmunds	5
Briar Chemicals Ltd	Briar Chemicals Ltd	4
BRITISH SUGAR PLC	CANTLEY SUGAR FACTORY	15
British Sugar plc	BURY ST EDMUNDS SUGAR FACTORY	77
British Sugar Plc	WISSINGTON SUGAR FACTORY, BRITISH SUGAR PLC (CHP 2)	93
Cantelo Nurseries	BRADON FARM	10
CARGILL PLC	CARGILL MANCHESTER CHP 2	28
CARILLION SERVICES LTD, TA CARILLION HEALTH	QUEEN ALEXANDRA HOSPITAL	3
CEREAL PARTNERS UK	CEREAL PARTNERS UK	5
CEREAL PARTNERS UK	CEREAL PARTNERS UK	5
Chichester Power Ltd	Chichester Power	8
City West Homes Limited	PUMP HOUSE	3
CLEVELAND POTASH LIMITED	BOULBY MINE. CLEVELAND POTASH LIMITED	10
COFELY LTD	Rampton Hospital	1
Cofely Ltd	TRAFFORD PARK, KELLOGG COMPANY OF GREAT BRITAIN	5
Cofely UK Energy Services Ltd (UK) LTD	SULLOM VOE POWER STATION	89
Community Energy	Citigen_2	9
ContourGlobal Solutions (Northern Ireland) Ltd	KNOCKMORE HILL CHP, CONTOURGLOBAL SOLUTIONS (NORTHERN iRELAND)	15
CYCLERVAL UK LTD	NEWLINCS EFW, NEWLINCS DEVELOPMENT LTD	3
Cynergin Projects Limited	VILLA NURSERY LIMITED	1
Cynergin Projects Limited	George Eliot NHS Trust Hospital	1
Dalkia	FREEMAN HOSPITAL	4
Dalkia	ROYAL VICTORIA INFIRMARY	4
DALKIA UTILITIES SERVICES	ELI LILLY & CO LTD	10
DS Smith Paper Limited	KEMSLEY CHP	81
DSM NUTRITIONAL PRODUCTS (UK) LTD	DSM DALRY	46
DWR Cymru Welsh Water	AFAN WWTW, DWR CYMRU WELSH WATER	3
DWR Cymru Welsh Water	FIVE FORD WWTW	1
E.ON	St James University Hospital	5
E.ON UK Cogeneration Ltd	Nufarm UK Limited	5
East Sussex Healthcare NHS TRUST	EASTBOURNE DISTRICT GENERAL HOSPITAL	1
Eco Sustainable Solutions Ltd	Eco Piddlehinton AD	1
ENGIE	ICC ENERGY CENTRE	3
ENGIE	LDEC-City Centre and Leicester East	3
ENGIE	LDEC-LEICESTER NORTH	2
ENGIE	THE HEAT STATION (CHP 2)	7
Engie	DOW CORNING CHP	27
ENGIE	MOD MAIN BUILDING, COFELY LIMITED	5
ENGIE	SOAS CHP, THE BOILER HOUSE	1
ENGIE	ASTON UNIVERSITY ENERGY CENTRE, ASTON UNIVERSITY	3
ENGIE	BIRMINGHAM CHILDRENS HOSPITAL	2
Engie Group Energy Infrastructure	ENGIE HUMBER ENERGY	21
ENGIE Services Holding UK Ltd	Leeds GSC	19
Enviroenergy Ltd	London Road Heat Station	11
EON	QUEENS MEDICAL CENTRE NHS TRUST	5
EON UK	CITIGEN CHP, CITIGEN (LONDON) LIMITED	16
Esso Petroleum Company Limited	Fawley Cogen	316

For footnotes see page 218

7.10 Large scale CHP schemes in the United Kingdom
(operational at the end of December 2017)[1] *(continued)*

Company Name	Scheme Location	Installed Capacity (MWe) *(2)*
FEC Energy	BUCKLAND GARDEN NURSERIES	2
FEC Energy	Vitacress Herbs Ltd	4
Fine Organics Limited	FINE ORGANICS LIMITED	4
Frimley Park Hospital NHS Foundation Trust	Frimley Park Hospital	1
G4 Power Grid Ltd	Brookenby Power Station	2
Genzyme Ltd	GENZYME Ltd	1
GlaxoSmithKline	GLAXOSMITHKLINE (ULVERSTON)	2
GLAXOSMITHKLINE	GLAXOSMITHKLINE MONTROSE	1
GlaxoSmithKline	GLAXOSMITHKLINE, IRVINE	4
GlaxoSmithKline	WARE GMS	2
GlaxoSmithKline Research & Development Ltd	GSK R & D Ware	4
GlaxoSmithKline Research & Development Ltd	Stevenage R&D	4
Great Ormond Street Hospital	Great Ormond Street Hospital	1
GSK	Barnard Castle	2
Guy's and St Thomas' Hospital NHS Foundation Trust	ST THOMAS' HOSPITAL	3
GUY'S AND ST THOMAS' HOSPITAL NHS FOUNDATION TRUST	GUYS HOSPITAL	3
Heathcoat Fabrics Ltd	HEATHCOAT FABRICS LIMITED	1
Helix Agencies Limited	BLACKPOOL VICTORIA HOSPITAL	1
Helix Agencies Limited	SOUTH KENSINGTON CAMPUS CHP PLANT	9
Helix Agencies Limited	NATURAL HISTORY MUSEUM	2
Iggesund Paperboard (Workington) Ltd	Iggesund Paperboard (Workington) Ltd	50
Imerys Minerals Ltd	PAR GRADE DRIER	4
Imerys Minerals Ltd	ROCKS DRIERS	4
INBEV UK LTD	MAGOR BREWERY, INBEV UK LTD	7
Inbev UK Ltd	SAMLESBURY BREWERY, INBEV UK LTD	7
INEOS RUNCORN (TPS) LIMITED	RUNCORN EFW FACILITY	37
Inovyn Chlorvinyls Ltd	Inovyn Chlorvinyls Ltd	10
Inovyn Chlorvinyls Ltd	Gas Engine CHP	2
INTEGRATED ENERGY UTILITIES LTD	CALLENDAR PARK ENERGY CENTRE, FALKIRK COUNCIL	1
Jacobs Douwe Egberts	JDE Banbury	8
JAGUAR LAND ROVER LIMITED	CASTLE BROMWICH, JAGUAR LAND ROVER LTD	6
JAGUAR LANDROVER	LANDROVER GROUP - SOLIHULL NORTH WORKS	3
JAGUAR LANDROVER	LANDROVER - SOLIHULL PAINT SHOP 21	3
JAMES CROPPER PLC	JAMES CROPPER PLC	7
JOHN THOMPSON AND SON LTD	John Thompson	6
Johnson Matthey	JOHNSON MATTHEY ENFIELD	3
Johnson Matthey	JOHNSON MATTHEY - ROYSTON	6
Kronospan Limited	KRONOSPAN LTD (CHIRK CHP B)	13
Lawrence Brown Interiors (VMC) Ltd	BROWNS LANE, LAWRENCE AUTOMOTIVE INTERIORS (VMC) LTD	3
London Borough of Islington	Bunhill Heat and Power	2
LOUGHBOROUGH UNIVERSITY	Central Park	2
Medway NHS Foundation Trust	MEDWAY HOSPITAL, MEDWAY MARITIME HOSPITAL	1
Nestle UK Ltd	NESTLE YORK	10
NHS Grampian	ABERDEEN ROYAL INFIRMARY	5
NORTH TEES & HARTLEPOOL NHS FOUNDATION TRUST	UNIVERSITY HOSPITAL OF NORTH TEES	2
Northumbrian Water	LEVENMOUTH WASTE WATER TREATMENT WORKS	3
Northumbrian Water Ltd	BRAN SANDS (BIOGAS)	5
Northumbrian Water Ltd	Howdon STW	6
Northwood & WEPA Ltd	Bridgend CHP	9
Novartis Grimsby Ltd	NOVARTIS GRIMSBY LIMITED	8
P3P Partners	Woodhouse Nurseries	3
P3P Partners	Harvest Energy Centre	11
P3P Partners	Glasshouse Energy Centre	11
P3P Partners	Spark Steam Energy Centre	7
P3P Partners	Europa Nursery	15
Peel Utilities Holdings Limited	MEDIA CITY, UTILITIES (MEDIA CITY UK) LTD	2
Portals De La Rue Limited	Portals De La Rue Overton Mill	7
Powell Energy	ST. GEORGES HOSPITAL	4
PRESTON BOARD AND PACKAGING LTD	ROMILEY BOARD	1
Queen Elizabeth Hospital King's Lynn NHS Foundation Trust	Queen Elizabeth Hospital	1
Reckitt Benckister	KWE HULL	2
REG BIO POWER LTD	BENTWATERS CHP	6

For footnotes see page 218

7.10 Large scale CHP schemes in the United Kingdom

(operational at the end of December 2017)[1] *(continued)*

Company Name	Scheme Location	Installed Capacity
ROTHERHAM GENERAL HOSPITAL NHS TRUST	ROTHERHAM DISTRICT GENERAL HOSPITAL	1
Royal Devon and Exeter Foundation Trust	ROYAL DEVON AND EXETER HOSPITAL WONFORD	1
RWE NPOWER	BASF CHP	98
RWE npower Cogen Ltd	Markinch CHP	65
RYOBI ALUMINIUM CASTING (UK) LTD	RYOBI	1
SARIA LTD	Re-Food AD Plant Saria Ltd	5
SCOTTISH AND SOUTHERN ENERGY	SLOUGH NURSERIES, G & C PROPERTIES	2
SELLAFIELD LTD	COMBINED HEAT AND POWER PLANT F238	193
Shanks Waste Management Limited	Westcott Biogas Generating Plant	3
SLOUGH HEAT & POWER LTD	SLOUGH POWER STATION	21
Smurfit Kappa SSK	SMURFIT KAPPA SSK LIMITED	9
Solvay Solutions UK Ltd	Oldbury	2
SOUTHERN WATER SERVICES	BUDDS FARM WTW, SOUTHERN WATER	2
SOUTHERN WATER SERVICES	MILLBROOK WTW, SOUTHERN WATER	1
SOUTHERN WATER SERVICES	ASHFORD STC	2
SPRINGFIELDS FUELS LTD	SPRINGFIELDS	12
STAPLES BROTHERS LTD	Sibsey 1	2
Swansea University	Swansea University	2
T & L SUGARS LTD	Thames Refinery	28
Tata Chemicals Europe	Winnington CHP	103
THAMES WATER UTILITIES LTD	Swindon STW CHP 2015	1
THAMES WATER UTILITIES LTD	Mogden STW 2016	6
THAMES WATER UTILITIES LTD	Beddington STW	2
THAMES WATER UTILITIES LTD	Deephams STW 2016	3
THAMES WATER UTILITIES LTD	Rye Meads STW CHP 2015	2
THAMES WATER UTILITIES LTD	Slough STW CHP 2015	1
THAMES WATER UTILITIES LTD	Riverside STW	6
THAMES WATER UTILITIES LTD	Beckton STW Biogas CHP	6
THAMES WATER UTILITIES LTD	Crossness STW Biogas CHP	6
THAMES WATER UTILITIES LTD	MAPLE LODGE STW	4
THAMES WATER UTILITIES LTD	LONG REACH STW	3
THAMES WATER UTILITIES LTD	OXFORD STW	2
THAMES WATER UTILITIES LTD	CRAWLEY STW	1
THAMES WATER UTILITIES LTD	READING (ISLAND ROAD) STW	1
THAMES WATER UTILITIES LTD	CHERTSEY STW	1
Thameswey Central Milton Keynes Ltd	WOKING TOWN CENTRE PHASE I	1
Thameswey Central Milton Keynes Ltd	TCMK PHASE 1 CHP NO 2 GAS ENGINE	6
The Royal Marsden Hospital (NHS Foundation Trust)	Royal Marsden Hospital	2
The University of Birmigham	The University of Birmingham scheme ref 740A	4
The University of Bradford	Richmond Boiler House	2
Transport for London	PALESTRA, TRANSPORT FOR LONDON	1
University College London	UNIVERSITY COLLEGE LONDON, GOWER STREET HEAT AND POWER LTD	3
University of Aberdeen	OLD ABERDEEN CAMPUS	2
UNIVERSITY OF BRISTOL	UNIVERSITY OF BRISTOL CHP 2	1
UNIVERSITY OF DUNDEE	UNIVERSITY OF DUNDEE, MAIN CHP BOILERHOUSE	4
University of East Anglia	University of East Anglia	7
UNIVERSITY OF EDINBURGH UTILITIES SUPPLY COMPANY	KINGS BUILDINGS	3
UNIVERSITY OF EDINBURGH UTILITIES SUPPLY COMPANY	GEORGE SQUARE ENERGY CENTRE	2
University of Reading	Whiteknights Energy Centre	1
University of Southampton	UNIVERSITY OF SOUTHAMPTON	3
University of Surrey	UNIVERSITY OF SURREY	1
University of Sussex	UNIVERSITY OF SUSSEX	1
University of Warwick	Cryfield Energy Centre	4
University of Warwick	CHP BOILERHOUSE (CHP 2), UNIVERSITY OF WARWICK	4
UNIVERSITY OF YORK	University of York	3
Unversity of Edinburgh Utilities Supply Company	Holyrood Energy Centre	1
UPM-Kymmene (UK)	UPM Shotton	25
Veolia BioEnergy UK Limited	CHILTON BIOMASS PLANT, Veolia BioEnergy UK Limited	17
Veolia Environmental Services plc	SHEFFIELD ERF	21
Veolia Plc	LINCOLN COUNTY HOSPITAL	1
Vinnolit Hillhouse LTD	Hillhouse International Business Park	5
VPI Immingham LLP	VPI IMMINGHAM LLP	1,344
Weetabix	Weetabix Limited	6
WESSEX WATER SERVICES LTD	BRISTOL WASTE WATER TREATMENT WORKS SCHEME A	6
Total *(2)*		**3,496**
Electrical capacity of good quality CHP for these sites in total		**3,214**

(1) These are sites of 1 MW installed electrical capacity or more that either have agreed to be listed in the Ofgem register of CHP plants or whose details are publicly available elsewhere, or who have provided the information directly to BEIS. It excludes CHP sites that have been listed as major power producers in Table 5.10.

