Department for Business, Energy & Industrial Strategy

DIGEST OF UNITED KINGDOM ENERGY STATISTICS 2016

July 2016

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Digest of United Kingdom Energy Statistics

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This is a National Statistics publication

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the UK Statistics Authority: Code of Practice for Official Statistics.

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

Any enquiries regarding this publication should be sent to us at energy.stats@decc.gsi.gov.uk

This publication is available for download at www.gov.uk/government/publications.

Contents

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

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

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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/collections/digest-of-uk-energy-statistics-dukes

II The current issue updates the figures given in the Department of Energy and Climate Change's (DECC) *Digest of United Kingdom Energy Statistics 2015*, published in July 2015.

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 2012 are included on the internet, and tables that show five years in this publication show eighteen years in their internet form because page sizes are not a limiting factor. In addition, the following appear on the internet:

Long term trends text and tables
Major events from 1990 to 2016 - Annex D
(only Major events for 2014 to 2016 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 5.67 to 5.73.

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 1.56 to 1.60.

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, BEIS 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 being 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 printed copy of the 2015 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 2016 when this Digest is published, revisions can be made to 2014 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. 2016) are published in *Energy Trends* in March of the following year (e.g. March 2017), percentage growth rates are liable to be distorted if the prior year (i.e. 2015) data are constrained to the Digest total, when revisions are known to be required. In these circumstances the prior year (i.e. 2015) 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 2016 data published in *Energy Trends* prior to publication in the 2017 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/assessment/code-of-practice/index.html. BEIS's statements of compliance with the Code are available at: www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy. 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.

Contacts

XXVIII For general enquiries on energy statistics contact:

BEIS Energy Statistics
(e-mail:energy.stats@decc.gsi.gov.uk)

or

Kevin Harris
(e-mail: kevin.harris@decc.gsi.gov.uk)

Department for Business, Energy and Industrial Strategy
Energy Statistics Team
6th Floor – Area B,
3 Whitehall Place,
London SW1A 2AW

Enquirers with hearing difficulties can contact the Department on 0300 060 4000. Overseas callers can contact the Department on +44 (20) 7979 7777.

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

Contact List

The following people in the Department for Business, Energy and Industrial Strategy may be contacted for further information about the topics listed:

Topic	Contact	Telephone 0300 068	E-mail
Total energy	Iain MacLeay	5048	Iain.MacLeay@decc.gsi.gov.uk
Solid fuels and derived gases	Chris Michaels	5050	coalstatistics@decc.gsi.gov.uk
Oil and upstream gas resources	Matthew Curds	8414	Matthew.Curds@decc.gsi.gov.uk
Petroleum (downstream)	Natalie Cartwright	5260	Natalie.Cartwright@decc.gsi.gov.uk
Gas supply (downstream)	James Halliwell	8121	James.Halliwell@decc.gsi.gov.uk
Electricity	Stephen Ashcroft	2928	electricitystatistics@decc.gsi.gov.uk
Renewable sources of energy	James Hemingway	5042	renewablesstatistics@decc.gsi.gov.uk
Combined heat and power	Liz Waters	5735	Elizabeth.Waters@decc.gsi.gov.uk
Prices and values, industrial, international and oil prices	Iain MacLeay	5048	Iain.MacLeay@decc.gsi.gov.uk
Regional and Local Authority Energy	Mita Kerai	5044	EnergyEfficiency.Stats@decc.gsi.gov.uk
Calorific values and conversion factors	Iain MacLeay	5048	Iain.MacLeay@decc.gsi.gov.uk
General enquiries	BEIS Energy Statistics		energy.stats@decc.gsi.gov.uk

For information on **North Sea profits, operating costs and investments** contact Mike Earp, Oil & Gas Authority, 0300 067 1604, Mike.Earp@oga.gsi.gov.uk

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

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Chapter 1
Energy

Key points

- In 2015, UK energy production was up 9.6 per cent on a year earlier, its first increase since 1999. The rise was driven by strong growth in UK Continental Shelf output with both oil and gas output up. There was also strong growth in renewable electricity production. However, coal output decreased to record low levels. (Tables 1.1 and 1.2).

- Imports in 2015 were down, with exports up; as a result net imports decreased though they still accounted for 38 per cent of energy used in the UK.

- Primary energy consumption was up 0.4 per cent; but on a temperature adjusted basis primary energy consumption was down 0.8 per cent continuing the downward trend of the last ten years. UK temperatures were above normal, but colder compared to the record warm weather in 2014. (Table 1.1.7).

- Final energy consumption rose by 1.7 per cent as demand for heating increased with temperature adjusted final energy consumption broadly unchanged on 2014 levels. (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 account for 82 per cent, a record low level. Supply from renewables increased, with their contribution accounting for 8.3 per cent of final consumption on the EU agreed basis (see Chapter 6).

- In 2015, there was a further switch in the main sources of electricity generation away from the fossil fuel of coal to more low carbon generation. Generation from coal fell by 25 per cent, as a number of plants closed or switched to burning biomass; gas fell marginally by 0.9 per cent; nuclear output rose by 10 per cent with renewables up by 29 per cent. The overall renewables share of generation increased to a record 25 per cent share of generation.

- Provisional BEIS estimates suggest that overall emissions fell by 17 million tonnes of carbon dioxide ($MtCO_2$) (4.1 per cent) to 404.7 $MtCO_2$ between 2014 and 2015, 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, 2015. 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. Table 1.8 covers final energy consumption by the main industrial sectors over the last five years, followed by Table 1.9, which shows the fuels used for electricity generation by these industrial sectors. 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) for production, consumption, and expenditure on energy, as well as

long term temperature data and analyses such as the relationship between energy consumption and the economy of the UK are available on BEIS's energy statistics web site at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Calorific values when producing energy statistics

1.3 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.

The energy industries

1.4 **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 2015, based on the latest available data from the Office for National Statistics (ONS):

- 2.5 per cent of GDP;
- 12 per cent of total investment;
- 35 per cent of industrial investment in 2015;
- 159,000 people directly employed (5.6 per cent of industrial employment);
- Many others indirectly employed (e.g. an estimated 160,000 in support of UK Continental Shelf activities).

1.5 The share of GDP at 2.5 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 the latest fall taking energy's share of the UK economy to its lowest level for over 40 years. The latest fall is largely due to the decline in the price of oil; which fell by around 45 per cent in 2015. In 2015 investment in the energy industries fell back from the recent high levels with reduced spending for oil and gas extraction. Employment has remained broadly unchanged in the last seven years, but up from 10 years ago.

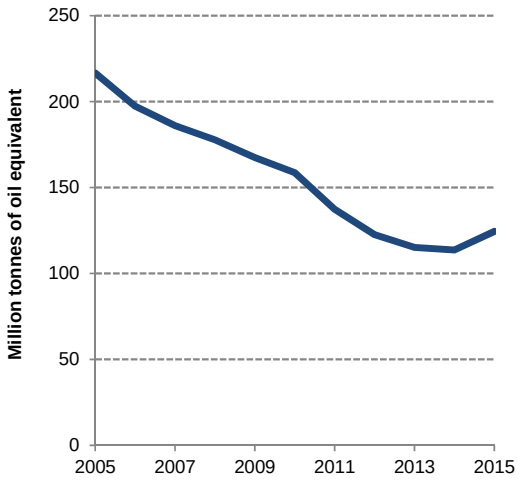
Aggregate energy balance (Tables 1.1, 1.2 and 1.3)

1.6 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 1.29 for other energy units.

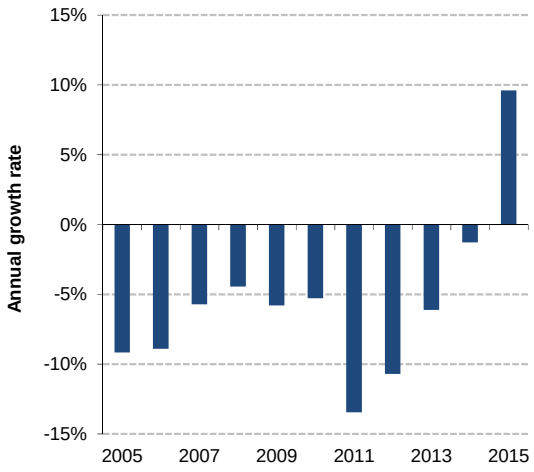
1.7 Indigenous **production in 2015 was 9.6 per cent higher than in 2014** (Chart 1.1). This is the first rise in UK energy production since 1999. Production has fallen in each of the previous 15 years, mainly due to declines in output from the UK Continental Shelf (UKCS). However, despite the rise in output in 2015, production is 58 per cent below its peak in 1999. The rise in 2015 was mainly due to increased output from the UKCS, with crude oil production up 13 per cent, and with gas production up 7.6 per cent. This growth was mainly down to new fields commencing production, but also due to less maintenance activity taking place in 2015. Other significant sources of growth were from primary electricity production, with wind and solar photovoltaics output both up sharply on increased capacity and due to higher wind speeds. Bioenergy production was also up and helped to offset the impact on growth of the reduction in coal production. Coal output fell sharply, down 26 per cent with a number of mines closing and others producing less coal as they near the end of their productive life. More details on these changes are given in the later fuel specific chapters.

Chart 1.1: UK energy production

Level

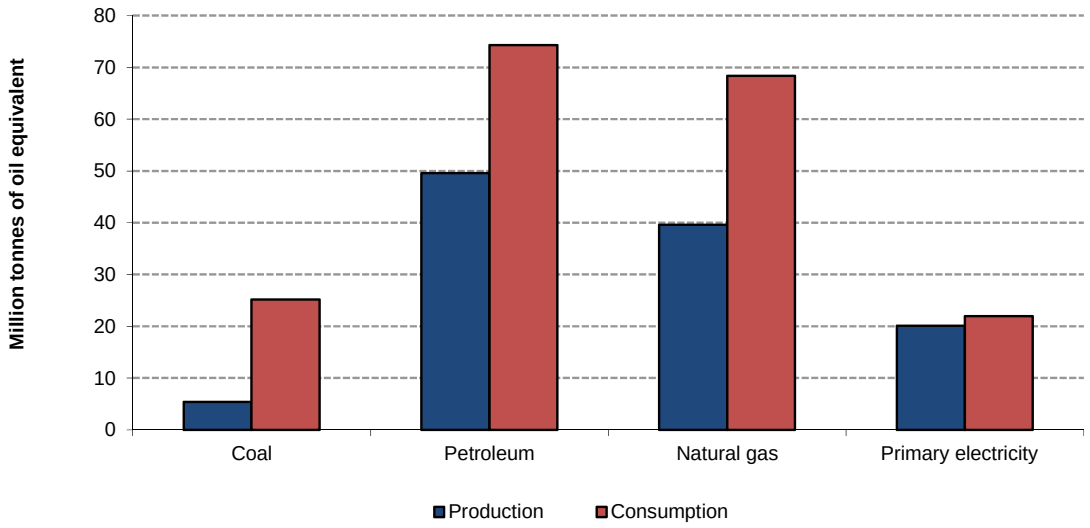


Annual growth rate



1.8 **In 2015, the primary supply of fuels was 203.0 million tonnes of oil equivalent (mtoe), a 1.0 per cent increase compared to 2014**. Chart 1.2 illustrates the figures for the production and consumption of individual primary fuels in 2015. In 2015, 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.

Chart 1.2: Production and consumption of primary fuels 2015



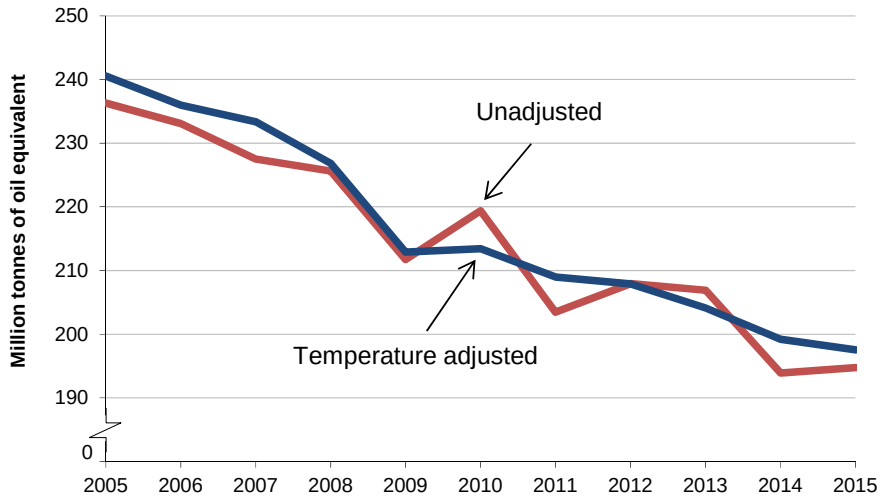
Note: Includes non-energy use of petroleum and gas. Differences between consumption and production are made up by foreign trade, marine bunkers and stock changes.

However, 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 2015 at 154.8 million toe fell back by 6.1 per cent from last year level and are down 13 per cent from their peak in 2013. Exports at 76.7 million toe were up 8.5 per cent with increases in both crude oil and gas exports. The UK remained a net importer of all main fuel types in 2015. In 2015 the UK net import gap fell back to 78.2

million toe from the 2013 peak of 102 million toe. **Net imports accounted for 38 per cent of energy used in the UK in 2015, down from their share of 46 per cent in 2014.**

1.9 Total primary energy demand was 0.5 per cent higher in 2015 than in 2014 at 202.5 mtoe. The very small difference between demand and supply is classed as the statistical difference, which is explained in paragraph 1.62. The slight rise in demand compared to a year earlier was mainly due to temperatures in 2015 being below those in the UK's record warm year of 2014. Temperatures in 2015 were above average but 0.6 degrees Celsius cooler than those in 2014 resulting in increased demand for heating compared to a year earlier. There has been a general trend since 2005 for underlying demand to fall. Primary energy consumption (primary supply less non-energy use) was up by 0.4 per cent in 2015**. On a temperature corrected basis, primary energy consumption was estimated to have fallen by 0.8 per cent.** A table showing temperature corrected demand is shown in Table 1.1.4 in the internet annex on long term trends, while Chart 1.3 shown below, shows the continued fall in primary energy consumption. Chart 1.4 shows the composition of primary demand in 2015.

Chart 1.3: Primary energy consumption

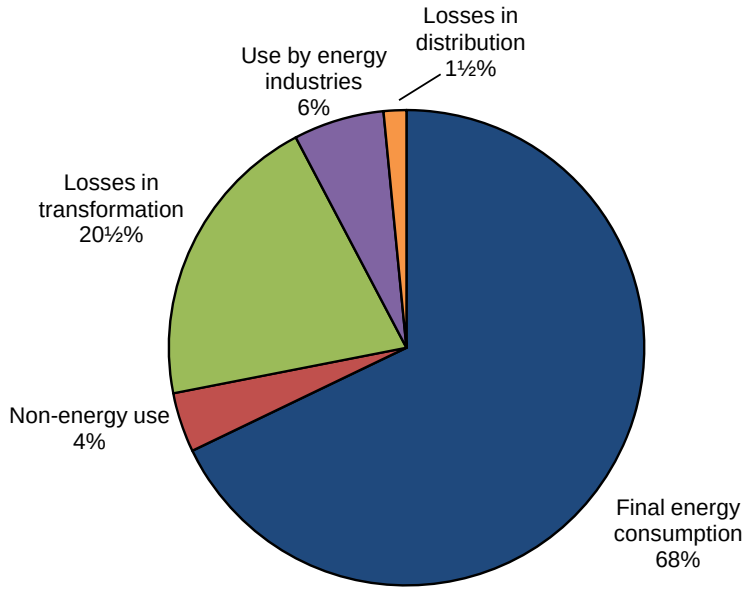


1.10 The transformation section of the energy balance shows, for each fuel, the net inputs for transformation uses. For example, Table 1.1 shows that 2,812 thousand tonnes of oil equivalent of coal feeds into the production of 2,636 thousand tonnes of oil equivalent of coke, representing a loss of 176 thousand tonnes of oil equivalent in the manufacture of coke in 2015. In 2015, energy losses during the production of electricity and other secondary fuels amounted to 41.2 million tonnes of oil equivalent, (20 per cent of primary supply) shown in the transformation row in Table 1.1.

1.11 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.

1.12 In 2015, gas accounted for 30 per cent of UK generation a similar proportion to that in 2014. Coal's share declined further accounting for a 22 per cent share; this is down sharply from a share of just under 40 per cent in 2012 and a share of 30 per cent in 2014. This decline is due to the closure of several power stations and the conversion of another to using biomass. The decline of 7.3 percentage points (ppts) from coal was offset by increases from wind and solar (up 3.5 ppts), biomass (up 2.0 ppts) and nuclear (up 1.9 ppts). Nuclear increased due to a reduced number of outages whilst renewable sources (biomass, wind & solar) were up on increased capacity. More details on electricity are available in Chapter 5, with increased information on renewable generation available in Chapter 6. Data in the energy balance tables show fuel inputs and overall generation but do not directly show the generation from each specific fuel, this detail is available in Table 5.5 in Chapter 5.

Chart 1.4: Primary demand 2015



Primary demand: 202.5 million tonnes of oil equivalent

1.13 This switch from coal to non-fossil fuel sources (wind, nuclear and biomass) have resulted in a **sharp decrease in carbon dioxide emissions between 2014 and 2015**. Provisional BEIS estimates suggest that overall emissions fell by 17.2 million tonnes of carbon dioxide ($MtCO_2$) (4.1 per cent) to 404.7 $MtCO_2$ between 2014 and 2015. 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.

1.14 The energy industry use section of the table represents use of fuels by the energy industries themselves. 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 2015, energy industry use amounted to 12.5 million tonnes of oil equivalent of energy (6.2 per cent of primary demand), slightly up on 2014 reflecting the increased demand from energy extraction in the North Sea. This series broadly follows the trend in UK energy production, so has generally been falling since 2000.

1.15 Losses presented in the energy balance include distribution and transmission losses in the supply of manufactured gases, natural gas, and electricity. Recorded losses have been broadly unchanged for the last four years.

1.16 Total **final consumption**, which includes non-energy use of fuels, was 145.7 million tonnes of oil equivalent in 2015; this is a 3.4 million tonnes of oil equivalent increase, **2.4 per cent up, on the consumption in 2014.** The majority of this increase was from the domestic sector, where consumption rose by 3.6 per cent. This rise in consumption was mainly due to the slightly cooler weather in 2015 compared to 2014, as mentioned earlier in this Chapter. It is likely that the rise would have been larger, but for the contribution from improvements in energy efficiency. On average over 50,000 energy efficiency improvements have been installed in UK domestic properties in each month over the past two years[1]. **On a temperature adjusted basis domestic consumption is estimated to have fallen by 1.0 per cent**, slightly below the average fall of 2.1 per cent per annum seen since 2004. Consumption in the transport sector rose by 1.3 per cent, this rise taking consumption to its highest level since 2009 is likely due to increased demand resulting from lower prices as petroleum product prices fell sharply during the year. More details on these are published in Quarterly Energy

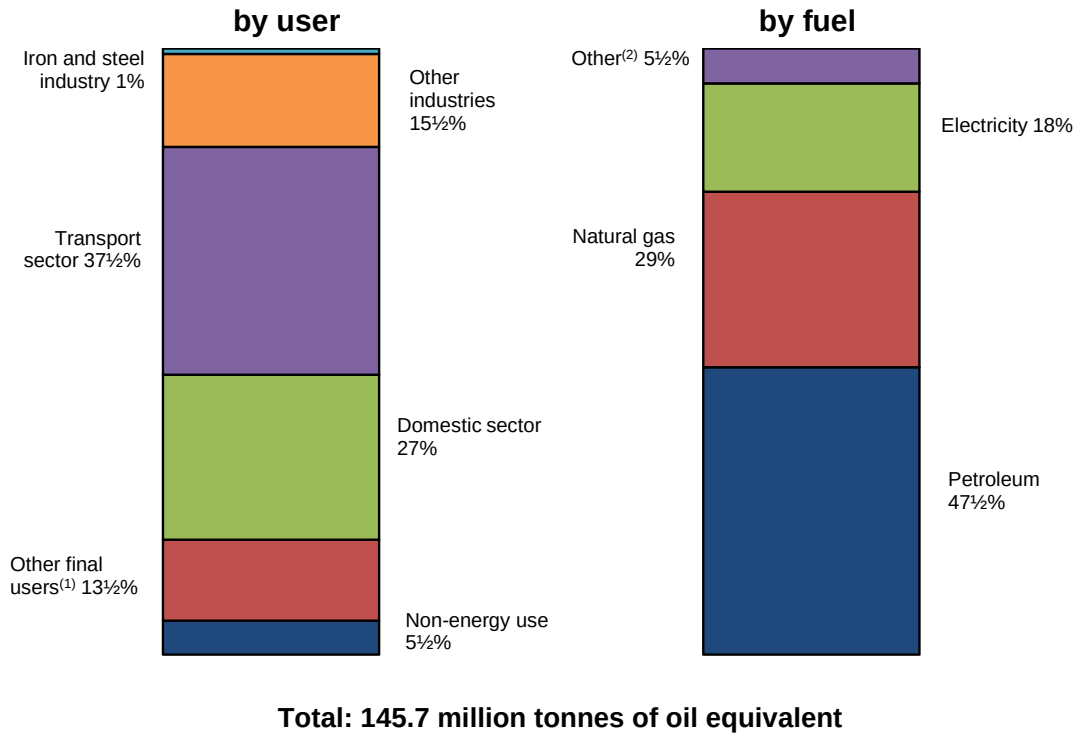
[1] www.gov.uk/government/collections/household-energy-efficiency-national-statistics

Prices[2]. Consumption in the service sector increased by 1.8 per cent on increased heating demand, whilst consumption in the industrial sector fell marginally by 0.5 per cent. There was also a large rise in non-energy use, which rose sharply following three years of lower purchases; this is discussed in Chapter 3.

1.17 Final consumption in 2015 is accounted for by the transport sector (37.6 per cent), the domestic sector (27.2 per cent), the industrial sector (16.2 per cent), the services sector (13.3 per cent) and non-energy use (5.6 per cent). These figures are illustrated in Chart 1.5. Recent trends in industrial consumption are shown in Table 1.8 and are discussed in paragraph 1.27. Final energy consumption (where non-energy use is excluded) was up by 1.7 per cent on the year. On a temperature corrected basis final energy consumption was estimated to be broadly unchanged in 2015 compared to 2014, but is down by an average of 1.5 per cent per annum over the last 10 years.

1.18 The main fuels used by final consumers in 2015 were petroleum products (47.5 per cent), natural gas (28.9 per cent) and electricity (17.9 per cent). Biofuels accounted for 3.2 per cent of final consumption. The amount of heat that was bought for final consumption accounted for 0.8 per cent of the total final energy consumption.

Chart 1.5: Final consumption 2015



Total: 145.7 million tonnes of oil equivalent

(1) Includes services and agricultural sectors.
(2) Includes coal, manufactured fuels, renewables & waste, and heat sold.

1.19 Of the petroleum products consumed by final users 11.1 per cent was for non-energy purposes; for natural gas 1.1 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 2015 is shown in Table 1A. Further details of non-energy use are given in Chapter 2 paragraph 2.34, Chapter 3, paragraph 3.39 and Chapter 4, paragraph 4.24.

[2] www.gov.uk/government/collections/quarterly-energy-prices

Table 1A: Non-energy use of fuels 2015

Thousand tonnes of oil equivalent

	Petroleum	Natural gas	Manufactured fuel
Petrochemical feedstocks	4,944	453	98
Other	2,728	-	-
Total	**7,673**	**453**	**98**

1.20 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.

Table 1B: Net import dependency 2013 to 2015

Thousand tonnes of oil equivalent

	2013	2014	2015
Net imports	101,934	94,326	78,179
Primary energy supply + bunkers	217,074	204,017	205,595
Net import dependency	47.0%	46.2%	38.0%

1.21 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 2015, the share of energy from fossil fuels decreased further to a record low of 82.0 per cent**, whilst that from low-carbon sources increased from having a 14.3 per cent to a 16.5 per cent share. The largest component of this series is currently nuclear; its share of energy supplied increased from 7.1 per cent to 7.9 per cent in 2015. There was a rise also in the share from renewables; with increases in wind output, solar pv, hydro and bioenergy. 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" 8.3 per cent share of final energy consumption in 2015 (the normalisation process takes out weather effects from this statistic; see paragraph 6.54). 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 2013 to 2015

Per cent

	2013	2014	2015
Fossil fuel	85.8%	84.3%	82.0%
Low-carbon	13.2%	14.3%	16.5%
Other	0.9%	1.4%	1.5%

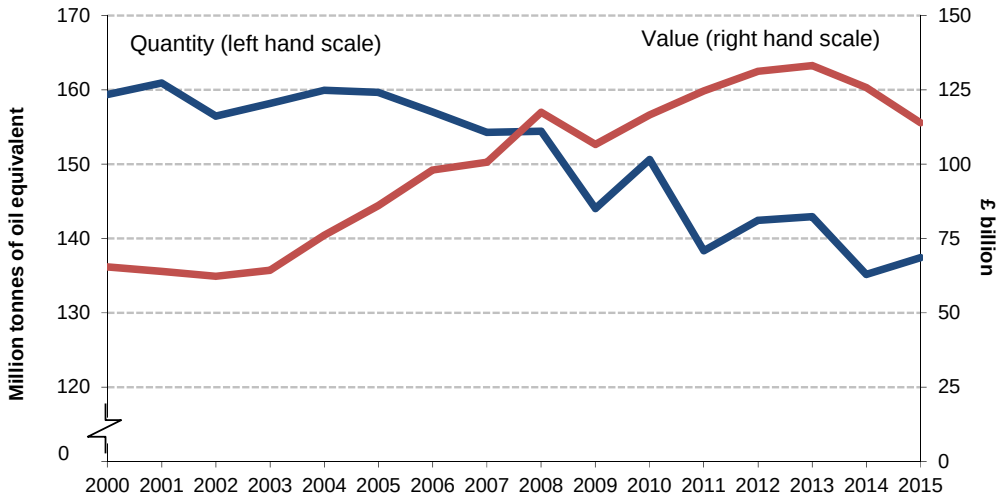
Value balance of traded energy (Tables 1.4, 1.5 and 1.6)

1.22 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. 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.

1.23 **Total expenditure by final consumers** in 2015 is estimated at £113,810 million, (£113,475 million shown as actual final consumption and £335 million of coal consumed by the iron and steel sector in producing coke for their own consumption). This **is down by 9.5 per cent on 2014**, with the most significant changes being the reduced price for crude and petroleum products. In 2015, crude oil prices averaged $52 per barrel, down sharply compared to the average of just under $100 per barrel in 2014, which was itself down from the average $110 per barrel in the three previous years. Chart 1.6 shows energy consumption and expenditure by final users.

1.24 The value balance demonstrates how the value chain works in the production and consumption of energy. For example, in 2015, £12,260 million of crude oil was indigenously produced, of which £9,920 million was exported; and £13,365 million of crude oil was imported. Allowing for stock changes, this provides a total value of UK inland crude oil supply of £15,715 million. This fuel was then completely consumed within the petroleum industry in the process of producing £22,790 million of petroleum products. Again, some external trade and stock changes took place before arriving at a basic value of petroleum products of £25,450 million. In supplying the fuel to final consumers, distribution costs were incurred and some profit was made amounting to £2,005 million, whilst duty and tax meant a further £32,540 million was added to the basic price to arrive at the final market value of £60,265 million. This was the value of petroleum products purchased, of which industry purchased £1,650 million, domestic consumers for heating purposes purchased £975 million, with the vast majority £52,990 million, purchased by the transport sector.

Chart 1.6: Energy consumption and estimated expenditure on energy by final users



1.25 Of the total final expenditure on energy in 2015 (£114 billion), the biggest share, 49 per cent, fell to the transport sector. Industry purchased 10 per cent (£11 billion), the domestic sector purchased 29 per cent (£33 billion), with the remaining 12 per cent (£14 billion) purchased by the service sector.

Sales of electricity and gas by sector (Table 1.7)

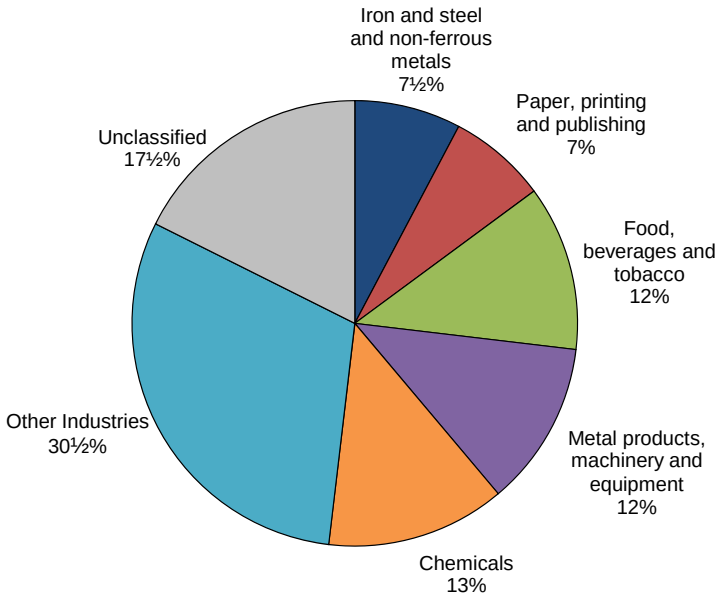
1.26 Table 1.7 shows broad estimates for the total value of electricity and gas to final consumption. Net selling values provide some indication of typical prices paid in broad sectors and can be of use to supplement more detailed and accurate information contained in the rest of this chapter. More detailed 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

Energy consumption by main industrial groups (Table 1.8)

1.27 This table presents final energy consumption for the main industrial sub-sectors over the last five years. So far as is practicable, the user categories have been regrouped on the basis of the 2007 Standard Industrial Classification (see paragraphs 1.56 to 1.60). However, some data suppliers have

difficulty in classifying consumers to this level of detail and the breakdown presented in these tables must therefore be treated with caution. The groupings used are consistent with those used in Table 1.9 which shows industrial sectors' use of fuels for generation of electricity (autogeneration). In 2015, 23.6 million tonnes of oil equivalent were consumed by the main industrial groups. The largest consuming groups were chemicals (13.0 per cent), metal products, machinery and equipment (12.0 per cent), food, beverages and tobacco (12.0 per cent), iron and steel and non-ferrous metals (7.7 per cent), and paper, printing and publishing (7.2 per cent). The figures are illustrated in Chart 1.7. The large other industries sector includes mineral products (11.5 per cent) as well as a number of the smaller energy consuming sectors. For some fuels, biofuels and also some petroleum products, no breakdown of use by industrial sector is available – so this consumption is shown as unclassified.

Chart 1.7: Energy consumption by main industrial groups 2015



Total final energy consumption by industry
23.6 million tonnes of oil equivalent

Fuels consumed for electricity generation by main industrial groups (autogeneration) (Table 1.9)

1.28 This table gives details of the amount of each fuel consumed by industries in order to generate electricity for their own use. Fuel consumption is consistent with the figures given for "other generators" in Table 5.3 of Chapter 5. The term autogeneration is explained further in paragraphs 1.33 and 1.34. Electricity produced via autogeneration is included within the figures for electricity consumed by industrial sectors in Table 1.8. Table 1.9 has been produced using the information currently available and shows the same sector detail as Table 1.8, data cannot be given in as much detail as in the individual commodity balances and the energy balance because it could disclose information about individual companies. Table 1.9 allows users to allocate the fuel used for autogeneration to individual industry groups in place of the electricity consumed. Further information on the way Table 1.9 links with the other tables is given in paragraph 1.34.

Technical notes and definitions

I Units and measurement of energy

Units of measurement

1.29 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.

Thermal content - energy supplied basis of measurement

1.30 Tables 1.1 to 1.3, 1.8 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 1.54).

1.31 Estimated gross and net calorific values for 2015 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 Table 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 42.9 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 5.9 (39.1 per cent in 2015). (See Chapter 5, paragraphs 5.75 and 5.83).

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 3.39.

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 1.9, and 5.1 to 5.5. Table 1.9 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 1.9. 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 7.42. 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.

1.41 All figures are estimates and have been rounded to the nearest £5 million.

Fuel definitions in value balances

1.42 **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

1.43 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

1.44 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.6. **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)

1.45 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

1.46 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

1.47 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.

1.48 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

1.49 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

1.50 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 2015 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 2015 – 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	75	0	24	1	100	Industry	8	17	35	35	5	100
Petroleum	6	87	4	3	100	Transport	0	97	-	1	2	100
Gas	19	-	60	20	100	Domestic	1	6	64	24	5	100
Electricity	31	1	36	32	100	Others	0	9	44	44	3	100
Bioenergy	24	21	45	11	100							
All fuels	**17**	**40**	**29**	**14**	**100**	**All users**	**2**	**45**	**31**	**19**	**3**	**100**

Table 1E: Total primary fuel consumption by final users in 2015 - 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	36	1	34	29	100	Industry	24	11	40	16	9	100
Petroleum	7	86	4	3	100	Transport	1	96	0	1	2	100
Gas	24	0	51	24	100	Domestic	15	5	58	13	9	100
Primary electricity	31	1	36	32	100	Others	21	6	46	19	9	100
Bioenergy	28	9	39	25	100							
All fuels	**21**	**30**	**30**	**18**	**100**	**All users**	**13**	**34**	**35**	**11**	**7**	**100**

1.51 In 2015, every 1 toe of secondary electricity consumed by final users required, on average, 0.8 toe of coal, 0.8 toe of natural gas, 0.6 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.

1.52 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 2015

Percentage of each sector

	Solid fuels	Petroleum	Gas	Secondary electricity	Heat	Biofuels	Total
Industry	7	14	17	60	2	1	100
Transport	-	96	-	1	-	4	100
Domestic	1	3	43	51	-	2	100
Others	-	6	18	75	1	-	100
All users	**1**	**50**	**16**	**30**	**0**	**2**	**100**

Systems of measurement - international statistics

1.53 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

1.54 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 via the internet.

V Definitions of fuels

1.55 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 (C_5 or heavier) and petroleum gases other than methane C_1, that is ethane C_2, propane C_3 and butane C_4, 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 C_1 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 5.67 to 5.73.
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

1.56 The Digest has been prepared, as far as is practicable, on the basis of the *Standard Industrial Classification (SIC)2007* (www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/standard-industrial-classification/index.html). 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.

1.57 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.

1.58 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 1.58
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.

1.59 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

1.60 In Tables 1.8 and 1.9 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 Tables 1.8 and 1.9

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

1.61 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

1.62 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

1.63 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 restricted to two years only. Next year revisions for earlier years are likely as further methodological improvements are made. Key methodological changes this year include a change in the treatment of backflows from petrochemical companies to refineries for re-processing. More details of this change can be found in paragraphs 3.18, 3.58 and 3.59. Also, following consultation with industry and as a result of an expanded data collection, revisions have been made for oil product consumption for international bunkers and national navigation.

.

Table 1J: Revisions since DUKES 2015

Thousand tonnes of oil equivalent

	2012	2013	2014	Percentage revisions to 2014 data
Indigenous production	-	183	716	0.6%
Primary supply	-	-523	46	0.0%
Primary demand	-	-664	-28	0.0%
Transformation	-	-215	-322	0.7%
Energy industry use	-	-3	254	2.2%
Final consumption	-	-871	-611	-0.4%
Industry	-	-376	-268	-1.1%
Transport	-	-73	-51	-0.1%
Other	-	62	176	0.3%
Non energy use	-	-484	-468	-6.2%

Contact: *Iain MacLeay*
Energy Statistics Team
iain.macleay@decc.gsi.gov.uk
0300 068 5048

1.1 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										
Indigenous production	5,384	-	49,544	-	39,621	9,862	20,136	-	-	124,547
Imports	15,950	806	55,278	34,804	42,337	3,717	-	1,953	-	154,846
Exports	-290	-79	-36,813	-25,073	-13,893	-366	-	-153	-	-76,667
Marine bunkers	-	-	-	-2,593	-	-	-	-	-	-2,593
Stock change*(4)*	+3,342	+46	-18	-804	+302	-	-	-	-	+2,868
Primary supply	**24,387**	**772**	**67,991**	**6,333**	**68,368**	**13,213**	**20,136**	**1,800**	**-**	**203,001**
Statistical difference*(5)*	+160	+4	-32	+92	+157	-	-	+144	-	+524
Primary demand	**24,227**	**769**	**68,023**	**6,241**	**68,211**	**13,213**	**20,136**	**1,657**	**-**	**202,477**
Transfers	-	+34	-1,459	+1,481	-36	-	-4,657	+4,657	-	+21
Transformation	**-22,445**	**863**	**-66,564**	**65,749**	**-20,497**	**-8,526**	**-15,479**	**24,264**	**1,423**	**-41,212**
Electricity generation	-18,245	-783	-	-598	-18,313	-8,449	-15,479	24,264	-	-37,603
Major power producers	-18,233	-	-	-204	-15,989	-4,060	-15,479	21,791	-	-32,175
Autogenerators	-12	-783	-	-394	-2,323	-4,389	-	2,473	-	-5,429
Heat generation	-132	-51	-	-62	-2,184	-76	-	-	1,423	-1,084
Petroleum refineries	-	-	-67,015	66,975	-	-	-	-	-	-40
Coke manufacture	-2,812	2,636	-	-	-	-	-	-	-	-176
Blast furnaces	-1,098	-1,103	-	-	-	-	-	-	-	-2,201
Patent fuel manufacture	-157	164	-	-71	-	-	-	-	-	-64
Other(7)	-	-	450	-494	-	-	-	-	-	-44
Energy industry use	**-**	**716**	**-**	**4,354**	**4,959**	**-**	**-**	**2,186**	**270**	**12,485**
Electricity generation	-	-	-	-	-	-	-	1,434	-	1,434
Oil and gas extraction	-	-	-	756	4,307	-	-	52	-	5,115
Petroleum refineries	-	-	-	3,598	99	-	-	414	270	4,380
Coal extraction	-	-	-	-	15	-	-	43	-	58
Coke manufacture	-	329	-	-	-	-	-	4	-	333
Blast furnaces	-	387	-	-	28	-	-	30	-	445
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	84	-	84
Other	-	-	-	-	511	-	-	126	-	637
Losses	**-**	**228**	**-**	**-**	**559**	**-**	**-**	**2,361**	**-**	**3,147**
Final consumption	**1,782**	**722**	**-**	**69,118**	**42,160**	**4,688**	**-**	**26,031**	**1,152**	**145,653**
Industry	**1,342**	**457**	**-**	**3,935**	**8,123**	**1,102**	**-**	**7,940**	**695**	**23,594**
Unclassified	-	12	-	3,046	1	1,102	-	-	-	4,160
Iron and steel	31	446	-	6	462	-	-	317	-	1,263
Non-ferrous metals	13	-	-	0	170	-	-	378	-	561
Mineral products	673	-	-	179	1,353	-	-	520	-	2,725
Chemicals	47	-	-	121	1,301	-	-	1,342	260	3,070
Mechanical engineering etc	8	-	-	-	494	-	-	542	-	1,044
Electrical engineering etc	4	-	-	1	212	-	-	513	-	730
Vehicles	42	-	-	198	398	-	-	414	-	1,052
Food, beverages etc	38	-	-	106	1,765	-	-	923	-	2,832
Textiles, leather etc	46	-	-	42	439	-	-	230	-	757
Paper, printing etc	71	-	-	29	676	-	-	911	-	1,687
Other industries	364	-	-	32	491	-	-	1,734	435	3,056
Construction	5	-	-	175	361	-	-	115	-	656
Transport *(6)*	**9**	**-**	**-**	**53,412**	**-**	**1,003**	-	**385**	**-**	**54,810**
Air	**-**	**-**	**-**	12,573	**-**	**-**	**-**	**-**	**-**	12,573
Rail	9	**-**	**-**	663	**-**	**-**	**-**	377	**-**	1,049
Road	**-**	**-**	**-**	39,510	**-**	1,003	**-**	8	**-**	40,521
National navigation	**-**	**-**	**-**	667	**-**	**-**	**-**	**-**	**-**	667
Pipelines	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	-
Other	**430**	**167**	-	**4,098**	**33,584**	**2,582**	**-**	**17,706**	**458**	**59,026**
Domestic	417	167	-	2,455	25,143	2,088	**-**	9,300	52	39,623
Public administration	5	-	-	330	3,172	121	**-**	1,653	389	5,670
Commercial	4	-	-	678	4,322	63	**-**	6,402	17	11,485
Agriculture	-	-	-	365	76	310	**-**	351	-	1,103
Miscellaneous	5	-	-	270	871	0	-	-	-	1,146
Non energy use	**-**	**98**	**-**	**7,673**	**453**	**-**	**-**	**-**	**-**	**8,223**

(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 5.12 regarding electricity use in transport and 6.41 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.2 Aggregate energy balance 2014
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										
Indigenous production	7,289	-	43,705r	-	36,831r	8,347r	17,453r	-	-	113,626r
Imports	27,581r	669	58,676r	31,826r	41,001r	3,203r	-	1,999r	-	164,954r
Exports	-319r	-80	-33,774r	-24,848r	-11,013r	-361r	-	-234r	-	-70,629r
Marine bunkers	-	-	-	-3,004r	-	-	-	-	-	-3,004r
Stock change*(4)*	-3,241r	-151	-648r	309r	-205r	-	-	-	-	-3,935r
Primary supply	**31,310r**	**439**	**67,960r**	**4,284r**	**66,614r**	**11,189r**	**17,453r**	**1,764r**	**-**	**201,013r**
Statistical difference*(5)*	+24r	-4r	-56r	-125r	-109r	-	-	-104r	-	-374r
Primary demand	**31,285r**	**442r**	**68,016r**	**4,409r**	**66,723r**	**11,189r**	**17,453r**	**1,868r**	**-**	**201,386r**
Transfers	-	+9	-1,778r	1,778r	-12	-	-3,603r	3,603r	-	-3r
Transformation	**-29,234r**	**+1,451r**	**-66,238r**	**+65,001r**	**-20,935r**	**-6,877r**	**-13,850r**	**25,227r**	**1,445r**	**-44,010r**
Electricity generation	-23,948r	-914r	-	-547r	-18,731r	-6,815r	-13,850r	25,227r	-	-39,578r
Major power producers	-23,936r	-	-	-176	-16,330	-3,156	-13,850r	22,918	-	-34,531r
Autogenerators	-12r	-914r	-	-371r	-2,401r	-3,659r	-	2,309r	-	-5,047r
Heat generation	-169r	-51	-	-65r	-2,204r	-62r	-	-	1,445r	-1,105r
Petroleum refineries	-	-	-66,677r	66,172r	-	-	-	-	-	-505r
Coke manufacture	-3,784	3,450	-	-	-	-	-	-	-	-334
Blast furnaces	-1,150	-1,229	-	-	-	-	-	-	-	-2,379
Patent fuel manufacture	-183	195	-	-78	-	-	-	-	-	-66
Other(7)	-	-	439r	-482r	-	-	-	-	-	-44r
Energy industry use	**0**	**802**	**-**	**4,097r**	**4,494r**	**-**	**-**	**2,193r**	**285**	**11,873r**
Electricity generation	-	-	-	-	-	-	-	1,417r	-	1,417r
Oil and gas extraction	-	-	-	717r	3,903r	-	-	46r	-	4,666r
Petroleum refineries	-	-	-	3,380r	98r	-	-	419r	285	4,182r
Coal extraction	0	-	-	-	14	-	-	57r	-	72r
Coke manufacture	-	381	-	-	-	-	-	7	-	388
Blast furnaces	-	421	-	-	29	-	-	38	-	488
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	86	-	86
Other	-	-	-	-	450r	-	-	123r	-	573r
Losses	**-**	**216**	**-**	**-**	**590r**	**-**	**-**	**2,464r**	**-**	**3,270r**
Final consumption	**2,051r**	**884r**	**-**	**67,090r**	**40,692r**	**4,312r**	**-**	**26,042r**	**1,160r**	**142,232r**
Industry	**1,603r**	**566r**	**-**	**4,059r**	**8,026r**	**776r**	**-**	**7,976r**	**713r**	**23,718r**
Unclassified	-	46	-	3,209r	1	776r	-	-	-	4,031r
Iron and steel	38	520r	-	6r	469r	-	-	326r	-	1,359r
Non-ferrous metals	15	-	-	0r	171r	-	-	385r	-	571r
Mineral products	808r	-	-	183r	1,303r	-	-	539r	-	2,834r
Chemicals	65r	-	-	103r	1,251r	-	-	1,326r	281r	3,026r
Mechanical engineering etc	10	-	-	-	502r	-	-	594r	-	1,106r
Electrical engineering etc	5	-	-	1r	214r	-	-	491r	-	711r
Vehicles	49r	-	-	174r	368r	-	-	415r	-	1,006r
Food, beverages etc	45r	-	-	117r	1,761r	-	-	915r	-	2,838r
Textiles, leather etc	52r	-	-	43r	444r	-	-	234r	-	773r
Paper, printing etc	93r	-	-	28r	668r	-	-	923r	-	1,712r
Other industries	416r	-	-	28r	508r	-	-	1,708r	432r	3,092r
Construction	5	-	-	167r	366	-	-	120r	-	658r
Transport *(6)*	**9**	**-**	**-**	**52,487r**	**-**	**1,243r**	-	**387r**	**-**	**54,126r**
Air	-	**-**	**-**	12,419	**-**	**-**	-	-	-	12,419
Rail	9	**-**	**-**	676r	**-**	**-**	-	381r	-	1,067r
Road	-	**-**	**-**	38,713	**-**	1,243r	-	6	-	39,962r
National navigation	-	**-**	**-**	679r	**-**	**-**	-	-	-	679r
Pipelines	-	**-**	**-**	-	**-**	**-**	-	-	-	-
Other	**438r**	**182**	-	**4,055r**	**32,199r**	**2,294r**	-	**17,678r**	**447r**	**57,295r**
Domestic	413r	182	-	2,529r	23,912	1,829r	-	9,314r	52	38,232r
Public administration	17r	-	-	334r	3,179r	120r	-	1,591r	384r	5,624r
Commercial	4	-	-	615r	4,165r	56	-	6,443r	12r	11,295r
Agriculture	-	-	-	311r	76r	289r	-	331r	-	1,006r
Miscellaneous	5r	-	-	266r	867r	0	-	-	-	1,138r
Non energy use	-	**136**	-	**6,490r**	**467**	-	-	-	-	**7,093r**

(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 5.12 regarding electricity use in transport and 6.41 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.3 Aggregate energy balance 2013
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										
Indigenous production	7,973	-	44,468	-	36,523	7,665r	18,462r	-	-	115,091r
Imports	32,122	593	64,489r	31,138r	46,011	2,203r	-	1,507r	-	178,064r
Exports	-447r	-83	-36,192	-29,463	-9,429	-247r	-	-267r	-	-76,130r
Marine bunkers	-	-	-	-2,881r	-	-	-	-	-	-2,881r
Stock change(4)	-793r	-87r	+791	+84	+53	-	-	-	-	+48r
Primary supply	**38,855r**	**423r**	**73,556r**	**-1,122r**	**73,157**	**9,621r**	**18,462r**	**1,240r**	**-**	**214,192r**
Statistical difference(5)	+74r	+0r	-104r	-113r	+72r	-	-	-86r	-	-157r
Primary demand	**38,781r**	**423r**	**73,660r**	**-1,009r**	**73,085r**	**9,621r**	**18,462r**	**1,326r**	**-**	**214,349r**
Transfers	-	+5	-2,122	+2,117	-5	-	-3,019r	+3,019r	-	-5
Transformation	**-36,831r**	**1,519r**	**-71,538r**	**70,400r**	**-19,791r**	**-5,577r**	**-15,443r**	**27,546r**	**1,347r**	**-48,368r**
Electricity generation	-31,329r	-939	-	-580r	-17,702r	-5,547r	-15,443r	27,546r	-	-43,994r
Major power producers	-31,309	-	-	-231	-15,065	-2,403	-15,443r	25,301	-	-39,150r
Autogenerators	-21r	-939	-	-349r	-2,636r	-3,144r	-	2,245r	-	-4,845r
Heat generation	-225r	-51	-	-60r	-2,090r	-30r	-	-	1,347r	-1,109r
Petroleum refineries	-	-	-72,037r	71,682r	-	-	-	-	-	-354r
Coke manufacture	-4,020	3,574r	-	-	-	-	-	-	-	-446r
Blast furnaces	-1,073	-1,304	-	-	-	-	-	-	-	-2,376
Patent fuel manufacture	-184	239	-	-95	-	-	-	-	-	-40
Other(7)	**-**	**-**	499r	-548r	-	-	-	-	-	-49r
Energy industry use	**2**	**777**	**-**	**4,644**	**4,632**	**-**	**-**	**2,321r**	**160r**	**12,536r**
Electricity generation	-	-	-	-	-	-	-	1,535r	-	1,535r
Oil and gas extraction	-	-	-	672	4,003	-	-	49	-	4,725
Petroleum refineries	-	-	-	3,972	99	-	-	402r	160r	4,633r
Coal extraction	2	-	-	-	14	-	-	68	-	84
Coke manufacture	-	378	-	-	-	-	-	7	-	385
Blast furnaces	-	400	-	-	31	-	-	38	-	468
Patent fuel manufacture	-	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	88	-	88
Other	-	-	-	-	485	-	-	133r	-	619r
Losses	**-**	**215**	**-**	**-**	**643r**	**-**	**-**	**2,379r**	**-**	**3,236r**
Final consumption	**1,948r**	**954**	**-**	**66,863r**	**48,014r**	**4,044r**	**-**	**27,191r**	**1,187r**	**150,202r**
Industry	**1,430r**	**594**	**-**	**4,056r**	**8,075r**	**636r**	**-**	**8,333r**	**736r**	**23,860r**
Unclassified	-	74	-	3,199r	1	636r	-	-	-	3,910r
Iron and steel	38	520	-	4r	459	-	-	327r	-	1,347r
Non-ferrous metals	14	-	-	0	166r	-	-	381r	-	561r
Mineral products	776	-	-	168r	1,305r	-	-	578r	-	2,827r
Chemicals	55r	-	-	106r	1,305r	-	-	1,421r	325r	3,211r
Mechanical engineering etc	8	-	-	-	494r	-	-	607r	-	1,110r
Electrical engineering etc	4	-	-	1r	225r	-	-	531r	-	760r
Vehicles	37	-	-	180r	385r	-	-	436r	-	1,038r
Food, beverages etc	31	-	-	129r	1,771r	-	-	953r	-r	2,884r
Textiles, leather etc	42	-	-	45r	443r	-	-	249r	-	779r
Paper, printing etc	70	-	-	30r	699r	-	-	929r	-	1,729r
Other industries	350	-	-	32r	445r	-	-	1,796r	411	3,035r
Construction	5	-	-	161r	377	-	-	126	**-**	669r
Transport *(6)*	**10**	**-**	**-**	**52,014r**	**-**	**1,092r**	-	**374r**	**-**	**53,490r**
Air	-	**-**	**-**	12,434	**-**	**-**	**-**	**-**	**-**	12,434
Rail	10	**-**	**-**	667r	**-**	**-**	**-**	371r	**-**	1,049r
Road	-	**-**	**-**	38,177	**-**	1,092r	**-**	3	**-**	39,271r
National navigation	-	**-**	**-**	736r	**-**	**-**	**-**	**-**	**-**	736r
Pipelines	-	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	-
Other	**508**	**221**	-	**4,150r**	**39,458r**	**2,317r**	**-**	**18,484r**	**451r**	**65,588r**
Domestic	484	221	-	2,845r	29,536r	1,909r	**-**	9,755r	52	44,801r
Public administration	16	-	-	300r	3,820r	124r	**-**	1,617r	384r	6,261r
Commercial	4	-	-	398r	4,970r	53	**-**	6,779r	15	12,218r
Agriculture	-	-	-	356r	94r	230r	**-**	333	-	1,013r
Miscellaneous	5	-	-	252r	1,038r	0	-	-	-	1,295r
Non energy use	-	**140**	-	**6,644r**	**481**	-	-	-	-	**7,265r**

(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 5.12 regarding electricity use in transport and 6.41 regarding renewables use in transport.
(7) Back-flows from the petrochemical industry.

1.4 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	285	205	12,260	22,790	5,815	16,745	395	2,745	61,245
Imports	1,015	70	13,365	12,405	7,240	950	-	420	35,565
Exports	-45	-20	-9,920	-8,675	-2,265	-80	-	-	-21,005
Marine bunkers	-	-	-	-825	-	-	-	-	-825
Stock change	250	-20	5	-250	55	-	-	-	-60
Basic value of inland consumption	**1,500**	**230**	**15,715**	**25,450**	**10,850**	**17,615**	**395**	**3,165**	**74,920**
Tax and margins									
Distribution costs and margins	**370**	**20**	**-**	**2,005**	**11,300**	**16,910**	**-**	**100**	**30,710**
Electricity generation	105	-	-	5	-	-	-	-	105
Solid fuel manufacture	85	-	-	-	-	-	-	-	85
of which iron & steel sector	100	-		-	-	-	-	-	100
Iron & steel final use	30	10		-	-	-	-	-	40
Other industry	65	-	-	330	-	-	-	-	395
Air transport	-	-	-	110	-	-	-	-	110
Rail and national navigation	-	-	-	20	-	-	-	-	20
Road transport	-	-	-	960	-	-	-	100	1,060
Domestic	85	10	-	100	-	-	-	-	195
Agriculture	-	-	-	20	-	-	-	-	20
Commercial and other services	-	-	-	70	-	-	-	-	70
Non energy use	-	-	-	390	105	-	-	-	495
VAT and duties	**10**	**5**	**-**	**32,540**	**680**	**795**	**-**	**1,390**	**35,425**
Electricity generation	-	-	-	30	-	-	-	-	30
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	230	-	-	-	-	230
Air transport	-	-	-	5	-	-	-	-	5
Rail and national navigation	-	-	-	160	-	-	-	-	160
Road transport	-	-	-	31,900	-	-	-	1,360	33,255
Domestic	10	5	-	65	680	795	-	35	1,590
Agriculture	-	-	-	30	-	-	-	-	30
Commercial and other services	-	-	-	120	-	-	-	-	120
Climate Change Levy/Carbon Price Support	**465**	**-**		**270**	**700**	**325**			**1,760**
Total tax and margins	**845**	**25**	**-**	**34,815**	**12,680**	**18,030**	**-**	**1,490**	**67,890**
Market value of inland consumption	**2,345**	**255**	**15,715**	**60,265**	**23,530**	**35,650**	**395**	**4,655**	**142,810**
Energy end use									
Total energy sector	**1,805**	**-**	**15,715**	**1,065**	**4,680**	**1,235**	**75**	**1,810**	**26,385**
Transformation	1,805	-	15,715	175	3,775	915	-	1,810	24,190
Electricity generation	1,420	-	-	155	3,370	915	-	1,810	7,670
of which from stocks	30	-	-	-	-	-	-	-	40
Heat Generation	10	-	-	20	405	-	-	-	435
Petroleum refineries	-	-	15,715	-	-	-	-	-	15,715
Solid fuel manufacture	375	-	-	-	-	-	-	-	375
of which iron & steel sector	335	-	-	-	-	-	-	-	335
Other energy sector use	**-**	**-**	**-**	**890**	**910**	**320**	**75**	**-**	**2,195**
Oil & gas extraction	-	-	-	220	795	50	-	-	1,070
Petroleum refineries	-	-	-	670	20	220	75	-	985
Coal extraction	-	-	-	-	-	45	-	-	45
Other energy sector	-	-	-	-	95	5	-	-	100
Total non energy sector use	**540**	**215**	**-**	**56,395**	**18,745**	**34,415**	**320**	**2,845**	**113,475**
Industry	**330**	**115**	**-**	**1,615**	**1,885**	**6,825**	**195**	**105**	**11,075**
Iron & steel final use	140	115	-	-	105	240	-	15	615
Other industry	190	5	-	1,615	1,780	6,585	195	90	10,460
Transport	**5**	**-**	**-**	**52,990**	**-**	**430**	**-**	**2,000**	**55,425**
Air	-	-	-	4,230	-	-	-	-	4,230
Rail and national navigation	5	-	-	630	-	425	-	-	1,060
Road	-	-	-	48,125	-	5	-	2,000	50,135
Other final users	**205**	**95**	**-**	**1,790**	**16,860**	**27,160**	**125**	**740**	**46,980**
Domestic	205	95	-	975	14,295	16,725	15	705	33,015
Agriculture	-	-	-	185	30	455	-	25	695
Commercial and other services	5	-	-	630	2,540	9,980	110	10	13,270
Total value of energy end use	**2,345**	**215**	**15,715**	**57,460**	**23,425**	**35,650**	**395**	**4,655**	**139,860**
Value of non energy end use	**-**	**40**	**-**	**2,805**	**105**	**-**	**-**	**-**	**2,950**
Market value of inland consumption	**2,345**	**255**	**15,715**	**60,265**	**23,530**	**35,650**	**395**	**4,655**	**142,810**

(1) For further information see paragraphs 1.39 to 1.44.

1.5 Value balance of traded energy in 2014[(1)]

£million

	Coal	Manufactured fuels	Crude oil	Petroleum products	Natural gas	Electricity	Heat sold	Other fuels	Total
Supply									
Indigenous production	440r	270r	18,185	34,345r	6,655	16,525	470r	2,250r	79,135r
Imports	2,260r	75	24,070r	16,455	7,250	1,020	-	610	51,735r
Exports	-55	-20	-14,630r	-14,080	-2,005	-125	-	-	-30,920r
Marine bunkers	-	-	-	-1,405r	-	-	-	-	-1,405r
Stock change	-360r	-30	-275	135	-40	-	-	-	-570r
Basic value of inland consumption	**2,275r**	**285**	**27,355r**	**35,450r**	**11,860r**	**17,425r**	**470r**	**2,855r**	**97,975r**
Tax and margins									
Distribution costs and margins	**580r**	**25**	**-**	**2,200r**	**11,920**	**16,885**	**-**	**115**	**31,725r**
Electricity generation	225r	-	-	5	-	-	-	-	230r
Solid fuel manufacture	120	-	-	-	-	-	-	-	120
of which iron & steel sector	105	-		-	-	-	-	-	105
Iron & steel final use	35	10		-	-	-	-	-	45
Other industry	90r	-	-	355r	-	-	-	-	450r
Air transport	-	-	-	175	-	-	-	-	175
Rail and national navigation	-	-	-	30r	-	-	-	-	30r
Road transport	-	-	-	1,110	-	-	-	115	1,225
Domestic	100	10	-	105r	-	-	-	-	220
Agriculture	-	-	-	25r	-	-	-	-	25r
Commercial and other services	5	-	-	55r	-	-	-	-	60r
Non energy use	-	-	-	340r	125	-	-	-	465r
VAT and duties	**10**	**5**	**-**	**33,555r**	**680**	**800**	**-**	**1,440r**	**36,490r**
Electricity generation	-	-	-	30	-	-	-	-	30
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	225r	-	-	-	-	225r
Air transport	-	-	-	10	-	-	-	-	10
Rail and national navigation	-	-	-	165r	-	-	-	-	165r
Road transport	-	-	-	32,890	-	-	-	1,410	34,300
Domestic	10	5	-	85r	680	800	-	30r	1,610
Agriculture	-	-	-	25r	-	-	-	-	25r
Commercial and other services	-	-	-	120r	-	-	-	-	120r
Climate Change Levy/Carbon Price Support	**485**	**-**		**280**	**475**	**255**			**1,495**
Total tax and margins	**1,075r**	**30**	**-**	**36,030r**	**13,075r**	**17,945r**	**-**	**1,555**	**69,705r**
Market value of inland consumption	**3,350r**	**315**	**27,355r**	**71,480r**	**24,930r**	**35,370r**	**470r**	**4,410r**	**167,685r**
Energy end use									
Total energy sector	**2,715r**	**-**	**27,355r**	**1,205r**	**5,575r**	**1,210r**	**95**	**1,340r**	**39,490r**
Transformation	2,715r	-	27,355r	220	4,595r	905r	-	1,340r	37,125r
Electricity generation	2,170r	-	-	190r	4,110r	905r	-	1,340r	8,715r
of which from stocks	45	-	-	-	-	-	-	-	45
Heat Generation	15r	-	-	30	485r	-	-	-	530r
Petroleum refineries	-	-	27,355r	-	-	-	-	-	27,355r
Solid fuel manufacture	530	-	-	-	-	-	-	-	530
of which iron & steel sector	460	-	-	-	-	-	-	-	460
Other energy sector use	**-**	**-**	**-**	**985r**	**980r**	**305**	**95**	**-**	**2,365r**
Oil & gas extraction	-	-	-	345	860r	45	-	-	1,250r
Petroleum refineries	-	-	-	645r	20	195	95	-	955r
Coal extraction	-	-	-	-	-	55r	-	-	60
Other energy sector	-	-	-	-	100	5	-	-	105
Total non energy sector use	**635r**	**260**	**-**	**67,610r**	**19,235r**	**34,160**	**375r**	**3,075r**	**125,350r**
Industry	**420r**	**155**	**-**	**2,195r**	**2,165r**	**6,800**	**235r**	**85r**	**12,055r**
Iron & steel final use	160	140	-	5	125	235	-	20	685
Other industry	265r	15	-	2,190r	2,035r	6,565	235r	65	11,370r
Transport	**5**	**-**	**-**	**63,070r**	**-**	**405**	**-**	**2,310**	**65,790r**
Air	-	-	-	6,580	-	-	-	-	6,580
Rail and national navigation	5	-	-	855r	-	390	-	-	1,250r
Road	-	-	-	55,635	-	15	-	2,310	57,960
Other final users	**210**	**105**	**-**	**2,345r**	**17,070**	**26,950**	**145r**	**680r**	**47,505r**
Domestic	205	105	-	1,410r	14,290	16,800	15	645r	33,470r
Agriculture	-	-	-	195r	30	430	-	25	680r
Commercial and other services	5	-	-	740r	2,750	9,720	125	10	13,355r
Total value of energy end use	**3,350r**	**260**	**27,355r**	**68,820r**	**24,805r**	**35,370r**	**470r**	**4,410r**	**164,840r**
Value of non energy end use	**-**	**55**	**-**	**2,660r**	**125**	**-**	**-**	**-**	**2,840**
Market value of inland consumption	**3,350r**	**315**	**27,355r**	**71,480r**	**24,930r**	**35,370r**	**470r**	**4,410r**	**167,685r**

(1) For further information see paragraphs 1.39 to 1.44.

1.6 Value balance of traded energy in 2013[(1)]

£million

	Coal	Manufactured fuels	Crude oil	Petroleum products	Natural gas	Electricity	Heat sold	Other fuels	Total
Supply									
Indigenous production	500r	370	21,330	41,250r	7,755	16,700	545r	2,235r	90,685r
Imports	3,235	65	30,010r	18,585	10,985	935	-	415	64,235r
Exports	-90	-25	-17,460	-18,905	-2,510	-170	-	-	-39,155
Marine bunkers	-	-	-	-1,495r	-	-	-	-	-1,495r
Stock change	-25r	-65	380	-45	15	-	-	-	260r
Basic value of inland consumption	**3,620r**	**345**	**34,260r**	**39,390r**	**16,245**	**17,470**	**545r**	**2,650r**	**114,525r**
Tax and margins									
Distribution costs and margins	**615**	**20**	**-**	**2,350r**	**11,675r**	**17,305r**	**-**	**110**	**32,070r**
Electricity generation	245	-	-	5	-	-	-	-	250
Solid fuel manufacture	165	-	-	-	-	-	-	-	165
of which iron & steel sector	140	-		-	-	-	-	-	140
Iron & steel final use	40	-		-	-	-	-	-	40
Other industry	70	5	-	345r	-	-	-	-	420r
Air transport	-	-	-	190	-	-	-	-	190
Rail and national navigation	-	-	-	35r	-	-	-	-	35r
Road transport	-	-	-	1,155	-	-	-	110	1,260
Domestic	90	15	-	125	-	-	-	-	230
Agriculture	-	-	-	30	-	-	-	-	30
Commercial and other services	5	-	-	85r	-	-	-	-	90r
Non energy use	-	-	-	380r	145	-	-	-	525r
VAT and duties	**10**	**5**	**-**	**33,565r**	**790**	**790**	**-**	**1,315r**	**36,475r**
Electricity generation	-	-	-	30	-	-	-	-	30
Iron & steel final use	-	-	-	-	-	-	-	-	-
Other industry	-	-	-	225r	-	-	-	-	225r
Air transport	-	-	-	10	-	-	-	-	10
Rail and national navigation	-	-	-	170r	-	-	-	-	170r
Road transport	-	-	-	32,895	-	-	-	1,280	34,175
Domestic	10	5	-	100r	790	790	-	30	1,730
Agriculture	-	-	-	30	-	-	-	-	30
Commercial and other services	-	-	-	115r	-	-	-	-	115r
Climate Change Levy/Carbon Price Support	**235**	**-**		**135**	**325**	**370**			**1,065**
Total tax and margins	**860**	**25**	**-**	**36,050r**	**12,790r**	**18,465r**	**-**	**1,420**	**69,610r**
Market value of inland consumption	**4,480r**	**370**	**34,260r**	**75,440r**	**29,035r**	**35,935r**	**545r**	**4,070r**	**184,135r**
Energy end use									
Total energy sector	**3,815r**	**-**	**34,260r**	**1,455r**	**6,510r**	**1,285r**	**65**	**1,085**	**48,475r**
Transformation	3,815r	-	34,260r	250r	5,280r	950r	-	1,085	45,645r
Electricity generation	3,070r	-	-	220	4,720r	950r	-	1,085	10,050r
of which from stocks	30	-	-	-	-	-	-	-	30
Heat Generation	20r	-	-	30r	560r	-	-	-	610r
Petroleum refineries	-	-	34,260r	-	-	-	-	-	34,260r
Solid fuel manufacture	720	-	-	-	-	-	-	-	720
of which iron & steel sector	620	-	-	-	-	-	-	-	620
Other energy sector use	**-**	**-**	**-**	**1,210**	**1,230**	**335**	**65**	**-**	**2,835**
Oil & gas extraction	-	-	-	375	1,070	45	-	-	1,495
Petroleum refineries	-	-	-	830	25	215	65	-	1,140
Coal extraction	-	-	-	-	-	65	-	-	65
Other energy sector	-	-	-	-	130	5	-	-	135
Total non energy sector use	**665**	**310**	**-**	**71,115r**	**22,380r**	**34,650**	**480r**	**2,985r**	**132,585r**
Industry	**425**	**185**	**-**	**2,410r**	**2,465r**	**7,130**	**300r**	**90r**	**13,005r**
Iron & steel final use	190	160	-	-	145	255	-	25	775
Other industry	235	25	-	2,405r	2,320r	6,875r	300r	65	12,230r
Transport	**5**	**-**	**-**	**65,990r**	**-**	**390**	**-**	**2,175**	**68,560r**
Air	-	-	-	7,205	-	-	-	-	7,205
Rail and national navigation	5	-	-	975r	-	375	-	-	1,355r
Road	-	-	-	57,810	-	15	-	2,175	60,000
Other final users	**240**	**125**	**-**	**2,715r**	**19,915**	**27,130**	**180**	**720r**	**51,020r**
Domestic	230	125	-	1,775r	16,570	16,600	20	680r	36,005r
Agriculture	-	-	-	235r	40	435	-	25	735r
Commercial and other services	5	-	-	705r	3,305	10,095	160	10	14,280r
Total value of energy end use	**4,480r**	**310**	**34,260r**	**72,570r**	**28,890r**	**35,935r**	**545r**	**4,070r**	**181,065r**
Value of non energy end use	**-**	**55**	**-**	**2,870r**	**145**	**-**	**-**	**-**	**3,075**
Market value of inland consumption	**4,480r**	**370**	**34,260r**	**75,440r**	**29,035r**	**35,935r**	**545r**	**4,070r**	**184,135r**

(1) For further information see paragraphs 1.39 to 1.44.

1.7 Sales of electricity and gas by sector

United Kingdom

	2011	2012	2013	2014	2015
Total selling value (£ million)[1]					
Electricity generation - Gas	5,275	4,614	4,722r	4,108r	3,370
Industrial - Gas[2]	2,053	2,173	2,457r	2,156r	1,880
- Electricity	6,879	7,092	7,462	7,143r	7,194
of which:					
Fuel industries	335	337	334	320r	329
Industrial sector	6,545	6,755	7,129	6,823r	6,864
Domestic sector - Gas	11,738	14,970	15,822r	13,613r	13,484
- Electricity	13,860	14,942	15,809	15,926r	15,704
Other - Gas	2,878	3,122	3,488r	2,900	2,676
- Electricity	9,758	10,363	10,918r	10,867r	11,105
of which:					
Agricultural sector	403	416	437	455r	499
Commercial sector	7,748	8,162	8,613r	8,504r	8,610
Transport sector	302	357	398r	431r	438
Public lighting	151	164	170	178r	190
Public admin. and other services	1,155	1,264	1,300	1,299r	1,368
Total, all consumers	**52,441**	**57,276**	**60,678r**	**56,714r**	**55,412**
of which gas	**21,943**	**24,879**	**26,489r**	**22,777r**	**21,409**
of which electricity	**30,498**	**32,397**	**34,189r**	**33,937r**	**34,003**
Average net selling value per kWh sold (pence)[1]					
Electricity generation - Gas	1.914	2.135	2.299	1.890	1.586
Industrial - Gas	2.172	2.375	2.616	2.310	1.990
- Electricity	7.142	7.585	7.992	8.073	8.191
of which:					
Fuel industries	7.390	8.048	8.219	8.645	8.652
Industrial sector	7.130	7.563	7.981	8.048	8.170
Domestic sector - Gas	4.001	4.338	4.606	4.895	4.611
- Electricity	12.433	13.089	14.017	14.831	14.679
Other - Gas	2.588	2.800	3.023	3.009	2.726
- Electricity	9.711	10.286	10.854	11.380	11.748
of which:					
Agricultural sector	10.202	10.740	11.284	11.846	12.221
Commercial sector	10.202	10.740	11.284	11.846	12.221
Transport sector	7.390	8.385	9.142	9.558	9.779
Public lighting	7.910	8.590	9.166	9.622	10.041
Public admin. and other services	7.910	8.590	9.166	9.622	10.041
Average, all consumers	**4.842**	**5.340**	**5.698**	**5.808**	**5.615**
of which gas	**2.833**	**3.256**	**3.494**	**3.324**	**3.069**
of which electricity	**9.893**	**10.505**	**11.146**	**11.648**	**11.752**

(1) Excludes VAT where payable - see paragraph 1.45 for a definition of average net selling value.

(2) Excludes Fuel Industry use

1.8 Final energy consumption by main industrial groups[(1)]

Thousand tonnes of oil equivalent

	2011	2012	2013	2014	2015
Iron and steel and non-ferrous metals					
Coal	51	49	52	53	44
Manufactured solid fuels *(2)*	281	343	445	451	384
Blast furnace gas	64	26	13	14r	11
Coke oven gas	59	43	62	55r	50
Natural gas	659	600	625	640r	632
Petroleum	4	5	4	6r	7
Electricity	931	723	708r	710r	696
Total iron and steel and non-ferrous metals	**2,050**	**1,789**	**1,908r**	**1,930r**	**1,823**
Chemicals					
Coal	50	49	55	65r	47
Natural gas	1,379	1,307	1,305r	1,251r	1,301
Petroleum	189	124	106r	103r	121
Electricity	1,517	1,500	1,421r	1,326r	1,342
Heat purchased from other sectors *(3)*	350	336	325r	281r	260
Total chemicals	**3,484**	**3,316**	**3,211r**	**3,026r**	**3,070**
Metal products, machinery and equipment					
Coal	48	46	49	64r	54
Natural gas	1,028	1,073	1,104r	1,084r	1,104
Petroleum	138	149	181r	175r	199
Electricity	1,619	1,577	1,574	1,501r	1,469
Heat purchased from other sectors *(3)*	-	-	-	-	-
Total metal products, machinery and equipment	**2,833**	**2,845**	**2,907r**	**2,823r**	**2,827**
Food, beverages and tobacco					
Coal	32	31	31	45r	38
Natural gas	1,764	1,734	1,771r	1,761r	1,765
Petroleum	141	126	129r	117r	106
Electricity	973	958	953	915r	923
Heat purchased from other sectors *(3)*	2	3	-r	-	-
Total food, beverages and tobacco	**2,912**	**2,851**	**2,884r**	**2,838r**	**2,832**

(1) Industrial categories used are described in Table 1I. Data excludes energy used to generate heat for all fuels except manufactured solid fuels and electricity.
(2) Includes tars, benzole, coke and breeze and other manufactured solid fuels.
(3) Data equates to heat sold information in the energy balances.

