



Department for
Business, Energy
& Industrial Strategy



ENERGY TRENDS

DECEMBER 2019

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

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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 December editions cover the third 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, heating degree days, 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 third quarter of 2019:

- Total energy production was 1.8 per cent lower than in the third quarter of 2018, with increases in oil and renewables output offset by falls from coal, gas, biomass and nuclear output.
- Oil production rose by 0.2 per cent when compared with the third quarter of 2018.
- Natural gas production was 0.8 per cent lower than the third quarter of 2018. Gas imports fell by 19 per cent, whilst exports fell by 43 per cent. Gas consumption was down 3.0 per cent, with domestic consumption down by 3.5 per cent.
- Coal production in the third quarter of 2019 was 17 per cent lower than the third quarter of 2018, due to falling demand. Coal imports were 40 per cent lower. Generators' demand for coal fell by 58 per cent.
- Total primary energy consumption for energy uses fell by 2.7 per cent to a record quarterly low. However, when adjusted to take account of weather differences between the third quarter of 2018 and the third quarter of 2019, primary energy consumption fell by 1.1 per cent.
- Temperatures in the quarter were on average 0.1 degrees Celsius cooler than a year earlier, with the average temperature in July being 1.1 degrees Celsius cooler than a year earlier, whilst average temperatures in August and September were respectively 0.4 and 0.5 degrees Celsius warmer than a year earlier.
- Final energy consumption (excluding non-energy use) fell by 1.5 per cent compared to the third quarter of 2018. Domestic consumption fell by 2.4 per cent in the quarter, industrial consumption fell by 2.2 per cent, transport consumption fell by 1.4 per cent and service consumption fell by 0.5 per cent. On a seasonally and temperature adjusted basis, final energy consumption fell by 0.3 per cent.
- Gas demand was 1.5 per cent lower than the third quarter of 2018, with a 1.5 per cent fall in use by electricity generators. Overall electricity consumption was at a record low, 1.1 per cent lower than in the third quarter of 2018.
- Electricity generated in the third quarter of 2019 fell by 1.5 per cent, from 75.1 TWh a year earlier to 74.0 TWh.
- Of electricity generated in the third quarter of 2019, gas accounted for 38.8 per cent, up marginally from 38.7 per cent in the third quarter of 2018, whilst coal accounted for 1.0 per cent, down from 2.5 per cent in the third quarter of 2018. Nuclear generation accounted for 18.4 per cent of total electricity generated in the third quarter of 2019, down from 23.0 per cent in the third quarter of 2018.
- Low carbon electricity's share of generation increased from 55.9 per cent in the third quarter of 2018 to a record high of 57.3 per cent in the third quarter of 2019, due to increased renewables generation. Conversely, the share of generation from fossil fuels decreased to a record low of 40.1 per cent in the third quarter of 2019.
- Renewables' share of electricity generation increased to a record 38.9 per cent, up from the 32.9 per cent share in the third quarter of 2018, and marginally exceeded the share of gas for the first time ever.
- Renewable electricity generation was 28.8 TWh in the third quarter of 2019, an increase of 16 per cent on the 24.7 TWh in the third quarter of 2018. For the first time, offshore wind generation exceeded onshore wind generation.
- Renewable electricity capacity was 46.9 GW at the end of the third quarter of 2019, a 7.2 per cent increase (3.2 GW) on a year earlier.

Section 1 – UK Total Energy July to September 2019

Key results show:

Total energy production was 1.8 per cent lower than in the third quarter of 2018, with increases in oil and wind, solar and hydro output offset by falls from coal, gas, biomass and nuclear output. (**Charts 1.1 & 1.2**)

Total primary energy consumption for energy uses fell by 2.7 per cent to a record quarterly low. However, when adjusted to take account of weather differences between the third quarter of 2018 and the third quarter of 2019, primary energy consumption fell by 1.1 per cent. (**Chart 1.3**)

Final energy consumption (excluding non-energy use) fell by 1.5 per cent compared to the third quarter of 2018. Domestic consumption fell by 2.4 per cent in the quarter, industrial consumption fell by 2.2 per cent, transport consumption fell by 1.4 per cent and service consumption fell by 0.5 per cent. (**Charts 1.4 & 1.5**)

On a temperature adjusted basis, final energy consumption fell by 0.3 per cent. (**Chart 1.5**)

Net import dependency was 28.5 per cent, down 0.4 percentage points from the third quarter of 2018. (**Chart 1.6**)

Fossil fuel dependency was 76.7 per cent in the third 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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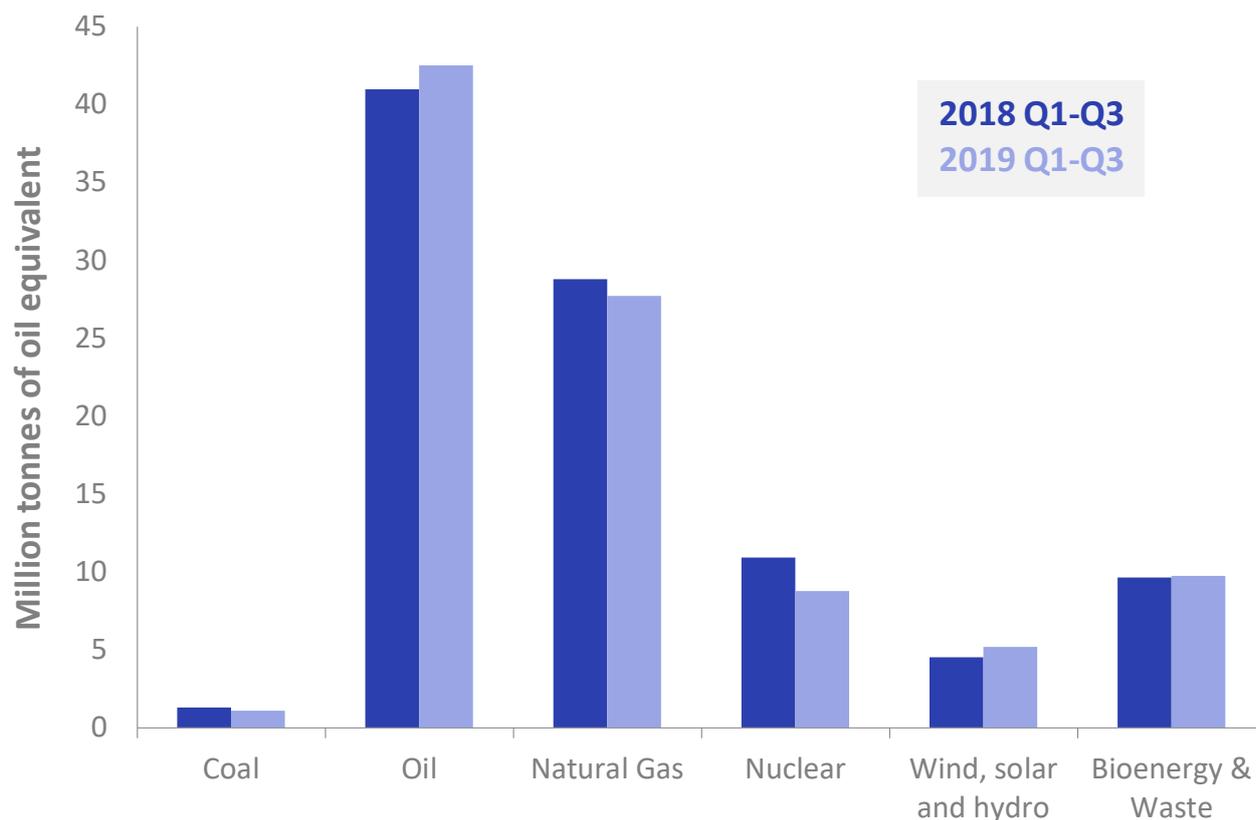
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Chart 1.1 Production of indigenous primary fuels [\(Table 1.1\)](#)

Total production in the third quarter of 2019 at 30.0 million tonnes of oil equivalent was 1.8 per cent lower than in the third quarter of 2018.

Production of oil rose by 0.3 per cent, whilst production of gas fell by 0.8 per cent compared to the third quarter of 2018.

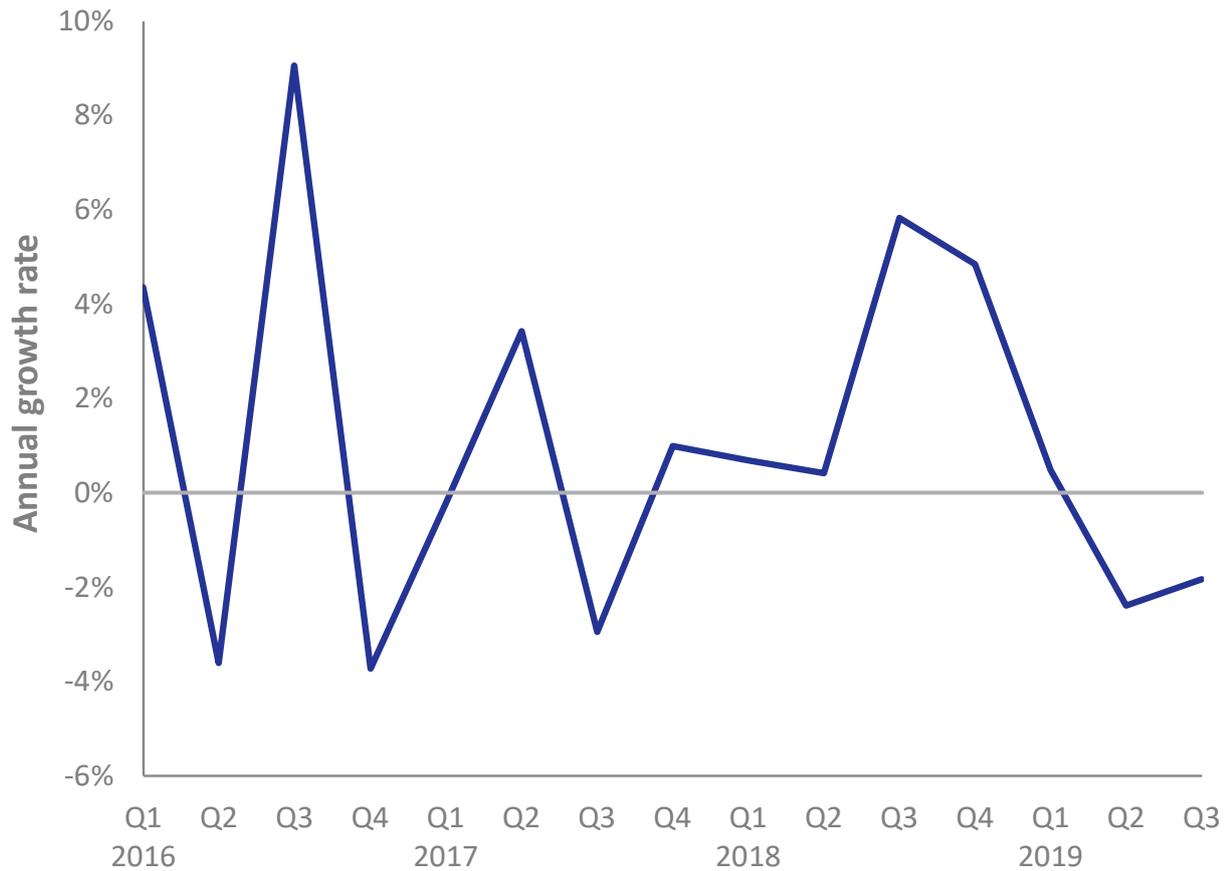
Primary electricity output in the third quarter of 2019 was 8.9 per cent lower than in the third quarter of 2018, within which nuclear electricity output was 21 per cent lower as a result of outages at several major reactors. Output from wind, solar and natural flow hydro was 24 per cent higher than the same period in 2018, due to increased renewable capacity, primarily from offshore wind (see section 6).

Production of bioenergy and waste was 0.5 per cent lower compared to the third quarter in 2018.

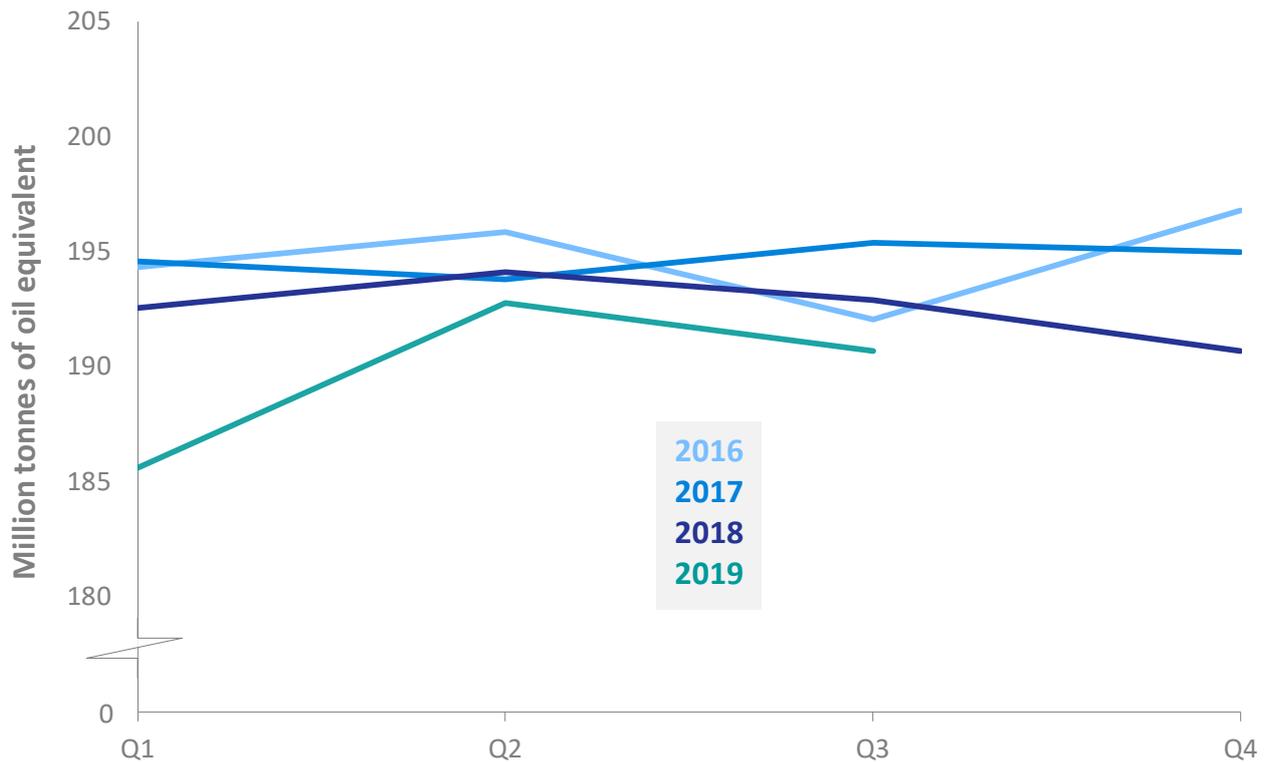
In the third quarter of 2019 production of coal and other solid fuels was 14 per cent lower than the corresponding period of 2018.

Total Energy

Chart 1.2 UK production (annual growth rate) [\(Table 1.1\)](#)



In the third quarter of 2019, the annual growth rate of UK production was -1.8 per cent, with the growth in oil wind, solar and natural flow hydro production more than offset by the reductions in coal, gas, biomass and nuclear production.

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 (temperature corrected, seasonally adjusted annualised rate), was 190.7 million tonnes of oil equivalent in the third quarter of 2019, 1.1 per cent lower than in the third quarter of 2018.

The average temperature in the third quarter of 2019 was 0.1 degrees Celsius cooler than the same period a year earlier.

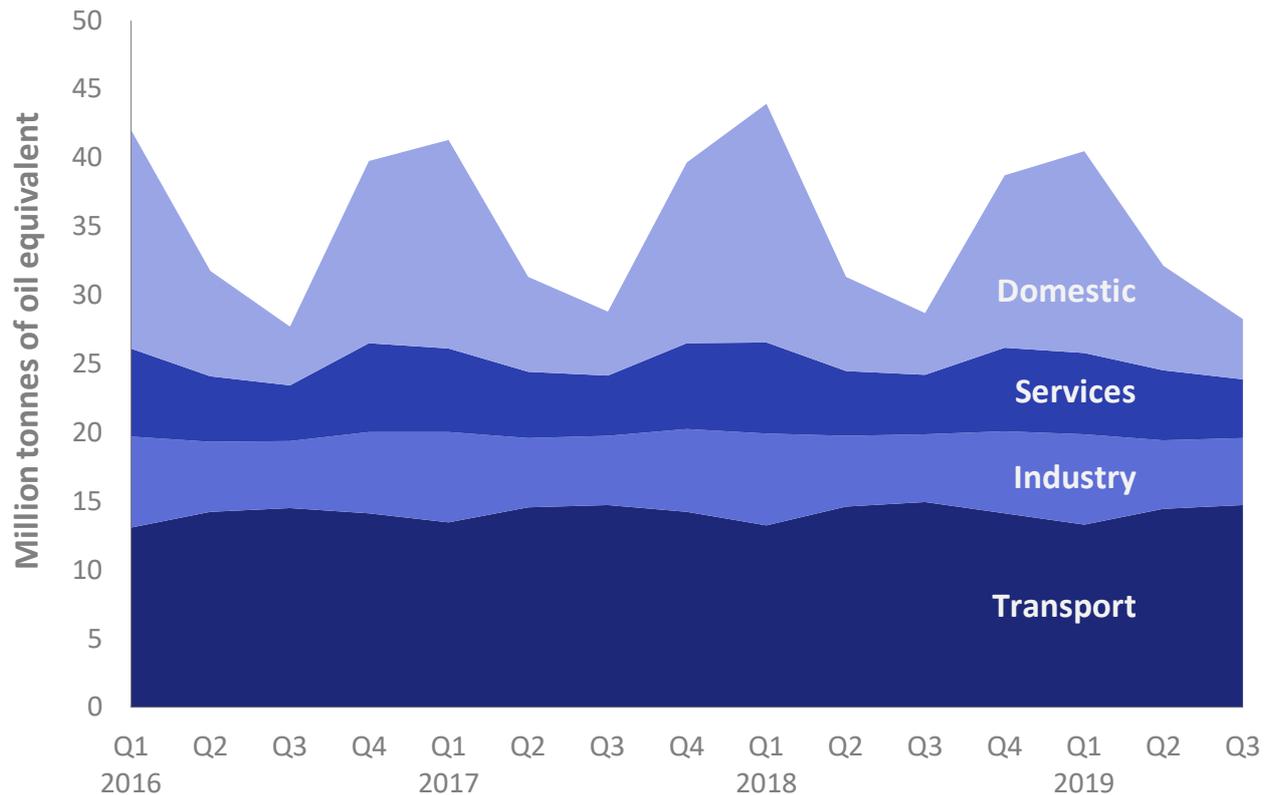
Between the third quarter of 2018 and the third quarter of 2019 (on a seasonally adjusted and temperature corrected basis) coal consumption fell by 15 per cent driven by less coal use in electricity generation, as a result of high carbon prices for coal and strong performance from renewable sources.

On the same basis, oil consumption fell by 1.7 per cent, whilst gas consumption rose by 1.1 per cent.

Also, on a seasonally adjusted and temperature corrected basis there were rises in both bioenergy & waste and wind solar & hydro, up 5.8 per cent and 24 per cent respectively. Nuclear consumption fell by 21 per cent due to a series of maintenance outages.

Total Energy

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



Total final energy consumption fell by 2.4 per cent between the third quarter of 2018 and the third quarter of 2019.

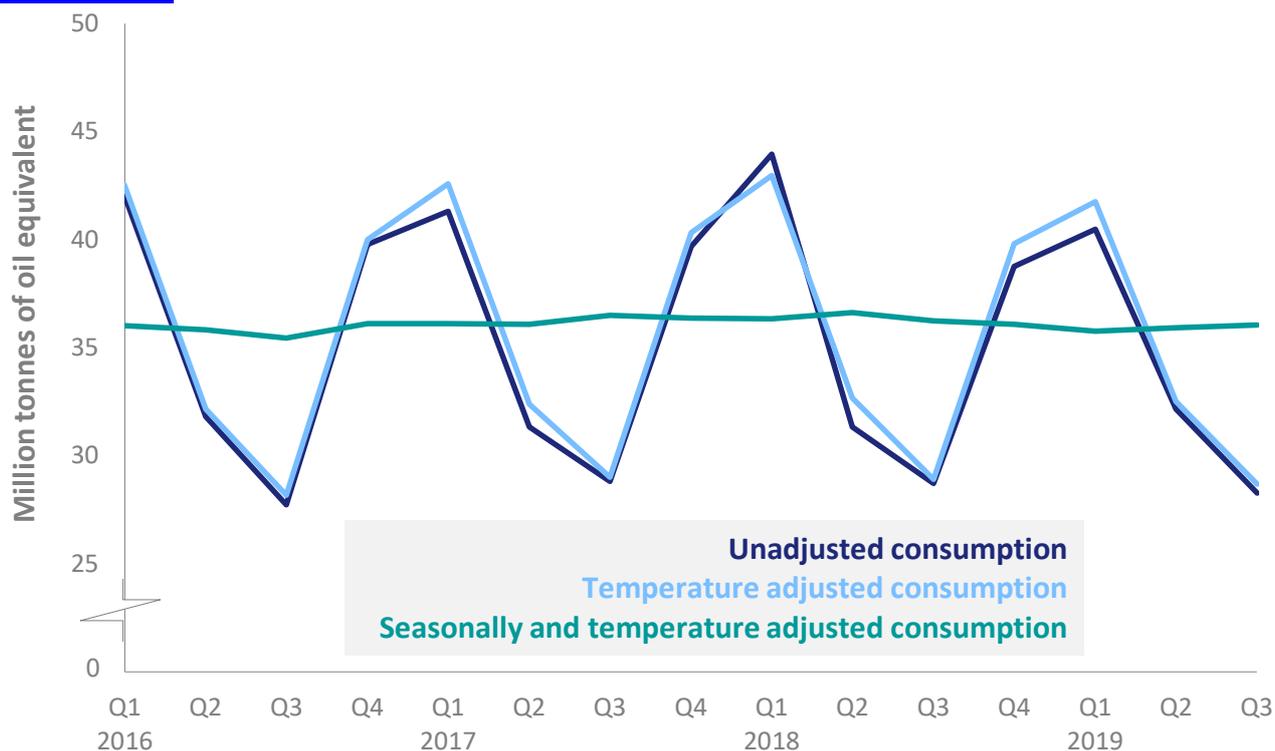
Domestic sector energy consumption fell by 2.4 per cent compared to a year earlier. Average temperatures in the third quarter of 2019 were 0.1 degrees Celsius cooler than a year earlier, with the average temperature in July 2019 being 1.1 degrees Celsius cooler than a year earlier, whilst average temperatures in August and September were respectively 0.4 and 0.5 degrees Celsius warmer than a year earlier.

Industrial sector energy consumption fell by 2.2 per cent.

Transport sector energy consumption fell by 1.4 per cent.

Service sector energy consumption fell by 0.5 per cent.

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



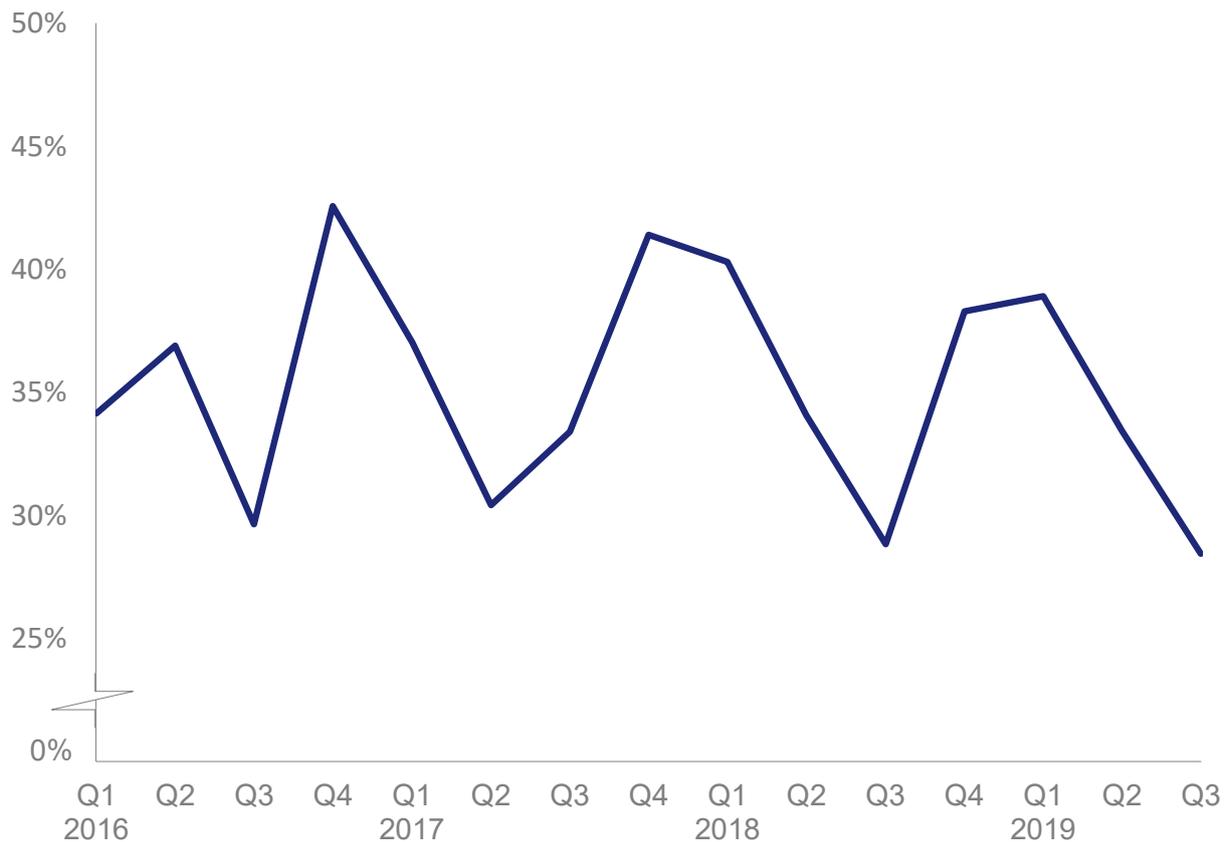
Total unadjusted final energy consumption (excluding non-energy use) fell by 1.5 per cent between the third quarter of 2018 and the third quarter of 2019.

On a seasonally and temperature adjusted basis final energy consumption (excluding non-energy use) fell by 0.3 per cent between the third quarter of 2018 and the third quarter of 2019.

Unadjusted domestic consumption fell by 2.4 per cent over this same period but was up 1.3 per cent on a seasonally and temperature adjusted basis.

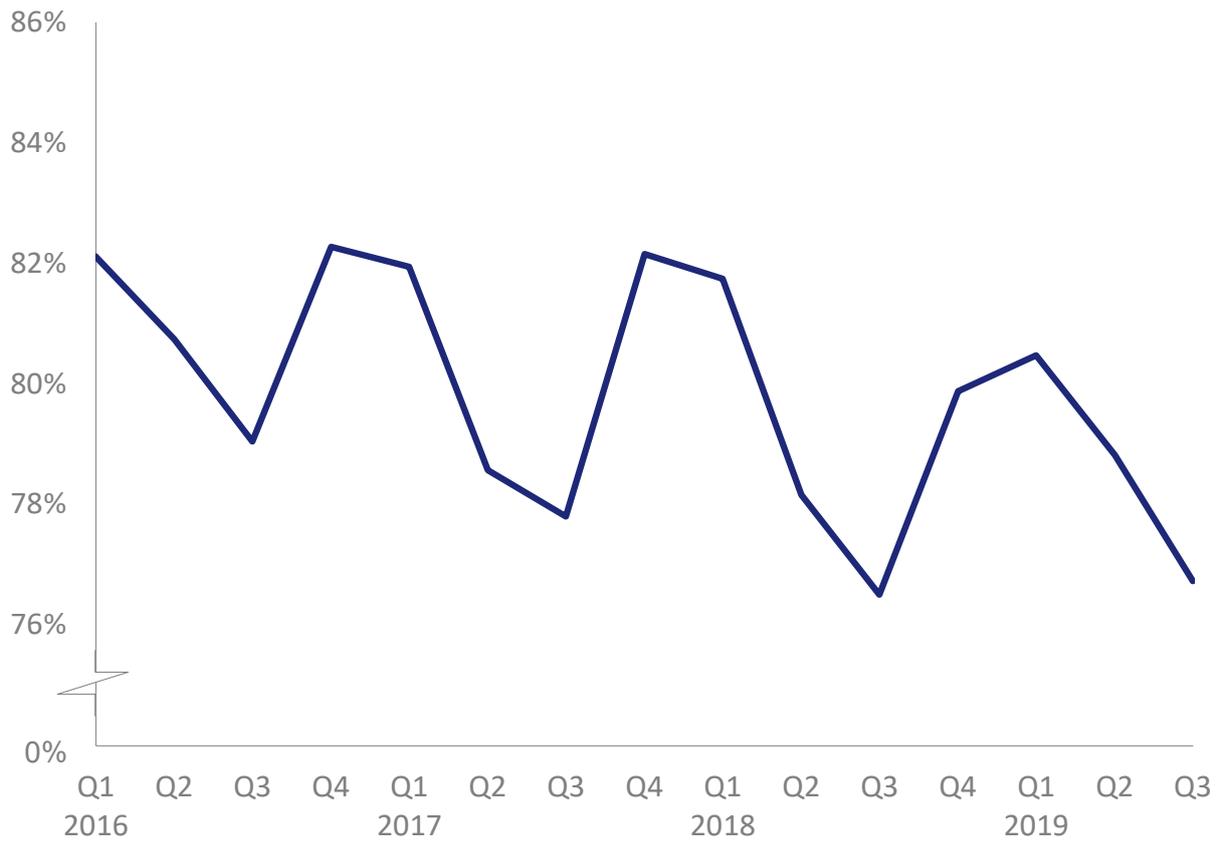
Total Energy

Chart 1.6 Net import dependency ([Table 1.3a](#))



In the third quarter of 2019 net import dependency was 28.5 per cent, down 0.4 percentage points from the third quarter of 2018, due to falls in imports and exports of 10 and 13 per cent respectively, and at the lowest level since the third quarter of 2010.