(2) This is the total power capacity from these sites and includes all the capacity at that site, not just that classed as good quality CHP under CHPQA.

Annexes

Annex A: Energy and commodity balances, conversion factors and calorific values

Annex B: Glossary and acronyms

Annex C: Further sources of UK energy publications

Annex D: Major events in the Energy Industry, 2016-2018

Department for Business, Energy and Industrial Strategy

Annex A

Energy and commodity balances, conversion factors and calorific values

Balance principles

A.1 This Annex outlines the principles behind the balance presentation of energy statistics. It covers these in general terms. Fuel specific details are given in the appropriate chapters of this publication.

A.2 Balances are divided into two types, each of which performs a different function.

a) *commodity balance* – a balance for each energy commodity that uses the units usually associated with that commodity. By using a single column of figures, it shows the flow of the commodity from its sources of supply through to its final use. Commodity balances are presented in the individual fuel chapters of this publication.

b) energy balance - presents the commodity balances in a common unit and places them alongside one another in a manner that shows the dependence of the supply of one commodity on another. This is useful as some commodities are manufactured from others. The layout of the energy balance also differs slightly from the commodity balance. The energy balance format is used in Chapter 1.

A.3 Energy commodities can be either primary or secondary. Primary energy commodities are drawn (extracted or captured) from natural reserves or flows, whereas secondary commodities are produced from primary energy commodities. Crude oil and coal are examples of primary commodities, whilst petrol and coke are secondary commodities manufactured from them. For balance purposes, electricity may be considered to be both primary electricity (for example, hydro, wind) or secondary (produced from steam turbines using steam from the combustion of fuels).

A.4 Both commodity and energy balances show the flow of the commodity from its production, extraction or import through to its final use.

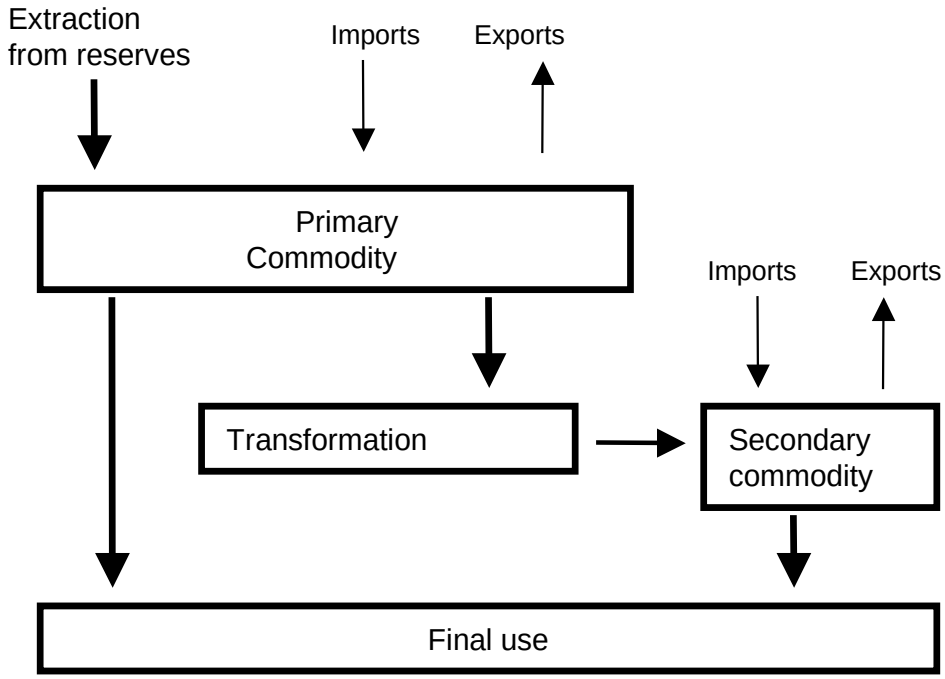
A.5 A simplified model of the commodity flow underlying the balance structure is given in Chart A.1. It illustrates how primary commodities may be used directly and/or be transformed into secondary commodities. The secondary fuels then enter final consumption or may also be transformed into another energy commodity (for example, electricity produced from fuel oil). To keep the diagram simple these “second generation” flows have not been shown.

A.6 The arrows at the top of the chart represent flows to and from the “pools” of primary and secondary commodities, from imports and exports and, in the case of the primary pool, extraction from reserves (eg the production of coal, gas and crude oil).

Commodity balances (Tables 2.1 to 2.3, 3.1 to 3.4, 4.1, 5.1, 5.2 and 6.1 to 6.3)

A.7 A commodity balance comprises a supply section and a demand section. The supply section gives available sources of supply (ie exports are subtracted). The demand section is divided into a transformation section, a section showing uses in the energy industries (other than for transformation) and a section covering uses by final consumers for energy or non-energy purposes. Final consumption for energy purposes is divided into use by sector of economic activity. The section breakdowns are described below.

Chart A.1: Energy flows



Supply

Production

A.8 Production, within the commodity balance, covers indigenous production (extraction or capture of primary commodities) and generation or manufacture of secondary commodities. Production is always gross, that is, it includes the quantities used during the extraction or manufacturing process.

Other sources

A.9 Production from other sources covers sources of supply that do not represent "new" supply. These may be recycled products, recovered fuels (slurry or waste coal), or electricity from pumped storage plants. The production of these quantities will have been reported in an earlier accounting period or have already been reported in the current period of account. Exceptionally, the *Other sources* row in the commodity balances for ethane, propane and butane is used to receive transfers of these hydrocarbons from gas stabilisation plants at North Sea terminals. In this manner, the supplies of primary ethane, propane and butane from the North Sea are combined with the production of these gases in refineries, so that the disposals may be presented together in the balances.

Imports and exports

A.10 The figures for imports and exports relate to energy commodities moving into or out of the United Kingdom as part of transactions involving United Kingdom companies. Exported commodities are produced in the United Kingdom and imported commodities are for use within the United Kingdom (although some may be re-exported before or after transformation). The figures thus exclude commodities either exported from or imported into HM Revenue and Customs bonded areas or warehouses. These areas, although part of the United Kingdom, are regarded as being outside of the normal United Kingdom's customs boundary, and so goods entering into or leaving them are not counted as part of the statistics on trade used in the balances.

A.11 Similarly, commodities that only pass through the United Kingdom on their way to a final destination in another country are also excluded. However, for gas these transit flows are included because it is difficult to identify this quantity separately, without detailed knowledge of the contract information covering the trade. This means that for gas, there is some over statement of the level of imports and exports, but the net flows are correct.

A.12 The convention in these balances is that exports are shown with a negative sign.

Marine bunkers

A.13 These are deliveries of fuels (usually fuel oil or gas oil) to ships of any flag (including the United Kingdom) for consumption during their voyage to other countries. Marine bunkers are treated rather like exports and shown with a negative sign.

Stock changes

A.14 Additions to (- sign) and withdrawals from stocks (+ sign) held by producers and transformation industries correspond to withdrawals from and additions to supply, respectively.

Transfers

A.15 There are several reasons why quantities may be transferred from one commodity balance to another:

- a commodity may no longer meet the original specification and be reclassified;
- the name of the commodity may change through a change in use;
- to show quantities returned to supply from consumers. These may be by-products of the use of commodities as raw materials rather than fuels.

A.16 A quantity transferred from a balance is shown with a negative sign to represent a withdrawal from supply and with a positive sign in the receiving commodity balance representing an addition to its supply. The transfers' row in Tables 1.1 to 1.3 should ideally sum to zero with transfers from primary oils to petroleum products amounting to a net figure of zero. Similarly the manufactured gases and natural gas transfers should sum to zero. However differences in calorific values between the transferred fuels can result in non-zero values.

Total supply

A.17 The total supply available for national use is obtained by summing the flows above this entry in the balance.

Total demand

A.18 The various figures for the disposals and/or consumption of the commodities are summed to provide a measure of the demand for them. The main categories or sectors of demand are described in paragraphs A.31 to A.42.

Statistical difference

A.19 Any excess of supply over demand is shown as a statistical difference. A negative figure indicates that demand exceeds supply. Statistical differences arise when figures are gathered from a variety of independent sources and reflect differences in timing, in definition of coverage of the activity, or in commodity definition. Differences also arise for methodological reasons in the measurement of the flow of the commodity e.g. if there are differences between the volumes recorded by the gas producing companies and the gas transporting companies. A non-zero statistical difference is normal and, provided that it is not too large, is preferable to a statistical difference of zero as this suggests that a data provider has adjusted a figure to balance the account.

Transformation

A.20 The transformation section of the balance covers those processes and activities that transform the original primary (and sometimes secondary) commodity into a form which is better suited for specific uses than the original form. Most of the transformation activities correspond to particular energy industries whose main business is to manufacture the product associated with them. Certain activities involving transformation take place to make products that are only partly used for energy needs (coke oven coke) or are by-products of other manufacturing processes (coke oven and blast furnace gases). However, as these products and by-products are then used, at least in part, for their energy content they are included in the balance system.

A.21 The figures given under the activity headings of this section represent the quantities used for transformation. The production of the secondary commodities will be shown in the Production row of the corresponding commodity balances. The transformation section of the energy balance shows, for each fuel, the net inputs for transformation uses. For example, Table 1.1 for 2017 shows that 1,435

thousand tonnes of oil equivalent of coal feeds into the production of 1,351 thousand tonnes of oil equivalent of coke, representing a loss of 84 thousand tonnes of oil equivalent in the manufacture of coke in 2017. In 2017, energy losses during the production of electricity and other secondary fuels amounted to 35.8 million tonnes of oil equivalent, (18 per cent of primary supply) shown in the transformation row in Table 1.1.

Electricity generation

A.22 The quantities of fuels burned for the generation of electricity are shown in their commodity balances under this heading. The activity is divided into two parts, covering the major power producers (for whom the main business is the generation of electricity for sale) and autogenerators (whose main business is not electricity generation but who produce electricity for their own needs and may also sell surplus quantities). The amounts of fuels shown in the balance represent the quantities consumed for the gross generation of electricity. Where a generator uses combined heat and power plant, the figures include only the part of the fuel use corresponding to the electricity generated.

A.23 In relation to autogenerators' data, the figures for quantities of fuel used for electricity generation appear under the appropriate fuel headings in the *Transformation* section heading for *Autogenerators,* whilst the electricity generated appears in the *Electricity* column under *Production*. A breakdown of the information according to the branch of industry in which the generation occurs is not shown in the balance but is given in Chapter 5, Table 5.4. The figures for energy commodities consumed by the industry branches shown under final consumption include all use of electricity, but exclude the fuels combusted by the industry branches to generate the electricity.

Heat generation

A.24 The quantities of fuel burned to generate heat that is sold under the provision of a contract to a third party are shown in their commodity balances under this heading. It includes heat that is generated and sold by combined heat and power plants and by community heating schemes (also called district heating).

