Department for
Business, Energy
& Industrial Strategy

ENERGY TRENDS
SEPTEMBER 2019

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Introduction

Energy Trends and Energy Prices are produced by the Department for Business, Energy and Industrial Strategy (BEIS) on a quarterly basis. Both periodicals are published concurrently in June, September, December and March. The September editions cover the second quarter of the current year.

Energy Trends includes information on energy as a whole and by individual fuels. The text and charts provide an analysis of the data in the tables. The tables are mainly in commodity balance format, as used in the annual Digest of UK Energy Statistics. The 2019 edition of the Digest was published on 25 July 2019 and is available on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

The balance format shows the flow of a commodity from its sources of supply, through to its final use. The articles provide in-depth information on current issues within the energy sector.

The text and tables included in this publication represent a snapshot of the information available at the time of publication. However, the data collection systems operated by BEIS, which produce this information, are in constant operation. New data are continually received and revisions to historic data made. To ensure that those who use the statistics have access to the most up-to-date information, revised data will be made available as soon as possible. The tables are available free of charge from the BEIS section of the GOV.UK website. In addition to quarterly tables, the main monthly tables continue to be updated and are also available on the BEIS section of the GOV.UK website. Both sets of tables can be accessed at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Energy Trends does not contain information on Foreign Trade, Weather (temperature, wind speed, sun hours and rainfall) and Prices. Foreign Trade and Weather tables are however available on the BEIS section of the GOV.UK website at:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics
Information on Prices can be found in the Energy Prices publication and on the BEIS section of the GOV.UK website at: www.gov.uk/government/collections/quarterly-energy-prices

Please note that the hyperlinks to tables within this document will open the most recently published version of a table. If you require a previously published version of a table, please contact Kevin Harris (see details below).

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The main points for the second quarter of 2019:

- Total energy production was 1.9 per cent lower than in the second quarter of 2018.
- Oil production rose by 1.5 per cent when compared with the second quarter of 2018, with crude oil production up 1.9 per cent and Natural Gas Liquids (NGLs) production up 0.3 per cent.
- Natural gas production was 4.7 per cent lower than the second quarter of 2018, mainly due to the closure of the Theddlethorpe terminal in August 2018. Gas imports rose by 31 per cent, driven by higher LNG imports, whilst exports nearly doubled.
- Coal production fell to a new record low in the second quarter of 2019 and was 25 per cent lower than the second quarter of 2018, due to falling demand. Coal imports were 19 per cent lower. Generators' demand for coal fell by 61 per cent to a record low.
- Total primary energy consumption for energy uses fell by 0.1 per cent. However, when adjusted to take account of weather differences between the second quarter of 2018 and the second quarter of 2019, total primary energy consumption fell by 1.8 per cent.
- Temperatures in the quarter were on average 1.3 degrees Celsius cooler than a year earlier, with May and June 2019 being particularly cooler than in 2018.
- Final energy consumption (excluding non-energy use) was 1.2 per cent higher than in the second quarter of 2018. Domestic consumption rose by 5.7 per cent and other final users consumption rose by 4.8 per cent, whilst industrial consumption fell by 1.4 per cent and transport consumption fell by 1.3 per cent. On a temperature adjusted basis, final energy consumption fell by 3.0 per cent.
- Gas demand was 3.9 per cent higher than the second quarter of 2018 due to the cooler weather in the period, whilst electricity consumption was 0.2 per cent higher than in the second quarter of 2018.
- Electricity generated in the second quarter of 2019 fell by 0.9 per cent to 76.3 TWh compared to a year earlier.
- Of electricity generated in the second quarter of 2019, coal accounted for only 0.6 per cent, whilst gas accounted for 43.6 per cent. Nuclear generation accounted for 17.1 per cent of total electricity generated in the second quarter of 2019.
- Low carbon electricity's share of electricity generation fell slightly to 52.6 per cent in the second quarter of 2019, compared to 53.6 per cent in the second quarter of 2018.
- Renewables' share of electricity generation was a 35.5 per cent in the second quarter of 2019, up 3.5 percentage points on the share in the second quarter of 2018, mainly due to increased capacity.
- Renewable electricity generation was 27.1 TWh in the second quarter of 2019, an increase of 10 per cent on the 24.6 TWh in the second quarter of 2018.
- Renewable electricity capacity was 45.9 GW at the end of the second quarter of 2019, a 7.9 per cent increase (3.4 GW) on a year earlier, with two thirds of the annual increase coming from wind.

Section 1 – UK Total Energy
April to June 2019

Key results show:

Total energy production was 1.9 per cent lower than in the second quarter of 2018. (**Charts 1.1 & 1.2**)

Total primary energy consumption for energy uses fell by 0.1 per cent. However, when adjusted to take account of weather differences between the second quarter of 2018 and the second quarter of 2019, primary energy consumption fell by 1.8 per cent. (**Chart 1.3**)

Final energy consumption (excluding non-energy use) rose by 1.2 per cent compared to the second quarter of 2018. Domestic consumption rose by 5.7 per cent, other final users (mainly from the service sector) consumption rose by 4.8 per cent, whilst industrial consumption fell by 1.4 per cent and transport consumption fell by 1.3 per cent. (**Charts 1.4 & 1.5**)

On a temperature adjusted basis, final energy consumption fell by 3.0 per cent, with falls in all sectors. (**Chart 1.5**)

Net import dependency was 32.5 per cent, down 1.6 percentage points from the second quarter of 2018. (**Chart 1.6**)

Fossil fuel dependency was 78.5 per cent, in the second quarter of 2019. (**Chart 1.7**)

Relevant tables

1.1: Indigenous production of primary fuels
1.2: Inland energy consumption: primary fuel input basis
1.3: Supply and use of fuels, and Seasonally adjusted and temperature corrected final energy consumption

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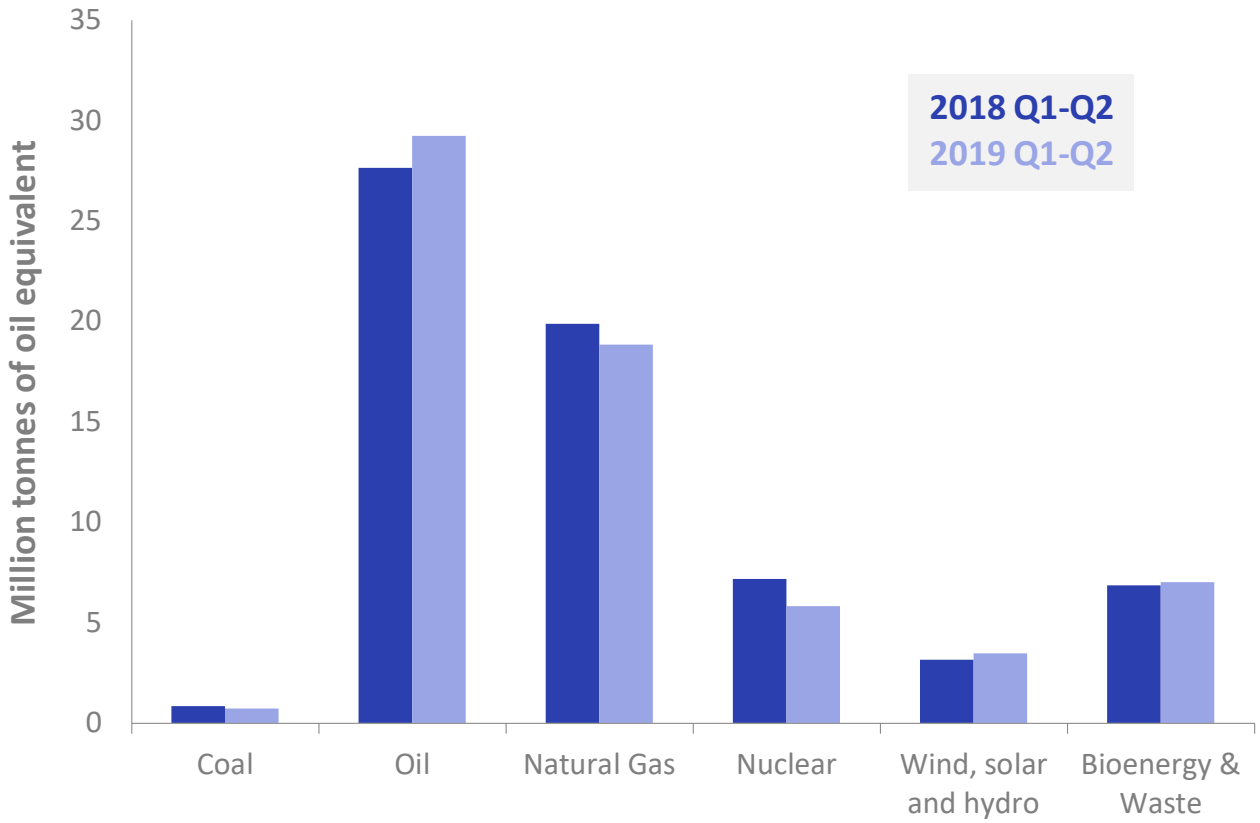
Chart 1.1 Production of indigenous primary fuels (Table 1.1)



Total production in the second quarter of 2019 was 31.4 million tonnes of oil equivalent, 1.9 per cent lower than in the second quarter of 2018.

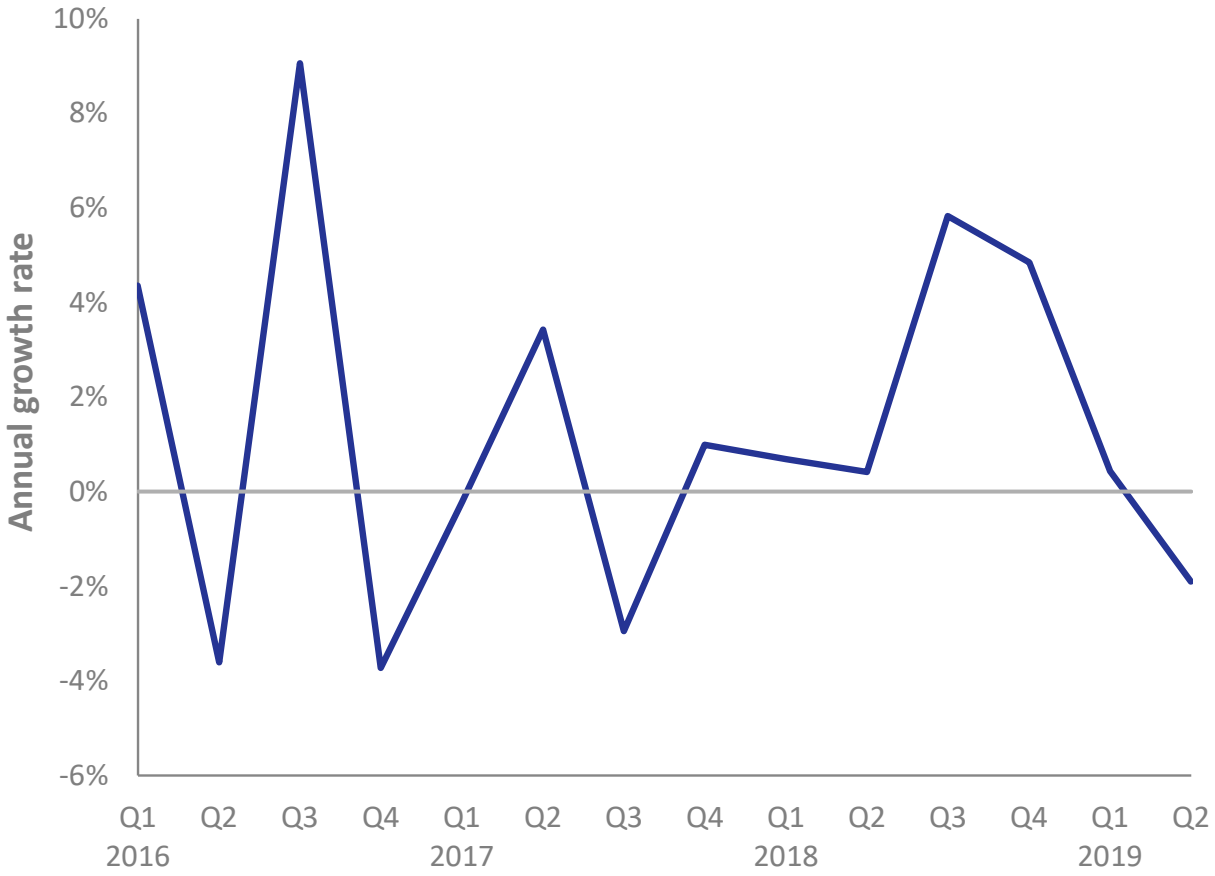
Production of oil rose by 1.8 per cent, whilst production of natural gas fell by 4.7 per cent due to the closure of the Theddlethorpe terminal in August 2018.

Primary electricity output in the second quarter of 2019 was 12 per cent lower than in the second quarter of 2018. Nuclear electricity output was 21 per cent lower due to maintenance outages at the major reactors at Hunterston B, Dungeness B and Sizewell B, and refuelling outages at Hartlepool and Heysham 1 nuclear stations, whilst output from wind, hydro and solar pv was 11 per cent higher, driven by increased wind capacity.

Production of bioenergy and waste was 10 per cent higher compared to the second quarter in 2018, due to a corresponding increase in capacity.

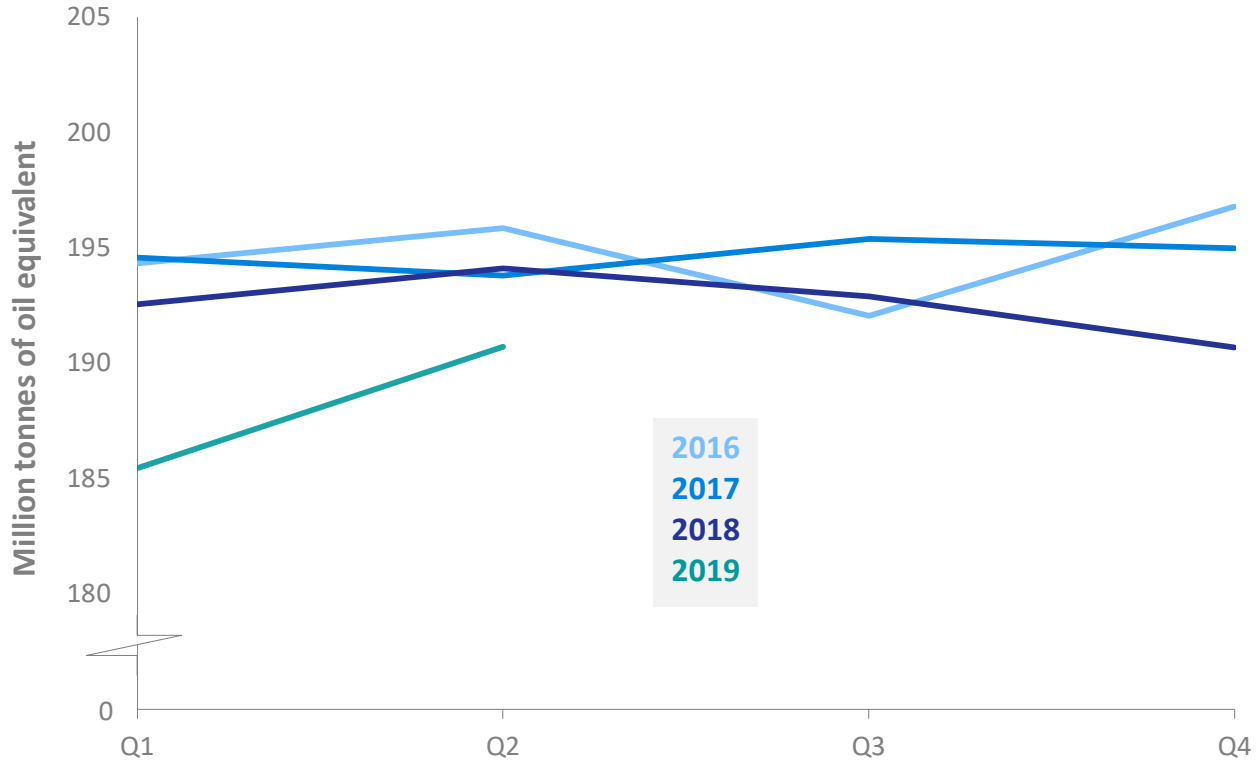
In the second quarter of 2019 production of coal and other solid fuels was 22 per cent lower than the corresponding period of 2018 and at a record low level, due to reduced demand from electricity generators.

Chart 1.2 UK production (annual growth rate) (Table 1.1)



In the second quarter of 2019, the annual growth rate of UK quarterly production was -1.9 per cent on the same quarter last year with increases in oil, bioenergy & waste and wind and solar output offset by decreases in coal, gas, nuclear and hydro output.

Chart 1.3 Total inland consumption (primary fuel input basis) [1] (Table 1.2)



(1) Seasonally adjusted and temperature corrected annual rates

Total inland consumption on a primary fuel input basis (seasonally adjusted and temperature corrected annualised rate), was 190.7 million tonnes of oil equivalent in the second quarter of 2019, 1.8 per cent lower than in the second quarter of 2018. The main driver for reduced level of consumption is the switch by electricity generators from using fossil fuels to renewable sources (bioenergy, wind, solar and hydro), as well as improvements in energy efficiency.

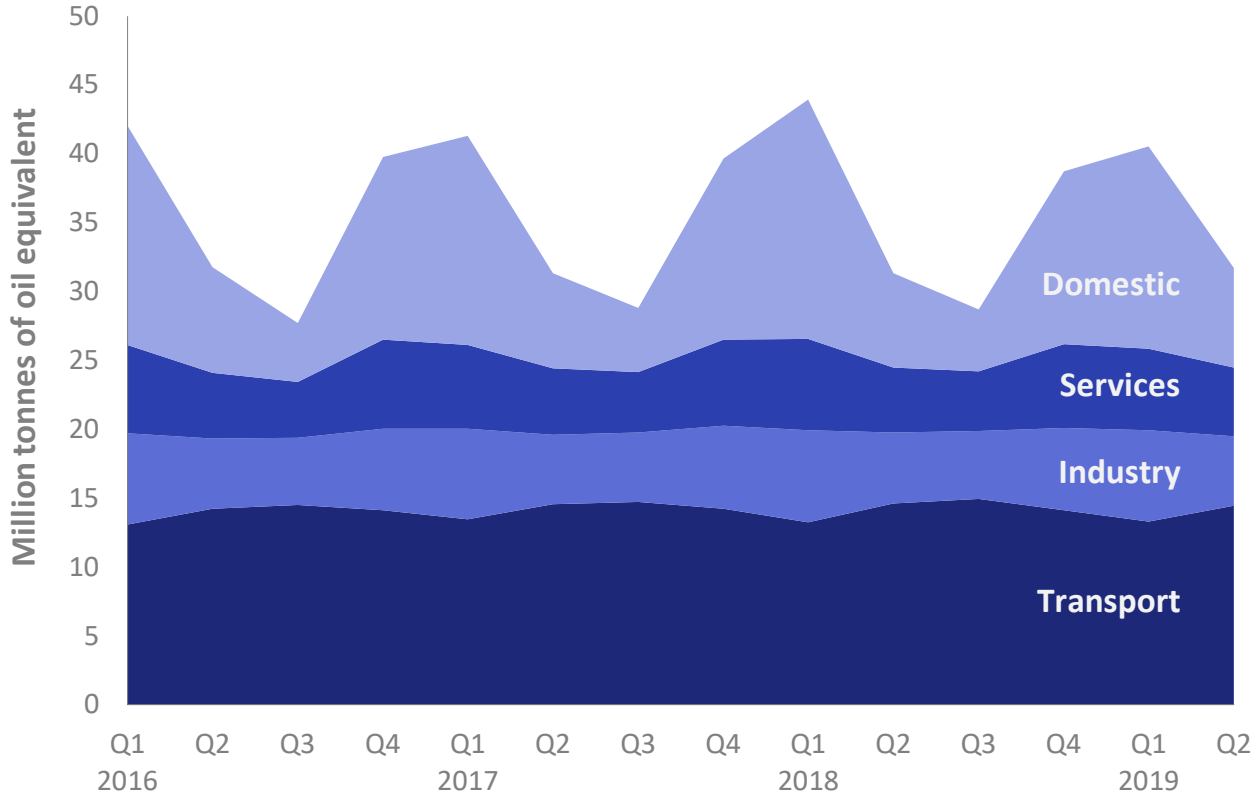
The average temperature in the second quarter of 2019 was 1.3 degrees Celsius cooler than the same period a year earlier, with May and June being particularly cooler than in 2018.

Between the second quarter of 2018 and the second quarter of 2019 (on a seasonally adjusted and temperature corrected basis) coal and other solid fuel consumption fell by 21 per cent, driven by decreased coal use in electricity generation.

On the same basis, natural gas consumption fell by 0.8 per cent between the second quarter of 2018 and the second quarter of 2019, whilst oil consumption in the second quarter of 2019 was 1.4 per cent lower than in the second quarter of 2018.

Also, on a seasonally adjusted and temperature corrected basis there was a fall of 21 per cent in nuclear consumption, but record quarterly high levels of wind, hydro and solar pv (up 12 per cent) and of bioenergy & waste (up 13 per cent) consumption.

Chart 1.4 Final energy consumption by user (Table 1.3a)



Total final energy consumption rose by 0.9 per cent between the second quarter of 2018 and the second quarter of 2019.

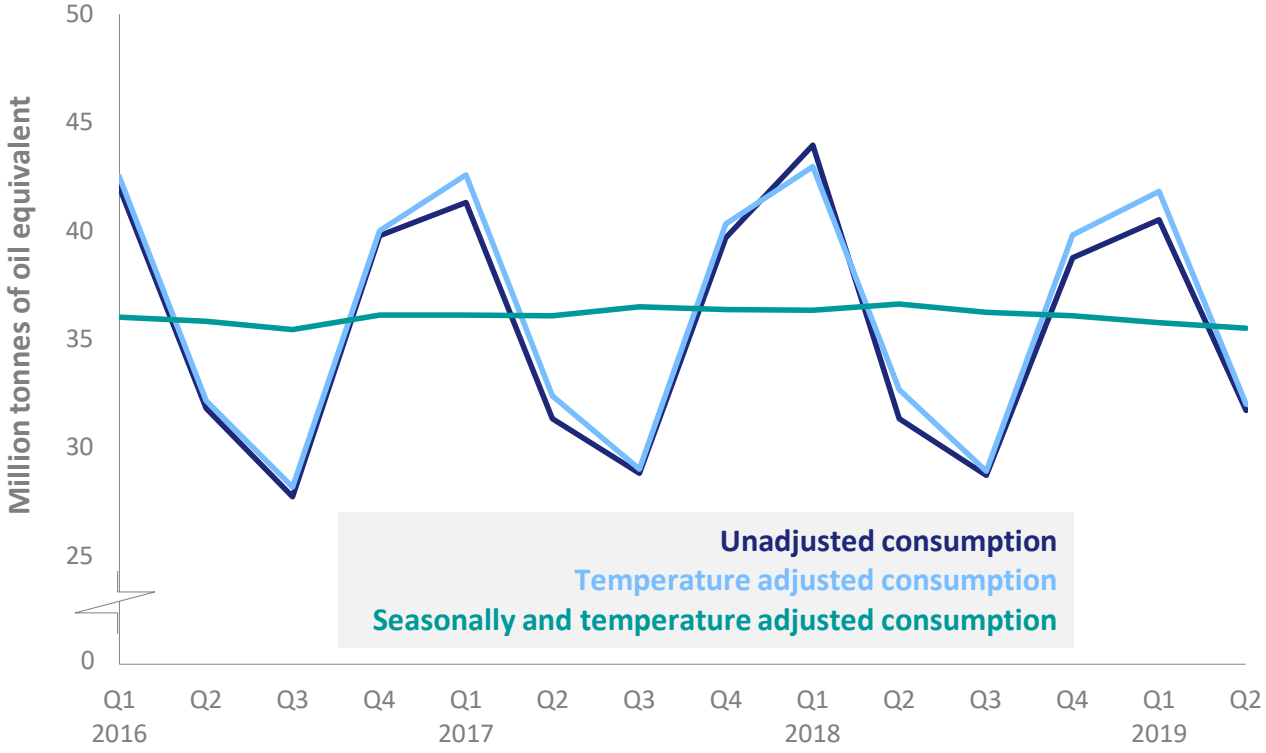
Domestic sector energy consumption rose by 5.7 per cent. Average temperatures in the second quarter of 2019 were 1.3 degrees Celsius cooler than a year earlier, with May and June being 1.7 and 1.6 degrees Celsius cooler than in 2018.

Service sector energy consumption rose by 4.8 per cent.

Industrial sector energy consumption fell by 1.4 per cent.

Transport sector energy consumption fell by 1.3 per cent.

Chart 1.5 Seasonally adjusted and temperature corrected final energy consumption (Table 1.3c)

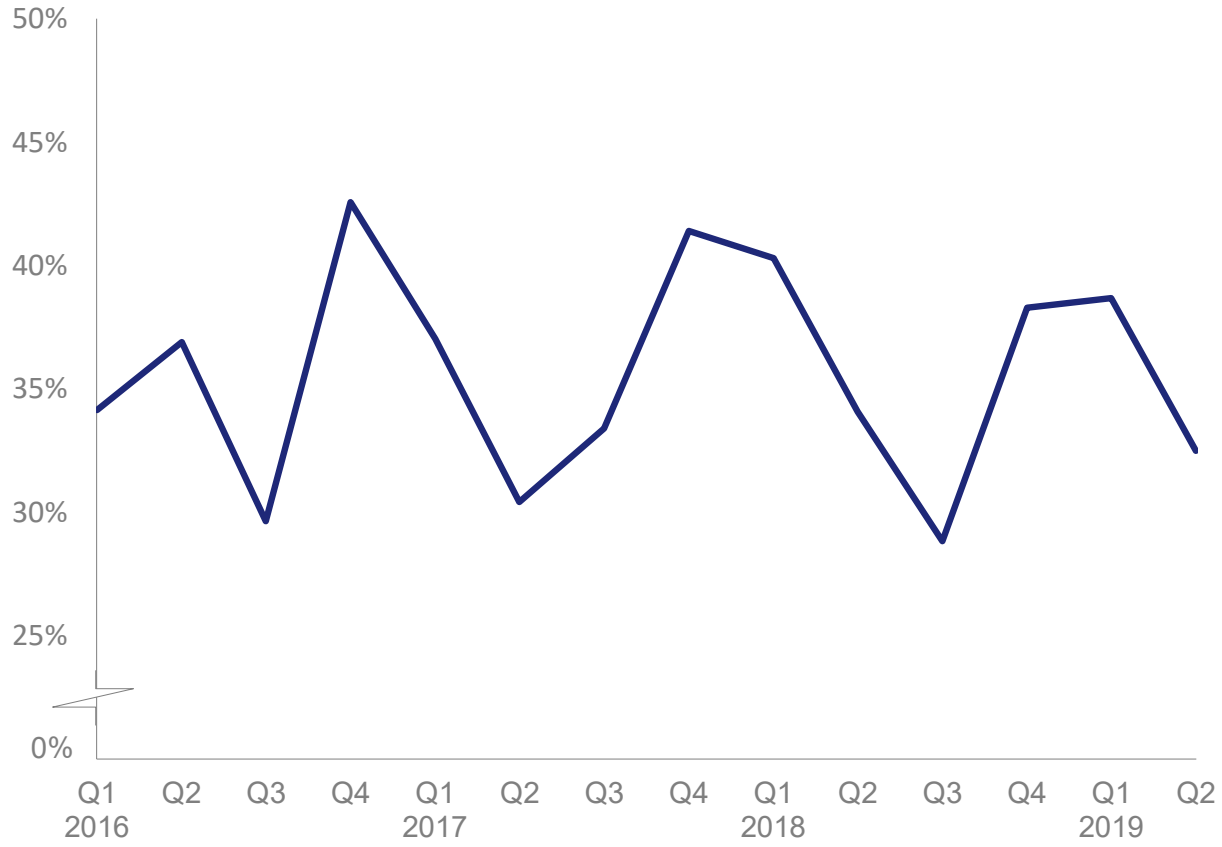


Total unadjusted final energy consumption (excluding non-energy use) rose by 1.2 per cent between the second quarter of 2018 and the second quarter of 2019.

On a seasonally and temperature adjusted basis final energy consumption (excluding non-energy use) fell by 3.0 per cent between the second quarter of 2018 and the second quarter of 2019.

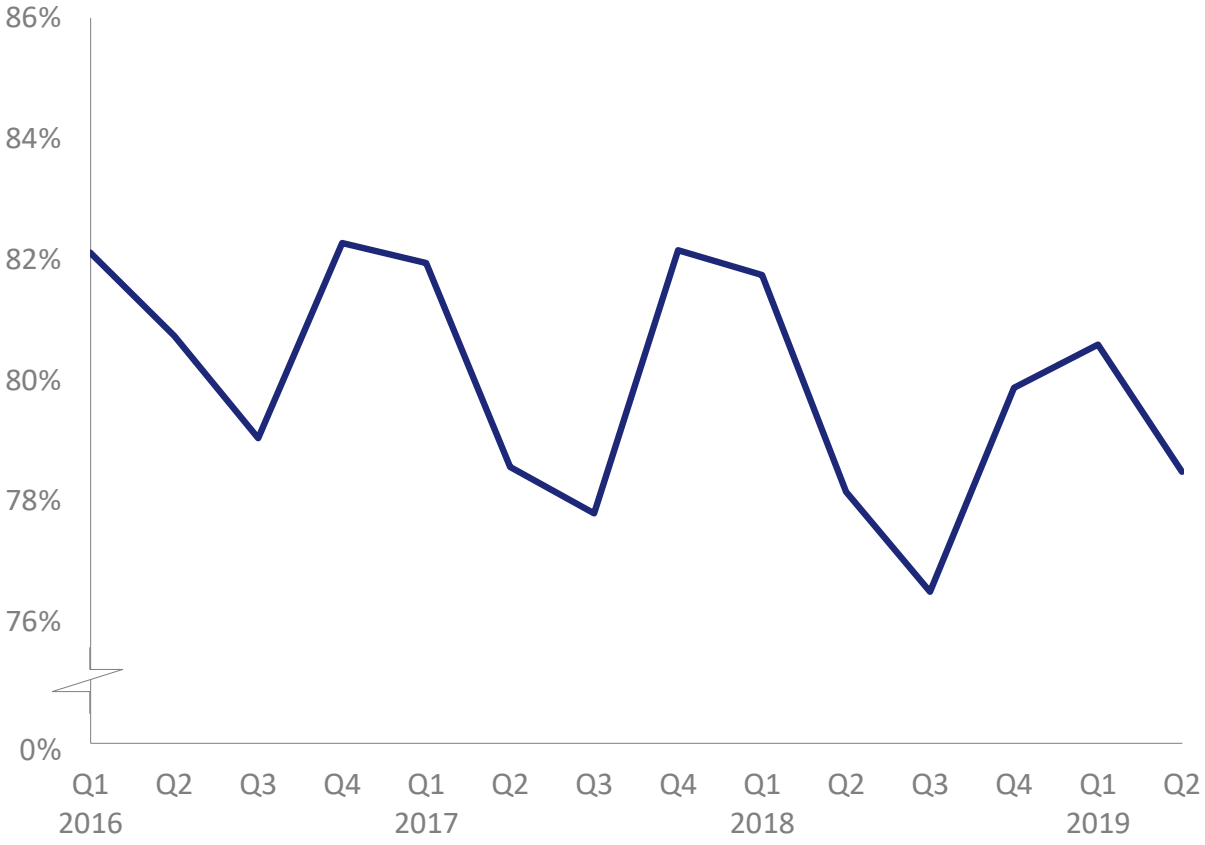
Unadjusted domestic consumption rose by 5.7 per cent over the same period but was down 6.0 per cent on a seasonally and temperature adjusted basis.

Chart 1.6 Net import dependency (Table 1.3a)



In the second quarter of 2019 net import dependency was 32.5 per cent, down 6.2 percentage points from the first quarter of 2019, and down 1.6 percentage points from the second quarter of 2018, reflecting rises in export volumes, primarily from gas.

Chart 1.7 Fossil fuel dependency (Table 1.3a)



In the second quarter of 2019 fossil fuel dependency was 78.5 per cent, up 0.3 percentage points from the second quarter of 2018 but down 2.1 percentage points from the first quarter of 2019.

Section 2 – UK Solid Fuels and Derived Gases
April to June 2019

Key results show:

Overall coal production in the second quarter of 2019 fell to a new record low of 0.5 million tonnes, down 25 per cent compared with the second quarter of 2018. Surface mining production fell to 493 thousand tonnes. This is as a result of mine closures and falling demand for coal for electricity generation. **(Chart 2.1)**

Coal imports fell 19 per cent on the second quarter of 2018. This was the lowest in the recorded time series. **(Charts 2.1 and 2.2)**

The demand for coal by electricity generators in the second quarter of 2019 fell to a new record low of 0.2 million tonnes and was 61 per cent lower than demand in the second quarter of 2018. The decline was due to high carbon prices, an increase in renewables generation, the closure of Eggborough power station which contributed to the longest period without coal generation since the 1880s, **(Chart 2.3)**

Total stock levels were up 36 per cent (+1.6 million tonnes) to 6.1 million tonnes compared to a year earlier as a result of a build-up of electricity generators stocks as less coal was used in electricity generation. **(Chart 2.4)**

Relevant tables

2.1: Supply and consumption of coal
2.2: Supply and consumption of coke oven coke, coke breeze and other manufactured solid fuels
2.3: Supply and consumption of coke oven gas, blast furnace gas, benzole and tars
2.4: Coal imports

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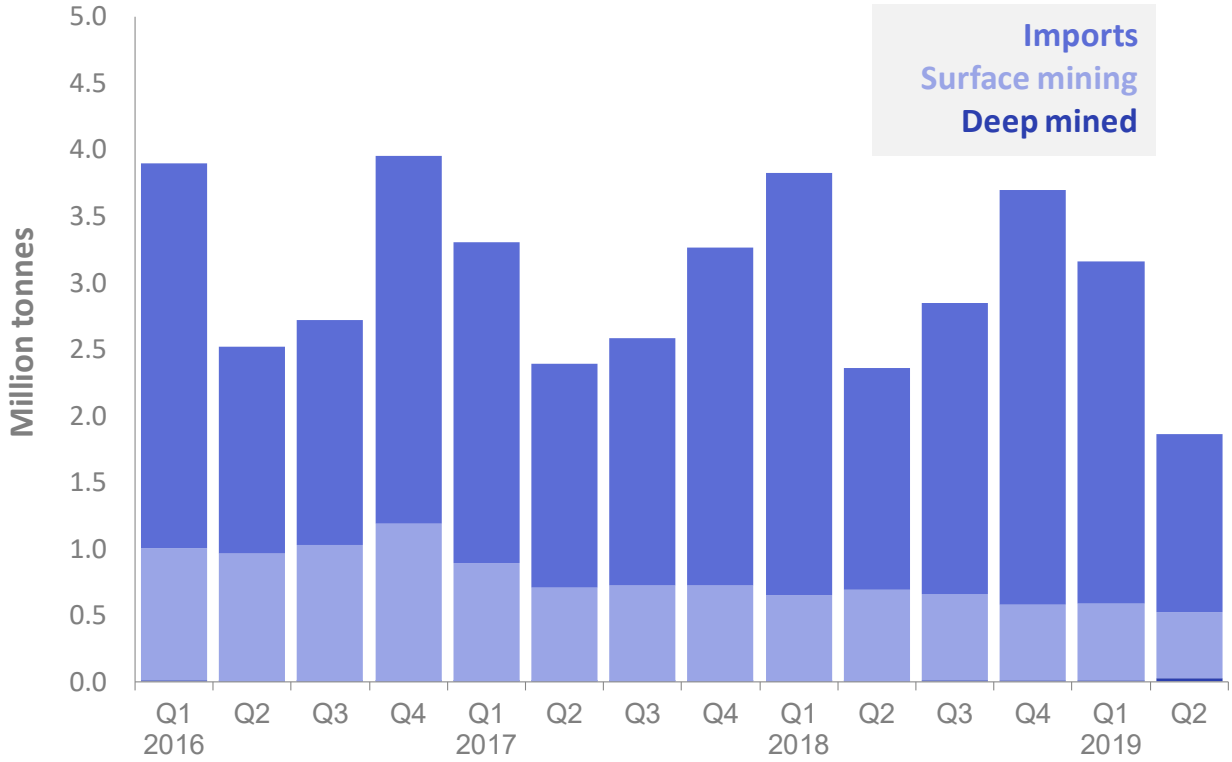
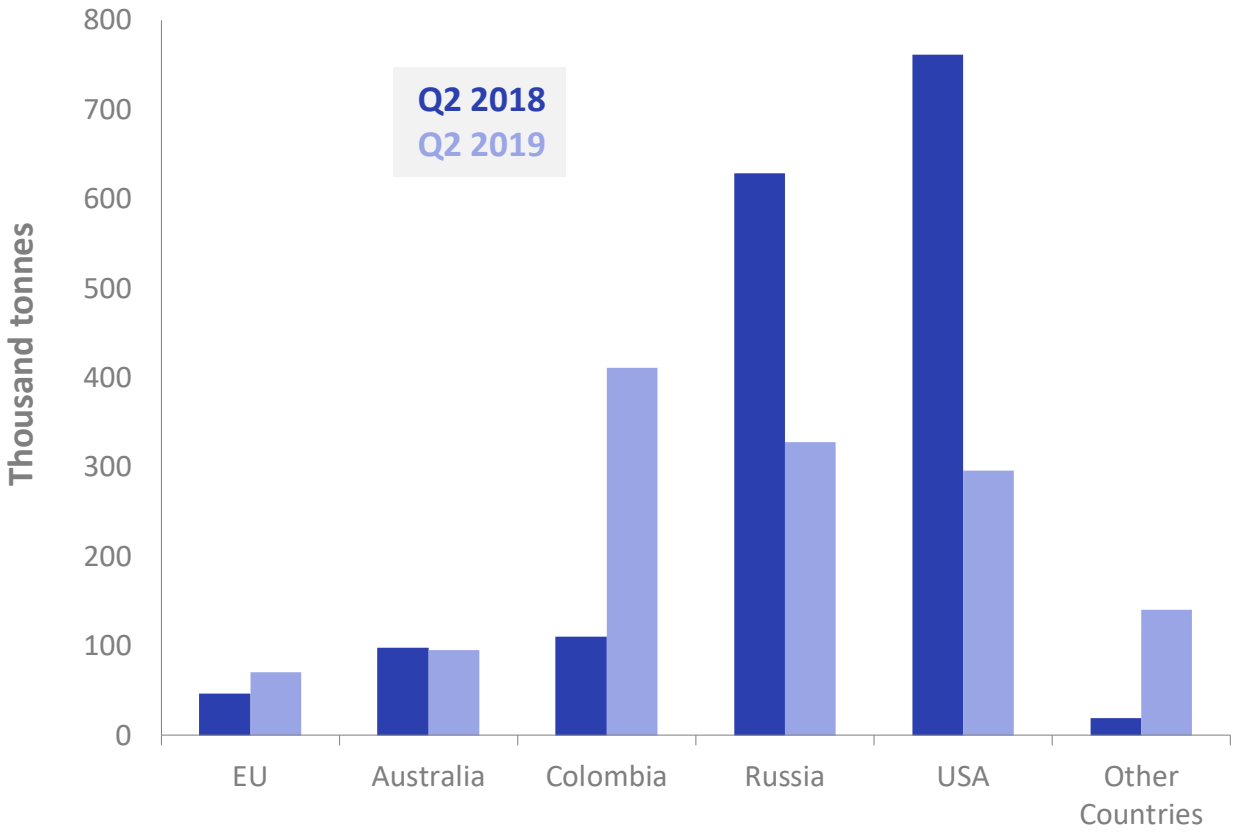
Chart 2.1 Coal supply (Table 2.1)



Coal production in the second quarter of 2019 fell to 0.5 million tonnes, 25 per cent down compared to the second quarter of 2018. The bulk of this decrease came from the contraction in surface mine output as deep mine production is now only 5 per cent of production with only seven small deep mines remaining. This is as a result of mine closures and falling demand for coal for electricity generation.