The net import dependency of oil was 29.6 per cent in the third quarter of 2019, down 1.2 percentage points from the third quarter of 2018, whilst the net import dependency of gas was 29.8 per cent, up 3.0 percentage points.

Chart 1.7 Fossil fuel dependency ([Table 1.3a](#))

In the third quarter of 2019 dependency on fossil fuels was 76.7 per cent, up 0.2 percentage points from the third quarter of 2018.

Section 2 – UK Solid Fuels and Derived Gases July to September 2019

Key results show:

Overall coal production in the third quarter of 2019 fell to 0.5 million tonnes down 17 per cent compared with the third quarter of 2018. Surface mining production fell to 510 thousand tonnes. This is as a result of mine closures and falling demand for coal for electricity generation. Some mines are not producing as they are restoring or under care and maintenance which has also contributed to lower production. **(Chart 2.1)**

Coal imports fell 40 per cent on levels shown in the third quarter of 2018. This was the lowest value in the published time series covering 21 years. **(Charts 2.1 and 2.2)**

The demand for coal by electricity generators fell to 0.3 million tonnes and was 58 per cent lower than demand in the same quarter as last year as a result of high carbon prices for coal and strong performance from renewable sources. Coal fired electricity's share of the Major Power Producer (MPP) supply was down by 1.5 percentage points on the same period in 2018. This comes following several months of low coal-fired electricity generation, which was down 61 per cent for the year to date in comparison to 2018 (see Energy Trends table 5.1). A slight increase in coal-fired electricity was registered in the month of August 2019 (relative to 2018) attributed to Cottam power station burning its remaining coal in preparation for its closure on the 30 September 2019. **(Chart 2.3)**

Total stock levels were up 21 per cent (+1.1 million tonnes) to 6.2 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](#)

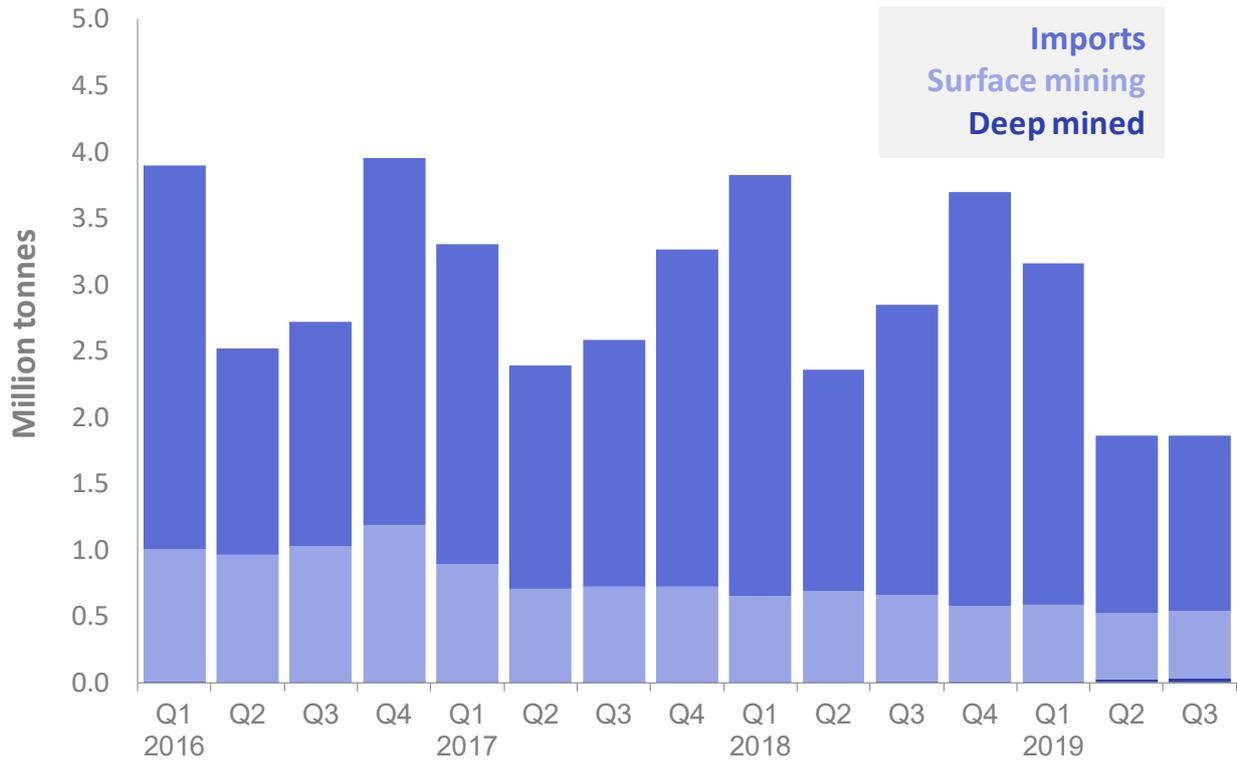
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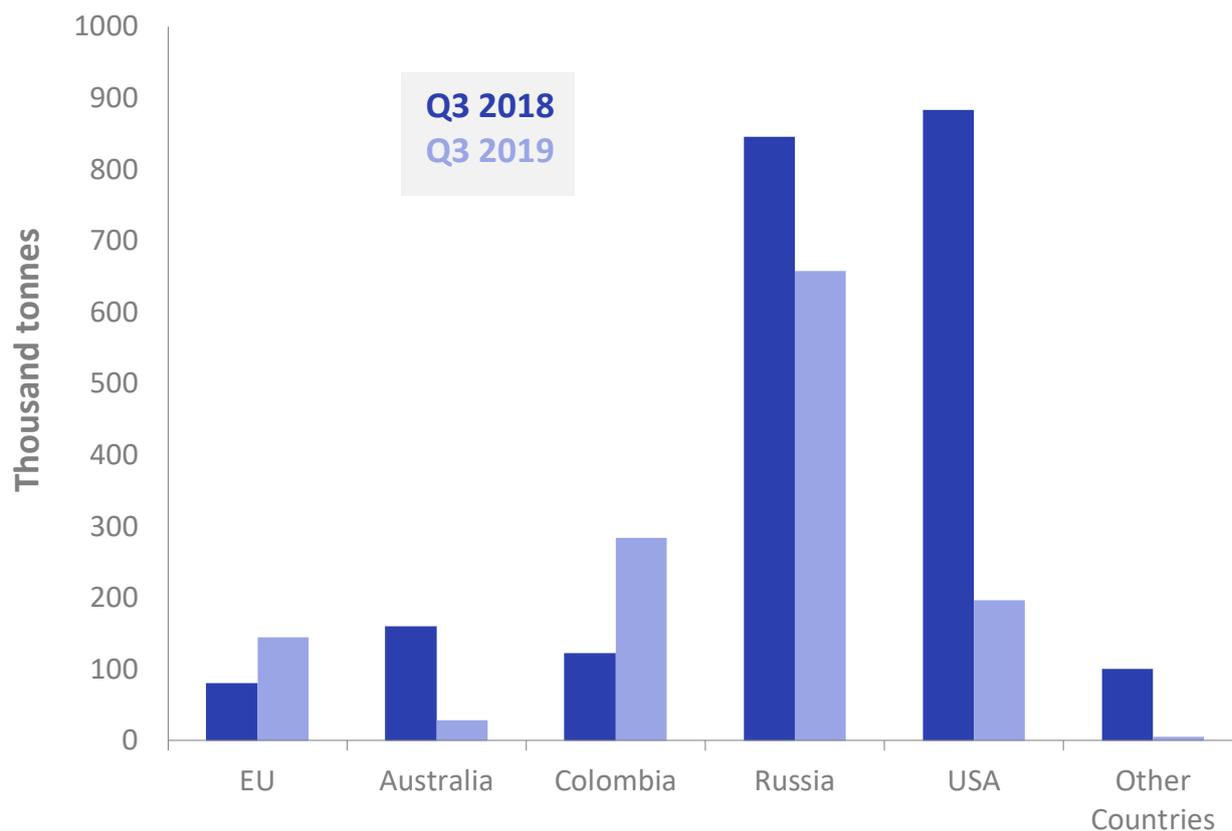
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Chart 2.1 Coal supply [\(Table 2.1\)](#)

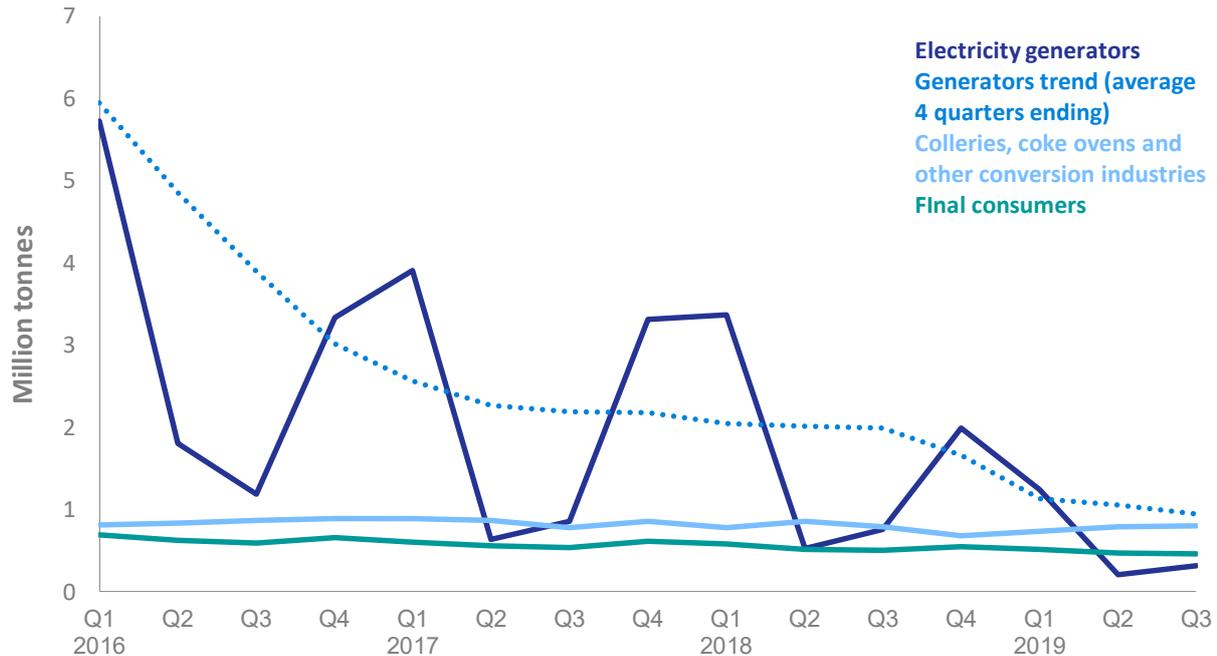
Coal production in the third quarter of 2019 was 0.5 million tonnes, 17 per cent down compared to the third quarter of 2018. This came from further contraction in surface mine output whilst deep mine production increased by 7 thousand tonnes to 32 thousand tonnes. Whilst volumes have increased in recent months (as Aberpergwm colliery came out of care and maintenance), volumes for the quarter are only eight per cent of the same period in 2015, when the last of the large deep mines closed.

Chart 2.2 Steam coal imports [\(Table 2.4\)](#)

In the third quarter of 2019, total coal imports fell by 40 per cent to 1.3 million tonnes with Russia (50 per cent), Colombia (21 per cent) and the USA (15 per cent) accounting for 86 per cent of total coal imports. Steam coal imports in the third quarter of 2019 fell by 41 per cent to 0.9 million tonnes, accounting for 65 per cent of total coal imports. The USA, one of the top three suppliers of steam coal imports continuously in the last nine years did not export coal to the UK in the third quarter of 2019 as cheaper steam coal from other producing countries made USA steam coal less competitive. Coking coal imports in the third quarter of 2019 fell by 40 per cent to 0.4 million tonnes and accounted for 33 per cent of total coal imports. Anthracite accounted for the remaining 2 per cent of imports.

Table 2A Coal imports by origin

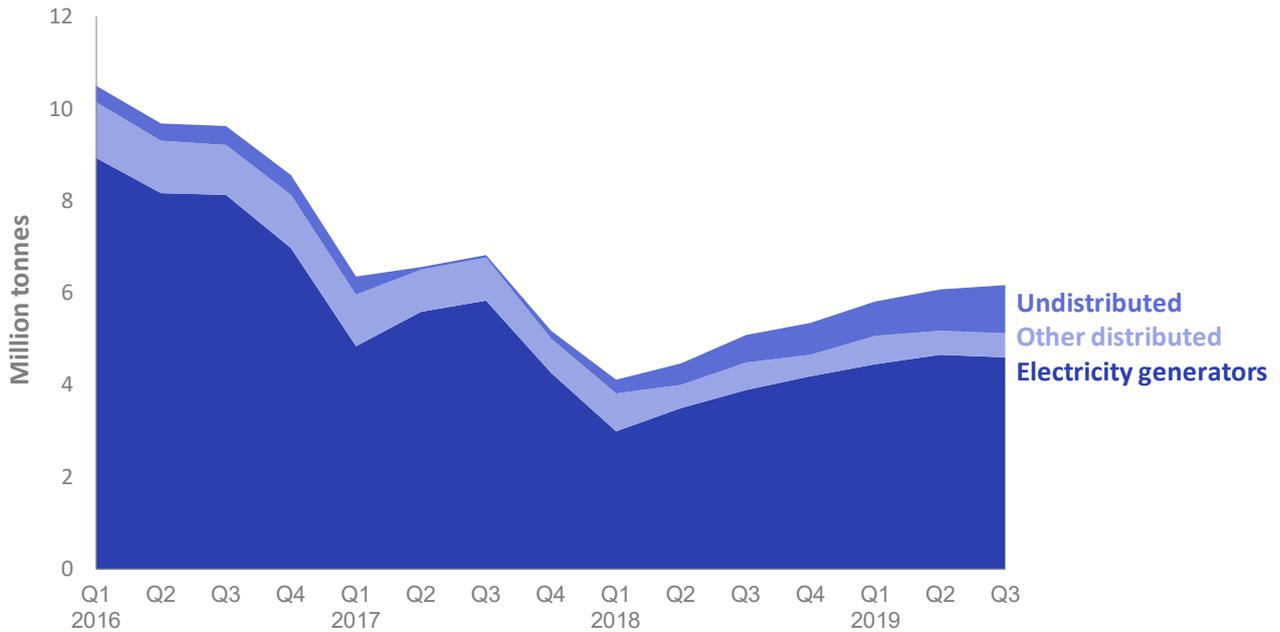
	Thousand Tonnes			
	2017	2018	2018 Q3	2019 Q3p
European Union	356	344	80	145
Russia	3,883	4,695	846	658
Colombia	731	635	123	284
USA	2,352	3,573	884	197
Australia	749	630	160	29
Other Countries	427	268	101	5
Total Imports	8,498	10,144	2,194	1,318

Chart 2.3 Coal consumption ([Table 2.1](#))

Total demand for coal in the third quarter of 2019, at 1.6 million tonnes, was 23 per cent lower than in the third quarter of 2018. Consumption by electricity generators was down by 58 per cent to 0.3 million tonnes. Electricity generators accounted for 20 per cent of total coal use in the third quarter of 2019 compared with 37 per cent a year earlier. The fall was the result of high carbon prices for coal and strong performance from renewable sources. Coal fired electricity's share of the MPP supply was down by 1.5 percentage points on the same period in 2018. This comes following several months of low coal-fired electricity generation, which was down 61 per cent for the year to date in comparison to 2018 (see Energy Trends table 5.1). A slight increase in coal-fired electricity was registered in the month of August 2019 (relative to 2018) attributed to Cottam power station burning its remaining coal in preparation for its closure on the 30 September 2019.

In the third quarter of 2019, sales to industrial users fell by 11 per cent to 0.4 million tonnes whilst sales to other final consumers (including domestic) fell by 1.6 per cent to 0.1 million tonnes. Coal used in blast furnaces was up 3.9 per cent compared to the third quarter of 2018, to 0.3 million tonnes.

Chart 2.4 Coal stocks [\(Table 2.1\)](#)



Coal stocks rose by 0.1 million tonnes from the second quarter of 2019 and at the end of September stood at 6.2 million tonnes. This was 1.1 million tonnes higher than at the end of September 2018.

The level of coal stocks at power stations at the end of the third quarter of 2019 was 4.6 million tonnes, 0.7 million tonnes higher than at the end of September 2018.

Stocks held by coke ovens were 0.4 million tonnes at the end of the third quarter of 2019, this was 75 thousand tonnes lower than stock levels at the end of September 2018.

Stocks held by producers (undistributed stocks) at the end of the third quarter of 2019 were 1.0 million tonnes.

Section 3 – UK Oil and Oil Products July to September 2019

Key results show:

Total indigenous UK production of crude oil and Natural Gas Liquids (NGL) in Q3 2019 were stable on last year. **(Chart 3.1)**

Net imports of primary oils (crude oil, NGLs and process oils) in Q3 2019 stood at just 1.5 million tonnes, halving on the previous year as exports remained stable and imports fell by 11 per cent during a period of refinery maintenance. Net imports were equivalent to 10 per cent of the UK's refinery demand. **(Chart 3.3)**

Indigenous production of petroleum products was down in Q3 2019 by 6.6 per cent on the same quarter of last year. In contrast production in the year to date has increased by 0.6 per cent in the year to Q3, as a result of low production resulting from refinery maintenance in early 2018. **(Chart 3.2)**

Trade in petroleum products was down in Q3 2019 compared to the same period a year earlier, with imports stable and exports down 19 per cent. The UK has been a net importer of petroleum products since 2013, by 3.8 million tonnes in Q3 2019 where it remains short in middle distillates such as road diesel and jet fuel. **(Chart 3.2)**

Total deliveries of the main transport fuels were down 2.1 per cent on a year earlier. Excluding the biofuel component, diesel deliveries decreased by 2.7 per cent in line with recent trends back towards petrol consumption, where deliveries increased by 0.6 per cent. The diesel share of road fuels is now 68 per cent. **(Chart 3.5)**

Overall stocks of crude oil and petroleum products stood at 15.0 million tonnes, up 5.0 per cent on the same period last year. **(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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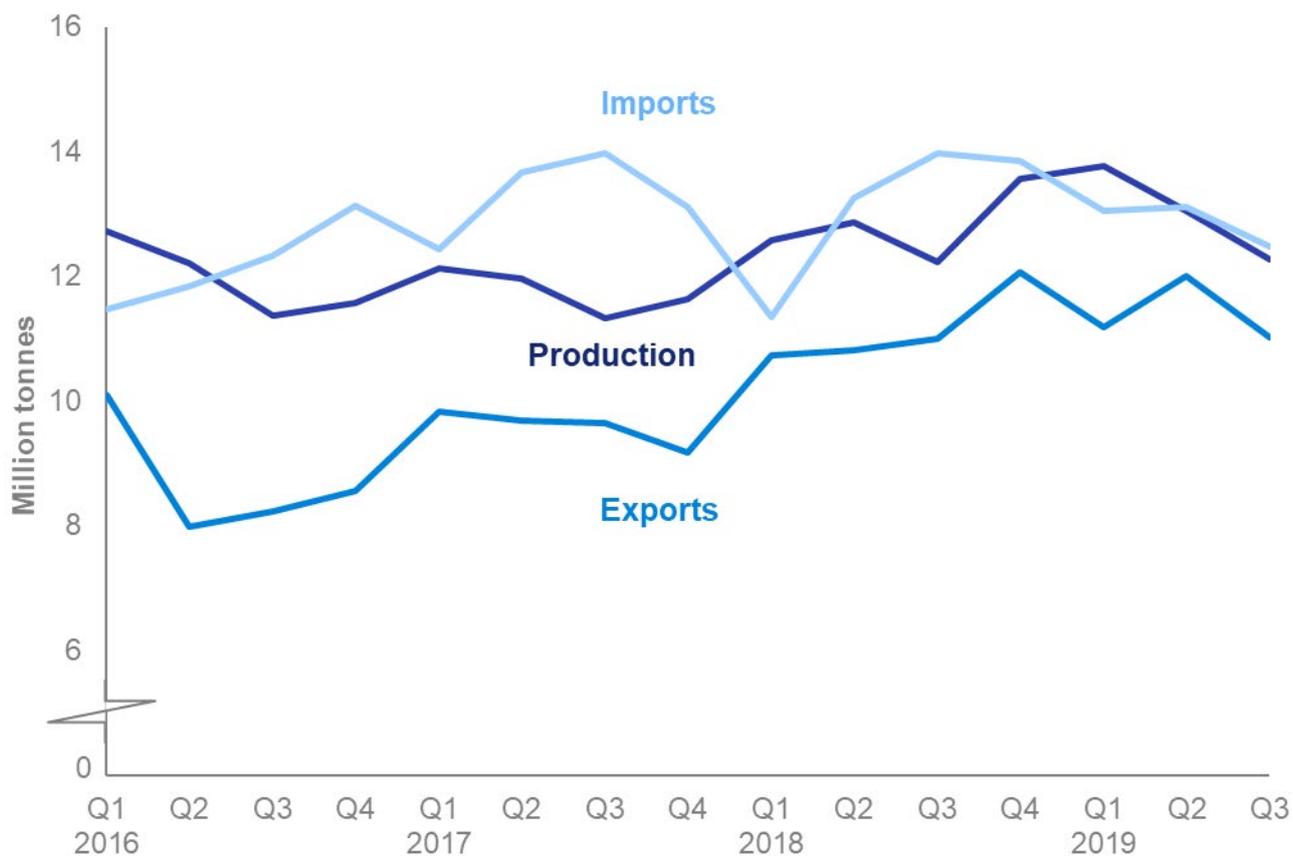
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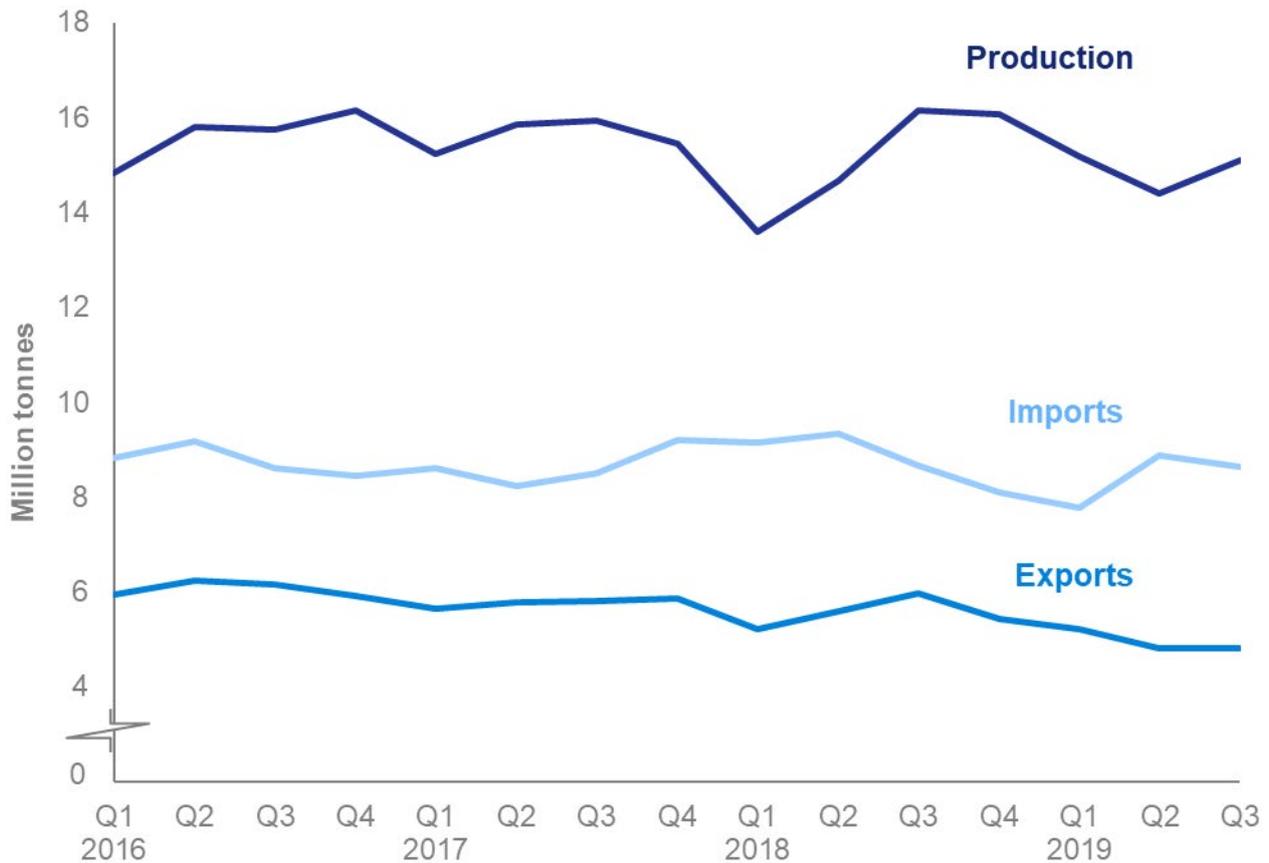
Chart 3.1 Production and trade of crude oil and NGLs (Table 3.1)



Indigenous UK crude oil production in Q3 2019 was stable on Q3 2018 (up 0.5 per cent), with production of NGLs down by 4.4 per cent. Overall indigenous production was up 0.2 per cent.

Exports of primary oils remained stable while imports were 11 per cent lower than Q3 2018 during a period of refinery maintenance.

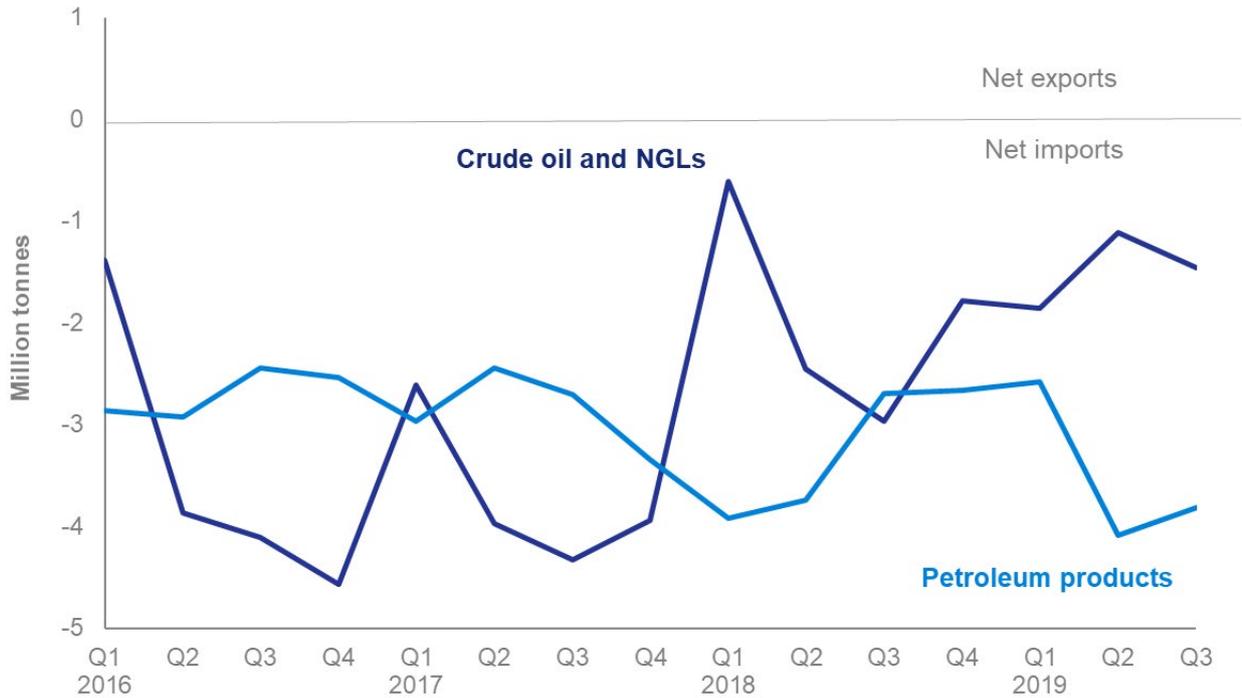
As a result, net imports of primary oils (crude, NGLs and feedstocks) halved, down from 3.0 million tonnes in Q3 2018 to 1.5 million tonnes in Q3 2019.

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

Indigenous production of petroleum products at refineries in Q3 2019 was 6.6 per cent less compared with a year earlier as a result of refinery maintenance. Imports of petroleum products were stable in Q3 2019, with exports down 19 per cent as a result of reduced refinery production.