Petroleum refineries

A.25 Crude oil, natural gas liquids and other oils needed by refineries for the manufacture of finished petroleum products are shown under this heading.

Coke manufacture and blast furnaces

A.26 Quantities of coal for coke ovens and all fuels used within blast furnaces are shown under this heading. The consumption of fuels for heating coke ovens and the blast air for blast furnaces are shown under *Energy industry use*.

Patent fuel manufacture

A.27 The coals and other solid fuels used for the manufacture of solid patent fuels are reported under this heading.

Other

A.28 Any minor transformation activities not specified elsewhere are captured under this heading.

Energy industry use

A.29 Consumption by both extraction and transformation industries to support the transformation process (but not for transformation itself) are included here according to the energy industry concerned. Typical examples are the consumption of electricity in power plants (e.g. for lighting, compressors and cooling systems) and the use of extracted gases on oil and gas platforms for compressors, pumps and other uses. The headings in this section are identical to those used in the transformation section with the exception of *Pumped storage*. In this case, the electricity used to pump the water to the reservoir is reported. This section also includes consumption by those parts of the iron and steel industry which behave like an energy industry i.e. they are involved in the transformation processes (see paragraph A.20 of Annex A). In 2017, energy industry use amounted to 12.0 million tonnes of oil equivalent of energy (6.0 per cent of primary demand), down 0.1 per cent on 2016, reflecting the reduced energy needed as coal production fell. This series broadly follows the trend in UK energy production, so has generally been falling since 2000.

Losses

A.30 This heading covers the intrinsic losses that occur during the transmission and distribution of electricity and gas (including manufactured gases). Other metering and accounting differences for gas and electricity are within the statistical difference, as are undeclared losses in other commodities.

Final consumption

A.31 *Final consumption* covers both final energy consumption (by different consuming sectors) and the use of energy commodities for non-energy purposes, that is *Non energy use*. Final consumption occurs when the commodities used are not for transformation into secondary commodities. The energy concerned disappears from the account after use. Any fuel used for electricity generation by final consumers is identified and reported separately within the transformation section. When an enterprise generates electricity, the figure for final consumption of the industrial sector to which the enterprise belongs includes its use of the electricity it generates itself (as well as supplies of electricity it purchases from others) but does not include the fuel used to generate that electricity.

A.32 The classification of consumers according to their main business follows, as far as practicable, the *Standard Industrial Classification (SIC2007).* The qualifications to, and constraints on, the classification are described in the technical notes to Chapter 1. Table 1G in Chapter 1 shows the breakdown of final consumers used, and how this corresponds to the SIC2007.

Industry

A.33 Two sectors of industry (iron and steel and chemicals) require special mention because the activities they undertake fall across the transformation, final consumption and non-energy classifications used for the balances. Also, the data permitting an accurate allocation of fuel use within each of these major divisions are not readily available.

Iron and steel

A.34 The iron and steel industry is a heavy energy user for transformation and final consumption activities. Figures shown under final consumption for this industry branch reflect the amounts that remain after quantities used for transformation and energy sector own use have been subtracted from the industry's total energy requirements. Use of fuels for transformation by the industry may be identified within the transformation section of the commodity balances.

A.35 The amounts of coal used for coke manufacture by the iron and steel industry are in the transformation section of the coal balance. Included in this figure is the amount of coal used for coke manufacture by the companies outside of the iron and steel industry, i.e. solid fuel manufacturers. The corresponding production of coke and coke oven gas may be found in the commodity balances for these products. The use of coke in blast furnaces is shown in the commodity balance for coke, and the gases produced from blast furnaces and the associated basic oxygen steel furnaces are shown in the production row of the commodity balance for blast furnace gas.

A.36 Fuels used for electricity generation by the industry are included in the figures for electricity generation by autogenerators and are not distinguishable as being used by the iron and steel sector in the balances. Electricity generation and fuel used for this by broad industry group are given in Table 5.4.

A.37 Fuels used to support coke manufacture and blast furnace gas production are included in the quantities shown under *Energy industry use.* These gases and other fuels do not enter coke ovens or blast furnaces, but are used to heat the ovens and the blast air supplied to furnaces.

Chemicals

A.38 The petro-chemical industry uses hydrocarbon fuels (mostly oil products and gases) as feedstock for the manufacture of its products. Distinguishing the energy use of delivered fuels from their non-energy use is complicated by the absence of detailed information. The procedures adopted to estimate the use are described in paragraphs A.41 and A.42 under *Non energy use*.

Transport

A.39 Figures under this heading are almost entirely quantities used strictly for transport purposes. However, the figures recorded against road transport may include some fuel that is actually consumed

in some “off-road” activities. Similarly, figures for railway fuels may include some amounts of burning oil not used directly for transport purposes. Transport sector use of electricity includes electricity used by rail companies (both over and underground) for traction purposes, and electricity used by electric road vehicles. The electricity used for non-traction purposes in industries classified to SIC2007 Groups 49 to 51 is included within the commercial sector. Fuels supplied to cargo and passenger ships undertaking international voyages are reported as *Marine bunkers* (see paragraph A.13). Supplies to fishing vessels are included under “agriculture”.

Other sectors

A.40 The classification of all consumers groups under this heading, except *domestic and transport*, follows *SIC2007* and is described in Table 1G in Chapter 1. The consistency of the classification across different commodities cannot be guaranteed because the figures reported are dependent on what the data suppliers can provide.

Non energy use

A.41 The non energy use of fuels may be divided into two types. They may be used directly for their physical properties e.g. lubricants or bitumen used for road surfaces, or by the petro-chemical industry as raw materials for the manufacture of goods such as plastics. In their use by the petro-chemical industry, relatively little combustion of the fuels takes place and the carbon and/or hydrogen they contain are largely transferred into the finished product. However, in some cases heat from the manufacturing process or from combustion of by-products may be used. Data for this energy use are rarely available. Depending on the feedstock, non energy consumption is either estimated or taken to be the deliveries to the chemicals sector.

A.42 Both types of non energy use are shown under the *Non energy use* heading at the foot of the balances.

The energy balance (Tables 1.1 to 1.3)

Principles

A.43 The energy balance conveniently presents:

- an overall view of the United Kingdom’s energy supplies;
- the relative importance of each energy commodity;
- dependence on imports;
- the contribution of our own fossil and renewable resources;
- the interdependence of commodities on one another.

A.44 The energy balance is constructed directly from the commodity balances by expressing the data in a common unit, placing them beside one another and adding appropriate totals. Heat sold is also included as a fuel. However, some rearrangements of the commodity balance format is required to show transformation of primary into secondary commodities in an easily understood manner.

A.45 Energy units are widely used as the common unit, and the current practice for the United Kingdom and the international organisations which prepare balances is to use the tonne of oil equivalent or a larger multiple of this unit, commonly thousands. One tonne of oil equivalent is defined as 10^7 kilocalories (41.868 gigajoules). The tonne of oil equivalent is another unit of energy like the gigajoule, kilocalorie or kilowatt hour, rather than a physical quantity. It has been chosen as it is easier to visualise than the other units. Due to the natural variations in heating value of primary fuels such as crude oil, it is rare that one tonne of oil has an energy content equivalent to one tonne of oil equivalent, however it is generally within a few per cent of the heating value of a tonne of oil equivalent. The energy figures are calculated from the natural units of the commodity balances by multiplying by the factors representing the calorific (heating) value of the fuel. The gross calorific values of fuels are used for this purpose. When the natural unit of the commodity is already an energy unit (electricity in kilowatt hours, for example) the factors are just constants, converting one energy unit to another.

A.46 Most of the underlying definitions and ideas of commodity balances can be taken directly over into the energy balance. However, production of secondary commodities and, in particular, electricity

are treated differently and need some explanation. The components of the energy balance are described below, drawing out the differences of treatment compared with the commodity balances.

Primary supply

A.47 Within the energy balance, the production row covers only extraction of primary fuels and the generation of primary energy (hydro, nuclear, wind, solar photovoltaics). Note the change of row heading from *Production* in the commodity balances to *Indigenous production* in the energy balance. Production of secondary fuels and secondary electricity are shown in the transformation section and not in the indigenous production row at the top of the balance.

A.48 For fossil fuels, indigenous production represents the marketable quantity extracted from the reserves. Indigenous production of *Primary electricity* comprises hydro-electricity, wind, photovoltaics and nuclear energy. The energy value for hydro-electricity is taken to be the energy content of the electricity produced from the hydro power plant and not the energy available in the water driving the turbines. A similar approach is adopted for electricity from wind generators and photovoltaics. The electricity is regarded as the primary energy form because there are currently no other uses of the energy resource "upstream" of the generation. The energy value attached to nuclear electricity is discussed in paragraph A.52.

A.49 The other elements of the supply part of the balance are identical to those in the commodity balances. In particular, the sign convention is identical, so that figures for exports and international marine bunkers carry negative signs. A stock build carries a negative sign to denote it as a withdrawal from supply whilst a stock draw carries a positive sign to show it as an addition to supply.

A.50 The *Primary supply* is the sum of the figures above it in the table, taking account of the signs, and expresses the national requirement for primary energy commodities from all sources and foreign supplies of secondary commodities. It is an indicator of the use of indigenous resources and external energy supplies. Both the amount and mixture of fuels in final consumption of energy commodities in the United Kingdom will differ from the primary supply. The "mix" of commodities in final consumption will be much more dependent on the manufacture of secondary commodities, in particular electricity.

Transformation

A.51 Within an energy balance the presentation of the inputs to and outputs from transformation activities requires special mention, as it is carried out using a compact format. The transformation section also plays a key role in moving primary electricity from its own column in the balance into the electricity column, so that it can be combined with electricity from fossil fuelled power stations and the total disposals shown.

A.52 Indigenous production of primary electricity comprises nuclear electricity, hydro electricity, electricity from wind generation and from solar photovoltaics. Nuclear electricity is obtained by passing steam from nuclear reactors through conventional steam turbine sets. The heat in the steam is considered to be the primary energy available and its value is calculated from the electricity generated using the average thermal efficiency of nuclear stations, currently 40.0 per cent (in 2017) in the United Kingdom. The electrical energy from hydro and wind is transferred from the *Primary electricity* column to the *Electricity* column using the *transfers* row because this electricity is in the form of primary energy and no transformation takes place. However, because the form of the nuclear energy is the steam from the nuclear reactors, the energy it contains is shown entering electricity generation and the corresponding electricity produced is included with all electricity generation in the figure, in the same row, under the *Electricity* column.

A.53 Quantities of fuels entering transformation activities (fuels into electricity generation and heat generation, crude oil into petroleum product manufacture (refineries), or coal into coke ovens) are shown with a negative sign to represent the input and the resulting production is shown as a positive number.

A.54 For electricity generated by Major power producers, the inputs are shown in the *Major power producers'* row of the *coal, manufactured fuel, primary oils, petroleum products, gas, bioenergy and waste* and *primary electricity* columns. The total energy input to electricity generation is the sum of the values in these first seven columns. The *Electricity* column shows total electricity generated from these inputs and the transformation loss is the sum of these two figures, given in the *Total* column.

A.55 Within the transformation section, the negative figures in the *Total* column represent the losses in the various transformation activities. This is a convenient consequence of the sign convention chosen for the inputs and outputs from transformation. Any positive figures represent a transformation gain and, as such, are an indication of incorrect data.

A.56 In the energy balance, the columns containing the input commodities for electricity generation, heat generation and oil refining are separate from the columns for the outputs. However, for the transformation activities involving solid fuels this is only partly the case. Coal used for the manufacture of coke is shown in the coke manufacture row of the transformation section in the coal column, but the related coke and coke oven gas production are shown combined in the *Manufactured fuels* column. Similarly, the input of coke to blast furnaces and the resulting production of blast furnace gas are not identifiable and have been combined in the *Manufactured fuels* column in the *Blast furnace* row. As a result, only the net loss from blast furnace transformation activity appears in the column.

A.57 The share of each commodity or commodity group in primary supply can be calculated from the table. This table also shows the demand for primary as well as foreign supplies. Shares of primary supplies may be taken from the *Primary supply* row of the balance. Shares of fuels in final consumption may be calculated from the final consumption row.

Energy industry use and final consumption

A.58 The figures for final consumption and energy industry use follow, in general, the principles and definitions described under commodity balances in paragraphs A.29 to A.42.

