Department for
Business, Energy
& Industrial Strategy

ENERGY TRENDS
MARCH 2020

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

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

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

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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 March editions cover the fourth quarter of the previous year and also the previous year as a whole.

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

Annual data for 2019 included within this edition is on a provisional basis. New data are continually received and revisions to previous data made. Finalised figures for 2019 will be published on the 30 July 2020 in the annual Digest of UK Energy 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 2019:

- Total energy production was 0.5 per cent lower than in 2018. This fall the first since 2014, follows four consecutive rises, was due to rises in output from oil, bioenergy and waste, wind, solar and hydro being offset by falls from coal, gas and nuclear.
- Imports in 2019 were 2.1 per cent lower than in 2018, whilst exports fell by 0.3 per cent. As a result, net import dependency fell back from 36.0 per cent to 35.2 per cent.
- Crude oil & NGL production was 1.8 per cent higher than in 2018, boosted by new production from the Clair Ridge project which opened in late 2018.
- Natural gas production was 2.2 per cent lower than in 2018. Gas exports were 5.6 per cent higher, whilst imports were broadly unchanged; net imports fell 0.9 per cent on 2018.
- Coal production was 16 per cent lower than in 2018, and at a record low level, mainly due to lower demand for electricity generation. Imports of coal in 2019 were 33 per cent lower compared to 2018. Coal stocks were broadly similar to 2018.
- Total primary energy consumption for energy uses was 1.9 per cent lower than in 2018. However, when adjusted to take account of weather differences between 2018 and 2019, primary energy consumption fell by 1.3 per cent.
- Temperatures in 2019 were broadly similar to a year earlier, with average temperatures in Q2, Q3 and Q4 being cooler than a year earlier, but Q1 being noticeably warmer than in 2018 when the UK was in the midst of the 'Beast from the East' weather storm.
- Final energy consumption (excluding non-energy use) was 1.1 per cent lower than in 2018. On a seasonally and temperature adjusted basis it is estimated to have fallen by 0.8 per cent with falls in the domestic, industrial and transport sectors but a rise in the services sector.
- Gas demand was 0.5 per cent lower than in 2018, with less use of gas in electricity generation, whilst electricity consumption was 1.8 per cent lower.
- Electricity generation in 2019 fell by 2.8 per cent, from 333 TWh a year earlier to 324 TWh, with falls in generation from coal and nuclear offset by an increase from renewables, primarily bioenergy, wind and solar generation.
- Of electricity generated in 2019, gas accounted for 40.9 per cent (up 1.4 percentage points compared to 2018) and coal 2.1 per cent (a fall of 2.9 percentage points on 2018). Nuclear's share decreased by 2.2 percentage points on 2018 to 17.4 per cent due to outages.
- Renewable electricity generation was 119.3 TWh in 2019, a record high, an increase of 8.5 per cent on the 110.0 TWh in 2018, largely due to increased capacity. Renewables' share of electricity generation increased by 3.8 percentage points on 2018 to 36.9 per cent, also a record high, due to higher renewable generation and lower overall electricity generation. Renewable electricity capacity was 47.4 GW at the end of 2019, a 6.9 per cent increase (3.0 GW) on a year earlier, with half of the increase from offshore wind.
- Low carbon electricity's share of generation increased from 52.6 per cent in 2018 to a record high of 54.2 per cent in 2019, driven by growth in renewable generation due to increased capacity.
- Provisional estimates show that carbon dioxide emissions fell between 2018 and 2019 by 3.9 per cent; the key factor leading to this decrease was the switch in electricity generation away from coal to renewable sources. A separate BEIS statistical release provides more detail.

The main points for the fourth quarter of 2019:

- Total energy production was 1.4 per cent higher when compared with the fourth quarter of 2018, boosted by strong growth in gas, nuclear and bioenergy and waste output.
- Crude oil & NGL production fell by 4.1 per cent when compared with the fourth quarter of 2018, with NGL production down by 19 per cent due to the closure of the Mossmorran processing plant at Fife.
- Natural gas production was 4.7 per cent higher than the fourth quarter of 2018. Gas imports rose by 7.0 per cent, with LNG imports rising by over 80 per cent, whilst exports rose by 26 per cent; net imports rose by 5.7 per cent compared to the fourth quarter of 2018.
- Coal production in the fourth quarter of 2019 was 12 per cent lower than the fourth quarter of 2018. Coal imports were 58 per cent lower, whilst generators' demand for coal was down by 43 per cent.
- Total primary energy consumption for energy uses rose by 3.8 per cent. However, when adjusted to take account of weather differences between the fourth quarter of 2018 and the fourth quarter of 2019, primary energy consumption rose by 1.2 per cent.
- Temperatures in the quarter were on average 1.0 degrees Celsius cooler than a year earlier, with average temperatures in all months being cooler than a year earlier, but with November 2019 being noticeably cooler, 1.8 degrees Celsius lower than November 2018.
- Final energy consumption (excluding non-energy use) was 4.3 per cent higher than in the fourth quarter of 2018. Domestic consumption rose by 11 per cent due to the cooler weather in the quarter, particularly in November 2019. On a seasonally and temperature adjusted basis final energy consumption rose by 0.3 per cent; domestic consumption rose by 2.0 per cent.
- Gas demand was 7.8 per cent higher driven by cooler temperatures, whilst electricity consumption was up 0.6 per cent compared to the fourth quarter of 2018.
- Electricity generated in the fourth quarter of 2019 decreased by 0.8 per cent, from 87.5 TWh a year earlier to 86.8 TWh.
- Of electricity generated in the fourth quarter of 2019, gas accounted for 38.9 per cent, whilst coal accounted for 3.1 per cent. Nuclear generation accounted for 16.0 per cent of total electricity generated in the fourth quarter of 2019.
- Low carbon electricity's share of generation increased from 53.4 per cent in the fourth quarter of 2018 to 55.4 per cent in the fourth quarter of 2019, due to a rise in nuclear generation compared with 2018 Q4 as plants resumed operation following outages.
- Renewables' share of electricity generation increased from 36.8 per cent in the fourth quarter of 2018 to 37.4 per cent in the fourth quarter of 2019, reflecting higher renewable generation and lower overall electricity generation. Renewable electricity generation was a record 32.5 TWh in the fourth quarter of 2019, an increase of 0.9 per cent on the 32.2 TWh in the fourth quarter of 2018, driven by record offshore wind and bioenergy generation.

Section 1 – UK Total Energy 2019 and October to December 2019

Key results show:

Provisional 2019

Total energy production was 0.5 per cent lower than in 2018. This fall, the first since 2014, follows four consecutive annual rises, was due to rises in output from oil, bioenergy and waste, wind, solar and hydro being offset by falls from coal, gas and nuclear. Oil output rose, up 1.8 per cent, and together with gas, which fell 2.2 per cent, accounts for 73 per cent of UK production. Coal output fell to a record low level, whilst output from nuclear also fell, due to outages. The output from bioenergy and waste and wind, solar and hydro is now nearly 15 times higher than coal, notable as coal output was greater as recently as 2012. **(Chart 1.1**)

Total primary energy consumption for energy uses was 1.9 per cent lower than in 2018. However, when adjusted to take account of weather differences between 2018 and 2019, primary energy consumption fell by 1.3 per cent. **(Chart 1.3**)

Final energy consumption (excluding non-energy use) was 1.1 per cent lower than in 2018. On a seasonally and temperature adjusted basis it is estimated to have fallen by 0.8 per cent with falls in the domestic, industrial and transport sectors but a rise in the services sector.
(**Chart 1.5**)

Net import dependency was 35.2 per cent in 2019. Imports and exports both fell in 2019. Fossil fuel dependency was at a record low in 2019 at 79.0 per cent. (**Charts 1.6 & 1.7**)

Quarter 4 2019

Total energy production was 1.4 per cent higher than in the fourth quarter of 2018, boosted by strong growth in gas, nuclear and bioenergy and waste output. (**Chart 1.2**)

Total primary energy consumption for energy uses rose by 3.8 per cent. However, when adjusted to take account of weather differences between the fourth quarter of 2018 and the fourth quarter of 2019, primary energy consumption rose by 1.2 per cent. **(Chart 1.3**)

Final consumption rose by 3.3 per cent compared to the fourth quarter of 2018, with the cooler weather in the quarter, notably in November 2019, a significant factor, resulting in domestic consumption rising by 11 per cent. (**Chart 1.4**)

Relevant tables

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

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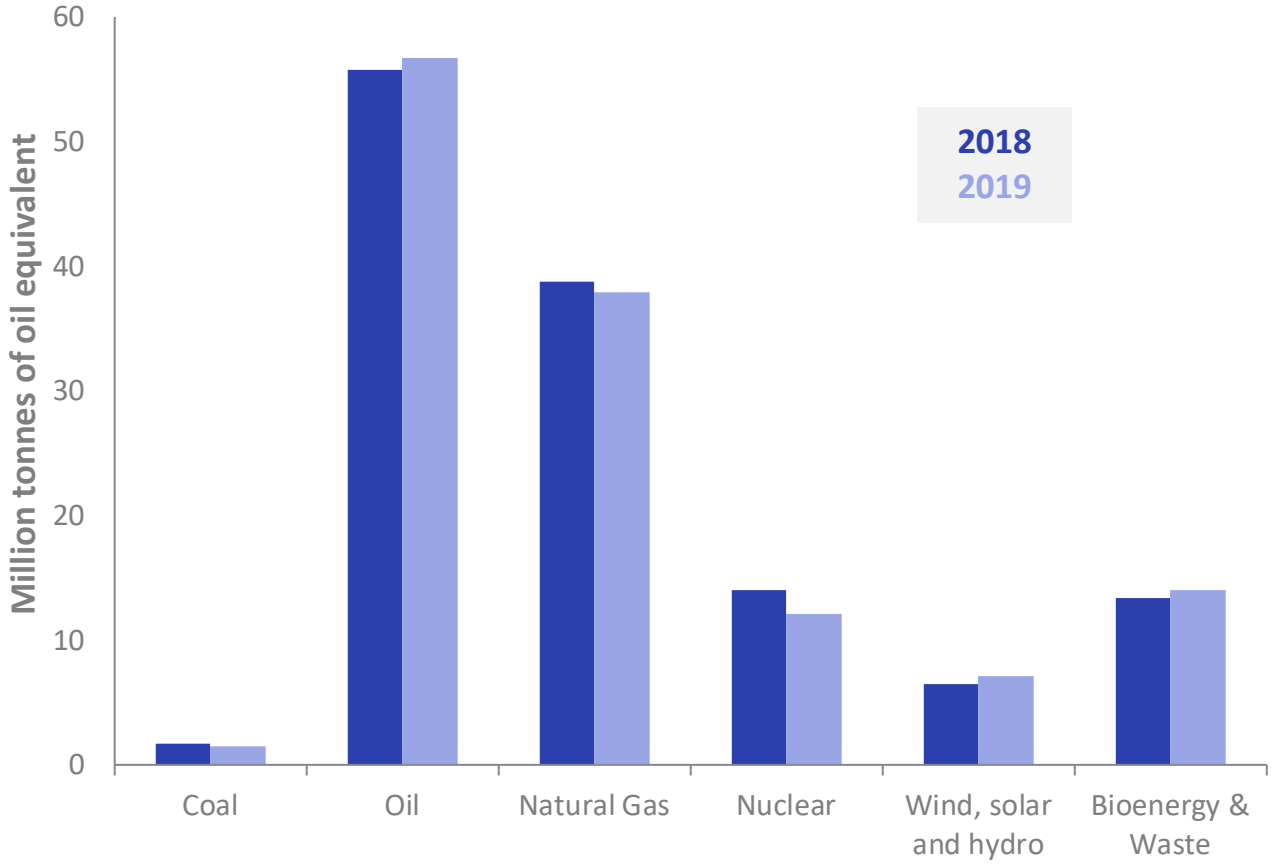
Chart 1.1 Production of indigenous primary fuels (Table 1.1)



Total production in 2019 was 129.3 million tonnes of oil equivalent, 0.5 per cent lower than in 2018. This fall, the first since 2014, follows four consecutive annual rises, and is due to rises in output from oil, bioenergy and waste, wind, solar and hydro being offset by the continued decline in UK coal production and reduced output from gas and nuclear. Output from bioenergy and waste and wind, solar and hydro is now nearly 15 times that of coal, when as recently as 2012 coal output was greater.

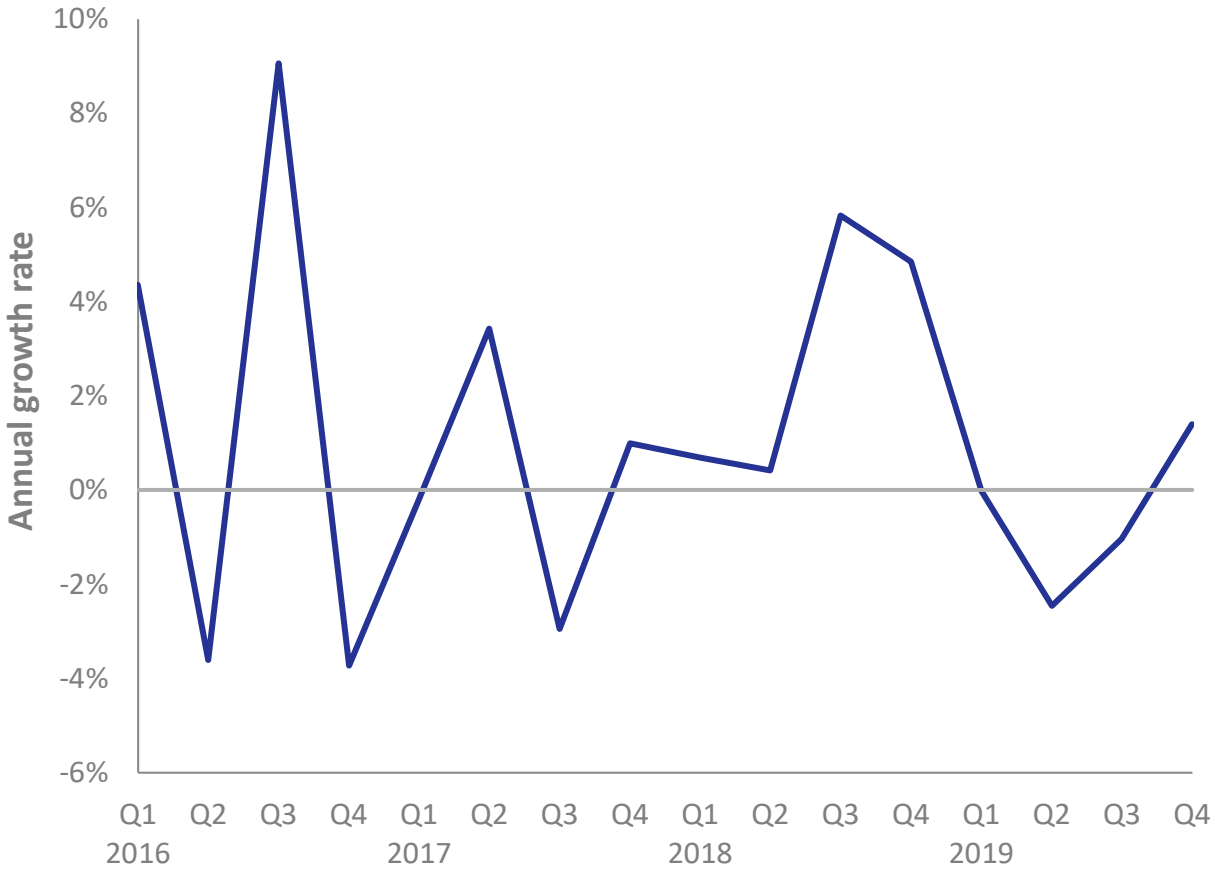
Production of oil rose by 1.8 per cent to the highest level since 2011, due to new production from the Clair Ridge field which opened at the end of 2018, whilst gas fell by 2.2 per cent due to the closure of the Theddlethorpe terminal in 2018, as well as reduced output at several large gas terminals during 2019.

Production of bioenergy & waste rose by 5.1 per cent between 2018 and 2019 to a record 14.1 million tonnes of oil equivalent, driven by an increase in plant biomass capacity.

Primary electricity output fell by 6.2 per cent between 2018 and 2019, within which nuclear output fell by 14 per cent to the lowest level since 2008, due a series of prolonged outages throughout the year at Dungeness B and Hunterson B, reducing the UK's operational nuclear capacity, whilst output from wind, solar and hydro rose by 10 per cent, to a record high level, due to increased wind and solar capacity.

Production of coal fell by 13 per cent, to a new record low.

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



Total production in the fourth quarter of 2019 at 34.3 million tonnes of oil equivalent was 1.4 per cent higher than in the fourth quarter of 2018, and the highest level since the second quarter of 2011.

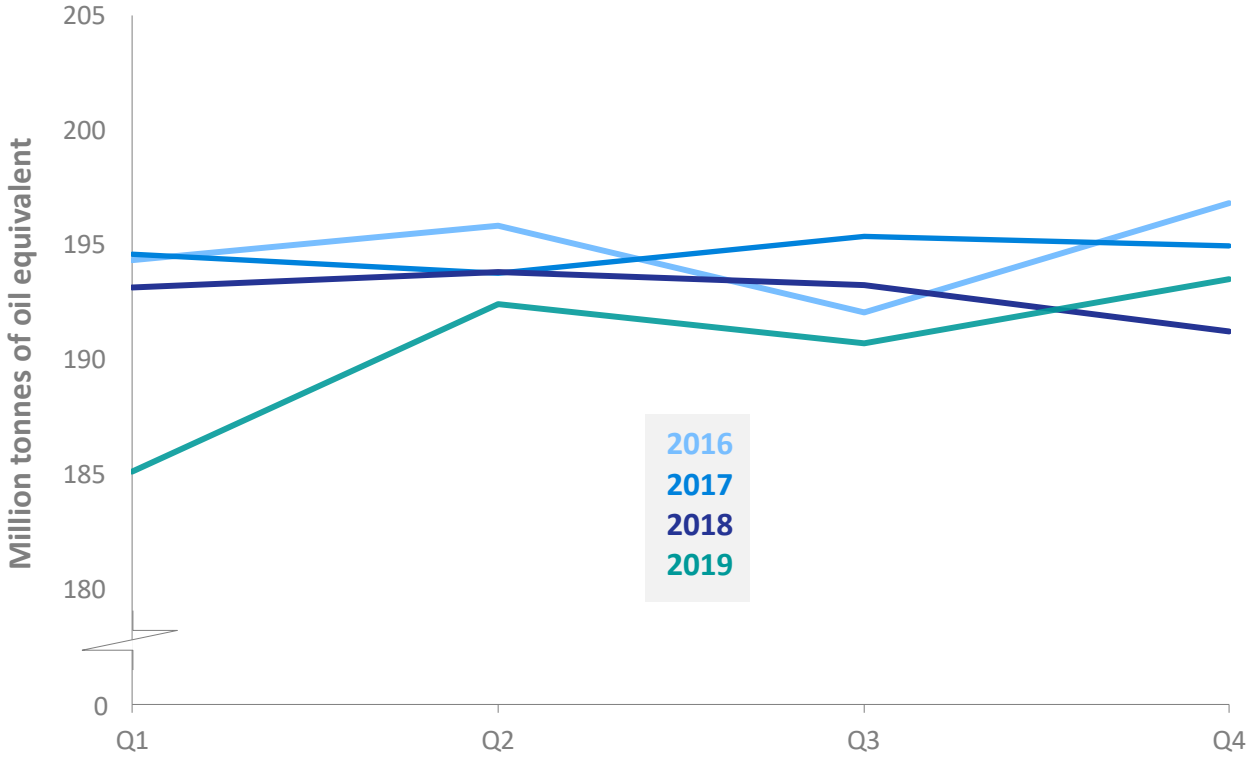
Production of oil fell by 4.3 per cent driven by a fall in NGL output following flaring at the Mossmorran plant, whilst gas rose by 4.7 per cent due to increased output from several of the larger terminals compared to the fourth quarter of 2018.

Primary electricity output in the fourth quarter of 2019 was 4.6 per cent higher than in the fourth quarter of 2018, within which nuclear electricity output was 7.4 per cent higher following outages, whilst output from wind, solar and hydro was broadly unchanged with increases in capacity offset by less favourable weather conditions for electricity generation.

Production of bioenergy and waste was 12 per cent higher compared to the fourth quarter in 2018, driven by an increase in plant biomass capacity.

In the fourth quarter of 2019 production of coal was 8.2 per cent lower than the corresponding period of 2018.

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



(1) Seasonally adjusted and temperature corrected annual rates

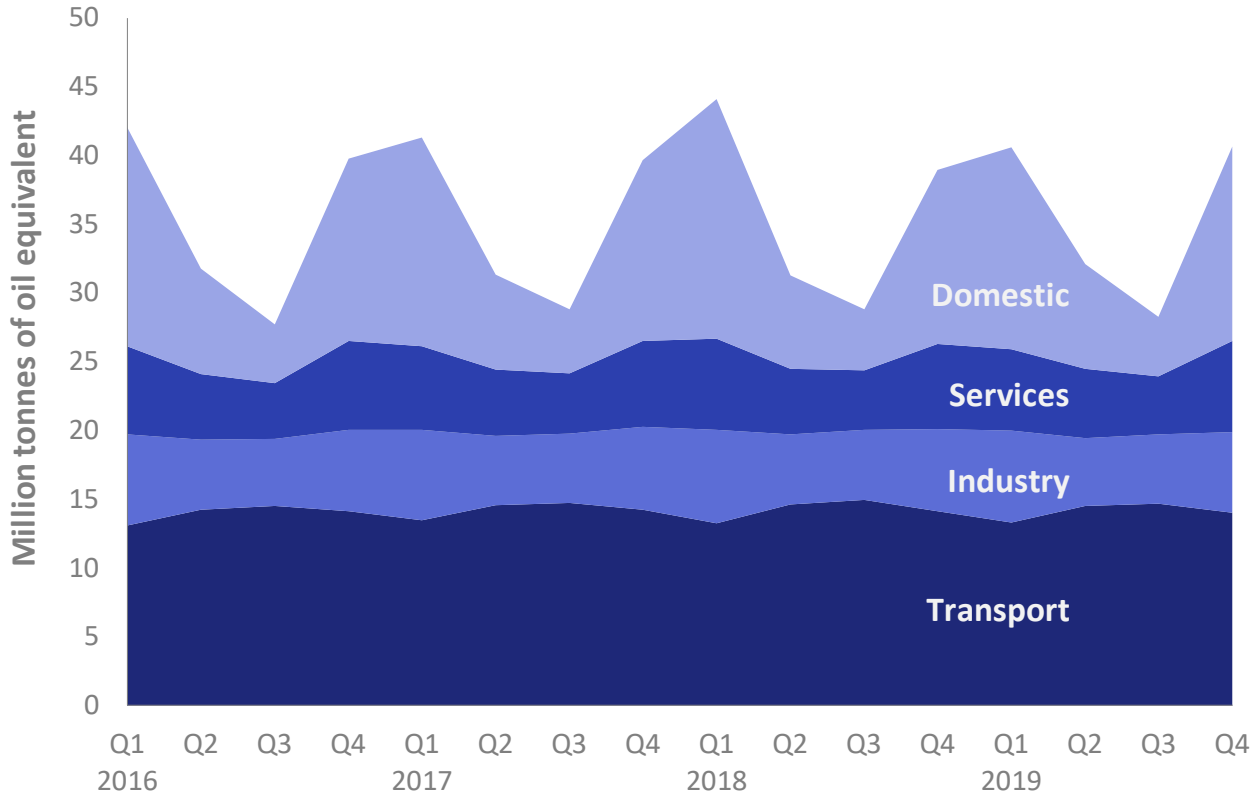
Total inland consumption on a primary fuel input basis (temperature corrected, seasonally adjusted annualised rate), was 190.4 million tonnes of oil equivalent in 2019, a fall of 1.3 per cent from 2018. On an unadjusted basis, consumption was down 1.9 per cent. The average temperature in 2019 was broadly similar to 2018, and BEIS estimate that the number of heating degree days decreased by 0.4 per cent from 1,992 to 1,983.

Between 2018 and 2019 (on a seasonally adjusted and temperature corrected basis) oil consumption fell by 0.9 per cent, whilst gas rose by 0.5 per cent and bioenergy rose by 6.8 per cent. Primary electricity consumption fell by 4.9 per cent, within which nuclear fell by 14 per cent but wind, solar and hydro rose by 10 per cent, whilst coal consumption fell by 26 per cent to a record low.

Total inland consumption on a primary fuel input basis (temperature corrected, seasonally adjusted annualised rate), was 193.5 million tonnes of oil equivalent in the fourth quarter of 2019, a rise of 1.2 per cent compared to the fourth quarter of 2018. On an unadjusted basis, consumption rose by 3.8 per cent. Average temperatures in the fourth quarter of 2019 were 1.0 degrees Celsius cooler than the equivalent quarter in 2018; in November 2019 the daily average temperature was 6.5 degrees Celsius, 1.8 degrees Celsius lower than November 2018.

Consumption of coal fell by 22 per cent on an unadjusted basis in the fourth quarter of 2019 compared to a year earlier, oil consumption fell by 1.0 per cent whilst gas consumption rose by 8.4 per cent. Primary electricity consumption rose by 6.5 per cent, within which nuclear rose by 7.4 per cent but wind, solar and hydro fell marginally by 0.1 per cent. Bioenergy consumption rose by 10 per cent.

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



In 2019, total final consumption (including non-energy use) was 1.4 per cent lower than in 2018.

Total final energy consumption rose by 3.3 per cent between the fourth quarter of 2018 and the fourth quarter of 2019.

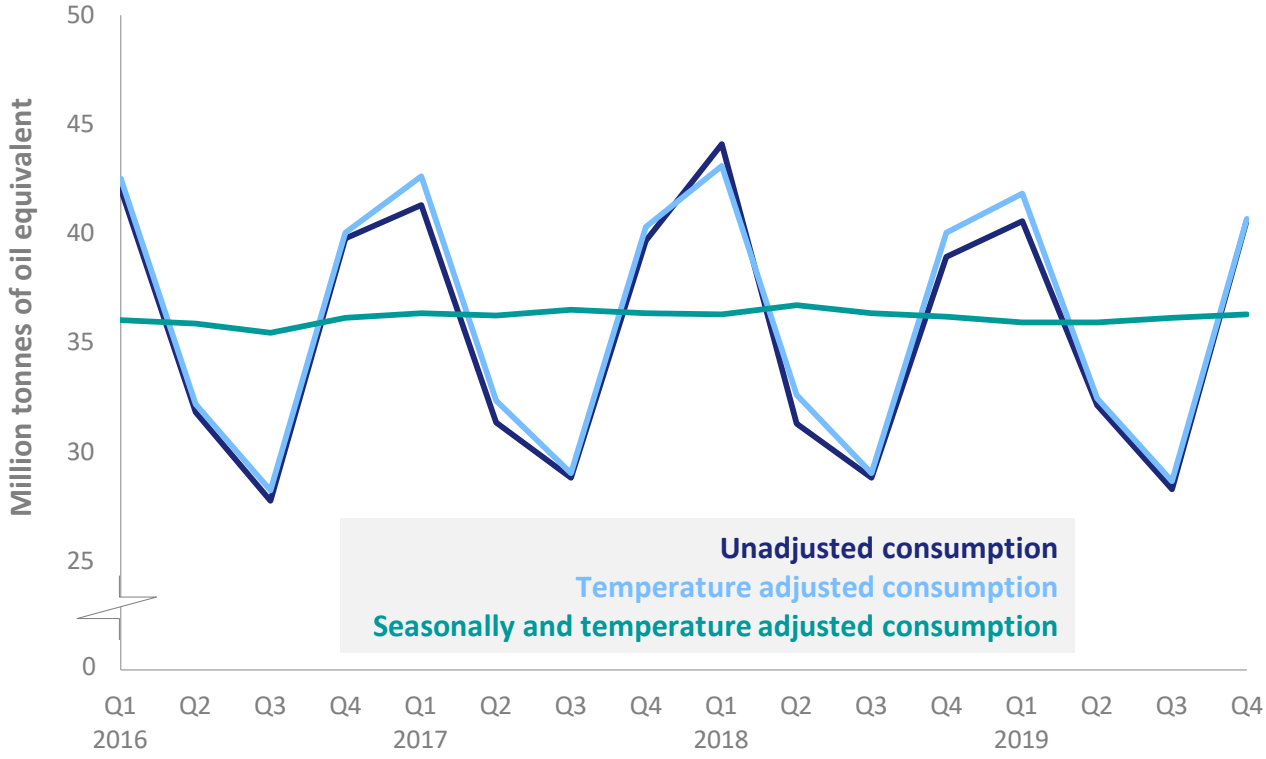
Domestic sector energy consumption rose by 11 per cent between the fourth quarter of 2018 and the fourth quarter of 2019 reflecting the cooler weather in the quarter; annually it fell by 1.6 per cent reflecting the warmer weather in the first quarter of 2019 when temperatures were 1.9 degrees Celsius warmer than a year earlier when the UK was in the midst of the 'Beast from the East' weather storm.

Service sector energy consumption rose by 7.7 per cent between the fourth quarter of 2018 and the fourth quarter of 2019; annually it fell by 0.2 per cent.

Industrial sector energy consumption fell by 1.3 per cent between the fourth quarter of 2018 and the fourth quarter of 2019; annually it fell by 1.8 per cent.

Transport sector energy consumption fell by 0.9 per cent between the fourth quarter of 2018 and the fourth quarter of 2019; annually it fell by 0.8 per cent.

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

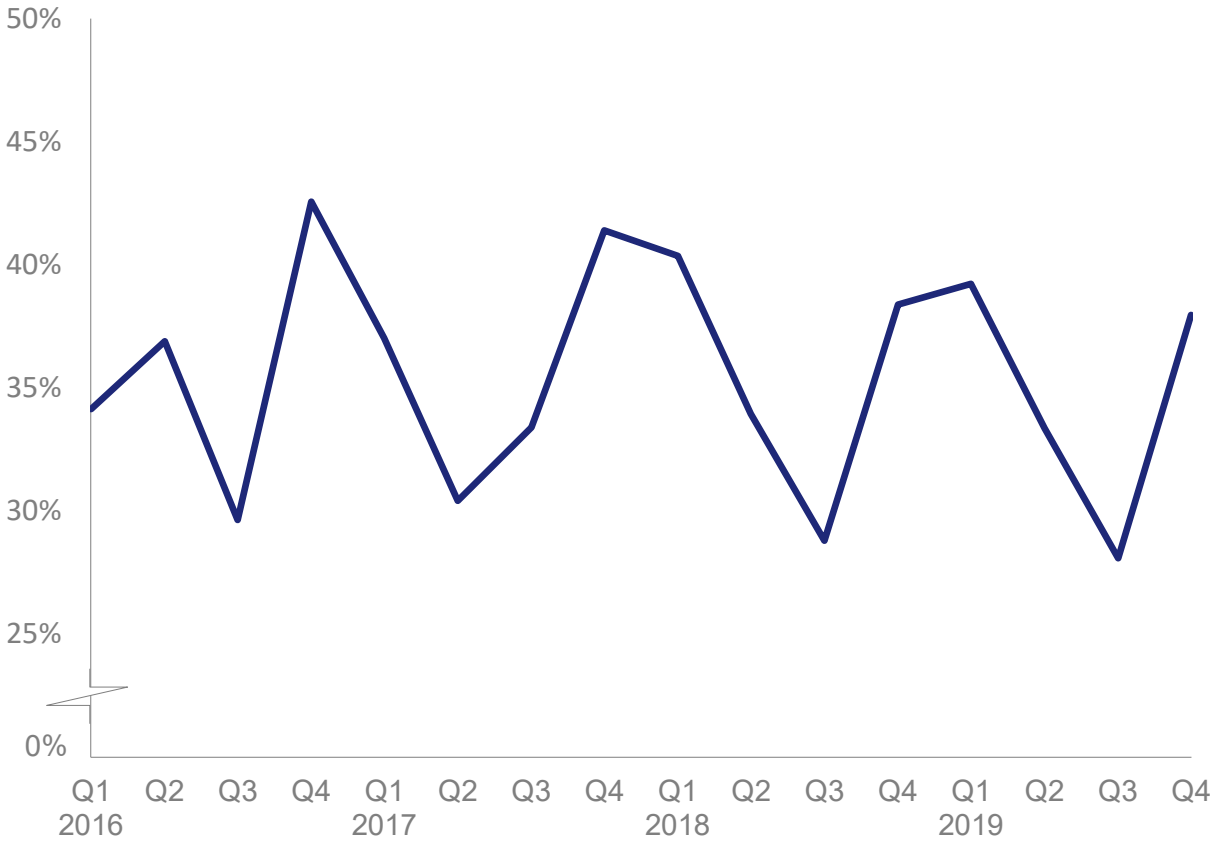


Total unadjusted final energy consumption (excluding non-energy use) fell by 1.1 per cent between 2018 and 2019.

On a seasonally and temperature adjusted basis final energy consumption (excluding non-energy use) is estimated to have fallen by 0.8 per cent driven by falls in all sectors except the services sector.

Total unadjusted final energy consumption (excluding non-energy use) rose by 4.3 per cent between the fourth quarter of 2018 and the fourth quarter of 2019. On a seasonally and temperature adjusted basis final energy consumption (excluding non-energy use) is estimated to have risen by 0.3 per cent between the fourth quarter of 2018 and the fourth quarter of 2019.