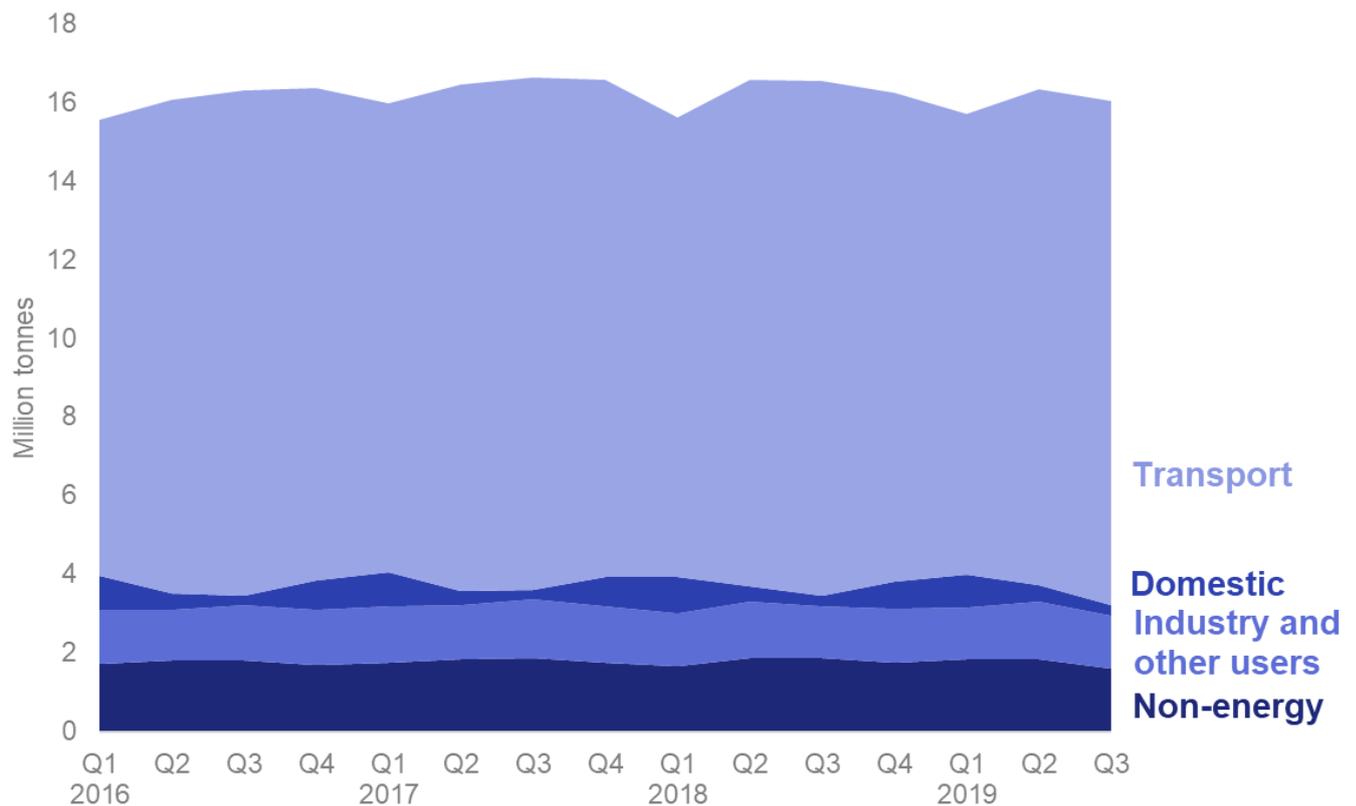
Whilst the trade balance on some products has varied slightly on the same quarter last year, the broad pattern is similar to last year with the UK reliant on imports of middle distillates (particularly road diesel and jet fuel which equal over two thirds of imports) and strong exports of petrol (which have comprised nearly 50 per cent of the UK's petroleum product exports in 2019 to date).

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



Net imports of primary oils (crude, NGLs and feedstocks) halved from 3.0 million tonnes in Q3 2018 to just 1.5 million tonnes in Q3 2019. New developments in the North Sea have increased UK exports, notably towards the end of the year, with a corresponding decrease in net imports. Net imports decreased sharply early in 2018 following the shut-down of the Forties pipeline system.

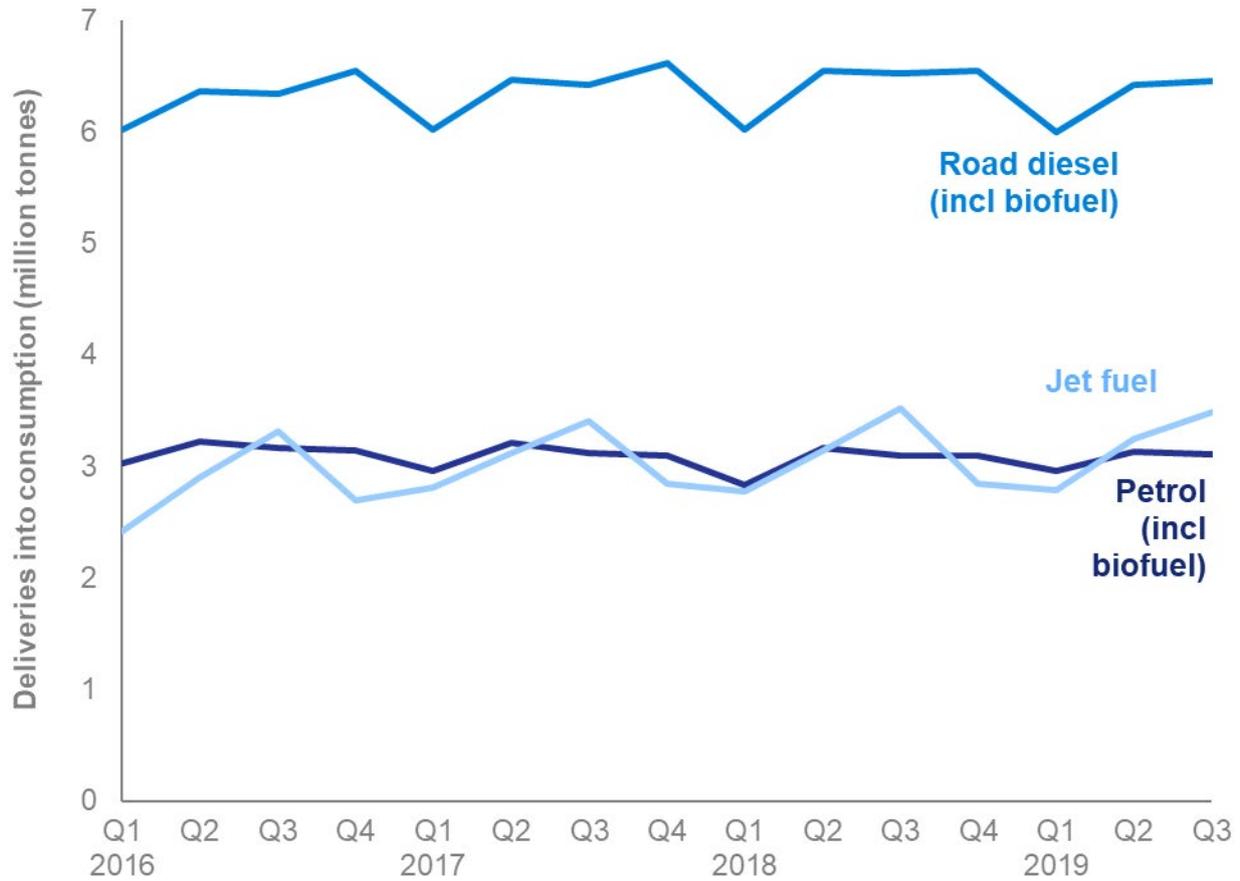
In Q3 2019 the UK was a net importer of petroleum products by 3.8 million tonnes, an increase from 2.7 million tonnes seen last year following weak exports this year during the period of refinery maintenance.

Chart 3.4 Final consumption of oil ([Table 3.4](#))

Final consumption in the oil sector has a small seasonal element with different products peaking at different times of the year. Consumption of domestic fuels for heating peaks in Q1 and Q4 each year, and consumption of aviation fuels is higher in Q2 and Q3.

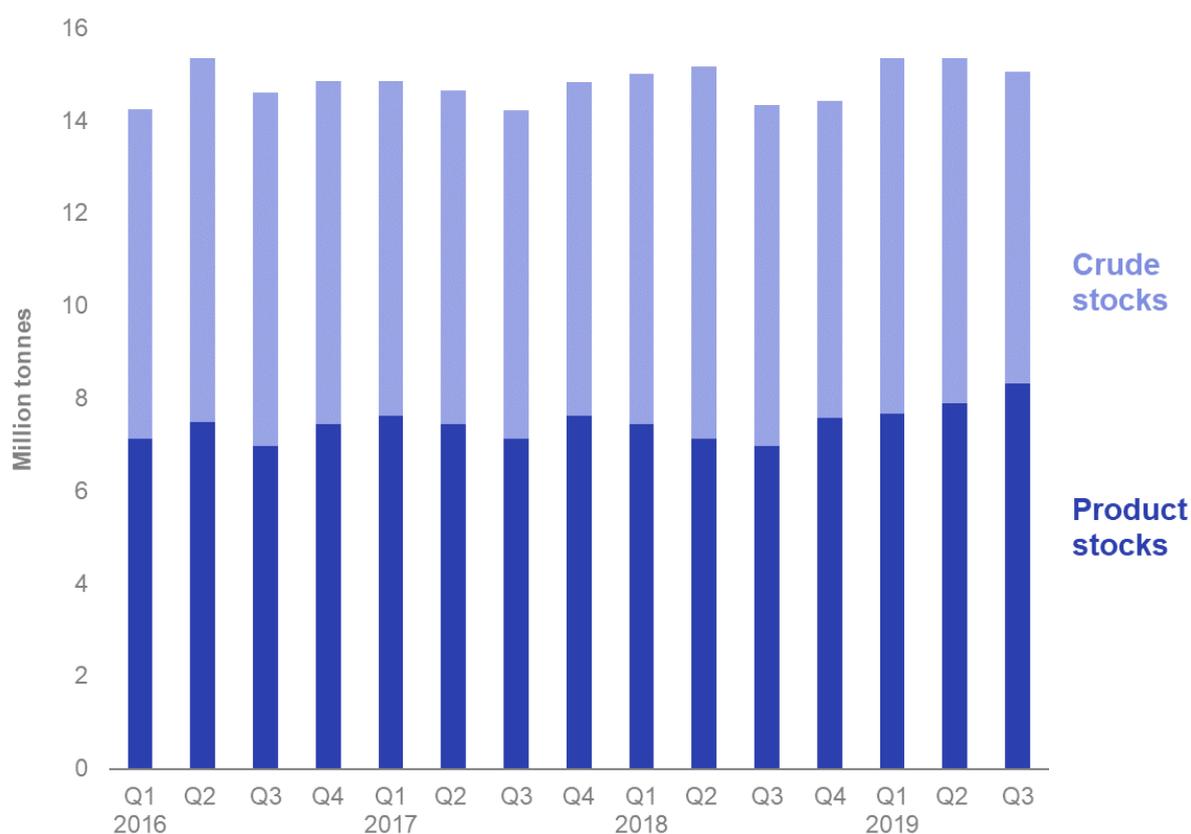
Final consumption of petroleum products in Q3 2019 decreased 3.1 per cent, driven by lower demand for transport fuels and petroleum products for non-energy use. Demand for petroleum products in the domestic and other final users sectors showed increases on the same period last year as a result of campaigns to encourage customers to buy early in preparation for the winter.

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



Transport fuels accounted for 74 per cent of demand for petroleum products, with road fuels alone accounting for more than half of total demand.

Consumption of all transport fuels was down 2.1 per cent on last year. Hydrocarbon motor spirit sales saw an increase (up 0.6 per cent), which was countered by a decrease in hydrocarbon road diesel (down 2.7 per cent) in continuation with recent trends as more motorists switch away from diesel. Deliveries of aviation turbine fuel were similar to the same period last year, down 0.9 per cent.

Chart 3.6 UK oil stocks (Table 3.6)

At the end of Q3 2019 total stocks for all oil were up by 5.0 per cent (0.7 million tonnes) compared to the same point in 2018.

Stocks of primary oils were down by 8.7 per cent, with increases of stocks held offshore but larger falls in stocks held at refineries, terminals and under bilateral agreements.

Product stocks increased by nearly one-fifth, with an increase other products stocks (notably petroleum coke) and in volumes held under bilateral agreements.

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. In Q3 2019 the UK stockholding was comprised of just over half (55 per cent) petroleum products, with the remainder as primary oils.

At the end of the Q3 2019, the UK had stocks equal to around 60 days 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 July to September 2019

Key results show:

In the third quarter of 2019, pipeline imports fell by 37 per cent, following continued planned maintenance on Norwegian pipelines and reduced production. This shortfall in pipeline supply was met by Liquefied Natural Gas (LNG) imports, which doubled to 20 TWh compared to Q3 2018. This meant LNG comprised nearly a third of the total imports in Q3 2019 (**Chart 4.4 and 4.5**).

Total exports reduced by over forty per cent to 25 TWh when compared to the same period last year, primarily due to falls in volumes to Belgium. In contrast, exports to the Republic of Ireland continue to increase as the output from the Corrib field gradually declines. This overall reduction in trade resulted in an increase in net imports in Q3 2019 by 9.5 per cent (**Chart 4.3**).

Total production of gas was stable on last year, down by 0.8 per cent. Production of natural gas from the UK Continental Shelf was down by 1.6 per cent on last year with biomethane production up by 13 per cent (Chart 4.1). Within natural gas, production of associated gas and dry gas production was down by 9.8 per cent and 12 per cent respectively (**Chart 4.2**).

Demand for natural gas in Q3 2019 decreased by 1.5 per cent compared to last year to 137 TWh (**Chart 4.6**).

Despite similar temperatures to 2018, there was a 3.0 per cent decrease in final consumption, with domestic use down by 3.5 per cent. Meanwhile, demand for electricity generation was also down by 1.5 per cent in comparison to the same quarter last year (**Chart 4.6**).

Relevant table

[4.1: Natural gas supply and consumption](#)

Contacts for further information:

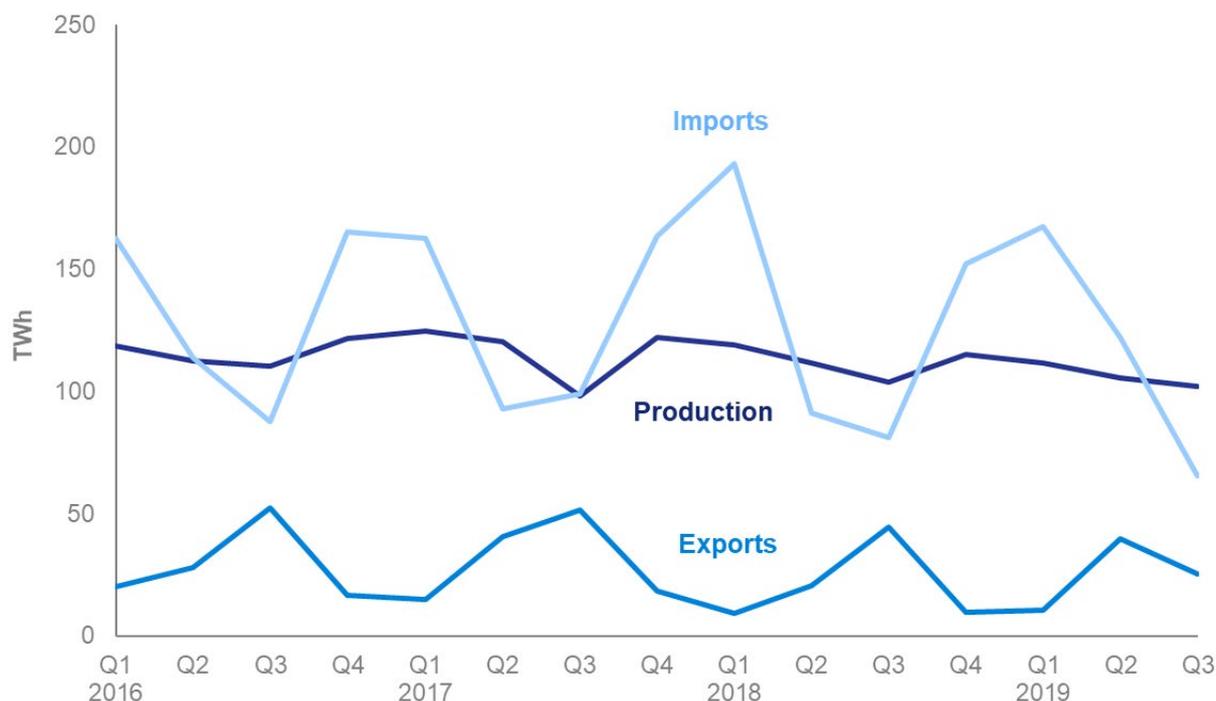
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Chart 4.1 Production and nominated flow trades of natural gas (Table 4.1)

Production of natural gas in Q3 2019 was down by 1.6 per cent compared to the same quarter in 2018 (Chart 4.1). However, biomethane production was up by 13 per cent, making total production down by just 0.8 per cent (see Tables 4.1 and 4.2).

In the year to date natural gas production has decreased by 3.9 per cent on 2018, with current volumes more than two-thirds lower than the average quarterly production in 2000 when gas production peaked.

There was a marked decrease in pipeline imports, which were down by 37 per cent and led to an overall decrease in total imports by nearly one-fifth (on a nominated flow basis¹). Imports of Liquefied Natural Gas (LNG) more than doubled to help meet the shortfall in supply.

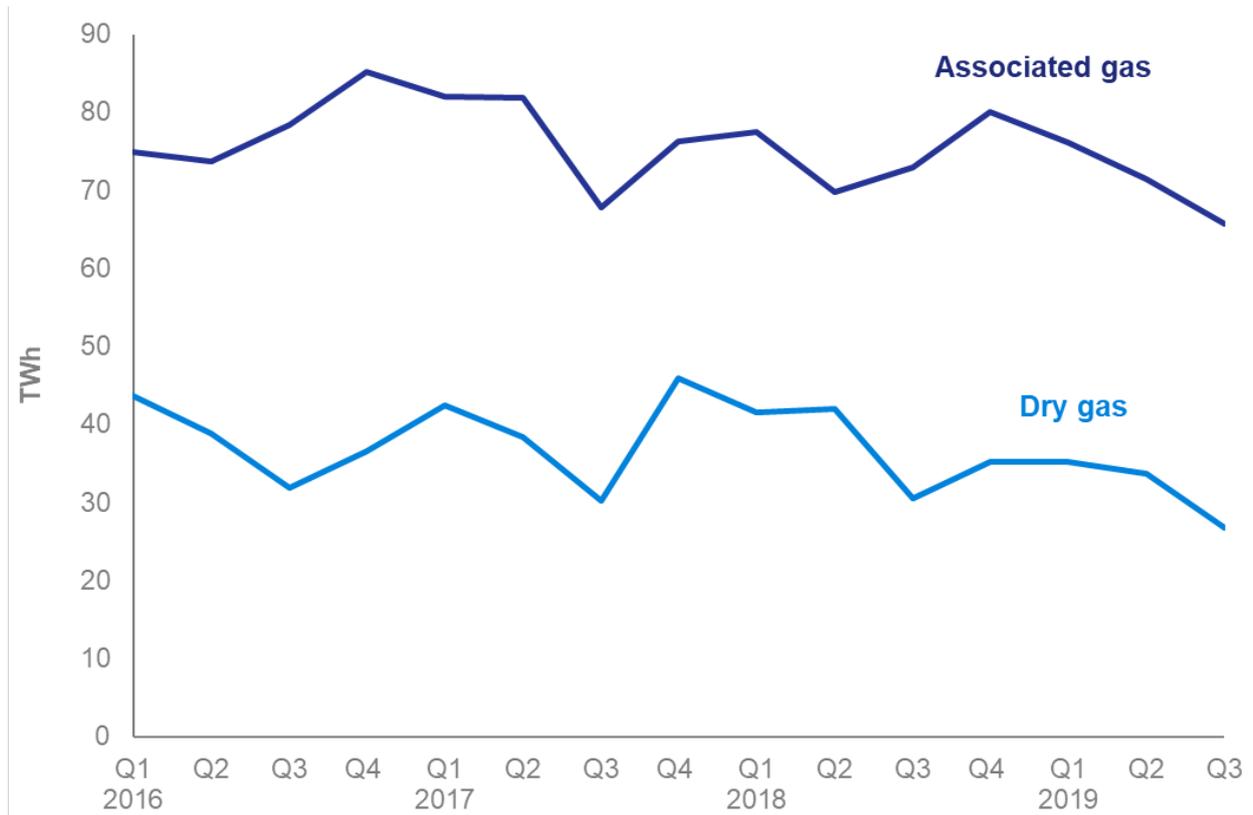
Exports were down over 40 per cent to 25 TWh, with a reduction in exports to Belgium being the primary source of this fall. Overall net imports increased by 9.5 per cent after particularly low levels last year.

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.

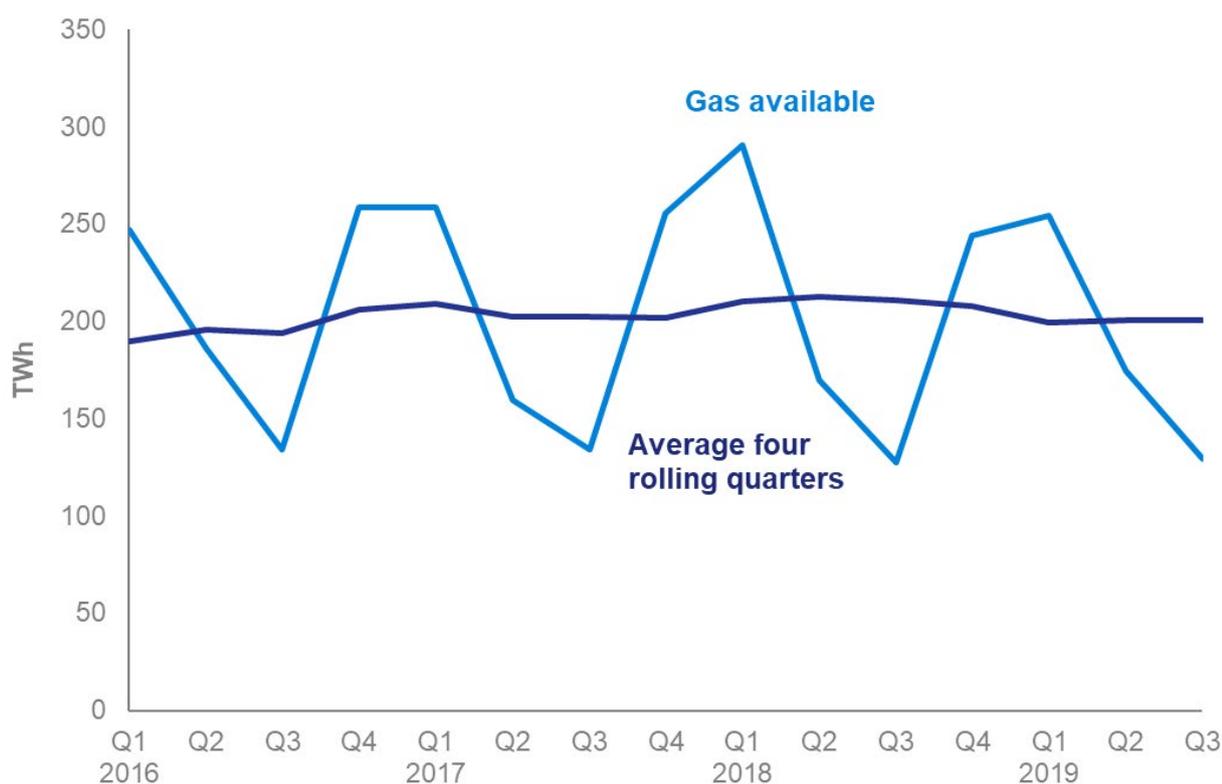
Gas

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 Q3 2019 was down by 9.8 per cent compared to the same quarter last year, from 71 to 66 TWh. Dry gas production (natural gas composed mainly of methane) also decreased by 12 per cent in Q3 2019 compared to last year.

Chart 4.3 Gas availability (Table 4.2)

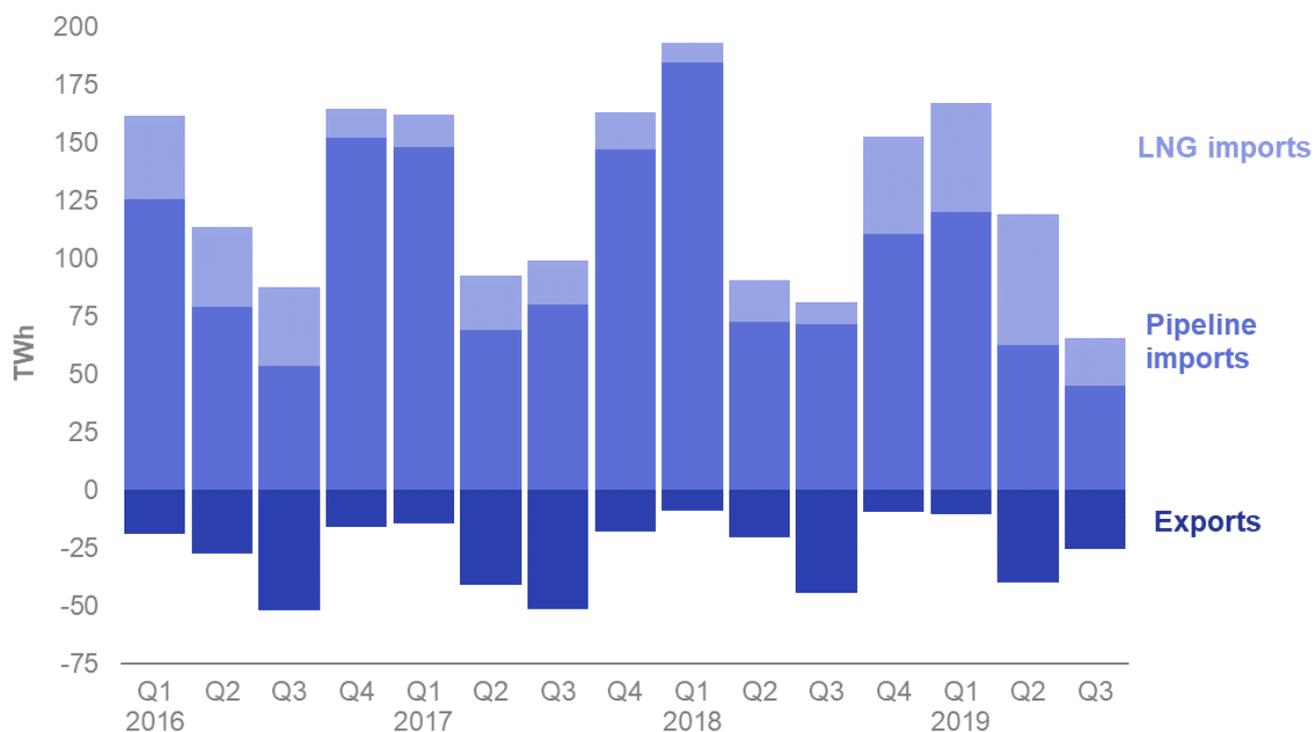


Gas available at terminals is broadly equal to gross gas production minus producers' own use, plus net imports. This is seasonal and peaks during Q1 and Q4, associated with the colder temperatures over the winter months.

While demand was down in Q3 2019 on last year, gas available at terminals was up by 1.2 per cent. The excess gas primarily entered stocks, with an 8.0 TWh stock build. Gas used at LNG terminals was also up because of the relatively high import volumes in this period. The average availability of gas over four rolling quarters remains above average for Q3 2019.

Gas

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).

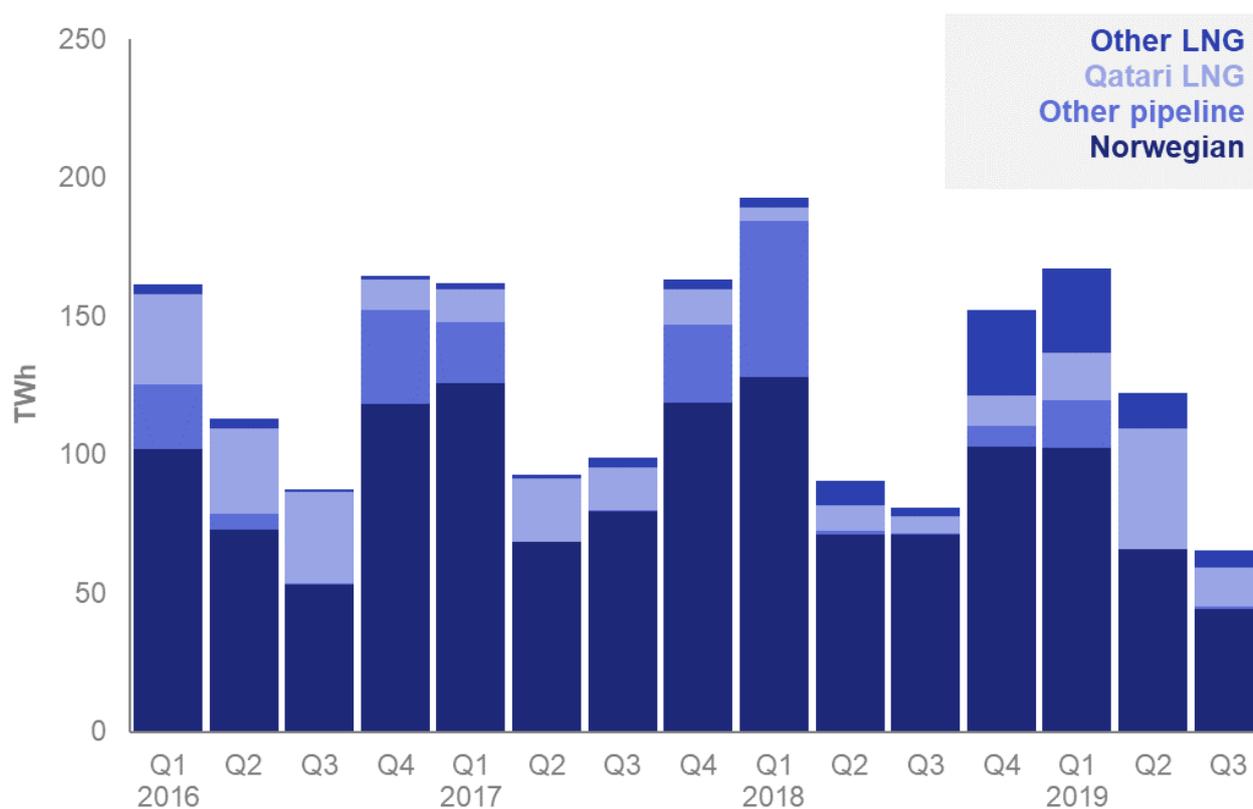
Total imports (on a physical instead of a nominated flow basis²) were down nearly one-fifth on the year before in Q3 2019. This was driven by the substantial 37 per cent decrease in pipeline imports mainly associated with the contraction of flows from Norway which also fell by 37 per cent. This was partly due to reduced flows via the Vesterled pipeline, which were suspended due to planned maintenance earlier this summer. Sales in August were affected as low export prices drove a reduction in production in Norway. Flows via the SAGE pipeline were also suspended following maintenance work at the Mossmorran plant, where these flows are received.

Due to established LNG import infrastructure, the UK utilised LNG imports to make up for the shortfall in supply. This meant LNG comprised nearly a third of total imports in Q3 2019 as volumes more than doubled, despite the near record low seen in the month of August.

Meanwhile, exports decreased by over 40 per cent to 25 TWh in Q3 2019 compared with the same quarter of 2018. This is primarily due to a 53 per cent fall in volumes to Belgium. In particular exports to Belgium were down, where export volumes have remained comparatively low since the long-term Belgian interconnector contract ended in October 2018. However, these volumes have started to recover in recent months. In contrast, exports to Ireland increased over the quarter by 30 per cent as the output from the Corrib field gradually declines.

Overall, net imports were up 9.5 per cent in Q3 2019 as the decrease in exports outstripped the decrease in imports.

