Department for
Business, Energy
& Industrial Strategy

ENERGY TRENDS
JUNE 2019

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

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

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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 June editions cover the first quarter of the current year.

Energy Trends includes information on energy as a whole and by individual fuels. The text and charts provide an analysis of the data in the tables. The tables are mainly in commodity balance format, as used in the annual Digest of UK Energy Statistics. The 2018 edition of the Digest was published on 26 July 2018 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 2018 included within this edition is on a provisional basis. New data are continually received and revisions to previous data made. Finalised figures for 2018 will be published on the 25 July 2019 in the annual Digest of UK Energy Statistics.

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

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

If you have any comments on Energy Trends please send them to:

Kevin Harris
BEIS
Energy Statistics Team
5th Floor - Victoria 3
1 Victoria Street
London SW1H 0ET
E-mail: Kevin.Harris@beis.gov.uk
Tel: 0300 068 5041

The main points for the first quarter of 2019:

- Total energy production was 0.1 per cent higher than in the first quarter of 2018.
- Oil production rose by 9.3 per cent when compared to the first quarter of 2018 as new projects that opened in late 2017 ramped up production.
- Natural gas production was 5.7 per cent lower, following the closure of the Theddlethorpe terminal in August 2018.
- Coal production in the first quarter of 2019 was 8.9 per cent lower than the first quarter of 2018. This is a result of mine closures and falling demand for coal for electricity generation. Coal imports were 19 per cent lower and generators' demand for coal fell by 63 per cent.
- Total primary energy consumption for energy uses fell by 7.8 per cent. However, when adjusted to take account of weather differences between the first quarter of 2018 and the first quarter of 2019, total primary energy consumption fell by 3.2 per cent.
- Temperatures in the quarter were on average 1.9 degrees warmer than a year earlier, when the UK was in the midst of the 'Beast from the East' weather storm; average temperatures in February and March 2019 were notably warmer than a year earlier.
- Final energy consumption (excluding non-energy use) was 7.0 per cent lower than in the first quarter of 2018. Domestic consumption fell by 16 per cent due to warmer weather. On a seasonally and temperature adjusted basis final energy consumption fell by 1.2 per cent, within which domestic consumption fell by 4.1 per cent.
- Gas demand was 11 per cent lower than the first quarter of 2018, whilst electricity consumption was 5.0 per cent lower, both driven by the warmer weather in the first quarter of 2019.
- Electricity generated in the first quarter of 2019 fell 6.9 per cent compared to 2018 Q1, by 6.5 TWh to 86.9 TWh, however net imports reached a record high of 6.0 TWh in 2019 Q1 due to the new interconnector with Belgium (NEMO) becoming operational at the end of January 2019.
- Coal's share of generation decreased from 9.3 per cent to a record low of 3.5 per cent, whilst gas's share rose from 39.5 per cent to 41.9 per cent. Nuclear's share of generation fell from 17.8 per cent in the first quarter of 2018 to 16.0 per cent in the first quarter of 2019.
- Low carbon electricity's share of generation increased from 48.3 per cent in the first quarter of 2018 to 51.8 per cent in the first quarter of 2019.
- Renewables' share of electricity generation increased to 35.8 per cent, compared to the 30.5 per cent share in the first quarter of 2018, due to increased wind and plant biomass capacity.
- Renewable electricity generation was 31.1 TWh in the first quarter of 2019, an increase of 9.2 per cent on the same period a year earlier.
- Renewable electricity capacity was 45.0 GW in the first quarter of 2019, an increase of 7.9 per cent on the same period a year earlier.

Section 1 – UK Total Energy
January to March 2019

Key results show:

Total energy production was 0.1 per cent higher than in the first quarter of 2018, with rises in oil and wind, solar and hydro output offset by falls in coal, gas, nuclear and bioenergy and waste output. (**Charts 1.1 & 1.2**)

Total primary energy consumption for energy uses fell by 7.8 per cent. However, when adjusted to take account of weather differences between the first quarter of 2018 and the first quarter of 2019, primary energy consumption fell by 3.2 per cent. The average temperature in the first quarter of 2019 was 6.3 degrees Celsius, 1.9 degrees Celsius higher than the same period a year earlier (**Chart 1.3**)

Final energy consumption (excluding non-energy use) fell by 7.0 per cent compared to the first quarter of 2018. Domestic consumption fell by 16 per cent reflecting the warmer weather in the quarter, other final users (mainly from the service sector) consumption fell by 11 per cent, industrial consumption was broadly unchanged, whilst transport consumption rose by 3.3 per cent. (**Charts 1.4 & 1.5**)

On a seasonally and temperature adjusted basis, final energy consumption fell by 1.2 per cent, with falls in the domestic and other final users sectors, but rises in the industrial and transport sectors. (**Chart 1.5**)

Net import dependency was 38.7 per cent, down 1.6 percentage points from the first quarter of 2018. (**Chart 1.6**)

Fossil fuel dependency was 80.7 per cent in the first quarter of 2019. (**Chart 1.7**)

Relevant tables

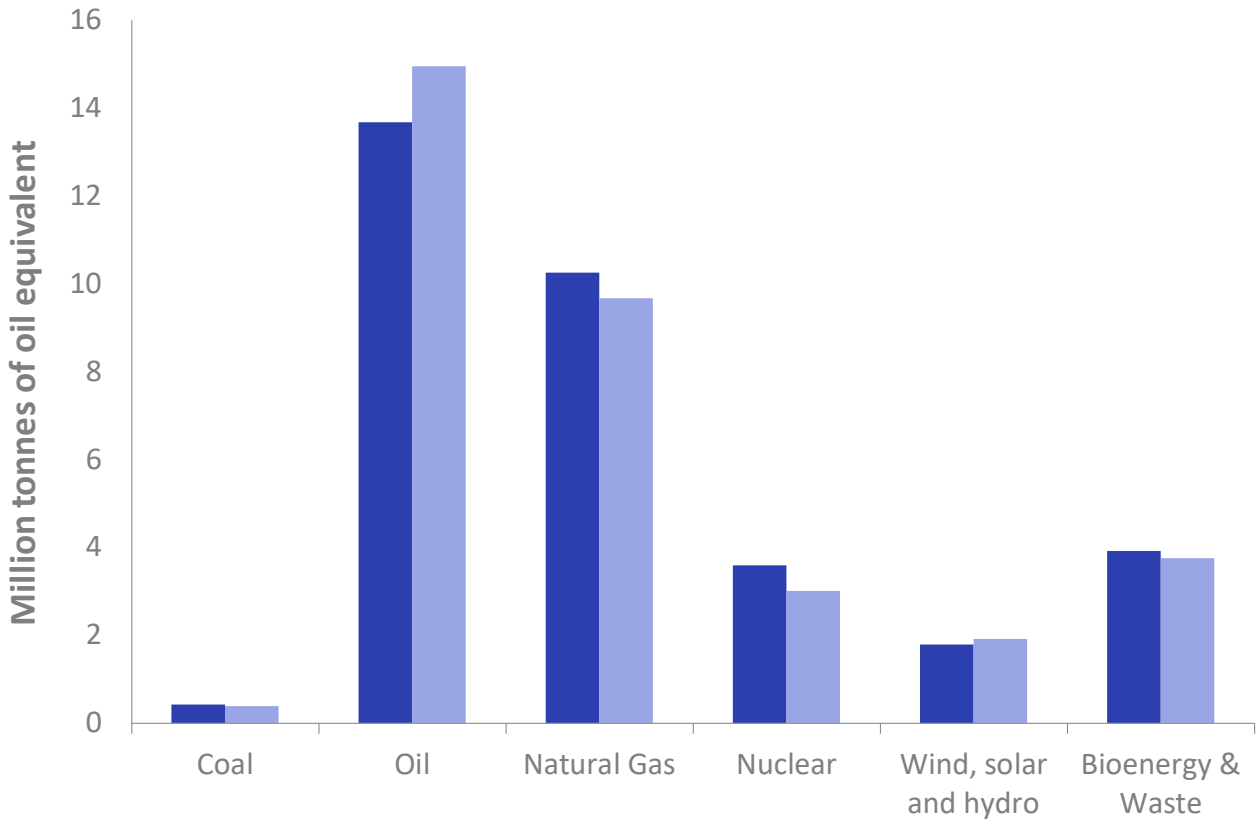
1.1: Indigenous production of primary fuels
1.2: Inland energy consumption: primary fuel input basis
1.3: Supply and use of fuels, and Seasonally adjusted and temperature corrected final energy consumption

Contacts for further information:

Warren Evans
Total energy statistics
Tel: 0300 068 5059
E-mail: Warren.Evans@beis.gov.uk

Kevin Harris
Total energy statistics
Tel: 0300 068 5041
E-mail: Kevin.Harris@beis.gov.uk

Chart 1.1 Production of indigenous primary fuels (Table 1.1)



Total production in the first quarter of 2019 stood at 33.7 million tonnes of oil equivalent, broadly similar to the level in the first quarter of 2018.

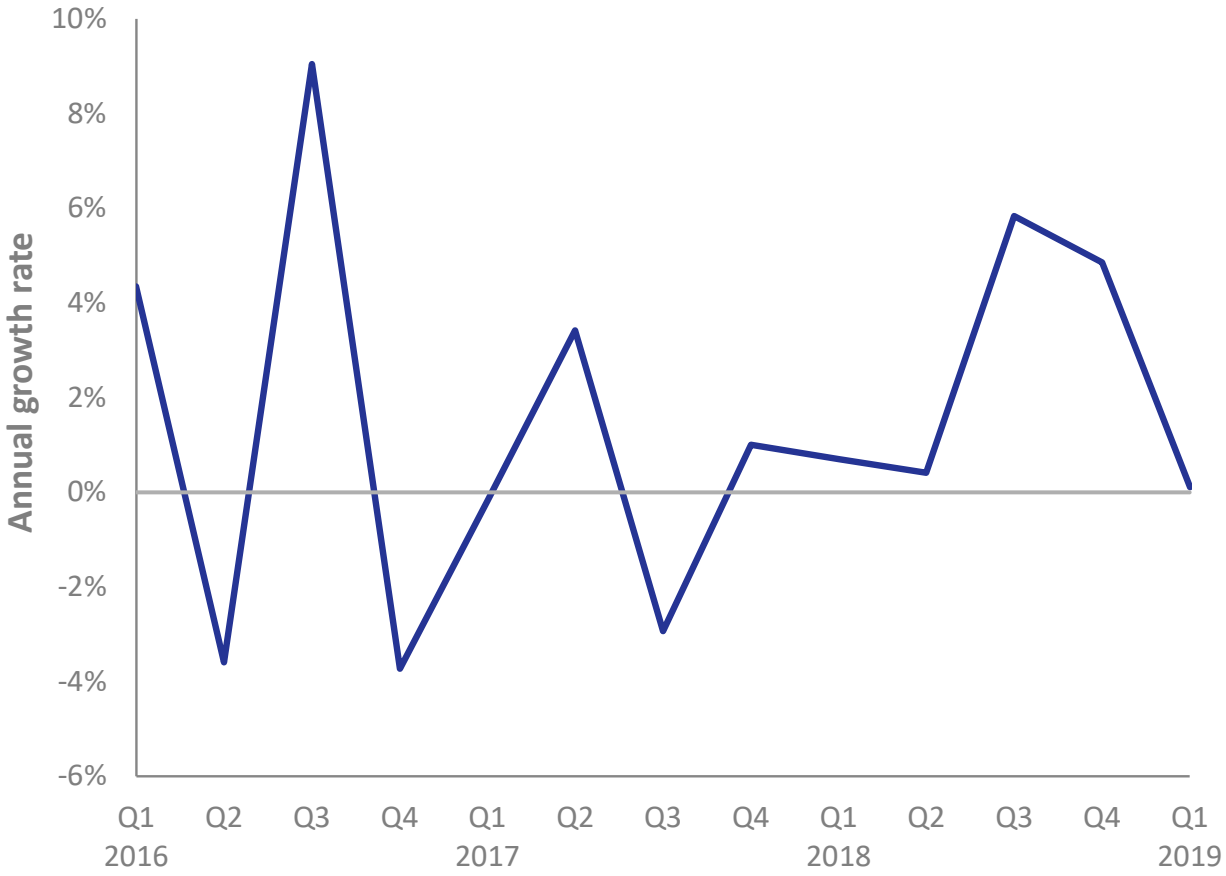
Production of oil rose by 9.2 per cent compared to the first quarter of 2018 due to new fields that came online at the end of 2017 ramping up production, whilst production of natural gas fell by 5.7 per cent driven by the closure of the Theddlethorpe terminal in August 2018.

Primary electricity output in the first quarter of 2019 was 8.4 per cent lower than in the first quarter of 2018, within which nuclear electricity output was 16 per cent lower due to maintenance outages at the major reactors at Hunterston B and Dungeness B, whilst output from wind, solar and natural flow hydro was 7.7 per cent higher mainly due to increased wind and solar capacity.

Production of bioenergy and waste was 3.9 per cent lower compared to the first quarter in 2018.

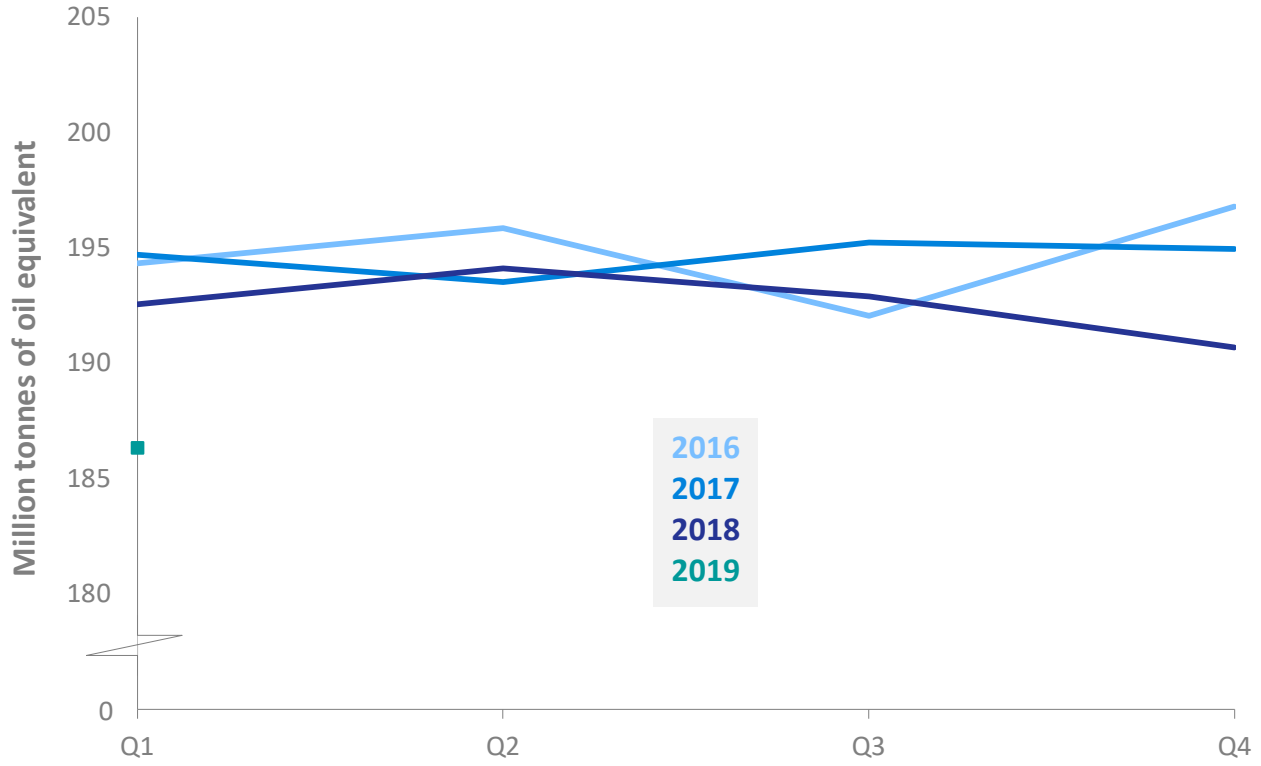
Coal production fell by 8.5 per cent compared to the first quarter in 2018 due to falling demand, particularly for electricity generation.

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



In the first quarter of 2019, the annual growth rate of UK production was +0.1 per cent, down 0.6 percentage points compared to the first quarter of 2018, with rises in oil and wind, solar and hydro output offset by falls in coal, gas, nuclear and bioenergy and waste output.

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



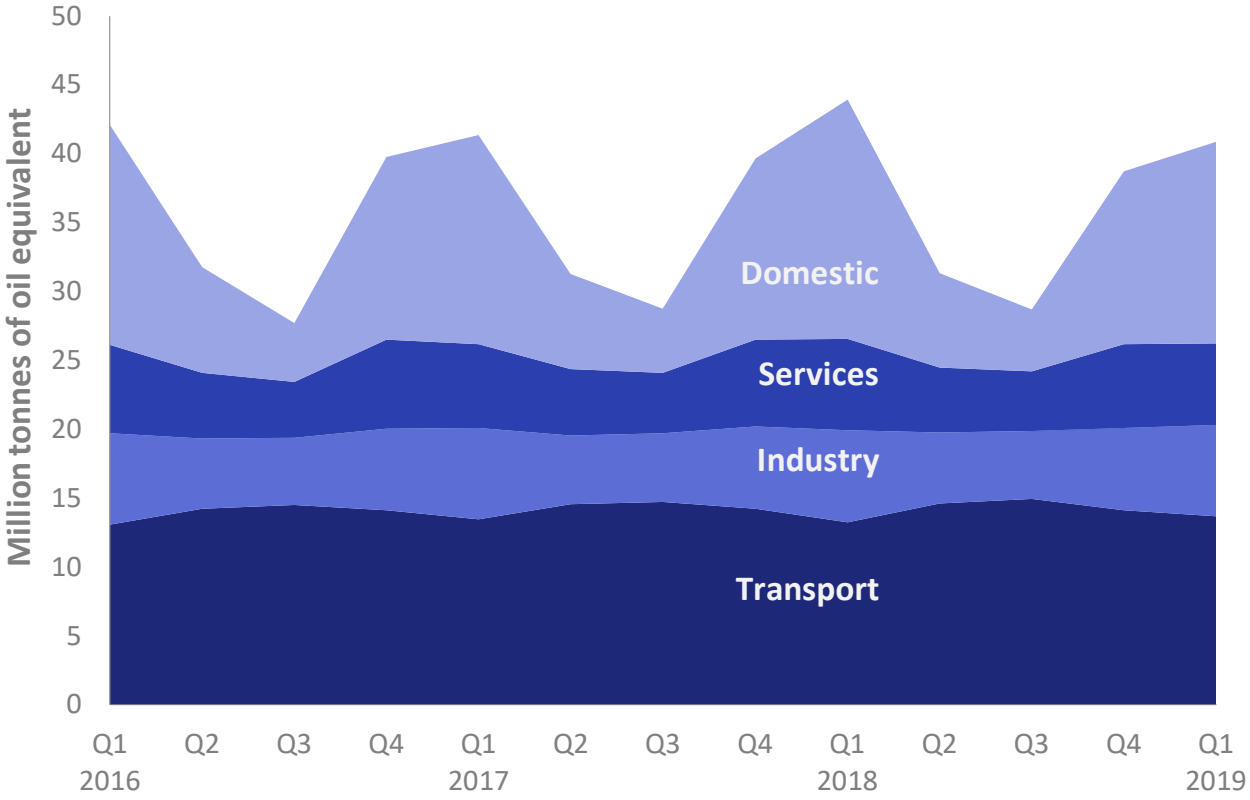
Total inland consumption on a primary fuel input basis (temperature corrected, seasonally adjusted annualised rate), was 186.3 million tonnes of oil equivalent in the first quarter of 2019, 3.2 per cent lower than in the first quarter of 2018. On an unadjusted basis inland consumption was 7.8 per cent lower, with the average temperature in the first quarter of 2019 being 6.3 degrees Celsius, 1.9 degrees Celsius higher than the same period a year earlier when the UK was in the midst of the 'Beast from the East' weather storm.

Between the first quarter of 2018 and the first quarter of 2019 (on a seasonally adjusted and temperature corrected basis) coal and other solid fuel consumption fell by 42 per cent as demand fell from electricity generators.

Also, on a seasonally adjusted and temperature corrected basis, between the first quarter of 2018 and the first quarter of 2019, oil consumption rose by 1.8 per cent, whilst natural gas consumption fell by 2.8 per cent.

On the same basis, bioenergy and waste consumption rose by 4.2 per cent between the first quarter of 2018 and the first quarter of 2019, whilst primary electricity consumption fell by 6.9 per cent. The fall in primary electricity consumption was despite rises of 8.6 per cent from wind, solar and hydro and 13 per cent from net imports, with consumption at a record quarterly high boosted by the England-Belgium 'Nemo Link' interconnector becoming fully operational in January 2019, offset by a fall in nuclear consumption of 16 per cent.

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



Total final consumption fell by 6.7 per cent between the first quarter of 2018 and the first quarter of 2019.

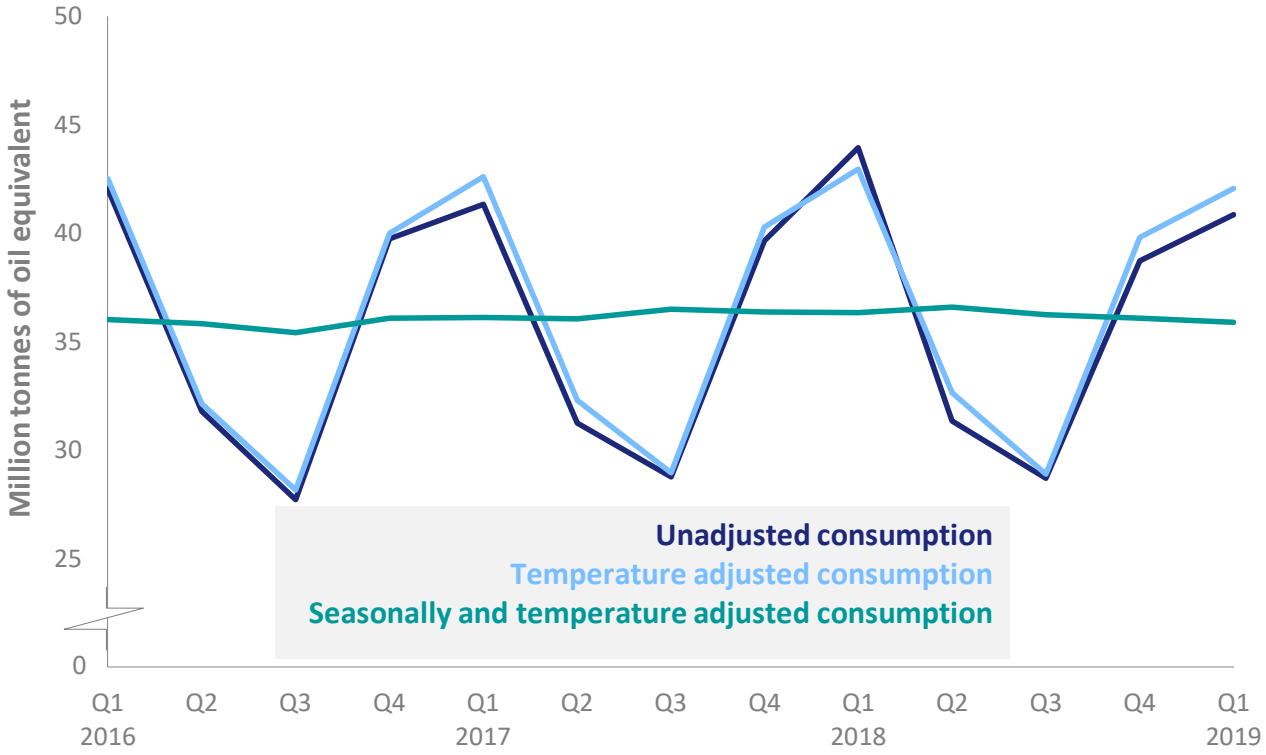
Domestic sector energy consumption fell by 16 per cent, reflecting the warmer weather compared to a year earlier.

Service sector energy consumption fell by 11 per cent.

Industrial sector energy consumption fell by 0.5 per cent.

Transport sector energy consumption rose by 3.3 per cent.