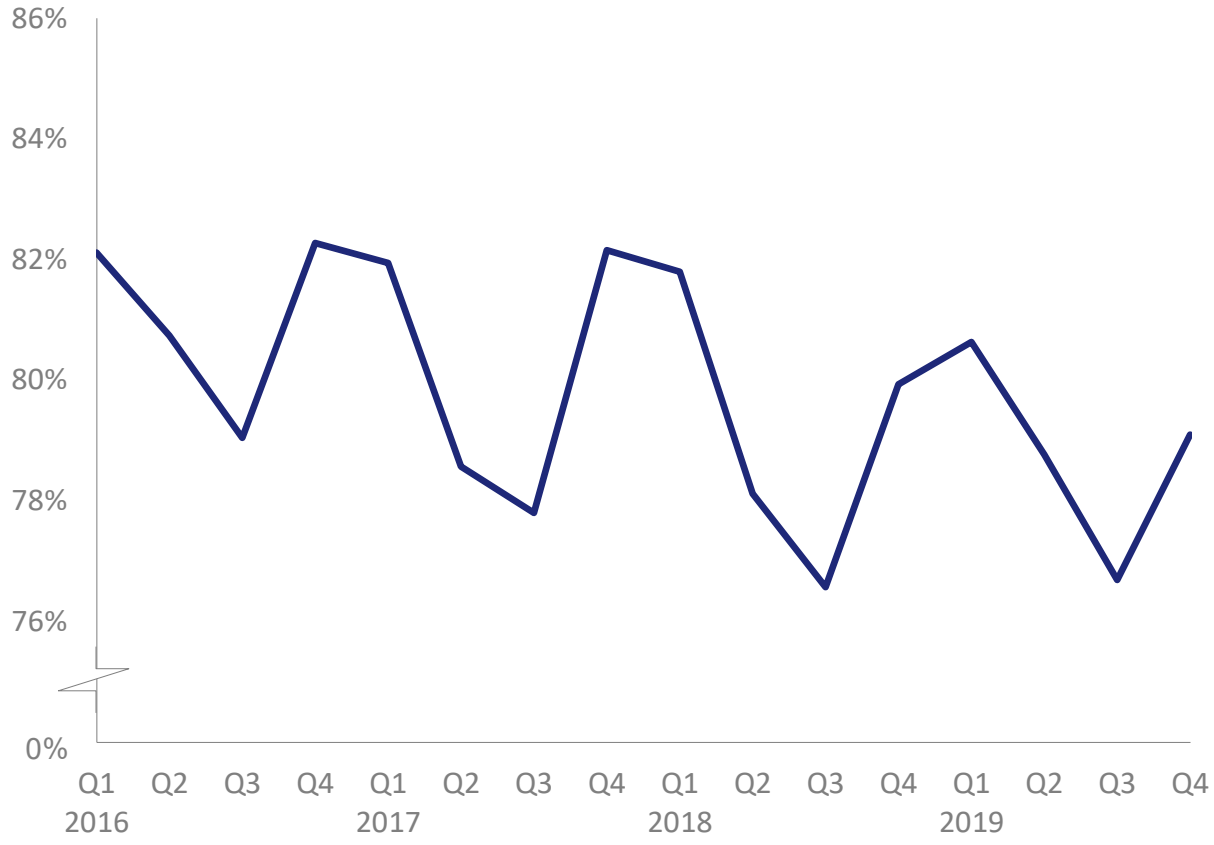
Chart 1.6 Net import dependency (Table 1.3a)



Annually, total imports fell by 2.1 per cent to 150.9 million tonnes of oil equivalent, whilst exports fell by 0.3 per cent to 81.1 million tonnes of oil equivalent. As a result, net import dependency fell 0.8 percentage points from 2018 to 35.2 per cent.

In the fourth quarter of 2019, imports rose by 0.5 per cent, whilst exports fell by 1.0 per cent. As a result, net import dependency fell 0.4 percentage points from the fourth quarter of 2018 to 38.0 per cent.

Chart 1.7 Fossil fuel dependency (Table 1.3a)



Annually fossil fuel dependency was at a record low of 79.0 per cent, down 0.4 percentage points from 2018.

Dependency on fossil fuels in the fourth quarter of 2019 was 79.1 per cent, down 0.8 percentage points from the fourth quarter of 2018.

Section 2 – UK Solid Fuels and Derived Gases 2019 and October to December 2019

Key results show:

Provisional 2019
Overall coal production in 2019 was 2.2 million tonnes, the lowest on record, and down 16 per cent compared to 2018, mainly as a result of continued low demand from electricity generators. In May 2019 electricity was generated from coal on only 5 days with the longest coal free spell (18 days and 6 hours) since the 1880's. Deep-mined output was up but now only accounts for 4.6 per cent of total production. **(Chart 2.1)**

Coal imports at 6.8 million tonnes were 33 per cent lower compared to 2018. This is the lowest amount since before the 1984 miners' strike. **(Chart 2.1)**

The demand for coal by electricity generators in 2019 was 2.9 million tonnes, a new record low and less than half of 2018's demand. Demand for coal-fired electricity generation continued to decline as production favoured gas, nuclear and renewables over coal for a variety of economic reasons, not least of which being the high carbon price floor for coal. Additionally, generation capacity which had fallen in recent years continued to fall with Fiddlers Ferry Unit 1 (March 2019), Cottam Power Station (September 2019) and Aberthaw B (December 2019) all closing during the year. **(Chart 2.3)**

Total stocks at the end of 2019 were 5.3 million tonnes, which remains steady when compared with 2018. **(Chart 2.4)**

Quarter 4 2019
In the fourth quarter of 2019, overall production was down 12 per cent compared to the fourth quarter of 2018 due to the further contraction of surface mined coal. Deep mined coal remains only a small component of coal production as only a few small deep mines are still operational. **(Chart 2.1)**

Coal imports were down 58 per cent on the levels in quarter 4 2018. This is the lowest value in the published series **(Chart 2.1)**

The demand for coal by electricity generators in the fourth quarter of 2019 was 43 per cent lower than demand in the fourth quarter of 2018 as production favoured gas, nuclear and renewables over coal. **(Chart 2.3)**

Relevant tables

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

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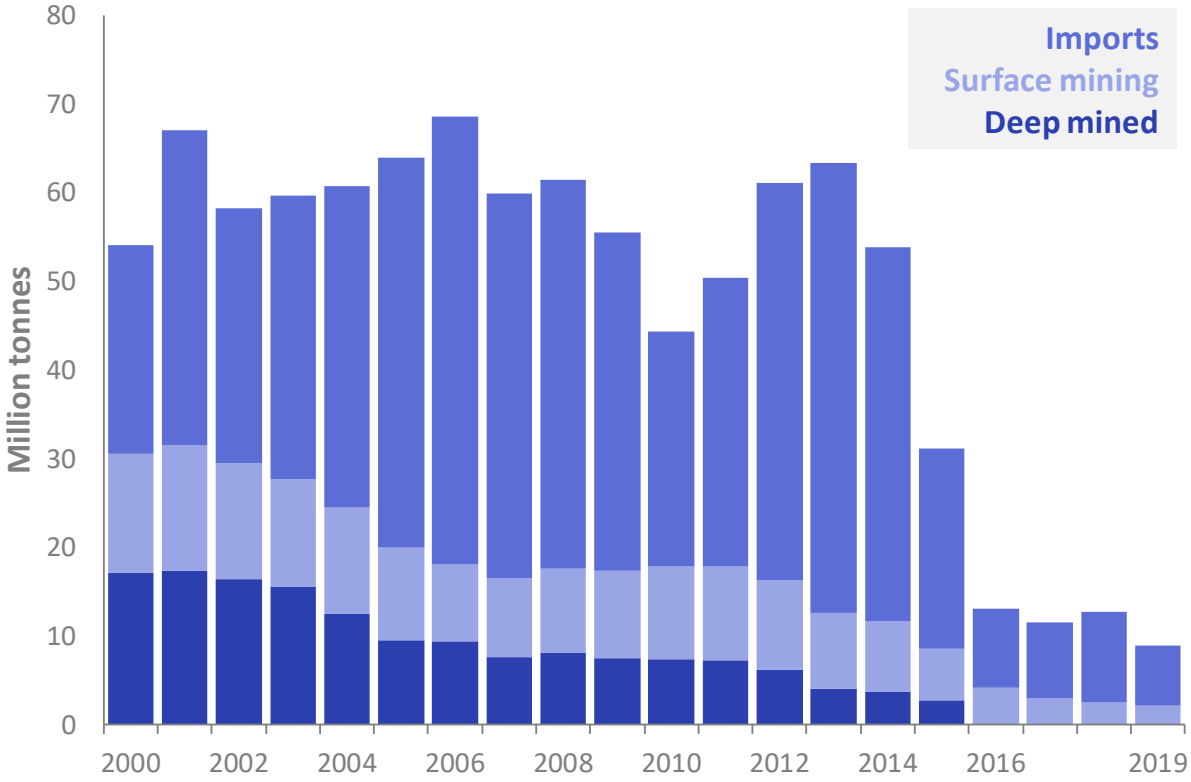
Chart 2.1 Coal supply (Table 2.1)



Provisional figures for 2019 show that coal production was 16 per cent down on 2018 at 2.2 million tonnes (a record low), mainly as a result of lower demand from electricity generators which continues to fall. Deep-mined output was up mainly due to Aberpergwm colliery increasing production and was 4.6 per cent of total production, a marked contrast to much of the time series (for instance, in 2015 deep mined production provided nearly a third of total coal production). Coal use has declined since the early seventies as new fuels have entered the market. In the last ten years UK coal production has fallen by 88 per cent.

Provisional figures for the fourth quarter of 2019 show that coal production fell to 0.5 million tonnes, down 12 per cent on the fourth quarter of 2018. This is as a result of mine closures and falling demand for coal for electricity generation.

Imports of coal in 2019 fell 33 per cent compared to 2018 and was down by 58 per cent in the final quarter of the year alone.

The decrease in demand reflects the fact that consumption by electricity generators was down by 56 per cent to 2.9 million tonnes (a new record) in 2019.

Table 2A Coal imports by origin

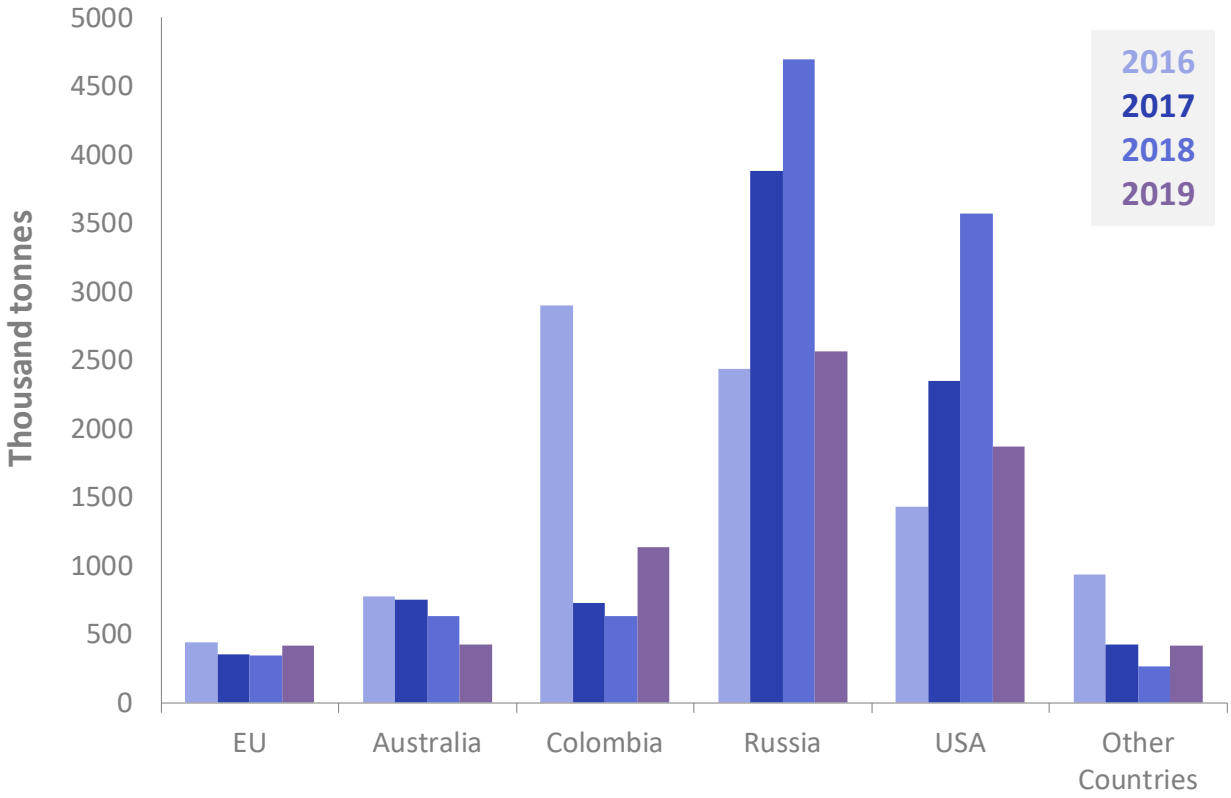
Thousand Tonnes

	2018	2019p	2018 Q4	2019 Q4p
European Union	344	420	114	111
Russia	4,695	2,560	1,333	459
Colombia	635	1,135	260	182
USA	3,573	1,873	1,282	367
Australia	630	423	84	0
Other Countries	268	418	39	178
Total Imports	**10,144**	**6,829**	**3,113**	**1,296**

Coal imports of 6.8 million tonnes in 2019 were down 33 per cent compared to 2018, to the lowest level since the 1984 Miners' Strike. Steam coal imports fell by 40 per cent to 4.5 million tonnes, while coking coal imports fell 9.9 per cent to 2.2 million tonnes. Steam coal accounted for 67 per cent of total coal imports in 2019 and coking coal accounted for 32 per cent of coal imports.

In the fourth quarter of 2019, total coal imports fell by 58 per cent to 1.3 million tonnes. This was the lowest quarterly value in the published time series covering 18 years. Russia (35 per cent), the USA (28 per cent) and Colombia (14 per cent) accounted for 78 per cent of total coal imports. Steam coal imports in the fourth quarter of 2019 fell by 71 per cent to 765 thousand tonnes and accounted for 59 per cent of total coal imports. Coking coal imports in the fourth quarter of 2018 rose by 10 per cent to 496 thousand tonnes and accounted for 38 per cent of total coal imports.

Chart 2.2 Total coal imports (Table 2.4)

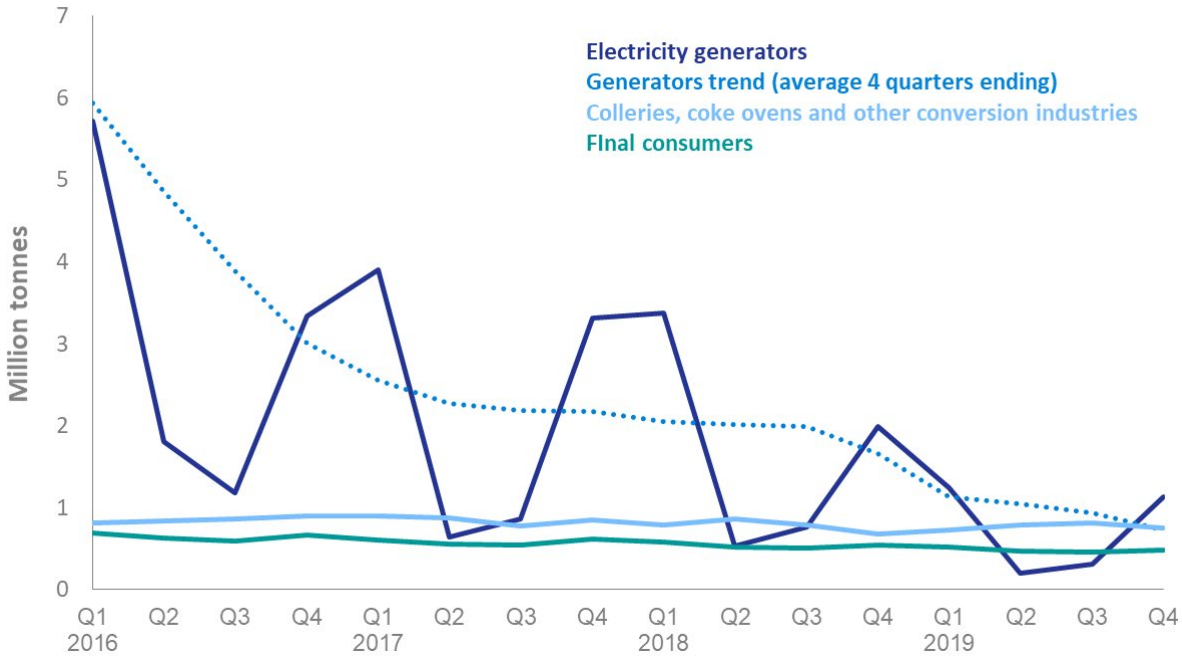


In 2019, 4.5 million tonnes of the coal imported (67 per cent) was steam coal, largely to fuel coal-fired power stations. Russia (41 per cent), Colombia (25 per cent) and the USA (20 per cent) in 2019 represented 85 per cent of steam coal imports.

Steam coal imports from the USA were 68 per cent lower in 2019 than in 2018, falling to 0.9 million tonnes. The USA, one of the top three suppliers of steam coal imports for many of the last nine years, did not export coal to the UK in the second half of 2019. Cheaper steam coal from other producing countries made USA steam coal less competitive. There was also a drop in steam coal imports from Russia of 51 per cent to 1.8 million tonnes. Steam coal imports from Colombia rose by 79 per cent to 1.1 million tonnes.

In the fourth quarter of 2019 imports of steam coal fell 71 per cent compared to a year earlier. Russia (45 per cent) and Colombia (24 per cent) provided most of the UK's steam coal imports. This was followed by Kazakhstan (9 per cent), South Africa (8 per cent) and Venezuela (7 per cent). Kazakhstan provided 64 thousand tonnes of steam coal imports and Venezuela provided 52 thousand tonnes of steam coal imports. These are shown in the Other countries group in the Main Table of Energy Trends table 2.4.

Chart 2.3 Coal consumption (Table 2.1)



Total demand for coal in 2019 was 7.9 million tonnes, 33 per cent lower than in 2018, with consumption by electricity generators down by 56 per cent to a new record low of 2.9 million tonnes. Demand for coal-fired electricity generation continued to decline as production favoured gas, nuclear and renewables over coal for a variety of economic reasons, not least of which being the high carbon price floor for coal. Additionally, generation capacity which had fallen in recent years continued to fall with Fiddlers Ferry Unit 1 (March 2019), Cottam Power Station (September 2019) and Aberthaw B (December 2019) closing in 2019.

There are now only five major coal-fired power stations that remain open and in the last ten years coal consumption has fallen by 84 per cent. Electricity generators accounted for 37 per cent of total coal use in 2019 compared with 56 per cent in 2018, and 81 per cent 10 years ago.

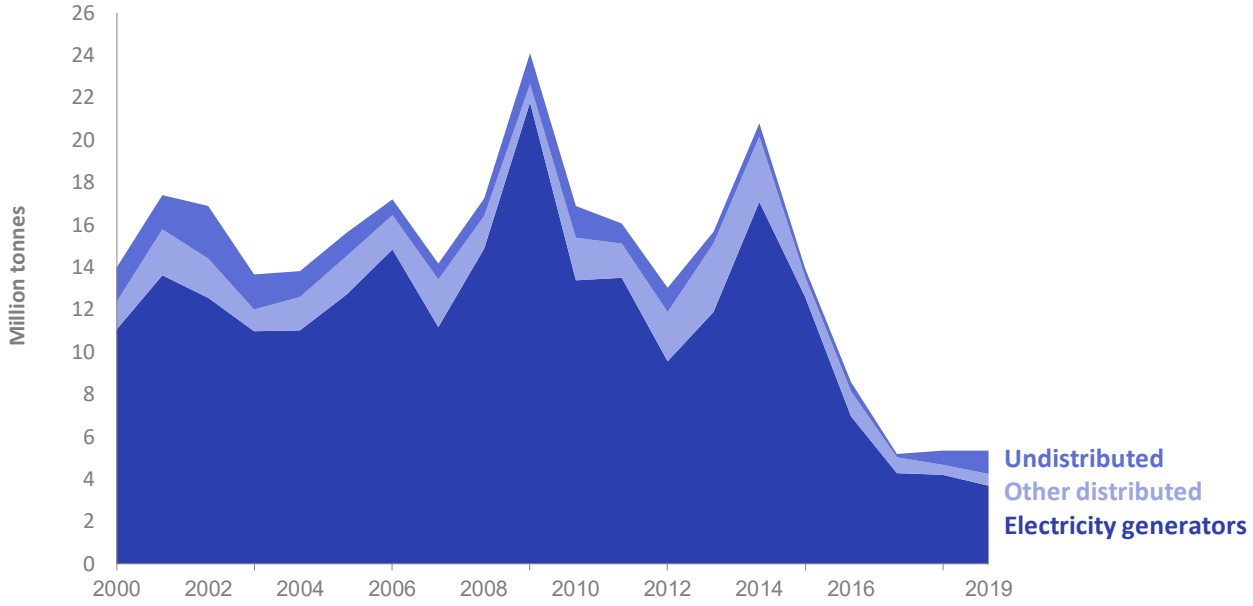
Coal used for coke manufacture rose 2.4 per cent to 1.8 million tonnes, while coal used in blast furnaces fell 1.9 per cent to 1.1 million tonnes.

Total demand for coal in the fourth quarter of 2019, at 2.4 million tonnes, was 26 per cent lower than in the fourth quarter of 2018. Consumption by electricity generators fell by 43 per cent to 1.1 million tonnes. Coal fired electricity's share of the MPP supply was down on the same period in 2018 (see Energy Trends table 5.4). The decline of coal is largely the result of the process becoming less economically favourable than gas-fired generation, attributed to low gas prices and higher carbon pricing. Coal generating capacity dropped significantly in 2019 following closures of Unit 1 at Fiddlers Ferry (March 2019), Cottam Power station (September 2019) and Aberthaw Power station (December 2019). This leaves only five major coal-fired power stations in the UK. Electricity generators accounted for 48 per cent of total coal use in the fourth quarter of 2019; compared to 62 per cent in 2018.

Sales to final consumers (as measured by disposals to final consumers) fell by 10 per cent in 2019. Sales to industrial users fell by 13 per cent to 1.4 million tonnes, with domestic sales remaining constant at 0.5 million tonnes. Sales to final consumers were down by 11 per cent in the fourth quarter of 2019 with decreases in most industrial sales, domestic users, and other final users.

Coal used in blast furnaces was 0.3 million tonnes in the fourth quarter of 2019, an increase of 12 per cent compared to the fourth quarter of 2018.

Chart 2.4 Coal stocks (Table 2.1)



Total coal stocks were 5.3 million tonnes at the end of 2019, virtually identical to stocks at the end of 2018. Of these stocks, the bulk – 3.7 million tonnes - were held at power stations, down 12 per cent on the stocks held at the end of 2018.

Section 3 – UK Oil and Oil Products 2019 and October to December 2019

Key results show:

Provisional 2019

UK production of crude and Natural Gas Liquids (NGLs) was up 1.8 per cent in 2019 compared with 2018. Production has remained robust following the increase seen in 2018 as well as the new production from the Clair Ridge project, which opened towards the end of that year. Net imports of crude oil and NGLs was up marginally as imports increased more than exports but remained low at 3.5 million tonnes. (**Chart 3.1**)

Production of petroleum products was stable on 2018. Refinery production has been fairly robust although production remains at one-third of the peak at the turn of the century. (**Chart 3.2**)

In 2019 final consumption of petroleum products was down by 2.1 per cent, the second consecutive annual fall in demand. The reduction was mainly driven by a 1.5 per cent decrease in demand for transport fuel. **(Chart 3.5)**

Net imports of primary oils (crude, NGLs and process oils) made up 12 per cent of UK supply in 2019 and the UK was a net importer of petroleum products by 12.7 million tonnes. The UK is a net importer of road diesel and aviation turbine fuel but a net exporter of motor spirit. **(Chart 3.3)**

Domestic demand over the year decreased by 1.9 per cent due to warmer average temperatures compared to 2019. **(Chart 3.4)**

Quarter 4 2019

In Q4 2019, UK production of crude oil and NGLs was down by 4.1 per cent, with NGLs down by nearly one-fifth following the closure of the Mossmorran processing plant at Fife. (**Chart 3.1)**

Refinery production was stable in the latest quarter of 2019 compared with the same quarter in 2019. (**Chart 3.2**)

Exports of petroleum products were up by 6.5 per cent while imports remained stable, up just 1.7 per cent. Over the last three months, the UK was a net importer of petroleum products by 2.5 million tonnes. **(Chart 3.2)**

Total deliveries of key transport fuels were lower in Q4 2019 by 2.2 per cent. This was driven by a decrease in demand for road diesel of 4.6 per cent. Bucking the trend of decline, demand for motor spirit increased by 0.5 per cent as motorists switch to petrol-engine cars. Aviation turbine fuel was stable on the same period in 2018. **(Chart 3.5)**

Total stocks for the UK at the end of quarter 4 2019 increased 5.5 per cent. A 1.6 per cent fall in primary oil stocks was more than offset by a 12 per cent increase in product stocks. **(Chart 3.6)**

Relevant tables

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

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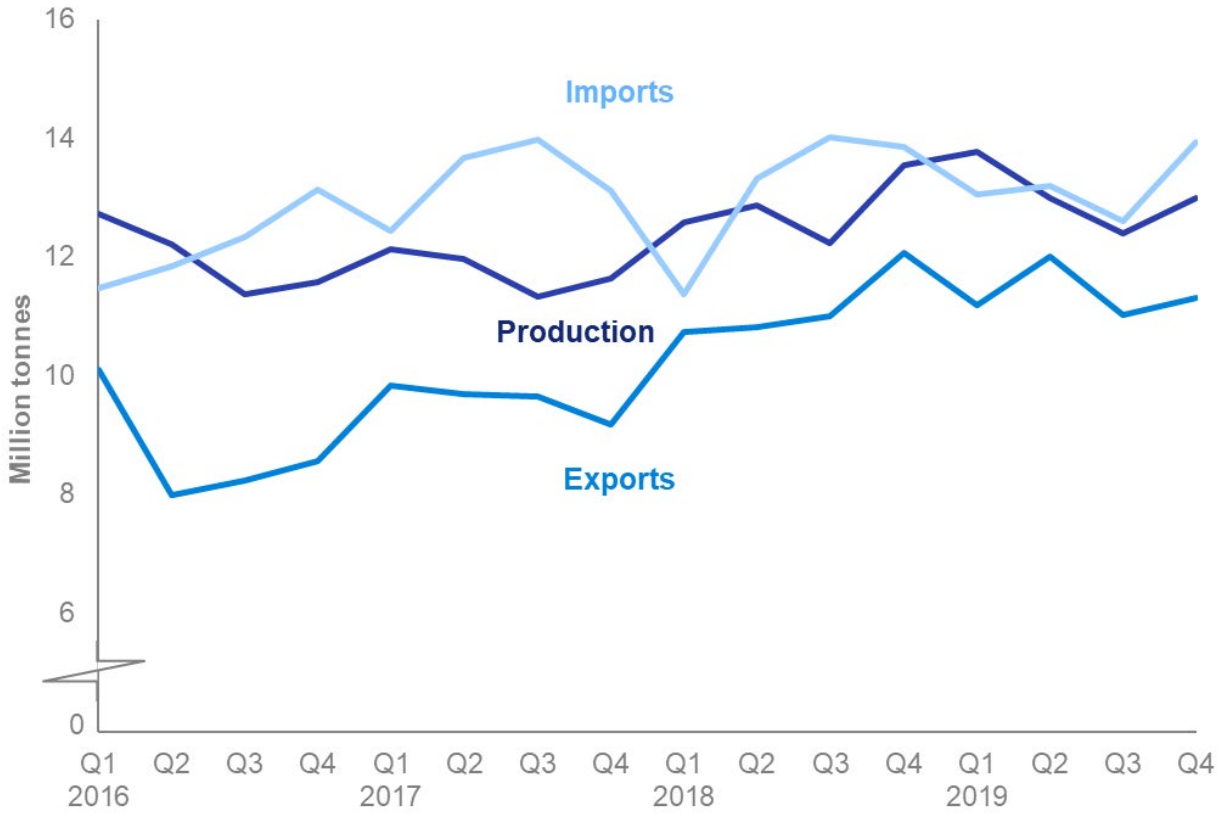
Chart 3.1 Production and trade of crude oil and NGLs (Table 3.1)



Provisional figures for 2019 show that UK crude oil and NGL production was 1.8 per cent higher than 2018. Production levels were robust following the increase seen in 2018 after new projects opened, with Clair Ridge also announcing first oil in late 2018.

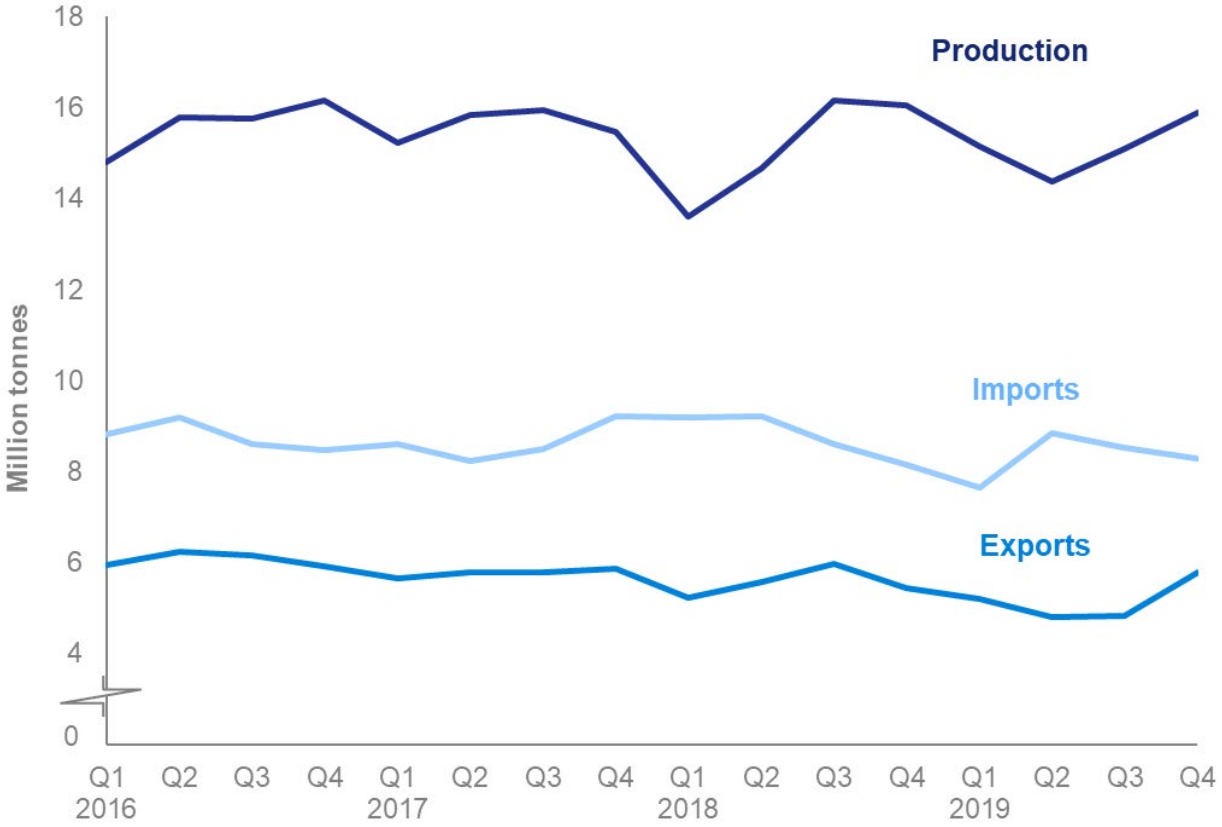
Much of this new production was exported, contributing to the highest annual exports since 2008, up again on 2018 by 1.8 per cent. Strong exports were also partially driven by the favourable price spread for Brent crude although 2019 did see a recovery in refinery receipts of oil from the UK Continental Shelf after the record low in 2018. Use of indigenous crude was up 10 per cent to 6.3 million tonnes in 2019, comprising 11 per cent of total refinery intake (see Table 3.10). Imports of crude oil and NGLs were up 2.1 per cent.

After increases in the first three quarters in 2019, production in Q4 was down by 4.1 per cent compared to the same period in 2018. In the last quarter of 2019, there was a sharp fall of nearly one-fifth in production of NGLs following the closure of the Mossmorran processing plant at Fife and the temporary suspension of flows through the SAGE pipeline as a result.

In the broader historical context, production now is around a third of the 1999 peak.

Imports of crude oil and NGLs were up by 3.8 per cent in Q4 2019 while exports fell by 4.8 per cent on the same period in 2018.

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

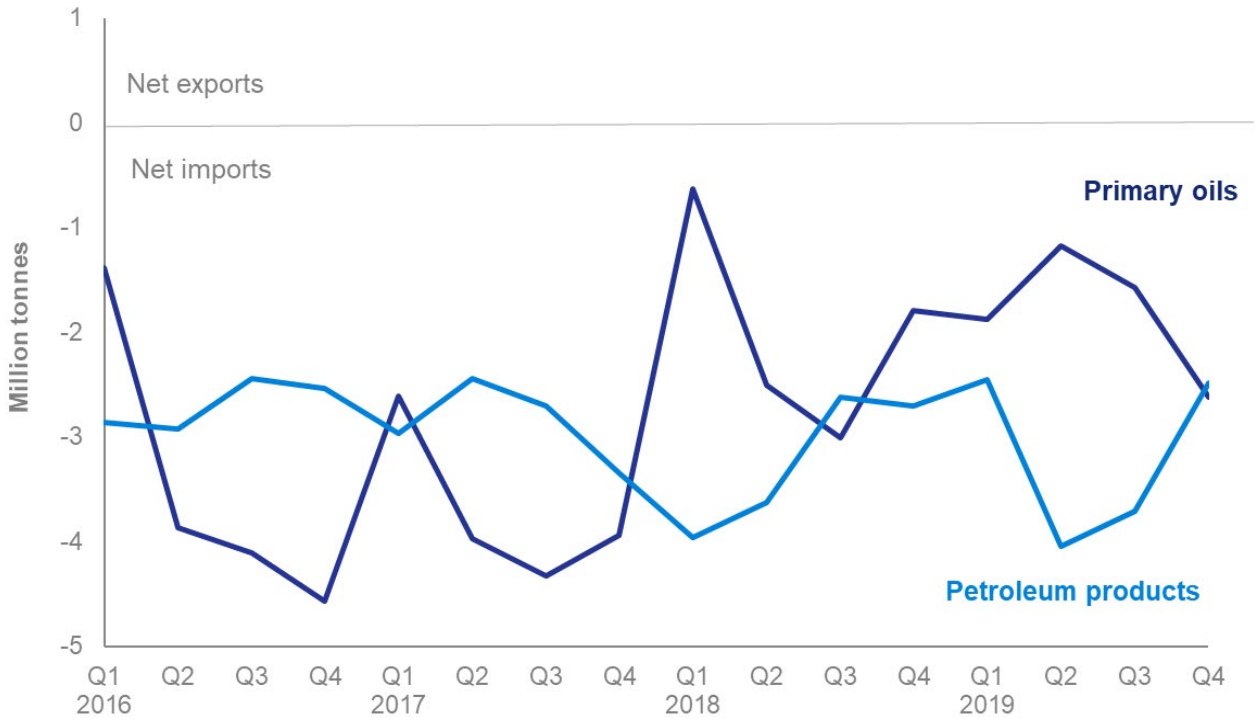


UK refinery production in 2019 was stable on 2018 and was equivalent to around 90 per cent of UK demand. However, UK production does not meet demand on a product mix basis, meaning the UK trades extensively to meet demand for diesel and jet fuel, and exports excess volumes of petrol.

Following reduced demand in 2019, imports were down by 5.1 per cent because of reductions in transport and non-energy demand (see Charts 3.4 and 3.5). Exports were down by 7.2 per cent, resulting in a small reduction of net imports by 1.7 per cent.

In Q4 2019 production of petroleum products was broadly stable, down just 0.9 per cent. Notably, demand was down by 2.9 per cent with a fall in demand for transport and non-energy use (see Charts 3.4 and 3.5).