1.8 Final energy consumption by main industrial groups[1] (continued)

Thousand tonnes of oil equivalent

	2011	2012	2013	2014	2015
Paper, printing and publishing					
Coal	71	80	70	93r	71
Natural gas	641	609	699r	668r	676
Petroleum	30	29	30r	28r	29
Electricity	938	934	929	923r	911
Heat purchased from other sectors *(3)*	1	1	-	-	-
Total paper, printing and publishing	**1,681**	**1,653**	**1,729r**	**1,712r**	**1,687**
Other industries					
Coal	941	957	1,173	1,282r	1,088
Natural gas	2,654	2,545	2,570r	2,621r	2,643
Petroleum	392	412	407r	421r	428
Electricity	2,824	2,750	2,749	2,601r	2,600
Heat purchased from other sectors *(3)*	417	426	411	432r	435
Total other industries	**7,228**	**7,090**	**7,311r**	**7,357r**	**7,195**
Unclassified					
Manufactured solid fuels *(2)*	42	49	74	46	12
Coke oven gas	-	-	-	-	-
Natural gas	2	2	1	1	1
Petroleum	3,604	3,824	3,199	3,209r	3,046
Bioenergy & waste	506	459	636r	776r	1,102
Total unclassified	**4,154**	**4,334**	**3,910r**	**4,031r**	**4,160**
Total					
Coal	1,194	1,212	1,430	1,603r	1,342
Manufactured solid fuels *(2)*	323	392	519	497	395
Blast furnace gas	64	26	13	14r	11
Coke oven gas	59	43	62	55r	50
Natural gas	8,127	7,870	8,075r	8,026r	8,123
Petroleum	4,500	4,669	4,056r	4,059r	3,935
Bioenergy & waste	506	459	636r	776r	1,102
Electricity	8,801	8,442	8,333r	7,976r	7,940
Heat purchased from other sectors *(3)*	769	766	736r	713r	695
Total	**24,344**	**23,879**	**23,860r**	**23,718r**	**23,594**

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

Thousand tonnes of oil equivalent
(except where shown otherwise)

	2011	2012	2013	2014	2015
Iron and steel and non-ferrous metals					
Coal (2)	651	521	-	-	-
Blast furnace gas	454	591	740	731r	641
Coke oven gas	196	182	172	154r	137
Natural gas	37	39	39	34r	43
Petroleum	7	7	7	7	16
Other (including renewables) (3)	60	63	58	62r	63
Total fuel input (4)	**1,404**	**1,402**	**1,016**	**989r**	**901**
Electricity generated by iron & steel and non-ferrous	**429**	**370**	**185**	**335r**	**166**
metals (5) (in GWh)	4,983	4,303	2,147r	3,896r	1,928
Electricity consumed by iron and steel and non-ferrous	**349**	**187**	**166r**	**181r**	**163**
metals from own generation (6) (in GWh)	4,065	2,170	1,931r	2,106r	1,892
Chemicals					
Coal	109	110	7r	7r	7
Natural gas	718	727	627r	454r	434
Petroleum	6	6	0r	0r	0
Other (including renewables) (3)	68	42	30r	29r	31
Total fuel input (4)	**900**	**885**	**664r**	**491r**	**472**
Electricity generated by chemicals (5)	**379**	**412**	**301r**	**206r**	**193**
(in GWh)	4,404	4,793	3,501r	2,391r	2,248
Electricity consumed by chemicals from own generation (6)	**239**	**242**	**161r**	**134r**	**148**
(in GWh	2,783	2,811	1,875r	1,557r	1,723
Metal products, machinery and equipment					
Coal	-	-	-	-	-
Natural gas	42	42	40r	27r	31
Petroleum	6	6	6	6	6
Other (including renewables) (3)	48	48	47r	63r	63
Total fuel input (4)	**96**	**95**	**93r**	**96**	**99**
Electricity generated by metal products, machinery	**22**	**22**	**24**	**25r**	**25**
and equipment (5) (in GWh)	251	256	279	286r	290
Electricity consumed by metal products, machinery	**21**	**21**	**23**	**24r**	**24**
and equipment from own generation (6) (in GWh)	241	245	267r	275r	278
Food, beverages and tobacco					
Coal	4	4	4	5	5
Natural gas	361	352	345	360r	366
Petroleum	4	3	3	2	2
Other (including renewables) (3)	6	10	3r	31r	30
Total fuel input (4)	**375**	**369**	**355r**	**397r**	**403**
Electricity generated by food, beverages and tobacco (5)	**186**	**187**	**187**	**198r**	**199**
(in GWh)	2,157	2,178	2,177	2,300r	2,317
Electricity consumed by food, beverages and tobacco	**110**	**115**	**112**	**116r**	**119**
from own generation (6) (in GWh)	1,277	1,339	1,301r	1,344r	1,379

(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. Consistent with figures for fuels used by other generators in Table 5.4.

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

Thousand tonnes of oil equivalent
(except where shown otherwise)

	2011	2012	2013	2014	2015
Paper, printing and publishing					
Coal	30	26	10	-	-
Natural gas	368	417	301	272r	248
Petroleum	0	0	0	0	0
Other (including renewables) (3)	83	94	92r	240r	270
Total fuel input (4)	**480**	**538**	**403r**	**511r**	**517**
Electricity generated by paper, printing and publishing (5)	**195**	**210**	**187**	**207r**	**195**
(in GWh)	2,264	2,441	2,180	2,412r	2,272
Electricity consumed by paper, printing and publishing	**126**	**141**	**137**	**161r**	**156**
from own generation (6) (in GWh)	1,468	1,642	1,590r	1,878r	1,816
Other industries					
Coal	-	-	-	-	-
Coke oven gas	28	28	28	28	5
Natural gas	79	71	59	60r	58
Petroleum	6	6	2	3	3
Other (including renewables) (3)	1,918	1,924	1,942	1,932	1,894
Total fuel input (4)	**2,032**	**2,028**	**2,031**	**2,023r**	**1,961**
Electricity generated by other industries (5)	**116**	**119**	**125r**	**140r**	**168**
(in GWh)	1,347	1,380	1,448r	1,623r	1,952
Electricity consumed by other industries from own	**103**	**106**	**114**	**130r**	**150**
generation (6) (in GWh)	1,192	1,238	1,326r	1,506r	1,742
Total					
Coal	794	661	20r	12r	12
Blast furnace gas	454	591	740	731r	641
Coke oven gas	224	210	200	182r	142
Natural gas	1,605	1,647	1,411r	1,208r	1,180
Petroleum	28	27	19r	18r	28
Other (including renewables) (3)	2,182	2,181	2,172r	2,356r	2,351
Total fuel input (4)	**5,287**	**5,317**	**4,561r**	**4,507r**	**4,354**
Electricity generated (5)	**1,325**	**1,320**	**1,009r**	**1,110r**	**946**
(in GWh)	15,408	15,351	11,732r	12,909r	11,006
Electricity consumed from own generation (6)	**948**	**812**	**713r**	**745r**	**759**
(in GWh)	11,025	9,445	8,291r	8,667r	8,830

(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	**2011**	**2012**	**2013**	**2014**	**2015**
All industry	5,287	5,317	4,561r	4,507r	4,354
Fuel industries	1,732	1,981	1,799	2,043r	2,338
Transport, Commerce and Administration	284	367	379r	409r	399
Services	1,381	814	1,143r	1,506r	2,276
Total fuel input	**8,684**	**8,478**	**7,882r**	**8,465r**	**9,367**
Electricity generated	**3,006**	**3,036**	**2,893r**	**3,358r**	**3,728**
Electricity consumed	**1,554**	**1,489**	**1,503r**	**1,585r**	**1,880**
					GWh
Electricity generated	**34,960**	**35,309**	**33,647r**	**39,050r**	**43,353**
Electricity consumed	**18,079**	**17,318**	**17,484r**	**18,428r**	**21,863**

Chapter 2
Solid fuels and derived gases

Key points

- Figures for 2015 show that coal production decreased by 26 per cent on 2014 to an all-time low of 9 million tonnes (Table 2.4), following the closure of a number of mines/companies and some other mines producing less coal as they are coming to the end of production.
- In 2015 UK imports were 24 million tonnes (the lowest value for 15 years), a decrease of 43 per cent on 2014 due to lower demand from generators (Table 2.4).
- In 2015 Russia was the UK's largest supplier of coal imports with a share of 38 per cent. The other main suppliers were Colombia with a 29 per cent share and USA with a 22 per cent share (Table 2B).
- Demand for coal decreased from 48 million tonnes in 2014 to 37 million tonnes in 2015 (Table 2.4), with a 24 per cent decrease in the use of coal for electricity generation.
- In 2015 around 78 per cent of demand for coal was from major power producers for electricity generation with around a further 10 per cent used for the manufacture of coke (Table 2.4).
- Total stock levels decreased in 2015 to 14 million tonnes, which was 5.2 million tonnes lower than in 2014, due to generators using more stocks for electricity generation. (Table 2.4).

Introduction

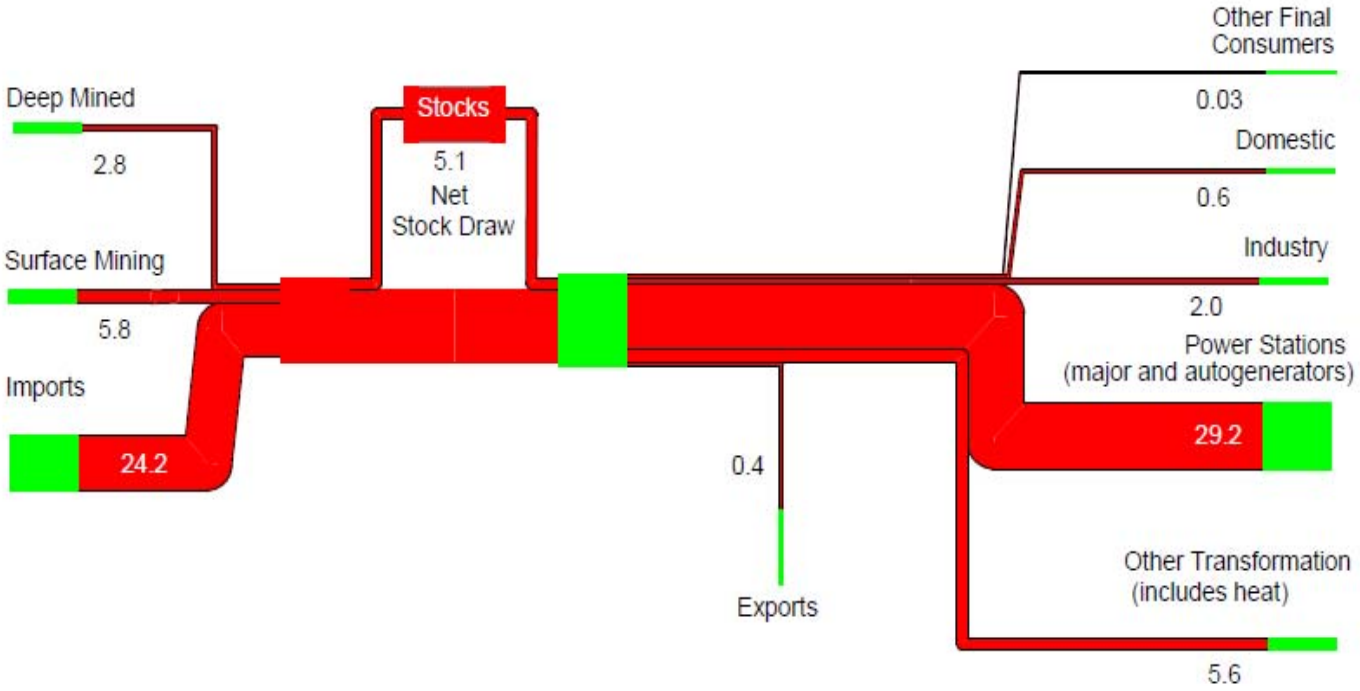
2.1 This chapter presents statistics on supply and demand for coal during the period 2011 to 2015 by grade of coal (steam coal, anthracite and coking coal). These are shown as commodity balances in Tables 2.1 to 2.3. Table 2.4 shows the same data as published in Table 2.1 to 2.3 at an aggregated level, i.e. not split by grade of coal, for the latest five years.

2.2 An energy flow chart for 2015 (page 42), 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. It illustrates the flow of coal from the point at which it becomes available from home production or imports (on the left) to the eventual final use of coal (on the right).

2.3 The supply and demand for manufactured solid fuels (including coke oven coke, coke breeze, other manufactured solid fuels (patent fuel), coke oven gas, blast furnace gas and benzole and tar) is shown in the commodity balances in Tables 2.5 and 2.6 for the latest five years.

2.4 Other data in the chapter shows: UK production and employment categorised by type of mine and devolved administration during 2013 to 2015 (Table 2A); UK imports of coal in 2015 split by grade of coal and country of origin (Table 2B); whilst Map 2A presents all UK coal production sites and ports of entry for international trade.

Coal flow chart 2015 (million tonnes of coal)



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

2.5 Information on long-term trends on coal production, consumption and stocks (Tables 2.1.1 and 2.1.2) are available on the BEIS section of the GOV.UK website at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

2.6 Detailed statistics on imports and exports of solid fuels are shown in Annex G (Table G2), available on the BEIS section of the GOV.UK website at:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Coal (Tables 2.1, 2.2, 2.3 and 2.4)

Coal Production and Trade

2.7 **Figures for 2015 show that coal production decreased by 26 per cent on 2014 to an all-time low of 8.6 million tonnes** (Chart 2.1).

2.8 **Deep mined** production, which contributed 7.4 per cent to UK coal supply in 2015 (32 per cent of total UK production), fell by 24 per cent on 2014 to a new record low. This was due mainly to the closure of Hatfield and Thoresby. In addition Kellingley, the last remaining large deep mine closed on 18 December 2015. Similarly, **surface mine** production decreased by 27 per cent to a new record low and contributed 15 per cent to UK coal supply. This was due to the closure of a number of mines in 2015 and some other mines producing less coal as they are coming to the end of operation. Together, production from deep mines and surface mines accounted for 23 per cent of UK coal supply.

2.9 **Steam coal**, mainly used by power stations, accounted for 89 per cent of total coal production in 2015, with 10 per cent **anthracite** and the remainder **coking coal** (Table 2.1).

2.10 Production of slurry was 95 thousand tonnes in 2013. Since 2014 no slurry has been produced as the main sites that produce slurry have closed (Table 2.4).

2.11 Table 2A shows how production of coal is divided between England, Wales and Scotland. In 2015, 58 per cent of coal output was in England, 27 per cent in Wales and 15 per cent in Scotland. 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		
		2013	2014	2015	2013	2014	2015
Deep mined	England	4.0	3.6	2.8	1,882	1,650	427
	Wales	0.1	0.0	0.0	71	116	50
	Total	4.1	3.7	2.8	1,953	1,766	477
Surface mining	England	3.4	2.9	2.2	615	505	388
	Scotland	2.8	2.5	1.3	454	647	421
	Wales	2.3	2.5	2.3	693	683	689
	Total	8.6	8.0	5.8	1,762	1,835	1,498
Total	England	7.4	6.5	4.9	2,497	2,155	815
	Scotland	2.8	2.5	1.3	454	647	421
	Wales	2.4	2.5	2.3	764	799	739
	Total	12.7	11.6	8.6	3,715	3,601	1,975

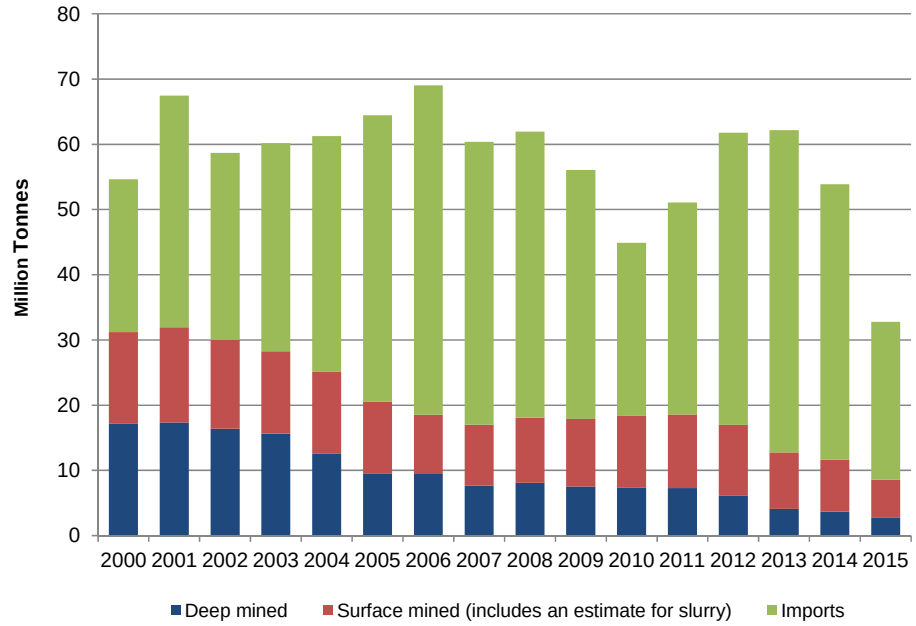
Source: The Coal Authority

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.*

2.12 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 2015 total employment, including contractors, was 45 per cent lower than in 2014.** At 31 December 2015, 41 per cent of the 1,975 people employed in UK coal mining worked in England, while 21 per cent were employed in Scotland and 37 per cent in Wales.

2.13 Based on comparative EU statistics for 2014[1], Poland had the highest coal production, contributing 69 per cent (73 million tonnes) to the EU total. The UK was the second largest EU hard coal producer accounting for 11 per cent (12 million tonnes) of total EU production (105 million tonnes). Other EU countries such as Germany have higher lignite and brown coal production.

Chart 2.1: Coal production and imports 2000 to 2015



2.14 **In 2015 UK imports were 24 million tonnes, a decrease of 43 per cent on 2014** (42 million tonnes). This was the lowest value for 15 years.

Table 2B: Imports of coal in 2015[1]

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Russia	7,886	1,291	10	9,187
Colombia	7,070	-	-	7,070
United States of America	3,241	2,075	0	5,317
Australia	-	910	-	910
European Union[2]	526	33	55	614
Canada	0	334	-	334
Republic of South Africa	311	-	6	317
Other countries	311	108	31	450
Total all countries	19,345	4,750	102	24,198

Source: HM Revenue and Customs, ISSB

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

[1] *EU statistics for 2015 are not yet available on the Eurostat website http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home. The statistics being referenced refer to steam coal, anthracite and coking coal.*

2.15 Table 2B shows that, in 2015, 38 per cent of the UK's total coal imports came from Russia (9 million tonnes), 29 per cent (7 million tonnes) came from Colombia and 22 per cent (5 million tonnes) came from the USA.

2.16 Steam coal accounted for 80 per cent of the total imports, of the rest, 19 per cent was coking coal, with anthracite accounting for the remainder. Imports from Russia decreased by 49 per cent in 2015 compared to 2014, from 18 million tonnes to 9 million tonnes. In 2015, Russia accounted for 41 per cent of total steam coal imports. A further 37 per cent came from Colombia and 17 per cent came from the USA. The UK imported 44 per cent of coking coal from the USA with a further 27 per cent from Russia and 19 per cent from Australia. The small volume of imported anthracite was mainly from the European Union (54 per cent) and China (22 per cent).

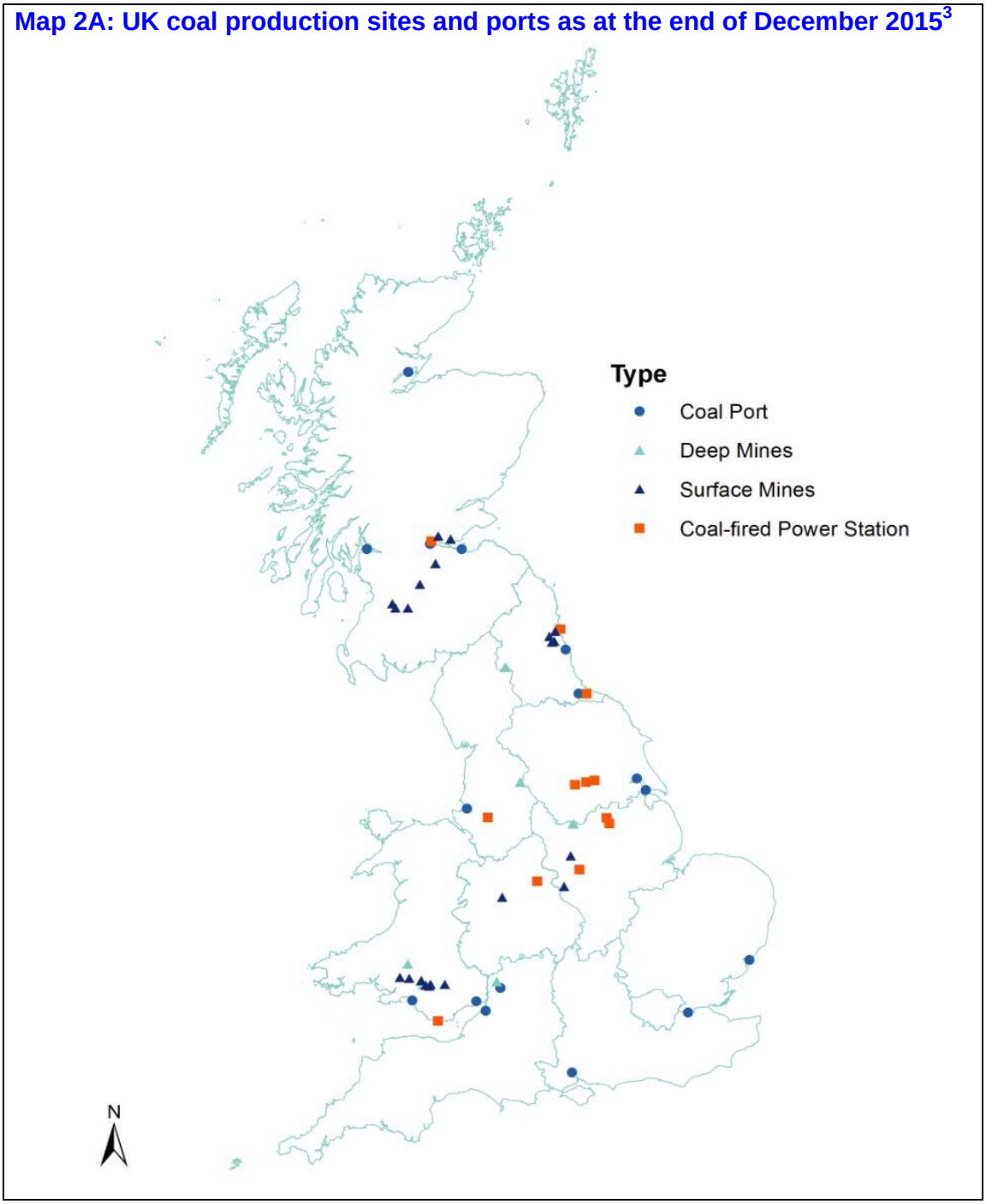
2.17 In 2014, the latest year for which data is available, the UK was the third largest importing country in the EU and accounted for 17 per cent of total EU imports (241 million tonnes), after being overtaken by the Netherlands. Germany was the top importing country in the EU accounting for 22 per cent, followed by the Netherlands with a 20 per cent share of the total[1].

Coal Consumption

2.18 **In 2015 the demand for coal decreased by 23 per cent compared with 2014, as coal for electricity generation fell** (Chart 2.2). Consumption by electricity generators was down by 24 per cent to 29 million tonnes (a new record low). The decline was due to increased availability of nuclear and wind generation, the conversion of a third unit at Drax from coal to high-range co-firing (85% to <100% biomass) in July 2015 and an increase in the carbon price floor (from April 2015). In previous years the price of gas relative to coal was a key reason for the decline, but in 2015 there was little difference in the percentage change in prices between the two fuels; the price of coal purchased by major power producers fell by 14 per cent in 2015, while the price of gas fell by 17 per cent.[2] Eighty-three per cent (31 million tonnes) of demand for all coal was for steam coal, 14 per cent (5.1 million tonnes) was for coking coal and the remaining 3 per cent (1.3 million tonnes) was for anthracite. These proportions have been broadly stable in the past few years.

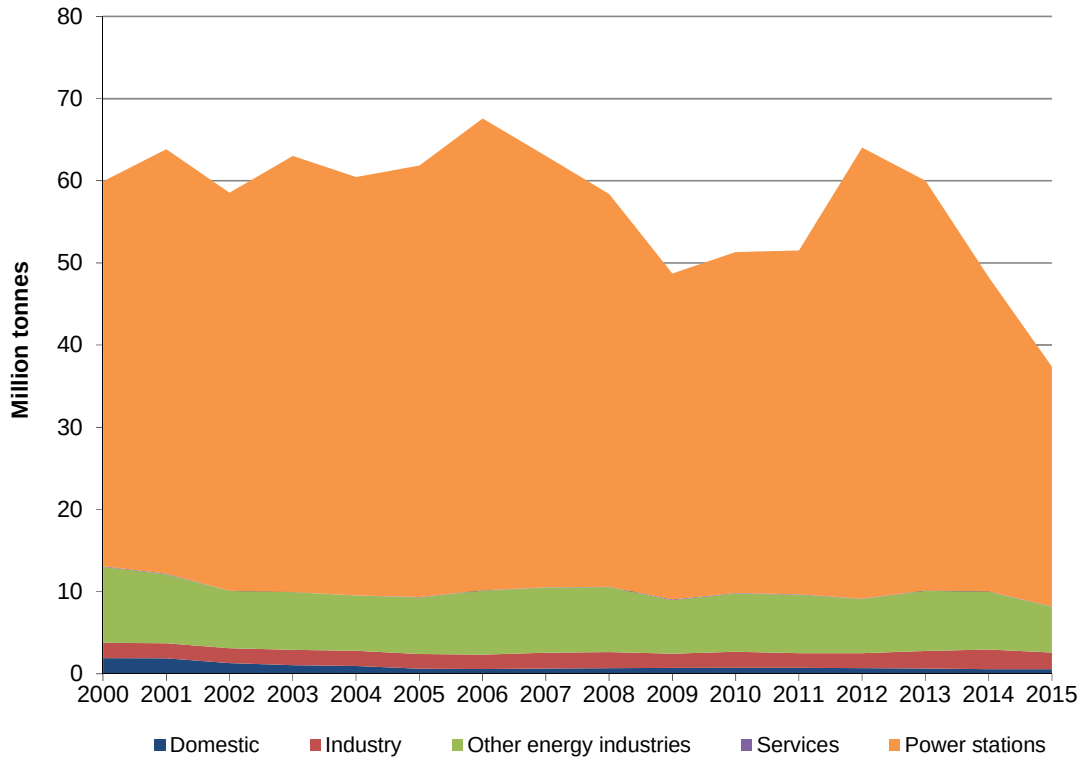
[2] *Quarterly Energy Prices – table 3.2.1, which can be accessed at;www.gov.uk/government/collections/industrial-energy-prices*

Map 2A: UK coal production sites and ports as at the end of December 2015[3]



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

Chart 2.2: Coal consumption, 2000 to 2015



2.19 **The transformation sector represented 93 per cent (35 million tonnes) of overall demand for coal in 2015.** Electricity generation accounted for 93 per cent of demand for steam coal and 37 per cent of demand for anthracite. Most coking coal was used in coke ovens (72 per cent) and the rest in blast furnaces (28 per cent) in the UK iron and steel industry. Coking coal used in blast furnaces decreased by 4.6 per cent from 1.5 million tonnes in 2014 to 1.4 million tonnes in 2015. A flow chart, similar to that shown on page 42 has been produced for manufactured fuel, and is included in the internet version in annex H.

2.20 Electricity generation use of coal by major power producers fell by 24 per cent from 38 million tonnes in 2014 to 29 million tonnes (a new record low) in 2015. Coal use by autogenerators was 19 thousand tonnes, which was unchanged from 2014.

2.21 **Coal consumption by final consumers accounted for 6.9 per cent (2.6 million tonnes) of total demand in 2015, a decrease of 13 per cent from 2014.** Final consumption mainly covers steam raising, space or hot water heating, or heat for processing. Steam coal accounted for 78 per cent of this final consumption (down 14 per cent from 2014).

2.22 The industrial sector is the largest final consumer (accounting for 78 per cent of total final consumption in 2015). Eighty one per cent of the coal used in the industrial sector was steam coal, with manufacturers of mineral products (e.g. cement, glass and brick) being the largest users.

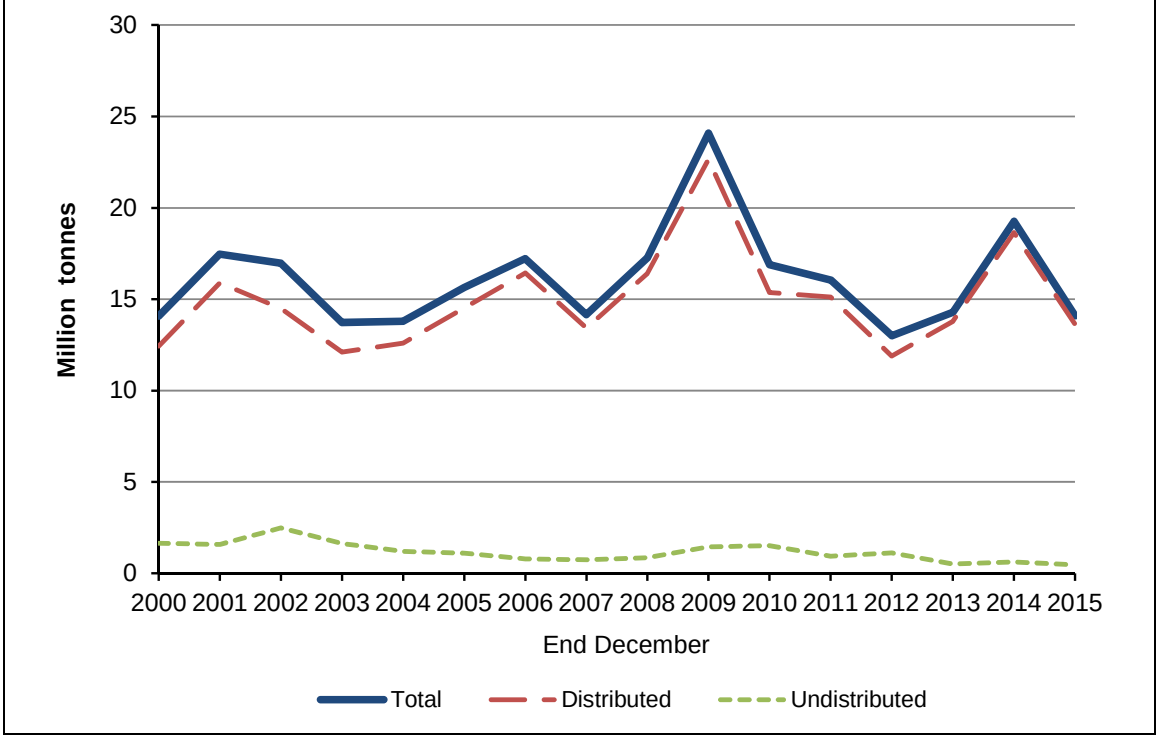
2.23 The domestic sector accounted for 21 per cent of the final consumption of coal, with 64 per cent of this demand being for steam coal and the remainder for anthracite. Domestic consumption rose by 1.0 per cent in 2015 compared with 2014.

2.24 **In 2014, the UK was the third largest consumer of coal among the EU countries,** accounting for 16 per cent (48 million tonnes) of total coal consumption in the EU (292 million tonnes). The top consumer was Poland accounting for 25 per cent (74 million tonnes) of total EU consumption, while Germany was second accounting for 21 per cent (62 million tonnes)[1].

Coal Stocks

2.25 Following a stock rise of 35 per cent in 2014 to 19.3 million tonnes, stocks fell by 5.2 million tonnes in 2015 (Chart 2.3). Undistributed stocks (stocks held at collieries and surface mine sites) of 0.5 million tonnes at the end of 2015 were 0.2 million tonnes lower than a year earlier. Stocks at major power stations and coke ovens, as a whole, decreased by 4.7 million tonnes and accounted for 94 per cent of total stocks in 2015. The fall was mainly due to generators using more coal stocks for electricity generation.

Chart 2.3: Coal stocks in the UK 2000 to 2015



Coal Resources

2.26 **The Coal Authority estimates that overall there are 3,560 million tonnes of coal resources, including prospects** (Table 2c). Economically recoverable and minable coal resource in current operations, and those in the planning or pre-planning process is 144 million tonnes in underground mines and 80 million tonnes in surface mines. Overall Wales had a 69 per cent share of UK current mines and licences resources, followed by Scotland with 20 per cent and England 11 per cent.

2.27 In addition there are some 53 million tonnes at closed underground mines still in licence. The tonnage in prospects is 2,506 million tonnes suitable for underground mining and 777 million tonnes suitable for surface mining. Table 2C gives details of the resource assessment by England, Scotland and Wales as at 6 June 2016.

Table 2c Identified GB Coal Resource Assessment at 6 June 2016

UNDERGROUND MINING

			Million Tonnes	
	England	**Scotland**	**Wales**	**Total**
Operational mines	1	0	0	1
Planning granted	5	0	0	5
In planning process	0	0	0	0
Pre-planning	0	0	138	138
Prospects	2,228	107	172	2,506
Closed mines still in licence	0	0	53	53
Total	**2,234**	**107**	**363**	**2,703**

SURFACE MINING

			Million Tonnes	
	England	**Scotland**	**Wales**	**Total**
Operational mines	1	4	9	14
Planning granted	4	28	3	35
In planning process	3	6	1	10
Pre-planning	11	7	3	21
Prospects	516	115	147	777
Total	**535**	**160**	**163**	**857**

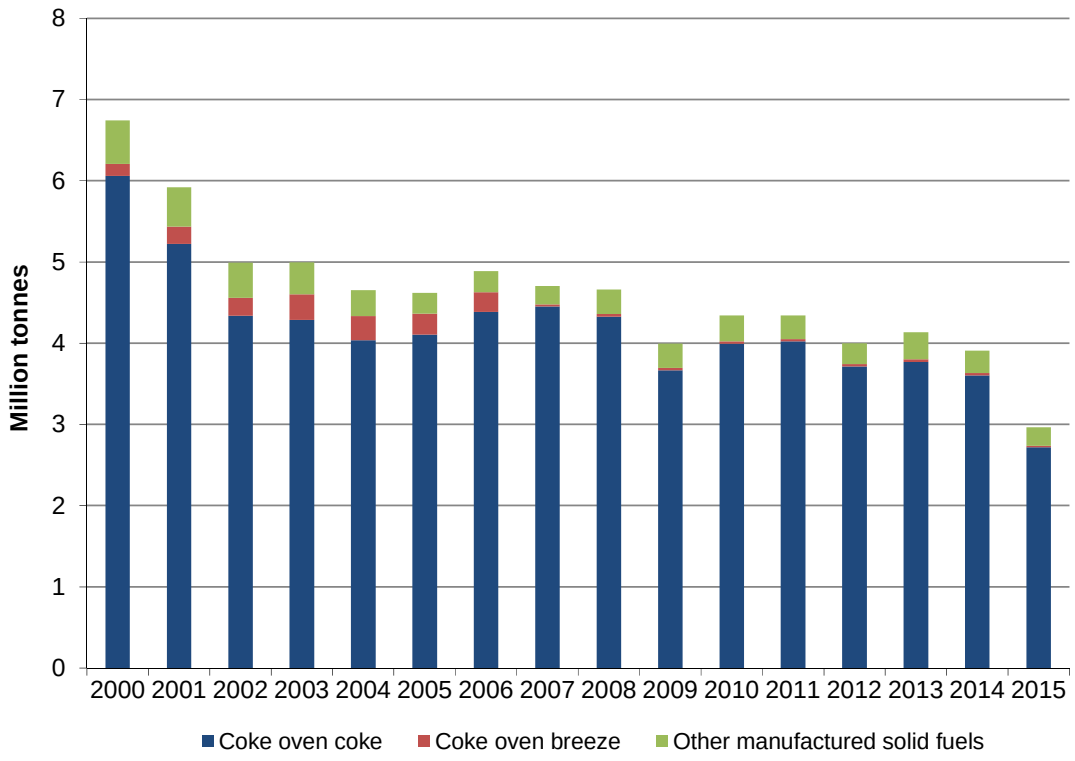
Source: Coal Authority

Manufactured Solid Fuels (Tables 2.5 and 2.6)

Production, Trade and Consumption

2.28 In 2015, around 92 per cent of manufactured solid fuel production was **coke oven coke**, a proportion that has remained the same for the past 16 years (Chart 2.4). In 2015, 73 per cent of the UK's supply of coke oven coke was home produced, with the remainder being imported, chiefly from the USA (2.1 million tonnes), Russia (1.3 million tonnes) and Australia (0.9 million tonnes). Between 2014 and 2015, home produced coke oven coke decreased by 25 per cent to 2.7 million tonnes. 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.

Chart 2.4: Total manufactured solid fuels production in the UK 2000 to 2015



2.29 The main purpose of coke oven coke is for use in blast furnaces in the UK iron and steel industry. In 2015, blast furnace use had fallen to 2.8 million tonnes, down 10 per cent from 2014, representing 99 per cent of total demand. The rest of production was added to stocks. The fall in blast furnace use was due to reduced steel production in the UK, as a result of the UK steel industry becoming less competitive[4]. Notably, SSI steelworks at Redcar ceased production in mid-September (with the subsequent closure in October).

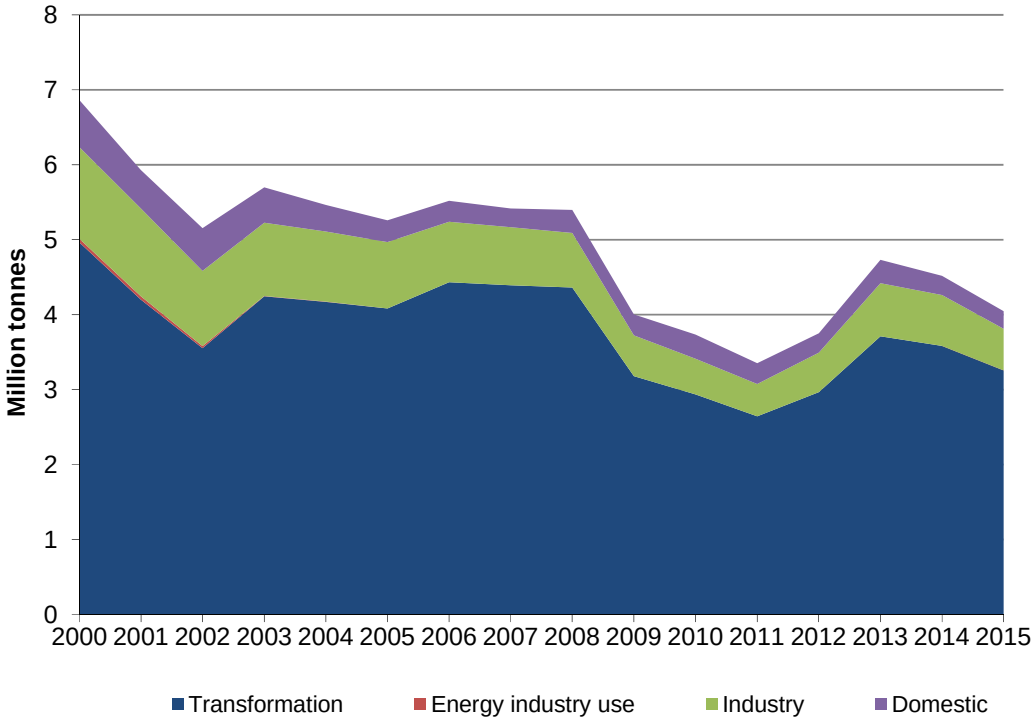
2.30 Most of the supply of **coke breeze** is from re-screened coke oven coke, with direct production accounting for only 1.9 per cent of total supply in 2015. In that year, 45 per cent of coke breeze was used in blast furnaces (0.4 million tonnes) for transformation and 55 per cent used for final consumption (Chart 2.5).

2.31 Other manufactured solid fuels (patent fuels) are manufactured smokeless fuels, produced mainly for the domestic market. A small amount of these fuels (only 8.5 per cent of total supply in 2015) was imported, but exports generally exceed this.

[4] *Fall in UK steel production due to cheaper imports from China*

2.32 The carbonisation and gasification of solid fuels in coke ovens produces coke oven gas as a by-product. In 2015, production of coke oven gas was 6.9 TWh, 19 per cent lower than in 2014 (8.5 TWh). Some of this (44 per cent) was used to fuel the coke ovens themselves. Another 23 per cent was used for electricity generation, 14 per cent for iron and steel and other industrial processes (including heat production), 10 per cent in blast furnaces and 11 per cent was lost.

Chart 2.5: Total manufactured solid fuels consumption in the UK 2000 to 2015



2.33 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 8.2 per cent in 2015 compared with 2014. The generation of electricity in 2015 used 53 per cent of total blast furnace gas and BOS gas, while 32 per cent was used in coke ovens and blast furnaces themselves, 1.3 per cent used in general heat production, 13 per cent was lost or burned as waste and a further 0.9 per cent was used in the iron and steel industry.

2.34 Demand for benzole and tars decreased by 28 per cent from 2014 (1,582 GWh), to 1,136 GWh in 2015, 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 2.54 (d) and (e).

Technical notes and definitions

2.35 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 1.63. 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

2.36 **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.

2.37 **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.

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

Steam coal, coking coal and anthracite

2.39 **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.

2.40 **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.

2.41 **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

2.42 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

2.43 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.

2.44 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 2015 is estimated at 39.5 thousand tonnes. This estimate is included in the domestic steam coal and domestic anthracite figures.

Stocks of coal

2.45 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 5.71 and 5.72), coke ovens, low temperature carbonisation plants and patent fuel plants.

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

2.46 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 2.45, below). Breeze (as defined in paragraph 2.46) is excluded from the figures for coke oven coke.

2.47 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.

2.48 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.

2.49 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.

2.50 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.

2.51 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.

2.52 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.

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

2.54 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.

2.55 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

2.56 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.

Contact: Chris Michaels
Energy Statistics Team
coalstatistics@decc.gsi.gov.uk
0300 068 5050

2.1 Commodity balances 2015

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	7,668	72	858	8,598
Other sources	-	-	-	-
Imports	19,345	4,750	102	24,198
Exports	-303	-1	-81	-385
Marine bunkers	-	-	-	-
Stock change *(1)*	+4,887	+174	74	+5,134
Transfers	-	-	-	-
Total supply	**31,597**	**4,995**	**953**	**37,545**
Statistical difference *(2)*	+639	-148	-317	+174
Total demand	**30,958**	**5,143**	**1,271**	**37,372**
Transformation	**28,937**	**5,143**	**696**	**34,776**
Electricity generation	28,725	-	473	29,197
Major power producers	28,706	-	473	29,178
Autogenerators	19	-	-	19
Heat generation	213	-	-	213
Petroleum refineries	-	-	-	-
Coke manufacture	-	3,699	-	3,699
Blast furnaces	-	1,444	-	1,444
Patent fuel manufacture and low temperature carbonisation	-	-	223	223
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	**2,021**	**-**	**575**	**2,596**
Industry	**1,637**	**-**	**375**	**2,012**
Unclassified	-	-	-	-
Iron and steel	2	-	43	44
Non-ferrous metals	21	-	-	21
Mineral products	1,010	-	0	1,010
Chemicals	74	-	-	74
Mechanical engineering etc	11	-	-	11
Electrical engineering etc	5	-	-	5
Vehicles	60	-	-	60
Food, beverages etc	33	-	21	54
Textiles, leather, etc	66	-	-	66
Paper, printing etc	123	-	-	123
Other industries	225	-	312	537
Construction	6	-	-	6
Transport	**13**	**-**	**-**	**13**
Air	-	-	-	-
Rail *(3)*	13	-	-	13
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**371**	-	**200**	**571**
Domestic	352	-	200	552
Public administration	7	-	-	7
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 2014

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	10,161	99	1,388	11,648
Other sources	-	-	-	-
Imports	35,754r	6,344	127	42,225r
Exports	-343	-1	-81	-425
Marine bunkers	-	-	-	
Stock change *(1)*	-4,666r	-276	-31r	-4,973r
Transfers	-	-	-	-
Total supply	**40,906r**	**6,165**	**1,403r**	**48,474r**
Statistical difference *(2)*	+736r	-325	-192r	+219r
Total demand	**40,170r**	**6,490**	**1,595**	**48,255r**
Transformation	**37,811r**	**6,490**	**954**	**45,255r**
Electricity generation	37,539r	-	695	38,234r
Major power producers	37,521	-	695	38,215
Autogenerators	19r	-	-	19r
Heat generation	272r	-	-	272r
Petroleum refineries	-	-	-	-
Coke manufacture	-	4,977	-	4,977
Blast furnaces	-	1,513	-	1,513
Patent fuel manufacture and low temperature carbonisation	-	-	259	259
Energy industry use	**1**	**-**	**-**	**1**
Electricity generation	-	-	-	-
Oil and gas extraction	-	-	-	-
Petroleum refineries	-	-	-	-
Coal extraction	1	-	-	1
Coke manufacture	-	-	-	-
Blast furnaces	-	-	-	-
Patent fuel manufacture	-	-	-	-
Pumped storage	-	-	-	-
Other	-	-	-	-
Losses	-	-	-	-
Final consumption	**2,358r**	**-**	**641**	**3,000r**
Industry	**1,966r**	**-**	**439**	**2,405r**
Unclassified	-	-	-	-
Iron and steel	2	-	52	54
Non-ferrous metals	25	-	-	25
Mineral products	1,213r	-	0	1,213r
Chemicals	103r	-	-	103r
Mechanical engineering etc	14	-	-	14
Electrical engineering etc	7	-	-	7
Vehicles	70r	-	-	70r
Food, beverages etc	44r	-	20	64r
Textiles, leather, etc	74r	-	-	74r
Paper, printing etc	161r	-	-	161r
Other industries	246r	-	366	612r
Construction	7	-	-	7
Transport	**13**	**-**	**-**	**13**
Air	-	-	-	-
Rail *(3)*	13	-	-	13
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**380r**	-	**202**	**582r**
Domestic	344r	-	202	546r
Public administration	23	-	-	23
Commercial	5	-	-	5
Agriculture	-	-	-	-
Miscellaneous	7r	-	-	7r
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 2013

Coal

Thousand tonnes

	Steam coal	Coking coal	Anthracite	Total
Supply				
Production	11,078	179	1,415	12,673
Other sources	95	-	-	95
Imports	42,995	6,246	161	49,402
Exports	-443	-9	-142	-593
Marine bunkers	-	-	-	-
Stock change *(1)*	-1,821r	+312	204r	-1,305r
Transfers	-	-	-	-
Total supply	**51,905r**	**6,729**	**1,638r**	**60,272r**
Statistical difference *(2)*	+292r	30	-65r	+258r
Total demand	**51,613r**	**6,698**	**1,703**	**60,014r**
Transformation	**49,563r**	**6,698**	**933**	**57,194r**
Electricity generation	49,196r	-	680	49,875r
Major power producers	49,163	-	680	49,842
Autogenerators	33r	-	-	33r
Heat generation	362r	-	-	362r
Petroleum refineries	-	-	-	-
Coke manufacture	-	5,288	-	5,288
Blast furnaces	-	1,411	-	1,411
Patent fuel manufacture and low temperature carbonisation	5	-	254	259
Energy industry use	**3**	**-**	**-**	**3**
Electricity generation	-	-	-	-
Oil and gas extraction	-	-	-	-
Petroleum refineries	-	-	-	-
Coal extraction	3	-	-	3
Coke manufacture	-	-	-	-
Blast furnaces	-	-	-	-
Patent fuel manufacture	-	-	-	-
Pumped storage	-	-	-	-
Other	-	-	-	-
Losses	-	-	-	-
Final consumption	**2,047**	**-**	**769**	**2,817r**
Industry	**1,616**	**-**	**516**	**2,132r**
Unclassified	-	-	-	-
Iron and steel	2	-	51	53
Non-ferrous metals	23	-	-	23
Mineral products	1,170	-	0	1,170
Chemicals	86	-	-	86
Mechanical engineering etc	12	-	-	12
Electrical engineering etc	6	-	-	6
Vehicles	52	-	-	52
Food, beverages etc	25	-	19	44
Textiles, leather, etc	59	-	-	59
Paper, printing etc	122	-	-	122
Other industries	53	-	445	498
Construction	6	-	-	6
Transport	**14**	**-**	**-**	**14**
Air	-	-	-	-
Rail *(3)*	14	-	-	14
Road	-	-	-	-
National navigation	-	-	-	-
Pipelines	-	-	-	-
Other	**417**	-	**254**	**671**
Domestic	383	-	254	636
Public administration	22	-	-	22
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

	2011	2012	2013	2014	2015
Supply					
Production	17,892	16,287	12,673	11,648	8,598
Deep-mined	7,312	6,153	4,089	3,685	2,784
Surface mining *(1)*	10,580	10,134	8,584	7,962	5,814
Other sources *(2)*	660	680	95	-	-
Imports	32,527	44,815	49,402	42,225r	24,198
Exports	-491	-488	-593	-425	-385
Stock change *(3)*	+836	+2,966	-1,305r	-4,973r	+5,134
Total supply	**51,424**	**64,259**	**60,272r**	**48,474r**	**37,545**
Statistical difference *(4)*	-83	+217	+258r	+219r	+174
Total demand	**51,507**	**64,042**	**60,014r**	**48,255r**	**37,372**
Transformation	**48,946**	**61,498**	**57,194r**	**45,255r**	**34,776**
Electricity generation	41,850	54,901	49,875r	38,234r	29,197
Major power producers	40,566	53,837	49,842	38,215	29,178
Autogenerators	1,284	1,064	33r	19r	19
Heat generation	562	461	362r	272r	213
Coke manufacture	5,282	4,965	5,288	4,977	3,699
Blast furnaces	995	987	1,411	1,513	1,444
Patent fuel manufacture and low temperature carbonisation	258	184	259	259	223
Energy industry use	**4**	**4**	**3**	**1**	**-**
Coal extraction	4	4	3	1	-
Final consumption	**2,557**	**2,541**	**2,817r**	**3,000r**	**2,596**
Industry	**1,798**	**1,826**	**2,132r**	**2,405r**	**2,012**
Unclassified	-	-	-	-	-
Iron and steel	53	51	53	54	44
Non-ferrous metals	23	21	23	25	21
Mineral products	1,056	1,123	1,170	1,213r	1,010
Chemicals	78	76	86	103r	74
Mechanical engineering etc	11	11	12	14	11
Electrical engineering etc	5	5	6	7	5
Vehicles	53	50	52	70r	60
Food, beverages etc	45	44	44	64r	54
Textiles, clothing, leather, etc	64	62	59	74r	66
Pulp, paper, printing etc	122	138	122	161r	123
Other industries	280	239	498	612r	537
Construction	7	6	6	7	6
Transport	**15**	**16**	**14**	**13**	**13**
Other	**744**	**698**	**671**	**582r**	**571**
Domestic	705	674	636	546r	552
Public administration	26	12	22	23	7
Commercial	5	5	5	5	5
Agriculture	1	1	-	-	-
Miscellaneous	7	6	7	7r	7
Non energy use					
Stocks at end of year *(5)*					
Distributed stocks	15,115	11,883	13,780r	18,641r	13,629
Of which:					
Major power producers	13,496	9,561	11,871	17,091	12,569
Coke ovens	1,355	831	518	795	621
Undistributed stocks	926	1,120	512r	623r	452
Total stocks *(6)*	**16,041**	**13,003**	**14,292r**	**19,264r**	**14,081**

(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

	2011	2012	2013	2014	2015
Coke oven coke					
Supply					
Production	4,021	3,712	3,769	3,601	2,716
Imports	-	147	764	823	1,006
Exports	-427	-450	-75	-85	-83
Stock change *(1)*	-520	+341	+178	-64	+184
Transfers	-744	-1,021	-1,277	-1,075	-970
Total supply	**2,331**	**2,728**	**3,358**	**3,199**	**2,853**
Statistical difference *(2)*	**-**	**-**	**-**	**-**	**-**
Total demand	**2,331**	**2,728**	**3,358**	**3,199**	**2,853**
Transformation	**2,287**	**2,674**	**3,271**	**3,144**	**2,823**
Blast furnaces	2,287	2,674	3,271	3,144	2,823
Energy industry use	**-**	**-**	**-**	**-**	**-**
Final consumption	**44**	**55**	**87**	**55**	**30**
Industry	**35**	**48**	**82**	**49**	**27**
Unclassified	28	35	69	35	13
Iron and steel	7	13	13	14	15
Non-ferrous metals	**-**	**-**	**-**	**-**	**-**
Other	**9**	**7**	**6**	**6**	**3**
Domestic	9	7	6	6	3
Stocks at end of year *(3)*	**972**	**393**	**215r**	**280r**	**95**
Coke breeze					
Supply					
Production *(4)*	31	31	32	31	18
Imports	26	46	55	103	107
Exports	-40	-71	-11	-3	-7
Stock change *(1)*	-8	-255	-283	-132	-123
Transfers	744	1,021	1,277	1,071	967
Total supply	**753**	**772**	**1,069**	**1,070**	**962**
Statistical difference *(2)*	**-**	**-**	**-**	**-**	**-**
Total demand	**753**	**772**	**1,069**	**1,070**	**962**
Transformation	**358**	**293**	**442**	**440**	**433**
Coke manufacture	**-**	**-**	**-**	**-**	**-**
Blast furnaces	358	293	442	440	433
Energy industry use	**-**	**-**	**-**	**-**	**-**
Final consumption	**395**	**479**	**627**	**629**	**528**
Industry	**395**	**479**	**627**	**629**	**528**
Unclassified	7	10	14	9	4
Iron and steel	388	469	613	620	525
Stocks at end of year *(3)*	**210**	**437**	**720r**	**852r**	**975**
Other manufactured solid fuels					
Supply					
Production	289	258	336	274	231
Imports	21	15	15	14	20
Exports	-32	-32	-30	-24	-22
Stock change *(1)*	-13	+7	-17	-15	+3
Total supply	**265**	**248**	**303**	**249**	**232**
Statistical difference *(2)*	-4	-5	-1	-1	+0
Total demand	**270**	**253**	**304**	**250**	**232**
Transformation	**-**	**-**	**-**	**-**	**-**
Energy industry use	**-**	**-**	**-**	**-**	**-**
Patent fuel manufacture	**-**	**-**	**-**	**-**	**-**
Final consumption	**270**	**253**	**304**	**250**	**232**
Industry	**-**	**-**	**-**	**-**	**-**
Unclassified	**-**	**-**	**-**	**-**	**-**
Other	**270**	**253**	**304**	**250**	**232**
Domestic	270	253	304	250	232
Stocks at end of year *(3)*	**32**	**24**	**42**	**57**	**54**

(1) Stock fall (+), stock rise (-).
(2) Total supply minus total demand.
(3) Producers stocks and distributed stocks.
(4) See paragraph 2.29.

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

GWh

	2011	2012	2013	2014	2015
Coke oven gas					
Supply					
Production	8,845	8,257	8,479	8,473	6,890
Imports	-	-	-	-	-
Exports	-	-	-	-	-
Transfers *(1)*	+62	+60	+64	+146	+439
Total supply	**8,907**	**8,317**	**8,544**	**8,620**	**7,329**
Statistical difference *(2)*	-62	-1	-1	-3r	28
Total demand	**8,969**	**8,318**	**8,545**	**8,622r**	**7,301**
Transformation	**3,019**	**2,858**	**2,741**	**2,538r**	**2,067**
Electricity generation	2,601	2,440	2,322	2,119r	1,649
Heat generation	418	418	418	418	418
Other	-	-	-	-	-
Energy industry use	**4,300**	**4,567**	**4,525**	**4,599**	**3,879**
Coke manufacture	3,832	3,816	3,643	3,725	3,185
Blast furnaces	469	751	882	874	694
Other	-	-	-	-	-
Losses	**758**	**192**	**389**	**682**	**768**
Final consumption	**891**	**701**	**890**	**804r**	**586**
Industry	**891**	**701**	**890**	**804r**	**586**
Unclassified	200	198	174	165	-
Iron and steel	691	504	716	639r	586
Blast furnace gas					
Supply					
Production	10,503	11,694	15,576	15,386	14,131
Imports	-	-	-	-	-
Exports	-	-	-	-	-
Transfers *(1)*	-2	-4	-4	-7	-19
Total supply	**10,501**	**11,690**	**15,572**	**15,380**	**14,111**
Statistical difference *(2)*	-70	-48	+17	-34	+13
Total demand	**10,571**	**11,738**	**15,555**	**15,414**	**14,099**
Transformation	**5,462**	**7,052**	**8,782**	**8,686r**	**7,637**
Electricity generation	5,283	6,873	8,602	8,507r	7,457
Heat generation	179	179	179	179	179
Other	-	-	-	-	-
Energy industry use	**3,370**	**3,569**	**4,516**	**4,732**	**4,451**
Coke manufacture	657	672	751	711	641
Blast furnaces	2,713	2,898	3,765	4,021	3,810
Other	-	-	-	-	-
Losses	**993**	**817**	**2,111**	**1,835**	**1,878**
Final consumption	**746**	**300**	**146**	**160r**	**133**
Industry	**746**	**300**	**146**	**160r**	**133**
Unclassified	-	-	-	-	-
Iron and steel	746	300	146	160r	133
Benzole and tars *(3)*					
Supply					
Production	1,657	1,543	1,630	1,582	1,136
Final consumption *(4)*	**1,657**	**1,543**	**1,630**	**1,582**	**1,136**
Unclassified	-	-	-	-	-
Iron and steel	-	-	-	-	-
Non energy use	1,657	1,543	1,630	1,582	1,136

(1) To and from synthetic coke oven gas, see paragraph 2.53.
(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 at 31 December 2015

Deep mines[1]

Licensee	Site Name	Location
Ayle Colliery Company Ltd	Ayle Colliery	Northumberland
European Coal Products Ltd	Eckington Colliery	Derbyshire
Grimebridge Colliery Company Ltd	Hill Top Colliery	Lancashire
NH Colliery Ltd	Nant Hir No.2 Colliery	Neath Port Talbot
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
	Nant Helen	Powys
	Selar	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
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 (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 3 underground mines on care & maintenance :-
Aberpergwm Colliery in Neath Port Talbot licensed to Energybuild Mining Ltd
Monument Colliery in the Forest of Dean licensed to Messrs Ashly, Daniels and Jones
Rediings 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 :-
Broken Cross site in South Lanarkshire licensed to OCCW (Broken Cross) Ltd
Bwlch Ffos site in Neath Port Talbot licensed to Horizon Mining Ltd (in administration)

Source: The Coal Authority

Chapter 3
Petroleum

Key points

- Production of crude oil and Natural Gas Liquids from the UK's North Sea increased 13.4 per cent in 2015, in contrast with the long-term decline. The rate of decline slowed in 2014 and production increased in 2015 due to the opening of new fields. Production is around a third of the UK's peak of 1999 (Table 3.1, Chart 3.1).

- Net imports of primary oils decreased in 2015 because of the increased production and also because refineries were processing more indigenous crude. Exports increased 2.8 million tonnes in 2015 and imports were down by over 3 million tonnes. (Table 3.1, Chart 3.1).

- UK refinery production increased to 61.0 million tonnes in 2015, up from 60.4 million tonnes in 2014 despite production loss from the closure of Milford Haven refinery in 2014. Production was strong in 2015 against a background of lower crude prices. However many refineries have reduced their distillation capacity in recent years and UK production was still around thirty per cent lower than the peak in 2000 (Table 3.2, Chart 3.4).

- The UK was a net importer of petroleum products in 2015 by nearly 9 million tonnes, the highest such figure since the 1984 miner's strike. Prior to 2013 the UK was consistently a net exporter but has since then been a net importer. Product exports were up marginally on 2014 and imports increased by 9.1 per cent in 2015 (Table 3.2, Chart 3.4).

- Refinery production does not meet demand for every product. Around 55 per cent of the UK's diesel is produced in the UK and just over 40 per cent of jet fuel. Whereas UK refineries continue to produce substantial volumes of petrol (motor spirit), approximately 17 million tonnes, more than sufficient to meet UK demand (Table 3.2, Chart 3.5).

- After several years where final consumption contracted, 2015 saw an increase of 2.9 per cent. This was largely driven by the use of oil for transport, particularly of road fuels, though demand of oil products for use in petrochemical plants also increased (Table 3.2 to 3.4), Chart 3.8).

Introduction

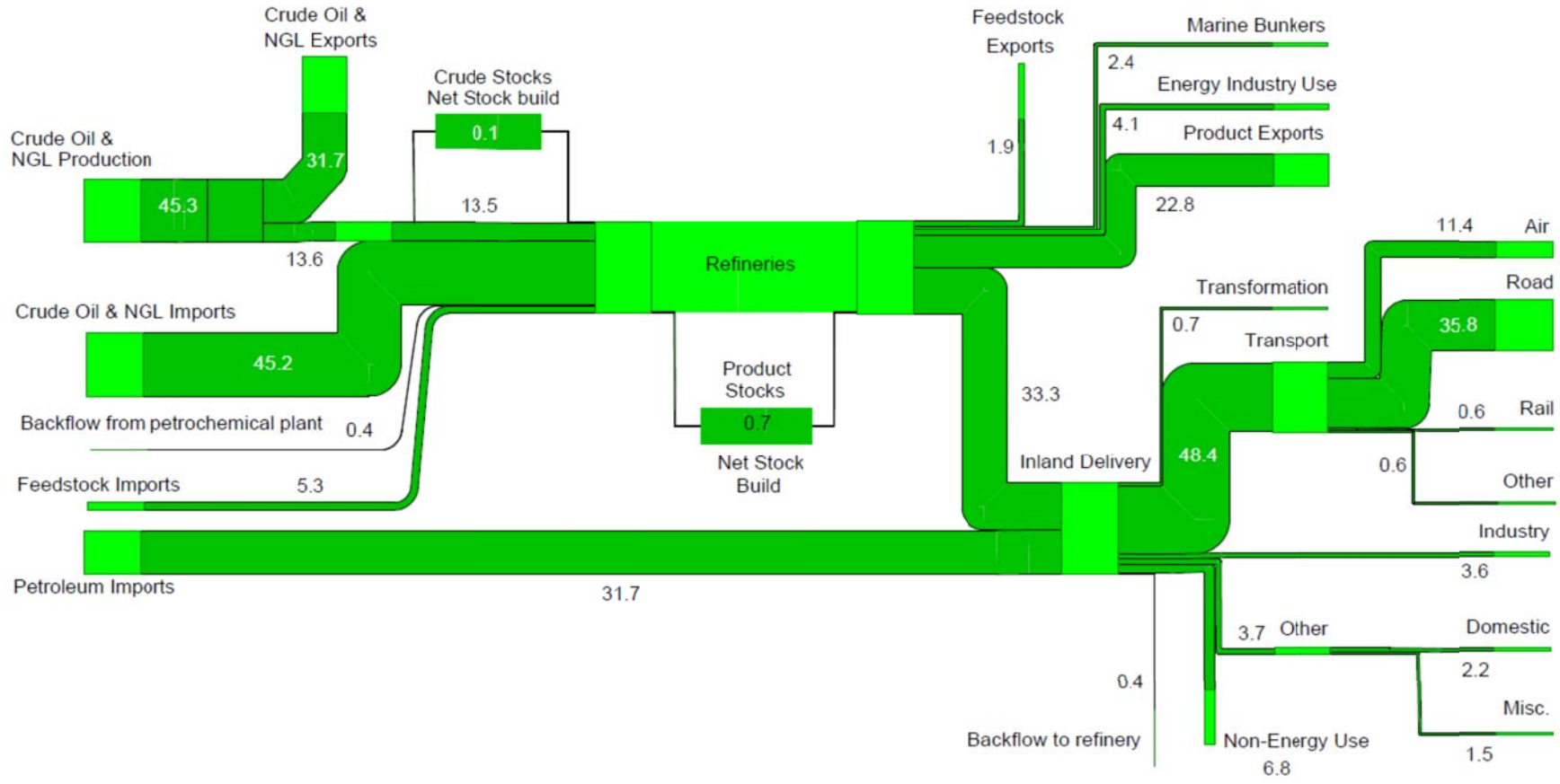
3.1 This chapter covers the supply and demand of primary oils and petroleum products. The first part of the chapter covers the supply and demand of primary oils; crude oil and Natural Gas Liquids (NGLs), and feedstocks. The second part of the chapter covers supply and demand of refined petroleum products.

3.2 The supply and demand of primary oils and petroleum products are shown as commodity balances at the end of the chapter, in Tables 3.1 and 3.2 to 3.4 respectively. Additional tables show information on refinery capacity, as well as additional detail on deliveries into consumption.

3.3 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 only available in the internet version of this publication which can be found on the the GOV.UK website at www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

3.4 A flow chart of the movement of primary oils and petroleum products for 2015 is provided, showing the flow from indigenous production and imports to eventual uses. The flows are measured in million tonnes and the widths of the bands are approximately proportional to the size of the flow they represent.

Petroleum Flow Chart 2015 (million tonnes)



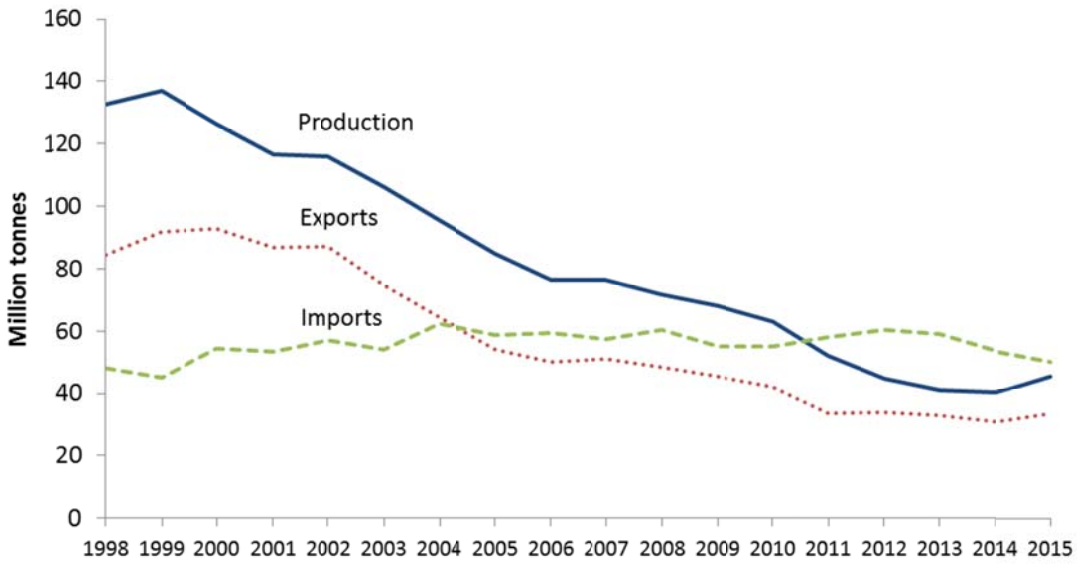
Note:
This flow chart is based on the data that appear in Tables 3.1 and 3.2.
The numbers on either side of the flow chart will not match due to losses in transformation.
Biofuels are not included.

Supply and demand for primary oil (Table 3.1)

3.5 Table 3.1 shows details of the production, supply and disposals of primary oils (crude oil, NGLs and feedstocks) in 2013, 2014 and 2015. The table examines the supply chain from the production of primary oils recorded by individual oil terminals and oil fields, to their disposal either to UK refineries or to export. It also covers the use of these primary oils as recorded by UK refineries.

3.6 From this edition of the Digest, production of feedstocks has been shown for 2013 to 2015 in Table 3.1. This figure represents the backflows of (in the main) petroleum gases from petrochemical companies to refineries where they will be further processed. Given relatively small volumes, these flows are not included in the Chart 3.1.

Chart 3.1: Production, imports and exports of primary oils 1998 to 2015



3.7 Chart 3.1 summarises the main trends since 1998. **Production from the United Kingdom Continental Shelf (UKCS) peaked in 1999 and had been in decline since**, **but rose this year.** In 2015 production of primary oils at 45.3 million tonnes showed a 13.4 per cent increase on 2014 due to the opening of new fields such as Golden Eagle. NGL production has also been strong because the oil being extracted from these new fields contains a higher proportion of NGLs.

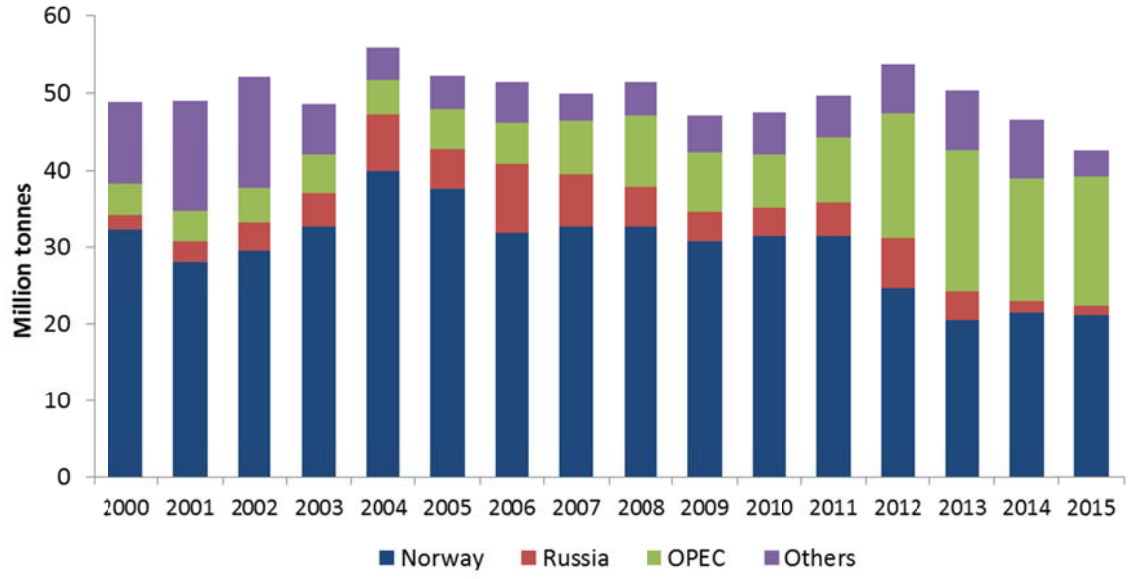
3.8 Whilst production is only around a third of the 1999 peak, the UK produced more oil in 2015 than any other country in the EU, and the second most in the European Economic Area after Norway.