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

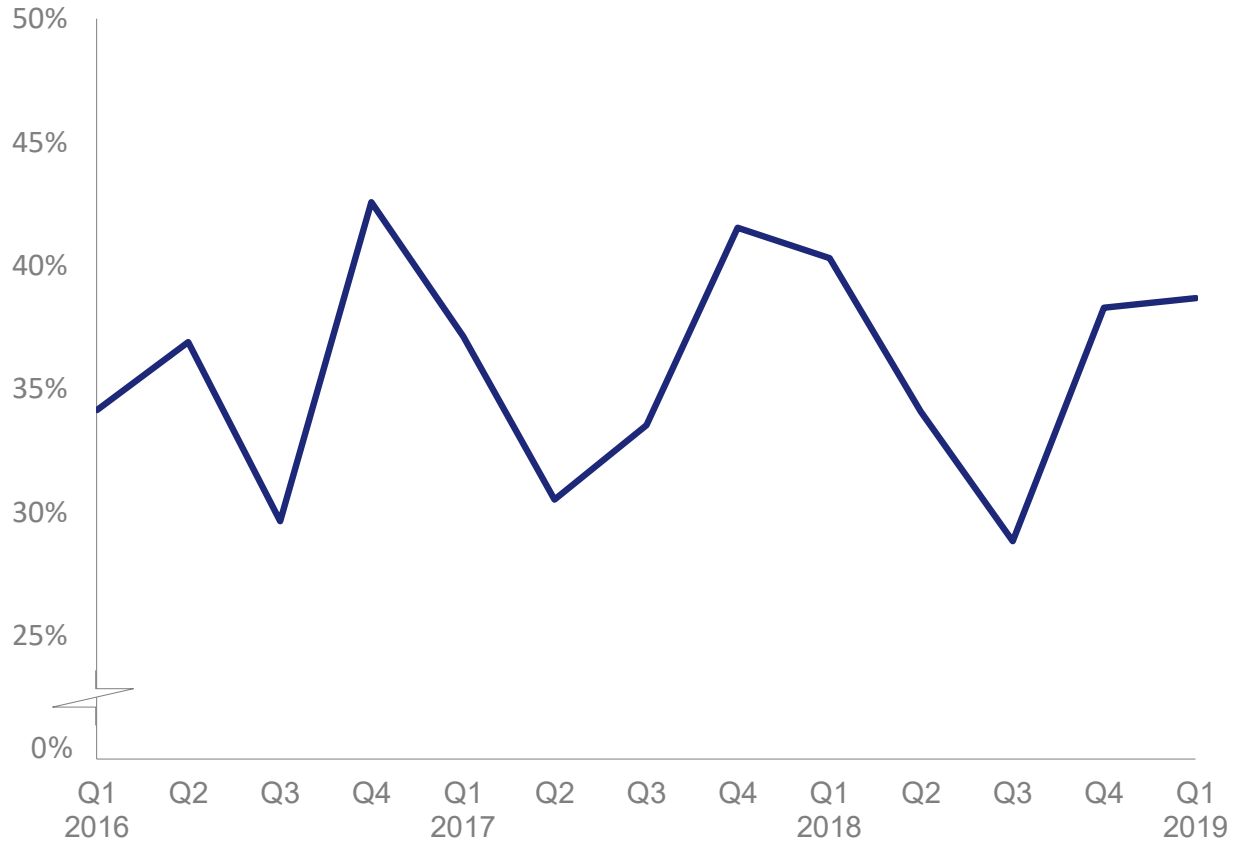


Total unadjusted final energy consumption (excluding non-energy use) fell by 7.0 per cent between the first quarter of 2018 and the first quarter of 2019.

On a seasonally and temperature adjusted basis final energy consumption (excluding non-energy use) fell by 1.2 per cent between the first quarter of 2018 and the first quarter of 2019.

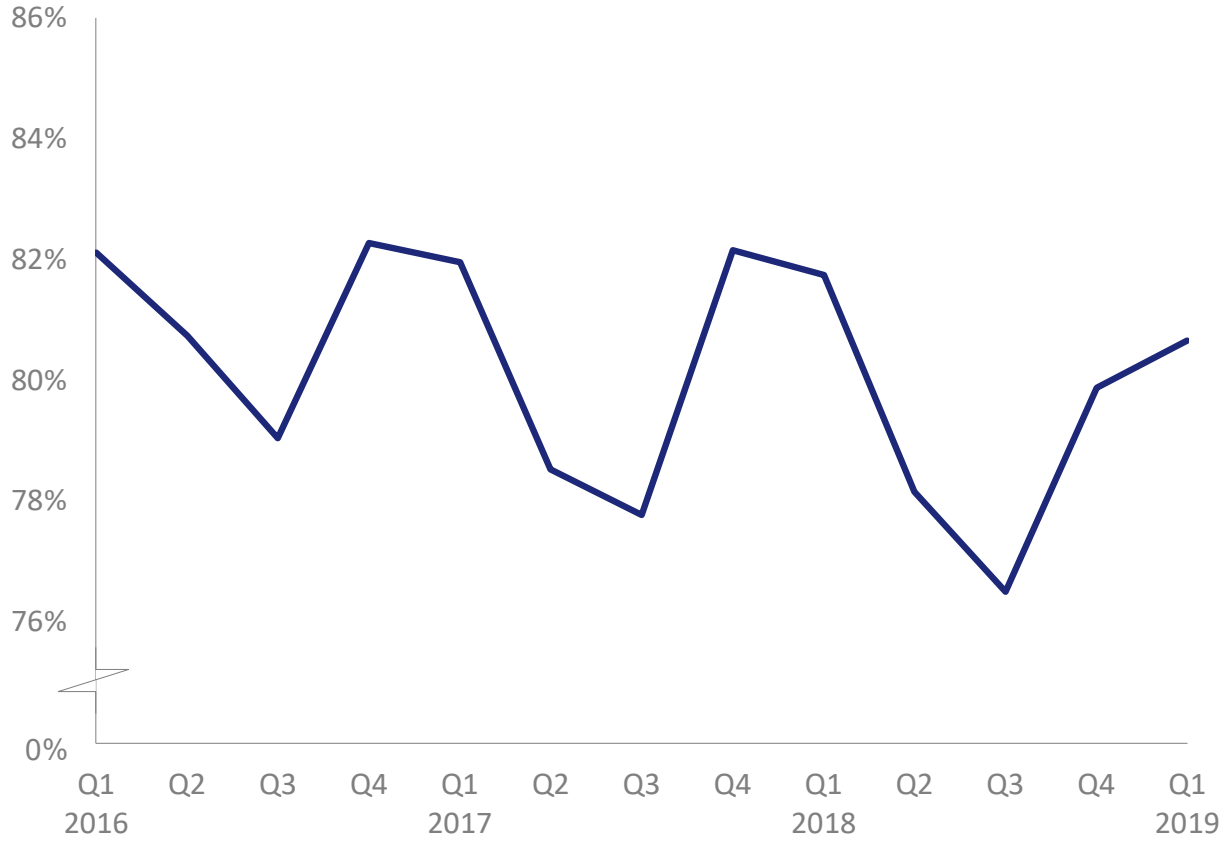
Unadjusted domestic consumption fell by 16 per cent over the same period and was down 4.1 per cent on a seasonally and temperature adjusted basis.

Chart 1.6 Net import dependency (Table 1.3a)



In the first quarter of 2019, imports fell by 4.2 per cent, whilst exports rose by 5.1 per cent. As a result, net import dependency fell 1.6 percentage points from the first quarter of 2018 to 38.7 per cent.

Chart 1.7 Fossil fuel dependency (Table 1.3a)



In the first quarter of 2019 fossil fuel dependency was 80.7 per cent, down 1.1 percentage points on the same quarter of 2018.

Section 2 – UK Solid Fuels and Derived Gases January to March 2019

Key results show:

Overall coal production in the first quarter of 2019 fell to 592 thousand tonnes, down 8.9 per cent compared with the first quarter of 2018. Surface mining production fell to 578 thousand tonnes due to falling demand for coal for electricity generation and mine closures. **(Chart 2.1)**

Coal imports fell 19 per cent on levels shown in the first quarter of 2019. **(Charts 2.1 and 2.2)**

The demand for coal by electricity generators in the first quarter of 2019 was 63 per cent lower than demand in the first quarter of 2018 due to milder weather in February and March 2019 (relative to 2018's 'Beast from the East'). The increase in generation from renewables and the closure of Eggborough power station in September 2018 also contributed to lower coal-fired generation. **(Chart 2.3)**

Total stock levels were up 41 per cent to 5.8 million tonnes compared to a year earlier. **(Chart 2.4)**

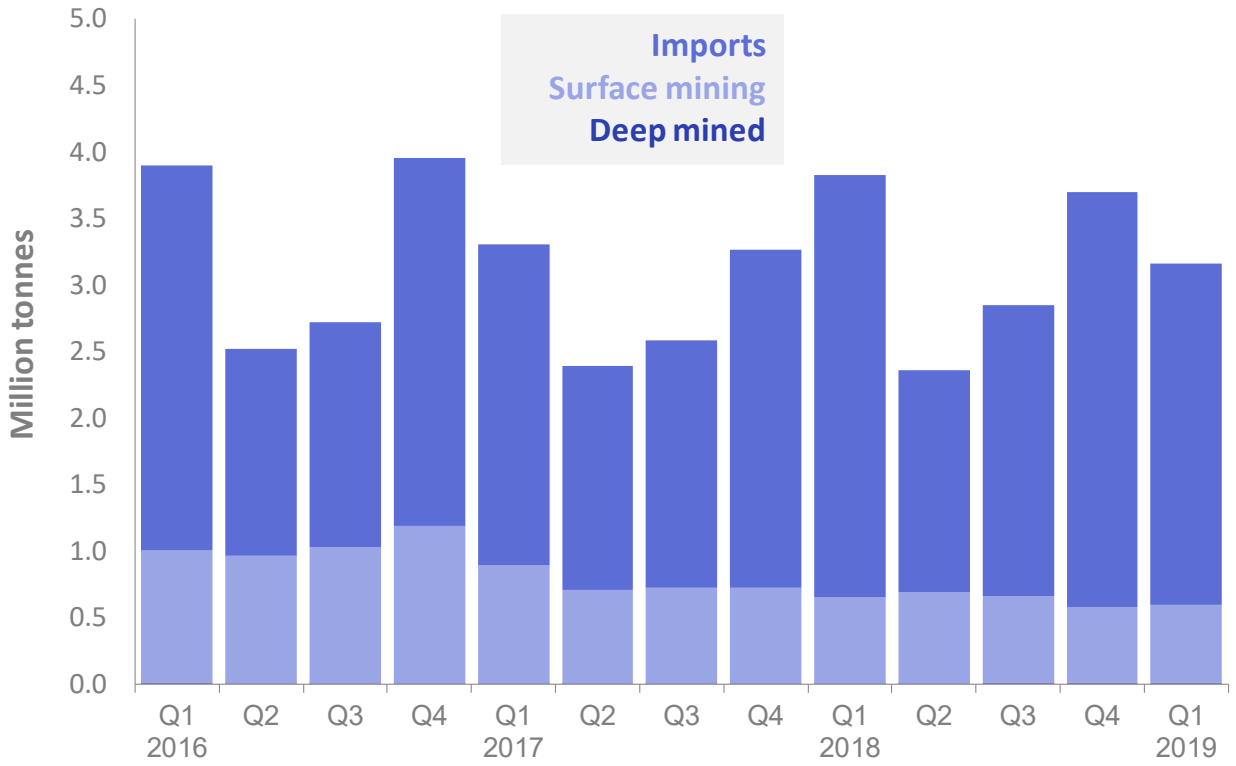
Relevant tables

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

Contact for further information:

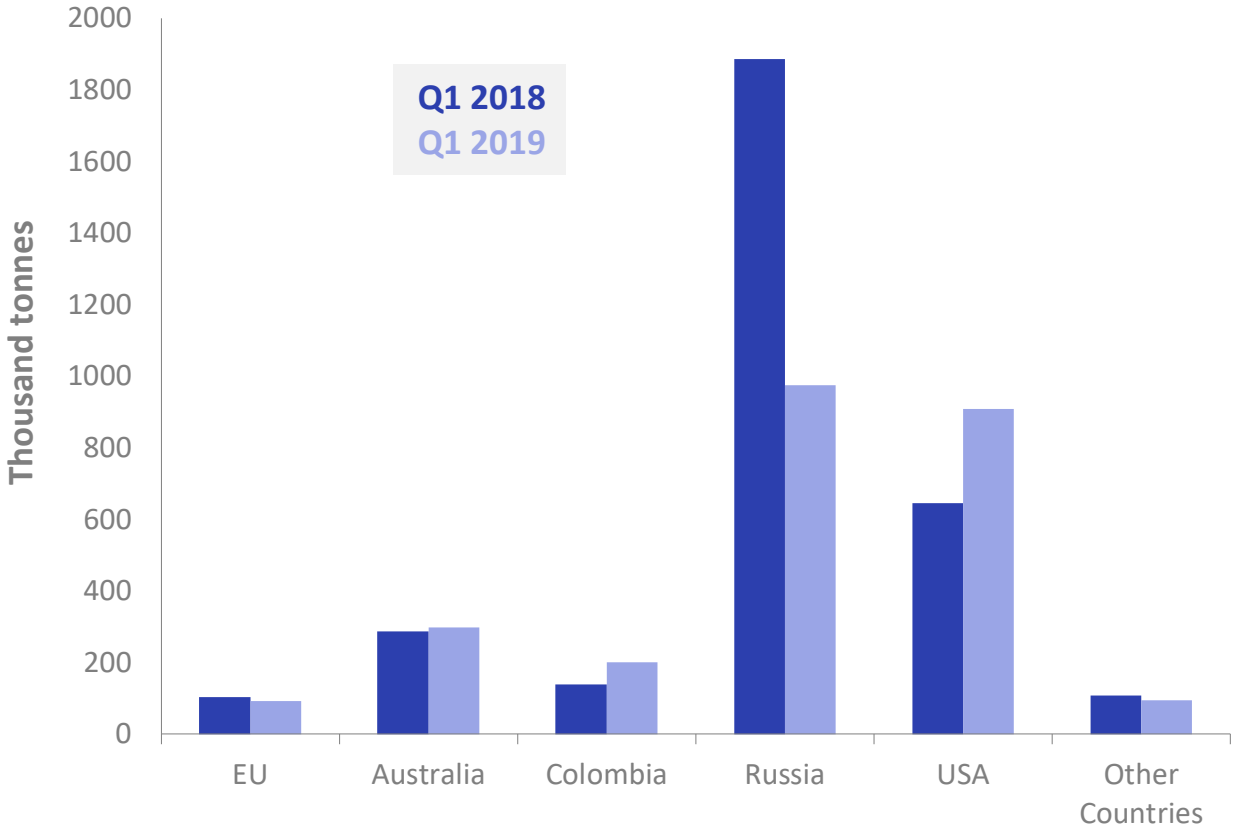
Chris Michaels
Coal statistics
Tel: 0300 068 5050
E-mail: coalstatistics@beis.gov.uk

Chart 2.1 Coal supply (Table 2.1)



Coal production in the first quarter of 2019 was 0.6 million tonnes, 8.9 per cent down compared to the first quarter of 2018. The bulk of this decrease came from the contraction in surface mine output as deep mine production is only 2 per cent of production with only seven small deep mines remaining. The falls were due to decreased demand, particularly for electricity generation, but also because some mines are working towards closure whilst other mines are under 'care and maintenance' and 'not producing currently'.

Chart 2.2 Total coal imports (Table 2.4)



Imports of coal in the first quarter of 2019 were 19 per cent lower than in the first quarter of 2018 at 2.6 million tonnes. Imports accounted for 81 per cent of supply in the first quarter of 2019.

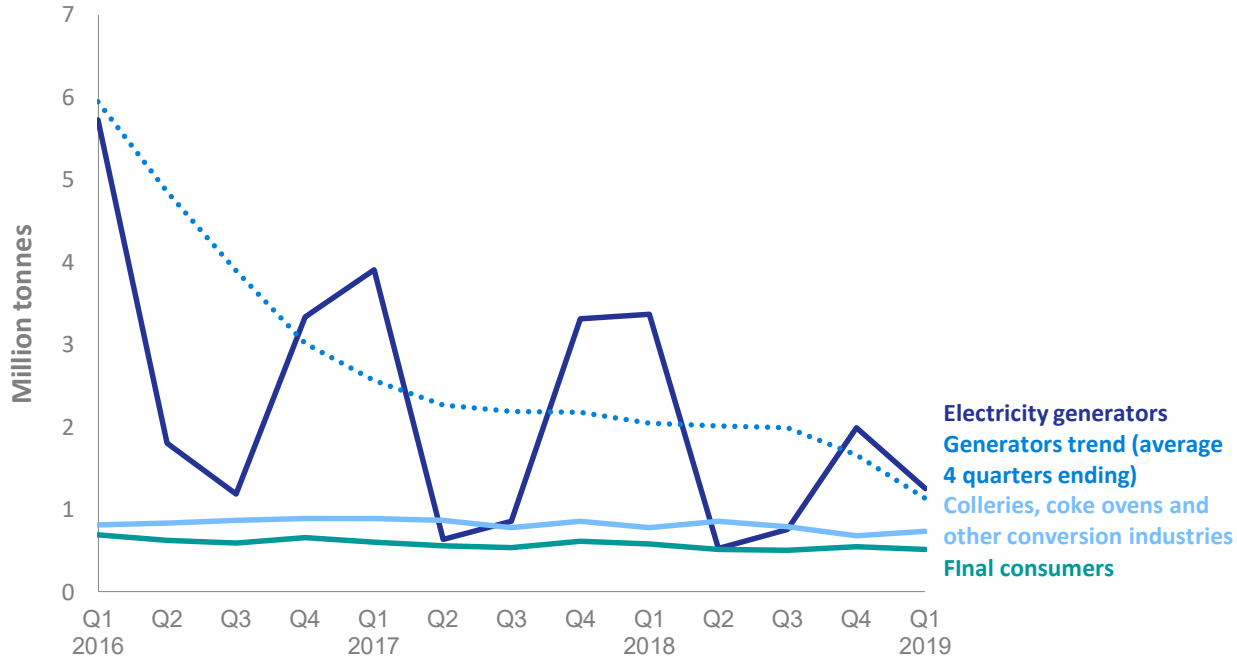
Russia (38 per cent) and the USA (35 per cent) accounted for 73 per cent of total coal imports in the first quarter of 2019. Steam coal imports in the first quarter of 2019 fell by 23 per cent to 1.8 million tonnes. Steam coal imports accounted for 71 per cent of total coal imports. Coking coal imports in the first quarter of 2019 fell by 4.7 per cent to 0.7 million tonnes and accounted for 28 per cent of total coal imports.

Table 2A Coal imports by origin

Thousand Tonnes

	2017	2018p	2018 Q1	2019 Q1p
European Union	356	344	103	93
Russia	3,883	4,695	1,886	975
Colombia	731	635	140	201
USA	2,352	3,573	645	908
Australia	749	630	288	299
Other Countries	427	268	108	95
Total Imports	**8,498**	**10,144**	**3,172**	**2,571**

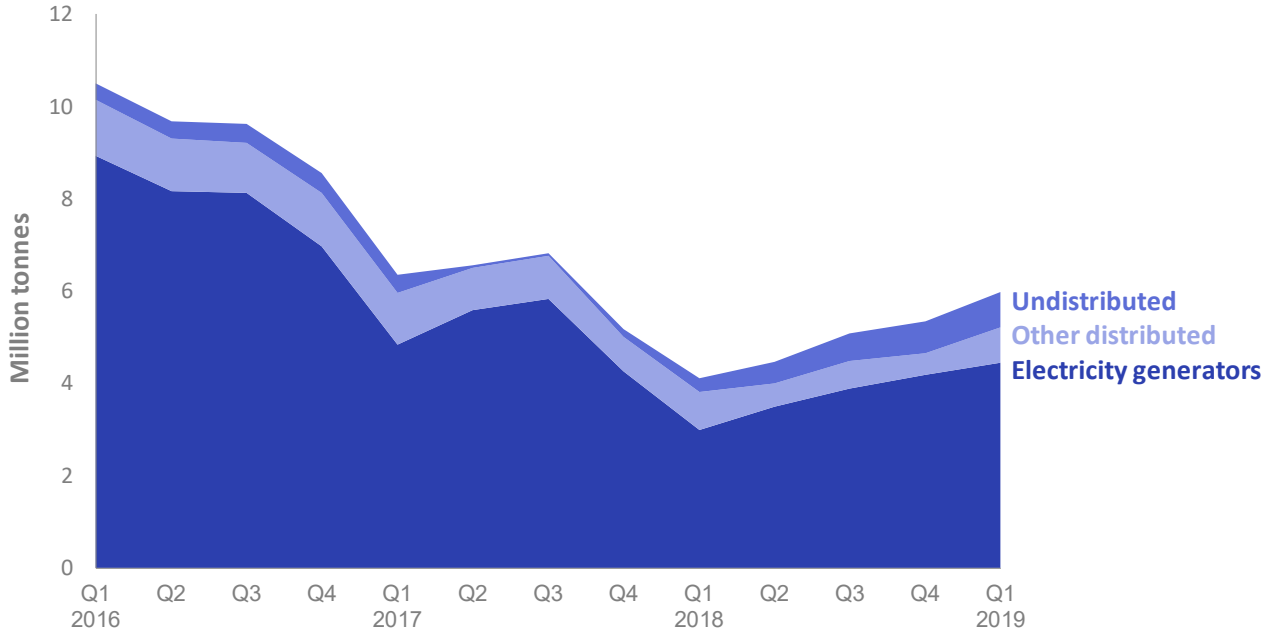
Chart 2.3 Coal consumption (Table 2.1)



Total demand for coal in the first quarter of 2019, at 2.5 million tonnes, was 47 per cent lower than in the first quarter of 2018 with 50 per cent relating to electricity generation. Consumption by electricity generators was down by 63 per cent to 1.3 million tonnes in the first quarter of 2019 due to milder weather in February and March 2019 (relative to 2018's 'Beast from the East'). The increase in generation from renewables and the closure of Eggborough power station in September 2018 also contributed to lower consumption of coal by electricity generators.

In the first quarter of 2019, the provisional data shows that sales to industrial users fell by 16 per cent to 0.3 million tonnes whilst sales to other final consumers (including domestic) decreased by 2.1 per cent to 0.2 million tonnes. Coal used in blast furnaces was down 12 per cent compared to the first quarter of 2019, to 0.3 million tonnes.

Chart 2.4 Coal stocks (Table 2.1)



Coal stocks rose seasonally by 0.5 million tonnes during the first quarter of 2019 and at the end of March stood at 5.8 million tonnes. This was 1.7 million tonnes higher than at the end of March 2018.

The level of coal stocks at power stations at the end of the first quarter of 2019 was 4.5 million tonnes, 1.5 million tonnes higher than at the end of March 2018.

Stocks held by coke ovens were 0.5 million tonnes at the end of the first quarter of 2019, this was 29 thousand tonnes lower than stock levels at the end of March 2018.

Stocks held by producers (undistributed stocks) at the end of the first quarter of 2019 were 0.8 million tonnes, 0.5 million tonnes higher than at the end of March 2018.