Standard conversion factors

1 tonne of oil equivalent (toe)	= 10^7 kilocalories
	= 396.83 therms
	= 41.868 GJ
	= 11,630 kWh
100,000 British thermal units (Btu)	= 1 therm

This Digest follows UK statistical practice and uses the term "billion" to refer to one thousand million or 10^9

The following prefixes are used for multiples of joules, watts and watt hours:

kilo (k)	= 1,000	or 10^3
mega (M)	= 1,000,000	or 10^6
giga (G)	= 1,000,000,000	or 10^9
tera (T)	= 1,000,000,000,000	or 10^{12}
peta (P)	= 1,000,000,000,000,000	or 10^{15}

WEIGHT

1 kilogramme (kg)	= 2.2046 pounds (lb)
1 pound (lb)	= 0.4536 kg
1 tonne (t)	= 1,000kg
	= 0.9842 long ton
	= 1.102 short ton (sh tn)
1 Statute or long ton	= 2,240 lb
	= 1.016 t
	= 1.120 sh tn

VOLUME

1 cubic metre (cu m)	= 35.31 cu ft
1 cubic foot (cu ft)	= 0.02832 cu m
1 litre	= 0.22 Imperial gallons (UK gal)
1 UK gallon	= 8 UK pints
	= 1.201 US gallons (US gal)
	= 4.54609 litres
1 barrel	= 159.0 litres
	= 34.97 UK gal
	= 42 US gal

LENGTH

1 mile	= 1.6093 kilometres
1 kilometre (km)	= 0.62137 miles

TEMPERATURE

1 scale degree Celsius (C)	= 1.8 scale degrees Fahrenheit (F)

For conversion of temperatures: $^oC = 5/9 (^oF - 32)$; $^oF = 9/5\ ^oC + 32$

Average conversion factors for petroleum 2017

	Litres per tonne
Crude oil:	
Indigenous	1,199
Imported	1,181
Average of refining throughput	1,192
Ethane	2,730
Propane	1,939
Butane	1,736
Naphtha	1,483
Aviation gasoline	1,405
Motor spirit:	
All grades	1,362
Super[1]	1,359
Premium[1]	1,370
Middle distillate feedstock	..
Kerosene:	
Aviation turbine fuel	1,251
Burning oil	1,246

	Litres per tonne
DERV fuel:	
0.005% or less sulphur	1,193
Gas /Marine diesel oil	1,171
Fuel oil (1% or less sulphur)	
All grades:	1,012
Light:	..
Medium	..
Heavy:	..
Lubricating oils:	
White	1,154
Greases	..
Bitumen	980
Petroleum coke	..
Petroleum waxes	1,184
Industrial spirit	1,247
White spirit	1,251

Note: The above conversion factors, which for refined products have been compiled by BEIS using data from UK Petroleum Industry Association companies, apply to the year 2017. The litres to tonnes conversions are made at a standard temperature of 15°C.

[1] Based on 2016 deliveries due to incomplete 2017 delivery data

.. Denotes commercially sensitive because too few companies are producing this to be able to report it.

Fuel conversion factors for converting fossil fuels to carbon dioxide

	kg CO_2 per tonne	kg CO_2 per kWh	kg CO_2 per litre
Gases			
Natural Gas		0.184	
LPG		0.214	1.517
Liquid fuels			
Gas oil	3190	0.254	2.724
Fuel oil	3217	0.267	
Burning oil	3150	0.245	2.524
Naptha	3131	0.236	
Petrol	3135	0.239	2.292
Diesel	3164	0.244	2.650
Aviation spirit	3128	0.238	2.225
Aviation turbine fuel	3150	0.245	2.514
Solid fuels			
Industrial coal	2428	0.322	
Domestic coal	2631	0.315	
Coking coal	3044	0.344	

All emission factors are based on a Gross Calorific Value basis

The information above is based on the 2018 Greenhouse gas conversion factors for company reporting, available at: www.gov.uk/government/collections/government-conversion-factors-for-company-reporting. The information on this website also provide emission factors on a Net Calorific Basis.

The figures are derived by Ricardo E&E based on data contained in the 2017 edition of this Digest, available at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes together with information from the National Atmospheric Emissions Inventory. More information on the Inventory is available at: http://naei.beis.gov.uk/reports/. For liquid fuels, the "kg CO_2 per tonne" figure remains fairly constant on a year to year basis, so it is possible to derive "kg CO_2 per kWh" and "kg CO_2 per litre" figures for other years using the average conversion factors for petroleum data contained annually in Annex A of the Digest.

A.1 Estimated average calorific values of fuels 2017

	GJ per tonne net	GJ per tonne gross
Coal:		
All consumers (weighted average) *(1)*	25.9	27.3
Power stations *(2)*	25.3	26.7
Coke ovens *(1)*	30.2	31.8
Low temperature carbonisation plants and manufactured fuel plants	26.9	28.4
Collieries	27.4	28.9
Agriculture	28.1	29.5
Iron and steel	28.9	30.4
Other industries (weighted average)	25.4	26.7
Non-ferrous metals	23.7	25.0
Food, beverages and tobacco	27.9	29.3
Chemicals	25.2	26.5
Textiles, clothing, leather etc.	28.0	29.4
Pulp, paper, printing etc.	23.0	24.2
Mineral products	26.2	27.6
Engineering (mechanical and electrical engineering and vehicles)	27.9	29.4
Other industries	30.9	32.5
Domestic		
House coal	27.2	28.7
Anthracite and dry steam coal	32.4	34.1
Other consumers	25.1	26.4
Imported coal (weighted average)	26.2	27.6
Exports (weighted average)	30.6	32.2
Coke (including low temperature carbonisation cokes)	29.8	29.8
Coke breeze	29.8	29.8
Other manufactured solid fuels	31.1	32.7

	GJ per tonne net	GJ per tonne gross	Moisture content
Renewable sources:			
Domestic wood *(3)*	14.7	16.3	20%
Industrial wood *(4)*	19.0	20.3	0%
Straw	13.1	15.4	15%
Poultry litter (5)	7.9	9.9	20%
Meat and bone	16.2	18.3	11%
General industrial waste	15.2	16.0	5%
Hospital waste	13.3	14.0	5%
Municipal solid waste *(6)*	6.5	9.3	30%
Refuse derived waste *(6)*	13.0	18.5	30%
Short rotation coppice *(7)*	12.6	14.2	30%
Tyres	30.4	32.0	5%
Wood pellets	16.9	18.3	10%
Biodiesel	37.2	38.7	4%
Bioethanol	26.8	29.7	10%
Petroleum:			
Crude oil (weighted average)	43.4	45.7	
Petroleum products (weighted average)	43.9	46.2	
Ethane	46.6	50.7	
Butane and propane (LPG)	45.9	49.3	
Light distillate feedstock for gasworks	45.4	47.8	
Aviation spirit and wide cut gasoline	45.0	47.4	
Aviation turbine fuel	43.9	46.2	
Motor spirit	44.7	47.1	
Burning oil	43.9	46.2	
Gas/diesel oil	42.6	45.3	
DERV	42.9	45.7	
Fuel oil	40.7	43.3	
Power station oil	40.7	43.3	
Non-fuel products (notional value)	40.8	43.0	

	MJ per cubic metre net	MJ per cubic metre gross
Natural gas produced *(8)*	35.8	39.8
Natural gas consumed *(9)*	35.6	39.5
Coke oven gas	16.2	18.0
Blast furnace gas	3.0	3.0
Landfill gas *(10)*	19-23	21-25
Sewage gas *(10)*	19-23	21-25
Anaerobic Digestion - farm/food food *(7)*	19-24	21-26

(1) Applicable to UK consumption - based on calorific value for home produced coal plus imports and, for "All consumers" net of exports.

(2) Home produced plus imports

(3) On an "as received" basis; seasoned logs at 20% moisture content. On a "dry" basis 20.3 GJ per tonne.

(4) Data reported on an oven dry basis of 20.3 GJ per tonne.

(5) The calorific value of poultry litter typically ranges on a net basis from 5 GJ/tonne to 10 GJ/tonne depending upon the moisture content of the fuel. For poultry manure, much lower calorific values should be used.

(6) Average figure based on survey returns.

(7) On an "as received" basis; at 30% moisture content. On a "dry" basis 18.6 GJ per tonne.

(8) The gross calorific value of natural gas can also be expressed as 11.126 kWh per cubic metre. This value represents the average calorific value seen for gas when extracted. At this point it contains not just methane, but also some other hydrocarbon gases (ethane, butane, propane). These gases are removed before the gas enters the National Transmission System for sale to final consumers.

(9) UK produced and imported gas. This weighted average of calorific values will approximate the average for the year of gas entering the National Transmission System. It can also be expressed as 11.007 kWh per cubic metre.

(10) Calorific value varies depending on the methane content of the gas.

Note: The above estimated average calorific values apply only to the year 2017. For calorific values of fuels in earlier years see Tables A.2 and A.3 and previous issues of this Digest. See the notes in Chapter 1, paragraph 1.55 regarding net calorific values. The difference between the net and gross thermal content is the amount of energy necessary to evaporate the water present in the fuel or formed during the combustion process.

The calorific values for coal other than imported coal are based on estimates provided by the main coal producers, but with some exceptions as noted on Table A.2. The calorific values for petroleum products have been calculated using the method described in Chapter 1, paragraph 1.31. Data reported in this Digest in 'thousand tonnes of oil equivalent' have been prepared on the basis of 1 tonne of oil equivalent having an energy content of 41.868 gigajoules (GJ), (1 GJ = 9.478 therms) - see notes in Chapter 1, paragraph 1.28.

A.2 Estimated average gross calorific values of fuels 1980, 1990, 2000, 2010 and 2015 to 2017

GJ per tonne (gross)

	1980	1990	2000	2010	2015	2016	2017
Coal							
All consumers *(1)(2)*	25.6	25.5	26.2	25.8	26.0	26.0	25.9
All consumers - home produced plus imports minus exports *(1)*	..	..	27.0	27.1	27.0	27.2	27.3
Power stations *(2)*	23.8	24.8	25.6	24.9	25.1	25.2	25.4
Power stations - home produced plus imports *(1)*	..	..	26.0	25.8	26.2	26.2	26.7
Coke ovens *(2)*	30.5	30.2	31.2	30.5	31.8	31.8	31.8
Coke ovens - home produced plus imports *(1)*	..	..	30.4	30.5	31.8	31.8	31.8
Low temperature carbonisation plants and manufactured fuel plants	19.1	29.2	30.3	30.2	28.5	28.4	28.4
Collieries	27.0	28.6	29.6	29.3	29.0	29.0	28.9
Agriculture	30.1	28.9	29.2	28.0	29.5	29.5	29.5
Iron and steel industry *(3)*	29.1	28.9	30.7	30.4	30.4	30.4	30.4
Other industries *(1)*	27.1	27.8	26.7	27.7	26.8	26.7	26.7
Non-ferrous metals	..	23.1	25.1	25.4	25.1	25.1	25.0
Food, beverages and tobacco	28.6	28.1	29.5	28.6	29.4	29.4	29.3
Chemicals	25.8	27.3	28.7	26.7	26.5	26.5	26.5
Textiles, clothing, leather and footwear	27.5	27.7	30.4	29.5	29.5	29.5	29.4
Pulp, paper, printing, etc.	26.5	27.9	28.7	24.1	24.2	24.2	24.2
Mineral products *(4)*	..	28.2	27.0	27.6	27.9	27.9	27.6
Engineering *(5)*	27.7	28.3	29.3	29.5	29.5	29.5	29.4
Other industry *(6)*	28.4	28.5	30.2	32.6	32.6	32.8	32.5
Unclassified	..	27.1	..	..	..	..	..
Domestic							
House coal	30.1	30.2	30.9	29.8	30.1	28.9r	28.7
Anthracite and dry steam coal	33.3	33.6	33.5	34.7	34.3	34.4	34.1
Other consumers	27.5	27.5	29.2	25.5	26.4	26.4	26.4
Transport - Rail	..	..	..	30.3	30.2	30.2	30.1
Imported coal *(1)*	..	28.3	28.0	27.9	27.4	27.5	27.6
of which Steam coal	..	..	26.6	26.5	26.5	27.0r	27.0
Coking coal	..	..	30.4	32.1	31.8	31.8	31.8
Anthracite	..	..	31.2	31.0	31.5	31.6	31.5
Exports *(1)*	..	29.0	32.0	32.3	32.2	32.2	32.2
of which Steam coal	..	..	31.0	31.2	31.2	31.2	31.0
Anthracite	..	..	32.6	33.2	32.5	32.5	32.5
Coke *(7)*	28.1	28.1	29.8	29.8	29.8	29.8	29.8
Coke breeze	24.4	24.8	24.8	29.8	29.8	29.8	29.8
Other manufactured solid fuels *(1)*	27.6	27.6	30.8	32.6	32.7	32.7	32.7
Petroleum							
Crude oil *(1)*	45.2	45.6	45.7	45.7	45.7	45.7	45.7
Liquified petroleum gas	49.6	49.3	49.1	49.2	49.3	49.3	49.3
Ethane	52.3	50.6	50.7	50.7	50.7	50.7	50.7
LDF for gasworks/Naphtha	47.8	47.9	47.6	47.8	47.8	47.9	47.8
Aviation spirit and wide-cut gasoline (AVGAS and AVTAG)	47.2	47.3	47.3	47.4	47.4	47.4	47.4
Aviation turbine fuel (AVTUR)	46.4	46.2	46.2	46.2	46.2	46.2	46.2
Motor spirit	47.0	47.0	47.0	47.1	47.2	47.1	47.1
Burning oil	46.5	46.2	46.2	46.2	46.2	46.2	46.2
Vaporising oil	45.9	45.9	..	..	..	..	..
Gas/diesel oil (8)	45.5	45.4	45.6	45.3	45.3	45.3	45.3
DERV (8)	..	..	..	45.6	45.7	45.7	45.7
Fuel oil	42.8	43.2	43.1	43.3	43.4	43.3	43.3
Power station oil	42.8	43.2	43.1	43.3	43.4	43.3	43.3
Non-fuel products (notional value)	42.2	43.2	43.8	43.1	42.8	42.8	43.0
Petroleum coke (Power stations)	..	..	..	30.9	28.6	28.6	28.6
Petroleum coke (Other)	..	39.5	35.8	35.8	35.8	35.8	35.8
Natural Gas *(9)*	..	38.4	39.4	40.0	40.2	40.1r	39.8
Renewable sources							
Domestic wood	..	..	10.0	13.9	16.3	16.3	16.3
Industrial wood	..	..	11.9	13.7	20.3	20.3	20.3
Straw	..	..	15.0	15.8	15.8	15.7	15.4
Poultry litter	..	..	8.8	9.1	9.1	9.5	9.9
Meat and bone	..	..	17.3	20.0	20.0	19.0	18.3
General industrial waste	..	..	16.0	16.0	16.0	16.0	16.0
Hospital waste	..	..	14.0	14.0	14.0	14.0	14.0
Municipal solid waste	..	..	9.5	9.5	9.6	9.8	9.3
Refuse derived waste	..	..	18.6	18.5	18.5	18.5	18.5
Short rotation coppice	..	..	10.6	11.1	14.2	14.2	14.2
Tyres	..	..	32.0	32.0	32.0	32.0	32.0
Wood pellets	..	..	..	17.2	18.3	18.3	18.3
Biodiesel	..	..	..	38.7	38.7	38.7	38.7
Bioethanol	..	..	..	29.7	29.7	29.7	29.7