3.9 The Energy Development Unit publishes data on field-by-field production. These are available three months in arrears owing to the need to protect commercially sensitive data. These data can be accessed at www.gov.uk/oil-and-gas-uk-field-data.

3.10 Although the UK's production of crude oil and NGLs would be sufficient to meet two thirds of refinery demand, there is an active trade in oil which leads to significant volumes of oil being imported and exported to meet global and UK demand.

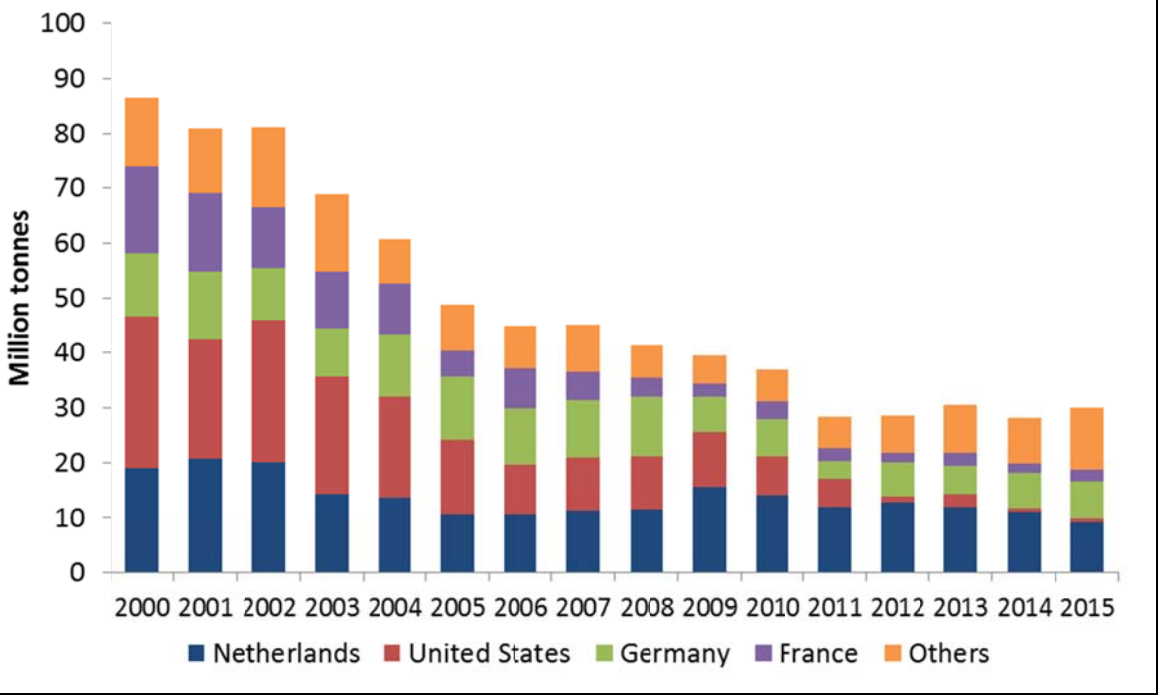
3.11 The sources of crude oil imports from other countries are shown in Chart 3.2. **The principal source of the UK's imports has consistently been Norway,** historically accounting for around 65 per cent of all imports, given not only its proximity to the UK but also the similarity in its crude types. The proportion of crude oil sourced from Norway has dropped in recent years and now stands at 50 per cent. Imports from OPEC countries have increased to make up the difference and now consist of 39 per cent of the UK's crude imports.

Chart 3.2: Source of UK crude oil imports 2000 to 2015



3.12 **Crude oil exports increased in 2015 to reach nearly 30 million tonnes.** However, Chart 3.3 shows that exports are substantially lower than their peak of 87 million tonnes in 2000. Crude oil is principally exported to the Netherlands, Germany, France and historically the US. Exports to the US and Germany remained steady in 2015 whereas exports to the Netherlands reduced by 1.7 million tonnes to account for 31 per cent of total exports, the lowest proportion since 2008. Exports to France and other countries were up.

Chart 3.3: Destination of UK crude oil exports 2000 to 2015



UK refineries

3.13 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 2015 are presented in Table 3A, with the location of these refineries illustrated in Map 3A. The location of the UK's petrochemical refineries and major import terminals are also marked.

Map 3A: Distribution of UK refineries and import terminal clusters as at end 2015

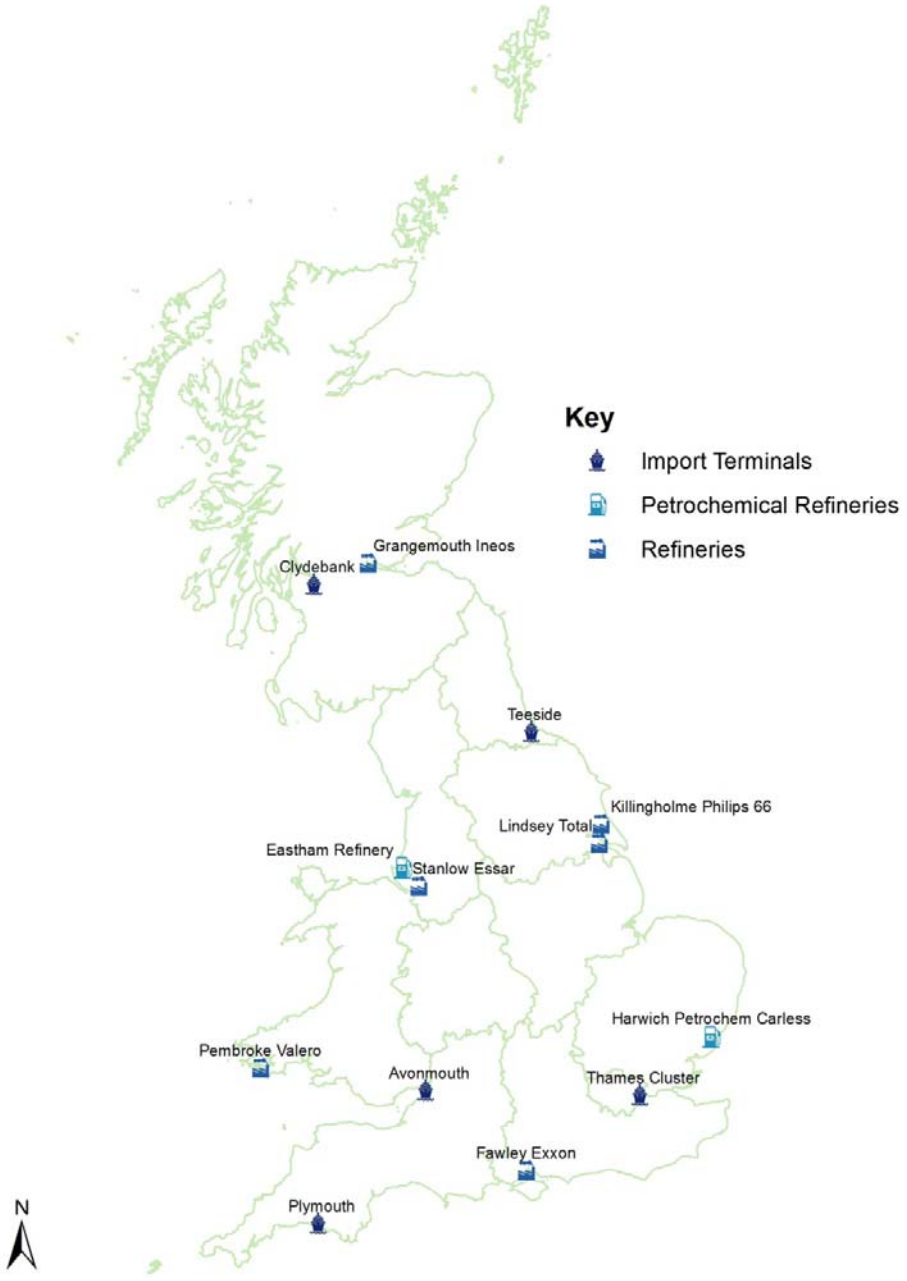


Table 3A: UK refinery processing capacity as at end 2015

Million tonnes per annum

Refinery	Distillation	Reforming	Cracking and Conversion
Fawley Exxon	13.1	4.4	5.0
Stanlow Essar	9.5	1.5	4.0
Pembroke Valero	10.8	1.5	6.3
Grangemouth Ineos	10.0	1.8	3.3
Killingholme Phillips 66	11.9	2.6	10.7
Lindsey Total	10.1	1.4	3.8
Petrochem Refinery	**Distillation**	**Reforming**	**Cracking and Conversion**
Harwich Petrochem Carless	-	-	-
Eastham Refinery	1.2	-	-
Total all refineries	**66.6**	**13.2**	**33.1**

3.14 **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 over 25 per cent on its 2008 total.

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

3.15 These tables show details of the production, supply and disposal of petroleum products into the UK market in 2013, 2014 and 2015.

3.16 The upper half of the table 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).

3.17 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.

3.18 Following consultation with industry and expanded data collection, BEIS have made revisions to figures for international bunkers and national navigation. Changes have affected data for years 2013 to 2015. A further development that has been introduced this year is the inclusion of backflows from petrochemical companies to refineries for re-processing. Deliveries to petrochemical plants have been shown under Other Transformation in Table 3.2 to 3.4. The receipt of backflows from petrochemical plants has been shown under production of feedstock in Table 3.1. For more details please see 3.58 – 3.59 of the technical notes.

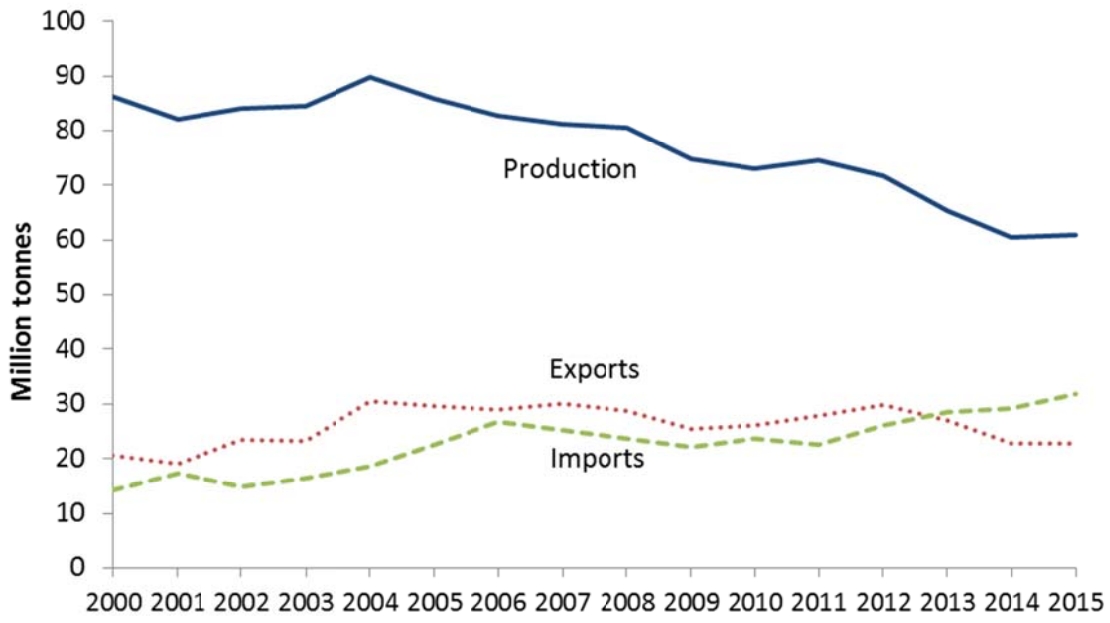
Supply of petroleum products

3.19 Chart 3.4 below shows the production output of petroleum products since 1998. **Despite the recent rationalisation in the sector, the UK's refineries produced 61 million tonnes of product in 2015, up 1.0 per cent on last year.** The price of crude fell in 2015 from $99/bbl to just $52/bbl[1]. The strong production in 2015 was partly attributable to these low prices for crude, and also because very little maintenance was seen through the year overall. The UK's refinery capacity remains substantial with only Germany and Italy having significantly greater capacity than the UK. However in the long term 2015 levels were down 29 per cent from the peak in 2000.

3.20 **In 2015 the UK was a net importer of petroleum products by 8.9 million tonnes, up 40 per cent on last year and the largest figure for net imports since 1984** when industrial action in the coal industry led to greater imports of petroleum products, particularly fuel oil, for power generation. With declining production of key fuels, the UK has been a net importer of petroleum since 2013, reversing the trend of previous decades as a net exporter.

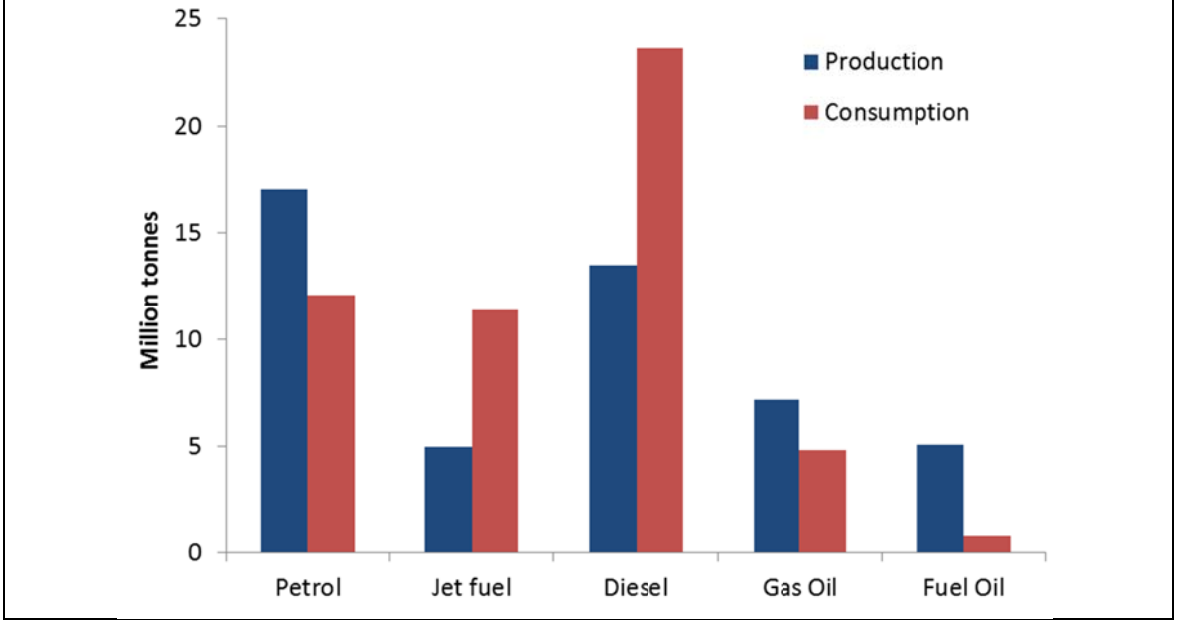
[1] Platts, from the 2015 BP Statistical Review of World Energy

Chart 3.4: Production, imports and exports of petroleum products 2000 to 2015



3.21 Given the recent increase in demand and relatively static refinery output, production is now nearly 7 million tonnes below demand. Furthermore, domestic supply and demand is not matched on a product by product basis. The UK's refineries – in common with many other European countries – are geared to produce petrol (motor spirit) 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 individual 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 in the OECD and one of the largest exporters of petrol.

Chart 3.5: Production and consumption of key petroleum products 2015



3.22 Chart 3.5 shows production and consumption figures for the key petroleum products, and illustrates

the deficit for jet and diesel fuel, and the surpluses for petrol, gas oil, and fuel oil.

3.23 Chart 3.6 shows the source of transport fuels imported by the UK in 2015. The ten countries shown account for around 82 per cent of the total volume of imports. Historically the bulk of the 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). However, Russia and Sweden were the biggest sources of transport fuels, being especially large suppliers of diesel as well as the US. The diversity of supply is increasing as demand for key transport fuels increases. The chart shows that there is a clear split between imports from European countries (which are mainly diesel) and imports from Asia (where the bulk of jet fuel is sourced from generally more modern refinery operations than seen in Europe).

Chart 3.6: Source of transport fuel imports 2015

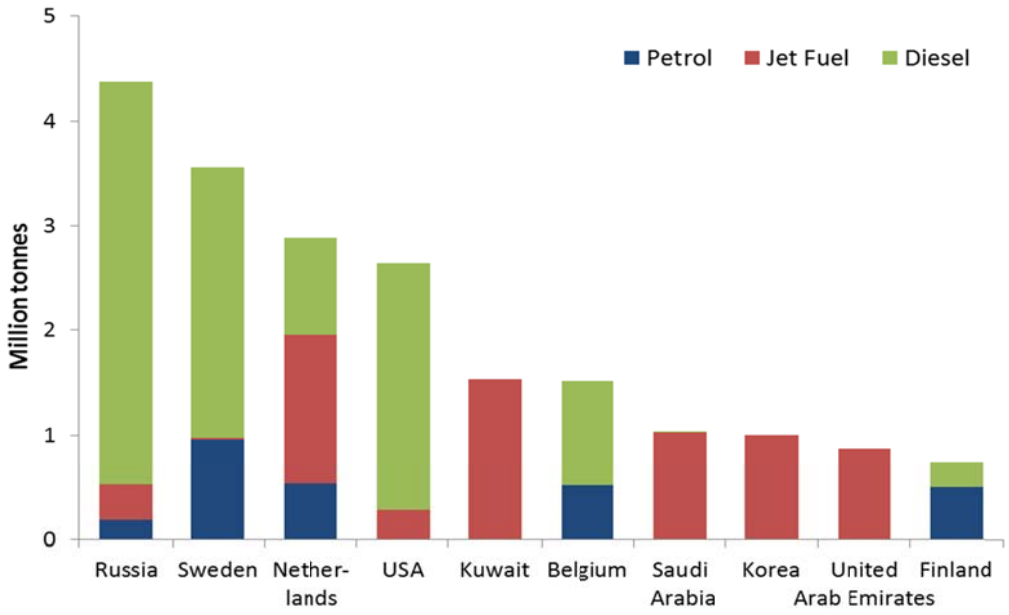
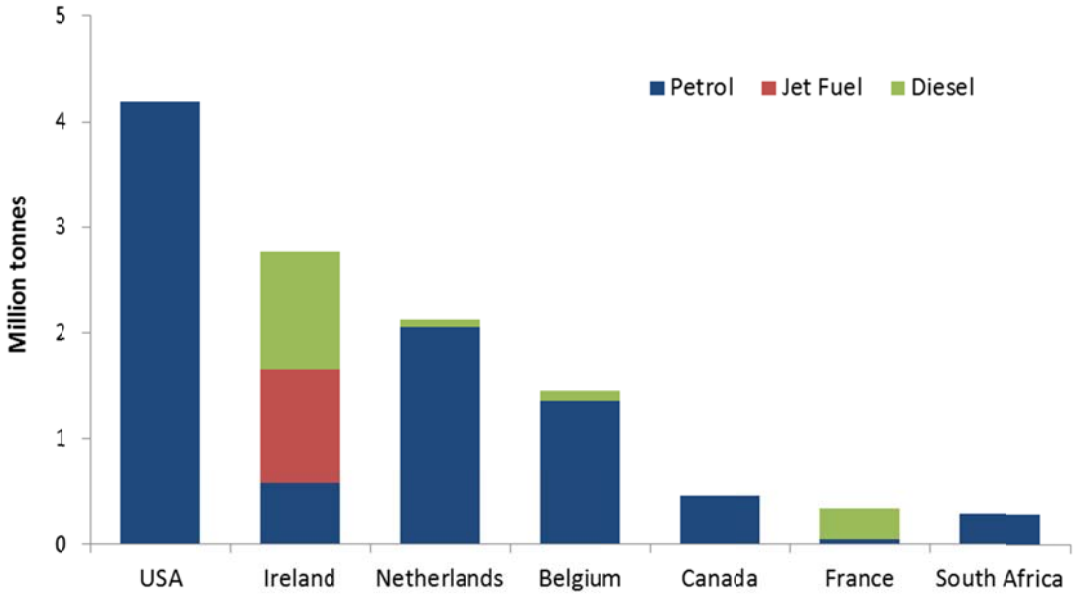


Chart 3.7: Destination of transport fuel exports 2015



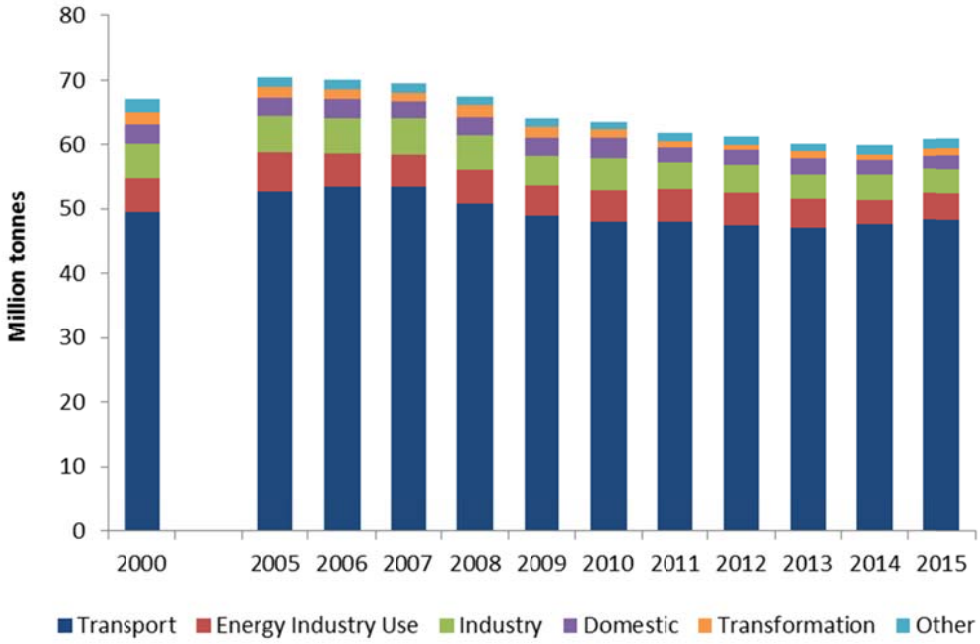
3.24 Similarly, Chart 3.7 shows the exports by country for the three principal transport fuels in 2015. The chart covers over 90 per cent of these exports. A considerable portion of the UK's total exports (nearly a third) is petrol exported to the United States. Ireland imports a substantial volume of its products from the UK as it has no indigenous production of aviation fuel.

Consumption of petroleum products

3.25 **The low oil prices that boosted refinery production in 2015 are likely to have contributed to the first increase in consumption of petroleum products since 2005,** mainly as a result of a substantial increase in road transport fuels as well as aviation fuel. Additionally, we have seen large imports of petroleum gases into the UK to some petrochemical operations.

3.26 Tables 3.2 to 3.4 show the consumption of oil products during the period 2013 to 2015, by consumers and products. The chart below shows that **the principal use for petroleum products is consistently for transport, consuming over 70 per cent of total demand in 2015.**

Chart 3.8: Petroleum products used for energy (share by main sector)

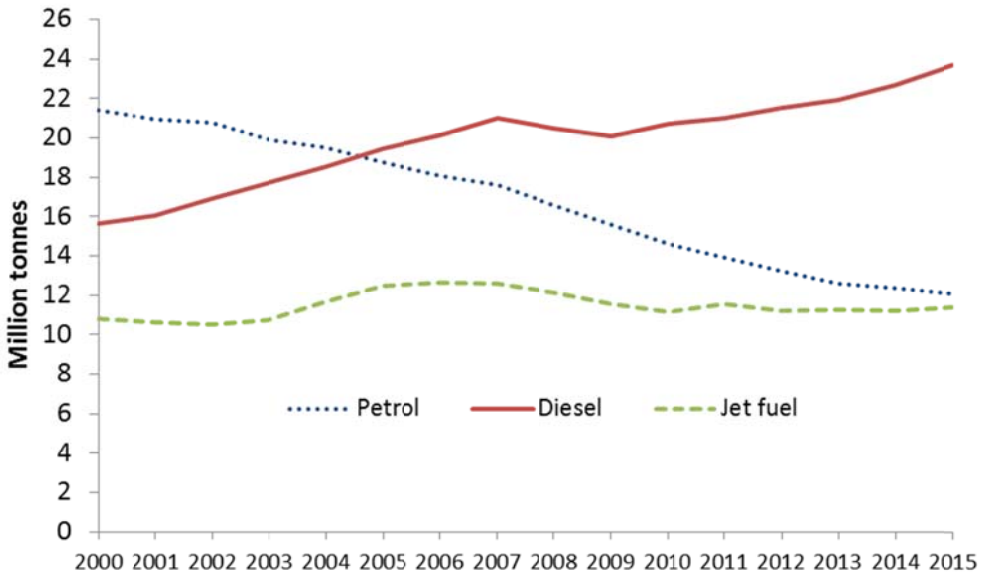


Consumption of transport fuels (Table 3.6)

3.27 The three main transport fuels – petrol, jet fuel and diesel – account for nearly 70 per cent of the UK's total demand for petroleum products. Around 11 per cent of oil is used by industry, including refinery use of oil, and a further 10 per cent is used for non-energy use (typically petrochemical feedstock). Relatively small amounts of oil are used in domestic heating and for transformation, meaning power generation from fuel oil or gas oil.

3.28 **Jet fuel deliveries increased more than 23 per cent between 1998 and 2015, but remain 10 per cent down on the 2006 peak.** Demand in recent years has been consistent, being between 11 and 11.5 million tonnes each year. Despite robust passenger numbers post the economic downturn, increased efficiencies in the airline industry have meant that less fuel has been needed.

Chart 3.9: Petrol, Diesel and Jet fuel deliveries 2000 to 2015



3.29 **Whilst the proportion of petroleum delivered to transport has remained relatively constant over time, the mix of fuels has changed greatly as many motorists have switched from petrol to diesel.** Chart 3.9 shows that contraction in petrol consumption reduced by just 2.0 per cent in 2015 compared to the average 3.5 per cent reduction year-on-year since 2000. Meanwhile deliveries of diesel increased by 4.3 per cent in 2015 compared to the average 2.6 per cent increase year-on-year (with a downturn in deliveries during the recession) over the same period. The increased demand for diesel, combined with the reduced contraction in demand for petrol, has driven the overall increase in demand for oil products seen in 2015. Demand has likely been affected by low road fuel prices seen in 2015; the average annual retail price of motor spirit was over 12 per cent lower compared to 2014, and road diesel was nearly 14 per cent lower (BEIS Monthly and annual prices of road fuels and petroleum products, Table 4.1.2).

3.30 The increase in diesel sales reflects in part the changing pattern of fuel consumption within the UK. The table below, derived from information provided by Ricardo-EE, shows that the share of diesel being consumed by cars and taxis more than doubled between 1995 and 2014, the most recent year for which data is available. The methodology used to calculate the split between vehicle types was updated this year, including using a new estimate of real world fuel consumption by passenger cars. This led to re-distribution between vehicle types; in particular, less diesel has been allocated to HGVs and more to passenger cars and LGVs than before. Please see the National Inventory Report on GHG emissions for further details:
https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1605241007_ukghgi-90-14_Issue2.pdf

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

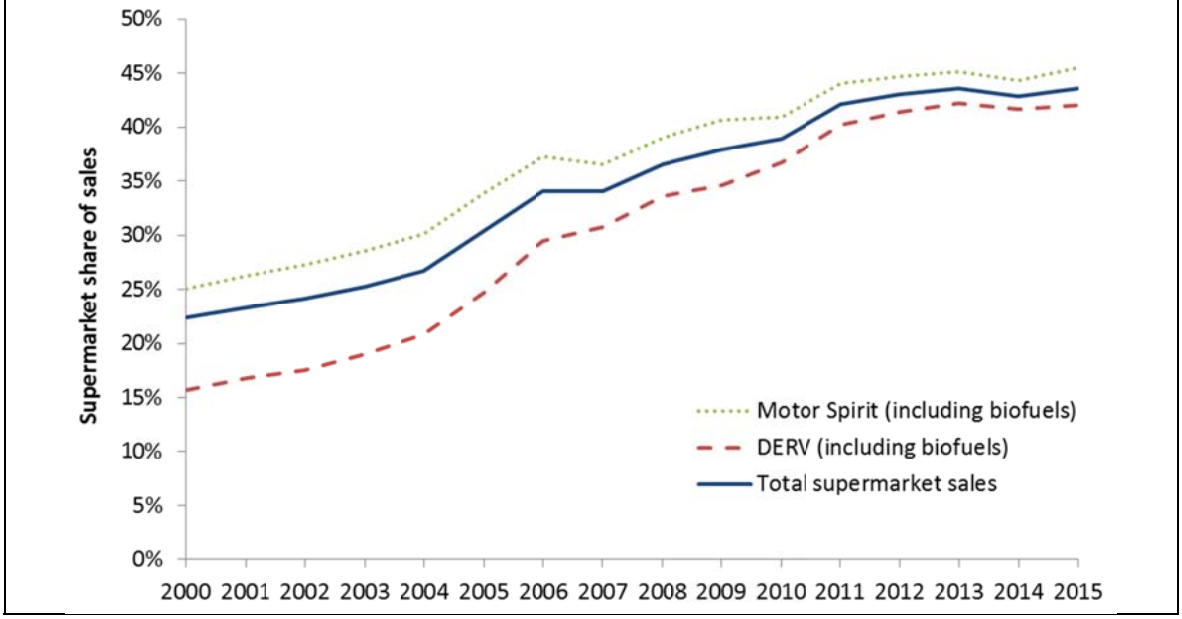
	1995	2000	2005	2010	2014
Petrol:					
Cars and taxis	92%	95%	96%	97%	97%
Light goods vehicles	7%	5%	3%	2%	2%
Motor cycles etc.	1%	1%	1%	1%	1%
Diesel:					
Cars and taxis	21%	27%	34%	41%	45%
Light goods vehicles	19%	23%	24%	23%	23%
Heavy goods vehicles	47%	40%	35%	29%	26%
Buses and coaches	13%	10%	8%	7%	5%

Source: Ricardo-EE. Percentages exclude off-road use of diesel.

3.31 Table 3.6 provides details of the consumption of motor spirit, gas oil/diesel and fuel oils for the period 2011 to 2015. The table includes information on retail, supermarket and commercial sales of motor spirit and DERV that are of interest but cannot be accommodated within the commodity balances. The supermarket sales refer to Asda, Morrisons, Sainsbury's and Tesco only.

3.32 **In 2015, the proportion of road fuels sold by supermarkets accounted for 46 per cent of petrol sales and 42 per cent of road diesel sales compared to 24 per cent and 15 per cent respectively in 1999.**

Chart 3.10: Percentage of road fuels sold by supermarkets 2000 to 2015



Biofuels in transport

3.33 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 3C, 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 3.2 per cent of total road fuels, they are down on last year which is likely to be driven by cost signals. Further details on biofuel consumption can be found in Chapter 6, paragraphs 6.37 to 6.42. Biofuels are also included in the overall energy balances in Chapter 1.

Table 3C: Consumption of Biodiesel and Bioethanol in the UK 2005 to 2015

Unit: Million litres

Year	Biodiesel	All diesel including biodiesel	Biodiesel as % diesel share	Bioethanol	All petrol including bioethanol	Bioethanol as % petrol share	Biofuels as % of road fuels
2005	33	23,233	0.1%	85	25,693	0.3%	0.2%
2006	169	24,286	0.7%	95	24,724	0.4%	0.5%
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%

Source: HM Revenue and Customs

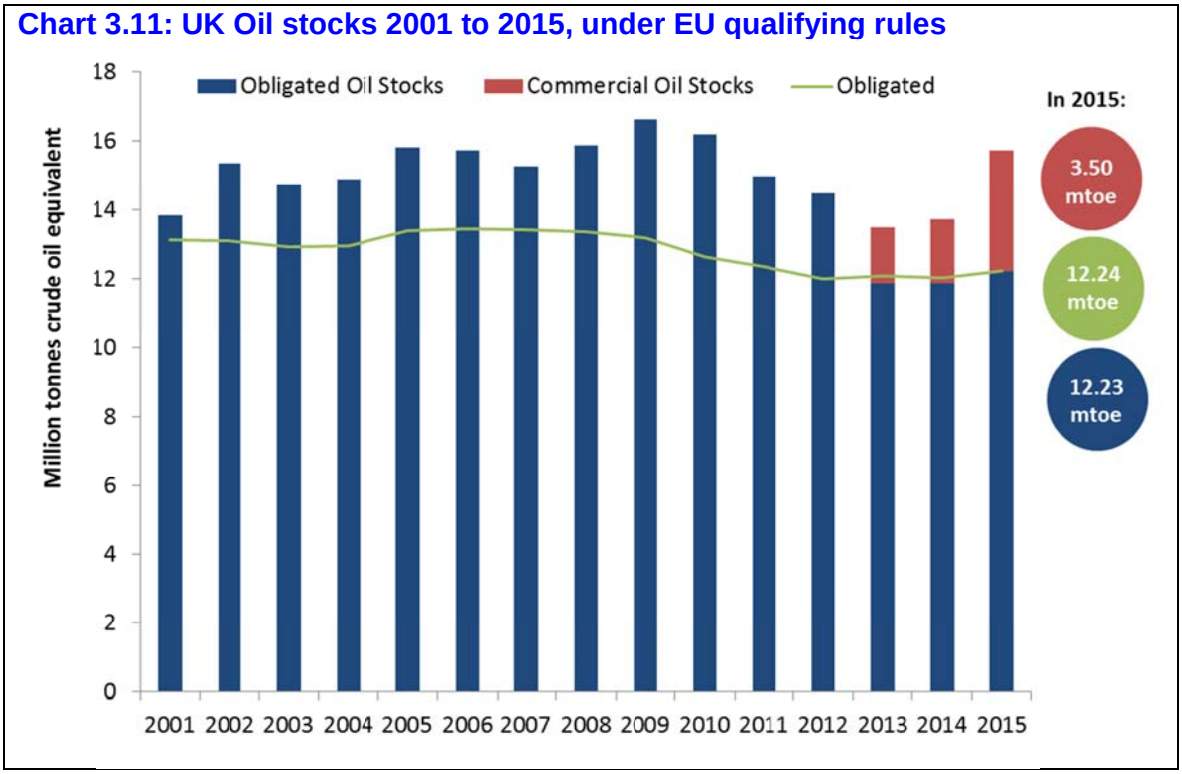
Stocks of oil (Table 3.7)

3.34 Table 3.7 shows the stocks of oil held either in the UK or on behalf of the UK. Stocks of crude oil and the various downstream petroleum products (petrol, diesel and other similar products) held under an obligation were 2.9 per cent higher at the end of 2015 versus 2014. At the end of 2015, UK companies held stocks equal to around 78 days of normal consumption.

3.35 In addition to stocks held for commercial purposes by oil companies operating in the UK, the UK obliges significant suppliers into the oil market to hold stocks of oil to help reduce the adverse impact on the UK and global economy of any disruptions to supply. The UK is required to hold these stocks under an EU directive (based on days of consumption held) and IEA qualifying arrangements (based on days of net imports held).

3.36 Chart 3.11 shows the total stocks over time, split into those stocks that are reserved to meet the condition of the EU directive (obligated oil stocks) and those stocks that are held under normal commercial arrangements (commercial oil stocks). The chart also shows the obligation on the UK to hold stocks under the EU directive (currently equivalent to 61 days of consumption). In accordance with the EU requirement, these are shown in terms of Tonnes of Oil Equivalent. Figures include crude, motor gasoline, aviation turbine fuel and diesel/gas oil stocks held both under obligation in the UK and under bilateral ticketing arrangements. For further information on the EU oil stocking requirements, see: http://eur-lex.europa.eu/legal-content/EN/ALL/?qid=1414672111051&uri=CELEX:32009L0119.

Chart 3.11: UK Oil stocks 2001 to 2015, under EU qualifying rules



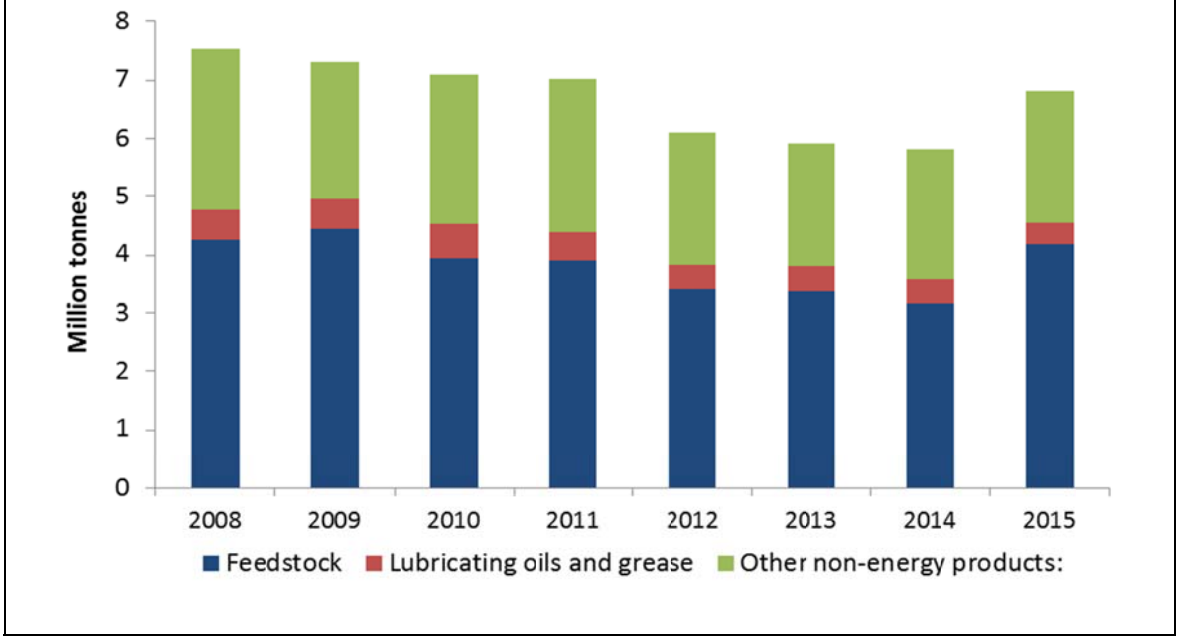
3.37 From 2013, following the introduction of a new EU directive on oil stocking, which was implemented at the end of 2012, commercial stocks can no longer be counted towards the EU's obligation. As a result, the UK's stocks are, on average, at around 60 days and marginally short of the EU's 61 day requirement. The UK is substantially above its requirement to the IEA (to hold 90 days of net imports), holding nearly 200 days of net imports at the end of 2015.

3.38 Further information on the method by which the UK obligates companies is described in www.gov.uk/government/uploads/system/uploads/attachment_data/file/401952/Guidance_for_Stakeholders_version_FEBRUARY_2015.pdf

Inland deliveries for non-energy uses (Table 3.8)

3.39 Table 3.8 summarises additional data on the non–energy uses made of the total deliveries of oil products included as the bottom line in the commodity balances in Tables 3.2 to 3.4. It provides extra information on the uses of lubricating oils and greases by use, and details of products used as petro-chemical feedstocks. Chart 3.12 below shows the principal use of non-energy products since 2008.

Chart 3.12: Use of non-energy products 2008 to 2015



3.40 The principal products for non-energy use are gases used as feedstocks in petrochemical plants. Natural gas liquids used as feedstocks accounted for over 60 per cent of the fuel put to non-energy use in 2015. Bitumen for road surfacing (21 per cent of non-energy use) and naphtha (16 per cent) are the other most significant fuels.

3.41 Deliveries for non-energy use increased substantially in 2015 as petrochemical processing increased towards the latter half of the year.

Technical notes and definitions

3.42 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

3.43 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.

3.44 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

3.45 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.

3.46 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.

3.47 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.

3.48 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.

3.49 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.

3.50 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.

3.51 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.

3.52 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.

3.53 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.).

3.54 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 3D below illustrates this.

Table 3D 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

3.55 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.

3.56 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.

3.57 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.

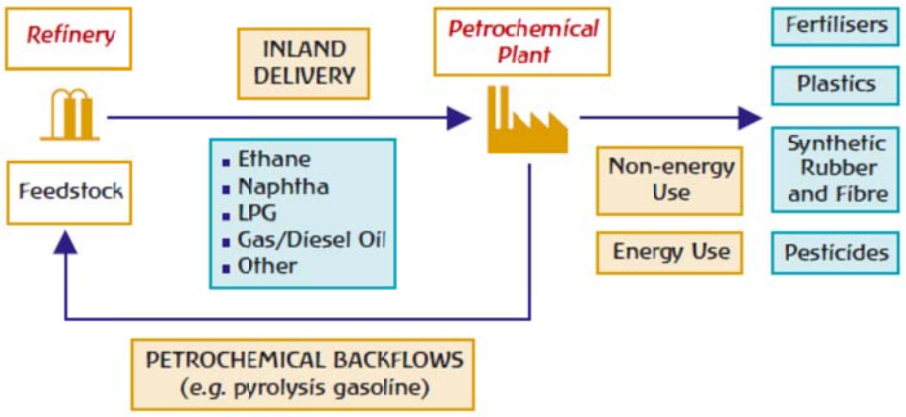
Revisions to published data

3.58 Following consultation with industry, BEIS have made a number of revisions to the statistics published here. The revisions affect data for 2013 and 2014.

3.59 Data now available since introducing the full DORS survey to importers as well as refiners suggests that historically volumes being delivered to international marine bunkers were under-estimated. Revisions have been made to 2013 and 2014 based on data for 2015.

3.60 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 they also return some petroleum products back to refineries for further processing.

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



3.61 Previously backflows data as received at the refinery were not included in the balances. BEIS have previously not separately identified deliveries of backflows from petrochemical plants but for this edition we have included them 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) to ensure that the downstream supply remains in balance for accounting purposes. We continue to consider how best to reflect these within the balances and welcome comments.

3.62 Last year BEIS carried out a more detailed analysis of the final destination of NGLs (propane, butane and condensate) which were previously recorded as 'unknown' on the upstream data collection system PPRS. Research identified that some disposals that were previously assumed to be exported were being consumed in the UK by petrochemical plants for non-energy use leading to an increase in these figures. To further improve our understanding of the uses of fuels for petrochemical processing BEIS will be conducting further research in the coming year to better understand this sector.

Indigenous production

3.63 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

3.64 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

3.65 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

3.66 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.

3.67 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.

Crude and process oils

3.68 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

3.69 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)

3.70 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 (C4H10), 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)

3.71 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

3.72 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.

Monthly and quarterly data

3.73 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.

Contacts: *Warren Evans*
Energy Statistics Team
warren.evans@decc.gsi.gov.uk
0300 068 5059

Natalie Cartwright
Downstream Oil Statistics (petroleum products)
natalie.cartwright@decc.gsi.gov.uk
0300 068 5260

Matthew Curds
Upstream Oil Statistics (primary oils)
matthew.curds@decc.gsi.gov.uk
0300 068 8414

3.1 Commodity balances 2013 - 2015[(1)]

Primary oil

Thousand tonnes

	Crude oil	Ethane	Propane	Butane	Condensate	Total NGL	Feedstock (2)	Total primary oil
2013								
Supply								
Production	38,456	341	683	542	624	2,190	454r	41,101r
Imports	50,311	515	582	396	666	2,158	6,497r	58,967r
Exports	-30,376	-14	-563	-384	-333	-1,293	-1,436	-33,105
Stock change (3)	+615	..	..	..	..	+19	+90	+724
Transfers (4)	-	-843	-680	-327	-371	-2,221	+463	-1,758
Total supply	**59,007**	..	..	..	..	**853**	**6,068r**	**65,928r**
Statistical difference (5)(6)	-20	..	..	..	..	-16	-8	-44
Total demand (5)	**59,026**	..	..	..	..	**870**	**6,076r**	**65,972r**
Transformation (Petroleum refineries)	59,026	..	..	..	..	870	6,076r	65,972r
Energy industry use	-	-	-	-	-	-	-	-
2014								
Supply								
Production	37,474	384	790r	605	675	2,454r	400r	40,328r
Imports	46,570	584	582	418	736	2,320	4,747r	53,638r
Exports	-28,204	-14	-704r	-505	-382r	-1,605r	-1,060	-30,869r
Stock change (3)	-497	..	..	..	..	-26	-69	-592
Transfers (4)	-	-944	-641r	-317	-352r	-2,255r	+817	-1,439r
Total supply	**55,342**	..	..	..	..	**888**	**4,835**	**61,066r**
Statistical difference (5)(6)	-	..	..	..	..	+1	+2	+4
Total demand (5)	**55,342**	..	..	..	..	**887**	**4,833**	**61,063r**
Transformation (Petroleum refineries)	55,342	..	..	..	..	887	4,833	61,063r
Energy industry use	-	-	-	-	-	-	-	-
2015								
Supply								
Production	42,826	345	744	642	730	2,462	410	45,698
Imports	42,674	678	665	697	444	2,484	5,322	50,480
Exports	-29,964	-11	-540	-577	-638	-1,766	-1,930	-33,660
Stock change (3)	-160	..	..	..	..	+28	+123	-9
Transfers (4)	-	-995	-743	-350	-265	-2,353	+1,218	-1,135
Total supply	**55,376**	..	..	..	..	**855**	**5,144**	**61,375**
Statistical difference (5)(6)	-	..	..	..	..	+8	-8	+0
Total demand (5)	**55,376**	..	..	..	..	**847**	**5,152**	**61,375**
Transformation (Petroleum refineries)	55,376	..	..	..	..	847	5,152	61,375
Energy industry use	-	-	-	-	-	-	-	-

(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 3.60 and 3.61 for more detail.

(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 2015

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit & SBP	Aviation turbine fuel
Supply									
Production	-	1,357	850	2,304	2,368	-	17,024	151	4,973
Other sources	995	743	350	-	265	-	-	-	-
Imports	-	660	138	-	963	13	3,805	98	8,186
Exports	-	-293	-520	-	-436	-	-10,340	-76	-1,201
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	4	10	-0	-8	-0	-137	-7	-201
Transfers	-	-	-	-	-1,986	-0	1,777	-6	-413
Total supply	**995**	**2,472**	**829**	**2,304**	**1,165**	**13**	**12,129**	**160**	**11,344**
Statistical difference *(3)*	**-**	**-7**	**-17**	**-52**	**50**	**1**	**47**	**-0**	**-28**
Total demand	**995**	**2,478**	**845**	**2,356**	**1,115**	**11**	**12,082**	**160**	**11,372**
Transformation	**-**	**12**	**282**	**379**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	253	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	253	-	-	-	-	-
Heat generation	-	9	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	3	282	126	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**1,942**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil & gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	1,942	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**995**	**2,467**	**563**	**35**	**1,115**	**11**	**12,082**	**160**	**11,372**
Industry	**-**	**275**	**72**	**-**	**43**	**-**	**-**	**-**	**-**
Unclassified	-	273	72	-	43	-	-	-	-
Iron & steel	-	2	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**82**	**-**	**-**	**-**	**11**	**12,082**	**-**	**11,372**
Air	-	-	-	-	-	11	-	-	11,372
Rail	-	-	-	-	-	-	-	-	-
Road	-	82	-	-	-	-	12,082	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**514**	**4**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	204	1	-	-	-	-	-	-
Public administration	-	16	-	-	-	-	-	-	-
Commercial	-	204	3	-	-	-	-	-	-
Agriculture	-	90	0	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**995**	**1,596**	**487**	**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 3.60 and 3.61 for further details
(5) For further details on non-energy usage see paragraphs 3.39 to 3.41 and 3.71

3.2 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	1,099	61,014	Production
-	-	-	-	-	-	-	-	2,353	Other sources
860	12,605	1,838	1,033	400	509	339	280	31,727	Imports
-151	-1,792	-2,806	-3,379	-365	-61	-455	-958	-22,835	Exports
-	-	-1,591	-835	-	-	-	-	-2,426	Marine bunkers
-46	-94	-105	-83	-19	7	-58	-7	-747	Stock change *(2)*
397	-422	285	-1,013	-0	14	-	150	-1,218	Transfers
3,091	**23,779**	**4,824**	**816**	**365**	**1,458**	**1,562**	**563**	**67,869**	**Total supply**
-20	**123**	**-1**	**3**	**3**	**-6**	**-8**	**-9**	**79**	**Statistical difference *(3)***
3,111	**23,656**	**4,825**	**814**	**363**	**1,464**	**1,571**	**572**	**67,790**	**Total demand**
-	**-**	**102**	**206**	**-**	**-**	**122**	**12**	**1,116**	**Transformation**
-	-	97	161	-	-	39	-	551	Electricity generation
-	-	38	132	-	-	39	-	208	Major power producers
-	-	60	30	-	-	-	-	343	Autogenerators
-	-	5	45	-	-	-	-	59	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	84	-	84	Patent fuel manufacture
-	-	-	-	-	-	-	12	423	Other (4)
-	**-**	**633**	**342**	**-**	**-**	**1,127**	**56**	**4,099**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	633	66	-	-	-	-	699	Oil & gas extraction
-	-	-	276	-	-	1,127	56	3,400	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,111	**23,656**	**4,089**	**266**	**363**	**1,464**	**322**	**504**	**62,576**	**Final consumption**
1,236	**-**	**1,647**	**160**	**-**	**-**	**184**	**-**	**3,617**	**Industry**
1,212	-	973	37	-	-	184	-	2,793	Unclassified
-	-	0	4	-	-	-	-	6	Iron & steel
-	-	-	0	-	-	-	-	0	Non-ferrous metals
-	-	158	7	-	-	-	-	165	Mineral products
-	-	88	25	-	-	-	-	112	Chemicals
-	-	-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	1	-	-	-	-	-	1	Electrical engineering, etc
24	-	152	6	-	-	-	-	182	Vehicles
-	-	28	73	-	-	-	-	101	Food, beverages, etc
-	-	39	-	-	-	-	-	39	Textiles, leather, etc
-	-	26	-	-	-	-	-	26	Paper, printing etc
-	-	30	-	-	-	-	-	30	Other industries
-	-	154	8	-	-	-	-	162	Construction
-	**23,656**	**1,224**	**-**	**-**	**-**	**-**	**-**	**48,427**	**Transport**
-	-	-	-	-	-	-	-	11,383	Air
-	-	611	-	-	-	-	-	611	Rail
-	23,656	-	-	-	-	-	-	35,820	Road
-	-	614	-	-	-	-	-	614	National navigation
-	-	-	-	-	-	-	-	-	Pipelines
1,875	**-**	**1,202**	**107**	**-**	**-**	**-**	**-**	**3,701**	**Other**
1,875	-	132	-	-	-	-	-	2,212	Domestic
-	-	262	26	-	-	-	-	304	Public administration
-	-	340	61	-	-	-	-	608	Commercial
-	-	233	5	-	-	-	-	328	Agriculture
-	-	235	14	-	-	-	-	249	Miscellaneous
-	**-**	**15**	**-**	**363**	**1,464**	**138**	**504**	**6,830**	**Non energy use (5)**

3.3 Commodity balances 2014

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit & SBP	Aviation turbine fuel
Supply									
Production	-	1,382	745r	2,266r	2,290	-	15,709	165	4,635
Other sources	944	641r	317	-	352r	-	-	-	-
Imports	-	295	170r	-	733	17	3,482	46	8,157
Exports	-	-392	-506	-	-585	-	-8,683	-80	-1,072
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	-27	-3	-0	-14	2	113	-5	123
Transfers	-	-2	0	24	-1,952	-0	1,610	-0	-642
Total supply	**944**	**1,898r**	**722r**	**2,291r**	**824r**	**18**	**12,232**	**125**	**11,201**
Statistical difference *(3)*	**-**	**-24**	**-23**	**23**	**28**	**0**	**-94**	**-1**	**-19**
Total demand	**944**	**1,922r**	**746r**	**2,267r**	**796r**	**18**	**12,326**	**126**	**11,220**
Transformation	**-**	**20r**	**277r**	**349r**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	237	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	237	-	-	-	-	-
Heat generation	-	11	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	9r	277r	112r	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**1,918**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil & gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	1,918	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**944**	**1,903r**	**469r**	**0**	**796r**	**18**	**12,326**	**126**	**11,220**
Industry	**-**	**239r**	**110r**	**-**	**32r**	**-**	**-**	**-**	**-**
Unclassified	-	237r	110r	-	32r	-	-	-	-
Iron & steel	-	3	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**88**	**-**	**-**	**-**	**18**	**12,326**	**-**	**11,220**
Air	-	-	-	-	-	18	-	-	11,220
Rail	-	-	-	-	-	-	-	-	-
Road	-	88	-	-	-	-	12,326	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**464r**	**19**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	212	19	-	-	-	-	-	-
Public administration	-	3r	-	-	-	-	-	-	-
Commercial	-	163r	-	-	-	-	-	-	-
Agriculture	-	85	0	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**944**	**1,111**	**340**	**0**	**763**	**-**	**-**	**126**	**-**

(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 3.60 and 3.61 for further details
(5) For further details on non-energy usage see paragraphs 3.38 to 3.39 and 3.69

3.3 Commodity balances 2014 (continued)

Petroleum products

Thousand tonnes

Burning oil	DERV	Gas Oil [1]	Fuel oils	Lubri -cants	Bitu -men	Petroleum coke	Misc. products	Total Products	
									Supply
2,093	13,726	8,049	5,409	373	1,006	1,745	798r	60,392r	Production
-	-	-	-	-	-	-	-	2,255r	Other sources
619	11,452r	1,406r	1,024r	386	465	537	306	29,093r	Imports
-164	-1,942	-3,463	-4,148	-337	-62	-567	-746	-22,748	Exports
-	-	-1,676r	-1,148r	-	-	-	-	-2,824r	Marine bunkers
-15	-61	24	107	29	18	16	-13	292	Stock change *(2)*
621	-509	489	-616	-20	-18	-	199	-817	Transfers
3,154	**22,666r**	**4,829r**	**627r**	**430**	**1,409**	**1,730**	**543r**	**65,643r**	**Total supply**
-26	**-10**	**-0**	**40**	**-6**	**-1**	**-**	**2**	**-109**	**Statistical difference *(3)***
3,179	**22,675**	**4,829r**	**588r**	**436**	**1,410**	**1,730**	**541r**	**65,752r**	**Total demand**
-	**-**	**118r**	**186r**	**-**	**-**	**91**	**15r**	**1,055r**	**Transformation**
-	-	112r	141r	-	-	-	-	490r	Electricity generation
-	-	46	122	-	-	-	-	168	Major power producers
-	-	66r	19r	-	-	-	-	322r	Autogenerators
-	-	5	45r	-	-	-	-	61r	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	91	-	91	Patent fuel manufacture
-	-	-	-	-	-	-	15r	413r	Other (4)
-	**-**	**647**	**156r**	**-**	**-**	**1,140r**	**-**	**3,861r**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	647	16r	-	-	-	-	663r	Oil & gas extraction
-	-	-	140r	-	-	1,140r	-	3,198r	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,179	**22,675**	**4,065r**	**246r**	**436**	**1,410**	**499r**	**526**	**60,837r**	**Final consumption**
1,270	**-**	**1,624r**	**145r**	**-**	**-**	**350r**	**-**	**3,771r**	**Industry**
1,246	-	981r	26r	-	-	350r	-	2,982r	Unclassified
-	-	0	3r	-	-	-	-	6r	Iron & steel
-	-	-	0	-	-	-	-	0	Non-ferrous metals
-	-	165r	5r	-	-	-	-	169r	Mineral products
-	-	76r	20r	-	-	-	-	96r	Chemicals
-	-	-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	1	-	-	-	-	-	1	Electrical engineering, etc
24	-	131r	5	-	-	-	-	160r	Vehicles
-	-	30r	82r	-	-	-	-	112r	Food, beverages, etc
-	-	40r	-	-	-	-	-	40r	Textiles, leather, etc
-	-	26r	-	-	-	-	-	26r	Paper, printing etc
-	-	26r	-	-	-	-	-	26r	Other industries
-	-	149r	5r	-	-	-	-	154r	Construction
-	**22,675**	**1,250r**	**-r**	**-**	**-**	**-**	**-**	**47,578r**	**Transport**
-	-	-	-	-	-	-	-	11,238	Air
-	-	624r	-	-	-	-	-	624r	Rail
-	22,675	-	-	-	-	-	-	35,089	Road
-	-	627	-r	-	-	-	-	627r	National navigation
-	-	-	-	-	-	-		-	Pipelines
1,909	**-**	**1,175r**	**101r**	**-**	**-**	**-**	**-**	**3,668r**	**Other**
1,909	-	138r	-	-	-	-	-	2,278r	Domestic
-	-	280r	26	-	-	-	-	309r	Public administration
-	-	336r	57r	-	-	-	-	556r	Commercial
-	-	189r	5	-	-	-	-	279r	Agriculture
-	-	232r	13	-	-	-	-	246r	Miscellaneous
-	**-**	**15**	**1**	**436**	**1,410**	**149**	**526**	**5,820r**	**Non energy use (5)**

3.4 Commodity balances 2013

Petroleum products

Thousand tonnes

	Ethane	Propane	Butane	Other gases	Naphtha	Aviation spirit	Motor spirit	White Spirit & SBP	Aviation turbine fuel
Supply									
Production	-	1,474	852	2,464r	2,013	-	17,691	106	4,527
Other sources	843	680	327	-	371	-	-	-	-
Imports	-	326	105	-	1,000	15	4,442	219	8,219
Exports	-	-597	-568	-	-738	-	-10,809	-49	-970
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(2)*	-	14	-3	0	93	1	-356	-10	-20
Transfers	-	-	-	23	-1,727	-0	1,606	12	-519
Total supply	**843**	**1,897**	**712**	**2,487r**	**1,011**	**16**	**12,575**	**278**	**11,238**
Statistical difference *(3)*	**3**	**-5**	**3**	**-31**	**-1**	**0**	**1**	**-1**	**-4**
Total demand	**840**	**1,902r**	**709**	**2,517**	**1,012**	**16**	**12,574**	**279**	**11,242**
Transformation	**-**	**12r**	**310r**	**361r**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	222	-	-	-	-	-
Major power producers	-	-	-	-	-	-	-	-	-
Autogenerators	-	-	-	222	-	-	-	-	-
Heat generation	-	7	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other (4)	-	5r	310r	139r	-	-	-	-	-
Energy industry use	**-**	**-**	**-**	**2,112**	**-**	**-**	**-**	**-**	**-**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil & gas extraction	-	-	-	-	-	-	-	-	-
Petroleum refineries	-	-	-	2,112	-	-	-	-	-
Coal extraction	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**840**	**1,891r**	**399r**	**44r**	**1,012**	**16**	**12,574**	**279**	**11,242**
Industry	**-**	**204**	**-**	**-**	**103**	**-**	**-**	**-**	**-**
Unclassified	-	203	-	-	103	-	-	-	-
Iron & steel	-	1	-	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-	-	-	-
Paper, printing etc	-	-	-	-	-	-	-	-	-
Other industries	-	-	-	-	-	-	-	-	-
Construction	-	-	-	-	-	-	-	-	-
Transport	**-**	**94**	**-**	**-**	**-**	**16**	**12,574**	**-**	**11,242**
Air	-	-	-	-	-	16	-	-	11,242
Rail	-	-	-	-	-	-	-	-	-
Road	-	94	-	-	-	-	12,574	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**-**	**374**	**28**	**-**	**-**	**-**	**-**	**-**	**-**
Domestic	-	272	28	-	-	-	-	-	-
Public administration	-	-	-	-	-	-	-	-	-
Commercial	-	-	-	-	-	-	-	-	-
Agriculture	-	102	0	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-
Non energy use *(5)*	**840**	**1,218r**	**372r**	**44r**	**909**	**-**	**-**	**279**	**-r**

(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 3.60 and 3.61 for further details
(5) For further details on non-energy usage see paragraphs 3.38 to 3.39 and 3.69

3.4 Commodity balances 2013 (continued)

Petroleum products

Thousand tonnes

Burning oil	DERV	Gas Oil [1]	Fuel oils	Lubri -cants	Bitu -men	Petroleum coke	Misc. products	Total Products	
									Supply
2,705	14,831	8,193	6,574	387	777	1,773	1,029r	65,397r	Production
-	-	-	-	-	-	-	-	2,221	Other sources
678	10,115	856r	620	411	648	577	187	28,418r	Imports
-381	-2,843	-3,310	-4,677	-395	-75	-578	-919	-26,910	Exports
-	-	-1,338r	-1,382r	-	-	-	-	-2,720r	Marine bunkers
52	46	91	93	47	-1	78	-19	106	Stock change *(2)*
447	-253	250	-401	-22	13	-	107	-463	Transfers
3,501	**21,896**	**4,743r**	**826r**	**428**	**1,361**	**1,850**	**385r**	**66,049r**	**Total supply**
-6	**-30**	**11**	**3**	**-9**	**2**	**-0**	**-45**	**-107**	**Statistical difference *(3)***
3,507	**21,926**	**4,732r**	**823r**	**437**	**1,358**	**1,851**	**431r**	**66,156r**	**Total demand**
-	**-**	**93**	**225**	**-**	**-**	**162**	**15**	**1,177r**	**Transformation**
-	-	88	179	-	-	51	-	541r	Electricity generation
-	-	30	156	-	-	51	-	237	Major power producers
-	-	58	24	-	-	-	-	304r	Autogenerators
-	-	5	45	-	-	-	-	57r	Heat generation
-	-	-	-	-	-	-	-	-	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	111	-	111	Patent fuel manufacture
-	-	-	-	-	-	-	15r	469r	Other (4)
-	**-**	**619**	**344**	**-**	**-**	**1,245**	**58**	**4,378**	**Energy industry use**
-	-	-	-	-	-	-	-	-	Electricity generation
-	-	619	-	-	-	-	-	619	Oil & gas extraction
-	-	-	344	-	-	1,245	58	3,759	Petroleum refineries
-	-	-	-	-	-	-	-	-	Coal extraction
-	-	-	-	-	-	-	-	-	Coke manufacture
-	-	-	-	-	-	-	-	-	Blast furnaces
-	-	-	-	-	-	-	-	-	Patent fuel manufacture
-	-	-	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	-	-	Other
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**Losses**
3,507	**21,926**	**4,019r**	**255r**	**437**	**1,358**	**444**	**358**	**60,600r**	**Final consumption**
1,383	**-**	**1,573r**	**164r**	**-**	**-**	**343**	**-**	**3,770r**	**Industry**
1,359	-	938r	29r	-	-	343	-	2,975r	Unclassified
-	-	0	3	-	-	-	-	4	Iron & steel
-	-	-	0	-	-	-	-	0	Non-ferrous metals
-	-	150r	5	-	-	-	-	155r	Mineral products
-	-	77r	21	-	-	-	-	98r	Chemicals
-	-	-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	1	-	-	-	-	-	1	Electrical engineering, etc
24	-	137r	5	-	-	-	-	166r	Vehicles
-	-	27r	96	-	-	-	-	123r	Food, beverages, etc
-	-	41r	-	-	-	-	-	41r	Textiles, leather, etc
-	-	28r	-	-	-	-	-	28r	Paper, printing etc
-	-	30r	-	-	-	-	-	30r	Other industries
-	-	144r	5	-	-	-	-	149r	Construction
-	**21,926**	**1,293r**	**-r**	**-**	**-**	**-**	**-**	**47,144r**	**Transport**
-	-	-	-	-	-	-	-	11,257	Air
-	-	615r	-	-	-	-	-	615r	Rail
-	21,926	-	-	-	-	-	-	34,593	Road
-	-	678	-r	-	-	-	-	678r	National navigation
-	-	-	-	-	-	-		-	Pipelines
2,125	**-**	**1,139r**	**90**	**-**	**-**	**-**	**-**	3,756r	**Other**
2,125	-	133r	-	-	-	-	-	2,558r	Domestic
-	-	258r	19	-	-	-	-	277r	Public administration
-	-	322r	47	-	-	-	-	369r	Commercial
-	-	203r	14	-	-	-	-	319r	Agriculture
-	-	222r	10	-	-	-	-	233r	Miscellaneous
-	**-**	**14r**	**-**	**437**	**1,358**	**101**	**358**	**5,930r**	**Non energy use (5)**

3.5 Supply and disposal of petroleum[(1)]

Thousand tonnes

	2011	2012	2013	2014	2015
Primary oils (Crude oil, NGLs and feedstocks)					
Indigenous production *(2)*	51,972	44,561	41,101r	40,328r	45,698
Imports	58,092	60,476	58,967r	53,638r	50,480
Exports *(3)*	-33,625	-30,946	-33,105	-30,869r	-33,660
Transfers - Transfers to products *(4)*	-2,255	-1,982	-2,221	-2,255r	-2,353
Product rebrands (5)	+19	+120	+463	+817	+1,218
Stock change *(6)*	+611	-486	+724	-592	-9
Use during production *(7)*	-	-	-	-	-
Calculated refinery throughput *(8)*	74,815	71,741	65,928r	61,066r	61,375
Overall statistical difference *(9)*	-265	-98	-44	4r	0
Actual refinery throughput	**75,080**	**71,839**	**65,972r**	**61,063r**	**61,375**
Petroleum products					
Losses in refining process *(10)*	373	209	575r	671r	360
Refinery gross production *(11)*	74,707	71,630	65,397r	60,392r	61,014
Transfers - Transfers to products *(4)*	2,255	1,982	2,221	2,255r	2,353
Product rebrands *(5)*	-19	-120	-463	-817	-1,218
Imports	22,656	26,207	28,418r	29,093r	31,727
Exports *(12)*	-27,800	-29,904	-26,910	-22,748	-22,835
Marine bunkers	-3,130	-2,663	-2,720r	-2,824r	-2,426
Stock changes *(6)* - Refineries	46	102	79	266	-774
Power generators	142	26	26	26	26
Calculated total supply	68,857	67,260	66,049r	65,643r	67,869
Statistical difference *(9)*	28	-87	-107r	-109r	79
Total demand *(4)*	**68,829**	**67,347**	**66,156r**	**65,752r**	**67,790**
Of which:					
Energy use	61,774	61,236	60,226r	59,932r	60,960
Of which, for electricity generation *(13)*	722	694	541r	490r	551
total refinery fuels *(13)*	4,585	4,299	3,759	3,198r	3,400
Non-energy use	7,055	6,111	5,930r	5,820r	6,830

(1) Aggregate monthly data on oil production, trade, refinery throughput and inland deliveries are available - see paragraph 3.73 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 with the advent of the new PPRS system.
(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

	2011	2012	2013	2014	2015
Motor spirit					
of which, Hydrocarbon *(2)*	13,895	13,231	12,574	12,326	12,082
of which, Bio-ethanol *(3)*	517	615	650	645	631
Total Motor Spirit including Bio-ethanol	**14,412**	**13,845**	**13,224**	**12,971**	**12,713**
of which, sold through Supermarkets (4)	6,345	6,196	5,974	5,755	5,794
of which, sold through Refiners, and other traders *(5)*	8,067	7,649	7,250	7,216	6,919
of which, sold via commercial sales *(6)*	-	-	-	-	-
Diesel Road Fuel	-	-	-	-	-
Hydrocarbon *(7)*	20,991	21,538	21,926	22,675	23,656
Bio-diesel (8)	825	563	682	850	595
Total Diesel Road Fuel including Bio-diesel	**21,816**	**22,101**	**22,607**	**23,525**	**24,251**
of which, sold through Supermarkets (4)	5,722	5,959	6,217	6,394	6,644
of which, sold through Refiners, and other traders *(5)*	8,502	8,446	8,519	8,946	9,168
of which, sold via commercial sales *(6)*	7,591	7,696	7,871	8,185	8,439
Other gas diesel oil (9)	**4,759**	**4,990**	**5,174**	**5,241**	**4,824**
Aviation Fuels	-	-	-	-	-
Total Sales - Aviation fuels	**11,594**	**11,238**	**11,257**	**11,238**	**11,383**
Aviation spirit	21	17	16	18	11
Aviation turbine fuel	11,574	11,221	11,242	11,220	11,372
Fuel Oil	-	-	-	-	-
Total Sales - Fuel Oils	**939**	**707**	**556r**	**579r**	**506**
Light	449	367	219	225r	197
Medium	106	118	139	128r	112
Heavy	384	221	209	209r	183

(1) Monthly data for inland deliveries of oil products are available -
See BEIS website: www.gov.uk/government/organisations/department-of-energy-climate-change/series/oil-statistics.
(2) Demand excluding bioethanol. Based on HMRC duty data.
(3) Bioethanol based on HMRC duty data, excluding other renewables.
(4) Sales by supermarkets are collected by a monthly reporting system. Includes Asda, Morrisons, Sainsburys and Tesco only.
(5) Total sales excluding supermarket and commercial sales.
(6) Commercial sales are currently estimated based on road movements and a number of assumptions.
Further details are available at:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/295224/Supermarket_share_of_retail_sales.pdf.
(7) Demand excluding biodiesel. Based on HMRC duty data.
(8) Biodiesel based on HMRC duty data, excluding other renewables.
(9) This includes gas diesel oil used for other purposes such as heating and middle distillate feedstock destined for use in the petrochemical industry.

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

Thousand tonnes

	2011	2012	2013	2014	2015
Crude and process oils					
Refineries *(2)*	3,889	3,829	3,592	3,876	3,106
Terminals *(3)*	694	1,194	1,102	1,147	1,629
Offshore *(4)*	540	473	513	460	499
Net bilateral stocks *(5)*	151	195	1,469	1,728	2,289
Total crude and process oils *(6)*	**5,274**	**5,690**	**6,677**	**7,211**	**7,524**
Petroleum products					
Ethane	-	-	-	-	-
Propane	23	28	19	46	37
Butane	38	25	29	35	27
Other petroleum gases	-	-	-	-	-
Naphtha	199	165	112	140	94
Aviation spirit	3	5	4	5	5
Motor spirit	846	727	1,287	1,141	1,246
White spirit & SBP	7	9	18	24	31
Aviation turbine fuel	1,216	1,229	1,162	999	1,232
Burning oil	238	198	287	231	281
Gas/Diesel oil (7)	3,776	4,222	2,482	2,399	2,842
of which, DERV	545	1,240	1,662	1,592	1,622
Fuel oils	645	514	1,340	1,060	898
Lubricating oils	132	143	186	67	121
Bitumen	95	106	127	101	88
Petroleum wax	6	4	10	3	8
Petroleum coke	252	274	236	318	343
Miscellaneous products	92	88	228	302	203
Total all products	**7,569**	**7,735**	**7,528**	**6,871**	**7,458**
Of which : net bilateral stocks *(5)*	2,100	2,441	2,432	2,064	2,022

(1) Aggregate monthly data on the level of stocks of crude oil and oil products are available - see paragraph 3.73 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

	2011	2012	2013	2014	2015
Feedstock for petroleum chemical plants:					
Propane	1,261	1,038	1,218r	1,177r	1,596
Butane	679	567	372r	365r	487
Other gases	1,003	899	884r	944r	1,031
Total gases	2,944	2,504	2,474r	2,487r	3,113
Naphtha (LDF)	969	910	909	782r	1,072
Middle Distillate Feedstock (MDF)	34	16	16r	17	15
Other products	-	-	-	-	-
Total feedstock	3,946	3,430	3,400r	3,285r	4,201
Lubricating oils and grease:					
Aviation	4	4	5r	6r	7
Industrial	248	197	221r	219r	145
Marine	19	17	17r	17r	17
Other motors, Gear oils & Transmissions	216	191	191r	191r	191
Agricultural	4	3	3	3	3
Fuel oil sold as lubricant	-	-	-	-	-
Total lubricating oils and grease	491	412	437	436	363
Other non-energy products:					
Industrial spirit/white spirit	143	219	279	126	160
Bitumen	1,621	1,355	1,358	1,410	1,464
Petroleum coke	262	154	101	149	138
Miscellaneous products	592	542	358	526	504
Total other non-energy products	2,618	2,268	2,096	2,210r	2,267
Total non-energy use	**7,055**	**6,111**	**5,930r**	**5,820r**	**6,830**

(1) Aggregate monthly data on the total non energy use of oil products are available - see paragraph 3.73 and Annex C
(2) For further details on non-energy usage see paragraphs 3.37 to 3.39 and 3.69.