Section 3 – UK Oil and Oil Products
January to March 2019

Key results show:

Total indigenous UK production of crude oil and NGLs (Natural Gas Liquids) in Q1 2019 was up 9.3 per cent on the same period last year as new projects that opened in late 2017 ramped up production through the last year. **(Chart 3.1)**

Indigenous production of petroleum products was up 11 per cent on Q1 2018 following relatively low levels during the period of maintenance at several larger refineries in the first quarter of 2018. (**Chart 3.2**)

Net imports of primary oils recovered on low levels in Q1 2018, and met 11 per cent of the UK's refinery demand, up from 4.6 per cent a year earlier. **(Chart 3.3)**

There was a decrease in imports of petroleum products, down 13 per cent, following record high imports in Q1 2018 to meet demand during a period of refinery maintenance. Subsequently net product imports were 2.7 million tonnes in the first quarter of 2019, down from 3.9 in Q1 2018. **(Chart 3.2)**

Demand for key transport fuels increased by 3.5 per cent compared with Q1 2018. Petrol deliveries were up by a notable 7.8 per cent whilst deliveries of road diesel were up 3.0 per cent. The scale of the increase in road fuel demand is partially the result of depressed consumption patterns last year during the particularly severe weather. The difference between the increase for each fuel type can be related to patterns of miles driven by vehicle types; cars, which tend to be used for discretionary travel, increased by 2.6 billion vehicle miles compared to last year where Heavy Goods and Light Goods vehicles, used for business, remained relatively stable. **(Chart 3.5)**

Final consumption of oil products in Q1 2019 was up by 1.5 per cent. (**Chart 3.5)**

Overall stocks of crude oil and petroleum products were stable, up just 0.5 per cent at end of Q1 2019 compared to a year earlier. **(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

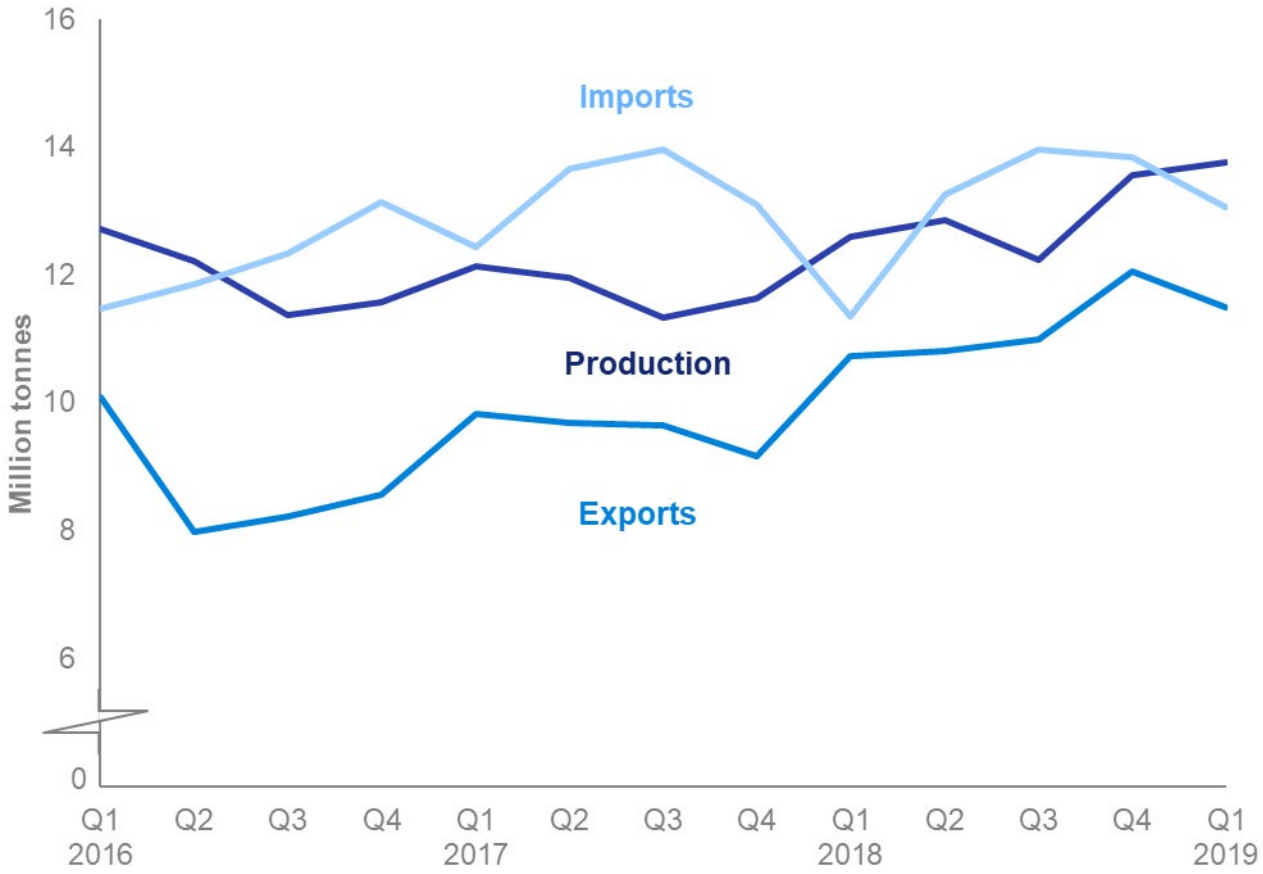
Contacts for further information:

Ben Lucking
Upstream Oil (primary oils)
Oil and Gas Statistics Team
Tel. 020 7215 5010

Nick Jesson
Downstream Oil (petroleum products)
Oil and Gas Statistics Team
Tel. 0300 068 5346

E-mail: Oil&Gas.Statistics@beis.gov.uk

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



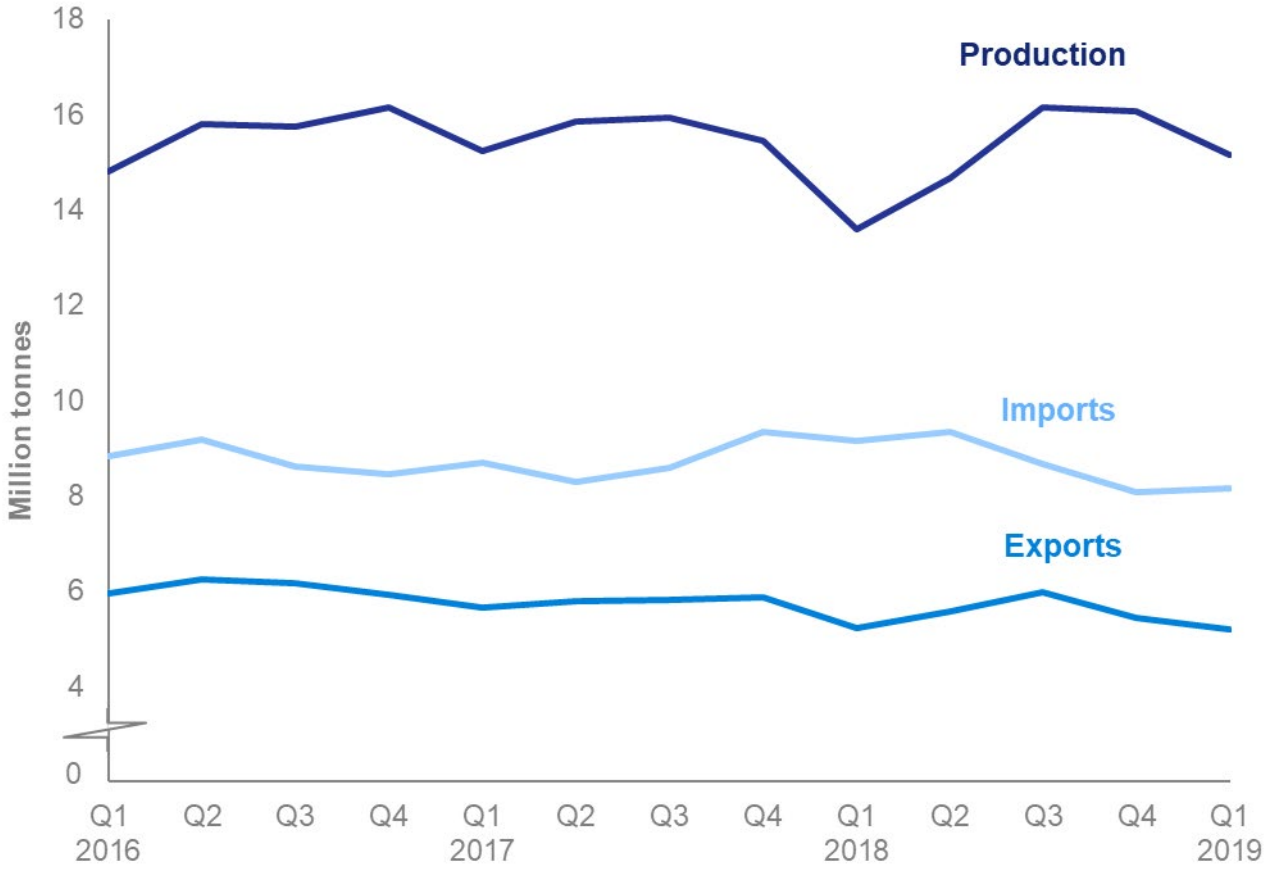
Indigenous production of primary oils was up 9.3 per cent as new projects that opened in late 2017 ramped up production through 2018. The bulk of the production from these new fields are, at this time, currently exported.

Imports of crude oil, NGLs and feedstocks were 15 per cent greater compared with Q1 2018 as they returned to normal levels following low demand in Q1 2018 stemming from a period of extensive refinery maintenance.

Exports of crude oil and NGLs increased by 7.0 per cent, following increased exports throughout 2018 as new projects on the UK Continental Shelf (UKCS) came online and increased their production.

Overall, net imports of primary oils (crude, NGLs and feedstocks) were 1.6 million tonnes in Q1 2019, compared with 0.6 million tonnes in the same quarter of 2018. Q1 2018 was one of the lowest levels since the UK became a net importer of primary oils in 2004, the result of reduced imports through the maintenance period last year (see Chart 3.3).

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

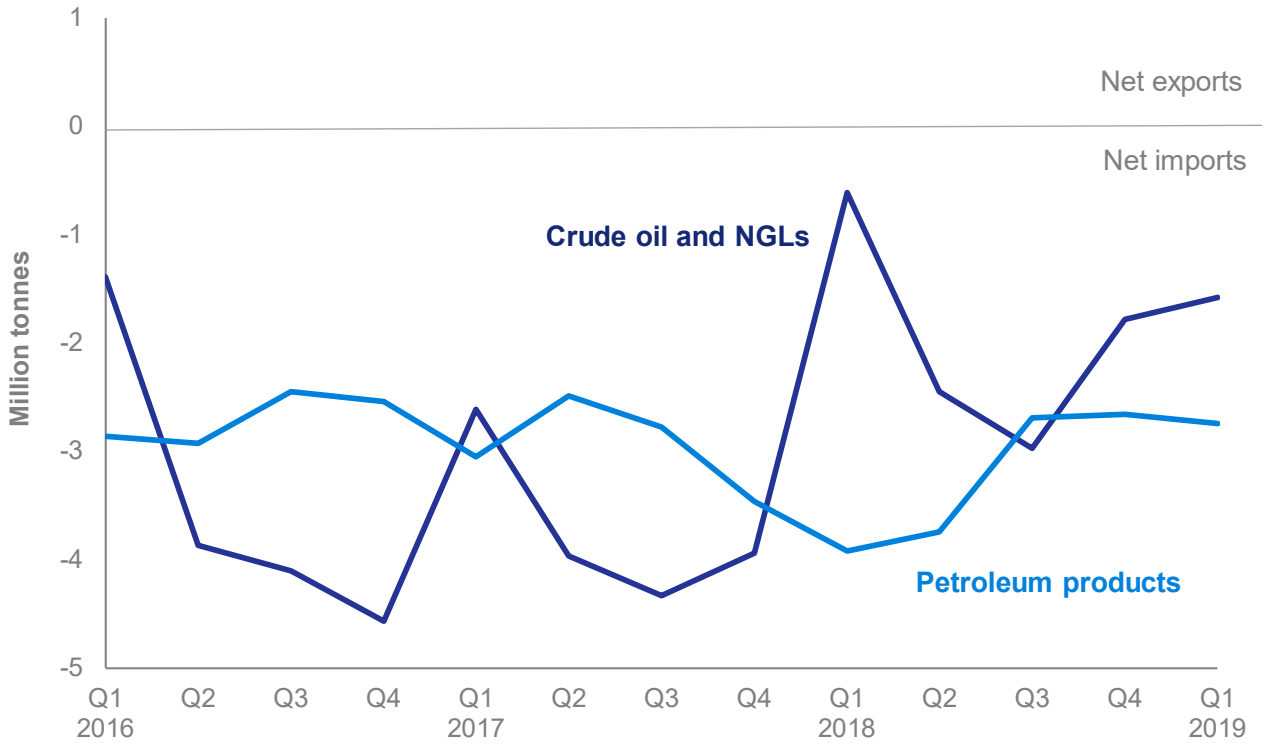


Indigenous production of petroleum products in Q1 2019 was up 11 per cent on the same quarter in 2018 when some of the UK's refineries completed major maintenance work. Refinery output of petroleum products now stands at 15.2 million tonnes.

Compared to Q1 2018 imports of petroleum products decreased by 13 per cent to 7.9 million tonnes – returning to more stable levels following high imports in Q1 2018. Exports remained stable, and net product imports stood at 2.7 million tonnes in Q1 2019, following the quarterly record low in Q1 last year.

On a product basis imports were down most notably for diesel and motor spirit, which each decreased by 15 per cent.

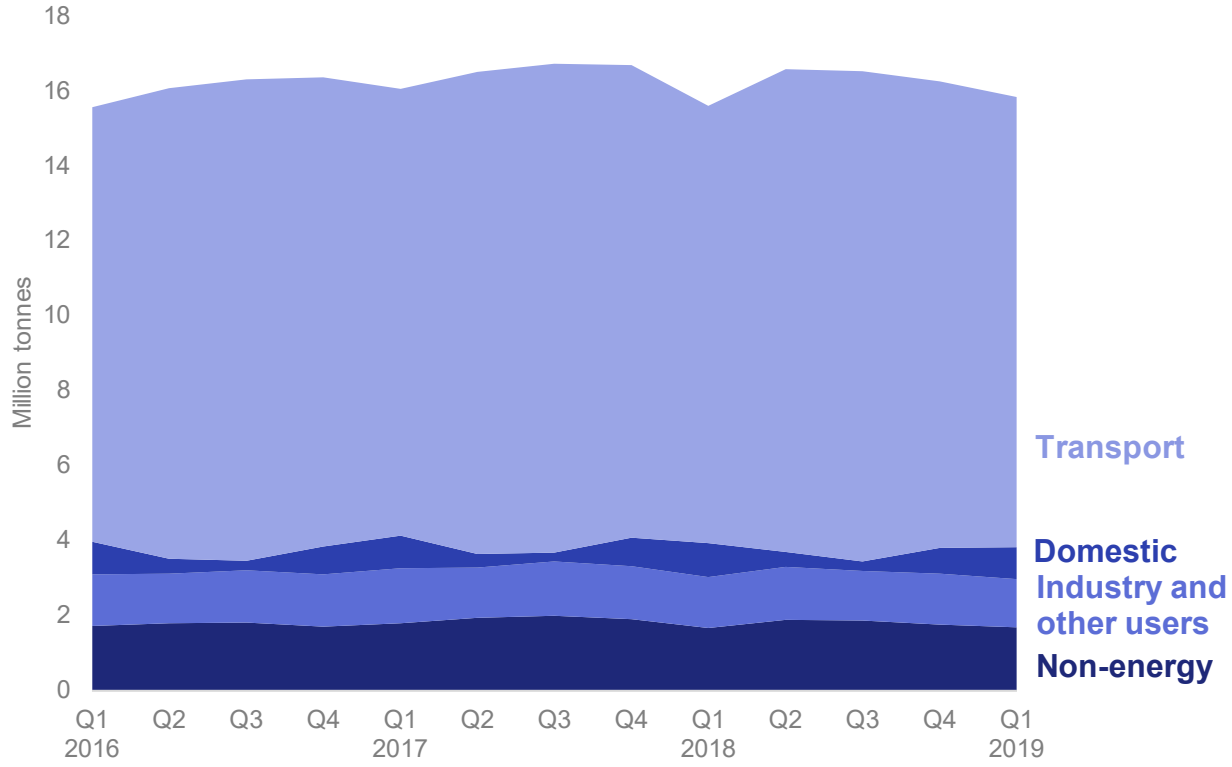
Chart 3.3 Overall trade in primary oils and petroleum products (Table 3.1)



Net imports of primary oils (crude, NGLs and feedstocks) nearly trebled from 0.6 million tonnes in Q1 2018 to 1.6 million tonnes in Q1 2019. This was a result of the lower imports in Q1 2018 due to reduced refinery demand last year (see Chart 3.1) and meant that the UK's overall net import dependence for primary oils was 11 per cent in Q1 2019, up from 4.6 per cent in Q1 2018.

In Q1 2019 the UK was a net importer of petroleum products by 2.7 million tonnes, down from 3.9 million tonnes in the first quarter of 2018. Exports were stable while imports decreased by 13 per cent, most notably for road fuels, because higher imports were required during the period of low refinery production this time last year. Imports will continue to form an important part of the UK's supply portfolio as refinery operations continue to be rationalised in the long term.

Chart 3.4 Final consumption of oil (Table 3.4)

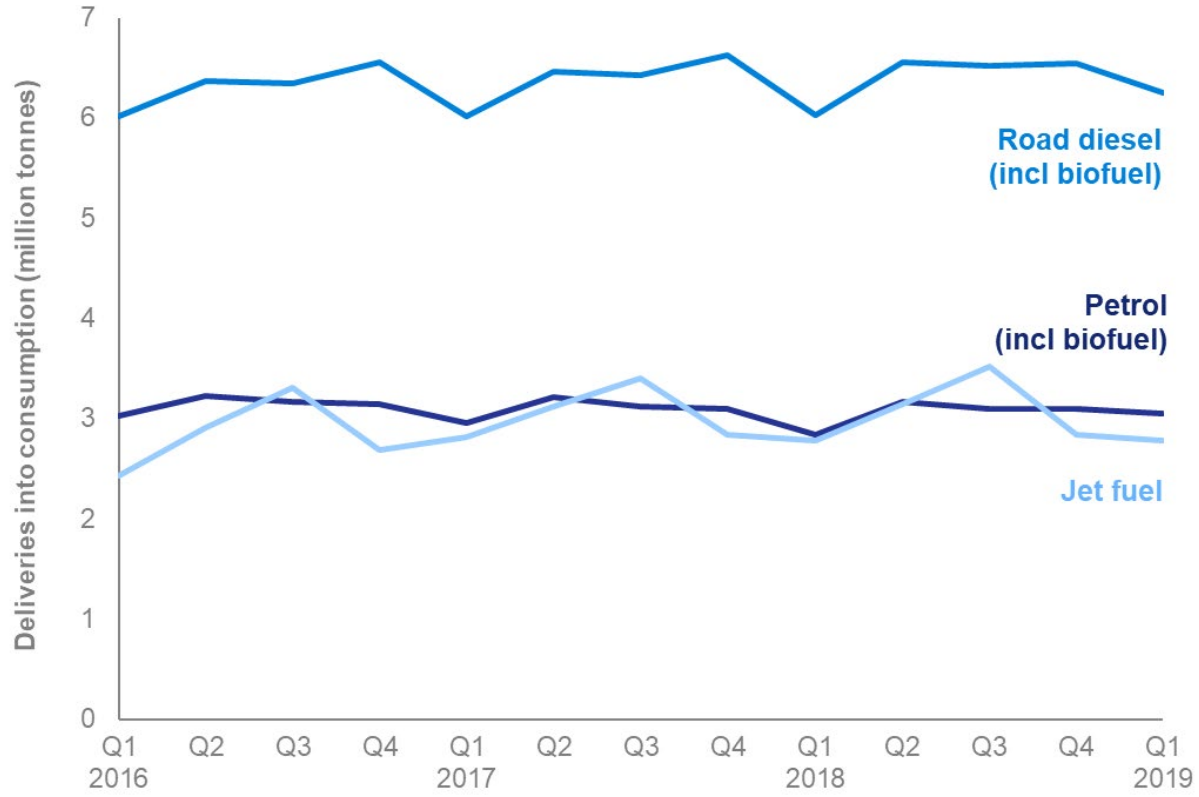


In Q1 2019 final consumption of petroleum products was up 1.5 per cent. Increases in consumption have largely been driven by key transport fuels, and in Q1 2019 demand was up by 3.5 per cent. The increase has been exaggerated by a period of particularly low demand in Q1 2018, potentially a result of the snow and ice during the 'Beast from the East' reducing road travel (see Chart 3.5). This is reflected in the pattern of miles driven; vehicle miles driven increased by 0.8 per cent, or 2.6 billion miles, in Q1 2019 compared to last year[1].

Fuel use in the domestic sector, primarily used for heating and deliveries, was down by 7.1 per cent compared to this time last year, again a result of the cold weather in 2018. Both non-energy use and demand for aviation turbine fuel were stable on the previous year.

[1] Department for Transport Road Traffic statistics: www.gov.uk/government/statistical-data-sets/tra25-quarterly-estimates

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



Final consumption increased by 1.5 per cent on Q1 2018 and total deliveries of the three key transport fuels were higher by 3.5 per cent.

Of note was the 7.8 per cent increase in petrol demand, the highest quarterly increase in the series and follows a slowing in the rate of decline in demand for petrol in recent years. Demand for diesel was up by 3.0 per cent after seeing falls in demand through 2018.

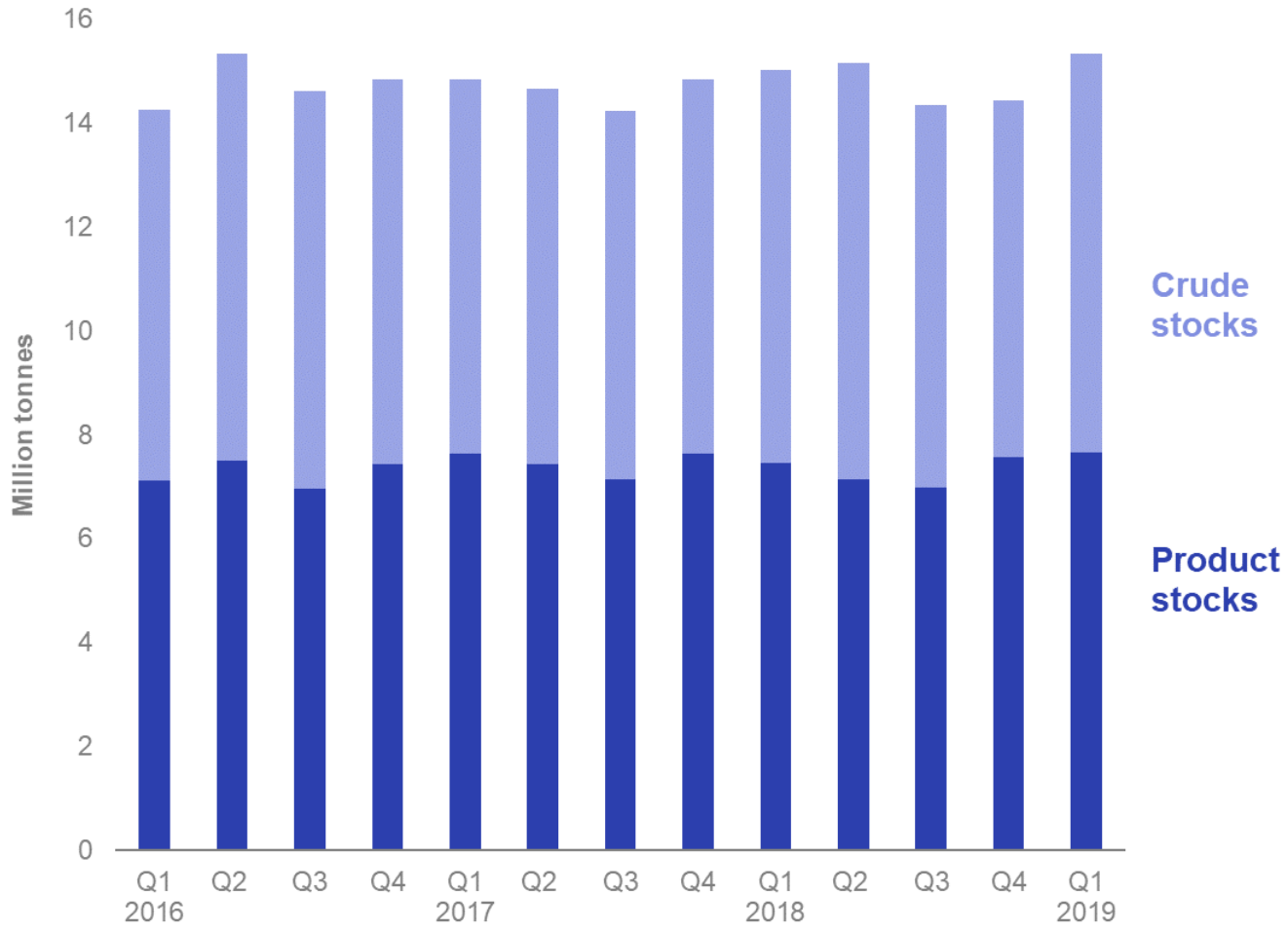
To help explain the increase in road fuel demand we can look to miles driven in Q1 of 2018 and 2019[1]. As described in Chart 3.4, total distances driven increased by 2.6 billion vehicle miles in Q1 2019 compared to last year. However, to explain the exaggerated increase in petrol demand compared to diesel we can consider miles travelled by vehicle type. The distance driven by cars was up by 2.4 billion miles, which accounted for around 90 per cent of the total increase in miles driven. Just under 60 per cent of cars have petrol engines[2], meaning the strong increase in car miles driven resulted in the robust increase for petrol demand. This likely reflects a reduction in discretionary travel by motorists last year during the severe weather that resulted in poor driving conditions.