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 Q3 2019, Norway continues to be the main source of imported gas to the UK at 68 per cent, although down from Q3 2019 when Norway imports comprised 88 per cent of the UK's total imports.

Qatar remains the major source of LNG to the UK for the second quarter in a row, with 69 per cent of LNG of Qatari origin, up from 36 per cent at the start of the year. Other sources were Russia, the USA and Algeria.

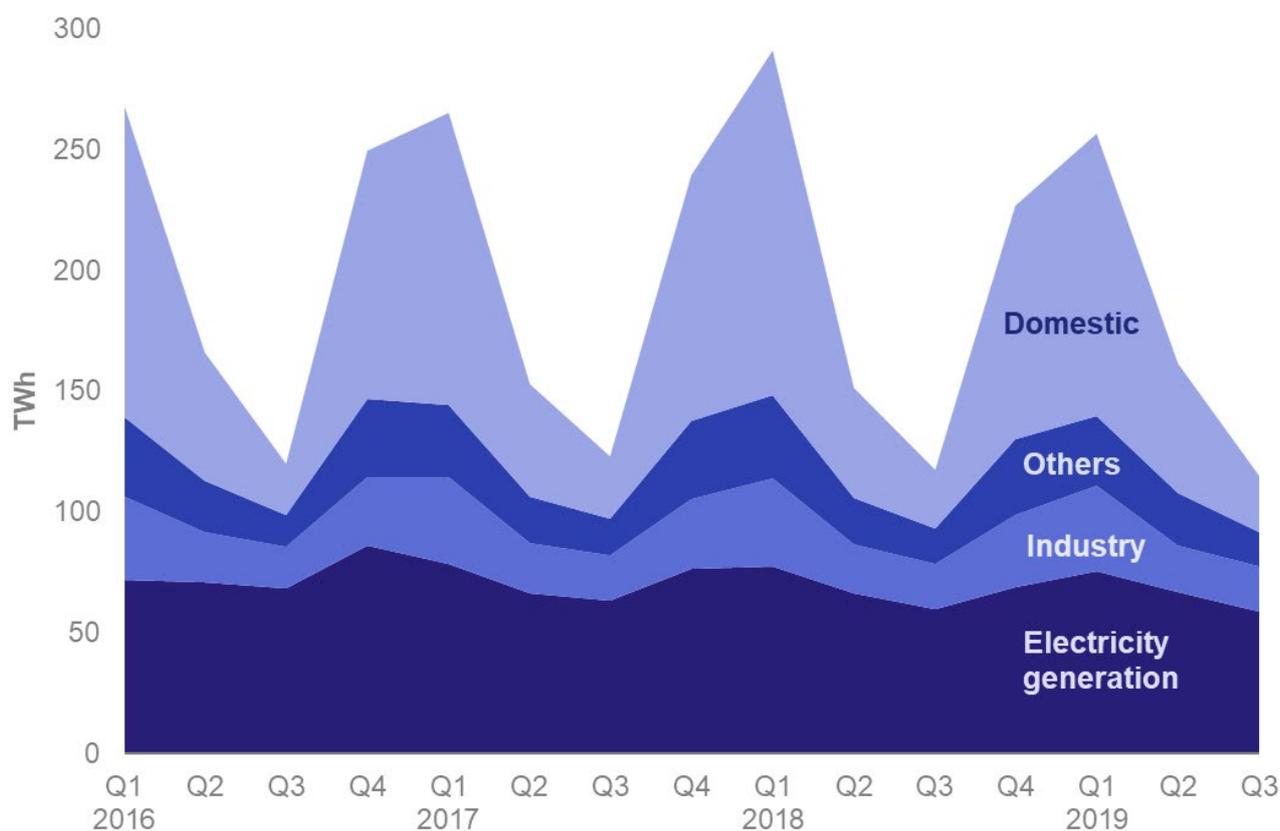
A complete country breakdown for physical pipeline and LNG imports is provided in Energy Trends Table 4.4 - [Supplementary information on the origin of UK gas imports](#).

Gas

Map 4.1: UK physical imports and exports of gas Q3 2019



Chart 4.6 UK demand for natural gas ([Table 4.1](#))



UK demand for natural gas in Q3 2019 was down 1.5 per cent in comparison to Q3 2018 to 137 TWh.

Demand for electricity generation fell, down 1.5 per cent in comparison to the same quarter last year as the increased output from renewable energy continues to displace the demand for gas for electricity generation.

Despite similar temperatures to the same period last year, final consumption dropped 3.0 per cent, with domestic use down by 3.5 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 July to September 2019

Key results show:

Total demand for electricity in Q3 2019 was the lowest quarterly value on the published time series. Demand decreased by 1.9 percent from 79.7 TWh in Q3 2018 to 78.1 TWh in Q3 2019, in part due to warmer weather. Final consumption by customers was also at its lowest published value in Q3 2019, down by 1.1 per cent to 68 TWh, with lower demand in all customer sectors. **(Chart 5.5).**

In the third quarter of 2019, total generation was 74 TWh. Electricity supply is driven by demand and this was the lowest quarterly figure in the published data series and a decrease of 1.5 per cent compared to Q3 2018. Nuclear generation remained low during Q3 2019, down 21 per cent compared to Q3 2018. A low level of nuclear generation has been a continuing trend throughout the year and is attributed to a series of extended maintenance outages at six of the UK's eight active nuclear power stations during the year. **(Chart 5.1).**

Renewable electricity generation was 29 TWh in Q3 2019, representing 38.9 percent of total electricity generation. This was the highest share seen in the UK and – marginally - surpassed the share of generation from gas (38.8 percent) for the first time. Conversely, the share of generation from fossil fuels decreased to a record low in Q3 2019 at 40.1 per cent of generation. **(Chart 5.2).**

High renewable generation also meant that the share of generation from low carbon sources continued to increase in Q3 2019 to reach a record high of 57.3 per cent, despite lower than usual nuclear generation. **(Chart 5.3).**

Gas remained the fuel with the highest generation at 29 TWh, though this was 1.2 per cent lower than in Q3 2018. Coal generation continued to decline and was down 61 per cent over this time to 0.7 TWh. These trends were also reflected in the fuel used. **(Chart 5.4).**

Net imports of electricity reduced by 9.7 per cent from 4.9 TWh in Q3 2018 to 4.4 TWh in Q3 2019. Despite the decrease, the UK remained a net importer of electricity in Q3 2019, a trend that has continued since Q2 2010. The decrease was driven by an increase in exports of electricity which more than doubled to 1.1 TWh in Q3 2019, up from 0.5 TWh in Q3 2018. Though imports of electricity also increased by 1.9 per cent (0.1 TWh) compared to Q3 2018, this was not enough to balance the increased exports. **(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](#)

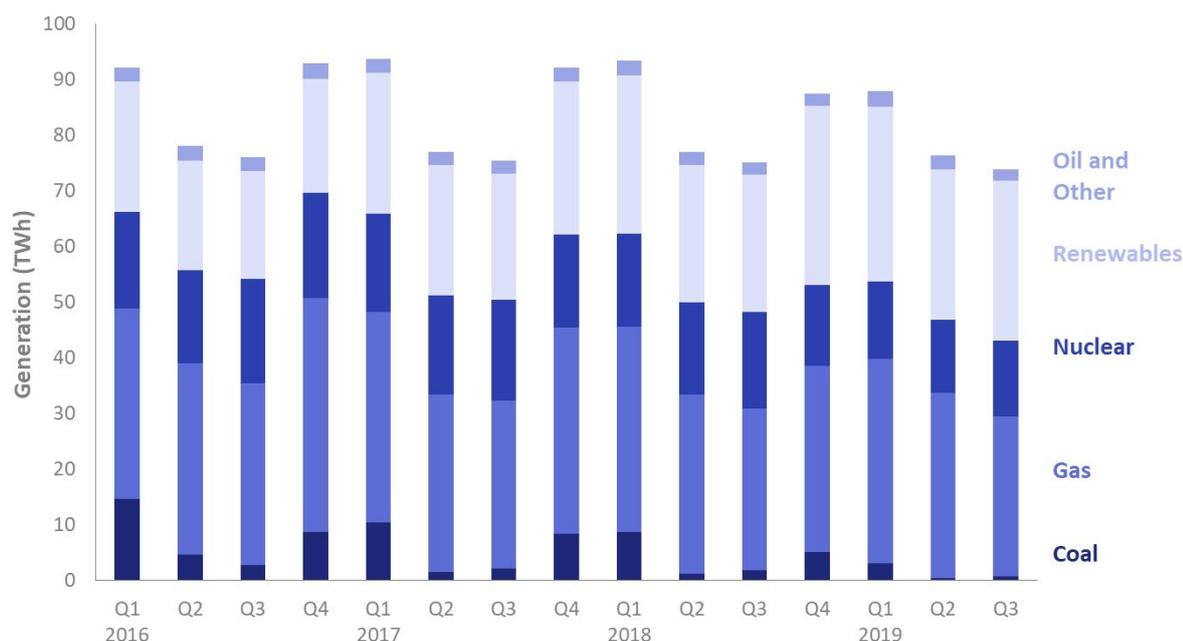
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Chart 5.1: Total electricity generated by fuel type (Table 5.1)

In the third quarter of 2019, total generation was 74 TWh, a decrease of 1.5 per cent compared to Q3 2018. This was the lowest quarterly figure in the published data series. Electricity supply is driven by demand, with electricity generated or imported as needed and demand also decreased by 1.9 per cent between Q3 2018 and Q3 2019, in part due to slightly warmer weather across Q3 2019.

Gas remained the single fuel with the highest generation at 29 TWh, though this was 1.2 per cent lower than in Q3 2018. Coal generation continued to decline and was down 61 per cent over this time to 0.7 TWh, with some slight fluctuations over the period attributed to Cottam Power Station burning its remaining coal stocks prior to closure on 30 September 2019. Cottam's closure leaves only six major coal fired power stations in the UK with Aberthaw B and Fiddlers Ferry power stations also announcing they are due to close in March 2020.

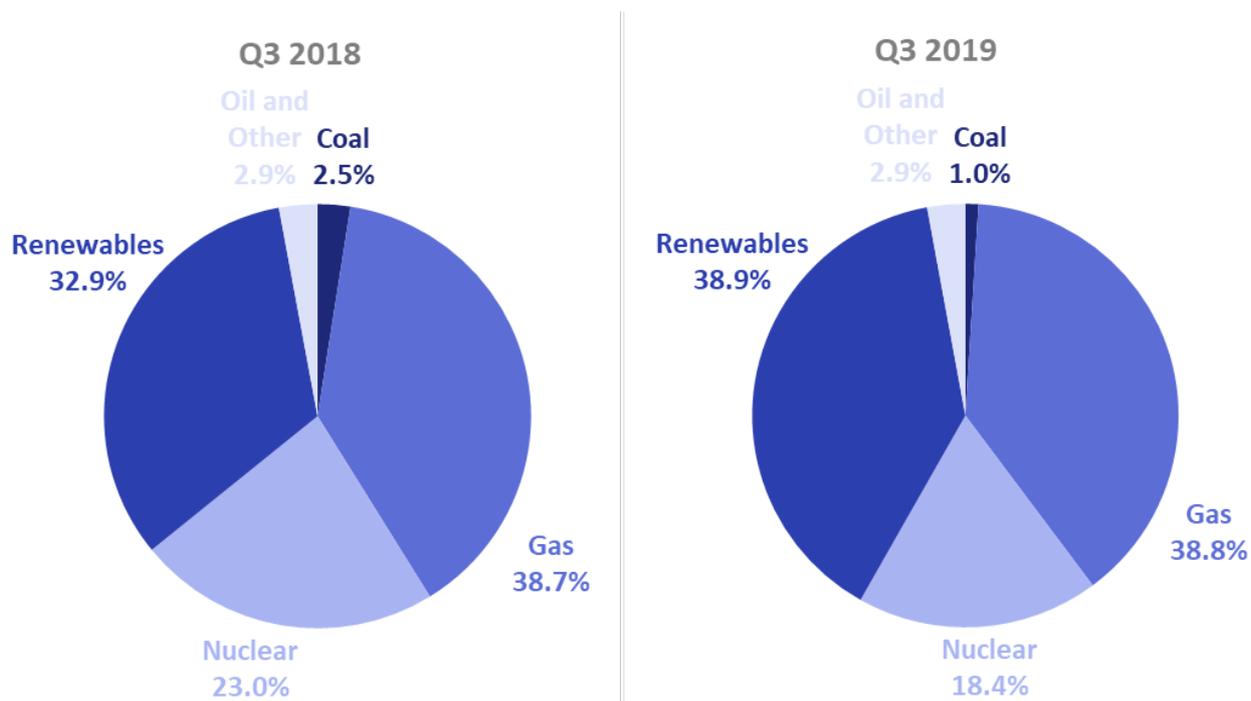
Renewable electricity generation was 29 TWh in Q3 2019, representing 38.9 percent of total electricity generation. Increases in generation were seen for all categories of renewables but were particularly substantial for wind and solar (up 22 per cent to 18 TWh) as well as for hydro generation, which was up 58 per cent to 1.4 TWh. These increases were down to increased capacity for renewable generation (up 7.2 per cent compared to Q3 2018) as well as favourable weather conditions, particularly for offshore wind generation¹.

Nuclear generation remained low during Q3 2019, down 21 per cent compared to Q3 2018. A low level of nuclear generation has been a continuing trend throughout the year and is attributed to a series of extended maintenance outages at six of the UK's eight active nuclear power stations during the year. During Q3 2019, outages continued at Dungeness B (statutory outages), Hartlepool (statutory outage) and Hutton B reactor 3 (graphite inspection outage) and were completed at Sizewell B (statutory outage), Heysham 1 (statutory outage) and Hutton B reactor 4 (graphite inspection outage). A statutory outage occurs when a reactor is shut down for maintenance, which is planned in advance with the National Grid to manage the impact on the national electricity supply.

¹ See tables 7.1-7.4 for details on weather conditions.

Electricity

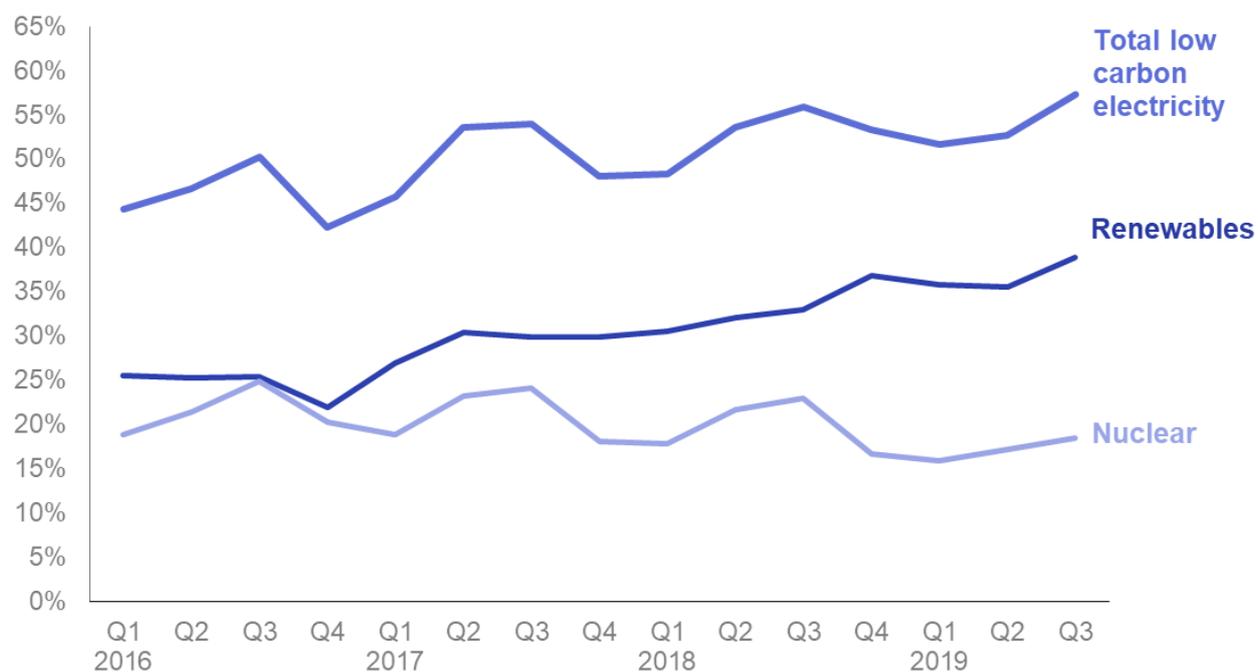
Chart 5.2 Shares of electricity generation² ([Table 5.1](#))



The share of electricity generated from renewables (wind, solar, hydro and other renewables) as 38.9 per cent in Q3 2019, up from 32.9 per cent in Q3 2018. This was the highest share on the published data series and surpassed, albeit marginally, the share of generation from gas for the first time. There was a decrease in the share of generation from nuclear, down to 18.4 per cent in Q3 2019, down from 23.0 per cent for the same period last year. This was because of a series of outages at the UK's nuclear plants, as detailed previously.

Fossil fuels accounted for 40.1 per cent of generation in Q3 2019. This is the lowest value on the published data series and continues the ongoing trend away from fossil fuels. The share for gas and 'oil and other' remained consistent between the two years, with the decrease coming from the reduced share in generation coming from coal, down to 1 per cent in Q3 2019.

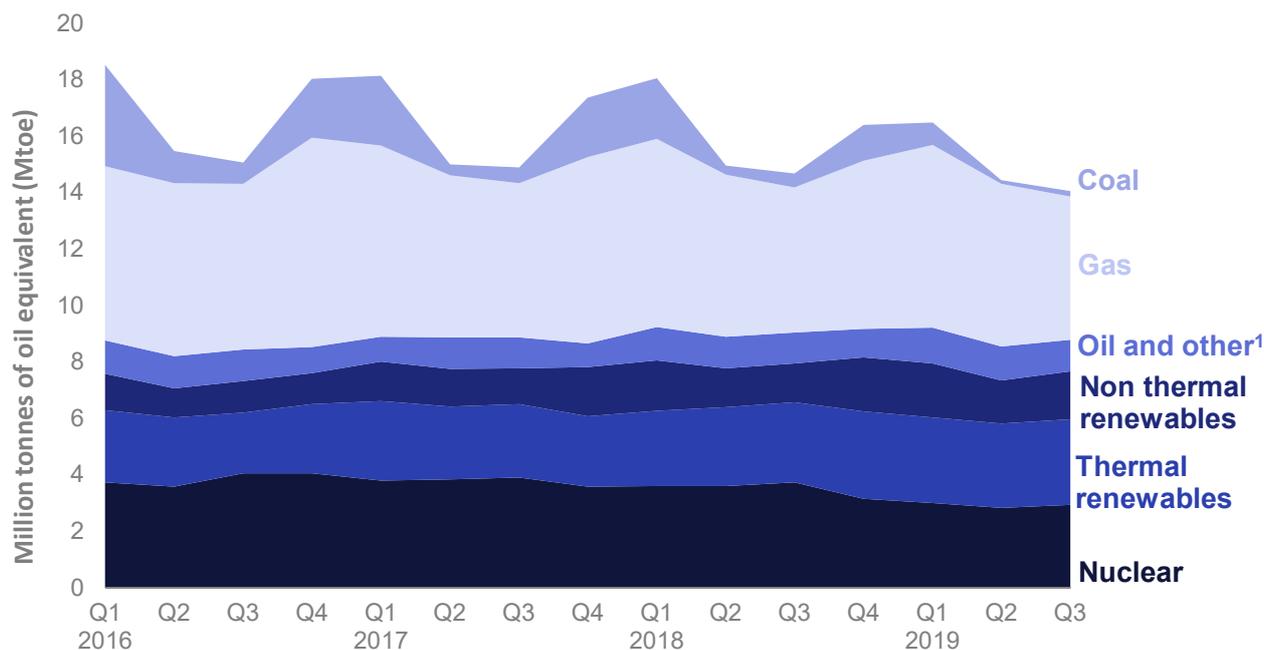
² Oil and other includes pumped storage, oil, and non-renewable wastes.

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

Despite reduced generation from nuclear, the share of generation from low carbon sources continued to increase in Q3 2019 to reach 57.3 per cent, the highest value for the UK. This was up from 55.9 per cent in Q3 2018 due to the strong output from renewable sources.

Electricity

Chart 5.4 Fuel used in generation (Table 5.1)



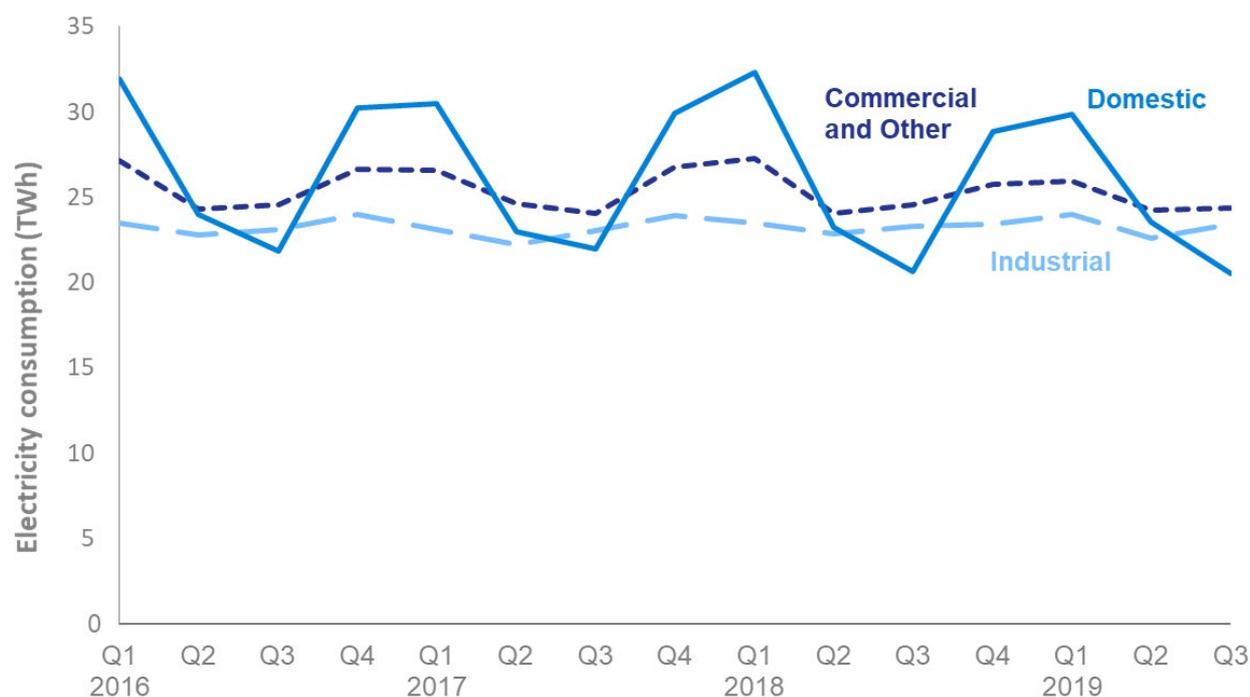
¹Includes imports

During Q3 2019, fuel used in electricity generation decreased by 4.2 per cent, from 15 million tonnes of oil equivalent (mtoe) in Q3 2018 to 14 mtoe in Q3 2019. This was the lowest level recorded in the UK and can be linked to the ongoing decrease in coal usage and lower nuclear generation as a result of outages, as well as to lower demand for electricity overall.

In terms of the fuels used for generation, the amount of coal used continued its downward trend, and fuel used for nuclear generation was down 21 per cent over the same period as a result of outages. There are also apparent increases for non-thermal renewables, but this reflects their increased generation since no actual fuel is used³.

³ For wind and solar (and other primary renewable sources), the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred.

Chart 5.5 Electricity final consumption (Table 5.2)



Total demand for electricity in Q3 2019 was the lowest quarterly value recorded in the UK. Demand decreased by 1.9 percent from 79.7 TWh in Q3 2018 to 78.1 TWh in Q3 2019. Final consumption by customers was also at its lowest published value in Q3 2019, down by 1.1 per cent to 67.7 TWh, with lower demand in all customer sectors.

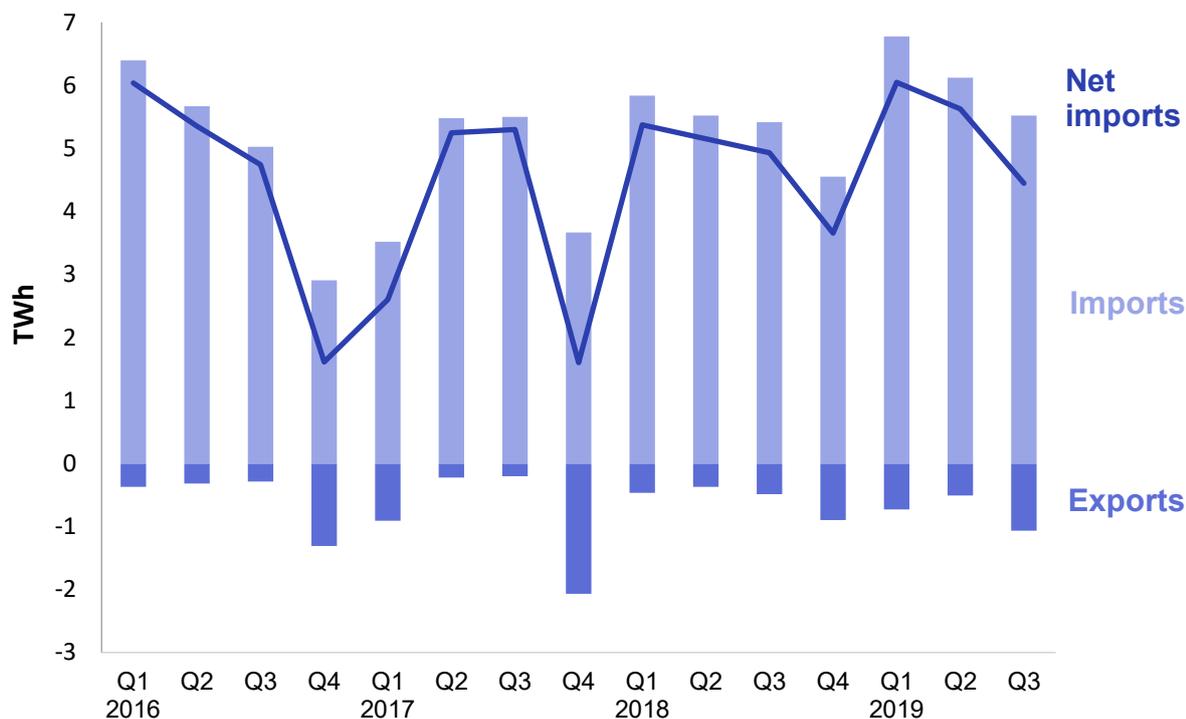
Domestic consumption was down to 20 TWh in Q3 2019, a decrease of 1.3 per cent compared to Q3 2018. This reflected slightly warmer temperatures over the period reducing the electricity demand from heating, with lower numbers of heating degree days (-0.3) over the period. Similar trends were seen for other users, down 1.3 per cent compared to Q3 2018.

Industrial electricity consumption also decreased in Q3 2019 to 23 TWh, a reduction of 1.4 percent compared to Q3 2018. This is in line with reductions in industrial output as measured in the Index of Production⁴.

⁴ For more information on the Index of Production, please see the latest publication from Office for National Statistics: www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofproduction/september2019

Electricity

Chart 5.6 UK trade in electricity (Table 5.6)



The UK has 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 operational on 31st January 2019.

Net imports of electricity reduced by 9.7 per cent from 4.9 TWh in Q3 2018 to 4.4 TWh in Q3 2019. Despite the decrease, the UK remained a net importer of electricity in Q3 2019, a trend that has continued since Q2 2010. Imports of electricity accounted for 6.0 per cent of total electricity supply (excluding own use) over the period.

Imports of electricity increased by 1.9 per cent to 5.5 TWh in Q3 2019 compared to Q3 2018. There were reduced imports on all interconnectors which were operational in 2018, with a particularly large decrease for both the Northern Ireland-Ireland and Ireland-Wales interconnectors, down 39 per cent and 41 per cent respectively. This decrease was balanced by imports of 1.2 TWh on the new England-Belgium interconnector, which is now the second largest source of net imports after the England-France interconnector.

Exports of electricity more than doubled to 1.1 TWh in Q3 2019, up from 0.5 TWh in Q3 2018. There was an increase in exports for all interconnectors which were operational in 2018, with particularly large increases in exports to France (up 280 per cent) and to the Netherlands (up 281 per cent).

Imports from Ireland to Northern Ireland decreased in Q3 2019 (down 39 per cent), while exports increased (up 62 per cent). Northern Ireland remained a net exporter to Ireland in Q3 2019, which continued the trend since Q3 2017. On the Ireland-Wales interconnector, imports decreased by 41 per cent to 0.2 TWh. This was set against exports of 0.3 TWh (up 72 per cent), making Ireland a net exporter to Wales for the first time since Q1 of 2016.

Net transfers from Scotland to England increased by 43 per cent compared to Q2 2018. The net transfers totalled to 3.6 TWh, the highest for the England-Scotland system for any Q3 on the published time series. Net transfers from Scotland to Northern Ireland also more than doubled to 0.4 TWh in Q3 2019. This reflects higher than usual wind generation in Scotland during the quarter, particularly from offshore wind.