(1) Weighted averages.

(2) Home produced coal only.

(3) From 2001 onwards almost entirely sourced from imports.

(4) Based on information provided by the British Cement Industry Association; almost all coal used by this sector in the latest 4 years was imported.

(5) Mechanical engineering and metal products, electrical and instrument engineering and vehicle manufacture.

(6) Includes construction.

(7) Since 1995 the source of these figures has been the ISSB.

(8) DERV included within gas/diesel oil until 2005.

(9) Natural Gas figures are shown in MJ per cubic metre.

A.3 Estimated average net calorific values of fuels 1980, 1990, 2000, 2010 and 2015 to 2017

GJ per tonne (net)

	1980	1990	2000	2010	2015	2016	2017
Coal							
All consumers *(1)(2)*	24.3	24.2	24.9	24.5	24.7	24.7	24.6
All consumers - home produced plus imports minus exports *(1)*	..	..	25.6	25.7	25.7	25.8	25.9
Power stations *(2)*	22.6	23.6	24.3	23.6	23.9	23.9	24.1
Power stations - home produced plus imports *(1)*	..	..	24.7	24.5	24.9	24.9	25.3
Coke ovens *(2)*	29.0	28.7	29.6	29.0	30.2	30.2	30.2
Coke ovens - home produced plus imports *(1)*	..	..	28.9	29.0	30.2	30.2	30.2
Low temperature carbonisation plants and manufactured fuel plants	18.1	27.7	28.8	28.7	27.0	26.9	26.9
Collieries	25.7	27.2	28.1	27.9	27.5	27.5	27.4
Agriculture	28.6	27.5	27.8	26.6	28.1	28.1	28.1
Iron and steel industry *(3)*	27.6	27.5	29.2	28.9	28.9	28.9	28.9
Other industries *(1)*	25.7	26.4	25.4	26.3	25.4	25.4	25.4
Non-ferrous metals	..	21.9	23.8	24.1	23.8	23.8	23.7
Food, beverages and tobacco	27.2	26.7	28.0	27.2	28.0	28.0	27.9
Chemicals	24.5	25.9	27.2	25.4	25.2	25.2	25.2
Textiles, clothing, leather and footwear	26.1	26.3	28.9	28.0	28.1	28.1	28.0
Pulp, paper, printing, etc.	25.2	26.5	27.3	22.9	23.0	23.0	23.0
Mineral products *(4)*	..	26.8	25.7	26.3	26.5	26.5	26.2
Engineering *(5)*	26.3	26.9	27.8	28.0	28.0	28.0	27.9
Other industry *(6)*	27.0	27.1	28.7	31.0	31.0	31.1	30.9
Unclassified	..	25.7	..	..	..	..	..
Domestic							
House coal	28.6	28.7	29.4	28.3	28.6	27.5r	27.2
Anthracite and dry steam coal	31.6	31.9	31.9	32.9	32.6	32.6	32.4
Other consumers	26.1	26.1	27.7	24.3	25.1	25.1	25.1
Transport - Rail	..	..	..	28.8	28.7	28.7	28.6
Imported coal *(1)*	..	26.9	26.6	26.5	26.0	26.1	26.2
of which Steam coal	..	..	25.3	25.2	25.2	25.7r	25.7
Coking coal	..	..	28.9	29.0	30.2	30.2	30.2
Anthracite	..	..	29.6	29.5	30.0	30.0	29.9
Exports *(1)*	..	27.6	30.4	30.7	30.6	30.6	30.6
of which Steam coal	..	..	29.4	29.6	29.6	29.6	29.4
Anthracite	..	..	30.9	31.6	30.9	30.9	30.9
Coke *(7)*	28.1	28.1	29.8	29.8	29.8	29.8	29.8
Coke breeze	24.4	24.8	24.8	29.8	29.8	29.8	29.8
Other manufactured solid fuels *(1)*	26.2	26.2	29.3	31.0	31.1	31.1	31.1
Petroleum							
Crude oil *(1)*	42.9	43.3	43.4	43.4	43.4	43.4	43.4
Liquified petroleum gas	46.2	46.0	46.0	46.0	46.0	45.9	45.9
Ethane	48.1	46.6	46.6	46.6	46.6	46.6	46.6
LDF for gasworks/Naphtha	45.4	45.5	45.3	45.4	45.4	45.5	45.4
Aviation spirit and wide-cut gasoline (AVGAS and AVTAG)	44.8	44.9	44.9	45.0	45.0	45.0	45.0
Aviation turbine fuel (AVTUR)	44.1	43.9	43.9	43.9	43.9	43.9	43.9
Motor spirit	44.7	44.7	44.7	44.7	44.8	44.8	44.7
Burning oil	44.2	43.9	43.9	43.9	43.9	43.9	43.9
Vaporising oil	43.6	43.6	..	..	..	..	..
Gas/diesel oil (8)	42.8	42.7	42.9	42.6	42.6	42.6	42.6
DERV (8)	..	..	..	42.9	42.9	42.9	42.9
Fuel oil	40.2	40.6	40.5	40.7	40.8	40.7	40.7
Power station oil	40.2	40.6	40.5	40.7	40.8	40.7	40.7
Non-fuel products (notional value)	40.1	41.0	41.6	40.9	40.6	40.7	40.8
Petroleum coke (Power stations)	..	..	..	29.3	27.2	27.2	27.2
Petroleum coke (Other)	..	37.5	34.0	34.0	34.0	34.0	34.0
Natural Gas *(9)*	..	34.6	35.5	36.0	36.1	36.1r	35.8
Renewable sources							
Domestic wood	..	..	..	12.3	14.7	14.7	14.7
Industrial wood	..	..	..	12.1	19.0	19.0	19.0
Straw	..	..	..	13.4	13.4	13.4	13.1
Poultry litter	..	..	..	7.6	7.6	7.6	7.9
Meat and bone	..	..	..	16.8	16.8	16.8	16.2
General industrial waste	..	..	..	15.2	15.2	15.2	15.2
Hospital waste	..	..	..	13.3	13.3	13.3	13.3
Municipal solid waste	..	..	..	6.7	6.7	6.8	6.5
Refuse derived waste	..	..	..	13.0	13.0	13.0	13.0
Short rotation coppice	..	..	..	9.3	12.6	12.6	12.6
Tyres	..	..	..	30.4	30.4	30.4	30.4
Wood pellets	..	..	..	16.8	16.9	16.9	16.9
Biodiesel	..	..	..	37.2	37.2	37.2	37.2
Bioethanol	..	..	..	26.8	26.8	26.8	26.8

For footnotes see table A.2

The net calorific value of natural gas is the gross calorific value x 0.9.

Annex B
Glossary and Acronyms

Anthracite	Within this publication, anthracite is coal classified as such by UK coal producers and importers of coal. Typically it has a high heat content making it particularly suitable for certain industrial processes and for use as a domestic fuel.
Associated gas	Natural gas found in association with crude oil in a reservoir, either dissolved in the oil or as a cap above the oil.
Autogeneration	Generation of electricity by companies whose main business is not electricity generation, the electricity being produced mainly for that company's own use.
Aviation spirit	A light hydrocarbon oil product used to power piston-engined aircraft power units.
Aviation turbine fuel	The main aviation fuel used for powering aviation gas-turbine power units (jet aircraft engine).
Backflows	These are finished or semi-finished products, which are returned from final consumers to refineries for processing, blending or sale. They are usually by-products of petrochemical manufacturing.
BEIS	Department for Business, Energy and Industrial Strategy
Benzole	A colourless liquid, flammable, aromatic hydrocarbon by-product of the iron and steel making process. It is used as a solvent in the manufacture of styrenes and phenols but is also used as a constituent of motor fuel.
BETTA	British Electricity Trading and Transmission Arrangements (BETTA) refer to changes to electricity generation, distribution and supply licences. On 1 April 2005, the England and Wales trading arrangements were extended to Scotland by the British Electricity Trading and Transmission Arrangements creating a single GB market for trading of wholesale electricity, with common arrangements for access to and use of GB transmission system. From 1 April 2005, NGC has become the System Operator for the whole of GB. BETTA replaced NETA on 4 April 2005.
Biodiesel	(FAME - biodiesel produced to BS EN 14214). Produced from vegetable oils or animal fats by mixing them with ethanol or methanol to break them down.
Bioenergy	Bioenergy is renewable energy made from material of recent biological origin derived from plant or animal matter.
Bioethanol	Created from crops rich in starch or sugar by fermentation, distillation and finally dehydration.
Biogas	Energy produced from the anaerobic digestion of sewage and industrial waste.

Biomass Renewable organic materials, such as wood, agricultural crops or wastes, and municipal wastes. Biomass can be burned directly or processed into biofuels such as ethanol and methane

Bitumen The residue left after the production of lubricating oil distillates and vacuum gas oil for upgrading plant feedstock. Used mainly for road making and construction purposes.

Blast furnace gas Mainly produced and consumed within the iron and steel industry. Obtained as a by-product of iron making in a blast furnace, it is recovered on leaving the furnace and used partly within the plant and partly in other steel industry processes or in power plants equipped to burn it. A similar gas is obtained when steel is made in basic oxygen steel converters; this gas is recovered and used in the same way.

Breeze Breeze can generally be described as coke screened below 19 mm (¾ inch) with no fines removed but the screen size may vary in different areas and to meet the requirements of particular markets.

BG British Gas

BOS Basic Oxygen Steel furnace gas

BNFL British Nuclear Fuels plc.

BRE Building Research Establishment

Burning oil A refined petroleum product, with a volatility in between that of motor spirit and gas diesel oil primarily used for heating and lighting.

Butane Hydrocarbon (C_4H_{10}), gaseous at normal temperature but generally stored and transported as a liquid. Used as a component in Motor Spirit to improve combustion, and for cooking and heating (see LPG).

Calorific values (CVs) The energy content of a fuel can be measured as the heat released on complete combustion. The SI (Système International) derived unit of energy and heat is the Joule. This is the energy in a given quantity of the fuel and is often measured in GJ per tonne. The energy content can be expressed as an upper (or gross) value and a lower (or net) value. The difference between the two values 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.