Chapter 4
Natural gas

Key points

- **UK natural gas production in 2015 was up 7.6 per cent on 2014 to 460 TWh, the largest increase since 2000**. The increase contrasts with both the small increase in 2014 and the long term decline in UK natural gas production which had fallen by an average of 8.0 per cent from peak production in 2000 to the end of 2013. Gas production is just over a third of the peak level recorded in 2000 (Table 4.1, Chart 4.1).

- **Net imports were 5.1 per cent lower in 2015 compared to 2014** (Table 4.1). This was driven by a rise of 26.2 per cent in exports, with exports to Belgium increasing by 75.7 per cent to 84 TWh making up over a half of all exports in 2015. In contrast imports only rose slightly, up 3.3 per cent (Table 4.5).

- **Imports of Liquefied Natural Gas (LNG) increased to 149 TWh in 2015, up just over a fifth**. Pipeline imports were broadly stable on last year, but Norwegian volumes increased by similar volumes to the drop in Netherlands imports (Table 4.5, Chart 4.3).

- **Total gas demand (natural gas plus colliery methane) increased by 2.2 per cent in 2015 to 793 TWh.** This is mainly due to the slight rise in domestic consumption, up 5.1 per cent (Table 4.1, Chart 4.2).

Introduction

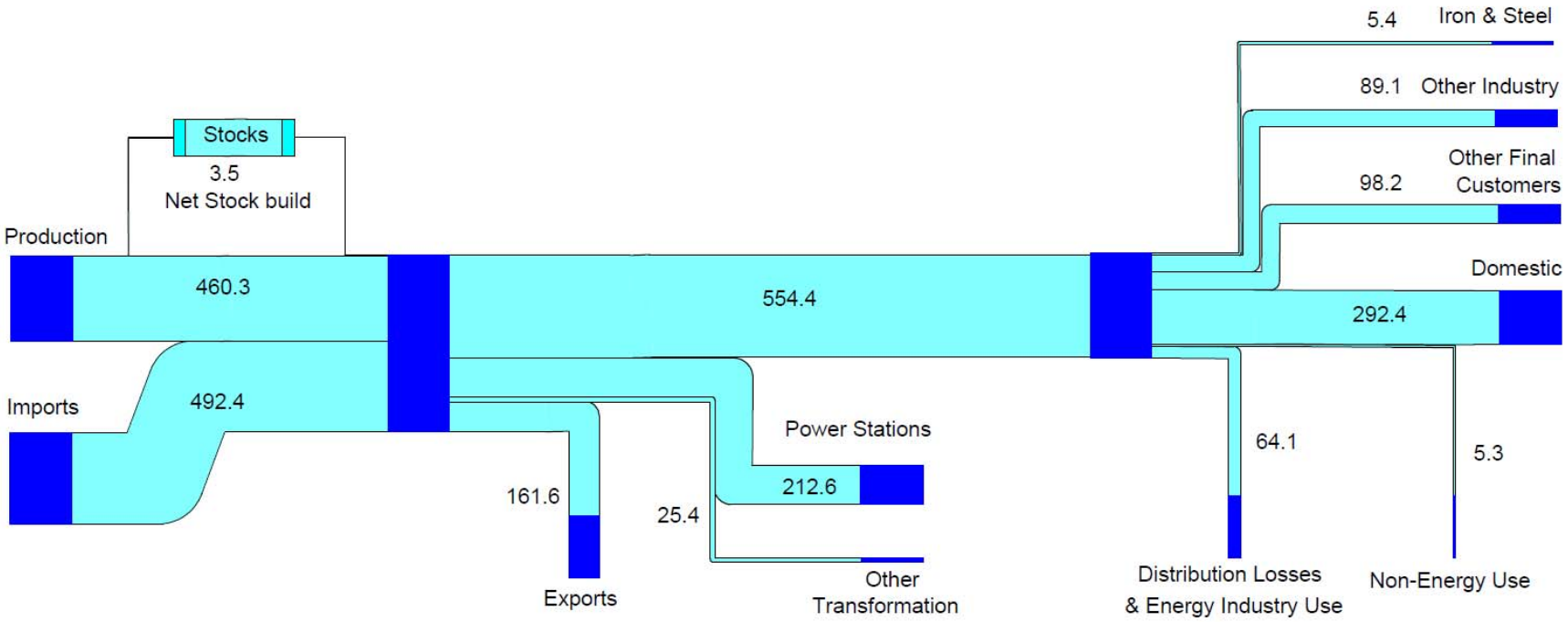
4.1 This chapter presents six data tables on the production, transmission and consumption of natural gas and colliery methane, and two maps showing flows of gas in and around Europe and the gas transmission system in the UK (pages 106 & 110).

4.2 An energy flow chart for 2015, 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 the gas transformed into other forms of energy or exported.

4.3 Table 4.1 shows the commodity balances for natural gas and colliery methane, both separately and in aggregate. In Table 4.2, the two gases are aggregated and presented as a five year time-series, showing supply, transformation and consumption. The natural gas statistics include bio-methane gas which is currently being produced by a small number of companies to feed into the national grid. At this stage volumes are small, but as this increases we will look to present these separately. A more detailed examination of the various stages of natural gas from gross production through to consumption is given in Table 4.3. Table 4.4 details the UK's gas storage sites and interconnector pipelines, while Table 4.5 shows the UK's imports and exports of gas and Table 4.6 shows LNG imports by terminal. Long-term trends, commentary and a table on production and consumption of gas back to 1970 are to be found on BEIS's energy statistics web site at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

4.4 Petroleum gases are covered in Chapter 3. Gases manufactured in the coke-making and iron and steel-making processes (coke oven gas and blast furnace gas) appear in Chapter 2. Biogases (landfill gas and sewage gas) are part of Chapter 6. Details of net selling values of gas for the domestic, industrial and other sectors are to be found in Chapter 1.

Natural gas flow chart 2015 (TWh)



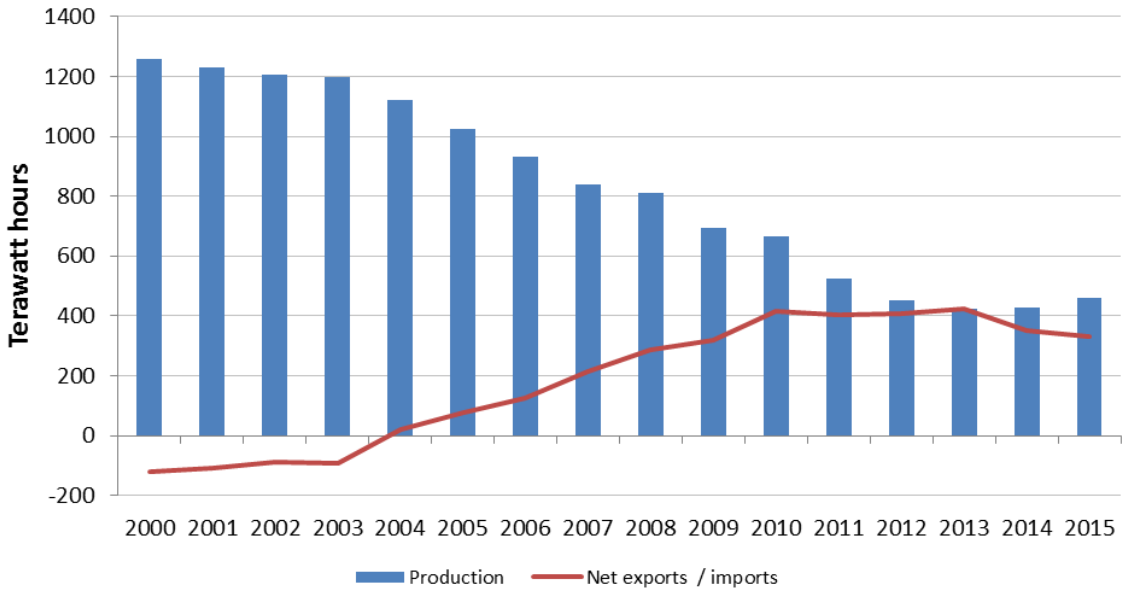
Notes:
This flow chart is based on the data that appear in Table 4.1, excluding colliery methane.

Commodity balances for gas (Tables 4.1 and 4.2)

4.5 Apart from 2015 and 2014, which both showed an increase, **UK Continental Shelf (UKCS) production of natural gas has been in decline since the turn of the millennium**. Between 2000 and 2013, gas production fell at a rate of 8 per cent per year. However, the rate of decline over the past 15 years has varied and there have been large year-on-year falls in production in 2011 and 2012 (20.8 and 14.1 per cent respectively). **In 2015 production increased by 7.6 per cent, the second year-on year increase since the peak of 2000**, the other being in 2014 when production rose by 0.9 per cent. In context UK production in 2015 (at 460 TWh) was 37 per cent of the level produced in 2000 (1,260 TWh). Despite this the UK, along with the Netherlands, remains one of the two major gas-producing nations within the EU. In 2015, the UK's indigenous production was sufficient to meet nearly 60 per cent of the UK's demand.

4.6 The UK imports natural gas by pipeline from Norway, Belgium and the Netherlands and LNG by ship. **The UK has been a net importer of gas since 2004**, with net imports of gas in 2015 accounting for just over 40 per cent of supply. The UK imported 492 TWh in 2015.

Chart 4.1: Natural gas production and net exports/imports 2000 to 2015

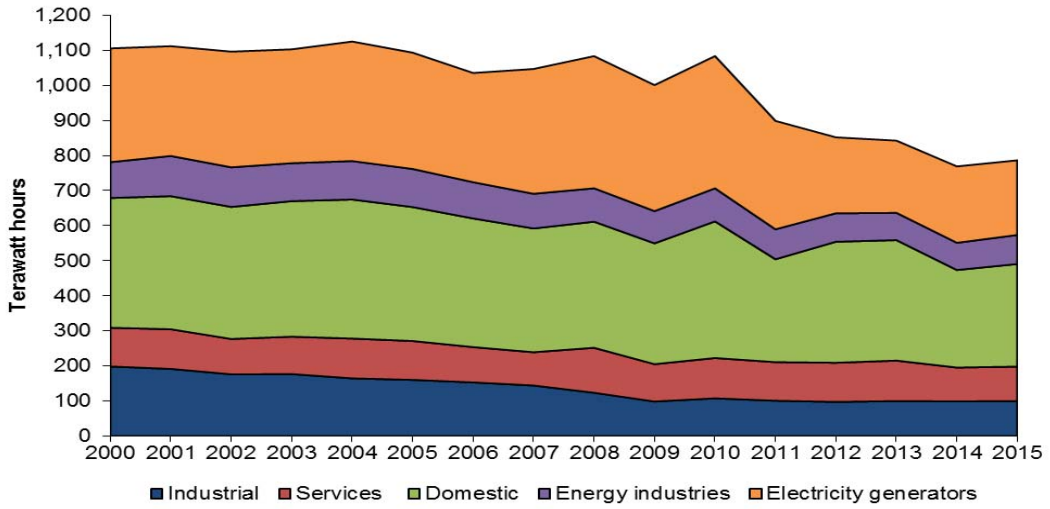


4.7 **LNG imports have declined from the 2011 peak and, by 2015, were 149 TWh**; this is 46 per cent lower than 2011. However, 2015 saw an increase in LNG imports to the UK by just over a fifth compared to 2014. Prior to 2014 LNG imports had been on a downward trajectory from their 2011 peak. Total pipeline imports into the UK have only slightly decreased to a total of 337 TWh in 2015, from 341 TWh in 2014. Within this, Norwegian imports increased 32 TWh and imports from the Netherlands decreased 34 TWh.

4.8 **Total gas demand (including colliery methane) increased from 776 TWh in 2014 to 793 TWh in 2015**, a 2.2 per cent increase. This is the first rise in demand since 2010. Chart 4.2 shows how this varies by sector. Demand for gas for domestic purposes increased by 5.1 per cent in 2015, reflecting colder temperatures, the average number of heating degree days per month was up from 4.9 in 2014 to 5.3 in 2015. However 2015 was still a warm year in comparison to 2012 and 2013 in particular, which is evidenced by the higher demand for domestic purposes during these two years. Gas used by the industrial sector was up by 1.2 per cent but gas used for electricity generation decreased by 2.2 per cent. Chart 4.2 also illustrates the importance of temperature on short-term gas demand patterns (especially in the domestic sector), with demand being higher in 2010 (a cold year, average temperature 9.0°C) and lower in 2014 (a warm year, average temperature 10.9°C).

4.9 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. Definitions for each sector in Chart 4.2 are provided in paragraph 4.31.

Chart 4.2: Consumption of natural gas 2000 to 2015



UK continental shelf and onshore natural gas (Table 4.3)

4.10 Table 4.3 shows natural gas flows, from production, through transmission and onto consumption. Total UK consumption was up 1.7 per cent in comparison to 2014, but it has fallen significantly since 2010 with consumption down 28 per cent on the 2010 figure. Please note that this table departs from the standard balance methodology. For more information, see the technical notes and definitions (paragraphs 4.34 to 4.37).

4.11 Table 4.3 also includes two rows at the bottom of the table showing gas stocks and gas storage capacity at the end of the year. Storage data are not available before 2004. Stocks data for 2006 onwards have been sourced from the National Grid and storage capacity data from its 2015 Ten Year Statement. Gas stocks fluctuate throughout the year, being at or near capacity by the end of the autumn before being depleted through the winter heating season. At the end of December stocks are normally fairly full, with a level of 89 per cent in December 2015

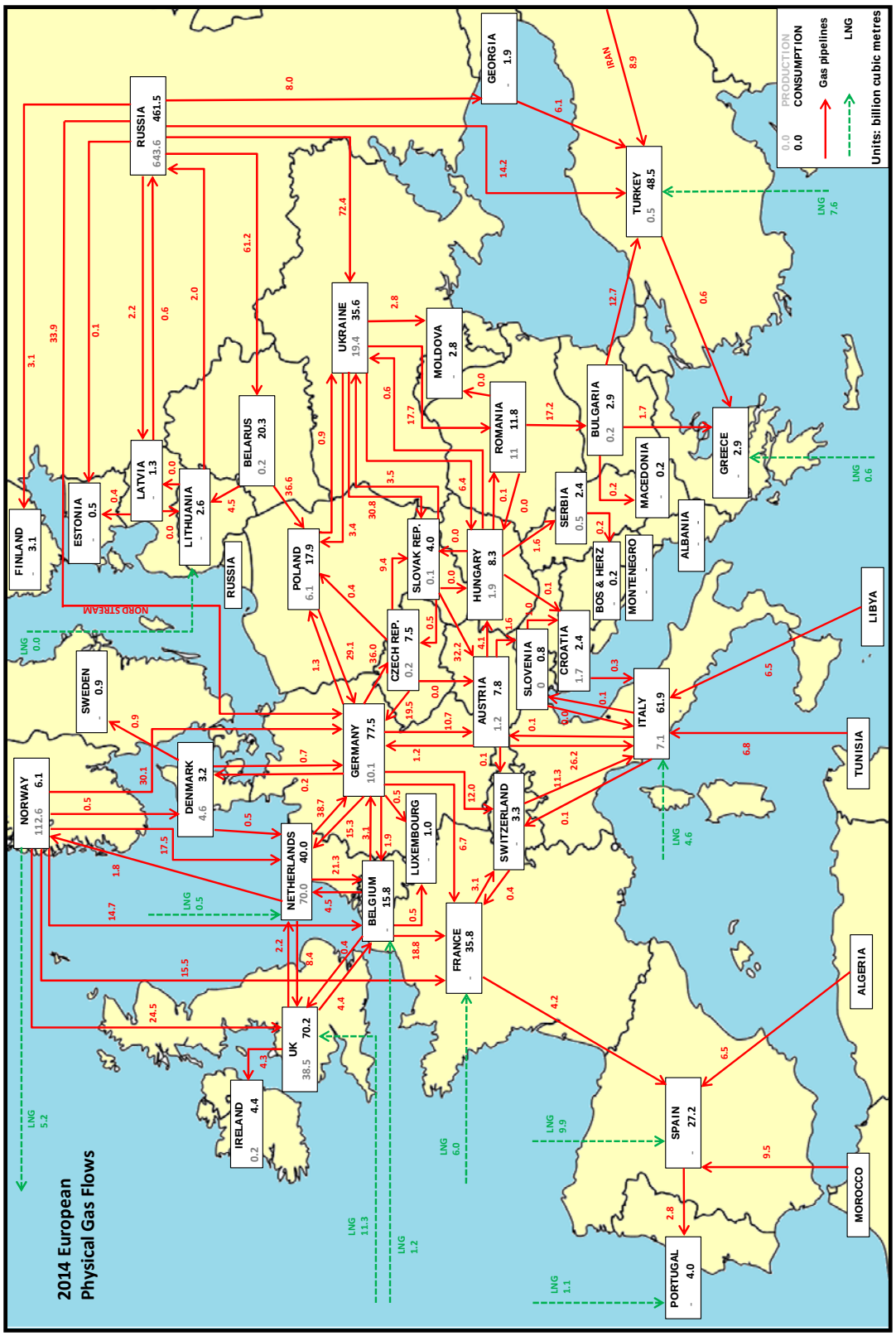
Gas storage sites and import/export pipelines (Table 4.4)

4.12 This table details current gas storage facilities in the UK as of 31 May 2016 and also the two operational pipelines that bring gas to the UK from continental Europe. **Significant increases in onshore and offshore storage capacity/deliverability are being considered at existing and new sites**. National Grid's Gas Transportation Ten Year Statement includes public details of such projects in Great Britain. Total storage in the UK stands at 4.6 billion cubic metres, with total demand for 2015 recorded at 72 billion cubic metres.

Natural gas imports and exports (Tables 4.5 and 4.6)

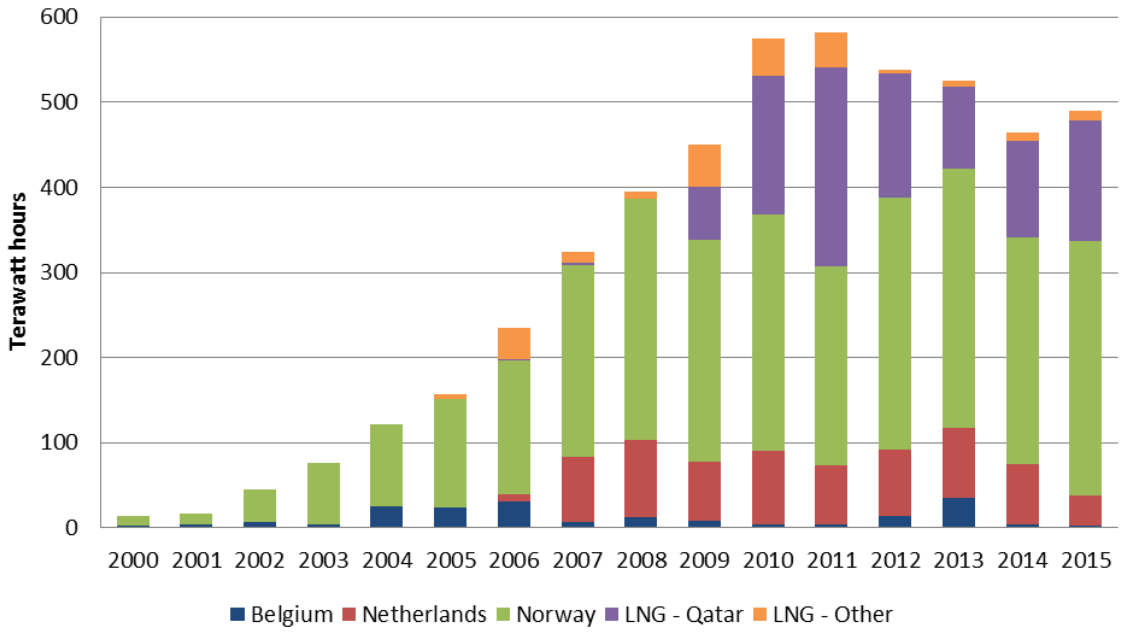
4.13 These tables show how much gas was imported to, and exported from, the UK via i.) the interconnector pipelines, ii.) UKCS gas fields using the Dutch offshore pipeline system, and iii.) via ships to the UK's LNG terminals. **Norwegian gas imports were 61 per cent of total gas imports** compared to 57 per cent in 2014. In 2015, 66 per cent of gas exports were to continental Europe, with 32 per cent to the Republic of Ireland and 2 per cent being Liquefied Natural Gas Reloads to various countries. The flows of gas across Europe for 2014 are illustrated in Map 4.1, originally published in Energy Trends December 2015 at:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/386890/Physical_gas_flows.pdf

Map 4.1: Gas European Transit System



Source: International Energy Agency and BEIS. Gas data are less transparent at the wider European level given missing information on transit flows and incomplete trade information. The above map was produced using published International Energy Agency data to reconstruct the missing physical gas flow data and is based on 2013 data.

Chart 4.3: Imports of Natural Gas 2000 to 2015

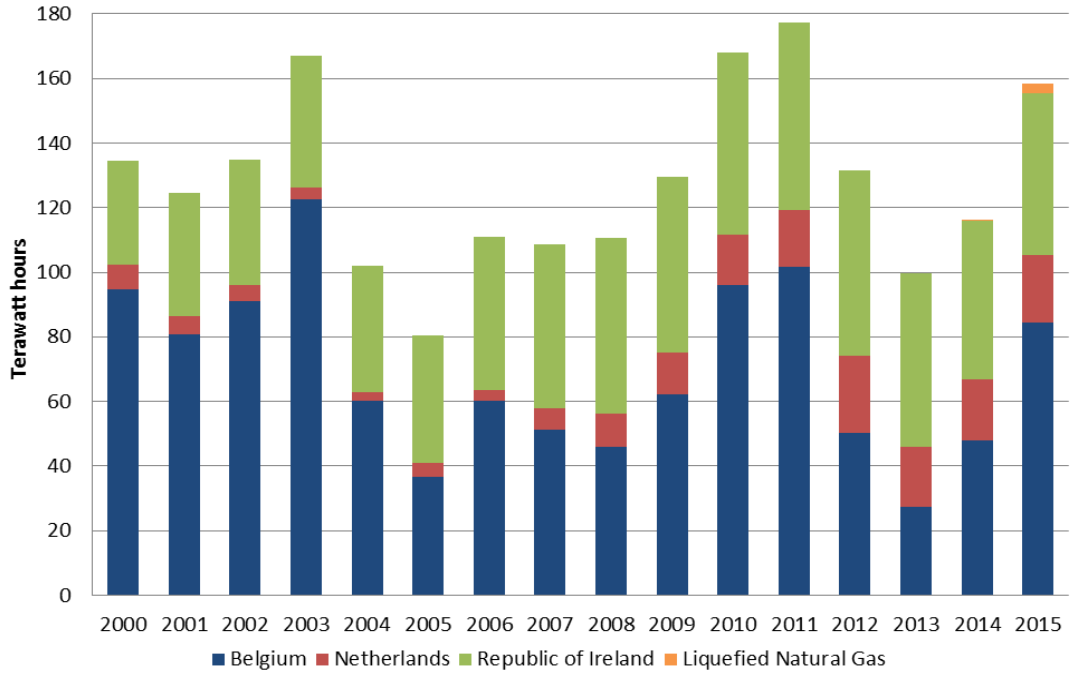


4.14 Chart 4.3 shows the share of natural gas imports by interconnector pipelines and LNG since 2000. The methodology for calculating LNG imports has been updated for 2013 and 2014 to reflect LNG terminal own use. Imports have increased sharply since 2000, reflecting the decline in the UK's indigenous production. **Physical pipeline imports comprised 69 per cent of natural gas imports in 2015, with LNG making up 31 per cent**. Imports have generally declined over the past five years reflecting the decrease in natural gas demand during this time (see Chart 4.2).

4.15 The UK imports natural gas via pipeline (from Norway, the Netherlands and Belgium) and shipped LNG (to terminals at Milford Haven (South Hook and Dragon), the Isle of Grain and Teesside Gasport). Since the turn of the century, the most significant changes to the UK's import diversity include the completion of the interconnector from the Netherlands at the end of 2006 (resulting in significant natural gas imports from the Netherlands) and completion of two new LNG terminals in 2009. LNG's share of total gas imports have risen from 25 per cent in 2009 to 47 per cent in 2011, but fell to 20 per cent in 2013. Despite this, LNG remains an important component of the UK's energy mix. In 2015 LNG imports increased 23 per cent on 2014, making up 31 per cent of all gas imported. In 2015, Qatar accounted for 93 per cent of LNG imports. The origins of LNG imports can be found in Table 4.5 and the total import volumes by each LNG terminal in Table 4.6.

4.16 The increased import infrastructure afforded by the new LNG terminals has ensured that UK exports remain robust, despite the decrease in the UK's production. During 2014 and continuing into 2015 LNG reloads took place at the Isle of Grain, consequently the UK has exported LNG to various countries. Chart 4.4 shows that exports have remained robust since the turn of the century, with record levels of exports in 2011 and a significant rise in 2015's figures over 2014. **The UK 2015 physical exports of natural gas were up a 36 per cent in comparison to 2014** to 158 TWh, with exports to Belgium increasing by 75 per cent to 84 TWh making up over a half of all exports in 2015. In contrast UK Imports only rose slightly, up 5.2 per cent, leading to net imports reducing by 5.1 per cent. The total volume of physical gas traded in 2015 was up 11.5 per cent to 648 TWh.

Chart 4.4: Exports of Natural Gas 2000 to 2015



Sub-national gas data

4.17 Table 4A gives the number of consumers with a gas demand below 73,200 kWh per year in gas year 2014 (see Technical Terms and Definitions) and the total number of gas consumers by region. The table covers customers receiving gas from the national transmission system. The 'below 73,200 kWh' category covers both domestic and small business customers, and it was this section of the market that was progressively opened up to competition between April 1996 and May 1998. It should be noted that the data are for gas year 2014, which is approximately one year in arrears of the other data presented in this chapter (aside from the European gas map). Table 4A shows that the South East and London has the largest number of consumers, whilst the North East and Scotland has the lowest.

Table 4A: Consumption by gas customers by region in 2014[1]

	Consumption by customers below 73,200 kWh (2,500 therms) annual demand		Consumption by all customers (where regional classification is possible)	
Region/Country	Number of consumers (thousands)	Gas sales 2014 (GWh)	Number of consumers (thousands)	Gas sales 2014 (GWh)
North East	1,094	14,759	1,105	22,379
North West	2,885	37,397	2,914	61,205
Yorkshire and the Humber	2,109	28,805	2,132	48,601
East Midlands	1,757	23,722	1,774	37,099
West Midlands	2,097	27,800	2,119	43,705
East	2,051	27,471	2,071	41,698
London	3,001	39,701	3,040	59,102
South East	3,176	43,371	3,213	59,769
South West	1,831	21,526	1,850	32,207
Wales	1,974	27,390	1,997	46,294
Scotland	1,108	13,851	1,118	22,132
Great Britain	23,085	305,793	23,334	474,191

Source: Xoserve and the independent gas transporters.

[1] These data cover the gas year (1st October to 30th September). Please note that the gas data are weather normalised.

[2] Customers with an annual consumption of 73,200 kWh or lower will include some small industrial and commercial consumers.

[3] Data excludes approximately 171,000 customers (0.7 per cent) for whom regional allocation was not possible.

4.18 In February 2016, 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.

Table 4B: Domestic gas market penetration (in terms of percentage of customers supplied[2]) by region, Quarter 4 2015

Region/Country[1]	All Payment Types	
	Home supplier	Other large supplier
North Scotland	33	67
South Wales	34	66
North East	35	65
South East	38	62
East Midlands	38	62
Southern	39	61
South West	41	59
Yorkshire	42	58
South Scotland	42	58
Eastern	42	58
West Midlands	43	57
North West	45	55
Merseyside & N Wales	47	53
London	50	50
Great Britain	41	59

[1] *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).*
[2] *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.*

4.19 **At the end of December 2015, BEIS estimates that 63 per cent of domestic gas customers in Great Britain were no longer with their home supplier, British Gas**. The proportions in the table 4B are based on the BEIS price survey, which does not include the majority of small suppliers, therefore underestimate the proportion of customers not with their home supplier. By the end of December 2015 of the companies surveyed, around 41 per cent of customers were supplied by British Gas. Table 4B gives market penetration in more detail, by distribution areas of the former public electricity suppliers supplied by the larger energy companies. For all types of domestic customer, it is in the markets in North Scotland, South Wales and the North East of England that new suppliers have had most success. As of the end of 2015, the share of the market not supplied by British Gas stood at 45 per cent of the credit market, 66 per cent of the direct debit market, and 55 per cent of the pre-payment market.

4.20 Competition in the domestic market remained broadly unchanged between 2008 and 2013. During 2015 the concentration of sales by the largest three and largest six suppliers for each relevant sector has diluted compared to 2014 and 2008 to 2013. This reflects customers switching to smaller or cheaper providers. In 2014 an estimated 2 million customers were with small suppliers, compared to an estimated 1 million at the end of 2013. In 2015, the largest three suppliers accounted for just under 60 per cent of sales and the largest six accounting for over 88 per cent. This was similar to 2014, however the concentration has reduced for 2015. Data on supply into the industrial sector in 2015 show that the largest three suppliers accounted for 48 per cent and the largest six suppliers 75 per cent of sales, a lower concentration than 2014. The commercial sector decreased in concentration compared to last year, with the largest three and largest six suppliers accounting for 42 and 69 per cent of sales respectively compared to 47 and 76 per cent during 2013.

Map 4.2: The National Gas Transmission System 2015

Source: International Energy Agency and BEIS

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 printed and bound 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 web site.

Definitions used for production and consumption

4.21 **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.

4.22 **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.

4.23 **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.

4.24 **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 20145in 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

4.25 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

4.26 Production figures are generally obtained from returns made under BEIS'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 4.28).

4.27 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.

4.28 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.

4.29 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.

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

4.31 The sectors as defined in Chart 4.2 can be mapped across from Table 4.1 as follows: Industrial = Coke manufacture + Blast furnaces + Industry (sum) + Non energy use. Services = Public administration + Commercial + Agriculture + Miscellaneous. Domestic = Domestic. Energy industries = Heat generation + Oil and gas extraction + Petroleum refineries + Coal extraction + Other (Energy industry use). Electricity generators = Electricity generation.

Period covered

4.32 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

4.33 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 web site.

Statistical and metering differences

4.34 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.

4.35 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.

4.36 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 2014 as follows:

	GWh
Total UK consumption (Table 4.3)	731,826
Plus producers' own use	50,087
Plus operators' own use	3,932
	Equals
Consumption of natural gas	785,846
Plus upstream losses and metering differences	-
Plus downstream losses – leakage assessment	1,070
Plus downstream losses – own gas use	30
Plus downstream losses – theft	147
Plus downstream losses – iron and steel losses	2
Plus downstream metering differences	5,251
	Equals
Total demand for natural gas (Table 4.1)	792,346

4.37 The statistical difference row in Table 4.1 is made up of the following components in 2015:

	GWh
Statistical difference between gas available at terminals and gas input to downstream (Table 4.3)	1527
Plus Downstream gas industry: Distribution losses and metering differences	297
	Equals
Statistical difference for natural gas (Table 4.1)	1824

4.38 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.

4.39 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.

4.40 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.

4.41 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.

Contacts:

Warren Evans
Energy Statistics Team
warren.evans@decc.gsi.gov.uk
0300 068 5059

James Halliwell (downstream gas)
Energy Statistics Team
james.halliwell@decc.gsi.gov.uk
0300 068 8121

Matthew Curds (upstream gas)
Energy Statistics Team
matthew.curds@decc.gsi.gov.uk
0300 068 8414

4.1 Commodity balances

Natural gas

GWh

	2013			2014			2015		
	Natural gas	Colliery methane	Total Natural gas	Natural gas	Colliery methane	Total Natural gas	Natural gas	Colliery methane	Total Natural gas
Supply									
Production	424,153	604	424,757	427,784r	562	428,346r	460,268	530	460,797
Other sources	-	-	-	-	-	-	-	-	-
Imports	535,105	-	535,105	476,837r	-	476,837r	492,382	-	492,382
Exports	-109,664	-	-109,664	-128,076r	-	-128,076r	-161,575	-	-161,575
Marine bunkers	-	-	-	-	-	-	-	-	-
Stock change *(1)*	+621	-	621	-2,383	-	-2,383	+3,515	-	3,515
Transfers *(2)*	-61	-	-61	-140	-	-140	-420	-	-420
Total supply	**850,155**	**604**	**850,759**	**774,022r**	**562**	**774,583r**	**794,170**	**530**	**794,699**
Statistical difference *(3)*	+837r	-	+837r	-1,269r	-	-1,269r	+1,824	-	+1,824
Total demand	**849,318r**	**604**	**849,921r**	**775,291r**	**562**	**775,853r**	**792,346**	**530**	**792,876**
Transformation	**229,680r**	**491**	**230,170r**	**243,022r**	**451**	**243,473r**	**237,957**	**421**	**238,378**
Electricity generation	205,378r	491	205,869r	217,392r	451	217,842r	212,556	421	212,976
Major power producers	175,210	-	175,210	189,919	-	189,919	185,955	-	185,955
Autogenerators	30,168r	491	30,659r	27,473r	451	27,924r	26,601	421	27,022
Heat generation *(4)*	24,302r	-	24,302r	25,631r	-	25,631r	25,401	-	25,401
Petroleum refineries	-	-	-	-	-	-	-	-	-
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	-	-	-	-	-	-	-	-	-
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Energy industry use	**53,775**	**98**	**53,873**	**52,172r**	**98**	**52,270r**	**57,580**	**98**	**57,678**
Electricity generation	-	-	-	-	-	-	-	-	-
Oil and gas extraction	46,556	-	46,556	45,391r	-	45,391r	50,087	-	50,087
Petroleum refineries	1,151	-	1,151	1,140r	-	1,140r	1,149	-	1,149
Coal extraction	60	98	158	70	98	168	79	98	177
Coke manufacture	-	-	-	-	-	-	-	-	-
Blast furnaces	363	-	363	338	-	338	323	-	323
Patent fuel manufacture	-	-	-	-	-	-	-	-	-
Pumped storage	-	-	-	-	-	-	-	-	-
Other	5,645	-	5,645	5,232r	-	5,232r	5,941	-	5,941
Losses *(5)*	**7,473r**	**-**	**7,473r**	**6,856r**	**-**	**6,856r**	**6,500**	-	**6,500**
Final consumption	**558,390r**	**15**	**558,405r**	**473,241r**	**13**	**473,254r**	**490,309**	**11**	**490,320**
Industry	**93,900r**	**15**	**93,915r**	**93,332r**	**13**	**93,345r**	**94,462**	**11**	**94,473**
Unclassified	-	15	15	-	13	13	-	11	11
Iron and steel	5,338	-	5,338	5,454r	-	5,454r	5,374	-	5,374
Non-ferrous metals	1,930r	-	1,930r	1,993r	-	1,993r	1,972	-	1,972
Mineral products	15,175r	-	15,175r	15,156r	-	15,156r	15,731	-	15,731
Chemicals	15,176r	-	15,176r	14,549r	-	14,549r	15,136	-	15,136
Mechanical Engineering, etc	5,744r	-	5,744r	5,835r	-	5,835r	5,747	-	5,747
Electrical engineering, etc	2,612r	-	2,612r	2,492r	-	2,492r	2,465	-	2,465
Vehicles	4,480r	-	4,480r	4,276r	-	4,276r	4,630	-	4,630
Food, beverages, etc	20,596r	-	20,596r	20,477r	-	20,477r	20,533	-	20,533
Textiles, leather, etc	5,157r	-	5,157r	5,167r	-	5,167r	5,101	-	5,101
Paper, printing, etc	8,134r	-	8,134r	7,771r	-	7,771r	7,867	-	7,867
Other industries	5,172r	-	5,172r	5,905r	-	5,905r	5,707	-	5,707
Construction	4,387	-	4,387	4,255	-	4,255	4,200	-	4,200
Transport	-	-	-	-	-	-	-	-	-
Air	-	-	-	-	-	-	-	-	-
Rail	-	-	-	-	-	-	-	-	-
Road	-	-	-	-	-	-	-	-	-
National navigation	-	-	-	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-	-	-	-
Other	**458,892r**	**-**	**458,892r**	**374,479r**	**-**	**374,479r**	**390,580**	**-**	**390,580**
Domestic	343,501r	-	343,501r	278,101	-	278,101	292,417	-	292,417
Public administration	44,426r	-	44,426r	36,972r	-	36,972r	36,888	-	36,888
Commercial	57,800r	-	57,800r	48,439r	-	48,439r	50,264	-	50,264
Agriculture	1,096r	-	1,096r	886r	-	886r	886	-	886
Miscellaneous	12,068r	-	12,068r	10,080r	-	10,080r	10,125	-	10,125
Non energy use	**5,598**	-	**5,598**	**5,430**	-	**5,430**	**5,267**	-	**5,267**

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

(2) Natural gas used in the manufacture of synthetic coke oven gas.

(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 4.36.

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

GWh

	2011	2012	2013	2014	2015
Supply					
Production	526,711	452,696	424,757	428,346r	460,797
Imports	588,475	549,518	535,105	476,837r	492,382
Exports	-183,689	-144,023	-109,664	-128,076r	-161,575
Stock change *(2)*	-22,623	-269	+621	-2,383	+3,515
Transfers	-60	-56	-61	-140	-420
Total supply	**908,813**	**857,867**	**850,759**	**774,583r**	**794,699**
Statistical difference *(3)*	+208	-1,858	+837r	-1,269r	+1,824
Total demand	**908,605**	**859,725**	**849,921r**	**775,853r**	**792,876**
Transformation	**332,012**	**241,634**	**230,170r**	**243,473r**	**238,378**
Electricity generation	309,076	216,543	205,869r	217,842r	212,976
Major power producers	277,527	184,307	175,210	189,919	185,955
Autogenerators	31,548	32,236	30,659r	27,924r	27,022
Heat generation	22,936	25,091	24,302r	25,631r	25,401
Other	-	-	-	-	-
Energy industry use	**62,905**	**56,333**	**53,873**	**52,270r**	**57,678**
Electricity generation	-	-	-	-	-
Oil and gas extraction	53,163	48,461	46,556	45,391r	50,087
Petroleum refineries	1,757	1,619	1,151	1,140	1,149
Coal extraction	223	194	158	168	177
Coke manufacture	-	-	-	-	-
Blast furnaces	453	266	363	338	323
Other	7,309	5,793	5,645	5,232r	5,941
Losses *(4)*	**9,926**	**7,891**	**7,473r**	**6,856**	**6,500**
Final consumption	**503,762**	**553,867**	**558,405r**	**473,254r**	**490,320**
Industry	**94,515**	**91,524**	**93,915r**	**93,345r**	**94,473**
Unclassified	21	18	15	13	11
Iron and steel	5,829	5,091	5,338	5,454r	5,374
Non-ferrous metals	1,840	1,890	1,930r	1,993r	1,972
Mineral products	16,093	15,092	15,175r	15,156r	15,731
Chemicals	16,034	15,205	15,176r	14,549r	15,136
Mechanical engineering, etc	5,661	5,836	5,744r	5,835r	5,747
Electrical engineering, etc	2,529	2,633	2,612r	2,492r	2,465
Vehicles	3,762	4,006	4,480r	4,276r	4,630
Food, beverages, etc	20,516	20,163	20,596r	20,477r	20,533
Textiles, leather, etc	5,348	5,233	5,157r	5,167r	5,101
Paper, printing, etc	7,458	7,081	8,134r	7,771r	7,867
Other industries	5,155	5,071	5,172r	5,905r	5,707
Construction	4,270	4,205	4,387	4,255	4,200
Transport	-	-	-	-	-
Road *(5)*	-	-	-	-	-
Other	**403,297**	**456,573**	**458,892r**	**374,479r**	**390,580**
Domestic	293,400	345,080	343,501r	278,101	292,417
Public administration	42,960	43,243	44,426r	36,972r	36,888
Commercial	55,757	57,377	57,800r	48,439r	50,264
Agriculture	1,351	1,162	1,096	886	886
Miscellaneous	9,830	9,711	12,068r	10,080r	10,125
Non energy use	**5,949**	**5,771**	**5,598**	**5,430**	**5,267**

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

	2011	2012	2013	2014	2015
Total production	**680**	**602**	**604**	**562**	**530**
Electricity generation	497	486	491	451	421
Coal extraction	162	98	98	98	98
Other industries	21	18	15	13	11
Total consumption	**680**	**602**	**604**	**562**	**562**

(2) Stock fall (+), stock rise (-).
(3) Total supply minus total demand.
(4) Refers to downstream losses. For an explanation of what is included under these losses, see paragraph 4.36.
(5) 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

	2011	2012	2013	2014	2015
Upstream gas industry:					
Gross production *(2)*	526,030	452,094	424,153	427,784r	460,268
Minus Producers' own use *(3)*	53,163	48,461	46,556	45,391r	50,087
Exports	183,689	144,023	109,664	128,076r	161,575
Plus Imports of gas	588,475	549,518	535,105	476,837r	492,382
Gas available at terminals *(4)*	877,653	809,129	803,038	731,153r	740,987
Minus Statistical difference *(5)*	-662	-331	-440	-976r	1,527
Downstream gas industry:					
Gas input into the national transmission system *(6)*	878,316	809,460	803,478	732,129r	739,461
Minus Operators' own use (7)	5,852	3,900	3,534	3,324r	3,932
Stock change (storage sites) *(8)*	22,623	269	-621	2,383	-3,515
Metering differences *(5)*	8,037	6,099	5,697	5,302	5,251
Gas output from the national transmission system *(9)*	841,804	799,191	794,869	721,121r	733,792
Minus Leakage assessment *(10)*	1,603	1,537	1,537	1,370	1,070
Own use gas *(11)*	32	34	34	30	30
Theft *(12)*	253	218	203	154	147
Transfers *(13)*	60	56	61	140	420
Losses *(14)*	3	3	2	1	2
Statistical difference and metering differences *(5)*	869	-1,527	1,277r	-293r	297
Total UK consumption *(15)*	**838,984**	**798,871**	**791,754r**	**719,719r**	**731,826**
Stocks of gas (at end year) *(16)*	43,363	43,632	43,011	45,394	41,879
Storage capacity *(17)*	47,310	47,310	47,310	47,310	47,310

(1) For details of where to find monthly updates of natural gas production and supply see paragraph 4.33.
(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 4.41.
(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.
(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 4.36 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 DECC 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 31 May 2016

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	3.10	45	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	0.05	11	Salt cavern	Medium
Humbly Grove Energy	Humbly Grove	Hampshire	0.30	7	Depleted field	Medium
Scottish Power	Hatfield Moor	South Yorkshire	0.07	2	Depleted field	Medium
National Grid LNGS	Avonmouth	Avon and Somerset	0.08	13	LNG	Short
EDF Energy	Hill Top Farm	Cheshire	0.02	2	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	53
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
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	31

(1) Information on gas storage as detailed in the National Grid Gas Ten Year Statement 2015

(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

	2011	2012	2013	2014	2015
Imports					
by pipelines from:					
Belgium *(2)*	4,032	14,264	35,367	3,949	2,116
The Netherlands *(3)*	69,001	78,258	81,519	70,293	35,933
Norway *(4)*	234,194	294,586	305,516	266,548	298,773
Liquefied Natural Gas (5)	274,794	150,097	102,620	124,081r	152,397
of which:					
Algeria	*2,687*	*1,311*	*4,492*	*5,774*	*5,170*
Australia	-	-	-	-	-
Egypt	*890*	*145*	*755*	-	-
Nigeria	*13,025*	*475*	-	*534*	*478*
Norway	*10,114*	*1,735*	*1,068*	-	*601*
Qatar	*234,077*	*146,431*	*95,204*	*113,769r*	*141,143*
Trinidad & Tobago	*5,903*	-	*1,101*	*4,004*	*5,005*
USA	*1,575*	-	-	-	-
Yemen	*6,521*	-	-	-	-
Total Imports	**582,021**	**537,205**	**525,022**	**464,871r**	**489,219**
Exports to:					
Belgium *(2)*	101,526	50,343	27,458	48,074	84,465
The Netherlands *(6)*	17,544	23,729	18,597	18,852	20,789
Norway *(7)*	125	49	20	9	3
Republic of Ireland *(8)*	58,041	57,590	53,508	49,004	50,121
Liquefied Natural Gas (10)				171r	3,035
Total Exports	**177,236**	**131,711**	**99,583**	**116,110r**	**158,413**
Net Imports *(9)*	**404,785**	**405,494**	**425,439**	**348,761r**	**330,806**

(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) and Gjoa/Vega (to FLAGS).

(5) From various sources to the Isle of Grain, Milford Haven and Teesside.

(6) Direct exports from the Grove, 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 for which separate figures are not available.

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

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

4.6 Liquefied Natural Gas imports by terminal

GWh

	2011	2012	2013	2014	2015
LNG Imports via:					
Dragon (*Milford Haven) (1)*	28,790	1,819	968	3,326	8,014
Isle of Grain (*Isle of Grain*) *(2)*	86,357	38,196	15,664	13,979r	14,214
South Hook (*Milford Haven*) *(3)*	159,646	110,082	85,989	106,776	130,169
Teesside GasPort (*Teesside*) *(4)*	-	-	-	-	-
	274,794	**150,097**	**102,620**	**124,081r**	**152,397**

(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 (including pumped storage) in the UK increased slightly, from 338 TWh in 2014 to 339 TWh in 2015. Total electricity supply (including net imports) increased by 0.4 per cent to 360 TWh. (Tables 5.5 and 5.1)
- Final consumption of electricity in 2015, at 303 TWh, was broadly the same as in 2014 and at its lowest level since 1995. (Table 5.1).
- Coal's share of generation fell from 30 to 22 per cent in 2015, as generation from coal fell from 100 TWh to 76 TWh; gas's share of generation in 2015 was 30 per cent, broadly similar to 2014, as generation fell slightly by 0.9 per cent to 100 TWh. (Table 5.5)
- Renewables' share of generation increased from 19.1 per cent in 2014 to a record 24.6 per cent in 2015, as a result of increased capacity. (Table 6A, in chapter 6)
- Low carbon electricity's share of generation increased from 39 per cent to a record 46 per cent. This was due to the rise renewables generation but also reflects an increase in nuclear generation (up 10.3 per cent), due to greater availability following outages towards the end of 2014. (Table 5.5)
- Total capacity was 2.7 GW lower at the end of 2015 at 81 GW, with the closure of several stations partially offset by new renewable capacity. (Table 5.6)
- The UK remained a net importer of electricity in 2015, with net imports contributing 5.8 per cent of electricity supply. (Table 5.1)

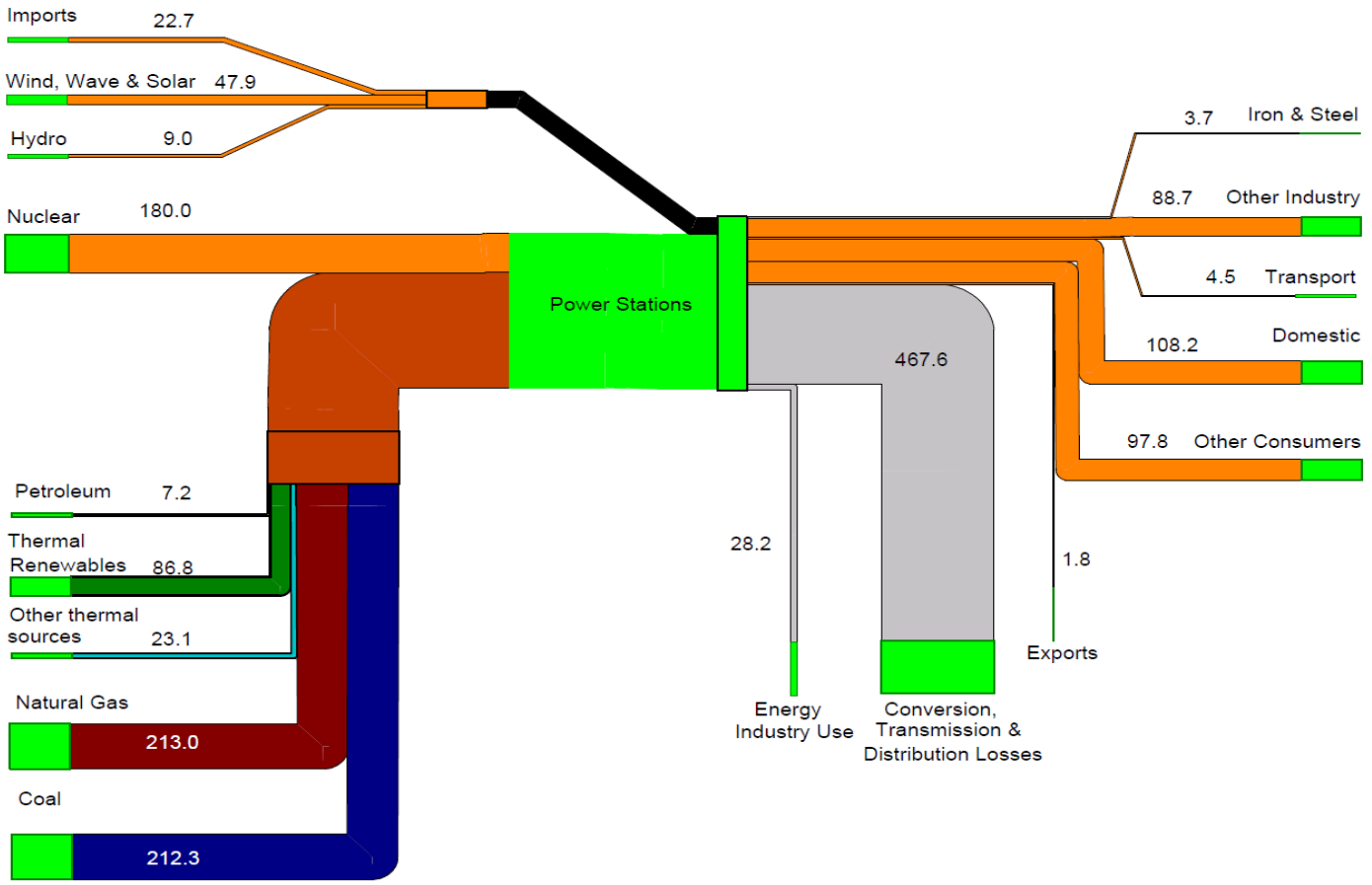
Introduction

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 2016 (page 127).

5.2 An energy flow chart for 2015, showing the flows of electricity from fuel inputs through to consumption, is included overleaf. This is a way of simplifying the figures that can be found in the commodity balance tables. It illustrates the flow of primary fuels from the point at which they become available for the production of electricity (on the left) to the eventual final use of the electricity produced or imported (on the right) as well as the energy lost in conversion, transmission and distribution.

5.3 Commodity balances for electricity, for each of the last five years, form the introductory table (Table 5.1). Table 5.2 separates out the *public* distribution system for electricity from the electricity generated and consumed by *autogenerators*, using a commodity balance format. Fuels used to generate electricity in the UK in each of the last five years are covered in Table 5.3. Table 5.4 shows the relationship between the commodity balance definitions and traditional Digest definitions of electricity, so that the most recent data can be linked to the long term trends data, which can be found on BEIS's energy statistics website. Table 5.5 shows the relationship between fuels used, generation and supply in each of the latest five years. Tables on plant capacity (Tables 5.6, 5.7, 5.8 and 5.12) and on plant loads and efficiency (Table 5.9) are also included. Table 5.10 lists individual power stations in operation and is supplemented by a table showing large scale Combined Heat and Power (CHP) schemes in the UK (Table 5.11). The 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/collections/digest-of-uk-energy-statistics-dukes

Electricity flow chart 2015 (TWh)



Notes:
This flow chart is based on the data in Tables 5.1 (for imports, exports, use, losses and consumption) and 5.5 (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 5.5) minus generation (Table 5.5) plus losses (Table 5.1).

Commodity balances for electricity (Table 5.1)

5.4 **In 2015, the total UK electricity supply was 360 TWh, broadly the same as 2014**. Of this total supply, just over 94 per cent was home produced with the rest from imports, net of exports. For electricity, supply is totally driven by demand – the impacts of improving energy efficiency and overall warmer temperatures, left final consumption in 2015 at its lowest level in a series since 1998 (see paragraph 5.10). Table 5A below summarises the trend in total generation and supply over the last three years.

Table 5A: Electricity generation and supply

GWh

	2013	2014	2015
Total Generation (excl. pumped storage)	355,474	335,291	336,356
Total Supply	372,804	358,694	360,034

5.5 In 2015, indigenous production rose slightly by 0.3 per cent on 2014. Of the 336 TWh produced (excluding pumped storage production), 87 per cent was from major power producers and 13 per cent from other generators, while 37 per cent was from primary sources (including nuclear, wind, solar and hydro) and 63 per cent from secondary sources (including coal, gas, oil, bioenergy and non-bio waste).

5.6 **Net imports in 2015 were up by 2.0 per cent on 2014, to a record 21 TWh**. Imports fell by 2.3 per cent whilst exports were down by 35 per cent. In 2015, net imports from continental Europe via interconnectors with France and the Netherlands decreased by 4.3 per cent to 22 TWh, with the France interconnector running at 79 per cent utilisation (down from 85 per cent in 2014) and the Netherlands interconnector running at a record 91 per cent utilisation (up slightly from 90 per cent in 2014). Net exports to the Republic of Ireland fell to under 1 TWh from 2.3 TWh in the previous year. Of this, net exports to the Republic of Ireland in 2015 via the Wales interconnector, which opened in 2012, were down by 56 per cent compared to 2014. Overall exports to the Republic of Ireland accounted for 90 per cent of UK exports in 2015. Net imports contributed 5.8 per cent of electricity supply in 2015 (up 0.1 percentage point on the previous year). Table 5B below shows the UK's net imports via interconnectors during the past three years.

Table 5B: Net Imports via interconnectors 2013 to 2015

GWh

	France - UK[1]	Ireland - N. Ireland[2]	Netherland - UK[1]	Ireland - Wales[1]	Total
2013	10,302	-45	6,335	-2,161	14,431
2014	14,951	121	7,856	-2,408	20,520
2015	13,838	167	7,999	-1,065	20,938

1. 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/.

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

5.7 Electricity generated by each type of fuel is also shown on the second page of Table 5.1. The link between electricity generated and electricity supplied is made in Table 5.5, and is discussed further in paragraphs 5.25 to 5.32.

5.8 Overall electricity demand fell by only 0.4 per cent, from 360 TWh in 2014 to 358 TWh in 2015. Of total demand, 28 TWh (7.9 per cent) was used within the energy industry; 27 TWh (7.7 per cent) was accounted for by losses, and 303 TWh (84 per cent) was final consumption, which was broadly similar to 2014 and remaining at its lowest level in a series since 1998. Electricity demand broadly equals supply, although for a number of reasons there is a small difference which is termed the statistical difference[1].

5.9 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 2014-15 was 1.3 degrees cooler than the same

[1] *Further explanations of the statistical difference can be found in paragraph 5.91 and in paragraph A.19 of DUKES annex A.*

period a year earlier. In 2015, the daily average temperature was 0.6 degrees cooler than in 2014 while the average temperature during the first six months of 2015 was 1.3 degrees cooler than in 2014.

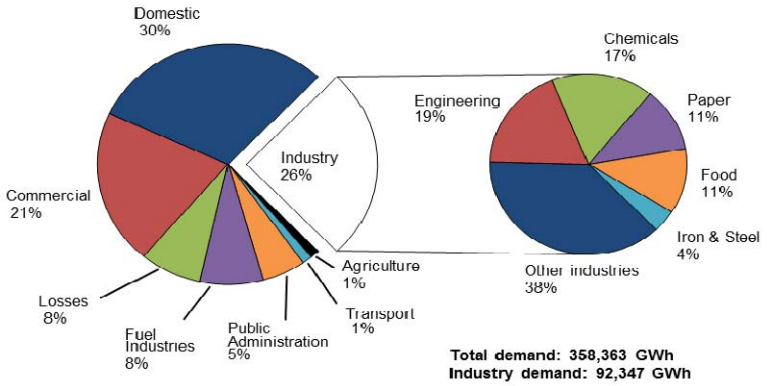
5.10 **Despite the slightly cooler temperatures in 2015, domestic consumption dropped slightly by 0.2 per cent**, from 108.3 TWh in 2014 to 108.2 TWh. Domestic consumption has generally been declining on account of milder winters and continuing energy efficiency improvements. Commercial sector consumption in 2015 fell by 0.6 per cent, to 74.5 TWh. Agriculture consumption rose by 6.3 per cent, while public administration consumption rose by 3.9 per cent.

5.11 Since 2010 **industrial consumption has fallen with a slight decrease in 2015 of 0.4 per cent on 2014**, from 92.8 TWh to 92.3 TWh. Iron and steel fell by 2.6 per cent, while the other sectors across the industrial sector fell by 0.4 per cent.

5.12 **Consumption in the transport sector fell slightly by 0.6 per cent in 2015**, to 4.5 TWh. Of this total electricity consumption in the transport sector, 98 per cent came from rail with the rest from road which increased by 44 per cent to 97 GWh in 2015 as **the number of electric vehicles increased from 20,000 to 29,000**[2].

5.13 Industrial consumption accounted for 26 per cent of total demand for electricity, less than the share of consumption by households (30 per cent), with transport and the services sector accounting for 29 per cent. Within the industrial sector, the three largest specified consuming industries are chemicals, food and paper, which together account for 40 per cent of industrial consumption. Taken together, the engineering industries and vehicles accounted for a further 19 per cent of industrial consumption of electricity. The iron and steel sector is 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 5.86 to 5.89. Chart 5.1 shows the total demand for electricity in 2015, by final consumer.

Chart 5.1: Electricity demand by sector 2015



5.14 **Consumption by the energy industries fell by 0.8 per cent**. This was despite an increase in the amount of electricity used in generation, which accounts for 59 per cent of the energy industries' total use of electricity in 2015. This was offset by large decreases in use in the coal extraction and manufacture and blast furnace industries reflecting the decline in production in the steel and coke industries. Additionally, 13 per cent of energy industry use is accounted for by pumping at pumped storage stations (see 'pumped storage' line in Table 5.1), while petroleum refineries are also significant consumers with 17 per cent of energy industry use. Energy industry use as a proportion of total demand was 7.9 per cent in 2015.

[2] *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).*

5.15 Losses as a proportion of electricity demand in 2015, at 7.7 per cent, were down by 0.3 percentage points on 2014 (8.0 per cent). Losses comprise three components[3]:

- transmission losses (7.4 TWh) from the high voltage transmission system, which represented about 27 per cent of the losses figure in 2015;
- distribution losses (19 TWh), which occur between the gateways to the public supply system's network and the customers' meters, and accounted for about 69 per cent of losses; and
- theft or meter fraud (just under 1.0 TWh, around 4 per cent).

Commodity balances for the public distribution system and for other generators (Table 5.2)

5.16 Table 5.2 expands on the commodity balance format to show consumption divided between electricity distributed over the public distribution system (PDS) and electricity provided by other generators (largely autogeneration and generation from renewable sources). Major power producers (MPPs) provide the majority of power to the PDS, with the remainder made up of transfers from other generators and net imports. Further information on the definitions of other generators and MPPs can be found in paragraph 5.66. Table 5.2 also expands the domestic sector (to show consumption by payment type) and the commercial sector (to show detailed data beyond that presented in Table 5.1).

5.17 The proportion of electricity supplied by the public distribution system dropped slightly (1 percentage point) to 93 per cent in 2015. Of the electricity supplied by other generators, 43 per cent (19 TWh) was transferred to the public distribution system in 2015, which was almost similar to 2014.

5.18 In 2015, 5.7 per cent of final consumption of electricity was by other generators and did not pass over the public distribution system. This was a slight increase on the 5.0 per cent in 2014. A substantial proportion of electricity used in the energy industries is self-generated (around 24 per cent in 2015). At petroleum refineries the proportion is even higher; in 2015, 72 per cent of electricity consumed was self-generated.

5.19 In 2015, 9.0 per cent of the industrial demand for electricity was met by autogeneration, an increase of 0.4 percentage points on the previous year. Table 1.9 in Chapter 1 shows the fuels used by autogenerators to generate this electricity within each major sector and also the quantities of electricity generated and consumed.

5.20 Of the electricity consumed by the domestic sector in 2015, 20 per cent was reported as being purchased under some form of off-peak pricing structure (e.g. Economy 7). Just under 16 per cent of consumption was through prepayment systems, broadly unchanged from the level in 2014.

5.21 Domestic consumption of electricity produced, and consumed, by households with micro-generation units (such as solar photovoltaic panels) installed is also shown in the table from 2010. The number of these installations has increased sharply since the Great Britain Feed in Tariff (FiT) scheme was launched in April 2010 (see paragraph 6.18 for further information on FiTs uptake). **In 2015, consumption of self-produced electricity by the domestic sector increased by 26 per cent on 2014**, to stand at 1,180 GWh, which was more than fifty times the 23 GWh consumed in 2010. However, self-produced electricity still remains around 1 per cent of domestic consumption.

Electricity fuel use, generation and supply (Tables 5.3 & 5.5)

5.22 In Table 5.3, fuel used by electricity generators is measured in both original units and, for comparative purposes, in the common unit of million tonnes of oil equivalent. In Table 5.5, figures are quoted in a third unit, namely GWh, in order to show the link between fuel use and electricity generated[4] as well as showing generation from conventional steam stations and from combined cycle gas turbine stations over the most recent five years.

5.23 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

[3] *See paragraph 5.78 for further information on the calculation of losses.*

[4] *Conversion factors for switching between mtoe, GWh and other units of energy can be found on the inside back cover page.*

UK Energy Statistics home page: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

5.24 **Despite a small increase in generation, fuel used in 2015 fell 2.7 per cent**, from 70.3 million tonnes of oil equivalent (mtoe) to 68.3 mtoe, due to increases in 100 per cent efficient wind and solar generation (where the fuel use is the same as the generation), and a reduction in generation from less thermally efficient coal. Coal use was down by 24 per cent, and gas use down by 2.2 per cent.

5.25 Total electricity generated (including pumped storage) in the United Kingdom in 2015 was 339 TWh, an increase of 0.3 per cent on the 338 TWh in 2014. Major power producers (MPPs, as defined in paragraph 5.67) accounted for 87 per cent of electricity generation in 2015. Generation by MPPs was down 1.7 per cent on 2014, at 296 TWh, while generation by other generators was 16 per cent up on a year earlier, at 43 TWh.

5.26 In 2015 there was a 10.3 per cent increase in generation from nuclear, from 64 TWh to 70 TWh. This was following a decrease in generation in 2014 due to maintenance outages at a number of plants.

5.27 Generation from gas decreased by 0.9 per cent, from 101 TWh in 2014 to 100 TWh in 2015. In 2015, generation from coal decreased 25 per cent, from 100 TWh in 2014 to 76 TWh due to the closure of several power stations and the conversion of a third unit at Drax from coal to high-range co-firing (85% to <100% biomass). Generation by coal in the 'Other Generators' sector had seen a large fall in 2013, due to Lynemouth power station being re-classified as a MPP (following the closure of the aluminium smelter it previously powered).

5.28 In 2015, generation from oil rose slightly to 2.1 TWh, a 12.5 per cent increase on 2014 (which was the lowest level in the last nineteen years), but a fall of 4.6 TWh on 2008's ten year high.

5.29 **Generation by all renewable sources**[5] **rose 29 per cent, to 84 TWh, between 2014 and 2015**. Increased capacity in 2015 resulted in overall wind and solar generation[6] increasing by 33 per cent to 48 TWh. **With rainfall levels in catchment areas during 2015 around 13 per cent higher than 2014, hydro generation increased by 6.7 per cent**, from 5.9 TWh to a record 6.3 TWh. Over the same period, **generation from bio-energy (including biodegradable wastes) rose 30 per cent to 29 TWh**, due to the conversion of third unit at Drax from coal to high-range co-firing (85% to <100% biomass) during 2015[7]. More information on renewable electricity can be found in Chapter 6.

5.30 Table 5.5 also shows electricity supplied data, which deducts stations' own use of electricity from its generation. These data take into account the fact that some stations use relatively more electricity
than others in the generation process itself. In total, gross electricity supplied in 2015 was 0.2 per cent higher than in 2014, at 322 TWh. For coal-fired stations it was 25 per cent less, for nuclear it was 10.3 per cent more, and for gas stations it was 0.9 per cent less.

5.31 Chart 5.2 shows the share of 2015 generation by fuel, on an output basis (i.e. the percentage of electricity generated by the fuel), compared with 2014. Further information on this, and the alternative, input basis, of comparing fuel use, can be found in paragraphs 5.74 to 5.75.

5.32 Gas's share of generation in 2015, at 30 per cent, was 0.3 percentage points lower than in 2014. Coal's share, at 22 per cent, was 7.3 percentage points below that in 2014. Nuclear's 21 per cent share was 1.8 percentage points higher than in 2014. Renewables' share increased from 19.1 per cent in 2014 to a new record 24.6 per cent in 2015. Other fuels, including oil and pumped storage, increased from 2.6 per cent in 2014 to 2.8 per cent in 2015.

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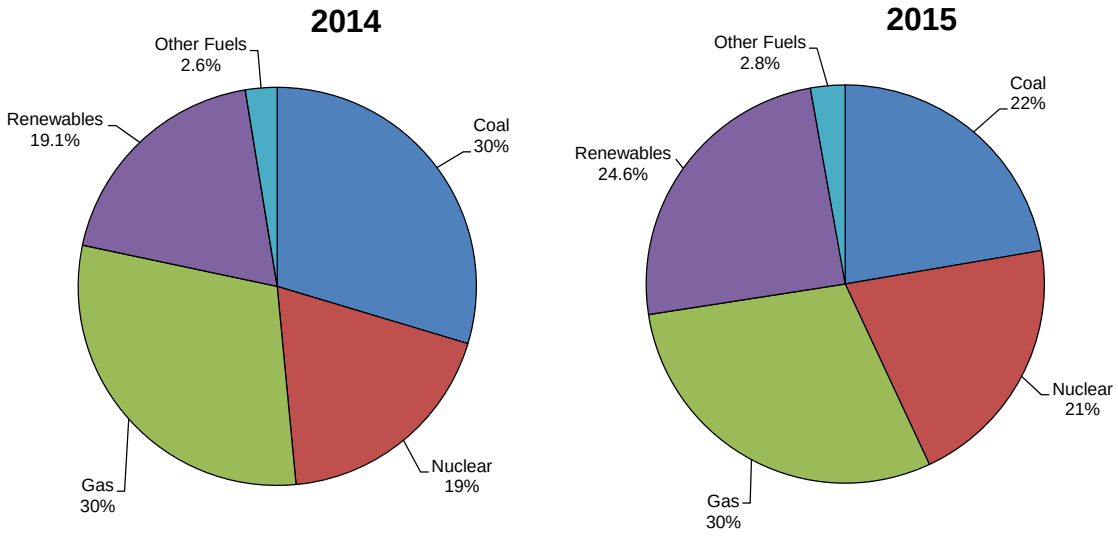
[5] *Renewables includes wind, natural flow hydro, solar, wave, tidal and bioenergy (including co-firing).*

[6] *Including generation from wave and tidal.*

[7] *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 remain in thermal renewables.*

Chart 5.2: Shares of electricity generation, by fuel



Relating measurements of supply, consumption and availability (Table 5.4)

5.33 Table 5.4 shows the relationship between these terms for the latest five years. For the full definitions of the terms used in the commodity balances see Annex A, paragraphs A.7 to A.42.

Plant capacity (Tables 5.6, 5.7 and 5.8)

5.34 Table 5.6 shows capacity, i.e. the maximum power available at any one time, for MPPs and other generators by type of plant. From 2006 onwards, MPP capacities are measured in Transmission Entry Capacity (TEC) terms, rather than Declared Net Capacity (DNC)[8].

5.35 **In 2015, total capacity of all generators was 80,820 MW, down 3.3 per cent** from the 83,543 MW installed at the end of 2014. MPPs fell by 3,817 MW, from 75,696 MW to 71,879 MW. This was mostly due to the closure of Littlebrook D (in Kent) and Wylfa (in Anglesey), along with Killingholme A and B (both in Lincolnshire) going into Supplemental Balancing Reserve (SBR - stations in SBR are closed but are made available in times of need, e.g. during winter periods when electricity demand is high). Some of this reduction in capacity was offset by the increase in wind capacity (de-rated, see paragraph 5.79), which increased by 394 MW in 2015, along with a 743 MW increase in capacity of renewables other than hydro and wind. The past six 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 below.

8 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 5.79. 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 2016), 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 1)	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	360	2013
Tilbury B	Coal [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 [7]	Partially Closed	1,960	980	2014
Drax	Coal [3]	Partially Converted	3,225	2,580	2014
Drax	Biomass	Partially Converted	645	1,290	2014
Uskmouth	Coal [8]	Mothballed	363	0	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	360	0	2015
Killingholme A	CCGT	SBR [9]	665	0	2015
Killingholme B	CCGT	SBR [9]	900	0	2015
Lynemouth	Coal	Mothballed	420	0	2015
Wylfa (Reactor 2)	Nuclear [2]	Closed	490	0	2015
Ferrybridge C	Coal [7]	Closed	980	0	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 1 closed on 30 April 2012, reactor 2 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 900 MW), before reducing to 360 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.

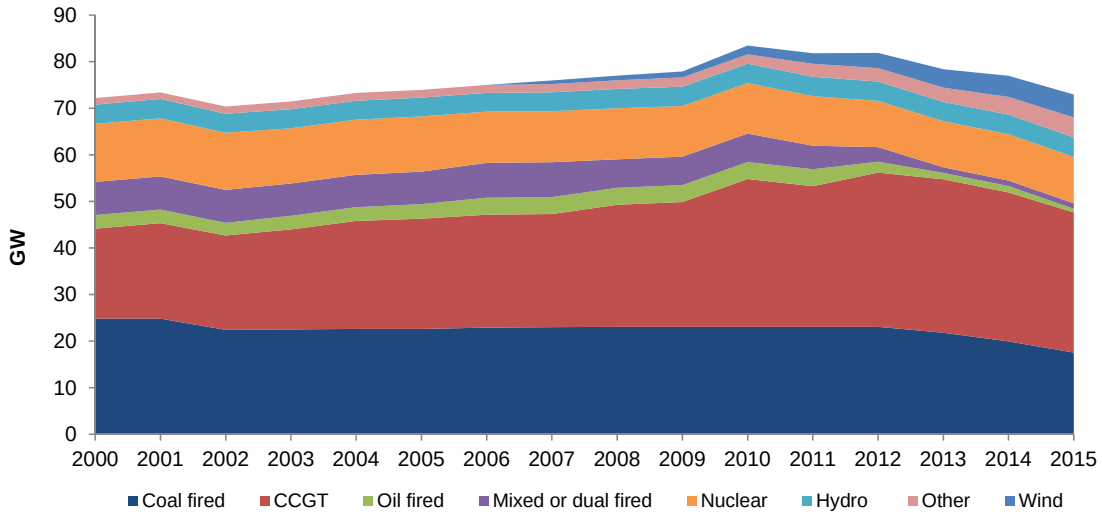
7. Two units (980 MW) closed in April 2014 and the second unit (980 MW) closed in March 2016.