Deep mined production increased from 4 thousand tonnes to 27 thousand tonnes due to Aberpergwm colliery which came out of care and maintenance and went back into production.

Chart 2.2 Steam coal imports (Table 2.4)



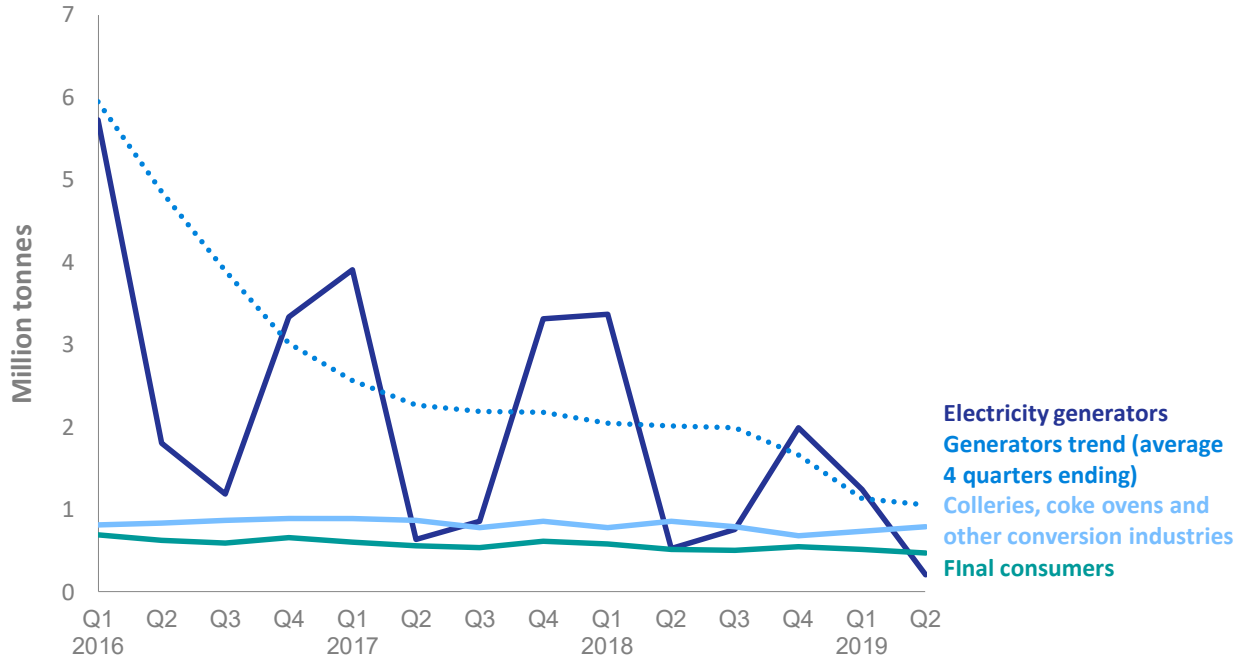
In the second quarter of 2019, total coal imports decreased by 19 per cent to 1.3 million tonnes. Colombia (31 per cent), Russia (24 per cent) and the USA (22 per cent) accounted for 77 per cent of total coal imports. Steam coal imports in the second quarter of 2019 fell by 30 per cent to 0.8 million tonnes. Steam coal imports accounted for 59 per cent of total coal imports. Coking coal imports in the second quarter of 2019 rose by 5.7 per cent to 0.5 million tonnes and accounted for 39 per cent of total coal imports.

Table 2A Coal imports by origin

Thousand Tonnes

	2017	2018	2018 Q2	2019 Q2p
European Union	356	344	47	70
Russia	3,883	4,695	629	328
Colombia	731	635	111	412
USA	2,352	3,573	762	297
Australia	749	630	98	96
Other Countries	427	268	19	141
Total Imports	**8,498**	**10,144**	**1,666**	**1,343**

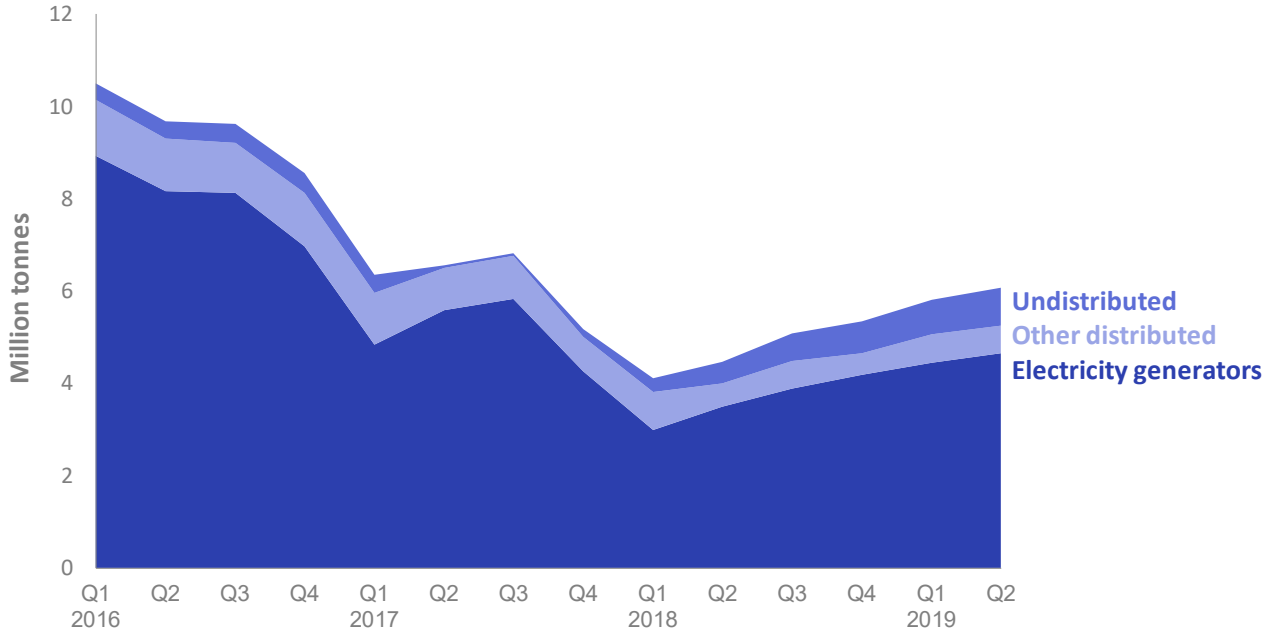
Chart 2.3 Coal consumption (Table 2.1)



Total demand for coal in the second quarter of 2019, at 1.5 million tonnes, was 22 per cent lower than in the second quarter of 2018. Consumption by electricity generators was down by 61 per cent to a record low of 0.2 million tonnes. Electricity generators accounted for 14 per cent of total coal use in the second quarter of 2018 compared with 28 per cent a year earlier. High carbon prices and significantly lower demand have continued to result in the decline of coal-fired electricity, where April-June had the first quarter with coal generation below 1 per cent of total generation. This comes after coal's share of supply fell to a record low of 0.2 per cent in May after just 5 days of coal-fired generation on the GB grid during the month and the UK's longest period without coal generation since the 1880s, at 18 days and 6 hours (see Energy Trends table 5.4). The increase in generation from renewables and the closure of Eggborough power station in September 2018 also contributed to lower coal-fired generation.

In the second quarter of 2019, sales to industrial users fell by 10 per cent to 0.4 million tonnes whilst sales to other final consumers (including domestic) increased by 1.0 per cent to 0.1 million tonnes. Coal used in blast furnaces was down 7.8 per cent compared to the second quarter of 2018, to 0.3 million tonnes.

Chart 2.4 Coal stocks (Table 2.1)



As part of the usual seasonal pattern, coal stocks rose by 0.2 million tonnes from the first quarter of 2019 and at the end of June stood at 6.1 million tonnes. This was 1.6 million tonnes higher than at the end of June 2018.

The level of coal stocks at power stations at the end of the second quarter of 2019 was 4.6 million tonnes, 1.2 million tonnes higher than at the end of June 2018. This was mainly due to a build up of electricity generators stocks as less coal was used in electricity generation.

Stocks held by coke ovens were 0.5 million tonnes at the end of the second quarter of 2019, this was 83 thousand tonnes higher than stock levels at the end of June 2018.

Stocks held by producers (undistributed stocks) at the end of the second quarter of 2019 were 0.8 million tonnes.

Section 3 – UK Oil and Oil Products
April to June 2019

Key results show:

Demand for transport was down by 2.1 per cent because demand for road fuels fell by 3.0 per cent overall. This was only the sixth quarter in which road fuel demand fell since 2013. Excluding the bio component, demand for petrol was down 1.0 per cent while demand for road diesel decreased by 4.0 per cent. Deliveries of jet fuel increased by 3.2 per cent. **(Chart 3.5)**

The reduction in transport, combined with a 3.5 per cent fall in non-energy use, meant final consumption was down by 1.7 per cent. **(Chart 3.4)**

Strong growth in exports and a small decrease in imports meant that the UK primary oil net import position was just 1.0 million tonnes, the second lowest level in 10 years and down by nearly two-thirds compared to 2018. This meant that UK refinery dependence on net imports was just 7.3 per cent – the second lowest level since 2010. **(Chart 3.3)**

Indigenous production of crude oil and Natural Gas Liquids (NGLs) in Q2 2019 was up 1.5 per cent, with a 1.9 per cent increase in crude oil production and a 0.3 per cent increase in NGLs. **(Chart 3.1)**

Indigenous production of petroleum products was down 1.7 per cent on last year. Imports decreased by 5.4 per cent while exports decreased by 14 per cent. The UK was a net importer of petroleum products in Q2 2019 by 4.0 million tonnes following the sharp fall in exports. This is a new quarterly high since the UK became a net importer in 2013. **(Chart 3.2)**

Overall stocks of crude oil and petroleum products were up by 0.2 per cent at end of Q2 2019. **(Chart 3.6)**

Relevant tables

3.1: Supply and use of crude oil, natural gas liquids and feedstocks
3.2: Supply and use of petroleum products
3.4: Supply and use of petroleum products: latest quarter
3.5: Biofuels sales and sales through supermarkets
3.6: Stocks of petroleum at end of period

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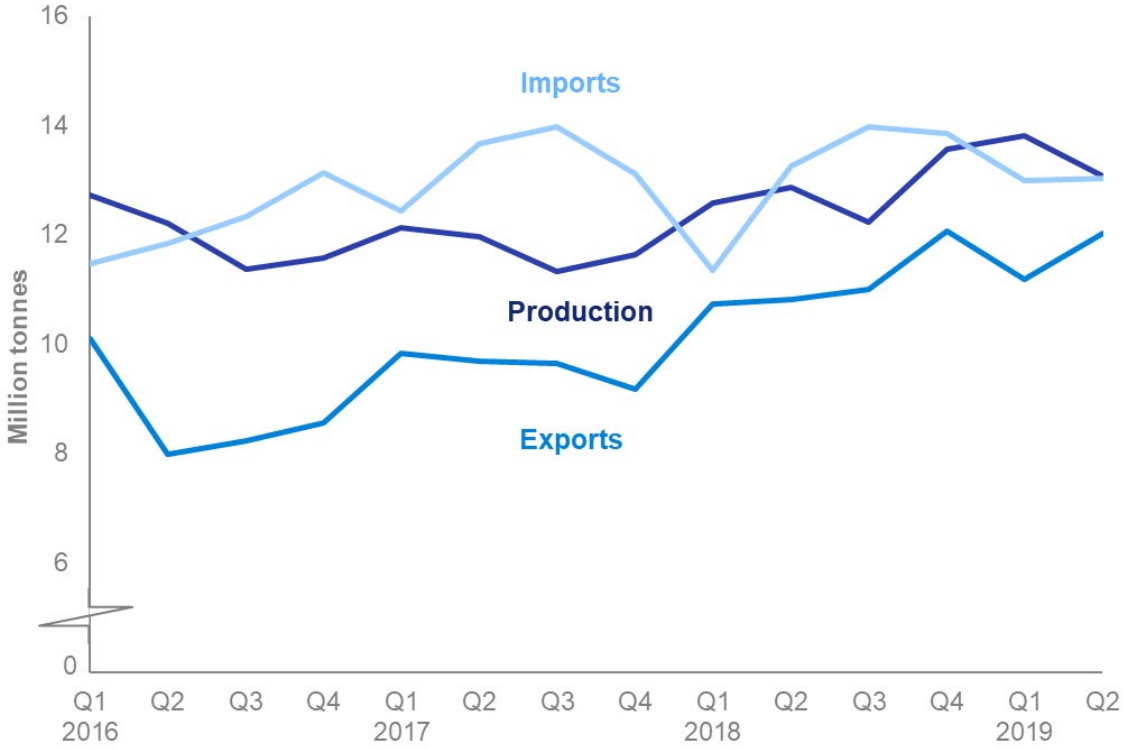
Chart 3.1 Production and trade of crude oil and NGLs (Table 3.1)

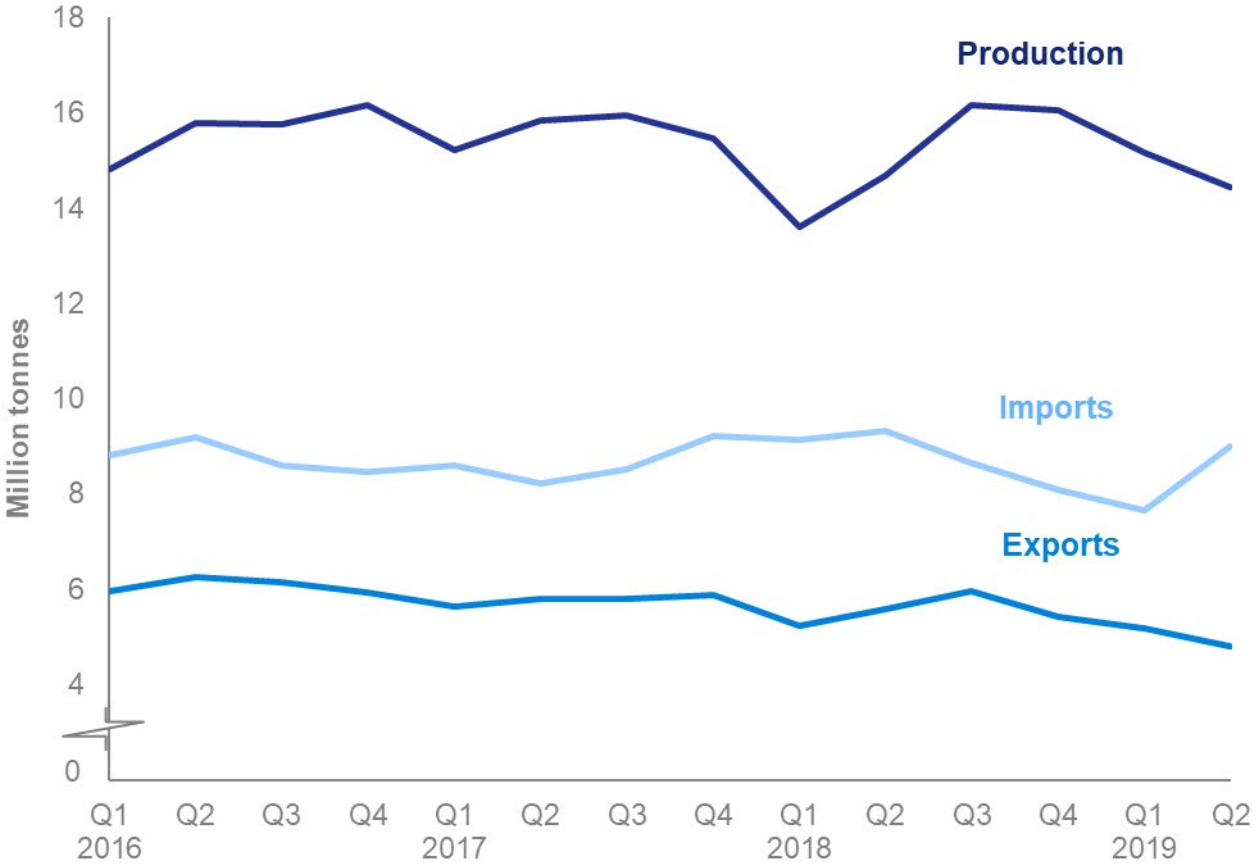


Since the opening of new projects in the North Sea in late 2017 and during 2018 production has been steadily increasing, reversing the long-term trend of decline. Crude oil production in Q2 2019 increased by 1.9 per cent whilst production of Natural Gas Liquids (NGLs) was up 0.3 per cent. As a result, indigenous production of crude and NGLs was 1.5 per cent higher on last year.

Much of this additional production is exported, resulting in robust growth in export figures since the beginning of 2018; in Q2 2019 exports increased by 11 per cent and reached the highest level since 2009.

The robust growth in exports and slight reduction in imports meant that net imports were down nearly two-thirds compared to Q2 2018 and stood at just 1.0 million tonnes. This was the lowest level in 10 years with the sole exception of Q1 2018 when the Forties Pipeline outage substantially reduced import capacity. The UK was a net exporter of primary oils in May with near zero net imports in June.

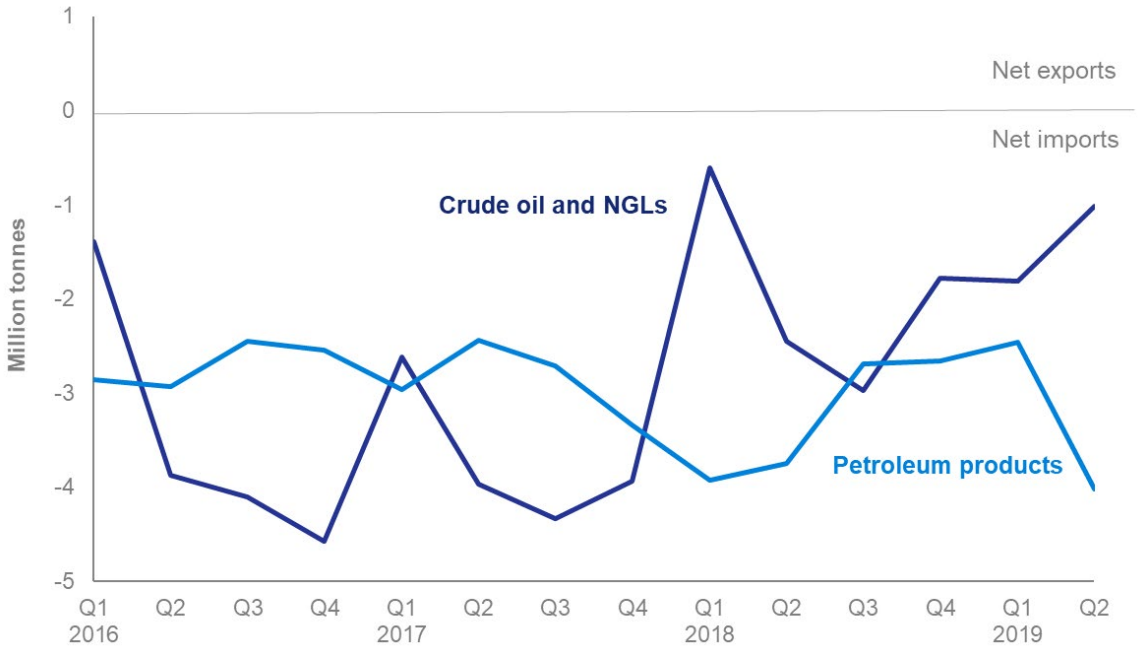
Chart 3.2 Production and trade of petroleum products (Table 3.2)



Indigenous production of petroleum products in Q2 2019 was down 1.7 per cent on last year. Imports of petroleum products decreased by 5.4 per cent (0.5 million tonnes) and exports decreased 14 percent (0.8 million tonnes) on Q2 2018.

The reduction in exports meant that net imports were high at 4.0 million tonnes in Q2 2019, the highest quarterly level after reaching 3.7 million tonnes in Q2 last year when refineries were undergoing an extended period of maintenance.

Chart 3.3 Overall trade in primary oils and petroleum products (Table 3.1)

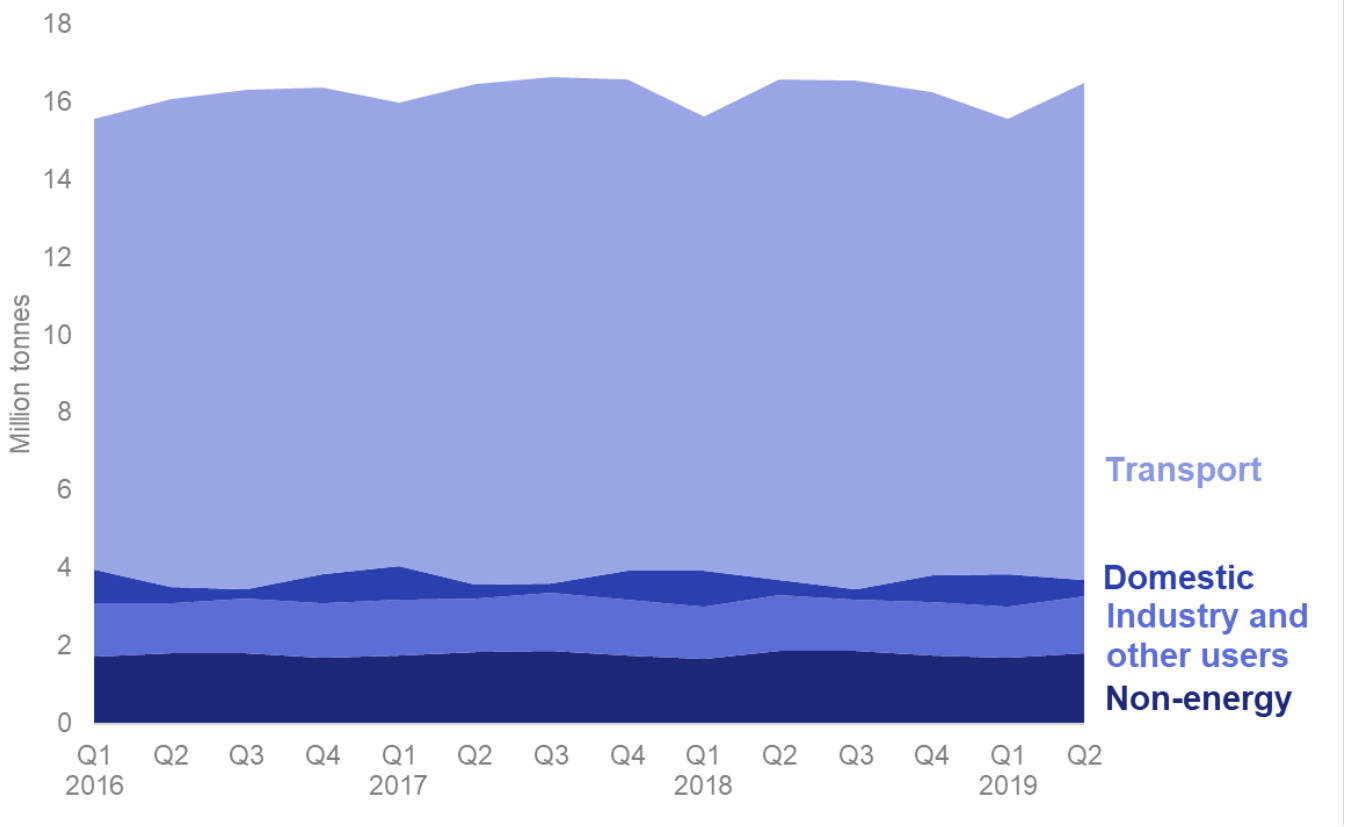


In Q2 2019 net imports of primary oils (crude, NGLs and feedstocks) decreased by nearly two-thirds to 1.0 million tonnes compared with 2.5 million tonnes in Q2 2018.

The UK's overall net import dependence for primary oils was just 7.3 per cent in Q2 2019, the lowest since 2010 except for Q1 2018 when the Forties pipeline outage reduced imports. In Q2 2018 refinery net import dependence was 17.3 per cent.

In Q2 2019 the UK was a net importer of petroleum products by 4.0 million tonnes, up from 3.7 million tonnes in the second quarter of 2018 and the highest on record following a sharp decline in exports.

Chart 3.4 Final consumption of oil (Table 3.4)

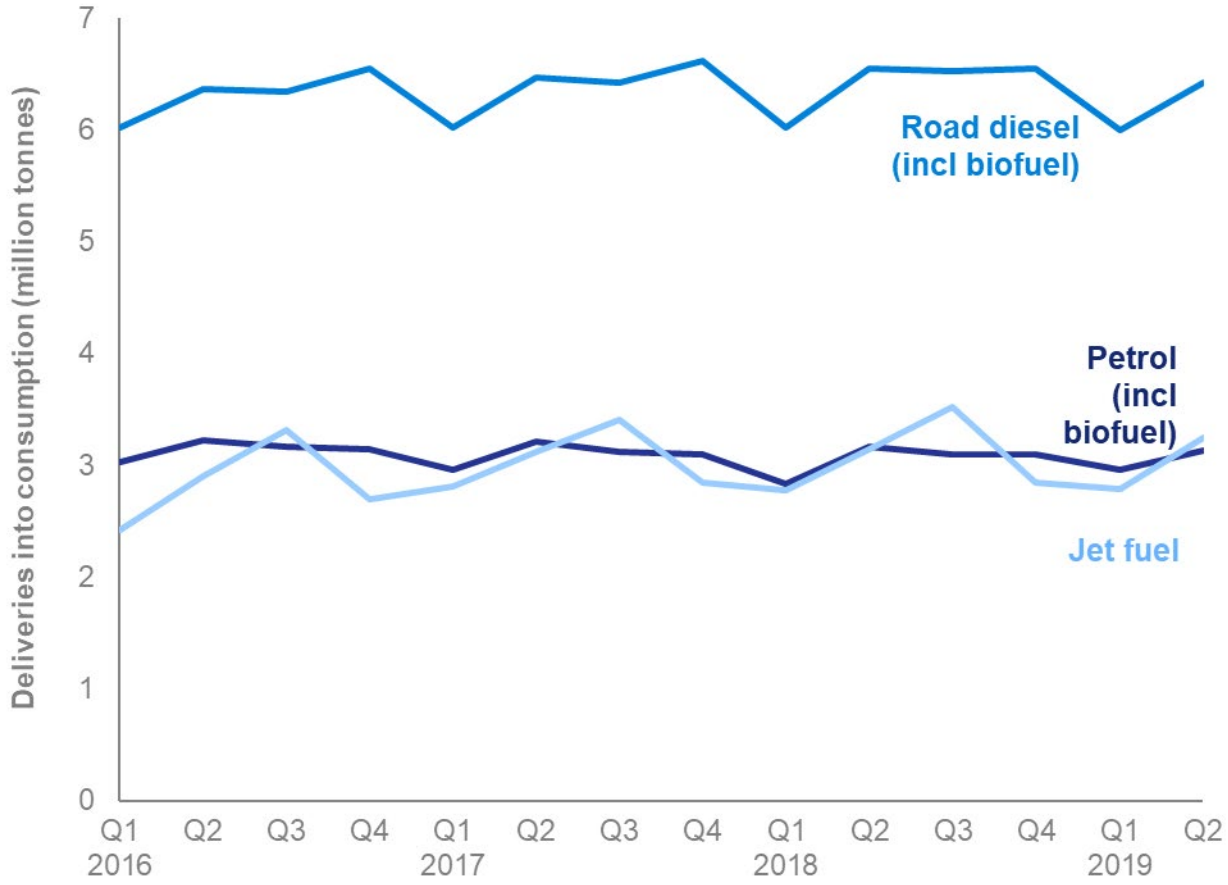


In Q2 2019 final consumption of petroleum products was down 1.7 per cent on last year as demand for transport and non-energy use fell 2.1 per cent and 3.5 per cent respectively.

Transport, which accounts for over three-quarters of UK final consumption fell by a record 2.1 per cent. This reduction matches the same decrease in Q1 2018 seen during the severe weather that restricted travel during the Beast from the East early last year.

While demand for aviation fuel increased by 3.2 per cent, road fuel demand was down by 3.0 per cent, a far larger contraction than usual. Diesel demand was down by 4.0 per cent (a record fall since Q1 2009) and petrol by 1.0 per cent. (See Chart 3.5 for more detail).

Chart 3.5 Demand for key transport fuels (Table 3.4 and Table 3.5)



Overall demand for road fuels (excluding biofuels) fell by 3.0 per cent, the largest decrease since 2013 and only the sixth quarterly fall in the 26 quarters since Q1 2013.

Demand for petrol was down by 1.0 per cent and diesel by 4.0 per cent compared to Q2 2018, the largest decrease seen since 2009[1]. Overall diesel demand was down by 1.9 per cent as biodiesel reached record highs in terms of volume (0.4 million tonnes) and proportion of the total (5.7 per cent).

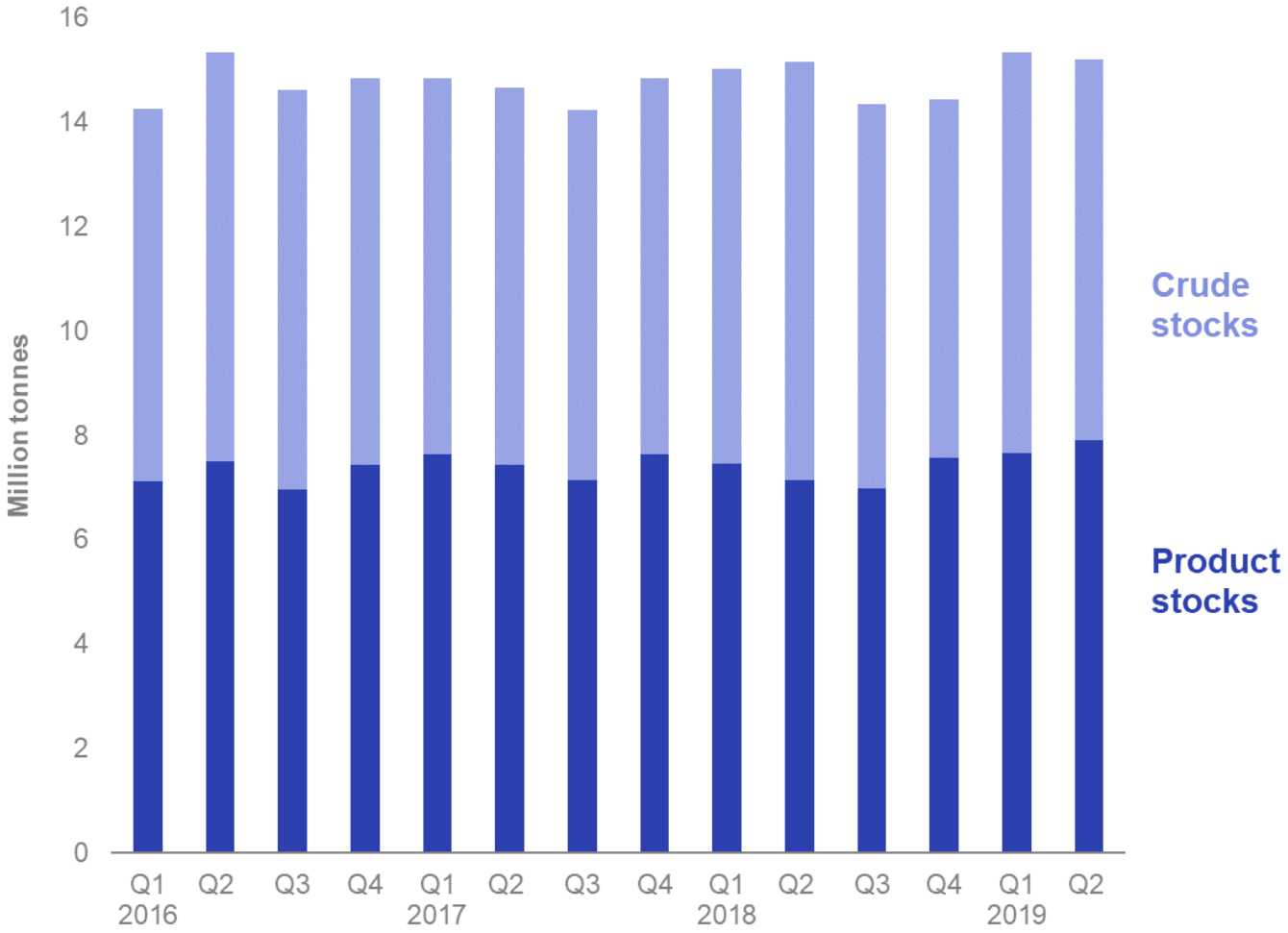
The reduction in demand for overall road fuels can be linked to the 0.6 billion reduction in vehicle miles driven in Q2 2019 compared to 2018 (down 0.7 per cent)[2].

Notably less miles were driven by Light (LGV) and Heavy (HGV) Goods vehicles. Nearly all LGVs and all HGVs are diesel-fuelled, meaning that the 3.6 per cent reduction in miles travelled by each of these vehicle classes has had a substantial effect on diesel demand. This has been compounded by the recent shift seen in the increased use of petrol over diesel fuelled cars meaning the fall in diesel demand far outstripped the fall in demand for petrol.

Demand for aviation turbine fuel increased by 3.2 per cent compared to Q2 2018. Consumption increased sharply on the first quarter of this year because demand is seasonal with more people flying during summer months.

[1] Please note that these figures are derived from a new HMRC data system and should be seen as provisional.
[2] See Department for Transport quarterly traffic estimates TRA 2501: www.gov.uk/government/statistical-data-sets/tra25-quarterly-estimates

Chart 3.6 UK oil stocks (Table 3.6)



At the end of Q2 2019 total stocks for all oil were up 0.2 per cent (0.3 million tonnes) compared to the same point in 2018.

Stocks of primary oils were down 9.2 per cent, primarily because of a decrease in stocks held at terminals.

In contrast, product stocks were up 11 per cent with an increase in volumes held under bilateral agreements offsetting a fall in physical stocks of motor gasoline and kerosene.

Chart 3.6 combines stocks of products with the product equivalent of stocks of crude oil to give an overall level of UK stocks of key products.

At the end of the Q2 2019 the UK held stocks broadly equivalent to two months of demand, or 180 days of net imports.

Further information on how the UK meets its oil stocking obligations are set out at:
www.gov.uk/government/publications/uk-emergency-oil-stocking-international-obligations

Section 4 – UK Gas
April to June 2019

Key results show:

The most notable development this quarter relates to trade. In the second quarter of 2019, pipeline imports fell by 14 per cent following planned maintenance in Norwegian pipelines during June. This shortfall in pipeline supply was met by Liquefied Natural Gas imports, which tripled in Q2 2019 to 56 TWh. As a result, total imports were up 31 per cent on the previous quarter **(Chart 4.4 and 4.5)**.

Total exports nearly doubled when compared with the same period last year, associated with continued trade with Republic of Ireland and Belgium. However, whilst exports increased by 19 TWh, imports grew by 28 TWh which resulted in net imports going up by 12 per cent **(Chart 4.3).** This was driven by an increase in gas demand across the quarter due to colder temperatures.