All Heavy Goods Vehicles (HGVs) and 96 per cent of Light Goods Vehicles (LGVs) have diesel-fuelled engines. In Q1 2019 miles driven by HGVs were stable on last year, and LGVs were up by 0.4 per cent, likely because despite the severe weather businesses endeavoured to keep supply chains operational. This, in addition to the increase in miles driven by cars (around 40 per cent of which are fuelled by diesel), resulted in the relatively smaller 3.0 per cent increase in demand for diesel.

Demand for aviation turbine fuel remained stable, up just 0.3 per cent.

[2] Department for Transport Vehicle statistics: www.gov.uk/government/statistical-data-sets/veh02-licensed-cars

Chart 3.6 UK oil stocks (Table 3.6)



Overall stocks were stable on Q1 2018 (up just 0.5 per cent), but with a change to the way that stocks were held in Q1 2019[3]. There was a 15 per cent decrease in the net stocks of primary oils that were held abroad and a 5.5 per cent increase in physical stocks held in the UK. Conversely, net volumes of oil product stocks held abroad were up by a quarter, with a 5.7 per cent decrease in physical stocks held in the UK.

Overall the net volume of stocks held abroad was up by 2.4 per cent, and at 4.9 million tonnes was a new quarterly record high. Volumes held in the UK on behalf of other countries amounted to just under 600kt compared to 500kt in 2018, while volumes held by UK companies abroad remained roughly stable. Of the additional 100kt held in the UK on behalf of other countries in 2019, 90kt was held on behalf of Australia and New Zealand with whom the UK agreed stockholding bilateral agreements during 2018.

Total stocks held by the UK remained at 15 million tonnes, approximating to 60 days' demand.

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

[3] Companies who have been directed by UK government to hold stocks have the option to either hold stocks physically in tanks or enter into an arrangement with another company to hold stocks on their behalf, known as 'tickets'. Ticketed volumes can be traded in other countries with whom the UK has a bilateral agreement.

Section 4 – UK Gas
January to March 2019

Key results show:

UK production of natural gas was down by 5.7 per cent in the first quarter of 2019 compared with the same quarter of 2018. This is associated with the closure of the Theddlethorpe Gas Terminal as well as consistently lower output from other large gas terminals **(Chart 4.1).** Within this, production of associated gas was 16 per cent lower whilst dry gas production was down 21 per cent **(Chart 4.2).**

In contrast to the record imports at the start of the year in 2018, imports in Q1 2019 fell by 14 per cent **(Chart 4.4).** Despite this overall decrease, Liquefied Natural Gas (LNG) imports increased five-fold, resulting from decreased demand in Asia and increased availability from the diversification of the LNG market **(Chart 4.5).**

Meanwhile exports increased by 15 per cent, driven by increased trade with the Republic of Ireland, while exports to the Netherlands were lower. As a result, net imports decreased by 15 per cent **(Chart 4.4).**

This decrease in net imports was driven by lower gas demand, down 10 per cent compared to Q1 2018. Comparatively high temperatures in February and March this year contrasted with colder temperatures brought over by 'Beast from the East' in this period of 2018, resulted in a 19 per cent decrease in domestic gas use, which underpinned a 15 per cent reduction in total final consumption **(Chart 4.6).**

Demand for gas for electricity generation continued to fall against the previous year in Q1 2019, down 2.9 per cent as increased output from renewable energy continues to displace demand for gas for electricity generation **(Chart 4.6).**

Relevant table

4.1: Natural gas supply and consumption

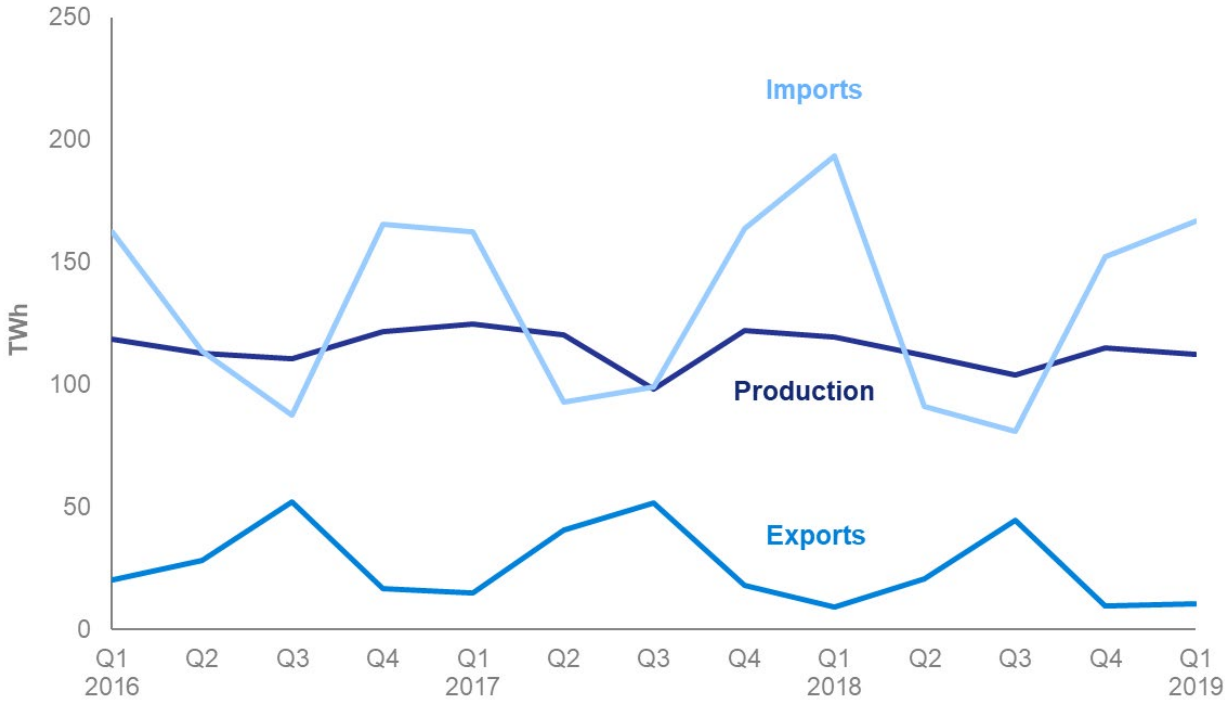
Contacts for further information:

Benjamin Lucking
Gas production and trade
Oil and Gas Statistics Team
Tel. 020 7215 5010

Amy Pearce
Gas demand
Oil and Gas Statistics Team
Tel. 020 7215 8211

E-mail: Oil&Gas.Statistics@beis.gov.uk

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



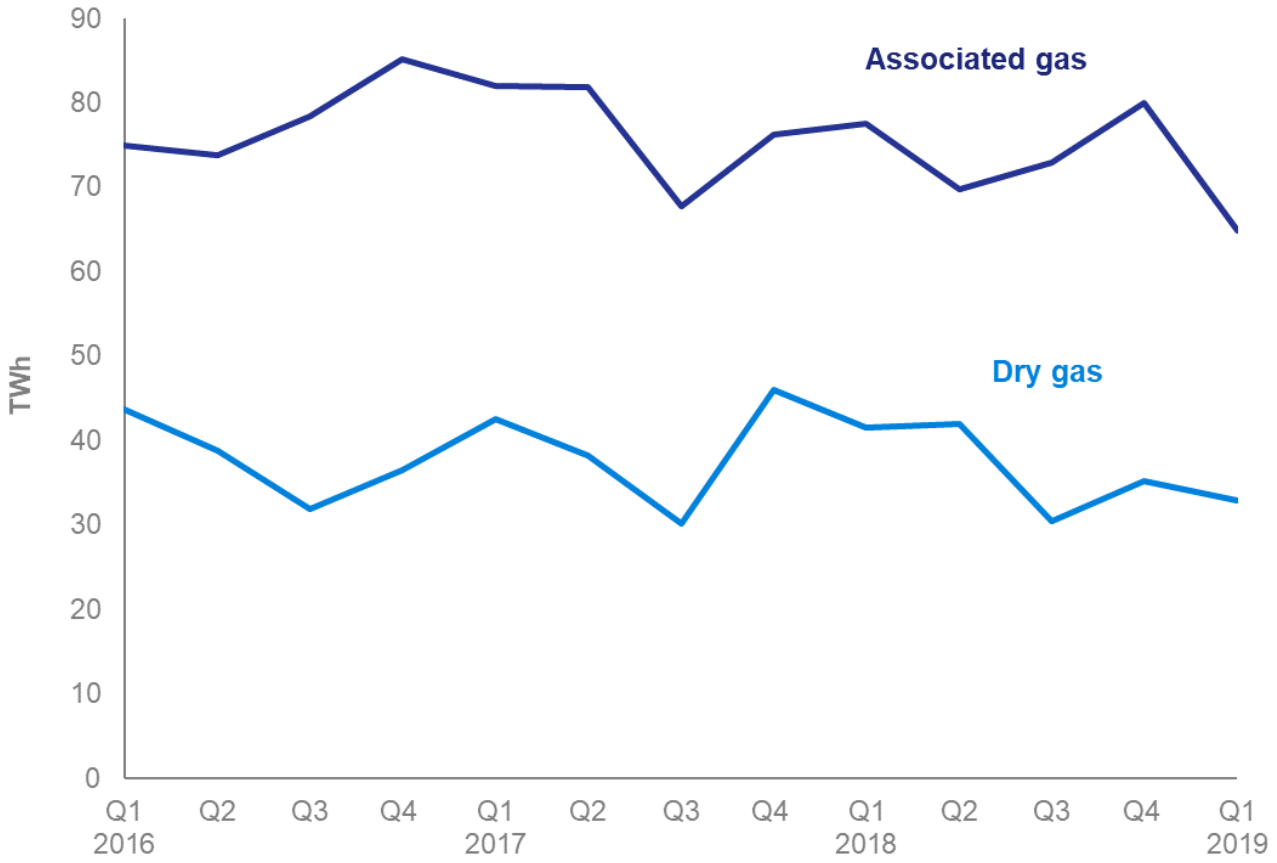
Production of natural gas in the first three months of 2019 decreased by 5.7 per cent compared with the same quarter of 2018. This is associated with the closure of the Theddlethorpe gas terminal last August as well as consistently lower output from the St Fergus Frigg pipeline and other large gas terminals. Since 2014 we had seen year-on-year production increases until 2018, which marked the first annual decrease in five years. In the longer term, the trend is one of decline and production in Q1 2019 was down 70 per cent on peak levels seen in Q1 2000.

On a nominated flow basis[1], imports in Q1 2019 were down 14 per cent on the same quarter in 2018, driven by the decrease in gas demand due to the significantly higher temperatures across the quarter. Meanwhile, exports increased by 15 per cent in the same period, resulting in an overall reduction in net imports by 15 per cent.

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

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

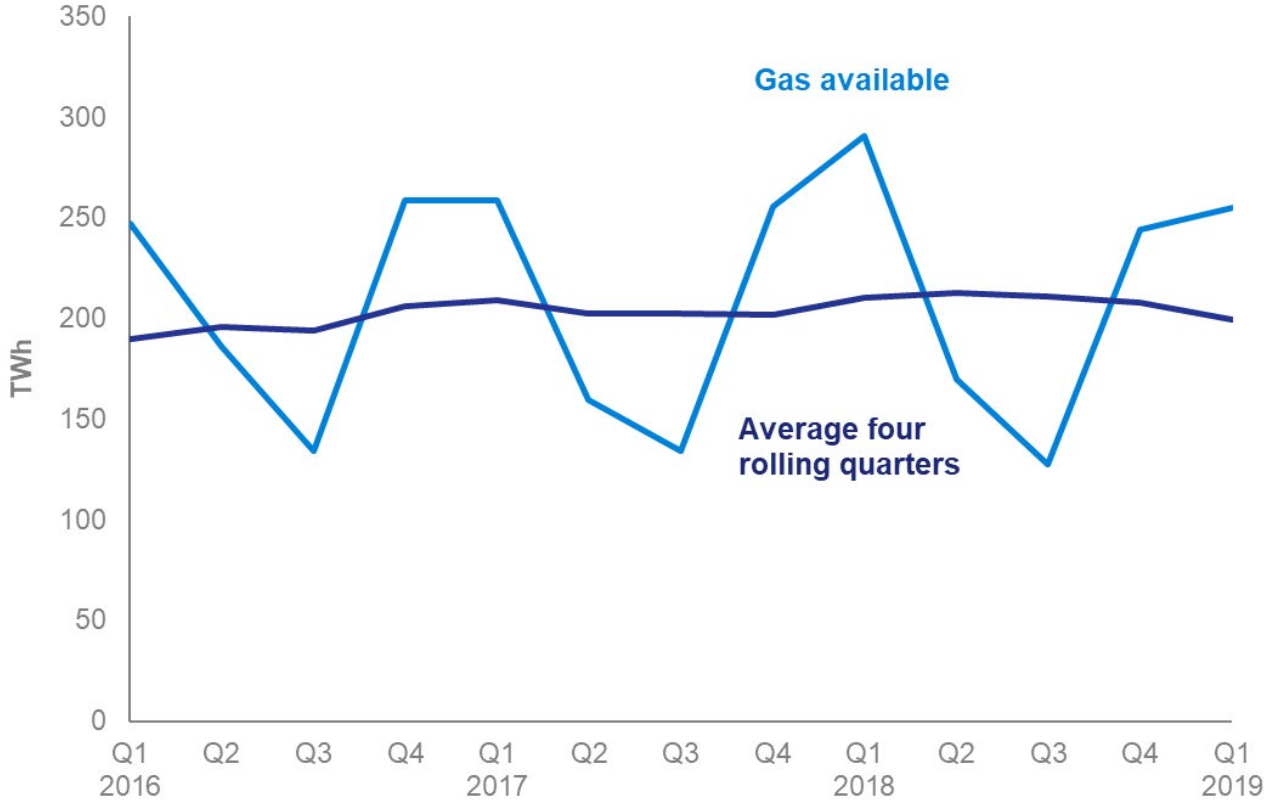
Chart 4.2 Production of dry gas and associated gas (not shown in published tables)



Production of associated gas (natural gas produced from oil fields) in Q1 2019 fell by 16 per cent against Q1 2018, from 78 TWh to 65 TWh.

Compared to the same quarter in 2018 dry gas production (natural gas composed mainly of methane) decreased by 21 per cent to 33 TWh.

Chart 4.3 Gas availability (Table 4.2)

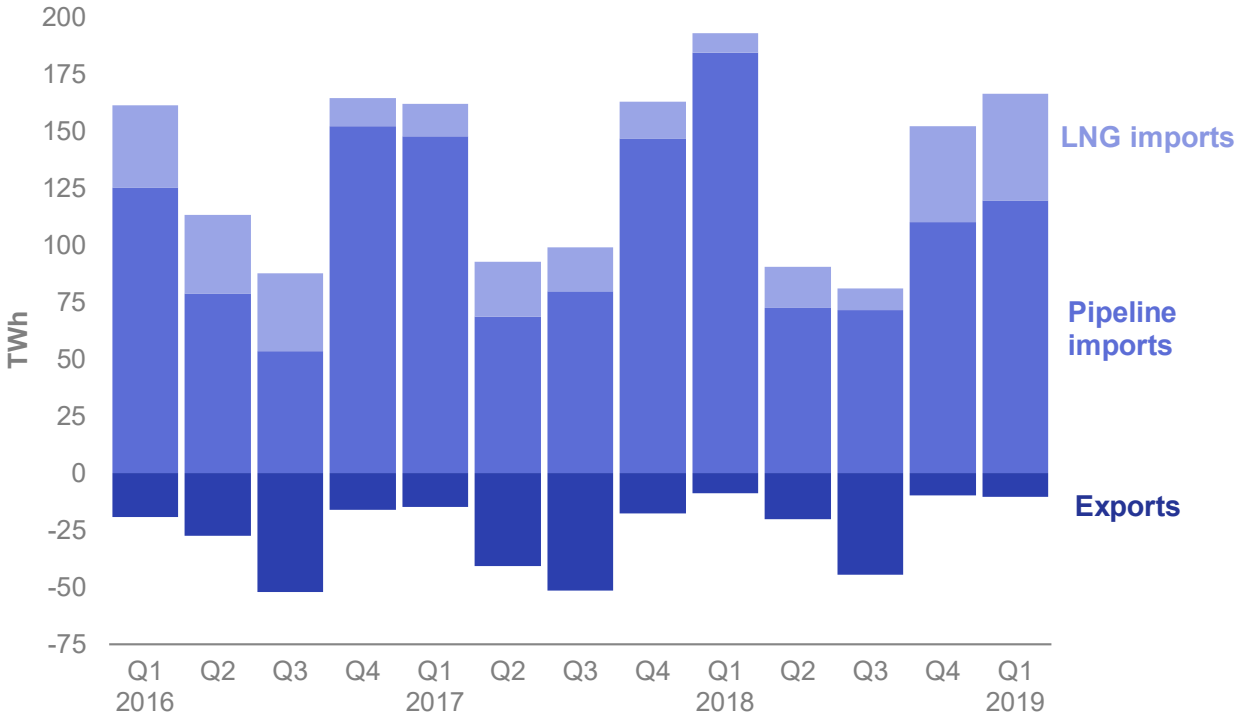


Gas available at terminals is equal to the gross gas production minus producers' own use, plus net imports. Gas availability is seasonal, mirroring gas demand, and peaks during Q1 and Q4 each year associated with the colder temperatures over the winter months.

High temperatures in February and March this year, contrasted by notably colder temperatures brought over during the 'Beast from the East' in the same period of 2018, meant gas availability decreased by 12 per cent to 256 TWh in the first three months of 2019 compared with Q1 2018.

The average availability of gas over four rolling quarters remains above average for Q1 2019 although it is the first decrease seen in the last five years.

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



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

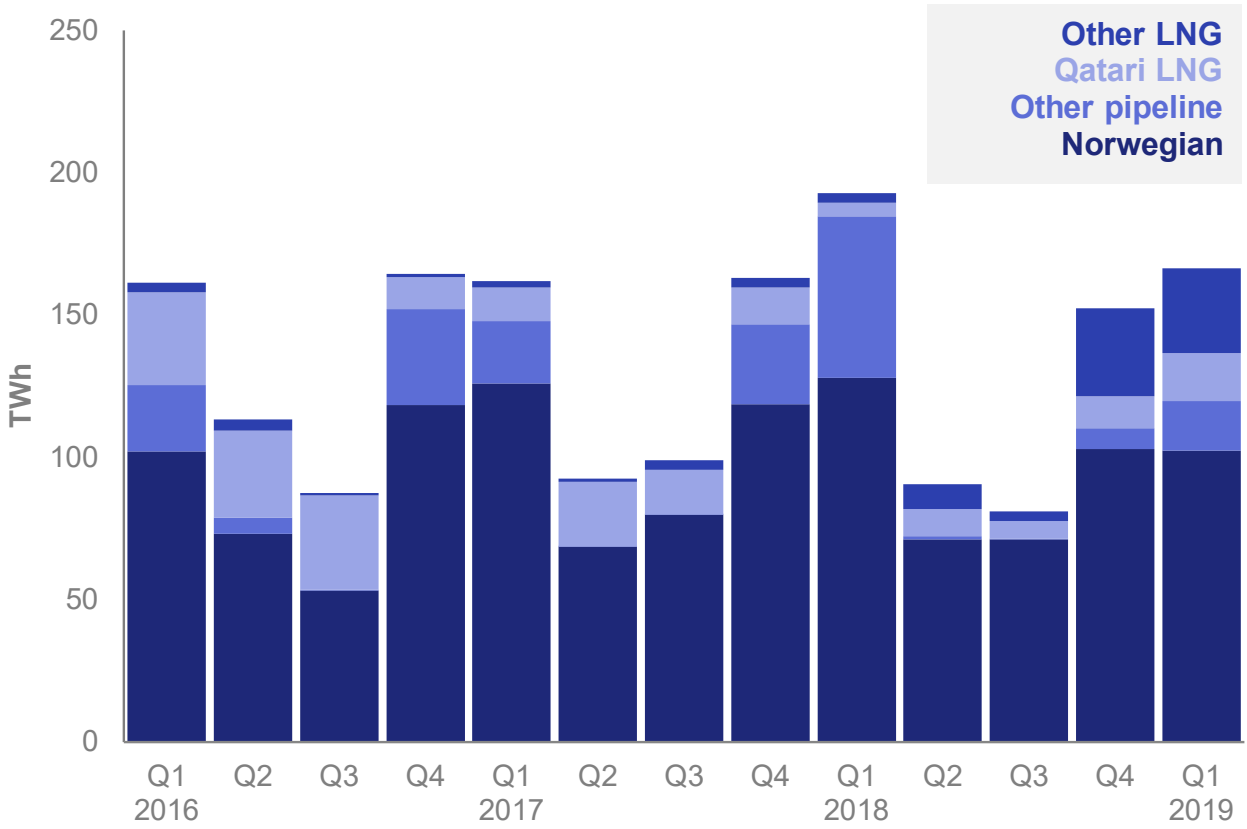
After a record level of net imports during Q1 2018, with both the lowest quarterly exports since 1998 and highest quarterly import levels in our time series, net imports fell by 15 per cent in Q1 2019. This was the result of a drop in total physical imports by 14 per cent whilst physical exports[2] increased by 17 per cent, reflecting the lower UK demand across the quarter.

Pipeline imports were down by 35 per cent, with decreases from all sources, especially from Belgium and the Frigg/Vesterled pipeline from Norway. Imports of LNG opposed this trend, increasing five-fold to 47 TWh and accounting for 28 per cent of total imports, after dropping considerably in the last two years. Decreased demand in Asia and the increased availability from the diversification of the LNG market was a significant factor for this increase.

Over this quarter, the 17 per cent increase in total exports was driven by the 44 per cent increase in trade with the Republic of Ireland. Meanwhile exports to the Netherlands decreased to 2 TWh, which is the lowest volume in the first quarter of the year since 2007. Exports to Belgium have generally been reduced since October 2018 due to the termination of the Bacton Zeebrugge Interconnector long term capacity contract.

[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)



Following record pipeline imports at the start of the year in 2018, over the first quarter of 2019 pipeline imports fell sharply, by 35 per cent, with a decrease in imports through all pipelines bringing gas into the UK. Imports from Belgium decreased significantly due to the Bacton Zeebrugge Interconnector long term capacity contract terminating at the beginning of October 2018. Although Norway pipeline imports were 20 per cent lower than last year, Norway remained the largest single source of imported gas to the UK at 62 per cent (including LNG contribution).

The LNG share of imports increased to 28 per cent in the first quarter of 2019 with LNG imports increasing five-fold to 47 TWh. Like last year, Qatar remained the biggest source of LNG imports to the UK across the quarter, although its share of LNG imports fell to 36 per cent compared with 59 per cent in Q1 2018 and 89 per cent for total LNG imports between 2010 and 2017. A considerable increase in LNG imports from both Russia and the USA, along with the further diversification of the LNG market, including the first imports from Cameroon, contributed to this reduction in the Qatari share.