8. One unit (120 MW) closed in April 2013, with the remaining two closing in April 2014.

9. Station placed on Supplemental Balancing Reserve – the station is closed but will be available in times of need, eg. during winter periods when electricity demand is high.

5.36 At the end of 2015, MPPs accounted for 89 per cent of the total generating capacity, 1.7 percentage points down from 2014. The capacity of other generators increased by 1,094 MW (13.9 per cent), with a 769 MW increase in capacity from renewables other than hydro and wind, a 351 MW increase in capacity from solar[9] and a 145 MW increase in wind capacity. This was partially offset by a net 152 MW decrease in Combined Cycle Gas Turbine (CCGT) stations and a 30 MW decrease in conventional thermal steam. A breakdown of the capacity of the MPPs' plants at the end of December each year from 2000 to 2015 is shown in Chart 5.3.

Chart 5.3: Generating capacity of major power producers 2000-2015



1. 'Other' includes gas turbines, oil engines and renewables other than hydro.
2. 'Hydro' includes natural flow and pumped storage.
3. 'Mixed or dual fired' includes non-CCGT stations that can be fuelled by a combination of gas, coal and oil
4. Wind included from 2007

5.37 Table 5.7 separates the capacities of MPPs geographically to show England and Wales, Scotland and Northern Ireland. In 2015, 83 per cent of the generating capacity in the UK owned by MPPs was in England and Wales, 14 per cent was in Scotland and 3.5 per cent in Northern Ireland. Of the net decrease in UK MPP capacity of 3,816 MW between 2014 and 2015, there was a 3,991 MW fall in England and Wales and a 153 MW increase in Scotland. The capacity in Northern Ireland increased by 22 MW between 2014 and 2015.

5.38 In Table 5.8, 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). In 2015, 65 per cent of capacity was in the commercial and domestic sectors, a 6.4 percentage points increase on a year earlier[10]. In 2015, the chemicals sector and the oil and gas terminals and oil refineries sector each had 8 and 10 per cent of capacity respectively, while engineering and other metal trades had a 1.9 per cent share and paper, printing and publishing and food, drink and tobacco had a combined share of 11 per cent.

5.39 In addition to tables 5.6-5.8, table 5.12 showing installed capacity, disaggregated by connection type (high voltage or low voltage) and technology, can be found on the BEIS section of the GOV.UK website, at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.

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

[10] *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 5.68). 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.*

Plant loads, demand and efficiency (Table 5.9)

5.40 Table 5.9 shows the maximum load met each year, load factors (by type of plant and for the system in total) and indicators of thermal efficiency. 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 5.54), England, Wales and Scotland are covered by a single network and a single maximum load is shown for Great Britain for 2006 to 2015.

5.41 Maximum load (demand) in the UK (52,735 MW) during the winter of 2015/2016 occurred on 18 January 2016, in the half-hour ending 17:30; this was 2.1 per cent lower than the previous winter's maximum (on 19 January 2015). This occurred at the time of maximum demand in Great Britain (51,100 MW); at this time, Northern Ireland had a load of 1,653 MW. In Northern Ireland, the maximum load occurred on 11 January 2016 at the period ending 17:30 (1,679 MW), which was 5.1 per cent below that of the previous winter.[11]

5.42 **Maximum demand in 2015/2016 was 72 per cent of the UK capacity of major power producers** (as shown in Table 5.6) as measured at the end of December 2015, a 3.1 per cent increase on 2014/2015.

5.43 In Great Britain, maximum demand in 2015/2016 was 72 per cent of the England, Wales and Scotland capacity of MPPs (Table 5.7). For Northern Ireland, the proportion was 67 per cent (52 per cent in 2015/16). These percentages do not include the capacities available via the interconnectors with neighbouring grid systems nor demand for electricity via these interconnectors.

5.44 Plant load factors measure how intensively each type of plant has been used. The load factor of nuclear stations in 2015 at 75.1 per cent was 6.8 percentage points higher than in 2014, due to planned and unplanned outages at four EDF nuclear stations at the end of 2014[12]. The CCGT load factor increased to 31.7 per cent, following a first increase since 2009 in 2014. Between 2014 and 2015, the load factor for coal fired power stations decreased by 10 percentage points, to 37.9 per cent, a record low.

5.45 Load factors for natural flow hydro and wind (as well as other renewables) can be found in table 6.5[13]. **Onshore wind speeds in 2015 were the highest in the last fifteen years**, and up 7.2 per cent (0.6 knots) on 2014. This resulted in the highest onshore wind load factor (on an unchanged configuration basis), at 29.4 per cent, since 1999, and an increase of 3.0 percentage points on 2014. Similarly, offshore wind load factors were at a record 39.7 per cent, 1.9 percentage points up on 2014, reflecting the higher wind speeds and technological advances in newer sites. **The overall wind load factor (on an unchanged configuration basis) was a record 33.3 per cent, higher than the load factor for CCGT stations in 2015**. Rainfall (in the main hydro areas) was 13 per cent higher in 2015 compared to 2014, leading to an increase in the hydro load factor (on an unchanged configuration basis) of 0.9 percentage points, from 38.8 per cent to a five year high of 39.8 per cent in 2015[14]. Pumped storage use is less affected by the weather and the load factor fell successively from 2009 to 2011, as lower peak time demand for electricity and lower prices deterred its use. In 2015, the load factor fell by 0.6 percentage points from 2014 to 11.4 per cent.

5.46 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 a fall of 0.5 percentage points from 2014 to 39.1 per cent in 2015. The efficiencies presented here are calculated using **gross** calorific values to obtain the energy content of the fuel inputs[15].

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

12 This is based on the end of year nuclear capacity which does not include Wylfa, which closed at the end of December. With Wylfa included, the nuclear load factor would be 73.4 per cent.

13 The load factors presented in table 5.9 use transmission entry capacity (as presented in table 5.6). 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.

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

15 For more information on gross and net calorific values, see paragraph 5.81

Power stations in the United Kingdom (Tables 5.10, 5.11 and 5.12)

5.47 Table 5.10 lists the operational power stations owned by Major Power Producers in the United Kingdom as at the end of May 2016, along with their installed capacity and the year they began to generate electricity. Where a company operates several stations they are grouped together.

5.48 Table 5.11 shows CHP schemes of 1 MW and over for which the information is publicly available. However, it is the total power output of these stations that is given, 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.

5.49 In Table 5.10, generating stations using renewable sources are also listed in aggregate form in the "Other power stations" section apart from biomass/waste stations operated by the major power producers, which appear in the main table. For completeness, CHP stations not appearing in the main table are included in aggregate in this section. Details of the interconnectors between England and France, England and the Netherlands, Scotland and Northern Ireland, Northern Ireland and the Irish Republic, and Wales and the Irish Republic are also given in this table. The total installed capacity of all the power stations individually listed in Table 5.10 is 60,235 MW[16].

5.50 Table 5.12 shows capacity of the transmission and distribution networks for Great Britain, Northern Ireland and the United Kingdom as a whole. Transmission network connected capacity for the UK as a whole has reduced each year since 2012 due to closures and conversions of coal, oil and gas plants. These closures have been slightly offset by the increase in renewables capacity, in particular bioenergy which increased by 23 per cent in 2015 due to the conversion of a third unit at Drax from coal to high-range co-firing (85% to <100% biomass). **The capacity of the distribution network has increased each year since 2011** for Great Britain and Northern Ireland, with capacity in 2015 in each around double that of 2011, driven by increasing quantities of embedded solar and wind. In 2015, distribution-connected capacity in Great Britain increased by 25 per cent (4.8 GW) on 2014, with 69 per cent of this increase (3.7 GW) attributable to solar. **In 2015, total installed capacity across all networks in the UK was 96.0 GW, up 1.3 per cent on 2014**. Of all capacity in Great Britain, 74 per cent was estimated to have been connected to the transmission network in 2015, and 73 per cent in Northern Ireland.

Carbon dioxide emissions from power stations

5.51 **It is estimated that carbon dioxide emissions from power stations accounted for 26 per cent of the UK's total carbon dioxide emissions in 2015**. Emissions vary by type of fuel used to generate the electricity and emissions estimates for all electricity generation for 2013 to 2015 are shown in Table 5D below.

Table 5D: Estimated carbon dioxide emissions from electricity supplied 2013 to 2015 [1,2]

Fuel	Emissions (tonnes of carbon dioxide per GWh electricity supplied)		
	2013	2014	2015[3]
Coal	910	907	920
Gas	384	388	379
All fossil fuels	691	652	618
All fuels (including nuclear and renewables)	449	400	332

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 5.5, with the figure for All fuels in 2015 being 318,712 GWh.

3. The 2015 emissions figures are provisional.

16 The total installed capacity for stations listed in table 5.10 differs from the total in table 5.6, as the latter is on a Transmission Entry Capacity basis, and taken as at the end of 2015. See paragraph 5.79 for more information on the measures of capacity.

Sub-national electricity data

5.52 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. A summary of electricity consumption at regional level is given in Table 5E and relates to 2014. 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.

Table 5E: Electricity sales 2014

	Domestic sector sales (GWh)	Number of domestic customers (thousand)[1]	Industrial and commercial sector sales (GWh)	Number of I & C customers (thousand)[1]	All consumers sales (GWh)
North East	4,099	1,200	7,645	83	11,744
North West	11,974	3,146	20,301	240	32,275
Yorkshire and the Humber	8,627	2,347	15,497	182	24,124
East Midlands	7,749	1,999	14,231	161	21,980
West Midlands	9,474	2,377	15,682	197	25,156
East of England	11,016	2,575	15,970	218	26,986
Greater London	13,204	3,456	27,753	403	40,957
South East	16,133	3,759	22,550	336	38,683
South West	10,369	2,465	15,330	255	25,699
Wales	5,182	1,388	11,644	128	16,826
Scotland	10,695	2,730	14,815	212	25,510
Unallocated	648	169	4,737	21	5,385
Great Britain	109,170	27,611	186,155	2,436	295,325
Northern Ireland[2]					7,839
Sales direct from high voltage lines[3]					3,373
Total					306,537

1. Figures are the number of Meter Point Administration Numbers (MPANs); every metering point has this unique reference number.
2. Northern Ireland data are based on data for electricity distributed provided by Northern Ireland Electricity.
3. Based on estimate provided by Ofgem.

5.53 Table 5F provides domestic electricity market penetration by distribution areas and by payment type. **By the end of March 2016, around 67 per cent of customers were no longer with their home supplier**. Data on the share of supply by the smaller companies are not currently available so the table has not been adjusted for the survey coverage and only contains data from: British Gas, EDF, E.On, RWE, Scottish Power and Scottish and Southern Energy (SSE). As such, the table underestimates non-home suppliers by around 3 percentage points, showing 64 per cent. For all types of domestic customer, it is in the markets in the West Midlands, Yorkshire and the North East of England that new suppliers have had most success. As of the end of 2015, the share of the market not supplied by the home supplier stood at 57 per cent of the credit market, 68 per cent of the direct debit market, and 63 per cent of the pre-payment market.

Table 5F: Domestic electricity market penetration (in terms of percentage of customers supplied) by Public Electricity Supply area and payment type, fourth quarter of 2015

Region	Home Supplier				Other Major Supplier			
	Credit	Direct Debit	Prepayment	All Payment Types	Credit	Direct Debit	Prepayment	All Payment Types
North East	33	25	21	26	67	75	79	74
West Midlands	33	25	24	27	67	75	76	73
Yorkshire	34	26	24	28	66	74	76	72
North West	37	26	29	29	63	74	71	71
Merseyside & N	39	27	38	32	61	73	62	68
Eastern	42	29	29	33	58	71	71	67
East Midlands	40	31	35	34	60	69	65	66
South East	41	32	36	35	59	68	64	65
South West	44	33	40	37	56	67	60	63
London	44	36	41	40	56	64	59	60
South Scotland	44	35	52	41	56	65	48	59
Southern	54	41	47	45	46	59	53	55
South Wales	61	48	63	54	39	52	37	46
North Scotland	72	60	69	64	28	40	31	36
Great Britain	42	32	38	36	58	68	62	64

Source: Quarterly Energy Price Table 2.4.1: Percentage of domestic electricity customers by region by supplier type at www.gov.uk/government/statistical-data-sets/quarterly-domestic-energy-price-statistics

Data is not adjusted to account for survey coverage. The Domestic Fuels Inquiry survey coverage is estimated at around 88 per cent of the domestic energy market. All those not surveyed are with non-home suppliers.

Structure of the industry

5.54 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.

5.55 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 5.52 and Table 5F give more details of the opening up of the domestic gas and electricity markets to competition.

5.56 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.

5.57 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.

5.58 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.

5.59 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.

Comparisons of electricity in the European Union in 2014[17]

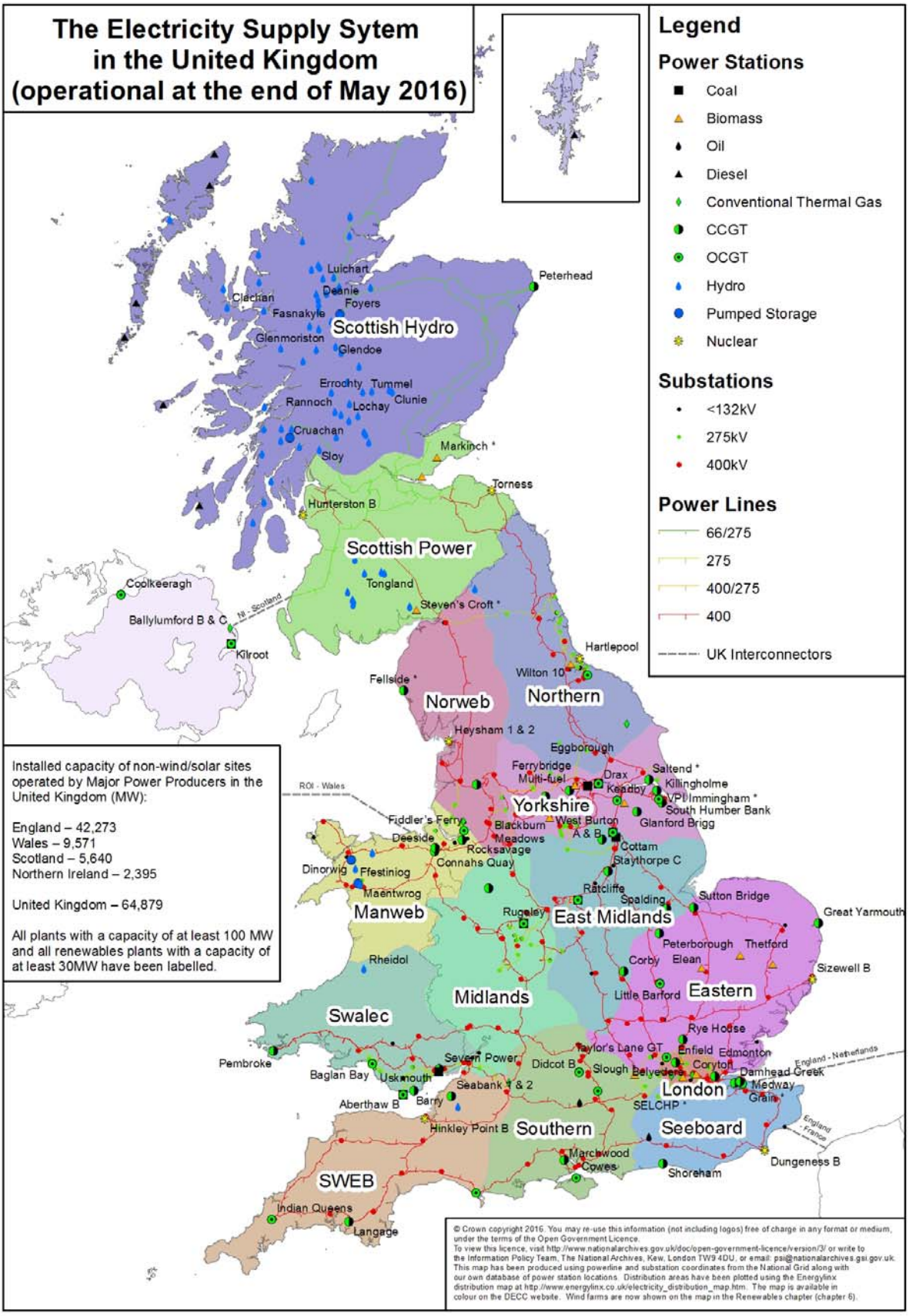
5.60 **The European Union (EU) as a whole generated 3,191 TWh of electricity in 2014. Of this, 11 per cent was generated in the UK**. Germany generated the largest share of electricity in the EU, with 20 per cent. Industry had 37 per cent of EU final electricity consumption, households 29 per cent, services 32 per cent and transport 2 per cent.

5.61 In 2014, the largest sources of the EU's generation were nuclear and coal, with shares of 27 per cent and 25 per cent of total generation respectively and gas 14 per cent. France sources the largest share of its generation from nuclear, with 77 per cent, while 42 per cent of Sweden's electricity is from nuclear. The largest shares of coal in the generation mix are in Germany (with over half coming from lignite/brown coal), with 43 per cent, and Denmark, with 34 per cent. Italy source the largest share of their electricity from gas with 33 per cent of generation in 2014.

5.62 Renewables represented 29 per cent of the EU's generation. Sweden sources 57 per cent of its electricity from renewables (mainly hydro, but also 8 per cent from biomass). Denmark's 58 per cent renewables share comes from wind (41 per cent) and biomass (16 per cent), the highest share of generation from wind in the EU. Spain's 41 per cent renewables share comes mainly from wind (18 per cent) and hydro (15 per cent). Italy had 42 per cent of its generation from renewables, with Germany and France 27 per cent and 17 per cent respectively.

5.63 France's exports, net of imports, were 12 per cent of its generation in 2014, making it the highest net exporter of electricity. For Italy, however, net imports represented 15 per cent of its electricity requirements, making it the highest net importer.

[17] *At the time of writing, the latest available data were for 2014. Data from Eurostat, at: http://ec.europa.eu/eurostat/data/database*


The Electricity Supply Sytem in the United Kingdom (operational at the end of May 2016)
Legend
Power Stations
Coal
Biomass
Oil
Diesel
Conventional Thermal Gas
CCGT
OCGT
Hydro
Pumped Storage
Nuclear
Substations
<132kV
275kV
400kV
Power Lines
66/275
275
400/275
400
UK Interconnectors
Installed capacity of non-wind/solar sites operated by Major Power Producers in the United Kingdom (MW):
England – 42,273
Wales – 9,571
Scotland – 5,640
Northern Ireland – 2,395
United Kingdom – 64,879
All plants with a capacity of at least 100 MW and all renewables plants with a capacity of at least 30MW have been labelled.
Scottish Hydro
Scottish Power
Northern
Norweb
Yorkshire
East Midlands
Manweb
Midlands
Eastern
Swalec
London
Seeboard
Southern
SWEB
Luichart
Deanie
Foyers
Clachan
Fasnakyle
Glenmoriston
Glendoe
Errochty
Tummel
Clunie
Rannoch
Lochay
Cruachan
Sloy
Peterhead
Markinch *
Torness
Hunterston B
Tongland
Coolkeeragh
Ballylumford B & C
NI - Scotland
Kilroot
Steven's Croft *
Hartlepool
Wilton 10
Fellside *
Heysham 1 & 2
Eggborough
Ferrybridge Multi-fuel
Drax
Keadby
Saltend *
Killingholme
VPI Immingham *
South Humber Bank
Glanford Brigg
ROI - Wales
Fiddler's Ferry
Blackburn Meadows
West Burton A & B
Cottam
Staythorpe C
Deeside
Rocksavage
Connahs Quay
Dinorwig
Ffestiniog
Maentwrog
Ratcliffe
Spalding
Sutton Bridge
Great Yarmouth
Rugeley
Peterborough
Thetford
Corby
Elean
Sizewell B
Rheidol
Little Barford
Rye House
Pembroke
Severn Power
Didcot B
Taylor's Lane GT
Enfield
Edmonton
Slough
Belvedere
Coryton
England - Netherlands
Damhead Creek
Medway
Grain *
Baglan Bay
Uskmouth
Seabank 1 & 2
Aberthaw B
Barry
SELCHP *
Hinkley Point B
Marchwood
Cowes
Shoreham
Dungeness B
England - France
Indian Queens
Langage
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This map has been produced using powerline and substation coordinates from the National Grid along with our own database of power station locations. Distribution areas have been plotted using the Energylinx distribution map at http://www.energylinx.co.uk/electricity_distribution_map.htm. The map is available in colour on the DECC website. Wind farms are now shown on the map in the Renewables chapter (chapter 6).

Technical notes and definitions

5.64 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 1.62. 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 web site.

Electricity generation from renewable sources

5.65 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

5.66 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

5.67 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.

5.68 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.

5.69 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.

5.70 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.

5.71 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.

5.72 **Major power producers at the end of 2015 were:**
AES Electric Ltd, Baglan Generation Ltd, British Energy plc, Coolkeeragh ESB Ltd, Corby Power Ltd, Drax Power Ltd, Eggborough Power Ltd, Energy Power Resources, Ferrybridge Multifuel Energy Limited, Intergen, LondonWaste Ltd, Magnox Ltd, MPF Operations Ltd, Px Ltd, Riverside Resources Recovery Ltd, Semcorp Utilities (UK) Ltd, SELCHP Ltd, Statkraft Energy Ltd, Third Energy Trading Ltd, VPI Immingham LLP.

5.73 **Additionally, the following major wind farm companies are included**, beginning with data for 2007:

CEP Wind 2 Ltd, Dong Energy, Ecotricity, Eneco Wind UK Limited, Engie, Falck Renewables Ltd, Fred Olsen, Greencoat UK Wind, HG Capital, Infinis, Peel Energy Ltd, Renewable Energy Systems Limited, Statkraft Wind UK Ltd, Vattenfall Wind Power.

Generation from wind farms owned or operated by the following MPPs that had previously been excluded from the MPP category are now included for 2007 onwards:

Centrica Energy, EDF Energy, E.On UK plc, RWE Npower plc, Scottish Power plc, Scottish and Southern Energy plc.

Additionally, the following major solar companies are included, beginning with data for 2015:

Anesco, British Solar Renewables, Cubico Sustainable Investments Limited, Lark Energy, Lightsource.

Types of station

5.74 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

5.75 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

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

5.76 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 three percentage points in 2015) compared with the fuel input basis. This is because of the higher conversion efficiency of gas.

Public distribution system

5.77 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

5.78 The various sectors used for sales and consumption analyses are standardised across all chapters of the 2015 Digest. For definitions of the sectors see Chapter 1 paragraphs 1.56 to 1.60 and Annex A paragraphs A.31 to A.42.

Losses

5.79 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 5.4 (339,651 GWh in 2015).

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

5.80 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.

5.81 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 in paragraph 6.115, and at: www.legislation.gov.uk/uksi/1990/264/made?view=plain

Load factors

5.82 The following definitions are used in Table 5.9:

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 5.53) 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

5.83 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

5.84 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 – 2015:	12 months ended 31 December

5.85 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

Monthly and quarterly data

5.86 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

5.87 For MPPs, as defined in paragraphs 5.66 to 5.72, 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).

5.88 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

5.89 A sample of companies that generate electricity mainly for their own use (known as autogenerators or autoproducers – see paragraph 5.66, 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.

5.90 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

5.91 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 5.83 and 5.84, above. Sales data based on calendar years will always have included more electricity consumption than the slightly shorter statistical year of exactly 52 weeks.

5.92 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.

Contact: *Stephen Ashcroft*
Energy Statistics Team
electricitystatistics@decc.gsi.gov.uk
0300 068 2928

Contact: *Anwar Annut*
Energy Statistics Team
electricitystatistics@decc.gsi.gov.uk
0300 068 5060

5.1 Commodity balances

Electricity

GWh

	2011	2012	2013	2014	2015
Total electricity					
Supply					
Production	364,516	360,612	355,474r	335,291r	336,356
Other sources *(1)*	2,906	2,966	2,904	2,883	2,739
Imports	8,689	13,742	17,531r	23,243r	22,716
Exports	-2,467	-1,871	-3,105r	-2,723r	-1,778
Marine bunkers	-	-	-	-	-
Stock change	-	-	-	-	-
Transfers	-	-	-	-	-
Total supply	**373,644**	**375,450**	**372,804r**	**358,694r**	**360,034**
Statistical difference *(2)*	-631	-570	-997r	-1,210r	+1,671
Total demand	**374,274**	**376,020**	**373,800r**	**359,905r**	**358,363**
Transformation	-	-	-	-	-
Energy industry use	**28,319**	**29,156**	29,899r	28,387r	**28,160**
Electricity generation	16,430	17,968	17,856r	16,484r	16,672
Oil and gas extraction	576	565	570	536r	601
Petroleum refineries	4,684	3,793	4,681r	4,873r	4,815
Coal extraction and coke manufacture	929	902	873	741r	549
Blast furnaces	253	369	438	440	344
Patent fuel manufacture	-	-	-	-	-
Pumped storage	3,843	3,978	3,930	3,884	3,711
Other	1,603	1,581	1,551	1,429r	1,468
Losses	**28,128**	**28,905**	**27,666r**	**28,651r**	**27,458**
Final consumption	**317,827**	**317,959**	**316,235r**	**302,867r**	**302,745**
Industry	**102,361**	**98,175**	**96,917r**	**92,764r**	**92,347**
Unclassified	-	-	-	-	-
Iron and steel	3,852	3,376	3,799r	3,787r	3,688
Non-ferrous metals	6,971	5,028	4,430	4,475r	4,401
Mineral products	7,010	6,747	6,726	6,267r	6,053
Chemicals	17,637	17,450	16,525r	15,419r	15,604
Mechanical engineering, etc	7,261	7,072	7,064	6,912r	6,304
Electrical engineering, etc	6,383	6,189	6,172	5,714r	5,971
Vehicles	5,188	5,081	5,067	4,831r	4,814
Food, beverages, etc	11,319	11,137	11,083r	10,644r	10,732
Textiles, leather, etc	2,992	2,910	2,894	2,721r	2,680
Paper, printing, etc	10,904	10,866	10,806	10,735r	10,590
Other industries	21,304	20,828	20,888r	19,866r	20,171
Construction	1,539	1,494	1,464	1,393r	1,339
Transport *(3)*	**4,253**	**4,263**	**4,352r**	**4,504r**	**4,476**
Air	-	-	-	-	-
Rail *(4)*	4,232	4,236	4,319r	4,437r	4,379
Road *(5)*	21	26	33	68	97
National navigation	-	-	-	-	-
Pipelines	-	-	-	-	-
Other	**211,213**	**215,521**	**214,966r**	**205,599r**	**205,922**
Domestic	111,591	114,667	113,450r	108,324r	108,157
Public administration	18,396	18,903	18,802r	18,502r	19,227
Commercial	77,278	78,081	78,839r	74,928r	74,453
Agriculture	3,948	3,871	3,874	3,844r	4,085
Miscellaneous	-	-	-	-	-
Non energy use	-	-	-	-	-

5.1 Commodity balances (continued)

Electricity

GWh

	2011	2012	2013	2014	2015
Electricity production					
Total production *(6)*	**364,516**	**360,612**	**355,474r**	**335,291r**	**336,356**
Primary electricity					
Major power producers	**86,414**	**91,711**	**98,174**	**95,146**	**109,913**
Nuclear	68,980	70,405	70,607	63,748	70,345
Large scale hydro *(6)*	4,291	3,898	3,348	4,333	4,578
Small scale hydro	303	272	261	301	328
Wind and solar *(7)*	12,840	17,137	23,958	26,763	34,662
Other generators	**4,142**	**5,169**	**7,547r**	**10,503r**	**14,593**
Nuclear	-	-	-	-	-
Large scale hydro	698	733	678	720	736
Small scale hydro	388	382	418r	538r	647
Wind, wave and solar photovoltaics *(7)*	3,056	4,054	6,452r	9,245r	13,211
Secondary electricity					
Major power producers	**243,141**	**233,592**	**223,647**	**202,794**	**183,090**
Coal	104,797	140,164	130,204	100,158	75,563
Oil	1,074	1,132	745	530	683
Gas	132,753	86,229	82,891	88,871	88,461
Renewables	4,518	6,067	9,285	12,707	17,694
Other	-	-	522	528	689
Other generators	**30,818**	**30,139**	**26,105r**	**26,849r**	**28,760**
Coal	3,774	2,992	83r	72r	66
Oil	2,043	1,439	1,321r	1,366r	1,450
Gas	13,767	13,931	12,952r	12,024r	11,574
Renewables	8,435	8,581	8,878r	9,977r	11,695
Other	2,799	3,196	2,871r	3,410r	3,975
Primary and secondary production *(9)*					
Nuclear	68,980	70,405	70,607	63,748	70,345
Hydro	5,680	5,285	4,704r	5,893r	6,289
Wind, wave and solar photovoltaics	15,896	21,191	30,410r	36,008	47,872
Coal	108,571	143,156	130,287r	100,230r	75,630
Oil	3,117	2,571	2,066r	1,896r	2,133
Gas	146,520	100,160	95,843r	100,895r	100,035
Other renewables	12,953	14,648	18,163r	22,684r	29,388
Other	2,799	3,196	3,393r	3,938r	4,664
Total production	**364,516**	**360,612**	**355,474r**	**335,291r**	**336,356**

(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 5.68
(8) From 2015, major solar companies are included under Major Power Producers, see paragraph 5.70
(9) These figures are the same as the electricity generated figures in Table 5.5 except that they exclude pumped storage production. Table 5.5 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 5.31).

5.2 Commodity balances

Public distribution system and other generators

GWh

	2013			2014			2015		
	Public distribution system	**Other generators**	**Total**	**Public distribution system**	**Other generators**	**Total**	**Public distribution system**	**Other generators**	**Total**
Supply									
Major power producers	321,821	-	321,821	297,939	-	297,939	293,003		293,003
Other generators	-	33,653r	33,653r	-	37,352r	37,352r	-	43,353	43,353
Other sources *(1)*	2,904	-	2,904	2,883	-	2,883	2,739		2,739
Imports	17,531	-	17,531	23,243r	-	23,243r	22,716		22,716
Exports	-3,105r	-	-3,105r	-2,723r	-	-2,723r	-1,778		-1,778
Transfers	13,976r	-13,976r	-	16,378r	-16,378r	-	18,733	-18,733	-
Total supply	**353,128r**	**19,676r**	**372,804r**	**337,721r**	**20,974r**	**358,694r**	**335,414**	**24,620**	**360,034**
Statistical difference *(2)*	-863r	-134r	-997r	-109r	-1,102r	-1,210r	+1,108	+564	+1,671
Total demand	**353,991r**	**19,810r**	**373,800r**	**337,829r**	**22,076r**	**359,905r**	**334,306**	**24,056**	**358,363**
Transformation	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Energy industry use	**23,656**	**6,242r**	**29,899r**	**21,540r**	**6,847r**	**28,387r**	**21,323**	**6,837**	**28,160**
Electricity generation	15,669	2,187r	17,856r	13,957	2,526r	16,484r	13,805	2,867	16,672
Oil and gas extraction	570	-	570	536r	-	536	601	-	601
Petroleum refineries	1,291	3,390r	4,681r	1,218r	3,655r	4,873r	1,343	3,471	4,815
Coal extraction and coke manufacture	796	77	873	665r	76	741	500	49	549
Blast furnaces	-	438	438	-	440	440	-	344	344
Pumped storage	3,930	-	3,930	3,884	-	3,884	3,711	-	3,711
Other fuel industries	1,402	150	1,551	1,280r	150r	1,429r	1,362	106	1,468
Losses	**27,644r**	**22**	**27,666r**	28,634r	**17**	**28,651r**	**27,454**	**4**	**27,458**
Transmission losses	6,351		6,351	6,509r		6,509r	7,394		7,394
Distribution losses	20,317	22	20,339	21,124r	17	21,141r	19,063	4	19,067
Theft	1,036		1,036	1,000r		1,000r	997		997
Final consumption	**302,690**	**13,545r**	**316,235r**	**287,656r**	**15,212r**	**302,867**	**285,530**	**17,215**	**302,745**
Industry	**89,314**	7,604r	96,917r	84,780r	7,984r	92,764r	**84,020**	**8,327**	**92,347**
Iron and steel	2,960	839r	3,799r	2,967	820	3,787	2,974	714	3,688
Non-ferrous metals	3,875	555	4,430	3,721r	754r	4,475r	3,620	781	4,401
Mineral products	6,627	99	6,726	6,159r	108r	6,267r	5,963	89	6,053
Chemicals	14,650	1,875r	16,525r	13,862r	1,557r	15,419r	13,881	1,723	15,604
Mechanical engineering etc	6,955	109r	7,064r	6,798r	114r	6,912r	6,191	112	6,304
Electrical engineering etc	6,166	5r	6,172	5,708r	6r	5,714r	5,965	6	5,971
Vehicles	4,914	154r	5,067	4,676r	154r	4,831r	4,655	159	4,814
Food, beverages etc	9,782	1,301r	11,083r	9,300r	1,344r	10,644r	9,353	1,379	10,732
Textiles, leather, etc	2,887	7r	2,894	2,714r	7r	2,721r	2,673	7	2,680
Paper, printing etc	9,216	1,590r	10,806	8,857r	1,878r	10,735r	8,774	1,816	10,590
Other industries	19,833	1,055r	20,888r	18,639r	1,227r	19,866r	18,646	1,525	20,171
Construction	1,449	15	1,464	1,378r	15	1,393r	1,324	15	1,339
Transport *(3)*	**4,352r**	**-**	**4,352r**	**4,504r**	**-**	**4,504r**	**4,476**	**-**	**4,476**
Rail *(4)*	4,319r	-	4,319r	4,437r	-	4,437r	4,379	-	4,379
Road *(5)*	33	-	33	68	-	68	97	-	97
Other	**209,024r**	**5,942r**	**214,966r**	**198,371r**	**7,228r**	**205,599r**	**197,034**	**8,888**	**205,922**
Domestic *(6)*	112,782	668r	113,450r	107,385r	940	108,324r	106,977	1,180	108,157
Standard	76,060	-	76,060	73,067r	-	73,067r	72,641	-	72,641
Economy 7 and other off-peak *(7)*	18,740	-	18,740	17,083r	-	17,083r	17,353	-	17,353
Prepayment (standard)	13,850	-	13,850	13,144r	-	13,144r	13,007	-	13,007
Prepayment (off-peak) *(7)*	4,131	-	4,131	4,046r	-	4,046r	3,940	-	3,940
Sales under any other arrangement	-	-	-	43r	-	43r	36	-	36
Public administration	16,041	2,762r	18,802r	15,355r	3,147r	18,502r	15,520	3,706	19,227
Public lighting *(8)*	1,859	-	1,859	1,855r	-	1,855r	1,895	-	1,895
Other public sector	14,182	2,762r	16,943r	13,500r	3,147r	16,647r	13,625	3,706	17,331
Commercial	76,327r	2,512r	78,839r	71,787r	3,141r	74,928r	70,451	4,002	74,453
Shops	30,272	-	30,272	28,029r	-	28,029r	27,702	-	27,702
Offices	24,864	-	24,864	23,631r	-	23,631r	23,082	-	23,082
Hotels	8,767	-	8,767	8,384r	-	8,384r	8,106	-	8,106
Combined domestic/ commercial premises	2,684	-	2,684	2,395r	-	2,395r	2,347	-	2,347
Post and telecommunications	5,904	-	5,904	5,937r	-	5,937r	5,572	-	5,572
Unclassified	-	-	-	-	-	-	-	-	-
Transport services	3,836r	-	3,836	3,412r	-	3,412r	3,643	-	3,643
Agriculture	3,874	-	3,874	3,844r	-	3,844r	4,085	-	4,085

(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 5.21.
(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 elemen

5.3 Fuel used in generation[(1)]

	Unit	2011	2012	2013	2014	2015
						Original units of measurement
Major power producers (2)						
Coal	M tonnes	40.57	53.84	49.84	38.22r	29.18
Oil (3)	"	0.294	0.302	0.186	0.168	0.171
Gas (5)	GWh	277,527	184,307	174,070r	189,695r	185,955
Other generators (2)						
Transport undertakings:						
Gas	GWh	14	13	10	10	6
Undertakings in industrial and commercial sectors:						
Coal (4)	M tonnes	1.2836	1.0641	0.0331r	0.0187r	0.0190
Oil (5)	"	0.38	0.28	0.30r	0.322r	0.34
Gas (6)	GWh	31,548	32,236	30,659r	27,924r	27,022
						Mtoe
Major power producers (2)						
Coal		25.232	33.666	31.310	24.000	18.246
Oil (3)		0.346	0.407	0.239	0.182	0.224
Gas		23.863	15.848	15.065	16.330	15.989
Nuclear		15.626	15.206	15.443	13.850	15.479
Hydro (natural flow) (7)		0.395	0.359	0.310	0.398	0.422
Wind		1.104	1.473	2.060	2.301	2.860
Solar		-	-	-	-	0.121
Other renewables (7)		1.263	1.766	2.221	2.967	3.825
Other fuels (9)		-	-	0.182	0.189	0.235
Net imports		0.535	1.021	1.240r	1.764	1.800
Total major power producers (2)		**68.363**	**69.745**	**68.071r**	**61.982r**	**59.201**
Of which: conventional thermal and other stations (10)		28.413	37.721	36.187r	29.880r	25.770
combined cycle gas turbine stations		**23.394**	**15.438**	**14.891r**	**16.089r**	**15.730**
Other generators (2)						
Transport undertakings:						
Gas (6)		0.001	0.001	0.001	0.001	0.001
Undertakings in industrial and commercial sectors:						
Coal (4)		0.794	0.661	0.021r	0.012r	0.012
Oil (5)		0.437	0.320	0.350r	0.371r	0.394
Gas		2.713	2.772	2.636r	2.401r	2.323
Hydro (natural flow) (7)		0.093	0.096	0.094	0.108	0.119
Wind, wave and solar photovoltaics		0.263	0.349	0.555	0.795r	1.136
Other renewables (7)		3.362	3.169	2.813r	3.152r	3.636
Other fuels (9)		1.024	1.112	1.414r	1.627r	1.747
Total other generators *(2)*		**8.687**	**8.479**	**7.883r**	**8.466r**	**9.367**
All generating companies						
Coal (4)		26.026	34.327	31.331r	24.011r	18.258
Oil (3)(5)		0.783	0.727	0.588r	0.552r	0.618
Gas (6)		26.577	18.620	17.702r	18.732r	18.313
Nuclear		15.626	15.206	15.443	13.850	15.479
Hydro (natural flow) (7)		0.488	0.454	0.404	0.507r	0.541
Wind, wave and solar photovoltaics		1.367	1.822	2.615	3.096r	4.116
Other renewables (7)		4.625	4.934	5.034r	6.119r	7.461
Other fuels (9)		1.024	1.112	1.414r	1.627r	1.747
Net imports		0.535	1.021	1.240r	1.764	1.800
Total all generating companies		**77.050**	**78.224**	**75.772r**	**70.259r**	**68.333**

(1) A monthly update of fuel used in electricity generation by major power producers is given in Table 5.1 of Energy Trends, and a quarterly update of fuel used in electricity generation by all generating companies is given in Table 5.4 of Energy Trends.
(2) See paragraphs 5.67 to 5.73 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 coke oven coke.
(5) Includes refinery gas.
(6) Includes colliery methane.
(7) Renewable sources which are included under hydro and other renewables in this table are shown separately in Table 6.6 of Chapter 6.
(8) Includes electricity supplied by gas turbines and oil engines. From 1988 also includes electricity produced by plants using renewable sources.
(9) Main fuels included are coke oven gas, blast furnace gas, and waste products from chemical processes.
(10) Includes gas turbines and oil engines and plants producing electricity from renewable sources other than hydro.

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

GWh

	2011	2012	2013	2014	2015
Total supply					
(as given in Tables 5.1 and 5.2)	373,644	375,450	372,804r	358,694r	360,034
less imports of electricity	-8,689	-13,742	-17,531r	-23,243r	-22,716
plus exports of electricity	+2,467	+1,871	+3,105r	+2,723r	1,778
less electricity used in pumped storage	-3,843	-3,978	-3,930	-3,884	-3,711
less electricity used on works	-16,430	-17,968	-17,856r	-16,484r	-16,672
equals					
Electricity supplied (net)	347,149	341,633	336,592r	317,807r	318,712
(as given in Tables 5.5, 5.1.2 and 5.1.3)					
Total supply					
(as given in Tables 5.1 and 5.2)	373,644	375,450	372,804r	358,694r	360,034
less electricity used in pumped storage	-3,843	-3,978	-3,930	-3,884	-3,711
less electricity used on works	-16,430	-17,968	-17,856r	-16,484r	-16,672
equals					
Electricity available	353,371	353,504	351,018r	338,326r	339,651
(as given in Table 5.1.2)					
Final consumption					
(as given in Tables 5.1 and 5.2)	317,827	317,959	316,235r	302,867r	302,745
plus Iron and steel consumption counted as energy industry use	+380	+485	+572	+561	+411
equals					
Final users	318,207	318,445	316,808r	303,428r	303,157
(as given in Table 5.1.2)					
Final consumption					
Public distribution system					
(as given in Table 5.2)	303,765	304,221	302,690	287,656r	285,530
plus Oil and gas extraction use	+576	+565	+570	+536r	+601
plus Petroleum refineries use	+1,357	+1,338	+1,291	+1,218r	+1,343
plus Coal and coke use	+847	+825	+796	+665r	+500
plus Other fuel industries use	+1,489	+1,460	+1,402	+1,280r	+1,362
equals					
UK Electricity sales *(1)*	308,033	308,408	306,748	291,353r	289,337

(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/publications/electricity-section-5-energy-trends

5.5 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
2011											
Major power producers *(2) (5)*											
Fuel used	293,444	4,023	277,527	181,732	14,685	-	771,411	4,594	2,906	12,840	791,751
Generation	104,797	1,074	132,753	68,980	4,518	-	312,122	4,594	2,906	12,840	332,461
Used on works	5,245	161	2,268	6,325	454	-	14,453	16	10	-	14,479
Supplied (gross)	99,552	913	130,485	62,655	4,064	-	297,669	4,578	2,895	12,840	317,983
Used in pumping											3,843
Supplied (net)											314,140
Other generators *(2) (5)*											
Fuel used	9,234	5,081	31,548	-	38,021	11,910	95,795	1,086	-	3,056	99,937
Generation	3,774	2,043	13,767	-	8,435	2,799	30,818	1,086	-	3,056	34,960
Used on works	204	151	426	-	989	161	1,931	21	-	-	1,951
Supplied	3,570	1,892	13,341	-	7,446	2,638	28,888	1,066	-	3,056	33,009
All generating companies											
Fuel used	302,677	9,105	309,076	181,732	52,706	11,910	867,206	5,680	2,906	15,896	891,688
Generation	108,571	3,117	146,520	68,980	12,953	2,799	342,940	5,680	2,906	15,896	367,422
Used on works	5,449	311	2,694	6,325	1,442	161	16,383	37	10	-	16,430
Supplied (gross)	103,122	2,805	143,826	62,655	11,510	2,638	326,557	5,643	2,895	15,896	350,992
Used in pumping											3,843
Supplied (net)											347,149
2012											
Major power producers *(2) (5)*											
Fuel used	391,530	4,736	184,307	176,846	20,535	-	777,954	4,169	2,966	17,137	802,226
Generation	140,164	1,132	86,229	70,405	6,067	-	303,998	4,169	2,966	17,137	328,270
Used on works	7,121	187	1,474	6,456	609	-	15,848	1	10	-	15,859
Supplied (gross)	133,043	944	84,755	63,949	5,458	-	288,150	4,168	2,956	17,137	312,411
Used in pumping											3,978
Supplied (net)											308,433
Other generators *(2) (5)*											
Fuel used	7,687	3,720	32,236	-	36,853	12,932	93,428	1,116	-	4,054	98,598
Generation	2,992	1,439	13,931	-	8,581	3,196	30,139	1,116	-	4,054	35,309
Used on works	170	106	431	-	1,183	197	2,088	20	-	-	2,108
Supplied	2,822	1,333	13,500	-	7,398	2,999	28,051	1,095	-	4,054	33,200
All generating companies											
Fuel used	399,217	8,456	216,543	176,846	57,388	12,932	871,382	5,285	2,966	21,191	900,824
Generation	143,156	2,571	100,160	70,405	14,648	3,196	334,137	5,285	2,966	21,191	363,579
Used on works	7,291	293	1,905	6,456	1,792	197	17,935	22	10	-	17,967
Supplied (gross)	135,865	2,277	98,255	63,949	12,856	2,999	316,201	5,263	2,956	21,191	345,611
Used in pumping											3,978
Supplied (net)											341,633
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	130,204	745	82,891	70,607	9,285	522	294,254	3,609	2,904	23,958	324,725
Used on works	6,681	97	1,409	6,474	932	52	15,646	13	10	-	15,669
Supplied (gross)	123,523	648	81,482	64,133	8,353	470	278,608	3,596	2,894	23,958	309,056
Used in pumping											3,930
Supplied (net)											305,127
Other generators *(2) (5)*											
Fuel used	239r	4,066r	30,659r	-	32,714r	16,440r	84,118r	1,095r	-	6,452r	91,665r
Generation	83r	1,321r	12,952r	-	8,878r	2,871r	26,105r	1,095r	-	6,452r	33,653r
Used on works	4r	97r	402r	-	1,496	166r	2,165r	22	-	-	2,187r
Supplied	79r	1,224r	12,550r	-	7,382r	2,706r	23,940r	1,073r	-	6,452r	31,466r
All generating companies											
Fuel used	364,380r	6,841r	205,869r	179,601	58,546r	18,559r	833,796r	4,704r	2,904	30,410r	871,814r
Generation	130,287r	2,066r	95,843r	70,607	18,163r	3,393r	320,359r	4,704r	2,904	30,410r	358,378r
Used on works	6,685r	195r	1,810r	6,474	2,429	218r	17,811r	35	10	-	17,856r
Supplied (gross)	123,602r	1,872r	94,033r	64,133	15,735r	3,175r	302,548r	4,669r	2,894	30,410r	340,522r
Used in pumping											3,930
Supplied (net)											336,592r

5.5 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
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	26,763	703,215
Generation	100,158	530	88,871	63,748	12,707	528	266,542	4,635	2,883	26,763	300,823
Used on works	5,153	72	1,519	5,845	1,276	53	13,919	29	10	-	13,957
Supplied (gross)	95,005	458	87,352	57,903	11,431	475	252,623	4,606	2,873	26,763	286,865
Used in pumping											3,884
Supplied (net)											282,981
Other generators *(2) (5)*											
Fuel used	135r	4,311r	27,924r	-	36,660r	18,920r	87,950r	1,258r	-	9,245r	98,452r
Generation	72r	1,366r	12,024r	-	9,977r	3,410r	26,849r	1,258r	-	9,245r	37,352r
Used on works	3r	101r	373r	-	1,814r	207r	2,498r	28	-	-	2,526r
Supplied	69r	1,266r	11,651r	-	8,163r	3,202r	24,351r	1,230r	-	9,245r	34,825r
All generating companies											
Fuel used	279,252r	6,423r	217,842r	161,079	71,163r	21,124r	756,884r	5,893r	2,883	36,008r	801,668r
Generation	100,230r	1,896r	100,895r	63,748	22,684r	3,938r	293,391r	5,893r	2,883	36,008r	338,175r
Used on works	5,156r	173r	1,892r	5,845	3,090r	260r	16,417r	57r	10	-	16,484r
Supplied (gross)	95,073r	1,724r	99,003r	57,903	19,594r	3,677r	276,974r	5,836r	2,873	36,008r	321,691r
Used in pumping											3,884
Supplied (net)											317,807r
2015											
Major power producers *(2) (5)*											
Fuel used	212,198	2,606	185,955	180,025	44,483	2,738	628,004	4,907	2,739	34,662	670,312
Generation	75,563	683	88,461	70,345	17,694	689	253,435	4,907	2,739	34,662	295,742
Used on works	3,877	88	1,517	6,450	1,777	69	13,779	17	10	-	13,805
Supplied (gross)	71,686	595	86,943	63,895	15,917	620	239,656	4,889	2,730	34,662	281,937
Used in pumping											3,711
Supplied (net)											278,226
Other generators *(2) (5)*											
Fuel used	137	4,587	27,022	-	42,285	20,312	94,343	1,382	-	13,211	108,936
Generation	66	1,450	11,574	-	11,695	3,975	28,760	1,382	-	13,211	43,353
Used on works	3	106	358	-	2,086	280	2,834	33	-	-	2,867
Supplied	63	1,344	11,215	-	9,609	3,696	25,927	1,349	-	13,211	40,486
All generating companies											
Fuel used	212,336	7,192	212,976	180,025	86,768	23,050	722,347	6,289	2,739	47,872	779,248
Generation	75,630	2,133	100,035	70,345	29,388	4,664	282,195	6,289	2,739	47,872	339,095
Used on works	3,880	194	1,876	6,450	3,863	349	16,612	51	10	-	16,672
Supplied (gross)	71,749	1,939	98,159	63,895	25,525	4,315	265,583	6,238	2,730	47,872	322,423
Used in pumping											3,711
Supplied (net)											318,712

	2011		2012		2013		2014		2015	
	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	111,255	131,886	147,946	85,647	141,114	82,533	114,534	88,259	95,358	87,732
Supplied (gross)	105,345	129,669	139,994	84,207	133,330	81,145	107,945	86,775	89,505	86,256
Other generators										
Generated	20,258	10,560	20,065	10,074	17,805r	8,300r	19,272r	7,577r	21,795	6,965
Supplied (gross)	18,854	10,033	18,480	9,571	16,054r	7,886r	17,152r	7,199r	19,309	6,617
All generating companies										
Generated	131,513	142,447	168,011	95,721	158,919r	90,833r	133,806r	95,836r	117,153	94,697
Supplied (gross)	124,200	139,702	158,474	93,778	149,385r	89,031r	125,097r	93,974r	108,814	92,874

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

(2) See paragraphs 5.67 to 5.73 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, this is wind only; 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 5.69.

(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.

5.6 Plant capacity - United Kingdom

MW

	end December				
	2011	2012	2013	2014	2015
Major power producers *(1)*					
Total transmission entry capacity *(2)*	**81,789**	**81,879**	**77,169r**	**75,696r**	**71,879**
Of which:					
Conventional steam stations:	31,763	28,523	23,141r	21,282r	18,714
Coal fired	23,072	23,072	20,591r	18,732r	17,534
Oil fired	3,638	2,338	1,370	1,370	-
Mixed or dual fired *(3)*	5,053	3,113	1,180	1,180	1,180
Combined cycle gas turbine stations	30,183	33,113	32,967	31,994	30,080
Nuclear stations	10,663	9,946	9,906	9,937	9,487
Gas turbines and oil engines	1,706	1,651	1,639r	1,643r	1,333
Hydro-electric stations:					
Natural flow *(4)*	1,397	1,398	1,399	1,400	1,400
Pumped storage	2,744	2,744	2,744	2,744	2,744
Wind *(4) (5)*	2,240	3,276	3,947	4,528r	4,921
Solar *(4)*	-	-	-	-	288
Renewables other than hydro and wind *(6)*	1,092	1,228	1,426	2,168r	2,911
Other generators *(1)*					
Total capacity of own generating plant ***(7)***	**7,241**	**7,420**	**7,430r**	**7,847r**	**8,941**
Of which:					
Conventional steam stations *(8)*	2,401	2,464	2,089r	2,110r	2,080
Combined cycle gas turbine stations	2,212	2,244	1,905r	1,813r	1,661
Hydro-electric stations (natural flow) *(4)*	153	158	163r	169r	180
Wind *(4) (9)*	541	550	874r	1,079r	1,224
Solar *(4)*	-	-	488r	922r	1,273
Renewables other than hydro and wind *(4) (6)*	1,934	2,003	1,911r	1,755r	2,524
All generating companies					
Total capacity	**89,031**	**89,299**	**84,598r**	**83,543r**	**80,820**
Of which:					
Conventional steam stations *(8)*	34,164	30,988	25,230r	23,392r	20,794
Combined cycle gas turbine stations	32,395	35,357	34,872r	33,807r	31,741
Nuclear stations	10,663	9,946	9,906	9,937	9,487
Gas turbines and oil engines	1,706	1,651	1,639r	1,643r	1,333
Hydro-electric stations:					
Natural flow *(4)*	1,550	1,556	1,561	1,569r	1,580
Pumped storage	2,744	2,744	2,744	2,744	2,744
Wind *(4)*	2,781	3,827	4,821r	5,606r	6,145
Solar *(4)*	-	-	488	922	1,561
Renewables other than hydro and wind *(4)*	3,027	3,231	3,337r	3,923r	5,435

(1) See paragraphs 5.67 to 5.73 for information on companies covered.
(2) See paragraph 5.80 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 5.81.
(5) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.6
(6) For Major Power Producers, this includes bioenergy; for other generators, this includes bioenergy, solar photovoltaics, wave and tidal.
(7) "Other generators" capacities are given in declared net capacity terms, see paragraph 5.81.
(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.

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

MW

	2011	2012	2013	2014	end December 2015
Major power producers in England and Wales *(1)*					
Total transmission entry capacity *(2)*	**69,186**	**68,841**	**65,021r**	**63,350r**	**59,359**
Of which:					
Conventional steam stations:	27,247	24,007	19,821	17,962	15,394
Coal fired	19,616	19,616	18,331	16,472	15,274
Oil fired	3,638	2,338	1,370	1,370	-
Mixed or dual fired *(3)*	3,993	2,053	120	120	120
Combined cycle gas turbine stations	27,985	30,915	30,765	29,792	27,876
Nuclear stations	8,374	7,657	7,617	7,648	7,198
Gas turbines and oil engines	1,316	1,261	1,191r	1,195r	885
Hydro-electric stations:					
Natural flow	141	141	141	141	141
Pumped storage	2,004	2,004	2,004	2,004	2,004
Wind *(4)*	1,080	1,682	2,110	2,526	2,795
Solar					264
Renewables other than hydro and wind *(5)*	1,039	1,174	1,372r	2,082r	2,802
Major power producers in Scotland *(1)*					
Total transmission entry capacity *(2)*	**10,168**	**10,602**	**9,630r**	**9,827r**	**9,980**
Of which:					
Conventional steam and combined cycle gas turbine stations	4,638	4,638	3,442r	3,442r	3,440
Nuclear stations	2,289	2,289	2,289	2,289	2,289
Gas turbines and oil engines	131	131	131r	131r	131
Hydro-electric stations:					
Natural flow	1,257	1,257	1,258	1,259	1,259
Pumped storage	740	740	740	740	740
Wind *(4)*	1,059	1,493	1,716	1,881	2,006
Solar					7
Renewables other than hydro and wind *(5)*	54	54	54	86	109
Major power producers in Northern Ireland *(1)*					
Total transmission entry capacity *(2)*	**2,436**	**2,436**	**2,518**	**2,518**	**2,540**

(1) See paragraphs 5.67 to 5.73 for information on companies covered
(2) See paragraph 5.80 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 5.69
(5) Bioenergy only.

5.8 Capacity of other generators

MW

	2011	2012	2013	2014	end December 2015
Capacity of own generating plant *(1) (2)*					
Undertakings in industrial and commercial sector:					
Oil and gas terminals and oil refineries	1,050	1,019	1,019	917	874
Iron and steel	315	314	314	314	314
Chemicals	1,018	1,061	815r	767r	714
Engineering and other metal trades	644	644	199r	199r	171
Food, drink and tobacco	428	442	438	457r	464
Paper, printing and publishing	420	467	470	508r	499
Other *(3)*	3,261	3,371	4,072r	4,581r	5,802
Total industrial, commercial and domestic sector	7,138	7,317	7,327r	7,744r	8,838
Undertakings in transport sector	103	103	103	103	103
Total other generators	**7,241**	**7,420**	**7,430r**	**7,847r**	**8,941**

(1) For combined heat and power plants the electrical capacity only is included. Further CHP capacity is included under major power producers in Table 5.6. A detailed analysis of CHP capacity is given in the tables of Chapter 7
Figures may not sum to 5.6 due to rounding.
(2) From 2007, major wind farm companies are included under Major Power Producers, see paragraph 5.69
(3) Includes companies in the commercial sector, and domestic installations

5.9 Plant loads, demand and efficiency

Major power producers [1]

	Unit	2011	2012	2013	2014	2015
Simultaneous maximum load met *(2) (3)*	MW	57,086	57,490	53,420	53,858	52,753
of which England and Wales	MW					
Scotland	MW					
Great Britain	MW	55,505	55,765	51,811	52,516	51,100
Northern Ireland	MW	1,581	1,725	1,609	1,342	1,653
Maximum demand as a percentage of UK Major Power Producers' capacity	Per cent	69.8	70.2	69.2r	71.2r	73.4
Plant load factor *(2) (4)*						
Combined cycle gas turbine stations	Per cent	47.8	30.3	28.0	30.5	31.7
Nuclear stations	"	66.4	70.7	73.8	66.6	75.1
Pumped storage hydro	"	12.0	12.3	12.0	12.0	11.4
Conventional thermal and other stations *(5)*	"	34.7	48.3	52.8r	48.0r	42.5
of which coal-fired stations *(6)*	"	40.8	56.9	58.1r	50.7r	39.1
All plant *(7)*	"	**42.5**	**42.0**	**41.8r**	**39.9r**	**40.2**
System load factor *(8)*	"	**66.7**	**66.2**	**70.8**	**67.3r**	**68.2**
Thermal efficiency *(9)* **(gross calorific value basis)**						
Combined cycle gas turbine stations	"	48.1	47.2	47.7r	47.2r	48.0
Coal fired stations	"	35.7	35.8	35.8	35.9	35.6
Nuclear stations	"	38.0	39.8	39.3	39.6	39.1

(1) See paragraphs 5.67 to 5.73 for information on companies covered.
(2) Load met by transmission network, net of demand met by embedded generation. See paragraph 5.82 for definitions
(3) Data cover the 12 months ending March of the following year, e.g. 2015 data are for the year ending March 2016
(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.
(6) Includes both coal-fired stations, and dual/mixed fired stations that mainly use coal.
(7) Includes wind (from 2008) and natural flow hydro, using capacity that has not been de-rated for intermittency.
(8) Average electricity available as percentage of maximum demand. See paragraph 5.82.
(9) See paragraph 5.83 for definition of thermal efficiency.

5.10 Power Stations in the United Kingdom

(operational at the end of May 2016)[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 C	CCGT	616	2003	Northern Ireland	
	Kilroot	Coal / oil	540	1981	Northern Ireland	
	Ballylumford B	Gas	540	1968	Northern Ireland	
	Ballylumford B OCGT	Gas oil	116	1968	Northern Ireland	
	Kilroot OCGT	Gas oil	142	1981	Northern Ireland	
Beaufort Wind Ltd	Carno	Wind	34	1996	Wales	*(2)*
Braes of Doune Windfarm	Braes of Doune	Wind	72	2007	Scotland	*(3)*
British Energy	Dungeness B	Nuclear	1,050	1983	South East	*(4)*
	Hartlepool	Nuclear	1,180	1984	North East	*(4)*
	Heysham 1	Nuclear	1,155	1984	North West	*(4)*
	Heysham 2	Nuclear	1,230	1988	North West	*(4)*
	Hinkley Point B	Nuclear	955	1976	South West	*(4)*
	Hunterston B	Nuclear	965	1976	Scotland	*(4)*
	Sizewell B	Nuclear	1,198	1995	East	*(4)*
	Torness	Nuclear	1,185	1988	Scotland	*(4)*
British Solar Renewables	Bradenstoke Solar Park	Solar	70	2015	South West	
	Owl's Hatch Solar Park	Solar	52	2015	South East	
Calon Energy	Severn Power	CCGT	850	2010	Wales	
	Baglan Bay CCGT	CCGT	520	2002	Wales	
	Baglan Bay OCGT	OCGT	32	2002	Wales	
	Sutton Bridge	CCGT	819	1999	East	
Centrica	Barry	CCGT	235	1998	Wales	*(5)*
	Glanford Brigg	CCGT	150	1993	Yorkshire and the Humber	*(5)*
	Killingholme	CCGT	0	1994	Yorkshire and the Humber	
	Langage	CCGT	905	2010	South West	
	Peterborough	CCGT	240	1993	East	*(5)*
	South Humber Bank	CCGT	1,310	1996	Yorkshire and the Humber	
	Inner Dowsing	Wind (offshore)	97	2009	East Midlands	
	Lynn	Wind (offshore)	97	2009	East Midlands	
Coolkeeragh ESB Ltd	Coolkeeragh	CCGT	408	2005	Northern Ireland	
	Coolkeeragh OCGT	Gas oil	53	2005	Northern Ireland	
Corby Power Ltd	Corby	CCGT	401	1993	East Midlands	
Cubico Sustainable Investments Limited	Broxted	Solar	32	2015	East	
Dong Energy	Barrow	Wind (offshore)	90	2006	North West	*(6)*
	Burbo Bank	Wind (offshore)	90	2009	North West	
	Gunfleet Sands 1	Wind (offshore)	108	2010	South East	
	Gunfleet Sands 2	Wind (offshore)	65	2010	South East	
	Lincs	Wind (offshore)	270	2012	East	*(6b)*
	Walney 1	Wind (offshore)	184	2011	North West	*(7)*
	Walney 2	Wind (offshore)	184	2011	North West	*(7)*
	West of Duddon Sands	Wind (offshore)	389	2014	North West	
	Westermost Rough	Wind (offshore)	210	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	Steven's Croft	Biomass	50	2007	Scotland	
	Blackburn Meadows	Biomass	33	2015	Yorkshire and the Humber	
	Castleford	CCGT	56	2002	Yorkshire and the Humber	
	Connahs Quay	CCGT	1,380	1996	Wales	
	Cottam Development Centre	CCGT	395	1999	East Midlands	
	Enfield	CCGT	408	1999	London	
	Grain CHP *	CCGT	1,365	2010	South East	
	Killingholme	CCGT	900	1993	Yorkshire and the Humber	
	Sandbach	CCGT	56	1999	North West	
	Thornhill	CCGT	50	1998	Yorkshire and the Humber	
	Ratcliffe	Coal	2,000	1968	East Midlands	
	Grain GT	Gas oil	55	1978	South East	
	Ratcliffe GT	Gas oil	34	1966	East Midlands	
	Taylor's Lane GT	Gas oil	144	1979	London	
	Camster	Wind	50	2012	Scotland	
	Tween Bridge	Wind	44	2012	North East	
	Humber Gateway	Wind (offshore)	219	2015	North East	
	Robin Rigg East	Wind (offshore)	90	2010	Scotland	
	Robin Rigg West	Wind (offshore)	90	2010	Scotland	
	Scroby Sands	Wind (offshore)	60	2004	East	

For footnotes see page 150

5.10 Power Stations in the United Kingdom

(operational at the end of May 2016)[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	
EDF Energy	West Burton CCGT	CCGT	1,332	2012	East Midlands	
	Cottam	Coal	2,008	1969	East Midlands	
	West Burton	Coal	2,012	1967	East Midlands	
	Barkantine Heat & Power Company *	Gas	1	2000	London	
	London Heat & Power Company *	Gas	9	2000	London	
	West Burton GT	Gas oil	40	1967	East Midlands	
EDF Energy Renewables	Burnfoot Hill	Wind	30	2010	Scotland	
	Fallago Rig	Wind	144	2013	Scotland	
	Green Rigg	Wind	36	2012	North East	
	Longpark	Wind	38	2009	Scotland	
	Teesside	Wind (offshore)	62	2014	North East	
Eggborough Power Ltd	Eggborough	Coal	1,960	1967	Yorkshire and the Humber	
Eneco Wind UK Limited	Lochluichart	Wind	69	2014	Scotland	
ENGIE	Deeside	CCGT	515	1994	Wales	
	Saltend	CCGT	1,200	2000	Yorkshire and the Humber	
	Rugeley	Coal	1,006	1972	West Midlands	
	Rugeley GT	Gas oil	50	1972	West Midlands	
	Indian Queens	Gas oil / kerosene	140	1996	South West	
	Dinorwig	Pumped storage	1,728	1983	Wales	
	Ffestiniog	Pumped storage	360	1961	Wales	
EPR Ely Limited	Elean	Straw	38	2001	East	
	Eye Suffolk	Biomass	13	1992	East	
EPR Glanford Ltd	Glanford	Meat & bone meal	13	1993	East	
EPR Scotland Ltd	Westfield	Biomass	12	2000	Scotland	
EPR Thetford Ltd	Thetford	Biomass	39	1998	East	
Falck Renewables Wind Ltd	Cefn Croes	Wind	59	2006	Wales	
	Earlsburn	Wind	38	2007	Scotland	
	Kilbraur	Wind	68	2008	Scotland	
	Millennium	Wind	65	2008	Scotland	
	West Browncastle	Wind	30	2014	Scotland	
Ferrybridge MFE Limited	Ferrybridge Multi-fuel	Biomass	79	2015	Yorkshire and the Humber	
Fred Olsen	Crystal Rig	Wind	63	2003	Scotland	
	Crystal Rig 2	Wind	138	2010	Scotland	
	Mid Hill	Wind	76	2014	Scotland	
	Paul's Hill	Wind	64	2005	Scotland	
	Rothes	Wind	51	2004	Scotland	
	Rothes 2	Wind	41	2013	Scotland	
Infinis	Dalswinton	Wind	30	2008	Scotland	
	Lissett	Wind	30	2007	Yorkshire and the Humber	
	Minsca	Wind	37	2008	Scotland	
	Slieve Divena	Wind	30	2009	N Ireland	
Intergen	Coryton	CCGT	800	2001	East	
	Rocksavage	CCGT	810	1998	North West	
	Spalding	CCGT	880	2004	East Midlands	
Lightsource	Ermine	Solar	32	2015	East Midlands	
	Melborn Muncey	Solar	31	2015	East	
London Array Ltd	London Array	Wind (offshore)	630	2012	South East	*(8)*
Londonwaste Limited	Edmonton	Waste	60	1970	South East	
Magnox Ltd	Maentwrog	Hydro	35	1928	Wales	*(9)*
Marchwood Power Limited	Marchwood	CCGT	898	2009	South West	*(10)*
MEAG	Scout Moor	Wind	65	2009	North West	*(7) (11)*
Px Limited	Fellside CHP *	Gas	180	1995	North West	*(12)*
Riverside Resource Recovery Limited	Belvedere	Waste	80	2011	South East	

For footnotes see page 150

5.10 Power Stations in the United Kingdom

(operational at the end of May 2016)[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	
RWE Generation UK Plc	Didcot B	CCGT	1,470	1998	South East	
	Great Yarmouth	CCGT	420	2001	East	
	Little Barford	CCGT	749	1995	East	
	Pembroke	CCGT	2,269	2012	Wales	
	Staythorpe C	CCGT	1,792	2010	East Midlands	
	Aberthaw B	Coal	1,586	1971	Wales	
	Aberthaw GT	Gas oil	51	1971	Wales	
	Cowes	Gas oil	140	1982	South East	
	Didcot GT	Gas oil	100	1972	South East	
	Little Barford GT	Gas oil	17	2006	East	
	Markinch CHP	Biomass	65	2014	Scotland	
RWE Innogy UK Ltd (Part of RWE Npower)	Causeymire	Wind	48	2004	Scotland	
	Farr	Wind	92	2006	Scotland	
	Ffynnon Oer	Wind	32	2006	Wales	
	Goole Fields	Wind	33	2013	North East	
	Little Cheyne Court	Wind	60	2008	South East	
	Middlemoor	Wind	54	2013	North East	
	Novar 2	Wind	37	2012	Scotland	
	Gwynt y Mor	Wind (offshore)	576	2013	Wales	
	North Hoyle	Wind (offshore)	60	2003	Wales	
	Rhyl Flats	Wind (offshore)	90	2009	Wales	
Scira Offshore Energy Ltd	Scira (Sheringham Shoal BMU 1)	Wind (offshore)	158	2012	East	
	Scira (Sheringham Shoal BMU 2)	Wind (offshore)	158	2012	East	
Scottish and Southern: Greater Gabbard Offshore Winds Limited	Greater Gabbard	Wind (offshore)	504	2011	East	*(13)*
Scottish and Southern: Hydro Schemes - Affric/Beauly	Deanie	Hydro	38	1963	Scotland	
	Fasnakyle	Hydro	69	1951	Scotland	
Scottish and Southern: Hydro Schemes - Breadalbane	Lochay	Hydro	46	1958	Scotland	
Scottish and Southern: Hydro Schemes - Conon	Luichart	Hydro	34	1954	Scotland	
Scottish and Southern: Hydro Schemes - Foyers	Foyers	Hydro / pumped storage	300	1974	Scotland	
Scottish and Southern: Hydro Schemes - Great Glen	Glendoe	Hydro	100	2008	Scotland	
	Glenmoriston	Hydro	37	1957	Scotland	
	Clachan	Hydro	40	1955	Scotland	
Scottish and Southern: Hydro Schemes - Sloy/Awe	Sloy	Hydro	153	1950	Scotland	
Scottish and Southern: Hydro Schemes - Tummel	Clunie	Hydro	61	1950	Scotland	
	Errochty	Hydro	75	1955	Scotland	
	Rannoch	Hydro	45	1930	Scotland	
	Tummel	Hydro	34	1933	Scotland	
Scottish and Southern: Island Generation	Arnish	Diesel	10	2001	Scotland	
	Barra	Diesel	3	1990	Scotland	
	Bowmore	Diesel	6	1946	Scotland	
	Kirkwall	Diesel	16	1953	Scotland	
	Lerwick	Diesel	67	1953	Scotland	
	Loch Carnan, South Uist	Diesel	9	1971	Scotland	
	Stornoway	Diesel	24	1950	Scotland	
	Tiree	Diesel	3	1945	Scotland	
Scottish and Southern: Thermal	Medway	CCGT	735	1995	South East	
	Peterhead	CCGT	1,180	1980	Scotland	*(14)*
	Fiddler's Ferry	Coal	1,961	1971	North West	
	Slough *	Biomass / gas / waste derived fuel	35	1918	South East	
	Chippenham	Gas	10	2002	South West	
	Fiddler's Ferry GT	Gas oil	34	1969	North West	
	Keadby	CCGT	755	1994	Yorkshire and the Humber	
	Keadby GT	Gas oil	25	1994	Yorkshire and the Humber	
	Burghfield	Gas / oil	45	1998	South East	
	Chickerell	Gas / oil	45	1998	South West	
	Five Oaks	Light oil	9	1995	South East	
	Thatcham	Light oil	9	1994	South East	

For footnotes see page 150

5.10 Power Stations in the United Kingdom

(operational at the end of May 2016)[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	
Scottish and Southern: Wind	Achany	Wind	38	2010	Scotland	
	Drumderg	Wind	37	2008	Scotland	
	Fairburn	Wind	40	2009	Scotland	
	Gordonbush	Wind	70	2011	Scotland	
	Hadyard Hill	Wind	120	2005	Scotland	
	Slieve Kirk	Wind	74	2011	Northern Ireland	
	Strathy North	Wind	68	2015	Scotland	
Scottish and Southern: Wind - Clyde Windfarm (Scotland) Limited	Clyde Central	Wind	113	2011	Scotland	
	Clyde North	Wind	108	2012	Scotland	
	Clyde South	Wind	129	2011	Scotland	
Scottish and Southern: Wind - Griffin Windfarm Limited	Griffin	Wind	189	2011	Scotland	
Scottish and Southern: Wind - Keadby Wind Farm Limited	Keadby	Wind	68	2013	Yorkshire and the Humber	
Scottish Power: Hydro schemes - Cruachan	Cruachan	Pumped storage	440	1966	Scotland	
Scottish Power: Hydro schemes - Galloway	Tongland	Hydro	33	1935	Scotland	
Scottish Power: Thermal	Damhead Creek	CCGT	805	2000	South East	
	Rye House	CCGT	715	1993	East	
	Shoreham	CCGT	420	2000	South East	
	Blackburn	CCGT	59	2011	North West	
	Pilkington - Greengate *	Gas	10	1998	North West	
Scottish Power: Wind	Arecleoch	Wind	120	2010	Scotland	
	Beinn an Tuirc 2	Wind	44	2012	Scotland	
	Black Law	Wind	124	2005	Scotland	
	Harestanes	Wind	136	2013	Scotland	
	Mark Hill	Wind	56	2011	Scotland	
	Penryddian & Llidiartywaun	Wind	31	1992	Wales	
	Whitelee	Wind	322	2007	Scotland	
	Whitelee 2	Wind	217	2012	Scotland	
Seabank Power Limited	Seabank 1	CCGT	812	1998	South West	*(15)*
	Seabank 2	CCGT	410	2000	South West	
Sembcorp Utilities (UK) Ltd	Wilton 10	Biomass	38	2007	North East	
	Wilton GT2	Gas	42	2005	North East	
	Wilton GT1 *	Gas	42	1952	North East	
South East London Combined Heat & Power Ltd	SELCHP ERF	Waste	32	1994	London	
Statkraft Energy Ltd	Rheidol	Hydro	56	1961	Wales	
Statkraft Wind UK Ltd	Baillie	Wind	53	2013	Scotland	
	Berry Burn	Wind	67	2013	Scotland	
The Renewables Infrastructure Group (UK) Ltd	Hill of Towie	Wind	48	2012	Scotland	
Third Energy Trading Ltd (Formerly RGS)	Knapton	Gas	40	1994	Yorkshire and the Humber	
Vattenfall Wind Power	Clashindarroch	Wind	37	2015	Scotland	
	Edinbane	Wind	41	2010	Scotland	
	Kentish Flats	Wind (offshore)	90	2005	South East	
	Kentish Flats Extension	Wind (offshore)	50	2015	South East	
	Ormonde	Wind (offshore)	150	2011	North West	
	Thanet	Wind (offshore)	300	2010	South East	
VPI Immingham LLP	VPI Immingham *	Gas	1,240	2004	Yorkshire and the Humber	
Total			**73,309**			

For footnotes see page 150

Other power stations

Renewable sources and combustible wastes	Other MPP wind onshore	2,317
	Other MPP wind offshore	16
	Other generators wind	2,784
	Other generators landfill gas	1,061
	Other generators sewage gas	216
	Other generators biomass and waste	1,374
	Other MPP hydro	601
	Other generators hydro	302
	Other MPP Solar	1,618
	Other generators solar photovoltaics and wave/tidal	7,357
CHP schemes listed in Table 5.11	Various fuels	1,954
CHP schemes other than major power producers and renewables and those listed in Table 5.11	Mainly gas	1,794

For footnotes see page 150

5.10 Power Stations in the United Kingdom

(operational at the end of May 2016)[1] (continued)

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 30MW capacity (which are included in the database tab); other power stations (including many renewable sites and auto-generators) are included in the sub table on page 151.