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

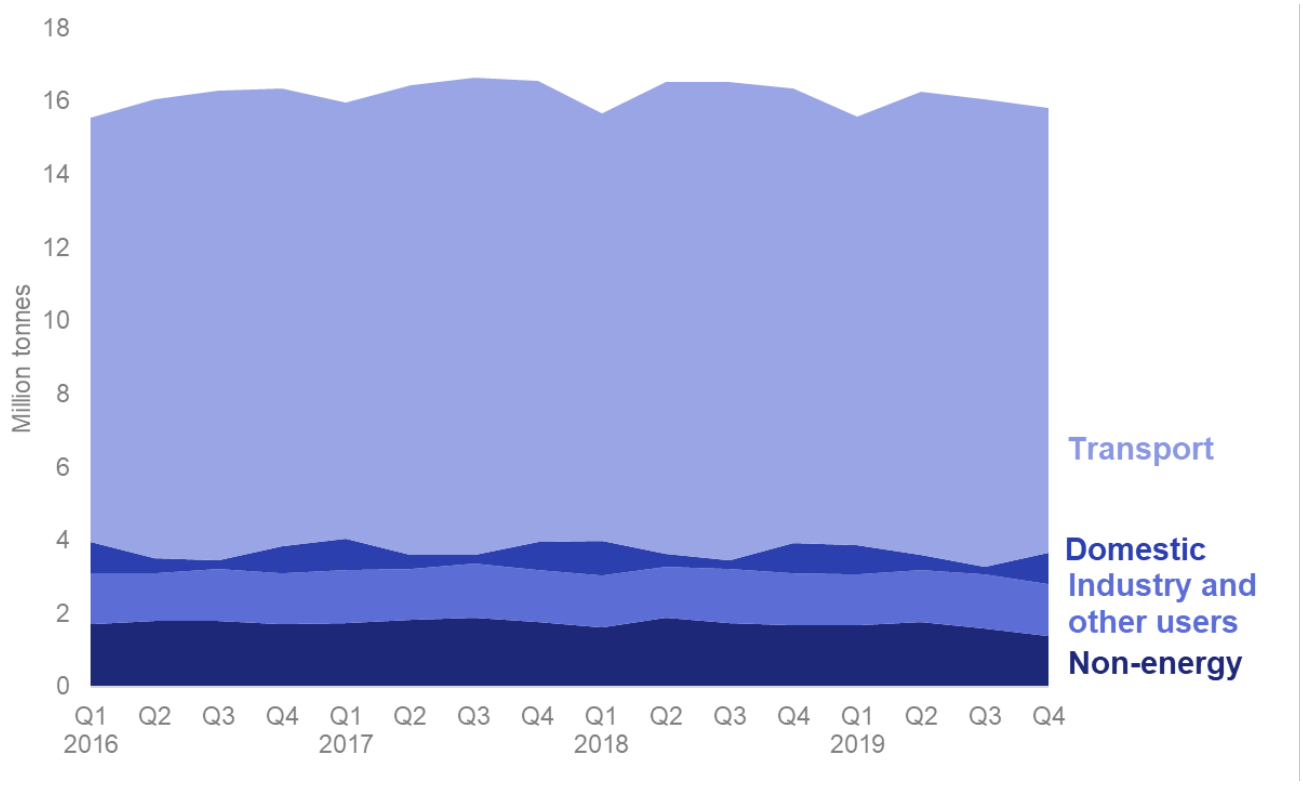


Whilst net imports of primary oils had stood at roughly 15 million tonnes in 2015 and 2016, this halved in 2018 and stood at 7.9 million tonnes in 2019. The reduction has been caused a large increase in exports of crude oil as production from new projects on the UK Continental Shelf is predominantly sent abroad. In 2019 there was small decrease in net imports of 8.7 per cent as exports increased more than imports.

In 2019 the UK was a net importer of petroleum products by 12.7 million tonnes, down from 12.9 million tonnes in 2018.

In Q4 2019 net imports of crude oil and NGLs increased by nearly half to 2.6 million tonnes, up from 1.8 million tonnes in 2018 because of a reduction in exports and increase in imports in Q4 2019. Higher volumes of indigenous crude were delivered to UK refineries in late 2019 compared to 2018, resulting in the lower exports. Conversely, net imports of petroleum products decreased by 8.1 per cent to 2.5 million tonnes, down from 2.7 million tonnes in Q4 2018.

Chart 3.4 Final consumption of oil (Table 3.4)



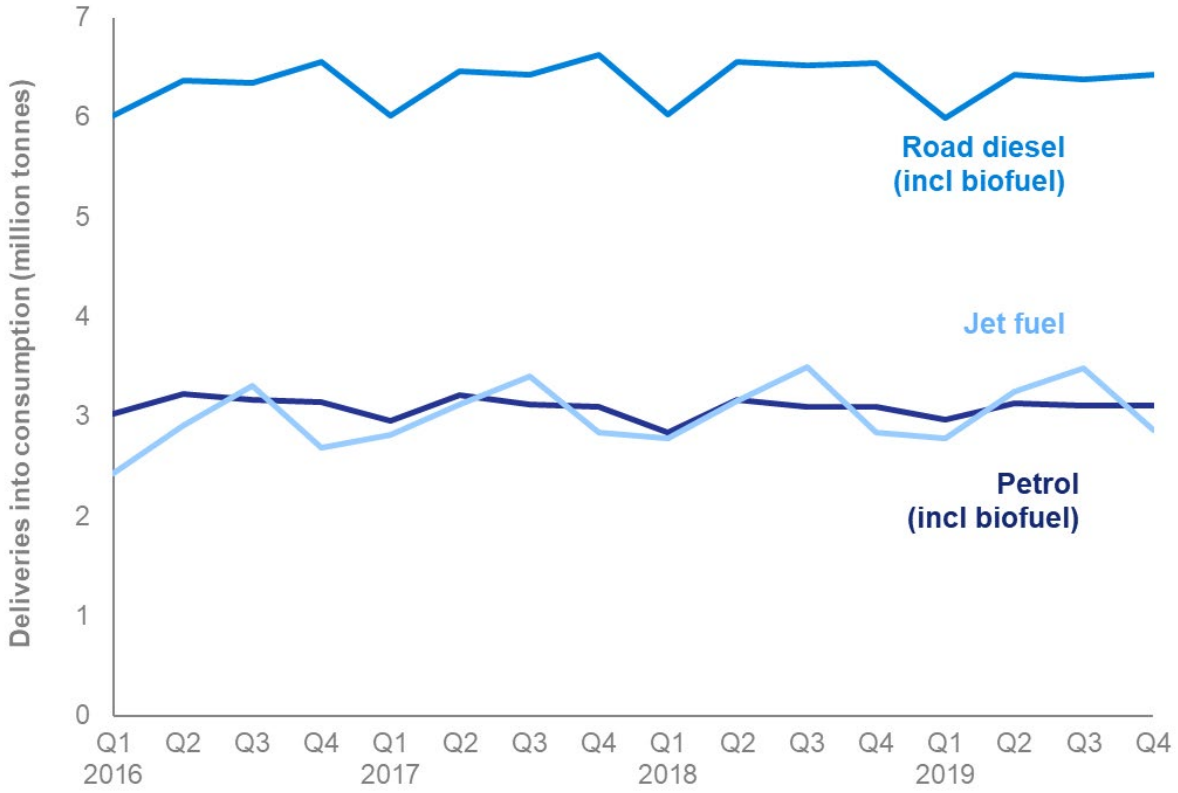
Provisional annual data shows that final consumption of petroleum products was down by 2.1 per cent in 2019 compared with 2018, the second consecutive annual decrease. Within this:

- Transport use, which accounts for more than three-quarters of UK final consumption, was lower by 1.5 per cent. Sales of road diesel were down by 3.4 per cent, with petrol up by 1.1 per cent (see Chart 3.5). Trends in sales of petrol and diesel have been changing as motorists switch from diesel- to petrol-fuelled cars, reflecting factors such as changes to diesel car taxation.
- Non-energy use of oil products was down by 7.3 per cent in the UK despite global trends of rapid increase.
- Demand by other users, including the domestic and industrial sectors was also down following slightly warmer average temperatures over the year compared to 2018.

In Q4 2019 final consumption of petroleum products was down by 3.3 per cent on the same period in 2018, again with reductions in transport and non-energy being the principal reasons. Transport fell by 2.2 per cent, although the direction of this downward trend was due to the contraction in diesel sales, down by 4.6 per cent. Sales of petrol and demand for jet fuel were stable on the same period in 2018. Demand for non-energy use saw a sharp decrease of nearly one-fifth as deliveries of gases used as feedstocks were reduced because of the closure of the Mossmorran processing plant at Fife.

Domestic demand in Q4 2019 was up by 4.1% on 2018 due to the cooler temperatures and higher number of heating degree days in that period compared to 2018.

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



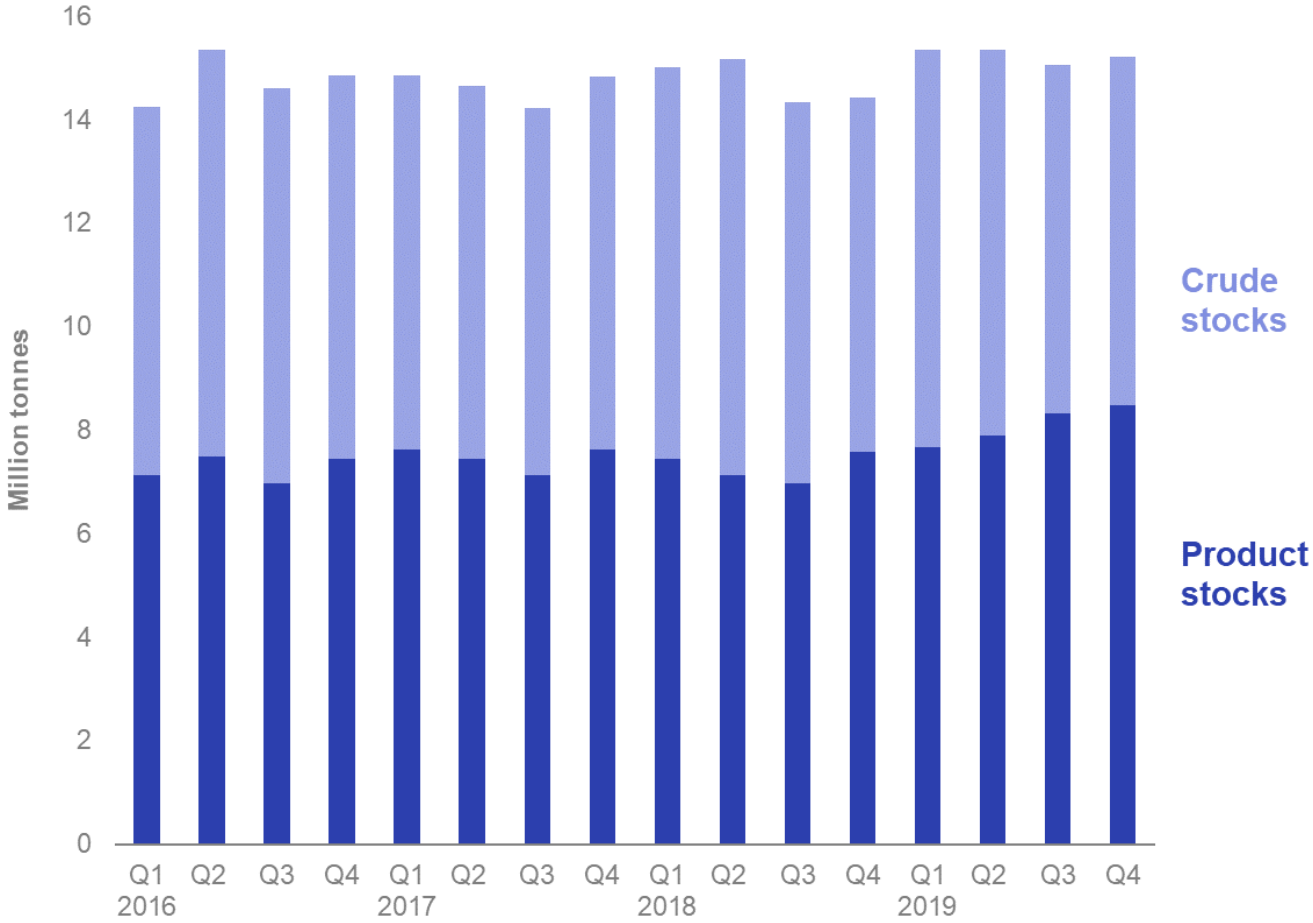
Annual demand for transport fuels has decreased for the second consecutive year, bucking the persistent upward trend that had been seen since 2013. Demand for road diesel decreased for the second consecutive year in 2019; previously the last fall was in 2009 following the economic crisis of 2008 when significantly fewer miles were driven by commercial vehicles. Demand for aviation turbine fuel was up by just 0.9 per cent compared to 2018 as the trend of year-on-year growth has slowed.

Including biofuels, annual diesel sales in 2019 were lower by 1.6 per cent. The bio-component of diesel increased from 3.9 per cent in 2018 to 5.6 per cent in 2019; total sales of biodiesel were up by 40 per cent. The proportion of petrol that is derived from renewable sources remained stable at roughly 5 per cent. The increase seen in biodiesel is the result of the Renewable Transport Fuel Obligation[1], which requires larger suppliers of road fuels to demonstrate that a pre-determined proportion of the fuels they supply is derived from renewable and sustainable sources.

In Q4 2019 quarterly petrol sales including biofuels was broadly stable, up by 0.5 per cent, but diesel sales were lower by 1.8 per cent.

[1] www.gov.uk/guidance/renewable-transport-fuels-obligation

Chart 3.6 UK oil stocks (Table 3.6)



The UK holds oil stocks both for operational and commercial purposes and to meet obligations set out by the European Union (EU) and the International Energy Agency (IEA) to ensure the continuity of oil supply in times of significant disruption. The UK meets these obligations by directing companies to hold stocks of oil over and above those required for operational purposes. The UK is required to hold stock equivalent to 61 days of consumption to meet EU requirements and stock equivalent to 90 days of net imports to meet IEA requirements.

At the end of Q4 2019 the UK held 15.2 million tonnes, equivalent to 64.5 days of consumption, with an additional 10 days of commercial stocks available on top of volumes held towards the obligation. The same volume is equivalent to around 180 days of net imports. UK total oil stocks were up 5.5 per cent on the same period last year, with primary oil stocks down 1.6 per cent and petroleum product stocks up 12 per cent to a 10 year high of 8.5 million tonnes.

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
2019 and October to December 2019

Key results show:

Provisional 2019
In 2019 gross gas production decreased by 2.2 per cent compared to last year, in line with the longer-term trend of decline since the production peak in 2000. **(Chart 4.1)**

In 2019, imports of natural gas were stable on 2018 at 518 TWh. Whilst pipeline imports were down by more than one-quarter, volumes of Liquefied Natural Gas (LNG) more than doubled in 2019. There was a steep increase in the final quarter when LNG volumes climbed to the near record levels last seen during the peak in 2011. Exports increased by 5.6 per cent in 2019, although at 87.5 TWh these were still notably depressed and 2019 was only the fourth instance that the UK exported less than 100 TWh in the series. Overall, these trends in trade meant a 0.9 per cent decrease in net imports over the past twelve months. **(Chart 4.4)**

Overall gas demand was fairly stable in 2019, with final consumption down by 1.4 per cent, and domestic demand down 1.7 per cent after warmer temperatures at the start of the year compared to 2018. **(Chart 4.6)**

Quarter 4 2019
Despite the overall decline in production in 2019, production was up by 4.7 per cent to 121 TWh in the final quarter of 2019 compared to the same quarter in 2018 **(Chart 4.1).** Production of associated gas increased by 8.0 per cent whilst dry gas production was down by 13 per cent. **(Chart 4.2**)

In the last quarter of 2019, imports increased by 7.0 per cent to 163 TWh with LNG imports comprising nearly half of this total. Exports followed the same trend, increasing by a quarter to 12 TWh compared to the same quarter last year. This combination of overall increased trade levels resulted in a 5.7 per cent increase in net imports during the final quarter of 2019. **(Chart 4.4)**

In contrast with the annual trend, in the final three months of 2019 UK demand for natural gas increased by 7.8 per cent compared with Q4 2018. This was mainly attributed to the 14.5 and 14.9 per cent increases in domestic and other final users respectively as a result of colder temperatures. **(Chart 4.6)**

Relevant table

4.1: Natural gas supply and consumption

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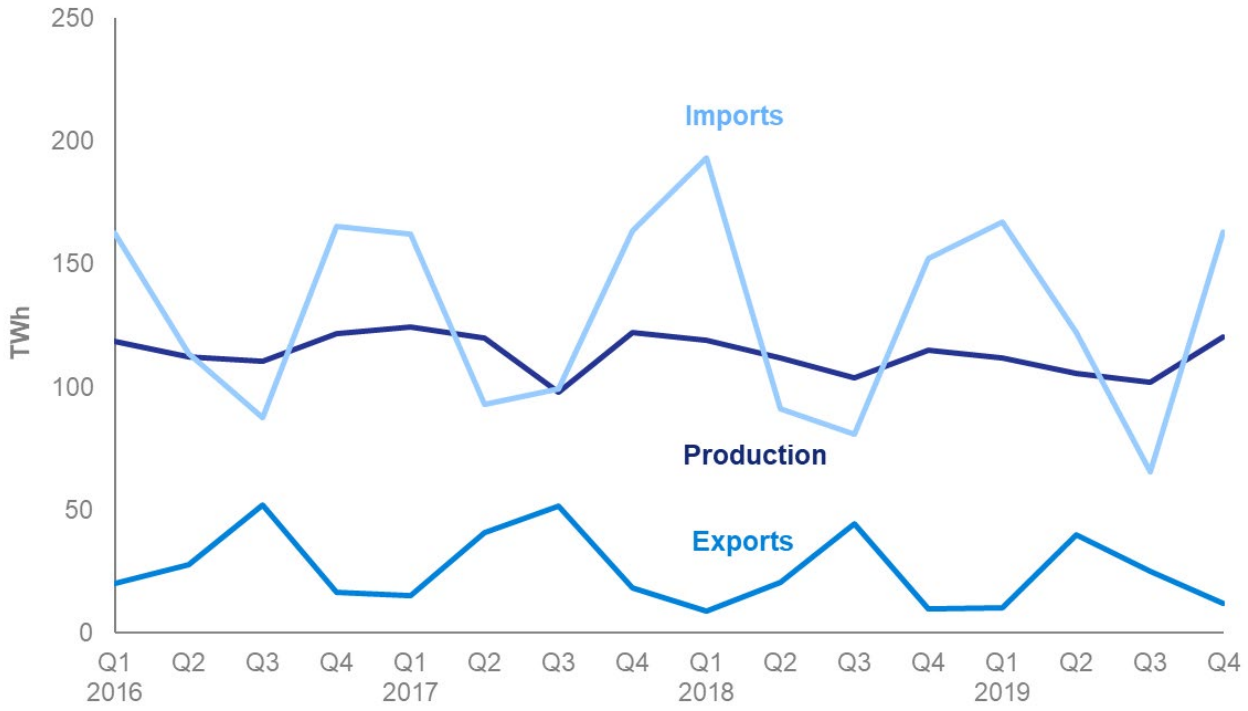
Chart 4.1 Production and nominated flow trades of natural gas (Table 4.1)



Production of natural gas in 2019 decreased by 2.2 per cent to 440 TWh. This is the second year since 2013 that gross gas production has decreased compared to the previous year, although the long-term trend has been downwards since the peak in 2000. This latest annual reduction was partly due to the continued effects of the closure of Theddlethorpe in 2018, but also a reduction in output at several large gas terminals.

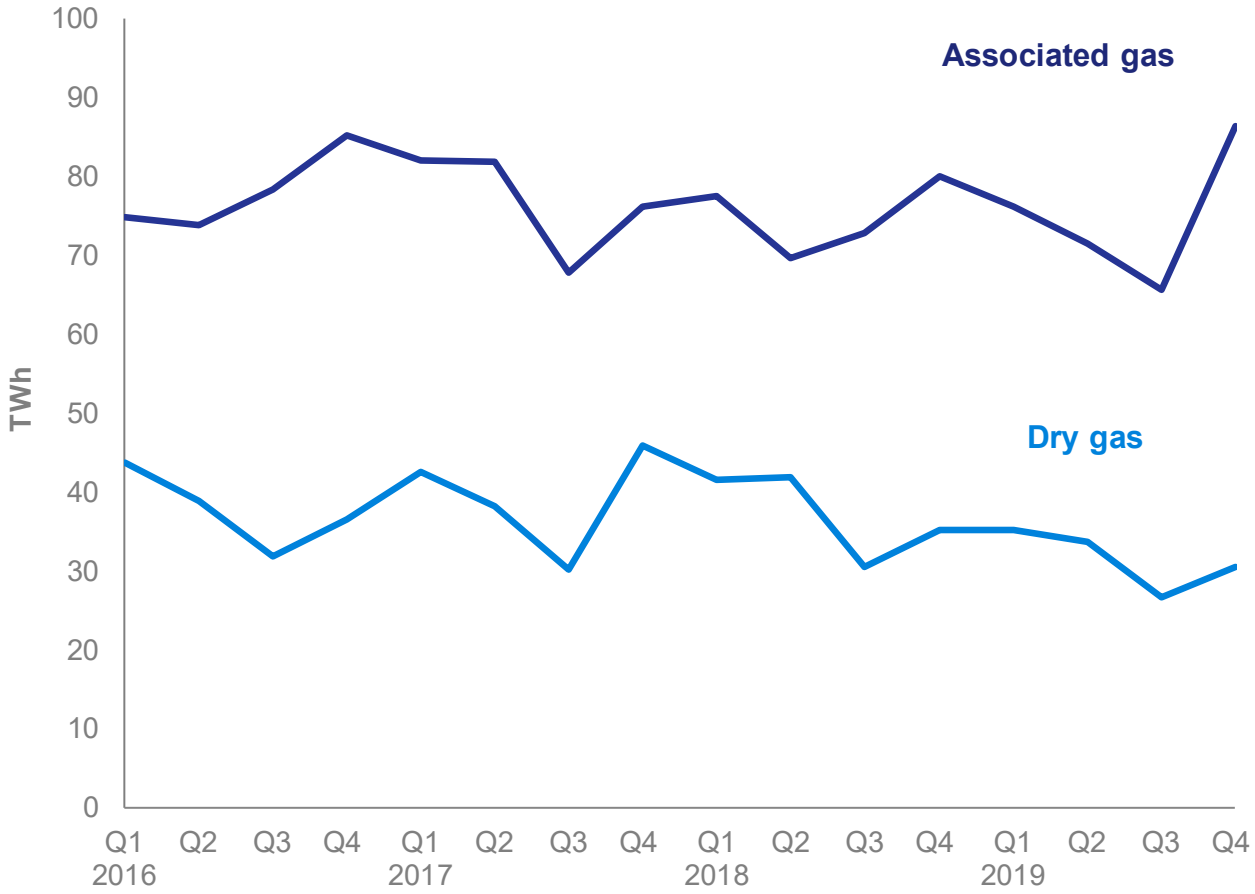
Despite the annual production decline in 2019, production in the last quarter of 2019 increased to 121 TWh compared to the same quarter in 2018. This was as a result of strong output at several terminals from high demand for natural gas due to colder temperatures in the quarter (see chart 4.6).

After dropping to their lowest levels since 1997 in 2018, exports of gas (on a nominated flow basis[1]) in 2019 increased by 4.7 per cent. However, exports were still significantly lower than just two years previous in 2017. This is only the fourth time in the series that the UK exported less than 100 TWh, and is related to relatively low levels of exports to Belgium and Netherlands compared with historical norms. Meanwhile, imports in 2019 remained stable at 518 TWh despite Liquefied Natural Gas (LNG) imports more than doubling compared with 2018 as pipeline imports were substantially reduced.

In the last quarter of 2019, imports increased by 7.0 per cent to 163 TWh with LNG imports comprising nearly half of this total. Exports followed the same trend, increasing by a quarter to 12 TWh compared to the same quarter last year. This combination of overall increased trade levels resulted in a 5.7 per cent increase in net imports during the final three months of 2019. For more detail on trade, see Chart 4.4.

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

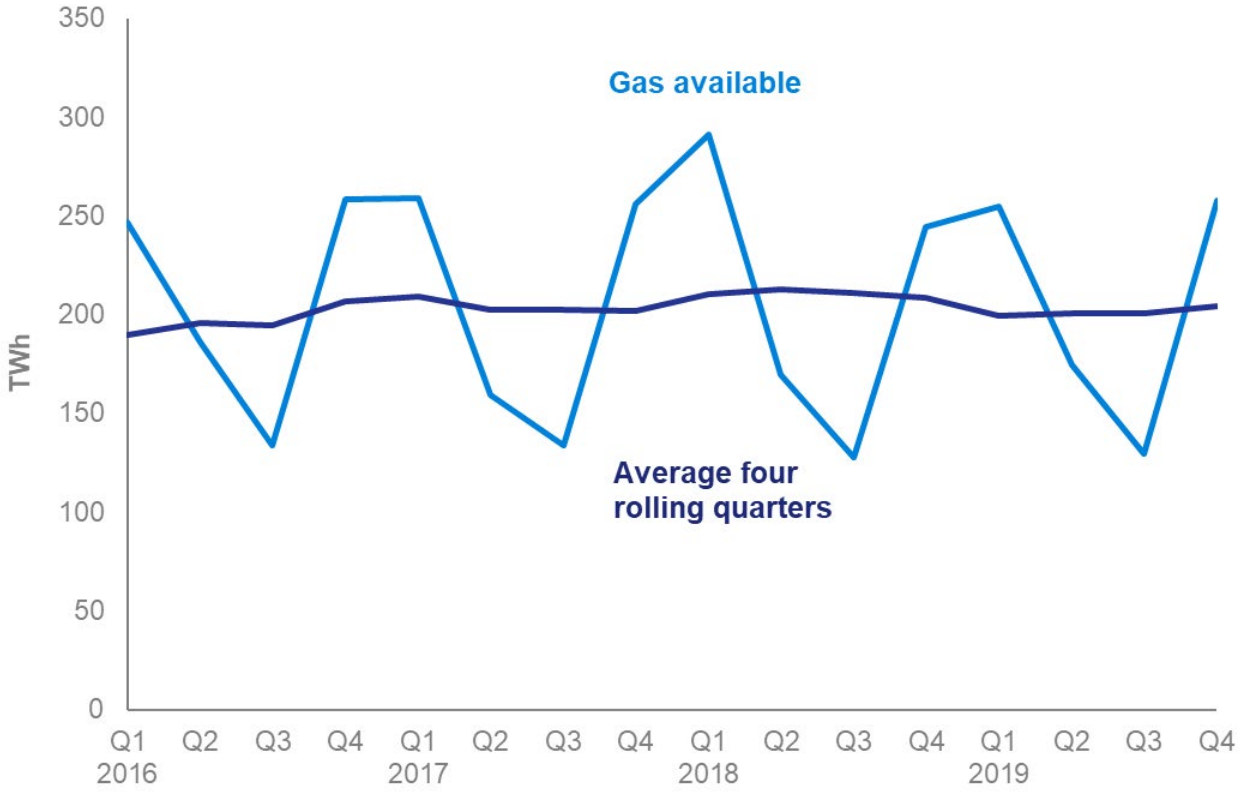
Chart 4.2 Production of dry gas and associated gas (not shown in published tables)



Production of associated gas (natural gas produced from oil fields) in 2019 was stable on 2018 at 300 TWh. However, in Q4 2019, associated gas production increased by 8.0 per cent on Q4 2018, from 80 TWh to 86 TWh.

Annual dry gas production (natural gas composed mainly of methane) in 2019 decreased by 15 per cent compared to 2018 at 126 TWh. Q4 2019 followed the same trend, decreasing by 13 per cent compared to Q4 2018 from 35 TWh to 30 TWh.

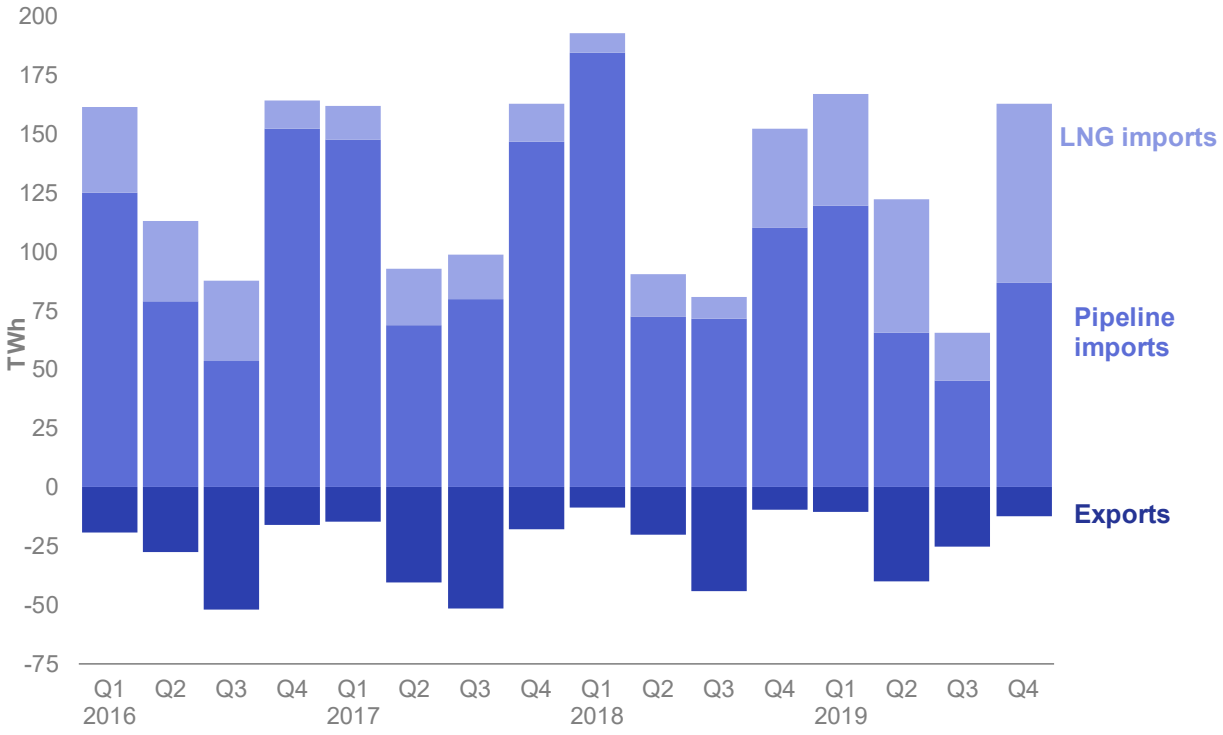
Chart 4.3 Gas availability (Table 4.2)



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.

Compared to the same quarter in 2018, gas availability in the final three months of 2019 increased by 5.5 per cent, associated with the colder temperatures and therefore increased demand. The average availability of gas over four rolling quarters remains above average for Q4 2019.

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



Map 4.1 shows the pipeline infrastructure that connects the UK with Norway. We import gas form 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). Whilst pipeline imports were down 28 per cent in 2019, LNG imports more than doubled to 200 TWh, accounting for 39 per cent of the UK's total imports. This meant in 2019, total imports of natural gas were stable on the year before.

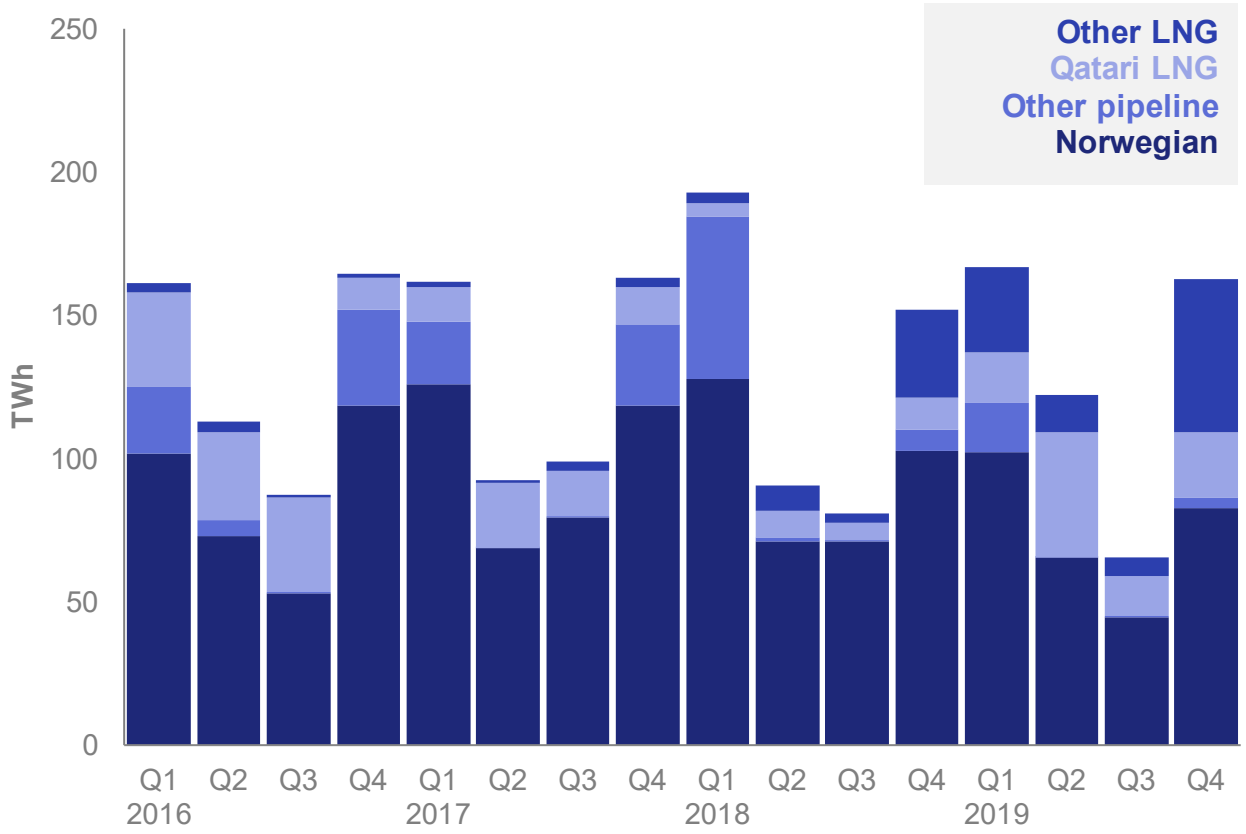
Meanwhile, after dropping to their lowest levels since 2005 in 2018, exports of gas (on a physical instead of a nominated flow basis[2]) increased by 5.6 per cent in 2019. These was the result of increased exports to the Republic of Ireland, which were up by 38 per cent, as output from the Corrib field naturally declines. Volumes to the Isle of Man also increased. However, exports were still significantly lower than just two years ago in 2017 and this was only the fourth time in the series that the UK exported less than 100 TWh. These trends in overall trade meant a 0.9 per cent decrease in net imports over the past twelve months.