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 Q1 2019

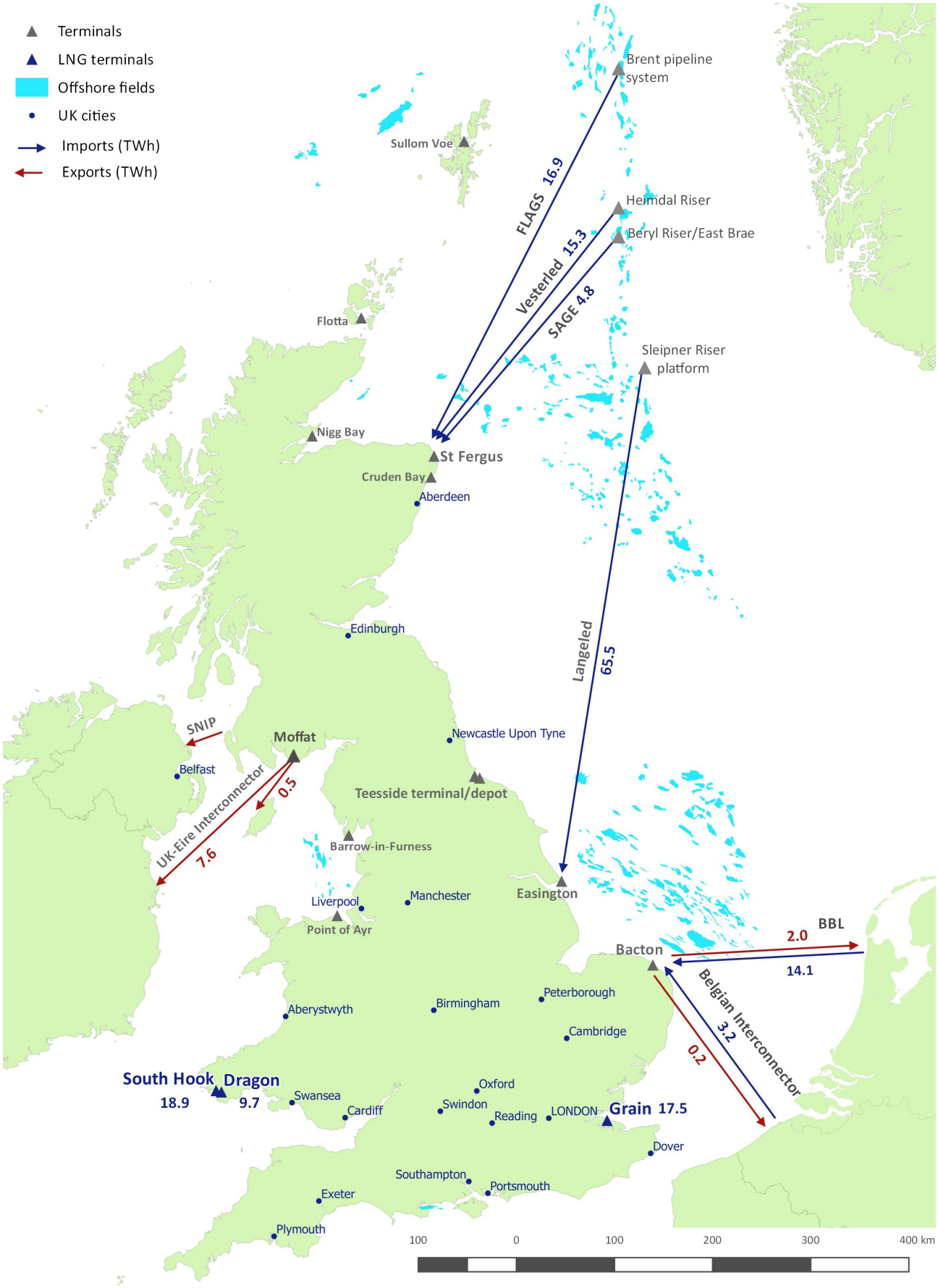
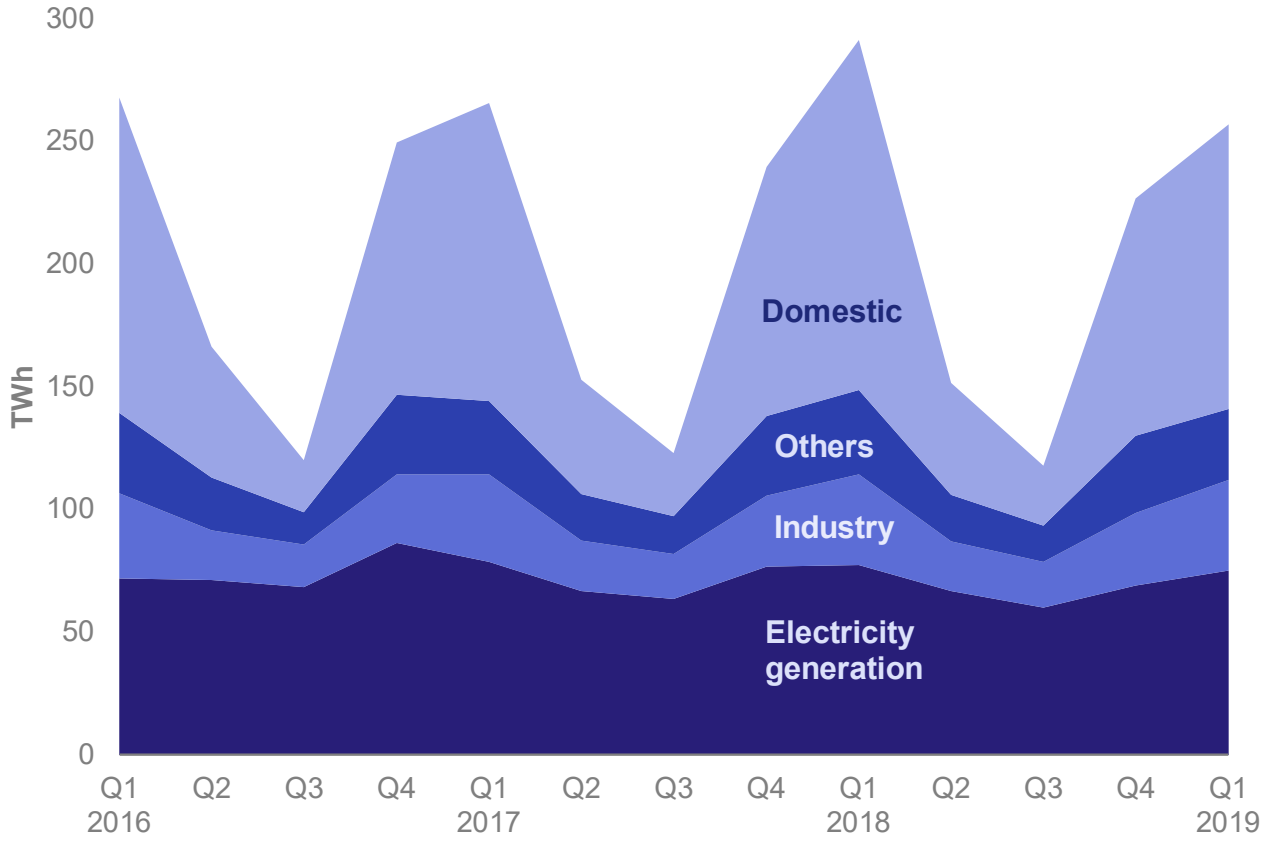


Chart 4.6 UK demand for natural gas (Table 4.1)



Temperatures during the last three months were substantially higher than the same period last year when colder temperatures brought over by 'Beast from the East' resulted in more heating degree days and a subsequent increase in demand for gas in the domestic sectors. As a result, UK demand for natural gas in Q1 2019 decreased by 10 per cent with domestic use and final users down by 19 and 17 per cent respectively. This underpinned a 15 per cent reduction in total final consumption.

Demand for gas used for electricity generation was down 2.9 per cent in Q1 2019 compared to the same quarter in 2018 as the increased output from renewable energy continues to displace the demand for gas used for electricity generation.

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

Section 5 – UK Electricity
January to March 2019

Key results show:

Total electricity supply and demand decreased by 5.9 and 6.0 per cent in Q1 2019 on Q1 2018, resulting in total generation decreasing to 86.9 TWh. (**Chart 5.1**).

Renewables share of generation increased to 35.8 per cent in Q1 2019 – a record high for Q1 and the second highest quarterly renewables share. The increase in renewable generation is largely due to increased capacity. Wind and solar's share of generation reached a record high of 23.6 per cent. (**Chart 5.2**).

Low carbon's share of generation increased to 51.8 per cent in Q1 2019 - a record high share for low carbon for Q1. This increase resulted from increased renewable generation, due to the reduced generation and share from nuclear, as a result of outages. (**Chart 5.3**).

The share of generation from fossil fuels decreased to 45.8 per cent in Q1 2019 – a record low for the quarter. This resulted from total fossil fuel generation decreasing 13 per cent to 39.8 TWh. Coal's share of generation decreased to a record low of 3.5 per cent. Meanwhile, the share of generation from gas increased to 41.9 per cent. (**Chart 5.2**).

The shift in fuel mix from fossil fuels to more renewable sources, along with the demand reduction, led to an 8.9 per cent reduction in fuel used in Q1 2019. The most significant reduction was a 63 per cent reduction in coal use for generation (**Chart 5.6**).

During Q1 2019, the new interconnector with Belgium (NEMO) became fully operational. The UK's net imports reached a record high of 6.0 TWh in Q1 2019. This increase was driven by a 16 per cent increase in imports; however, exports also increased 56 per cent. (**Chart 5.4**).

Total demand in Q1 2019 decreased, partly due to a 5.0 per cent reduction in final consumption compared to Q1 2018. This reduction occurred in all sectors. Most notably, domestic consumption decreased by 7.9 per cent in Q1 2019 compared to the previous year, due to warmer temperatures. (**Chart 5.5**).

Relevant tables

5.1: Fuel used in electricity generation and electricity supplied
5.2: Supply and consumption of electricity

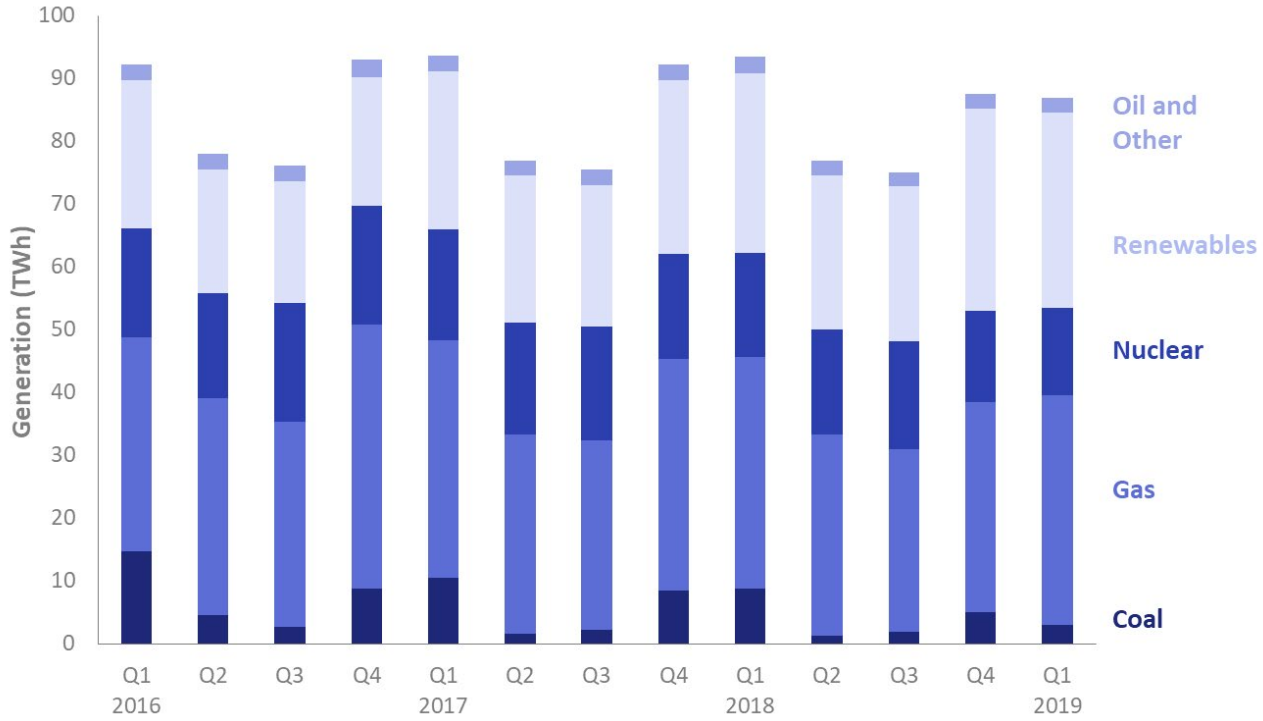
Contacts for further information:

Tim Roberts
Electricity Statistics
Tel: 0300 068 5046

Chrissie Frankland
Electricity Statistics
Tel: 020 7215 1215

E-mail: electricitystatistics@beis.gov.uk

Chart 5.1 Electricity generated by fuel type (Table 5.1)



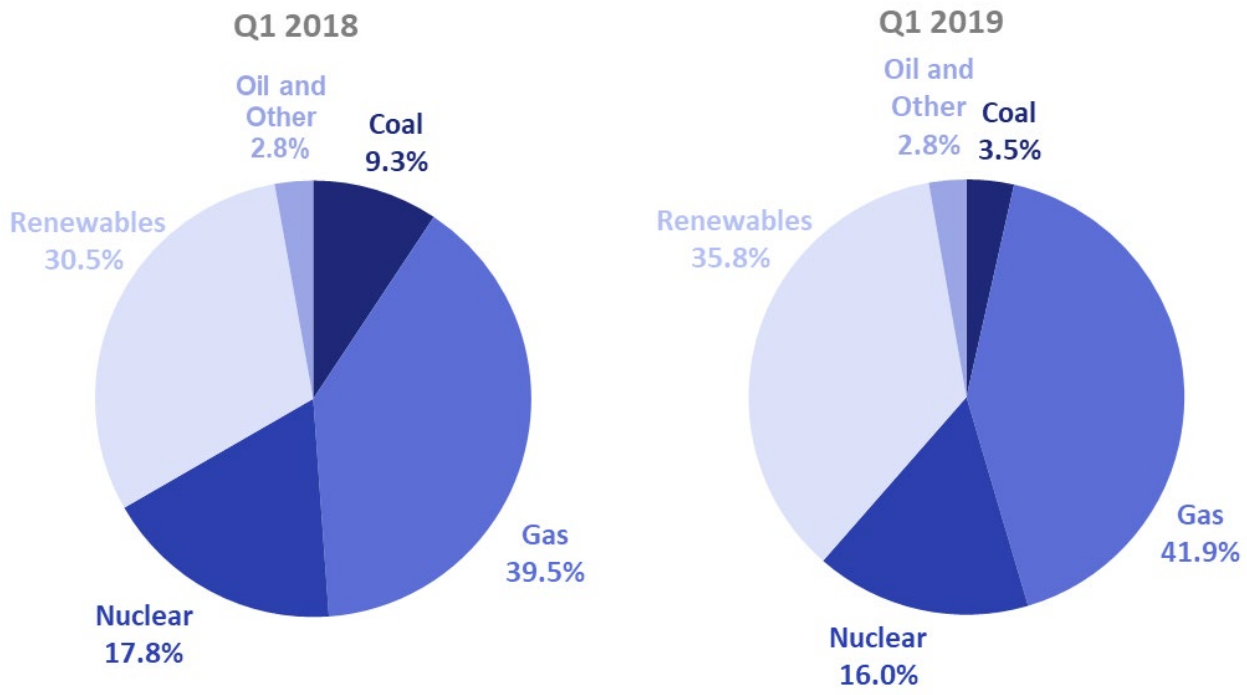
Total electricity generation fell 6.9 per cent in Q1 2019 compared to Q1 2018, reaching the lowest level of any previous Q1 at 86.9 TWh. This was in line with a significant drop in demand compared to Q1 2018, when the 'Beast from the East' led to much higher electricity consumption. Further temperatures in Q1 2019 were 1.1 degrees Celsius warmer than the long-term mean, contributing to reduced demand. Major Power Producers (MPPs) saw an 8.6 per cent fall in total generation, whilst generation from other generators (which includes autogenerators as well as domestic solar PV) rose 3.5 per cent.

Renewable generation, comprised of wind, solar, hydro and bioenergy, was 31.1 TWh in Q1 2019 and was the second highest on record – this was slightly lower than the record of 32.2 TWh in Q4 2018. This was an 9.2 per cent increase on Q1 2018, as generation from wind, solar, hydro and bioenergy all rose – see Chapter 6 for more information on renewable electricity generation. Bioenergy increased 13 per cent on Q1 2018. This was partly due to an 18 per cent rise in capacity, but it was added to by outages at Drax in Q1 2018, which limited overall bioenergy generation in that quarter. Wind and solar generation increased 7.1 per cent to a new record high of 20.5 TWh, despite weather conditions remaining broadly similar to Q1 2018. Instead, the rise was due to significant increases in capacity for both wind (up 7.8 per cent) and solar (up 3.9 per cent). Meanwhile, hydro (natural flow) generation increased 15 per cent on Q1 2018, despite a 6.5 per cent fall in average rainfall. The rise was likely due to an exceptionally wet March, which led to a spike in MPP hydro generation in that month. For further information on weather conditions, see Energy Trends tables 7.1 to 7.4.

Generation from fossil fuels fell 13 per cent from 46.0 TWh in Q1 2018 to 39.8 TWh in Q1 2019. This was driven by a 65 per cent reduction in coal generation, as higher renewable generation and lower demand significantly reduced the need for coal-fired generation. In comparison, gas generation remained much more stable, falling 1.3 per cent from Q1 2018. Gas generation varied a lot over the quarter; January saw the highest MPP gas generation since January 2017 due to a jump in demand, but February and March saw much lower generation as demand fell and renewable generation increased.

Nuclear generation fell 16 per cent on Q1 2018, reaching its lowest level since Q3 2010 at 13.9 TWh. This was due to outages at several reactors significantly reducing overall nuclear generation for the quarter.

Chart 5.2 Shares of electricity generation (Table 5.1)

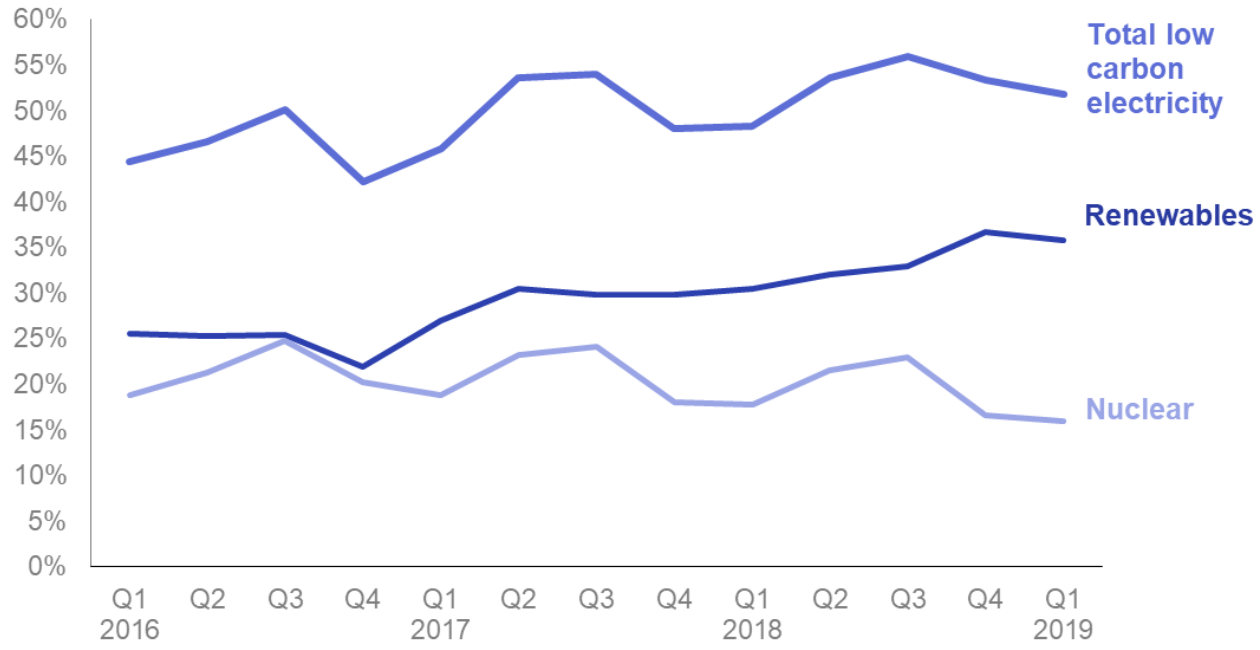


The share of electricity generated from renewables (wind, solar, hydro and other renewables) was 35.8 per cent in Q1 2019, up from 30.5 per cent in Q1 2018, after renewable technologies saw sizeable increases in generation. Wind and solar accounted for a record 23.6 per cent of total generation, up 3.1 pp on Q1 2018, as both technologies saw significant increases in capacity. Although average wind speeds were 4.1 per cent lower for the quarter, in March 2019 wind speeds were exceptionally high, leading to a spike in MPP wind generation. Bioenergy's generation share also increased, rising from 8.3 per cent in Q1 2018 to 10.1 per cent in Q1 2019.

The share of generation from fossil fuels (gas, coal and oil) fell to 45.8 per cent from 49.2 per cent in Q1 2018 – see Table 5.1 for share calculations. This was driven by a large reduction in coal generation; coal accounted for 3.5 per cent of electricity generation in Q1 2019, down from 9.3 per cent in Q1 2018. Meanwhile, despite gas generation falling in absolute terms, its share of generation increased slightly in Q1 2019 to 41.9 per cent from 39.5 per cent in Q1 2018.

Nuclear accounted for 16.0 per cent of total generation in Q1 2019, falling 1.8 pp from Q1 2018 to its lowest level since Q4 2014. This was due to a continued unplanned outage at Hunterston B and a statutory outage at Dungeness B, which stopped generation at both sites for the entire quarter. The capacity of these two power stations accounts for 23.0 per cent of nuclear capacity.

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



The share of electricity generation from low carbon sources increased to 51.8 per cent in Q1 2019, up from 48.3 per cent in Q1 2018. This rise was driven by higher generation from renewables, as their share of generation increased 5.3 pp from Q1 2018 to 35.8 per cent in Q1 2019. This was due to a combination of increased wind and bioenergy capacity (up 7.8 and 18 per cent, respectively) and particularly favourable weather conditions in March 2019.

Meanwhile, nuclear's share of generation fell from 17.8 per cent in Q1 2018 to 16.0 per cent in Q1 2019, after outages at several reactors limited overall nuclear generation.

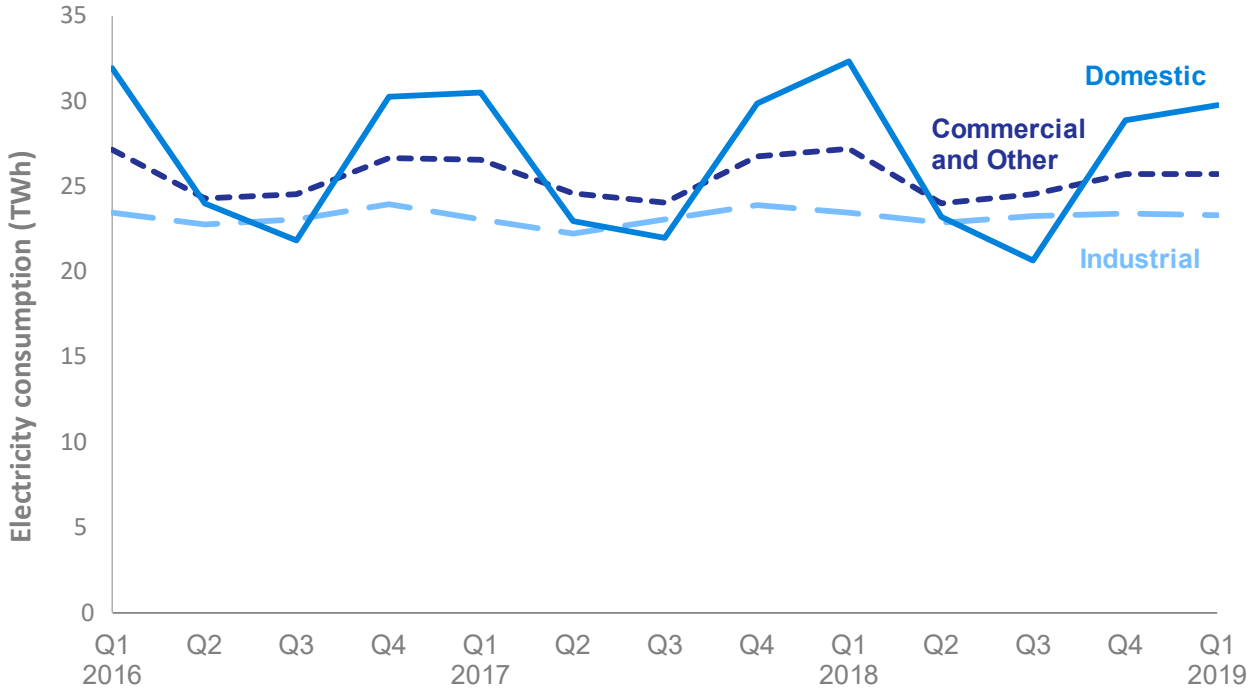
Chart 5.4 UK trade in electricity (Table 5.6)

The UK has five interconnectors allowing trade with continental Europe: England-France (2 GW capacity), England-Netherlands (1 GW), England-Belgium (1 GW), Northern Ireland-Ireland (0.6 GW) and Wales-Ireland (0.5 GW). The England-Belgium 'Nemo Link' interconnector has been included in this data for the first time after becoming fully operational on 31st January 2019.