UK production of natural gas in the second quarter of 2019 was 4.7 per cent lower compared with the same quarter of 2018 **(Chart 4.1).** This continues to be associated with the closure of the Theddlethorpe gas terminal last August. Within this, production of associated gas was up 9.2 per cent whilst dry gas production decreased by 16 per cent **(Chart 4.2).**

UK demand for natural gas in Q2 2019 increased by 3.9 per cent in comparison to Q2 2018 (to 180 TWh). The cooler temperatures in Q2 2019 compared to particularly warm temperatures in May and June of the previous year resulted in 8.2 and 7.0 per cent increases in demand in the domestic and other final users respectively **(Chart 4.6).**

In contrast, demand for gas for electricity generation was stable whilst industrial use fell by 1.4 per cent **(Chart 4.6).**

4.1: Natural gas supply and consumption

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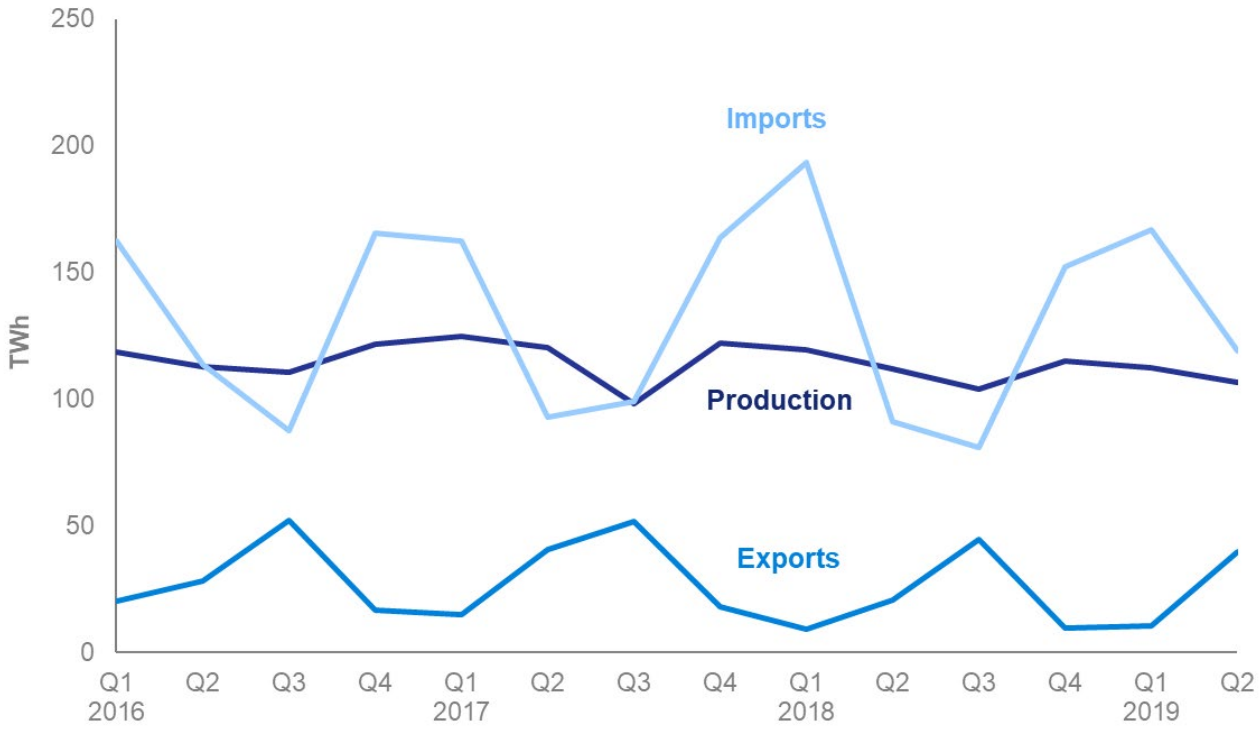
Chart 4.1 Production and nominated flow trades of natural gas (Table 4.1)



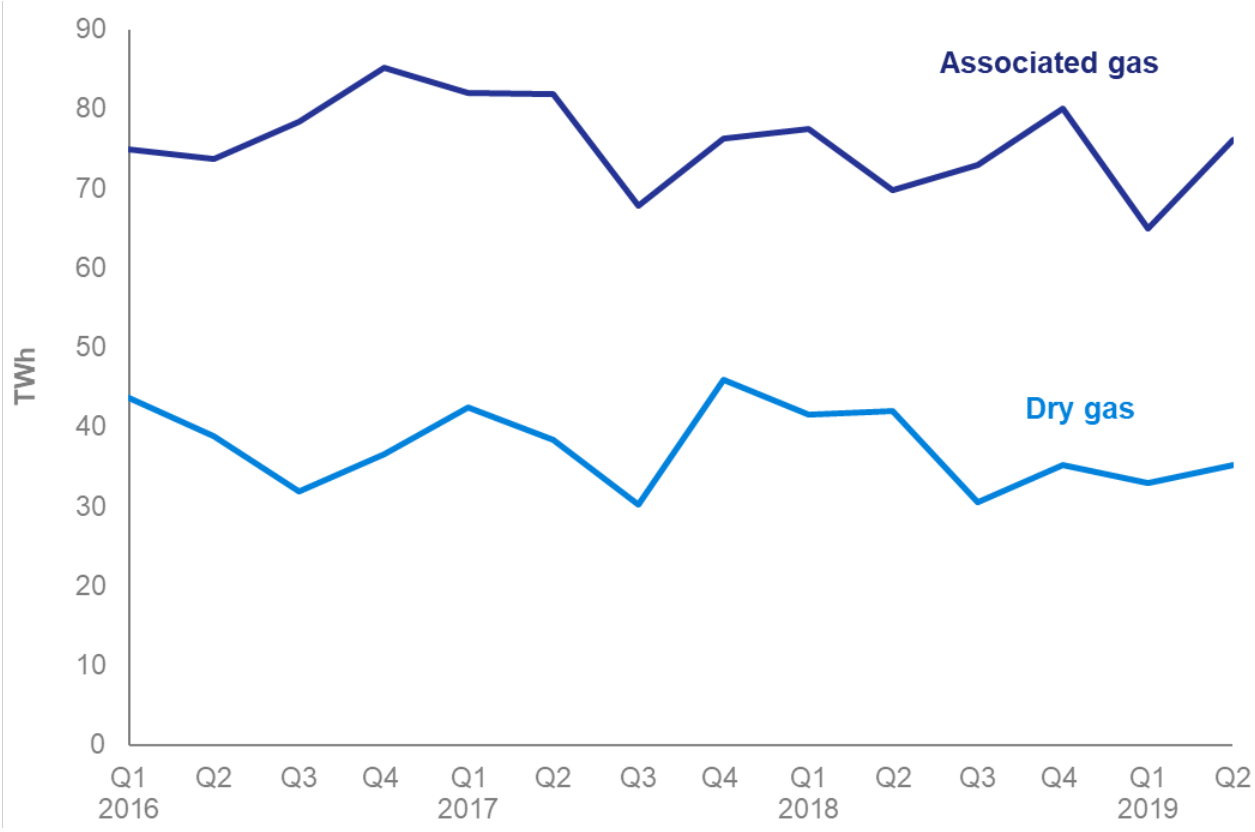
Production of natural gas in the second quarter of 2019 decreased by 4.7 per cent compared with the same quarter of 2018. This continues to be associated with the closure of the Theddlethorpe gas terminal last August. Current volumes of production are less than 64 per cent of the average quarterly production in 2000 when gas production peaked and follows the general annual trend of decline.

Exports increased substantially, up 19 TWh compared to the same period last year, but the increase to imports was even higher at 28 TWh (on a nominated flow basis[1]). This resulted in an increase in net imports by 12 per cent, driven by the strong increase in imports to meet the higher gas demand.

For more detail on trade, see Charts 4.4 and 4.5.

[1] Nominated flows include some trade with Belgium whereby gas has been traded between companies, but then 'sold back' before the gas has been physically transferred. Table 4.3 shows physical flows.

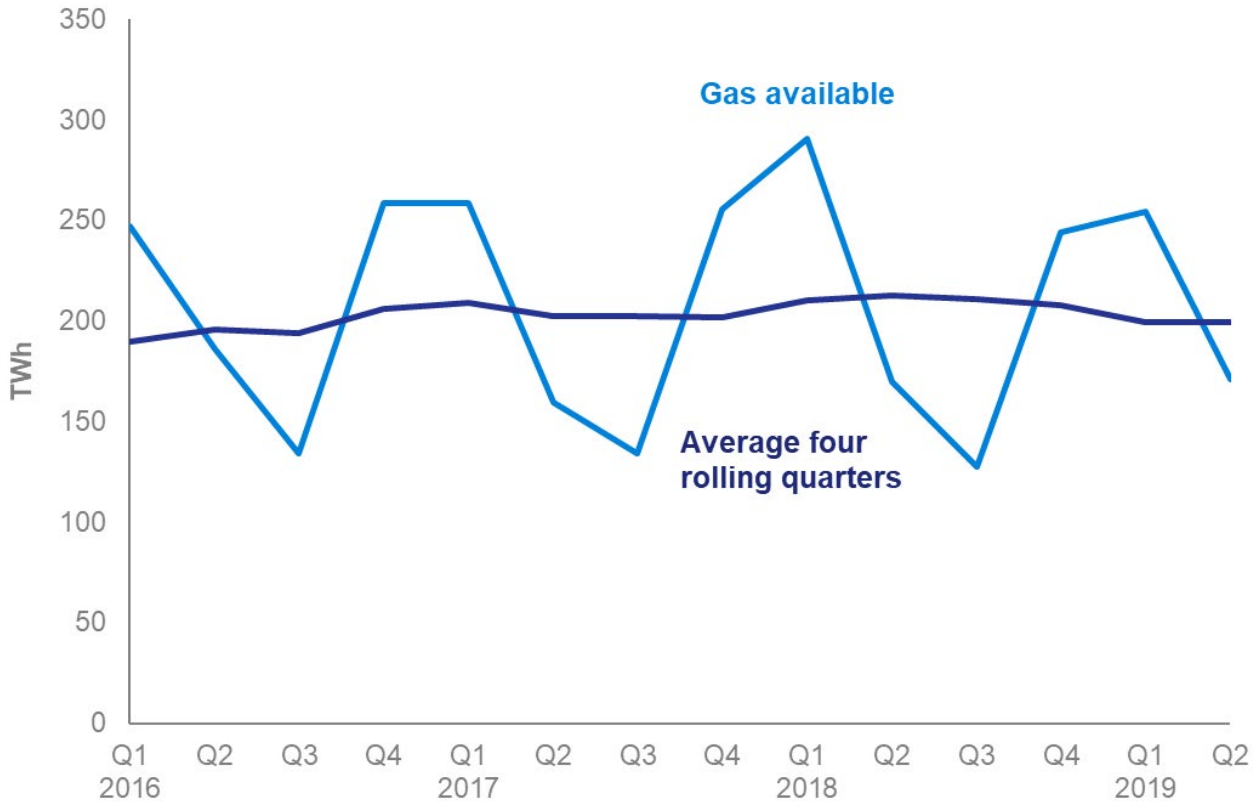
Chart 4.2 Production of dry gas and associated gas (not shown in published tables)



Production of associated gas (natural gas produced from oil fields) in Q2 2019 was up 9.2 per cent compared to the same quarter last year, from 70 to 76 TWh.

In comparison, dry gas production (natural gas composed mainly of methane) decreased by 16 per cent in Q2 2019 on last year.

Chart 4.3 Gas availability (Table 4.2)

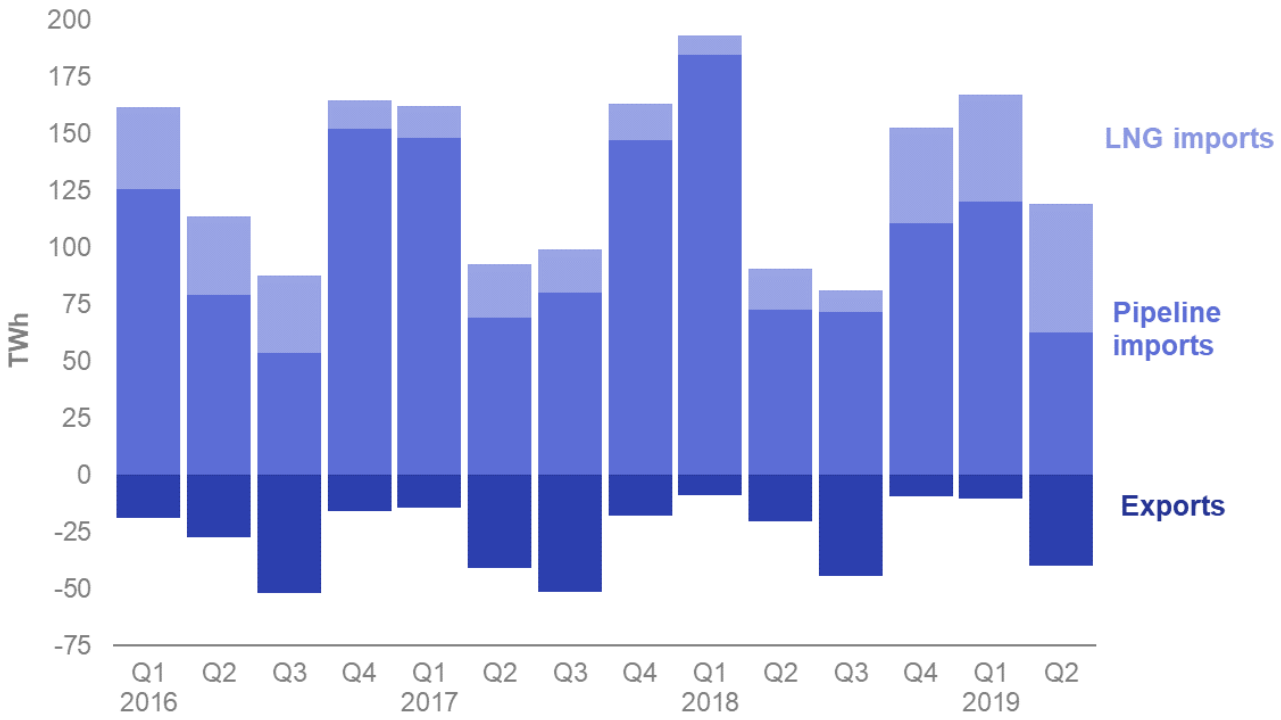


Gas available at terminals is roughly equal to gross gas production minus producers' own use, plus net imports. Gas availability is seasonal and peaks during Q1 and Q4 each year, associated with the colder temperatures over the winter months.

The temperatures in Q2 2019 were lower than the particularly warmer weather in May and June last year, meaning gas availability increased by 0.9 per cent compared with the previous year to 171 TWh. Combined with a stock draw down, this meant that gas output from the transmission system increased by 2.7 per cent.

The average availability of gas over four rolling quarters remains above average for Q2 2019.

Chart 4.4 Physical imports and exports of natural gas (Table 4.3 and Table 4.4)



As shown in Map 4.1, the UK imports natural gas primarily from Norway (predominantly via the SAGE, FLAGS and Vesterled pipelines). Smaller volumes are imported from Belgium (via the UK-Belgium Interconnector) and the Netherlands (via the Balgzand to Bacton line).

Despite a 31 per cent increase in total imports (on a physical instead of a nominated flow basis[1]), pipeline imports fell by 14 per cent as flows through the St Fergus terminal from Norway were reduced. This was compounded with the suspension of imports for the month of June via the Vesterled pipeline from Norway due to planned maintenance. In addition, some Norwegian exports via the Langeled pipeline were partially diverted to mainland Europe in May before returning to more typical levels in June.

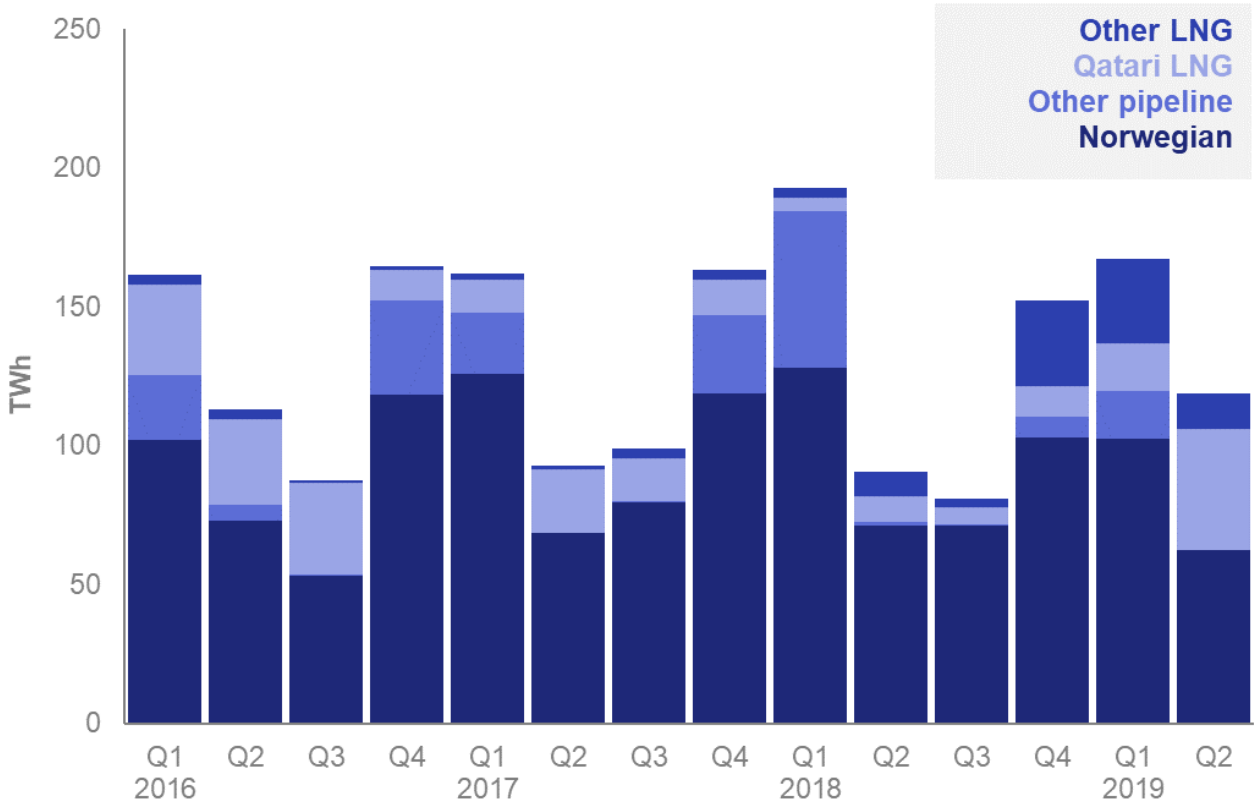
The diversification of the global Liquefied Natural Gas (LNG) market and established import infrastructure in the UK meant that the shortfall in supply via pipelines could be met by LNG imports, which are a flexible source of gas to the UK. Subsequently LNG imports nearly tripled over the three months to June compared to this period last year; in April and May imports of LNG exceeded pipeline imports of gas for the first time since August 2014. When pipeline imports returned to more typical levels in June, LNG imports reduced to around a quarter of the levels seen in April and May.

Total exports in Q2 2019 nearly doubled, driven by continued trade with the Republic of Ireland owing to a natural decline in output from Ireland's Corrib field. Exports to Belgium more than doubled, mostly due to particularly low volumes last year[2].

As a result, net imports were up 12 per cent in Q2 2019 as growth in imports outstripped the growth in exports to meet the higher UK demand across the quarter.

[2] The export total in Tables 4.3 only includes gas that has physically flowed through pipeline border points and is lower compared to the nominated flows in Tables 4.1 and 4.2.

Chart 4.5 Imports by origin (Table 4.4)



Despite the decrease in pipeline imports in Q2 2019, Norway continues to be the main source of imported gas to the UK at 53 per cent, although down from Q2 2018 when Norway imports comprised 79 per cent of the UK's total imports.

LNG from Qatar returns to be the source of the majority of LNG; over the second quarter of 2019, 77 per cent of LNG was of Qatari origin, up from up from 36 per cent at the start of the year. The LNG market is increasingly diversified and this year the UK has received substantial volumes from Qatar, Russia, Algeria and the US.

A complete country breakdown for physical pipeline and LNG imports is provided in Energy Trends Table 4.4 - *Supplementary information on the origin of UK gas imports*.

Map 4.1: UK physical imports and exports of gas Q2 2019

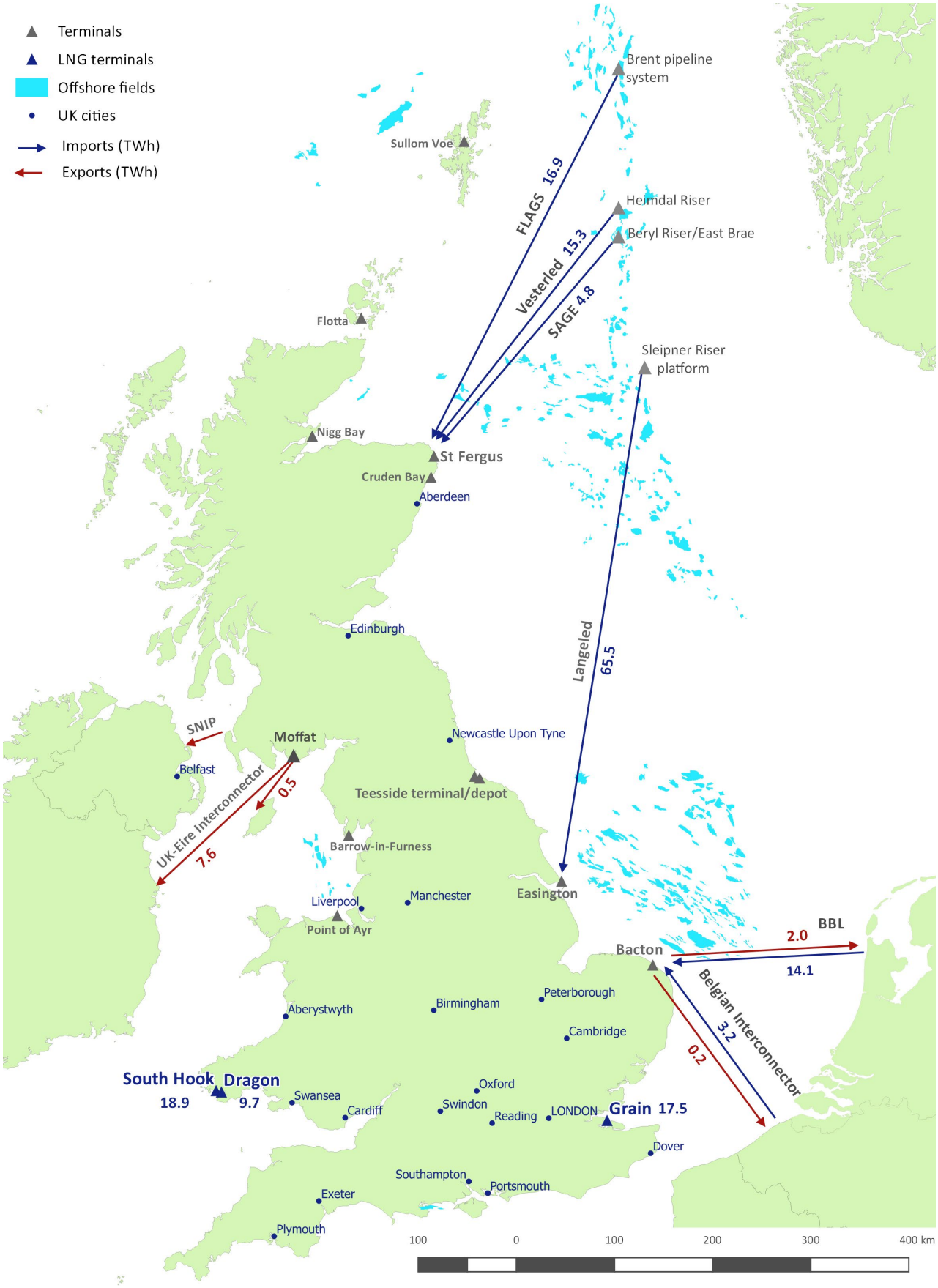
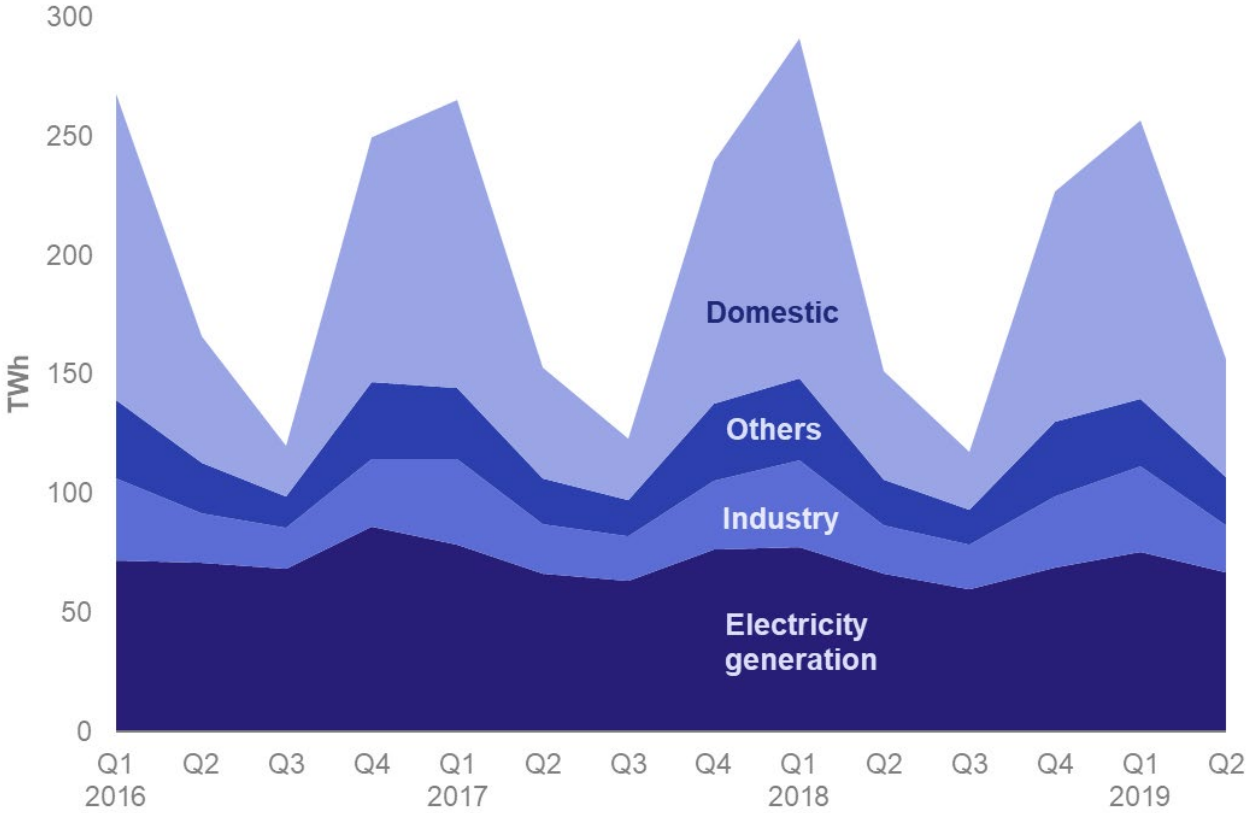


Chart 4.6 UK demand for natural gas (Table 4.1)



UK demand for natural gas in Q2 2019 increased by 3.9 per cent in comparison to Q2 2018 (to 180 TWh).

Cooler temperatures in Q2 of 2019 compared with particularly high temperatures in May and June of the previous year resulted in 8.2 and 7.0 per cent increases in demand in the domestic and other final users respectively.

Meanwhile, demand for gas for electricity generation was stable and industrial use fell by 1.4 per cent.

A complete breakdown for gas demand is provided in Energy Trends table 4.1 - *Natural gas supply and consumption.*

Section 5 – UK Electricity
April to June 2019

Key results show:

Total electricity demand decreased by 0.5 per cent in Q2 2019 compared to the same period in 2018, to 81.9 TWh. Total generation decreased by 0.9 per cent to 76.3 TWh with the remaining demand met by imports**. (Chart 5.1).**

Q2 2019 was the first quarter since the 19th century with coal-fired generation below 1% of total generation (0.5 TWh). Coal's share of supply fell to a record low in May after just 5 days of coal-fired generation on the GB grid during the month and the UK's longest period without coal generation since the 1880s, at 18 days and 6 hours. Gas remained the dominant fuel type with its share of generation increasing to 43.6 per cent. **(Chart 5.2)**

Renewables' share of electricity generation increased from 32.0 per cent in Q2 2018 to 35.5 per cent in Q2 2019. As weather conditions for renewable generation were similar in both quarters, this is largely due to increases in capacity. **(Chart 5.2)**

More than half (52.6 per cent) of generation in Q2 2019 was from low carbon sources (renewables and nuclear generation). This was down from Q2 2018 (53.6 per cent) because planned and unplanned outages at five reactors substantially reduced nuclear generation over the period (down 21 per cent) **(Chart 5.3).**

Final consumption showed a slight increase over the same period, up by 0.2 per cent from 70.1 TWh in Q2 2018 to 70.3 TWh in Q2 2019. This came from increased demand by domestic and commercial consumers, but a reduction in demand from industry. **(Chart 5.4).**

The UK remains a net importer of electricity with 7.2 per cent of electricity supplied from net imports in Q2 2019. This was supported by the new interconnector with Belgium which became fully operational in February 2019 and was the second largest source of net imported electricity in the quarter. **(Chart 5.6)**

Relevant tables

5.1: Fuel used in electricity generation and electricity supplied
5.2: Supply and consumption of electricity
5.6: Imports, exports and transfers of electricity

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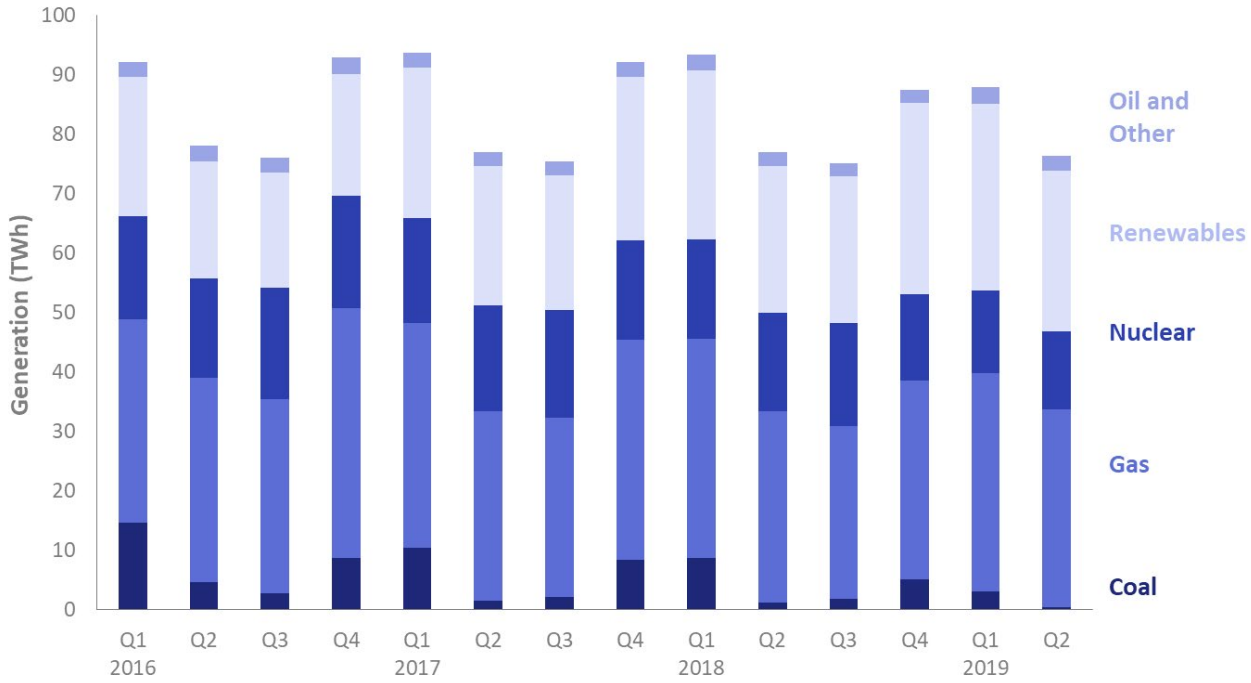
Chart 5.1: Total electricity generated by fuel type (Table 5.1)



Generation from fossil fuels was the highest contributor to the total generation at 34.0 TWh in Q2 of 2019, up 1.3 percent compared to Q2 2018. Almost all fossil fuel generation was from gas generation (33.3 TWh), with only 0.5 TWh coming from coal generation. The use of fossil fuels was slightly higher in Q2 2019 than in Q2 2018 (33.5 TWh) as fossil fuels compensated for reduced generation from nuclear plants.

In particular, coal-fired electricity continued to decline in Q2 of 2019, which was the first quarter since the 19th century with coal generation below 1% of total generation (0.5 TWh). Coal's share of supply by MPPs fell to a record low of 0.2 per cent in May after just 5 days of coal-fired generation on the GB grid during the month and the UK's longest period without coal generation since the 1880s, at 18 days and 6 hours[1].

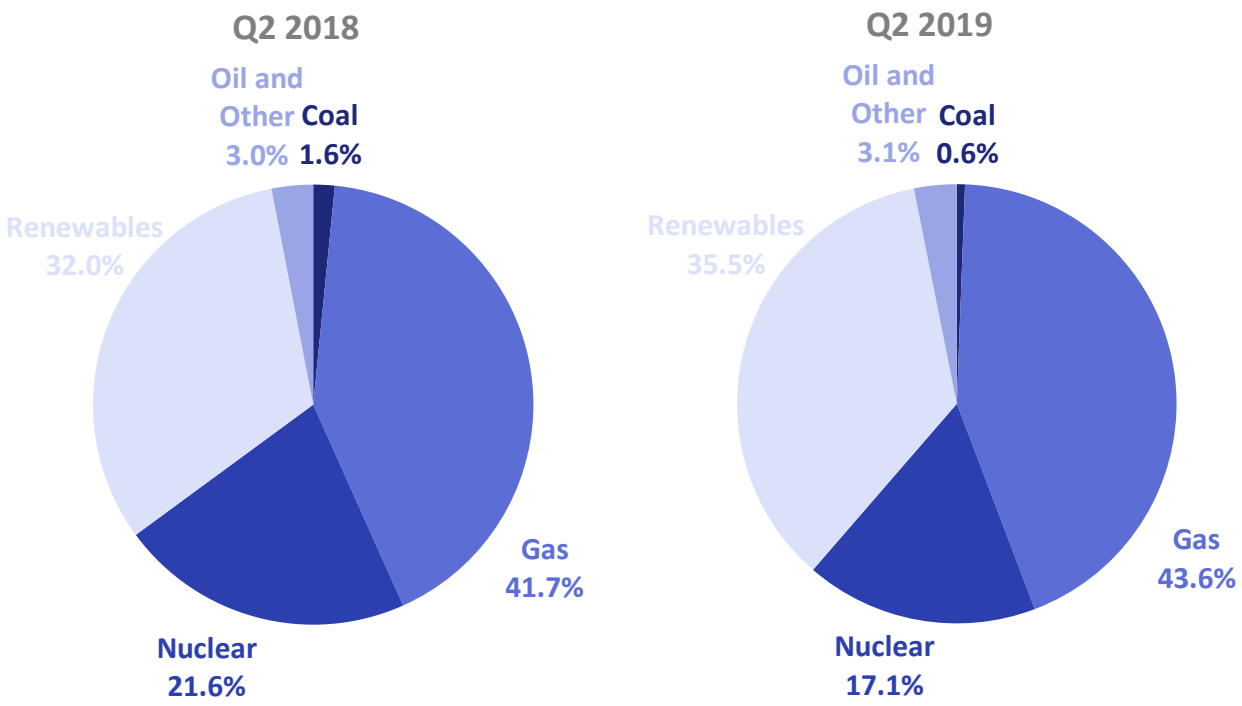
Lower demand for electricity in Q2 2019 reduced generation needed. Q2 2019 saw total electricity generation fall to 76.3 TWh, down 0.9 per cent compared to Q2 2018. This was the lowest level for Q2 in recent years.

Renewable generation, comprised of wind, solar, hydro and bioenergy, saw a 9.9 per cent rise for Q2 of 2019 compared to the same period in 2018. Whilst both solar and bioenergy saw small increases, it was wind generation that was the driving factor, with a 19 per cent increase in generation. The increase was even more dramatic for offshore wind, which saw a 25 per cent increase. Overall, weather conditions for renewables were similar for Q2 2019 as for the same time last year, though June saw substantially higher average wind speeds in June 2019 (7.9 knots compared to 7.0 in June 2018). Sunlight hours were also slightly lower for Q2 2019 compared to 2018. Instead the increased generation from renewables was driven by increases in capacity (up 6.6, 17.8 and 2.8 per cent for onshore wind, offshore and solar photovoltaics respectively).

Nuclear generation was 21.4 per cent lower in Q2 of 2019 than 2018 at 13.1 TWh, the lowest quarterly nuclear generation since Q3 2010. This came as a result of two major nuclear outages at Hunterston B (unplanned outage) and Dungeness B (statutory outage) as well as a recent major outage at Sizewell B (statutory/refuelling outage) and refuelling at both Hartlepool and Heysham 1.

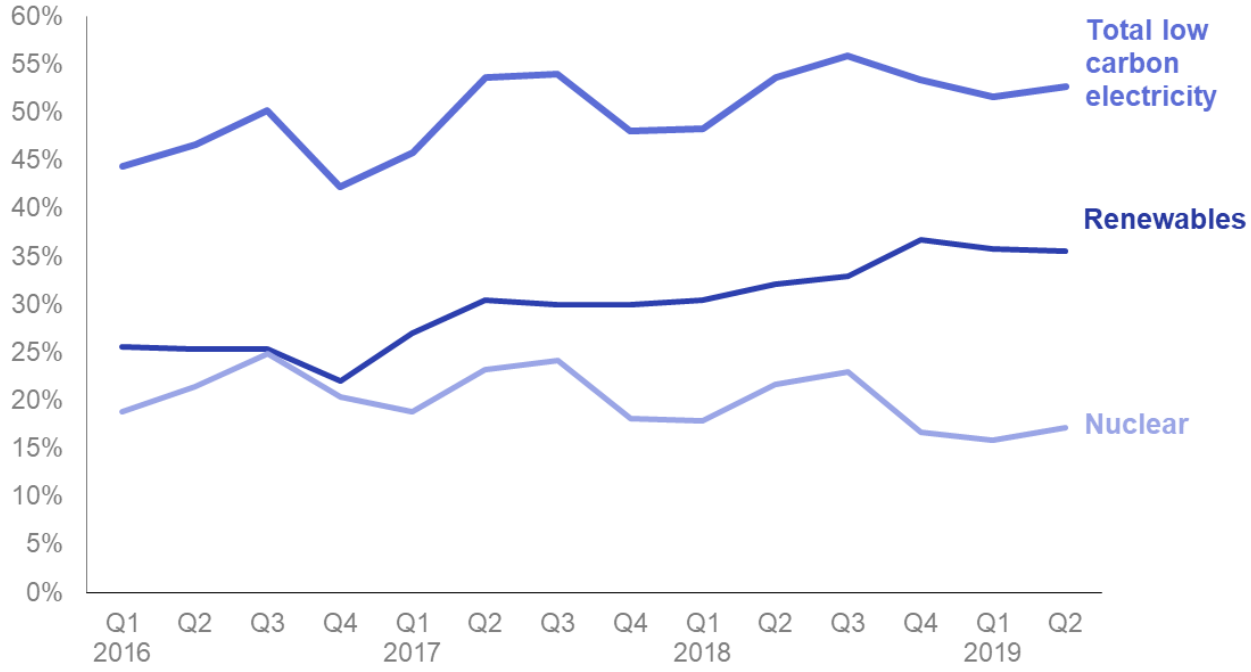
[1] Data for these statistics was provided by Elexon. Half-hourly electricity generation data is available from their website.