The final three months of 2019 followed the annual trend of exports which increased by a quarter to 12 TWh compared to the same quarter of last year. Again, this was attributed to increased exports the Republic of Ireland which were up by a third and accounted for over three-quarters of exports from the UK.

Similarly, compared to the same quarter of last year, total imports were up by 7.0 per cent in Q4 2019. This was despite a decrease of one-fifth in pipeline imports, mainly associated with the contraction of flows from Norway. To make up for this shortfall in supply LNG imports nearly doubled on the already high volumes seen in Q4 2018 to 76 TWh in Q4 2019, the highest quarterly volume since the peak in LNG imports of 2011. LNG subsequently accounted for nearly half of all imports in the final three months of 2019, although Norway remained the single largest source of UK imports of gas.

[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 imports from Norway decreasing by a fifth on last year to their lowest level since 2011, Norway continues to be the main source of imported gas (including LNG) to the UK at 58 per cent in 2019, although this is down from 73 per cent in 2018. The reduction in Norwegian imports was due to the suspension of flows on the Vesterled and SAGE pipelines for maintenance and the diversion of flows on the Langeled pipeline to mainland Europe over the summer. Imports from Belgium and the Netherlands contracted substantially as well, down 89 per cent and 42 per cent respectively compared to 2018.

In comparison, LNG imports increased significantly in 2019 on 2018, reaching 200 TWh. This was the highest level of LNG imports since 2011, with strong deliveries in all quarters but a notable peak in the final quarter of the year. This meant LNG imports accounted for 39 per cent of total gas imports to the UK, up from 15 per cent in 2018. Of this, Qatar remains the major source of LNG to the UK with a 49 per cent share as imports from Qatar tripled on 2018. Other sources also increased, with LNG imports from the USA and Russia more than doubling in 2019. The UK also took delivery of first-time imports from Angola, Cameroon and a transhipment of LNG from the Netherlands during 2019.

The final quarter of 2019 LNG imports jumped sharply to 76 TWh, accounting for 47 per cent of all imports to the UK. This was a significant increase on the 28 per cent share for the same period in 2018. Qatar remains the biggest importer of LNG over the quarter, comprising 30 per cent of total LNG imports, but this is one of the lowest shares on record. The reduced share of Qatar is the result of the increase in diversity of supply sources as the UK received its first cargoes from Angola, Cameroon and the Netherlands in 2019. See Energy Trends special article Trends in trade of Liquefied Natural Gas in the UK and Europe.

Compared to the same quarter last year, pipeline imports decreased by one-fifth in Q4 2019, the result of a similar decrease in pipeline flows from Norway. Despite this, Norway remained the largest supplier of total imports to the UK (including LNG) at 52 per cent in Q4 2019.

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

Map 4.1: UK physical imports and exports of gas Q4 2019

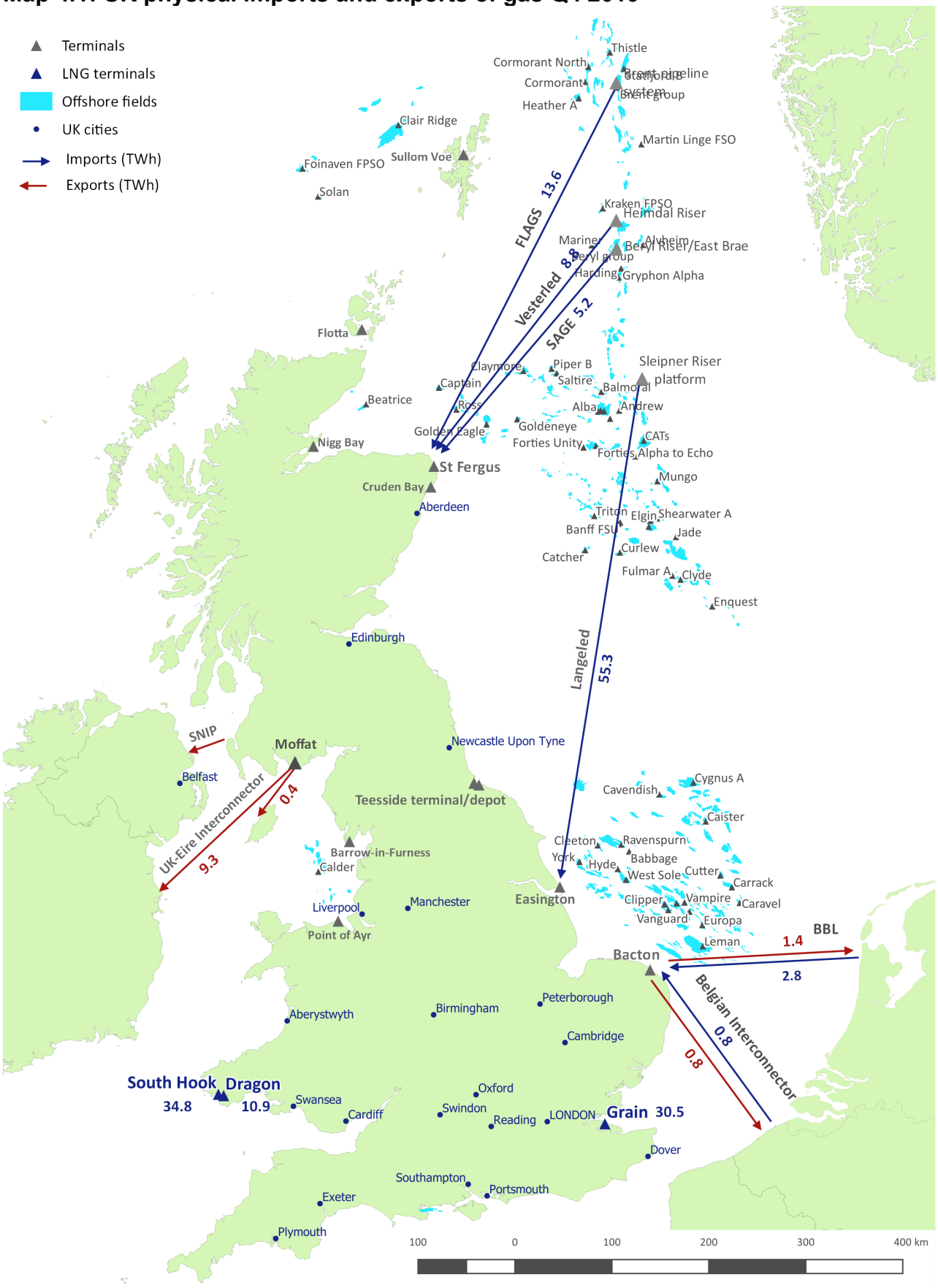
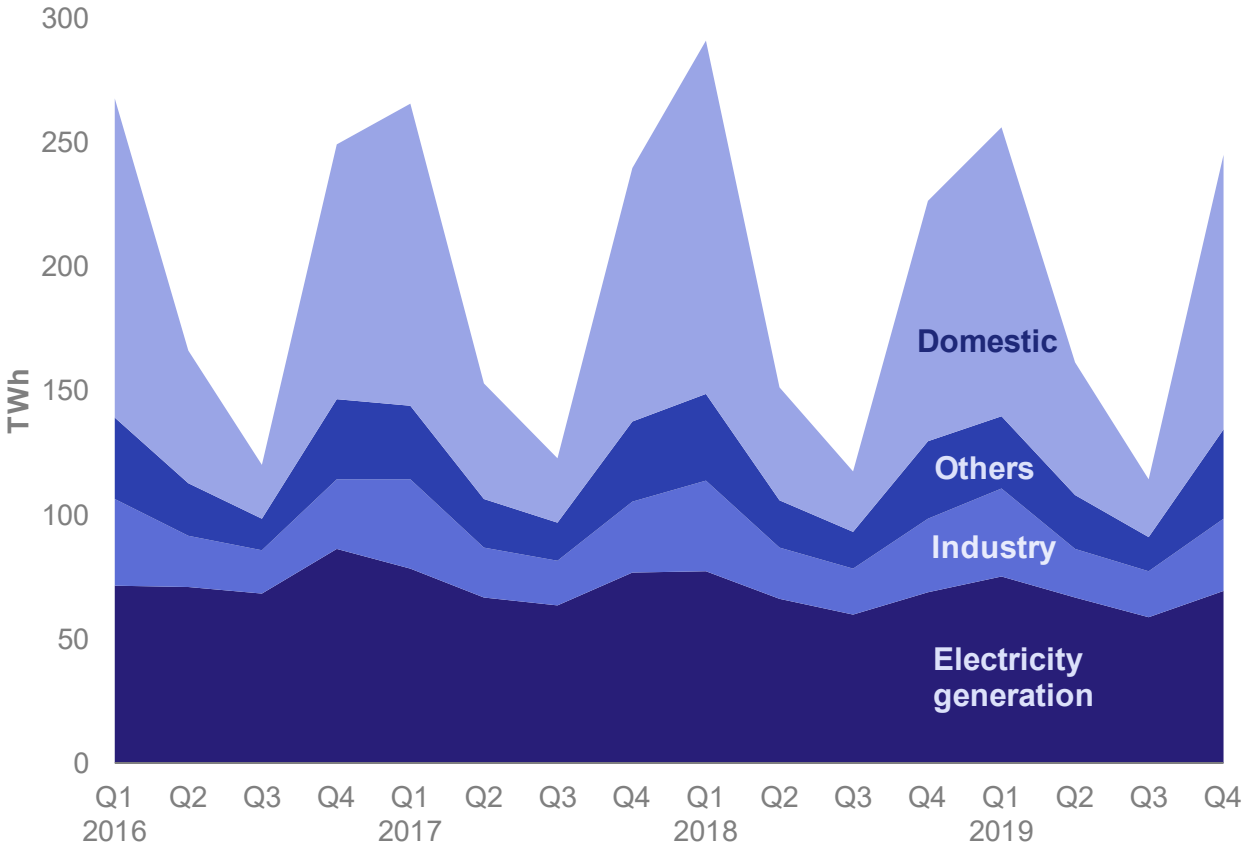


Chart 4.6 UK demand for natural gas (Table 4.1)



In 2019, the UK's overall gas demand decreased by 0.5 per cent on the year before to 876 TWh. Within this final consumption decreased by 1.4 per cent with domestic demand down 1.7 per cent as a result of the warmer temperatures at the start of the year after the Beast from the East in 2018, which was partially offset by higher demand towards the end of 2019.

Similarly, demand for gas used for electricity generation was down by 1.0 per cent to 270 TWh, the lowest since 2015 as capacity for low carbon generation continues to increase.

In contrast with the annual trend, in the final three months of 2019 UK demand for natural gas increased by 7.8 per cent compared with Q4 2018. This is mainly attributed to the 14.5 and 14.9 per cent increases in domestic and other final users respectively due to the colder temperatures during the quarter compared with 2018, which drove up demand for heating.

Meanwhile, demand for electricity generation remained broadly stable at 69 TWh.

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

Section 5 – UK Electricity
2019 and October to December 2019

Key results show:

Provisional 2019

Total electricity generated in 2019 was 323.7 TWh, a decrease of 2.8 per cent compared to 2018 (332.9 TWh). This reflects decreasing demand for electricity, linked to increasing efficiency. Consumption of electricity in 2019 totalled 294 TWh, down 1.8 per cent compared to 2018. Consumption decreased year on year in all sectors, down 1.8 per cent for the industrial sector, 1.3 per cent for the domestic sector and 2.4 per cent for other final users. **(Charts 5.1 & 5.5)**

The sources of our electricity also changed in 2019, with lower generation coming from Major Power Producers (MPPs), offset by increased generation from autogenerators and increased imports. **(Chart 5.1)**

Coal generation decreased substantially in 2019, pushing fossil fuels to an all-time low share of the generation mix at 43.4 per cent. **(Chart 5.1)**

More than a third (36.9 per cent) of UK generation came from renewable sources in 2019, up from 33.0 per cent in 2018. This was driven by high generation from wind, solar and bioenergy sources and is largely attributable to growing renewable capacity. For the third successive year over half of all generation came from low carbon sources, up to a record 54.2 per cent. **(Charts 5.1 & 5.3)**

Net imports increased by 11 per cent in 2019 compared to 2018, to 21.2 TWh. This was the highest level on the published data series and accounted for 6.4 per cent of the total electricity supply over the year. **(Chart 5.6)**

Quarter 4 2019

Total generation was 86.8 TWh in Quarter 4 of 2019, the lowest value for a Quarter 4 in the published data series and a decrease of 0.8 per cent compared to Quarter 4 2018. Demand for electricity was higher over this period (up 0.8 per cent) but the demand was met by increased net imports. **(Chart 5.2)**

Domestic electricity consumption in Quarter 4 2019 increased by 2.6 per cent compared to the same period in 2018 while consumption by other final users (including commercial) increased by 0.7 per cent. This reflects cooler average temperatures over the quarter. Industrial electricity consumption fell 1.9 percent over the same period. **(Chart 5.5)**

Renewable electricity generation was 37.4 per cent of total electricity generation in Quarter 4 2019, the highest share for any Quarter 4 on the published data series. Electricity generated from by fossil fuels was 42.2 per cent of the total UK generation in Quarter 4 2019, down 2.1 percentage points compared to the same period in 2018. **(Chart 5.2)**

Quarter 4 of 2019 saw a substantial rise in net imports compared to the same period in 2018, up 38 per cent to 5.0 TWh. **(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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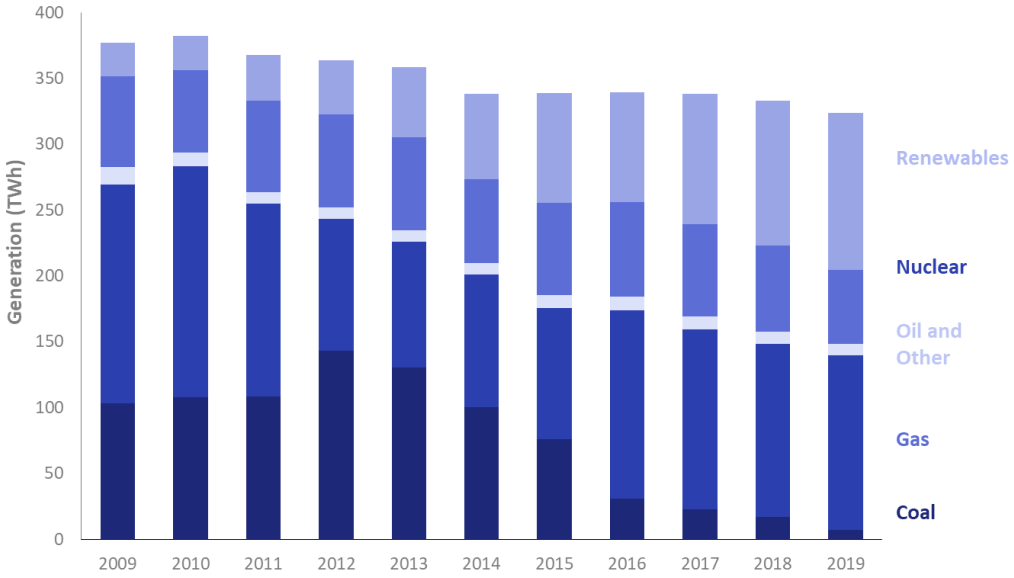
Chart 5.1 Total electricity generated by fuel type (Table 5.1)



Total electricity generated in 2019 was 323.7 TWh, a decrease of 2.8 per cent compared to 2018 (332.9 TWh). Total generation has been falling overall since 2010, linked to increased efficiency, while warmer temperatures in 2019 reduced demand for electricity compared to 2018. The generation mix changed too, with higher renewable and lower nuclear and coal generation.

More than a third (36.9 per cent) of UK generation came from renewable sources in 2019, up from 33.0 per cent in 2018. This was driven by high generation from wind, solar and bioenergy sources and came despite less favourable weather conditions for wind generation (which carries the bulk of the UK's renewable capacity) with the lowest average wind speeds since 2012[1]. This means that the growing generation is largely attributable to growing renewable capacity[2].

The record levels of renewable generation meant that for the third year running over half of all generation came from low carbon sources, improving on the percentage share from 2018 (up from 52.6 per cent to 54.2 per cent). This was despite a fall in the generation from nuclear generators, which dropped 14 per cent to 56 TWh, its lowest value since 2008. This was the result of a series of prolonged outages throughout the year which reduced the UK's operational nuclear capacity.

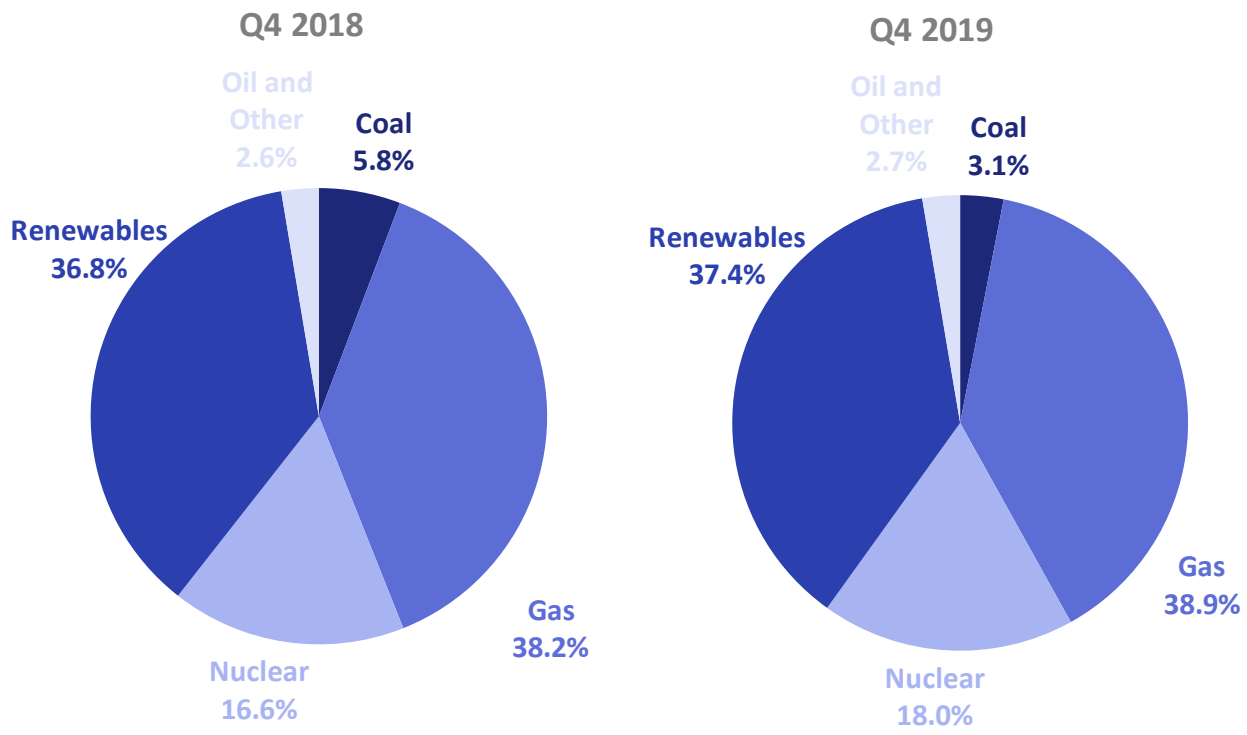
Coal generation continued to decrease in 2019, pushing fossil fuels to an all-time low share of the generation mix at 43.4 per cent. In 2019, electricity supplied by coal-fired generators fell almost 60 per cent compared to 2018 to just 6.9 TWh, a record low. The decline of coal is due to plant closures in recent years and coal-generation becoming less economically favourable than gas-fired generation, attributed to low gas prices and higher carbon pricing. Coal generating capacity dropped substantially in 2019 following closures of Unit 1 at Fiddlers Ferry (March 2019), Cottam Power station (September 2019) and Aberthaw Power station (December 2019), leaving only five major coal-fired power stations in operation. Gas generation saw a slight increase in 2019, up 1.4 per cent compared to 2018.

The production of our electricity also changed in 2019, with lower generation from Major Power Producers (MPPs) offset by increased generation from autogenerators and also increased imports as detailed below. Generation by MPPs was 269.0 TWh in 2019, down from 281.4 TWh in 2018, whereas generation from autogenerators increased from 51.5 TWh in 2018 to 54.6 TWh in 2019.

[1] Full wind speed data can be found in Table 7.2 at: www.gov.uk/government/statistics/energy-trends-section-7-weather

[2] See Chapter 6 (Renewables) and table 6.1 for a more detailed breakdown of renewable generation and capacity at: www.gov.uk/government/statistics/energy-trends-section-6-renewables.

Chart 5.2 Shares of electricity generation (Table 5.1)



For most fuels, the percentage shares of generation were similar between Quarter 4 2018 and 2019. The biggest changes were a 2.7 percentage point (pp) decrease in the share for coal, offset by 1.4 pp increases in nuclear generation and 1.6pp increase in offshore wind which increased the overall share for renewables. These changes saw a 2.1pp decrease in the share for fossil fuels and a 2.0 pp increase in the share for low carbon generation.

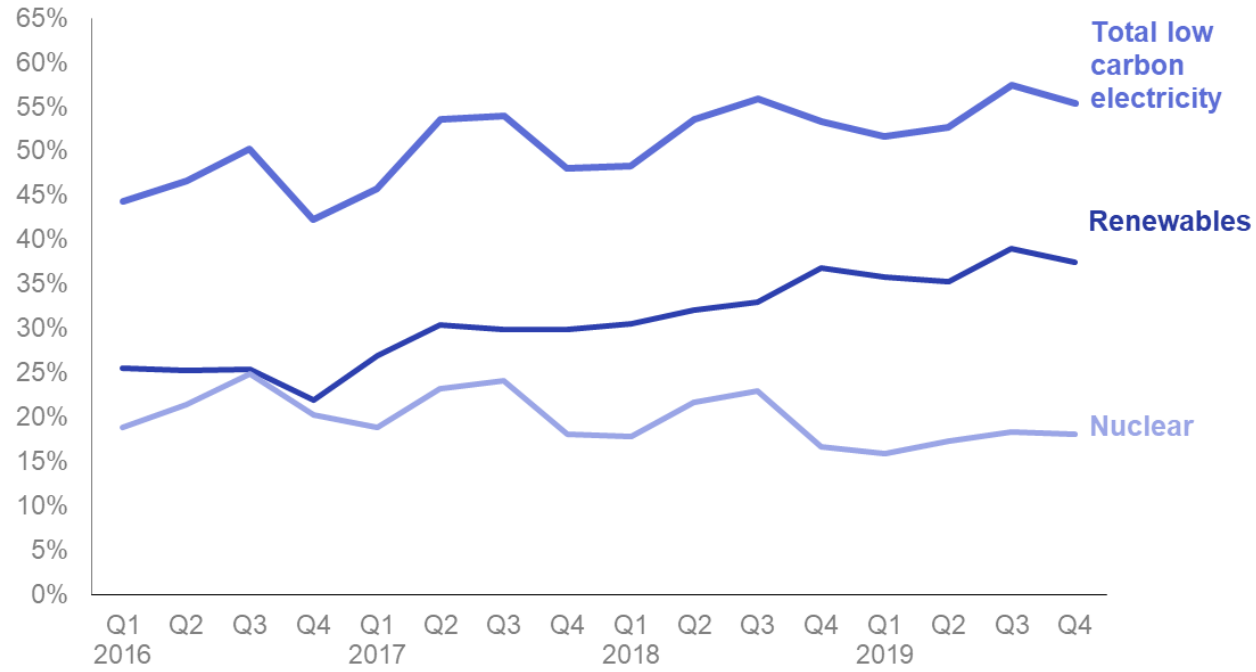
Renewable electricity generation was 32.5 TWh in Quarter 4 2019, representing 37.4 percent of total electricity generation. This was slightly down on the record renewable share seen in Quarter 3 but was the highest share for any Quarter 4 on the published data series. Generation was higher for wind and solar (up 1.0 per cent to 20.7 TWh) with the largest increase for offshore wind generation (up 14.5 per cent to 10.2 TWh). The higher generation was largely because of increased capacity for renewable generation[3] (up 7 per cent compared to Quarter 4 2018) as Quarter 4 saw less favourable weather conditions for renewable generation than the same period in 2018[4].

Electricity generated from by fossil fuels was 42.2 per cent of the total UK generation in Quarter 4 2019, down 2.1 percentage points compared to the same period in 2018. This reduction was supported by the record renewable supply and high net imports reducing the need for fossil fuel generated electricity. There was a particularly large decrease in electricity generated from coal in this period, which was down 47 per cent. This continued the downward trend for coal seen throughout 2019. Following the closure of Aberthaw (1590 MW) on the 13th of December 2019 there are now only five remaining major coal fired power stations in the UK.

[3] See Table 6.1 for details.

[4] See Table 7.2 for details.

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



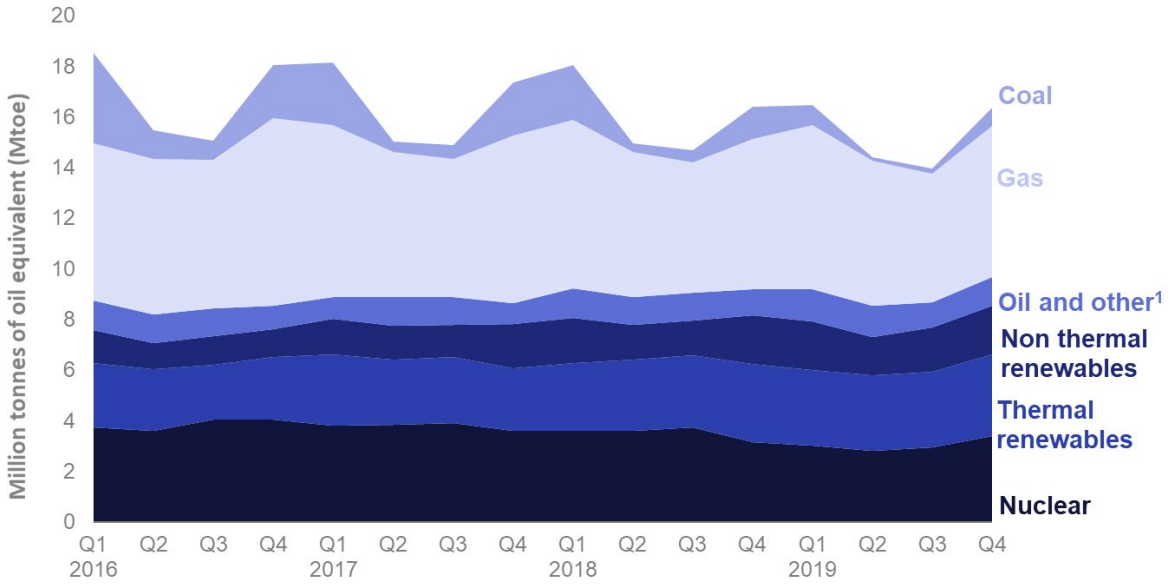
The share of generation from low carbon sources increased again in 2019 to reach 54.2 per cent. This was an increase of 1.6 percentage points compared to 2018. This increased share was driven by increases to renewable generation, with nuclear generation down 2.2 percentage points compared to 2018. The increased renewable generation was largely attributed to growing capacity for renewables[5] as 2019 had less favourable weather conditions for wind generation (which carries the bulk of the UK's renewable capacity) with the lowest average wind speeds since 2012[6].

Low carbon generation was 55.4 per cent of generation in Quarter 4 of 2019, up 2.0 percentage points compared to the same period in 2018. As renewable generation was similar to Quarter 4 2018 (up 0.6 per cent), the increase in low carbon generation was driven by an increase in nuclear generation. Nuclear generation was up 7.4 per cent compare to Quarter 4 2018 as the number of plants on outage reduced. During Quarter 4 2019, outages continued at Dungeness B R21 & R22 (statutory outage) and Hunterston B R3 & R4 (graphite inspection outage) and were completed at Hartlepool and Heysham 1.

[5] See Table 6.1 for details.

[6] See Table 7.2 for details.

Chart 5.4 Fuel used in generation (Table 5.1)



[1]Includes imports

Total fuel used for electricity generation continued to fall in 2019, down to a record low of 61.2 Mtoe. This was a 4.5 per cent reduction compared to 2018 and down by 30 per cent compared to 2010. The reduction in fuel used is attributed to falling demand for electricity as well as shifts towards non-thermal renewables[7], as well as increased supplies from imports.

There have also been substantial changes in the fuel mix over this time, in particular a shift away from fossil fuels. Coal use for electricity generation has dropped from 25.6 Mtoe in 2010 to just 1.9 Mtoe in 2019. Gas has been the dominant fuel used for electricity since 2016 with 23.3 Mtoe used in 2019, but the amount of gas used has declined slowly over the past 4 years, down 9 per cent compared to 2016 and down 1 per cent between 2018 and 2019.

Bioenergy and other fuels were the only categories (apart from non-thermal renewables) where an increase in fuel use was seen between 2018 and 2019. Thermal renewables (bioenergy) now represents 20 per cent of fuel used for electricity generation. In 2019, 12.2 Mtoe of bioenergy fuel was used, up 6.6 per cent since 2018. The use of other fuels also increased in 2019, up 4.8 per cent to 2.4 Mtoe in 2019. This includes the non-renewable component of waste.

Quarter 4 of 2019 saw similar trends to the year as a whole, with a small decrease in fuel use linked to lower generation, increased imports and record renewable generation. Fuel used totalled 16.4 Mtoe in Quarter 4, down 0.3 per cent compared to the same period in 2018.

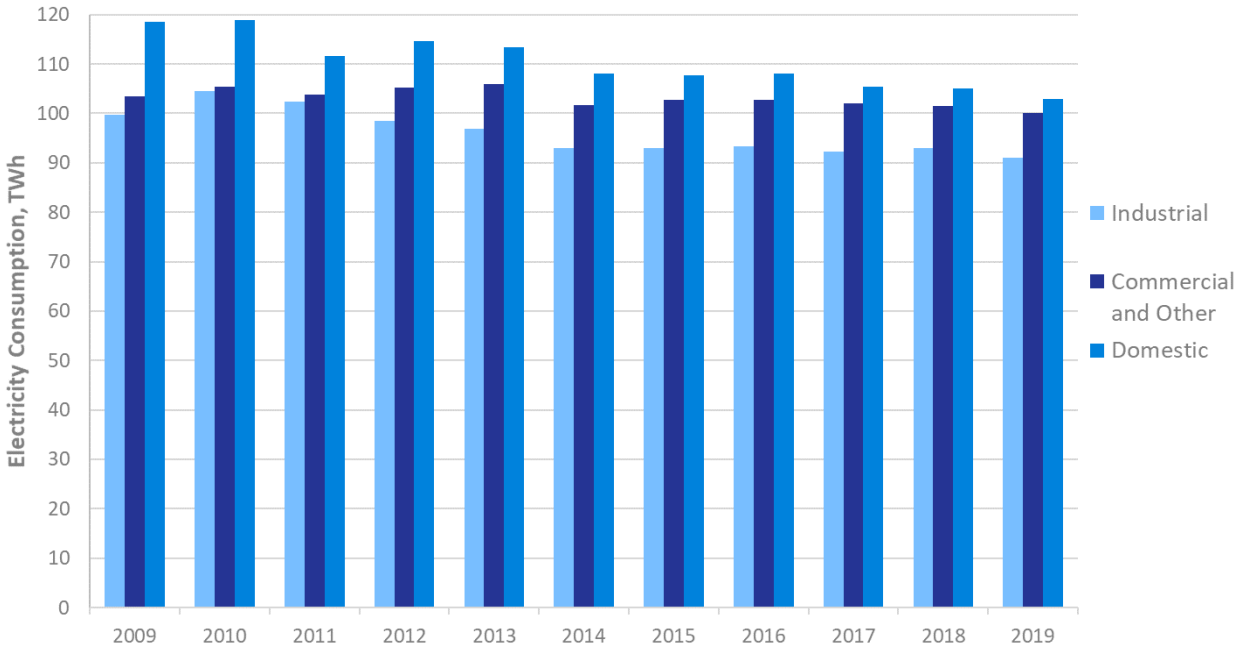
Although the total fuel used was similar, there was a substantial decrease in the amount of fossil fuels used, down 7.8 per cent in Quarter 4 2019 compared to 2018. Fossil fuels in Quarter 4 2019 totalled 6.8 Mtoe, with 6.0 Mtoe of gas. The decrease in fossil fuel usage comes from a reduction in the amount of coal used, down 43 per cent to 0.7 Mtoe in Quarter 4 2019.

Increases in fuel used were seen for nuclear generators, bioenergy and other fuels in Quarter 4 of 2019, compared to the previous year. Fuel used by nuclear generators rose 7.4 per cent to 3.4 Mtoe as outages were completed at Hartlepool and Heysham 1, while an increase in biomass capacity[8] saw thermal renewable (bioenergy) fuel use increase by 4.4 per cent to 3.2 Mtoe in Quarter 4 2019.

[7] Note that for wind and other primary renewable sources the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred.

[8] See Table 6.1 for details.

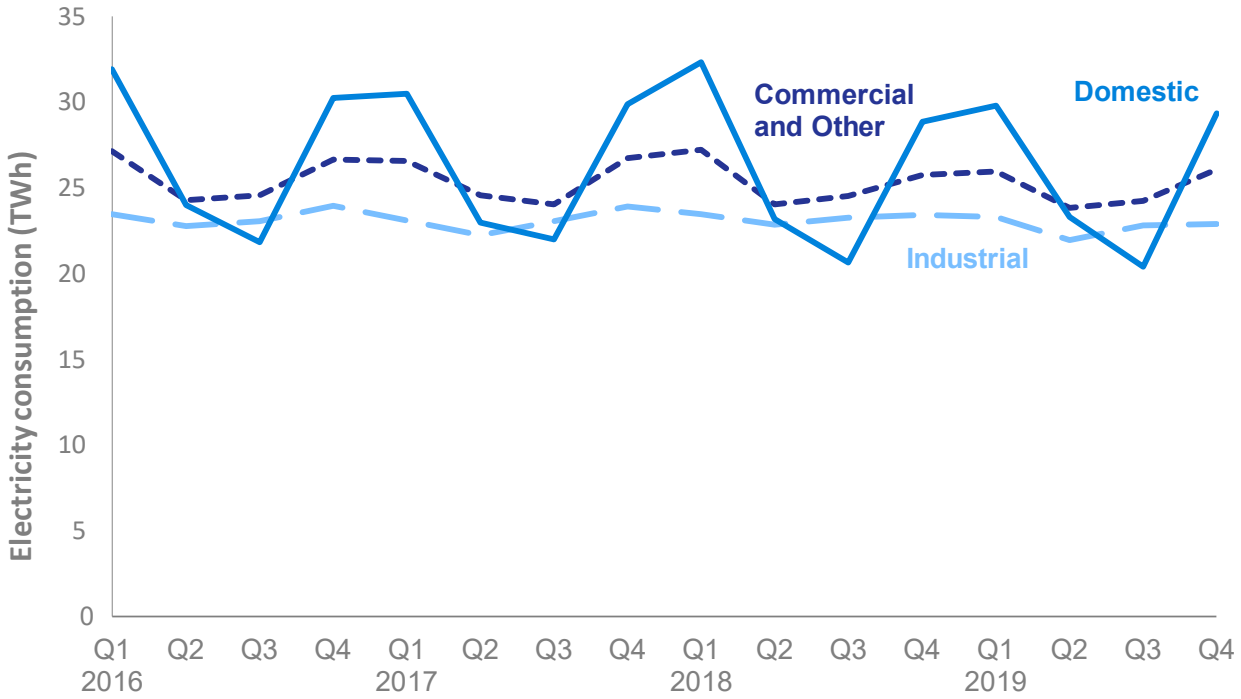
Chart 5.5 Electricity final consumption (annual) (Table 5.2)



Total consumption of electricity decreased in 2019 compared to 2018. Total consumption was 294 TWh in 2019, down 1.8 per cent compared to 2018. There were year on year decreases in all sectors, down 1.9 per cent for the industrial sector, 1.3 per cent for the domestic sector and 2.4 per cent for other final users (including the commercial sector).