The UK has been a net importer of electricity since Q2 2010, and in Q1 2019 net imports reached a record high 6.0 TWh, increasing 13 per cent on Q1 2018. This accounted for 6.8 per cent of total electricity supply (excluding own use) over the quarter. This was largely driven by a 16 per cent rise in total imports, after 0.9 TWh of electricity was imported across the new England-Belgium interconnector. However, total exports did also see an increase, rising 56 per cent from Q1 2018 to 0.7 TWh in Q1 2019.

Net imports from the Netherlands fell slightly, down 4.0 per cent on Q1 2018, whilst net imports from France remained relatively stable, increasing 0.4 per cent. There were significant rises in exports to the Republic of Ireland from both Northern Ireland (up 48 per cent) and Wales (up 70 per cent). Northern Ireland has been a net exporter of electricity to the Republic of Ireland since Q2 2017, with net exports in Q1 2019 at their highest level since Q3 2007, at 0.2 TWh. Meanwhile, the high exports from Wales meant that net imports to Wales from the Republic of Ireland remained low in Q1 2019 (0.02 TWh), after falling to practically zero in Q4 2018.

Chart 5.5 Electricity final consumption (Table 5.2)



Total demand and final consumption both reached record lows for the first quarter of 2019. In Q1 2019, total demand fell by 6.0 per cent to 92.8 TWh from 98.7 TWh in Q1 2018, driving a similar decrease in supply.

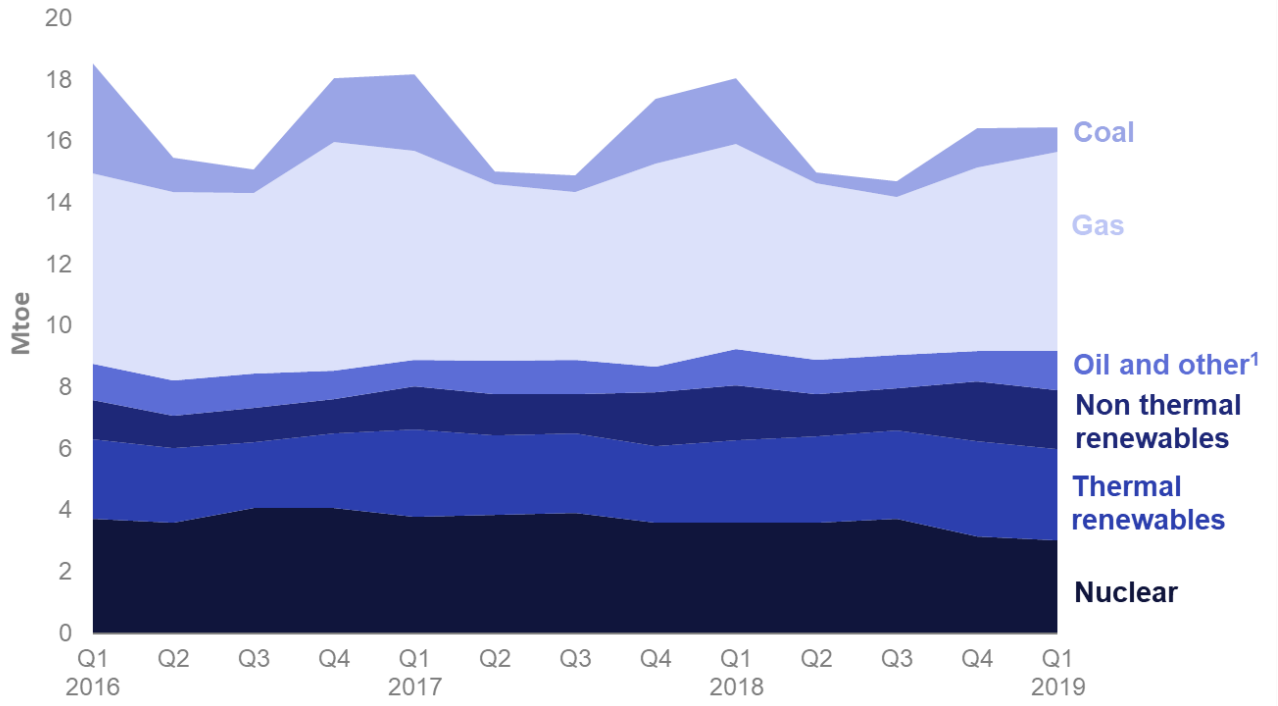
Energy industry use in Q1 2019 decreased by 11.9 per cent to 6.0 TWh from 6.8 TWh in Q1 2018. This includes electricity used in generation and for pumping, along with energy used by other fuel industries. Consistent with the decline in total demand, final consumption fell by 5.0 per cent to 78.8 TWh from 83.0 TWh in Q1 2018.

Over the first quarter of 2019, domestic consumption decreased by 7.9 per cent compared to Q1 2018, to reach 29.8 TWh. The average temperature in Q1 2019 increased by 42 per cent (4.5 degrees Celsius to 6.3 degrees Celsius), whilst the number of heating degree days fell 17 per cent (11.0 degree days to 9.2 degree days), compared to Q1 2018. This large temperature change reflected the cold snap 'the Beast from the East' in Q1 2018, but also the significantly warmer than average weather in Q1 2019, when temperatures were 21 per cent higher than the long-term mean. For more information on temperature trends, – see Energy Trends table 7.1 at: www.gov.uk/government/statistics/energy-trends-section-7-weather.

The temperature trends also contributed to consumption by other final users, which fell to 24.5 TWh in Q1 2019, decreasing by 5.7 per cent from Q1 2018. In contrast, industrial consumption decreased slightly over the quarter. In Q1 2019, industrial consumption (including iron and steel) was 23.3 TWh, compared to 23.5 TWh in Q1 2018. This decrease was smaller than the other sectors and in part reflects an increase in industrial productivity[1].

[1] Industrial productivity is measured by the Office for National Statistics in their publication of the Index of Production, available here: www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofproduction/previousReleases

Chart 5.6 Fuel used for electricity generation (Table 5.1)



1. 'Oil and other' includes the fuel use of oil, other fuels and net imports.

In Q1 2019, total fuel use by electricity generators fell to 16.4 mtoe, down 8.9 per cent on Q1 2018. This significant drop in fuel use came as a result of much lower demand compared to Q1 2018 and the continuing shift of the fuel mix to more efficient non-thermal renewables. (Note that for primary renewable sources, such as wind and solar, the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred).

Coal saw by far the largest drop in fuel use, falling 63 per cent compared to Q1 2018. Gas use was more stable, but also decreased 2.9 per cent. This continues the trend of declining fossil fuel use; fossil fuel use in Q1 2019 was down 17 per cent on Q1 2018, 21 per cent on Q1 2017 and 25 per cent on Q1 2016. Nuclear also saw a reduction in use, falling 16 per cent due to several significant outages.

In contrast, thermal renewables (including bioenergy) fuel use increased 11 per cent in Q1 2019 compared to Q1 2018. This was partly due to higher bioenergy capacity (up 18 per cent on Q1 2018) but was also caused by outages at Drax in Q1 2018, which reduced overall bioenergy fuel use in that quarter. Meanwhile, non-thermal renewable generation increased 7.7 per cent on Q1 2018, as generation from wind, solar and hydro all rose.

Section 6 – UK Renewables
January to March 2019

Key results show:

Total renewable generation increased by 9.2 per cent on the same quarter last year to 31.1 TWh (**Chart 6.2).** As a result, renewables' share of electricity generation was a near record 35.8 per cent in 2019 Q1, up 5.3 percentage points on the share in 2018 Q1, and reflective of increased capacity. **(Chart 6.1)**

Renewable electricity capacity was 45.0 GW at the end of 2019 Q1, a 7.9 per cent increase on a year earlier, mostly due to increased capacity for onshore and offshore wind and plant biomass. This was also a 1.4 per cent increase on the previous quarter. **(Chart 6.3)**

Onshore wind generation increased by 4.8 per cent to 9.8 TWh, whilst offshore wind increased by 7.3 per cent to 8.6 TWh. As a result, total wind generation increased by 6.0 per cent to 18.4 TWh, just short of the record which had been set in in the last quarter of 2018. Solar generation increased by 19 per cent, from 1.8 TWh in 2018 Q1 to 2.1 TWh in 2019 Q1. **(Chart 6.2).** Wind and solar generation was a record 23.6 per cent share of electricity generation.

In 2019 Q1, 119 MW of capacity eligible for the Feed in Tariff scheme was installed, increasing the total to 6.6 GW, across roughly 985,700 installations. **(Chart 6.5)**

Liquid biofuels consumption provisionally rose by 17 per cent, from 395 million litres in 2018 Q1 to 462 million litres in 2019 Q1. This represented 4.0 per cent of all petrol and diesel consumed in road transport. **(Chart 6.6)**

Relevant tables

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

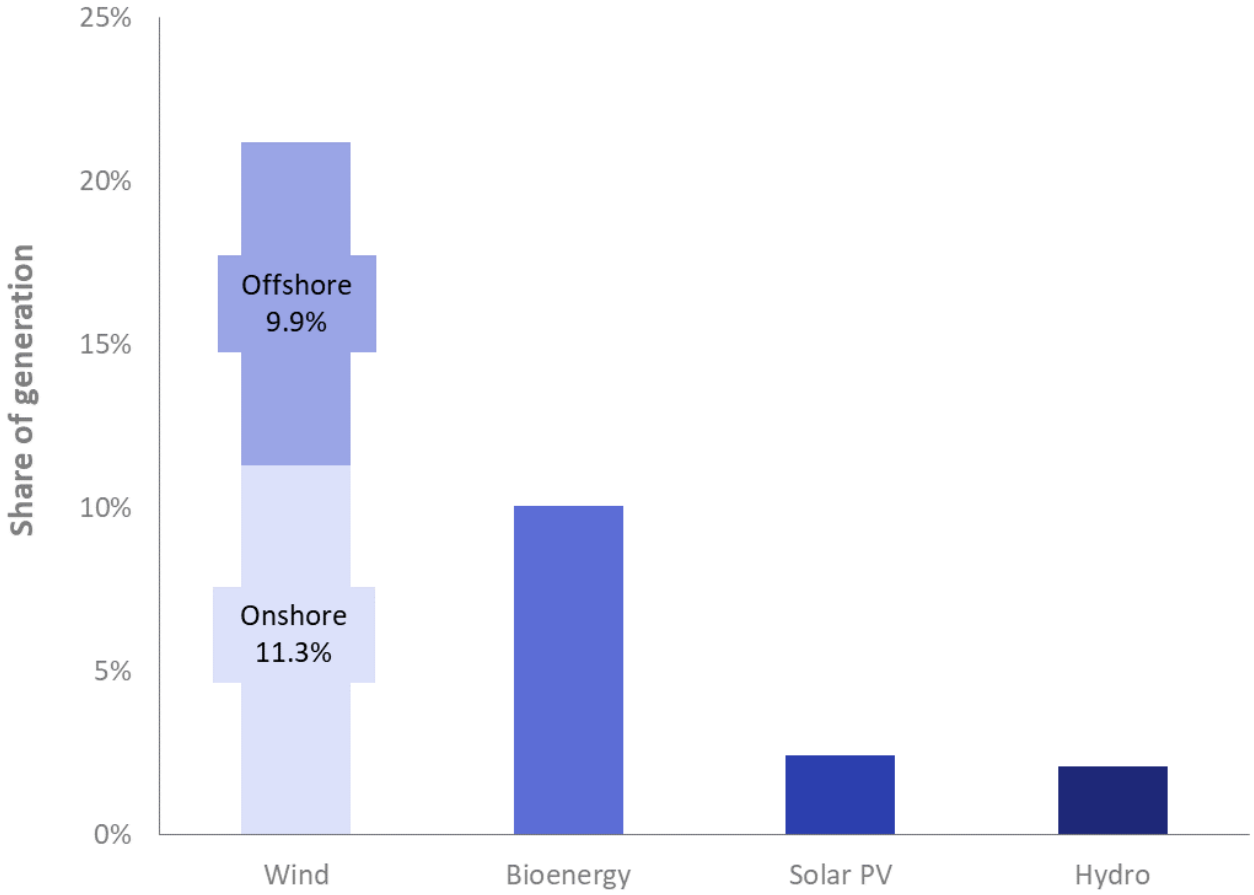
Contacts for further information:

Liz Waters
Renewables Statistics
Tel: 0300 068 5735

Will Spry
Renewables Statistics
Tel: 020 7215 5394

E-mail: renewablesstatistics@beis.gov.uk

Chart 6.1 Renewables' share of electricity generation – 2019 Q1 (Table 6.1)

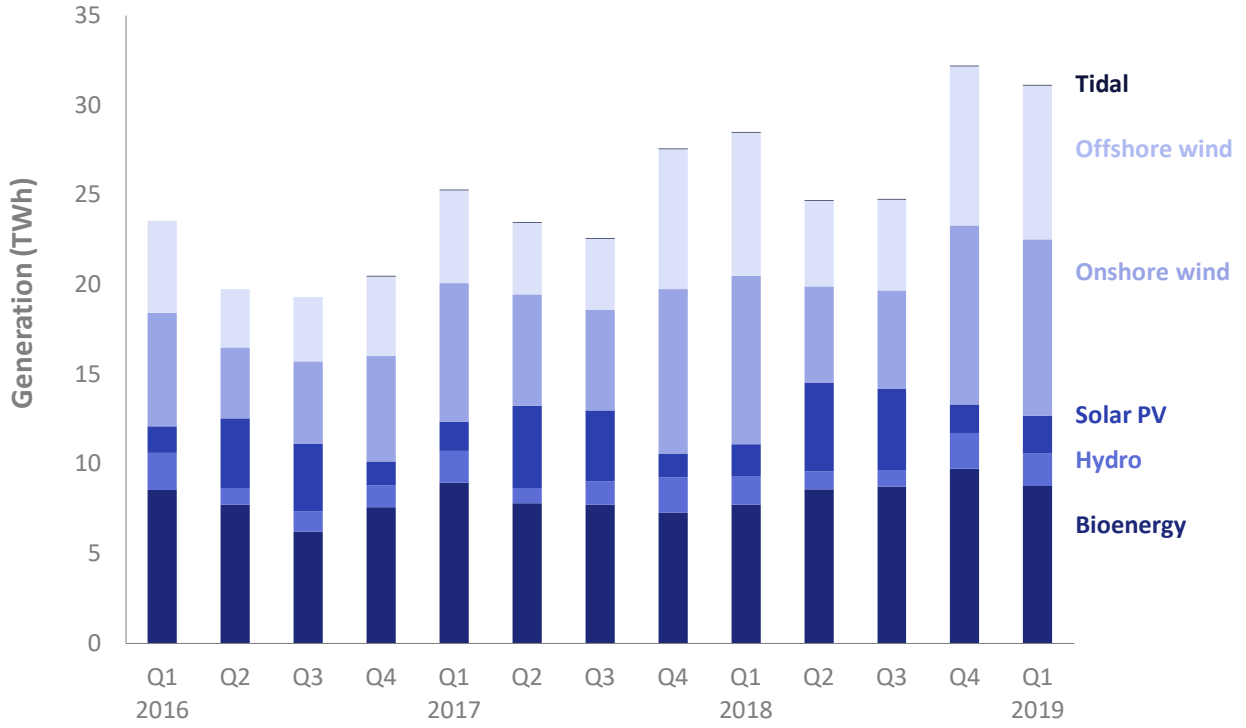


Total electricity generation from renewables in 2019 Q1 was 31.1 TWh, an increase of 9.2 per cent from 28.5 TWh in 2018 Q1. Renewables' share of total electricity generation increased from 30.5 per cent in 2018 Q1 to 35.8 per cent in 2019 Q1, down 1.0 percentage point on the record generation and share set at the end of 2018.

The increase on a year earlier reflects increased capacity, particularly in plant biomass (by 1.2 GW), offshore wind (by 0.8 GW), and onshore wind (also increased by 0.8 GW). In total, renewable capacity increased 7.9 per cent on the same quarter last year.

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

Chart 6.2 Renewable electricity generation (Table 6.1)



In 2019 Q1, generation from onshore wind was 9.8 TWh, up 4.8 per cent on the same quarter last year. Generation from offshore wind was 8.6 TWh, up 7.3 per cent on the same quarter last year. The increase in generation for both can be attributed to increases in capacity (6.1 per cent for onshore and 10.7 per cent for offshore) which more than offset lower wind speeds than in 2019 Q1, which were down 0.4 knots on 2018 Q1. See Energy Trends table 7.2 at: www.gov.uk/government/statistics/energy-trends-section-7-weather.

Generation from solar photovoltaics increased by 19 per cent (0.3 TWh) to 2.1 TWh, compared to 2018 Q1. This can be attributed to both a 6.1 per cent increase in solar PV capacity alongside an increase of 0.6 average daily sun hours compared to 2018 Q1.

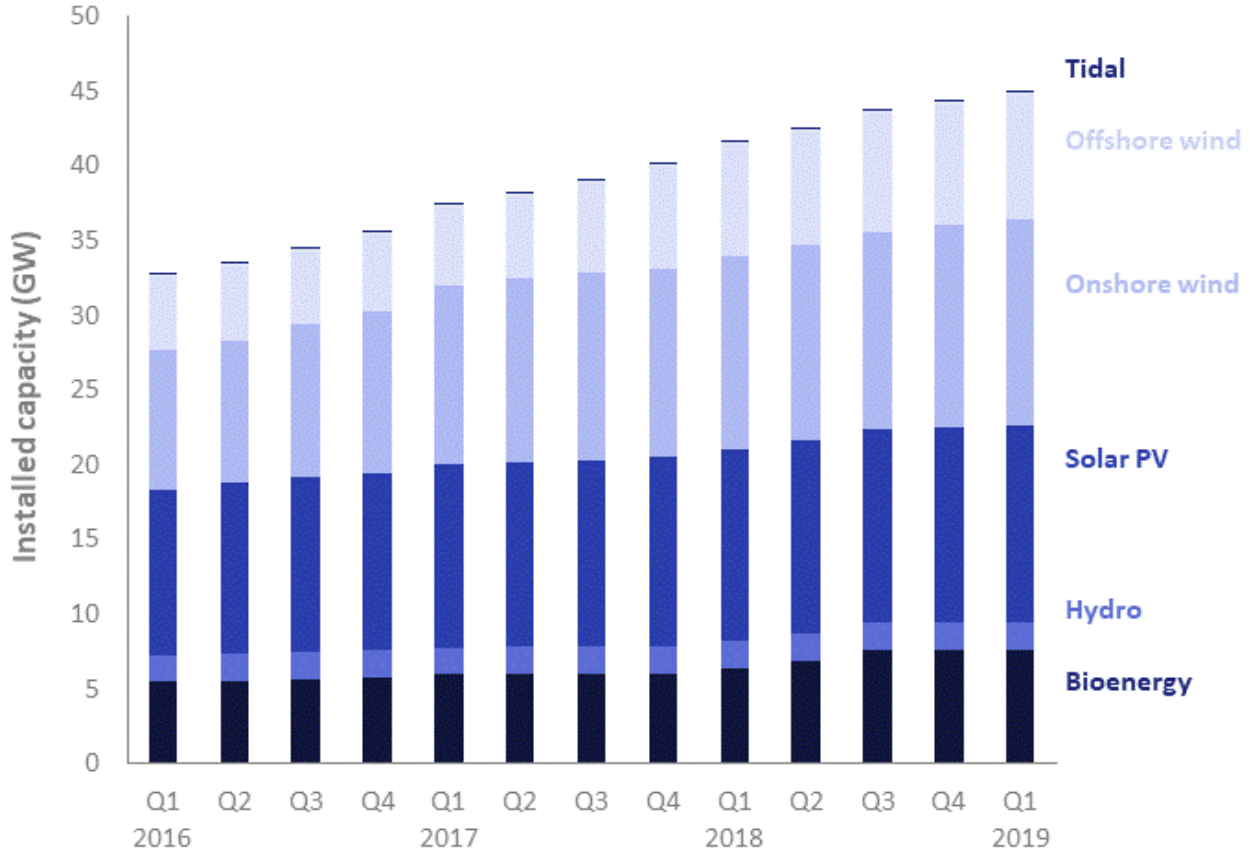
Hydro generation increased by 0.2 TWh to 1.8 TWh compared to 2018 Q1, a 15 per cent increase. However, generation in 2018 Q1 had been relatively low, the lowest figure for the first quarter of a year since 2013.

In 2019 Q1, generation from bioenergy[1] was 8.8 TWh, up 13.3 per cent on a year earlier. Within this, generation from plant biomass was up 25.7 per cent 5.9 TWh. This is largely due to the opening of Lynemouth Biomass plant in 2018 Q2 and the conversion of a unit from coal to biomass at Drax in 2018 Q3.

Onshore wind had the largest share of renewable generation with 31.6 per cent, followed by 28.2 per cent from bioenergy, 27.5 per cent from offshore wind, 6.8 per cent from solar PV and 5.8 per cent from hydro.

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

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



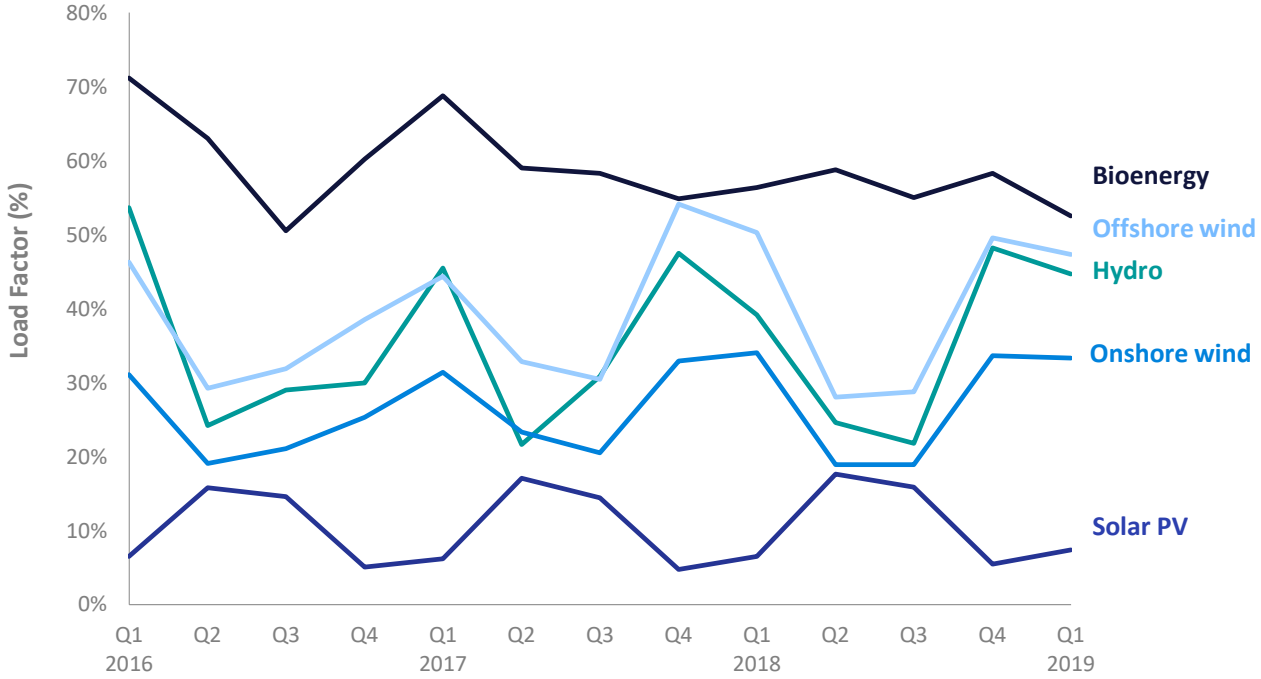
At the end of 2019 Q1, the UK's renewable electricity capacity totalled 45 GW, an increase of 7.9 per cent on that installed at the end of 2018 Q1. Over a third of the increase was from plant biomass (1.2 GW from the opening on the Lynemouth Biomass plant and further conversion work at the Drax power station). Offshore and onshore wind representing a further 25 per cent and 24 per cent respectively of the increase and now stands at a total of 22.3 GW.