Carbon Emission Reduction Target (CERT) The Carbon Emissions Reduction Target (CERT) follows on from the Energy Efficiency Commitment (EEC). CERT requires gas and electricity suppliers to achieve targets for a reduction in carbon emissions generated by the domestic sector.

CCA Climate Change Agreement. Climate Change Agreements allow energy intensive business users to receive a 65 per cent discount from the Climate Change Levy (CCL), in return for meeting energy efficiency or carbon saving targets. The CCL is a tax on the use of energy in industry, commerce and the public sector. The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.

CCL	Climate Change Levy. The Climate Change Levy is a tax on the use of energy in industry, commerce and the public sector, with offsetting cuts in employers' National Insurance Contributions and additional support for energy efficiency schemes and renewable sources of energy. The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.
CO_2	Carbon dioxide. Carbon dioxide contributes about 60 per cent of the potential global warming effect of man-made emissions of greenhouse gases. Although this gas is naturally emitted by living organisms, these emissions are offset by the uptake of carbon dioxide by plants during photosynthesis; they therefore tend to have no net effect on atmospheric concentrations. The burning of fossil fuels, however, releases carbon dioxide fixed by plants many millions of years ago, and thus increases its concentration in the atmosphere.
Co-firing	The burning of biomass products in fossil fuel power stations
Coke oven coke	The solid product obtained from carbonisation of coal, principally coking coal, at high temperature. It is low in moisture and volatile matter. Used mainly in iron and steel industry.
Coke oven gas	Gas produced as a by-product of solid fuel carbonisation and gasification in coke ovens, but not from low temperature carbonisation plants. Synthetic coke oven gas is mainly natural gas which is mixed with smaller amounts of blast furnace and basic oxygen steel furnace gas to produce a gas with almost the same qualities as coke oven gas.
Coking coal	Within this publication, coking coal is coal sold by producers for use in coke ovens and similar carbonising processes. The definition is not therefore determined by the calorific value or caking qualities of each batch of coal sold, although calorific values tend to be higher than for steam coal. Not all coals form cokes. For a coal to coke it must exhibit softening and agglomeration properties, ie the end product must be a coherent solid.
Colliery methane	Methane released from coal seams in existing and abandoned deep mines and from coal beds which is piped to the surface and consumed at the colliery or transmitted by pipeline to consumers.
Combined Cycle Gas Turbine (CCGT)	Combined cycle gas turbine power stations combine gas turbines and steam turbines which are connected to one or more electrical generators in the same plant. The gas turbine (usually fuelled by natural gas or oil) produces mechanical power (to drive the generator) and heat in the form of hot exhaust gases. These gases are fed to a boiler, where steam is raised at pressure to drive a conventional steam turbine, which is also connected to an electrical generator.
Combined Heat and Power (CHP)	CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process. The term CHP is synonymous with cogeneration and total energy, which are terms often used in the United States or other Member States of the European Community. The basic elements of a CHP plant comprise one or more prime movers driving electrical generators, where the steam or hot water generated in the process is utilised via suitable heat recovery equipment for use either in industrial processes or in community heating and space heating.
CHPQA	Combined Heat and Power Quality Assurance Scheme

Conventional thermal power stations	These are stations which generate electricity by burning fossil fuels to produce heat to convert water into steam, which then powers steam turbines.
Cracking/conversion	A refining process using combinations of temperature, pressure and in some cases a catalyst to produce petroleum products by changing the composition of a fraction of petroleum, either by splitting existing longer carbon chains or combining shorter carbon chain components of crude oil or other refinery feedstocks. Cracking allows refiners to selectively increase the yield of specific fractions from any given input petroleum mix depending on their requirements in terms of output products.
CRC	Carbon Reduction Commitment. The CRC Energy Efficiency scheme is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large public and private sector organistaions.
Crude oil	A mineral oil consisting of a mixture of hydrocarbons of natural origins, yellow to black in colour, of variable density and viscosity.
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DERV	Diesel engined road vehicle fuel used in internal combustion engines that are compression-ignited.
DFT	Department for Transport
Distillation	A process of separation of the various components of crude oil and refinery feedstocks using the different temperatures of evaporation and condensation of the different components of the mix received at the refineries.
DNC	Declared net capacity and capability are used to measure the maximum power available from generating stations at a point in time.
DNO	Distribution Network Operator
Downstream	Used in oil and gas processes to cover the part of the industry after the production of the oil and gas. For example, it covers refining, supply and trading, marketing and exporting.
DUKES	Digest of United Kingdom Energy Statistics, the Digest provides essential information for everyone, from economists to environmentalists and from energy suppliers to energy users.
EHCS	English House Condition Survey
Embedded Generation	Embedded generation is electricity generation by plant which has been connected to the distribution networks of the public electricity distributors rather than directly to the National Grid Company's transmission systems. Typically they are either smaller stations located on industrial sites, or combined heat and power plant, or renewable energy plant such as wind farms, or refuse burning generators. The category also includes some domestic generators such as those with electric solar panels.
Energy use	Energy use of fuel mainly comprises use for lighting, heating or cooling, motive power and power for appliances. See also non-energy use.

ESA European System of Accounts. An integrated system of economic accounts which is the European version of the System of National Accounts (SNA).

Ethane A light hydrocarbon gas (C_2H_6) in natural gas and refinery gas streams (see LPG).

EU-ETS European Union Emissions Trading Scheme. This began on 1st January 2005 and involves the trading of emissions allowances as means of reducing emissions by a fixed amount.

EUROSTAT Statistical Office of the European Commission.

Exports For some parts of the energy industry, statistics on trade in energy related products can be derived from two separate sources. Firstly, figures can be reported by companies as part of systems for collecting data on specific parts of the energy industry (eg as part of the system for recording the production and disposals of oil from the UK continental shelf). Secondly, figures are also available from the general systems that exist for monitoring trade in all types of products operated by HM Revenue and Customs.

Feed-In Tariffs The Feed-in Tariffs (FITs) scheme was introduced on 1 April 2010 to encourage deployment of small-scale (less than 5MW) low-carbon electricity generation. People with a qualifying technology receive a guaranteed payment from an electricity supplier of their choice for the electricity they generate and use, as well as a guaranteed payment for unused surplus electricity they export back to the grid.

Feedstock In the refining industry, a product or a combination of products derived from crude oil, destined for further processing other than blending. It is distinguished from use as a chemical feedstock etc.

Final energy consumption Energy consumption by final user – ie which is not being used for transformation into other forms of energy.

Fossil fuels 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.

Fuel oils The heavy oils from the refining process; used as fuel in furnaces and boilers of power stations, industry, in domestic and industrial heating, ships, locomotives, metallurgic operation, and industrial power plants etc.

Fuel oil - Light Fuel oil made up of heavier straight-run or cracked distillates and used in commercial or industrial burner installations not equipped with pre-heating facilities.

Fuel oil - Medium Other fuel oils, sometimes referred to as bunker fuels, which generally require pre-heating before being burned, but in certain climatic conditions do not require pre-heating.

Fuel oil - Heavy Other heavier grade fuel oils which in all situations require some form of pre-heating before being burned.

Fuel poverty A household is said to be in fuel poverty if they have required fuel costs that are above average (the national median level), and were they to spend that amount they would be left with a residual income below the official poverty line

Gas diesel oil The medium oil from the refinery process; used as a fuel in diesel engines (ie internal combustion engines that are compression-ignited), burned in central heating systems and used as a feedstock for the chemical industry.

GDP Gross Domestic Product.

GDP deflator An index of the ratio of GDP at current prices to GDP at constant prices. It provides a measure of general price inflation within the whole economy.

Gigajoule (GJ) A unit of energy equal to 10^9 joules.

Gigawatt (GW) A unit of electrical power, equal to 10^9 watts.

Green Deal A scheme by which energy-saving improvements can be made to a home or business without having to pay all the costs up front; energy-saving improvements include:

- insulation - eg loft or cavity wall insulation
- heating
- draught-proofing
- double glazing
- renewable energy technologies - eg solar panels or wind turbines

Heat pumps Heat pumps use a heat exchanger (much like that installed in fridges and freezers – although running in reverse) to take heat from the ground or air and convert it into heating in the home (either radiators, underfloor heating or warm air heating systems and hot water). Ground source heat pumps use pipes which are buried in the ground to extract heat. Air source heat pumps absorb heat from the outside air. Heat pumps need electricity to run, but the heat they extract from the ground or air is constantly being renewed naturally.

Heat sold 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 from community heating schemes without CHP plants.

HMRC HM Revenue and Customs.

Imports Before the 1997 edition of the Digest, the term "arrivals" was used to distinguish figures derived from the former source from those import figures derived from the systems operated by HM Revenue and Customs. To make it clearer for users, a single term is now being used for both these sources of figures (the term imports) as this more clearly states what the figures relate to, which is goods entering the UK.

Indigenous production The extraction or capture of primary fuels: for oil this includes production from the UK Continental Shelf, both onshore and offshore.

Industrial spirit Refined petroleum fractions with boiling ranges up to 200ºC dependent on the use to which they are put – e.g. seed extraction, rubber solvents, perfume etc.

International Energy Agency (IEA) The IEA is an autonomous body located in Paris which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

ISSB	International Steel Statistics Bureau
Joules	A joule is a generic unit of energy in the conventional SI system. It is equal to the energy dissipated by an electrical current of 1 ampere driven by 1 volt for 1 second; it is also equal to twice the energy of motion in a mass of 1 kilogram moving at 1 metre per second.
Kilowatt (kW)	1,000 watts
Landfill gas	The methane-rich biogas formed from the decomposition of organic material in landfill.
LDF	Light distillate feedstock
LDZ	Local distribution zone
Liquefied Natural Gas (LNG)	Natural gas that has been converted to liquid form for ease of storage or transport.
Liquefied Petroleum Gas (LPG)	Gas, usually propane or butane, derived from oil and put under pressure so that it is in liquid form. Often used to power portable cooking stoves or heaters and to fuel some types of vehicle, eg some specially adapted road vehicles, forklift trucks.
Lead Replacement Petrol (LRP)	An alternative to Leaded Petrol containing a different additive to lead (in the UK usually potassium based) to perform the lubrication functions of lead additives in reducing engine wear.
Lubricating oils	Refined heavy distillates obtained from the vacuum distillation of petroleum residues. Includes liquid and solid hydrocarbons sold by the lubricating oil trade, either alone or blended with fixed oils, metallic soaps and other organic and/or inorganic bodies.
Magnox	A type of gas-cooled nuclear fission reactor developed in the UK, so called because of the magnesium alloy used to clad the uranium fuel.
Major Power Producers (MPPs)	Companies whose prime purpose is the generation of electricity.
Megawatt (MW)	1,000 kilowatts. MWe is used to emphasise when electricity is being measured. MWt is used when heat ("thermal") is being measured.
Micro CHP	Micro CHP is a new technology that is expected to make a significant contribution to domestic energy efficiency in the future.
Motor spirit	Blended light petroleum product used as a fuel in spark-ignition internal combustion engines (other than aircraft engines).
NAEI	National Atmospheric Emissions Inventory
Naphtha	(Light distillate feedstock) – Petroleum distillate boiling predominantly below 200ºC.
National Allocation Plan (NAP)	Under the EU Emissions Trading Scheme (EU-ETS) Directive each EU country must have a National Allocation Plan which lays down the overall contribution of the EU-ETS participants (the "cap") for the country and the allowances that each sector and each individual installation covered under the Directive is allocated, effectively stating how much that sector can emit over the trading period of the scheme.