Chart 5.2: Share of electricity generation (Table 5.1)



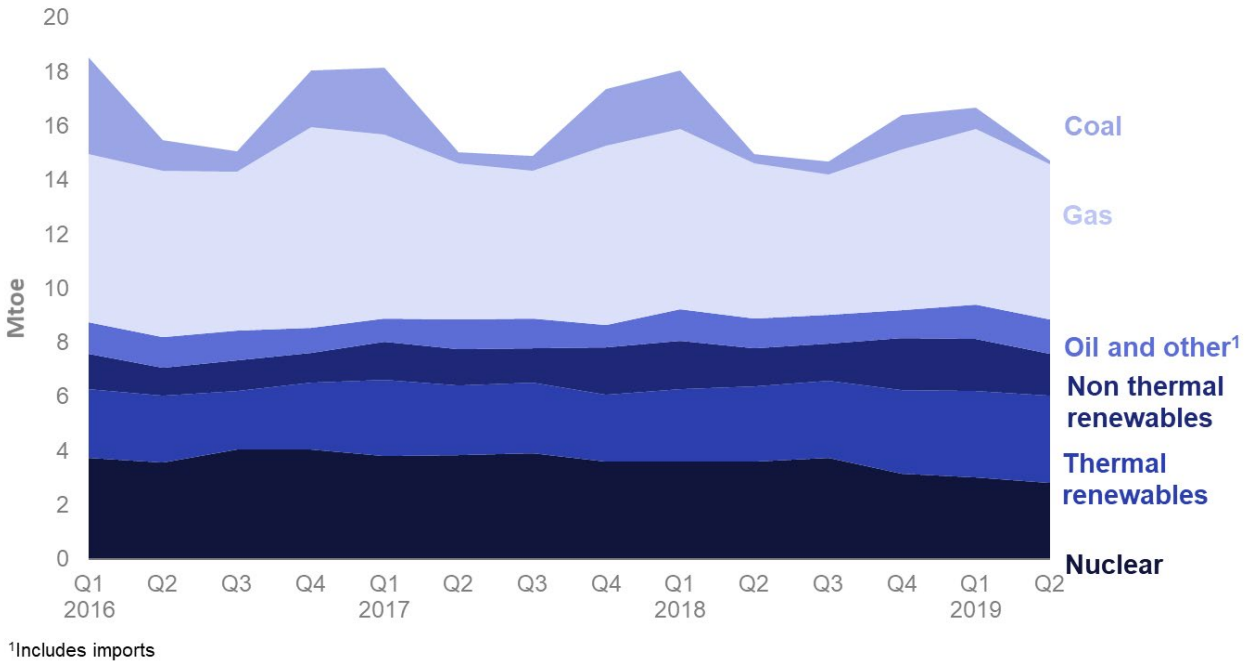
There were differences in most fuels' share of generation between Q2 2019 and Q2 2018. As described above, coal generation continued to decline and represented 0.6 per cent of supply in Q2 2019, down from 1.6 per cent in Q2 2018. The biggest fall in share of generation was seen for nuclear, which was 17.1 per cent in Q2 2019 but 21.6 per cent in Q2 2018. This is largely due to outages at nuclear power stations as detailed above. There were increases in the share of generation for renewable sources and also for gas generation, compensating for the reduction in generation from nuclear power. The share of generation coming from renewables increased from 32.0 per cent in Q2 2018 to 35.5 per cent in Q2 2019, while the share for gas increased from 41.7 per cent to 43.6 per cent over the same period.

Chart 5.3: Low carbon's share of electricity generation (Table 5.1)



Low carbon electricity accounted for 52.6 per cent of electricity generated in Q2 2019. This was a slight decrease compared to the same period last year (53.6 per cent). This decrease was driven by the decrease in nuclear's share of generation (down 4.5 percentage points at 17.1 percent), which was not fully offset by an increase in share for renewables. Renewable generation share increased by 3.5 percentage points to 35.5 percent of total generation.

Chart 5.4: Fuel used in generation (Table 5.1)

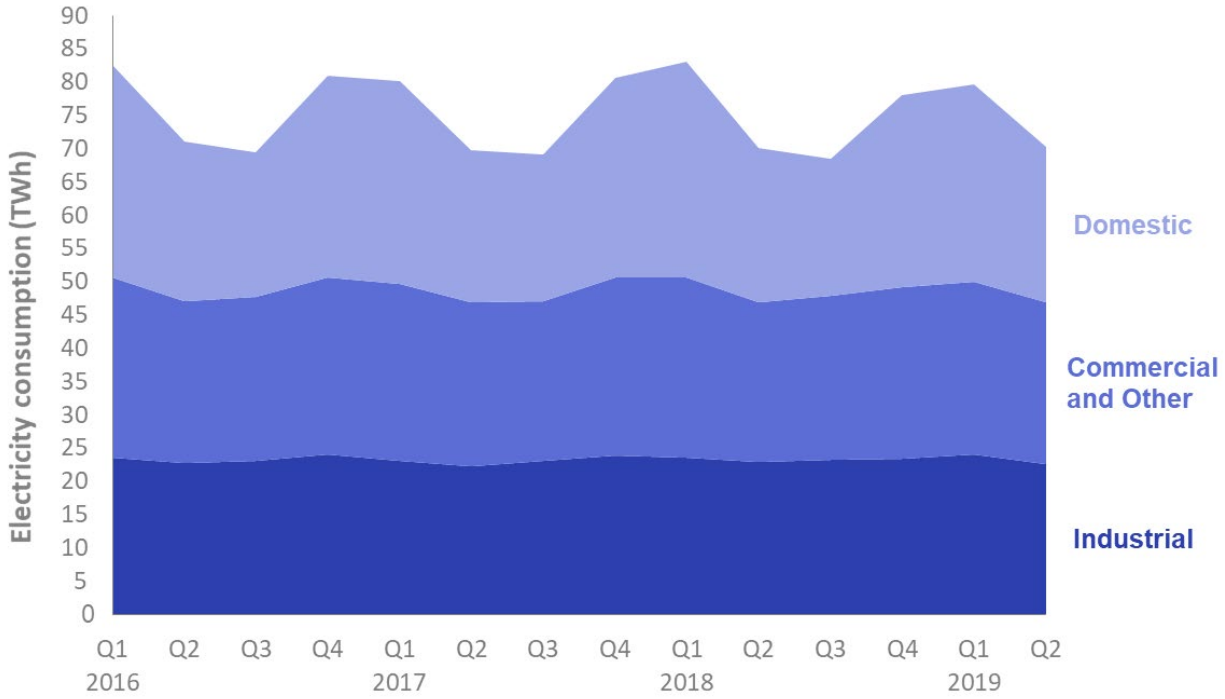


[1]Includes imports

Fuel used in generation continued to fall in Q2 2019. The total used over this period was 14.7 Mtoe (million tonnes of oil equivalent), a 1.6 per cent decrease compared to Q2 2018. This was the lowest amount used for any Q2 in the time series and reflects the continuing shift towards more efficient non-thermal renewable sources as well as a reduction in fuel used by nuclear power stations over this period. Fuel used for nuclear power decreased by 21 per cent in Q2 2019 compared to Q2 2018, as a result of outages at several nuclear power plants.

Lower electricity demand and high carbon prices led to less coal being used for electricity generation. Q2 2019 had the first quarter since the 19th century with coal generation below 1% of total generation and this was reflected in the very low amount of coal used over this period. The amount of coal used for electricity was down to 0.13 Mtoe, a 61 per cent decrease compared to Q2 2018. Gas use was slightly higher for Q2 of 2019 at 5.8 Mtoe, up 0.4 per cent on the same period last year.

Chart 5.5: Electricity final consumption (Table 5.2)



Total demand for electricity decreased slightly (-0.5 per cent) in Q2 2019 compared to Q2 2018, from 82.3 TWh in 2018 to 81.9 TWh in 2019. This was partly a result of a 16 per cent reduction in energy industry use, which includes electricity used in generation and for pumping, along with energy used by other fuel industries. In particular, electricity used for pumped storage was down 49 per cent compared to Q2 2018 at 0.3 TWh.

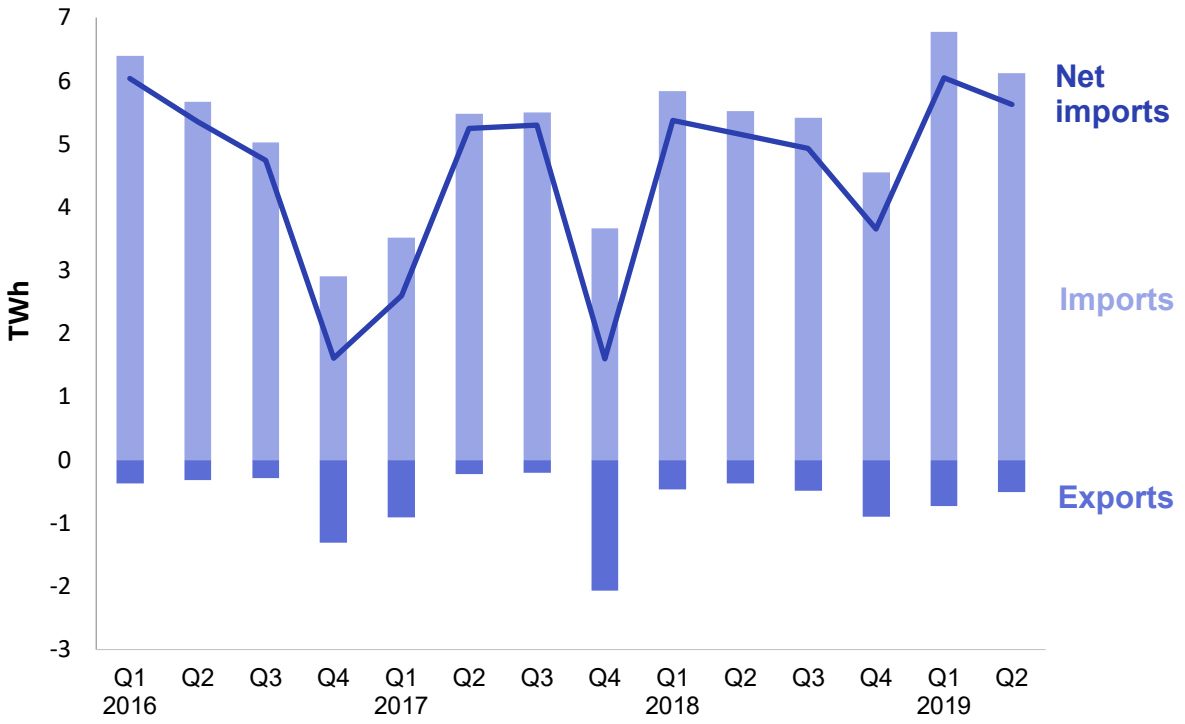
Final consumption by customers showed a slight increase over the same period, up by 0.2 per cent from 70.1 TWh to 70.3 TWh in Q2 2019. This came from increased demand by domestic and commercial consumers, but a reduction in demand from industry.

Domestic electricity consumption in Q2 2019 increased by 1.1 per cent compared to Q2 2018, to 23.5 TWh. There was also a 1.0 per cent rise in consumption by commercial users. This reflects slightly cooler average temperatures over the quarter, particularly in May and June[2], although the effect of temperature on consumption is typically weaker for the summer months. Overall, industrial electricity consumption dropped to 22.6 TWh, a decrease of 1.3 percent from Q2 2018. This is broadly in line with decreases in industrial productivity as measured by the ONS' Index of Production[3].

[2] More information about weather trends can be found in Energy Trends table 7.1 at: www.gov.uk/government/statistics/energy-trends-section-7-weather.

[3] For more information on the Index of Production, please see the latest publication from ONS.

Chart 5.6: UK trade in electricity (Table 5.6)



UK based electricity generation is supported by five interconnectors allowing trade with continental Europe: England-France (2 GW capacity), England-Netherlands (1 GW), England-Belgium (1 GW), Northern Ireland-Ireland (0.6 GW) and Wales-Ireland (0.5 GW). The England-Belgium 'Nemo Link' interconnector is the newest and became fully operational on 31st January 2019.

Net imports for Q2 2019 were up by 9.2 per cent in comparison to the same period last year and totalled 5.6 TWh, with 2019 setting peak net import records for both Q1 and Q2. This was supported by the new interconnector with Belgium which became the second largest source of net imported electricity in Q2 2019 after marginally surpassing the UK-Netherlands interconnector.

UK exports increased across all European interconnectors compared to Q2 2018, with total exports rising by 36 per cent to the highest level for Q2 since 2015. Exports remained particularly high on the NI–Ireland interconnector in Q2 2019 and were up 34 per cent compared to Q2 2018 at 0.2 TWh. This accounted for 47 per cent of UK exports and it remained the UK's only net exporting interconnector at +0.1 TWh for the quarter.

Net transfers from Scotland to England fell 23 per cent from Q2 2018 to 2.1 TWh as the England–Scotland system reported its greatest transfer for Q2 since 2012. Net transfers from Scotland to NI were also down to 0.1 TWh, the lowest quarterly transfer since Q3 of 2017.

Section 6 – UK Renewables
April to June 2019

Key results show:

Renewables' share of electricity generation was 35.5 per cent in 2019 Q2, a record for the second quarter and up 3.5 percentage points on the share in 2019 Q2. This was largely a reflection of increased capacity. **(Chart 6.1)**

Renewable electricity generation was 27.1 TWh in 2019 Q2, an increase of 9.9 per cent on the 24.6 TWh in 2019 Q2, but 14 per cent lower than the previous quarter which had been the second highest on record for renewable electricity generation (31.5 TWh). **(Chart 6.2)**

Onshore wind generation rose by 13 per cent to 6.1 TWh). Offshore wind increased by more than a quarter to 6.0 TWh which was still 30 per cent lower than the previous quarter when average wind speeds were much higher. The largest increase among the other technologies was for plant biomass (mainly wood pellets) which increased by 8.5 per cent to 6.0 TWh due increased capacity. **(Chart 6.2)**

Renewable electricity capacity was 45.9 GW at the end of 2019 Q2, a 7.9 per cent increase on a year earlier, and a 1.9 per cent increase on the previous quarter, with two thirds of the increase on last year's capacity coming from wind. Solar generation decreased 0.3 per cent as the small increase in capacity was offset by lower load factors. **(Chart 6.3)**

The Feed in Tariff (FiT) scheme closed at the end of 2019 Q1. At this point there was 6.6 GW of FiT capacity installed across 986,000 installations. This is subject to further revision. **(Chart 6.5)**

Liquid biofuels consumption increased by 30 per cent, from 462 million litres in 2018 Q2 to 599 million litres in 2019 Q2, boosted by a 53 per cent increase in biodiesel consumption. In 2019 Q2, liquid biofuels represented 3.8 per cent of petrol and diesel consumed in road transport, unchanged from a year earlier. **(Chart 6.6)**

Relevant tables

6.1: Renewable electricity capacity and generation
6.2: Liquid biofuels for transport consumption

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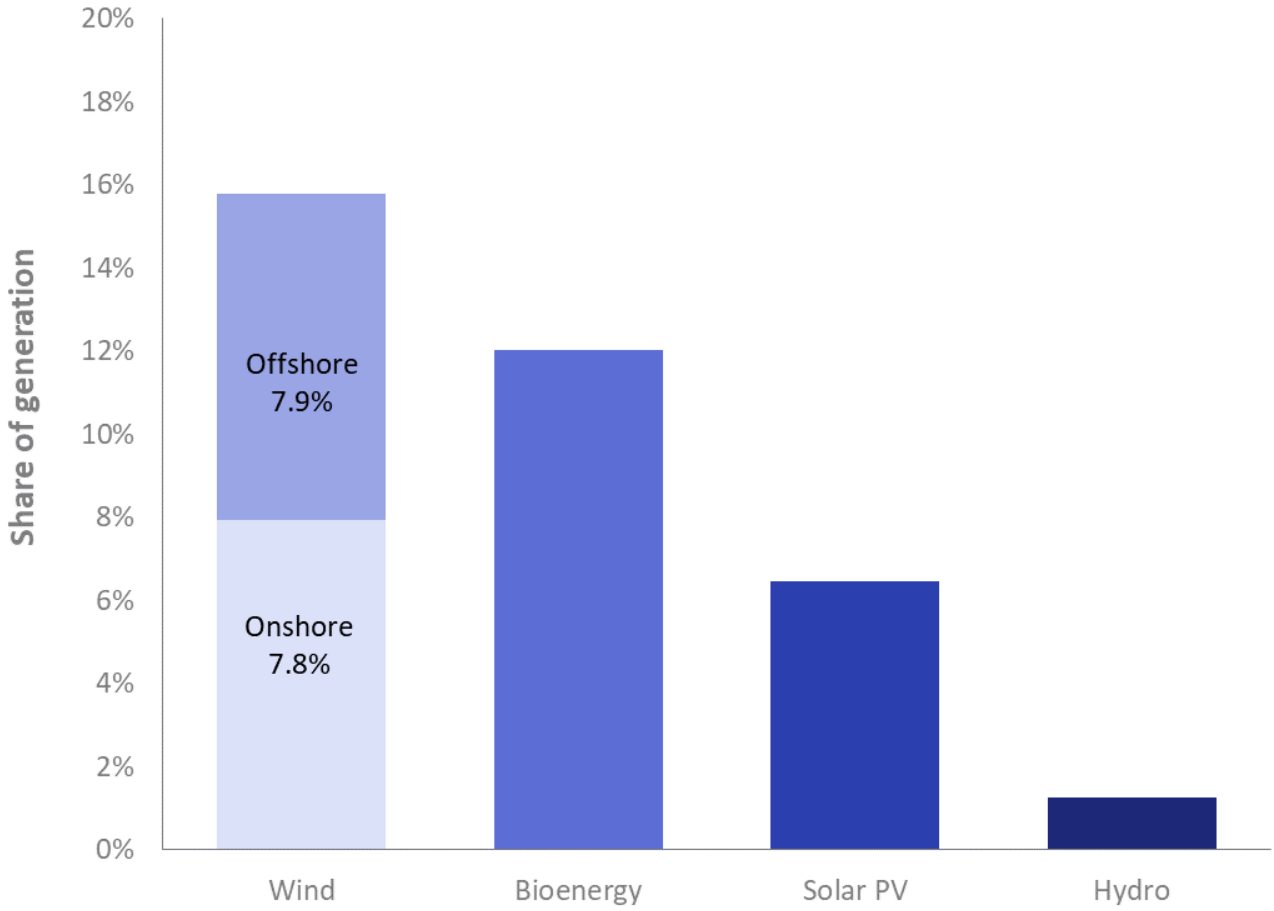
Chart 6.1 Renewables' share of electricity generation (Table 6.1)



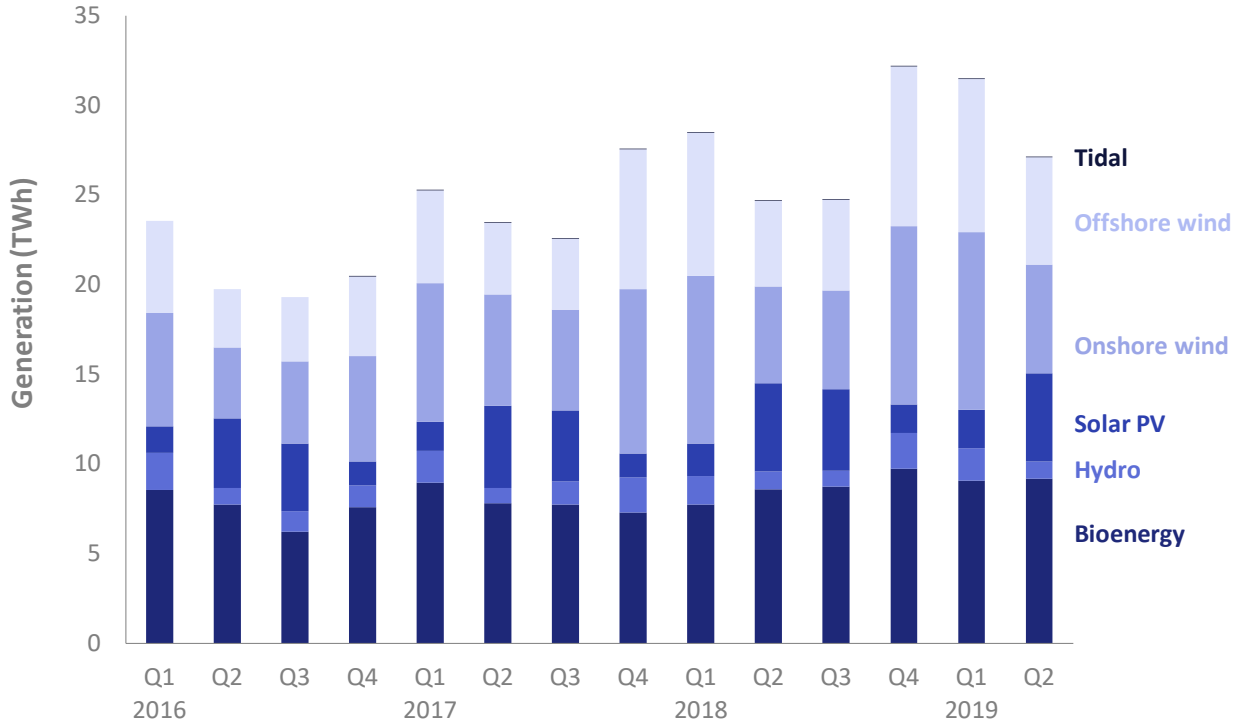
Renewables' share of electricity generation increased to 35.5 per cent in 2019 Q2 from 32.0 per cent in 2018 Q2 which at the time was a record. The share in 2019 Q2 is the highest on record for the second quarter of the year. However, the share of generation fell by 0.3 percentage points from 2019 Q1 when higher wind speeds had boosted renewable generation.

The increased share on a year earlier mostly reflects increased capacity, particularly in offshore wind and plant biomass, as well as lower overall generation.

Total electricity generated from renewables in 2019 Q2 was up by 2.4 TWh (9.9 per cent) on 2018 Q2, to 27.1 TWh, but remained 4.4 TWh (14 per cent) lower than previous quarter which had been the second highest on record at 31.5 TWh. As a result, the percentage share of electricity generated from renewables decreased from the previous quarter of 2019 but only by 0.3 percentage points, lower renewable generation was partly offset by lower total electricity generation.

Total electricity generation figures (all generating companies) can be found in table ET 5.1, at:
www.gov.uk/government/statistics/electricity-section-5-energy-trends

Chart 6.2 Renewable electricity generation (Table 6.1)



In 2019 Q2, electricity generated from onshore wind increased by 13 per cent, from 5.4 TWh in 2018 Q2 to 6.1 TWh. Generation from offshore wind saw an even greater increase, up by 25 per cent (1.2 TWh), to 6.0 TWh but still 30 per cent lower than the previous quarter when average wind speeds were much higher. Wind speeds in 2019 Q2, at 7.6 knots, were broadly stable with the same quarter of 2018, but both were lower than the long-term mean (8.4 knots) - see Energy Trends table 7.2 at: www.gov.uk/government/statistics/energy-trends-section-7-weather.

Generation from solar photovoltaics was at a similar level to 2018 Q2, decreasing by 0.3 per cent to 4.9 TWh. An increase in capacity of 2.8 per cent was offset by average daily sun hours being down from 6.7 hours in 2018 Q2 to 6.0 hours in 2019 Q2 - see Energy Trends table 7.3.

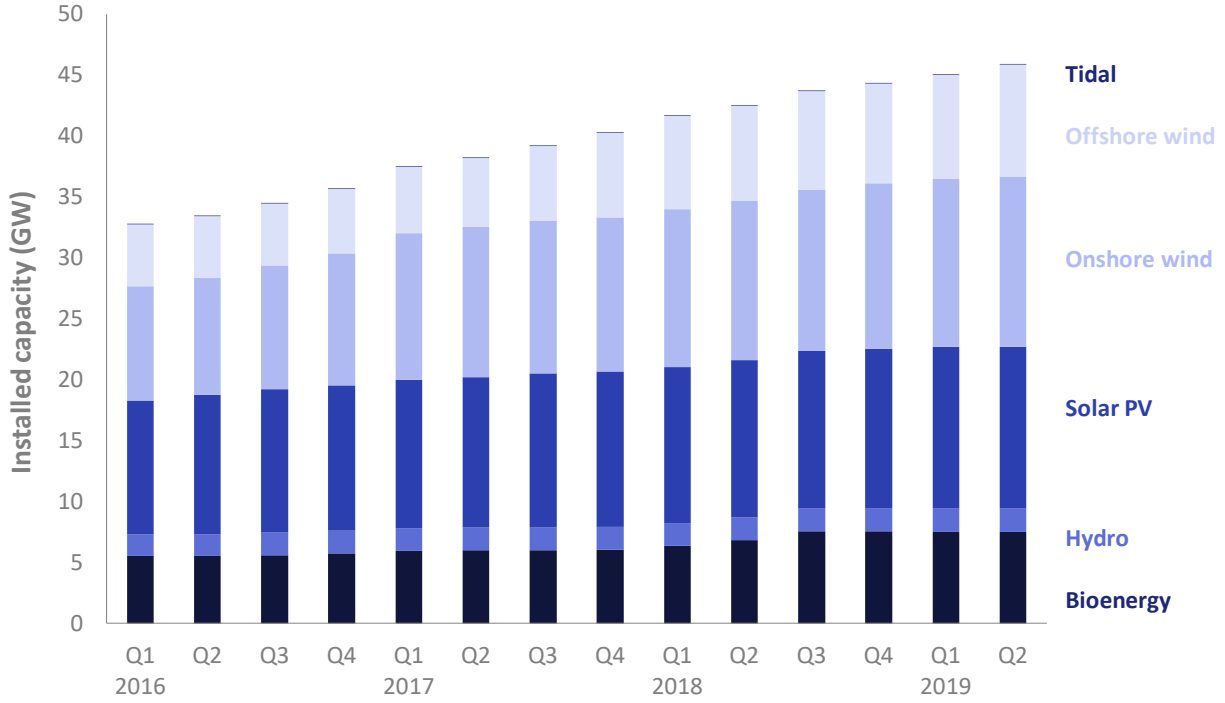
Hydro generation dropped 5.5 per cent but remains at 1.0 TWh when rounded. Generation fell despite a small increase in capacity of 0.7 per cent and an increase in average rainfall (in the main hydro catchment areas) of 2.4 per cent. However, actual generation depends on the precise location and timing of rainfall, as well as other conditions including vegetation and soil saturation. Average rainfall fell by 62 per cent on April of last year while rainfall in June 2019 was more than double that of June 2018 - see Energy Trends table 7.4.

In 2019 Q2, generation from bioenergy[1], at 9.2 TWh, was up by 7.2 per cent on a year earlier. Within this, the largest increase came from plant biomass (mainly wood pellets) which was up by 0.5 TWh (8.5 per cent) on 2018 Q2. These increases were partially offset by reduced generation from landfill gas and anaerobic digestion.

Bioenergy had the largest share of renewable generation (34 per cent), 22 per cent came from onshore wind as well as 22 per cent from offshore wind, 18 per cent from solar PV and 3.5 per cent from hydro.

[1] Bioenergy consists of: landfill gas, sewage gas, biodegradable municipal solid waste, plant biomass, animal biomass, anaerobic digestion and co-firing (generation only)

Chart 6.3 Renewable electricity capacity (as at end of quarter) (Table 6.1)



At the end of 2019 Q2, the UK's renewable electricity capacity totalled 45.9 GW, an increase of 7.9 per cent on that installed at the end of 2018 Q2, and 1.9 per cent higher than the previous quarter.

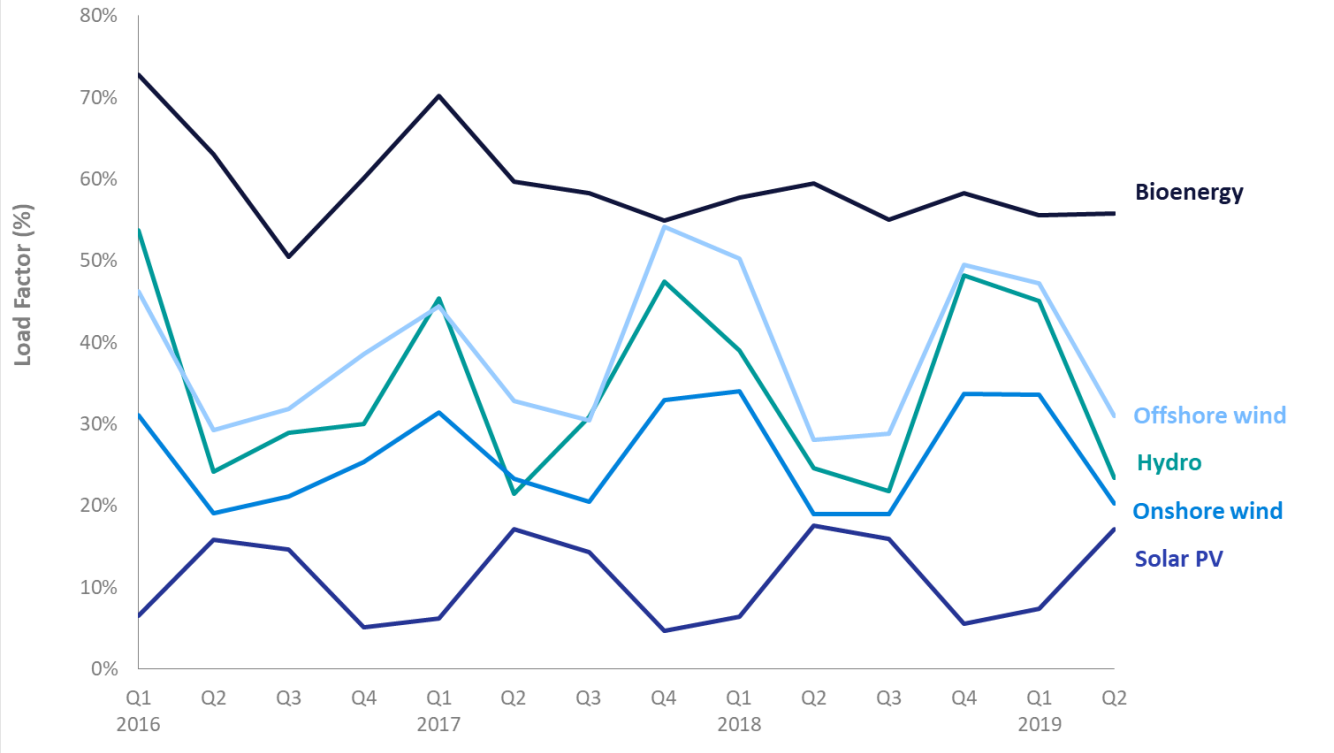
At the end of 2019 Q2, wind accounted for just over a half of total renewable generating capacity with around 30 per cent for onshore wind and 20 per cent for offshore wind. After onshore wind, solar PV had the highest share of renewable technologies at 29 per cent. Bioenergy represented 16 per cent of capacity and hydro 4 per cent.

Compared with 2019 Q2, the largest increase in absolute terms was in offshore wind capacity which rose by 18 per cent to 9.2 GW. The largest sites to be added over the 12 months are Hornsea and Beatrice. Hornsea started generating in 2019 Q1 and further capacity came online in 2019 Q2 to bring total capacity to 665 MW. Beatrice also came online in stages; capacity has been added in each of the last four quarters and stood at 588 MW when the project was completed in 2019 Q2. Onshore wind capacity increased by around 0.9 GW, there were 34 new sites in Q2, the largest of which were Kype Muir (88 MW), Middle Muir (51 MW) and Clocaenog Forest (18 MW).

Plant biomass capacity increased by 8.5 per cent to 6.0 GW, mainly due to the conversion to biomass of Lynemouth power station. Solar PV capacity increased by 2.8 per cent to 13.3 MW. The increases in Solar PV capacity are slower than the rapid expansion seen in 2010–2016, partly due to the closure of the Renewables Obligation (RO) and Feed in Tariffs (FiTs) at the end of March this year. Please note that small scale schemes that are not supported by government subsidy schemes or have not registered with the MCS are not included in these figures. As a result, the solar PV capacity and generation figures are likely to be underestimated. We are looking at options for extending our data coverage.

Chart 6.4 Renewable electricity load factors (Table 6.1)

Load factors are calculated as electricity generated by a technology as a proportion of maximum potential generation over the period, given the installed capacity.



In 2019 Q2, onshore wind's load factor increased by 1.3 percentage points, from 18.9 per cent in 2018 Q2 to 20.3 per cent. Offshore wind's load factor increased by 3.0 percentage points, from 28.1 per cent in 2018 Q2 to 31.0 per cent in 2019 Q2. Load factors were dampened in 2018 Q2 as several new sites came online partway through the quarter[2].

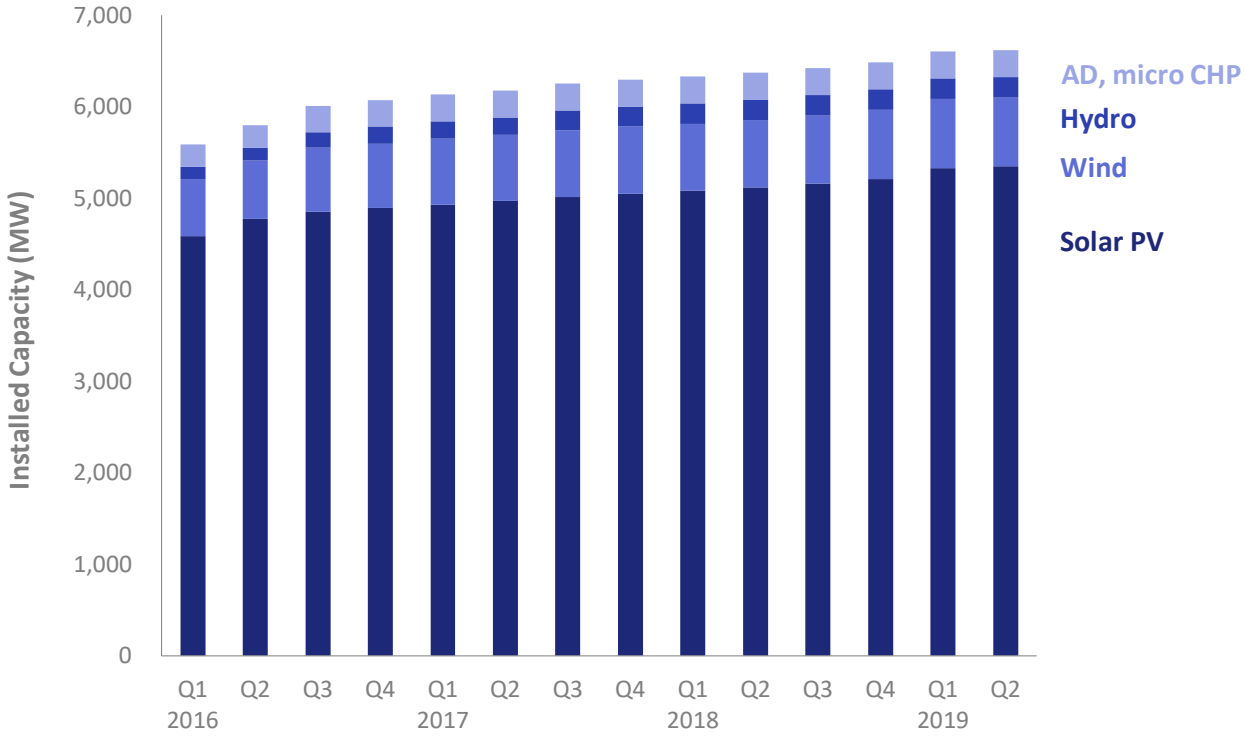
The load factor for solar PV fell from 17.6 per cent in 2018 Q2 to 17.2 per cent in 2019 Q2 as average sun hours fell from 6.7 per day to 6.0 per day.

Hydro's load factor in 2019 Q2 decreased by 1.2 percentage points, from 24.6 per cent in 2018 Q2 to 23.4 per cent despite an increase in average rainfall of 2.4 per cent. Quarterly load factors are affected by the timing of rainfall as there is a lag between rain falling and generation. Average rainfall in April was half of that of April last year but rainfall in June was more than double June 2018.

For plant biomass, the load factor in 2019 Q2, at 63.0 per cent, down 10 percentage points on a year earlier. However, this was higher than the previous quarter by 1.1 percentage points. Load factors have been affected by the conversion of another unit to biomass at Drax, the largest biomass power station in the UK.

[2] Load Factors are calculated using an average of capacity at the start and end of the quarter. Therefore, they can be influenced by the time in the quarter when any new capacity came online.

Chart 6.5 Feed in Tariffs: eligible installed capacity (as at end of quarter)



The GB Feed in Tariff (FiT) scheme[3] closed to new entrants at the end of March 2019. However, the number of installations accredited on FiTs at this point is still subject to revision as Ofgem update the records on its Central FiTs Register.

Revised data shows that there were over 986,000 installed and eligible for the FiT scheme, when the scheme closed at the end of Q1 2019. Renewable installations eligible for FiTs (all except MicroCHP) represented 14 per cent of all renewable installed capacity.

Solar photovoltaics (PVs) represent the majority of both installations and installed capacity on FiTs, with respectively 99 per cent and 81 per cent of the total. Nearly half of FiT-eligible PV installations are sub-4 kW retrofitted schemes, 2,596 MW (49 per cent) in 2019 Q1.

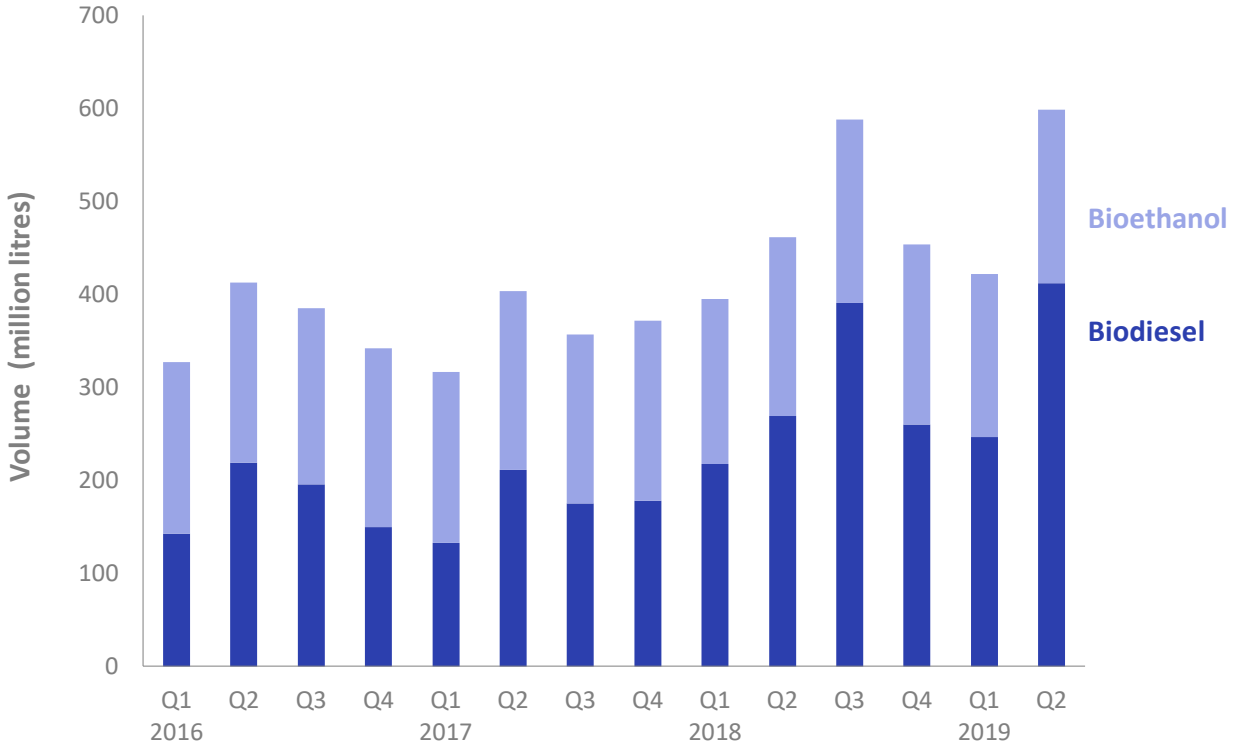
Statistics on Feed in Tariffs can be found at:
www.gov.uk/government/collections/feed-in-tariff-statistics

Following the closure of the FIT scheme to new installations, government laid legislation in June 2019 to introduce a new supplier-led smart export guarantee (SEG) in Great Britain from 1 January 2020. Under the SEG, licensed electricity suppliers (with 150,000 domestic customers or more) are required to offer small-scale low-carbon generators a price per kWh for electricity exported to the grid.