Levels of domestic and commercial consumption are largely driven by temperatures and were particularly influenced by warmer average temperatures in the first quarter of 2019. Quarter 1 of 2018 saw the 'Beast from the East' cold weather, driving up demand for electricity. In contrast Quarter 1 of 2019 was comparatively mild with average temperatures up 42 per cent. This led to an 8 per cent reduction in domestic consumption in the first quarter of the year. While temperatures were relatively similar for the rest of the year, this decrease in Quarter 1 drove the reduction for domestic electricity for the year as a whole. A similar picture was seen for commercial and other users, although consumption showed a lower decrease overall for this sector.

Chart 5.6 Electricity final consumption (quarterly) (Table 5.2)

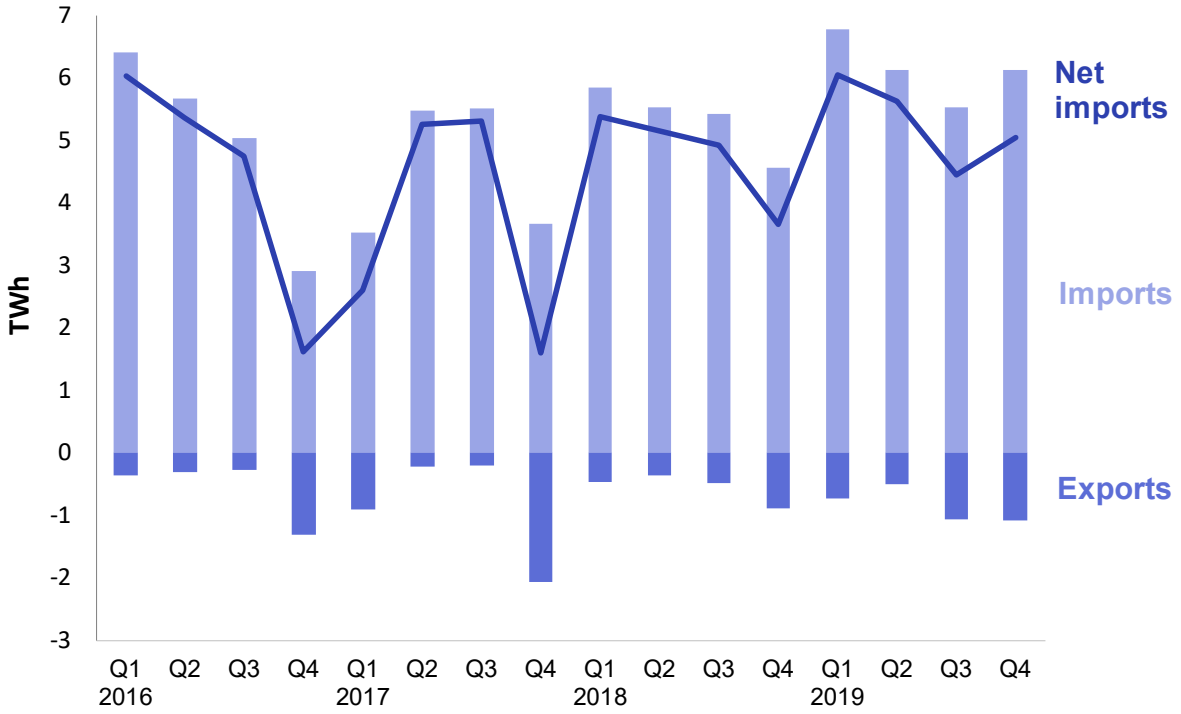


For Quarter 4, total final consumption was slightly higher than in Quarter 4 of 2018, up 0.6 per cent from 78.0 TWh to 78.5 TWh. Domestic and commercial consumption increased, offset by a decrease in industrial consumption.

Domestic electricity consumption in Quarter 4 2019 increased by 2.6 per cent compared to Quarter 4 2018, to 29.6 TWh. There was a rise of 0.7 per cent in consumption by 'other final users', which is largely commercial users. This reflects cooler average temperatures over the quarter[9], increasing the electricity demand for heating. Industrial electricity consumption was the only sector to decrease in Quarter 4 2019 to 23.0 TWh, a reduction of 1.9 percent from Quarter 4 2018.

[9] See table 7.1 for details.

Chart 5.7 UK trade in electricity (Table 5.6)



Net imports increased by 11 per cent in 2019 compared to 2018, to 21.2 TWh. This was the highest level on the published data series and accounted for 6.4 per cent of the total electricity supply over the year. Total imports increased by 15 per cent to 24.6 TWh in 2019; total exports were up 52 per cent to 3.4 TWh. The interconnectors with France and the Netherlands both saw a decrease in net imports, down 14 per cent for France and 8 per cent for the Netherlands. This is likely to be partly due to the new interconnector between the UK and Belgium which began operation in January 2019 and had net imports of 5.0 TWh in 2019.

The interconnector between Ireland and Northern Ireland was the only net exporter of electricity in 2019, with net imports of -0.8 TWh. This was substantially higher than in 2018, because of a large increase in exports, up 33 per cent to 1.1 TWh.

Quarter 4 of 2019 saw a substantial rise in net imports compared to the same period in 2018, up 38 per cent to 5.0 TWh. The interconnector with France had the highest net imports (2.4 TWh) with net imports also high on the Netherlands-UK interconnector (1.4 TWh) and on the new Belgium-UK interconnector (1.3 TWh). Though net imports on the France-UK interconnector remained relatively high, they were down by 12 per cent compared to Quarter 4 of 2018, as exports to France rose by over 50 per cent compared to Quarter 4 2018 to 0.4 TWh, the highest level since Quarter 4 of 2017. This follows reductions in France's nuclear generation (its primary source of electricity) due to multiple outages throughout the period.

The interconnector between Ireland and Northern Ireland was the only net exporter of electricity in Quarter 4 of 2019, with net imports of -0.2 TWh. This was a 6 per cent increase compared to Quarter 4 of 2018.

Section 6 – UK Renewables 2019 and October to December 2019

Key results show:

Provisional 2019
2019 was a record year for renewable electricity generation which increased by 8.5 per cent compared to 2018, from 110 TWh to 119 TWh, largely due to increased capacity. **(Table 6.1)**

Renewables' share of electricity generation was a record 36.9 per cent and an increase of 3.8 percentage points on the 33.0 per cent share in 2018. This reflects the higher renewable generation and lower overall electricity generation in 2019, compared to 2018. **(Table 6.1 and Chart 6.1)**

In 2019, on the 2009 Renewable Energy Directive basis (normalised to account for variable weather and with the addition of generation from the biogas within the gas supply grid), renewable generation was a record 34.6 per cent of gross electricity consumption, an increase of 2.9 percentage points on 2018's share. **(Table 6.1)**

Renewable electricity capacity was 47.4 GW at the end of 2019, a 6.9 per cent increase (3.0 GW) on a year earlier, around half of this increase was in offshore wind **(Chart 6.3)**

Quarter 4 2019
Renewables' share of electricity generation was 37.4 per cent in 2019 Q4, up 0.6 percentage points on the 36.8 per cent share in 2018 Q4, reflecting higher renewable generation and lower overall electricity generation. **(Chart 6.1).**

Renewable electricity generation was a record 32.5 TWh in 2019 Q4, an increase of 0.9 per cent on 32.2 TWh in 2018 Q4. This was driven by record offshore wind generation and bioenergy, a result of increased capacity. **(Chart 6.2).**

Liquid biofuel consumption increased by 44 per cent, from 454 million litres in 2018 Q4 to an estimated 655 million litres in 2019 Q4. Bioethanol consumption increased by 1.7 per cent while biodiesel consumption increased by 76 per cent. **(Chart 6.6)**

Relevant tables

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

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Table 6.1 Renewable electricity shares – 2018 and 2019 (provisional)

	2018	2019p
Renewable generation (TWh)	110.0	119.3
Total electricity generation (TWh)	332.9	323.7
International basis	**33.0%**	**36.9%**
Normalised renewable generation (TWh)[1]	110.3	118.8
Gross electricity consumption (TWh)	349.5	343.1
2009 Renewable Energy Directive basis	**31.5%**	**34.6%**

[1] Includes generation from the biogas component of gas in the grid

In 2019, renewables provided over a third of electricity generation (36.9 per cent) which is an increase of 3.8 percentage points from 2018. This was primarily due to the completion of new installed capacity through late 2018 and 2019. In addition, total electricity generation from non-renewable sources fell by 6.8 per cent, increasing the relative share for renewable generation.

Total electricity generated from renewables in 2019 increased by 6.9 per cent on 2018, from 110 TWh to 119 TWh. On a Directive basis, generation rose from 110 TWh in 2018 to 119 TWh in 2019.

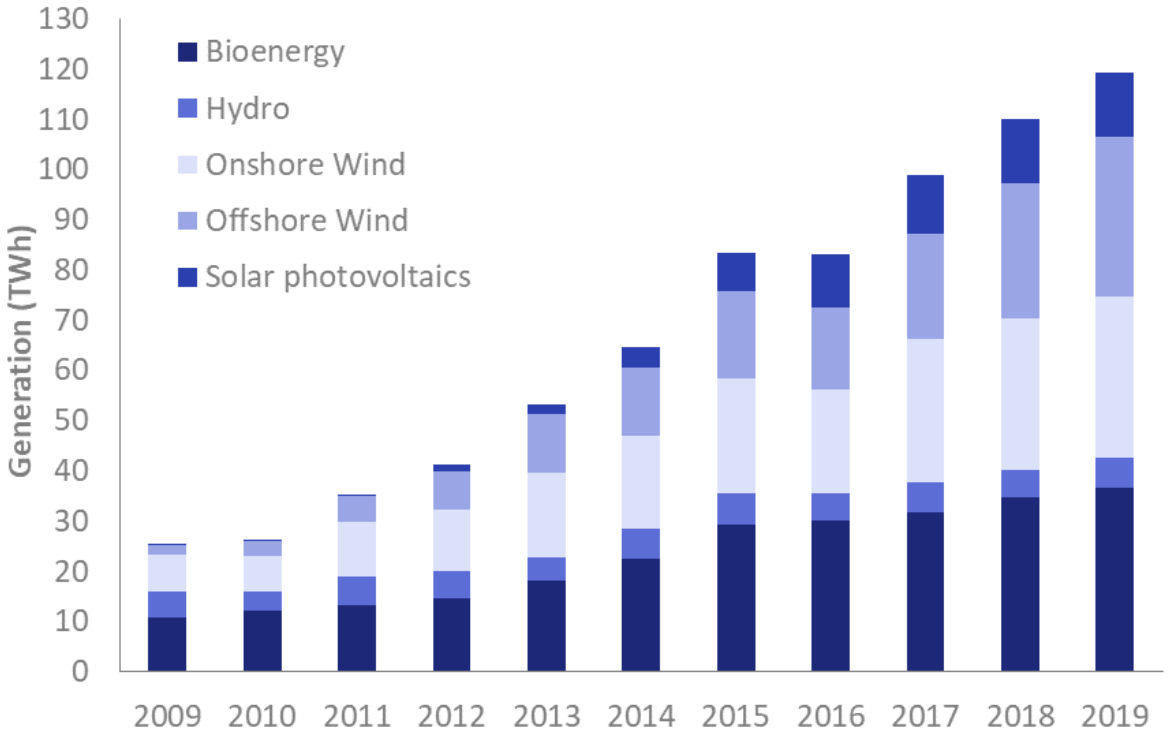
On the 2009 Renewable Energy Directive (RED) basis, the electricity share was 34.6 per cent, compared with 31.5 per cent in 2018. The RED measure uses normalised wind and hydro generation, to account for variable generation due to weather conditions and includes generation from biogas' share of gas in the grid. Under this measure, both wind and hydro were reduced by 2 per cent due to higher load factors in 2019.

For more information on normalisation, and the various measures of renewable electricity's shares, please see the June 2018 special feature article "Renewable energy in 2017", at: www.gov.uk/government/statistics/energy-trends-june-2018-special-feature-article-renewable-energy-in-2017

In 2019 Q4 saw an increase in the share of electricity generation compared to 37.4 per cent compared to 36.8 per cent in 2018 Q4. Total electricity generation and electricity demand figures (all generating companies) can be found in tables ET 5.1 and ET 5.2, at: www.gov.uk/government/statistics/electricity-section-5-energy-trends.

Overall quarterly electricity generation was 86.8 TWh in 2019 Q4, down by 0.8 per cent on the same quarter in 2018. A small amount of the increase in renewables share can be attributed to the continued drop in non-renewable electricity generation.

Chart 6.1 Renewables' share of electricity generation – 2019 Q4 (Table 6.1)



In 2019, record generation was seen in both onshore and offshore wind generation. This was largely due to new capacity coming online. Capacity at Hornsea gradually increased over the year and stood at 1218 MW by the end of 2019, making it the largest offshore wind farm in the world.

2019 also saw record electricity generation from bioenergy at 36.6 TWh, 5.2 per cent greater than the 34.8 TWh generated in 2018. Generation was boosted by Lynemouth power station reopening as a biomass fuelled plant in late 2018.

Hydro generation was up by 8.5 per cent on 2018 which had been a relatively low year. Generation was at a similar level to that of 2017 (6.0 TWh compared to 5.9 TWh).

In 2019 12.7 TWh of electricity was generated from solar, down from 12.9 TWh in 2018, a fall of 1.4 per cent. Average sunlight hours were down on 2018 which had been a record breaking year for solar generation.

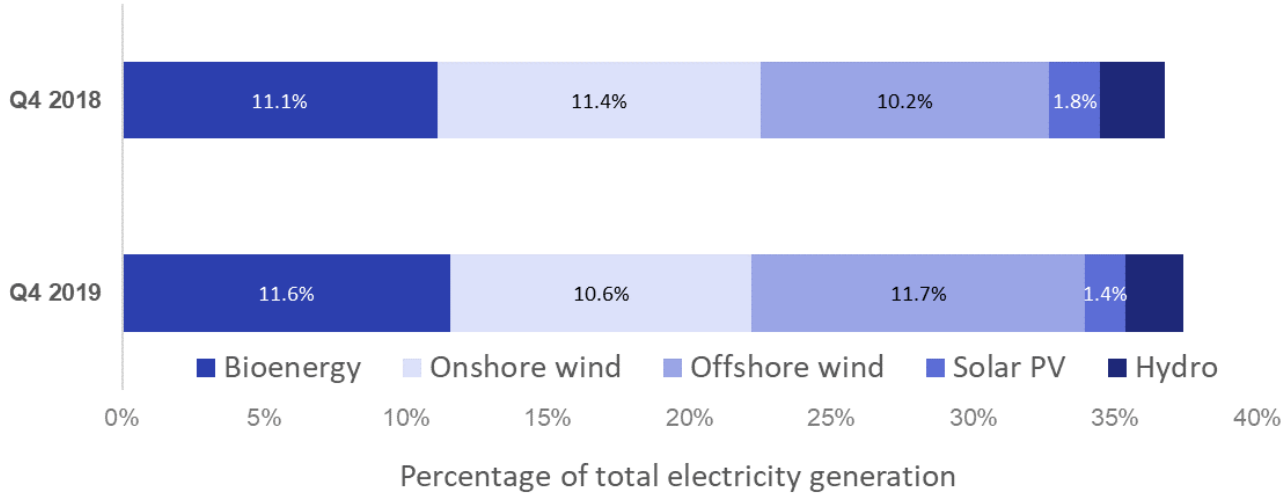
Offshore wind overtook onshore wind generation in the previous quarter and has continued to have the greatest share in Q4. Both onshore and offshore wind each generated 9.9 per cent of total energy in 2019, with onshore wind generating 0.3 TWh more than offshore wind for the year.

Bioenergy is the next most significant component of renewable generation at 11.3 per cent for 2019. Solar PV accounted for just 1.4 per cent of renewable generation this quarter as average sunlight hours were down on the fourth quarter of 2018. Solar PV generation varies significantly by season and accounted for 3.9 per cent of total 2019 electricity generation.

Total electricity generated from renewables in 2019 Q4 was 32.5 TWh. This is a new quarterly record, narrowly exceeding the previous record of 32.2 TWh set in 2018 Q4 by 0.9 per cent.

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)



Renewables' share of electricity generation increased from 36.8 per cent in 2018 Q4 to 37.4 per cent in the final quarter of 2019 leading to an overall share for the year at 36.9 per cent.

In 2019 Q4, both offshore wind and bioenergy[1] each exceeded 10 TWh for the first time. Offshore wind was the largest component of renewable generation at 31.4 per cent (10.2 TWh), increasing by 14.5 per cent compared to Q4 of 2018. In contrast, onshore wind generation decreased by 7.5 per cent to 9.2 TWh and was 28.4 per cent of total renewable generation. Average wind speeds in 2019 Q4 were 0.8 knots below 2018 Q4, causing the drop in onshore wind generation, whilst offshore wind increased due to a large amount of additional capacity being installed.

Bioenergy was the second largest component of total renewable generation at 10.0 TWh. This was an increase of 3.3 per cent compared to 2018 Q4.

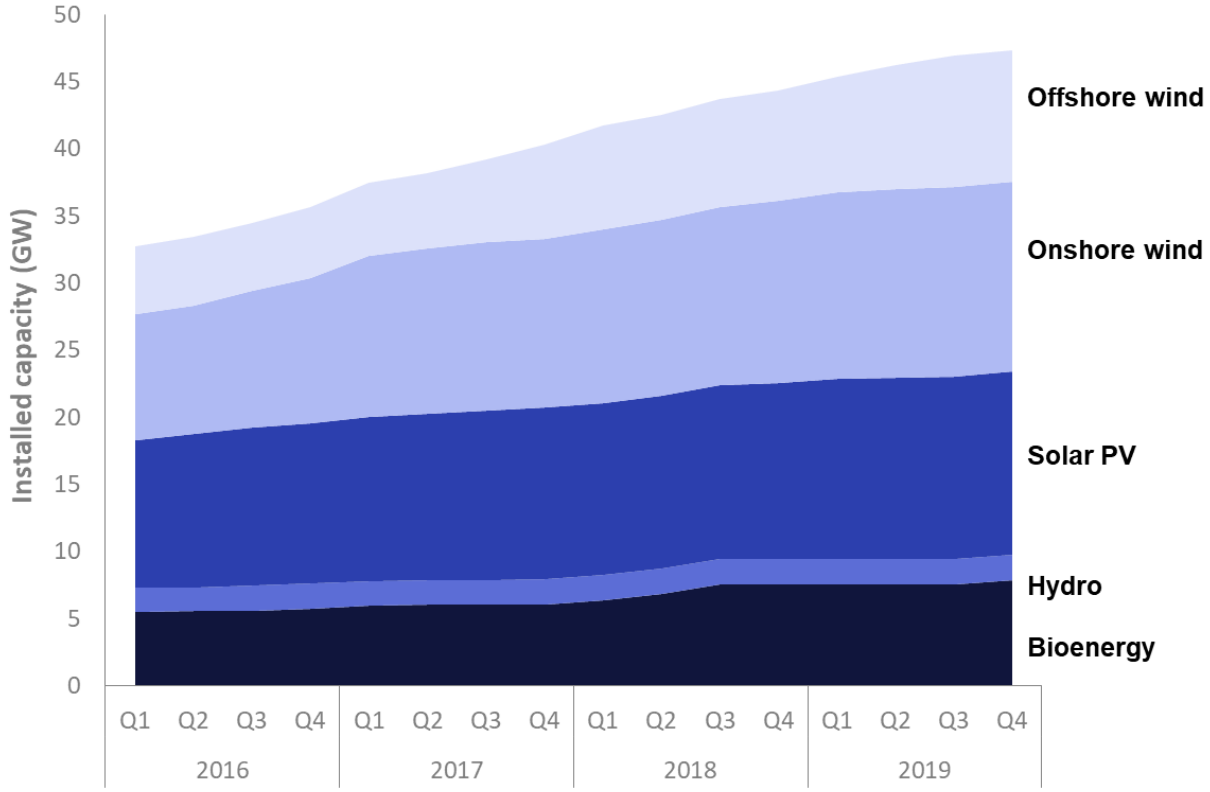
Generation from solar photovoltaics decreased by 21.4 per cent (0.3 TWh) to 1.2 TWh, compared to 2018 Q4, reflecting a drop in average sunlight hours of a similar scale (25.8 per cent).

Hydro generation fell to 1.8 TWh, decreasing by 11 per cent on the same quarter of 2018; average rainfall (in the main hydro catchment areas) was below the long term mean with November having a particularly low level of rainfall, the driest in our time series (from 2001). Hydro contributed 5.5 per cent of total renewable generation.

For more information on weather trends that affect energy generation and demand please see consult the tables in Energy Trends section 7: www.gov.uk/government/statistics/energy-trends-section-7-weather

[1] Bioenergy consists of: plant biomass, animal biomass, biodegradable municipal solid waste, landfill gas, sewage gas, 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, the UK's renewable electricity capacity totalled 47.4 GW, an increase of 6.9 per cent (3.0 GW) on that installed at the end of 2018. This is the smallest year on year capacity increase since 2010. Capacity was 0.9 per cent (0.4 GW) above the previous quarter.

At the end of 2019, onshore wind at 14.2 GW represented 29.9 per cent of all renewable capacity, dipping below 30 per cent for the first time since 2016 but remaining the highest share of total renewable capacity. This was followed by solar PV (28.7 per cent), offshore wind (20.7 per cent) and bioenergy (16.7 per cent).[2]

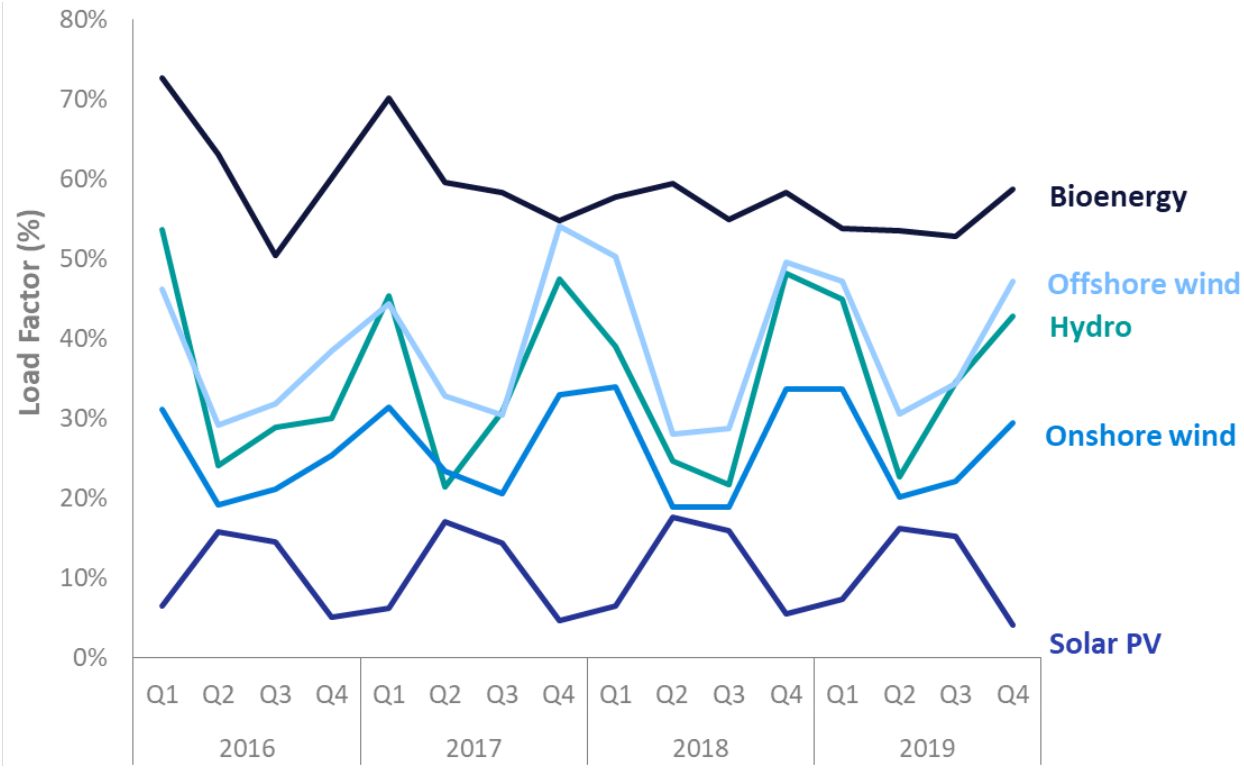
Compared with the end of 2018, the largest change in capacity was for offshore wind which increased by 1.6 GW (21 per cent). Two large offshore wind farms Beatrice (Scotland) and Hornsea (England) extended their total capacity to 588 MW and 1211 MW, respectively. New onshore capacity included Dorenell (177 MW) and Kype Muir (83 MW) in Scotland.

Bioenergy capacity increased by 0.3 GW to 7.9 GW in total which was an increase of 4.6 per cent from the capacity at the end of 2018.

[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 29.7 per cent, the overall load factor for renewables was at the same level to 2018 and 2017. Load factors were broadly stable for onshore and offshore wind and solar PV. The load factor for plant biomass in 2019 decreased by 8.2 percentage points to 62, this was largely affected by generation at a large plant being relatively low compared to the total capacity. However, the load factors for hydro and other forms of bioenergy increased.

At 31.2 per cent, the average load factor for all renewables was 1.9 percentage points lower than the last quarter of 2018. This included a reduction for all renewable technologies which are dependent on weather conditions (onshore wind, offshore wind, solar PV and hydro).

In 2019 Q4, onshore wind's load factor decreased by 4.2 percentage points to 29.5 per cent. Offshore wind's load factor decreased at a lower rate, by 2.4 percentage points to 47.2 per cent in 2018 Q4. Load factors are affected both by wind conditions, which can differ between onshore and offshore sites, as well as the timing that new capacity comes online[3].

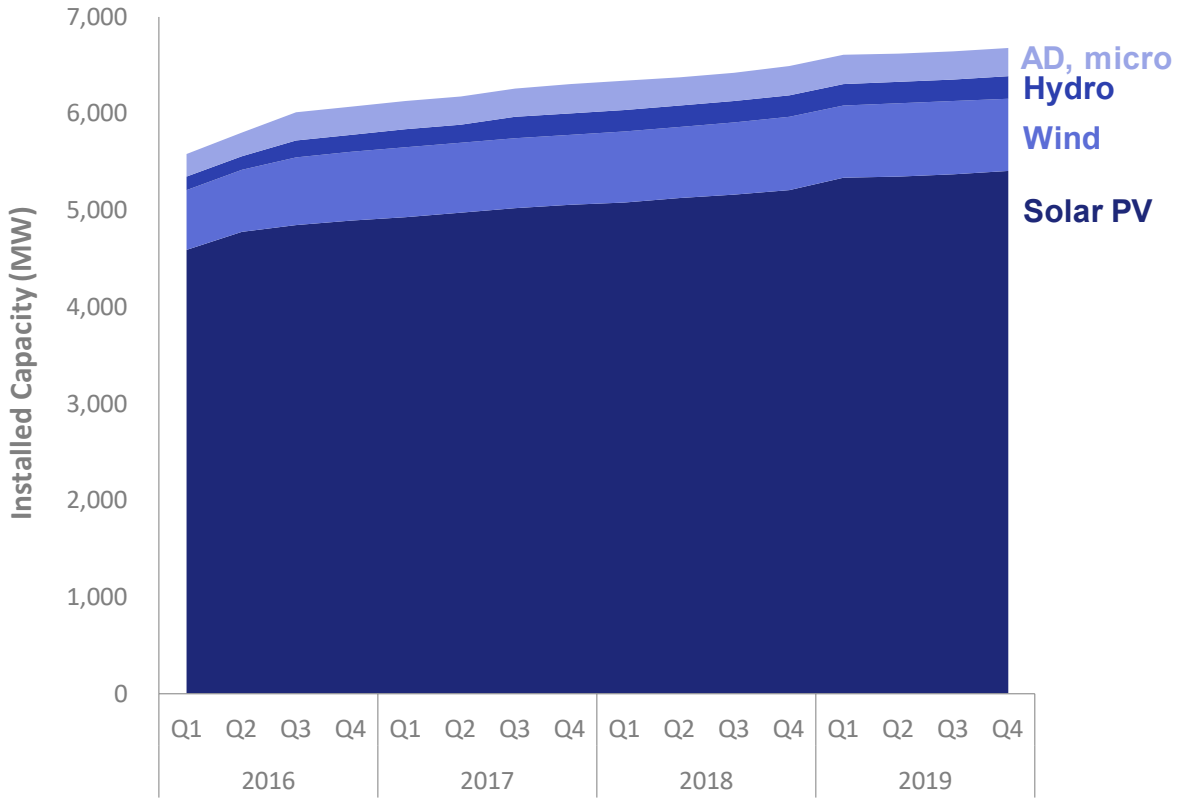
Hydro's load factor in 2019 Q4 decreased by 5.5 percentage points, driven by a decrease in average rainfall in the quarter of around 13 per cent.

Solar PV saw the lowest load factors since 2015 at 4.2 per cent, a decrease of 1.4 percentage points from 2018 Q4. A modest decrease of 0.5 percentage points was seen for 2019 overall.

Bioenergy was the only technology group to see an increased load factor in the current quarter compared to the previous year, rising from 58.3 to 58.8 per cent. The load factor for Plant biomass increased from 69.3 per cent to 69.6 per cent.

[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.

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



The Feed in Tariff (FiT) scheme[4] closed to new entrants at the end of March 2019. BEIS continues to monitor small scale generation using the Central FiTs Register as well as records of installations that register with the Micro Generation Certification Scheme (MCS) and the Renewable Energy Planning Database (REPD). The statistics published here do not currently include unsubsidised installations below 1MW capacity that are not registered on the MCS database. We are reviewing data sources to improve coverage.

There were over 1.01 million small scale installations (less than 5 MW) installed at the end of 2019, with a total capacity of 6,677 MW. This accounts for 14 per cent of total renewable capacity.

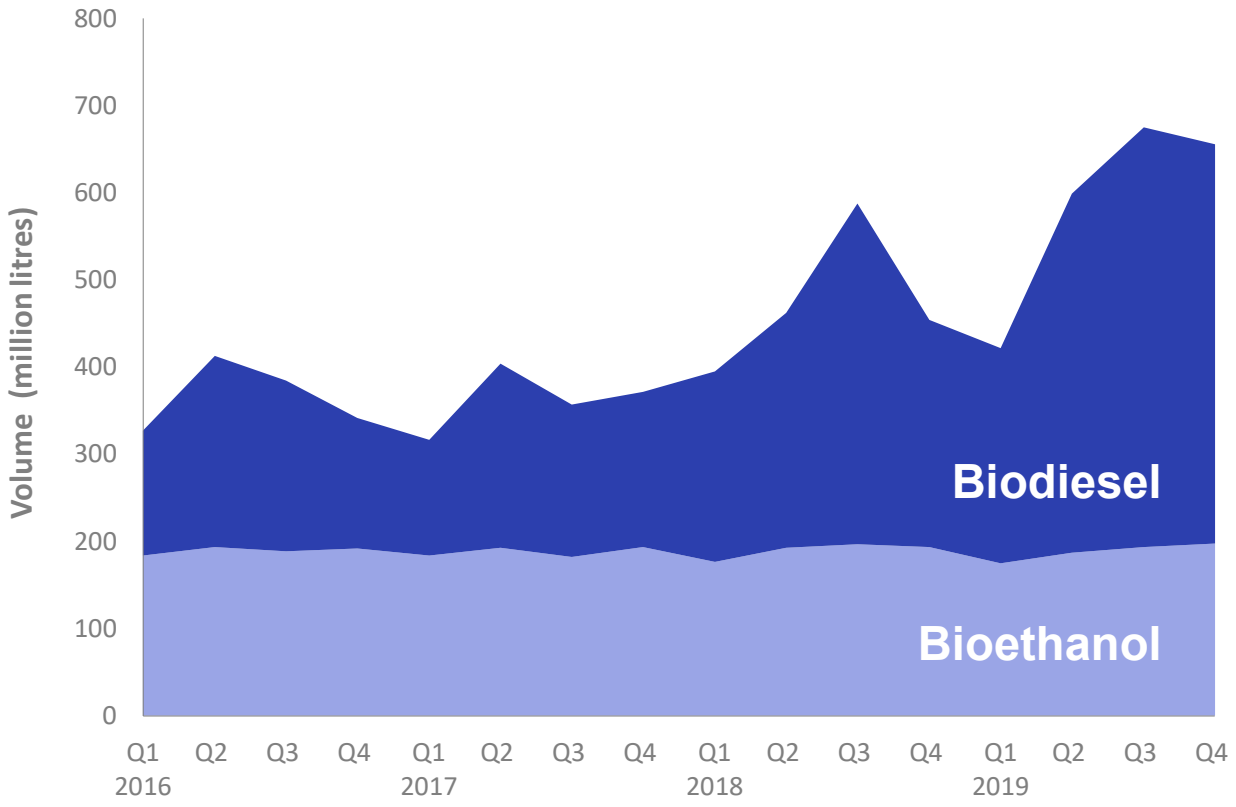
Solar photovoltaics (PVs) represents a significant majority of small scale installations and installed small scale capacity, with respectively 99 per cent and 81 per cent of the total. 931,000 of these installations are sub 4 kW retrofitted solar schemes. These account for nearly 40 per cent of total small scale capacity.