(2) Managed by RWE.

(3) Joint venture between Green Coat Capital and Hermes, but operated by SSE.

(4) Now owned by EDF.

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

(6) Barrow owned 100% by Dong Energy.

(6b) Lincs Co-owned by Centrica (50%), DONG Energy (25%) and Siemens (25%).

(7) Joint venture with Scottish and Southern Energy (25.1%), OPW (24.8%) and DONG Energy (50.1%).

(8) Co-owned by EON (26)%), Dong (25%), La caisse de dépôt et placement du Québec (25%) and Masdar 20%.

(9) Owned by NDA but operated by Magnox Ltd.

(10) Joint venture between SSE and ESB.

(11) Operated by Wind Prospect Operations.

(12) Owned by NDA but operated by Px Limited.

(13) Joint venture with Green Coat Capital, but operated by SSE.

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

(15) Joint venture with Scottish and Southern Energy and Electricity First Limited.

(16) SYND Holdco is a joint venture between Greencoat and Swiss Life where Greencoat owns 51.6% and Swiss Life owns 48.4%.

* indicates CHP plant

5.11 Large scale CHP schemes in the United Kingdom
(operational at the end of December 2015)[1]

Company Name	Scheme Location	Installed Capacity (MWe) (2)
A. Pearson And Sons (1949) Ltd	Woodhouse Nurseries	3
A. Pearson Growers Ltd	Europa Nursery - Ash	15
Adm Erith Ltd	Erith Oil Works	14
Agrivert Ltd	Cassington Ad	2
Arjo Wiggins Chartham Ltd	Chartham Paper Mill, Arjo Wiggins Chartham Ltd	6
Atkins Power	Yorkshire Grown Produce Limited - Burstwick	10
Atkins Power	Yorkshire Grown Produce Limited - Newport	4
Balcas Limited	Balcas Limited	3
Balcas Timber Ltd	Balcas Invergordon	9
Barkantine Heat & Power Company	Barkantine, Barkantine Heat & Power Company	1
Basf Performance Products	Water Treatments, Basf Plc	16
Briar Chemicals Limited	Briar Chemicals Ltd	4
British Sugar Plc	Bury St Edmunds Sugar Factory	77
British Sugar Plc	Cantley Sugar Factory	15
British Sugar Plc	Wissington Sugar Factory, British Sugar Plc (CHP 2)	93
Cambridge University Hospitals Foundation Trust	Addenbrookes Hospital	4
Cantelo Nurseries	Bradon Farm	10
Cargill Plc	Cargill Manchester CHP 2	28
Carillion Services Ltd, Ta Carillion Health	Queen Alexandra Hospital	3
Celts Ltd	Levenmouth Waste Water Treatment Works	3
Citywest Homes	Pump House	3
Cleveland Potash Limited	Boulby Mine. Cleveland Potash Limited	13
Cofely District Energy Ltd	The Heat Station (CHP 2)	7
Cofely District Energy Ltd	Mod Main Building, Cofely Limited	5
Cofely District Energy Ltd	Soas Chp, The Boiler House	1
Cofely District Energy Ltd	Icc Energy Centre	3
Cofely District Energy Ltd	Aston University Energy Centre, Aston University	3
Cofely District Energy Ltd	Birmingham Childrens Hospital	2
Cofely District Energy Ltd	Ldec-City Centre And Leicester East	3
Cofely District Energy Ltd	Ldec-Leicester North	2
Cofely IES	Cofely Humber Energy	46
Cofely Ltd	Trafford Park, Kellogg Company Of Great Britain	5
Cofely Ltd	Rampton Hospital	1
Contourglobal Solutions (Northern Ireland) Ltd	Knockmore Hill CHP, Contour Global Solutions (Northern Ireland) Ltd	15
Cyclerval Uk Ltd	Newlincs Efw, Newlincs Development Ltd	3
Cynergin Projects Limited	Villa Nursery Limited	1
Dalkia	Freeman Hospital	4
Dalkia	Royal Victoria Infirmary	4
Dalkia Plc	Lincoln County Hospital	1
Dalkia Utilities Services	Eli Lilly & Co Ltd	10
De La Rue Overton	Overton Mill, De La Rue International Ltd	7
Dow Corning Ltd	Dow Corning Chp	27
Ds Smith Paper Ltd	Kemsley CHP	81
Dsm Nutritional Products (Uk) Ltd	Dsm Dalry	46
Eon	Nufarm Uk Limited	5
East Sussex Healthcare Trust	Eastbourne District General Hospital	1
Eco Sustainable Solutions Ltd	Eco Piddlehinton Ad	1
Esso Petroleum Company Limited	Fawley Cogen	316
Energen Biogas	Energen Biogas	2
Enviroenergy	London Road Heat Station	11
Eon	Queens Medical Centre NHS Trust	5
Eon Uk	Citigen CHP, Citigen (London) Limited	16
Ere Developments Ltd	Evermore Renewable Energy	16
Fine Organics Limited	Fine Organics Limited	5
Frimley Park Hospital Nhs Foundation Trust	Frimley Park Hospital	1
G4 Power Grid Ltd	Brookenby Power Station	4
Genzyme Ltd	Genzyme Ltd	1
Glaxosmithkline	Glaxosmithkline Ulverston	2
Glaxosmithkline	Glaxosmithkline Montrose	1
Glaxosmithkline	Glaxosmithkline Irvine	4
Glaxosmithkline	Barnard Castle	2
Glaxosmithkline	Glaxosmithkline, Ware	2
Glaxosmithkline Research & Development Ltd	GSK R & D Ware	4
Glaxosmithkline Research & Development Ltd	Stevenage R&D	4
Great Ormond Street Hospital For Children NHS Trust	Great Ormond Street Hospital	1

For footnotes see page 153

5.11 Large scale CHP schemes in the United Kingdom
(operational at the end of December 2015)[1] *(continued)*

Company Name	Scheme Location	Installed Capacity (MWe) *(2)*
Heathcoat Fabrics Ltd	Heathcoat Fabrics Limited	1
Helix Agencies Limited	Natural History Museum	2
Helix Agencies Limited	Blackpool Victoria Hospital	1
Iggesund Paperboard (Workington) Ltd	Iggesund Paperboard (Workington) Ltd	50
Imperial College London	South Kensington Campus CHP Plant	9
Inbev Uk Ltd	Samlesbury Brewery, Inbev Uk Ltd	7
Inbev Uk Ltd	Magor Brewery, Inbev Uk Ltd	7
Ineos Chlorvinyls Limited	Ineos Chlorvinyls Limited	10
Ineos Chlorvinyls Limited	Gas Engine Chp	2
Integrated Energy Utilities Ltd	Seaton Energy Centre, Aberdeen Heat & Power	2
Integrated Energy Utilities Ltd	Callendar Park Energy Centre, Falkirk Council	1
Jaguar Landrover	Landrover - Solihull Paint Shop 21	3
Jaguar Landrover	Landrover Group - Solihull North Works	3
James Cropper Plc	James Cropper Plc	7
John Thompson And Son Ltd	John Thompson & Sons Limited	4
Johnson Matthey	Johnson Matthey Enfield	3
Johnson Matthey	Johnson Matthey - Royston	6
Lawrence Automotive 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
Mill Nurseries Ltd	Mill Chp, Mill Nurseries	14
Nestle Uk Limited	Nestle York	10
Nhs Grampian	Aberdeen Royal Infirmary	5
North Tees & Hartlepool NHS Foundation Trust	University Hospital Of North Tees	2
Northumbrian Water Ltd	Bran Sands (Biogas)	5
Northumbrian Water Ltd	Howdon Stw	6
Northwood & Wepa Ltd	Bridgend CHP	9
Novartis Grimsby Limited	Novartis Grimsby Limited	8
Peel Utilities Holdings Limited	Media City, Utilities (Media City Uk) Ltd	2
Powell Energy	St. Georges Hospital	4
Preston Board And Packaging Ltd	Romiley Board	1
Reckitt Benckister	Kwe Hull	2
Reg Bio Power Ltd	Bentwaters CHP	6
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
Scottish And Southern Energy	Slough Nurseries, G & C Properties	2
Sellafield Ltd	Combined Heat And Power Plant F238	193
Slough Heat & Power Ltd	Slough Power Station	21
Smurfit Kappa Ssk	Smurfit Kappa Ssk Limited	9
Southern Water Services	Ashford Stc	2
Southern Water Services	Millbrook Wtw, Southern Water	1
Southern Water Services	Budds Farm Wtw, Southern Water	2
Springfields Fuels Ltd	Springfields	12
Swansea University	Swansea University	2
Tata Chemicals Europe	Winnington CHP	146
Tate & Lyle Sugars Ltd	Thames Refinery, Tate and Lyle New Scheme	28
Thames Water Utilities Ltd	Maple Lodge Stw	4
Thames Water Utilities Ltd	Long Reach Stw	3
Thames Water Utilities Ltd	Mogden Stw	10
Thames Water Utilities Ltd	Beddington Stw	1
Thames Water Utilities Ltd	Deephams Stw	3
Thames Water Utilities Ltd	Ryemeads Stw	1
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

For footnotes see page 153

5.11 Large scale CHP schemes in the United Kingdom
(operational at the end of December 2015)[1] *(continued)*

Company Name	Scheme Location	Installed Capacity (MWe) *(2)*
Thameswey Central Milton Keynes Ltd	Tcmk Phase 1 CHP No 2 Gas Engine	6
Transport For London	Palestra, Transport for London	1
University of Aberdeen	Old Aberdeen Campus	2
University of Birmingham ALTA Estate Services CHP Energy Centre	The University Of Birmingham Scheme Ref 740A	4
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	5
University of Edinburgh Utilities Supply Company	Kings Buildings	3
University of Edinburgh Utilities Supply Company	George Square Energy Centre	2
University Of Liverpool	University Of Liverpool CHP 2	7
University of Southampton	University of Southampton	3
University of Surrey	University Of Surrey	1
University of Sussex	University of Sussex	1
University of Warwick	CHP Boilerhouse (CHP 2), University Of Warwick	4
University of Warwick	Cryfield Energy Centre	4
University Of York	University Of York	3
University of Edinburgh Utilities Supply Company	Holyrood Energy Centre	1
Upm-Kymmene (Uk)	Upm Shotton	22
Utilicom Ltd	University College London, Gower Street Heat And Power Ltd	3
Veolia Environmental Services Plc	Sheffield ERF	21
Vinnolit Hillhouse Ltd	Hillhouse International Business Park	5
Vital Energi	Kings Cross - Metro#1	2
Vital Energi	York Teaching Hospital	1
Vital Energi	Cheltenham General Hospital	1
Weetabix Ltd	Weetabix Limited	6
Wessex Water Services Ltd	Bristol Waste Water Treatment Works Scheme A	6
Total *(2)*		1,954
Electrical capacity of good quality CHP for these sites in total		1,794

(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.

5.12 Plant installed capacity, by connection - United Kingdom

MW

	2011	2012	2013	2014	end December 2015
Transmission Network - Great Britain					
Installed capacity (1)	**79,478**	**79,514**	**73,998**	**72,213**	**68,548**
Coal (2)	27,231	25,291	20,216	18,353	16,473
CCGT	29,366	32,067	30,805	29,880	29,444
Oil	4,025	2,725	1,370	1,370	-
Nuclear - Magnox	1,197	490	490	490	-
Nuclear - PWR	1,191	1,191	1,198	1,198	1,198
Nuclear - AGR	7,550	7,550	7,685	7,720	7,720
OCGT	1,104	981	1,112	1,076	937
Hydro	1,213	1,213	1,213	1,226	1,228
Onshore Wind	1,557	1,805	2,713	2,747	2,777
Offshore Wind	1,240	2,397	2,721	3,507	3,716
Bioenergy (3)	976	976	1,647	1,817	2,226
Pumped Storage	2,828	2,828	2,828	2,828	2,828
Distribution Network - Great Britain					
Installed capacity (1)	**12,401**	**14,285**	**15,697r**	**19,396r**	**24,175**
Coal (2)	593	589	28r	33r	22
CCGT	3,024	3,021	2,546r	2,586r	2,412
Oil	533	468	448r	340r	366
Diesel Engines	134	134	134	138	138
OCGT	169	166	105	90	90
Conventional Thermal Gas	737	766	862r	883r	842
Hydro	457	473	487r	494r	521
Onshore Wind	2,669	3,643	4,221r	5,100r	5,698
Offshore Wind	598	599	975	994	1,388
Bioenergy	2,093	2,160	2,344r	2,693r	2,916
PV	993	1,750	2,846r	5,362r	9,082
Wave/Tidal	2	5	6	7	8
Other Fuels (4)	586	732	695r	675r	694
Transmission Network - Northern Ireland					
Installed capacity (1)	**2,395**	**2,395**	**2,395**	**2,395**	**2,395**
Coal (2)	520	520	520	520	520
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)	**428**	**494**	**647r**	**798r**	**906**
Hydro	8	8	9	9	9
Onshore Wind	401	456	582	689r	713
Bioenergy	16	23	28	37r	77
PV	2	6	27r	62r	106
Wave/Tidal	1	1	1	1	1
Transmission Network - Total UK					
Installed capacity (1)	**81,873**	**81,909**	**76,393**	**74,608**	**70,943**
Coal (2)	27,751	25,811	20,736	18,873	17,013
CCGT	30,390	33,091	31,829	30,904	30,468
Conventional Thermal Gas	540	540	540	540	540
Oil	4,025	2,725	1,370	1,370	-
Nuclear - Magnox	1,197	490	490	490	-
Nuclear - PWR	1,191	1,191	1,198	1,198	1,198
Nuclear - AGR	7,550	7,550	7,685	7,720	7,720
OCGT	1,415	1,292	1,423	1,387	1,248
Hydro	1,213	1,213	1,213	1,226	1,228
Onshore Wind	1,557	1,805	2,713	2,747	2,777
Offshore Wind	1,240	2,397	2,721	3,507	3,716
Bioenergy	976	976	1,647	1,817	2,226
Pumped Storage	2,828	2,828	2,828	2,828	2,828
of which, good quality CHP	2,087	2,159	2,113	2,141	1,976
Distribution Network - Total UK					
Installed capacity (1)	**12,831**	**14,779**	**16,343r**	**20,195r**	**25,081**
Coal (2)	593	589	28r	33r	22
CCGT	3,024	3,021	2,546r	2,586r	2,412
Oil	533	468	448r	340r	366
Diesel Engines	134	134	134	138	138
OCGT	169	166	105	90	90
Conventional Thermal Gas	737	766	862r	883r	842
Hydro	465	482	496r	503r	530
Onshore Wind	3,072	4,099	4,803r	5,789r	6,411
Offshore Wind	598	599	975	994	1,388
Bioenergy	2,109	2,183	2,372r	2,731r	2,993
PV	995	1,755	2,873r	5,424r	9,188
Wave/Tidal	3	7	7	9	9
Other Fuels (4)	586	732	695r	675r	694
of which, good quality CHP	3,872	4,016	3,812r	3,753r	3,716

(1) See paragraph 5.80 for definition

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

(3) Includes 48 MW of Slough Heat and Power's mixed fuel capacity (remaining 13 MW included under coal)

(4) Includes coke oven gas, blast furnace gas, other gas/liquid/solid waste and waste heat from high temperature and chemical processes

Chapter 6
Renewable sources of energy

Key points

- Electricity generation in the UK from renewable sources increased by 29 per cent between 2014 and 2015, to reach 83.6 TWh. Capacity grew by 23 per cent (to 30.5 GW) over the same period (table 6.4).

- Generation from bioenergy sources was 30 per cent higher in 2015 compared to 2014 due to the conversion of a third unit at Drax Power Station to high-range co-firing (greater than 85 per cent biomass but less than 100 per cent).

- Offshore wind generation was 30 per cent higher than in 2014, with capacity up 13 per cent. Onshore wind generation was 23 per cent higher, with capacity up 7.6 per cent. Overall wind generation was 26 per cent higher and capacity 7.0 per cent higher (table 6.4).

- Solar photovoltaic generation increased by 87 per cent in 2015 to 7.6 TWh due to an increase in capacity, particularly from schemes accredited through the Renewables Obligation on energy suppliers. Capacity is now 9.2 GW, up from 5.4 GW in 2014, an increase of 69 per cent (table 6.4).

- Generation from hydro sources also increased by 6.7 per cent to 6.3 TWh, a record, due to high rainfall (table 6.4).

- 909 MW of renewable electricity capacity was added by energy producers qualifying for the Feed-in Tariffs (FiT) scheme during 2015. Following the introduction of the FiT scheme in April 2010, total commissioned FiT capacity amounts to 4,367 MW.

- The contribution of all renewables to UK electricity generation was 24.6 per cent in 2015, 5.5 percentage points higher than in 2014. However, using normalised load factors to take account of fluctuations in wind and hydro, the contribution of renewables to gross electricity consumption was 22.4 per cent, up 4.5 percentage points on 2014 (table 6A).

- Heat from renewable sources increased by 20 per cent during 2015 (to 3,535 ktoe). Renewable biofuels for transport decreased by 19 per cent (to 1,003 ktoe) (table 6.6).

- Progress has been made against the UK's 15 per cent target introduced in the 2009 EU Renewable Directive. Using the methodology set out in the Directive, provisional calculations show that 8.3 per cent of energy consumption in 2015 came from renewable sources; this is up from 7.1 per cent in 2014. There was a significant growth in the contribution of renewable electricity, while the renewable heating contributions also rose.

Introduction

6.1 This chapter provides information on the contribution of renewable energy sources to the United Kingdom's energy requirements. It covers:

- the use of renewables to generate electricity,
- heat obtained from renewable fuels and from other renewable sources, and
- the use of liquid biofuels for transport.

The chapter includes some sources that under international definitions are not counted as renewable sources or are counted only in part. This is to ensure that this Digest covers all sources of energy available in the UK. However, within this chapter the international definition of total renewables is used and this excludes non-biodegradable wastes. The energy uses of these wastes are still shown in the tables of this chapter but as "below the line" items.

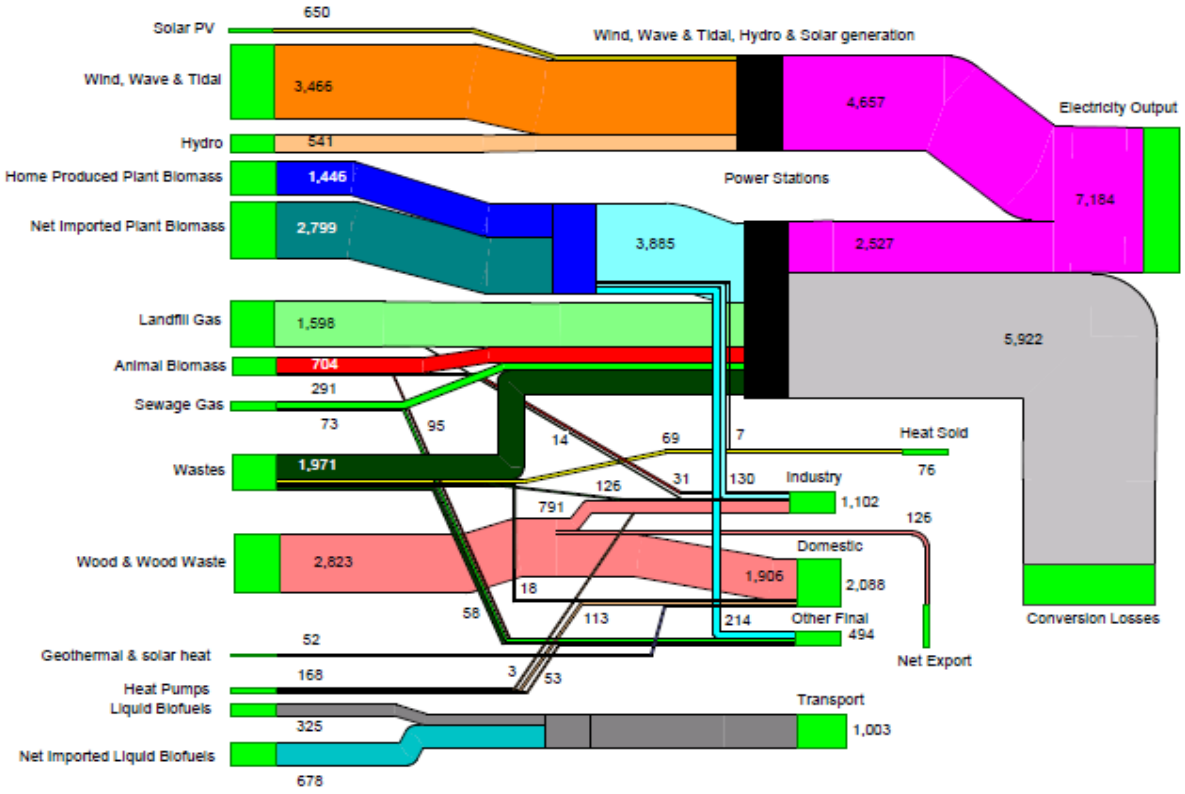
6.2 The data presented in this Chapter is drawn from the results of BEIS surveys of electricity generators, information from Combined Heat and Power (CHP) schemes, and The Renewable Energy STATisticS database (RESTATS) which is an on-going study undertaken by Ricardo Energy and Environment on behalf of BEIS to update a database containing information on all relevant renewable energy sources in the UK.

6.3 The renewable energy flow chart on page 157 summarises the flows of renewables from fuel inputs through to consumption for 2015. This is a way of simplifying the figures that can be found in the commodity balance for renewable energy sources in Table 6.1 and the renewable electricity output that can be derived from Table 6.4. The flow diagram illustrates the flow of primary fuels from the point at which they become available from home production or imports (on the left) to their eventual final uses (on the right) as well as the energy lost in conversion.

6.4 Commodity balances for renewable energy sources covering each of the last three years form the first three tables in this chapter (Tables 6.1 to 6.3). Unlike the commodity balance tables in other chapters of the Digest, Tables 6.1 to 6.3 have zero statistical differences. This is because the data for each category of fuel are, in the main, taken from a single source where there is less likelihood of differences due to timing, measurement, or differences between supply and demand. These balance tables are followed by five-year tables showing capacity of, and electricity generation from, renewable sources (Table 6.4). Table 6.5 focuses on load factors for electricity generation. Table 6.6 shows renewable sources used to generate electricity, to generate heat, and for transport purposes in each of the last five years. Finally, Table 6.7 shows the UK's progress against the 2009 EU Renewable Energy Directive target.

6.5 In addition to the tables and commentary contained within this Digest, a long-term trends commentary and table (Table 6.1.1) covering the use of renewables to generate electricity, to generate heat, and as a transport fuel is available on the BEIS section of the GOV.UK website, accessible from the Digest of UK Energy Statistics home page:
www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes.
Quarterly table ET 6.1, showing renewable electricity generation and capacity by UK country, can be found at: www.gov.uk/government/statistics/energy-trends-section-6-renewables

Renewables flow chart 2015 (thousand tonnes of oil equivalent)



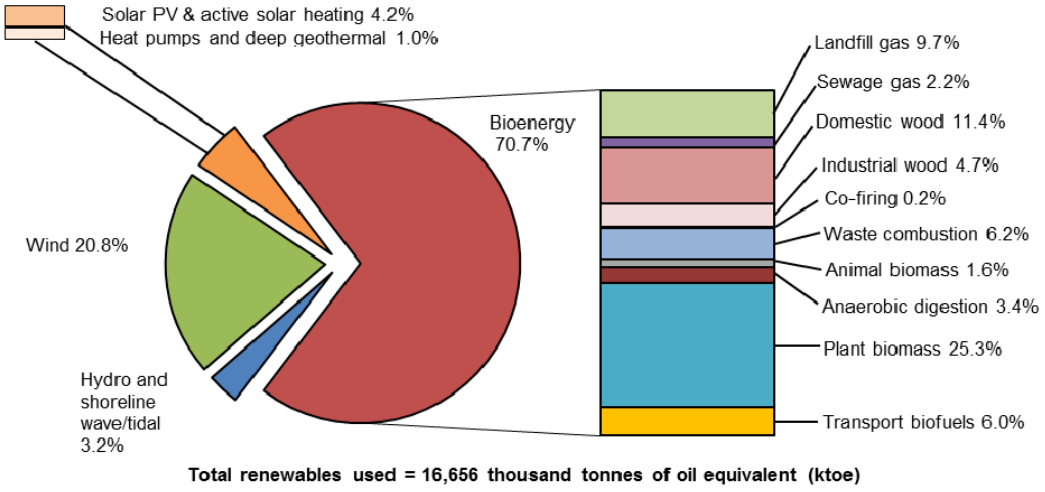
Note: This flow chart is based on data that appear in Tables 6.1 and 6.4

Commodity balances for renewables and waste in 2015 (Table 6.1), 2014 (Table 6.2) and 2013 (Table 6.3)

6.6 Twelve different categories of renewable fuels are identified in the commodity balances. Some of these categories are themselves groups of renewables because a more detailed disaggregation could disclose data for individual companies. In the commodity balance tables the distinction between biodegradable and non-biodegradable wastes cannot be maintained for this reason. The largest contribution to renewables and waste energy in input terms (around 71 per cent) is from bioenergy (excluding non-biodegradable wastes), with wind and solar photovoltaic generation contributing the majority of the remainder, as Chart 6.1 shows. Just 4.2 per cent of renewable energy comes from renewable sources other than biomass, wind and solar photovoltaic. These include hydro, heat pumps, and deep geothermal.

6.7 **Of the 16,656 ktoe of renewable energy (excluding non-biodegradable wastes) consumed in 2015, 73 per cent was transformed into electricity**. While bioenergy appears to dominate the picture when fuel inputs are being measured, hydroelectricity, wind power and solar together provide a larger contribution when the **output** of electricity is being measured as Table 6.4 shows. 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 (see Chapter 5, paragraph 5.75). 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, as the renewables flow chart (page 157) illustrates.

Chart 6.1: Renewable energy fuel use 2015 (1)



(1) Excludes all passive use of solar energy and all non-biodegradable wastes (1,147 ktoe). In this chart renewables are measured in primary input terms.
(2) Biomass co-fired with fossil fuels in power stations.
(3) 'Animal biomass' includes farm waste, poultry litter, and meat and bone combustion.
(4) 'Plant biomass' includes straw and energy crops.

Capacity of, and electricity generated from, renewable sources (Table 6.4)

6.8 Table 6.4 shows the capacity of, and the amounts of electricity generated from, each renewable source. **Total electricity generation from renewables in 2015 amounted to 83,550 GWh, an increase of 18,965 GWh (29 per cent) on 2014**. The largest absolute increase in generation came from wind, which was up by 8,344 GWh compared to 2014. Bioenergy saw the

second largest absolute increase, rising by 6,704 GWh to 29,338 GWh, largely due to an increase in plant biomass generation.

6.9 **Generation from plant biomass rose 42 per cent to 18,587 GWh**, although this was a smaller increase in percentage terms than the previous year (47 per cent). This was largely due to the conversion of a third unit at Drax Power Station from coal to high-range co-firing (greater than 85 per cent biomass but less than 100 per cent) in July 2015, and a small number of new generators.

6.10 **Total wind generation increased by 26 per cent to 40,310 GWh**, from 31,966 GWh in 2014. This was due to a combination of an increase in capacity, particularly for offshore wind, and higher than average wind speeds. 2015 saw average wind speeds of around 9.3 knots, 0.4 knots higher than the ten year mean and the highest in the last 15 years. Onshore wind saw a larger increase in absolute terms, from 18,562 GWh in 2014 to 22,887 in 2015, however, offshore's increase was more significant in percentage terms; 30 per cent compared to 23 per cent for onshore.

6.11 **Greater uptake of solar photovoltaics led to an increase in generation of 87 per cent**, from 4,040 GWh in 2014 to 7,561 GWh in 2015. These increases were seen in both larger schemes supported by the Renewables Obligation (RO and smaller schemes under the Feed in Tariff (FiT) programme. **Generation from hydro increased by 6.7 per cent to a record 6,289 GWh due to higher than average rainfall** (in the main hydro catchment areas) - the highest since 2011. **There were also large increases in municipal solid waste combustion up by 45 per cent and anaerobic digestion by 40 per cent**. Animal biomass increased 5.6 per cent, sewage sludge by 4.9 per cent and generation from landfill gas fell slightly, by 173 (3.4 per cent).

6.12 **Onshore wind continued to be the leading individual technology for the generation of electricity from renewable sources during 2015**, although its share of renewables generation decreased from 32 percent in 2013 to 29 per cent in 2014 and is now 27 per cent. This is despite a 7.6 per cent increase in capacity. Offshore wind's share of renewables generation remained the same as in 2014 at 21 percent. Solar photovoltaic generation's share increased from 6.3 per cent to 9.0 per cent. Hydro generation represented 7.5 per cent of renewable generation, mostly large scale. The combined generation from the variety of different bioenergy sources accounted for 35 per cent of renewable generation, the same as in 2014, with plant biomass accounting for 63 per cent of bioenergy generation and landfill gas accounting for 17 per cent.

6.13 **Renewable sources provided 24.6 per cent of the electricity generated in the UK in 2015** (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). This was 5.5 percentage points higher than the proportion recorded during 2014. Table 6A and Chart 6.2 show the growth in the proportion of electricity produced from renewable sources. The table also includes the progress towards the electricity renewables target set under the RO (see paragraphs 6.57 to 6.59), and progress towards the 2009 Renewable Energy Directive (see paragraph 6.53).

Table 6A: Percentages of electricity derived from renewable sources

	2011	2012	2013	2014	2015
Overall renewables percentage (international basis)	9.4	11.3	14.9	19.1	24.6
Percentage on a Renewables Obligation basis	9.8	11.9	15.5	19.8	26.1
Percentage on a 2009 Renewable Energy Directive basis (normalised)	8.8	10.7	13.8	17.9	22.3

6.14 **Installed generation capacity reached 30,465 MW at the end of 2015, an increase of 5,718 MW (23 per cent) during the year**; this excludes the capacity within conventional generation stations that was used for co-firing (a further 21 MW). The largest contributor towards the increase was 3,763 MW from solar photovoltaics with a further 671 from bioenergy, and 652 MW and 602 MW increases from onshore and offshore wind respectively.

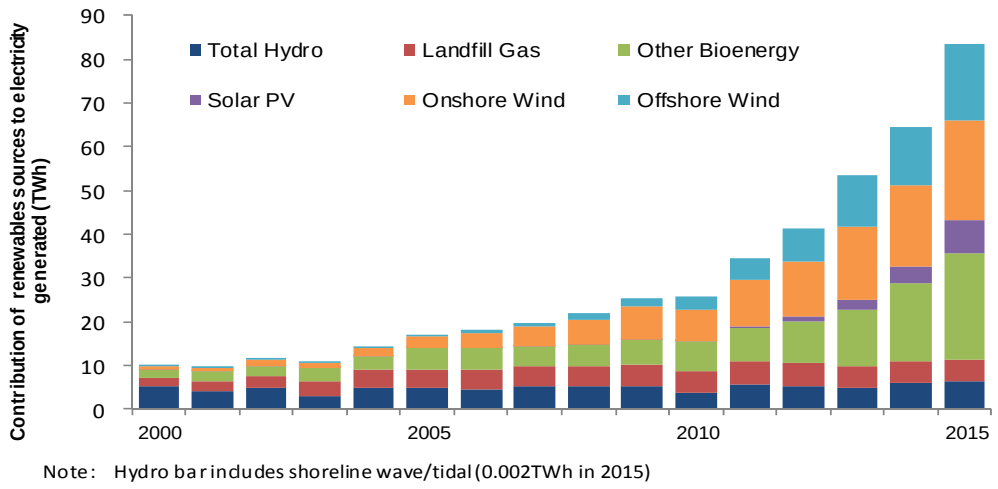
6.15 Onshore wind capacity grew from 8,536 MW in 2014 to 9,198 MW in 2015, with the biggest contributors being the new Strathy North (68 MW) (in North Sutherland), Clashindarroch (37 MW) (in Aberdeenshire) and Crook Hill (36 MW) (in East Lancashire) sites. Offshore wind capacity increased from 4,501 MW in 2014 to 5,103 in 2015. This was largely due to the new Humber Gateway (219 MW) (in the North Sea) and Kentish Flats Extension (49.5 MW) (outer Thames Estuary) schemes as

well as the completion of Westermost Rough (North Sea) and Gwynt y Mor (Irish Sea). Solar PV capacity increased from 5,424 MW to 9,187 MW (69 per cent), with the majority from large scale sites accredited on or awaiting accreditation on, the RO.

6.16 Capacity from the variety of bioenergy technologies increased from 4,548 MW in 2014 to 5,219 MW in 2015. This resulted from the extra capacity from an additional unit conversion to high-range co-firing at Drax Power Station (following two earlier unit conversions to dedicated plant biomass) and also several small scale new installations. These increases more than compensated for the fact that Ironbridge ceased generation in late 2015 (following a fire in 2014 which had already reduced capacity).

6.17 In capacity terms, onshore wind and solar photovoltaics were the leading technologies, each with a 30 per cent share of capacity at the end of 2015. Offshore wind had a 17 per cent share of total capacity, and hydro a 5.8 share. Bioenergy represented 17 per cent of capacity, with the main components being plant biomass (8.6 per cent) and landfill gas (3.5 per cent).

Chart 6.2: Electricity generation by main renewable sources since 2000



Note: Hydro bar includes shoreline wave/tidal (0.002TWh in 2015)

6.18 Much small-scale (up to 5 MW) renewable electricity capacity 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 69 MW of renewable capacity was installed and subsequently confirmed on it. During 2011, a further 953 MW of FiT supported renewable capacity was installed. For 2012, 849 MW of capacity was added and in 2013, 609 MW. In 2014, 940 MW of capacity was added, while in 2015, a further 909 MW of FiT capacity was installed, with 85 per cent of this new capacity coming from solar photovoltaics (PV). A further 274 MW of solar PV capacity was installed in 2015.

6.19 **The greatest increase in FiT capacity in percentage terms in 2015 was from solar photovoltaics**, from 2,802 MW at the end of 2014 to 3,574 MW at the end of 2015. Onshore wind increased from 433 MW at the end of 2014 to 514 MW at the end of 2015, while hydro capacity increased from 77 MW to 104 MW, and anaerobic digestion from 147 MW to 177 MW. At the end of 2015, solar PV represented 82 per cent of commissioned FiTs capacity (up from 81 per cent at the end of 2014), with onshore wind 12 per cent (down from 13 per cent), and anaerobic digestion 4.0 per cent (down from 4.3 per cent) and hydro increased slightly from 2.2 to 2.4 per cent. It should be noted that, due to administrative lags of around three months, much capacity installed towards the end of

2015 was not confirmed until the first quarter of 2016 (so the amount of capacity installed under FiTs at the end of 2015 will not equal the amount actually confirmed on the Central FiTs Register).[1]

6.20 Table 6B shows the number of sites generating renewable electricity at the end of 2015. There were 853,711 sites, although this figure is dominated by small-scale solar PV installations confirmed on FiTs. Table 6C shows the number of turbines in operation at these sites at the end of December 2015.

6.21 Chart 6.3 illustrates the continuing increase in the electricity generation capacity from all significant renewable sources since 2000. This upward trend in the capacity of renewable sources should continue as recently consented onshore and offshore wind farms and other projects come on stream. The map, shown below, shows the location of wind farms in operation at the end of December 2014, together with an indication of the capacity.

[1] At the end of 2015, 4,367 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.

Map 6.1: The Location of Wind Farms in the United Kingdom as at 31 December 2015

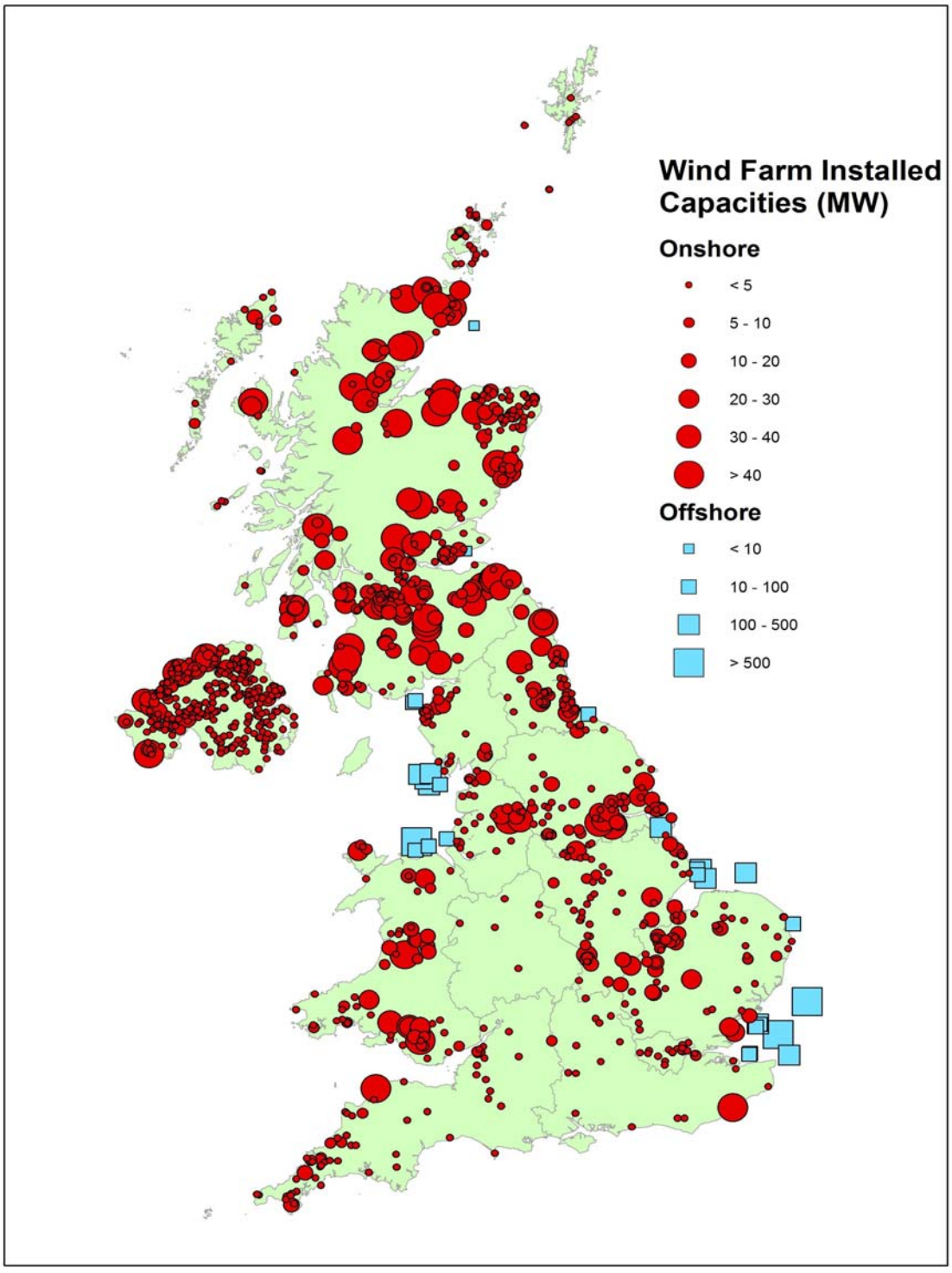


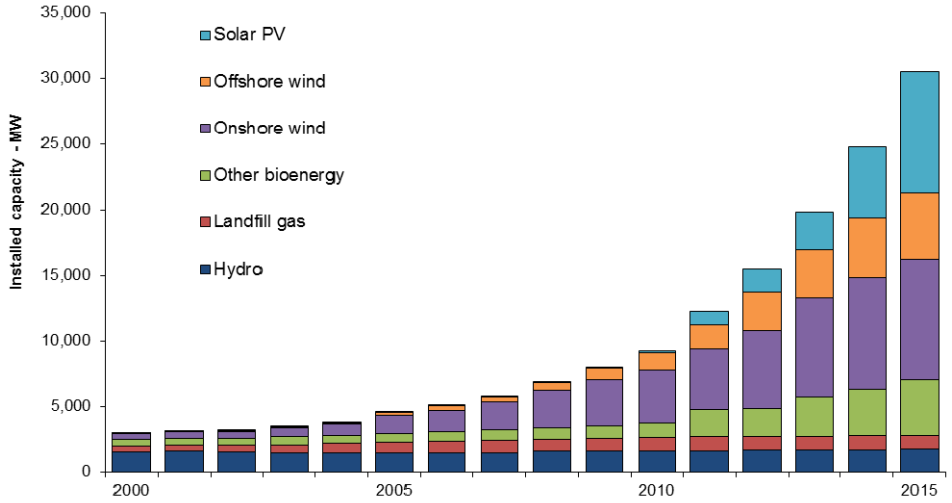
Table 6B: Number of sites generating renewable electricity, as at end of December 2015 (excluding co-firing)[2]

	FiTs confirmed	Other sites	TOTAL
Onshore Wind	6,898	1,671	8,569
Offshore Wind	-	30	30
Marine energy	-	13	13
Solar PV	740,077	102,760	842,837
Hydro	715	350	1,065
Landfill gas	-	446	446
Sewage sludge digestion	-	187	187
Energy from waste	-	47	47
Animal biomass (non-AD)	-	6	6
Anaerobic digestion	250	101	351
Plant biomass	-	160	160
TOTAL	747,940	105,771	853,711

Table 6C: Number of operational wind turbines split by FiTs and non FiTs accredited sites, as at end of December 2015[3]

	FiTs confirmed	Other sites	TOTAL
Onshore Wind	6,898	4,734	11,632
Offshore Wind	-	1,465	1,465
TOTAL	6,359	5,705	13,097

Chart 6.3: Electrical generating capacity of renewable energy plant since 2000



(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 and tidal (8.9 MW in 2015).

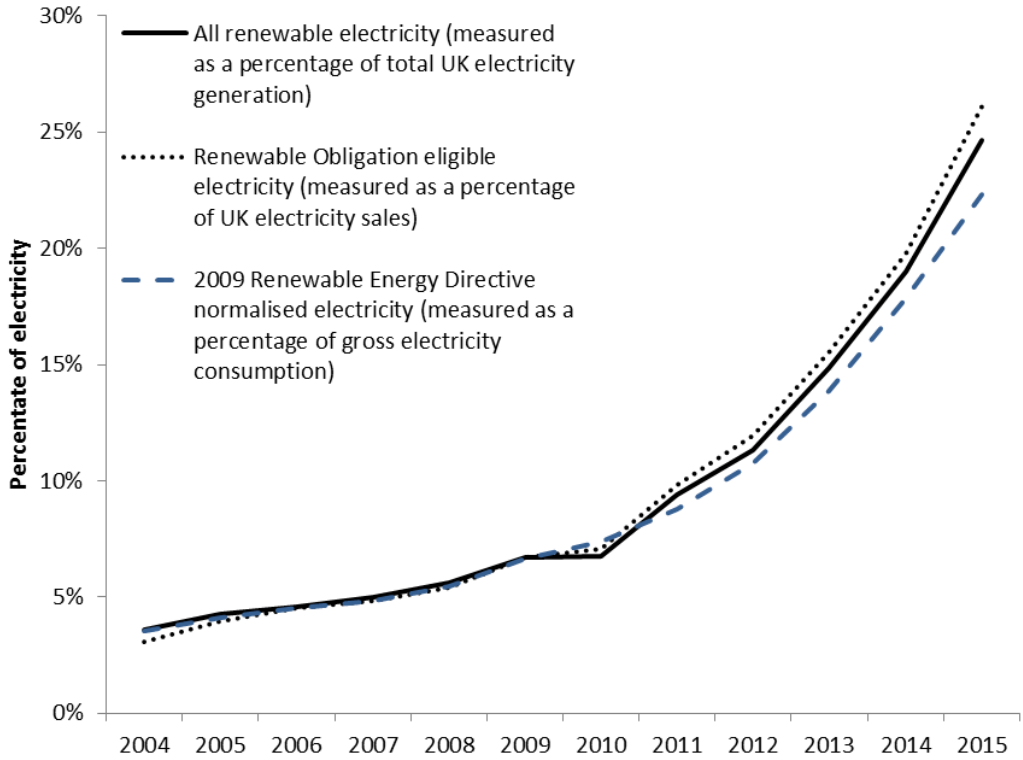
[2] The number of sites (as with overall capacity) is subject to revision, due to lags in data sources. This particularly affects solar PV, where more sites may have come online since compiling this edition of DUKES.

[3] For FiTs schemes, turbine information is not available, so it is assumed that each site consists of one turbine. For other sites, any sites that *could* be eligible for FiTs have been excluded, to avoid any double-counting; therefore, this may be an under-estimate. Additionally, the number of turbines for other sites is that given in the site's planning application, which may vary from the outturn.

6.22 Electricity generated in the UK from renewable sources claiming Renewable Obligation Certificates (ROCs) in 2015, at 67.8 TWh, was 28 per cent greater than in 2014. The growth in 2015 is mainly due to the increased capacity at Drax following the conversion of a third unit (to high-range co-firing) and also increased wind and solar photovoltaic capacity. Chart 6.4 shows the growth in the proportion of electricity produced from renewable sources claiming ROCs compared to the proportion calculated on the International basis and also using the 2009 Renewable Energy Directive methodology. Table 6A shows electricity eligible for and claiming ROCs as a percentage of electricity sales. RO supported generation has increased by over 60 TWh since its introduction in 2002, an increase of over 11 times[4]. This compares with an all-renewable electricity generation figure that has increased by 72 TWh, over seven times the same period, but from a higher starting level.

6.23 As shown in Table 6A, during 2015 renewable generation measured using the RO basis (i.e. as a proportion of electricity sales by licensed suppliers) increased to 26 per cent. Since the introduction of the RO in 2002, generation from wind has increased on average by around one-third each year, with year-on-year increases ranging from 2 per cent to 53 per cent.

Chart 6.4: Growth in electricity generation from renewable sources since 2000



Load factors for electricity generated from renewable sources (Table 6.5)

6.24 Plant load factors in Table 6.5 have been calculated in terms of installed capacity and express the average hourly quantity of electricity generated as a percentage of the average capacity at the beginning and end of the year. The method can be expressed as:

$$\frac{E}{\frac{(C_b + C_e)}{2} \times h}.$$

Where;

E Electricity generated during the year (kWh)

[4] 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.

C_b Installed capacity at the beginning of the year (kW)
C_e Installed capacity at the end of the year (kW)
h Hours in year

6.25 A key influence on load factors of renewable technologies is the weather, with rainfall being the key driver behind the availability of hydro. **In 2015, average rainfall (in hydro catchment areas) was 13 per cent higher than in 2014; as a consequence, the load factor of hydro schemes increased to 41.2 per cent, the highest in the last 19 years.**

6.26 **Average wind speeds during 2015 (at 9.3 knots) were 0.6 knots higher than in 2014, the highest in the last 15 years.** Wind speeds were particularly strong at the start and end of the year; wind speeds in January were the highest for that month since 2007, while December saw wind speeds averaging 13.3 knots, the highest for December in the last 15 years, and 0.4 knots higher than the long term mean. However, it was the least windy October in the last 15 years, and 2.4 knots lower than the 10 year mean. **As a result of the higher wind speeds, the load factor for total wind generation was 33.7, the highest in the last 19 years**; the next highest was seen in 2013. Other factors, such as improved design can also impact on load factors. Load factors for all non-renewable generating plant in the UK are shown in Chapter 5, Table 5.9.

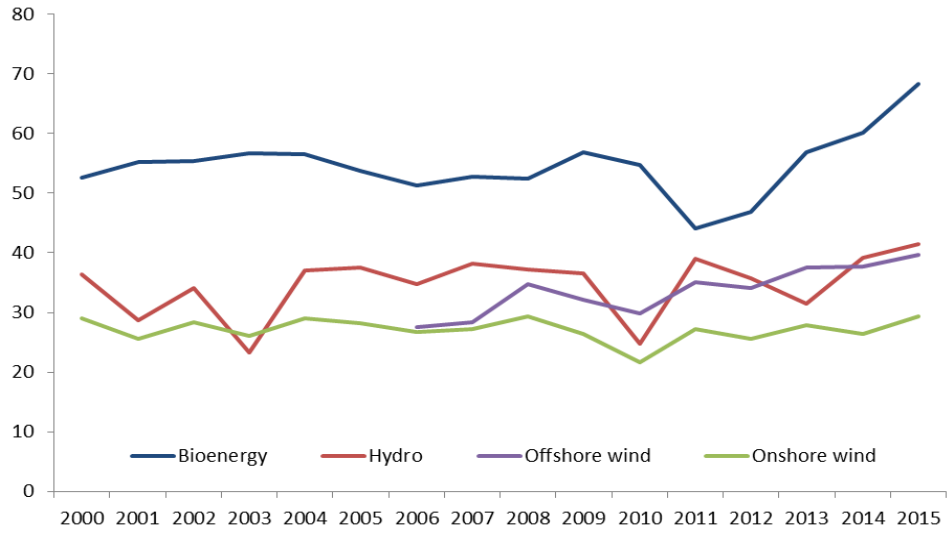
6.27 Changes in capacity during the year can also affect load factors calculated using this methodology; removing Ironbridge from the plant biomass load factor calculation resulted in a 1.8 percentage point reduction in the load factor. This is because Ironbridge ceased operating during the year but generated for the bulk of the year, contributing to the numerator in a bigger proportion compared to the capacity in the denominator which is averaged.

6.28 To compensate for these factors, a second "unchanged configuration" set of statistics have been calculated for many technologies and included in Table 6.5. These statistics use the same methodology as the other load factor statistics, but are restricted to those schemes that have operated continuously throughout the year without a change in capacity. One of the inputs to the unchanged configuration calculation is data on issued ROCs, and a site is included in the calculation only if it has been issued ROCs for each month during the calendar year. The formula for calculating the unchanged configuration load factors is:

$$\frac{\text{Electricity generated during the year (kWh)}}{\text{Installed capacity operating throughout the year with unchanged configuration (kW)} \times \text{hours in year}}$$

6.29 Chart 6.5 shows load factors for wind and hydro. The impacts of new capacity and changes in weather conditions – referred to in the preceding paragraphs - can be identified.

Chart 6.5: Load factors for renewable electricity generation since 2000



Renewable sources used to generate electricity, heat, and for transport fuels (Table 6.6)

Renewable electricity

6.30 **Between 2014 and 2015, there was an increase of 25 per cent in the *input* of renewable sources into electricity generation, to 12,118 ktoe.** Solar photovoltaics increased by 87 per cent, and anaerobic digestion by 40 per cent, and plant biomass by 32 per cent. Onshore and offshore wind increased by 23 per cent and 30 per cent respectively, while hydro increased by 6.7 per cent. Shoreline, wave and tidal (Marine Energy) fell by 10 per cent although its overall contribution to renewable electricity is very small and generation intermittent due to test rigs not being continuously on line. Co-firing with fossil fuels increased by 50 per cent; the reduction in capacity due to the conversion of a third unit at Drax Power Station to high-range co-firing was offset by an increase in capacity at other sites.

Renewable heat

6.31 DUKES 2015 saw some significant revisions to domestic wood consumption following a survey conducted in 2015 (see paragraphs 6.100 to 6.108). This year's Digest has seen more modest revisions to renewable heat, mostly within domestic and industrial wood use where the calorific values and moisture contents being standardised. Industrial wood was revised up by 42 ktoe (9.1 per cent) and domestic by 144 ktoe (9.2 per cent).

6.32 **Around 21 per cent of renewable sources were used to generate heat in 2015, the same proportion as in 2014**. **Energy used for all renewable heat sources increased by 20 per cent during 2015, from 2,954 ktoe to 3,535 ktoe**. Around 11 per cent of renewable heat was supported by The Renewable Heat Incentive (RHI) or Renewable Heat Premium Payment (RHPP) in 2015, compared to 4.6 per cent in 2014. This increase is largely due to growth in RHI supported heat; from 127 ktoe (1,460 GWh) in 2014 to 372 ktoe, (4,326 GWh) in 2015[5]. Further information on the RHI and RHPP schemes can be found in paragraphs 6.71 to 6.72.

6.33 **Of the 581 ktoe increase in renewables used for heat in 2015, 86 per cent was wood combustion** (208 domestic and 289 industrial). In percentage terms, industrial wood increased by 58 per cent, compared to 12 per cent for domestic wood; the average number of heating degree days was higher in 2015 (5.3) compared to 2014 (4.9) though remained below the long term mean (6.0). **The largest percentage growth component of renewable heat was anaerobic digestion** which almost doubled to 46 ktoe in 2015. This was largely driven by the RHI and Feed in Tariff mechanisms.

[5] Note RHI and RHPP data is by date of payment as opposed to when the heat was generated
Source; www.gov.uk/government/collections/renewable-heat-incentive-statistics

6.34 Plant biomass used for heat decreased by 5.2 per cent in 2015 from 379 ktoe to 359 ktoe due to a reduction in heat generation at some CHP plants.

6.35 **Renewable energy from heat pumps increased by 26 per cent in 2015, from 143 ktoe to 168 ktoe.** In DUKES 2015, only those heat pumps performing at the seasonal performance factor (SPF) required to meet the Renewable Energy Directive were included. However, following discussions with Eurostat, this year's Digest includes all heat pumps (with the exception of Table 6.7 which measures progress against the Directive). This change in methodology together with a review of heat pump properties has resulted in an upward revision for 2014 from 108 ktoe to 143 ktoe. The total installed capacity of ground source heat pumps, ambient air to water heat pumps, and exhaust air heat pumps was estimated to be 1,369 MW at the end of 2015. The capacity installed during 2014 was assumed to be installed at a steady rate throughout the year. Note that only the net gain in energy from heat pumps (i.e. total heat energy minus the electricity used to power the pump) is counted as renewable energy (see paragraph 6.93 for details on the methods used).

6.36 Over half of renewable heat is from domestic wood combustion (54 per cent), followed by industrial wood consumption (22 per cent). Plant biomass' share has fallen from 13 per cent in 2014 to 10 per cent in 2015. Non-bioenergy renewable heat sources include solar thermal, deep geothermal and heat pumps, and combined these accounted for 6.2 per cent of renewable heat in 2015.

Liquid biofuels for transport

6.37 Biodiesel and bioethanol consumption figures, previously sourced from The HMRC Hydrocarbon Oils Bulletin, have this year been obtained from data published by The Department for Transport, derived from The Renewable Transport Fuel Obligation (RTFO) statistics (see paragraphs 6.66 to 69 for more details),
www.gov.uk/government/collections/biofuels-statistics

6.38 The RTFO figures show that **674 million litres of biodiesel[6] were consumed in 2015, 29 per cent lower than in 2014.** Biodiesel is considered the 'marginal fuel' supplied under the RTFO and therefore the supply of biodiesel fluctuates in response to changing market conditions. It is estimated that 167 million litres of biodiesel were produced in the UK in 2015, 4.1 per cent less than in 2014. Of this, about 6 million litres are known to have been used for non-transport applications or exported. Therefore, at least 514 million litres of biodiesel were imported in 2015. The total annual capacity for biodiesel production in the UK in 2015 is estimated to be around 327 million litres.

6.39 RTFO data also shows that **797 million litres of bioethanol were consumed in the UK in 2015, a decrease of 2.1 per cent on 2014**. The UK capacity for bioethanol production at the end of 2015 was estimated to be around 900 million litres, although actual production was estimated to be 333 million litres, 37 per cent of capacity. Of UK production, 199 million litres was known to be used for non-transport applications, or exported, so at least 663 million litres was imported.

6.40 During 2015, biodiesel accounted for 2.4 per cent of diesel, and bioethanol 4.8 per cent of motor spirit. The combined contribution of liquid biofuels for transport was 3.3 per cent, a decrease of 0.6 percentage points on 2014.

6.41 The RTFO data have been converted from litres to tonnes of oil equivalent and the data 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 19 per cent (to 1,003 ktoe) between 2014 and 2015 with the majority of the decrease due to biodiesel. In 2014, liquid biofuels for transport comprised around 6.0 per cent of total renewable sources, 2.9 percentage points less than 2014, and less than half the high reached in 2010 of 14.8 per cent.

6.42 When measuring the contribution of transport biofuels for the Renewable Energy Directive, only those meeting sustainability criteria count. The RTFO tables referred to above do not contain

[6] The most usual way for biodiesel to be sold is for it to be blended with ultra-low sulphur diesel fuel.

sustainability information, including those which carry a higher weighting (mostly sourced from waste), and the table which does, is not yet a complete data set for 2015. 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 DfT 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 bio liquids being complaint and also the proportion meeting the double credited criteria (mostly those from waste sources). During RTFO obligation period 7, from April 2014 to April 2015, **almost 100 percent of transport biofuel consumption was demonstrated to be sustainable**. Under the RTFO, 1,177 million litres of transport biofuels were consumed in 2015, although, as at June 2015, only 62 per cent of this had been awarded with Renewable Transport Fuel Certificates (RTFCs) as suppliers have until August to apply for them. Further information on the RTFO is given in paragraphs 6.66 to 6.69.

Renewable sources data used to indicate progress under the 2009 EU Renewable Energy Directive (RED) (Table 6.7)

6.43 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 paragraphs 6.53 and 6.54.

6.44 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, and also shows the proportions of electricity, heat and transport energy coming from renewable sources. These provisional figures indicate that **during 2015, 8.3 per cent of final energy consumption was from renewable sources**. The RED introduced interim targets for member states to achieve on their route to attaining the 2020 proportion. The second interim target, averaged across 2013 and 2014, was set at 5.4 per cent, and was exceeded at 6.3 per cent. The third interim target is 7.5 per cent averaged across 2015 and 2016.

6.45 Overall renewable sources, excluding non-biodegradable wastes and passive solar design (see paragraph 6.73), provided 8.8 per cent of the UK's total primary energy requirements in 2015 (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 of 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 18 per cent, the final consumption denominator increased by just 1.3 per cent. Table 6D shows both measures.

Table 6D: Percentages of energy derived from renewable sources since 2011

	2011	2012	2013	2014	2015
Eligible renewable energy sources as a percentage of capped gross final energy consumption (i.e. the basis for the Renewable Energy Directive)	4.2%	4.6%	5.8%	7.1%	8.3%
Renewable energy as a percentage of primary energy demand	4.5%	4.9%	5.9%	7.3%	8.8%

6.46 Eurostat publishes data on how all countries are progressing towards their RED (final and interim) targets. The latest comparative data relates to 2014. The 2014 RED percentage for all EU countries combined was 16.0 per cent, an increase of 1.0 percentage point compared to 2014. Sweden achieved the highest proportion of renewable energy at 53 per cent.

6.47 Most member states' share of renewable energy increased from 2013 to 2014 with the highest increase being Finland with a 2.0 percentage point increase. **The UK increased its share of renewable energy by 1.4 percentage points, the sixth highest increase across member states**. The UK has the fourth lowest proportion of renewable energy in 2014, though it has managed to increase its share of renewable energy more than seven-fold since 2004. Since 2004, Denmark has seen the highest increase in its share of renewable energy at 14.3 percentage points.

6.48 A third of the member states have now exceeded their 2020 targets; Bulgaria, the Czech Republic, Estonia, Croatia, Italy, Lithuania, Romania, Finland and Sweden. Denmark and Austria are less than one percentage point from meeting theirs. Taking into account the UK's 2015 result it is now challenged to increase its share of renewable energy by a further 6.7 per cent to meet its 2020 target of 15 per cent. Further details of progress for all member states can be found at:
http://ec.europa.eu/eurostat/en/web/products-press-releases/-/8-10022016-AP

Technical notes, definitions, and policy context

6.49 The Renewable Energy STATisticS database (RESTATS) study started in 1989 and, where possible, information was collected on the amounts of energy derived from each renewable source. Additional technologies have been included for more recent years, such as the inclusion of energy from heat pumps from 2008 onwards and the recording of technology types such as anaerobic digestion. This technical notes section defines these renewable energy sources. The database now contains 27 years of data from 1989 to 2015. Information within RESTATS is also combined with supplementary data obtained from monitoring the planning process for new renewable electricity and heat installations to ensure that it is more comprehensive.

6.50 The information contained in the database is collected by a number of methods. For larger projects, an annual survey is carried out in which questionnaires are sent to project managers. For technologies in which there are large numbers of small projects, the values given in this chapter are estimates based on information collected from a sub-sample of the projects. Some data are also collected via other methods, such as desk research and data from the administration of renewable energy policies. Further details about the data collection methodologies used in RESTATS are also contained in a guidance note on the BEIS section of the GOV.UK website at:
www.gov.uk/government/collections/renewables-statistics#methodology

6.51 Energy derived from renewable sources is included in the aggregate energy tables in Chapter 1 of this Digest. The main commodity balance tables (Tables 6.1 to 6.3) present figures in the common unit of energy, the tonne of oil equivalent, which is defined in Chapter 1 paragraph 1.29. The gross calorific values and conversion factors used to convert the data from original units are given in Annex A. The statistical methodologies and conversion factors are in line with those used by the International Energy Agency and the Statistical Office of the European Communities (Eurostat). Primary electricity contributions from hydro and wind are expressed in terms of an electricity supplied model (see Chapter 5, paragraph 5.75). Electrical capacities in this chapter are quoted as Installed capacities. However, in Chapter 5, Declared Net Capacity (DNC) or Transmission Entry Capacity of renewables are used when calculating the overall UK generating capacity. These measures take into account the intermittent nature of the power output from some renewable sources (see paragraph 6.129).

6.52 The various renewable energy Directives, policies and technologies are described in the following paragraphs. This section also provides details of the quality of information provided within each renewables area, and the methods used to collect and improve the quality of this information. While the data in the printed and bound 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 section of the gov.uk website.

European and UK Renewable Energy Policy Context

EU Renewable Energy Directive

6.53 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, and

www.gov.uk/government/publications/second-progress-report-on-the-promotion-and-use-of-energy-from-renewable-sources-for-the-united-kingdom

The third progress report will cover 2015-16 and will be published in January 2018.

6.54 The RED uses different measures of both renewables and overall energy from those elsewhere in the Digest. The renewable numerator in the calculation uses 'normalised' wind and hydro generated electricity – combined with other actual electricity generated from other sources, energy for heating and cooling by final consumers, as well as the use of energy for transport purposes. Gross final energy consumption (which is calculated on a net calorific value basis) also includes consumption of electricity by electricity generators, consumption of heat by heat generators, transmission and distribution losses for electricity, and transmission and distribution losses for distributed heat. The normalisation process is carried out by calculating generation by applying an average load factor to current capacity. For wind, the load factor is calculated as the average of the past five years (including the present one), with current capacity taken as an average of the start and end of year capacity. For hydro, the load factor is the average of the past 15 years, applied to capacity at the end of the current year. The generation figures obtained from this procedure replace the actual generation figures for wind and hydro in the Directive calculation. The energy generated by heat pumps is also calculated differently; only heat pumps which meet a minimum Seasonal Performance Factor (SPF) of 2.5 are included as prescribed by the Commission's guidance for calculating renewable energy from heat pumps which is set out at;

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013D0114

Additionally, the Directive includes a cap on the proportion that air transport can contribute to the total; this cap is currently 6.18 per cent; certain fuels also receive a higher weighting in the calculation, with full details being set out in the Directive, which is available at:
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF.

6.55 In the UK, energy balances are usually published on a gross calorific value basis, but in order to facilitate comparisons with EU statistics the balances for 2004 to 2015 have been calculated on a net calorific value basis and are available in Table I.1 at:
www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes

UK Renewables Policy

6.56 The UK's progress report details the key policies and measures undertaken or in planning, to further increase renewables deployment. These include:

- Putting in place appropriate financial incentives to bring forward and support the take-up of renewable energy, including the "banded" Renewables Obligation (closing on 31st March 2017, although extensions are available in certain situations), Feed-in Tariffs (FiTs) for small scale (under 5 MW) electricity generation, the Renewable Transport Fuel Obligation, the Renewable Heat Incentive tariff scheme (for industry, commercial premises, the public sector, and, since April 2014, households), and the (now closed) Renewable Heat Premium Payment Scheme (for households); and, Contracts for Differences under Electricity Market Reform.
- Identifying and removing the most significant non-financial barriers to renewables deployment, including measures to improve existing grid connection arrangements; and
- Overcoming supply chain blockages and promoting business opportunities in the renewables sector in the UK.

More details of the main renewable technologies that either have the greatest potential to help the UK meet the 2020 RED target in a cost effective and sustainable way, or offer the greatest potential for the decades that follow, can be found in the UK Renewable Energy Roadmap, which was first published in July 2011, and updated in 2012 and 2013, available at:

www.gov.uk/government/publications/renewable-energy-roadmap
www.gov.uk/government/publications/uk-renewable-energy-roadmap-update
www.gov.uk/government/publications/uk-renewable-energy-roadmap-second-update

Renewables Obligation (RO)

6.57 In April 2002 the Renewables Obligation (RO) came into effect[7]. It is an obligation on electricity suppliers to source a specific proportion of electricity from eligible renewable sources or pay a penalty. The proportion is measured against total electricity sales (as shown in Table 5.5 contained in the electricity chapter of this Digest). The Obligation is intended to incentivise an increase in the level of renewable generating capacity and so contribute to our climate change targets. Examples of RO eligible sources include wind energy, bioenergy (including landfill gas, sewage gas, biomass, anaerobic digestion and energy from waste), hydro, photovoltaics, wave and tidal energy and deep geothermal. Ofgem (which administers the RO) issues Renewables Obligation Certificates (ROCs) to qualifying renewable generators. These certificates may be sold by generators directly to licensed electricity suppliers or traders. Suppliers present ROCs to Ofgem to demonstrate their compliance with the obligation.

6.58 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 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. Banding reviews ensure that, as market conditions and innovation within sectors change and evolve; renewables developers continue to receive the appropriate level of support necessary to maintain investments within available resources. The RO closed to large-scale solar PV (over 5MW) on 31 March 2015 and to small-scale solar (up to 5MW) on 31 March 2016. It also closed to all capacities of onshore wind in Great Britain on 12 May 2016 and to onshore wind over 5MW in Northern Ireland on 31 March 2016. The scheme will close to all other technologies on 31 March 2017, although existing generating stations will continue to receive support until 2037. Various grace periods are available which extend the closure date in certain specified situations. Details of the grace periods are available on Ofgem's website: www.ofgem.gov.uk/environmental-programmes/renewables-obligation-ro/information-generators/closure-renewables-obligation-ro . A list of technologies eligible for the RO, details of the RO banding review, and the level of ROCs received, is available: Calculating Renewable Obligation Certificates (ROCs) - Detailed guidance - GOV.UK

6.59 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.

Electricity Market Reform (EMR)

6.60 Contracts for Difference will replace the RO for new renewable energy stations from April 2017 (although new stations have a choice between support mechanisms until the RO's closure at the end of March 2017). Contracts for Difference tackle the risks and uncertainties of the underlying economics of different forms of electricity generation by offering long term contracts for low carbon energy.

6.61 In effect, companies will get a fixed and secure price at which they can sell their electricity to consumers. This will allow investors to be confident about the returns of their capital in advance of investing billions into new infrastructure schemes. It will also encourage banks to lend at cheaper rates because the projects are less risky. Further details of the reforms are available at: www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform

[7] Parliamentary approval of the Renewables Obligation Orders under The Utilities Act 2000 was given in March 2002. 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.

Feed-in Tariffs (FiTs)

6.62 Feed-in tariffs are a financial support scheme for eligible low-carbon electricity technologies, aimed at small-scale installations with a capacity of less than 5 Megawatts (MW). FiTs support new anaerobic digestion (AD), solar photovoltaic (PV), small hydro and wind, by requiring electricity suppliers to make payments (generation tariffs) to these generators based on the number of kilowatt hours (kWh) they generate. An additional guaranteed export tariff is paid for electricity generated that is not used on site and exported to the grid. The scheme also supports micro-combined heat and power (micro-CHP) installations with an electrical capacity of 2kW or less, as a pilot programme.

6.63 The number of PV installations, particularly on domestic properties, increased rapidly at the start of the FIT scheme. The rate of increase slowed significantly after August 2012 following tariff reductions introduced to reflect the rapidly falling costs of solar modules. A cost control mechanism (contingent degression) was also introduced, following a comprehensive review in 2011/12. A further review of the scheme occurred in 2015 covering all technologies except micro-CHP. This implemented a deployment cap of up to £100m for new expenditure by 2018/19. The budget is split across technologies and sub-divided into quarterly caps. If a quarterly cap is hit, tariffs are reduced through contingent degression. Tariffs are also reduced automatically every quarter (default degression). Similar proposals for micro-CHP installations regarding a deployment cap and contingent degression are being consulted on in 2016.

6.64 Tariff changes implemented as a result of the reviews only affect new entrants to the scheme. Policy information and statistical reports relating to FiTs can be found at: www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/feed-in-tariffs-scheme and www.gov.uk/government/organisations/department-of-energy-climate-change/series/feed-in-tariff-statistics

6.65 In the first five years of FITs (April 2010 – March 2015) over 680,000 installations, totalling over 3.5GW of installed capacity has been registered under the scheme. This is significantly ahead of original projections (750,000 installations by 2020), and has resulted in an annual spend considerably above the original budget estimates.