Natural gas	Natural gas is a mixture of naturally occurring gases found either in isolation, or associated with crude oil, in underground reservoirs. The main components are methane, ethane, propane and butane. Hydrogen sulphide and carbon dioxide may also be present, but these are mostly removed at or near the well head in gas processing plants.
Natural gas - compressed	Natural gas that has been compressed to reduce the volume it occupies to make it easier to transport other than in pipelines. Whilst other petroleum gases can be compressed such that they move into liquid form, the volatility of natural gas is such that liquefaction cannot be achieved without very high pressures and low temperatures being used. As such, the compressed form is usually used as a "half-way house".
Natural gas liquids (NGLs)	A mixture of liquids derived from natural gas and crude oil during the production process, including propane, butane, ethane and gasoline components (pentanes plus).
NDA	Nuclear Decommissioning Authority
NETA	New Electricity Trading Arrangements - In England and Wales these arrangements replaced "the pool" from 27 March 2001. The arrangements are based on bi-lateral trading between generators, suppliers, traders and customers and are designed to be more efficient, and provide more market choice.
NFFO	Non Fossil Fuel Obligation. The 1989 Electricity Act empowers the Secretary of State to make orders requiring the Regional Electricity Companies in England and Wales to secure specified amounts of electricity from renewable sources.
NFPA	Non Fossil Purchasing Agency
NIE	Northern Ireland Electricity
NI NFFO	Northern Ireland Non Fossil Fuel Obligation
Non-energy use	Includes fuel used for chemical feedstock, solvents, lubricants, and road making material.
NO_X	Nitrogen oxides. A number of nitrogen compounds including nitrogen dioxide are formed in combustion processes when nitrogen in the air or the fuel combines with oxygen. These compounds can add to the natural acidity of rainfall.
NUTS	Nonmenclature of Units for Territorial Statistics
OFGEM	The regulatory office for gas and electricity markets
OFT	Office of Fair Trading
ONS	Office for National Statistics
Orimulsion	An emulsion of bitumen in water that was used as a fuel in some power stations until 1997.
OTS	Overseas Trade Statistics of the United Kingdom

Patent fuel	A composition fuel manufactured from coal fines by shaping with the addition of a binding agent (typically pitch). The term manufactured solid fuel is also used.
Petrochemical feedstock	All petroleum products intended for use in the manufacture of petroleum chemicals. This includes middle distillate feedstock of which there are several grades depending on viscosity. The boiling point ranges between 200°C and 400°C.
Petroleum cokes	Carbonaceous material derived from hydrocarbon oils, uses for which include metallurgical electrode manufacture and in the manufacture of cement.
Photovoltaics	The direct conversion of solar radiation into electricity by the interaction of light with the electrons in a semiconductor device or cell.
PILOT	Phase 2 (PILOT) is the successor body to the Oil & Gas Industry Task Force (OGITF) and was established on 1 January 2000, to secure the long-term future of the oil and gas industry in the UK. A forum that brings together Government and industry to address the challenges facing the oil and gas industry. One outcome of PILOT's work is the published Code of Practice on Supply Chain Relationships.
Plant capacity	The maximum power available from a power station at a point in time.
Plant loads, demands and efficiency	Measures of how intensively and efficiently power stations are being used.
PPRS	Petroleum production reporting system. Licensees operating in the UK Continental Shelf are required to make monthly returns on their production of hydrocarbons (oil and gas) to BEIS. This information is recorded in the PPRS, which is used to report flows, stocks and uses of hydrocarbon from the well-head through to final disposal from a pipeline or terminal (see DUKES internet annex F on the BEIS energy statistics website for further information).
Primary electricity	Electricity obtained other than from fossil fuel sources, e.g. nuclear, hydro and other non-thermal renewables. Imports of electricity are also included.
Primary fuels	Fuels obtained directly from natural sources, e.g. coal, oil and natural gas.
Process oils	Partially processed feedstocks which require further processing before being classified as a finished product suitable for sale. They can also be used as a reaction medium in the production process.
Propane	Hydrocarbon containing three carbon atoms (C_3H_8), gaseous at normal temperature, but generally stored and transported under pressure as a liquid.
RD	Renewables Directive – this proposes that EU Member States adopt national targets that are consistent with the overall EU target of 20 per cent of energy from renewables by 2020.
Refinery fuel	Petroleum products produced by the refining process that are used as fuel at refineries.

Reforming	Processes by which the molecular structure of different fractions of petroleum can be modified. It usually involves some form of catalyst, most often platinum, and allows the conversion of lower grades of petroleum product into higher grades, improving their octane rating. It is a generic term for processes such as cracking, cyclization, dehydrogenation and isomerisation. These processes generally led to the production of hydrogen as a by-product, which can be used in the refineries in some desulphurization procedures.
Renewable energy sources	Renewable energy includes solar power, 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.
Reserves	With oil and gas these relate to the quantities identified as being present in underground cavities. The actual amounts that can be recovered depend on the level of technology available and existing economic situations. These continually change; hence the level of the UK's reserves can change quite independently of whether or not new reserves have been identified.
RESTATS	The Renewable Energy Statistics database for the UK.
Ricardo-AEA	Formerly known as AEA Energy & Environment.
RO	Renewables Obligation – this is an obligation on all electricity suppliers to supply a specific proportion of electricity from eligible renewable sources.
ROCs	Renewables Obligation Certificates
Seasonal Performance Factor	The Seasonal Performance Factor (SPF) of a heat pump is the total useful heat delivered during a year divided by the annual electricity consumption of the pump. The SPF gives an indication of the efficiency of the pump, with values greater than 1 implying that more useful heat is produced than the electricity used to power the pump.
Secondary fuels	Fuels derived from natural primary sources of energy. For example electricity generated from burning coal, gas or oil is a secondary fuel, as are coke and coke oven gas.
SI (Système International)	Refers to the agreed conventions for the measurement of physical quantities**.**
SIC	The United Kingdom Standard Industrial Classification of Economic Activities (SIC) is used to classify business establishments and other standard units by the type of economic activity in which they are engaged. It provides a framework for the collection, tabulation, presentation and analysis of data and its use promotes uniformity. In addition, it can be used for administrative purposes and by non-government bodies as a convenient way of classifying industrial activities into a common structure. The system is identical to the EUROSTAT System NACE at the four digit class level and the United Nations system ISIC at the two digit Divisional level.

SO_2	Sulphur Dioxide. Sulphur dioxide is a gas produced by the combustion of sulphur-containing fuels such as coal and oil.
SRO	Scottish Renewable Orders
Steam coal	Within this publication, steam coal is coal classified as such by UK coal producers and by importers of coal. It tends to be coal having lower calorific values; the type of coal that is typically used for steam raising.
Synthetic coke oven gas	Mainly a natural gas, which is mixed with smaller amounts of blast furnace, and BOS (basic oxygen steel furnace) gas to produce a gas with almost the same quantities as coke oven gas.
Tars	Viscous materials usually derived from the destructive distillation of coal which are by-products of the coke and iron making processes.
Temperature correction	The temperature corrected series of total inland fuel consumption 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.
Terawatt (TW)	1,000 gigawatts
Therm	A common unit of measurement similar to a tonne of oil equivalent which enables different fuels to be compared and aggregated.
Thermal efficiency	The 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 as a result of fission of the nuclear fuel inside the reactor.
Thermal sources of electricity	These 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.
Tonne of oil equivalent (toe)	A common unit of measurement which enables different fuels to be compared and aggregated
TWh	Terawatt hour
UKCS	United Kingdom Continental Shelf
UKPIA	UK Petroleum Industry Association. The trade association for the UK petroleum industry.
UKSA	UK Statistics Authority
Ultra low sulphur Diesel (ULSD)	A grade of diesel fuel which has a much lower sulphur content (less than 0.005 per cent or 50 parts per million) and of a slightly higher volatility than ordinary diesel fuels. As a result it produces fewer emissions when burned, and initially enjoyed a lower rate of hydrocarbon oil duty in the UK than ordinary diesel to promote its use, although duty rates on standard diesel and ULSD have since been equalised. Virtually 100 per cent of sales of DERV fuel in the UK are ULSD.

Ultra low sulphur Petrol (ULSP)	A grade of motor spirit with a similar level of sulphur to ULSD (less than 0.005 per cent or 50 parts per million). ULSP initially enjoyed a lower rate of hydrocarbon oil duty in the UK than ordinary petrol to promote its use, although duty rates on standard petrol and ULSP have since been equalised. It has quickly replaced ordinary premium grade unleaded petrol in the UK market place.
Upstream	A term to cover the activities related to the exploration, production and delivery to a terminal or other facility of oil or gas for export or onward shipment within the UK.
VAT	Value added tax
Watt (W)	The conventional unit to measure a rate of flow of energy. One watt amounts to 1 joule per second.
White spirit	A highly refined distillate with a boiling range of about 150ºC to 200ºC used as a paint solvent and for dry cleaning purposes etc.

Annex C

Further sources of United Kingdom energy publications

Some of the publications listed below give shorter term statistics, some provide further information about energy production and consumption in the United Kingdom and in other countries, and others provide more detail on a country or fuel industry basis. The list also covers recent publications on energy issues and policy, including statistical information, produced or commissioned by BEIS. The list is not exhaustive and the titles of publications and publishers may alter. All titles can be found on the GOV.UK website.

Department for Business, Energy and Industrial Strategy publications on energy statistics

Energy Statistics

Monthly, quarterly and annual statistics on production and consumption of overall energy and individual fuels in the United Kingdom together with energy prices is available in MS Excel format at: www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Energy Trends

A quarterly publication covering all major aspects of energy. It provides a comprehensive picture of energy production and use and contains analysis of data and articles covering energy issues. Available at: www.gov.uk/government/collections/energy-trends.

Energy Prices

A quarterly publication containing tables, charts and commentary covering energy prices to domestic and industrial consumers for all the major fuels as well as presenting comparisons of fuel prices in the European Union and G7 countries. Available at:
www.gov.uk/government/collections/quarterly-energy-prices.

Energy Flow Chart

An annual publication illustrating the flow of primary fuels from home production and imports to their eventual final uses. They are shown in their original state and after being converted into different kinds of energy by the secondary fuel producers. Available at:
www.gov.uk/government/collections/energy-flow-charts.

UK Energy in Brief

An annual publication summarising the latest statistics on energy production, consumption and prices in the United Kingdom. The figures are taken from “Digest of UK Energy Statistics”. Available at:
www.gov.uk/government/collections/uk-energy-in-brief

Energy Consumption in the United Kingdom

Energy consumption in the United Kingdom brings together statistics from a variety of sources to produce a comprehensive review of energy consumption and changes in efficiency, intensity and output since the 1970s, with a particular focus on trends since 1990. The information is presented in five sections covering overall energy consumption and energy consumption in the transport, domestic, industrial and service sectors. Available at:
www.gov.uk/government/collections/energy-consumption-in-the-uk

Sub-National Energy Consumption statistics

Sub-National data are produced by BEIS to emphasise the importance of local and regional decision making for energy policy in delivering a number of national energy policy objectives. Data is available at: www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Fuel Poverty statistics

An annual report detailing the latest statistics on fuel poverty. Available at: www.gov.uk/government/collections/fuel-poverty-statistics

Household Energy Efficiency statistics

BEIS publishes a range of information relating to the Energy Company Obligation (ECO) and Green Deal (GD). The headline release presents monthly updates of ECO measures and quarterly updates of in-depth ECO statistics, carbon savings and the Green Deal schemes. The detailed report presents annual updates on in-depth Green Deal statistics and insulation levels. Data is available at: www.gov.uk/government/collections/household-energy-efficiency-national-statistics

National Energy Efficiency Data-framework (NEED)

BEIS has constructed a National Energy Efficiency Data-framework (NEED) to enable detailed statistical analysis of energy efficiency. The data framework matches the gas and electricity consumption data collected for BEIS sub-national energy consumption statistics and records of energy efficiency measures in the Homes Energy Efficiency Database (HEED) run by the Energy Saving Trust (EST), as well as typographic data about dwellings and households. Data is available at: www.gov.uk/government/collections/national-energy-efficiency-data-need-framework

UK Greenhouse Gas Emissions statistics

Emissions data are produced by BEIS to show progress against the UK's goals, both international and domestic, for reducing greenhouse gas emissions. Data is available at: www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics

UK Energy and CO2 emissions projections

The Updated Energy Projections (UEP) are published annually by BEIS. They provide updated projections and analysis of energy use and carbon dioxide emissions in the UK. The UEP exercise incorporates all firm environmental policy measures and is based on updated assumptions consistent with the most recent UK Budget announcements. The latest report is available at: www.gov.uk/government/collections/energy-and-emissions-projections

Department for Business, Energy and Industrial Strategy policy publications on energy and climate change

The Clean Growth Strategy

On 12 October 2017 The Clean Growth Strategy was published. The strategy sets out proposals for decarbonising all sectors of the UK economy through the 2020s. It explains how the whole country can benefit from low carbon opportunities, while meeting national and international commitments to tackle climate change. The strategy is available at:
www.gov.uk/government/publications/clean-growth-strategy

Energy Act 2016

The Energy Act 2016 was given Royal Assent on 12 May 2016. The Act is available at:
www.legislation.gov.uk/ukpga/2016/20/contents/enacted

Annual Energy Statement

The Annual Energy Statement fulfilled the commitment in the Coalition Programme for the Government to present an annual statement of energy policy to Parliament. The first statement was delivered to Parliament on 27 June 2010, with subsequent statements delivered on 23 November 2011, 29 November 2012 and 31 October 2013. The last Statement, delivered on 6 November 2014, is available at: www.gov.uk/government/publications/annual-energy-statement-2014