Further information on the SEG is available at: www.gov.uk/government/consultations/the-future-for-small-scale-low-carbon-generation

[3] Data are for schemes accredited under the Microgeneration Certification Scheme (MCS) and ROOFIT, which are pre-requisites for registering for the FIT scheme; not all of these installations will eventually be confirmed onto the FIT scheme.

Chart 6.6 Liquid biofuels for transport consumption (Table 6.2)



In the second quarter of 2019, 599 million litres of liquid biofuels were consumed in transport, an increase of 30 per cent on the total of 462 million litres in the second quarter of 2018.

Bioethanol consumption fell by 3.1 per cent from 193 million litres in the second quarter of 2018 to 187 million litres. Biodiesel consumption increased by 53 per cent, from 269 million litres in Q2 2018 to a record 412 million litres in Q2 2019.

Biodiesel represented 69 per cent of biofuels consumption, with bioethanol accounting for the remaining 31 per cent.

In the second quarter of 2019, bioethanol accounted for 4.3 per cent of motor spirit, down from 4.5 per cent in Q2 2018. Biodiesel represented 3.5 per cent of diesel (DERV) consumption, the same as in the second quarter of 2018. Their combined contribution also remained unchanged from the same quarter in 2018 at 3.8 per cent.

Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2018

Introduction

This article provides information and analysis on the amount of electricity from renewable sources, disaggregated below UK level. It includes information on capacity, generation and number of operational sites, as well as derived load factors, for the four UK countries, the nine English regions and, from 2014, UK Local Authorities[1,2]. It updates that published in the September 2018 edition of *Energy Trends.*

These data are consistent with those published for the UK in Table 6.4 of the Digest of United Kingdom Energy Statistics 2019 (DUKES), and use similar categories[3]. These data cover renewable electricity schemes, including those accredited under the Renewables Obligation (RO), Feed in Tariff (FiT) and Contracts for Differences support mechanism. These data also include some schemes that not eligible for support, such as pre-April 2002 large-scale hydro and non-CHP energy from waste schemes and those schemes that are registered with the MCS (Microgeneration Certification Scheme) but are not accredited to FITs. However, scale schemes that are not supported by government subsidy schemes or have not registered with the MCS are not included in these figures. As a result, the solar PV capacity and generation figures are likely to be underestimated. We are looking at options for extending our data coverage.

Consistent time-series data for each year from 2003 for regional and Local Authority data from 2014, are available as Excel spreadsheets[4]. The spreadsheets include detailed data and additional charts for generation, capacity, number of sites, generation per GVA and load factors by country of the UK, region of England and by Local Authority.

Key points – 2018

Renewable generation in the UK grew by 11 per cent from 2017 to 2018. Within this:

- Generation in England was **up 14 per cent**
- Generation in Northern Ireland was **up 21 per cent**
- Generation in Scotland was **up 7.1 per cent**
- Generation in Wales was **down 2.2 per cent**

Generation in England, Scotland and Northern Ireland was boosted by new capacity coming online. The bulk of renewable generation in Wales comes from onshore wind, generation from onshore wind was down in Wales in 2018 as average wind speeds were lower.

Overall capacity increased by 10 per cent from 40.3 GW at the end of 2017 to 44.3 GW at the end of 2018. Within this:

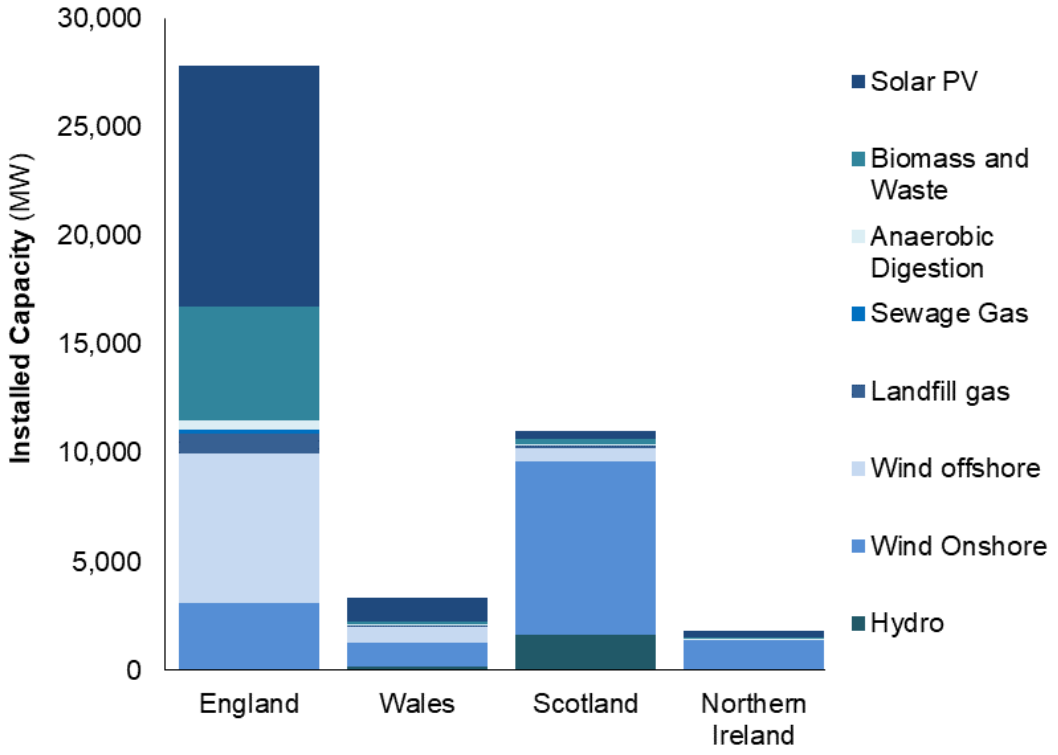
- Capacity in England was **up 9.7 per cent**
- Capacity in Northern Ireland was **up 19 per cent**
- Capacity in Scotland was **up 10.4 per cent**
- Capacity in Wales was up **4.7 per cent**

[1] Offshore wind is allocated to the region to which its output is connected. The exceptions are Robin Rigg, which comes ashore at Seaton, Cumbria but whose generation is associated with Scotland, and Burbo Bank, which comes ashore in Wales but whose generation is associated with the North West.
[2] Where disclosure of confidential generation data was likely at the site level, this has been addressed, where possible, by replacing this with data from publicly available sources. Where this is not possible, the data have been removed, and added to the unallocated row at the bottom of the Local Authority listings.
[3] On occasion, it has been necessary to combine some renewable sources into categories so that information about individual sites provided in confidence are not disclosed.
[4] Published at: www.gov.uk/government/statistics/regional-renewable-statistics

Capacity

- England had the most renewable capacity and generation, more than two and a half times that for Scotland; this is largely due to the fact that it has 90 per cent of the UK's bioenergy capacity (mostly from four biomass units at Drax in Yorkshire and the Humber), 85 per cent of the PV capacity and 32 per cent of the offshore wind capacity. Chart 1 shows a breakdown of capacity at the end of 2018 by technology and country.
- The technology with highest growth in capacity was **biomass and waste** which grew by 35 per cent overall. Within this, capacity grew by 37 per cent in England. The additional capacity was primarily in Yorkshire and the Humber from the conversion of a unit from coal to biomass at Drax and in the North East, Lynemouth Power Station has also been converted to biomass. Both of these plants are supported by Contracts for Difference (CFD).

Chart 1 – Renewable capacity at the end of 2018 by technology and country



- The second highest growth in capacity was in **offshore wind** which grew by 18 per cent in the UK. The additional capacity was largely in Scotland where capacity more than doubled over the course of the year, this was driven by the Beatrice wind farm where the first 273 MW of capacity was online by the end of 2018.
- The next highest growth was for **onshore wind** which grew by 7.6 per cent in the UK – 8.4 per cent in Scotland, 17 per cent in Northern Ireland and 11 per cent in Wales but just 0.6 per cent in England.
- **Solar PV** capacity only grew by 2.6 per cent with Northern Ireland having the largest percentage increase at 27 per cent. This could be due to the Renewables Obligation closing to new Solar PV entrants in England, Scotland and Wales prior to 2018 but a grace period still being available in Northern Ireland until March 2018.

Special feature – Sub-national renewable electricity

The largest new schemes (including capacity increases) in 2018 were as follows:

Onshore wind	Stronelairg Wind Farm	Scotland	228 MW
	Clyde Windfarm - North (capacity increase)	Scotland	80 MW
	Brechfa Forest West	Wales	57 MW
	Clyde Windfarm – Central (capacity increase)	Scotland	53 MW
	Blackcraig	Scotland	53 MW
Offshore wind	Walney (capacity increase)	North West	329 MW
	Galloper Wind Farm (capacity increase)	East of Eng	281 MW
	Beatrice Offshore windfarm	Scotland	273 MW
	Rampion	South East	217 MW
	Aberdeen Offshore Windfarm - Demonstration	Scotland	97 MW
Solar PV	Former Maghaberry Airfield	N Ireland	27 MW
	Fiskerton Airfield (Phase 2)	E Midlands	22 MW
Biomass and waste	Drax – new unit	Yorks & H	705 MW
	Lynemouth Power Station	North East	420 MW
	Tilbury Green Power	South East	41 MW
	Cramlington CHP	North East	28 MW
	Discovery Park	South East	27 MW
	Allerton Waste Recovery Park	Yorks & H	27 MW
	Energy Works (Hull)	Yorks & H	25 MW

The regions with the highest capacity in England (including PV) are:

- East of England - 5,378 GW (53 per cent from wind and 36 per cent from PV)
- Yorkshire and the Humber – 4,875 GW (63 per cent from biomass and waste - mostly from Drax – and 23 per cent from wind)
- South East (50 per cent from PV and 37 per cent from Wind).

Capacity by English region is shown in Chart 2:

Chart 2 – Renewable capacity at the end of 2018 by English region and technology

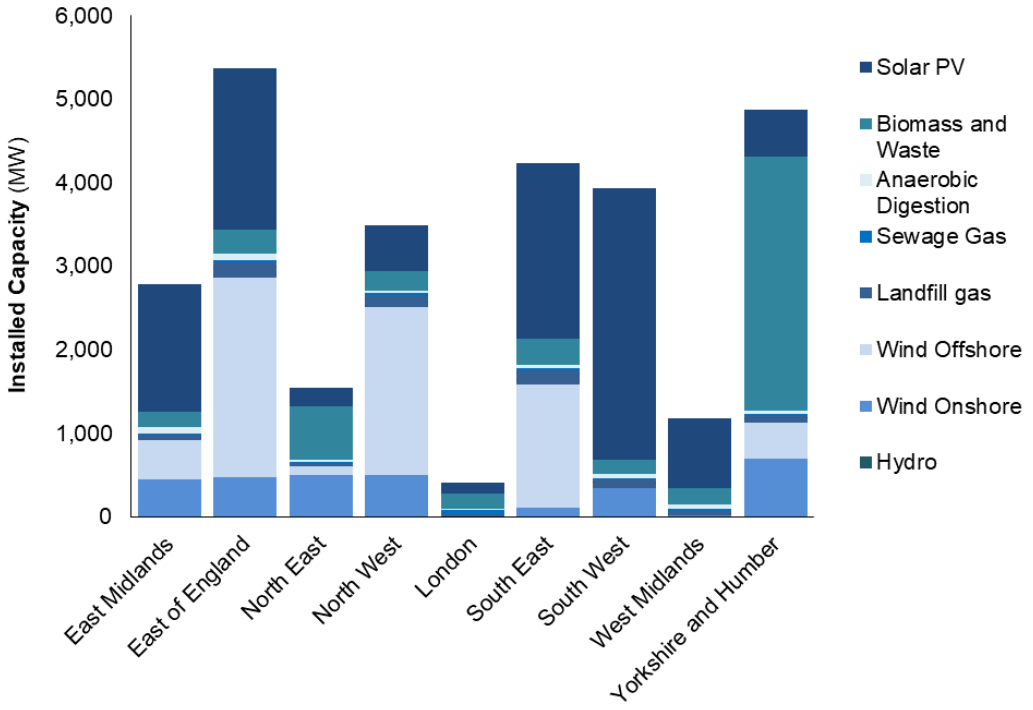


Table 1 summarises capacity growth, the key technologies in each region as well as the major sites:

Table 1: Regional capacity growth

Region	Key Technology	Growth (MW)	Key Schemes
East Midlands	Biomass and Waste	41.5	Riverside Industrial Estate Gasification Plant, Sinfin Lane, JG Pears' animal rendering facility, WellandBioPower
	Solar PV	42.5	Colpmans Farm (Islip), Stow Solar Farm, Fiskerton Airfield (Phase 2), Belper (Knob Farm)
East of England	Biomass and Waste	54.6	Tilbury Green Power, Energy10 Huntingdon, Great Blakenham Energy from Waste, Hoddesdon Energy Ltd
	Offshore Wind	305.7	Galloper Wind Farm, Race Bank
North East	Biomass and Waste	491.0	Cramlington CHP, Hull Biomass Plant (Tansterne power station), Hartlepool Works, Lynemouth Power Station
	Solar PV	8.6	Hunger Hill Farm PV Generation
North West	Biomass and Waste	21.6	Ince Bio Power
	Solar PV	17.4	Siddick Solar Farm, Clay Cross
	Offshore Wind	329.0	Walney 4
	Onshore Wind	15.8	Hallburn Farm (resubmission)
London	Biomass and Waste	1.0	Bioliquid CHP 30054 Dagenham DC
	Solar PV	4.3	Mainly medium and small-scale projects (FIT)
South East	Biomass and Waste	23.2	Discovery Park
	Solar PV	28.9	Great Seabrook Farm, Hill Farm Extension Solar Farm, Netley Solar Farm, Former Westhampnett Landfill
	Onshore Wind	4.4	Mainly medium and small-scale projects (FIT)
	Offshore Wind	217.2	Rampion
South West	AD	3.1	Evercreech Renewable Energy (Farm AD)
	Biomass and Waste	3.8	Stanley's Biomass Ltd CHP, Eco Parley ORC Facility
	Solar PV	48.5	Lower Slade Farm, Springhill Solar Park (Northwick), Milborne Port Solar FarmGreat Houndbeare FarmLand at Poles Hole FarmSouthwick PV FarmWick Road
West Midlands	Biomass and Waste	6.3	EnviRecover
Yorkshire and Humber	Biomass and Waste	769.8	Drax Units 1 + 2 + 3 + 4, Energy Works (Hull), King George Dock, Cross Green ERF, Allerton Waste Recovery Park (EfW)
	Solar PV	13.2	Sand Hutton Solar Farm
Northern Ireland	AD	11.9	AHS 500 (Farm AD), Airport Road West (Waste AD), ballyrenewables (Farm AD), Biogas51 Limited N. Ireland (Farm AD), Biogrid (Waste AD), BME (Farm AD), Cotwo AD (Farm AD), Devine AD (Farm AD), Gortahurk Road (Farm AD), Hewitts Meats - (Waste AD), Jambi (Farm AD), Kingspan (Farm AD), Newtownards (Farm AD), Pritchitts (Farm AD), RiverRidge (Farm AD),
	Biomass and Waste	10.0	Bombardier Aerospace (C Series), Encirc, Giants Park
	Landfill Gas	- 3.3	Drummee Dual Fuel Site, Glassmullagh Dual Fuel Site plus closures.
	Solar PV	68.8	Former Maghaberry Airfield, Gibson Farm, Laurelhill, Ballygarvey Road, Solar Farm DFD, South Antrim Solar Park - Phase 1
	Onshore Wind	206.3	Broughshane Wind Farm, Curraghmulkin (Dooish Wind Farm), Elginny Hill Resubmission, Pollnalaght Wind Farm, Teiges Mountain Wind Farm, Castle Craig
Scotland	Biomass and Waste	39.4	Levenseat EfW, Liberty Steel Dalzell, Acharn Forest Killin Biomass Plant
	Hydro	1.8	Allt Fionn Hydro Scheme, Upper Falloch Hydro
	Wave and tidal	2.0	Floating Energy Generation Platform - ATIR
	Offshore Wind	376.8	Aberdeen Offshore Windfarm - Demonstration, Beatrice Offshore windfarm
	Onshore Wind	611.9	Clyde Windfarm (Central), Clyde Windfarm (North), Tormywheel Wind Farm Limited, Blackcraig, Whiteside Hill, Tullymurdoch Wind Farm, Stronelairg Wind Farm, Afton Wind Farm, Keith Hill (resubmission), Auchadaduie Wind Farm, Bad a Cheo
Wales	Biomass and Waste	30.8	Liberty Steel Tredegar, Blazer Fuels, SIMEC Power 1 Limited
	Solar PV	10.0	Pant-Y-Moch CIC, Carmarthen
	Onshore Wind	110	Brechfa Forest West, Pen Bryn Oer Wind Farm, Brenig Wind Farm (Resubmission)

Generation

- For similar reasons to capacity, generation from renewable sources in England was also more than two and a half times higher than Scotland, with the higher utilisation rates of bioenergy offset by the lower rates of the more intermittent solar PV which accounted for 15 per cent of English renewable generation.

Number

- Excluding PV, England continues to have the largest number of renewable sites (5,706) followed by Scotland (4,428), Northern Ireland (1,493) and Wales (1,138); the position for the last two countries is reversed when PV is taken into consideration.
- Excluding PV, the regions with the highest number in England are the South West, East of England and Yorkshire and the Humber, respectively, a position that changes for the last two regions, when PV is taken into consideration, to the South East and the East of England.

Capacity and Generation per GVA

- Economic activity in each country or region is measured in terms of Gross Value Added (GVA)[5]. Scotland continues to show both the largest capacity from renewables per £ of GVA, followed by Wales, Northern Ireland and Yorkshire and the Humber.
- Scotland also shows the largest generation per £ of GVA, followed by Yorkshire and the Humber (due to Drax), Wales and Northern Ireland.

Load Factors

Load factors are the ratio of how much electricity was generated as a proportion of the total generating capacity. UCLFs or "load factor on an unchanged configuration basis" describes the amount of electricity generated from schemes that have been operating throughout the whole of the calendar year with the same installed capacity configuration[6].

The UCLFs and load factors on a standard basis can be found in the load factor time-series spreadsheets[7]. A summary by country is given in table 2:

Table 2 - Load factors on an unchanged configuration basis by country of the UK and technology:

	Onshore Wind	Offshore Wind	Solar PV	Hydro	Biomass and waste
England	25.8%	38.7%	11.4%	34.1%	66.0%
Northern Ireland	26.0%	n/a	9.2%	30.9%	64.4%
Scotland	26.5%	39.2%	9.4%	34.1%	68.0%
Wales	23.7%	34.6%	10.8%	18.6%	76.6%
UK average	**26.0%**	**38.3%**	**11.2%**	**32.6%**	**66.3%**

- Scotland now has the highest **onshore wind** load factor (26.5 per cent) breaking a consecutive three year run by England. This implies again that there have been fewer significant outages and curtailments than were noted in previous years for some large Scottish wind farms. Chart 3 shows the load factors for offshore wind in the different countries:

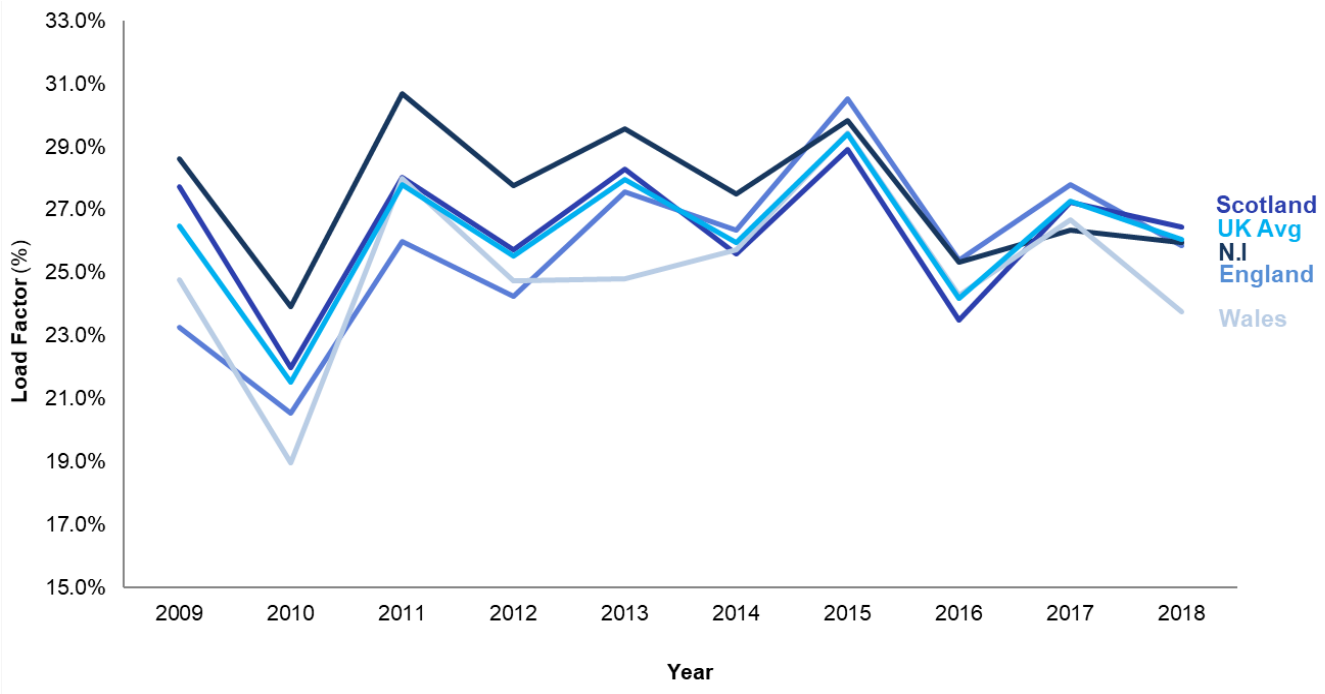
[5] *GVA is Gross Value Added as published as Total GVA in Regional Gross Value Added (Income Approach), December 2015 at:* www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedbalanceduk/1998to2016

[6] The formula for calculating UCLFs:

$$\frac{\text{Electricity generated during the year (MWh)}}{\text{(capacity of schemes operating throughout the year with an unchanged capacity (MW) x hours in year)}}$$

[7] Available at: *www.gov.uk/government/collections/renewables-statistics*. These data are only reported where the region contains three or more operational schemes.

Chart 3 – Onshore wind UC LFs since 2000 by UK country



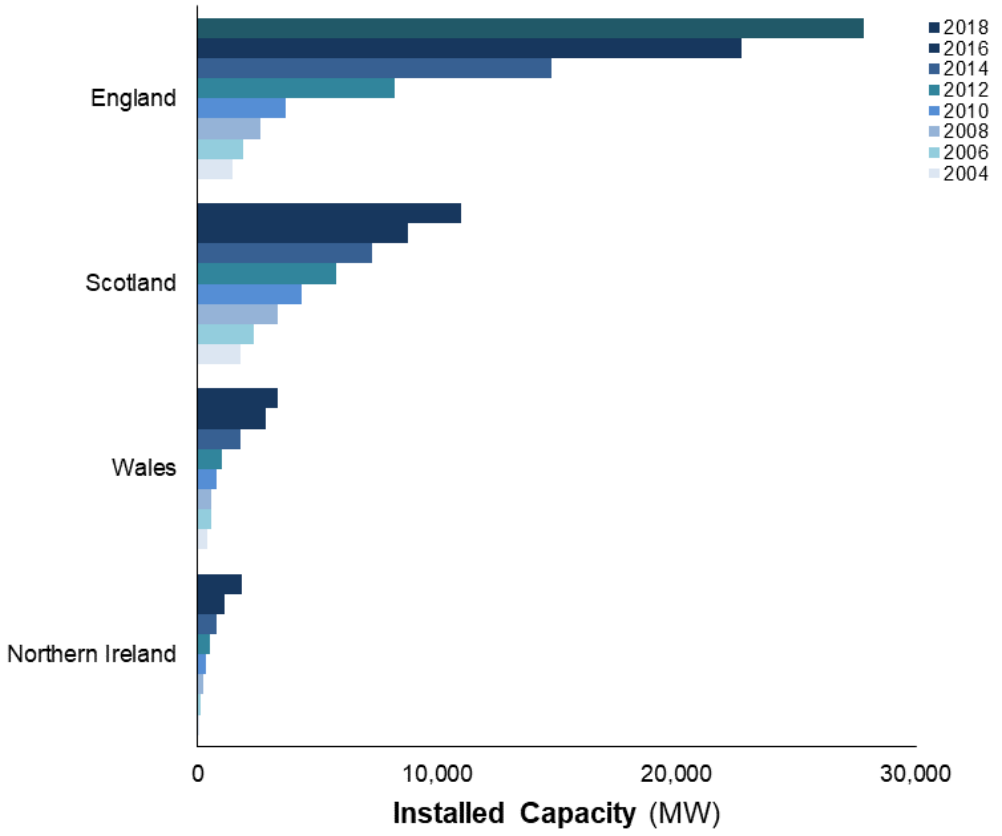
- Scotland also has the highest load factors for **offshore wind**.
- England has the highest average load factor for **Solar PV**, followed by Wales as solar irradiance tends to be slightly higher in England and Wales than in Scotland or Northern Ireland.
- Load factors for other technologies and additional graphs are included in the related spreadsheets.

Time Series

- Capacity and generation have grown at different rates in different regions for each technology. In the case of the installed capacity for solar PV, following a period of rapid growth encouraged by the RO and FiT schemes, the initial fast rate of growth has slowed down, which is also reflected in the corresponding generation figures; this is probably due to a combination of effects including closure of the RO, a reduction in FiT financial support mechanisms and the rapid exploitation of prime development sites.
- In the case of landfill gas, the rate of exploitation of prime sites reached saturation several years ago but interestingly there is no similar plateauing of generation data which instead decreases with time. This is because biogas production rates reduce with time as the biodegradable resource gets exploited.

Chart 4 shows how capacity has grown over time in each country.

Chart 4 – Total renewable capacity by country – 2004 – 2018



Local authority analysis

- Tables 3 to 5 rank the top five Local Authorities (LAs), per: number of installations, installed capacity, and generation for key technologies; these are also shown graphically in the Excel spreadsheets.
- **Number of sites**: Cornwall remains the top ranked (17,974), reflecting the large number of solar PV schemes installed in the South West; for other technologies, the top ranking LAs for number of installations for onshore wind, hydro, landfill gas, anaerobic digestion (AD) and plant biomass are the Orkney Islands, Highland, Thurrock, Shropshire and Mendip respectively.
- **Capacity**: Selby, is the top ranked, primarily from Plant Biomass (Drax Dedicated Biomass), followed closely by Highland, primarily from wind and hydro.
- **Generation**: Selby is top ranked, primarily from Plant Biomass; for other technologies, the top ranking LAs for onshore wind, PV, hydro, landfill gas and anaerobic digestion are Highland, Cornwall, Highland, Thurrock and Shropshire, respectively.
- Cornwall and Wiltshire continue to have large numbers of PV sites with correspondingly high capacity and generation which represents the installation of large solar farms. Sunderland and County Durham between them have an unusually large number of PV sites, especially for a region with low solar irradiance, however, they have much lower capacities and generation. This large number of small schemes represents the uptake of domestic installations.
- The Highland's overall capacity and generation is driven by the construction of large-scale wind farms. Whilst the Orkneys has the highest number of wind sites, more than 3 times that of the Highland's, it has a much smaller capacity and generation.
- Shropshire continues to show the highest number of AD facilities as well as capacity and generation, and probably reflects the availability of AD from the high levels of livestock farming undertaken in this District.

Table 3: Local Authority: Number of sites generating electricity from renewable sources, 2018[1]

Number

Onshore Wind		Solar PV		Hydro		Landfill gas		Anaerobic Digestion		Plant Biomass		Total [2]	
Orkney Islands	774	Cornwall	17,515	Highland	286	Thurrock	10	Shropshire	35	Mendip	30	Cornwall	**17,974**
Aberdeenshire	574	Wiltshire	9,409	Argyll & Bute	121	Doncaster	8	Herefordshire County of	20	Dumfries & Galloway	17	Wiltshire	**9,436**
Cornwall	426	Peterborough	9,157	Gwynedd	115	North Lanarkshire	8	Strabane	19	Herefordshire County of	17	Peterborough	**9,165**
Dumfries & Galloway	296	Sunderland	8,826	Perth & Kinross	88	Warrington	8	Dumfries & Galloway	14	East Riding of Yorkshire	10	Sunderland	**8,836**
Highland	251	County Durham	8,533	Dumfries & Galloway	84	Wiltshire	8	East Riding of Yorkshire	10	Powys	10	County Durham	**8,653**
										Shropshire	10		
UK Total	**9,718**		**957,038**		**1,559**		**460**		**619**		**429**		**970,150**

Table 4: Local Authority: Installed capacity of sites generating electricity from renewable sources, 2018[1]

MW

Onshore Wind		Solar PV		Hydro		Landfill gas		Anaerobic Digestion		Plant Biomass		Total [2]	
Highland	1,737	Wiltshire	594	Highland	803	Thurrock	44	Shropshire	19	Selby	2,663	Selby	**2,720**
South Lanarkshire	1,060	Cornwall	588	Argyll & Bute	296	Central Bedfordshire	33	East Cambridgeshire	18	Northumberland	448	Highland	**2,601**
Dumfries & Galloway	679	South Cambridgeshire	270	Perth & Kinross	278	Warrington	32	Redcar and Cleveland	10	Fife	77	Lancaster	**1,379**
South Ayrshire	653	Shropshire	213	Dumfries & Galloway	151	North Lanarkshire	26	Herefordshire County of	9	Slough	63	South Lanarkshire	**1,116**
Scottish Borders	638	Pembrokeshire	201	Stirling	85	Aylesbury Vale	21	Breckland	9	Sheffield	62	Dumfries & Galloway	**1,085**
UK Total	**13,554**		**13,116**		**1,878**		**1,063**		**502**		**4,434**		**44,338**

Table 5: Local Authority: Generation of electricity from renewable sources, 2018[1]

GWh

Onshore Wind		Solar PV		Hydro		Landfill gas		Anaerobic Digestion		Plant Biomass		Total [2]	
Highland	3,664	Cornwall	584	Highland	2,897	Thurrock	144	Shropshire	104	Selby	8,467	Selby	**8,567**
South Lanarkshire	2,631	Wiltshire	571	Perth & Kinross	755	Havering	120	East Cambridgeshire	98	Northumberland	530	Highland	**6,756**
Scottish Borders	1,483	South Cambridgeshire	269	Argyll & Bute	550	Aylesbury Vale	118	Redcar and Cleveland	54	Allerdale	370	Lancaster	**3,703**
South Ayrshire	1,388	Shropshire	200	Dumfries & Galloway	386	Central Bedfordshire	118	Strabane	49	Fife	341	Suffolk Coastal	**2,964**
Dumfries & Galloway	1,376	Pembrokeshire	197	Stirling	305	Warrington	114	Herefordshire County of	48	Sheffield	316	South Lanarkshire	**2,816**
UK Total	**30,217**		**12,857**		**5,490**		**3,916**		**2,681**		**22,897**		**110,019**

1 Top five ranked Local Authorities (LAs). Where more than five schemes are listed, this indicates that more than one LA has the same ranking.
2 Totals include offshore wind sites allocated to nearest Local Authority.

Revisions

Historic revisions this year were only carried out to the 2016 and 2017 datasets. Whilst this has resulted in changes to both capacity and generation for all but three regions (including the minor changes to Northern Ireland), these are primarily due to the reassignment of unknown FiT data from the Other category. In addition new data is available from several sources and some duplicates have been identified. These revisions are summarised in table 6:

Table 6: Historic capacity and generation revisions by

Year	2016		2017	
	MW	GWh	MW	GWh
England				
East Midlands	17	6	7	-5
East of England	0	0	0	0
North East	5	9	11	30
North West	1	1	-2	-8
London	1	1	4	0
South East	-17	-46	3	-41
South West	7	8	19	10
West Midlands	-3	4	0	-9
Yorkshire and the Humber	0	0	0	0
Northern Ireland	**-1**	**0**	**0**	**-1**
Scotland	**-24**	**-56**	**-203**	**-266**
Wales	**4**	**-9**	**1**	**-41**

Further information

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www.gov.uk/government/statistics/regional-renewable-statistics

Combined Heat and Power in Scotland, Wales, Northern Ireland and the regions of England in 2018

Background

Combined Heat and Power (CHP) is the simultaneous generation of usable heat and power (usually electricity) in a single process. CHP data for the UK as a whole are updated annually and published in the Digest of United Kingdom Energy Statistics (DUKES), the latest edition of which was published in July 2019. This article updates statistics published in the September 2018 edition of Energy Trends and provides a breakdown of CHP in the Devolved Administrations and English regions in 2018[1].

The data presented originates from a CHP database maintained by Ricardo Energy & Environment on behalf of The Department of Business Energy and Industrial Strategy (BEIS). Data relating to the overwhelming majority of CHP electrical capacity (>99 per cent of total capacity) is received annually from the reliable sources of the Combined Heat and Power Quality Assurance (CHPQA) programme, the Iron and Steel Statistics Bureau (ISSB) and from Ofgem's Renewable Obligations Certificates (ROCs) returns. Another source of data is the sales databases of the Association for Decentralised Energy (ADE). Data from CHP schemes not covered by the above sources are extrapolated from historical data. There is an ongoing data quality assurance exercise in respect of these schemes.

Between 2017 and 2018 there was a net increase in Good Quality CHP[2] capacity of 66 MWe and a net increase of 64 in the number of CHP schemes in the database (68 new schemes and the removal of 4 schemes). Good Quality CHP capacity in the UK increased from 5,919 MWe (revised 2017 figure) to 5,985 MWe in 2018. In 2018, 22.9 TWh of Good Quality CHP electricity was generated, which is 5.0 per cent higher than in 2017. This Good Quality CHP electricity constitutes 6.9 per cent of all electricity supplied in the UK.

Regional Trends[3]

Tables 1 and 1B show a comparison of the number of schemes, electrical capacity, electricity generated and heat generated in the regions[4] for the period 2016 to 2018. During this time, the total number of schemes increased from 2,224 to 2,473 and the capacity increased from 5,625 MWe to 5,985 MWe. Over this period, every region saw an increase in the number of CHP schemes and the capacity increased in all regions.

[1] Similar articles on CHP have appeared in previous Energy Trends publications from 2001 to 2018. The figures within any one article are a snapshot of the position as seen at the time and therefore figures between articles do not constitute a time series.

[2] Good Quality CHP denotes schemes that have been certified as being highly efficient through the UK's CHP Quality Assurance (CHPQA) programme.

[3] Note: The figures for previous years are revised on an annual basis to account for late information submitted after the publication date of the article. This is to ensure that the true trends are captured in the data. The figures herein therefore supersede the previous articles published.

[4] These regions are the Government Office Regions of England and Devolved Administrations of Scotland, Wales and Northern Ireland.

Table 1: Trend in number of CHP schemes and their electrical capacity over the period 2016-2018

	Number of Schemes			Electrical Capacity (MWe)		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
England	**1,879**	**2,016**	**2,066**	**4,773**	**5,026**	**5,096**
East Midlands	117	133	136	131	151	152
Eastern	183	196	200	313	347	353
London	324	337	344	244	253	258
North East	114	126	130	333	360	391
North West	295	311	318	696	747	760
South East	315	328	334	818	860	871
South West	153	169	173	120	137	143
West Midlands	181	204	215	111	147	151
Yorkshire/Humberside	197	212	216	2,006	2,024	2,018
Scotland	149	171	178	551	561	563
Wales	120	137	138	220	236	228
Northern Ireland	76	85	91	81	96	99
UK Total	**2,224**	**2,409**	**2,473**	**5,625**	**5,919**	**5,985**

Table 1B: Trend in CHP electricity and heat generated over the period 2016-2018

	Electricity Generated (GWh)			Heat Generated (GWh)		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**
England	**17,031**	**18,010**	**18,987**	**32,110**	**33,766**	**33,592**
East Midlands	637	732	720	1,336	1,383	1,369
Eastern	1,341	1,488	1,559	1,820	1,971	2,217
London	650	783	866	1,300	1,350	1,469
North East	1,080	1,342	1,184	3,580	4,019	3,497
North West	2,538	2,739	2,761	7,621	8,014	7,931
South East	2,742	3,016	3,712	6,498	6,845	6,991
South West	603	677	707	555	626	665
West Midlands	475	600	613	845	883	924
Yorkshire/Humberside	6,966	6,633	6,866	8,555	8,676	8,528
Scotland	2,326	2,607	2,593	6,119	6,247	6,155
Wales	712	785	859	1,934	2,004	2,123
Northern Ireland	337	383	428	507	503	546
UK Total	**20,406**	**21,785**	**22,867**	**40,671**	**42,521**	**42,416**

The region with the highest proportion of the UK's Good Quality electrical capacity is still the Yorkshire and Humber region with a 34 per cent share, followed by the South East (15 per cent) the North West (13 per cent) and Scotland (9 per cent). The Yorkshire and Humber region has constituted the largest share since 2003 and hosts the single largest CHP scheme in the UK. In all, just 6.2 per cent of sites account for 80 per cent of the electricity capacity shown in Table 1.

The four largest regions in terms of installed capacity were also the four largest regions in terms of electricity generation. In 2018, the Yorkshire and Humberside region accounted for 30 per cent of all Good Quality electricity generated in the UK, which is about the same as it was in 2017, but a decrease from 34 per cent in 2016. As with capacity, a very large proportion of Good Quality electricity generated is taken up by a very small number of schemes.

With 20 per cent of the total CHP heat delivered, the Yorkshire and Humber region provided the largest share of CHP heat in 2018, followed by the North West (19 per cent), South East (16 per cent) and Scotland (15 per cent). The fact that the Yorkshire and Humber region is not as dominant in terms of heat generation as it is for power generation is a reflection of the very large proportion of

capacity in this region being Combined Cycle Gas Turbine (CCGT) technology, where the heat to power rations is lower than for any other CHP technology.