In terms of overall growth rates, plant biomass showed the highest growth at 26 per cent. Shoreline, wave and tidal increased by 22 per cent (although from a comparatively small baseline). Offshore and onshore wind increased at 11 per cent and 6 per cent respectively. Solar PV installed capacity also increased by 4 per cent to 13.2 GW.

At the end of 2019 Q1, onshore wind capacity at 13.8 GW represented 30.6 per cent of all renewable capacity, the highest share of renewable technologies. This was followed by Solar PV (29.5 per cent), offshore wind (18.9 per cent) and bioenergy (16.8 per cent).[2]

[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 those not eligible for support or are commissioned but awaiting support accreditation. This should particularly be noted for solar PV (and onshore wind), where figures consist of many installations across several or all of these categories.

Chart 6.4 Renewable electricity load factors (Table 6.1)



At the end of 2019 Q1[3], the load factor for all renewables was 32.2 per cent, the same as this time last year.

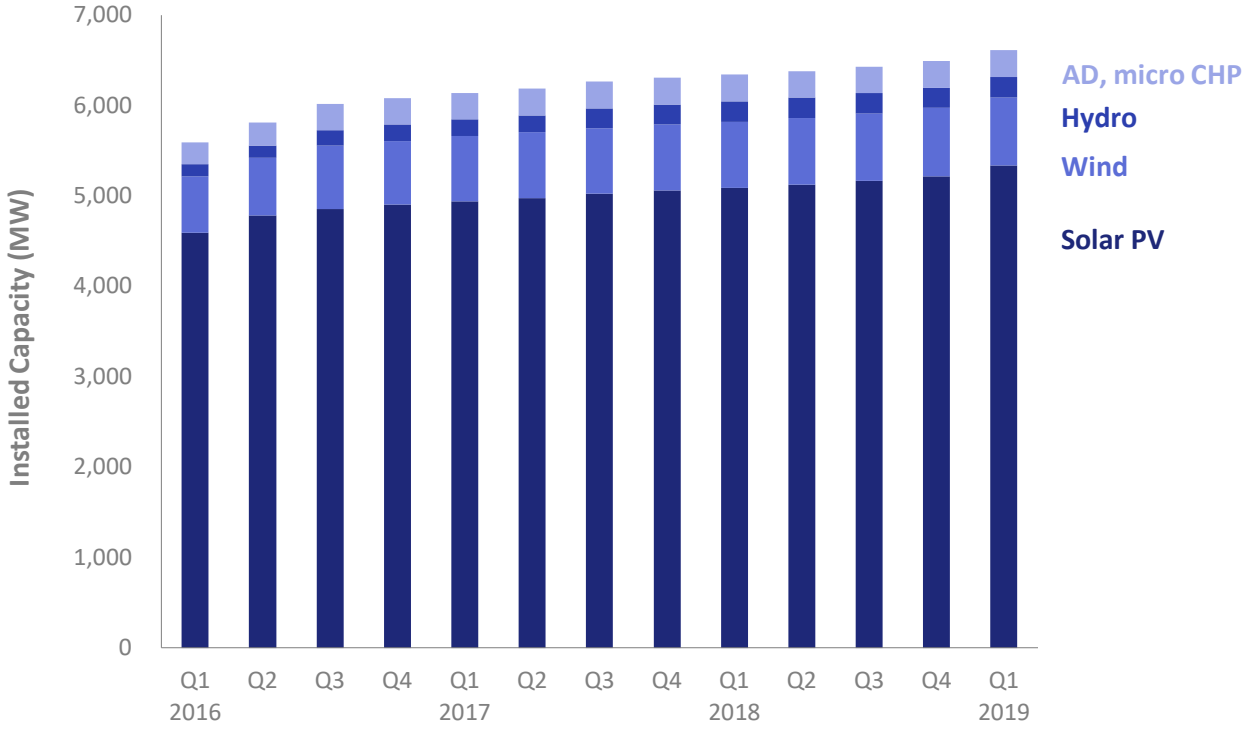
In 2019 Q1, onshore wind's load factor was 32.6 per cent, compared with 34.0 per cent at the same time last year. This fall was partly due to a drop in average wind speeds of 0.4 knots. Similarly, offshore wind's load factor was 46.3 per cent, compared with 50.3 per cent at the same time last year.

Hydro's load factor in 2019 Q1 was 43.7 per cent, compared with 39.2 per cent at the end of 2018. However, the load factor in Q1 2018 had been relatively low. Compared with the most recent quarter, 2018 Q4, hydro's load factor in 2019 Q1 was down 4.6 percentage points from 48.2 per cent.

For plant biomass, the load factor in 2019 Q1 was 60.3 per cent. This is compared with 69.6 per cent in 2018 Q1.

[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)



At the end of 2019 Q1, 6.6 GW of capacity was installed and eligible for the GB Feed in Tariff (FiT) scheme[4], a 4.3 per cent increase on that at the end of 2018 Q1. The Feed in Tariff scheme closed to new entrants at the end of 2019 Q1 which resulted in a high number of installations during the quarter.

In terms of number of installations, at the end of 2019 Q1, there were roughly 985,700 eligible for the FiT scheme, a 2.5 per cent increase on the 961,500 confirmed at the end of the previous quarter, and 5.9 per cent higher than the 931,000 schemes confirmed at the end of 2018 Q1.

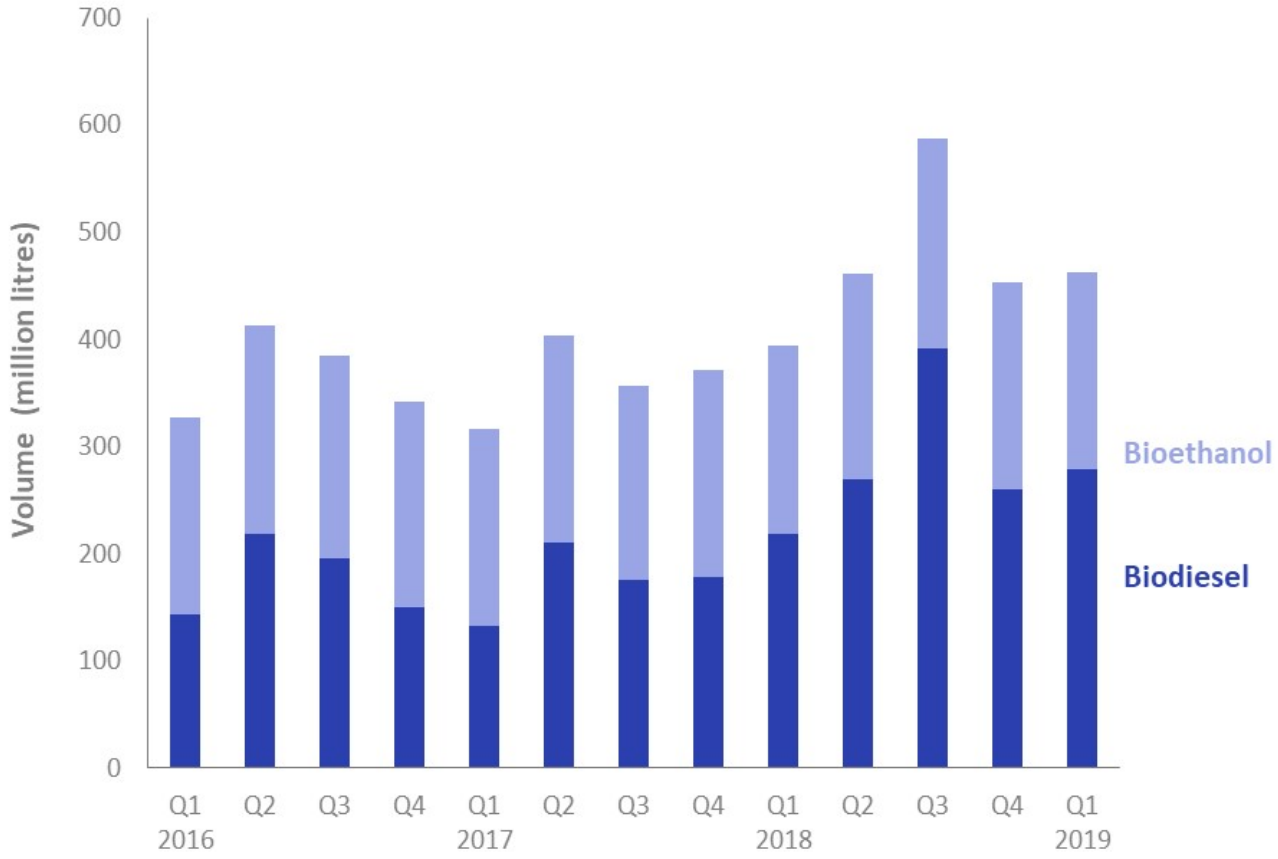
Solar photovoltaics (PVs) represent the majority of both installations and installed capacity confirmed on FiTs, with, respectively, 99 per cent and 81 per cent of the total. The majority of PV installations are sub-4 kW retrofitted schemes, which increased by nearly 19,000 installations (51 MW) during 2019 Q1 to bring the total to around 910,200 (2,600 MW) at the end of 2019 Q1.

Renewable installations confirmed on FiTs (all except MicroCHP) represented nearly 15 per cent of all renewable installed capacity.

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

[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 Q1[5], 462 million litres of liquid biofuels were consumed in transport, an increase of 17 per cent on the total of 395 million litres in 2018 Q1.

Bioethanol consumption increased by 3.5 per cent, from 177 million litres in 2018 Q1 to 183 million litres in 2019 Q1. Biodiesel consumption increased by 28 per cent, from 218 million litres in 2018 Q1 to 279 million litres in 2019 Q1.

Biodiesel represented 60 per cent of biofuels consumption, with bioethanol taking the other 40 per cent.

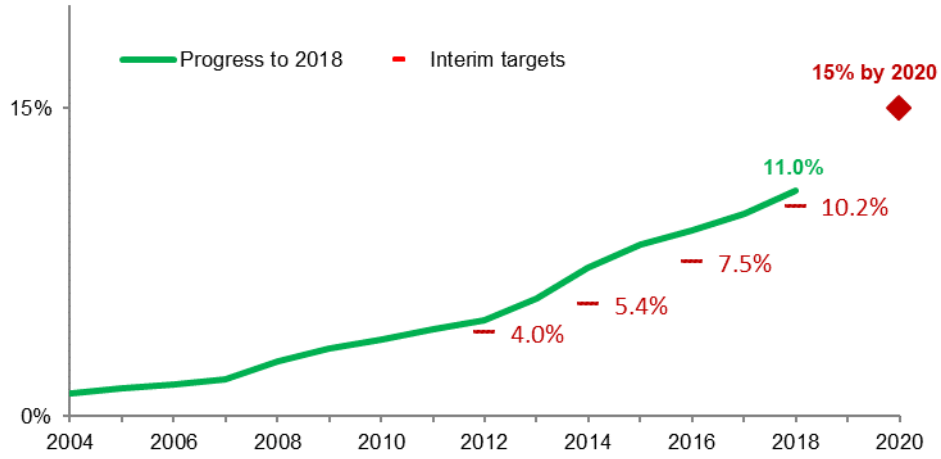
In the first quarter of 2019, bioethanol accounted for 4.5 per cent of motor spirit, down from 4.6 per cent in 2018 Q1. Biodiesel represented 3.7 per cent of diesel (DERV) consumption, an increase on the 3.0 per cent in the first quarter of 2018. Their combined contribution was 4.0 per cent, an increase from 3.6 per cent in the same quarter of 2018.

[5] Data for the latest quarter are provisional, due to unavailability of the last months' data at the time of compilation.

Progress against the Renewable Energy Directive (2009)

- Following the March 2019 edition of Energy Trends, where a first estimate was made for renewable electricity for the year 2018 on a Renewable Energy Directive basis, the below shows overall progress against the Directive split by electricity, heat and transport.
- In 2018, renewable energy provisionally accounted for 11.0 per cent of final energy consumption, as measured using the 2009 Renewable Energy Directive (RED) methodology, an increase of 1.1 percentage points on 2017.
- The UK has met its fourth interim target; averaged across 2017 and 2018, the UK achieved 10.4 per cent renewable energy compared to the 10.2 per cent interim target.
- The chart below shows progress to 2018, interim targets and the final 2020 target (15 per cent);

Progress against Renewable Energy Directive and UK targets



- Renewable electricity accounted for 31.1 per cent of total generation (as measured using the RED methodology), an increase of 3.3 percentage points compared to 2017.
- Renewable heat accounted for 7.3 per cent of total heat consumption, an increase of 0.4 percentage points on 2017.
- Renewable energy for transport accounted for 6.2 per cent of total transport energy, an increase of 1.3 percentage points on 2017.

Change to method of estimating sector demand for oil products

Background

The Department for Business, Energy and Industrial Strategy (BEIS) release data on UK demand for oil in total and by 'sector' of consumption both in Energy Trends[1] and the Digest of UK Energy Statistics (DUKES)[2]. Our data indicate that around two-thirds of oil is consumed for transport purposes, 10 per cent as a feedstock for petrochemical plants and a further seven per cent by the energy industry.

These sectoral estimates rely on sound data. While it is easy to identify the end use of transport fuels, commercial fuels (gas oil, fuel oil and other kerosene) have many uses and the supply chain is complex with oil passing between producers, importers and wholesalers before reaching final consumers. As a result, it is difficult to correctly allocate these fuels to sectors, which currently include industry, the domestic market, public administration, commercial enterprises and agricultural machinery.

The relatively smaller scale, variety and high number of end users of these commercial fuels mean that a direct survey of final consumers would be a disproportionate burden. We needed to find an alternative way to identify the end use of the roughly eight million tonnes a year not captured in our current data framework.

Developing the evidence base for commercial fuel demand

The main survey that underpins estimates of demand by sector is the Downstream Oil Reporting System (DORS), the monthly survey of all substantial suppliers of oil to the UK. A substantial supplier is defined as delivering more than 50 thousand tonnes of key fuels to the UK market in a 12-month period[3]. As a result of the changing market structure, in 2015 this survey was extended to also cover all major importers who were increasingly important in the market. However, this new survey evidence did not provide much further detail on sectoral consumption. The evidence showed that these major suppliers do not tend to supply direct to the end user. Instead around 80 per cent of deliveries are to energy wholesalers who then resell the oil end users, making it difficult for substantial suppliers and BEIS to identify the final use of commercial fuels.

A result of this has been that historically BEIS has taken steps to identify alternative sources of data to inform estimates of demand for each sector. These have included working with trade industry bodies (users of fuel such as the Food and Drinks Association) and direct surveys of trade body members (to understand sectoral consumption of liquid petroleum gas). We have worked with petrochemical companies to better understand demand in that sector and cross-referenced our estimates with data from the EU Emissions Trading Scheme. More recently, since the Purchasers' Inquiry (now the Annual Purchasers' Survey) conducted by the Office for National Statistics (ONS) was re-started in recent years, we have been working closely with ONS to quality assure and improve this data source. However, despite these efforts around 3 million tonnes of total oil have been allocated to 'unclassified' each year.

New improvements to the evidence base and the impact on sector estimates

Given the importance of accurately identifying the end use of oil, development work has been undertaken by BEIS to collect further data. Following a survey of all substantial suppliers in 2018 to

[1] Oil Energy Trends: www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends
[2] www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes
[3] Substantial suppliers are obligated to hold emergency reserves of oil in case of a supply disruption. Further information and a template DORS form can be found here: www.gov.uk/government/publications/emergency-oil-stocking-international-obligations

construct a full customer base, BEIS have used the data to correctly classify deliveries from substantial suppliers that are delivered direct to the end user and have also identified the largest wholesalers of oil in the UK.

We have initiated a data collection from these larger wholesalers, who sell direct to the end user, and preliminary data from this exercise have been used to improve sector demand estimates. The changes to allocations of commercial fuel demand by sector have been implemented in this edition of Energy Trends (June 2019) and will be featured in more granular breakdowns in DUKES, published on 25th July 2019.

The impact on sectoral allocations can be seen in Table 1, which shows the volume changes (new data minus previously published estimates) in Energy Trends Table 3.4[1]. We have been able to re-apportion volumes from Industry (Unclassified) to the commercial, public administration and agricultural sectors. In Energy Trends Table 3.4 the unclassified volumes are counted under 'Other industries' and the commercial, public administration and agricultural sectors are counted under 'Other final users'.

Table 1: Volume changes in commercial fuel sector allocations between previously published and newly published Energy Trends Table 3.4

	Gas oil			Fuel oil			Burning oil		
	2016	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
Other industries	-293	-208	-514	-8	-251	28	-1,258	-1,282	-1,251
Domestic	16	17	-3	-	-	-5	-54	-206	-175
Other final users	285	287	224	-8	-45	73	1,310	1,326	1,255

th. tonnes

The fuel most affected by the improvement work is burning oil, where approximately 1.2 million tonnes has been moved out of unclassified and into 'Other final users'. Burning oil, or other kerosene, is a multi-purpose product that can be used for heating or to fuel generators, among other uses. Historical estimates indicated that 60 per cent of consumption was used in the domestic sector, with the remaining 40 per cent in industry, predominantly in unclassified. Our new data sources provide confirmation that that around 60 per cent is used in the domestic sector, but there is evidence for demand in other sectors apart from industry.

As a result of this new evidence, we have reduced the three to four million tonnes reported as 'unclassified' to just over one million tonnes.

Next steps

The revisions to sector estimates are considered by BEIS to be provisional because they are not based on a complete sample of resellers. Going forward, we will be working closely with wholesalers and considering appropriate legal and other gateways for data collection as we move forward in this iterative process. An important legal gateway in this regard is the proposed legislation to mandate further data collection from all elements in the oil change. This has been recently subject to consultation (www.gov.uk/government/consultations/downstream-oil-supply-resilience).

Our intention is to be able to provide greater confidence in these data now, but also be able to provide greater confidence through further revisions to the back-series for the 2020 edition of DUKES.

As ever, we welcome comments on these changes.

Natalie Cartwright
Head of Oil & Gas Statistics
Tel: 0300 068 5260
E-mail: Oil&Gas.Statistics@beis.gov.uk

Experimental statistics on whole UK energy flow incorporating end use energy efficiency

Introduction

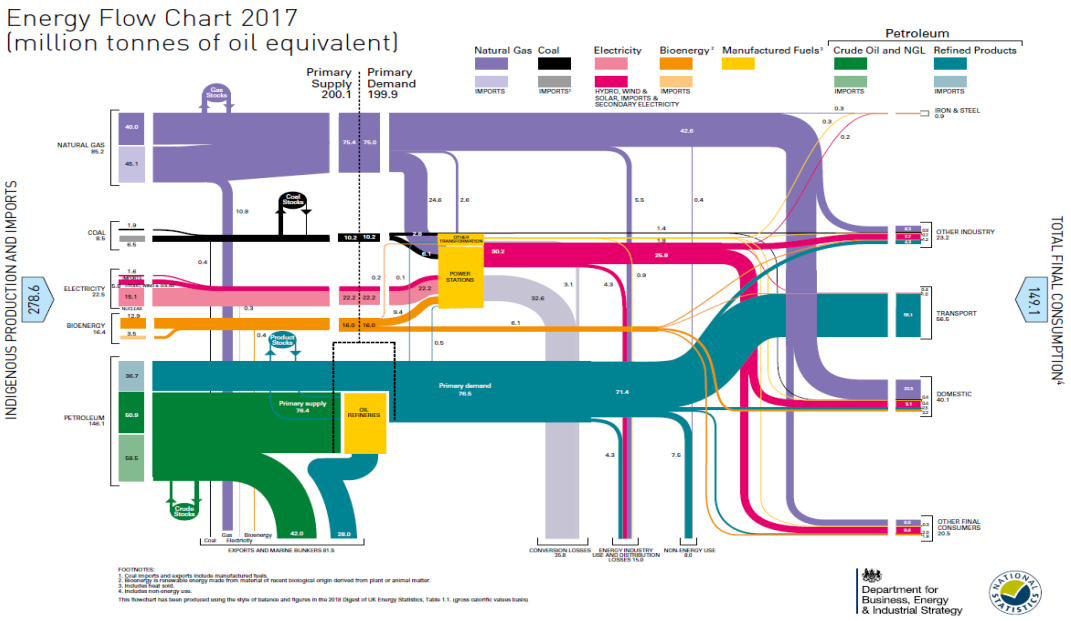
BEIS have published energy flow charts ('Sankey' diagrams) for over 40 years, most notably in the Digest of UK Energy Statistics[1] (DUKES). These provide a pictorial overview of the whole UK energy system, from supply through to consumption. The production of these charts is now common practice internationally, including International Energy Agency and Eurostat.

Currently, nearly all charts in use worldwide do not take account of the energy efficiency once the energy has been delivered into consumption. A notable exception to this is the work carried out by the Lawrence Livermore National Laboratory (LLNL)[2] for the US which refocuses the flowchart to consider energy efficiency and not simply consumption. This article uses a similar methodology and assumption base to apply to the UK's domestic consumption. These are the first steps towards expanding the pictorial representation of energy efficiency in the UK, therefore feedback is welcomed.

Why are we doing this? Energy efficiency is energy saved

The existing energy flow charts published in DUKES provide information on energy supply through to energy consumption. As shown in Figure 1, supply (on the left) comes from production and imports. The supply for each fuel then flows to electricity generation, oil refineries, exports and marine bunkers, final consumption or stocks. This flow chart accounts for losses in energy transformation processes with conversion losses, 35 million tonnes of oil equivalent (mtoe), shown at the bottom of the chart.

Figure 1: UK Energy flow chart, 2017



However, with these charts only losses in energy transformations are shown. What is not shown are the losses in end use consumption, be that as lighting, heating, or transport. Energy consumption can be reduced by consuming less energy (which can be assessed

[1] www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes
[2] LLNL 2017 US Flow Chart: https://flowcharts.llnl.gov/content/assets/images/energy/us/Energy_US_2017.png
LLNL Report on Residential Energy Use: https://e-reports-ext.llnl.gov/pdf/550009.pdf

through the usual Sankey diagrams in DUKES) but it can also be reduced by using the end-use energy more efficiently. The current flow charts do not document this. To explore this idea, the concepts of "useful" and "rejected" energy are introduced, where "useful" energy services the intended purpose of an appliance and all other energy is "rejected".

Definitions: "Useful" and "Rejected" Energy

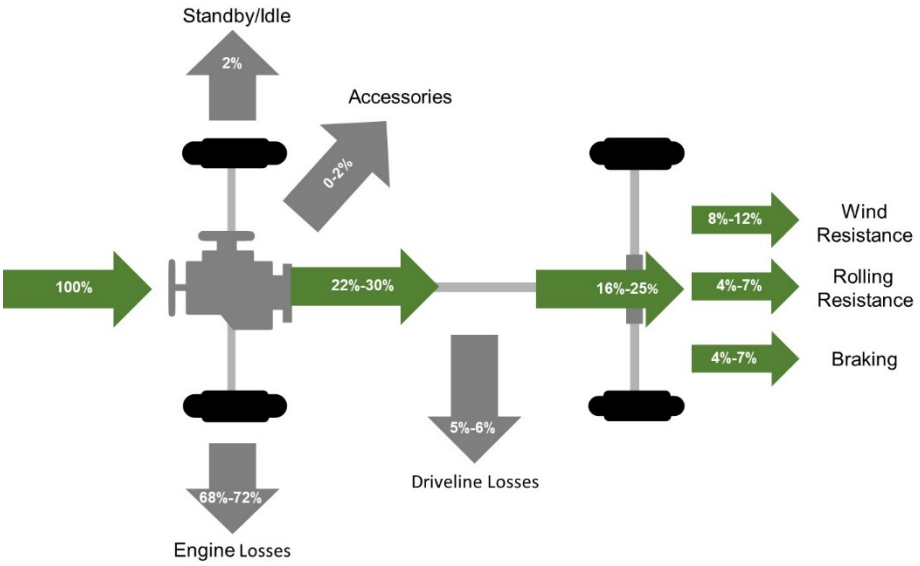
Useful energy: energy which services the intended purpose of an appliance
Rejected energy: all remaining energy which is not "useful" and does not service the intended purpose of the appliance is considered "rejected"

Limitations of the analysis:

- **Efficiencies are at appliance level** and do not account for, for example, energy loss as a result of heat loss through walls
- Heat energy is considered to be "rejected" if heating is not the intended purpose of the appliance. For example, heat from a light bulb is "rejected", despite the fact that in winter the energy would be useful heat. This analysis does not scale to this level of complexity.
- The efficiencies used in this analysis come from a variety of sources and the quality of these data will change and improve over time.