Section 6 – UK Renewables July to September 2019

Key results show:

Renewable electricity generation was 28.8 TWh in 2019 Q3, an increase of 16 per cent on the 24.7 TWh in 2018 Q3. **(Chart 6.2)**

The share of total electricity generation from renewables – 38.9 per cent – is the highest recorded and marginally exceeds the share of generation from gas for the first time. The increase was largely due to increased load factors for wind as well as increased renewable capacity. **(Chart 6.1)**

Onshore wind generation rose by 24 per cent (1.3 TWh) with offshore wind increasing by 43 per cent, the highest increase across the technologies, to 7.2 TWh. For the first time, offshore wind generation exceeded onshore wind generation. **(Chart 6.2)**

Renewable electricity capacity was 46.9 GW at the end of 2019 Q3, a 7.2 per cent increase (3.2 GW) on a year earlier, with more than half of the increase coming from offshore wind, and more than one quarter from onshore wind. **(Chart 6.3)**

Liquid biofuel consumption increased by 18 per cent, from 588 million litres in 2018 Q3 to an estimated 696 million litres in 2019 Q3. Bioethanol consumption decreased by 2.2 per cent while biodiesel consumption increased by 29 per cent. In 2019 Q3, liquid biofuels represented 5.8 per cent of petrol and diesel consumed in road transport, up from 4.9 per cent a year earlier. **(Chart 6.6)**

Relevant tables

[6.1: Renewable electricity capacity and generation](#)

[6.2: Liquid biofuels for transport consumption](#)

Contacts for further information:

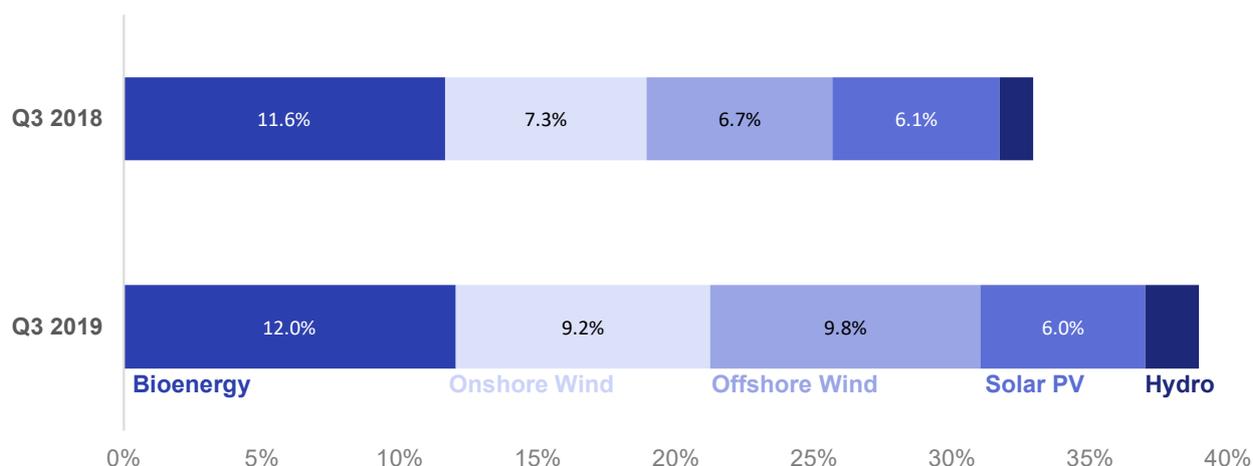
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Renewables

Chart 6.1 Renewables' share of electricity generation ([Table 6.1](#))

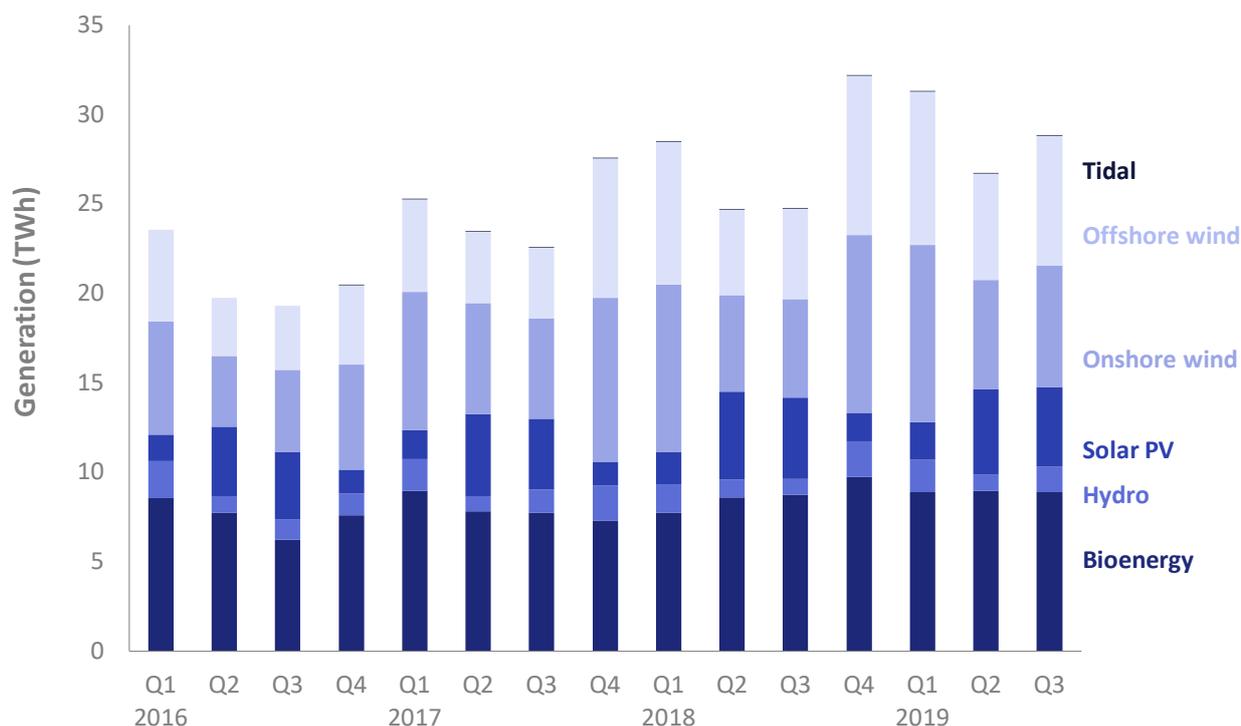


Renewables' share of electricity generation increased from 32.9 per cent in 2018 Q3 to 38.9 per cent in 2019 Q3. This is a new record for quarterly share, exceeding the previous record of 36.8 per cent in 2018 Q4.

Wind remains the principal source of renewable generation with onshore and offshore wind comprising 19.0 per cent of total generation, with bioenergy the other significant component at 12.0 per cent.

Total electricity generated from renewables in 2019 Q3 was 28.8 TWh, an increase of 4.1 TWh (16 per cent) compared to 2018 Q3, but 3.4 TWh lower than the record of 32.2 TWh in 2018 Q4.

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 Q3, generation from bioenergy¹, at 8.9 TWh, was up by 0.2 TWh (1.9 per cent) on this period last year. Bioenergy had the largest share of renewable generation at 30.9 per cent.

In 2019 Q3, electricity generated from wind increased by a third to 14.1 TWh with onshore wind generation increasing by 24 per cent and offshore wind generation increasing by 43 per cent to 7.2 TWh. This follows a significant increase in offshore capacity. Wind speeds in 2019 Q3, at 7.7 knots, were equal to the previous year but below the long term mean for the third quarter of the year which is 8.0 knots - see Energy Trends table 7.2 at:

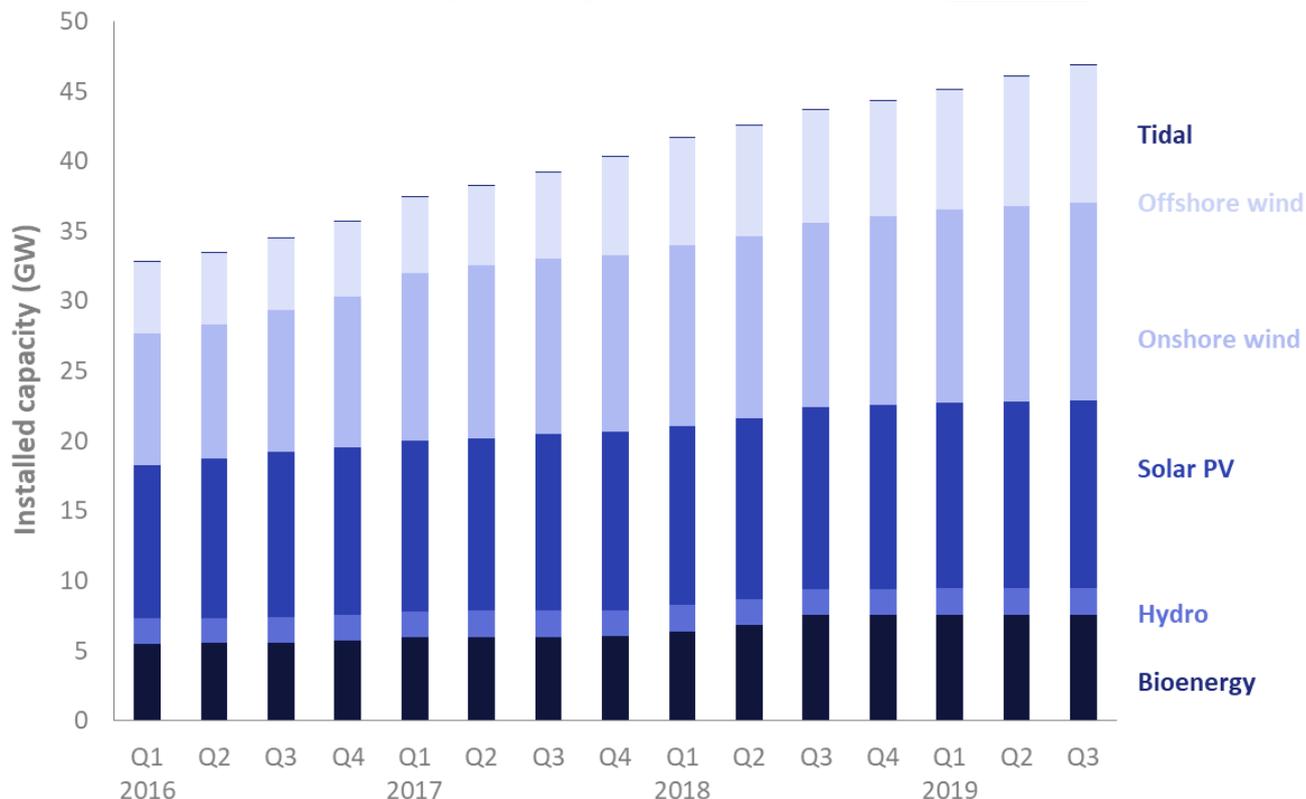
www.gov.uk/government/statistics/energy-trends-section-7-weather.

For the first time offshore wind had a larger share of renewable generation than onshore wind with 25.1 per cent and 23.7 per cent respectively.

Generation from solar photovoltaics decreased by 2.8 per cent (0.1 TWh) to 4.4 TWh, compared to 2018 Q3, reflecting a drop in average sunlight hours of a similar scale (3.4 per cent). In total Solar PV contributed 15.3 per cent of total renewable generation.

Hydro generation rose to 1.4 TWh, increasing by 58 per cent on this quarter in 2018; average rainfall (in the main hydro catchment areas) was well above the long term mean and was the wettest quarter since Q1 of 2016. This quarter also included the wettest August in our time series (from 2001). In addition, rainfall in June of this year was much higher than in June of 2018 which may have added to greater generation in Q3 of this year as there can be a lag between rain falling and hydro generation - see Energy Trends table 7.4 at: www.gov.uk/government/statistics/energy-trends-section-7-weather. Hydro contributed 5.0 per cent of total renewable generation.

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 Q3, the UK's renewable electricity capacity totalled 46.9 GW, an increase of 7.2 per cent (3.2 GW) on that installed at the end of 2018 Q3. However, this is the smallest year on year percentage increase since 2011. Capacity was 1.7 per cent (0.8 GW) above the previous quarter.

At the end of 2019 Q3, onshore wind at 14.1 GW represented 30.2 per cent of all renewable capacity, the highest share of renewable technologies. This was followed by solar PV (28.7 per cent), offshore wind (20.9 per cent) and bioenergy (16.2 per cent).²

Compared with 2018 Q3, the largest change in capacity was for offshore wind which increased by 1.7 GW (21 per cent). Two large offshore wind farms Beatrice (Scotland) and Hornsea (England) were extended to 588 MW and 1211 MW, respectively.

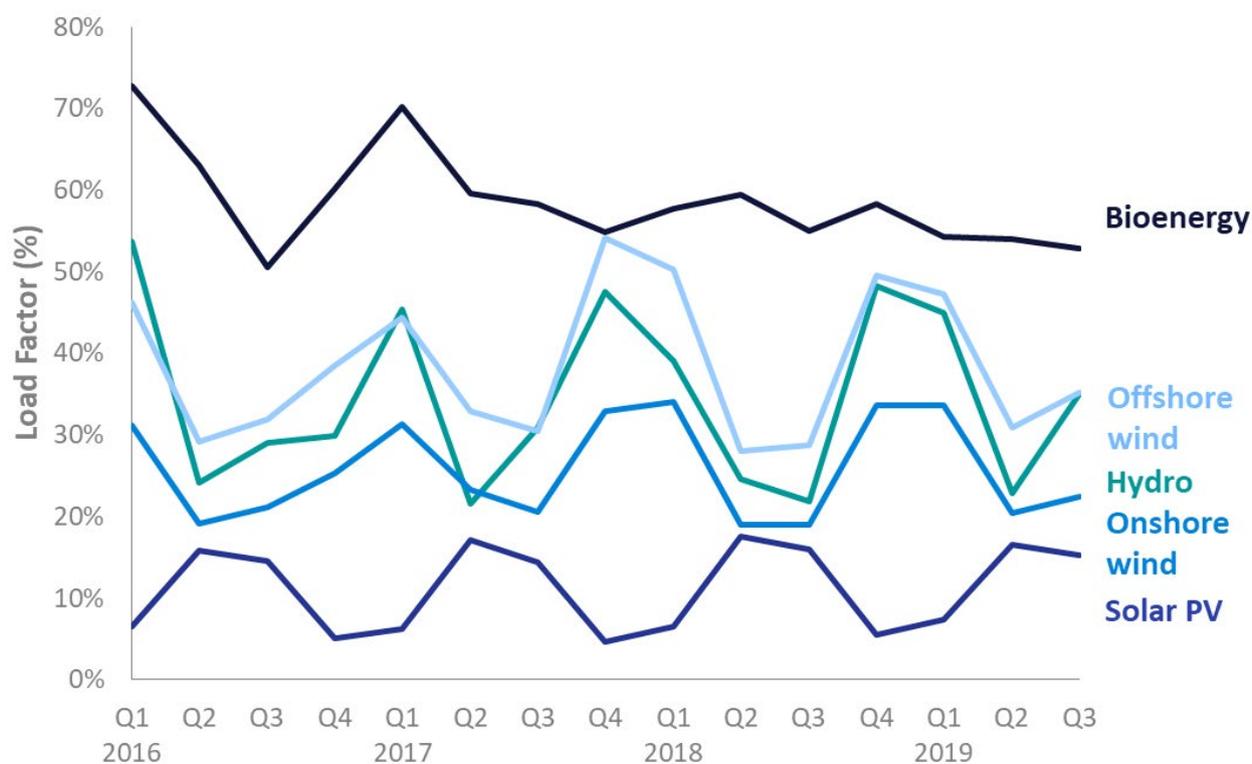
Eleven new onshore wind farms opened in the quarter, equating to 120 MW, the largest of which were Tom Nan Clach (39.1 MW) and Coire Na Cloiche (29.9 MW) both in Scotland. In addition, the capacity for Clocaenog Forest (Wales) also increased to 64 MW.

Bioenergy capacity was at a similar level to one year ago with small additions in plant biomass being largely offset by reductions in anaerobic digestion capacity.

² To note that renewable generation and capacity figures include installations accredited on all support schemes (Renewables Obligation, Feed in Tariffs, Contracts for Difference), as well as sub 50 kW installations commissioned, and registered on the Microgeneration Certification Scheme (MCS). In addition, the solar PV figures will also include installations awaiting accreditation when FITs closed at the end of March 2019. However, the figures presented here and in ET 6.1 do not currently include unsubsidised solar installations below 1MW capacity that are not registered on the MCS. We are reviewing data sources to improve 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.



At 28.1 per cent, the average load factor for all renewables was 2.1 percentage points higher than the previous year. However, within this, some technologies showed higher load factors and some showed falls.

In 2019 Q3, onshore wind's load factor increased by 3.0 percentage points to 22.0 per cent. Offshore wind's load factor increased at a greater rate, by 5.7 percentage points to 34.4 per cent in 2018 Q3. Load factors are affected both by wind conditions, which can differ between on and offshore sites, as well as the timing that the new capacity comes online³.

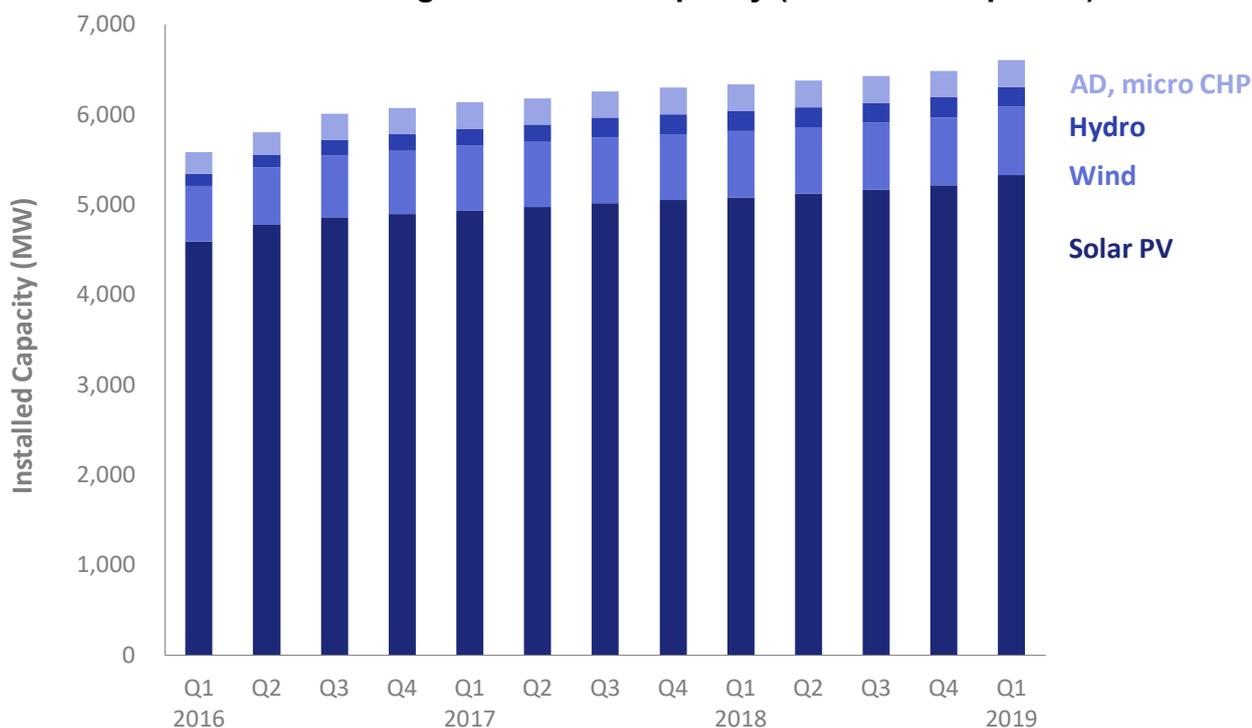
Hydro's load factor in 2019 Q3 increased by 12.6 percentage points, driven by an increase in average rainfall in the quarter of around 40 per cent.

For plant biomass, the load factor in 2019 Q3, at 60.3 per cent, was down by 4.6 percentage points on a year earlier. Generation was affected by an outage of a large plant biomass unit.

³ 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.

Renewables

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



The GB Feed in Tariff (FiT) scheme⁴ 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.

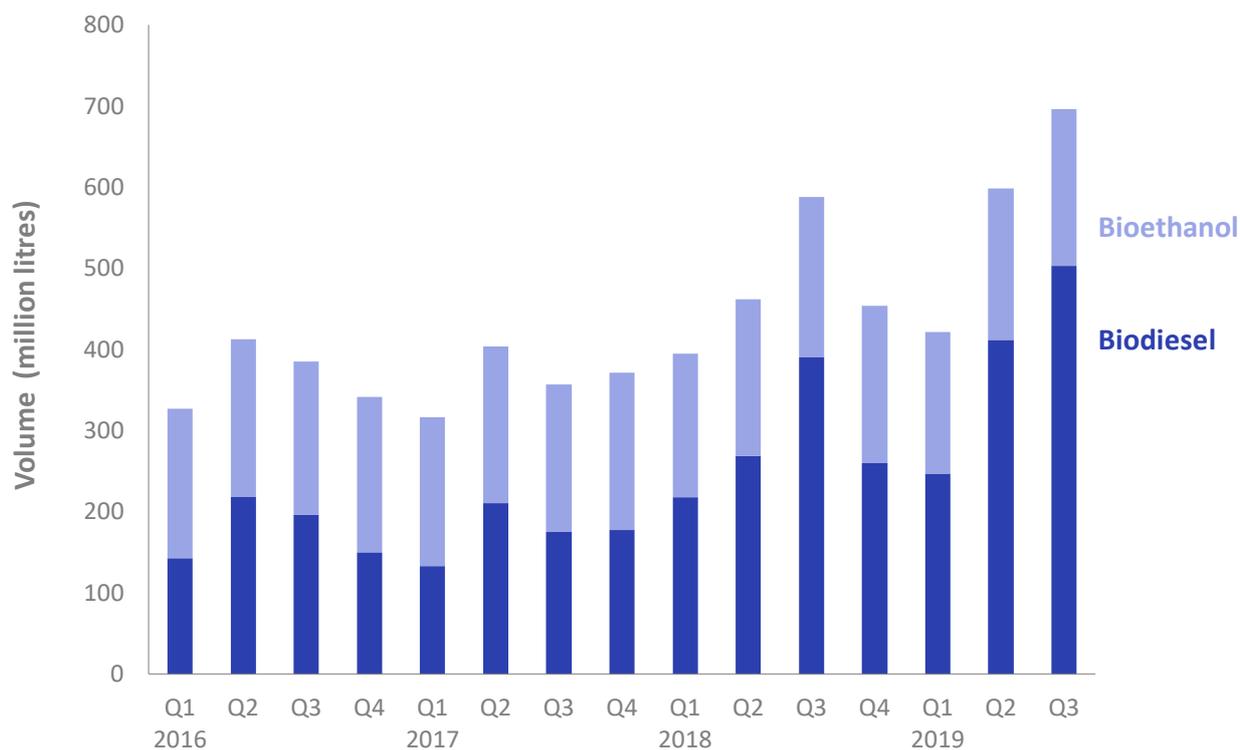
Solar photovoltaics (PVs) represent the majority of both installations and installed capacity on FiTs, with respectively 99 per cent and 81 per cent of the total. Nearly half of FiT-eligible PV installations are sub-4 kW retrofitted schemes, 2,596 MW (49 per cent) in 2019 Q1.

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

⁴ 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 third quarter of 2019, an estimated 696 million litres of liquid biofuels were consumed in transport, an increase of 18 per cent on the total of 588 million litres in the third quarter of 2018. This is 16 per cent greater than the previous record set last quarter.

Bioethanol consumption decreased by 2.2 per cent from 197 million litres in the third quarter of 2018 to 193 million litres. Biodiesel consumption increased by 29 per cent, from 391 million litres in 2018 to 504 million litres in 2019. This is 22 per cent more than the previous record set last quarter.

Bioethanol represented 28 per cent of biofuels consumption, with biodiesel accounting for the remaining 72 per cent.

In the third quarter of 2019, bioethanol accounted for 4.7 per cent of motor spirit, no significant change on this quarter last year. Biodiesel represented 6.5 per cent of diesel (DERV) consumption, an increase of 1.5 percentage points on this period last year. Their combined contribution increased by 0.9 percentage points to 5.8 per cent. The most recent two quarters have been the only ones in which more than 5 per cent of road fuel was from biofuel.

Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2015 to 2018

Introduction

This article shows how generation and consumption of electricity varies across the four countries of the United Kingdom. It updates and extends a previous version published in December 2018¹. The UK figures shown in this article are taken from chapters 5 and 6 of the Digest of United Kingdom Energy Statistics (DUKES) 2019² and so the definitions used are identical to those in the Digest. Tables 1 and 2 are included at the end of the main text and cover the last four years, with revised data for 2004 to 2017 available in the accompanying Excel spreadsheet.

Key points

- UK electricity generation in 2018 fell 1.6 per cent to 333 TWh, the lowest level on the published time series. This was predominantly driven by a 13 per cent drop in Welsh generation in 2018, the result of reductions in its gas and coal-fired electricity.
- The decreased generation was supplemented by net imports totalling 19.1 TWh. England received a net 19.1 TWh from France and the Netherlands, whilst Wales received 0.5 TWh from the Republic of Ireland and Northern Ireland exported 0.7 TWh to the Republic of Ireland.
- The share of electricity generation from coal fell across the UK in 2018 to a record low of just 5.1 per cent. In Northern Ireland coal-fired generation remained broadly similar to 2017 – at 14.2 per cent – whilst coal generation remained at zero in Scotland and dropped from 7.9 per cent to 1.5 per cent in Wales, and from 7.5 per cent to 6.1 per cent in England. The reduction in coal fired electricity is a continuing trend and is largely the result of market conditions and high carbon pricing which have reduced the profitability of coal generation relative to gas. The drop in England's generation was additionally aided by reductions in its capacity in 2018 following the closure of Eggborough Power station and the conversion of a unit at Drax to supply bioenergy.
- Renewables' share of generation rose in 2018 to 33.0 per cent, surpassing the record of 2017 by 3.8 percentage points. Scotland continued to have the highest share, where renewables were responsible for 54.9 per cent of generation. The rest of the UK also saw record shares of renewable generation, of 29.8 per cent for England (up 3.8 pp), 22.1 per cent for Wales (up 2.4 pp) and 42.3 per cent for Northern Ireland (up 8.7 pp). This jump in renewable generation came despite sub-optimal weather conditions for wind and hydro generators. The rise is subsequently the result of a 10 per cent increase in renewable capacity across the UK, which now accounts for 25 per cent of all generating capacity.

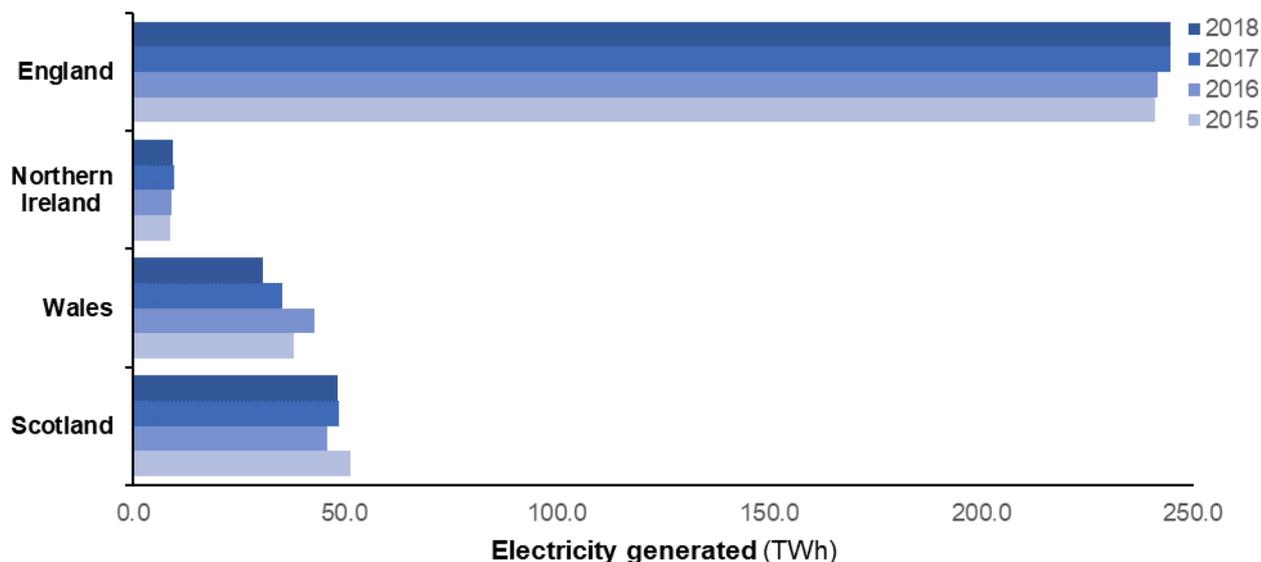
¹ Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2014 to 2017: www.gov.uk/government/publications/energy-trends-december-2018-special-feature-articles

² Digest of UK Energy Statistics (DUKES) 2019: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Generation, consumption and trade

Electricity generation within the UK decreased to 333 TWh in 2018, down 1.6 per cent on 2017 and its lowest level on the published time series. This follows a 4-year period from 2014 – 2017 where generation remained broadly stable at an average of 338 TWh. Chart 1 shows total generation of electricity in each UK country between 2015 and 2018.

Chart 1: Total generation by country (all generating companies) 2015 – 2018



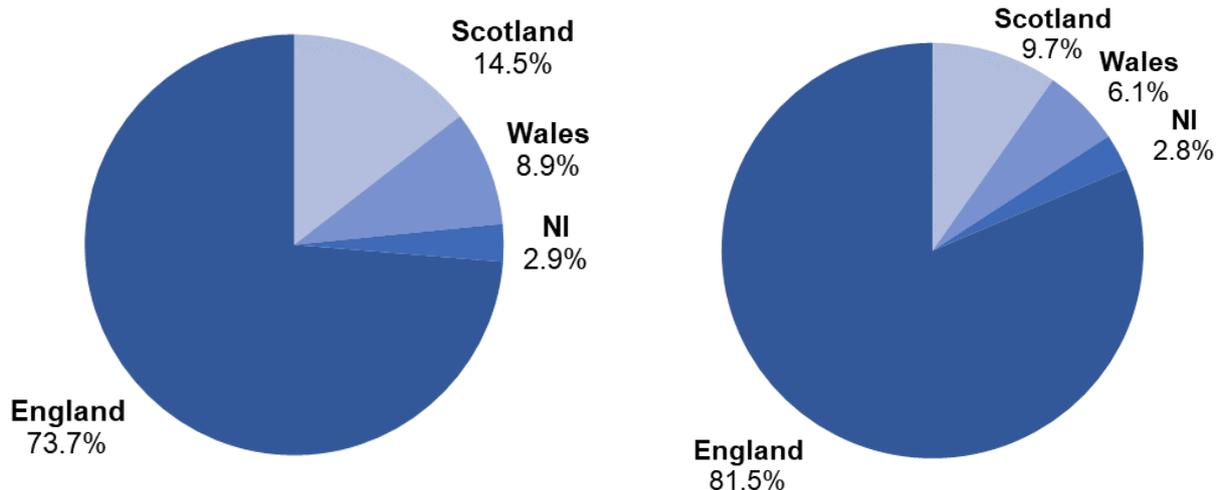
Generation within England in 2018 accounted for 73.5 per cent of the UK's total, up 1.1 percentage points (pp) on 2017 and its highest share of annual generation since 2012. This comes despite England's absolute generation remaining largely unchanged on 2017, as generation dropped in Wales (-13 pp) and Northern Ireland (-3.1 pp) and remained steady in Scotland. The rise in England's share of UK generation has been a continuing trend since 2015, when it reported its lowest generation on the published time series, 241 TWh. The large reduction in Welsh generation is the result of decreases in its coal and gas-fired generation, down 87 and 9 per cent respectively.