Chart 1: CHP generation by area in 2018

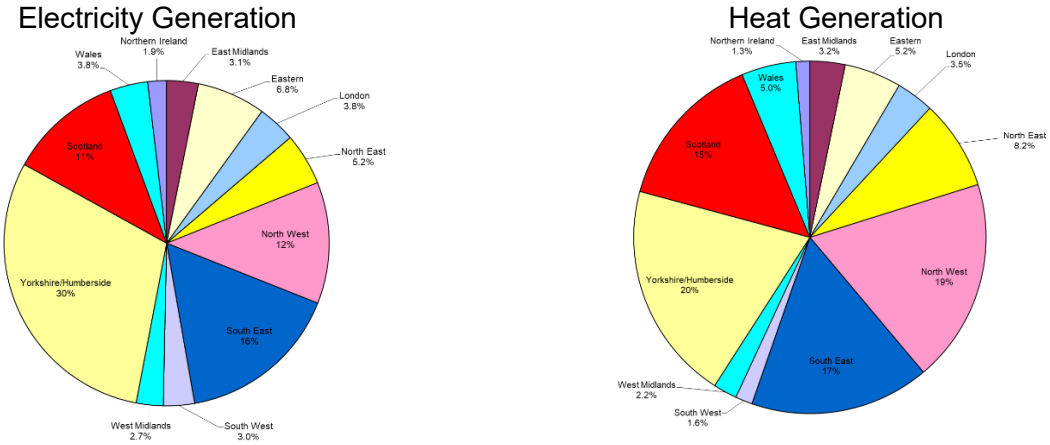


Table 2 shows an overview of CHP plant data broken down between the English regions and devolved administrations. The extent to which CHP capacity is utilised can be expressed by the Load Factor (LF). LF is the actual power generation as a proportion of the theoretical maximum power that can be generated for a given total installed capacity (TPC). The power output that is actually generated is the total power output (TPO). For 2018, the TPC was 8,825 MWe[5] and the TPO was 44,219 GWh, giving a LF of 57.2 per cent. This is 0.8 percentage points higher than in 2017. The highest LF over the last ten years was 60.0 per cent in 2016 and the lowest 51.0 per cent in 2013. The average LF over the last ten years has been 55.3 per cent.

Higher LF values tend to be found when CHP is deployed to satisfy industrial heat loads. This is because the demand for heat extends over a greater proportion of the year at industrial sites than at sites where CHP is deployed to satisfy space heating, where demand is seasonal. For example, in 2018 Yorkshire and Humber had the highest proportion of capacity that is industrial (94 per cent) and the highest LF (65 per cent) while London has the lowest proportion of capacity that is industrial (28 per cent) and the second lowest LF (50 per cent).

[5] The Total Power Capacity (TPC) is the registered maximum power generating capacity of a CHP scheme. It should be distinguished from Qualifying Power Capacity (QPC). QPC is defined under the CHPQA Standard and is also known as Good Quality capacity. QPC is the registered power generation capacity that achieves a QI of 100 or more under conditions of Maximum Heat Output under Normal Operating Conditions, as defined in the CHPQA Standard. Where a CHP scheme does achieve a QI of 100 or more under these conditions, its TPC and QPC are the same. Where it does not, then the capacity considered Good Quality is scaled- back and under these circumstances TPC>QPC. Unless otherwise stated, QPC is the basis of all power capacities quoted in this article.

Table 2: Overview of CHP schemes in 2018

	Number of Schemes	Electrical Capacity (QPC)* MWe	Electrical Capacity (TPC) MWe	Heat Capacity MWth	Fuel Used* GWh	Electricity Generated (QPO)* GWh	Electricity Generated (TPO) GWh	Heat Generated GWh	Load Factor** (%)
England	**2,066**	**5,096**	**7,683**	**16,872**	**74,007**	**18,987**	**38,268**	**33,592**	56.9%
East Midlands	136	152	194	633	2,965	720	941	1,369	55.3%
Eastern	200	353	353	951	5,124	1,559	1,642	2,217	53.1%
London	344	258	292	1,033	3,200	866	1,271	1,469	49.7%
North East	130	391	417	1,001	6,340	1,184	2,096	3,497	57.3%
North West	318	760	902	4,307	14,249	2,761	3,952	7,931	50.0%
South East	334	871	2,076	3,222	14,932	3,712	8,991	6,991	49.5%
South West	173	143	143	332	2,512	707	743	665	59.4%
West Midlands	215	151	189	630	2,767	613	1,012	924	61.3%
Yorkshire/Humberside	216	2,018	3,118	4,763	21,919	6,866	17,620	8,528	64.5%
Scotland	178	563	717	2,687	12,376	2,593	3,830	6,155	61.0%
Wales	138	228	327	924	4,468	859	1,677	2,123	58.6%
Northern Ireland	91	99	99	238	1,673	428	443	546	51.3%
UK Total	**2,473**	**5,985**	**8,825**	**20,722**	**92,523**	**22,867**	**44,219**	**42,416**	**57.2%**

∗This represents Good Quality CHP capacity (QPC), Good Quality CHP power output (QPO) and the fuel associated with the Good Quality CHP outputs. For further details on how these are defined, see Dukes 2019 Chapter 7 and the Combined Heat and Power Quality Assurance (CHPQA) Standard Issue 5): www.gov.uk/government/uploads/system/uploads/attachment_data/file/335471/CHPQAStandardIssue5.pdf

** These load factors are based on the total power output (TPO) and total power capacity (TPC) of the CHP (for partially and fully qualified schemes). This gives the true utilisation of the power generating plant.

Importance of CHP in the regional economies

Chart 1 shows the CHP outputs of each region and is derived from the data contained in Table 1B. It portrays only a limited picture as it does not account for the varying size of each region's economy. To allow for this, CHP heat capacity and electrical capacity can be compared with the level of economic activity in each region as measured by Gross Value Added (in £ million) in Table 3. Chart 2 maps the heat capacity per unit of GVA for the different regions.

The importance of the chemicals and oil refining industries in Yorkshire/Humber, the North West and Scotland - industrial sectors particularly suitable for CHP – explains the large heat capacities per unit of GVA in these regions.

Table 3: Density of CHP in different areas, ordered by heat capacity

	Heat capacity per unit GVA kWt/ (£million)*	Electrical capacity per unit GVA kWe/ (£million)*
Yorkshire/Humberside	40.18	17.02
North West	25.18	4.44
Scotland	**19.29**	**4.04**
North East	18.82	7.34
Wales	**15.00**	**3.70**
South East	12.24	3.31
England	**10.85**	**3.28**
Eastern	6.11	2.27
East Midlands	6.04	1.45
Northern Ireland	**5.99**	**2.48**
West Midlands	4.71	1.13
London	2.45	0.61
South West	2.49	1.07
UK total	**11.54**	**3.33**

*GVA is provisional gross value added in 2017 (income approach) at current prices[6]

The distribution of CHP capacity across the regions and economic sectors is summarised in Table 4, which shows the proportion of total CHP capacity in a particular economic sector in each region. The most striking feature of Table 4 is the very large proportion (62 per cent) of CHP capacity serving the oil refineries and oil and gas terminals sector being located in the Yorkshire and Humber region. Over 85 per cent of CHP capacity in the Chemicals sector is to be found in just three regions (Yorkshire and Humber, North West and North East), which is consistent with the importance of the Chemical industry to the economies of these parts of the country. A large proportion (nearly 83 per cent) of CHP capacity serving the paper sector is installed in just three regions (South East, North West and Scotland), attesting to the concentration of this industry in these regions. The dominance

[6] www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedincomeapproach

of the South East region for CHP serving the paper sector has reduced in recent years due to some significant site closures. In 2010, 51 per cent of all CHP capacity operating in the paper sector was located in the South East. By 2018 this had fallen to 35 percent.

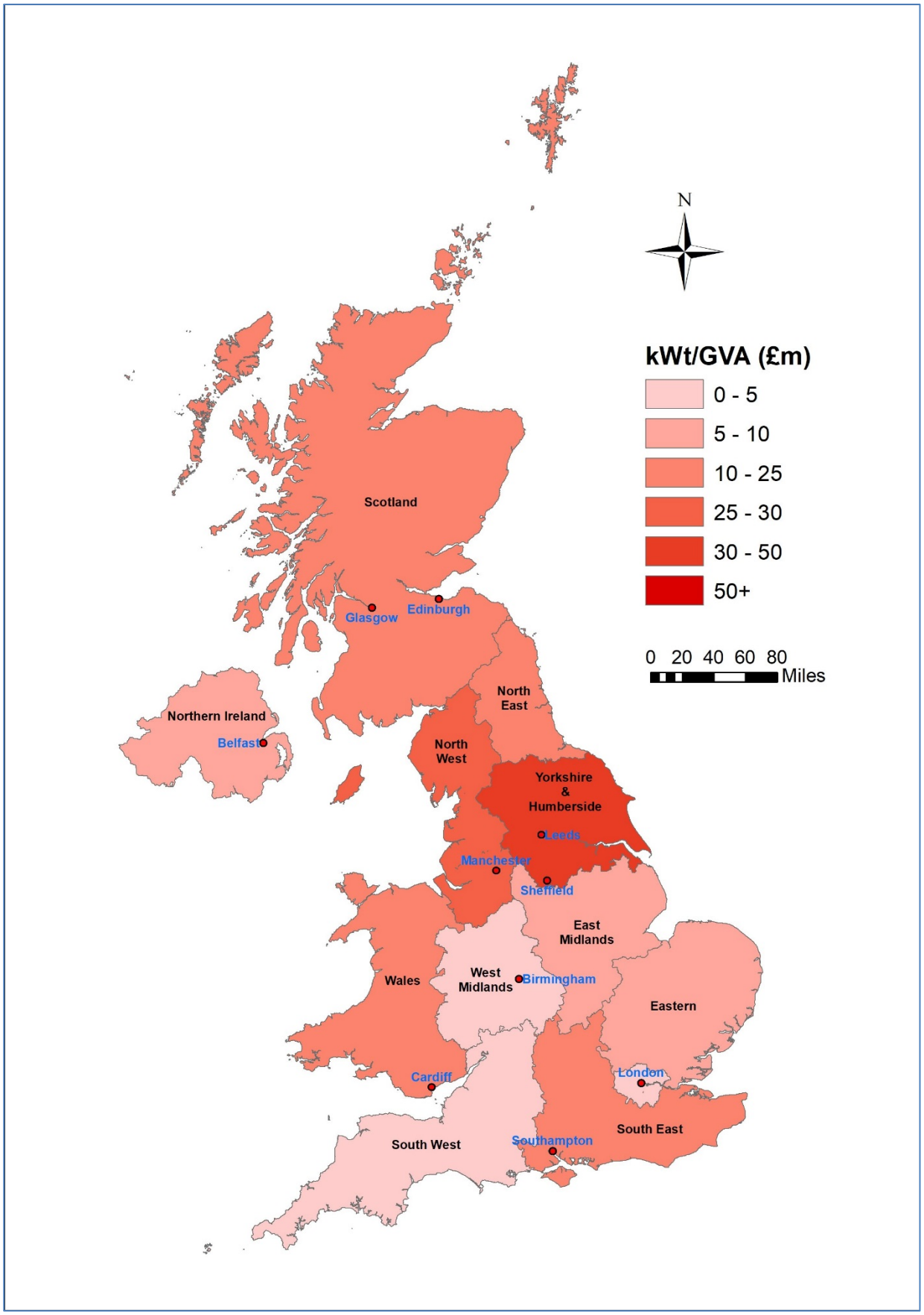
The production of primary steel and the availability of by-product gases for fuelling CHP is responsible for the large shares of capacity in the Iron and Steel and Non-ferrous sectors in Wales and Yorkshire/Humber.

The large proportion of capacity installed in the Food and Drink sector in the Eastern region (42 per cent), is substantially due to that region's sugar from sugar beet refining operations. The predominance of services in London and the South East is reflected by these two regions having the highest and second highest shares, respectively, of capacity installed within the Transport Commerce and Administration sector.

Table 4: Distribution of CHP capacity across the regions and economic sectors in 2018

Region	Sector									
	Iron and Steel and Non-ferrous Metals	Chemicals	Oil Refineries and Oil and Gas Terminals	Paper, Publishing and Printing	Food, Beverages and Tobacco	Metal Products, Machinery and Equipment	Mineral Products	Other Industrial Branches	Transport, Commerce and Administration	Other
England	65.9%	88.9%	86.6%	72.8%	85.0%	84.2%	100.0%	68.5%	84.0%	89.1%
East Midlands	0.0%	1.2%	0.0%	0.0%	6.1%	3.5%	7.7%	6.9%	5.4%	6.5%
Eastern	28.4%	1.4%	0.0%	0.0%	41.9%	0.0%	0.0%	8.1%	6.6%	7.6%
London	14.2%	0.0%	0.0%	0.0%	5.6%	11.7%	0.0%	12.6%	15.7%	12.2%
North East	0.0%	25.9%	0.0%	0.0%	0.0%	0.0%	14.0%	3.7%	6.7%	5.6%
North West	0.0%	24.0%	5.0%	29.4%	16.1%	4.6%	54.9%	8.3%	9.8%	10.1%
South East	0.0%	0.2%	19.5%	34.9%	5.2%	20.9%	0.0%	11.2%	12.1%	21.5%
South West	0.0%	0.7%	0.0%	0.0%	1.6%	5.3%	23.4%	5.4%	9.2%	5.7%
West Midlands	0.0%	0.2%	0.0%	2.5%	0.9%	38.1%	0.0%	7.4%	9.6%	4.8%
Yorkshire and Humber	23.4%	35.3%	62.2%	5.9%	7.7%	0.0%	0.0%	5.0%	8.8%	15.0%
Scotland	0.0%	6.9%	11.2%	18.2%	7.7%	0.6%	0.0%	8.6%	10.0%	5.7%
Wales	27.2%	3.1%	2.2%	9.0%	1.9%	7.5%	0.0%	17.1%	3.3%	2.5%
Northern Ireland	6.8%	1.0%	0.0%	0.0%	5.4%	7.7%	0.0%	5.8%	2.6%	2.8%
UK Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Chart 2: Map of CHP density in terms of heat capacity per unit gross value added



Technology type and size

Tables 5 and 6 show the regional split of installed electrical capacity (which qualifies as Good Quality CHP capacity) by prime mover (Table 5) and by size range (Table 6). In a number of regions disaggregation of the data by prime mover or size could result in the disclosure of confidential information and so, for these areas, only totals are shown. The following conclusions can be drawn from the tables:

- Gas turbines, whether on their own or as part of Combined Cycle Gas Turbines (CCGT), continue to dominate the CHP market. In 2018, just 137 schemes of the CCGT and Open Cycle Gas Turbine (OCGT) technologies accounted for 63 per cent of total Good Quality CHP capacity. This proportion of capacity taken up by these technologies has been much higher in the past and was 81 per cent in 2010. Most of this loss in share of capacity has been taken up by the reciprocating engine technology, as there has been a shift towards smaller capacity schemes of the types most conveniently served by reciprocating engines.
- The North West remains the region with the largest steam turbine based capacity. All of this capacity is at industrial sites. Scotland is the region with the second largest steam turbine based capacity, followed by the Yorkshire and the Humber.
- Reciprocating Engines constitute the vast majority of all CHP schemes (91 per cent of all schemes). The region with the largest number of reciprocating engine schemes is London, followed by the South East and the North West. These high population areas have a large number of sites which are well suited to the capacity range and grade of heat offered by reciprocating engines, namely leisure centres, hotels and retail outlets.

Table 5: CHP electrical capacity (MWe) by area and prime mover in 2018

	Gas Turbines*	Steam Turbines	Organic Rankine Cycle	Gas, Steam Turbine and ORC Subtotal	Reciprocating Engines	Total
England	**3,323**	**412**	**10**	**3,745**	**1,350**	**5,096**
East Midlands	-	-	-	60	92	152
East of England	-	-	-	203	149	353
London	-	-	-	42	215	258
North East	-	-	-	300	90	391
North West	388	202	1	590	170	760
South East	595	4	-	599	272	871
South West	18	26	-	46	97	143
West Midlands	-	-	2.9	24	127	151
Yorkshire and The Humber	1,815	65	-	1,880	138	2,018
Scotland	361	95	3	460	103	**563**
Wales	-	-	4	141	87	**228**
Northern Ireland	-	-	-	33	66	**99**
Grand Total	**-**	**-**	**-**	**4,379**	**1,606**	**5,985**

*Includes Combined Cycle Gas Turbines (CCGT)

The CHP market continues to be dominated by large-scale (>10MWe) plant, with 70 per cent of all installed capacity being in this size range. However, this proportion has been in steady decline over the years as larger (usually) industrial based CHP has closed and smaller (often) non-industrial based schemes have opened. For example in 2010, the proportion of installed capacity that was taken up by schemes > 10 MWe capacity was 83 per cent. Since 2010, the proportion of total capacity provided by schemes in the 2 MWe to 10 MWe range has increased from 11 per cent to 18 per cent

The regional distribution of CHP by capacity tranche is given in Table 6. Over 44 per cent of all capacity greater than 10 MWe is to be found in the Yorkshire and Humber region, followed by the South East (14 per cent), the North West (13 per cent) and Scotland (10 per cent). This is consistent with the tendency for heat intensive industries such as oil refineries, chemicals and paper, for which large CHP schemes are needed, to be located in these regions.

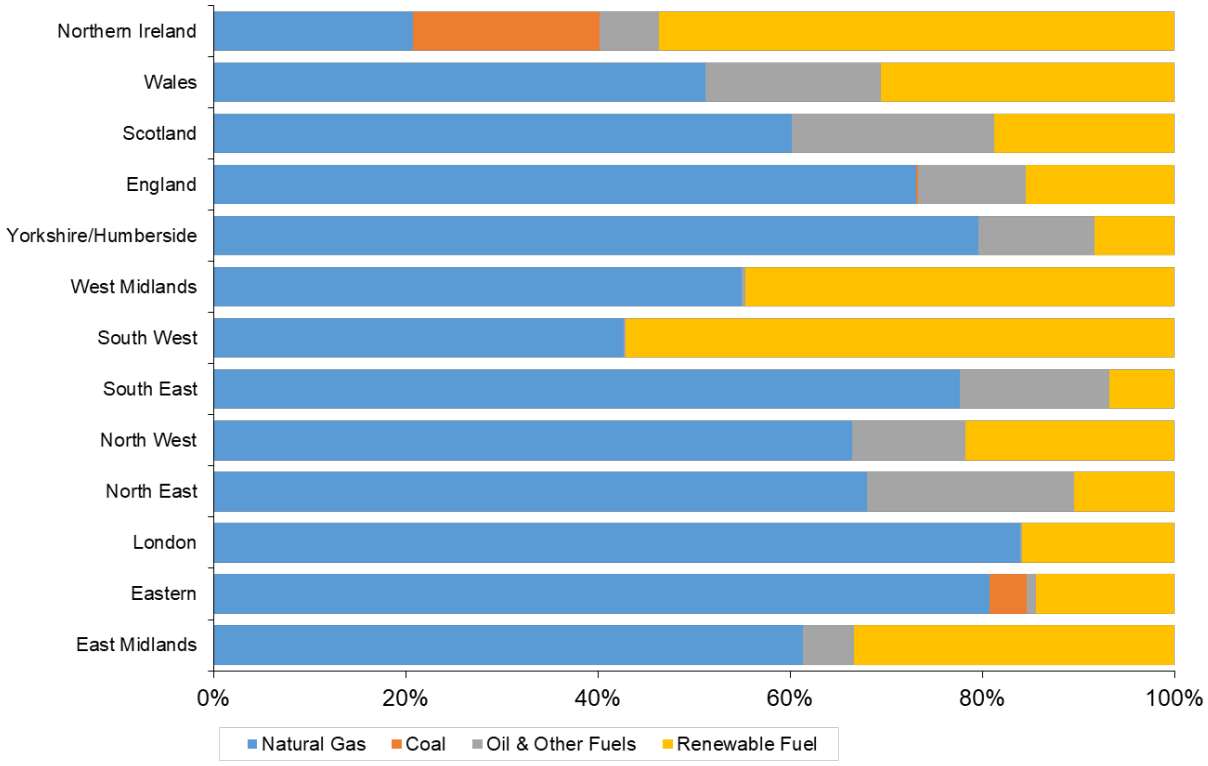
Table 6: CHP electrical capacity (MWe) by area and size in 2018

	<= 100 kWe	> 100 kWe to 1 MWe	>1 MWe to 2 MWe	> 2 MWe to 10 MWe	> 10 MWe +	Total
England	**37**	**289**	**245**	**928**	**3,596**	**5,096**
East Midlands	3	18	27	-	-	152
East of England	3	27	25	-	-	353
London	7	50	27	-	-	258
North East	3	11	11	83	282	391
North West	5	45	49	123	537	760
South East	5	47	35	182	602	871
South West	3	31	18	-	-	143
West Midlands	4	32	26	-	-	151
Yorkshire and The Humber	4	28	28	106	1,852	2,018
Scotland	3	20	33	86	421	563
Wales	3	19	11	53	142	228
Northern Ireland	1	22	6	-	-	99
Grand Total	**44**	**351**	**295**	**1,091**	**4,204**	**5,985**

The fuel mix

The proportion of coal, gas, renewable fuels and 'oil and other fuels' (comprising oil products, refinery gases, blast furnace gas and other industrial wastes) in the fuel mix for each region is shown in Chart 3.

Chart 3: Proportion of different fuels in the fuel mix for CHP in 2018 for each region



Natural gas represented 69 per cent of all fuel burned in CHP in 2018, which is 0.8 per centage points higher than in 2017 (revised). Over the last ten years, the share of all fuel burned that was natural gas has been within the range 69-73 per cent. With the exception of Northern Ireland and the South West, natural gas accounts for more than half of all fuel burned.

The South West had the highest proportion of fuel burned that was renewable (57 per cent) followed by Northern Ireland (54 per cent) and then the West Midlands (45 per cent). The South West also had the highest proportion of heat from CHP that was renewable (35 per cent of all CHP heat generated in the South West), but Northern Ireland had the highest proportion of Good Quality electricity generated that was renewable (58 per cent of all Good Quality CHP electricity generated in Northern Ireland).

In 2018 coal was again burned in only two regions (Northern Ireland and Eastern) and was confined to a very small number of schemes.

Summary

Between 2016 and 2018 the number of CHP schemes increased in all regions of the UK and all regions also saw an increase in the installed capacity.

CHP continues to play an important role in the economies of Yorkshire/Humber, the North West, Scotland and the North East. This reflects the importance of the oil refining and chemicals industries in these regions, which are well suited to the deployment of CHP. Other long established regional patterns endure, such as the importance of CHP in the food and drink and paper industries of the Eastern and South East regions, respectively, and the fact that the South East and London have the highest and second highest shares on non-industrial installed capacity.

In 2018 renewable fuels accounted for 17 per cent of CHP fuel consumption, 0.7 percentage points higher than in 2017 (revised). In 2008 the proportion of CHP fuel that was renewable was just 3.9 per cent. In 2018 the South West had the largest proportion of renewable fuel consumption in CHP followed by Northern Ireland and then the West Midlands.

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Diversity of supply for oil and oil products in OECD countries in 2018

Introduction and summary

Countries meet their oil needs through a combination of indigenous production and trade. This article is a comparative assessment of how OECD countries manage their crude oil and transport fuel demand using data from the IEA database[1]. The aim is to determine how the UK compares with other OECD countries in terms of how it secures oil supplies.

Within the OECD, the same three countries as last year were the only net exporters of crude oil in 2018: Norway, Canada, and Mexico. All other OECD countries met their demand at least partially through imports with 10 countries not producing any crude oil indigenously. Of these other countries, the UK had the highest self-sufficiency, producing over 90 per cent of its crude oil demand.

Half of OECD countries met their petrol demand through indigenous production, with much of Western Europe being net exporters. Subsequently petrol achieved the highest average security of supply score. Jet fuel had the joint lowest average diversity index with petrol, although on average OECD countries were 95 per cent self-sufficient. The self-sufficiency average was greatly increased by the high contributions notably from Lithuania (meeting 7.4 times the demand) and Korea (at 3.2 times the demand).

Approximately 43 per cent of OECD countries were self-sufficient in diesel production, Greece, Finland, and Korea remained the top three. Greece produced nearly four times the amount it consumed.

The UK could have met more than 90 per cent of its demand for crude through indigenous production and ranked in the top five for security of supply. The UK was able to more than meet demand for petrol through indigenous production. For jet fuel, the UK was in the lower half of the OECD in terms of indigenous production scores, even though consumption was the second highest. However, with a diversity score of 0.78 ranked joint second in terms of security of supply with Denmark and after France alone. On diesel, the UK produced less than half of demand, below the median for the OECD, but scored third highest for diversity and security of supply.

Charting oil self-sufficiency and diversity of supply

Bubble charts

The bubble charts demonstrate the relationship between demand, indigenous production, diversity of gross imports and the political stability of import sources. This year we have grouped OECD countries in Asia, the Middle East and the EU for the first time, using the average scores. See Appendix 1 for a list of the countries included in each of these categories. The profiles show:

- Self-sufficiency: the proportion of a country's demand that could be met through indigenous production is shown on the vertical axis. A score of 1 indicates a country produces as much oil as it uses, a score of 0 indicates that no demand was met with own production.
- A diversity score: the diversity and political stability – defined via the World Bank's governance indicators - of a country's gross imports is shown on the horizontal axis (see Appendix 3 for a methodological note).
- Consumption: is represented by the circle or bubble, the area of which indicates the level of consumption for 2018 for each OECD country.

[1] http://data.iea.org/ Following implementation of a new country list in the annual survey of member states in 2018 more detailed data was available for sources of supply. Compared to the 104 countries (and groupings) available for 2017 data, this analysis uses data from 163 supply sources. This has been reflected in movements in some countries' diversity scores where supply sources previously grouped into one category (e.g. Other Africa) have been counted separately.

Bar charts

The bar charts provide a means of comparing OECD countries by self-sufficiency and diversity of imports. These profiles combine the proportion of demand that could be met through indigenous production with the diversity and political stability of import origins. The sum of these two components is used as a simplified metric for security of supply, and thus does not represent a full description of security of supply beyond import diversity, stability and self-sufficiency. Appendix 2 shows the underlying data.

Choropleth map

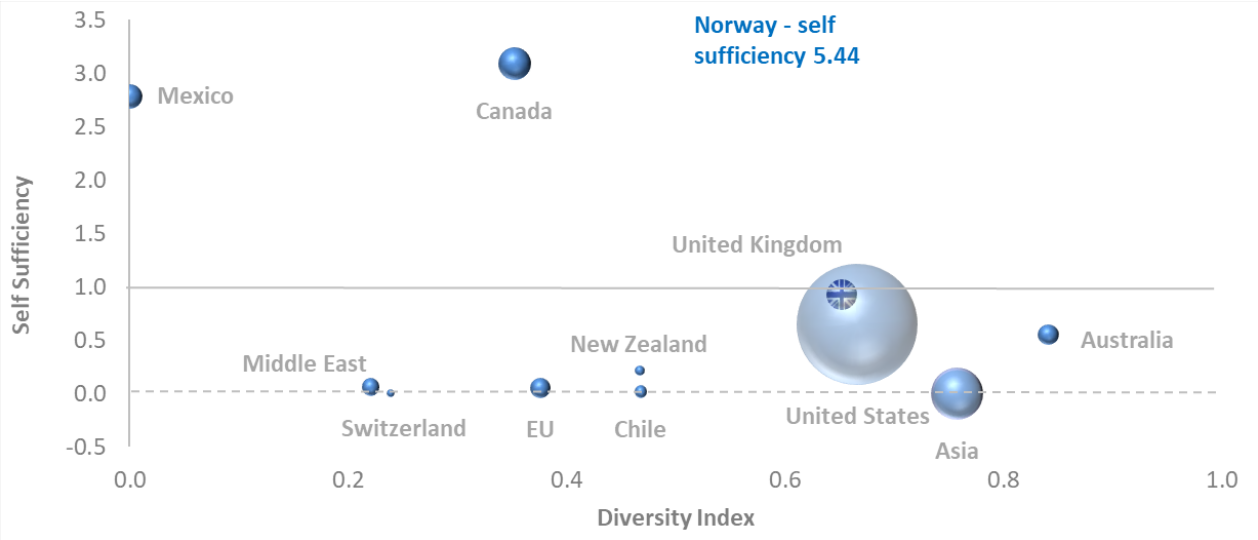
These maps indicate a visual representation of the source countries and quantities of each product's exports. A darker shade represents a high proportion of the world's exports originated from that country, whereas lighter shades indicate that fewer exports originated in that country. Appendix 2 shows the underlying data.

Results

Crude

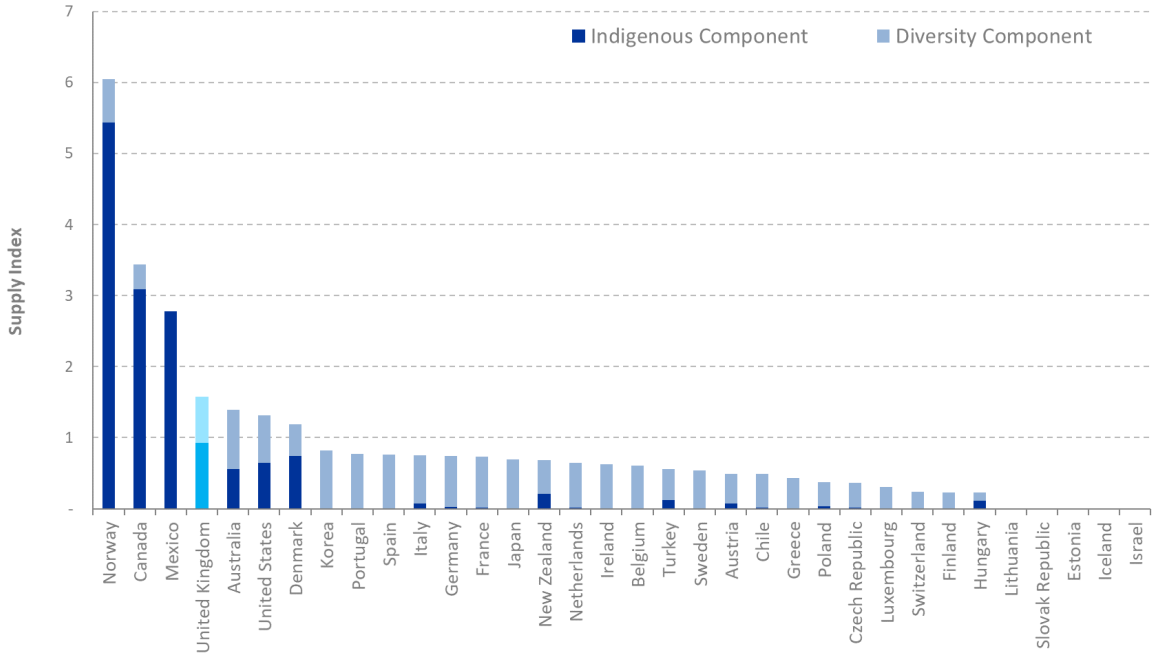
Only three OECD countries were self-sufficient for crude oil again in 2018 (Chart 1). Norway had by far the highest self-sufficiency score, producing nearly five and a half times its own consumption. With a self-sufficiency score of 0.92, the UK was above the OECD average of 0.41 and this marks an increase in self-sufficiency for the UK compared to 2017. Similarly, the UK's diversity score of 0.65 was above the average score of 0.38.

Chart 1: Diversity and self-sufficiency of crude oil for OECD countries, 2018



Most OECD countries showed diversity and political stability scores that reflect a strong trading element, with a relatively small contribution from indigenous production (Chart 2). Chart 2 shows that the UK placed highly in the ranking of OECD countries being one of only a few countries with substantial oil production.

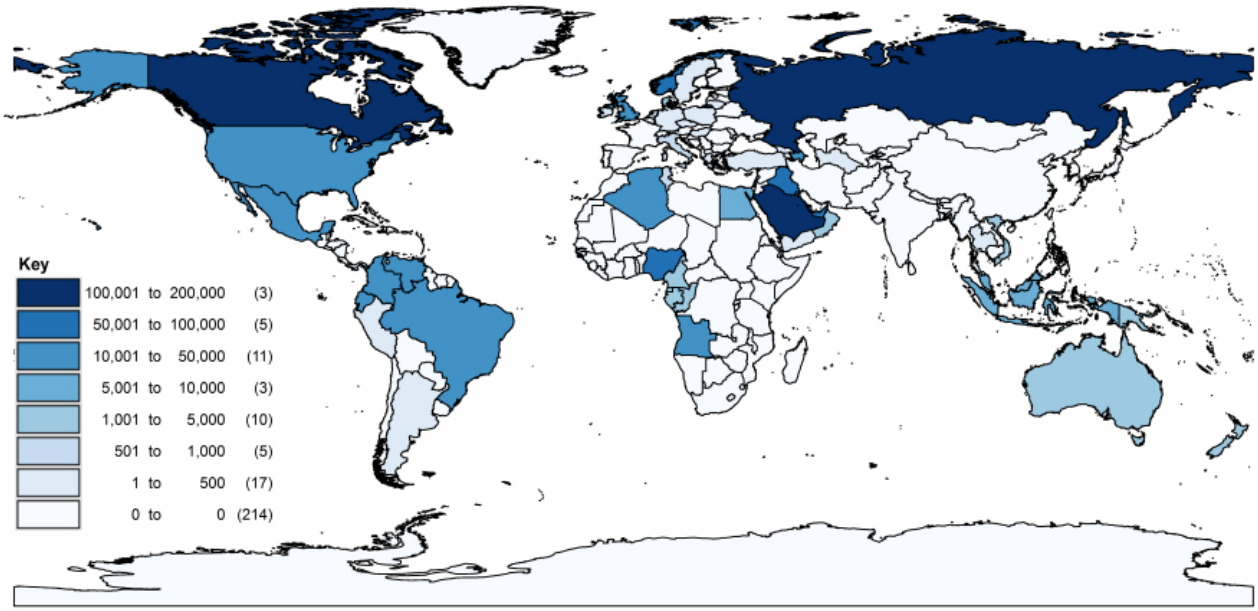
Chart 2: Security of supply of crude oil for OECD countries, 2018



Note: No data was available for Lithuania, Slovak Republic, Estonia, Iceland or Israel

Map 1 is an illustration of where crude oil exports originated in 2018. Saudi Arabia, Russia and increasingly the US[2] are the biggest exporters of crude in the world. Within the OECD, the UK was the 4th biggest exporter.

Map 1: Worldwide crude oil exports (kt), 2018

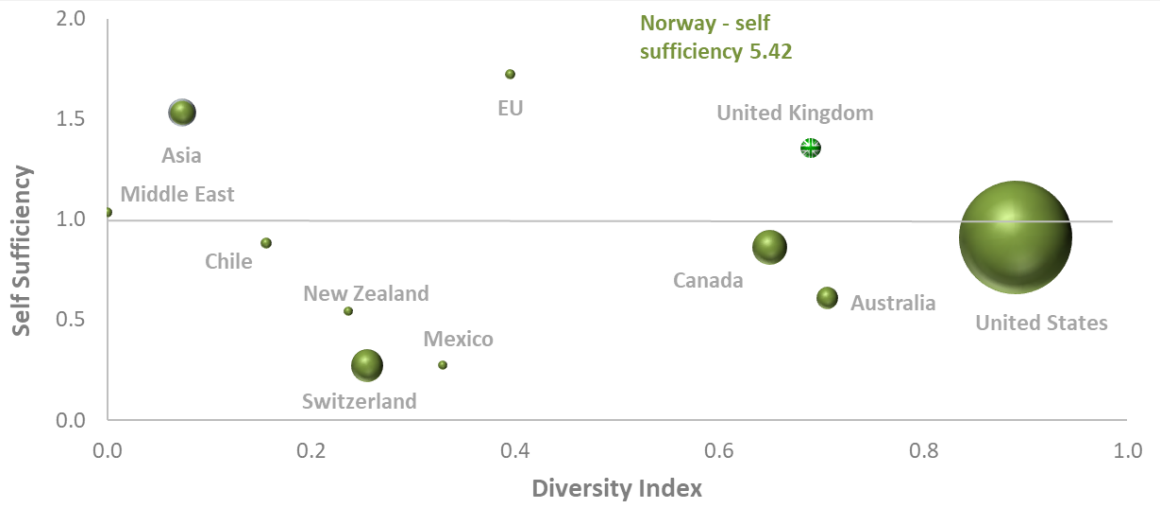


[2] www.eia.gov/dnav/pet/pet_move_expc_a_EPC0_EEX_mbbl_a.htm

Petrol

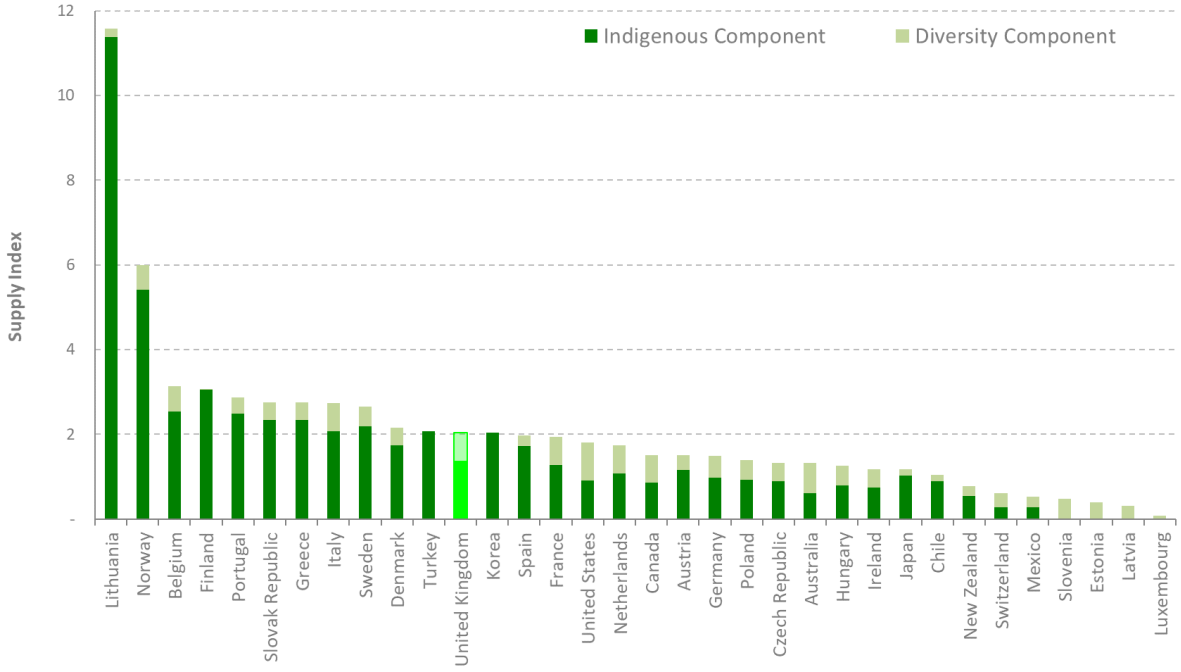
The profiles for petrol are different to that of crude. Half of the 36 OECD countries were self-sufficient in 2018 (Chart 3). Lithuania (combined in the EU average and who only joined the OECD in 2018), had a self-sufficiency score of 11.38, making it by far the highest ranking in this regard. Consumption in the US dwarfs that of other OECD countries, equal to nearly 64 per cent of the OECD total. The UK had a self-sufficiency score of 1.36, which was above the 0.96 average across all OECD countries. The UK's diversity score of 0.69 was also much higher than the OECD average of 0.38 and was the third highest overall after the US and Australia.