Energy Act 2013

The Energy Act 2013 was given Royal Assent on 18 December 2013. The Act is available at:
www.legislation.gov.uk/ukpga/2013/32/contents

Energy Act 2011

The Energy Act 2011 was given Royal Assent on 18 October 2011. The Act is available at:
www.legislation.gov.uk/ukpga/2011/16/contents

Electricity Market Reform (EMR) White Paper

On 12 July 2011 'Planning our electric future: a White Paper for secure, affordable and low-carbon electricity' was published. The White Paper sets out key measures to attract investment, reduce the impact on consumer bills, and create a secure mix of electricity sources including gas, new nuclear, renewables, and carbon capture and storage. The White Paper is available at:
www.gov.uk/government/publications/planning-our-electric-future-a-white-paper-for-secure-affordable-and-low-carbon-energy

Energy Act 2010

The Energy Act 2010 was given Royal Assent on 8 April 2010. The Act is available at:
www.legislation.gov.uk/ukpga/2010/27/contents

UK Low Carbon Transition Plan

The UK Low Carbon Transition Plan was published on 15 July 2009. The Plan is available at:
www.gov.uk/government/publications/the-uk-low-carbon-transition-plan-national-strategy-for-climate-and-energy

Energy Act 2008

The Energy Act 2008 was granted Royal Assent on 26 November 2008. The Act is available at:
www.legislation.gov.uk/ukpga/2008/32/contents

Climate Change Act 2008

The Climate Change Act 2008 was granted Royal Assent on 26 November 2008. The Act is available at: www.legislation.gov.uk/ukpga/2008/27/contents

Other publications including energy information

General

Eurostat Regional Yearbook (annual); *Statistical Office of the European Commission – Eurostat*
Eurostat Yearbook (annual); *Statistical Office of the European Commission - Eurostat*
Eurostatistics (monthly); *Statistical Office of the European Commission – Eurostat*
Overseas Trade Statistics (OTS) of the United Kingdom; *H.M. Revenue and Customs*
- OTS trade with EU countries (monthly)
- OTS trade with non-EU countries (monthly)

UK Index of production (monthly); *Office for National Statistics*
United Kingdom Minerals Yearbook; *British Geological Survey*

Energy

BP Statistical Review of World Energy (annual); *BP*
Energy Balance Sheets; *Statistical Office of the European Commission – Eurostat*
Energy Statistics; *Statistical Office of the European Commission – Eurostat*
Energy Balances (annual); *United Nations Statistical Office*
Energy Statistics Yearbook (annual); *United Nations Statistical Office*
World Energy Statistics and Balances (annual); *International Energy Agency*

Coal

Annual Reports and Accounts of The Coal Authority and the private coal companies; (*apply to the Headquarters of the company concerned)*
Coal Information (annual); *International Energy Agency*
Coal Statistics (quarterly); *International Energy Agency*

Oil and Gas

Annual Reports and Accounts of National Grid, Centrica and the independent oil and gas supply companies; (contact *the Headquarters of the company concerned directly)*
National Grid – Gas Ten Year Statement - (annual); *National Grid*
Oil and Gas Information (annual); *International Energy Agency*
Oil and Gas Statistics (quarterly); *International Energy Agency*
Petroleum Review (monthly); *Energy Institute*

Electricity

Annual Reports and Accounts of the Electricity Supply Companies, Distributed Companies and Generators; (*apply to the Headquarters of the company concerned)*
Annual Report and Accounts of The Office of Gas and Electricity Markets; *OFGEM*
Electricity Information (annual); *International Energy Agency*
Electricity Statistics (quarterly); *International Energy Agency*
National Grid – Electricity Ten Year Statement - (annual); *National Grid*

Renewables

Renewables Information (annual); *International Energy Agency*

Prices

Energy Prices and Taxes (quarterly); *International Energy Agency*

Useful energy related websites

The BEIS section of the GOV.UK website can be found at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

Other Government web sites

Department for Environment, Food and Rural Affairs	www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
Department for Transport	www.gov.uk/government/organisations/department-for-transport
HM Government Online (GOV.UK)	www.gov.uk/
HM Revenue & Customs	www.gov.uk/government/organisations/hm-revenue-customs
Ministry of Housing, Communities & Local Government	www.gov.uk/government/organisations/ministry-of-housing-communities-and-local-government
Northern Ireland Executive	www.northernireland.gov.uk/
Ofgem (The Office of Gas and Electricity Markets)	www.ofgem.gov.uk/
The Scottish Government	www.gov.scot/
The Scottish Parliament	www.parliament.scot/
UK Parliament	www.parliament.uk/
UK Statistics Authority	www.statisticsauthority.gov.uk/
Welsh Government	http://gov.wales/

Other useful energy related web sites

BP	www.bp.com/
British Geological Survey	www.bgs.ac.uk/
BRE (Building Research Establishment)	www.bre.co.uk/
The Coal Authority	www.gov.uk/government/organisations/the-coal-authority
Energy Institute	www.energyinst.org/home
Energy Networks Association	www.energynetworks.org/
Energy UK	www.energy-uk.org.uk/
Europa (European Union Online)	http://europa.eu/
Eurostat (European statistics)	http://ec.europa.eu/eurostat
Interconnector	www.interconnector.com/
International Energy Agency (IEA)	www.iea.org/
International Steel Statistics Bureau (ISSB)	www.issb.co.uk/
National Grid	www.nationalgrid.com/
Oil & Gas UK	http://oilandgasuk.co.uk/
Renewable UK	www.renewableuk.com/
Ricardo Energy & Environment	http://ee.ricardo.com/
The Stationery Office	www.tsoshop.co.uk/
UK-AIR: Air Information Resource	https://uk-air.defra.gov.uk/
UK Petroleum Industry Association	www.ukpia.com/home.aspx
United Nations Statistics Division	https://unstats.un.org/home/
US Department of Energy	www.energy.gov/
US Energy Information Administration	www.eia.gov/

Annex D

Major events in the Energy Industry

2018

Energy Prices

In February 2018 the Domestic Gas and Electricity (Tariff Cap) Bill was introduced to Parliament, which will put in place a requirement on the independent regulator, Ofgem, to cap energy tariffs until 2020. It will mean an absolute cap can be set on poor value tariffs, protecting the 11 million households in England, Wales and Scotland who are currently on a standard variable or other default energy tariff and who are not protected by existing price caps

An extension to Ofgem's safeguard tariff cap was introduced in February 2018 which will see a further one million more vulnerable consumers protected from unfair energy price rises.

Nuclear

In June 2018 the Government announced a deal with the nuclear sector to ensure that nuclear energy continues to power the UK for years to come through major innovation, cutting-edge technology and ensuring a diverse and highly-skilled workforce. Key elements include:

- a £200 million Nuclear Sector Deal to secure the UK's diverse energy mix and drive down the costs of nuclear energy meaning cheaper energy bills for customers;
- a £32 million boost from government and industry to kick-start a new advanced manufacturing programme including R&D investment to develop potential world-leading nuclear technologies like advanced modular reactors;
- a commitment to increasing gender diversity with a target of 40% women working in the civil nuclear sector by 2030.

2017

Energy Policy

In October 2017 the Government published The Clean Growth Strategy: Leading the way to a low carbon future, which aims to cut emissions while keeping costs down for consumers, creating good jobs and growing the economy.

Measures set out in the Strategy include funding of:

- up to £10 million for innovations that provide low carbon heat in domestic and commercial buildings;
- up to £10 million for innovations that improve the energy efficiency of existing buildings;
- an extra £14 million for the Energy Entrepreneurs Fund, including a new sixth fund;
- up to £20 million in a Carbon Capture and Utilisation demonstration programme;
- up to £20 million to demonstrate the viability of switching to low carbon fuels for industry;
- up to £20 million to support clean technology early stage funding.

Electricity

As part of the Clean Growth Strategy the Government announced in October 2017 that up to £557 million will be made available for less established renewable electricity projects, to drive economic growth and clean up the energy system.

The foundation stone for the new ElecLink electricity connection between Britain and France was laid in February 2017. The interconnector will run through the Channel Tunnel between Sellindge in the UK and Les Mandarins in France, and will provide 1000MW of electricity, enough capacity to power up to 2 million homes.

Energy Efficiency

Homes across Great Britain will get extra support to make their homes cheaper and easier to keep warm thanks to reforms that came into force in April 2017. Changes to the Energy Company Obligation (ECO) will make sure energy companies give support to people struggling to meet their heating bills, with plans announced to extend the scheme from April 2017 to September 2018.

Smart Meters

The Smart Meters Bill was introduced to Parliament in October 2017. The Bill, first announced in the Queen's Speech in June 2017, will enable the Government to continue to regulate the roll-out of smart meters, with every home and small business in Great Britain being offered a smart meter by the end of 2020.

2016

Energy Policy

The Energy Bill received Royal Assent in May 2016. In summary the Bill:

- Creates the framework to formally establish the Oil and Gas Authority (OGA) as an independent regulator, taking the form of a government company, so that it can act with greater flexibility and independence. It gives the OGA new powers including: access to external meetings; data acquisition and retention; dispute resolution; and sanctions. It also enables the transfer of the Secretary of State of the Department for Business, Energy and Industrial Strategy (BEIS) existing regulatory powers in respect of oil and gas to the OGA. The Secretary of State's environmental regulatory functions in relation to oil and gas are not transferred to the OGA.

- Enables more comprehensive charging of the offshore oil and gas industry in relation to environmental regulatory functions carried out by BEIS.

- Makes local communities the primary decision makers on new onshore wind developments, alongside measures taken by the Department for Communities and Local Government. It removes the need for the Secretary of State of BEIS consent for large onshore wind farms (over 50 megawatt) in England and Wales under the Electricity Act 1989.

- Brings forward the early closure of the Renewables Obligation subsidy scheme to new onshore wind developments in Great Britain.

Electricity

The Government gave development consent to the Hornsea Project Two offshore wind farm off the coast of Yorkshire in August 2016. Once built, the windfarm will deliver 1,800 megawatts of low carbon electricity to around 1.8 million UK homes.

The Government gave consent in January 2016 for a new electric line connection, which will form a major part of the infrastructure needed for the transmission of electricity from Hinkley Point C nuclear power station. The project will be the first scheme to use the new T-pylon, which resulted from a competition held in 2011 by the Royal Institute of British Architects, BEIS and National Grid to explore the potential for a new generation of pylon design

Nuclear

Following a comprehensive review of the Hinkley Point C project, and a revised agreement with EDF, the Government in September 2016 decided to proceed with the first new nuclear power station for a generation. A new legal framework will be imposed on future foreign investment in Britain's critical infrastructure, which will include nuclear energy and apply after Hinkley.

BEIS news stories including press releases, speeches and statements are available here.

For major events in earlier years see the full version of this annex on the BEIS section of the GOV.UK website at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Standard conversion factors

This Digest uses the tonne of oil equivalent (toe) as the common unit of energy for comparing and aggregating fuels. The following table gives factors for converting between this unit and alternative units of energy found in this and other publications. (See Chapter 1, Technical notes and definitions and Annex A).

	to: Thousand toe	Terajoules (TJ)	Gigawatt hours (GWh)	Million therms
from:	multiply by			
Thousand toe	1	41.868	11.630	0.39683
Terajoules (TJ)	0.023885	1	0.27778	0.0094778
Gigawatt hours (GWh)	0.085985	3.6000	1	0.034121
Million therms	2.5200	105.51	29.307	1

A selection of estimated average gross calorific values

The following selection of estimated average gross calorific values apply to 2017. (For further information and more detailed calorific values see Annex A).

Solid fuels	**GJ per tonne**	**Renewable sources**	**GJ per tonne**
Coal		Domestic wood	16.3
All consumers (weighted average)	27.3	Industrial wood	20.3
Power stations (including imports)	26.7	Municipal solid waste	9.3
Iron and steel	30.4		
Other industries (weighted average)	26.7	**Petroleum**	
Imported coal (weighted average)	27.6	Crude oil (weighted average)	45.7
Exported coal (weighted average)	32.2	Petroleum products (weighted average)	46.2
		Motor spirit	47.1
Coke	29.8	Gas/diesel oil	45.4
Coke breeze	29.8	DERV	45.7
Other manufactured solid fuel	32.7	Fuel oil	43.3
Gases			
Natural gas (produced)	39.8		
Landfill gas	21-25		
Sewage gas	21-25		

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1 Victoria Street, London SW1H 0ET
www.gov.uk/beis