Renewable Transport Fuel Obligation (RTFO)

6.66 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 are from a renewable source by 2013/14 and all subsequent years, with incremental levels of 2.5 per cent (by volume) for 2008/09, 3.25 per cent (by volume) in 2009/10, 3.5 per cent (by volume) in 2010/11, 4.0 per cent (by volume) in 2011/12, and 4.5 per cent (by volume) in 2012/13. 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.

6.67 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. Further information on the RTFO policy can be found at: www.gov.uk/government/publications/rtfo-guidance

6.68 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.

6.69 The Department for Transport will be consulting in 2016 on proposals to increase the obligation from 2017 and set a trajectory to 2020 and beyond.

Renewable Heat Incentive and Premium Payment

6.70 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.

6.71 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 the 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.

Table 6E below shows the breakdown of technologies accredited to the domestic scheme, over the period 9 April 2014 (launch date) to 31 December 2015, with average installed capacity and heat paid out for under the scheme. In total there were 26,628 installations, with 597,909 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 6E: Domestic Renewable Heat Incentive accreditations, average capacity installed and estimated heat generation to December 2015

Technology	Number of accreditations	Average (mean) capacity installed (kW)	Heat paid out under the scheme (MWh)
Air source heat pump	19,921	10.0	163,276
Ground source heat pump	6,522	12.2	91,582
Biomass systems	11,223	25.9	332,348
Solar thermal	7,445	-	10,705
Total	**45,111**	**-**	597,909

Sources of Renewable Energy

Use of passive solar energy

6.72 Nearly all buildings make use of some existing (passive) solar energy because they have windows or roof lights, which allow in natural light and provide a view of the surroundings. This existing use of passive solar energy is making a substantial contribution to the energy demand in the UK building stock. Passive solar design (PSD), in which buildings are designed to enhance solar energy use, results in additional energy savings. The installed capacity of PSD in the UK and other countries can only be estimated and is dependent on how the technology is defined. The unplanned benefit of solar energy for heating and lighting in UK buildings is estimated to be 145 TWh per year. The figure is very approximate and, as in previous years, has therefore not been included in the tables in this chapter. Only a few thousand buildings have been deliberately designed to exploit solar energy – a very small proportion of the total UK building stock. It has been estimated that the benefit of deploying PSD in these buildings is equivalent to a saving of about 10 GWh per year.

Active solar heating

6.73 Active solar heating employs solar collectors to heat water mainly for domestic hot water systems but also for swimming pools and other applications. There are primarily two key designs: flat-plate, comprising a dark absorbing material with a cover to reduce heat loss and a liquid – usually water with antifreeze – to extract the heat from the absorber, and evacuated-tube collectors that use heat pipes for their core to extract the energy instead of passing liquid directly through them. Planning permission is required for free-standing domestic solar panels of more than $9m^2$, but the more common form of installation is the roof mounted scheme which does not require planning permission.

6.74 Updated figures on the contribution of active solar heating have been calculated by Ricardo Energy and Environment (on behalf of BEIS) based on sales figures from the Solar Trade Association (STA) and the European Solar Thermal Industry Foundation (ESTIF) and using a conversion methodology recommended by the IEA Solar Heat and Cooling Programme and ESTIF which can be found at:
http://www.estif.org/no_cache/st_energy/area_to_energy_conversion_method/?sword_list[]=method

The figures reported are currently made up of two inputs:

- STA sales data, recently revised by applying a scaling factor of 1.2, (as done by ESTIF) to take into account that not the whole market is reported by the STA.
- An estimate of active solar for some designs of swimming pools not covered by the STA.

The model was updated in 2015 to correct the fact that the growth rates applied to swimming pools had been too high previously. This year, the model was further improved by allowing for equipment replacement after 20 years of operation and also for a small reduction in efficiency with age of the system.

6.75 For 2015, active solar heating replaced an estimated 262 GWh of gas (80 per cent) and electricity (20 per cent) for domestic hot water generation and an estimated 141 GWh of gas (45 per cent), oil (45 per cent) and electricity (10 per cent) for swimming pool heating.

Solar photovoltaics (PV)

6.76 Photovoltaics is the direct conversion of solar radiation into direct current electricity by the interaction of light with the electrons in a semiconductor device or cell. Since April 2010 support for small scale (less than 5 MW) solar PV and other micro-generation technologies in Great Britain has been provided by FiTs (see paragraph 6.62), resulting in a rapid expansion in solar PV capacity. Larger-scale (> 50 kW) solar PV and all installations in Northern Ireland are supported by the Renewables Obligation (RO) (see paragraph 6.57)[8]. Generation data are available for sites accredited under the RO (via ROCs issued), but are not currently available for other schemes, including those supported by FiTs. Where generation data are not available, this has been estimated using the methodology to be found at: www.gov.uk/government/statistics/energy-trends-december-2013-special-feature-article-estimating-generation-from-feed-in-tariff-installations

Onshore wind power

6.77 Onshore wind is one of the most mature renewable energy technologies. The UK has a good onshore wind resource, with wind speeds particularly good in Scotland, Northern Ireland and Wales but less good in England, particularly in the South East. A wind turbine extracts energy from the wind by means of a rotor (usually a three-bladed horizontal-axis rotor) that can be pitched to control the rotational speed of a shaft linked via a gearbox to a generator.

6.78 The rate of installation of new wind farms slowed down in 2015 after increasing year on year with the introduction of the Renewables Obligation (RO) in April 2002 and FiT in 2010. Turbine size has continued to steadily increase over the years and the average new turbine size for operational schemes over the last 5 years is around 2.5 MW. For those schemes under construction, however, this is moving towards 3 MW. Some of the early projects which were installed around 20 years ago have re-powered (replaced ageing turbines with more efficient ones) as increased tower height

[8] Eligible GB schemes between 50 kW and 5 MW capacity can currently choose between the RO and FiTs.

associated with increased turbine size has increased wind capture (wind speed generally increases with height above ground level) and turbine design has improved and become more sophisticated leading to improvements in efficiency. The figures included for generation from wind turbines are based on actual metered exports from the turbines and, where these data are unavailable, are based on estimates using regional load factors (see paragraphs 6.24 to 6.29 regarding load factors) and the wind farm installed capacity.

6.79 In the small-medium wind market (15–100 kW), generated energy is used to satisfy on-site demand. Small-scale wind system technology can be subdivided into three categories: micro wind turbines (0–1.5 kW), small wind turbines (1.5–15 kW) and small–medium wind turbines (15–100 kW). The two main designs are the horizontal axis wind turbines (HAWT) and vertical axis wind turbines (VAWT).

6.80 In terms of operational characteristics, siting considerations and the value and nature of the market, small-scale wind systems vary markedly from large-scale units. Small-scale wind systems can be off-grid or on-grid; mobile or fixed; free-standing or building-mounted; or they can form part of combined installations, most commonly with photovoltaic systems. As a result, they have a greater range of applications, compared to large-scale wind turbines and can be used in commercial, public or domestic settings and as single or multiple installations providing power to communities.

Offshore wind power

6.81 The UK has some of the best offshore wind resource in Europe, with relatively shallow waters and strong winds. The Renewable Energy Roadmap (referred to in paragraph 6.56) highlights offshore wind as a key technology that will help the UK meet the 2020 RED target, with a potential deployment by 2020 of up to 18 GW subject to cost reduction. This would correspond to around 17 per cent of the UK's net electricity production.

6.82 Offshore winds tend to blow at higher speeds and are more consistent than on land, thus allowing turbines to produce more electricity (because the potential energy produced from the wind is directly proportional to the cube of the wind speed, increased wind speeds of only a few miles per hour can produce a significantly larger amount of electricity) but it is more costly to implement than onshore wind. However, onshore constraints such as planning, noise effects, visual impact and the effects of transportation of large components are reduced offshore. As a result, offshore turbines are generally larger than their onshore counterparts, with the current commercially available turbines having a rated capacity of between 3 and 6 MW; a number of larger, offshore specific turbines, however, are currently being developed. Floating concepts are also being developed as they are considered by many to be more viable (both economically and environmentally) in deeper waters.

6.83 In the development of the UK's offshore wind capacity, the Crown Estate have run a number of leasing rounds under which areas of the seabed have been made available for the development of offshore wind farms. Round 1 started in December 2000 and Round 2 in July 2003 and 7.2 GW have already been enabled from these two rounds. In January 2010, the Crown Estate announced the successful development partners for each of nine new Round 3 offshore wind zones, with a potential installed capacity of up to 33 GW. The Round 3 zones were identified using the Crown Estate's marine asset planning expertise and by consultation with key national stakeholders. Construction of the Round 3 capacity is expected to begin in the next few years, though not all projects will be constructed and all projects will be subject to the relevant planning process.

Marine energy (wave and tidal stream power)

6.84 Ocean waves are created by the interaction of winds with the surface of the sea. Because of the UK's position on the north eastern rim of the Atlantic it has some of the highest wave power levels in the world. Tidal currents are created by the movement of the tides, often magnified by local topographical features such as headlands and channels. Tidal current energy is the extraction of energy from this flow, analogous to the extraction of energy from moving air by wind turbines. Tidal range power can be extracted from tidal barrage and tidal lagoon systems. With a tidal barrage across an estuary, water is collected during the flood tide, creating a head of water. During the ebb tide the water flows out of the pool through low-head hydro turbines thus generating electricity. Some technologies also allow generation on ebb and flood. A tidal lagoon works in a similar manner, but an artificial pool is used to collect the water. The UK is still seen as the world leader in wave and tidal stream technology, however a number of other countries are rapidly developing sites for wave and

tidal installations with the associated supply chain such as Canada, France, South Korea and Australia.

6.85 In 2015, The Crown Estate announced a new programme of leasing for small scale wave and tidal current test and demonstration projects under 3MW. This allows developers to apply for leases when their technology is ready and they have raised sufficient finance rather than being restricted to leasing calls. This also provides greater opportunities for turbines of 100kW or less to be deployed, with a large number of developers successfully commissioning small scale prototype turbines. This will continue in 2016, which will also see Atlantis, Andritz Hydro, Hammerfest Hydro, Open Hydro and ScotRenewables commission multi MW devices.

6.86 Wave power devices continue to be developed at a slower rate than tidal devices. Aquamarine Power with its Oyster device joined Pelamis falling into administration. Conversely, newly formed Wave Energy Scotland is now playing a leading role in the UK in supporting the development of wave energy technologies.

6.87 The Swansea Bay tidal barrage project continued development through 2015, however in early 2016 this was put on hold whilst a review is carried out by the UK Government to determine, amongst other things, in what circumstances, tidal lagoons could play a cost effective role as part of the UK energy mix. The review is expected to be completed by autumn 2016.

Large scale hydro

6.88 In hydro schemes the turbines that drive the electricity generators are powered by the direct action of water either from a reservoir or from the run of the river. Large-scale hydro covers plants with a capacity of 5 MW and over and most of the plants are located in Scotland and Wales and mainly draw their water from high-level reservoirs with their own natural catchment areas. Major Power Producers (MPPs) report their output to BEIS in regular electricity surveys. Prior to 2004 these data were submitted in aggregate form and not split down by size of scheme. This meant that some small-scale schemes were hidden within the generation data for the large-scale schemes. Since 2004 MPPs have provided a more detailed breakdown of their data and some smaller sites included under "large scale" before 2004 are now under "small scale". The data in this Chapter excludes pumped storage stations (see paragraph 5.74). The UK has one mixed pump storage and natural flow hydro station, at Foyers in Scotland. Whilst it is primarily a pumped storage site, the generation attributed to the natural flow component of this station can be calculated, and is included in the large-scale hydro generation figures in this Chapter. However, the natural flow share of the capacity cannot be separated, and is therefore not included.

Small scale hydro

6.89 Hydro electricity generation schemes with a capacity below 5 MW are classified as small scale. These are schemes for either domestic/farm purposes or for local sale to electricity supply companies. Currently there are 281.9 MW of installed small-scale hydro schemes. Of this, 68 per cent is owned by small-scale energy producers with the remainder owned by major power producers. There are 715 FiTs and 270 non-FiTs schemes in operation; 86 per cent of these non-FiTs schemes claim ROCs and 7 schemes have current NFFO contracts.

Deep geothermal energy

6.90 There are two broad types of deep geothermal technology, for direct heat use (where temperatures are above 60^{o}C) and for power generation (though normally for combined heat and power) usually where the resource temperature is above 120^{o}C. The UK's deep geothermal resources include hot aquifers (i.e. subterranean bodies of water) in the North East, Wessex and Cheshire and the 'hot dry rocks' in Cornwall which are likely to have the greatest potential (at 5km depth) for power generation. There are two simple models for deep geothermal projects. Where a hot aquifer has been identified, it is possible to simply pump the hot water to the surface and use it directly, for example in a heat network. The water then needs to be either disposed of or re-injected into the ground via a second borehole. An alternative model is to pump cold water from the surface down into a volume of hot rock, exploiting existing fractures in the rock or creating these through Enhanced Geothermal System techniques, and then recovering it to the surface once it has been heated.

6.91 Deep geothermal electricity generation is eligible for support under the Renewables Obligation. Deep geothermal energy for direct heat use is eligible for support under the Renewable Heat Incentive. The Government has also provided grant support for the sector. At present there are no deep geothermal power plants in the UK. The UK's only existing geothermal heat generating station is at Southampton, where an 1800m borehole taps into the edge of the aquifer under Wessex and provides heat to the Southampton district heat network, although this borehole is currently being refurbished.

6.92 Up to December 2013 geothermal was supported in the non-domestic RHI under the ground source heat pump tariff but a separate bespoke tariff for deep geothermal heat was introduced after this. The tariff is set at 5.08p/kWh from 1 April 2015, and deep geothermal heat is defined as coming from a drilling depth of a minimum of 500m.

Heat pumps

6.93 A ground source heat pump (GSHP) uses electricity to power a vapour compression cycle to pump heat from underground heat exchange coils and boreholes to a target heating system. An air source heat pump (ASHP) uses a vapour compression cycle to pump heat from ambient air to the target heating system. The ASHP data included in the Digest are air to water heat pumps extracting heat from external air only, and the renewable energy component of exhaust air systems, extracting heat from the exhaust air of a building.

6.94 Heat pumps use electricity to operate the compression cycle. The ratio of the heating output of a heat pump over the amount of electricity it uses gives the coefficient of performance (COP) of the heat pump. The seasonal performance factor (SPF), is the average COP for a heat pump over a whole year and reflects the efficiency a heat pump achieves when installed. The Renewable Energy Directive (Annex VII) sets out the equation for calculating how much of the energy generated by heat pumps should be considered renewable and a minimum SPF is part of that equation. The SPF is dependent on pan-EU average electricity generation efficiency. Heat pumps which do not meet the minimum SPF are not counted as renewable under the Directive. The latest available guidance from the European Commission gives a minimum SPF of 2.5. Guidance on measuring the contribution of heat pumps for the RED was produced by the European Commission in March 2013, and data in the 2014 edition of the Digest used this methodology. Eurostat now requires that renewable heat statistics should include renewable heat from all heat pumps, including those with an SPF lower than the minimum required under RED. This edition of DUKES follows the Eurostat methodology.

6.95 There have been a number of changes to values used in calculation of the renewable heat contribution this year. This is due to the availability of updated information on locations and capacities of heat pumps installed under the RHI and actual performance of domestic heat pumps installed in the UK under the RHPP. This is in line with advice from the European Commission to utilise country specific information where available and to opt for conservative estimates.

6.96 Estimates on number of heat pumps installed since 2008 continue to be based on sales information from BSRIA, a research organisation. It is assumed that there was no significant contribution from heat pumps installed before 2008. . All heat pumps installed after 2008 are assumed to contribute to renewable heat production in the UK. Average SPF values for all UK heat pumps are currently based on EU default values.

6.97 The contribution of energy from heat pumps is included in the Digest for 2008 onwards, in tables 6.1-6.3 and 6.6. For example, the output (less the electricity used to run the pump) is included in the production line in table 6.1, with the amount of this consumed by sector detailed within the final consumption sector below.

Bioenergy and wastes

(a) Landfill gas

6.98 Landfill gas is a methane-rich gas formed from the natural decomposition of organic material in landfill sites. The gas can be used to fuel reciprocating engines or turbines to generate electricity or used directly in kilns and boilers. In other countries, the gas is cleaned to pipeline quality or used as a vehicle fuel. Landfill gas exploitation benefited considerably from NFFO and this resulted in a large rise in electricity generation from 1992. Information on generation comes from Renewables Obligation Certificates (ROCs), supplemented by a RESTATS survey carried out by Ricardo Energy & Environment in 2008 on behalf of BEIS.

(b) Sewage sludge digestion

6.99 Sewage sludge digestion is the break down of the solid part of sewage by natural bacteria in a sealed tank in the absence of oxygen to produce a methane rich sewage gas. Some plants only use the sewage gas to generate heat but many use combined heat and power (CHP) systems, with the electricity generated being used on site or sold. Information on the projects was provided from the CHPSTATS Database, which is compiled and maintained by Ricardo Energy & Environment on behalf of BEIS (see Chapter 7). The majority of the information in the database is gathered through the CHP Quality Assurance (CHPQA) Programme. However, many sewage treatment works are not part of the CHPQA Programme and information on these plants comes from ROCs data. Estimates of electrical efficiencies and heat to power ratios typical of the technology and capacity are used to determine fuel inputs and heat outputs. In this year's statistics, data for 89 per cent of the schemes (98 per cent of the capacity) were from RESTATS (i.e. ROCs) with the remainder from CHPQA; all schemes, however, were vetted by CHPQA before being accepted by RESTATS.

(c) Domestic wood combustion

6.100 Domestic wood use includes the use of wood fuel in open fires, "AGA"-type cooker boilers, modern biomass boilers and other wood burning stoves. Domestic wood use was for a long time estimated based on the historic survey results of 1989.

6.101 During the survey of 2003, Ricardo Energy & Environment were asked to examine an accumulating body of anecdotal evidence that implied that there was considerable growth in this area, suggesting that the use of this resource might be being underestimated. This was based on the amount that was being burnt on open fires rather than dedicated wood-burning stoves, which had previously been overlooked. A revision in 2003 to subsequent domestic wood use figures was based on a 50 per cent growth rate in sales/installations of wood-burning stoves for each 2-3 year period since 2000, supported with anecdotal information from the sources listed below:

- HETAS, the official body recognised by Government to approve solid fuel domestic heating appliances, fuels and services;
- the National Association of Chimney Sweeps; and
- Discussions with a risk assessor acting on behalf of insurance companies.

6.102 Estimates from 2003 to 2013 were based on 2002 baseline data that were then extrapolated forward using information from annual discussions with representatives of the associations listed above. The estimates were then peer reviewed by the Forestry Commission prior to publication. Degree-day corrections were added, based on those used for seasonally adjusted and temperature corrected final energy consumption figures for gas, to model increased fuel use during colder weather[9]. These degree-day normalisation factors are based on monthly correction data and are weighted differently to those calculated using annual degree days. A degree day change in winter is likely to result in increased use of fuel for heating whereas this is unlikely in summer. The accuracy of these estimates was, however, dependent on the accuracy of the baseline figures for domestic wood use in 2002.

6.103 In 2014 BEIS commissioned a one-off, large scale, user survey of domestic wood fuel consumption in the UK. The purpose of the survey was to provide a new baseline for domestic wood fuel use in the UK. The survey was part of a weekly face to face omnibus survey and was conducted in England, Wales and Scotland. A separate dedicated survey was commissioned in Northern Ireland. A total of 16,046 households were surveyed, with 1,206 (7.5 per cent) confirmed as wood fuel users,

[9] www.gov.uk/government/uploads/system/uploads/attachment_data/file/295406/et1_3.xls

which is lower than the recent estimate of 12 per cent from the smaller scale Forestry Commission Public Opinion of Forestry 2013 survey. Information was collected on number, type and frequency of use of domestic wood fuel appliances and on types and quantities of wood fuels purchased over the previous year.

6.104 Wood fuel use was estimated by two independent methods. Firstly the appliance data was used to estimate total hours of operation in the year and wood fuel use was then calculated using standard data for appliance wood fuel use per hour. Secondly, the total wood fuel use was calculated from respondent estimates of quantities of wood fuel they had purchased in the past year.

6.105 There are uncertainties associated with each method. The appliance method is indirect in that respondents had to estimate how many hours per week they operated their appliances in winter and summer, and a standard factor for wood use per hour for each appliance type was required. For the second method respondents had to estimate the amount of wood fuel that was delivered in the past year, which many found challenging. It was also assumed that the wood used equalled the delivered wood.

6.106 Although both methodologies confirmed the anecdotal evidence that domestic wood fuel use has been consistently underestimated, the two estimates differed by a factor of almost two, with the estimate from wood fuel purchased being higher. This can be partially explained by timing issues; wood is purchased in anticipation of a heating season and if winter proves warmer than expected, then not all wood purchased would necessarily be burned. Average heating degree days[10] for 2014 were 21 per cent lower than in 2013, and 19 per cent lower than the long term mean (1981 to 2010). This compares to questions relating to appliance usage where the responses relate directly to the period being considered.

6.107 The lower estimate of 1,554 ktoe has been used in the current statistics as feedback from the survey confirmed that providing an accurate response to the appliance usage approach proved to be considerably less challenging than estimating actual wood fuel use. In addition, previous surveys have also indicated that the appliance method is more reliable because it is notoriously difficult to obtain reliable estimates from the general public for energy derived from burning wood which can vary depending on the species, quantity and moisture content of the wood. The survey data were further analysed this year and a special feature article was published in the March 2016 edition of Energy Trends[11] , but the new baseline figure has remained unchanged for the 2015 statistics as the more detailed analysis of the higher estimate has proved to be more time consuming that first envisaged and is still ongoing.

6.108 This new baseline was used with an uplift based on industry sales figures, and applying a weather correction methodology. In addition, this year the model has been modified to allow for a replacement rate for existing installation of 2 per cent based on the views of the Renewable Energy Association and Delta EE. Calorific values were also revised upwards following research into current typical values.

(d) Non-domestic wood combustion

6.109 In 1997, the industrial wood figure (which includes sawmill residues, furniture manufacturing waste etc.) was included as a separate category for the first time. Surveys in 2000 and 2006 highlighted that the in-house use of wood wastes had declined due to the imposition of more stringent emissions controls. Since these surveys, there has been increased interest in the use of wood, usually from forestry and woodland management but also in-house and recycled by-products. Typically these are being used for space heating and hot water in commercial and public sector properties such as hotels, schools, hospitals, nursing homes, poultry farms, horticulture, and government buildings. This has been almost exclusively in response to incentives, most notably the Renewable Heat Incentive which has supported some 5,031 GWh of heat from biomass, mostly wood, to December 2015 since its inception in November 2011. This is equivalent to some 1,184 thousand tonnes of commercial wood pellets.

[11] www.gov.uk/government/publications/energy-trends-march-2016-special-feature-article-summary-results-of-the-domestic-wood-use-survey

(e) Energy crops and forestry residues

6.110 Miscanthus and Short Rotation Coppice (SRC) are grown in the UK as energy crops intended for the heat and electricity energy markets. To date they have been burnt in power stations, CHP units and heating systems. Official area estimates of Miscanthus and SRC grown in England are available from 2008 in the Defra June survey of Agricultural statistics, and have been summarised by Defra[12]. These show that only small areas of these crops are currently planted in England, with estimates of about 7,000ha of Miscanthus and 2,900ha of SRC in 2014. Based on Renewables Obligation sustainability reporting data, Defra estimate that about 22,000 tonnes of UK Miscanthus and 6,700 tonnes of UK SRC was used in UK power stations in 2013/14. Data for 2015 are not yet available but are unlikely to be too dissimilar.

(f) Straw combustion

6.111 Straw can be burnt in high temperature boilers, designed for the efficient and controlled combustion of solid fuels and biomass to supply heat, hot water and hot air systems. There are large numbers of these small-scale batch-fed whole bale boilers.

6.112 Historically, the figures used were estimates based partly on 1990 information and partly on a survey of straw-fired boilers carried out in 1993-94 but these were always considered to be a particularly weak estimate. A BEIS/Defra initiative to investigate opportunities to improve these data resulted in questions on the end use of straw being introduced to the Cereal and Oilseed Production survey in 2014[13]. The total straw used for energy in 2014 was estimated to be 551.2 ktoe. Excluding straw that was used for co-firing and in dedicated straw power stations, this leaves a remainder of 206.5 kt (77.8 ktoe) assumed to have been used for heat production in 2014, not dissimilar to 200 ktoe (75.3 ktoe) reported in previous editions of the Digest. As no time series data are available to amend historic time series data or estimate growth rates, a linear growth rate has been assumed to back-correct to 2008. The same value for 2014 has been used for 2015 data.

6.113 A 40 MW straw-fired power station near Ely, Cambridgeshire and the 45MW Sleaford straw-fired power station are currently the only electricity generation schemes in operation.

(g) Waste combustion

6.114 Domestic, industrial and commercial wastes represent a significant resource for materials and energy recovery. Unprocessed wastes may be combusted in purpose built incinerators or the waste can be processed into a range of refuse derived fuels (RDF) for both on-site and off-site use. RDF can be partially processed to produce coarse RDF that can then be burnt in a variety of ways. By further processing the refuse, including separating off the fuel fraction, compacting, drying and densifying, it is possible to produce an RDF pellet. This pellet has around 60 per cent of the gross calorific value of British coal. Only the biodegradable portion of waste is counted in renewables statistics although non-biodegradable wastes are included in this chapter as "below the line" items. The paragraphs below describe various categories of waste combustion in greater detail.

6.115 **Municipal solid waste (MSW) combustion:** MSW comprises domestic waste plus other feedstocks, such as, general industrial waste, building demolition waste and tree clippings from civil amenities. Sample areas for the analysis of household collected waste are selected using ACORN socio-economic profiles (ACORN stands for A Classification Of Residential Neighbourhoods). This is based on the premise that households of similar socio-economic characteristics are likely to have similar behavioural, purchasing and lifestyle characteristics; this will be reflected in the quantity and composition of waste that those households produce. For several years, the analysis calculated that UK domestic waste had a biodegradable content of 67.5 per cent $\pm$ 1 per cent and this accounted for about 62.5 per cent of the energy generated from its combustion but work in 2009 revised this upwards to 63.5 per cent. The success of recycling strategies, however, has gradually changed the composition of waste available for combustion and the biodegradable content is now considered to be about 50 per cent which has been used since the 2014 survey but will continue to be reviewed periodically. As no time series data are available to amend historic time series data, a linear change in composition over this period has been assumed to back-correct to 2009. Information on the direct combustion of unprocessed MSW and the combustion of RDF was provided via a RESTATS questionnaire.

[12] www.gov.uk/government/uploads/system/uploads/attachment_data/file/483812/nonfood-statsnotice2014-10dec15.pdf

[13] www.gov.uk/government/uploads/system/uploads/attachment_data/file/483812/nonfood-statsnotice2014-10dec15.pdf

6.116 **General industrial waste (GIW) combustion:** Certain wastes produced by industry and commerce can be used as a source of energy for industrial processes or space heating. These wastes include general waste from factories such as paper, cardboard, wood and plastics. A survey conducted in 2001 noted that GIW was now burnt in MSW waste-to-energy facilities. As no sites are solely burning GIW for heat or electricity generation, this feedstock is being handled under the MSW category.

6.117 In 2015, 47 energy from waste plants were in operation, burning municipal solid waste (MSW), refuse derived fuel (RDF) and general industrial waste (GIW).

6.118 **Specialised waste combustion:** Specialised wastes arise as a result of a particular activity or process. Materials in this category include scrap tyres, hospital wastes, poultry litter, meal and bone and farm waste digestion.

6.119 **Specialist non-biodegradable waste**. Although the large tyre incineration plant with energy recovery has not generated since 2000, the cement industry has burned some waste tyres in its cement and lime kilns. Although part of waste tyre combustion is of biodegradable waste, because there is no agreed method of calculating the small biodegradable content, all of the generation from waste tyres has been included under non-biodegradable wastes in this chapter.

6.120 **Hospital waste**. Information is based on a RESTATS survey undertaken in 2007, repeated in 2010 and reviewed again in 2013. Additional information on sites that reclaim energy was obtained from the Environment Agency's clinical waste incineration database. The results continue to show an ongoing process of centralisation and consolidation, in response to changes in pollution emissions and clinical waste regulations. Generation is focusing on larger plants and many smaller facilities have closed as they were no longer viable due to the cost of compliance with regulations. One heat producing scheme was found to have closed.

6.121 **Animal biomass**. One poultry litter combustion project started generating electricity in 1992; a second began in 1993. Both of these are NFFO projects. In addition, a small-scale CHP scheme began generating towards the end of 1990. However, this has now closed due to new emissions regulations. A further NFFO scheme started generating in 1998, and during 2000 a SRO scheme began to generate. A further poultry litter scheme became fully operational in 2001. One of the earlier poultry litter projects was modified to be fuelled mainly by meat and bone; two additional schemes fuelled primarily by meat and bone have also been built.

(h) Anaerobic digestion (AD)

6.122 Anaerobic Digestion uses natural bacteria to break down biomass in a sealed tank in the absence of oxygen to produce a methane rich biogas. The biomass fuel includes wet wastes such as animal manures and slurries, crop residues and food waste and/ or purpose grown crops such as maize. The biogas can be used for process heat, or for heat and electricity generation using a combined heat and power unit. Alternatively, the biogas can be upgraded to biomethane for use in transport applications or injection into the gas grid. The leftover indigestible material is called digestate; this is rich in nutrients and can be used as a fertiliser. Digestate can be used whole and spread on land. Alternatively, it can be separated into liquor and fibres. Separated fibre can be used fresh as a soil conditioner or, after further aerobic composting to stabilise it, the material is suitable for making into a compost product.

6.123 Information on operational AD sites in the UK was obtained from a number of sources including; the CHPSTATS database, information from previous AD surveys conducted for RESTATS, the AD portal run by the National Non-Food Crops Centre (NNFCC), the Renewable Energy Association (REA), the Renewable Energy Planning Database, Waste & Resources Action Programme (WRAP), ROC, FiT and RHI returns and Ricardo Energy & Environment internal information. Electricity and heat production was estimated using survey information, where available, or information from ROC, FiT and RHI if no survey information existed. Where neither of these sources was available, the energy production was calculated from the capacity using an estimated load factor. The load factor was based on ROC data from operating schemes and date of commissioning where applicable for electricity schemes, and on historic load factors for heat only schemes. Of the 351 electricity-generating AD plants operating at the end of 2015, 67 (72.1 MW) qualified as CHP plant

under CHPSTATS. An additional 20 were heat only and 23 were producing bio-methane for grid injection. The majority of the heat-only schemes were small on-farm installations.

(i) Co-firing of biomass with fossil fuels

6.124 Compared with some other renewables, co-firing has a relatively low capital cost and is quick to implement. Biomass fuel is usually fed into a conventional power station boiler by means of the existing firing mechanism as a partial substitute for fossil fuel. The pulverised fuel preparation, transport and combustion system of a modern power plant may cope with approximately 5 - 10 per cent substitution without any major mechanical changes. The boiler design and airflows however may permit much higher percentages if the burner systems are modified. Specially designed burners have been introduced on some installations in the UK.

(j) Biodiesel and bioethanol (Liquid Biofuels for Transport)

6.125 In the UK biodiesel is defined for taxation purposes as diesel quality liquid fuel produced from biomass or waste vegetable and animal oils and fats, the ester content of which is not less than 96.5 per cent by weight and the sulphur content of which does not exceed 0.005 per cent by weight or is nil. Bioethanol is defined for taxation purposes as a liquid fuel consisting of ethanol produced from biomass and capable of being used for the same purposes as light oil. For further information, see HMRC Notice 179E: Biofuels and other fuel substitutes, available at:
www.gov.uk/government/publications/excise-notice-179e-biofuels-and-other-fuel-substitutes/excise-notice-179e-biofuels-and-other-fuel-substitutes

6.126 Diesel fuel currently sold at retail outlets in the UK can contain up to 7 per cent biodiesel. Petrol currently sold in at retail outlets in the UK can contain up to 5% bioethanol. Since March 2013 a revised petrol standard (EN228) allows retailers to sell petrol containing up to 10% ethanol by volume (E10), if appropriately labelled[14]. Quantities of biodiesel and bioethanol consumed in the UK in Calendar Year 2015 are based on information available from RTFO statistics[15] reports, specifically Y7 report 6 and Y8 report 3.

Combined Heat and Power (CHP)

6.127 A CHP plant is an installation where useful heat and power (usually electricity) are supplied from a single generation process. Some CHP installations are fuelled either wholly or partially by renewable fuels. The main renewable fuel currently used in CHP is sewage gas, closely followed by other biomass.

6.128 Chapter 7 of this Digest summarises information on the contribution made by CHP to the UK's energy requirements in 2010 to 2015 using the results of annual studies undertaken to identify all CHP schemes (CHPSTATS). Included in Tables 7.1 to 7.9 of that chapter is information on the contribution of renewable sources to CHP generation in each year from 2010 to 2015. Corresponding data for 1996 to 2008 are available on the BEIS section of the gov.uk website. The information contained in those tables is therefore a subset of the data contained within the tables presented in this chapter. There are occasionally differences in the numbers reported by CHPSTATS compared with RESTATS that are primarily attributed to whether the electricity is considered to come from 'good quality' CHP (further details on 'good quality' CHP are provided in Chapter 7). In addition, there are oddities with some CHP facilities where both biomass and fossil fuels are burnt (though not always as co-firing). The total installed capacity recorded for the site under CHPSTATS can cover multiple generators, some of which only handle fossil fuels (e.g. gas turbines). As it would be misleading to record the entire capacity reported in RESTATS as being potentially available for renewables generation, only the appropriate capacity figures are recorded.

Generating capacity and load factor

6.129 The electrical capacities are given in Table 6.4 as installed capacities i.e. the maximum continuous rating of the generating sets in the stations. In Chapter 5 Declared Net Capacity (DNC) is used, i.e. the maximum continuous rating of the generating sets in the stations, less the power consumed by the plant itself, and reduced by a specified factor to take into account the intermittent nature of the energy source e.g. 0.43 for wind, 0.365 for small hydro, 0.33 for shoreline wave, and

[14] www.gov.uk/government/uploads/system/uploads/attachment_data/file/232126/petrol-protection-extention-ia.pdf
[15] www.gov.uk/government/collections/biofuels-statistics

0.17 for solar photovoltaics. DNC represents the nominal maximum capability of a generating set to supply electricity to consumers. For electrical capacities of generation using renewables in DNC terms see Table 6.1.1 on the BEIS section of the gov.uk website.

6.130 Plant load factors shown in Table 6.5 have been calculated in terms of installed capacity (i.e. the maximum continuous rating of the generating sets in the stations) and express the average hourly quantity of electricity generated as a percentage of the average of the capacities at the beginning and end of the year. Additionally, the unchanged configuration load factor has now been used for a number of years, which calculates the amount of electricity generated from wind farms compared with the amount that such turbines would have generated had they been available for the whole of the calendar year and running continually and at maximum output throughout the calendar year.

6.131 It is recognised that one of the shortcomings of the data contained in the Digest (end of calendar year) is that finalised ROCs data are often not available for several months following the compilation process for the Digest. In particular this can have an impact on the schemes included in the unchanged configuration definition as new data could include or remove particular schemes. This should be kept in mind if users wish to reanalyse these results.

Contacts: *Liz Waters*
BEIS Energy Statistics Team
elizabeth.waters@decc.gsi.gov.uk
0300 068 5735

James Hemingway
BEIS Energy Statistics Team
james.hemingway@decc.gsi.gov.uk
0300 068 5042

6.1 Commodity balances 2015

Renewables and waste

Thousand tonnes of oil equivalent

	Wood waste	Wood	Poultry litter, meat and bone, and farm waste	Straw, SRC, and other plant-based biomass (4)	Sewage gas	Landfill gas
Supply						
Production	814	2,009	830	1,446	364	1,612
Other sources	-	-	-	-	-	-
Imports	50	35	-	2,836	-	-
Exports	-73	-138	-	-37	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-	-	-	-
Total supply (2)	**791**	**1,906**	**830**	**4,245**	**364**	**1,612**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**791**	**1,906**	**830**	**4,245**	**364**	**1,612**
Transformation	**-**	**-**	**704**	**3,892**	**291**	**1,598**
Electricity generation	-	-	704	3,885	291	1,598
Major power producers	-	-	209	3,381	-	-
Autogenerators	-	-	495	505	291	1,598
Heat generation	-	-	-	7	-	-
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	-	-	-	-7	-	-
Other	-	-	-	-	-	-
Losses	**-**	**-**	**-**	**-**	**-**	**-**
Final consumption	**791**	**1,906**	**126**	**352**	**73**	**14**
Industry	**791**	**-**	**31**	**138**	**-**	**14**
Unclassified	791	-	31	138	-	14
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	-	-	-	-
Other industries	-	-	-	-	-	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**-**	**1,906**	**95**	**214**	**73**	**-**
Domestic	-	1,906	-	-	-	-
Public administration	-	-	-	-	73	-
Commercial	-	-	-	-	-	-
Agriculture	-	-	95	214	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use						

(1) Stock fall (+), stock rise (-).
(2) Including non-biodegradable wastes, which accounted for 1,147 ktoe.
(3) Total supply minus total demand.
(4) SRC is short rotation coppice.
(5) Municipal solid waste, general industrial waste and hospital waste.
(6) The amount of marine energy included is 0.2 ktoe.

6.1 Commodity balances 2015 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(5)* and tyres	Geothermal, active solar heat and PV	Heat pumps	Hydro	Wind and marine energy *(6)*	Liquid biofuels	Total renewables	
							Supply
2,243	702	168	541	3,466	325	14,519	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	796	3,717	Imports
-	-	-	-	-	-117	-366	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-	Transfers
2,243	**702**	**168**	**541**	**3,466**	**1,003**	**17,870**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
2,243	**702**	**168**	**541**	**3,466**	**1,003**	**17,870**	**Total demand**
2,041	**650**	**-**	**541**	**3,466**	**-**	**13,183**	**Transformation**
1,971	650	-	541	3,466	-	13,106	Electricity generation
471	121	-	422	2,860	-	7,463	Major power producers
1,500	529	-	119	607	-	5,644	Autogenerators
69	-	-	-	-	-	76	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
-2	-	-	-	-	-	-	Pumped storage
-	-	-	-	-	-	-	Other
-	-	-	-	-	-	-	**Losses**
202	**52**	**168**	**-**	**-**	**1,003**	**4,688**	**Final consumption**
126	**-**	**3**	**-**	**-**	**-**	**1,102**	**Industry**
126	-	3	-	-	-	1,102	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	-	Mineral products
-	-	-	-	-	-	-	Chemicals
-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	-	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	-	Paper, printing, etc
-	-	-	-	-	-	-	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**1,003**	**1,003**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	1,003	1,003	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
76	**52**	**166**	**-**	**-**	**-**	**2,582**	**Other**
18	51	113	-	-	-	2,088	Domestic
47	0	-	-	-	-	121	Public administration
10	0	53	-	-	-	64	Commercial
-	-	-	-	-	-	310	Agriculture
-	-	-	-	-	-	-	Miscellaneous

6.2 Commodity balances 2014

Renewables and waste

Thousand tonnes of oil equivalent

	Wood waste	Wood	Poultry litter, meat and bone, and farm waste	Straw, SRC, and other plant-based biomass (4)	Sewage gas	Landfill gas
Supply						
Production	556r	1,767r	636r	1,171r	345	1,668
Other sources	-	-	-	-	-	-
Imports	24	14	-	2,190r	-	-
Exports	-79	-83	-	-44	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-	-	-	-
Total supply (2)	**501r**	**1,698r**	**636r**	**3,317r**	**345**	**1,668**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**501r**	**1,698r**	**636r**	**3,317r**	**345**	**1,668**
Transformation	**-**	**-**	**559r**	**2,944**	**277**	**1,655**
Electricity generation	-	-	559r	2,938	277	1,655
Major power producers	-	-	195	2,583	-	-
Autogenerators	-	-	364r	355	277	1,655
Heat generation	-	-	-	6	-	-
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	**501r**	**1,698r**	**77r**	**373r**	**68**	**14**
Industry	**501r**	**-**	**35**	**127**	**-**	**14**
Unclassified	501r	-	35	127	-	14
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	-	-	-	-
Other industries	-	-	-	-	-	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**-**	**1,698r**	**43**	**246r**	**68**	**-**
Domestic	-	1,698r	-	-	-	-
Public administration	-	-	-	-	68	-
Commercial	-	-	-	-	-	-
Agriculture	-	-	43	246r	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).
(2) Including non-biodegradable wastes, which accounted for 856 ktoe.
(3) Total supply minus total demand.
(4) SRC is short rotation coppice.
(5) Municipal solid waste, general industrial waste and hospital waste.
(6) The amount of marine energy included is 0.2 ktoe.

6.2 Commodity balances 2014 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(5)* and tyres	Geothermal, active solar heat and PV	Heat pumps	Hydro	Wind and marine energy *(6)*	Liquid biofuels	Total renewables	
							Supply
1,622r	398r	108	507r	2,749r	423	11,950r	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	975	3,203r	Imports
-	-	-	-	-	-155	-361	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-	Transfers
1,622r	**398r**	**108**	**507r**	**2,749r**	**1,243**	**14,792r**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
1,622r	**398r**	**108**	**507r**	**2,749r**	**1,243**	**14,792r**	**Total demand**
1,441r	**347r**	**-**	**507r**	**2,749r**	**-**	**10,480r**	**Transformation**
1,386r	347r	-	507r	2,749r	-	10,418r	Electricity generation
379	-	-	398	2,301	-	5,856	Major power producers
1,007r	347r	-	108	448r	-	4,562r	Autogenerators
55r	-	-	-	-	-	62r	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**
181r	**50r**	**108**	**-**	**-**	**1,243**	**4,312r**	**Final consumption**
97r	**-**	**2**	**-**	**-**	**-**	**776r**	**Industry**
97r	-	2	-	-	-	776r	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	-	Mineral products
-	-	-	-	-	-	-	Chemicals
-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	-	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	-	Paper, printing, etc
-	-	-	-	-	-	-	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**1,243**	**1,243**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	1,243	1,243	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
84r	**50r**	**105**	**-**	**-**	**-**	**2,294r**	**Other**
21	50r	61	-	-	-	1,829r	Domestic
51r	0	-	-	-	-	120r	Public administration
12	0	45	-	-	-	57	Commercial
-	-	-	-	-	-	289r	Agriculture
-	-	-	-	-	-	-	Miscellaneous
-	**-**	**-**	**-**	**-**	**-**	**-**	**Non energy use**

6.3 Commodity balances 2013

Renewables and waste

Thousand tonnes of oil equivalent

	Wood waste	Wood	Poultry litter, meat and bone, and farm waste	Straw, SRC, and other plant-based biomass (4)	Sewage gas	Landfill gas
Supply						
Production	399r	1,890r	512r	879r	318	1,706
Other sources	-	-	-	-	-	-
Imports	32	5	-	1,576r	-	-
Exports	-56	-104	-	-46	-	-
Marine bunkers	-	-	-	-	-	-
Stock change *(1)*	-	-	-	-	-	-
Transfers	-	-	-	-	-	-
Total supply (2)	**374r**	**1,790r**	**512r**	**2,409r**	**318**	**1,706**
Statistical difference *(3)*	-	-	-	-	-	-
Total demand	**374r**	**1,790r**	**512r**	**2,409r**	**318**	**1,706**
Transformation	**1**	**-**	**465r**	**2,070**	**250**	**1,692**
Electricity generation	-	-	465r	2,063	250	1,692
Major power producers	-	-	199	1,819	-	-
Autogenerators	-	-	265r	244	250	1,692
Heat generation	1	-	-	8	-	-
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	**374r**	**1,790r**	**48**	**338r**	**68**	**14**
Industry	**374r**	**-**	**29**	**127**	**-**	**14**
Unclassified	374r	-	29	127	-	14
Iron and steel	-	-	-	-	-	-
Non-ferrous metals	-	-	-	-	-	-
Mineral products	-	-	-	-	-	-
Chemicals	-	-	-	-	-	-
Mechanical engineering, etc	-	-	-	-	-	-
Electrical engineering, etc	-	-	-	-	-	-
Vehicles	-	-	-	-	-	-
Food, beverages, etc	-	-	-	-	-	-
Textiles, leather, etc	-	-	-	-	-	-
Paper, printing, etc	-	-	-	-	-	-
Other industries	-	-	-	-	-	-
Construction	-	-	-	-	-	-
Transport	**-**	**-**	**-**	**-**	**-**	**-**
Air	-	-	-	-	-	-
Rail	-	-	-	-	-	-
Road	-	-	-	-	-	-
National navigation	-	-	-	-	-	-
Pipelines	-	-	-	-	-	-
Other	**-**	**1,790r**	**19**	**211r**	**68**	**-**
Domestic	-	1,790r	-	-	-	-
Public administration	-	-	-	-	68	-
Commercial	-	-	-	-	-	-
Agriculture	-	-	19	211r	-	-
Miscellaneous	-	-	-	-	-	-
Non energy use	**-**	**-**	**-**	**-**	**-**	**-**

(1) Stock fall (+), stock rise (-).
(2) Including non-biodegradable wastes, which accounted for 668 ktoe.
(3) Total supply minus total demand.
(4) SRC is short rotation coppice.
(5) Municipal solid waste, general industrial waste and hospital waste.
(6) The amount of marine energy included is 0.5 ktoe.

6.3 Commodity balances 2013 (continued)

Renewables and waste

Thousand tonnes of oil equivalent

Waste *(5)* **and tyres**	**Geothermal, active solar heat and PV**	**Heat pumps**	**Hydro**	**Wind and marine** *energy (6)*	**Liquid biofuels**	**Total renewables**	
							Supply
1,283r	221r	88	404	2,442r	542r	10,684r	Production
-	-	-	-	-	-	-	Other sources
-	-	-	-	-	591r	2,203r	Imports
-	-	-	-	-	-41	-247	Exports
-	-	-	-	-	-	-	Marine bunkers
-	-	-	-	-	-	-	Stock change *(1)*
-	-	-	-	-	-	-	Transfers
1,283r	**221r**	**88**	**404**	**2,442r**	**1,092**	**12,640r**	**Total supply** *(2)*
-	-	-	-	-	-	-	**Statistical difference** *(3)*
1,283r	**221r**	**88**	**404**	**2,442r**	**1,092**	**12,640r**	**Total demand**
1,099r	**173r**	**-**	**404**	**2,442r**	**-**	**8,596r**	**Transformation**
1,078	173r	-	404	2,442r	-	8,566r	Electricity generation
385	-	-	310	2,060	-	4,774	Major power producers
693	173r	-	94	382r	-	3,793r	Autogenerators
21r	-	-	-	-	-	30r	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**
184r	**49r**	**88**	**-**	**-**	**1,092**	**4,044r**	**Final consumption**
90r	**-**	**2**	**-**	**-**	**-**	**636r**	**Industry**
90r	-	2	-	-	-	636r	Unclassified
-	-	-	-	-	-	-	Iron and steel
-	-	-	-	-	-	-	Non-ferrous metals
-	-	-	-	-	-	-	Mineral products
-	-	-	-	-	-	-	Chemicals
-	-	-	-	-	-	-	Mechanical engineering, etc
-	-	-	-	-	-	-	Electrical engineering, etc
-	-	-	-	-	-	-	Vehicles
-	-	-	-	-	-	-	Food, beverages, etc
-	-	-	-	-	-	-	Textiles, leather, etc
-	-	-	-	-	-	-	Paper, printing, etc
-	-	-	-	-	-	-	Other industries
-	-	-	-	-	-	-	Construction
-	-	-	-	-	**1,092**	**1,092**	**Transport**
-	-	-	-	-	-	-	Air
-	-	-	-	-	-	-	Rail
-	-	-	-	-	1,092	1,092	Road
-	-	-	-	-	-	-	National navigation
-	-	-	-	-	-	-	Pipelines
93r	**49r**	**86**	**-**	**-**	**-**	**2,317r**	**Other**
22	48r	49	-	-	-	1,909r	Domestic
55r	0	-	-	-	-	124r	Public administration
16	0	37	-	-	-	53	Commercial
-	-	-	-	-	-	230r	Agriculture
-	-	-	-	-	-	-	Miscellaneous
-	**-**	**-**	**-**	**-**	**-**	**-**	**Non energy use**

6.4 Capacity of, and electricity generated from, renewable sources

	2011	2012	2013	2014	2015
Installed Capacity (MW) *(1)*					
Wind:					
Onshore	4,629	5,904	7,516r	8,536r	9,188
Offshore	1,838	2,995	3,696	4,501	5,103
Marine energy (wave and tidal stream)	3	7	7	9	9
Solar photovoltaics	995	1,756	2,873r	5,424r	9,187
Hydro:					
Small scale	202	218	232r	252r	282
Large scale *(2)*	1,477	1,477	1,477	1,477	1,477
Bioenergy:					
Landfill gas	1,052	1,037	1,046r	1,058r	1,061
Sewage sludge digestion	198	204	199r	215r	216
Energy from waste *(3)*	505	517	545r	681r	925
Animal Biomass (non-AD) *(4)*	111	111	111	111	111
Anaerobic digestion	71	119	163r	238r	286
Plant Biomass *(5)*	1,149	1,171	1,955	2,245r	2,619
Total bioenergy and wastes	3,085	3,159	4,019r	4,548r	5,219
Total	12,230	15,515	19,820r	24,747r	30,465
Co-firing (6)	338	204	35	16	21
Generation (GWh)					
Wind:					
Onshore *(7)*	10,503	12,232	16,924r	18,562r	22,887
Offshore	5,149	7,603	11,472	13,404	17,423
Marine energy (wave and tidal stream) *(8)*	1	4	6	2	2
Solar photovoltaics	244	1,352	2,008r	4,040r	7,561
Hydro:					
Small scale *(7)*	691	654	678r	839r	975
Large scale *(2)*	4,989	4,631	4,026	5,053	5,314
Bioenergy:					
Landfill gas	5,085	5,145	5,160	5,045	4,872
Sewage sludge digestion	764	719	761	846	888
Biodegradable energy from waste *(9)*	1,503	1,774	1,649	1,923r	2,782
Co-firing with fossil fuels	2,964	1,783	309	133	183
Animal Biomass *(4)*	615	643	628	614	648
Anaerobic digestion	273	501	726r	1,019r	1,429
Plant Biomass *(5)*	1,749	4,083	8,929	13,105	18,587
Total bioenergy	12,953	14,648	18,163r	22,684r	29,388
Total generation	34,529	41,124	53,278r	64,584r	83,550
Non-biodegradable wastes *(10)*	1,085	1,429	1,481	1,923r	2,784
Total generation from sources eligible for the Renewable Obligation *(11)*	28,919	33,406	44,958r	53,157r	67,813

(1) Capacity on a DNC basis is shown in Long Term Trends Table 6.1.1 available on the DECC web site - see paragraph 6.5.
(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 6.58 for definition and coverage.

6.5 Load factors for renewable electricity generation

Per cent

	2011	2012	2013	2014	2015
Load factors - based on average beginning and end of year capacity (1)					
Wind	30.1	29.4	32.2	30.1	33.7
Onshore wind	27.6	26.4	28.8	26.4	29.5
Offshore wind	37.0	35.8	39.1	37.3	41.4
Marine energy (wave and tidal stream)	3.8	8.3	9.6	3.2	2.6
Solar photovoltaics	5.1	11.2	9.9	11.1	11.8
Hydro	39.0	35.7	31.6	39.1	41.2
Hydro (small scale)	40.9	35.5	34.4	39.6	41.7
Hydro (large scale)	38.8	35.7	31.1	39.1	41.1
Bioenergy (excludes cofiring and non-biodegradable wastes)	44.1	46.9	56.8	60.1	68.3
Landfill gas	56.3	56.1	56.6	54.8	52.5
Sewage sludge digestion	44.6	40.7	43.1	46.6	46.9
Energy from waste (3)	36.9	39.5	35.4	35.8	39.6
Animal Biomass (4)	63.5	66.2	64.9	63.4	66.9
Anaerobic Digestion	61.6	60.3	59.0	58.0	62.2
Plant Biomass (5)	27.3	40.1	65.2	71.2	87.2
All renewable technologies (excluding cofiring and non-biodegradable wastes)	33.6	32.3	34.2	33.0	34.5
Load factors - for schemes operating on an unchanged configuration basis (2)					
Wind	29.4	28.1	31.0	30.2	33.3
Onshore wind	27.2	25.6	27.9	26.4	29.4
Offshore wind	35.1	34.1	37.6	37.8	39.7
Solar photovoltaics				11.3	11.2
Hydro	41.5	35.3	31.5	38.8	39.5
Hydro (small scale)	43.2	36.7	35.2	39.6	41.8
Hydro (large scale)	41.4	35.1	31.2	38.8	39.2
Bioenergy (excludes cofiring and non-biodegradable wastes)	60.9	63.5	59.9	65.1	67.7
Landfill gas	59.4	58.8	56.9	55.1	52.6
Sewage sludge digestion	53.5	48.0	49.7	47.9	48.2
Energy from waste (3)	36.5	40.1	35.1	35.1	36.8
Animal Biomass (4)	69.0	66.2	70.4	63.4	66.9
Anaerobic Digestion	57.6	60.6	60.7	58.3	57.6
Plant Biomass (5)	60.9	67.2	61.6	70.5	74.3
All renewable technologies (excluding cofiring and non-biodegradable wastes)	37.2	36.2	35.5	38.1	38.2

(1) See paragraph 6.24 for details of the calculation.

(2) See paragraph 6.28 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

	2011	2012	2013	2014	2015
Used to generate electricity *(3)*					
Wind:					
Onshore	903.1	1,051.8	1,455.2r	1,596.0r	1,967.9
Offshore	442.7	653.8	986.4	1,152.6	1,498.1
Marine energy (wave and tidal stream) (4)	0.1	0.3	0.5	0.2	0.2
Solar photovoltaics	20.9	116.3	172.7r	347.4r	650.1
Hydro:					
Small scale	59.4	56.2	58.3r	72.2r	83.8
Large scale *(5)*	429.0	398.2	346.2	434.5	456.9
Bioenergy:					
Landfill gas	1,667.9	1,687.6	1,692.4	1,654.6	1,598.0
Sewage sludge digestion	250.4	235.9	249.6	277.4	291.1
Biodegradable energy from waste	567.4	638.5	564.7	689.9r	982.4
Co-firing with fossil fuels	763.5	400.5	53.7	25.1	37.8
Animal Biomass *(6)*	224.0	225.0	226.4	224.8	235.3
Anaerobic digestion	89.4	164.3	238.2r	334.1r	468.6
Plant Biomass *(7)*	553.7	1,062.3	2,009.1	2,912.9	3,847.6
Total bioenergy	4,116.4	4,414.1	5,034.1r	6,118.9r	7,460.7
Total	5,971.7	6,690.6	8,053.4r	9,721.8r	12,117.8
Non-biodegradable wastes *(8)*	415.5	520.3	513.1	696.2r	988.7
Used to generate heat					
Active solar heating	44.4	47.8	47.9r	49.6r	50.7
Bioenergy:					
Landfill gas	13.6	13.6	13.6	13.6	13.6
Sewage sludge digestion	64.3	63.7	68.3	67.7	73.1
Wood combustion - domestic	1,096.7	1,392.3	1,790.3r	1,698.1r	1,906.2
Wood combustion - industrial	281.9	289.5	374.2r	501.4r	790.8
Animal Biomass *(9)*	35.8	31.5	29.1	34.5	30.7
Anaerobic digestion	9.7	14.5	18.5r	42.9r	95.5
Plant Biomass *(10)*	289.6	276.6	346.0r	379.0r	359.4
Biodegradable energy from waste *(6)*	33.1	29.8	30.1	23.3	45.7
Total bioenergy	1,824.6	2,111.5	2,670.1r	2,760.6r	3,315.0
Deep geothermal	0.8	0.8	0.8	0.8	0.8
Heat Pumps	48.6	68.4	116.5r	142.5r	168.3
Total	1,918.4	2,228.4	2,835.3r	2,953.5r	3,534.8
Non-biodegradable wastes *(8)*	152.6	144.1	155.0	159.3	158.6
Renewable sources used as transport fuels					
as Bioethanol	367.5	436.9	462.2	458.8	449.1
as Biodiesel	760.0	520.9	629.4	783.8	554.1
Total	1,127.5	957.8	1,091.6	1,242.7	1,003.1
Total use of renewable sources and wastes					
Solar heating and photovoltaics	65.3	164.0	220.6r	396.9r	700.8
Onshore wind	903.1	1,051.8	1,455.2r	1,596.0r	1,967.9
Offshore wind	442.7	653.8	986.4	1,152.6	1,498.1
Marine energy (wave and tidal stream)	0.1	0.3	0.5	0.2	0.2
Hydro	488.4	454.4	404.5r	506.7r	540.7
Bioenergy	5,941.1	6,525.6	7,704.2r	8,879.6r	10,775.7
Deep geothermal	0.8	0.8	0.8	0.8	0.8
Heat Pumps	48.6	68.4	116.5r	142.5r	168.3
Transport biofuels	1,127.5	957.8	1,091.6	1,242.7	1,003.1
Total	9,017.6	9,876.9	11,980.3r	13,917.9r	16,655.7
Non-biodegradable wastes *(8)*	568.1	664.4	668.1	855.5r	1,147.3
All renewables and wastes *(11)*	9,585.8	10,541.2	12,648.4r	14,773.4r	17,803.0

(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) 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

	2011	2012	2013	2014	2015
Electricity generation component:					
Normalised hydro generation *(1) (2)*	440	448r	444	447r	457
Normalised wind generation *(3)*	1,217	1,615	2,218r	2,717r	3,234
Electricity generation from renewables other than wind, hydro, and compliant biofuels	1,135	1,376	1,740r	2,298r	3,163
Electricity generation from compliant biofuels	-	-	-	-	1
Total renewable generation from all compliant sources	2,792r	3,438	4,402r	5,463r	6,854
Total Gross Electricity Consumption *(2)*	31,878	32,028	31,806r	30,594r	30,722
Percentage of electricity from renewable sources	8.8%	10.7%	13.8%	17.9%r	22.3%
Heat component:					
Renewable energy for heating and cooling	1,674r	1,925r	2,433r	2,536r	3,037
Total Gross energy consumption for heating and cooling	53,569r	57,988r	59,262r	52,689r	53,867
Percentage of heating and cooling energy from renewable sources	3.1%r	3.3%r	4.1%	4.8%	5.6%
Transport component (excluding air transport):					
Road transport renewable electricity	0	0	1	1	2
Non-road transport renewable electricity	69r	72r	81r	90r	96
Biofuels (restricted to those meeting sustainability criteria from 2011) *(4)*	1,063r	880r	1,048r	1,173r	1,004
Total electricity consumption in transport	366	367	374r	387r	385
Total petrol and diesel consumption in transport	37,217r	37,065r	36,777r	37,251r	37,974
Total transport component numerator (including weighted components) *(5)*	1,133r	1,406r	1,712r	1,948r	1,688
Total transport component denominator (including weighted components) (5)	38,647r	38,782r	38,782r	39,496r	39,949
Percentage of transport energy from renewable sources *(5)*	2.9%r	3.6%r	4.4%	4.9%r	4.2%
Overall directive target:					
Renewables used for:					
Electricity generation	2,722r	3,366r	4,321r	5,372r	6,757
Heating and Cooling	1,674r	1,925r	2,433r	2,536r	3,037
Transport biofuels (restricted to those meeting sustainability criteria from 2011)	1,132r	952r	1,129r	1,264r	1,102
Total Final Consumption of Renewable Energy ["Row A"]	5,529r	6,244r	7,883r	9,172r	10,896
Final Electricity Consumption *(6)*	26,962r	26,973r	26,817r	25,655r	25,647
Transport Final Energy Consumption (including air transport) *(7)*	51,001r	50,297r	50,107r	50,696r	51,394
Heating and Cooling Final Energy Consumption	53,558r	57,976r	59,252r	52,680r	53,857
Total Final Energy Consumption *(8)*	131,522r	135,247r	136,176r	129,031r	130,898
plus Distribution losses for electricity	2,419r	2,485r	2,379r	2,464r	2,361
plus Distribution losses for heat	-	-	-	-	-
plus Consumption of electricity in the electricity and heat generation sectors	1,413	1,545	1,535r	1,417r	1,434
plus Consumption of heat in the electricity and heat generation sectors	-	-	-	-	-
Gross Final Energy Consumption (GFEC)	135,353r	139,277r	140,090r	132,911r	134,692
of which Air transport	12,163r	11,786r	11,813r	11,779r	11,932
Air transport as a proportion of GFEC	8.99%r	8.46%r	8.43%r	8.86%r	8.86%
Air transport cap specificed in Directive	6.18%	6.18%	6.18%	6.18%	6.18%
Capped air transport	8,365r	8,607r	8,658r	8,214r	8,324
Capped Gross Final Energy Consumption (CGFEC) ["Row B"] *(9)*	131,555r	136,098r	136,935r	129,347r	131,084
Headline Directive percentage : Renewable Energy Consumption as a percentage of Capped Gross Final Energy Consumption ["Row A" divided by "Row B"]	4.2%	4.6%r	5.8%r	7.1%r	8.3%

(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 DECC 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 fell by 202 MWe between 2014 and 2015 from 5,894 MWe to 5,692 MWe. (Table 7A)
- The amount of good quality electricity produced in 2015 was 19.9 TWh, which is 1.0 per cent higher than in 2014 (revised). The good quality electricity generated by CHP in 2015 corresponds to 5.9 per cent of all electricity produced in the UK.
- Seventy-one percent of the fuel used in CHP schemes was natural gas. This is 1.4 percentage points higher than in 2014 (revised). The use of renewable fuel fell both in absolute terms and its share of total fuels used. In 2015 renewable fuel constituted 10 per cent of total CHP fuel, compared with 11 per cent in 2014 (revised).
- The Oil and Gas sector has the largest Good Quality CHP capacity (39 per cent), followed by the Chemicals sector (21 per cent) and then the Paper and Food and Drink sectors, which have approximately the same Good Quality CHP capacity installed (8 per cent).
- The CO_2 savings delivered by CHP in 2015 were lower than in 2014. This is due to substantial falls in the provisional values of CO_2 intensity of electricity displaced by CHP generated electricity.

Introduction

7.1 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, or steam turbine) 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.

7.2 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. These gains are reflected in the calculation of CO_2 savings delivered by CHP (see 7.27-7.28). CHP can also provide important network services such as black start[2], improvements to power quality, and some have the ability to operate in island mode if the grid goes down. There are four principal types of CHP system: steam turbine, gas turbine, combined cycle systems and reciprocating engines. Each of these is defined in paragraph 7.35 later in this chapter.

7.3 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

[1] *But not always, see paragraph 7.5. In such cases there is an impact upon the electrical capacity and electrical output classified as CHP.*

[2] *Black start is the capability to operate in island mode if the grid goes down.*

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.

Efficiency of CHP schemes

7.4 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.

UK energy markets, and their effect on CHP

7.5 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 gap (i.e. the difference between the price of electricity and the price of the gas required to generate that electricity). Energy price trends that are applicable to CHP schemes differ depending upon the size and sector of the scheme. Volatility of energy prices continue to have an impact on the viability of CHP. Due to the long term nature of CHP investments long term trends in the spark gap need to be taken into account. The spark gap remains at low levels compared to what it has been historically, although there has been a sustained improvement over the last two years. Longer lived improvements in the spark spread are expected to be necessary to encourage new investment in gas fired CHP.

Use of CHPQA in producing CHP statistics

7.6 The CHPQA programme is the major source for CHP statistics. 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[3], 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 2015 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. Such schemes may not be sized to use all of the available heat. 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, 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 2014 Load Factor (CHPQA) steadily declined, before

3 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

increasing in 2015. This decline was confined to the industrial sectors, and was especially pronounced in the chemical and oil refinery sectors.

Table 7A: A summary of the recent development of CHP[(1)]

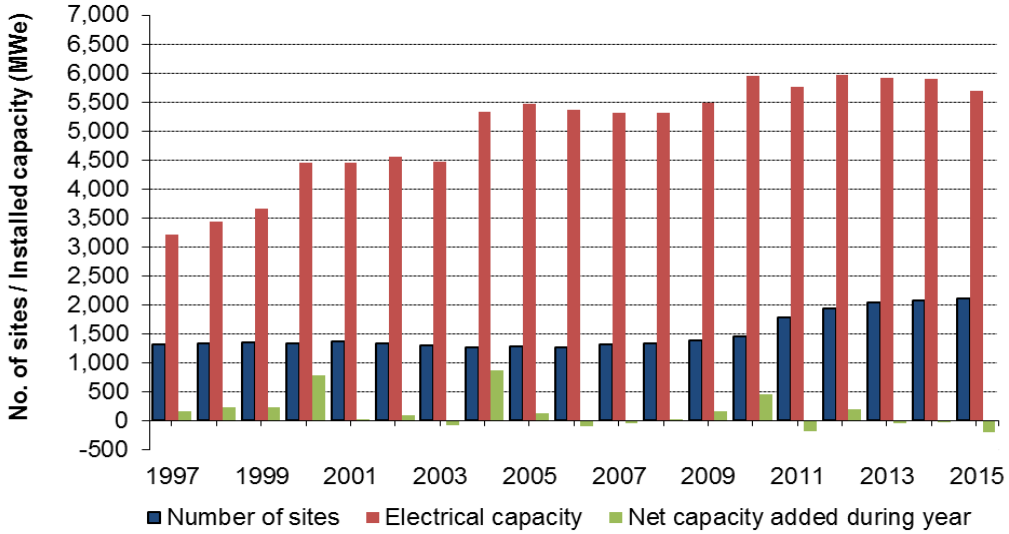
	Unit	2011	2012	2013	2014	2015
Number of schemes		1,789	1,945	2,032	2,081	2,102
Net No. of schemes added during year (2)		334	156	87	49	21
Electrical capacity (CHP_{QPC})	MWe	5,762	5,966	5,925	5,894	5,692
Net capacity added during year		-188	204	-41	-31	-202
Capacity added in percentage terms	Per cent	-3.2	3.5	-0.7	-0.5	-3.4
Heat capacity	MWth	21,744	22,545	22,168	22,230	19,711
Heat to power ratio *(3)*		2.1	2.1	2.3	2.1	2.0
Fuel input *(4)*	GWh	94,486	95,709	88,435	86,217	83,178
Electricity generation (CHP_{QPO})	GWh	22,046	22,228	19,593	19,698	19,900
Heat generation (CHP_{QHO})	GWh	46,635	46,694	44,353	41,962	40,325
Overall efficiency *(5)*	Per cent	73	72	72	72	72
Load factor (CHPQA) *(4)*	Per cent	43.7	42.5	37.7	38.2	39.9
Load factor (Actual) *(6)*	Per cent	58.3	53.2	51.7	52.3	51.3

(1) Data in this table for 2011 and 2014 have been revised since last year's Digest (see text for explanation).
(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) The load factor (CHPQA) is based on the qualifying power generation and capacity and does not correspond exactly to the number of hours run by the prime movers in a year
(5) Overall efficiencies are calculated using gross calorific values. Net efficiencies will be higher.
(6) The load factor (Actual) is based on the total power generated and total capacity

Changes in CHP capacity

7.7 Chart 7.1 shows the change in installed CHP capacity since 1997. **Installed capacity at the end of 2015 stood at 5,692 MWe, a decrease of 202 MWe (3.4 per cent) compared to 2014**. In spite of this capacity decrease, there was a net increase of 21 (1.0 per cent) schemes between 2014 and 2015. Overall, between 2014 and 2015, there were 50 new schemes included in the database and a removal of 29 schemes. There have been revisions to the capacity figures for 2011 to 2014 shown in the previous edition of the Digest, as recent information on the operational status of some schemes has come to light.

Chart 7.1: Operating CHP capacity by year



7.8 Table 7A gives a summary of the overall CHP market. C**HP schemes generated 19,900 GWh in 2015 of Good Quality electricity, just 1.0 per cent higher than in 2014.** This generated electricity represents 5.9 per cent of the total electricity generated in the UK. Good Quality electricity generated in industry was 1.5 per cent higher in 2015 than in 2014.

7.9 Table 7A shows that **in 2015 CHP schemes supplied a total of 40,325 GWh of heat, this was a decrease of 3.9 per cent compared to 2014**. Heat demand at several large schemes fell to a greater extent than qualifying power output. The heat supplied by CHP has been steadily decreasing in recent years. The heat provided by CHP schemes in 2015 was lower in all of the major industrial sectors, with the largest fall being in the paper sector (13 per cent decrease) followed by chemicals (6.4 per cent) and then refineries (2.4 per cent).

7.10 In terms of electrical capacity by size of scheme, schemes larger than 10 MWe represent 77 per cent of the total electrical capacity of CHP schemes as shown in Table 7B. However, schemes less than 1 MWe constitute the majority (82 per cent) in terms of the number of schemes and 5.8 per cent of the capacity. Table 7.5 provides data on electrical capacity for each type of CHP installation.

Table 7B: CHP schemes by capacity size ranges in 2015

Electrical capacity size range	Number of schemes	Share of total (per cent)	Total electricity capacity (MWe)	Share of total (per cent)
Less then100 kWe	608	29	39	0.7
100 kWe - 1 MWe	1,114	53	289	5.1
1 MWe - 2 MWe	140	6.7	203	3.6
2 MWe - 10 MWe	174	8.3	792	14
> 10 MWe +	66	3.1	4,369	77
Total	**2,102**	**100**	**5,692**	**100**

7.11 Table 7.5 shows nearly 64 per cent of total electrical capacity is in combined cycle gas turbine (CCGT) mode, followed by reciprocating engines at 20 per cent. Over the years there has been a gradual decrease in the total capacity taken up by CCGT schemes and a gradual increase in the total capacity taken up by reciprocating engines. This is mirrored in the results for Table 7B where, over the years, there has been a gradual fall in the proportion of capacity >10 MWe and a gradual increase in the proportion of capacity falling under all of the other capacity ranges, where reciprocating engines are deployed.

7.12 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 2015 there were 498 such schemes registered with Ofgem for FiTs with a total installed capacity of 514 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, they would have a negligible impact upon the capacity and generation figures presented in the statistics tables.

7.13 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 can be found in the CHP Methodology Note which is available from the following link:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/65876/57-chp-stats-methodologies.pdf

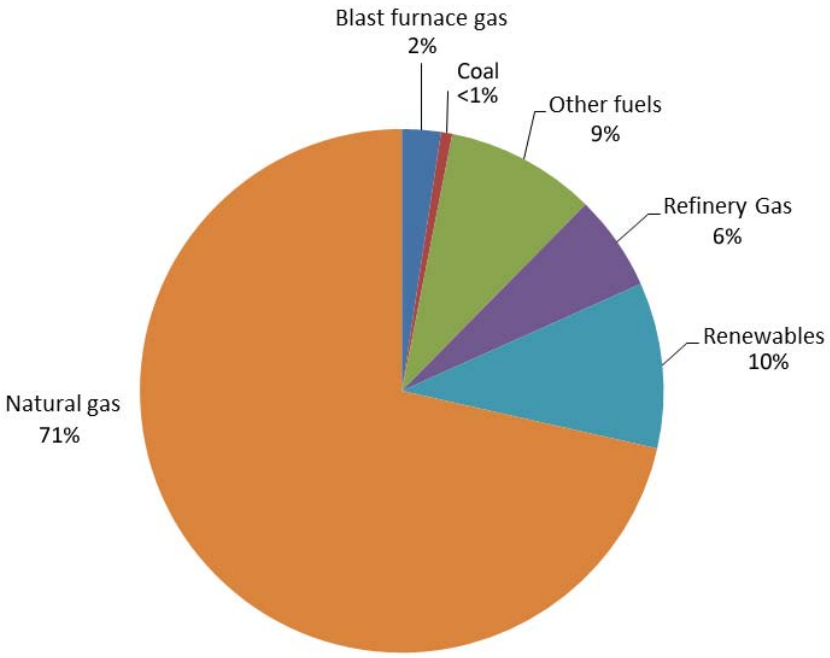
Fuel used by types of CHP installation

7.14 Table 7.2 shows the fuel used to generate electricity and heat in CHP schemes (see paragraphs 7.36 to 7.38, 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 7.35). Total fuel use is summarised in Chart 7.2. **In 2015, 71 per cent of the total fuel use was natural gas**. This is an increase of 1.4 percentage points compared with 2014. CHP schemes accounted for 8.1 per cent of UK gas demand in 2015 (see Table 4.3). The proportion of total fuel consumption that is coal is lower for the period 2011-2014 than in the 2015 edition of The Digest, and is less than 1 per cent for 2015. These revisions are due to more up to date information on the status of one scheme coming to light for this year's edition.