Shares of annual electricity consumption within the UK in 2018 did not significantly differ from 2017 with 81.5 per cent of electricity consumption occurring in England, 9.7 per cent in Scotland, 6.1 per cent in Wales and 2.8 per cent in Northern Ireland. This was similar to average shares over the 2015 – 17 period: 81.5 per cent, 9.8 per cent, 6.0 per cent and 2.7 per cent respectively. Chart 2 (below) shows the proportions of electricity supply and consumption figures in UK by region in 2018³.

Since 2010, England's electricity supply (generation minus own use at generating sites) has not met its demand (electricity consumed). Consequently, it received net positive transfers from both Scotland and Wales as well as net imports (imports minus exports) from continental Europe via the France and Netherlands interconnectors. In 2018, 16 per cent of total electricity consumed in England was provided by these sources, up 0.6pp on 2017.

³ As transmission and distribution losses are not separately available for Scotland, Wales, Northern Ireland and England, estimates have been made using the UK proportions for generation and sales. Consumption figures have then been calculated by deducting net transfers, own use, and losses figures from the electricity generated figures shown in Table 1. Separate data is collected for sales of electricity from the public supply system in Scotland, England and Wales, and Northern Ireland. This is published in monthly table ET 5.5 on the BEIS Energy Statistics website, but for this article the breakdown between England and Wales has been estimated. Because of definitional and other differences set out in the technical notes to Chapter 5 of DUKES 2019, there is a statistical difference between the calculated consumption and the sales data in Table 1. As part of its commitment to improving the quality of its statistics, BEIS continues to examine this statistical difference (-0.4 per cent for the UK in 2019) and look further at the component series to see where the differences might be arising and thus where improvements to the data might be made.

Chart 2: Electricity shares of supply (left) and demand (right) in the UK in 2018



In 2018, Scotland exported 28 per cent of its generation to consumers elsewhere in the UK (England and Northern Ireland), similar to transfers reported in 2017 of 27 per cent. This comes as generation remained steady in Scotland and total consumption decreased relative to 2017. Wales exported 27 per cent of its total generation to England in 2018, the lowest proportion since 2007 and the result of drops in Welsh coal and gas fired electricity generation. Wales started trading with the Republic of Ireland in 2012 and remained a net exporter of electricity until 2015. Since then it has been a net importer of electricity which totalled 0.5 TWh in 2018, 40 per cent lower than the previous year. Northern Ireland remained a net exporter to Ireland for the second consecutive year, exporting a net total of 0.5 TWh, over four times greater than the net exports of 2017. Northern Ireland also returned to receiving net positive electricity transfers from Scotland via the Moyle interconnector in 2018, accounting for a tenth of its consumption from public supply.

Net imports from Europe totalled 19.1 TWh in 2018, 29 per cent greater than 2017 but lower than 21.1 TWh in 2015. This accounted for 6.8 per cent of consumption from public supply in the UK, up from 5.2 per cent in 2017. This was predominantly driven by a 79 per cent rise in net imports from France to 12.9 TWh following a turbulent 2017 for the UK-France interconnector after repairs to the interconnector in Q1 of 2017 and a spike in French electricity prices in Q4 of 2017.

The share of electricity supply by generators other than Major Power Producers (MPPs) has steadily increased since 2013, reaching a new high of 15 per cent in 2018. This is a marginal increase on 2017 (less than 1 pp) and is driven largely by a 24 per cent rise in non-MPP supply in Northern Ireland. In Scotland, Wales and England generation by autogenerators is fairly consistent with 2017.

Generation by fuel

Chart 3 shows the fuel generation mix from 2015 – 2018 for each of the four UK countries.

Coal's share of UK generation has fallen significantly over the past 6 years, from 39.2 per cent in 2012 to a record low of just 5.1 per cent in 2018. This comes as the profitability of coal generation (relative to gas) continues to fall due to market conditions and high carbon pricing. UK coal capacity also continues to fall after the closure or partial closure of multiple coal plants that opted out of the Large Combustion Plant Directive (LCPD) and its successor, the Industrial Emissions Directive (IED). In 2018, the UK's coal capacity was significantly diminished following the closure of Eggborough power station (1960 MW) and the conversion of a unit at Drax to supply bioenergy (660 MW), both located in England. As a result, England's generation decreased 2pp in 2018, following two years of consistent generation. In Wales, an even larger drop was experienced (- 6pp) now providing a record low 1.5 per cent of its generation. Coal generation has remained zero in Scotland since the closure of its only remaining coal plant, Longannet, in March 2016.

The share of gas generation in the UK fell to 39.5 per cent in 2018, however there were increases in its share in Scotland (up 6.1 pp) and Wales (up 3.2 pp). In England, gas' share of generation decreased from 42.9 per cent in 2017 to 40.8 per cent, as higher renewable generation reduced the need for gas. This follows the 43 per cent jump in gas-fired generation in England between 2015 and 2016, as coal was replaced in the energy mix.

Nuclear generation fell in 2018 compared to the broadly stable levels of 2015, 2016 and 2017, providing only 19.5 per cent of the UK's annual generation. Whilst generation in England was consistent with 2017, the drop is associated with an increase in the number of maintenance outages at Scotland's two nuclear reactors. Consequently, its share of generation in Scotland dropped from 36.8 to 28.2 per cent. There has been no nuclear generation in Wales since the closure of Wylfa in December 2015.

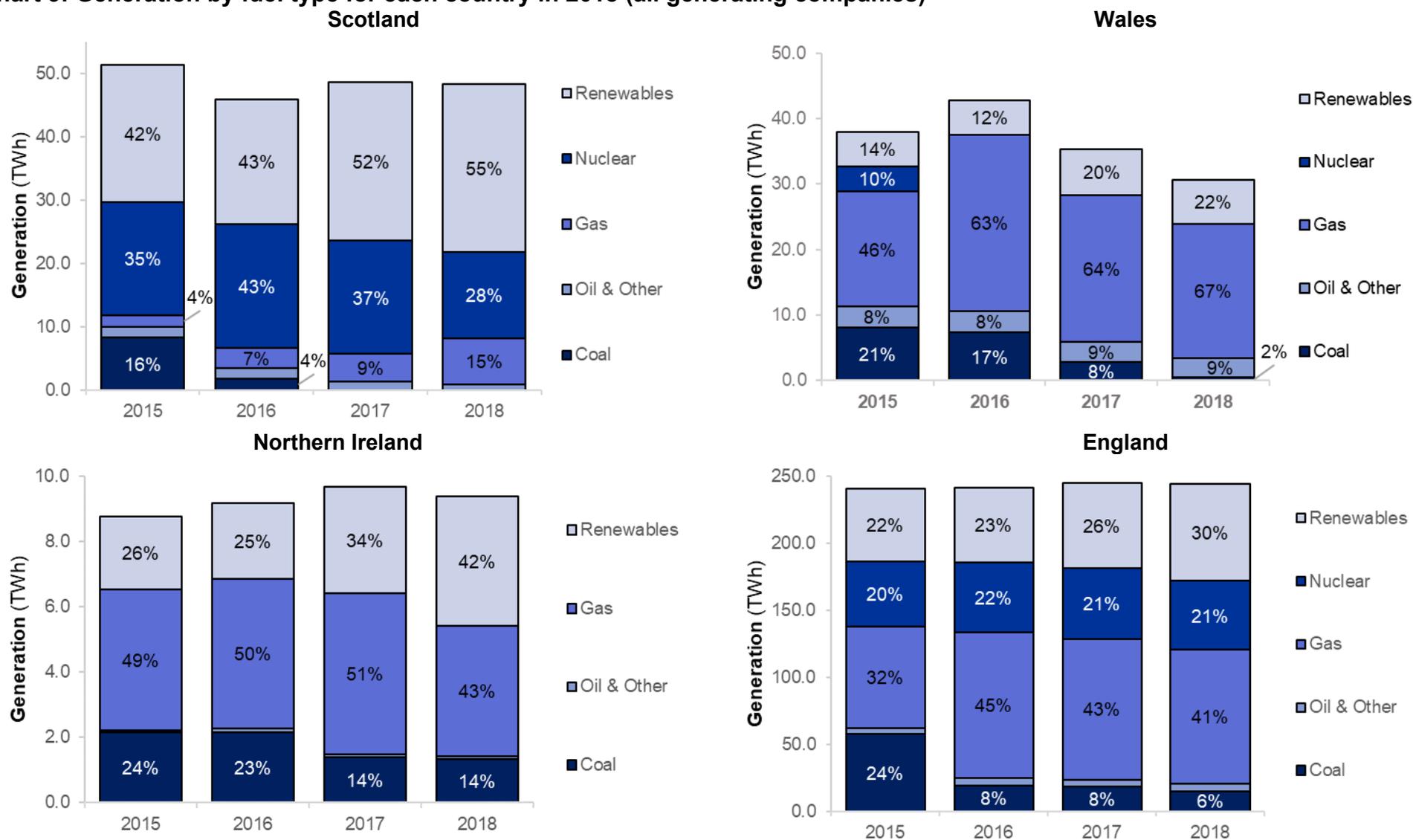
Renewable's share of generation in the UK rose to a new high of 33.0 per cent in 2018, driven by a 14 per cent increase in generation from wind and solar compared to 2017. These increases were largely the result of increases in wind and solar capacity, up 11 and 2.6 per cent respectively. Weather conditions for solar generators were particularly favourable, with 2018 reporting the greatest average sun hours since 2003. However, conditions for wind and hydro-generators were poorer in 2018, with both windspeeds and average rainfall down slightly on 2017 and more significantly on the 10-year averages. With wind generators providing the greatest source of electricity generation, the sub optimal conditions suggest that the full potential of the UK's increasing renewable capacity is yet to be realised. Bio energy also reported a 9.4 per cent rise in generation in 2018 following a 25 per cent increase in thermal renewable capacity due to the opening of Lynemouth Biomass plant (420 MW) and the conversion of another unit at Drax to supply bioenergy (660 MW).

All four countries saw record shares of renewable generation in 2018. In Scotland, renewables accounted for 54.9 per cent of generation, up 3.4 pp on 2017, whilst Wales saw a similar rise, up 2.4 pp to 22.1 per cent and Northern Ireland registered an 8.7 pp rise to 42.3 per cent. This came as the energy mix in all these countries moved away from coal towards renewable technologies. With large rises in renewable capacity in all three countries (up 10 per cent in Scotland, 5 per cent in Wales and 20 per cent in Northern Ireland⁴), renewable generation is now able to play a significant role in filling the gap left by coal, which only in 2014 accounted for 21.2 per cent of generation in Scotland, Wales and Northern Ireland. The increase in renewables' share in England was more significant than in previous years (up 3.8 pp to 29.8 per cent), as coal's share of generation decreased, and overall generation increased relative to 2017.

⁴ Renewable energy in Scotland, Wales, Northern Ireland and the regions of England in 2018 – Energy Trends September 2018, page 46:

www.gov.uk/government/publications/energy-trends-september-2019-special-feature-articles

Chart 3: Generation by fuel type for each country in 2018 (all generating companies)⁵

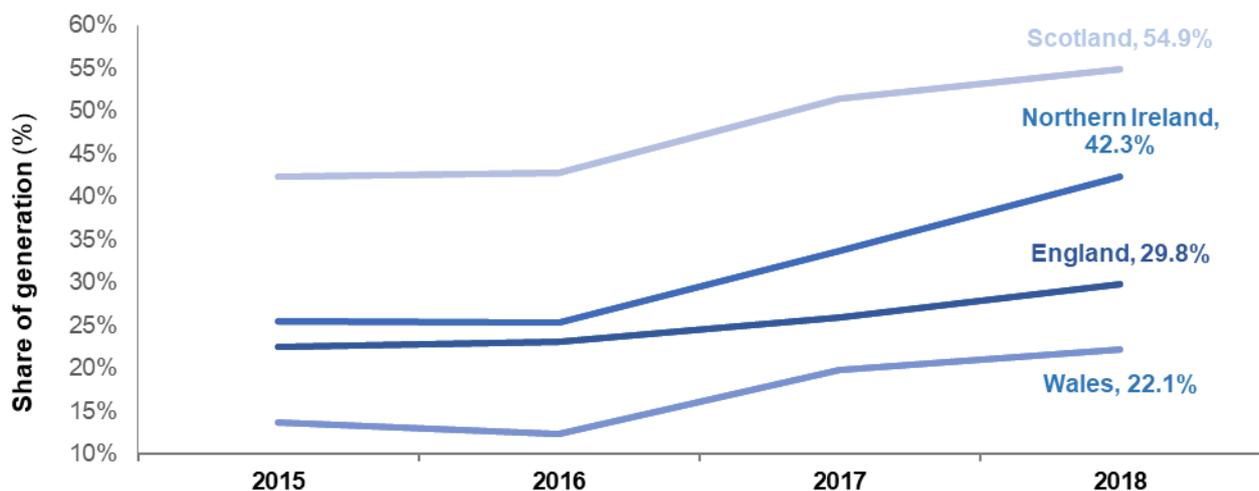


⁵ As the mix of generating plants varies by country, the fuel mix in individual years changes according to the competitiveness and availability of fuels and stations. 'Oil & Other' refers to oil, other fossil fuels and pumped hydro. Its share has been removed from Scotland, NI and England as it provides a relatively small and stable proportion of their generation.

Renewables

Chart 4 shows the share of renewable electricity by country for the four years from 2015 to 2018.⁶

Chart 4 : Renewable share of generation by country, 2015 to 2018



Renewable generation reached a record high in 2018 for the UK as a whole and in Scotland, Northern Ireland and England. This is largely the result of a 10 per cent rise in renewable capacity throughout the UK, from 40 GW at the end of 2017 to 44 GW at the end of 2018.

Within this 10 per cent rise in renewable capacity, Scotland's capacity rose by 10 per cent, Northern Ireland's 20 per cent, Wales' 5.0 per cent and England's 9.9 per cent. As a result, renewable generation in Scotland, Northern Ireland and England rose by 5.9, 22 and 14 per cent respectively. Welsh generation was down on 2017, though this is thought to be the result of the lower average wind speeds in 2018 as the bulk of Wales renewable generation comes from onshore wind. Despite this, renewables share of electricity generated in Wales is up on 2017 to a record level, 22.1 per cent.

In Scotland, the renewables target to reach 100 per cent by 2020 is expressed as generation as a proportion of gross electricity consumption (defined as generation plus transfers into Scotland less transfers out of Scotland). In 2018, Scotland reached a record 76.2 per cent of the renewable target, up 6.1 pp on 2017 and now 17 pp on the 2015.

Detailed renewables statistics for 2018 on a sub-national and regional basis were published in the September 2019 issue of Energy Trends⁷.

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⁶ Note previous editions of this article included a discussion of the percentage of electricity sales accounted for by renewables eligible under the Renewables Obligation (RO). This is no longer included given that the RO closed to new generating capacity in March 2017 with the last grace period expiring in September 2018. However, for reference, the amount of electricity generated by renewables eligible under the RO is still included in Table 2.

⁷ Renewable energy in Scotland, Wales, Northern Ireland and the regions of England in 2018 – Energy Trends September 2018, page 46:

www.gov.uk/government/publications/energy-trends-september-2019-special-feature-articles

Revisions

In versions of this article before 2018, generation from small-scale biodegradable waste was not separated from non-biodegradable waste and so was classified as 'other' in the percentage shares of generation. In order to match the definitions given in DUKES, this generation has been reallocated to 'thermal renewables', with revisions made back to 2010.

Previous versions of the figures remain available online for comparison at:

www.gov.uk/government/collections/energy-trends-articles

References

Digest of UK Energy Statistics 2019 (DUKES); available on BEIS's energy statistics website at:

www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes

Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2014 to 2017:

www.gov.uk/government/publications/energy-trends-december-2018-special-feature-articles

Capacity of, and electricity generated from, renewable sources (Energy Trends 6.1):

www.gov.uk/government/statistics/energy-trends-section-6-renewables

Renewable energy in Scotland, Wales, Northern Ireland and the regions of England in 2018 – Energy Trends September 2019, page 46:

www.gov.uk/government/publications/energy-trends-september-2019-special-feature-articles

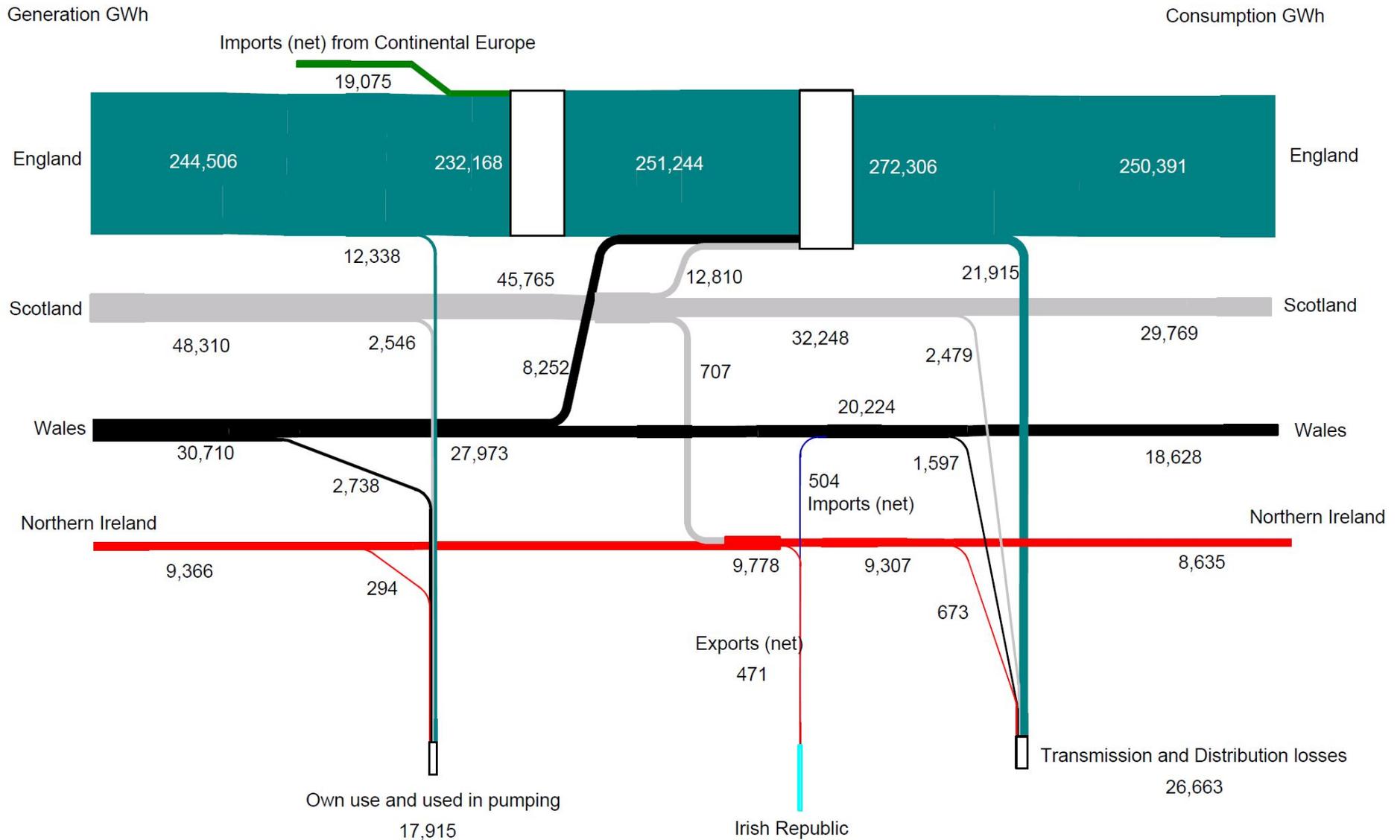
Energy Trends monthly table 5.5:

www.gov.uk/government/statistics/electricity-section-5-energy-trends

Energy Trends: weather

www.gov.uk/government/statistics/energy-trends-section-7-weather

Chart 5: Electricity generation and consumption flow chart, 2018



Special feature – Sub national electricity figures

Table 1: Generation and supply of electricity in Scotland, Wales, Northern Ireland and England, 2015 & 2016		<i>GWh</i>									
		2015					2016				
		UK total	Scotland	Wales	Northern Ireland	England	UK total	Scotland	Wales	Northern Ireland	England
Generated by	Major power producers	295,991	43,714	34,457	7,066	210,754	292,943	38,138	39,302	7,358	208,146
	Other generators	42,885	7,622	3,469	1,695	30,099	46,247	7,636	3,513	1,817	33,281
Total generated		338,875	51,335	37,926	8,761	240,853	339,191	45,774	42,814	9,175	241,428
Own use by Other generators		2,834	343	206	57	2,227	2,922	340	185	87	2,311
Electricity supplied (net) by Other generators		40,051	7,278	3,263	1,637	27,872	43,325	7,296	3,328	1,731	30,970
Used in pumping at pumped storage and other own use by MPPs		17,529	2,836	4,430	192	10,070	16,361	2,624	4,241	195	9,302
Electricity supplied (net) by MPPs		278,462	40,877	30,027	6,874	200,684	276,582	35,514	35,061	7,163	198,844
Electricity transferred to England (net of receipts)		-	14,598	13,372	-	-27,970	-	9,639	18,523	-	-28,162
Electricity transferred to Northern Ireland (net of receipts)		-	191	-	-191	-	-	-252	-	252	-
Electricity transferred to Europe (net of receipts)		-21,106	-	1,065	-334	-21,837	-17,745	-	-313	-399	-17,034
Transfers from other generators to public supply		19,057	3,463	1,553	779	13,262	20,400	3,435	1,567	815	14,582
Transmission losses		7,234	630	376	179	6,049	6,233	553	357	155	5,168
Distribution losses and theft		20,063	1,834	1,082	515	16,632	19,855	1,902	1,168	512	16,272
Consumption from public supply [A]		291,328	27,088	15,683	7,485	241,072	288,639	27,107	16,892	7,458	237,182
Consumption by autogenerators		20,993	3,815	1,711	858	14,610	22,925	3,861	1,761	916	16,388
Total electricity consumption		312,321	30,903	17,394	8,343	255,681	311,564	30,968	18,653	8,374	253,570
Electricity sales (public supply) [B]		290,039	26,508	15,642	7,446	240,442	288,331	27,771	16,970	7,312	236,277
Statistical difference between calculated consumption [A] and sales [B]		1,289	579	41	39	630	308	-664	-78	146	905

Table 1: Generation and supply of electricity in Scotland, Wales, Northern Ireland and England, 2017 & 2018							<i>GWh</i>				
		2017					2018				
		UK total	Scotland	Wales	Northern Ireland	England	UK total	Scotland	Wales	Northern Ireland	England
Generated by	Major power producers	287,745	39,937	31,343	7,182	209,283	281,356	39,613	26,830	6,279	208,634
	Other generators	50,428	8,566	3,972	2,480	35,410	51,536	8,623	3,880	3,087	35,946
Total generated		338,172	48,503	35,315	9,662	244,693	332,893	48,236	30,710	9,366	244,580
Own use by Other generators		3,760	474	264	123	2,899	4,335	649	331	154	3,202
Electricity supplied (net) by Other generators		46,668	8,092	3,708	2,357	32,510	47,201	7,974	3,550	2,933	32,744
Used in pumping at pumped storage and other own use by MPPs		15,520	2,478	3,703	163	9,176	13,580	1,881	2,407	140	9,152
Electricity supplied (net) by MPPs		272,225	37,459	27,640	7,019	200,107	267,776	37,733	24,423	6,138	199,483
Electricity transferred to England (net of receipts)		-	13,013	11,490	-	-24,503	0	12,810	8,252	0	-21,062
Electricity transferred to Northern Ireland (net of receipts)		-	-145	-	145	-	0	707	0	-707	0
Electricity transferred to Europe (net of receipts)		-14,760	-	-831	110	-14,039	-19,108	0	-504	471	-19,075
Transfers from other generators to public supply		21,544	3,736	1,712	1,088	15,008	22,245	3,758	1,673	1,382	15,431
Transmission losses		6,497	557	384	153	5,403	6,497	548	378	144	5,427
Distribution losses and theft		20,021	1,785	1,219	528	16,488	20,166	1,930	1,219	528	16,488
Consumption from public supply [A]		282,011	25,985	17,089	7,171	231,766	282,466	25,495	16,750	7,084	233,136
Consumption by autogenerators		25,124	4,356	1,996	1,269	17,502	24,956	4,216	1,877	1,551	17,312
Total electricity consumption		307,134	30,341	19,085	8,440	249,268	307,422	29,711	18,627	8,635	250,449
Electricity sales (public supply) [B]		281,641	24,899	17,123	7,389	232,230	281,612	23,552	16,760	8,034	233,266
Statistical difference between calculated consumption [A] and sales [B]		370	1,085	-34	-218	-464	854	1,943	-9	-950	-130

Figures in this table do not sum exactly to the UK totals shown because of rounding.

Special feature – Sub national electricity figures

		2015					2016					GWh
		UK total	Scotland	Wales	Northern Ireland	England	UK total	Scotland	Wales	Northern Ireland	England	
Major power producers:	Coal	75,812	8,275	8,153	2,102	57,283	30,613	1,806	7,316	2,107	19,384	
	Oil	683	188	163	42	290	606	156	180	68	201	
	Gas	88,461	126	16,859	4,187	67,289	131,972	1,523	26,092	4,489	99,868	
	Nuclear	70,345	17,763	3,887	0	48,696	71,726	19,630	0	0	52,096	
	Thermal renewables	17,694	789	7	0	16,898	17,400	756	33	0	16,611	
	Other thermal	689	0	0	0	689	968	0	0	0	968	
	Hydro natural flow	4,907	4,605	273	0	28	3,951	3,692	235	0	25	
	Hydro pumped storage	2,739	523	2,217	0	0	2,959	486	2,474	0	0	
	Non-thermal renewables	34,662	11,445	2,899	735	19,582	32,748	10,089	2,972	694	18,993	
	Total	295,991	43,714	34,457	7,066	210,754	292,943	38,138	39,302	7,358	208,146	
Other Generators:	Coal	66	0	0	38	28	56	0	0	36	20	
	Oil	1,354	693	30	40	592	1,285	527	36	42	679	
	Gas	11,415	1,793	693	115	8,814	11,384	1,618	804	108	8,854	
	Thermal renewables ¹	11,563	1,075	748	270	9,471	12,549	1,142	691	456	10,261	
	Other thermal	2,054	207	594	0	1,252	2,834	432	544	7	1,850	
	Hydro natural flow	1,391	1,209	78	29	74	1,443	1,248	86	24	86	
	Non-thermal renewables	13,148	2,620	1,193	1,204	8,131	14,926	2,644	1,238	1,145	9,898	
	Non-biodegradable wastes	1,894	26	132	0	1,735	1,771	25	113	0	1,633	
Total	42,885	7,622	3,469	1,695	30,099	46,247	7,636	3,513	1,817	33,281		
Total generation		338,875	51,335	37,926	8,761	240,853	339,191	45,774	42,814	9,175	241,428	
within which:	Renewables											
	Hydro natural flow	6,297	5,814	352	29	103	5,394	4,939	321	24	110	
	Wind, wave, solar	47,810	14,065	4,092	1,939	27,714	47,674	12,734	4,210	1,839	28,891	
	Thermal	29,257	1,864	755	270	26,369	29,950	1,898	724	456	26,872	
	Total	83,364	21,743	5,199	2,237	54,185	83,017	19,570	5,255	2,318	55,873	
Renewables eligible under the renewables obligation		68,134	17,078	4,212	2,116	44,728	63,241	14,098	4,060	1,937	43,146	
Percentage shares of generation:	Coal	22.4%	16.1%	21.5%	24.4%	23.8%	9.0%	3.9%	17.1%	23.4%	8.0%	
	Oil	0.6%	1.7%	0.5%	0.9%	0.4%	0.6%	1.5%	0.5%	1.2%	0.4%	
	Gas	29.5%	3.7%	46.3%	49.1%	31.6%	42.3%	6.9%	62.8%	50.1%	45.0%	
	Nuclear	20.8%	34.6%	10.2%	0.0%	20.2%	21.1%	42.9%	0.0%	0.0%	21.6%	
	Hydro natural flow	1.9%	11.3%	0.9%	0.3%	0.0%	1.6%	10.8%	0.7%	0.3%	0.0%	
	Other renewables	22.7%	31.0%	12.8%	25.2%	22.5%	22.9%	32.0%	11.5%	25.0%	23.1%	
	Other	2.2%	1.5%	7.8%	0.0%	1.5%	2.5%	2.1%	7.3%	0.1%	1.8%	
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

		2017					2018				
		UK total	Scotland	Wales	Northern Ireland	England	UK total	Scotland	Wales	Northern Ireland	England
Major power producers:	Coal	22,481	0	2,780	1,361	18,339	16,778	0	473	1,303	15,003
	Oil	390	120	54	59	156	625	121	34	43	426
	Gas	124,512	2,547	21,707	4,815	95,445	119,632	5,234	19,724	3,868	90,806
	Nuclear	70,336	17,827	0	0	52,509	65,064	13,611	0	0	51,453
	Thermal renewables	17,766	880	19	0	16,866	19,965	691	1	0	19,273
	Other thermal	1,276	0	0	0	1,276	1,132	0	0	0	1,132
	Hydro natural flow	4,179	3,890	276	0	12	3,826	3,597	208	0	21
	Hydro pumped storage	2,872	573	2,299	0	0	2,498	454	2,045	0	0
	Non-thermal renewables	43,933	14,099	4,207	948	24,679	51,836	15,905	4,345	1065	30,522
	Total	287,745	39,937	31,343	7,182	209,283	281,356	39,613	26,830	6,279	208,634
Other Generators:	Coal	49	0	0	28	21	53	0	0	32	21
	Oil	1,225	543	42	39	601	438	183	49	39	167
	Gas	12,233	1,786	768	106	9,573	11,857	2,028	816	116	8,898
	Thermal renewables ¹	14,013	1,568	858	548	11,039	14,794	1,443	996	635	11,720
	Other thermal	1,903	79	569	0	1,255	2,289	96	501	0	1,692
	Hydro natural flow	1,723	1,439	141	30	113	1,663	1,406	124	30	103
	Non-thermal renewables	17,180	3,115	1,464	1,729	10,872	17,935	3,431	1,119	2,235	11,150
	Non-biodegradable wastes	2,102	37	129	0	1,936	2,507	37	276	0	2,194
Total	50,428	8,566	3,972	2,480	35,410	51,536	8,623	3,880	3,087	35,946	
Total generation	338,172	48,503	35,315	9,662	244,693	332,893	48,236	30,710	9,366	244,580	
within which: Renewables	Hydro natural flow	5,902	5,330	417	30	125	5,490	5,003	333	30	124
	Wind, wave, solar	61,113	17,214	5,672	2,677	35,551	69,771	19,336	5,463	3,300	41,672
	Thermal	31,778	2,448	877	548	27,906	34,758	2,134	997	635	30,993
	Total	98,793	24,991	6,966	3,254	63,582	110,019	26,472	6,793	3,964	72,788
Renewables eligible under the renewables obligation	17,631	4,552	1,404	602	11,073	17,631	4,552	1,404	602	11,073	
Percentage shares of generation:	Coal	6.7%	0.0%	7.9%	14.4%	7.5%	5.1%	0.0%	1.5%	14.2%	6.1%
	Oil	0.5%	1.4%	0.3%	1.0%	0.3%	0.3%	0.6%	0.3%	0.9%	0.2%
	Gas	40.4%	8.9%	63.6%	50.9%	42.9%	39.5%	15.1%	66.9%	42.5%	40.8%
	Nuclear	20.8%	36.8%	0.0%	0.0%	21.5%	19.5%	28.2%	0.0%	0.0%	21.0%
	Hydro natural flow	1.7%	11.0%	1.2%	0.3%	0.1%	1.6%	10.4%	1.1%	0.3%	0.1%
	Other renewables	27.5%	40.5%	18.5%	33.4%	25.9%	31.4%	44.5%	21.0%	42.0%	29.7%
	Other	2.4%	1.4%	8.5%	0.0%	1.8%	2.5%	1.2%	9.2%	0.0%	2.1%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figures in this table do not sum exactly to the UK totals shown because of rounding.