Chart 3: Diversity and self-sufficiency of petrol for OECD countries, 2018



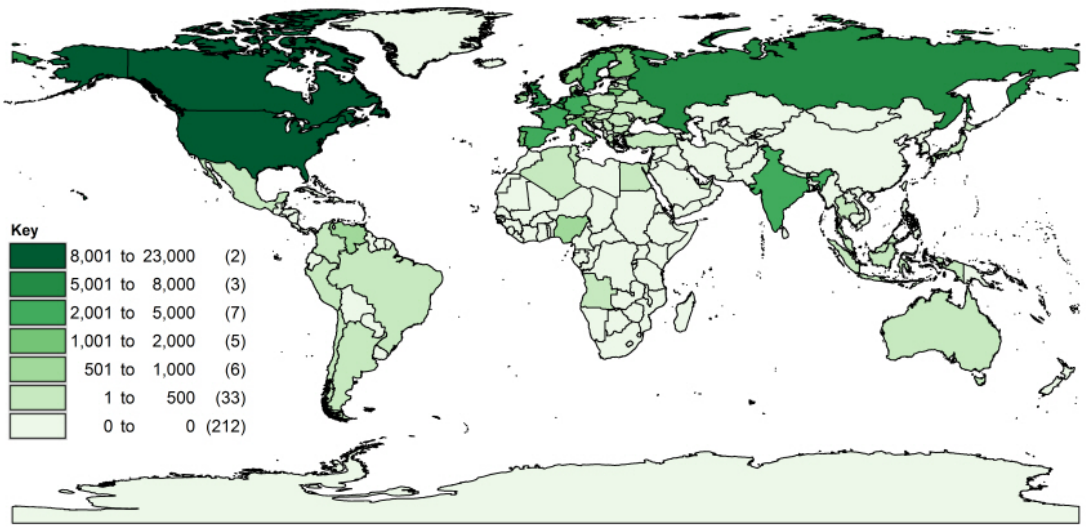
Our simplified security of supply index (Chart 4) shows how most countries produce enough petrol to meet their needs and how much trade there is in petrol amongst the OECD countries. The UK ranks 3rd out of the 36 OECD countries for security of supply of petrol.

Chart 4: Security of supply of petrol for OECD countries, 2018



The main exporter of petrol around the world is North America, exporting more than twice the amount of Canada, the next biggest exporter. Europe is also shown on the map to be a very significant exporter of petrol to the rest of the world, notably including the United Kingdom, the Netherlands and Belgium. Many large economies such as Australia, Japan and China export comparatively low quantities of petrol.

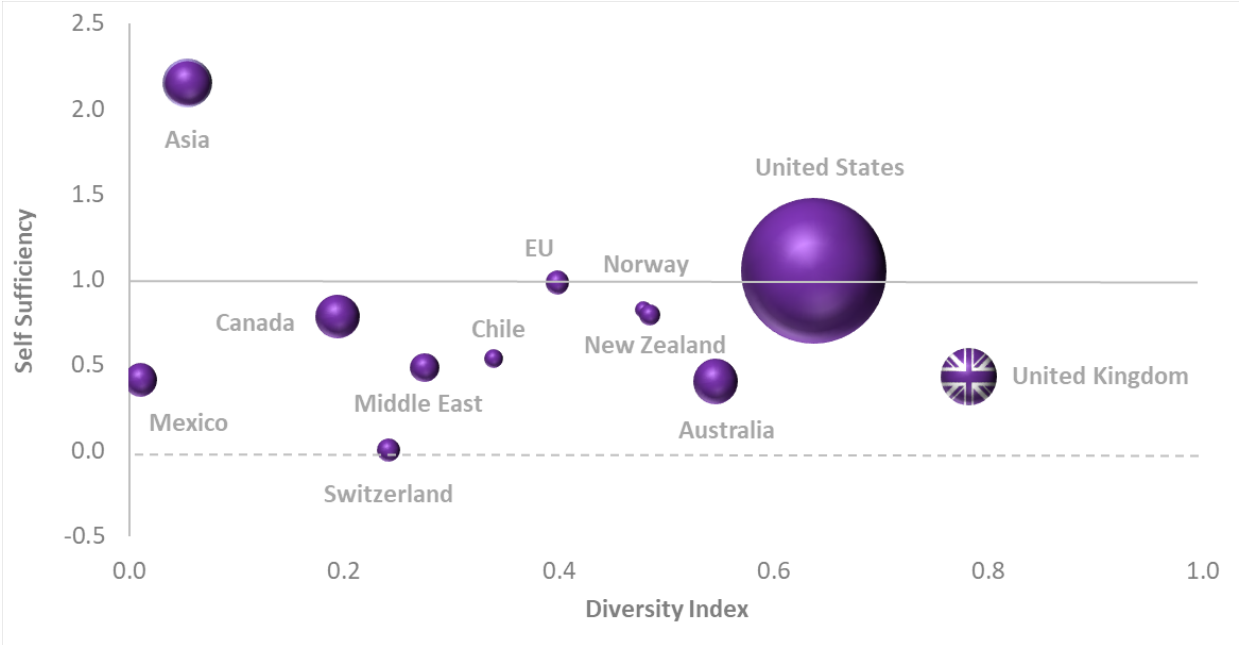
Map 2: Worldwide petrol exports (kt), 2018



Jet Fuel

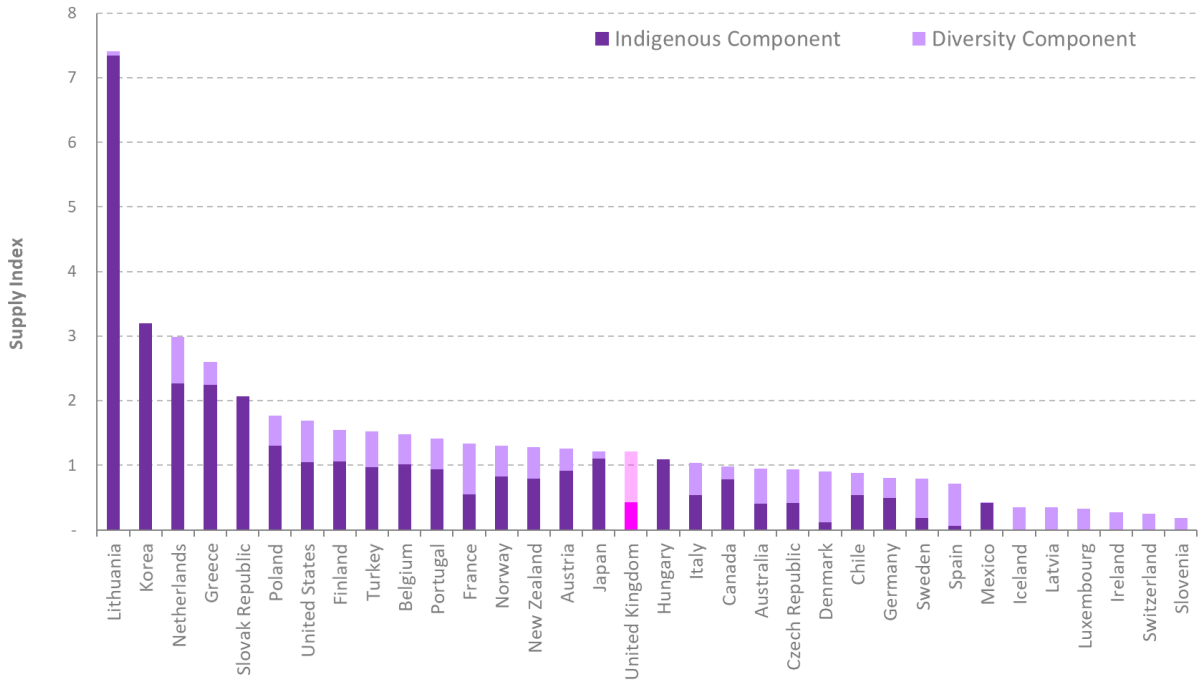
Chart 5 shows that, with a score of 0.43, the UK was below both the self-sufficient threshold of 1 and the OECD average 0.95 for jet fuel. However, the UK's import diversity score of 0.78 was higher than the average for all OECD countries of 0.38.

Chart 5: Diversity and self-sufficiency of jet fuel for OECD countries, 2018



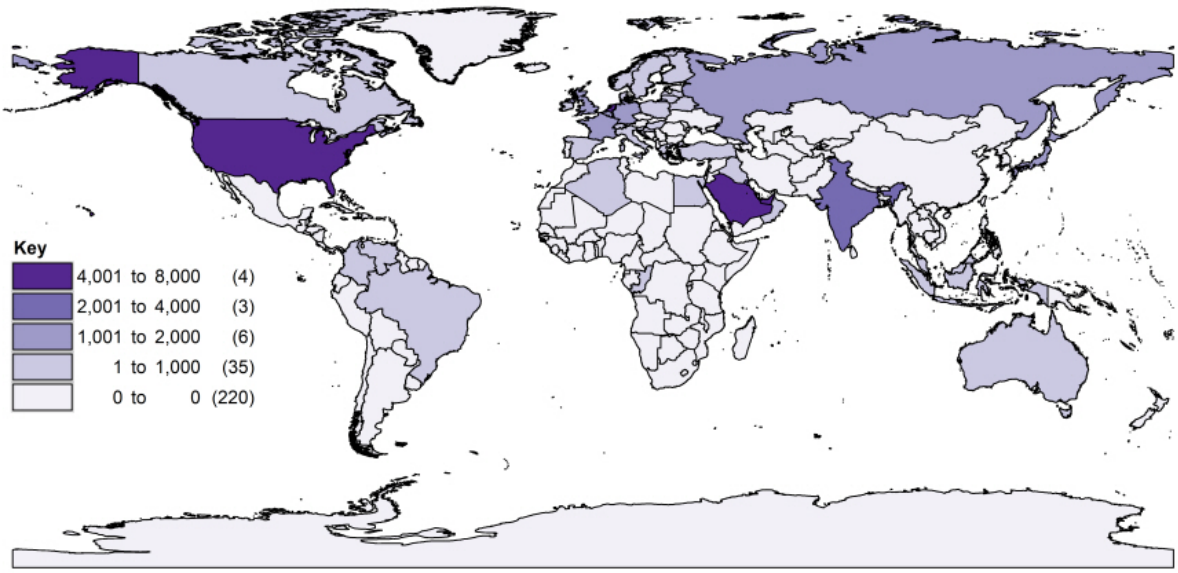
Many OECD countries have significant production capacity of jet fuel. For instance, with a refining capacity of approximately 10 million tonnes a year Lithuania has relatively low demand so produces more than seven times its demand, and Korea more than three times. The UK's low capacity to meet demand through indigenous production is of the largest deficits in the OECD, significantly lower than the OECD and EU average. However, Heathrow (being the busiest airport in Europe), causes the UK to have the second highest demand for jet fuel, behind only the United States.

Chart 6: Security of supply of jet fuel for OECD countries, 2018



Jet fuel is only exported in significant quantities in a few countries around the world with Korea, the Netherlands, the United Arab Emirates, the United States and Saudi Arabia exporting the most. The Netherlands is a trading hub for many oil products, with large amounts of imports 're-exported' and not used for the country's own consumption. Europe exports relatively small amounts of jet fuel (excluding the Netherlands), as does Canada and North Africa.

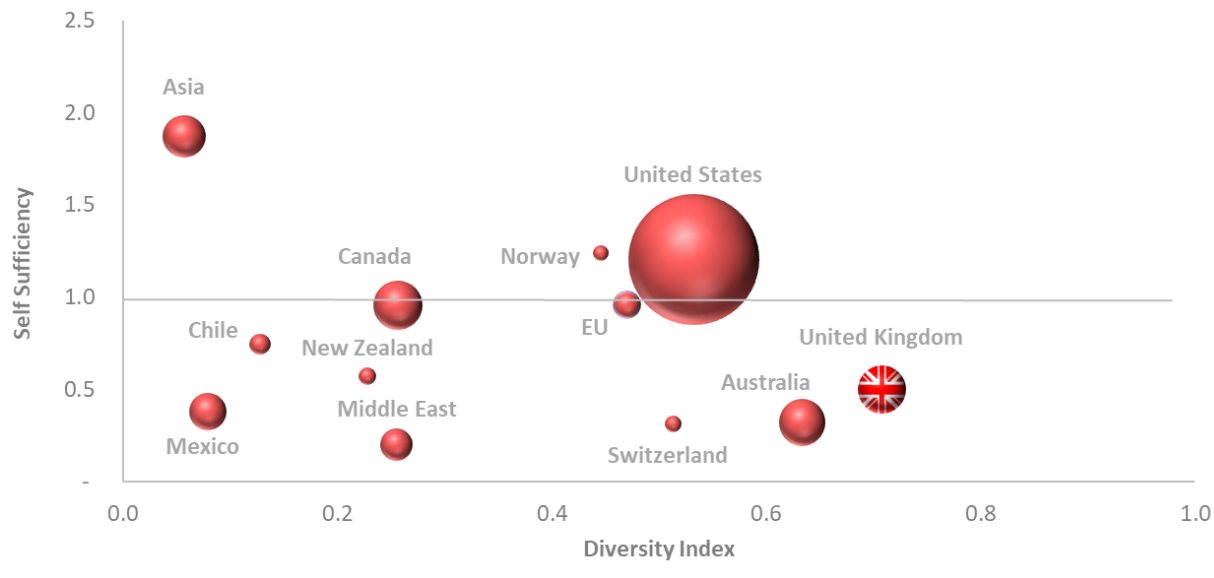
Map 3: Worldwide jet fuel exports (kt), 2018



Diesel road fuel

At 0.50 on the self-sufficiency axis the UK was below the average OECD self-sufficiency score of 0.90 in 2018, producing just half of the diesel it consumed. However, the UK is in a favourable position in terms of diversity and political stability of imports; the UK's diversity score of 0.71 was the joint second with Denmark only after France, but with demand of around 12 million tonnes compared to 1.0 for Denmark and 7.6 for France. The UK score was also substantially above the OECD average of 0.38 (Chart 7).

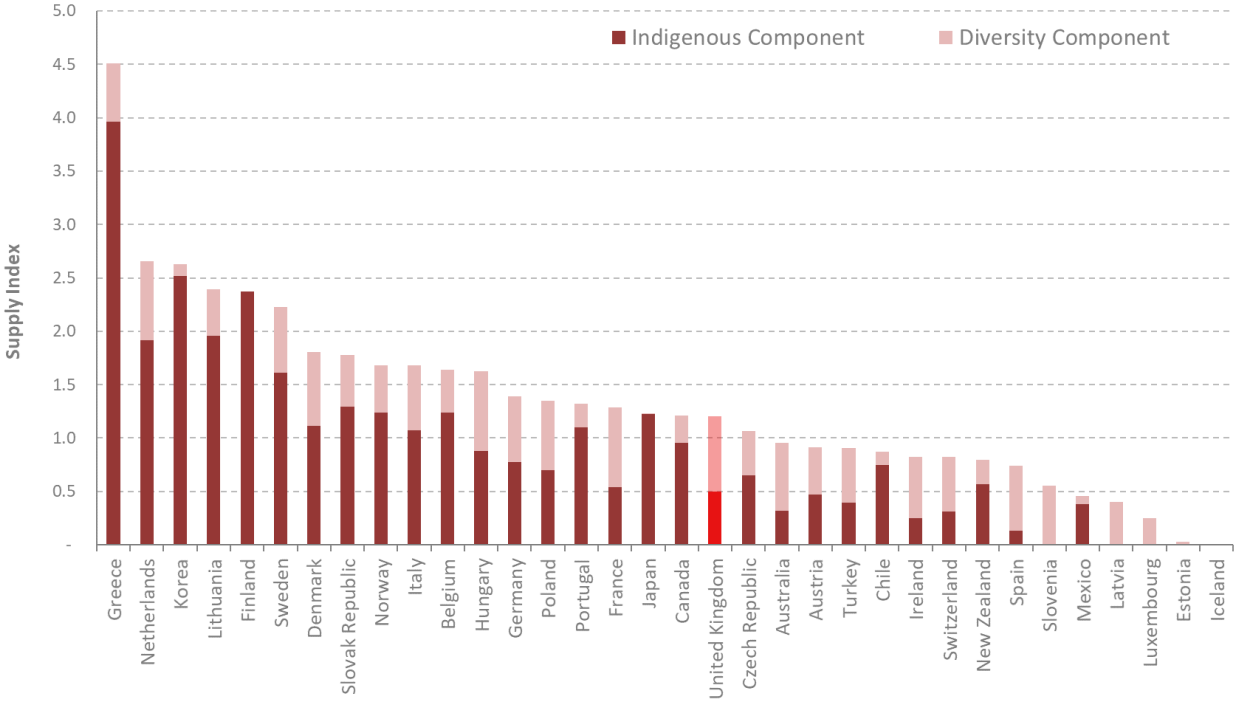
Chart 7: Diversity and self-sufficiency of diesel for OECD countries, 2018



Note: Data on imports to Australia in 2018 was not available; 2017 data was used in its place.

Most countries either met demand through indigenous production or by a combination of production and diverse imports. The profile depicts how the UK's security of supply score was the highest value of all of the OECD countries' scores owing to its high diversity component (Chart 8).

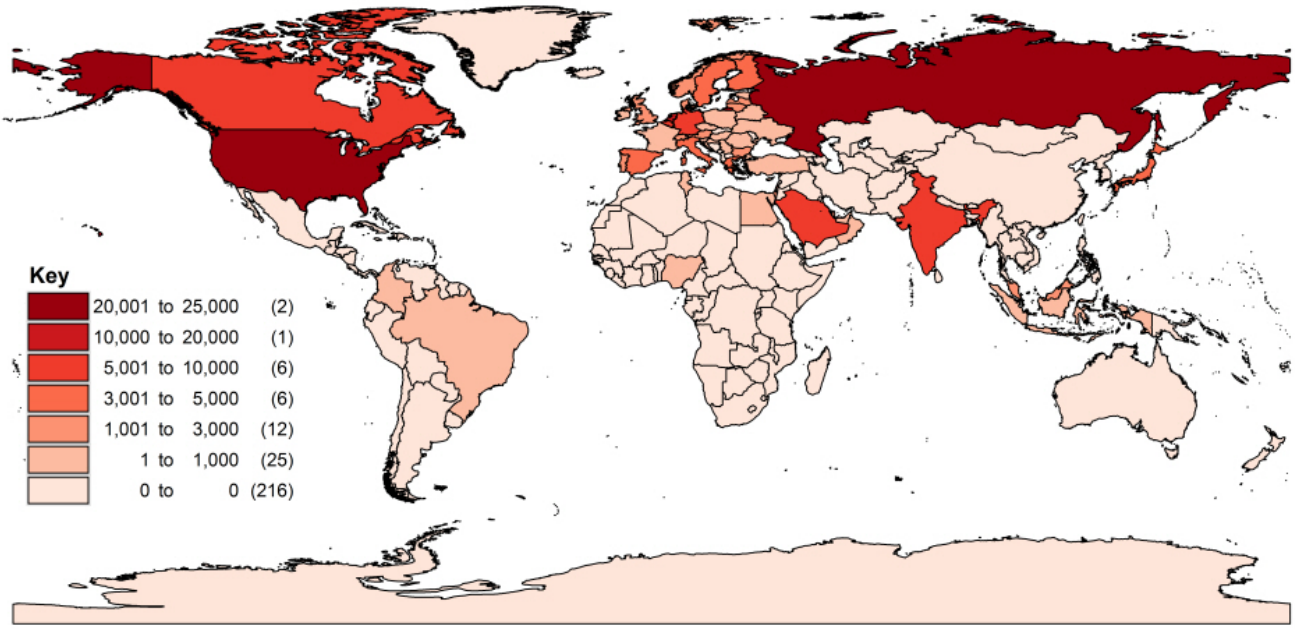
Chart 8: Security of supply of diesel for OECD countries, 2018



Note: No data was available for Iceland

Map 4 shows that the United States and Russia are the most significant exporters of diesel. There are limited quantities of exports from Asia and South America, with Europe and Canada exporting diesel in moderate quantities. The UK was the 4th largest exporter out of all 36 OECD countries in 2018.

Map 4: Worldwide diesel exports (kt), 2018



Summary

Self-Sufficiency and Import Diversity of OECD countries in 2018

The overall picture of diversity of supply for oil and oil products reflects a higher security of supply for oil products than for crude oil, primarily driven by higher levels of refinery production than for crude itself. With an average self-sufficiency score of 0.41, OECD countries are very much dependent on imports of crude oil to meet refinery demand, compared to average scores of 1.55, 0.92 and 0.90 for petrol, jet fuel and diesel respectively. Although average self-sufficiency scores for transport fuels were much higher, these scores are dependent on refining crude oil, and as such indigenous production of these products cannot be decoupled easily from crude oil security of supply.

Total petrol production was an average of one and a half times the average consumption in OECD countries. However, half of these 36 countries were self-sufficient; particularly notable were Lithuania, Norway, Finland and Belgium, each country producing much higher quantities than the amounts they consumed. With an average self-sufficiency score of 1.55 the OECD is well-placed to meet demand for petrol.

Diesel consumption across the OECD is around 10 per cent higher than production, with an average self-sufficiency score of 0.90. Almost 40 per cent of OECD countries were self-sufficient in 2018, with Greece notably producing nearly four times the amount it consumed. These comparatively robust self-sufficiency scores along with a diversity and political stability score of 0.42, makes diesel the oil product with the highest security of supply score, according to our simplified index.

Jet fuel imports had an average diversity score of 0.38 amongst OECD countries. This was the joint lowest diversity score along with petrol, but OECD countries on average met 95 per cent of demand with own production. The UK, along with several north-western European countries, scored much higher than average on the diversity index which offsets the relatively low production,

and suggesting that a number of countries have taken steps to maximise the diversity and political stability of jet fuel imports.

Self-Sufficiency and Import Diversity of the UK in 2018

The UK compares well with other OECD countries for both self-sufficiency and diversity, with strong diversity scores for jet fuel, petrol and diesel. Offsetting the relatively lower diversity score for crude oil, the UK could have met over 90 per cent of crude consumption via indigenous production and ranks strongly amongst OECD countries for self-sufficiency. The UK more than meets its needs for petrol from indigenous production. Conversely, the UK relies on imports to meets its requirements for jet fuel and road diesel because its refineries do not produce sufficient volumes to meet increasing demand.

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We welcome any comments or suggestions on this analysis. Please get in touch at:
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Appendix 1 – List of OECD countries in category averages

Asia
Japan
Korea

EU (excluding UK)
Austria
Belgium
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Lithuania
Luxembourg
Netherlands
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden

Middle East
Israel
Turkey

Appendix 2 – Provisional data for 2018

	CRUDE			PETROL			JET FUEL			DIESEL		
	Diversity index	Self-sufficiency	Demand (kt)	Diversity index	Self-sufficiency	Demand (kt)	Diversity index	Self-sufficiency	Demand (kt)	Diversity index	Self-sufficiency	Demand (kt)
Australia	0.84	0.55	22,513	0.71	0.61	13,801	0.55	0.40	7,415	0.63	0.32	24,119
Austria	0.42	0.07	8,950	0.34	**1.16**	1,659	0.34	0.91	833	0.44	0.47	7,170
Belgium	0.61	-	33,025	0.61	**2.53**	1,587	0.46	**1.02**	1,813	0.40	**1.24**	6,730
Canada	0.35	**3.09**	59,266	0.65	0.86	37,564	0.19	0.78	7,089	0.26	0.95	26,570
Chile	0.47	0.02	8,469	0.16	0.88	3,364	0.34	0.54	1,170	0.13	0.74	4,515
Czech Republic	0.35	0.01	7,546	0.43	0.88	1,605	0.52	0.42	430	0.42	0.65	4,861
Denmark	0.44	0.75	7,586	0.42	**1.74**	1,261	0.78	0.11	1,023	0.69	**1.11**	2,634
Estonia	-	-	-	0.39	-	256	0.16	-	46	0.03	-	536
Finland	0.23	-	11,587	0.00	**3.05**	1,455	0.49	**1.06**	749	-	**2.37**	2,539
France	0.72	0.01	53,681	0.67	**1.27**	8,212	0.79	0.55	7,637	0.75	0.54	34,938
Germany	0.72	0.02	87,763	0.52	0.98	21,205	0.31	0.50	10,237	0.61	0.78	37,407
Greece	0.42	0.01	24,328	0.42	**2.33**	2,297	0.35	**2.25**	1,394	0.55	**3.96**	2,399
Hungary	0.11	0.11	7,009	0.47	0.79	1,405	-	**1.09**	274	0.75	0.88	3,276
Iceland	-	-	-	0.00	-	133	0.35	-	418	0.01	-	367
Ireland	0.63	-	3,023	0.43	0.74	810	0.27	-	1,028	0.58	0.25	3,035
Israel	-	-	9,792	-	-	3,005	-	-	1,113	-	-	-
Italy	0.68	0.07	66,660	0.67	**2.06**	7,244	0.50	0.54	4,797	0.61	**1.07**	22,293
Japan	0.70	0.00	148,796	0.15	**1.02**	36,657	0.11	**1.11**	10,994	0.01	**1.23**	23,002
Korea	0.82	0.00	154,336	-	**2.04**	9,334	-	**3.20**	6,747	0.11	**2.52**	16,987
Latvia	-	-	-	0.32	-	197	0.35	-	149	0.40	-	841
Lithuania	-	0.00	9,688	0.21	**11.38**	225	0.06	**7.35**	130	0.44	**1.96**	1,661
Luxembourg	0.30	-	-	0.08	-	350	0.32	-	574	0.25	-	1,753
Mexico	-	**2.78**	34,155	0.25	0.27	31,911	0.01	0.41	3,906	0.08	0.38	15,238
Netherlands	0.63	0.02	52,938	0.66	**1.08**	3,351	0.72	**2.27**	3,846	0.74	**1.91**	6,804
New Zealand	0.47	0.21	5,145	0.24	0.54	2,447	0.48	0.79	1,543	0.23	0.57	3,073
Norway	0.61	**5.44**	13,513	0.58	**5.42**	815	0.48	0.83	949	0.45	**1.24**	2,607
Poland	0.34	0.04	26,897	0.46	0.92	4,578	0.47	**1.30**	1,006	0.65	0.70	16,846
Portugal	0.77	-	12,483	0.39	**2.49**	1,022	0.47	0.93	1,519	0.22	**1.10**	4,471
Slovak Republic	-	0.00	5,428	0.41	**2.34**	581	-	**2.07**	45	0.48	**1.29**	2,031
Slovenia	-	-	-	0.48	-	430	0.19	-	34	0.56	-	1,468
Spain	0.76	0.00	67,894	0.24	**1.73**	5,329	0.65	0.06	6,687	0.61	0.13	23,559
Sweden	0.54	-	20,193	0.47	**2.18**	2,296	0.61	0.19	1,079	0.61	**1.61**	4,728
Switzerland	0.24	-	3,015	0.33	0.27	2,349	0.24	0.00	1,857	0.51	0.31	2,845
Turkey	0.44	0.12	23,800	-	**2.07**	2,266	0.55	0.97	4,927	0.51	0.39	22,506
United Kingdom	0.65	0.92	51,511	0.69	**1.36**	12,225	0.78	0.43	11,873	0.71	0.50	25,271
United States	0.67	0.65	836,944	0.89	0.91	399,110	0.64	**1.05**	78,978	0.53	**1.20**	190,416
OECD - Asia average	0.76	0.00	151,566	0.07	**1.53**	22,995	0.05	**2.15**	8,871	0.06	**1.87**	19,994
OECD - EU average	0.38	0.05	22,029	0.39	**1.72**	2,934	0.40	0.98	1,989	0.47	0.96	8,363
OECD - Middle East average	0.35	0.30	26,255	-	**1.03**	2,636	0.27	0.48	3,020	0.26	0.20	11,253
OECD average	**0.41**	**0.41**	**52,165**	**0.38**	**1.55**	**17,287**	**0.38**	**0.92**	**5,120**	**0.42**	**0.90**	**15,264**

Source: IEA (http://data.iea.org/)
Items in **bold** highlight those countries where indigenous capacity exceeded domestic consumption

Appendix 3 – Methodology

Data for crude oil and transport fuel self-sufficiency

Data for crude oil, petrol and jet fuel were extracted from the IEA database. For diesel, data were provided on request from the IEA. Self-sufficiency was determined from data on indigenous production and consumption (production (kt) ÷ consumption (kt)).

Crude oil and transport fuel diversity indices

The diversity index used here is a product of a standard diversity index and an index for political stability. As a basic index for measuring diversity, we used the Shannon-Wiener diversity index. The Shannon-Wiener index is of the form:

$$\sum_{i=1}^{n} -x_i \ln(x_i)$$

Where x is the proportion of total fuel supply represented by the i^{th} source country and n represents the final source country. A value below 1 signifies a country that is dependent on a small range of import sources, a value above 2 represents a country with a wide range of import sources. The minimum value of zero denotes a country that has one imported fuel source or relies entirely on indigenous production.

A previous comparative study on import diversities in Energy Trends March 2011 used the Herfindahl Index as the basic diversity index. Although both of these indices have their advantages, the Shannon-Wiener was chosen here as this represents the data with less skew, as well as placing more weight on the diversity of contributions from smaller countries and lessening the impact of larger nations.

Political stability was determined using data from the World Bank worldwide governance indicators. Specifically, the index reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. These data were standardised between 0 and 1.

Source: **World Bank** (http://info.worldbank.org/governance/wgi/index.aspx#home)

Once Shannon-Wiener and political stability indices were determined, these were multiplied and summed:

$$\sum_{i=1}^{n} -x_i \ln(x_i)\, b_i$$

Where b is an index of political stability of producing country. This is called the SWNI (Shannon-Weiner-Neumann index), in line with previous work.

Each SWNI index was normalised for each petroleum product between 0 and 1, in order to have a standardised index. This was done by working out a maximum diversity score, by assuming maximum diversity was equivalent to importing products in line with proportional contributions of exporting countries (e.g. if a single country were responsible for exporting 50 per cent of all product, and five other countries were responsible for 10 per cent each, we assumed maximum import diversity at a ratio of 5:1:1:1:1:1). This maximum diversity score then acted as our upper score of 1, with all other scores divided by this maximum to standardise the data.

Competition in gas supply

Introduction

This article describes the number of companies operating, the market concentrations of the domestic, commercial and industrial markets, and data on the size of the companies operating.

Key Points

- The total number of companies supplying over 1,750 GWh has increased from 17 in 2009 to 28 in 2018 (falling from 29 in 2017);
- The market concentration of the domestic sector has decreased since 2017, with increases in the commercial and industrial sectors;
- For the first time since 2013, the total market share of the largest companies increased, although by a very small percentage. In 2017, the share of the top 9 suppliers was 74.4 per cent whilst in 2018 it was 75 per cent. This value remains significantly lower than the 2014 figure of 80.4 per cent.

Background to changes in the gas market

Three-quarters of the non-domestic market for gas (customers with demand above 25,000 therms per year) was effectively opened up to competition at the end of 1986. Most of the remainder (between 2,500 and 25,000 therms a year) was opened up in August 1992. The domestic market was opened for competition in between April 1996 and May 1998, with large increases in the number of gas suppliers up to 2000.

Since 2000 the number of companies supplying gas decreased by more than 50 per cent from its peak, driven by company mergers. There are effectively four competitive sectors - sales to the electricity generators, the industrial sector, the commercial sector and the domestic sector.

Competition for electricity generation cannot be calculated accurately due to complexities associated with this sector. BEIS collect data on final sales from gas companies; companies who generate electricity from gas are often the same companies who trade gas, therefore at the point of sale, sellers do not know the proportion of gas sold which will be used for generation and that which will be traded on. As such data for electricity generation competition are not presented here.

Number of companies supplying gas at least 1,750 GWh of gas

The table below shows the number of companies supplying gas to final consumption in the domestic, commercial and industrial sectors. The table shows only those companies supplying at least 1,750 GWh of gas to each respective sectors. [1]

Table 1: Number of companies supplying gas

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2017	2018
Domestic sector	14	12	7	6	6	7	7	9	12	15	17
Commercial sector	10	10	10	7	6	8	8	8	12	11	11
Industrial sector	15	15	10	9	8	8	7	11	11	12	11

(1) Companies can supply into more than one market and are counted in each market they supply. Companies who supply less than 1,750 GWh within each sector are excluded. In September 2019 Ofgem data indicate that 230 suppliers were licensed to supply gas to domestic customers, but some suppliers have more than one supply licence and own or part own more than one supply company.

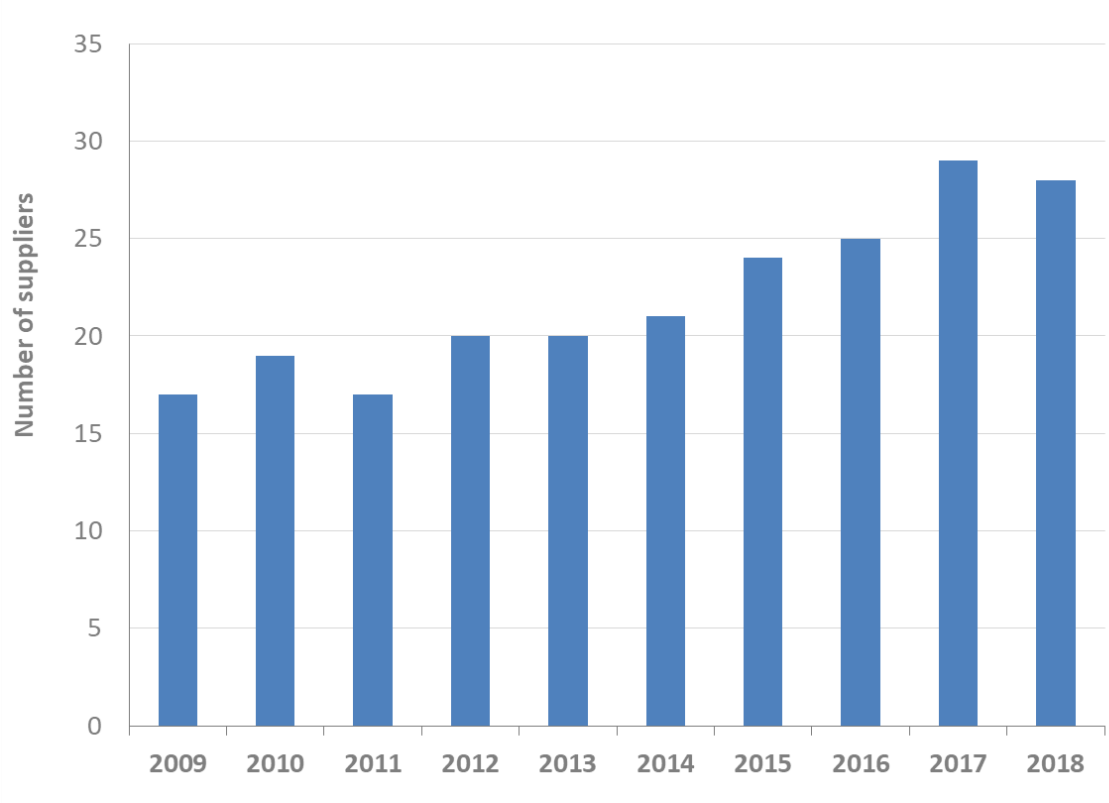
[1] This represents a methodological change from previous data shown in Energy Sector Indicators where the cut-off was previously 0.25 per cent of the market share for each market. The methodological change brings the table in line with the collection methodology used by BEIS.

The data indicate that the number of companies supplying gas above the threshold of 1,750 GWh has remained the same in the commercial sector since 2017, but with a decrease of one in the industrial sector and a new company becoming a larger supplier to the domestic sector in 2018.

Number of large and small suppliers in the market

The total number of large suppliers fell by one company compared to last year when the activities of Wingas were transferred to Gazprom[2], although a general trend of increases was previously observed. Chart 1 shows the number of companies supplying more than 1,750GWh a year of gas, (excluding gas to electricity generation) and indicates a generally sustained pattern of increase from 17 in 2009 to 28 in 2018.

Chart 1: Total number of companies supplying over 1,750 GWh of gas, 2009 to 2018



Note: Data for 2017 have been revised from 30 to 29

Smaller suppliers continue to enter the market. BEIS collects information from companies licenced to supply gas through two surveys, one a mandatory return for companies supplying more than 1,750 GWh a year of gas, the other a voluntary return for companies supplying less than that threshold (in total ~ 2 per cent of final consumption). Return rates for the survey of companies over the 1,750 GWh threshold is 100 per cent. As there are a large number of smaller companies, a sample are selected to be surveyed and data is aggregated and weighted up to represent the national total .