7.15 The proportion of renewable fuels decreased from 11 per cent in 2014 (revised) to 10 per cent in 2015, as shown in Chart 7.2. This was the first decrease in the renewables proportion seen in the statistics and is entirely explained by a fall in the fuel consumed at one scheme that could be considered to be associated with Good Quality outputs, rather than a fall in the absolute quantity of renewable fuel consumed. In fact, the renewable fuel consumed for all outputs (Good Quality and non-Good Quality) was 8 per cent higher in 2015 than in 2014.

7.16 Fuels which are liquids, solids or gases that are by-products or waste products from industrial processes, or are renewable fuels, accounted for 26 per cent of all fuel used in CHP in 2015. These fuels represented 27 per cent of total fuel consumption in 2014 (revised). Between 2014 and 2015 the proportion of total fuel that was by-products or waste products of industrial processes decreased slightly. Some of these by-product fuels are not commonly used by the mainstream electricity generating industry, and some would otherwise be flared or disposed of by some means. These fuels, with the exception of some waste gases, will generally be utilised in steam turbines being fed by boilers. In almost all cases, the technical nature of the combustion process, and the lower fuel quality (lower calorific value of the fuel, high moisture content of the fuel and the need to maintain certain combustion conditions to ensure complete disposal) will generally result in a lower efficiency. However, given that the use of such fuels avoids the use of fossil fuels, and since they need to be disposed of in some way, the use of these fuels in CHP provides environmental benefits.

Chart 7.2: Types of fuel used by CHP schemes in 2015



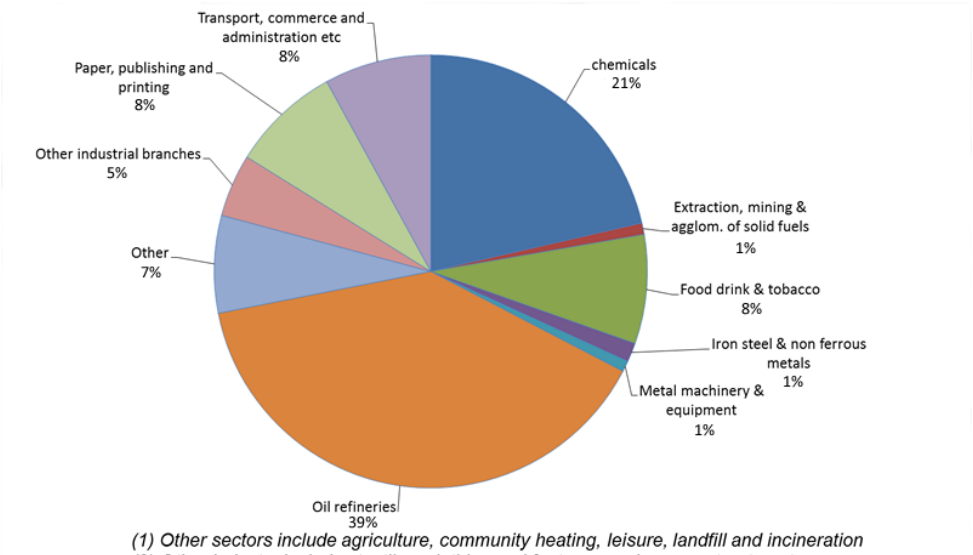
CHP capacity, output and fuel use by sector

7.17 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.

7.18 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 1.59 and Table 1H:

- **383 schemes (85 per cent of electrical capacity) are in the industrial sector** and 1,719 schemes (15 per cent of capacity) are in the agricultural, commercial, public administration, residential and transport sectors.
- Installed Good Quality capacity by sector is shown in Chart 7.3. Four industrial sectors account for 77 per cent of the CHP electrical capacity – oil refineries (39 per cent), chemicals (21 per cent), paper and publishing and printing (8 per cent) and food, beverages and tobacco (8 per cent). Since 2010 there has been a steady decrease in total and Good Quality power generating capacity within the chemicals sector. The capacity attributable to oil refineries fell again between 2014 and 2015, due to the closure of the CHP scheme at one refinery. The increase in capacity in the food, beverages and tobacco, sewage treatment and transport, commerce and administration sectors, seen in previous editions of the Digest, has continued.

Chart 7.3: CHP electrical capacity by sector in 2015



(1) Other sectors include agriculture, community heating, leisure, landfill and incineration
(2) Other industry includes textiles, clothing and footware and sewage treatment

7.19 Table 7C gives a summary of the 1,522 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 (35 per cent), mainly hospitals. About half of all schemes in buildings are in the leisure and hotel sectors, although schemes in these sectors only account for 20 per cent of the capacity in buildings. Table 7.9 gives details of the quantities of fuels used in each sector.

Table 7C: Number and capacity of CHP schemes installed in buildings by sector in 2015

	Number of schemes	Electrical capacity (MWe)	Heat capacity (MWth)
Leisure	485	64	110
Hotels	267	39	64
Health	216	181	1,004
Residential Group Heating	100	51	198
Universities	94	91	478
Offices	39	14	17
Education	58	14	50
Government Estate	31	14	48
Retail	229	47	74
Other *(1)*	3	0.7	1.1
Total	**1,522**	**515**	**2,043**

(1) All schemes under Other are at airports

7.20 District heating and cooling, according to the Energy Performance in Buildings Directive, 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. Observing this definition, research has been undertaken to identify the number, capacity and outputs of CHP schemes serving district heating and cooling. In 2014 there were considered to be 88 CHP schemes serving district heating and cooling, with a Good Quality CHP capacity of 2,076 MWe and with Good Quality power outputs and heat outputs of 5,575 GWh and 11,686 MWh, respectively. CHP serving communal heating and cooling schemes are not included in this figure, where 'communal' is taken to mean serving a number of customers in the same building. These data were gathered as part of a district heating and cooling survey carried out for BEIS. Updated information for 2015 is not yet ready for this edition of the Digest.

CHP performance by main prime mover

7.21 Table 7D gives a summary of the performance of schemes in 2015 by main prime mover type. In 2015 the prime mover type with the highest average operating hours was gas turbines followed by reciprocating engines. Combined cycle schemes have historically had among the highest average operating hours. However, after 2009 this ceased to be the case. After this year the Good Quality combined cycle capacity has produced less Good Quality power, particularly in the chemicals sector. This has a distorting effect on the average operating hours for this technology type in the statistics. The average operating hours of the cohort of combined cycle schemes has declined steadily since 2008.

7.22 In 2015, the average operating hours were 3,496 hours. The average operating hours in 2014 was 3,342 hours (revised), indicating a slight increase in the utilisation of good quality capacity between the two years. The revision to 2014 figures was the result of the submission of data for this year of operation too late to be incorporated in 2015 edition of the Digest. Between 2007 and 2013, the operating hours have declined year on year. Since 2013 there has been a slight increase.

7.23 In 2015, the average electrical efficiency was 24 per cent and the heat efficiency 48 per cent, giving an overall average of 72 per cent, which is the same as the revised figure for 2014. Overall efficiency is simply the sum of the individual electrical and heat efficiencies.

Table 7D: A summary of scheme performance in 2015

	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	2,759	10	77	87	7.9
Pass out condensing steam turbine	2,820	13	47	59	3.7
Gas turbine	4,895	23	50	73	2.2
Combined cycle	3,386	26	48	74	1.9
Reciprocating engine	3,638	29	40	69	1.4
All schemes	**3,496**	**24**	**48**	**72**	**2.0**

CHP schemes which export and schemes with mechanical power output

7.24 Table 7E shows the electrical exports from CHP schemes between 2013 and 2015. In the 2015 edition of the Digest, for the first time rigorous values for both total power exported and the Qualifying Power Output (QPO) exported were presented following a more proactive approach to following up with schemes; in previous editions of the Digest, power export figures had 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

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. The data presented in Table 7E for 2013 assumes the same distribution across recipient types as in 2014.

Table 7E: Electrical exports from CHP (TPO)

GWh

	2013	2014	2015
To part of same qualifying group *(1)*	339	237	372
To a firm NOT part of same qualifying group	13,636	14,424	9,349
To an electricity supplier	10,191	9,325	12,685
Total	**24,166**	**23,986**	**22,406**

(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

	2013	2014	2015
To part of same qualifying group *(1)*	241	232	348
To a firm NOT part of same qualifying group	4,400	4,807	3,872
To an electricity supplier	3,157	2,329	3,683
Total	**7,797**	**7,368**	**7,903**

7.25 In 2015, 47 large schemes also exported heat, with some exporting to more than one customer. In 2014 there were 44 (revised) schemes exporting heat. As Table 7G shows, together these schemes supplied 8,098 GWh of heat in 2015. There have been appreciable revisions to the heat export data for 2013 and 2014, as new information has come to light revealing that some schemes have ceased operation.

Table 7G: Heat exports from CHP

GWh

	2013	2014	2015
To part of same qualifying group *(1)*	1,755	511	496
To a firm NOT part of same qualifying group	6,717	8,086	7,569
To an electricity supplier	-	32	32
Total	**8,473**	**8,629**	**8,098**

(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.

7.26 There are an estimated 11 schemes with mechanical power output. For those schemes, mechanical power accounts for 10 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.

Table 7H: CHP schemes with mechanical power output in 2015

	Unit	
Number of schemes		11
Total Power Capacity of these schemes (CHP_{TPC})	MWe	2,248
Mechanical power capacity of these schemes	MWe	229

Emissions savings

7.27 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. 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 2015 as compared to the fossil fuel basket were 12.47 $MtCO_2$, which equates to 2.19 Mt CO_2 per 1,000 MWe installed capacity. Against the total basket, CHP saved 6.29 Mt CO_2 which equates to 1.11 Mt CO_2 per 1,000 MWe installed capacity.

7.28 Corresponding figures for 2013 and 2014 are shown in Table 7I. The 2013 and 2014 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 (MtCO2) 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**. The lower absolute savings for 2015 compared to 2014 are mainly attributable to the lower CO_2 intensity attributed to grid electricity for 2015** compared to 2014. There was a significant fall in the CO_2 intensity attributed to the electricity displaced in the all fuels (i.e. including renewables and nuclear) category. The relative savings ($MtCO_2$/MWe) in 2015 was also lower than in 2014 and this can be attributed to the lower CO2 intensities of grid electricity in 2015 compared to 2014, since the CHP load factor on CHPQA basis in 2015 was slightly higher than in 2014.

Table 7I: Carbon dioxide savings due to CHP, absolute and per 1,000 MWe of installed good quality CHP capacity

	2013		2014		2015	
	$MtCO_2$	$MtCO_2$/1000 MWe	$MtCO_2$	$MtCO_2$/1000 MWe	$MtCO_2$	$MtCO_2$/1000 MWe
Carbon savings against all fossil fuels	13.92	2.35	13.20	2.24	12.47	2.19
Carbon savings against all fuels (including nuclear and renewables)	8.79	1.48	7.83	1.34	6.29	1.11

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 2015 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 2013 and 2014 have also been revised in response to changes in the CO_2 intensity factors for electricity for these years since reporting in DUKES 2015.The figures have also been revised to reflect revisions to CHP electricity and heat output and fuel consumption.

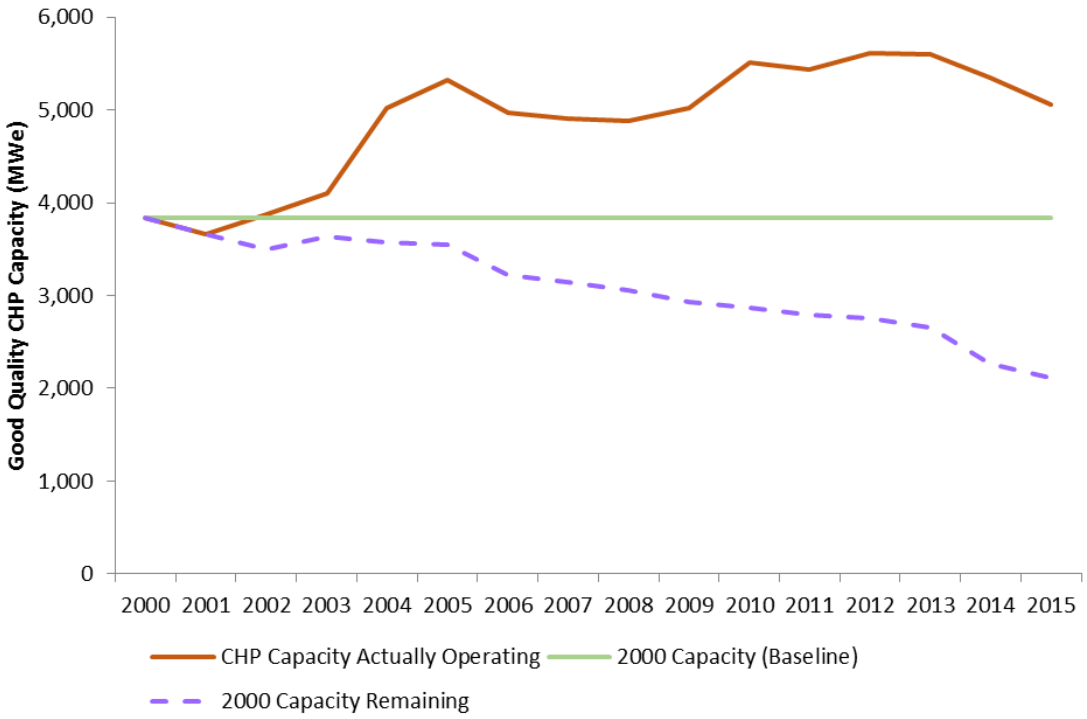
Government policy towards CHP

7.29 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.
- 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.

7.30 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 2015 there had been just under 3.0 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

7.31 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 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 100% of the allocation determined using the benchmark for the duration of Phase III of EU ETS. 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[4].

4 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

7.32 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 1.60.

Data for 2015

7.33 The data are summarised from the results of a long-term project undertaken by Ricardo Energy & Environment on behalf of the Department for Business, Energy and Industrial Strategy (BEIS). Data are included for CHP schemes installed in all sectors of the UK economy.

7.34 Data for 2015 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-four 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 information from Ofgem returns. The data from these sources accounts for approximately 3.2 per cent of total electrical capacity. 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

7.35 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 passout 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.

Determining fuel consumption for heat and electricity

7.36 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.

7.37 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.

7.38 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

7.39 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 311 schemes were scaled back. For information, in 2014, 297 (revised) schemes were scaled back.

7.40 In 2015, the power output from these schemes was scaled back from a total of 29,949 GWh to 11,911 GWh. The total fuel input to these schemes was 103,200 GWh of which 49,970 GWh was regarded as being for power only. For 2014, the total power output was scaled back from 31,999 GWh (revised) to 11,908 GWh (revised).

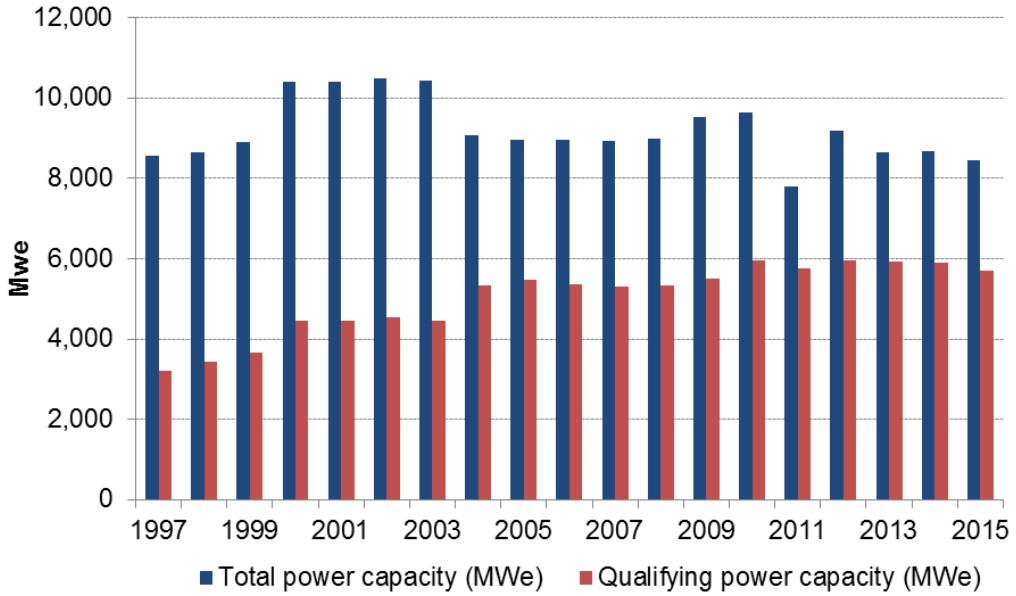
Table 7J: CHP capacity, output and fuel use which has been scaled back in 2015

	Units	
Number of schemes requiring scaling back		311
Total Power Capacity of these schemes (CHP_{TPC})	MWe	6,657
Qualifying Power Capacity of these schemes (CHP_{QPC})	MWe	3,911
Total power output of these schemes (CHP_{TPO})	GWh	29,949
Qualifying Power Output of these schemes (CHP_{QPO})	GWh	11,911
Electricity regarded as “Power only” not from CHP (CHP_{TPO} - CHP_{QPO})	GWh	18,038
Total Fuel Input of these schemes (CHP_{TFI})	GWh	103,200
Fuel input regarded as being for “Power only” use i.e. not for CHP	GWh	49,970

**This figure includes generation from major power producers*

7.41 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



Exports of heat

7.42 The figures quoted in Table 7G for exports of heat for 2013 and 2014 are based on voluntary returns from schemes. As such, there is the potential for these figures to underestimate the true situation. More robust follow up with schemes on heat exports was implemented for year of operation 2015 and, as such, should represent a better estimate of the true situation going forward.

Typical Power and Heat Efficiencies and Heat to Power Ratios of Prime Movers

7.43 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.

Contacts:
Richard Hodges
Ricardo-AEA
Richard.Hodges@ricardo-aea.com
01235 753 047

Liz Waters
BEIS Energy Statistics Team
elizabeth.waters@decc.gsi.gov.uk
0300 062 5735

7.1 CHP installations by capacity and size range

	2011	2012	2013	2014	2015
Number of schemes *(1,2)*	**1,789r**	**1,945r**	**2,032r**	**2,081r**	**2,102**
<= 100 kWe	519	571r	602r	609r	608
> 100 kWe to 1 MWe	959r	1,048r	1,086r	1,106r	1,114
>1 MWe to 2 MWe	98	105	114r	132r	140
> 2 MWe to 10 MWe	149	154	165r	169	174
> 10 MWe +	64r	67r	65r	65r	66
					MWe
Total capacity	**5,762r**	**5,966r**	**5,925r**	**5,894r**	**5,692**
<= 100 kWe	33	37	39	39	39
> 100 kWe to 1 MWe	237	261r	274r	282r	289
>1 MWe to 2 MWe	138	149	164r	190r	203
> 2 MWe to 10 MWe	694	723	759r	781r	792
> 10 MWe +	4,660r	4,797r	4,689r	4,601r	4,369

(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 2015 498 such schemes were registered on Ofgems Central FIT Register totalling 0.51MWe

7.2 Fuel used to generate electricity and heat in CHP installations

GWh

	2011	2012	2013	2014	2015
Fuel used to generate electricity *(1)*					
Coal *(2)*	421r	543r	420r	386r	137
Fuel oil	468r	525r	145r	120r	127
Natural gas	34,723r	36,207r	31,316r	30,621r	30,785
Renewable fuels *(3)*	3,638	3,966	4,428r	5,374r	4,703
Other fuels *(4)*	5,840	5,083r	4,735r	4,773r	4,442
Total all fuels	**45,090r**	**46,325r**	**41,045r**	**41,274r**	**40,195**
Fuel used to generate heat					
Coal *(2)*	1,401r	1,491r	1,592r	863r	439
Fuel oil	616r	723r	205r	140r	169
Natural gas	33,147r	33,645r	32,040r	29,786r	28,661
Renewable fuels *(3)*	3,215	3,301	3,429r	3,924r	3,805
Other fuels *(4)*	11,017r	10,223r	10,124r	10,230r	9,909
Total all fuels	**49,397r**	**49,384r**	**47,390r**	**44,943r**	**42,983**
Overall fuel use					
Coal *(2)*	1,822r	2,035r	2,012r	1,249r	577
Fuel oil	1,085r	1,248r	350r	260r	296
Natural gas	67,870r	69,852r	63,357r	60,406r	59,446
Renewable fuels *(3)*	6,853	7,268	7,856r	9,298r	8,508
Other fuels *(4)*	16,857r	15,306r	14,859r	15,003r	14,351
Total all fuels	**94,486r**	**95,709r**	**88,435r**	**86,217r**	**83,178**

(1) See paragraphs 7.37 to 7.38 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) Renewable fuels include: Biomass; sewage gas; other biogases; municipal waste and refuse derived fuels.
(4) 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

	2011	2012	2013	2014	2015
Coal					
Back pressure steam turbine	542	518	550	572	577
Gas turbine	-	-	-	-	-
Combined cycle	2,672r	1,371r	1,358r	674r	-
Reciprocating engine	4	6	1	0	-
Pass out condensing steam turbine	286	139	102	2r	-
Total coal	**1,822r**	**2,035r**	**2,012r**	**1,249r**	**577**
Fuel Oil					
Back pressure steam turbine	158	117	145	100	95
Gas turbine	2	0	5	3	2
Combined cycle	789r	987r	56r	16r	25
Reciprocating engine	118	122	123	122r	122
Pass out condensing steam turbine	18	22	21	20	51
Total fuel oil	**1,085r**	**1,248r**	**350r**	**260r**	**296**
Natural Gas					
Back pressure steam turbine	1,549	1,305	2,544	2,079r	1,857
Gas turbine	9,176	9,411	8,683	8,492r	8,604
Combined cycle	48,048r	49,365r	42,164r	39,617r	37,920
Reciprocating engine	8,767	9,398r	9,578r	9,998r	10,761
Pass out condensing steam turbine	330	374	388	221r	303
Total natural gas	**67,870r**	**69,852r**	**63,357r**	**60,406r**	**59,446**
Renewable Fuels *(1)*					
Back pressure steam turbine	1,413	1,527	1,484	1,081r	1,043
Gas turbine	11	6	11	12	12
Combined cycle	514	344	87	60	67
Reciprocating engine	2,609	2,815	3,226r	3,492r	3,709
Pass out condensing steam turbine	2,306	2,576	3,049	4,654r	3,677
Total renewable fuels	**6,853**	**7,268**	**7,856r**	**9,298r**	**8,508**
Other Fuels *(2)*					
Back pressure steam turbine	3,409	3,175	1,581	1,634r	1,634
Gas turbine	222	209	155	153	212
Combined cycle	11,087r	9,241r	10,306r	9,915r	9,730
Reciprocating engine	93	69	47	68r	80
Pass out condensing steam turbine	2,047	2,613	2,771	3,234r	2,695
Total other fuels	**16,857r**	**15,306r**	**14,859r**	**15,003r**	**14,351**
Total - all fuels					
Back pressure steam turbine	7,072	6,642	6,303	5,466r	5,206
Gas turbine	9,410	9,626	8,854	8,659r	8,830
Combined cycle	61,426r	61,309r	53,972r	50,281r	47,742
Reciprocating engine	11,591r	12,409r	12,976r	13,680r	14,672
Pass out condensing steam turbine	4,986	5,724	6,331	8,131r	6,727
Total all fuels	**94,486r**	**95,709r**	**88,435r**	**86,217r**	**83,178**

(1) Renewable fuels include: Biomass; sewage gas, other biogases, municipal solid waste and refuse derived fuels.

(2) 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

	2011	2012	2013	2014	2015
Coal					
Back pressure steam turbine	60	62	63	67	66
Gas turbine	-	-	-	-	-
Combined cycle	96r	165r	101r	113r	-
Reciprocating engine	1	1	0	0	-
Pass out condensing steam turbine	20	1	9	0r	-
Total coal	**177r**	**228r**	**173r**	**179r**	**66**
Fuel oil					
Back pressure steam turbine	19	14	17	13	12
Gas turbine	0	0	1	0	0
Combined cycle	169r	200r	12r	3r	6
Reciprocating engine	41	41	42	42	42
Pass out condensing steam turbine	1	1	1	1	2
Total fuel oil	**230r**	**257r**	**72r**	**59r**	**62**
Natural gas					
Back pressure steam turbine	121	126	167	172r	150
Gas turbine	2,169	2,262	2,034	1,953r	1,976
Combined cycle	12,661r	12,779r	10,467r	10,097r	10,394
Reciprocating engine	2,357	2,558r	2,630r	2,798r	3,020
Pass out condensing steam turbine	24	8	34	27r	34
Total natural gas	**17,332r**	**17,734r**	**15,333r**	**15,048**	**15,574**
Renewable fuels *(1)*					
Back pressure steam turbine	218	214	213	168	174
Gas turbine	2	1	2	2	2
Combined cycle	4	10	15	16	18
Reciprocating engine	760	839	971r	1,056r	1,127
Pass out condensing steam turbine	419	441	599	885r	683
Total renewable fuels	**1,402**	**1,506**	**1,801r**	**2,128r**	**2,004**
Other fuels *(2)*					
Back pressure steam turbine	226	214	82	106r	106
Gas turbine	41	38	29	21	35
Combined cycle	2,513r	2,060r	1,967r	1,935r	1,899
Reciprocating engine	25	18	11	16r	19
Pass out condensing steam turbine	100	174	127	206r	134
Total other fuels	**2,905r**	**2,505r**	**2,215r**	**2,284r**	**2,192**
Total - all fuels					
Back pressure steam turbine	643	630	543	526r	509
Gas turbine	2,212	2,301	2,066	1,977r	2,014
Combined cycle	15,442r	15,214r	12,561r	12,164r	12,317
Reciprocating engine	3,184r	3,458r	3,654r	3,912r	4,208
Pass out condensing steam turbine	564r	626	770	1,119r	853
Total all fuels	**22,046r**	**22,228r**	**19,593r**	**19,698r**	**19,900**

(1) Renewable fuels include: Biomass; sewage gas, other biogases, municipal solid waste and refuse derived fuels.
(2) 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

	2011	2012	2013	2014	2015
Coal					
Back pressure steam turbine	20	20	20	21	22
Gas turbine	-	-	-	-	-
Combined cycle	144r	175r	197r	128r	-
Reciprocating engine	0	1	0	0	-
Pass out condensing steam turbine	4	3	2	0r	-
Total coal	**168r**	**199r**	**220r**	**150r**	**22**
Fuel oil					
Back pressure steam turbine	6	6	6	5	4
Gas turbine	0	0	0	0	0
Combined cycle	34r	45r	3r	1r	1
Reciprocating engine	7	6	7	6r	6
Pass out condensing steam turbine	1	1	1	1	2
Total fuel oil	**48r**	**58r**	**17r**	**13r**	**14**
Natural gas					
Back pressure steam turbine	31	39	79	71r	63
Gas turbine	401	412	422	360r	401
Combined cycle	3,275r	3,395r	3,114r	3,220r	3,063
Reciprocating engine	676	718r	763r	826r	842
Pass out condensing steam turbine	6	7	9	9r	13
Total natural gas	**4,389r**	**4,571r**	**4,387r**	**4,486r**	**4,382**
Renewable fuels *(1)*					
Back pressure steam turbine	38	39	37	28	28
Gas turbine	1	0	1	1	1
Combined cycle	3	4	2	2	3
Reciprocating engine	175	195	230r	236r	289
Pass out condensing steam turbine	88	105	162	180r	190
Total renewable fuels	**306**	**344**	**432r**	**447r**	**510**
Other fuels *(2)*					
Back pressure steam turbine	109	107	67	67r	67
Gas turbine	13	12	9	4	10
Combined cycle	631r	576r	700r	602r	570
Reciprocating engine	23	21r	16	19r	19
Pass out condensing steam turbine	76	77	77	107r	98
Total other fuels	**851r**	**793r**	**869r**	**799r**	**764**
Total - all fuels					
Back pressure steam turbine	205	211	210	192r	184
Gas turbine	415	425	431	365r	411
Combined cycle	4,086r	4,196r	4,018r	3,954r	3,637
Reciprocating engine	881	941r	1,016r	1,087r	1,157
Pass out condensing steam turbine	175	193	251	297r	302
Total all fuels	**5,762r**	**5,966r**	**5,925r**	**5,894r**	**5,692**

(1) Renewable fuels include: Biomass; sewage gas, other biogases, municipal solid waste and refuse derived fuels.
(2) 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

	2011	2012	2013	2014	2015
Coal					
Back pressure steam turbine	421	405	434	432	423
Gas turbine	-	-	-	-	-
Combined cycle	523r	745r	776r	381r	-
Reciprocating engine	2	3	1	0	-
Pass out condensing steam turbine	274	111	92	1r	-
Total coal	**1,220r**	**1,263r**	**1,302r**	**813r**	**423**
Fuel oil					
Back pressure steam turbine	134	98	121	78	71
Gas turbine	1	0	3	2	1
Combined cycle	428r	562r	31r	8r	13
Reciprocating engine	35	35	36	35r	36
Pass out condensing steam turbine	10	14	13	13	32
Total fuel oil	**607r**	**708r**	**204r**	**136r**	**153**
Natural gas					
Back pressure steam turbine	1,139	1,183	2,082	1,716r	1,588
Gas turbine	4,773	4,689	4,506	4,365r	4,304
Combined cycle	22,437r	22,526r	19,961r	18,540r	17,648
Reciprocating engine	3,774r	4,247r	4,446r	4,429r	4,802
Pass out condensing steam turbine	278	268	291	121r	151
Total natural gas	**32,401r**	**32,913r**	**31,286r**	**29,169r**	**28,492**
Renewable fuels *(1)*					
Back pressure steam turbine	718	712	758	554r	414
Gas turbine	2	3	2	2	2
Combined cycle	57	70	34	30	34
Reciprocating engine	727	779	873r	961r	1,009
Pass out condensing steam turbine	688	757	1,113	1,422r	1,401
Total renewable fuels	**2,193**	**2,321**	**2,780r**	**2,970r**	**2,861**
Other fuels *(2)*					
Back pressure steam turbine	3,023	2,820	1,458	1,519r	1,519
Gas turbine	127	108	83	62	91
Combined cycle	5,831r	4,839r	5,564r	5,243r	5,199
Reciprocating engine	17	17	15	20r	26
Pass out condensing steam turbine	1,216	1,704	1,660	2,030r	1,562
Total other fuels	**10,213r**	**9,488r**	**8,781r**	**8,874r**	**8,397**
Total - all fuels					
Back pressure steam turbine	5,434	5,218	4,853	4,298r	4,014
Gas turbine	4,903	4,800	4,595	4,430r	4,399
Combined cycle	29,276r	28,741r	26,366r	24,201r	22,894
Reciprocating engine	4,556	5,081r	5,371r	5,445r	5,872
Pass out condensing steam turbine	2,466	2,854	3,168	3,587r	3,146
Total all fuels	**46,635r**	**46,694r**	**44,353r**	**41,962r**	**40,325**

(1) Renewable fuels include: Biomass; sewage gas, other biogases, municipal solid waste and refuse derived fuels.
(2) 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

	2011	2012	2013	2014	2015
Coal					
Back pressure steam turbine	122	125	124	134	137
Gas turbine	-	-	-	-	-
Combined cycle	312r	283r	301r	169r	-
Reciprocating engine	3	5	2	1	-
Pass out condensing steam turbine	90	57	48	20r	-
Total coal	**527r**	**470r**	**474r**	**324r**	**137**
Fuel oil					
Back pressure steam turbine	43	40	42	32	31
Gas turbine	0	0	1	1	1
Combined cycle	131r	179r	14r	6r	5
Reciprocating engine	7	12	8	7r	6
Pass out condensing steam turbine	7	5	5	5	15
Total fuel oil	**189r**	**236r**	**70r**	**51r**	**57**
Natural gas					
Back pressure steam turbine	446	465	829	751r	584
Gas turbine	1,717	1,763	1,781	1,663r	1,785
Combined cycle	9,906r	10,761r	9,750r	9,836r	8,997
Reciprocating engine	2,529r	2,596r	2,758r	2,992r	3,122
Pass out condensing steam turbine	99	133	145	241r	71
Total natural gas	**14,697r**	**15,718r**	**15,263r**	**15,482r**	**14,559**
Renewable fuels *(1)*					
Back pressure steam turbine	137	161	155	129	128
Gas turbine	3	2	4	4	4
Combined cycle	1,598	1,627	258	12	14
Reciprocating engine	237	230	303r	313r	377
Pass out condensing steam turbine	519	546	737	905r	1,022
Total renewable fuels	**2,495**	**2,566**	**1,456r**	**1,363r**	**1,544**
Other fuels *(2)*					
Back pressure steam turbine	964	944	586	593r	592
Gas turbine	54	48	32	7	20
Combined cycle	2,113r	1,856r	3,578r	1,991r	1,895
Reciprocating engine	18	17	15	19r	19
Pass out condensing steam turbine	687	691	694	2,401r	886
Total other fuels	**3,837r**	**3,555r**	**4,905r**	**5,011r**	**3,414**
Total - all fuels					
Back pressure steam turbine	1,713	1,735	1,735	1,638r	1,471
Gas turbine	1,774	1,813	1,818	1,674r	1,810
Combined cycle	14,060r	14,707r	13,900r	12,014r	10,911
Reciprocating engine	2,794r	2,858r	3,086r	3,331r	3,525
Pass out condensing steam turbine	1,402	1,432	1,628	3,573r	1,994
Total all fuels	**21,744r**	**22,545r**	**22,168r**	**22,230r**	**19,711**

(1) Renewable fuels include: Biomass; sewage gas, other biogases, municipal solid waste and refuse derived fuels.
(2) 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	2011	2012	2013	2014	2015
Iron and steel and non ferrous metals						
Number of sites		6	6	6	6	6
Electrical capacity	MWe	81	81	81	81	81
Heat capacity	MWth	674	674	674	674	674
Electrical output	GWh	144	212	163	158r	118
Heat output	GWh	1,263	1,764	1,701	1,776r	1,506
Fuel use	GWh	2,197	2,766	2,885	2,743r	2,720
of which : for electricity	GWh	369	484	435	395r	316
for heat	GWh	1,828	2,282	2,450	2,348r	2,404
Chemicals						
Number of sites		53r	53r	52r	52r	51
Electrical capacity	MWe	1,548r	1,539r	1,461r	1,437r	1,218
Heat capacity	MWth	5,256r	5,139r	4,828r	4,878r	4,321
Electrical output	GWh	5,971r	5,783r	5,212r	4,574r	5,046
Heat output	GWh	13,743r	13,334r	12,282r	11,010r	10,300
Fuel use	GWh	28,296r	27,646r	25,189r	22,685r	22,096
of which : for electricity	GWh	13,157r	12,960r	11,543r	10,214r	10,609
for heat	GWh	15,139r	14,686r	13,646r	12,470r	11,487
Oil and gas terminals and oil refineries						
Number of sites		11	11	11	10	9
Electrical capacity	MWe	2,298	2,380	2,380	2,278	2,235
Heat capacity	MWth	7,039	7,600	7,600	7,255	6,825
Electrical output	GWh	8,239	8,105	6,184	6,391r	6,395
Heat output	GWh	16,786	16,211	14,446	13,615r	13,283
Fuel use	GWh	30,964	31,340	26,634	25,759r	24,741
of which : for electricity	GWh	14,998	15,486	12,218	12,362r	11,970
for heat	GWh	15,965	15,854	14,416	13,397r	12,771
Paper, publishing and printing						
Number of sites		21	23	22	21	21
Electrical capacity	MWe	407	453	451	477r	464
Heat capacity	MWth	1,857	2,060	1,776	1,764	1,771
Electrical output	GWh	2,020	2,170	1,948	2,025r	1,643
Heat output	GWh	4,806	4,875	4,849	4,389r	3,842
Fuel use	GWh	9,299	9,448	9,221	8,831r	7,350
of which : for electricity	GWh	4,250	4,553	4,138	4,295r	3,416
for heat	GWh	5,049	4,895	5,082	4,536r	3,934
Food, beverages and tobacco						
Number of sites		46	49	54	59r	58
Electrical capacity	MWe	429	439	436	455r	464
Heat capacity	MWth	1,681	1,712	1,743	1,787r	1,802
Electrical output	GWh	2,124	2,146	2,117	2,265r	2,265
Heat output	GWh	4,112	4,046	4,277	4,291r	4,241
Fuel use	GWh	8,308	8,129	8,362	8,717r	8,674
of which : for electricity	GWh	4,220	4,177	4,172	4,487r	4,475
for heat	GWh	4,087	3,952	4,190	4,230r	4,199
Metal products, machinery and equipment						
Number of sites		19	19	19r	20	21
Electrical capacity	MWe	69	68	43r	43r	46
Heat capacity	MWth	288	288	254r	254r	257
Electrical output	GWh	94	106	119	139r	141
Heat output	GWh	149	159	193r	190r	199
Fuel use	GWh	581	603	462r	625r	695
of which : for electricity	GWh	250	270	250r	301r	339
for heat	GWh	331	332	212r	324r	356

For footnotes see page 219

7.8 CHP capacity, output and total fuel use[(1)] by sector (continued)

	Unit	2011	2012	2013	2014	2015
Mineral products, extraction, mining and agglomeration of solid fuels						
Number of sites		8	8	8	8	7
Electrical capacity	MWe	57	54	54	54	49
Heat capacity	MWth	183	183	183	183	154
Electrical output	GWh	111	102	104	109r	106
Heat output	GWh	544	494	526	530r	505
Fuel use	GWh	892	816	836	881r	796
of which : for electricity	GWh	258	236	230	253r	238
for heat	GWh	634	580	605	628r	558
Sewage treatment						
Number of sites		192	199	197	200r	198
Electrical capacity	MWe	165	173	164	165r	211
Heat capacity	MWth	233	241	240	245r	303
Electrical output	GWh	690	688	657r	719r	786
Heat output	GWh	742	740	740r	822r	878
Fuel use	GWh	2,494	2,458	2,391r	2,601r	2,805
of which : for electricity	GWh	1,628	1,605	1,540r	1,660r	1,807
for heat	GWh	866	853	851r	941r	998
Other industrial branches *(2)*						
Number of sites		12	11	12	12	12
Electrical capacity	MWe	45	46	50	50	56
Heat capacity	MWth	254	254	274	274	219
Electrical output	GWh	224	213	225	243	374
Heat output	GWh	384	374	409	422	472
Fuel use	GWh	1,000	1,182	812	845r	911
of which : for electricity	GWh	547	621	423	452r	521
for heat	GWh	453	562	389	393	391
Total industry						
Number of sites		368r	379r	381r	388r	383
Electrical capacity	MWe	5,101r	5,234r	5,119r	5,039r	4,824
Heat capacity	MWth	17,466r	18,151r	17,571r	17,312r	16,327
Electrical output	GWh	19,617r	19,524r	16,729r	16,625r	16,874
Heat output	GWh	42,530r	41,998r	39,423r	37,046r	35,225
Fuel use	GWh	84,031r	84,388r	76,792r	73,685r	70,788
of which : for electricity	GWh	39,677r	40,392r	34,950r	34,419r	33,690
for heat	GWh	44,353r	43,996r	41,842r	39,266r	37,098
Transport, commerce and administration						
Number of sites		838r	932r	959r	979r	995
Electrical capacity	MWe	345	399r	420r	446r	454
Heat capacity	MWth	1,555	1,674r	1,730r	1,824r	1,872
Electrical output	GWh	1,398r	1,696r	1,744r	1,870r	1,799
Heat output	GWh	2,573	2,984r	3,137r	3,033r	3,172
Fuel use	GWh	5,810r	6,929r	6,961r	7,387r	7,129
of which : for electricity	GWh	2,989r	3,693r	3,570r	4,111r	3,735
for heat	GWh	2,821r	3,236r	3,391r	3,276r	3,394
Other *(3)*						
Number of sites		583	634r	692r	714r	724
Electrical capacity	MWe	316	333r	386r	408r	414
Heat capacity	MWth	2,724	2,720r	2,866r	3,093r	1,512
Electrical output	GWh	1,030	1,008	1,121r	1,203r	1,226
Heat output	GWh	1,533	1,711	1,793r	1,884r	1,928
Fuel use	GWh	4,645	4,392	4,683r	5,144r	5,260
of which : for electricity	GWh	2,423	2,240	2,525r	2,744r	2,770
for heat	GWh	2,222	2,152	2,158r	2,401r	2,490
Total CHP usage by all sectors						
Number of sites		1,789r	1,945r	2,032r	2,081r	2,102
Electrical capacity	MWe	5,762r	5,966r	5,925r	5,894r	5,692
Heat capacity	MWth	21,744r	22,545r	22,168r	22,230r	19,711
Electrical output	GWh	22,046r	22,228r	19,593r	19,698r	19,900
Heat output	GWh	46,635r	46,694r	44,353r	41,962r	40,325
Fuel use	GWh	94,486r	95,709r	88,435r	86,217r	83,178
of which : for electricity	GWh	45,090r	46,325r	41,045r	41,274r	40,195
for heat	GWh	49,397r	49,384r	47,390r	44,943r	42,983

(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

	2011	2012	2013	2014	2015
Iron and steel and non ferrous metals					
Coal	-	-	-	-	
Fuel oil	18	22	21	20	51
Natural gas	221	225	204	169r	237
Blast furnace gas	1,397	1,892	2,169	2,114r	2,001
Coke oven gas	486	599	489	440r	431
Other fuels *(1)*	75	29	2	-	-
Total iron and steel and non ferrous metals	**2,197**	**2,766**	**2,885**	**2,743r**	**2,720**
Chemicals					
Coal	1,304r	1,699r	1,697r	1,033r	359
Fuel oil	4r	6r	10r	12r	2
Gas oil	43	5	4	6	8
Natural gas	23,187r	22,748r	20,118r	18,169r	18,225
Refinery gas	1,181	556	646	653	648
Renewable fuels *(2)*	58	52	90	92	84
Other fuels *(1)*	2,520r	2,579r	2,623r	2,720r	2,770
Total chemical industry	**28,296r**	**27,646r**	**25,189r**	**22,685r**	**22,096**
Oil and gas terminals and oil refineries					
Fuel oil	789	983	48	7	25
Gas oil	106	52	763	906r	884
Natural gas	19,520	21,260	18,484	17,847r	16,895
Refinery gas	5,618	3,774	3,872	3,996r	4,271
Other fuels *(1)*	4,931	5,272	3,466	3,003r	2,666
Total oil refineries	**30,964**	**31,340**	**26,634**	**25,759r**	**24,741**
Paper, publishing and printing					
Coal	286	139	102	-	-
Fuel oil	0	0	-	-	-
Gas oil	2	6	7	2	3
Natural gas	7,227	7,455	6,298	5,402r	4,916
Renewable fuels *(2)*	1,620	1,643	2,516	2,786r	2,189
Other fuels *(1)*	164	204	298	641	241
Total paper, publishing and printing	**9,299**	**9,448**	**9,221**	**8,831r**	**7,350**
Food, beverages and tobacco					
Coal	209	181	205	214	218
Fuel oil	157	116	148	100	95
Gas oil	32	19	3	4	4
Natural gas	7,785	7,642	7,653	7,885r	7,933
Renewable fuels *(2)*	123	171	354	515r	424
Other fuels *(1)*	2	-	-	-	-
Total food, beverages and tobacco	**8,308**	**8,129**	**8,362**	**8,717r**	**8,674**
Metal products, machinery and equipment					
Coal	-	-	-		
Fuel oil	89	89	89	89	89
Gas oil	0	0	0	0	0
Natural gas	412	439	332r	364r	434
Renewable fuels *(2)*	80	75	41	172r	172
Other fuels *(1)*	-	-	-	-	
Total metal products, machinery and equipment	**581**	**603**	**462r**	**625r**	**695**

For footnotes see page 221

7.9 CHP - use of fuels by sector (continued)

GWh

	2011	2012	2013	2014	2015
Mineral products, extraction, mining and agglomeration of solid fuels					
Coal	-	-	-	-	
Fuel oil	-	-	-	-	
Gas oil	-	-	-	-	-
Natural gas	663	586	606	651r	646
Coke oven gas	229	230	230	230	150
Total mineral products, extraction, mining and agglomeration of solid fuels	**892**	**816**	**836**	**881r**	**796**
Sewage treatment					
Fuel oil	29	32	32	33	33
Gas oil	37	32	17	26r	26
Natural gas	197	181	36	50r	44
Renewable fuels *(2)*	2,231	2,213	2,305r	2,491r	2,701
Total sewage treatment	**2,494**	**2,458**	**2,391r**	**2,601r**	**2,805**
Other industrial branches					
Fuel oil	-	-	-	-	
Gas oil	1	14	0	0	2
Natural gas	817	762	803	837r	821
Renewable fuels *(2)*	183	406	9	7	88
Total other industrial branches	**1,000**	**1,182**	**812**	**845r**	**911**
Transport, commerce and administration					
Coal	-	-	-	-	-
Fuel oil	0	0	-	-	-
Gas oil	2	17	12	34r	37
Natural gas	5,331r	6,024r	6,292r	6,265r	6,465
Refinery gas	-	-	-	-	
Renewable fuels *(2)*	471	884	657	1,088r	626
Other fuels *(1)*	6	5	-	0	0
Total transport, commerce and administration	**5,810r**	**6,929r**	**6,961r**	**7,387r**	**7,129**
Other *(3)*					
Coal	23	16	7	3	-
Fuel oil	-	0	2	0r	0
Gas oil	15	10	14	13	12
Natural gas	2,510	2,531	2,530r	2,768r	2,829
Renewable fuels *(2)*	2,087	1,824	1,886r	2,148r	2,223
Other fuels *(1)*	11	10	244	213	196
Total other	**4,645**	**4,392**	**4,683r**	**5,144r**	**5,260**
Total - all sectors					
Coal	1,822r	2,035r	2,012r	1,249r	577
Fuel oil	1,085r	1,248r	350r	260r	296
Gas oil	238	156	820	992r	976
Natural gas	67,870r	69,852r	63,357r	60,406r	59,446
Blast furnace gas	1,397	1,892	2,169	2,114r	2,001
Coke oven gas	715	829	719	670r	581
Refinery gas	6,798	4,329	4,519	4,650r	4,919
Renewable fuels *(2)*	6,853	7,268	7,856r	9,298r	8,508
Other fuels *(1)*	7,708r	8,100r	6,633r	6,577r	5,874
Total CHP fuel use	**94,486r**	**95,709r**	**88,435r**	**86,217r**	**83,178**

(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.

Digest of United Kingdom Energy Statistics 2016

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, 2014-2016

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.

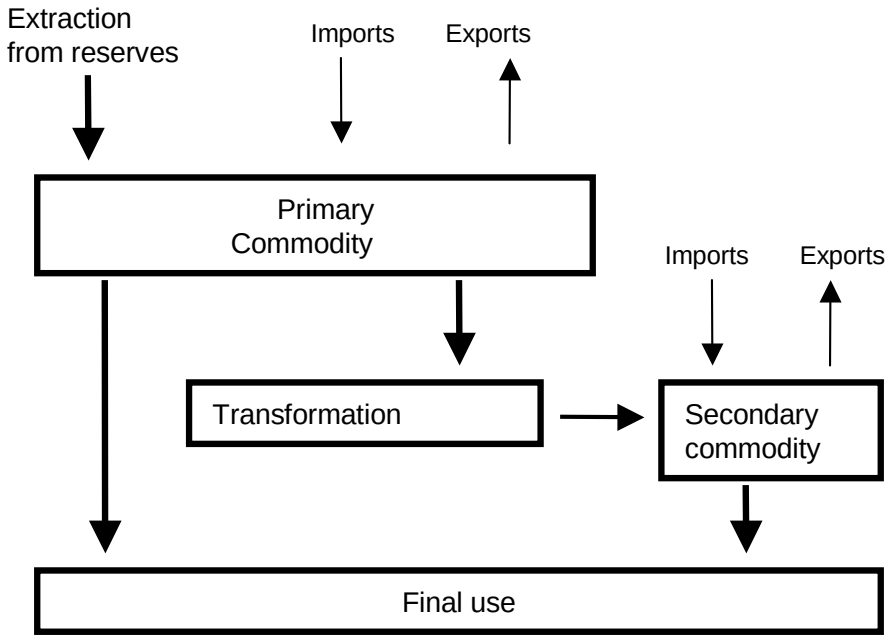
A.5 A simplified model of the commodity flow underlying the balance structure is given in Chart A.1. It illustrates how primary commodities may be used directly and/or be transformed into secondary commodities. The secondary fuels then enter final consumption or may also be transformed into another energy 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.

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 eg 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.

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 1, Table 1.9. 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 (eg 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.

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, ie 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 1.9.

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 eg 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 39.1 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 2015

	Litres per tonne
Crude oil:	
Indigenous	1,199
Imported	1,181
Average of refining throughput	1,192
Ethane	2,730
Propane	1,961
Butane	1,737
Naphtha	1,479
Aviation gasoline	1,408
Motor spirit:	
All grades	1,369
Super	1,359
Premium	1,370
Middle distillate feedstock	..
Kerosene:	
Aviation turbine fuel	1,253
Burning oil	1,250

	Litres per tonne
DERV fuel:	
0.005% or less sulphur	1,194
Gas /Marine diesel oil	1,175
Fuel oil (1% or less sulphur)	
All grades:	1,018
Light:	..
Medium	..
Heavy:	..
Lubricating oils:	
White	1,144
Greases	..
Bitumen	975
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 2015. The litres to tonnes conversions are made at a standard temperature of 15^oC.

.. Denotes commercially sensitive as too few companies are producting this to be able to report it.

Fuel conversion factors for converting fossil fuels to carbon dioxide, 2015

	kg CO_2 per tonne	kg CO_2 per kWh	kg CO_2 per litre
Gases			
Natural Gas		0.184	
LPG		0.214	1.502
Liquid fuels			
Gas oil	3190	0.254	2.722
Fuel oil	3214	0.267	
Burning oil	3150	0.245	2.520
Naptha	3131	0.236	
Petrol	3135	0.239	2.292
Diesel	3164	0.249	2.655
Aviation spirit	3128	0.238	2.221
Aviation turbine fuel	3150	0.245	2.508
Solid fuels			
Industrial coal	2396	0.319	
Domestic coal	2634	0.315	
Coking coal	3198	0.362	

All emission factors are based on a Gross Calorific Value basis

The information above is based on the 2015 Greenhouse gas conversion factors for company reporting, available at: www.ukconversionfactorscarbonsmart.co.uk/. The information on this website also provide emission factors on a Net Calorific Basis.

The figures are derived by AEA based on data contained in the 2015 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.defra.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 2015

	GJ per tonne net	GJ per tonne gross
Coal:		
All consumers (weighted average) *(1)*	25.7	27.0
Power stations *(2)*	23.9	25.1
Coke ovens *(1)*	30.2	31.8
Low temperature carbonisation plants and manufactured fuel plants	27.0	28.5
Collieries	27.5	29.0
Agriculture	28.1	29.5
Iron and steel	28.9	30.4
Other industries (weighted average)	25.4	26.8
Non-ferrous metals	23.8	25.1
Food, beverages and tobacco	28.0	29.4
Chemicals	25.2	26.5
Textiles, clothing, leather etc.	28.1	29.5
Pulp, paper, printing etc.	23.0	24.2
Mineral products	26.5	27.9
Engineering (mechanical and electrical engineering and vehicles)	28.0	29.5
Other industries	31.0	32.6
Domestic		
House coal	28.6	30.1
Anthracite and dry steam coal	32.6	34.3
Other consumers	25.1	26.4
Imported coal (weighted average)	26.0	27.4
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 fuel	28.3	29.8

	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	13.4	15.8	15%
Poultry litter (5)	7.6	9.1	16%
Meat and bone	16.8	20.0	16%
General industrial waste	15.2	16.0	5%
Hospital waste	13.3	14.0	5%
Municipal solid waste *(6)*	6.7	9.6	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)	46.0	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	44.8	47.2	
Burning oil	43.9	46.2	
Gas/diesel oil	42.6	45.3	
DERV	42.9	45.7	
Fuel oil	40.8	43.4	
Power station oil	40.8	43.4	
Non-fuel products (notional value)	40.9	43.0	

	MJ per cubic metre net	MJ per cubic metre gross
Natural gas produced *(8)*	36.9	41.0
Natural gas consumed *(9)*	35.4	39.4
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 11.031 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 10.908 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 2015. 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 1.54 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 1.29.

A.2 Estimated average gross calorific values of fuels 1980, 1990, 2000, 2010 and 2013 to 2015

GJ per tonne (gross)

	1980	1990	2000	2010	2013	2014	2015
Coal							
All consumers *(1)(2)*	25.6	25.5	26.2	25.8	26.0	26.0	26.0
All consumers - home produced plus imports minus exports *(1)*	..	..	27.0	27.1	27.0	27.0	27.0
Power stations *(2)*	23.8	24.8	25.6	24.9	25.2	25.1	25.1
Power stations - home produced plus imports *(1)*	..	..	26.0	25.8	26.3	26.2	26.2
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	28.5	28.5
Collieries	27.0	28.6	29.6	29.3	29.0	29.0	29.0
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	26.8
Non-ferrous metals	..	23.1	25.1	25.4	25.1	25.1	25.1
Food, beverages and tobacco	28.6	28.1	29.5	28.6	29.4	29.4	29.4
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	29.5
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	27.8	27.9	27.9
Engineering *(5)*	27.7	28.3	29.3	29.5	29.5	29.5	29.5
Other industry *(6)*	28.4	28.5	30.2	32.6	32.6	32.7	32.6
Domestic							
House coal	30.1	30.2	30.9	29.8	30.2	30.1	30.1
Anthracite and dry steam coal	33.3	33.6	33.5	34.7	34.3	34.3	34.3
Other consumers	27.5	27.5	29.2	25.5	26.3	26.4	26.4
Transport - Rail	..	..	..	30.3	30.2	30.2	30.2
Imported coal *(1)*	..	28.3	28.0	27.9	27.4	27.4	27.4
of which Steam coal	..	..	26.6	26.5	26.5	26.5	26.5
Coking coal	..	..	30.4	32.1	31.8	31.8	31.8
Anthracite	..	..	31.2	31.0	31.7	31.7	31.5
Exports *(1)*	..	29.0	32.0	32.3	32.3	32.2	32.2
of which Steam coal	..	..	31.0	31.2	31.2	31.2	31.2
Anthracite	..	..	32.6	33.2	32.6	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	29.8	29.8	29.8	29.8
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	49.4	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	47.7	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	46.3	46.2
Motor spirit	47.0	47.0	47.0	47.1	47.1	47.1	47.2
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	43.3	43.4	43.4
Power station oil	42.8	43.2	43.1	43.3	43.3	43.4	43.4
Non-fuel products (notional value)	42.2	43.2	43.8	43.1	43.1	43.2	43.0
Petroleum coke (Power stations)	..	..	..	30.9	30.1	30.1	28.6
Petroleum coke (Other)	..	39.5	35.8	35.8	35.8	35.8	35.8
Natural Gas *(9)*	..	38.4	39.4	40.1	39.7	39.8	41.0

(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 2013 to 2015

GJ per tonne (net)

	1980	1990	2000	2010	2013	2014	2015
Coal							
All consumers *(1)(2)*	24.3	24.2	24.9	24.5	24.7	24.7	24.7
All consumers - home produced plus imports minus exports *(1)*	..	..	25.6	25.7	25.7	25.6	25.7
Power stations *(2)*	22.6	23.6	24.3	23.6	24.0	23.9	23.9
Power stations - home produced plus imports *(1)*	..	..	24.7	24.5	25.0	24.9	24.9
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	27.1	27.0
Collieries	25.7	27.2	28.1	27.9	27.5	27.5	27.5
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	25.5	25.4	25.4
Non-ferrous metals	..	21.9	23.8	24.1	23.8	23.8	23.8
Food, beverages and tobacco	27.2	26.7	28.0	27.2	27.9	28.0	28.0
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	28.1
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	26.4	26.5	26.5
Engineering *(5)*	26.3	26.9	27.8	28.0	28.0	28.0	28.0
Other industry *(6)*	27.0	27.1	28.7	31.0	31.0	31.1	31.0
Domestic							
House coal	28.6	28.7	29.4	28.3	28.7	28.6	28.6
Anthracite and dry steam coal	31.6	31.9	31.9	32.9	32.6	32.6	32.6
Other consumers	26.1	26.1	27.7	24.3	25.0	25.1	25.1
Transport - Rail	..	..	..	28.8	28.7	28.7	28.7
Imported coal *(1)*	..	26.9	26.6	26.5	26.0	26.0	26.0
of which Steam coal	..	..	25.3	25.2	25.2	25.2	25.2
Coking coal	..	..	28.9	29.0	30.2	30.2	30.2
Anthracite	..	..	29.6	29.5	30.1	30.1	30.0
Exports *(1)*	..	27.6	30.4	30.7	30.7	30.6	30.6
of which Steam coal	..	..	29.4	29.6	29.6	29.6	29.6
Anthracite	..	..	30.9	31.6	31.0	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	28.3	28.3	28.3	28.3
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	46.0	46.0
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	45.3	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	44.0	43.9
Motor spirit	44.7	44.7	44.7	44.7	44.8	44.8	44.8
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	40.7	40.7	40.8
Power station oil	40.2	40.6	40.5	40.7	40.7	40.7	40.8
Non-fuel products (notional value)	40.1	41.0	41.6	40.9	40.9	40.9	40.9
Petroleum coke (Power stations)	..	..	..	29.3	28.6	28.6	27.2
Petroleum coke (Other)	..	37.5	34.0	34.0	34.0	34.0	34.0
Natural Gas *(9)*	..	34.6	35.5	36.1	35.7	35.8	36.9

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, known as biomass.
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	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 200^{o}C.
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 1971 to 2000.
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

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. The 2015 edition of the chart shows the flows for 2014. 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

UK Energy Sector Indicators

An annual publication designed to show the extent to which secure, diverse and sustainable supplies of energy to UK businesses and consumers, at competitive prices, are ensured. Available at: www.gov.uk/government/collections/uk-energy-sector-indicators

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

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

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

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 the Government published 'Planning our electric future: a White Paper for secure, affordable and low-carbon electricity'. 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 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)

Regional Yearbook (annual); *Statistical Office of the European Commission – Eurostat*
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 - Yearly Statistics; *Statistical Office of the European Commission – Eurostat*
Energy Balance Sheets; *Statistical Office of the European Commission – Eurostat*
Energy Statistics and Balances of Non-OECD Countries (annual); *International Energy Agency*
Energy Statistics and Balances of OECD Countries (annual); *International Energy Agency*
UN 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 Report of The Office of Gas and Electricity Markets; *OFGEM*
Annual Reports and Accounts of the Electricity Supply Companies, Distributed Companies and Generators; (*apply to the Headquarters of the company concerned)*
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 (annual); *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 Communities and Local Government.	www.gov.uk/government/organisations/department-for-communities-and-local-government
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	www.gov.uk/
HM Revenue & Customs	www.gov.uk/government/organisations/hm-revenue-customs
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	www2.nationalgrid.com/
Oil & Gas UK	www.oilandgasuk.co.uk/
Renewable UK	www.renewableuk.com/
Ricardo Energy & Environment	http://ee.ricardo.com/cms/
The Stationery Office	www.tso.co.uk/
UK-AIR: Air Information Resource	http://uk-air.defra.gov.uk/
UK Petroleum Industry Association	www.ukpia.com/home.aspx
United Nations Statistics Division	http://unstats.un.org/unsd/default.htm
US Department of Energy	http://energy.gov/
US Energy Information Administration	www.eia.gov/

Annex D

Major events in the Energy Industry

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 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

2015

Climate Change

A new global climate agreement was agreed at the United Nations conference on climate change in Paris in December 2015. For the first time ever 195 countries, including the world's largest emitters, have committed to act together to combat climate change and be held equally accountable. The agreement sets out a clear long-term goal of net zero emissions by the end of the century, showing that the world is committed to decarbonising. Progress against this goal will be independently assessed in 2018 and every five years thereafter.

Coal

Kellingley Colliery located at Beal in North Yorkshire, closed on 18 December 2015, marking the end of deep-pit coal mining in the UK.

2015 (continued)

Electricity

The Government gave approval in October 2015 for the construction of the Ferrybridge Multifuel 2 Power Station at Knottingley, West Yorkshire. If built, the power station will be capable of producing up to 90MWe of electricity, by burning fuel derived from refuse and industrial and commercial waste, such as wood, which would have originally ended up in landfill.

The Government gave approval in September 2015 for the construction of a new gas power plant in Sutton Bridge, Lincolnshire. If built, the station will produce up to 1.8 GW of electricity.

The Government gave approval in August 2015 for the construction of an offshore windfarm off the UK North East coast. If built, Dogger Bank Teesside A and B Offshore wind project will include up to 400 wind turbines in total, across two offshore wind generating stations, each with an installed capacity of up to 1.2 GW. Onshore elements will be located in Redcar and Cleveland, with the potential to generate enough green electricity to power up to 1.8 million British homes.

The Government approved the construction of two gas-fired power generation plants in July 2015 by Progress Power Ltd in Eye, Suffolk, and by Hirwaun Power Limited near Aberdare in South Wales. Both plants will have a generating capacity of up to 299 megawatts of electrical output.

Planning consent was given in June 2015 for the construction of the world's first tidal lagoon. If built, turbines in the proposed six-mile horseshoe shaped sea wall around Swansea Bay in Wales could generate around 500GWh per year of low carbon electricity.

The Government gave consent to the Dogger Bank Creyke Beck A and B offshore wind project off the coast of Yorkshire in February 2015. Once built it will generate enough electricity to power almost 2 million homes.

Energy Policy

The Government set out in November 2015 their vision for an energy system that puts consumers first, delivers more competition, reduces the burden on bill-payers and ensures enough electricity generation to power the nation, supported by 4 key policy priorities:

- Consultation on ending unabated coal-fired power stations by 2025
- New gas-fired power stations a priority
- Commitment to offshore wind support completes commitment to secure, low-carbon, affordable electricity supplies
- Move towards a smarter energy system

A new Energy Bill was proposed in the Queen's Speech in May 2015 which will:

- Ensure there will be affordable and reliable energy for businesses and families;
- Give the Oil and Gas Authority the powers it needs to become a robust, independent and effective regulator, and enable it to maximise the economic recovery of oil and gas from UK waters.
- Change the law to give local communities the final say on wind farm applications.

2015 (continued)

The Infrastructure Act became law in February 2015 enshrining new measures to make it easier, quicker and simpler to get Britain building. The legislation will give local people the right to buy a stake in renewable energy projects, as well as boosting energy security and economic growth by extracting domestic shale gas, which has the potential to create jobs, making the UK less reliant on imports from abroad and so help tackle climate change.

Fuel Poverty

A new Fuel Poverty strategy, the first for over a decade, was launched in March 2015 which outlines the challenges and actions for the next 15 years to ensure Government take the right steps to tackle fuel poverty and to get help to those who need it most. A new legally binding target, in force since December 2014, forms a key part of the new strategy; it requires that as many fuel poor homes as reasonably practicable, achieve a minimum energy efficiency rating of a Band C, by 2030. The strategy also set out interim milestones: to lift as many fuel poor homes in England as is reasonably practicable to Band E by 2020; and Band D by 2025 .

2014

Carbon Capture and Storage (CCS)

In February 2014 the Government agreed a multi-million pound contract for engineering, design and financial work on the Peterhead CCS project in Aberdeenshire with Shell, to take their gas carbon capture and storage (CCS) project into the next stage of development. The world's first planned gas CCS project, Peterhead involves installing carbon capture technology onto SSE's existing Peterhead gas power plant, and transporting the CO2 100km offshore for safe, permanent storage 2km under the North Sea in the old Goldeneye gas field. If built, the project could save 1 million tonnes CO2 each year and provide clean electricity to over 500,000 homes.

Climate Change

At a meeting in October 2014 the European Union reached a deal to cut greenhouse gases by at least 40% domestically by 2030. The target is part of a package of measures to make Europe's energy system more secure, sustainable and competitive.

Electricity

The Government gave consent to the Hornsea Project One offshore wind farms off the coast of Yorkshire in December 2014. Once built, the wind farms are expected to generate enough electricity to power more than 800.000 homes.

The Government gave consent to the Walney extension offshore wind farm in the Irish Sea in November 2014. Once built, the wind farm is expected to generate enough electricity to power over half a million homes.

In October 2014 the Norwegian Government granted a licence for the longest sub-sea electricity interconnector in the world, to be built between the UK and Norway. The interconnector, known as NSN, will have a capacity of 1400 megawatt (MW), and is planned to be commissioned in 2020.

The Government provided £10 million worth of grant funding to the Meygen project in August 2014. The project will see the world's biggest tidal array be built in North Scotland and will provide enough electricity to power 175,000 homes.

The Government gave consent to the Rampion offshore wind farm off the coast of Sussex in July 2014. Once built it is expected to generate enough electricity to power approximately 450,000 homes.

2014 (continued)

The Government gave consent to the East Anglia One offshore wind farm in June 2014. Once built it is expected to generate enough electricity to power approximately 820,000 homes.

In April 2014 the Government announced that eight renewable electricity projects were offered under the Final Investment Decision Enabling Programme (launched in advance of the Contracts for Difference (CfD) regime being put in place, which forms part of the Electricity Market Reform programme). They include offshore wind farms, coal to biomass conversions and a dedicated biomass plant with combined heat and power, which could add a further 4.5GW of low-carbon electricity to Britain's energy mix (or around 4% of capacity), generating enough clean electricity to power over three million homes.

Energy Efficiency

The Green Deal Home Improvement Fund (GDHIF) was launched in May 2014 with up to £120m available in 2014-15. The GDHIF is a new, innovative home improvement scheme open for all householders from early June. The scheme means householders could get up to £7,600 back on incentives covering a range of 13 energy efficiency improvements, including solid wall insulation, new heating systems and glazing."

The Government announced proposals for a set of changes to ECO in December 2013. These include: extending through to 2017, with new targets; reducing the ambition of the Carbon Saving Target element; and allowing new measures (loft and standard cavity wall insulation, and district heating) to be eligible under that element. The Government published a consultation on these proposals in March 2014, and intends subject to consultation that revised regulations will come into force later in 2014, but with many changes taking effect as from 1 April 2014.

Energy Policy

In March 2014 a range of energy policy measures were announced in the Budget, these include:

- Carbon Price Floor (CPF) - capping the Carbon Price Support (a tax on fossil fuels used to generate electricity) at £18.00 from 2016–17 to 2019–20;

- Energy intensive industries – these industries will continue to be compensated for the costs of the EU Emissions Trading Scheme (ETS) and Carbon Price Floor (CPF) until 2019–20. There will be a new compensation scheme for the price of the Renewables Obligation and small scale feed-in-tariffs from 2016–17.

- CHP - the Government is exempting fuel used to generate good quality electricity by Combined Heat and Power plants from the Carbon Price Floor (CPF), where that electricity is used onsite.

- Competition and small businesses - reaffirming the Government's commitment to make energy markets more competitive for small and very small businesses.

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2014 (continued)

Energy Policy (continued)

- Oil & Gas industry - investment to the tune of £1.9 million for 2014–15 and £5 million for 2015–16 to fund the establishment of a new body to take stewardship of the UK's oil and gas resources; introducing a new tax allowance to encourage offshore operators to invest further in new and existing ultra-high-pressure, high-temperature fields in the North Sea, and bringing forward a new tax allowance which will encourage further exploration of promising onshore shale gas resources.

- Carbon Capture and Storage innovation - the Government is providing £60m for low carbon energy innovation to Carbon Capture and Storage (CCS) technologies that have significant potential to reduce the cost of low carbon generation to the UK

Oil and Gas

As part of the Budget announcement in March 2014, details of how the Capacity Market is being designed ahead of the first auction being held in December 2014 were published. The Capacity Market will help drive new investment in gas demand side capacity, and get the best out of the existing generation fleet as the UK moves to a low carbon electricity future. The Capacity Market is designed to ensure:

- 15 year capacity agreements will be available to new capacity providers;

- Existing capacity will be able to access rolling one year agreements;

- Penalties for unreliable capacity will be capped;

- The capacity auction's prices will be capped to protect consumers.

Sir Ian Wood's review into maximising North Sea oil and gas reserves was published in February 2014. The Review announced:

- a joint commitment between government and the industry to ensure production licences are awarded on the basis of recovering the maximum amount of petroleum from UK waters as a whole;

- greater collaboration between industry and government;

- a new independent regulator to supervise licensing and ensure maximum collaboration between companies to explore, develop and produce oil and gas.

Renewable Heat

In April 2014 the Government launched the domestic Renewable Heat Incentive to encourage a switch to renewable heating system in the domestic sector. This financial incentive scheme is open to homeowners, private landlords, social landlords and self-builders and is targeted at, but not limited to, homes off the gas grid. The scheme supports air to water heat pumps; biomass only boilers and biomass pellet stoves with integrated boilers; ground to water and water to water source heat pumps; flat plate and evacuated tube solar thermal panels.

2014 (continued)

Renewables

In March 2014, Siemens announced its decision to invest £160 million in wind turbine production and installation facilities in Yorkshire creating more than 1,000 new jobs in the Hull area. The plan will be spread across two sites comprising:

- the Green Port Hull project construction, assembly and service facility, and
- a new rotor blade manufacturing facility in East Riding.

BEIS news stories including press releases, speeches and statements are available at: www.gov.uk/government/announcements

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 2015. (For further information and more detailed calorific values see Annex A).

Solid fuels	**GJ per tonne**
Coal	
All consumers (weighted average) (1)	27.0
Power stations (including imports)	25.1
Iron and steel	30.4
Other industries (weighted average)	26.8
Imported coal (weighted average)	27.4
Exported coal (weighted average)	32.2
Coke	29.8
Coke breeze	29.8
Other manufactured solid fuel	29.8
Gases	
Natural gas (produced)	41.0
Landfill gas	21-25
Sewage gas	21-25

Renewable sources	**GJ per tonne**
Domestic wood (2)	16.3
Industrial wood (3)	20.3
Municipal solid waste (4)	9.6
Petroleum	
Crude oil (weighted average)	45.7
Petroleum products (weighted average)	46.2
Motor spirit	47.1
Gas/diesel oil	45.3
DERV	45.7
Fuel oil	43.4

Notes

(1) All consumers (home produced plus imports minus exports).

(2) Based on a moisture content of 20 per cent.

(3) Average figure covering a range of possible feedstock.

(4) Average figure based on survey returns.

Department for Business, Energy & Industrial Strategy
3 Whitehall Place, London SW1A 2AW
www.gov.uk/beis