Feed-in Tariff load factor analysis

Introduction

This article updates the Feed-in Tariff (FIT) load factor analysis presented in the December 2018 edition of Energy Trends¹ with data for FIT year nine (financial year 2018/19). We also present regional analysis of solar PV for the eight years that data has been published (FIT years two to nine) and wind for years five to nine. All the data in this article is also available in Excel format at the following link, including quarterly load factors for solar PV:

www.gov.uk/government/statistics/quarterly-and-annual-load-factors

Background

Load factors are a measure of the efficiency of electricity generation. A load factor is defined as the ratio of how much electricity was generated over a certain time period as a proportion of the total generating capacity.

The Feed-in Tariff scheme was launched in April 2010. It is a financial support scheme for eligible low-carbon electricity technologies, aimed at small-scale installations. The following technologies are supported:

- Solar photovoltaic (PV; Up to 5 MW capacity)
- Anaerobic digestion (AD; Up to 5 MW capacity)
- Hydro (Up to 5 MW capacity)
- Wind (Up to 5 MW capacity)
- Micro combined heat and power (MicroCHP; Up to 2 kW capacity)

Installers receive support through generation and export tariffs, paid directly from electricity suppliers. The generation tariff is based on the number of kilowatt hours (kWh) generated whereas the export tariff is based on electricity that is generated on site, not used and exported back to the grid.

Since the start of the scheme, BEIS² has provided regular updates on the number and capacity of installations installed under the scheme, currently publishing quarterly updates on deployment levels and reports on geographical distribution, amongst other outputs³. From 2013, BEIS obtained meter readings for registered installations from Energy Suppliers and used this to produce quarterly and annual load factors for FIT years two to nine (data from year one is not available as the number of installations running for the full year was very small).

The FIT scheme closed to new entrants at the end of March 2019.

Methodology

The methodology used for the load factor analysis was described in detail in an Energy Trends article from September 2014⁴. One additional quality assurance (QA) step has been added since 2015, to remove any installations from the analysis where more than one generation meter is attached. This step has only been applied to FIT year five to nine data; previously produced statistics have not been

¹ The article published in December 2018 can be found at the following link: www.gov.uk/government/publications/energy-trends-december-2018-special-feature-articles

² Department for Business, Energy & Industrial Strategy. FITs was overseen by the Department for Energy & Climate Change (DECC) until machinery of government changes in 2016.

³ See this link for the full FIT statistics collection: www.gov.uk/government/collections/feed-in-tariff-statistics

⁴ The article published in September 2014 can be found at the following link: www.gov.uk/government/statistics/energy-trends-september-2014-special-feature-article-analysis-of-feed-in-tariff-generation-data

revised. Whilst all efforts have been made to quality assure the data in this publication, the results are based on a sample.

Table 1 shows how many installations were registered on the Central Feed-in Tariff Register at the start of FIT year nine and how many installations had meter readings in March 2018 and 2019. For this analysis a meter reading is required in both of these months in order to cover the whole financial year and remove seasonal effects which would otherwise bias the results. As generators can submit meter readings throughout the year, of the 829,370 schemes registered for FITs as of 1st April 2018, 22 per cent were found to have meter readings in both March 2018 and March 2019. Extreme load factor values were further excluded (as in previous years' analysis), accounting for around 11,533 (5.9%) of installations. The column 'Valid load factor' in Table 1 indicates how many installations were included in the final analysis for each technology for the annual generation data. Micro CHP data is included in the main results, but this data must be treated with caution as the number of installations remains low.

Table 1: Installations included in analysis by technology – FIT Year 9

Technology	Commissioned by 1st April 2018	Generation Data Reported*	Valid load factor	% remaining in analysis
Anaerobic digestion	417	127	111	27%
Hydro	1,153	231	204	18%
Micro CHP	490	40	21	4%
Photovoltaic	819,816	192,979	181,693	22%
Wind	7,494	1,997	1,812	24%
All Technologies	829,370	195,374	183,841	22%

* Meter reading in March 2018 and March 2019.

Results

Table 2 gives the weighted mean and median load factors as well as associated percentiles for each technology. Chart 1 presents this data across all available years (FITs years two to nine), highlighting the large range present for Hydro compared to other technologies, whilst solar installations have the smallest range of load factors.

Table 2: FIT Year 9 (2018/2019) load factors by technology

Technology	Count	Mean	Weighted mean	Percentile				
				5 th	25 th	50 th (median)	75 th	95 th
Anaerobic digestion	111	80.2	75.9	35.5	71.6	87.2	95.3	98.5
Hydro	204	38.6	36.4	17.1	28.3	37.1	46.4	66.1
Micro CHP	21	14.8	17.5	6.0	8.9	10.0	15.5	24.1
Photovoltaic	181,693	10.4	10.5	7.5	9.4	10.5	11.4	12.6
Wind	1,812	21.5	26.0	7.7	14.2	20.4	27.4	39.7

The median load factor for Solar PV in 2018/19 was the highest since 2011/12 at 10.5%. This increase can be attributed to an increase in average daily sun hours from 4.1 hours to 4.9 hours⁵. Load factors were at a similar level to 2011/12 despite sun hours being up. However, there was a much smaller sample in 2011/12 so comparisons should be made with caution. It is also possible

⁵ Energy Trends section 7: weather, table 7.3: www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2018/19 is provisional and subject to revision.

Special feature – FiT load factor analysis

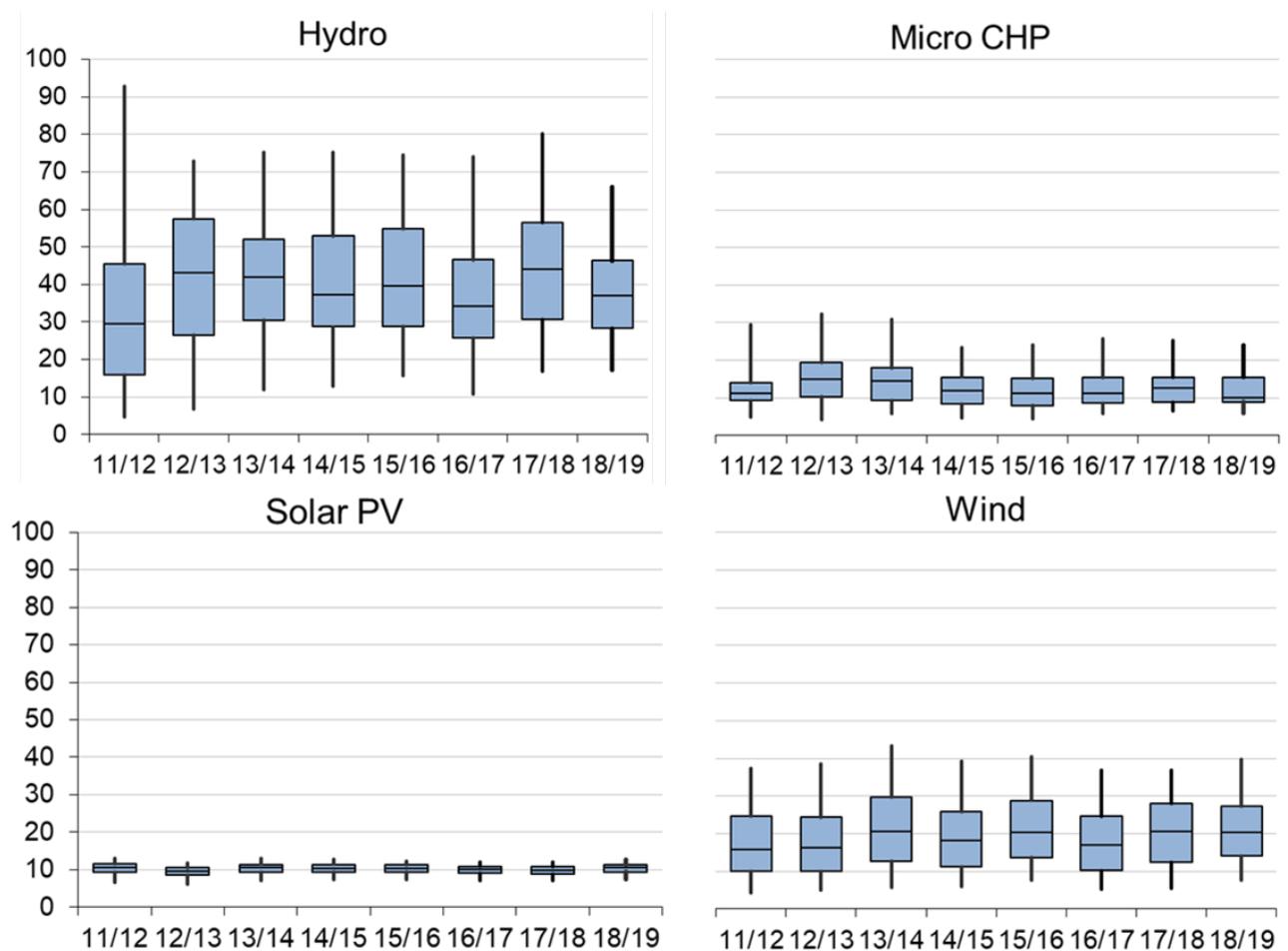
that the average age of solar panels was older in 2018/19 and there is some evidence that the efficiency of solar panels degrades over time.

Table 3: Solar PV load factors and average sun index

Year	Median load factor	Average daily sun hours
2011/12	10.5	4.5
2012/13	9.6	3.7
2013/14	10.4	4.5
2014/15	10.4	4.5
2015/16	10.4	4.3
2016/17	10.1	4.2
2017/18	9.8	4.1
2018/19	10.5	4.9

Chart 1: Load factor range by technology and year

Lines indicate range from 5th to 95th percentile. Boxes indicate range from lower to upper quartile (25th to 75th percentile) with median indicated.



As in previous years, the weighted mean load factor for wind installations is higher than the mean (see Table 2), and this difference has generally increased over the time-series, possibly reflecting the increase in the number of higher performing larger wind schemes in the analysis. The relationship between average daily wind speed⁶ and load factor for wind installations is weaker than that observed between sun hours and solar load factors (see Table 4). For 2018/19 the median load factor decreased slightly to 20.4% compared to 20.5% in 2017/18. This decrease reflects the decrease in average wind speed (see Table 4). Load factors for wind vary much more than those for solar PV, Chart 1 (above) shows that there is a much wider spread between the lower and upper quartiles for wind but these ranges overlap from year to year. This may be because the wind farms that are on FITs are on average much smaller than major power producers and they may not be located in the optimum position for wind generation.

There is a relationship between wind speed and wind load factors. However, wind speeds are measured at ground level which may vary with the wind speed at the level of the wind turbine. The average wind speed quoted here is for the whole of the UK, however, wind speed varies by location.

Table 4: Wind load factors and average wind speed

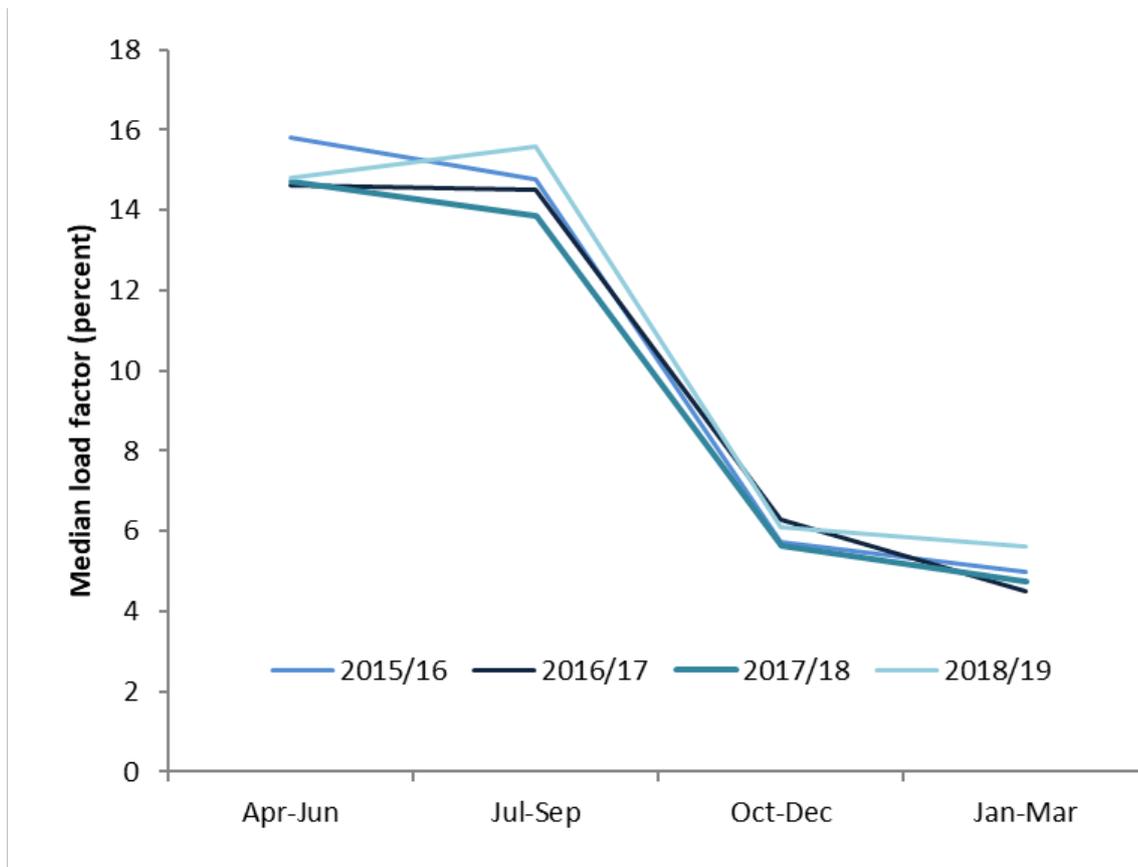
Year	Median load factor	Average wind speed (knots)
2011/12	15.9	9.2
2012/13	16.3	8.0
2013/14	20.5	9.3
2014/15	18.1	8.6
2015/16	20.3	9.2
2016/17	17.0	8.2
2017/18	20.5	8.8
2018/19	20.4	8.4

Solar PV load factors

Quarterly load factors for Solar PV installations are available in the accompanying excel workbook and the last four years are presented graphically in Chart 2. These show an expected association between load factor and daily hours of sunshine, where the quarters mainly covering Autumn and Winter have the lowest load factors. This chart also highlights that the high annual load factors seen in FIT year nine (2018/19) for Solar PV are driven by high sun levels and load factors in all four quarters, most significantly in the summer quarter (Jul-Sep).

⁶ Average wind speed taken from Energy Trends section 7: weather, table 7.2 " Average wind speed and deviations from the long term mean (ET 7.2)" www.gov.uk/government/statistics/energy-trends-section-7-weather. Note that data for 2018/19 are provisional and subject to revision.

Chart 2: Quarterly Solar PV load factors by FIT year



Regional Solar PV load factors

Solar PV Factors for each region have been published for FIT years two to eight and are updated with data from year nine in Table 5. Chart 3 highlights that the lowest load factors are seen in Scotland, while the highest are seen in the South East. For year nine (2018/19), in each region, the load factors are higher than in the preceding two years, reflecting the increase in average daily sun hours. Furthermore, the load factors are the highest since records began in FIT year two for Scotland and six of the nine English regions. London again has a lower load factor than the South East which may be due to pollution or particles settling on the panels or because panels are shaded by tall buildings nearby.

Chart 3: Regional Solar PV load factors for FITs years 2-9

Annual PV Load Factors by Region

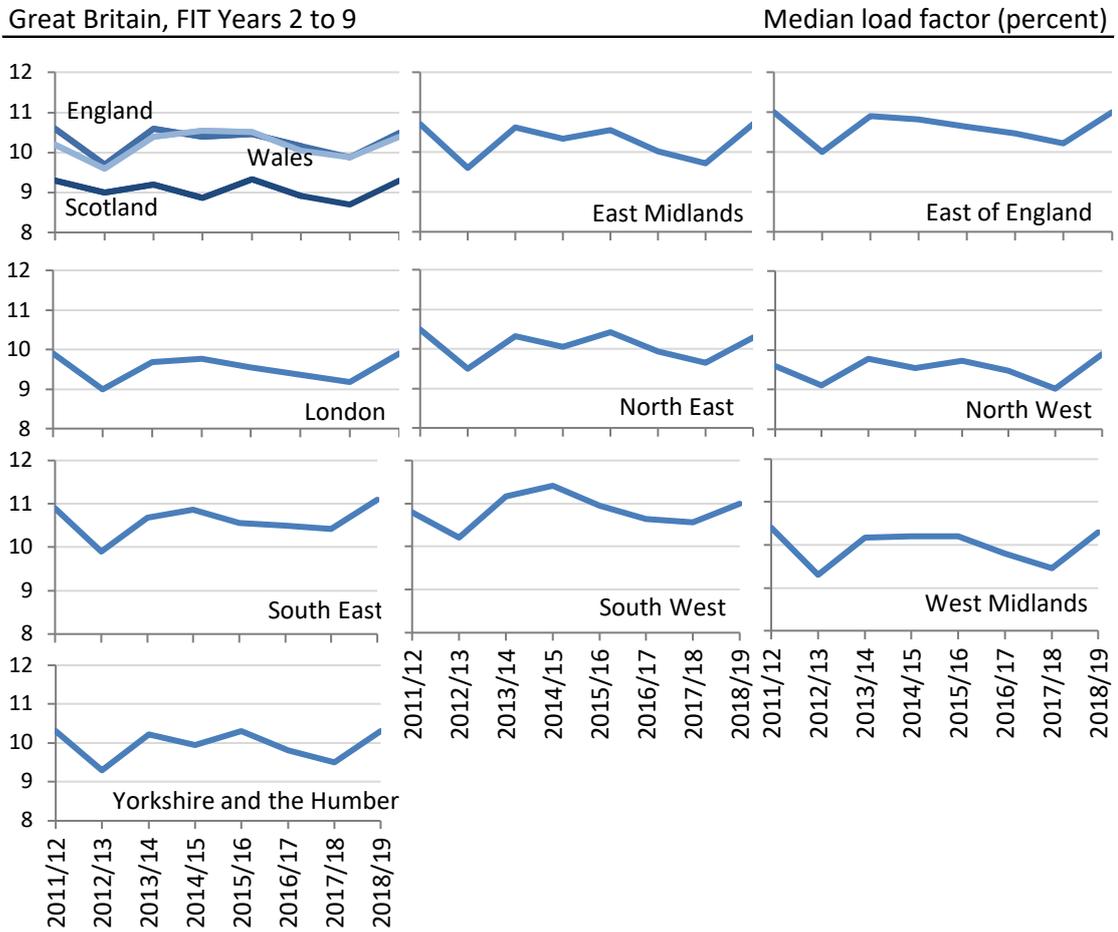


Table 5: Regional Solar PV load factors for FITs years 4-9

Region	FIT Year 4 (2013/14)		FIT Year 5 (2014/15)		FIT Year 6 (2015/16)		FIT Year 7 (2016/17)		FIT Year 8 (2017/18)		FIT Year 9 (2018/19)	
	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median
North East	5,805	10.3	8,023	10.1	6,444	10.4	5,595	9.9	9,625	9.7	8,086	10.3
North West	13,024	9.8	17,360	9.5	13,689	9.7	11,546	9.5	19,736	9	21,398	9.9
Yorkshire and the Humber	11,299	10.2	18,507	9.9	15,058	10.3	12,826	9.8	19,339	9.5	15,866	10.3
East Midlands	12,936	10.6	18,735	10.3	13,489	10.5	11,548	10	19,023	9.7	16,041	10.7
West Midlands	11,118	10.2	15,312	10.2	12,013	10.2	10,219	9.8	13,946	9.5	11,843	10.3
East of England	16,306	10.9	21,247	10.8	16,917	10.6	14,308	10.5	22,240	10.2	26,783	11
London	4,117	9.7	4,996	9.8	3,813	9.6	3,240	9.4	4,852	9.2	4,027	9.9
South East	23,235	10.7	25,994	10.9	18,955	10.6	15,632	10.5	24,933	10.4	21,379	11.1
South West	31,965	11.2	36,938	11.4	29,331	11	25,715	10.6	36,357	10.6	32,044	11
England	129,805	10.6	167,112	10.4	129,709	10.5	110,629	10.2	170,137	9.9	157,467	10.5
Scotland	11,531	9.2	11,363	8.9	6,802	9.3	5,731	8.9	11,036	8.7	11,681	9.5
Wales	13,643	10.4	15,100	10.5	11,614	10.5	9,946	10.0	14,598	9.9	12,545	10.4

Regional Wind load factors

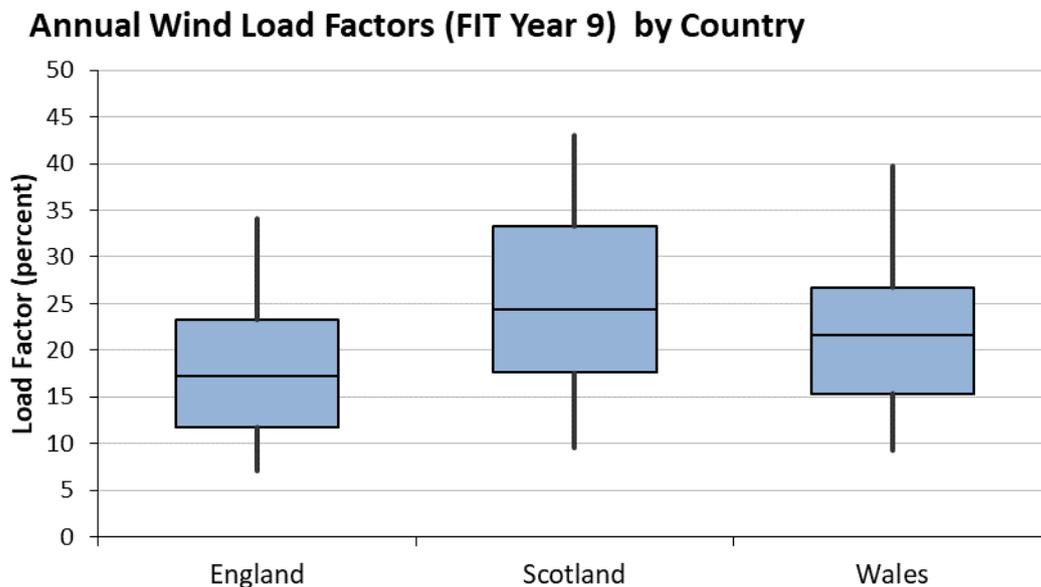
Regional load factors for Wind schemes for FIT years six to nine have also been produced; these are presented in Table 6. Data from London and the South East have been aggregated as there was a low number of installations within these regions with a valid load factor. Chart 4 summarises this data for England, Scotland and Wales, showing that the highest Wind load factors are found in Scotland.

Table 6: Regional Wind load factors for FITs years 6 to 9

Region	FIT Year 6 (2015/16)		FIT Year 7 (2016/17)		FIT Year 8 (2017/18)		FIT Year 9 (2018/19)	
	Count	Median	Count	Median	Count	Median	Count	Median
North East	73	17.5	67	14.2	63	18.5	60	17.8
North West	137	23.6	129	18.9	90	18.8	133	20.6
Yorkshire and the Humber	318	20.8	321	17	161	19.7	313	17.9
East Midlands	123	17.5	134	13.6	60	18.9	132	17
West Midlands	63	17.1	63	13.6	38	11.1	56	12.2
East of England	405	13	361	8.6	74	16	73	17.8
London and South East	23	12.1	18	10.2	16	8	9	14
South West	296	25.7	276	20.6	166	20.2	284	20.2
England	1,438	18.2	1,369	14.6	668	18.3	1,060	17.2
Scotland	469	25.6	436	24.0	360	23.5	546	24.4
Wales	178	24.4	192	20.4	85	20.6	206	21.6

Chart 4: Wind regional load factors for FITs year 9 by country

Lines indicate range from 5th to 95th percentile. Boxes indicate range from lower to upper quartile (25th to 75th percentile) with median indicated.



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Diversity and security of gas supply in the EU, 2018

Introduction

The EU is a large consumer of natural gas. In 2018, the EU consumed 480 bcm of natural gas. Demand for natural gas is met through indigenous production¹ and trade. In 2018, one quarter (120 bcm) of EU demand was met through indigenous production, the remainder was imported. Approximately 90 per cent of EU imports arrive via pipelines; however, imports of Liquefied Natural Gas (LNG) are increasingly important.

Using International Energy Agency (IEA) Statistics² this article assesses the diversity and security of gas supply in the EU and the UK. It provides comparative analysis of the UK compared to other EU countries.

Methods

Three indicators were used to analyse the diversity and security of natural gas supply in this article.

Self-sufficiency score

Self-sufficiency is a country's ability to meet its natural gas demand through indigenous production alone. It is calculated by dividing the volume of indigenous production by demand. If a country has a self-sufficiency score of 1 it produced as much gas as it used. A value below 1 means a country must meet demand at least partially through imports. A value above 1 means a country can meet more than its own demand through production and is therefore a net exporter. In general, high self-sufficiency means natural gas supply is more secure.

Diversity index

Diversity is used to describe the number of import sources of a given country. This is combined with the political stability³ of the source country to provide a weighted metric of diversity. This means that a country with many import sources of high political stability will have a high diversity index. Conversely few import sources of low political stability results in a low diversity index. In general, a diverse source of imports means gas supply is more secure. This is further improved if the source countries are politically stable.

Supply index

The supply index combines the self-sufficiency score and diversity index. It is a simple indication of security of supply. A supply index of zero indicates that a country has no indigenous production and only one import source.

Security of gas supply for EU countries, 2018

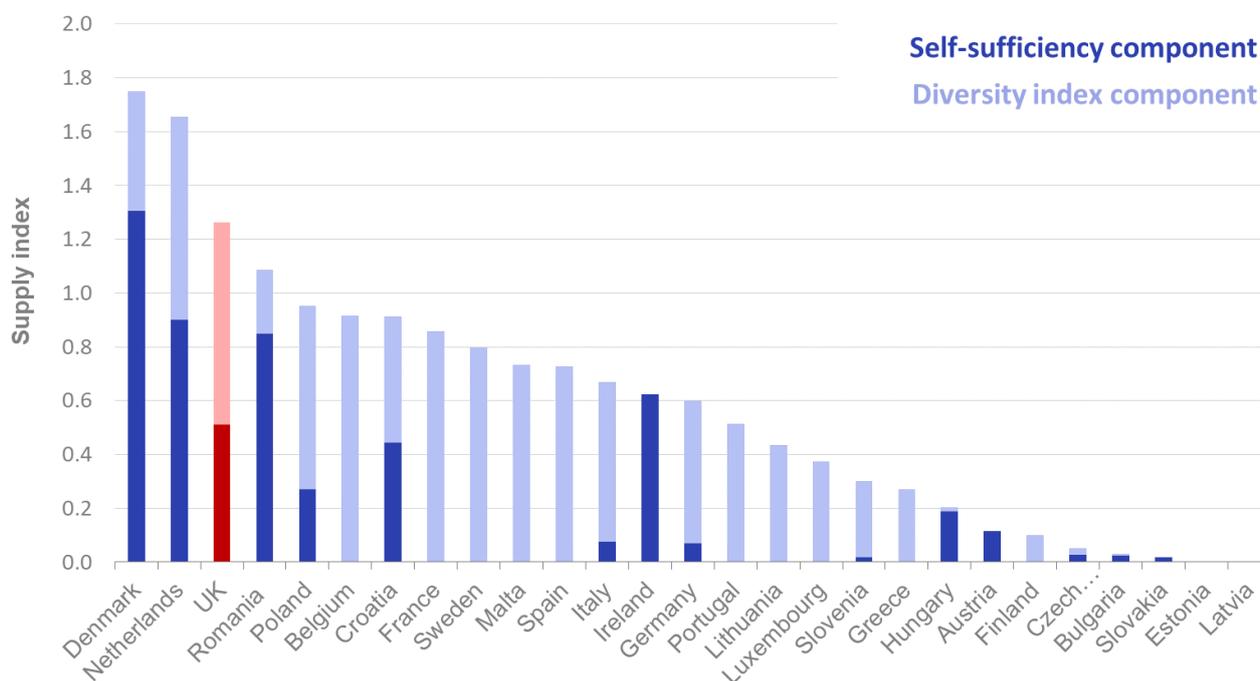
The EU had an average security index of 0.57. Denmark had the highest score at 1.75, and the UK ranked in third place with a score of 1.26, behind the Netherlands. Estonia and Latvia had a supply index of zero indicating they had no indigenous production and one import source, which was Russia.