More statistics on small scale renewable electricity generation and 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 2019, total biofuels increased by 24 per cent compared to 2018. The final three quarters of 2019 saw the three highest totals for quarterly biofuel consumption. The Renewable Transport Fuel Obligation (RTFO) requires fuel producers to produce a given percentage of their total from renewable bio sources. The obligation increased from 7.25 to 8.5 per cent between 2018 and 2019 and will as part of a gradual increase towards 12.4 per cent by 2032. The annual increase between 2019 and 2018 was driven primarily by biodiesel. Bioethanol saw a modest 1 per cent increase compared to a 40 per cent increase in biodiesel.

The total biofuel consumption in 2019 was greater than 5 per cent of all transport fuel consumption for the first time. This broke the record set in 2018 of 4 per cent.

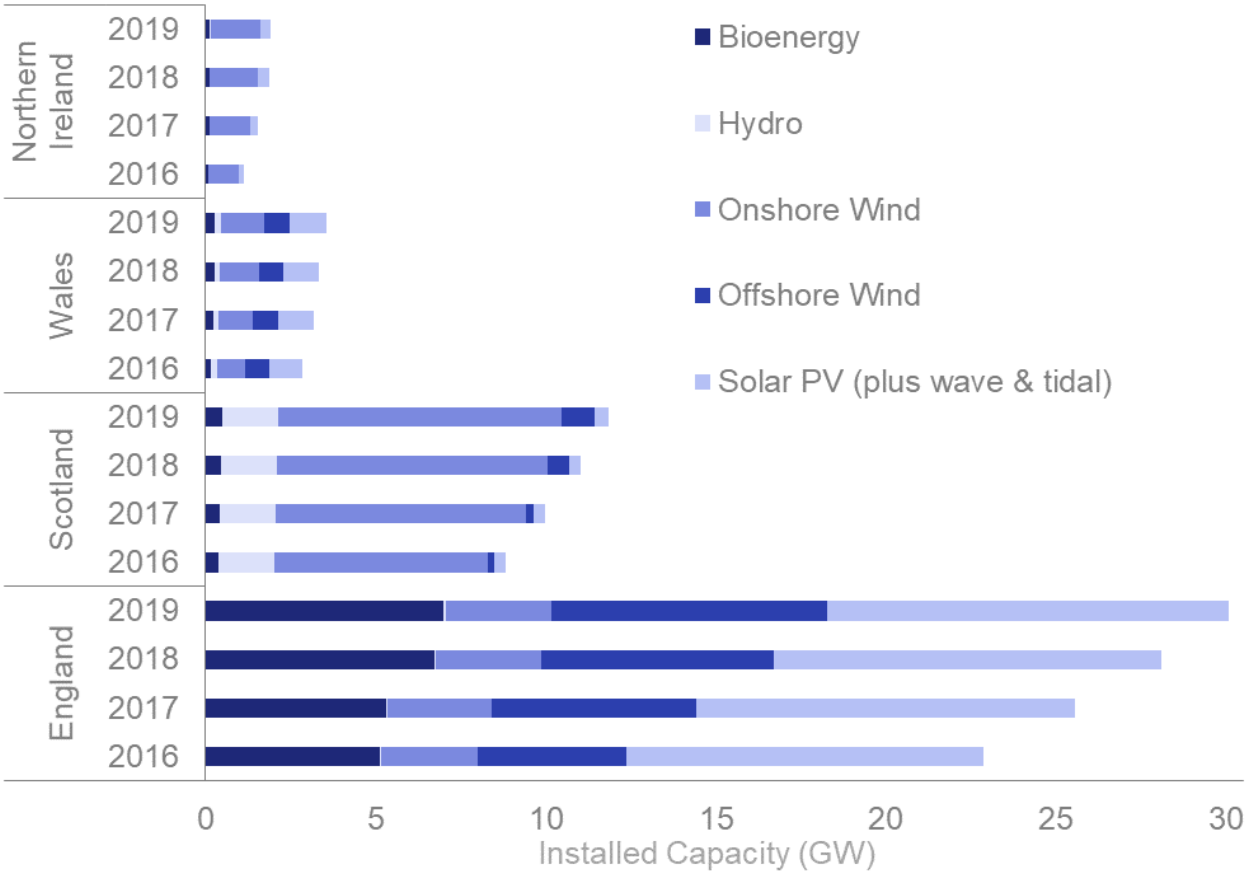
In the final quarter of 2019, an estimated 655 million litres of liquid biofuels were consumed in transport, an increase of 44 per cent on the total of 454 million litres in the final quarter of 2018.

Bioethanol consumption increased by 1.7 per cent from 194 million litres in the final quarter of 2018 to 197 million litres. Biodiesel consumption increased by 76 per cent to 458 million litres in this quarter compared to 260 million litres in same quarter in 2018.

Bioethanol represented 30 per cent of biofuels consumption, with biodiesel accounting for the remaining 70 per cent for the quarter.

In the final quarter of 2019, bioethanol accounted for 4.7 per cent of motor spirit increasing by 0.1 percentage point. Biodiesel represented 6.0 per cent of diesel (DERV) consumption, an increase of 1.6 percentage points on this period last year. Their combined contribution increased by 1.7 percentage points to 5.5 per cent.

Chart 6.7 Renewable electricity capacity, by UK country



At the end of 2019, England's renewable electricity capacity was 30.1 GW, an increase of 7.1 per cent (2.0 GW) of capacity at the end of 2018, with offshore wind (up 1.2 GW), Solar (up 0.4 GW) and bioenergy (up 0.3 GW) being the main contributors to this increase.

Scotland's capacity was 11.8 GW, increasing by 7.3 per cent (0.8 GW) on last year, 93 per cent of this increase was due to additional wind capacity, split between onshore and offshore installations.

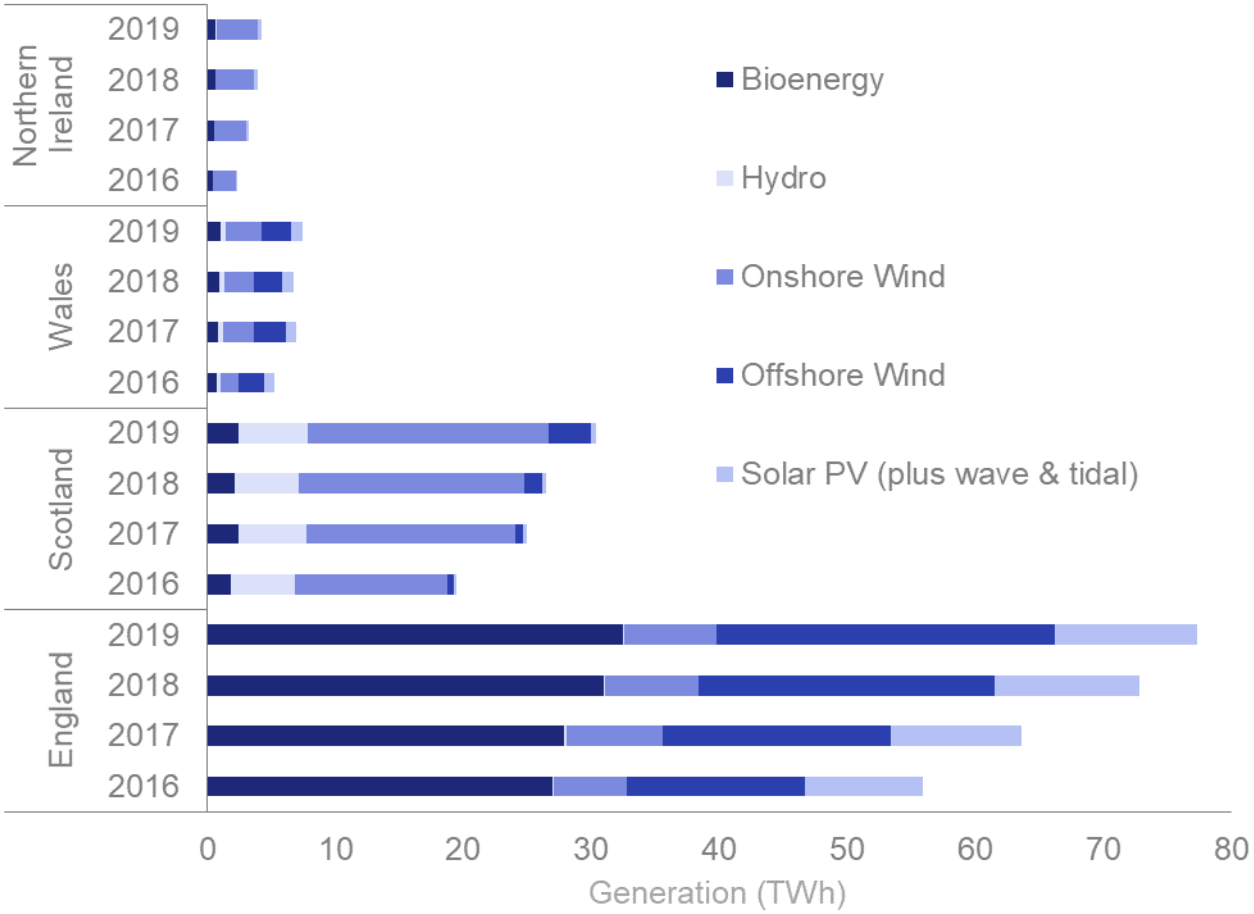
Wales's capacity was 3.6 GW, an increase of 6.2 per cent (0.2 GW) on the capacity at the end of 2018. Over two thirds of this increase was in onshore wind.

Northern Ireland's capacity increased to 1.91 GW from 1.86 GW, an increase of 2.7 per cent (0.05 GW) on the previous year, nearly all of this increase was attributable to onshore wind farms.

At the end of 2018, England accounted for 64 per cent of UK renewable electricity capacity; Scotland's share was 25 per cent, Wales's was 7.5 per cent and Northern Ireland's stood at 4.0 per cent.

Quarterly renewable electricity statistics by UK country can be found in table ET 6.1, at: www.gov.uk/government/statistics/energy-trends-section-6-renewables

Chart 6.8 Renewable electricity generation, by UK country



In 2019, renewable electricity generation in England was 77.0 TWh, an increase of 5.8 per cent (4.2 TWh) on 2018. Of this extra generation, 3.1 TWh came from offshore wind, due to increased capacity.

Generation in Scotland was 30.5 TWh, an increase of 15 per cent (4.1 TWh) on 2018; 2.0 TWh of this additional generation was from offshore wind and a further 1.4 TWh was from onshore wind.

Generation in Wales was 7.6 TWh, an increase of 12 per cent (0.8 TWh) on 2018. Most of this change (74 per cent) was due to increases to onshore wind.

Generation in Northern Ireland was 4.2 TWh, an increase of 5.6 per cent (0.2 TWh) on 2018, most of this increase was from wind, the remainder was from bioenergy.

In 2019, England accounted for nearly two thirds (65 per cent) of UK renewable electricity generation; Scotland's share was 26 per cent, Wales's was 6.4 per cent and Northern Ireland's 3.5 per cent.

Trends in trade of Liquefied Natural Gas in the UK and Europe

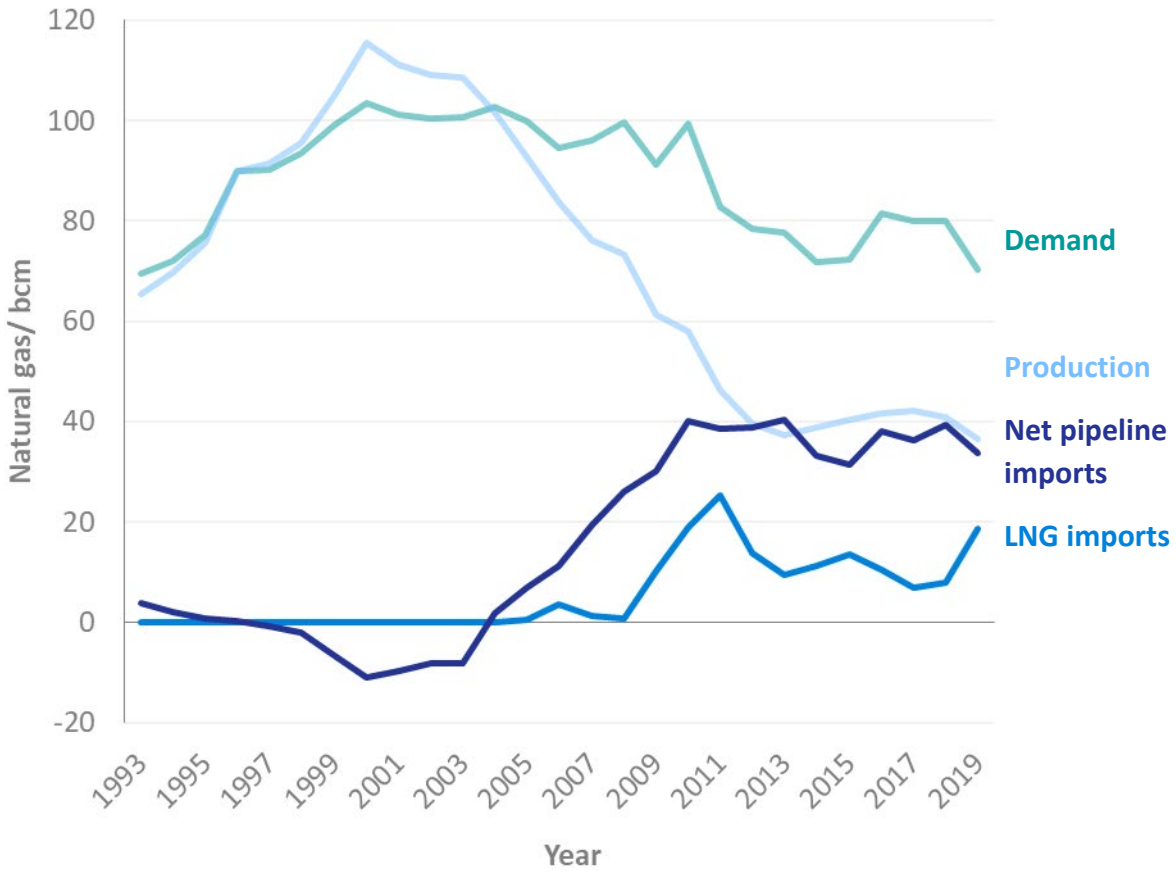
Introduction

Traditionally, natural gas has been moved from producing regions to markets via pipeline. Where pipeline infrastructure does not already exist, or is not viable, an alternative means of transportation is by ship. When natural gas is cooled to approximately -160 °C, Liquefied Natural Gas (LNG) is produced. The volume of LNG is around 600 times smaller than that of gaseous natural gas meaning it can be shipped more easily. Once at its destination, LNG is regasified and used in the same way as natural gas which has not been liquefied.

Growing demand has seen global liquefication capacity increase by five times in the last six years. There are several reasons for this. For example, as easily accessible natural gas reserves are depleted LNG has provided an alternative means of meeting supply to established pipeline infrastructure. The aim of this article is to provide analysis on UK LNG trends. For context, EU and global trends and trade are also considered.

UK LNG use

Chart 1: Summary of UK natural gas use, 1993 – 2019



The UK produces natural gas indigenously from the North Sea in the form of methane; this gas is transported via well-established pipeline infrastructure inland and to key trading partners. Chart 1 shows that indigenous production of natural gas exceeded demand in the late 1990s, but since then has been on a general trend of decline before stabilising at around a third of the peak in 2013. Demand has also followed a general downward path since 2005, but in 2019 production could have met only around half of demand.

As expected, imports have increased to meet demand as indigenous production decreased. The UK began importing LNG for commercial use in 2005. Imports of LNG were minimal until 2008 when they increased rapidly and peaked in 2011 since then LNG imports have fluctuated. From 2010 natural gas imports by pipeline and of LNG are negatively correlated, meaning that LNG is used to make up shortfalls in supply when pipeline flows are disrupted. The UK exports a small amount of natural gas, the majority of this by pipeline. The UK does not produce LNG, so any exports of LNG were previously imported - this is called a reload.

UK LNG imports

Chart 2: UK LNG imports, 2005 – 2019

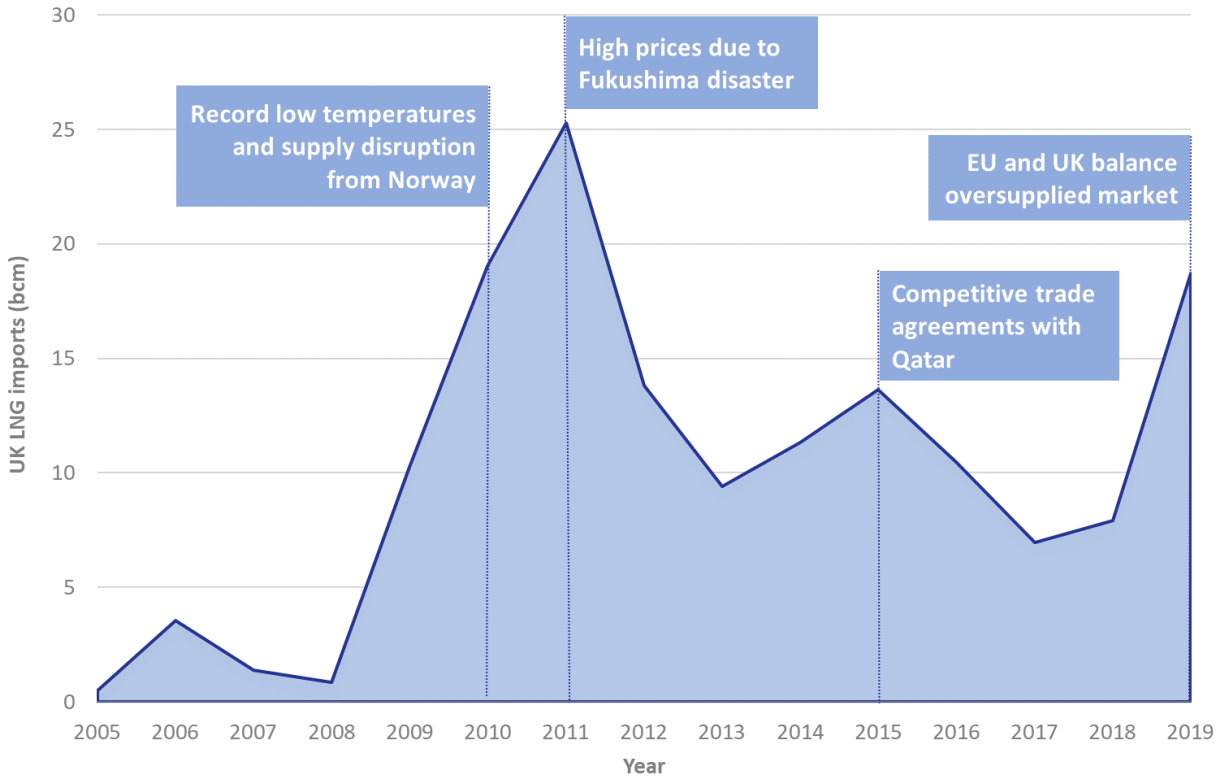


Chart 2 shows that UK imports of LNG increased rapidly from 2008 peaking at 25.3 billion cubic metres (bcm) in 2011, accounting for 46 per cent of natural gas imports and 31 per cent of consumption in that year. Record low temperatures and pipeline supply disruption due to industrial action in Norway contributed to this peak. During the winter of 2010/11, on peak demand days, LNG was the second most relied upon source of natural gas behind drawdowns of gas in storage, making it more important than pipeline imports to meet demand.

The 2011 peak was followed by a rapid decline until 2013. The decline is associated with an increase in the price of LNG, which was affected by the 2011 Tōhoku earthquake and tsunami that caused the Fukushima disaster. LNG was used as an emergency fuel to meet demand. This led to the creation of an LNG spot market in Asia and subsequent changes to the global market structure.

Following this, peaks in UK LNG imports have been heavily related to market pressures. The UK has several supply and purchase agreements (SPAs) with Qatar, which are binding legal contracts that obligate the UK to buy and Qatar to sell LNG. These are based on oil indexed pricing and were competitively priced in the mid-2010s, resulting in a 'bump' in supply to the UK in 2014-15. Given the strong trading relationship the UK has for Qatari LNG, supply of LNG to the UK has historically primarily been from Qatar.

In 2019, the UK played a role in the EU 'LNG sink', which saw a steep increase in supply of LNG to the UK and Europe (and is discussed later). The UK imported 18.7 bcm of LNG in 2019, accounting for 39 per cent of natural gas imports and one-fifth of total supply – record high levels since the peak in 2011 with volumes more than doubling compared to 2018. UK sources of supply diversified during this period.

UK LNG import sources

Chart 3: top 5 2019 import sources as a percentage of total LNG imports, 2005 – 2019

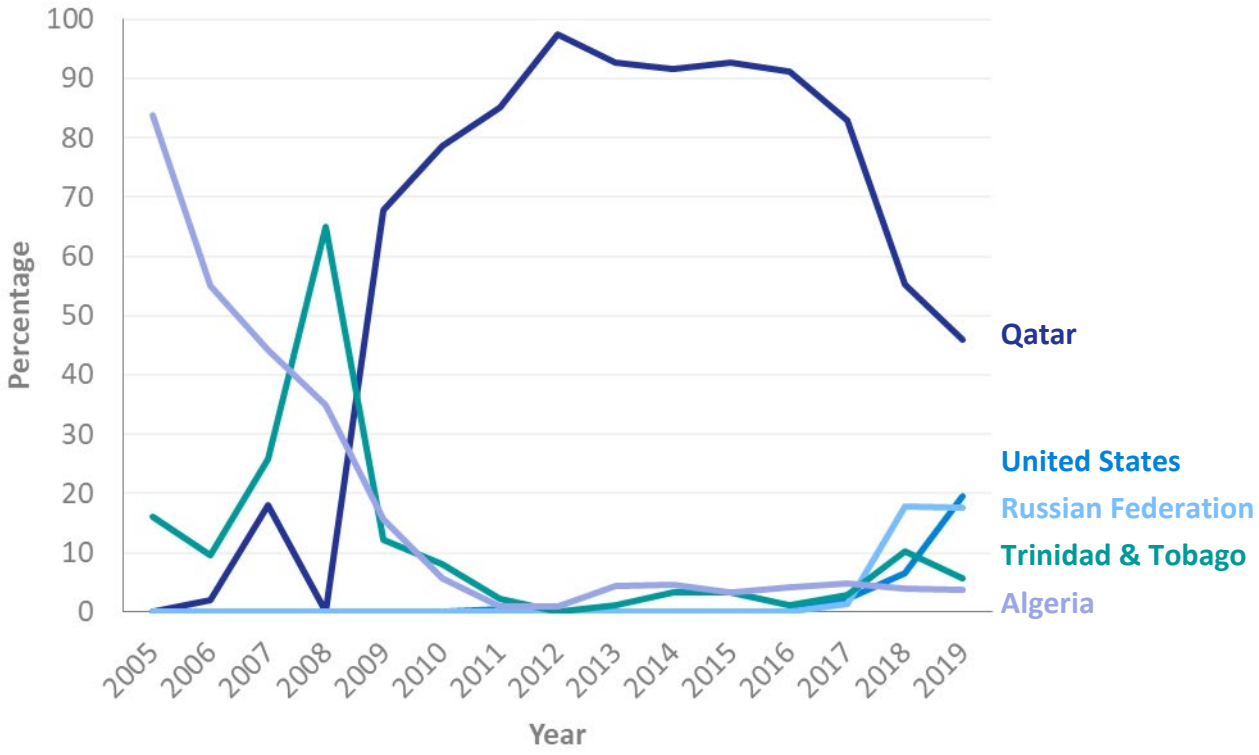
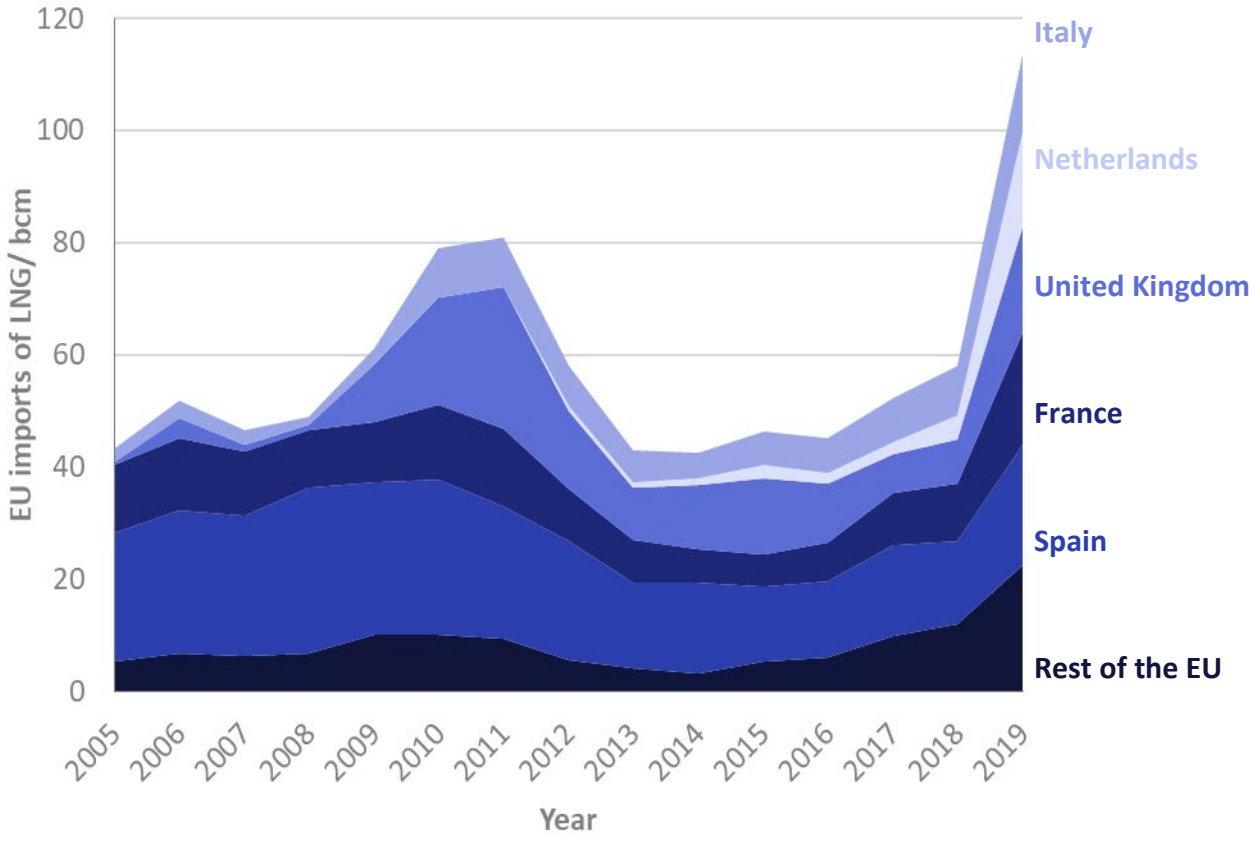


Chart 3 shows the top five sources of LNG to the UK as a percentage of total LNG imports between 2005 and 2019. Historically, Qatar has been the dominant import source, reaching 98 per cent in 2012. However, its share has been declining in recent years so that Qatari LNG met half of UK LNG imports in 2019. Imports from Algeria have also declined because of declining indigenous production and non-UK European contractual commitments.

In 2005 the UK imported LNG from just two sources, climbing to eight in 2011 and 12 in 2019. The number of import sources has increased in line with the increases in global production capacity. The UK received cargoes from Angola, Cameroon and the Netherlands for the first time in 2019 and there was sustained growth in volumes from other more recent sources to the UK such as the US, Russia and Peru.

EU LNG imports

Chart 4: EU LNG imports, 2005-2019

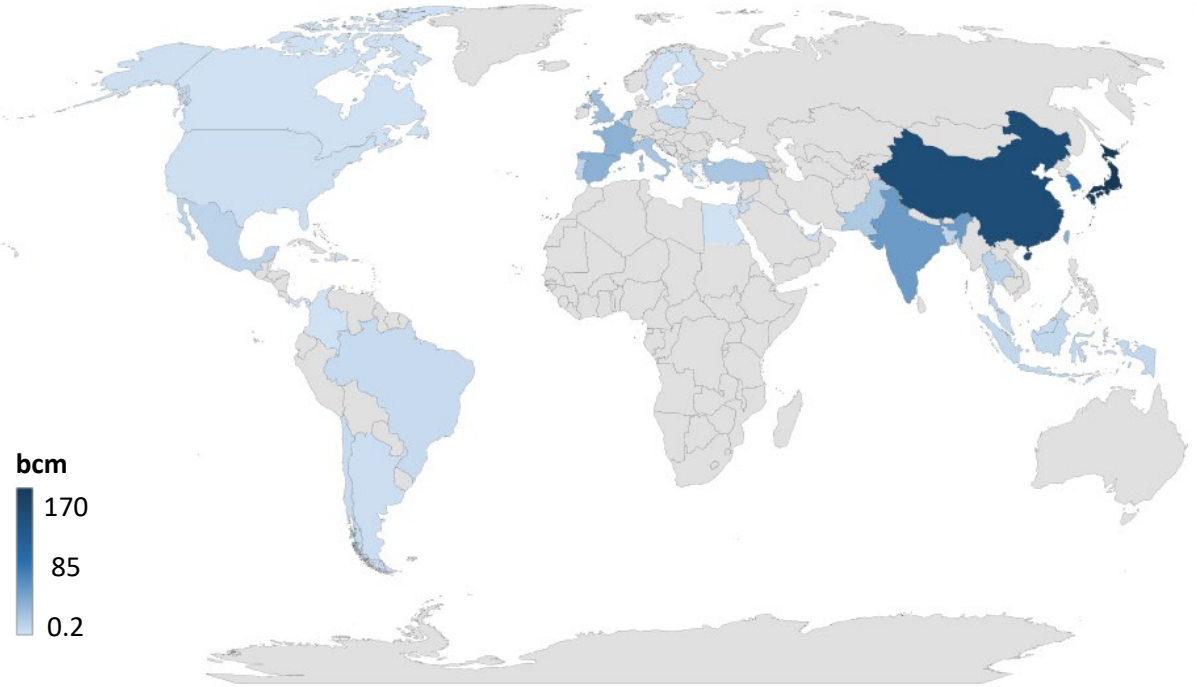


Between 2005 and 2019, 13 of the 28 EU member states imported LNG (including the UK). In 2019, EU imports of LNG increased by 1.96 times compared to 2018. In addition to increases from the top 5 EU importers, other EU countries' imports increased by 89 per cent compared to 2018. This boom in EU imports was the result of an oversupplied market. Warm weather in Asia reduced demand whilst new projects in Qatar, the US and Russia increased supply. LNG spot price reached a record low and the EU played the role of the balancing market.

In 2019, the top five EU LNG importers accounted for 80 per cent of total EU imports (Chart 4). Between 2005 and 2019 Spain almost consistently imported the greatest amount of LNG. Only the UK imported more in 2011 and 2015. Malta only imports natural gas as LNG, however as the least populous of all EU countries, it has the lowest demand (except for Cyprus which does not have any natural gas demand).

Global LNG imports

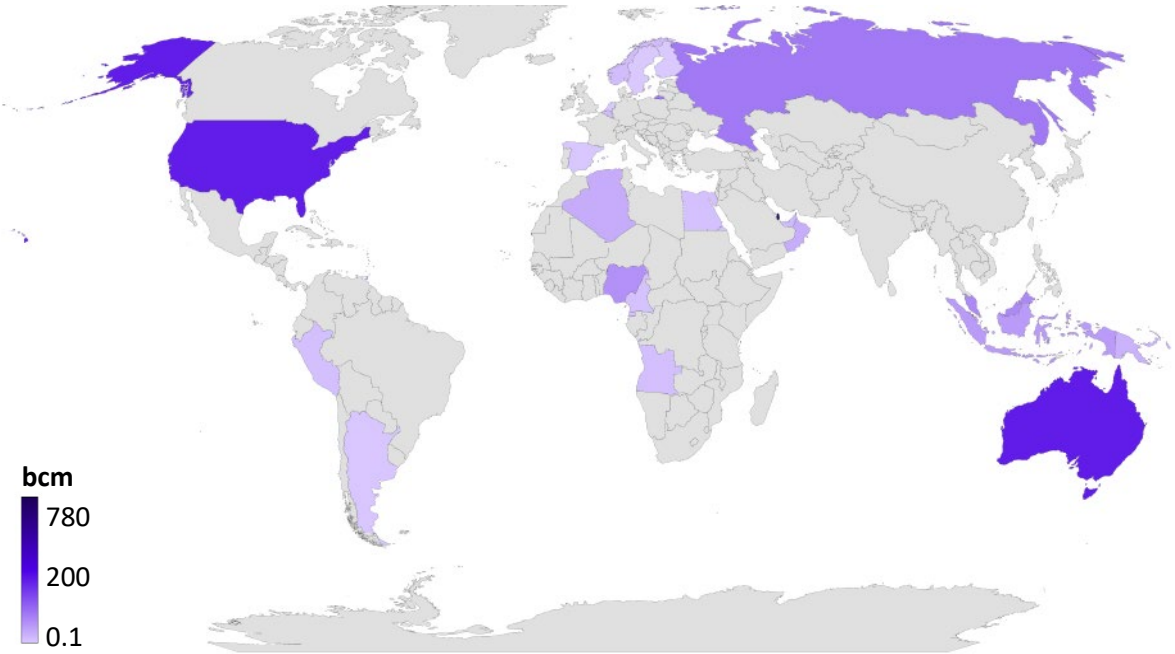
Map 1: Global importers of LNG by volume, 2019



Map 1 shows global demand for LNG by volume. Globally, Japan is the greatest importer, only importing natural gas as LNG. The top 5 global importers of LNG are in Asia. The next 5 greatest importers are the European countries shown in Chart 3. For perspective, in 2019, the sum of the top 5 European importers is equivalent to 30 per cent of the top 5 Asian importers.

Global LNG supply

Map 2: Global suppliers of LNG by volume, 2019



Map 2 shows global supply sources of LNG. In 2019, Qatar and Australia were the greatest exporters of LNG globally. The US followed in third place but exported volumes less than half of those of each of the top 2. Other exporters of LNG tend to be those with large natural gas reserves including Russia, Malaysia and Nigeria. The largest European exporter of LNG is Norway. Whilst LNG can be traded flexibly outside of existing pipeline supply routes, factors such as shipping costs and boil-off[1] mean that proximity of the market to the supply source plays some role in trade. A good example of this is Australia, which supplied 39 per cent of Japanese imports in 2019 whereas the UK has only ever received one cargo from Australia.

Europe is not a major exporter of LNG. Spain and the Netherlands have been the only regular exporters of LNG from within the EU since 2010. The UK does not produce LNG meaning that any LNG exports are reloads; the UK only reloaded LNG between 2005 and 2018. During this time SPAs with Qatar were competitively priced meaning the UK could take advantage of reselling imported volumes on an inflated spot market.