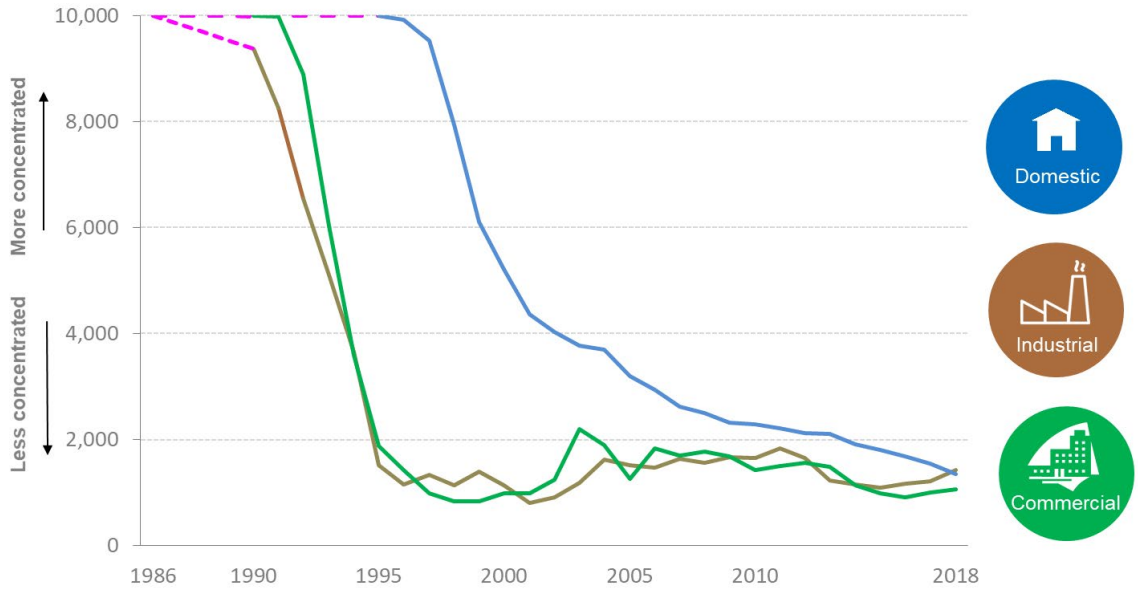
Competition in gas sales to the domestic, commercial and industrial sectors, 1986 to 2018

Continuing the trend of recent years, the domestic market has seen the market concentrations decrease in comparison to 2017. This is due to the increasing number of small suppliers joining the market and taking a larger part of the market share. In contrast the industrial and commercial market concentration has bucked the trend of decline seen since 2011 and increased over the last 12 months.

[2] www.wingas-uk.com/

Chart 2 shows the market concentration as expressed through the Herfindahl-Hirschman index, one of the standard metrics for analysing concentration. In the chart higher numbers show more concentration and lower numbers indicate a more diverse market.

Chart 2: Herfindahl-Hirschman Index for market concentration, 1986 to 2018



Since 2011 the market concentration had consistently decreased in all three sectors as smaller companies joined the markets. In 2018 this pattern continued for the domestic market, but the industrial and commercial markets saw small increases in concentration.

The domestic market has become less concentrated due to an increasing number of small suppliers taking an increasing percentage of the market share. Despite the number of large suppliers increasing to 17, their share of the market fell from 97 per cent in 2017 to 95 per cent in 2018.

The commercial market has seen the number of companies supplying more than 1,750 GWh remain the same as in 2017 at 11. The increase in concentration seen in 2018 is the result of a falling number of smaller suppliers.

The industrial market has become more concentrated in 2018, the third year on year rise. Although the number of large suppliers fell by one in 2018, their market share increased from 98 per cent in 2017 to 99 per cent in 2018.

Gas supplied to all consumers by aggregated shares

Table 2 shows how the market shares of the largest companies have changed over the last 5 years, with the largest consistently losing market share to the medium sized and smaller companies. In 2014 the top 9 accounted for 80 per cent of the market, which is down to 75 per cent in 2018. Figures are based on total gas supplied excluding gas for electricity generation.

Table 2: Gas supplied to all consumers by aggregated shares

	Market share (%)				
Gas suppliers	2014	2015	2016	2017	2018
Aggregated share of top 3 suppliers	44.4	42.9	40.8	37.5	36.4
Aggregated share of next 3 suppliers	21.1	20.9	20.5	21.1	22.7
Aggregated share of next 3 suppliers	14.9	14.0	15.4	15.8	15.8
Aggregated share of top 9 suppliers	**80.4**	**77.9**	**76.7**	**74.4**	**75.0**
Other suppliers	19.6	22.1	23.3	25.6	25.0

Herfindahl-Hirschman

The Herfindahl-Hirschman measure attempts to measure market concentration. It places extra emphasis on the contributions of participants with the largest shares. The measure is commonly used to assess whether mergers should go ahead and whether they will significantly affect the balance of the market in a particular sector.

It is expressed by the following equation:
Herfindahl-Hirschman measure = the square of each participant's market share added together across all participants in the market

Values vary between zero, which signifies a perfectly competitive industry, and ten thousand, for a pure monopoly.

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Competition in UK electricity markets

Introduction

This article includes information relating to competition in the UK electricity market, formerly published as part of UK Energy Sector Indicators. The article examines the two parts of the industry where there is competition for provision: generation and sales. For both markets, the article describes the number of companies operating, and the market concentrations. The Herfindahl-Hirschman measure (see explanation at the end of this article) is used to provide the market concentration as it provides extra emphasis on the contribution of participants with the largest shares. For electricity sales, this article covers the major suppliers[1] surveyed by BEIS comprising approximately 96% of the market.

Key points

- Major electricity suppliers[1] increased in number from 16 in 1989 before privatisation to 39 in 2018. In 2018, BEIS surveyed 12 new small suppliers to maintain coverage of the market, with two companies discontinuing supply. Of these four had a market share above 0.1%.
- Since 2010, electricity market concentration has slowly declined year-on-year across the domestic, commercial and industrial sectors as more companies entered the market. However, market concentration in 2018 showed a slight increase in the commercial sector.
- The market share of smaller suppliers (outside the top nine) rose from 4.0 per cent in 2010 to 17.6 per cent in 2018, as new and smaller suppliers took market share from the large companies.
- Major power producers (MPPs) increased in number from 6 in 1989 to 56 in 2018.
- The top nine MPPs' share of generation decreased from 86.7 per cent in 2013 to 74.8 per cent in 2018. Their share of capacity decreased from 79.4 per cent in 2013 to 67.1 per cent in 2018 as new smaller generators entered the market.

Background to changes in the electricity market

Electricity generation

Following the restructuring of the electricity supply industry in 1990, the former nationalised companies were classified as major generating companies to distinguish them from autogenerators and the new companies set up to generate electricity. However, over the next few years, some new independent companies were beginning to make significant contribution to the electricity supply and therefore a new terminology "Major Power Producers" (MPPs) was introduced to signify those companies whose prime purpose is the generation of electricity. The breakup of the nationalised power suppliers into smaller privatised companies immediately increased market competitiveness, with new companies beginning to build their own Combined Cycle Gas Turbine (CCGT) stations from 1992. Major wind farm companies and major solar photovoltaic (PV) operators are now also included in the MPP definition.

Electricity supply

Competition was introduced to the electricity markets in three phases. First the upper tier of the non-domestic market (customers with a maximum demand of over 1 MW, comprising 30 per cent of the market) was opened to competition in March 1990. Next, the 100 kW to 1 MW tier (15 per cent of the market) was opened to competition in April 1994. Full competition for the remaining 55 per cent of the market (below 100 kW peak load) was introduced in stages between September 1998 and June 1999. This final phase covered domestic consumers who account for over a third of electricity consumed in the UK.

[1] In this article 'electricity supplier' refers to the major electricity suppliers surveyed by BEIS, covering approximately 96% of all UK electricity sales in 2018. Major electricity suppliers include suppliers that sold over 0.1% of traded electricity in the reference year. This differs from previous editions of this article where all suppliers surveyed by BEIS were included. The change allows BEIS to increase its survey coverage whilst still presenting comparable trends in this article. Please see the BEIS Electricity statistics data sources and methodologies and the revisions note below for more details.

Competition in electricity sales

The number of electricity suppliers[(1)] rapidly increased, from 16 before privatisation in 1989 to an early peak of 21 in 2004. The number of companies reduced from 2004 to 2010 (14 companies), as despite new market entrants, other companies were either taken over or bought additional power stations to add to their portfolios. After 2010, the number of companies increased again, reaching their highest levels in 2018 of 39 companies. This was a net increase of two companies from 2017 and reflects new market entrants and that BEIS engaged with new and smaller companies, to maintain coverage in the more fragmented market.

The number of companies supplying electricity to each sector is given for selected years between 1996 and 2018 in Table 1.

Table 1: Number of companies supplying electricity [(1)]

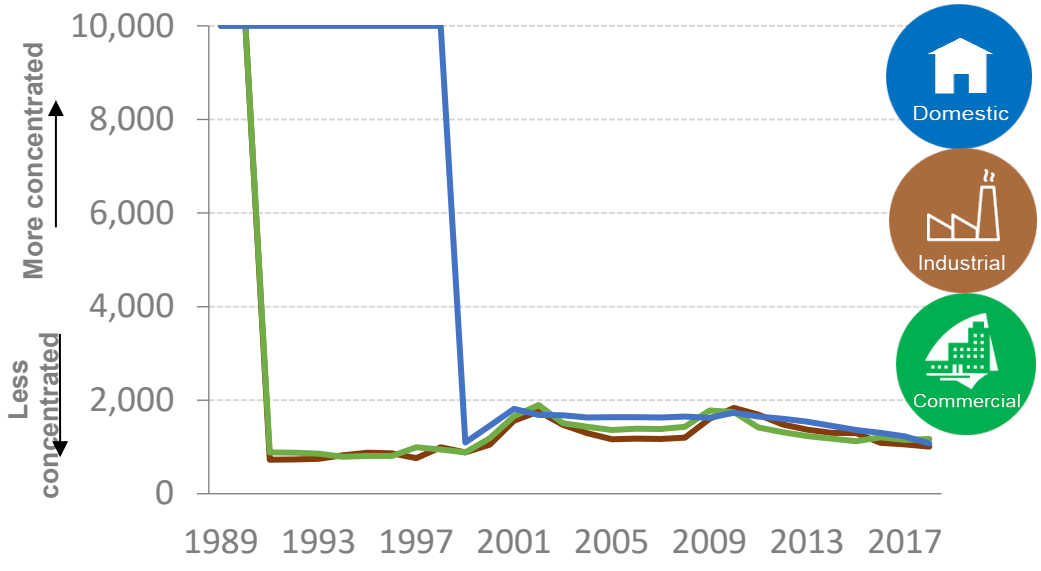
	1996	2000	2002	2004	2006	2008	2010	2012	2014	2016	2017	2018
Domestic Sector	1	11	7	10r	9r	9r	9r	12r	17r	20	23r	27
Commercial Sector	17	13r	11r	17r	12r	13r	12r	18r	23r	27	28r	30
Industrial Sector	18	17r	14r	20r	16r	15r	13r	20r	22r	25r	25r	25
Total	18	18r	17r	21r	19r	18r	14r	22r	28r	34r	37r	39

(1) Companies can supply into more than one market and are counted in each market they supply to. Includes only companies that sold over 0.1% of traded electricity in the reference year.
(r) shows a revision to the data. See the revisions note at the end of the article for more information.
Source: BEIS.

Four of the new electricity suppliers surveyed by BEIS in 2018 supplied over 0.1 per cent of the market, whilst two companies discontinued supply. All four of these suppliers sold to the domestic sector, whilst two existing companies also started supplying to domestic customers, increasing the net total to 27. Two of the new companies supplied the commercial sector, increasing the net total to 30. There were no new companies supplying electricity to the industrial sector in 2018. Across all sectors, there were 39 companies selling electricity in 2018; this is an increase of 25 compared to 2010. Despite some of the new companies supplying a small share of the market, the growth in the number of companies over the last 10 years resulted in a decrease to market concentration.

Chart 1 below shows the market concentration as expressed through the Herfindahl-Hirschman Index. In the chart, higher numbers show more concentration while lower numbers indicate a more diverse market.

Chart 1: Herfindahl-Hirschman Index for electricity sales market concentration, 1989 to 2018



There was an initial sharp decrease in market concentration following privatisation, then a rise between 1998 and 2002, mainly due to a spate of mergers. The market concentration subsequently fell and stabilised between 2003 and 2008, as the number of industrial and commercial suppliers increased. In 2009 and 2010, market concentration increased again, as several closures reduced the number of market participants. Since 2010, electricity market concentration has declined annually across the domestic and industrial sectors, as the market became more competitive; whilst market concentration in the commercial sector also dropped each year since 2010 with the exceptions of 2016 and 2018. For the domestic and industrial sectors, the index fell further across in 2018 and all sectors are now at similar level to in 2000. This downward trend in market concentration resulted from increasing numbers of smaller suppliers entering the market and reducing the market share of bigger companies.

The domestic market was a regional monopoly before 1998, dominated by the Regional Electricity Company (REC). Following a decrease in market concentration in 1999 as domestic sales became more competitive, concentration rose until 2002 due to mergers between former RECs, and with other suppliers/generators. Similarly, market concentration rose for industrial and commercial sales over the same period. Between 2002 and 2009, the Herfindahl-Hirschman Index for the domestic sector was broadly stable. In 2010 the index increased, though subsequently the index has decreased annually. In 2018, the index fell again to from 1,226 in 2017 to 1,074 – the lowest level recorded – reflecting the share of new entrants to the market.

The commercial market had 17 major electricity suppliers in 2004 but this fell to 12 in 2010, leading to an increase in market concentration. Since 2010, there has been a downwards trend in market concentration, as the number of commercial electricity suppliers grew. Despite the number of commercial companies growing again in 2018, market concentration increased slightly due to one large company taking commercial sales from other large and medium suppliers. With 25 industrial electricity suppliers in 2018, the industrial market was less concentrated than in 2010, when there were 13 industrial electricity suppliers. The largest concentration decreases in the industrial sector occurred in 2012 and 2016.

Electricity supplied to all consumers by aggregated shares.

Table 2 shows how the market share of the largest companies have changed since 2010. The market share of the top nine suppliers peaked in 2010, but since has steadily fallen to 82.4 per cent in 2018. Between 2017 and 2018, the aggregated share of the top six suppliers fell a further 3 percentage points from 73.0 per cent to 70.4 per cent. When compared to 2010, the aggregated top six share for 2018 is 17.1 percentage points lower.

As the number of companies supplying electricity has increased, as evidenced in Table 1, the share of these suppliers outside the top nine has grown. The share of those outside of the top nine rose from 4 per cent in 2010 to 17.6 per cent in 2018. This reflects the fragmentation of the market from new entrants taking market share from the larger companies. This increase in share of suppliers outside the top nine further reflects the reduced market concentration as evidenced by the Herfindahl-Hirschman Index in Chart 1.

Table 2: Percentage of total electricity supplied to all consumers

	Market Share (%)								
Electricity Suppliers	2010	2011	2012	2013	2014	2015	2016	2017	2018
Aggregated share of top 3 suppliers	50.9%	48.9%	47.2%	46.3%	47.4%	45.1%	42.5%	41.9%	41.3%
Aggregated share of next 3 suppliers	36.4%	35.2%	36.7%	35.4%	33.5%	32.7%	32.3%	31.1%	29.1%
Aggregated share of next 3 suppliers	8.8%	8.5%	8.0%	8.1%	8.9%	10.1%	10.8%	11.7%	12.1%
Aggregated share of top 9 suppliers	**96.0%**	**92.6%**	**91.8%**	**89.8%**	**89.8%**	**87.8%**	**85.6%**	**84.7%**	**82.4%**
Other suppliers	4.0%	7.4%	8.2%	10.2%	10.2%	12.2%	14.4%	15.3%	17.6%

Electricity generation competition

Table 3 shows the number of companies that are counted as Major Power Producers (MPPs). The number of companies increased rapidly, from six before privatisation up to an early peak of 36 in 2001, before mergers caused numbers to fall back to 29 in 2006. Starting in 2007, several renewable generators were reclassified as MPPs, leading to an increase in the number of MPPs to 34; this remained stable through to 2009. Since 2010, the number of MPPs has steadily increased as new generators came online, reaching a new peak in 2018 of 56.

Table 3: Number of Major Power Producers

Year	Number	Number producing at least 5% of total generation
1989	6	-
1990	6	-
1991	11	-
1992	14	-
1993	20	-
1994	23	-
1995	25	-
1996	26	-
1997	27	-
1998	29	-
1999	30	-
2000	34	7
2001	36	6
2002	36	7
2003	34	6
2004	32	7
2005	30	7
2006	29	7
2007	34	8
2008	34	9
2009	34	8
2010	39	8
2011	41	7
2012	44	7
2013	44	7
2014	47	7
2015	53	6
2016	52	5
2017	54	4
2018	56	5

Source: BEIS
(r) shows a revision to the data

Table 4 shows the MPPs aggregated share of generation and aggregated share of capacity for 2013 to 2018. The market share of the top 9 generators in this period peaked in 2013 at 86.7 per cent but has subsequently declined to 74.7 per cent in 2018, as new companies entered the market and reduced the share of total generation produced by the top 9 companies. The top 9 generators held a lower share of capacity (67.1 per cent in 2018) compared to generation. This indicates that a greater proportion of their generation is from non-renewable sources, which have higher load factors i.e. they operate closer to full capacity.

Table 4: Percentage of total generation and total capacity by Major Power Producers

	Share in Generation (%)						Share in Capacity (%) [1]					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Aggregated share of top 3 companies	50.9	48.5	48.6	48.9	50.7r	48.9	41.9	43.5	32.5	32.9r	35.3r	33.8
Aggregated share of next 3 companies	24.0	25.6	21.4r	15.5	15.0	16.6	24.9	24.2	26.8r	18.2r	22.2	21.4
Aggregated share of next 3 companies	11.8	10.7	12.7	11.4r	9.2r	9.2	12.6	13.1	15.2	11.4	8.8r	11.9
Aggregated share of top 9 companies	**86.7**	**84.8**	**82.8r**	**75.8r**	**75.0r**	**74.7**	**79.4**	**80.9**	**74.5r**	**62.4r**	**66.4r**	**67.1**
Other major power producers	13.3	15.2	17.2r	24.2r	25.0r	25.3	20.6	19.1	25.5r	37.6r	33.6r	32.9

(1) Of the same companies in each band in generation terms
Source: BEIS
(r) shows a revision to the data

User feedback

We welcome all feedback from users; therefore, if you have any comments or queries regarding this analysis, please contact either Vanessa Martin or Chrissie Frankland using the contact details below.

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Herfindahl-Hirschman

The Herfindahl-Hirschman measure attempts to measure market concentration. It places extra emphasis on the contributions of participants with the largest shares. The measure is commonly used to assess whether mergers should go ahead and whether they will significantly affect the balance of the market in a particular sector.

It is expressed by the following equation: Herfindahl-Hirschman measure = the square of each participant's market share added together across all participants in the market.

Values vary between zero, which signifies a perfectly competitive industry, and ten thousand, for a pure monopoly.

Revisions

This year we have revised the method for **Table 1: Number of companies supplying electricity**. In previous years all electricity suppliers in the BEIS electricity survey were included; however, from 2019 we introduced a 'major electricity supplier' definition which includes companies with a market share above 0.1%. This allows us to more accurately reflect the market rather than showing an apparent sharp increase due to smaller suppliers which were added to the BEIS electricity supplier survey to improve its coverage. We are considering further improvements to the electricity and gas articles. Please contact us with your feedback.

Aggregated energy balances showing proportion of renewables in supply and demand

Introduction

In 2016, the Economics and Social Affairs Department of the United Nations published its International Recommendations for Energy Statistics (IRES)[1]. The report recommended countries should include an "of which renewables" column to their energy balances, both absolute values and percentages.

Adding this breakdown provides a fuller picture of renewable energy in the UK. Although DUKES chapter 6 reports progress against the Renewable Energy Directive (RED), it is based on final consumption and is calculated using a methodology specific to the directive[2]. BEIS has considered that publishing this information will provide users with additional insights into renewable energy trends in the UK.

Summary Table

The summary table for 2018 (Table 1 below) uses a simplified version of the annual energy balance shows the renewables components for supply, demand, transformation, and final consumption.

Table 1: 2018 Energy balance, showing proportion of renewables (ktoe)[3]

	Hard Coals	Man. Solid Fuels	Crude Oil & NGL	Petroleum Products	Natural Gas	Bioenergy & Waste	Primary Electricity	Electricity	Heat Sold	TOTAL	of which renewables	share of renewables
SUPPLY												
Indigenous production	1,655	0	55,707	0	38,711	13,375	20,532	0	0	129,981	18,247	14.0%
Imports	6,751	714	57,369	38,661	44,529	4,259	0	1,834	0	154,116	4,566	3.0%
Exports	-424	-8	-48,797	-24,387	-7,196	-283	0	-191	0	-81,286	-352	0.4%
Marine bunkers	0	0	0	-2,615	0	0	0	0	0	-2,615	0	0%
Stock change	-126	-47	312	294	-657	-9	0	0	0	-232	-9	4%
Primary supply	7,857	658	64,591	11,953	75,388	17,341	20,532	1,643	0	199,964	22,451	11.2%
Statistical difference	-124	-3	-49	101	-68	0	0	-5	0	-148		
Primary demand	7,981	661	64,640	11,852	75,456	17,341	20,532	1,648	0	200,112	22,452	11.2%
Transfers	0	4	-962	1,133	265	-284	-6,471	6,471	0	155		
TRANSFORMATION	-6,562	356	-63,678	62,965	-26,055	-10,590	-14,061	21,938	1,585	-34,103	-5,398	
Electricity generation	-4,213	-489	0	-435	-23,508	-10,367	-14,061	21,938	0	-31,135	-5,306	
Heat generation	-4	-1	0	-48	-2,547	-223	0	0	1,585	-1,238	-92	
Petroleum refineries	0	0	-64,090	63,953	0	0	0	0	0	-137	0	
Coke manufacture	-1,343	1,259	0	0	0	0	0	0	0	-84	0	
Blast furnaces	-879	-553	0	0	0	0	0	0	0	-1,432	0	
Patent fuel manufacture	-124	140	0	-61	0	0	0	0	0	-45	0	
Other	0	0	412	-443	0	0	0	0	0	-31	0	
Energy industry use	0	446	0	4,283	4,900	0	0	2,000	321	11,950	738	
Losses	0	90	0	0	566	0	0	2,293	0	2,949	799	
FINAL CONSUMPTION	1,418	484	0	71,667	44,200	6,467	0	25,765	1,263	151,265	15,518	10.3%
Industries	1,027	266	0	2,232	9,064	1,452	0	7,998	677	22,716	4,188	18.4%
Transport	11	0	0	55,151	0	1,364	0	429	0	56,954	1,513	2.7%
Domestic	355	171	0	2,477	26,584	2,369	0	9,034	260	41,249	5,629	13.6%
Other Final Users	26	0	0	3,727	8,139	1,283	0	8,304	325	21,805	4,189	19.2%
Non energy use	0	48	0	8,079	413	0	0	0	0	8,541	0	0.0%

The spreadsheet, available at; www.gov.uk/government/collections/renewables-statistics#energy-trends:-articles also shows this on a year-by-year basis from 2000, alongside a time- series without the individual fuels, as shown in Table 2.

[1] https://unstats.un.org/unsd/energy/ires/IRES_edited2.pdf

[2] The key differences are that the RED basis uses net calorific values and a normalisation process to smooth out the effects of extreme weather years for hydro and wind generation.

[3] Note that for a number of rows, the tables do not show the proportion of biofuels. For transformation for instance, the total in the energy balance is the net loss of the transformation process. A renewable component of this can be calculated but it is in itself fairly meaningless.

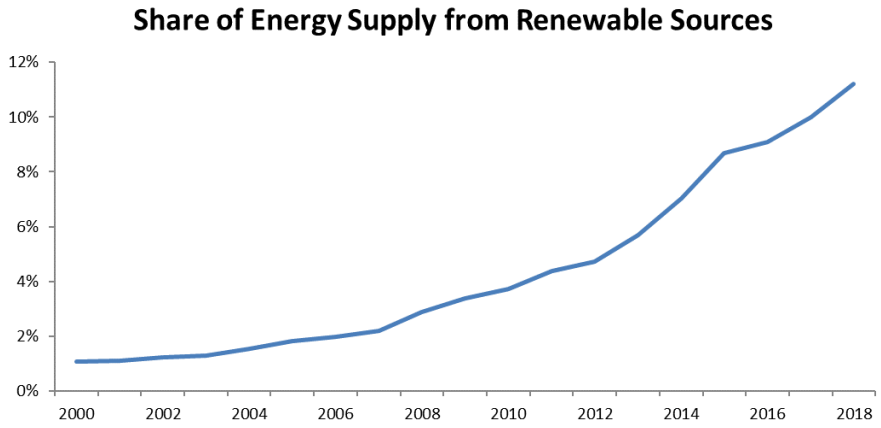
Table 2: Energy balance 2016 to 2018, showing proportion of renewables (ktoe)

	2016			2017			2018		
	TOTAL (ktoe)	of which renewables (ktoe)	share of renewables (%)	TOTAL (ktoe)	of which renewables (ktoe)	share of renewables (%)	TOTAL (ktoe)	of which renewables (ktoe)	share of renewables (%)
SUPPLY									
Indigenous production	125,927	14,739	11.7%	126,364	16,798	13.3%	129,981	18,247	14.0%
Imports	149,848	4,021	2.7%	152,193	3,736	2.5%	154,116	4,566	3.0%
Exports	-75,803	-425	0.6%	-79,254	-549	0.7%	-81,286	-352	0.4%
Marine bunkers	-2,840	0	0.0%	-2,619	0	0.0%	-2,615	0	0.0%
Stock change	4,795	0	0.0%	3,481	0	0.0%	-232	-9	3.9%
Primary supply	201,927	18,335	9.1%	200,166	19,985	10.0%	199,964	22,451	11.2%
Statistical difference	-192			-8			-148		
Primary demand	202,119	18,332	9.1%	200,174	19,981	10.0%	200,112	22,452	11.2%
Transfers	18			105			155		
TRANSFORMATION	-37,536	-4,661	-	-35,733	-4,916	-	-34,103	-5,398	-
Electricity generation	-34,318	-4,585	-	-32,580	-4,830	-	-31,135	-5,306	-
Heat generation	-1,211	-76	-	-1,269	-85	-	-1,238	-92	-
Petroleum refineries	-125	0	-	-127	0	-	-137	0	-
Coke manufacture	-81	0	-	-84	0	-	-84	0	-
Blast furnaces	-1,692	0	-	-1,585	0	-	-1,432	0	-
Patent fuel manufacture	-64	0	-	-54	0	-	-45	0	-
Other	-46	0	-	-34	0	-	-31	0	-
Energy industry use	12,052	566	-	11,974	668	-	11,950	738	-
Losses	2,804	593	-	2,850	710	-	2,949	799	-
FINAL CONSUMPTION	149,744	12,512	8.4%	149,721	13,688	9.1%	151,265	15,518	10.3%
Industries	22,417	3,314	14.8%	22,656	3,698	16.3%	22,716	4,188	18.4%
Transport	56,001	1,116	2.0%	57,002	1,126	2.0%	56,954	1,513	2.7%
Domestic	41,113	4,707	11.4%	39,874	5,086	12.8%	41,249	5,629	13.6%
Other Final Users	21,779	3,376	15.5%	21,571	3,778	17.5%	21,805	4,189	19.2%
Non energy use	8,434			8,619			8,541		

Trends

- Over time, the proportion of renewables in energy supply has been steadily increasing over the years, rising from 1.1 per cent in 2000 to 11.2 per cent in 2018

Figure 1



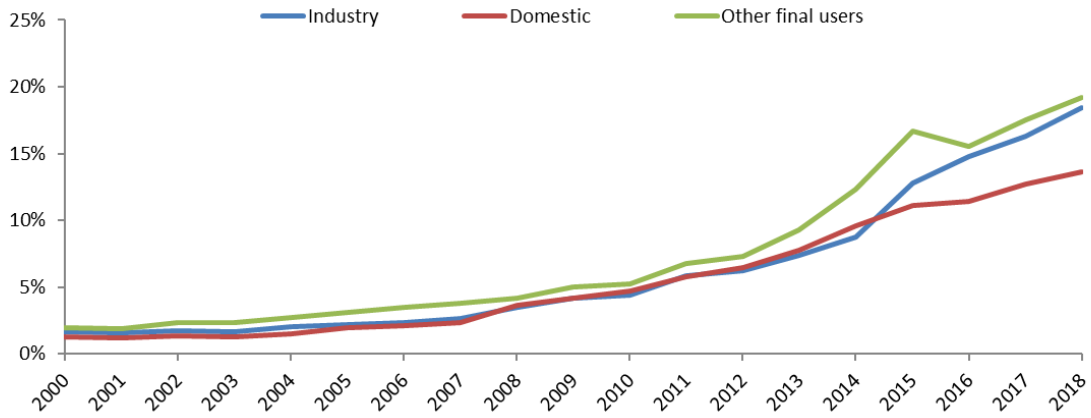
- This is in line with the 11.0 per cent progress against the RED as reported in DUKES 2019. As the two measures are calculated on a different basis, they do not match exactly.

- For demand, the proportion met through renewables depends on the fuel mix supplied into the sector. The greater the demand met through electricity, in general the greater the proportion of renewables given the relatively high level of renewables within the electricity generation mix.

- Accordingly, the proportion of demand met from renewables varies from a low of 2.7 per cent (for transport, mainly from biofuels) to a high of 19.2 per cent for 'other final users', which is largely the service and commercial sectors that consume relatively large quantities of electricity.

- Figure 2 shows a comparison of the final energy consuming sectors (excluding transport) and the changing renewable component since 2000.

Figure 2: Final consuming sectors; proportion of renewables



Since 2016, the proportion of renewables has been steadily increasing though Figure 2 above shows a fall between the years 2015 and 2016 for 'other final users'. This represents an increase in the denominator, i.e. total demand which resulted in a fall in the renewables proportion. This is due to a re-allocation of oil consumption from unclassified industry to other sectors including agriculture, public administration, and commerce for 2016 and 2017[4]. This brings the proportion in renewables demand for other users in line with that for the industry sector (19 per cent for the former and 18 per cent for the latter). This compares with 14 per cent renewables in the domestic sector reflecting the high proportion of gas consumption for heating purposes.

For further information, please contact:

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[4] See www.gov.uk/government/publications/energy-trends-june-2019-special-feature-article-change-to-method-of-estimating-sector-demand-for-oil-products

Methodological Annex

The following calculations were used to derive the renewable components:

Bioenergy and waste: For bioenergy, the non-biodegradable part of waste which is included in the balances is excluded.

Renewable electricity imports: The renewable mix for those countries exporting electricity to the UK grid (France, Ireland, and The Netherlands) was calculated for each year using data from the International Energy Agency (IEA).

Renewable electricity exports: BEIS assumed that electricity exported from the UK contained renewables in proportion to the overall supply.

Biogas: The ratio of biogas injected into the gas grid to natural gas, is used to calculate the renewable component.

Worked example – domestic renewables consumption

This table illustrates the calculation of the renewable components with reference to domestic consumption in 2018.

Table A.1. worked example (ktoe)

Fuel Source	Fossil	Renewable	Total
Coal	355	0	355
Manufactured Fuel	171	0	171
Petroleum	2,477	0	2,477
Natural Gas	26,484	100	26,584
Bioenergy	0	2,369	2,369
Electricity	5,893	3,141	9,034
Heat	241	19	260
Total	35,621	5,629	41,250
Proportion, of which renewables			**13.6%**

Notes for renewable data

Natural gas: BEIS estimate that 284 ktoe of biomethane was injected into the gas grid. If this biogas was consumed equally by all gas consumers, then 100 ktoe were consumed by the domestic sector.

Bioenergy: Sum of domestic consumption of wood, solar thermal and heat pumps.

Electricity: BEIS estimate 33.0 per cent of electricity supply was produced from renewables.

Heat: BEIS estimate that 8.0 per cent of heat sold was generated from renewables.

Recent and forthcoming publications of interest to users of energy statistics

Smart Meters quarterly statistics

This publication provides estimates of the number of Smart Meters installed and operating in homes and businesses in Great Britain. The latest release, covering estimates of the number of Smart Meters deployed up to the end of June 2019, was published on 29 August 2019 at:
www.gov.uk/government/collections/smart-meters-statistics

Household Energy Efficiency statistics

This series presents statistics on the Energy Company Obligation (ECO), Green Deal and homes insulated. 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 latest release was published on 19 September 2019 at:
www.gov.uk/government/collections/household-energy-efficiency-national-statistics

Renewable Heat Incentive statistics

This series presents statistics on deployment data for the non-domestic Renewable Heat Incentive (RHI) to support the uptake of renewable heat in the non-domestic sector, and the domestic RHI to encourage a switch to renewable heating systems in the domestic sector. The latest release was published on 19 September 2019 at:
www.gov.uk/government/collections/renewable-heat-incentive-statistics

Sub-national consumption of other fuels

This publication presents the findings of the residual fuels sub–national energy consumption analysis in the UK for the period covering 1 January to 31 December 2017. Other fuels are defined as non-gas, non-electricity and non-road transport fuels, and cover consumption of coal, petroleum, manufactured solid fuels and bioenergy and waste not used for electricity generation or road transport. The release was published on 26 September 2019 at:
www.gov.uk/government/collections/sub-national-consumption-of-other-fuels

Sub-national total final energy consumption

This publication presents the findings of the sub–national energy consumption analysis in the UK for all fuels, for the period covering 1 January to 31 December 2017, with gas consumption covering the period mid-June 2017 to mid-June 2018. The release was published on 26 September 2019 at:
www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level

Sub-national electricity consumption in Northern Ireland

This publication presents estimates of the latest analysis of electricity consumption in Northern Ireland at District Council level, with electricity covering the period 31 January 2017 to 30 January 2018. The release was published on 26 September 2019 at:
www.gov.uk/government/collections/sub-national-electricity-consumption-in-northern-ireland.

Sub-national gas consumption in Northern Ireland

This publication presents estimates of the latest analysis of gas consumption in Northern Ireland at District Council level, with gas consumption covering the period mid-June 2017 to mid-June 2018. The release will be published on 31 October 2019 at:
www.gov.uk/government/collections/sub-national-gas-consumption-in-northern-ireland.

Local Authority consumption tables England and Wales

This publication presents statistics on gas and electricity consumption for domestic properties in England and Wales, with the figures broken down by both local authority, and household and property characteristics. The release will be published on 31 October 2019 at:
www.gov.uk/government/collections/national-energy-efficiency-data-need-framework

Energy Trends and Energy Prices: December 2019

Energy Trends and Energy Prices are normally released concurrently on the last Thursday of March, June, September and December. Given that the last working Thursday of December, the 26 December, will fall between Christmas and New Year it has been decided that the release date for the December 2019 editions will be brought forward to Thursday 19 December 2019.

Sub-national electricity consumption, 2018

This publication looks at electricity consumption by consuming sector for Great Britain, and regional/devolved administration areas, together with some commentary relating to local authority trends. The data analysed in this publication are based on the aggregation of Meter Point Administration Number (MPAN) readings throughout Great Britain as part of BEIS's annual meter point electricity data exercise. The data cover the electricity year between late January 2018 and late January 2019. These data follow on from the results produced from similar exercises carried out for 2005 to 2017. The latest release will be published on 19 December 2019, at:
www.gov.uk/government/collections/sub-national-electricity-consumption-data.

Sub-national gas consumption, 2018

This publication looks at gas consumption by consuming sector for Great Britain, and regional/devolved administration areas, together with some commentary relating to local authority trends. The data analysed in this factsheet are based on the aggregation of Meter Point Reference Number (MPRN) readings throughout Great Britain as part of BEIS's annual meter point gas data exercise. The data cover the gas year between Mid May 2018 and Mid May 2019 and are subject to a weather correction factor. In the domestic sector, gas consumption is predominately used for heating purposes and as a result usage is driven by external temperatures and weather conditions. The weather correction factor enables comparisons of gas use over time, controlling for weather changes. These data follow on from the results produced from similar exercises carried out for 2005 to 2017. The latest release will be published on 19 December 2019, at:
www.gov.uk/government/collections/sub-national-gas-consumption-data.

Sub-national electricity and gas consumption at Postcode, LSOA, MSOA and IGZ level, 2018

This publication comprising a series of Excel spreadsheets provides details of domestic and non-domestic electricity and gas consumption at Postcode, Lower Super Output Area (LSOA), Middle Super Output Area (MSOA) and Intermediate Geography Zone (IGZ) for 2018.

The latest release will be published on 19 December 2019, for electricity at:
www.gov.uk/government/statistics/lower-and-middle-super-output-areas-electricity-consumption
and
www.gov.uk/government/collections/sub-national-gas-consumption-data#postcode-level-data

and gas at:
www.gov.uk/government/statistics/lower-and-middle-super-output-areas-gas-consumption
and
www.gov.uk/government/collections/sub-national-electricity-consumption-data#postcode-level-data

Explanatory notes

General

More detailed notes on the methodology used to compile the figures and data sources are available on the BEIS section of the GOV.UK website.

Symbols used in the tables

.. not available
- nil or not separately available
p provisional
r revised; where a column or row shows 'r' at the beginning, most, but not necessarily all, of the data have been revised.
e estimated; totals of which the figures form a constituent part are therefore partly estimated

Notes to tables

- Figures for the latest periods and the corresponding averages (or totals) are provisional and are liable to subsequent revision.
- The figures have not been adjusted for temperature or seasonal factors except where noted.
- Due to rounding the sum of the constituent items may not equal the totals.
- Percentage changes relate to the corresponding period a year ago. They are calculated from unrounded figures but are shown only as (+) or (-) when the percentage change is very large.
- Quarterly figures relate to calendar quarters.
- All figures relate to the United Kingdom unless otherwise indicated.

- Further information on Oil and Gas is available from The Oil & Gas Authority at: www.ogauthority.co.uk/

Conversion factors

1 tonne of crude oil =	7.55 barrels
1 tonne =	1,000 kilograms
1 gallon (UK) =	4.54609 litres
1 kilowatt (kW) =	1,000 watts
1 megawatt (MW) =	1,000 kilowatts
1 gigawatt (GW) =	1,000 megawatts
1 terawatt (TW) =	1,000 gigawatts

All conversion of fuels from original units to units of energy is carried out on the basis of the gross calorific value of the fuel. More detailed information on conversion factors and calorific values is given in Annex A of the Digest of United Kingdom Energy Statistics.

Conversion matrices

To convert from the units on the left hand side to the units across the top multiply by the values in the table.

To:	**Thousand toe**	**Terajoules**	**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

To:	**Tonnes of oil equivalent**	**Gigajoules**	**kWh**	**Therms**
From	**Multiply by**			
Tonnes of oil equivalent	1	41.868	11,630	396.83
Gigajoules (GJ)	0.023885	1	277.78	9.4778
Kilowatt hours (kWh)	0.000085985	0.003600	1	0.034121
Therms	0.0025200	0.105510	29.307	1

Note that all factors are quoted to 5 significant figures

Abbreviations

ATF	Aviation turbine fuel
CCGT	Combined cycle gas turbine
DERV	Diesel engined road vehicle
LNG	Liquefied natural gas
MSF	Manufactured solid fuels
NGLs	Natural gas liquids
UKCS	United Kingdom continental shelf

Sectoral breakdowns

The categories for final consumption by user are defined by the Standard Industrial Classification 2007, as follows:

Fuel producers	05-07, 09, 19, 24.46, 35
Final consumers	
Iron and steel	24 (excluding 24.4, 24.53 and 24.54)
Other industry	08, 10-18, 20-23, 24.4 (excluding 24.46), 24.53, 24.54, 25-33, 36-39, 41-43
Transport	49-51
Other final users	
Agriculture	01-03
Commercial	45-47, 52-53, 55-56, 58-66, 68-75, 77-82
Public administration	84-88
Other services	90-99
Domestic	Not covered by SIC 2007