¹ Marketable production within national boundaries, including offshore production

² www.iea.org/data-and-statistics

³ World bank governance indicators, see Appendix 1 for underlying data and Appendix 2 for method

Chart 1: Supply index as a proportion of demand for EU countries, 2018



See Appendix 1 for underlying data

Chart 1 shows the supply index for EU countries in 2018. The self-sufficiency score and diversity index have been stacked, indicating the relative contribution of these components to the security of supply rankings.

Indigenous production met one half of UK demand 2018. This has decreased over the last 10 years, down from two-thirds in 2008. The UK has maintained a self-sufficiency score of around one-half since 2016. As an average, one-quarter of EU demand was met through production.

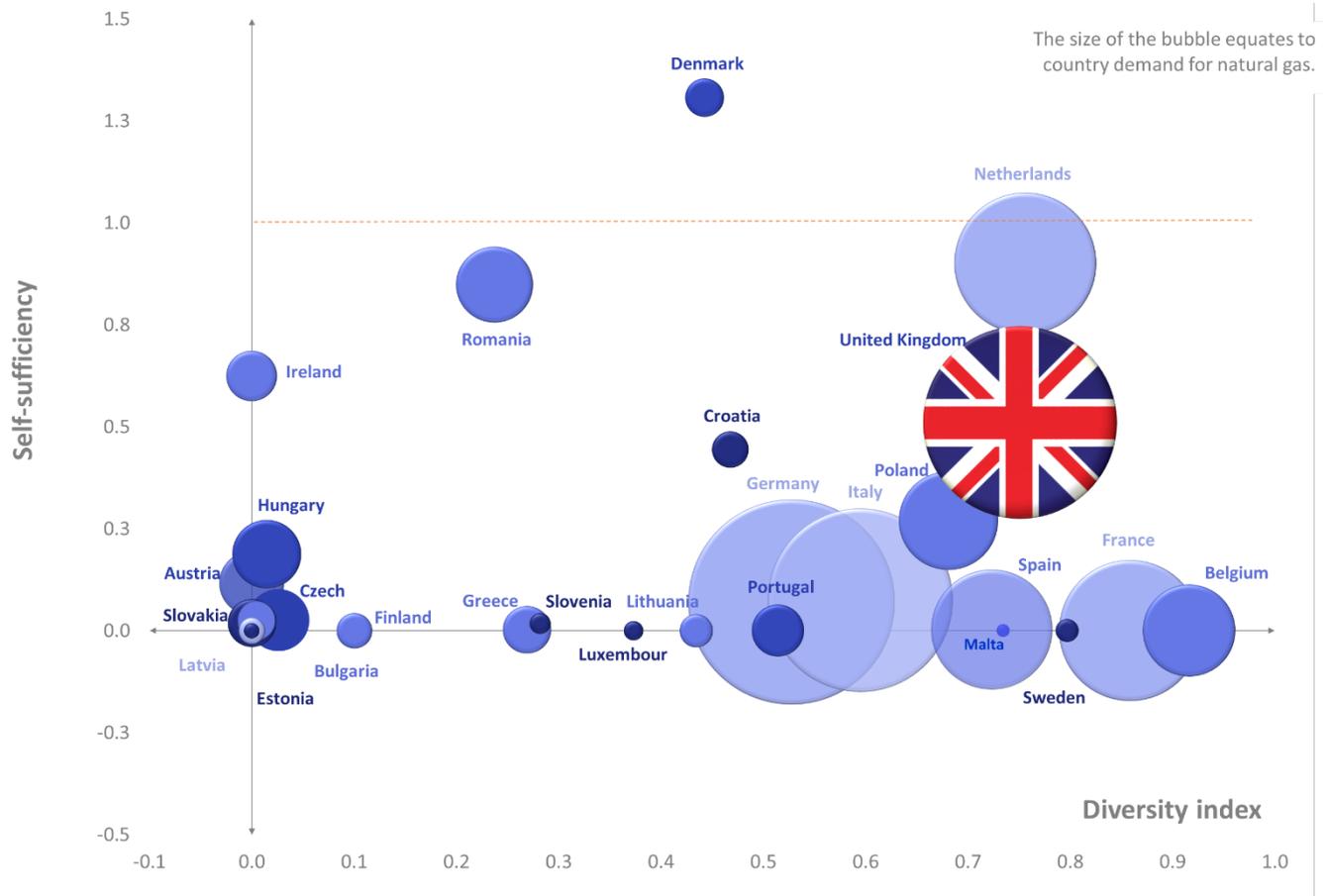
To meet the shortfall in supply the EU and UK import gas from a variety of sources. The UK's proportion of total supply⁴ from imports has been broadly stable over the last 10 years, fluctuating between 40 and 60 per cent since 2009. This settled to just over 50 per cent in 2014 and has remained there since; in 2018 imports comprised 54 per cent of total UK supply of gas.

Diversity of gas supply for EU countries, 2018

In 2018, the UK had a diversity index of 0.75, higher than the EU average of 0.32. This high score is because the UK has high number of import sources, some of which are very politically stable. The UK also has a high self-sufficiency score; one half of supply was met by indigenous production. On average one-fifth of EU supply is met though indigenous production. Denmark was the only EU country which was a net exporter of natural gas; exporting to the Netherlands, Italy and Sweden via pipeline. All other countries met demand through imports.

⁴ Production plus imports

Chart 2: Demand, self-sufficiency and diversity index for EU countries, 2018



See Appendix 1 for underlying data

Chart 2 shows the relationship between a country’s demand, self-sufficiency score, and diversity index. The size of the bubble indicates each country’s demand. Cyprus has no natural gas demand and therefore no need for indigenous production or imports.

Import sources of EU and UK gas

In 2018, the EU met 80 per cent of supply through imports; for the UK this was 54 per cent. Most imports arrive via pipeline because the infrastructure is well-established, and this is a cost-effective way of transporting gas. Pipeline infrastructure means it is often convenient to import gas from neighbouring countries. Therefore, Central and Eastern European countries receive most of their gas imports from Russia. Russia acts as a transit country for gas from Kazakhstan and Turkmenistan, so it should be noted that the origin of this gas is not necessarily all Russian. Nineteen EU countries imported gas from Russia. For Estonia, Latvia and Slovakia, Russia was the only import source. Approximately, 10 per cent of imports are sourced through pipelines from Northern Africa.

Chart 3: Sources of gas imports for the EU and UK, 2018

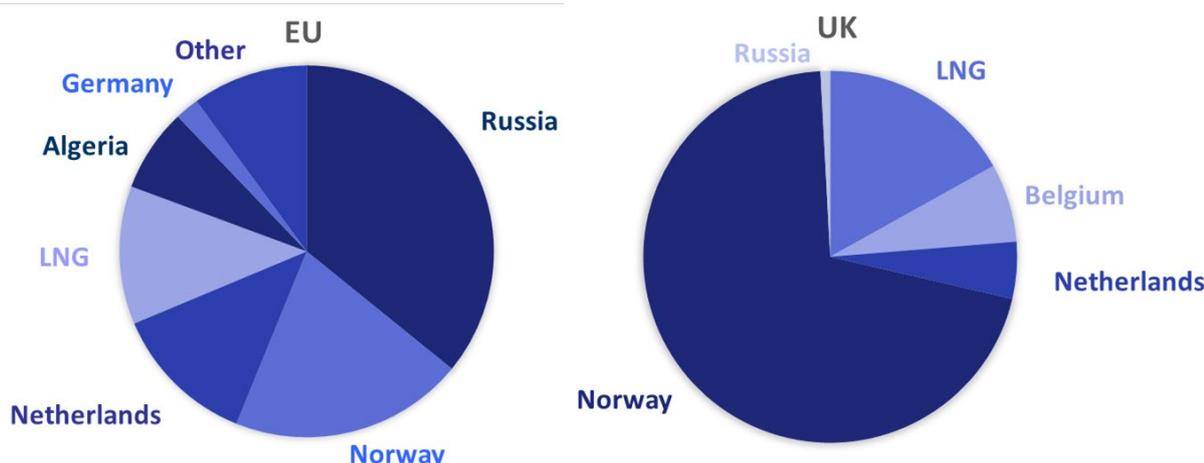


Chart 3 shows the main import sources of natural gas for the EU and UK. When considering EU countries together, imports from Russia were the largest source of supply of natural gas. The UK received 0.8 per cent of imports from Russia via pipeline indirectly through the Netherlands⁵ and a further 3.2 per cent as LNG, together accounting for 1.7 per cent of total UK supply.

For the UK, the largest source of supply of natural gas was indigenous production, followed by imports from Norway. This is largely because of the UK's proximity to Norway and shared infrastructure in the North Sea. Norway has one of the highest political stability ratings of all countries, therefore these imports are beneficial to the UK's diversity index. In 2018 the EU and UK received 9.6 and 9.0 per cent of imports via LNG shipments respectively (see Liquefied Natural Gas section).

In Chart 3 small quantities of gas imports have been grouped together as 'other'; this includes 16 countries⁶. Chart 3 shows the diversity of imports into the EU. Map 1 also reflects this diversity of supply, as well as the complexities of inter-EU gas trade.

For readers wanting a greater level of detail, the IEA have made available an interactive gas map, based on entry and exit points throughout Europe. This map is available free of charge at: www.iea.org/gtf/.

⁵ Central point estimate see Appendix 2 for method

⁶ United Kingdom, Libya, Belgium, Hungary, Denmark, France, Austria, Turkey, Spain, Slovenia, Czech Republic, Croatia, Portugal, Bulgaria, Romania, Greece (listed in order of volume imported)

Liquefied Natural Gas

Liquefied Natural Gas (LNG) is natural gas that has been cooled to a liquefied state, making it easier to store and transport – usually by ship. It can then be regasified at import terminals or processing facilities before being transferred to the pipeline system. The UK has three LNG import terminals, the Isle of Grain, South Hook and Dragon.

Historically, Qatar has been the largest source of LNG imports for the UK and EU. In 2011, UK imports of LNG reached a peak at 25 bcm and formed 25 per cent of total supply (and 46 per cent of imports). Nearly all (97 per cent) of this was from Qatar.

However, in recent years the number of LNG projects coming onstream has increased rapidly, increasing the number of import sources. Following a sharp increase in US production, LNG imports from the US to EU countries increased in 2018. The increased diversification of supply sources of LNG is expected to continue. Large projects are planned, including the expansion of LNG production in Qatar and new projects planned in the US, Canada and Russia.

Chart 4: sources of EU and UK LNG imports, 2018⁷

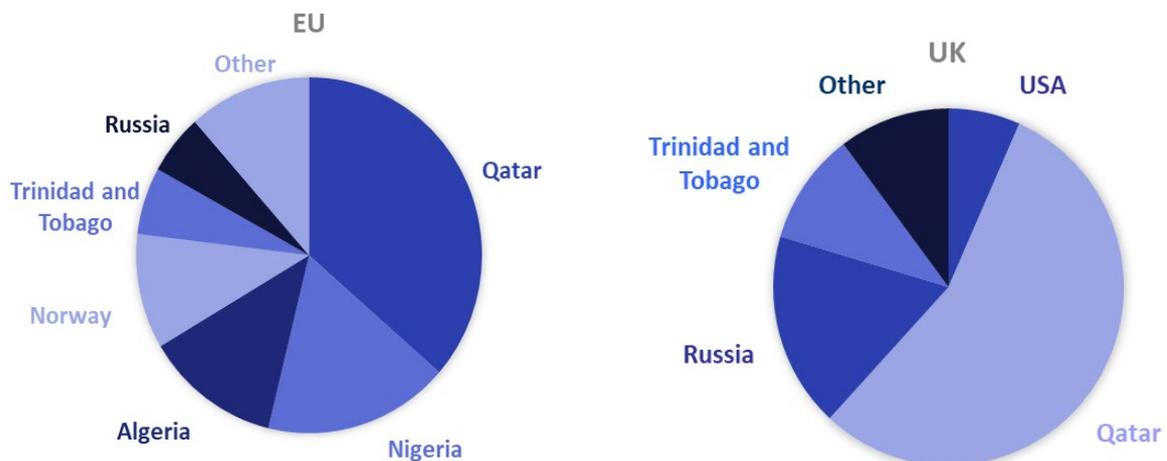


Chart 4 shows the proportion of LNG imports from different countries for the EU and UK. While Qatar remains a major supplier, in 2018 the EU received LNG cargoes from more than 20 countries and the UK from 10 countries. The Qatari share of LNG has fallen to just over a third for the EU and to just over half for the UK.

Following several years of decline, imports increased in 2018. Interestingly half of all LNG imports for the year arrived in the final quarter of 2018. This was partially because the long-term contract on the UK-Belgium interconnector ended in October, which reduced pipeline flows. In addition, the global LNG market was well-supplied as new projects came onstream and low LNG demand growth was seen in Asia. As a result, global LNG prices fell, and excess LNG was available to other markets including Europe. Recent trends in LNG supply will be explored in a special gas article due to be published in Energy Trends in March 2020.

⁷ EU 'Other' includes the US, Peru, Angola, Egypt, Equatorial Guinea, Cameroon, Bulgaria, Belgium, Netherlands, France, Finland, South Africa, Lithuania and Spain

UK 'Other' includes Egypt, Guinea, Norway, Peru, US and Algeria. For a full breakdown see Energy Trends Table 4.4

Summary

The EU consumed 480 bcm of natural gas in 2018. One quarter of this demand was met with indigenous production. Comparatively the UK met half of its demand through indigenous production compared to two-thirds 10 years ago. When considering the supply index, the UK had the third most secure supply of EU countries. As well as the comparatively high self-sufficiency score, the UK also had a high number of import sources, many of which have high political stability ratings. These countries include Norway, which provided 78 per cent of all UK natural gas imports. Nearly half (44 per cent) of UK supply was met through pipeline imports. Whilst the well-established pipeline infrastructure provides a relatively stable supply story for the EU and UK, developments in LNG capacity are expected to continue to grow.

Supply of LNG to the UK peaked in 2011 and had been in decline before the sharp growth seen in late 2018. Whereas Qatar has historically been the primary source of LNG supply to the UK and EU global capacity is rapidly increasing and Qatar has been losing share as new projects come onstream. UK supply of LNG from Qatar had fallen from 97 per cent in 2011 to 55 per cent in 2018. Historic trends and the current supply mix of UK and EU imports of LNG will be explored in further detail in a special feature in Energy Trends March 2020.

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Appendices

Appendix 1: underlying data for chart 1 and chart 2, 2018

EU Country	Self sufficiency	Diversity Component	Supply index	Demand (mcm)
Austria	0.12	0.00	0.12	8,921
Belgium	0.00	0.92	0.92	18,178
Bulgaria	0.03	0.00	0.03	3,187
Croatia	0.44	0.47	0.91	2,771
Cyprus	0.00	0.00	0.00	0
Czech Republic	0.03	0.03	0.05	8,268
Denmark	1.31	0.44	1.75	3,151
Estonia	0.00	0.00	0.00	504
Finland	0.00	0.10	0.10	2,646
France	0.00	0.86	0.86	41,522
Germany	0.07	0.53	0.60	90,653
Greece	0.00	0.27	0.27	4,864
Hungary	0.19	0.01	0.20	10,051
Ireland	0.62	0.00	0.62	5,432
Italy	0.07	0.59	0.67	72,667
Latvia	0.00	0.00	0.00	1,431
Lithuania	0.00	0.43	0.43	2,307
Luxembourg	0.00	0.37	0.37	784
Malta	0.00	0.73	0.73	339
Netherlands	0.90	0.76	1.66	42,987
Poland	0.27	0.68	0.95	20,903
Portugal	0.00	0.51	0.51	5,757
Romania	0.85	0.24	1.09	12,495
Slovakia	0.02	0.00	0.02	4,912
Slovenia	0.02	0.28	0.30	896
Spain	0.00	0.72	0.73	31,135
Sweden	0.00	0.80	0.80	1,102
UK	0.51	0.75	1.26	80,012
EU average	0.19	0.38	0.57	17,067

Source: IEA (<http://data.iea.org/>)

Bold indicates self-sufficiency

Appendix 2: Methodology

Self-sufficiency

Data for natural gas was extracted from the IEA database. Self-sufficiency was determined from data on indigenous production and demand (indigenous production (mcm) ÷ demand (mcm)).

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 natural gas 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 1 represents a country with a wider range of import sources. The minimum value of zero denotes a country that has one imported fuel source or relies entirely on indigenous production (or a country with no imports).

The Shannon-Wiener was chosen here as it places weight on the diversity of contributions from smaller countries and reduces 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/wqi/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 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 natural gas, 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). This maximum diversity score then acted as our upper score of 1, with all other scores divided by this maximum to standardise the data.

Other sources of gas

Sometimes, due to a variety of reasons, countries may report an import of natural gas from a “Non-Specified/ Other” source country. In 2018 low volumes of imports were reported as Non-Specified/ Other, except for Austria where all imports were reported in this way. Because of this in for Austria, we used Border Point Data which is publicly available at www.iea.org/gtf/. This data is collected by the IEA and shows gas flows in Europe on a monthly basis.

Calculation of Russian pipeline flows to the UK

The UK sourced 5.8 per cent of its natural gas imports through pipeline from the Netherlands in 2018. In turn Russian imports comprised 14 per cent of total supply to the Netherlands (Russian imports to the Netherlands as a percentage of Netherlands' production plus total imports). For transparency purposes the proportion of Netherlands' supply from Russia was applied to UK imports from the Netherlands as an estimate of the volume of pipeline gas that the UK indirectly imports from Russia.

Gas consumption savings from bead and mineral wool cavity wall insulation

Introduction

This article gives estimated domestic gas consumption savings from installing bead and mineral wool cavity wall insulation. It covers installations during 2013-2015 in England and Wales.

Summary

- The cavity walls of existing properties are classified as either hard to treat or easier to treat and are filled with two main types of insulation; bead or mineral wool.
- Bead insulation has a single lambda value (0.034 w/mK). There are two varieties of mineral wool insulation, with lambda values 0.034 and 0.040. A lower lambda means lower thermal conductivity and higher performing insulation.
- All hard to treat properties have bead or the lower lambda (0.034) mineral wool insulation installed. This isn't the case for easier to treat properties, where the proportion of the two mineral wool varieties (lambda 0.034 and 0.040) installed is unknown in the data.
- To find the savings the National Energy Efficiency Data-Framework (NEED) "Impact of Measures" method was used¹.
- For hard to treat properties no difference was found in median gas consumption savings between bead and mineral wool insulation (wool had 0.3% higher savings in 2013, and bead had 0.3% higher savings in 2014). This is consistent with the two types of material sharing the same lambda value.
- For easier to treat properties, bead insulation showed higher average savings (1.2% in 2014; 0.4% in 2015; 2% in 2016) than mineral wool insulation. This is likely to reflect the lower average lambda value of bead installations.
- All other factors being equal, cavity wall insulation materials with lower lambda values result in higher gas savings.

Background

Many properties in the UK have a cavity walls, or walls with a gap between two layers of masonry. These gaps, or cavities, can be empty or filled. Filling an empty cavity with an insulating material is known to improve the energy efficiency of the home by reducing heat leakage².

Until now, the relative gas savings from different cavity fill materials has not been analysed on a large scale. There are two main cavity fill materials: mineral wool and polystyrene beads. This project aimed to find out whether there are different savings in gas consumption from installing these two types of insulation materials.

Different materials have different thermal conductivity properties, measured by the lambda value. A lower lambda means lower heat transfer and therefore more heat can be expected to be retained in the property.

¹ Full details of the method are available in the Impact of Measures chapter of the [NEED methodology note](#)

² NEED has been used to estimate the energy savings from cavity wall insulation, with the results presented in [Headline impacts of measures 2016](#). This found median gas savings of 7.3% for 2016 installations

Bead insulation generally has a lambda of 0.034 w/mK, whereas mineral wool has a value of either 0.034 or 0.040 w/mK.

When installing cavity wall insulation, properties are classified as either ‘hard to treat’ or ‘easier to treat’³.

Comparing gas consumption following bead and mineral wool insulation with the same lambda values is possible for hard to treat properties. This is because the mineral wool deployed in these properties was exclusively the 0.034 lambda variety.

For easier to treat properties, the mineral wool installed was either the 0.034 or 0.040 lambda varieties but this isn’t identified in the data available for analysis. Because of this a direct comparison between materials with the same lambda values isn’t possible for easier to treat properties.

Method

Data on installation date, difficulty to treat and type of cavity fill was provided to BEIS by the Cavity Insulation Guarantee Agency (CIGA). This was linked to the NEED data⁴, which includes annual gas consumption at the property level. It also includes property characteristics, household characteristics and the installation of energy efficiency measures under government schemes.

NEED is used to assess the impact of energy efficiency measures including solid wall insulation and solar panels ([the results of which are here](#)). The method used for these assessments was applied to each combination of difficulty to treat, insulation material and year of installation. This gave a total of 10 combinations to test.

Properties which had another energy efficiency measure installed during the period of interest were removed from the group. Other filters were also applied, such as requiring annual gas consumption to be between 2,500 and 50,000 kWh to remove outliers. This excludes properties using electricity or other fuels for heating. The sizes of the filtered samples are shown in Table.

Table 1: combinations and sample sizes

Material	Treatment type	Year of installation	Sample size
Bead	Hard to treat	2013	6297
Mineral wool	Hard to treat	2013	1914
Bead	Hard to treat	2014	10654
Mineral wool	Hard to treat	2014	4248
Bead	Easier to treat	2013	8246
Mineral wool	Easier to treat	2013	20154
Bead	Easier to treat	2014	5350
Mineral wool	Easier to treat	2014	10260
Bead	Easier to treat	2015	5516
Mineral wool	Easier to treat	2015	8405

Hard to treat installations in 2015 are not included due to small sample sizes.

³ Detailed definitions of “easier to treat” (also known as “standard fillable”) and “hard to treat” are shown in Box 1 of Chapter 2 of the [English housing survey 2012: energy efficiency of English housing report](#)

⁴ For an overview of NEED, see Annex D: What is NEED? of the [2018 NEED publication](#)

Special feature – Gas consumption savings

Features other than the type of insulation used will affect the measured savings. These include property type, behaviour of residents and quality of installation. With the large sample sizes in this analysis, the behaviour of residents and quality of installations is assumed to have a net effect of zero.

The method matches the intervention groups to comparator properties to control for factors which could affect year-on-year energy use (e.g.: an unusually cold winter). Properties are matched by various characteristics, including banded gas consumption and property type⁵.

The results are weighted to provide estimates which are representative of the housing stock in England and Wales.

Results

Table 2 shows the weighted and unweighted median and mean gas consumption savings. These savings are comparable to those estimated for all cavity wall installs in these years (median savings of 8.4%, 9.5% and 7.3% for 2013, 2014 and 2015)⁶.

Table 2: Gas savings by material, treatment type and year of installation

Material	Treatment type	Year of installation	Sample size	Median savings	Weighted median	Mean savings	Weighted mean
Bead	Hard to treat	2013	6297	11.3%	9.9%	11.0%	10.0%
Wool	Hard to treat	2013	1914	10.0%	10.2%	9.6%	9.8%
Bead	Hard to treat	2014	10654	8.9%	7.5%	8.7%	7.7%
Wool	Hard to treat	2014	4248	7.0%	7.2%	7.0%	6.7%
Bead	Easier to treat	2013	8246	9.3%	9.3%	9.2%	9.0%
Wool	Easier to treat	2013	20154	8.6%	8.1%	8.4%	8.1%
Bead	Easier to treat	2014	5350	11.5%	9.5%	11.3%	9.9%
Wool	Easier to treat	2014	10260	8.7%	9.1%	8.5%	8.6%
Bead	Easier to treat	2015	5516	7.8%	7.0%	7.8%	7.0%
Wool	Easier to treat	2015	8405	5.7%	5.0%	5.6%	5.0%

Figure 1 shows the savings for hard to treat properties with a point for each year and material. Fluctuation between years is expected for the method used; the important comparison is between materials in the same year. There is no difference in median gas consumption savings between mineral wool and bead in hard to treat properties (wool has 0.3% higher savings in 2013, and bead has 0.3% higher savings in 2014). As these properties have insulation with the same thermal conductivity, these data are consistent with the hypothesis that the savings from different cavity wall insulation materials can be attributed in large part to the lambda values of the materials.

⁵ The Impact of Measures chapter of the [NEED methodology note gives further information on the matching and weighting process used](#)

⁶ Estimates of gas savings from cavity wall insulation installed for each year between 2010 – 2015 are published in the table [Impact of Measures Time Series \(2005 – 2015\)](#). The method used has been updated for the results presented in this report, so the estimated savings published will not exactly match those presented here.

Figure 1: Weighted median gas savings for mineral wool and bead for hard to treat properties

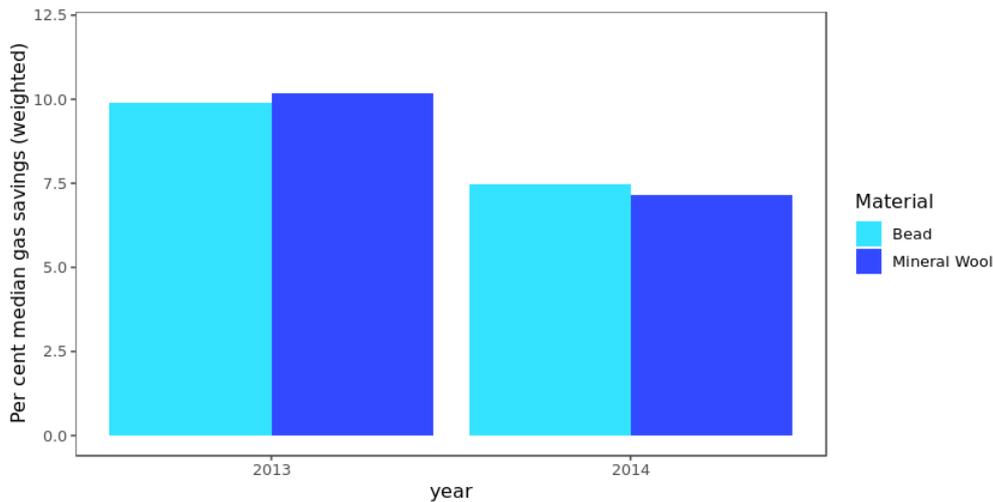
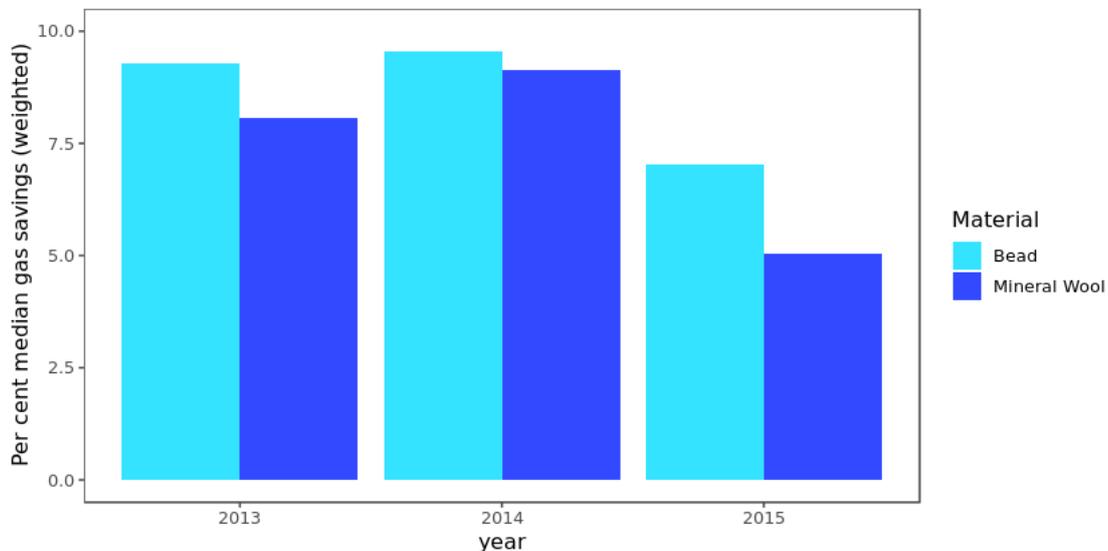


Figure 2 shows the savings for easier to treat properties. Unlike hard to treat properties there is a higher saving for bead in every year. Due to the large sample sizes the difference in savings between bead and mineral wool is statistically significant in every year.

Figure 2: Weighted median gas savings for mineral wool and bead for easier to treat properties



The difference in median gas savings from bead and mineral wool for easier to treat properties ranges from 0.4 to 2% (2013: 9.3% vs 8.1%, 2014: 9.5% vs 9.1%, 2015: 7% vs 5%). These include installations of both the higher and lower lambda valued mineral wool. As the average lambda value of mineral wool installed is not known, it cannot be concluded whether the difference is entirely attributable to the comparatively lower lambda values of bead in easier to treat properties.

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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 September 2019, was published on 28 November 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 December 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 December 2019 at:

www.gov.uk/government/collections/renewable-heat-incentive-statistics

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 was 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 was 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 was 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-electricity-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-gas-consumption-data#postcode-level-data

Greenhouse Gas Emissions final 2018 statistics

This publication provides final estimates of UK greenhouse gas emissions going back to 1990. Estimates are presented by source in February of each year and are updated in March of each year to include estimates by end-user and fuel type. Final 2018 UK greenhouse gas emissions statistics will be published on 4 February 2020 at:

www.gov.uk/government/collections/final-uk-greenhouse-gas-emissions-national-statistics

Greenhouse Gas Emissions provisional 2019 statistics

This publication provides the latest annual provisional estimates of UK greenhouse gas emissions based on provisional inland energy consumption statistics as published in Energy Trends. A quarterly emissions time series will also be included within this publication. Provisional 2019 UK greenhouse gas emissions statistics will be published on 26 March 2020 at:

www.gov.uk/government/collections/provisional-uk-greenhouse-gas-emissions-national-statistics

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.

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/

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

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

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

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