Summary

The UK uses natural gas from indigenous production as well as imports. Some of these imports arrive as LNG. The UK began importing LNG in 2005 with the peak in 2011 when LNG comprised more than one-quarter of total supply. Since 2011, import volumes have been related to economic factors. Asia is a major consumer of LNG hence Asian markets tend to influence UK and EU imports. Asian markets continue to grow despite fluctuations relating to natural disasters and weather. Growth of established importers as well as increasing demand from emerging economies is likely to continue into the 2020s.

Global capacity has met investment to meet growing demand, particularly in the US, Qatar and Russia. These increases in capacity, combined with a warm Asian summer, created an oversupply of LNG in 2019. The EU balanced the market meaning that we saw notable increases in LNG imports. UK imports subsequently reached the highest volume since peaking in 2011 as LNG comprised one-fifth of total supply. This trend was already set to continue into 2020 and with the Covid-19 pandemic, which heavily impacted demand in Asia in the first quarter, we will continue to see changes in trade patterns as the LNG markets are impacted once again.

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[1] The vapours created due to the ambient heat input while maintaining constant pressure in the cryogenic storage vessel, which must be either re-liquefied, used as fuel or burned in a gasification unit.

Wind powered electricity in the UK

This article looks at wind powered electricity in the UK, examining how its position in the UK energy mix has shifted from 2010 to 2019[1], and how wind capacity may change in the future.

Key points

- Total wind generating capacity increased by 19 GW from 5.4 GW in 2010 to 24 GW in 2019. This is the result of sizeable increases in capacity both onshore and offshore, which are up 10 GW and 8.5 GW respectively.
- In the last year, UK offshore wind capacity rose 1.6 GW following the opening of Hornsea One, Beatrice extension (partially operational in 2018) and East Anglia One (partially operational). Hornsea One is now the largest offshore wind farm in the world with an operational capacity of over 1.2 GW.
- In 2019, wind generators became the UK's second largest source of electricity, providing 64 TWh; almost one fifth of the UK's total generation. This was achieved by record onshore and offshore generation despite suboptimal conditions for wind, with 2019 reporting the lowest average wind speeds since 2012.
- Onshore generation exceeded offshore for every year 2010 to 2019, however the gap narrowed each year. In 2019 the difference was marginal with each providing 32 TWh of electricity and 9.9 per cent of the UK's total generation.
- Offshore sites are typically able to use more of their available capacity for generation, as wind speed and direction are more consistent offshore. This is measured by the load factor, the proportion of maximum generation achieved. Offshore load factors averaged 38 per cent versus 26 per cent for onshore from 2010 – 2019. In 2018, relative to the global averages, UK wind farms achieved greater load factors both onshore and offshore[2].
- Among OECD European countries, the UK's share of total wind generation grew almost every year from 2010 to 2017[3]. In 2018, the UK was the second largest generator of wind powered electricity in the group, behind Germany, with the third largest capacity; Germany and Spain being first and second.
- England was the largest generator of wind powered electricity of the four UK countries in 2019, providing 52 per cent of the UK's total wind generation. Scotland, Wales and Northern Ireland provided 35, 8.0 and 5.0 per cent respectively.

Growth of UK wind generation

Commercial wind farms comprising a series of wind turbines at a single site were introduced in the UK in 1991 with the opening of Delabole wind farm. The site consisted of ten 50m wind turbines with total capacity of 4 MW. Throughout the 1990s the pickup of wind-powered electricity generation was slow but momentum gradually grew. Government subsidy schemes introduced from the early 2000's as well as technological developments unlocked rapid growth. The subsidy schemes were the Renewables Obligation (RO, 2002-2017)[4], Feed in Tariff scheme (FIT, 2010-2019)[5] and Contracts for Difference (CfD, 2015-)[6]. Development of offshore wind began in 2001,

[1] Please note that all data for 2019 is provisional and may be subject to revisions.
[2] Offshore Wind Outlook 2019: www.iea.org/reports/offshore-wind-outlook-2019
[3] Data beyond 2017 for all of Europe is currently unavailable from the IEA, the most up to date data can be found at: www.iea.org/data-and-statistics/data-tables?country=WORLD&energy=Electricity&year=2017
[4] The RO closed for new generating capacity for large-scale and small-scale solar PV in March 2015 & 2016 respectively. It was then closed for onshore wind in May 2016 and for all other technologies in March 2017. Dates differ for Northern Ireland.
[5] FiT closed for new generators in April 2019.

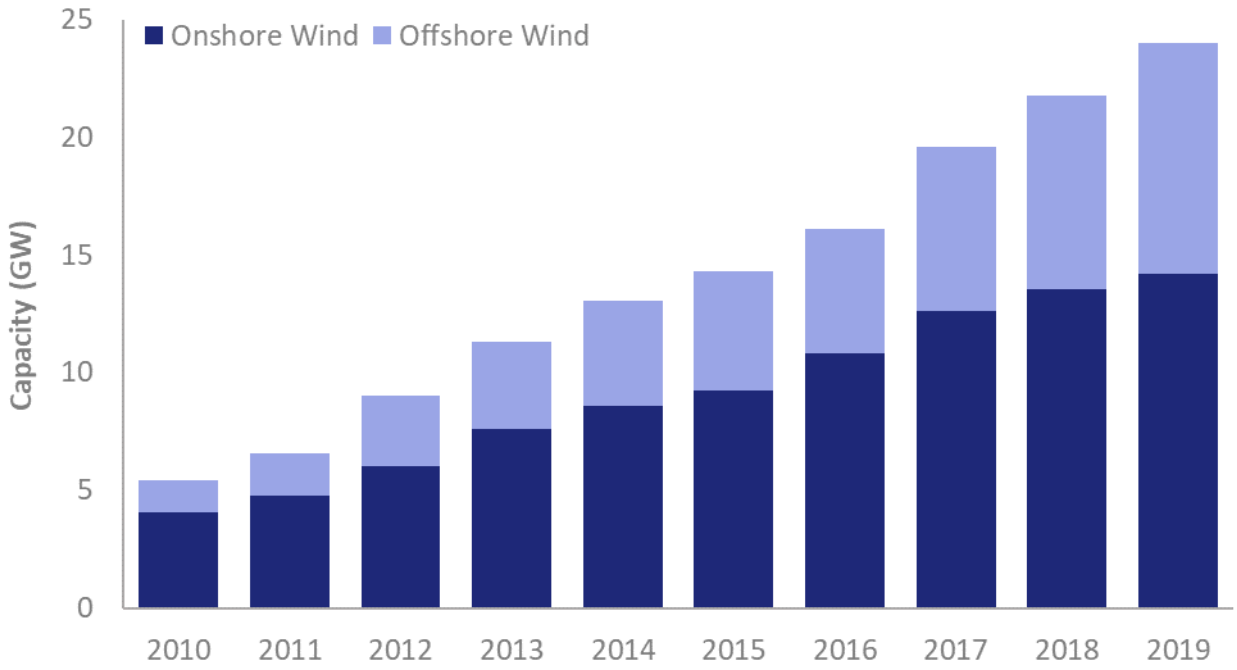
when the British Wind Energy Association and the Crown Estate selected a series of locations that offered potential for offshore wind farms. A portfolio of 17 offshore wind projects were granted permission and of these, 12 would eventually be developed. The wind farms became known as 'Round 1' wind farms. The first of these became operational in 2003 and the last in 2013.

From 2010 to the present, onshore and offshore wind capacity grew dramatically. For onshore wind, this includes large scale projects as well as smaller scale developments, supported by FiTs. For offshore wind, almost all projects are of a large scale.

Onshore and offshore wind in the UK

Charts 1 and 2 describe the UK's onshore and offshore wind capacity and generation in the period from 2010 to 2019.

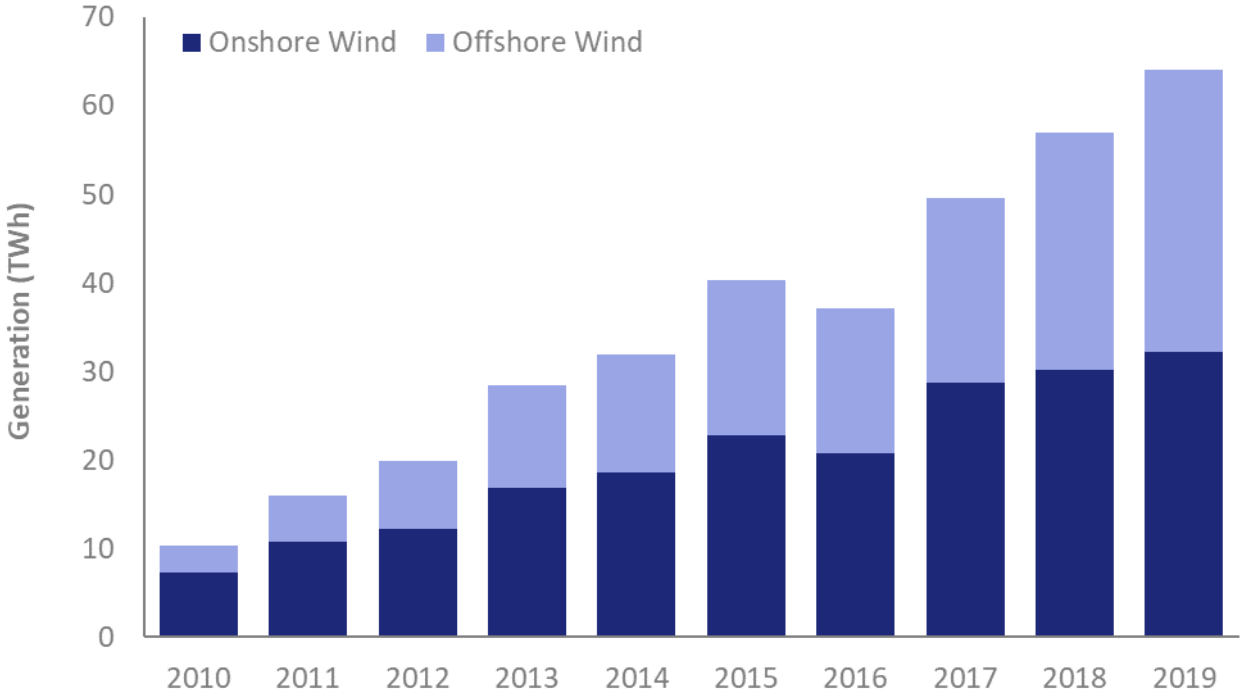
Chart 1. UK onshore/offshore wind capacity 2010 to 2019[7]



In 2010, the UK's total wind capacity was 5.4 GW. Over the past 10 years, this capacity more than quadrupled to 24 GW, the result of substantial rises both onshore (up from 4.1 to 14.2 GW) and offshore (up from 1.3 to 9.8 GW). From 2010 to 2017, onshore wind capacity grew more rapidly relative to offshore. However, the trend reversed in 2018 and 2019 as the growth of onshore wind slowed and major offshore wind sites came online. Over the past two years, notable openings offshore include: Beatrice (0.6 GW), Walney extension (0.7 GW), East Anglia One (0.2 GW of its 0.7GW capacity is operational) and Hornsea One (1.2 GW). With an operational capacity of 1.2 GW, Hornsea One is currently the world's largest offshore wind farm. The site covers an area of 407 km^2 (greater than the area of the Isle of Wight) and consists of 174 turbines, each standing at 190m. In 2019, over half of new UK renewable capacity came from offshore wind (+1.6 GW) with onshore wind also providing 21 per cent of the growth (+0.6 GW).

[6] CfD continues to support both new offshore and onshore projects however pot one technologies (those which are more established: Solar PV and Onshore wind) were not able to enter the auctions between 2015 and 2019.
[7] Renewable electricity capacity and generation, March 2020 (Energy trends 6.1), www.gov.uk/government/statistics/energy-trends-section-6-renewables

Chart 2. UK onshore/offshore wind generation 2010 to 2019



In 2010, wind (both onshore and offshore) generated 10.3 TWh of electricity; 2.7 per cent of total UK generation. Excluding 2016, where average wind speeds were down 11 per cent on the year prior, the increases in onshore and offshore wind capacity have correlated to year on year records for generation. In 2019, generation totalled 64.1 TWh, over 6 times greater than the figure reported at the start of the decade.

Onshore generation has remained greater than offshore for every year 2010 – 2019, however the difference between them was only marginal in 2019 with each providing 32 TWh of electricity and 9.9 per cent of the UK's total generation. Table 1 shows onshore and offshore wind's share of annual electricity generation for the period 2010 – 2019. In Q3 and Q4 of 2019, offshore generation exceeded onshore for the first time. This was despite onshore wind's larger capacity (+4.4 GW) and is because offshore wind benefits from more consistent wind speeds and directions. Offshore generators are therefore typically able to use more of their available capacity for generation resulting in higher load factors (calculated as the total electricity generated as a proportion of total potential generation for a given capacity). From 2010 to 2019, load factors averaged 38 per cent for offshore generation compared to 26 per cent onshore.

Table 1. Shares of total electricity generation 2010 – 2019.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Onshore	1.9%	2.9%	3.4%	4.7%	5.5%	6.7%	6.1%	8.5%	9.1%	9.9%
Offshore	0.8%	1.4%	2.1%	3.2%	4.0%	5.1%	4.8%	6.2%	8.0%	9.9%
Total	**2.7%**	**4.3%**	**5.5%**	**7.9%**	**9.5%**	**11.9%**	**11.0%**	**14.7%**	**17.1%**	**19.8%**

Wind speeds over the decade averaged at 8.5 knots. 2010 reported the lowest average wind speeds, at 7.8 knots, whilst 2015 reported the highest at 9.4 knots. Consequently, onshore and offshore load factors were also the lowest and highest in these years respectively. The drop in generation in 2016 is the result of 2015's record wind speeds followed by below average wind speeds in 2016. 2019 also reported wind speeds below average (at 8.2 knots), however the

increase in capacity offset this leading to the record generation figures both onshore and offshore. Table 2 shows the onshore and offshore load factors for the period 2010 – 2019.

Table 2. Onshore and offshore load factors 2010 – 2019[8]

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Load factors										*%*
Onshore	21.8%	27.9%	25.8%	28.4%	26.2%	29.3%	23.6%	28.0%	26.4%	26.5%
Offshore	30.5%	37.0%	35.8%	39.1%	37.3%	41.5%	36.0%	38.9%	40.1%	40.5%
Wind speed										*knots*
Average	7.8	9.0	8.2	8.6	8.7	9.4	8.4	8.7	8.5	8.2

At the start of the decade, Scotland was the largest generator of wind powered electricity of the four UK countries, providing 48 per cent of the UK's total. In 2013 England overtook Scotland to become the primary supplier of wind generated electricity in the UK. Generation in all four countries increased year on year with few exceptions; however compared to 2010, 2019's shares of the UK's total wind generation shifted. These are shown in charts 3 and 4.

Chart 3. Share of UK wind generation in 2010

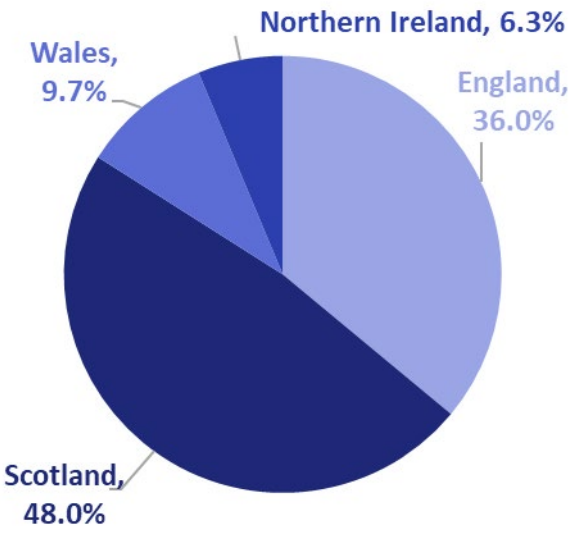
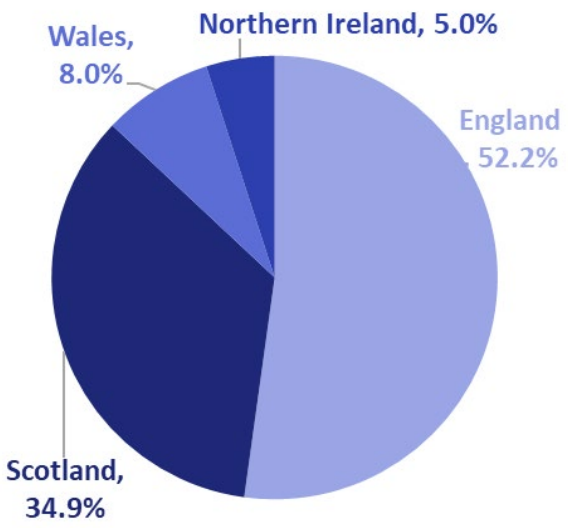


Chart 4. Share of UK wind generation in 2019



Onshore/offshore splits also differ. Whilst England provides the vast majority of the UK's offshore wind, Scotland is the primary source of onshore generation. Wales maintains a broadly even generation onshore and offshore and Northern Ireland has only onshore capacity. The map at the end of the article shows UK's onshore and offshore wind sites capacity in 2019.

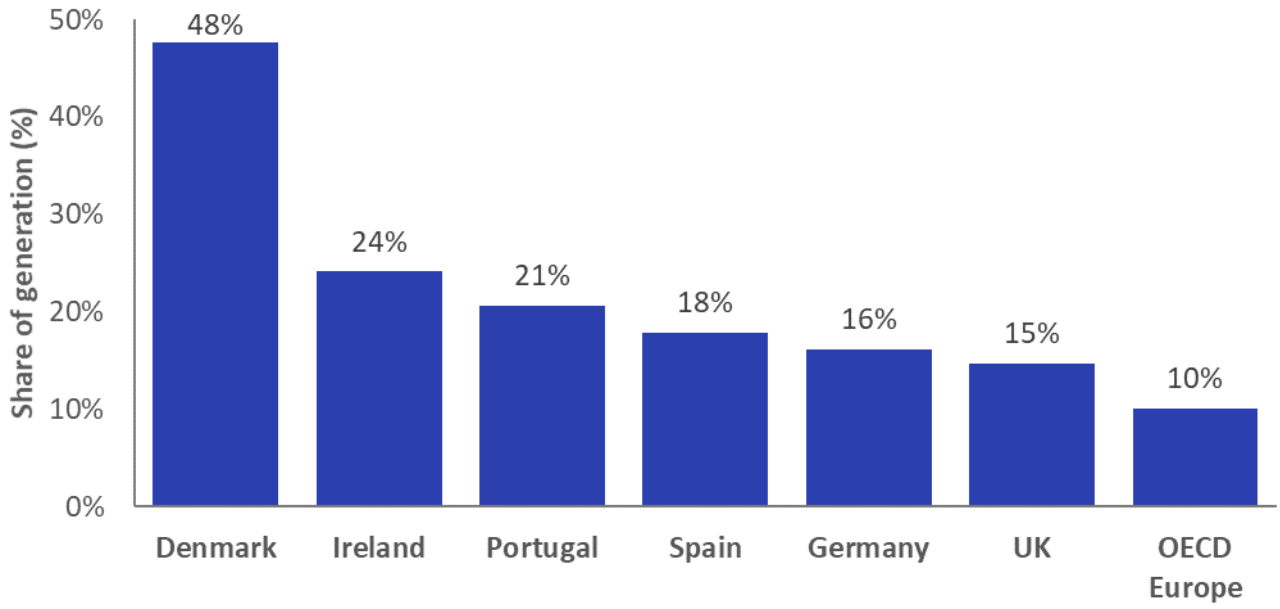
The rapid increase in generation from wind (and other renewable sources) over the decade helped fill the gap in generation left by the phase out of coal-fired electricity. In 2012 coal-fired generators supplied 133 TWh of electricity, which has drastically reduced to only 6.5 TWh in 2019, a record low.

[8] Load factors are calculated using generation divided by mid-year capacity times 365 (days/year) times 24 (hours/day)

International comparison for UK for wind generation

The UK is one of the world leaders for wind generation, particularly for offshore wind, with the UK reporting the world's largest offshore wind capacity[9]. Hornsea One, Walney extension and London Array are currently the three largest offshore wind sites in the world. In terms of European comparisons, in 2017[10] there were five countries reporting a higher share of their electricity production from wind, as shown in Chart 5. In 2018, the UK was the second largest generator of wind powered electricity in Europe (behind Germany) with the third largest capacity (with Germany and Spain first and second respectively). Excluding 2016, the UK's share of the OECD Europe's total wind generation has risen year on year from 2010 to 2017, reaching 13.3 per cent. One tenth of all electricity generated in OECD Europe was from wind technologies. The UK also benefits from favourable wind speeds, with 2018 reporting load factors for onshore and offshore wind of 26 and 40 per cent respectively, greater than the global averages of 25 and 33 per cent[11].

Chart 5: Wind share of total electricity generation - OECD Europe countries in 2017



2020 and beyond

In June 2019 the UK government passed legislation committing the UK to a 'net-zero' greenhouse gas emissions target by 2050. To achieve this goal, wind is expected to play an increasing role in the UK's electricity supply mix. The UK offshore sector deal in 2019 reported that subject to costs coming down, offshore wind could contribute up to 30 GW of generating capacity by 2030. This would more than treble its current operational capacity. Multiple GW of onshore and offshore capacity is currently under construction and due to become operational between 2020 and 2023 and an additional 5.8 GW of offshore and Remote Island onshore wind capacity has recently gained funding under the Contracts for Difference round 3 auction (2019). This will become operational between 2023 – 2025. A potential 7 GW have also been recently announced by the UK Government and the Crown Estate for new offshore projects to be developed in the waters around England and Wales.

[9] www.gov.uk/government/publications/offshore-wind-sector-deal/offshore-wind-sector-deal
[10] Data beyond 2017 for all OECD Europe is currently unavailable from the IEA, the most up to date data can be found at: www.iea.org/data-and-statistics/data-tables?country=WORLD&energy=Electricity&year=2017
[11] BEIS calculation based on 'IEA Renewables 2019': www.iea.org/reports/renewables-2019

Since 2015, significant reductions in the strike price for offshore wind farms have been experienced in each CfD allocation round. In allocation round 1 (2015), the strike price ranged from 114 to 119 £/MWh. This dropped to 40 to 42 £/MWh[12] in the round 3 allocations (2019) as the technology matured. Technological developments are expected to further reduce offshore and onshore wind costs, including larger turbines and advances in foundation and installation technology to allow offshore wind farms to be built in deeper waters. These developments will help increase the potential for wind generation and support the UK in reducing its greenhouse gas emissions.

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Energy Trends: Weather: www.gov.uk/government/statistics/energy-trends-section-7-weather

Renewable energy in Scotland, Wales, Northern Ireland and the regions of England in 2018 – Energy Trends September 2019, page 46 https://www.gov.uk/government/publications/energy-trends-september-2019-special-feature-articles

[12] Prices given in 2012 figures.

UK Onshore and Offshore Wind Capacity

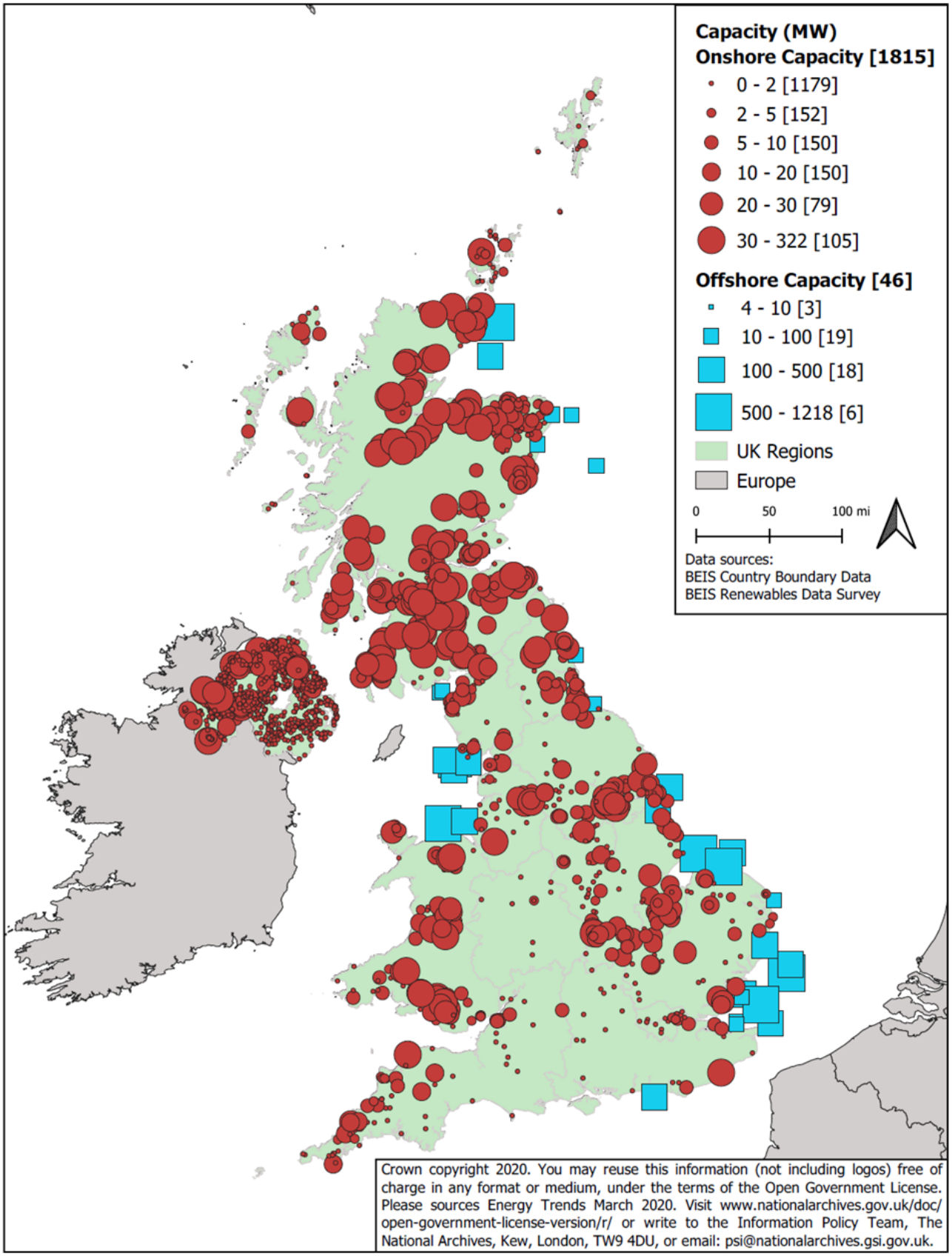


Table 3. Regional data wind data 2010 to 2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cumulative Installed Capacity										MW
Onshore Wind										
England	865	1,023	1,316	1,840	2,188	2,439	2,819	3,059	3,078	3,125
Scotland	2,486	2,898	3,765	4,589	5,079	5,398	6,298	7,338	7,936	8,327
Wales	388	429	494	576	607	644	829	1,018	1,137	1,279
Northern Ireland	341	409	460	581	697	731	886	1,182	1,404	1,453
Total	4,080	4,758	6,035	7,586	8,573	9,212	10,832	12,597	13,554	14,183
Offshore Wind										
England	1,001	1,498	2,655	3,313	3,726	4,180	4,380	6,016	6,869	8,085
Scotland	190	190	190	190	197	187	187	246	623	981
Wales	150	150	150	193	578	726	726	726	724	726
Northern Ireland	-	-	-	-	-	-	-	-	-	-
Total	1,341	1,838	2,995	3,696	4,501	5,094	5,293	6,988	8,217	9,792
Total	**5,422**	**6,597**	**9,031**	**11,282**	**13,074**	**14,306**	**16,126**	**19,585**	**21,770**	**23,975**
Generation										GWh
Onshore Wind										
England	-	2,156	2,478	3,829	4,640	6,043	5,715	7,501	7,279	7,088
Scotland	-	6,653	7,752	10,564	11,131	13,339	11,891	16,306	17,627	19,022
Wales	-	1,004	972	1,187	1,325	1,610	1,410	2,395	2,314	2,912
Northern Ireland	-	1,002	1,042	1,345	1,458	1,860	1,733	2,515	2,997	3,183
Total	7,226	10,814	12,244	16,925	18,555	22,852	20,749	28,717	30,217	32,205
Offshore Wind										
England	-	4,091	6,588	10,403	11,870	14,933	13,892	17,870	23,118	26,377
Scotland	-	604	540	587	569	539	502	614	1,371	3,329
Wales	-	455	475	482	966	1,951	2,012	2,431	2,198	2,223
Northern Ireland	-	-	-	-	-	-	-	-	-	-
Total	3,060	5,149	7,603	11,472	13,405	17,423	16,406	20,916	26,687	31,929
Total	**10,286**	**15,963**	**19,847**	**28,397**	**31,959**	**40,275**	**37,155**	**49,633**	**56,904**	**64,134**
										GWh
Total UK generation	**382,068**	**367,982**	**363,873**	**358,284**	**338,096**	**338,875**	**339,191**	**338,172**	**332,893**	**323,708**

International comparisons of household energy efficiency

Introduction

To evaluate the energy efficiency of UK households it is useful to compare how well they perform relative to other countries. To this end, this article presents country-level indicators for the energy efficiency of European households from 2000 to 2017 based on data published by the ODYSSEE-MURE project.[1] It begins by examining how much energy is consumed by each country's domestic sector on an annual basis. It then shifts to a detailed assessment of the four main categories of domestic consumption: space heating, lighting & appliances, water heating and cooking. Finally, it concludes by highlighting that the technical efficiency of the UK's domestic sector has improved by 33 per cent over the past two decades.

When using indicators designed to make meaningful comparisons between countries, it is not possible to account for every factor that may vary from one country to the next. As a result, it is helpful to compare the UK to countries that possess similar characteristics in terms of climate, energy demands and economy, such as France and Germany, rather than to dissimilar countries, like Malta. Accordingly, the analysis presented below focuses on the fourteen countries that were members of the EU prior to 2004, plus Norway, to ensure that meaningful comparisons can be made with the UK.

All data presented in this article were taken from the ODYSSEE database. This database is part of the ODYSSEE-MURE project, which is a European Commission supported initiative that includes EU Member States, the UK and Norway. The majority of countries have data available from 2000 to 2017. However, in cases where data for 2017 were not available, the most recent data were used instead. If a country's name is not included in one of the provided charts, it is because they had yet to report any data for the indicator in question at the time of writing.

Household energy consumption

The UK's domestic sector consumed a total of 430 TWh in 2017.[2] This figure is equivalent to 28 per cent of the UK's final consumption in 2017, making the domestic sector the second largest consumer of energy after transport (40 per cent). Any variation in the energy efficiency of UK households is therefore likely to have a significant impact on the energy efficiency of the country as a whole.

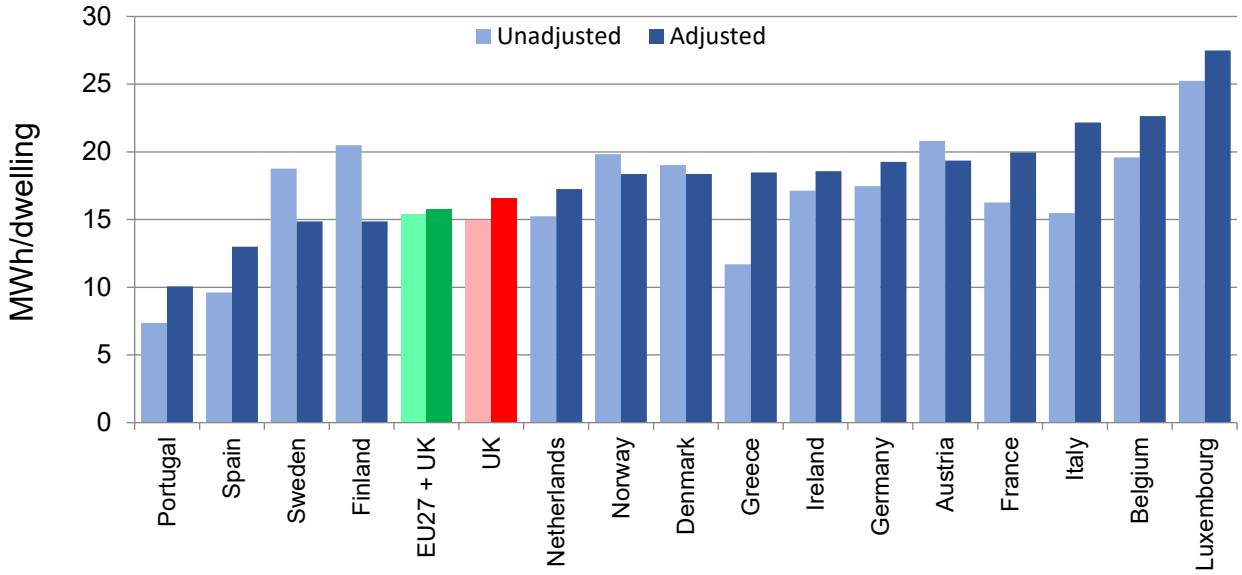
The main challenge when seeking to make international comparisons of energy efficiency is that all countries possess a unique combination of underlying characteristics. For example, a household that lives in a country with a cooler climate may use more energy to heat their home than a household living in a country with a warmer climate, even if their underlying heat source is more energy efficient. It is therefore advisable to use climate adjusted data to ensure that these comparisons are as meaningful as possible.

For the UK, there is little variation in its relative performance regardless of the chosen measure. The unadjusted data in Chart 1 show that it consumed an average of 14.9 MWh per dwelling in 2017, which places it slightly below the EU average of 15.4 MWh and fourth overall. And the adjusted data show that it consumed an average of 16.6 MWh per dwelling, which places it slightly above the EU average of 15.8 MWh and fifth overall. These data also show that the UK consumed 15 per cent less energy per household than Germany when adjusted for climate and 19 per cent less than France.

[1] Additional information on the ODYSSEE-MURE project can be found at: www.odyssee-mure.eu.

[2] All consumption data in ODYSSEE is reported on a Net Calorific Value (NCV) basis and hence differs from the main tables in UK statistical publications.

Chart 1: Domestic energy consumption per household in 2017, unadjusted and adjusted to EU average climate

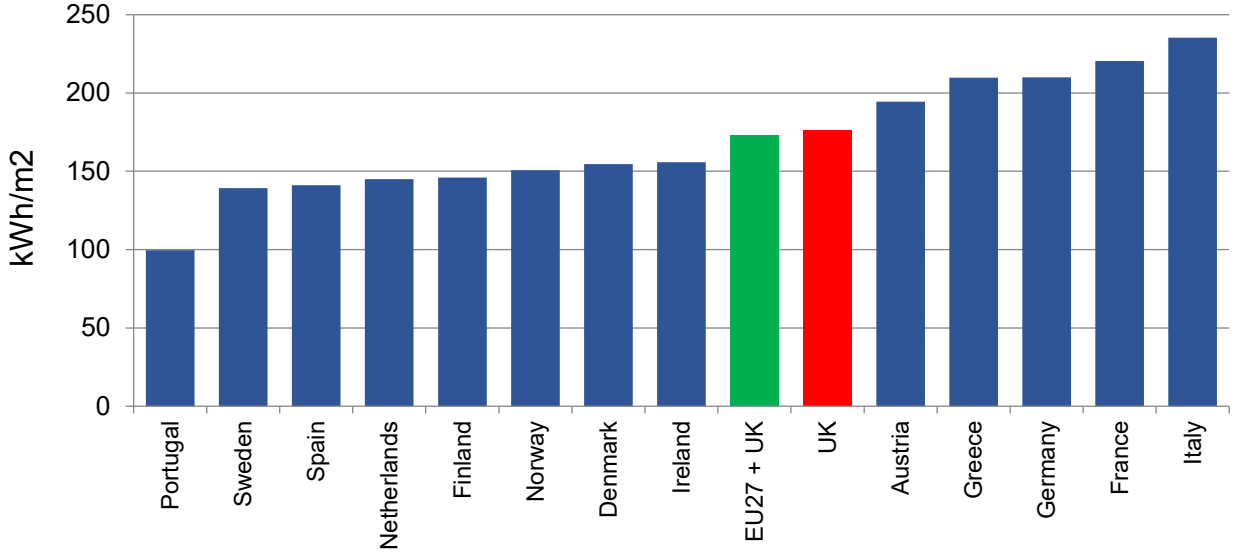


Source: ODYSSEE

An alternative method of evaluating the efficiency of a country's domestic sector is to use domestic energy consumption per m^2. This indicator helps to account for variation in the size of each country's dwellings, in the same way that the use of climate adjusted data helps to control for variation in external temperature. As a result, it provides a fairer comparison for space heating, but less so for appliance usage and in cases where the number of occupants per household varies. Overall though, a household that consumes less energy for a given unit of space is assumed to be more energy efficient than a household that consumes more energy for that same unit of space, even if their overall consumption is identical.

As shown in Chart 2, the UK's domestic sector consumes a relatively high amount of energy when measured on a per m^2 basis. With an average floor area of 94m^2, UK households consumed 176 kWh per m^2 in 2017, which places it slightly above the EU average of 173 kWh per m^2 and ninth overall. By contrast, the performance of some countries can be seen to improve when using this alternative indicator, with the Netherlands, Norway, Denmark and Ireland all shown to consume less energy than the UK when measured per m^2 rather than per dwelling.

Chart 2: Domestic energy consumption per m^2 in 2017, adjusted to EU average climate

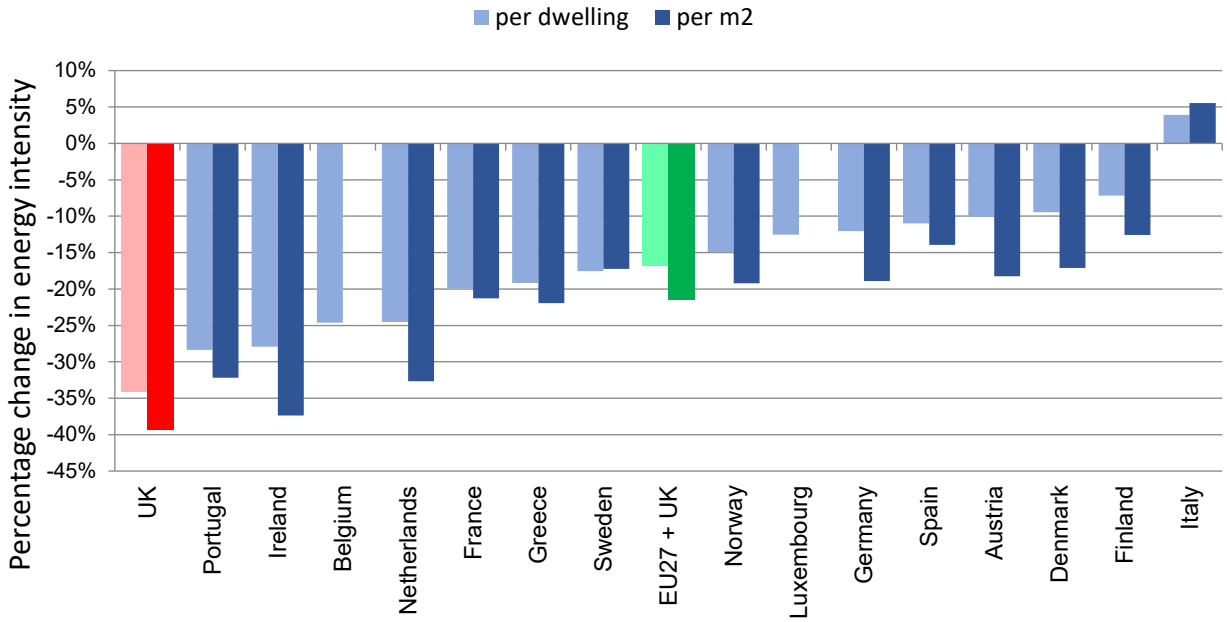


Source: ODYSSEE

The main reason for this difference is likely to be the smaller size of the UK's dwellings combined with its high rates of appliance ownership. The UK had the fifth smallest dwellings amongst the chosen sample in 2017, with an average floor area of only 94m^2. Its rate of appliance ownership was also the highest in the sample, with roughly five large appliances per household in 2017. By comparison, the country with the lowest level of consumption per m^2, Portugal, had an average dwelling size of 101m^2 and three large appliances per household. As a result, the energy intensity of each m^2 in the UK is higher than in Portugal, due to the need to distribute a larger amount of appliance consumption across a smaller amount of space. This phenomenon can also be observed for countries with similar size to ownership ratios as the UK, such as Germany and France, who see a similar shift in their relative ranking when measured on a per m^2 basis.

The data in Chart 3 show that the energy efficiency of the UK's domestic sector has improved by more than any other country in the sample from 2000 to 2017, regardless of which indicator is used to measure its progress. It experienced a 34 per cent improvement when measured on a per dwelling basis and a 39 per cent improvement when measured per m^2, despite its high ratio of appliances to floor space. These figures also indicate that the UK improved by roughly twice as much as the EU average over this time period, which experienced a 17 per cent improvement in consumption per dwelling and a 21 per cent improvement per m^2.

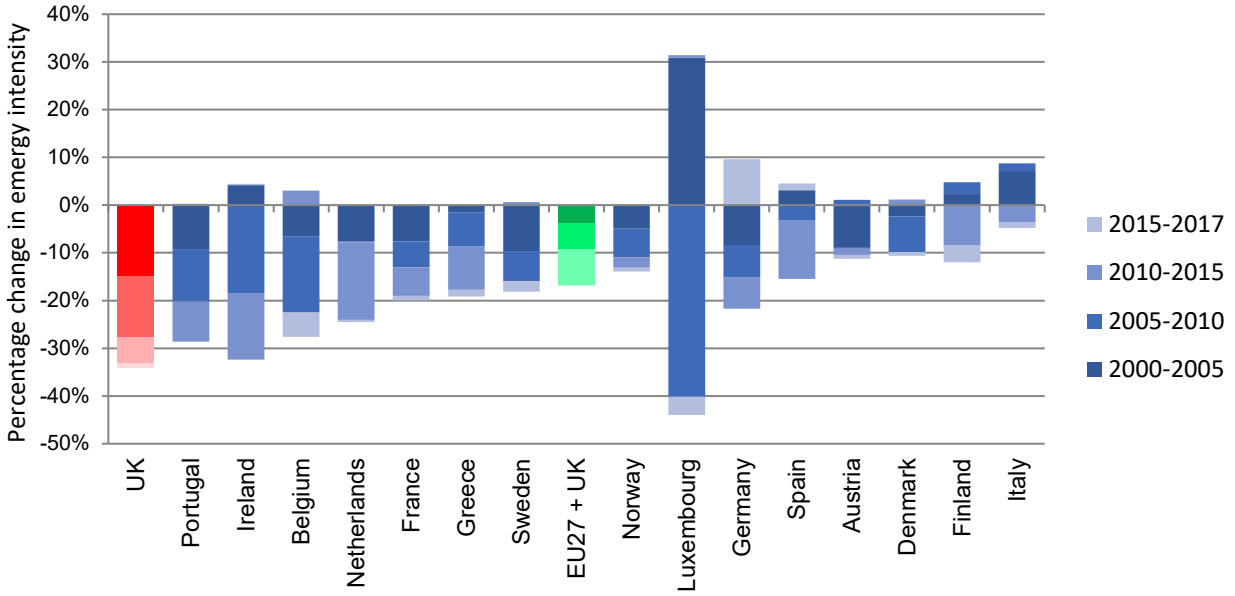
Chart 3: Percentage change in domestic consumption per dwelling and m^2, from 2000 to 2017, adjusted to EU average climate



Source: ODYSSEE

Having said that, it is worth noting that the UK's rate of improvement has not been consistent over time. As shown in Chart 4, the UK's consumption per dwelling improved by 15 per cent from 2000-2005 and then a further 13 per cent from 2005-2010, compared to EU averages of 4 per cent and 6 per cent. Its progress then slowed to a further 6 per cent reduction from 2010-2015 followed by an additional 1 per cent from 2015-2017, compared to EU averages of 7 per cent and no change. These data suggest that the UK is not alone in terms of its slowing rate of progress, which has been mirrored across the EU as a whole. However, they also suggest that the most significant improvements to the UK's household energy efficiency were achieved in the first decade of the millennium, with less improvement made in recent years.

Chart 4: Cumulative percentage change in domestic consumption per dwelling relative to the baseline year of 2000, by time period, adjusted to EU average climate



Source: ODYSSEE

Space heating, lighting & appliances, water heating and cooking

The previous section showed that the UK's domestic sector is relatively efficient compared with other European countries, in addition to being amongst the most improved. This section shows that the majority of the UK's progress in this area can be linked to improvements in the energy efficiency of space heating, as well as more modest gains in terms of lighting & appliances, water heating and cooking.

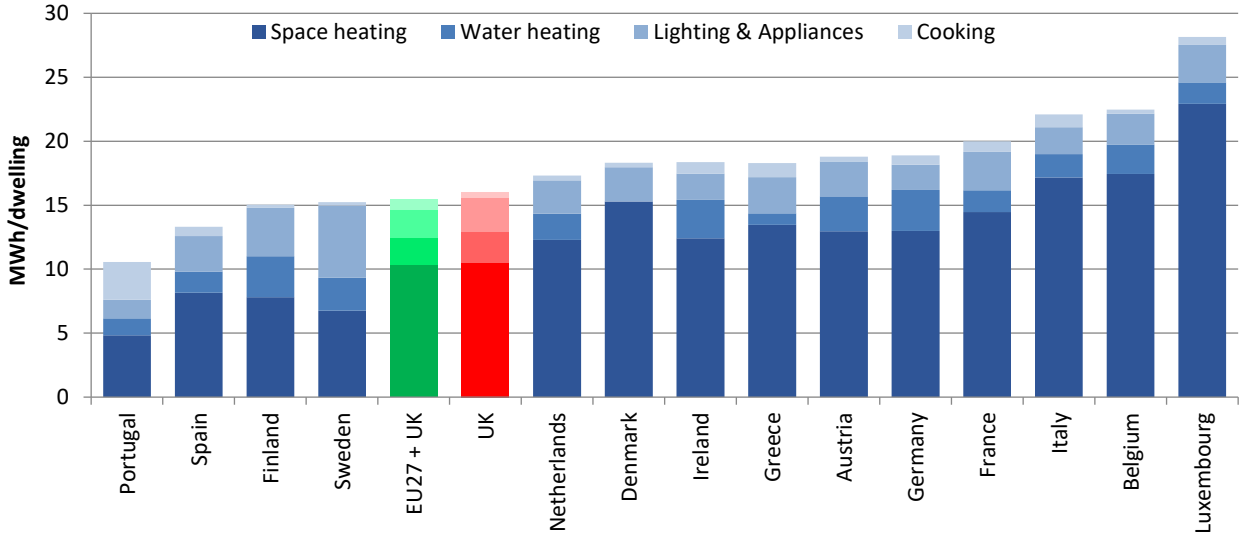
As shown in Chart 5, the largest component of household energy consumption in all fifteen countries is space heating. It accounts for 67 per cent of average national consumption, with the remainder consisting of lighting & appliances at 14 per cent, water heating at 13 per cent and cooking at 5 per cent.[3] For the UK, these data reveal a similar pattern, with space heating consuming 65 per cent, lighting & appliances 17 per cent, water heating 15 per cent and cooking 3 per cent. They also show that the UK uses less energy than France and Germany for space heating, that it falls in-between these two countries for both lighting & appliances and water heating, and that it consumes the least amount of energy for cooking.

Due to the large share of space heating in the UK's consumption profile, any reduction in the consumption of this single category is likely to have a considerable effect on the consumption of the domestic sector as a whole.[4] It is therefore important to note that the UK made the third largest reduction in this end use from 2000 to 2017, with a 31 per cent decrease in consumption per dwelling.

[3] The data for water heating were not available in a climate adjusted form so the provided totals are likely to be slightly higher for colder countries than they are for warmer countries. A fifth category of domestic end usage – air cooling – has also been excluded from Chart 5, due to its relatively small share of overall consumption in each country (i.e. no larger than 0.67 per cent).

[4] Due to missing data, all calculations involving the unit consumption of space heating in the UK use the total from 2002 for both 2001 and 2000.

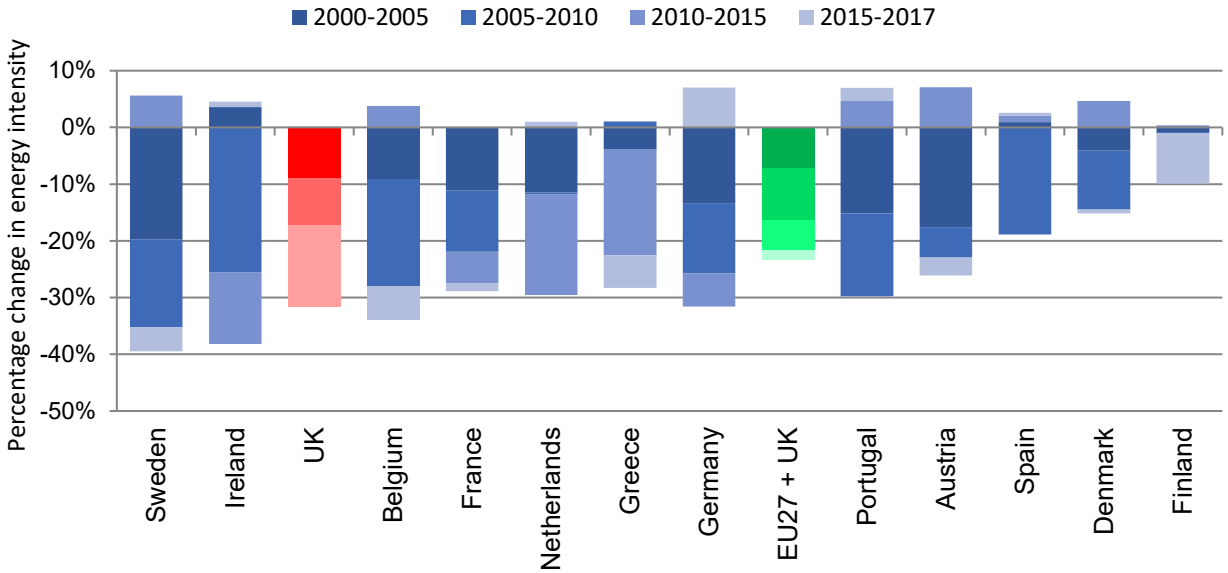
Chart 5: Unit consumption per dwelling for 2017, by end usage, with space heating usage adjusted to EU average climate



Source: ODYSSEE

However, as shown in Chart 6, the consumption of space heating in the UK has not decreased at a consistent rate over time. After decreasing by roughly 9 per cent from 2000-2005 and then a further 8 per cent from 2005-2010, it decreased by an additional 14 per cent from 2010-2015 and then increased by 0.2 per cent from 2015-2017. Although this last figure is close to the EU average, which decreased by 1.7 per cent over this final two-year period, it suggests that the UK's progress in this area has stalled in recent years.

Chart 6: Cumulative percentage change in unit consumption of space heating per dwelling relative to the baseline year of 2000, by time period, adjusted to EU average climate



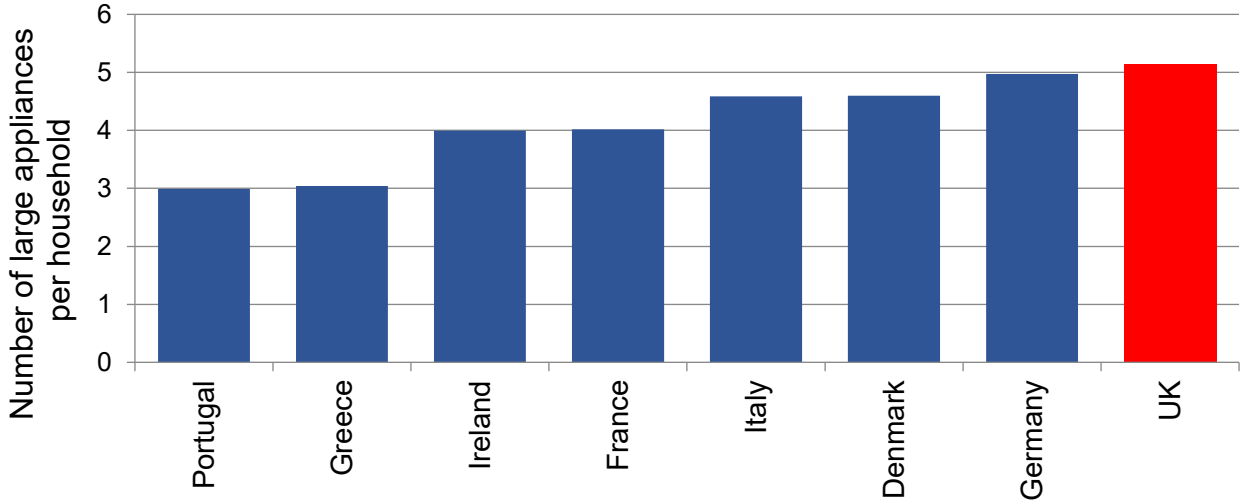
Source: ODYSSEE

Although their absolute impact has not been as large, the amount of energy consumed for other end uses in the UK has also decreased over the past two decades. The largest reduction in consumption per dwelling was for water heating (32 per cent), followed closely by cooking (30 per cent). However, the relatively small share of domestic consumption for cooking, which stood at only 0.4 MWh per dwelling in 2017, means that the overall impact of this improvement is likely to have been limited.

By contrast, the UK experienced an 8 per cent reduction in energy consumption for lighting & appliances from 2010-2017, which accounted for a more substantial 2.7 MWh per household in 2017. The size of this reduction was larger than the EU average for this time period, which stood at 3 per cent, as well as relative to the 4 per cent improvement in Germany and the 13 per cent decline in France.

To identify the potential source of this reduction, it is useful to start by looking at how many appliances are owned by a typical UK household. As shown in Chart 7, the average household in the UK possessed slightly more than five large appliances in 2017,[5] which is around the same as ownership levels in Germany. When broken down further, these data show that the average UK household owned 2.4 televisions, 1.1 refrigerators (including fridge-freezers), 0.8 washing machines, 0.5 freezers and 0.4 dishwashers in 2017.

Chart 7: Average number of large appliances per household in 2017



Source: ODYSSEE

These kinds of details are helpful because they can be used to understand why appliance-related consumption in the UK declined from 2000 to 2017. For example, the average dishwasher in the UK used approximately 288 kWh per year in 2017, which was nearly triple the amount of energy required to power an average television.[6] However, due to the disparity in ownership levels between these two types of appliances, the total energy consumed by televisions was roughly double the amount of energy consumed by dishwashers. As a result, improvements in the energy efficiency of certain types of appliances will end up having a greater impact on household consumption than others.

As shown in Chart 8, the energy efficiency of the UK's freezer stock (excluding fridge-freezers) improved by more than any other appliance over this time period, with a 52 per cent decrease in unit consumption from 2000 to 2017.[7] However, due to the relatively low rates of freezer ownership across the UK, this large decrease at the unit level actually resulted in the lowest substantive impact

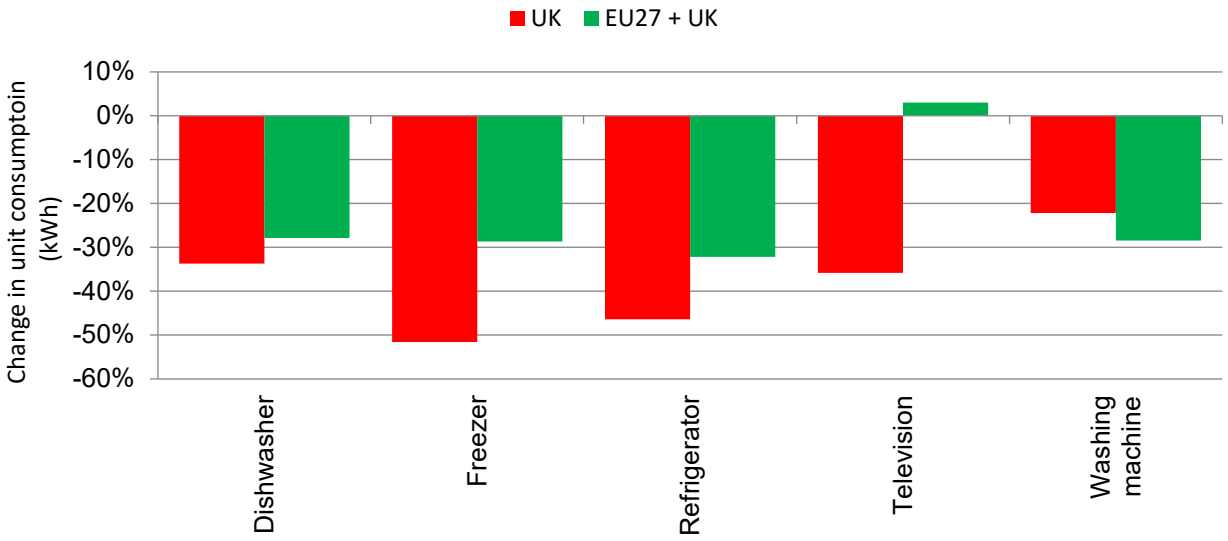
[5] Although this category of appliances is not exhaustive, with the definition of a 'large' appliance restricted to freezers, refrigerators, televisions, dishwashers and washing machines, it accounts for the majority of appliance-related consumption in European households.

[6] The consumption figures for televisions are based on the average power of the television stock as a whole, rather than a specific type of size or type of television, so it is likely to underestimate the usage of some televisions and overestimate the usage of others.

[7] When calculating unit consumption figures, ODYSSEE used a mixture of theoretical assumptions about each country's appliance stock rather than measurements of energy usage. For example, the energy efficiency of dishwashers and washing machines was estimated by multiplying the average electricity consumption per cycle for each appliance by a set number of cycles per year. See their methodology note for additional details: www.indicators.odyssee-mure.eu/odex-indicators-database-definition.pdf.

of all five types of appliance. By contrast, the 46 per cent improvement in the efficiency of refrigerators had the largest substantive effect, due to a combination of high ownership rates and high unit consumption. It is also worth noting that the energy efficiency of the UK's appliances improved by more than the EU average in all five categories, as well as relative to Germany in every category aside from washing machines.

Chart 8: Percentage change in unit consumption of large household appliances, from 2000 to 2017



Source: ODYSSEE

Technical energy efficiency

The previous section demonstrated that the efficiency gains made by the UK's domestic sector have primarily been driven by improvements to the energy efficiency of its space heating, water heating and large appliances. This section provides further evidence for this relationship by highlighting how much the modelled technical efficiency of UK households has improved over the past two decades.

A country is considered to be more technically efficient than another when it is able to produce more of a given output when using an equal amount of energy. A more technically efficient household should require less energy to heat to the same temperature and be able to run its appliances for longer than a less efficient household whilst consuming the same amount of power.

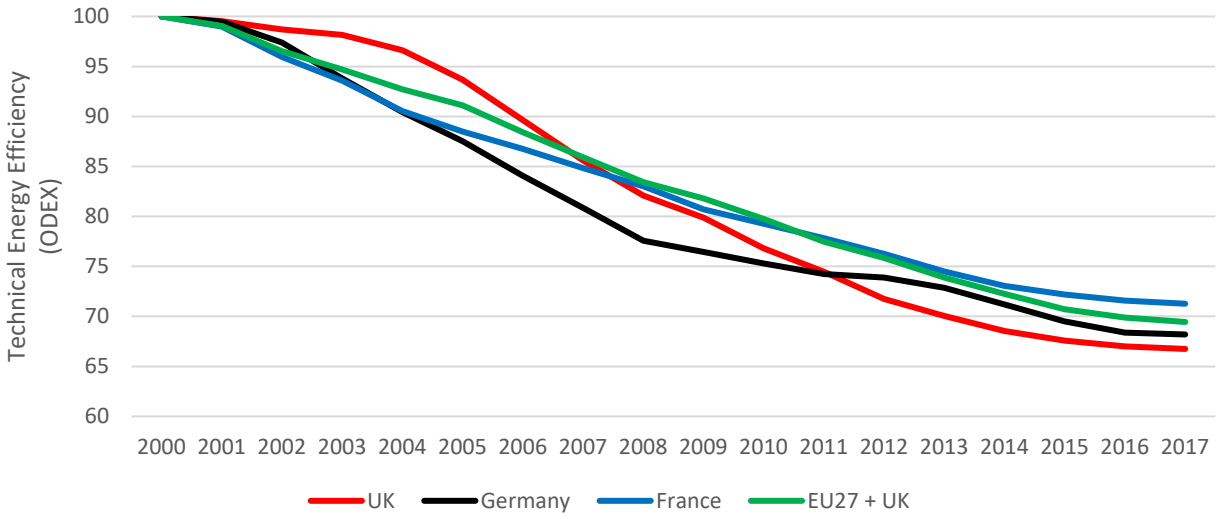
To measure technical efficiency, the ODYSSEE-MURE project developed a model that combines the efficiency gains made by four types of domestic consumption: space heating, water heating, cooking and large appliances. After weighting the gains in each category relative to their share of overall consumption, the model makes additional calculations to account for the effects of non-technical variation in consumption, such as the energy efficiency of each country's building stock.[8] The end result is the creation of a technical energy efficiency index (ODEX) consisting of a single value per country per year, with values above 100 indicating a net decrease in energy efficiency since the baseline year of 2000 and values below 100 indicating a net increase in energy efficiency.

As shown in Chart 9, the technical energy efficiency of the UK's domestic sector improved by roughly 33 per cent from 2000 to 2017. The largest change occurred from 2004 to 2014, which accounted for 85 per cent of the UK's overall improvement. The UK's experience also slightly exceeded that of its European neighbours over the whole time period, with the 33 per cent improvement in the UK

[8] For a more detailed explanation of the steps used to calculate ODEX, see the 'Energy Efficiency index ODEX' section of ODYSSEE's methodology note: www.indicators.odyssee-mure.eu/odex-indicators-database-definition.pdf.

roughly equivalent to the 32 per cent improvement in Germany and the 29 per cent improvement in France.

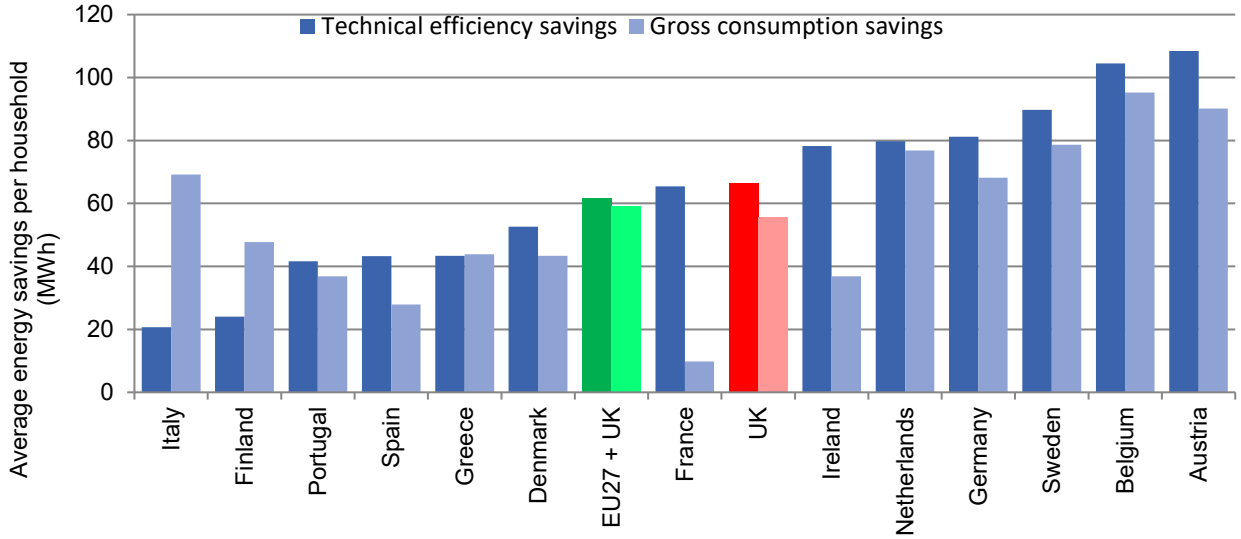
Chart 9: Technical energy efficiency index (ODEX) of the domestic sector, from 2000 to 2017



Source: ODYSSEE

Due to the abstract nature of ODEX scores, it can be difficult to understand the substantive impact of these improvements without a more tangible point of reference. The data in Chart 10 show that the UK made cumulative technical efficiency savings of 66.5 MWh per household from 2000 to 2017,[9] compared to average annual household consumption of 16.6 MWh in 2017 when adjusted for climate.

Chart 10: Cumulative energy savings per household, from 2000 to 2017, adjusted to EU average climate



Source: ODYSSEE

[9] This figure was calculated by first estimating how much energy the UK's domestic sector would have consumed if it had not made any efficiency gains since 2000 and then subtracting the amount of energy that the domestic sector actually consumed from this total. The resulting figure was then divided by the number of permanently occupied dwellings in the UK by the end of 2017.

Conclusion

The purpose of this article has been to evaluate the energy efficiency of UK households by comparing their performance relative to other countries. To ensure that a meaningful comparison could be made, the UK's performance was assessed relative to a group of similar European countries using energy efficiency indicators published by the ODYSSEE-MURE data project.

The main conclusion of this exercise is that the UK's domestic sector is relatively efficient by European standards. It is ranked as the fifth most efficient country in the sample if assessed on a per household basis and the ninth most efficient if assessed on a per m^2 basis, in addition to experiencing the largest overall improvement from 2000 to 2017. However, this article has also shown that the most significant improvements to household energy efficiency in the UK were achieved during the first decade of the millennium, with less improvement made in recent years.

To understand why the UK's energy efficiency has improved, this article also disaggregated domestic energy consumption into its four main end uses: space heating, lighting & appliances, water heating and cooking. In doing so, it demonstrated that the majority of the UK's improvement can be linked to the increased efficiency of space heating, which constitutes the single largest consumption category for UK households. It also showed that there have been improvements to the energy efficiency of water heating, cooking and large appliances over time. As a result, the technical efficiency of the UK's domestic sector has improved by 33 per cent over the past two decades, meaning that UK households now use one third less energy to produce the same level of output as they did in 2000.

For further information on International Energy Efficiency Statistics, please contact:

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Recent and forthcoming publications of interest to users of energy statistics

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 were published on 4 February 2020 at:
www.gov.uk/government/collections/final-uk-greenhouse-gas-emissions-national-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 December 2019, was published on 12 March 2020 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 March 2020 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 March 2020 at:
www.gov.uk/government/collections/renewable-heat-incentive-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 is also included within this publication. Provisional 2019 UK greenhouse gas emissions statistics were published on 26 March 2020 at:
www.gov.uk/government/collections/provisional-uk-greenhouse-gas-emissions-national-statistics

Annual Fuel Poverty statistics report and sub-regional data

This annual publication details the latest statistics on fuel poverty in England. The 2020 edition, detailing the 2018 statistics, will be released on 30 April 2020, along with a series of detailed data tables, at: www.gov.uk/government/collections/fuel-poverty-statistics. Data for 2018 at sub-regional will be also be released on 30 April 2020 at: www.gov.uk/government/collections/fuel-poverty-sub-regional-statistics

Local authority carbon dioxide emissions

This annual publication provides estimates of local authority carbon dioxide emissions in the United Kingdom. Data for 2018 will be released on 25 June 2020 at:
www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics

Sub-national road transport consumption

This annual publication provides estimates of road transport fuel consumption in the United Kingdom, by vehicle and fuel type. Data for 2018 will be released on 25 June 2020 at:
www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level

List of special feature articles published in Energy Trends between March 2019 and December 2019

Subject	Title
Energy	
June 2019	Experimental statistics on whole UK energy flow incorporating end use energy efficiency
Combined Heat and Power (CHP)	
September 2019	Combined Heat and Power in Scotland, Wales, Northern Ireland and the regions of England in 2018
Electricity	
March 2019	Nuclear electricity in the UK
September 2019	Competition in UK electricity markets
December 2019	Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2015 to 2018
Feed-in Tariffs	
December 2019	Feed-in Tariff load factor analysis
Fuel Poverty	
March 2019	Comparison of theoretical energy consumption with actual usage
Gas	
March 2019	Diversity and security of gas supply in the EU, 2017 Proposed change to method of reporting UK Liquefied Natural Gas imports
September 2019	Competition in gas supply
December 2019	Diversity and security of gas supply in the EU, 2018
Petroleum (oil and oil products)	
June 2019	Change to method of estimating sector demand for oil products Road fuel consumption and the UK motor vehicle fleet
September 2019	Diversity of supply for oil and oil products in OECD countries in 2018
Renewables	
September 2019	Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2018 Aggregated energy balances showing proportion of renewables in supply and demand
Sub-national energy consumption	
December 2019	Gas consumption savings from bead and mineral wool cavity wall insulation

Explanatory notes

General

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

Symbols used in the tables

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

Notes to tables

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

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

Conversion factors

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

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

Conversion matrices

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

To:	**Thousand toe**	**Terajoules**	**GWh**	**Million therms**
From	**Multiply by**			
Thousand toe	1	41.868	11.630	0.39683
Terajoules (TJ)	0.023885	1	0.27778	0.0094778
Gigawatt hours (GWh)	0.085985	3.6000	1	0.034121
Million therms	2.5200	105.51	29.307	1

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

Note that all factors are quoted to 5 significant figures

Abbreviations

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

Sectoral breakdowns

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

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

Energy Prices

From March 2019 onwards Energy Prices articles previously published in Energy Trends will be published as part of the quarterly Energy Prices publication, released on the same day as Energy Trends and available at: www.gov.uk/government/collections/quarterly-energy-prices

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