To illustrate the concept, Figure 2 shows the typical flow of energy used and lost in the process of moving a petrol-powered Internal Combustion Engine (ICE) car[3].

Figure 2: Energy losses in an internal combustion engine (ICE) car[4]



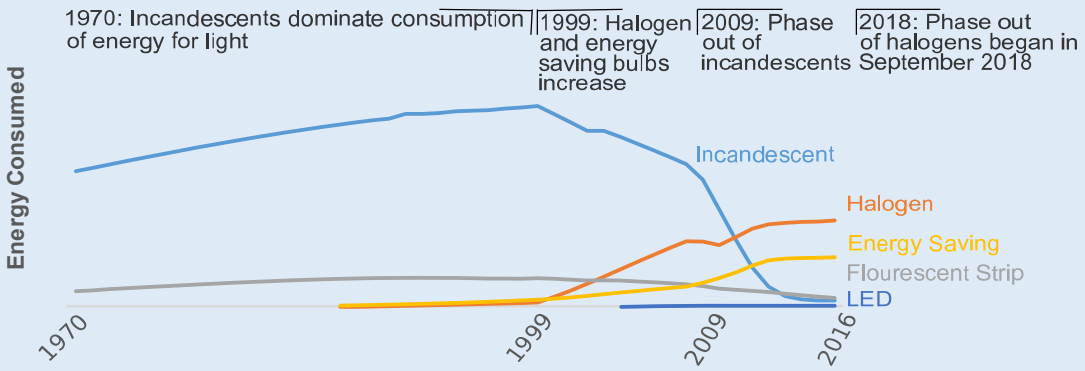
Not every unit of energy going into a car is used to move the car. For each unit of energy, (e.g. a litre of petrol/diesel), nearly two thirds are lost to engine friction, engine-pumping losses and waste heat; a sixth is lost to idling; and only one eighth is used to move the vehicle, with the remainder lost to driving friction and accessory use. Despite regular vehicle improvements most of the energy is not used for forward momentum and is 'rejected'.

[3] Efficiencies differ depending on vehicle specification. For example, diesel-powered vehicles can achieve a greater engine efficiency and air resistance is dependent on the shape of a vehicle.
[4] Figures sourced from: www.fueleconomy.gov/feg/atv.shtml. Note that this example is for illustrative purposes only and that this efficiency differs from the 21% used for petrol/DERV cars in this project's methodology.

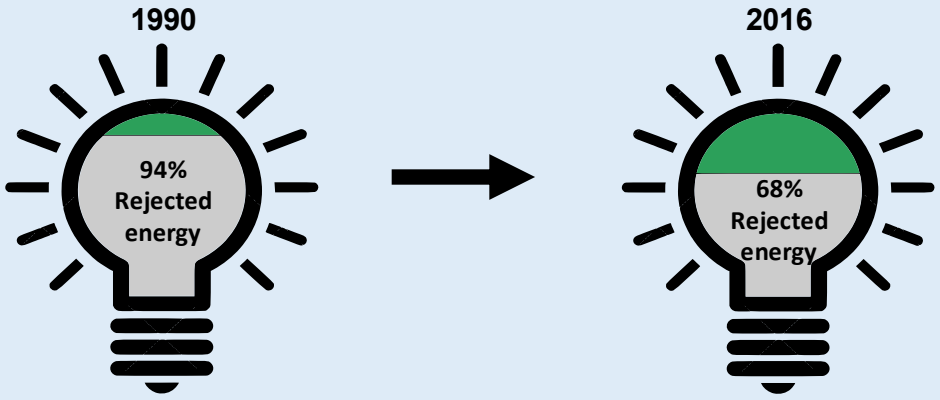
A similar situation exists for industrial and home appliances. For example, lights release heat energy as well as light energy. This heat energy is not serving the appliance's intended and primary purpose and is therefore lost, or "rejected" and only light energy is considered "useful".

Case Study: Lightbulbs

Chart B1: Evolution of energy consumed for light by bulb type



As of 1999, consumption from incandescent bulbs began to decline, displaced by halogen and energy saving bulbs. The phase out in 2009 increased the rate of decline pushing incandescent consumption towards zero in 2016. As of September 2018, halogens will be phased out and will likely be replaced by energy saving bulbs and LEDs driving down consumption and 'rejected' energy for lighting due to their higher efficiencies.



From 1990 to 2016, a change in bulb types used to light buildings and homes in the UK has resulted in a reduction in rejected energy for lighting, from 94% to 68%.

Given the potential savings through greater energy efficiency, a pictorial representation of how "useful" and "rejected" energy offers further insight into the energy consumption and can identify where the greatest potential savings can be made.

Method

The method adopted for this project uses two main pieces of data: energy consumption and appliance efficiencies. For each appliance, the consumption is multiplied by its respective efficiency to calculate "useful" energy and the remaining consumed energy is considered "rejected". The data for UK energy consumption were sourced from the 2018 DUKES and Energy Consumption in the UK (ECUK) publications, which report on 2017 figures. The data for end use energy efficiencies is collected from a range of sources which are detailed in the

supporting workbook at: www.gov.uk/government/publications/energy-trends-june-2019-special-feature-article-experimental-statistics-on-whole-uk-energy-flow-incorporating-end-use-energy-efficiency, along with rationales for using these efficiencies. A range of sources have been used due to the varying levels of detail and data availability in each. All the efficiencies used for transport, and some for domestic, have been sourced from LLNL's Energy Flow Charts[5] publication for the US. For industry, the sub-sector efficiencies have been sourced from the US Office of Energy Efficiency & Renewable Energy[6]. The remaining efficiencies have been sourced through a combination of BEIS' internal assumptions and product policy data, along with desktop research for some efficiencies at lower and more detailed levels of disaggregation. These data facilitate users to gain insights on end use energy efficiencies.

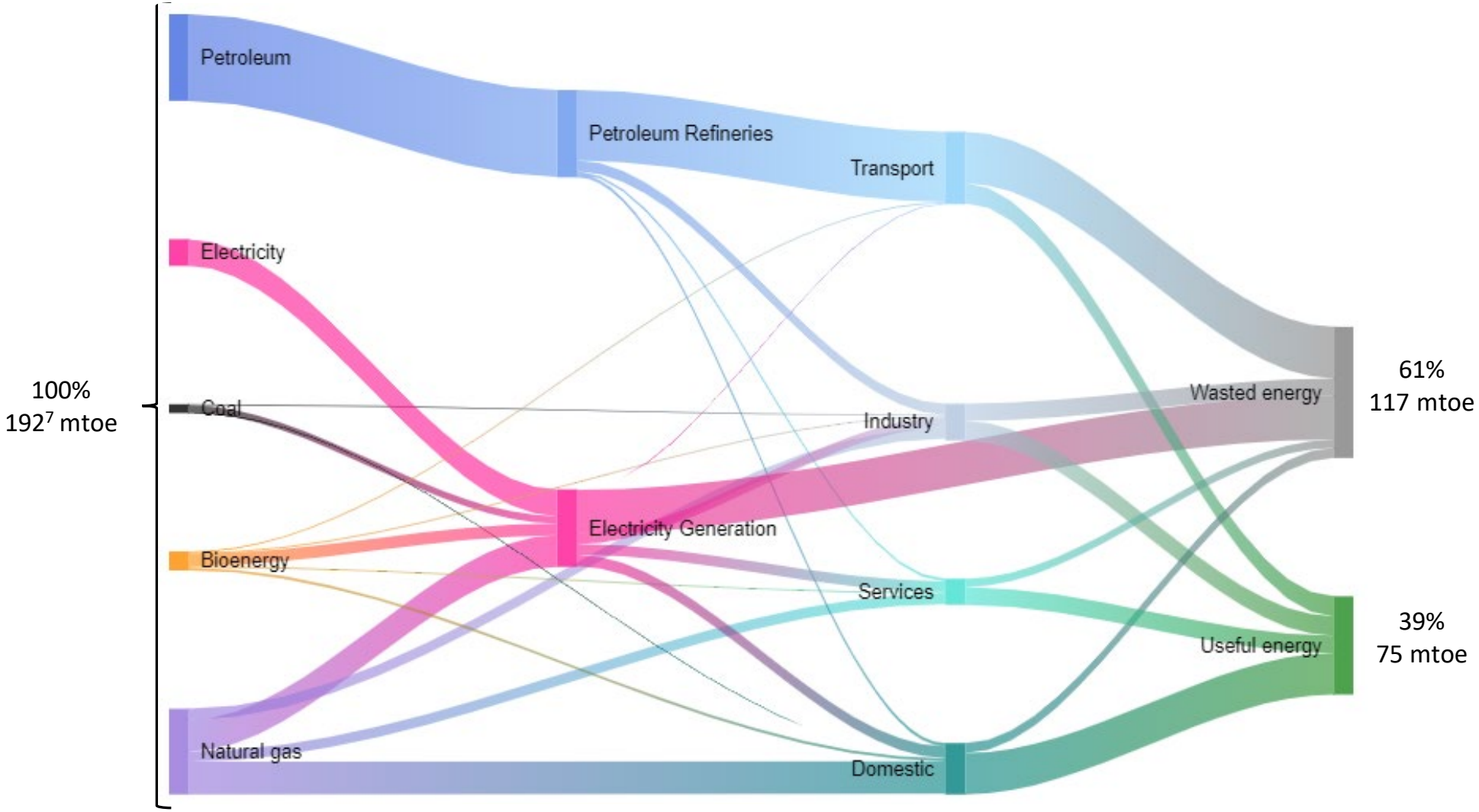
The flowchart

Figure 3 presents a simplified UK energy flow chart with the inclusion of "useful" and "rejected" energy. The chart illustrates energy flows from primary fuel on the left, through energy transformations and finally to end use on the right. End use by sector is split into "useful" and "rejected" energy as can be seen on the far right. Broadly, from an input of 192[7] mtoe, the energy is split between 'useful' and 'rejected' energy approximately 39 per cent to 61 per cent.[8]

The Excel worksheets published alongside this article enable users to alter energy efficiencies and consumption to understand how the balance between "useful" and "rejected" energy can change, and the impact it has on the bigger picture. These alterations will aggregate and feed into the summary table and chart. Users may wish to put in their own efficiency factors which incorporates losses in the fabric of buildings.

[5] Transport: https://e-reports-ext.llnl.gov/pdf/537889.pdf
Domestic: https://e-reports-ext.llnl.gov/pdf/550009.pdf
[6] www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2010-mecs
[7] The input figure is sourced from the UK Energy Balance published in DUKES. Fuel consumption for non-energy purposes have been excluded from this analysis (e.g. The petro-chemical industry uses hydrocarbon fuels as feedstock for the manufacture of its products). This figure is equal to primary supply subtract non-energy use.
[8] Note that in this analysis electric boilers have an assumed efficiency of 100% compared to 84% for gas. Taking into consideration the efficiency of the electricity generation process of roughly 40%, this would then imply that gas boilers are more efficient if electricity was supplied from the grid. However, if the electricity was to be fully supplied by solar PV, this would then imply that the electric boiler is more efficient.

Figure 3: Energy flow chart with final "useful" and "rejected" end use energy

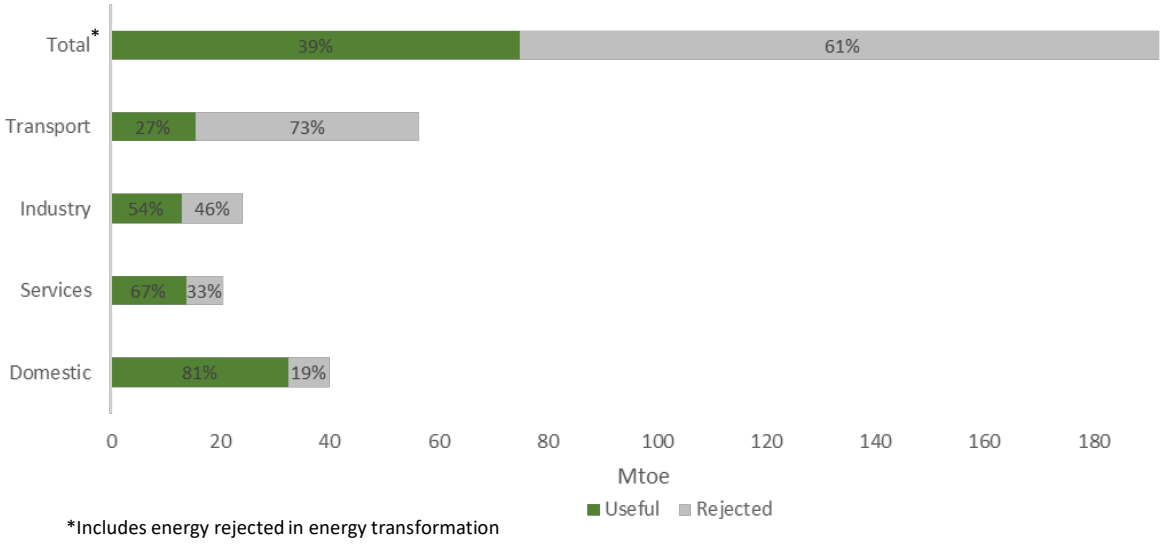


Differences in energy efficiency rates between sectors

The results show substantial variation between sectors. Based on the data assembled here, 81% of end use energy in the domestic sector is "useful" and 19% "rejected". This is followed by services, industry and transport with 68%, 53% and 27% of "useful" energy, respectively. Overall, an estimated 39% of end use energy in the UK was "useful" in 2017.

Figure 4 presents proportions of "useful" and "rejected" energy by sector as well as the energy values in million tonnes of oil equivalent (mtoe) for each sector.

Figure 4: "Useful" and "rejected" energy proportions by sector, 2017



The principal difference in efficiency between sectors is very closely related to the fuel mix entering the sector. The greatest amount of "rejected" energy is from transport, where the "rejected" energy for petrol and diesel cars alone accounts for over 20 mtoe annually. Putting this into perspective, total industrial consumption in 2017 was 24 mtoe, of which 13 mtoe was "useful".

International comparisons

Figure 5 provides a UK-US comparison at sectoral level. Note that the US domestic and transport figures use 2005 efficiency assumptions therefore a cautious approach is advised when drawing conclusions from these tables. Due to limited research in this area to date, this is the best international benchmark to compare with, but caution should be used as energy efficiency rates will have changed over time.

Figure 5: UK-US end use energy efficiency comparison

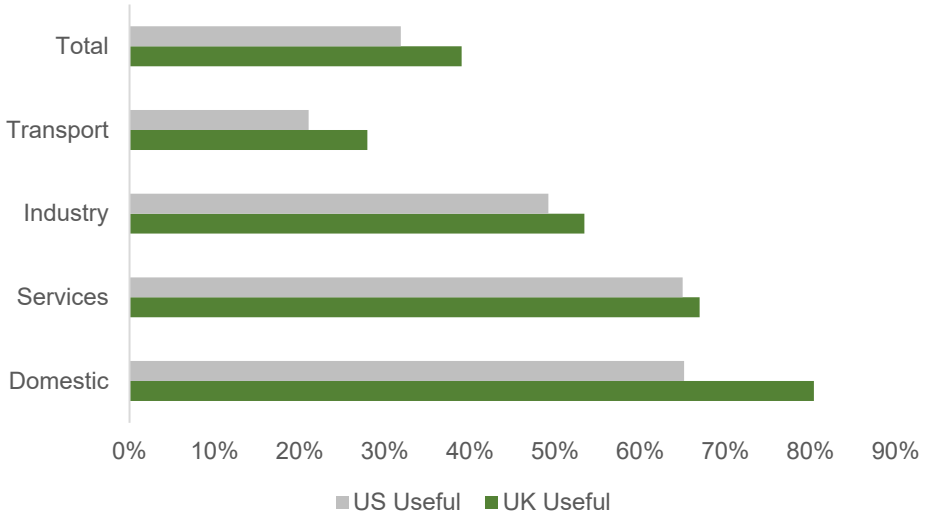


Figure 5 shows that, overall, the UK has a higher proportion of useful energy (39%) when compared with the US (32%). This can broadly be attributed to differences in the domestic and transports sectors:

- Domestic – The UK's "useful" energy proportion is 15 percentage points greater than that of the US which can largely be attributed to differences in boiler efficiency assumptions for space heating (UK – 84% and US – 77%)
- Transport – The UK has a higher proportion of energy used by air and HGV, compared to the US, which have higher efficiencies than cars and LGV. Therefore, the UK has a higher proportion of energy consumption used in higher efficient vehicles, result in an overall greater "useful" energy.

Concluding comment: these are first steps towards an energy efficiency flowchart

To date, BEIS' statistical description of energy has concentrated on supply and demand with little attention given to the efficiency of how energy is consumed. More efficient consumption requires less energy, is cheaper, and reduces greenhouse gas emissions other factors remaining equal.

However, the data presented here are very much a first step, using reliable secure consumption data put against a range of efficiencies which will change over time and will need refinement and improvement.

The data supporting this analysis has been published alongside and can be found at: www.gov.uk/government/publications/energy-trends-june-2019-special-feature-article-experimental-statistics-on-whole-uk-energy-flow-incorporating-end-use-energy-efficiency. The Excel worksheets enable users to alter energy efficiencies and consumption to understand how the balance between "useful" and "rejected" energy can change, and the impact it has on the bigger picture. These alterations will aggregate and feed into the summary table and chart.

As these are the first steps towards expanding the pictorial representation of energy efficiency in the UK, comments are welcome.

Rebecca Cavanagh
BEIS Energy Statistics Team
Tel: 020 7215 4673
E-mail: rebecca.cavanagh@beis.gov.uk

Andrew Smith
BEIS Energy Statistics Team
Tel: 020 7215 5475
E-mail: andrew.smith3@beis.gov.uk

Road fuel consumption and the UK motor vehicle fleet

Key points

In the UK, road transport accounts for more than half of oil demand in the UK and relies on petrol and diesel to meet around 98 per cent of its energy needs. Demand is met through a combination of production and imports; the UK is a net importer of diesel but a net exporter of petrol.

Historically, consumption of petrol was greater than diesel until the end of 2004, which marked a period of crossover. Demand for petrol had until very recently decreased each year since 2000, whereas demand for diesel has increased in 17 of the last 19 years.

The number of diesel-fuelled vehicles has nearly trebled between 2001 and 2018, primarily because of an increase in the number of diesel-fuelled cars and LGVs. In the same period the number of petrol vehicles has decreased by 14 per cent.

Diesel has accounted for around two-thirds of road fuel consumption since 2014, but in a recent reversal of the trend of growth, diesel consumption excluding biodiesel fell in 2018 for the first time since 2009. This is partly a result of slowing growth in the diesel vehicle fleet following sharp drops in new registrations as well as increased efficiencies.

The UK will remain reliant on imports to meet road diesel demand in the near to mid-term future but will diversify propulsion methods of road transport including Electric and Ultra Low Emissions Vehicles over the next few decades.

Background

This article draws together data on road fuel consumption from the Department of Business, Energy and Industrial Strategy's Energy Trends and DUKES publications, along with vehicle data from the Department of Transport (DfT) to explore trends in and between the size and composition of the vehicle fleet, miles travelled, and demand for road fuels.

More than half of oil is consumed for road transport purposes in the UK, amounting to just over 36 million tonnes in 2018[1]. Overall demand for road fuel has been generally stable since 2001, however within this there are distinct patterns for petrol and diesel consumption. Demand for petrol has reduced by 40 per cent whereas demand for diesel has increased by 60 per cent since 2001. The size and mix of the UK car fleet, in addition to changes in fuel efficiency and miles travelled are the primary factors influencing demand for fuels.

Historic supply and demand of road fuels

Consumption of imported oil products took off in 1945, rising steadily until the 1973-4 oil supply crisis. Imports were gradually replaced with indigenous production of crude oils following the major discoveries in the North Sea at that time. UK refineries, generally built in the 1960s, peaked at 23 in operation by 1970 and were built to meet post-war demand for fuels that catered for a recovering economy, including increasing (generally petrol) car ownership and fuel oil for power generation.

[1] DUKES Table 1.1-1.3, Aggregate Energy Balances (Chapter 1): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729420/DUKES_1.1-1.3.xls

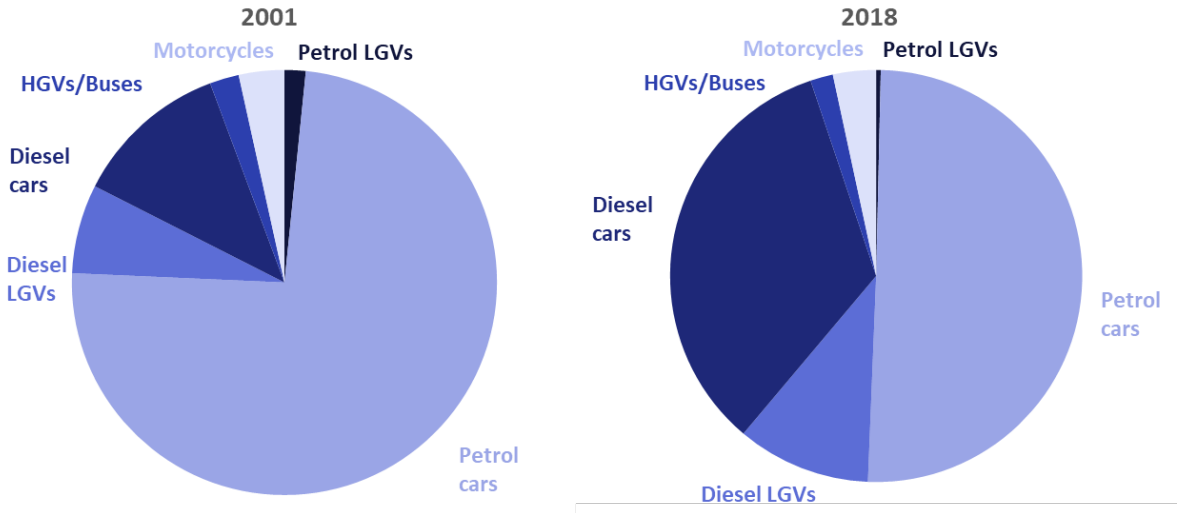
Over recent decades passenger modes of transport have changed dramatically, with more than 80 per cent of journeys completed in cars, vans and taxis in 2017 compared to just 27 per cent in 1952[2]. Road travel has trebled since 1952, and by 2017 stood at 718 billion passenger kilometres.

A growing and changing UK motor vehicle fleet

Reflecting the increasing distances travelled by motor vehicle, the size of the UK vehicle fleet has increased nearly every year since the end of WW2, and by 2018 had grown by more than a quarter compared to the end of 2001 and now stands at 39.4 million vehicles[3].

However, within the overall increase there are distinct patterns for petrol and diesel vehicles. Diesel vehicles have more than doubled on 2001 to 18.9 million, whilst petrol-fuelled vehicles have decreased 15 per cent to 19.3 million[3].

Chart 1: The UK motor vehicle fleet 2001 and 2018



Source: DfT Vehicle statistics (https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01)

Of note are the increases in the number of diesel-fuelled cars and Light Goods Vehicles (LGVs), or vans. This increasing share of the fleet was at the expense of petrol cars and vans, which in 2018 comprised less than half of the fleet compared to nearly three-quarters in 2001. The proportion of the fleet that is motorcycles and Heavy Goods Vehicles (HGVs) has remained relatively constant.

The composition of the fleet is affected by government policy and new registrations. We can consider the effect of these factors to explain the shift from petrol to diesel vehicles between 2001 and 2018.

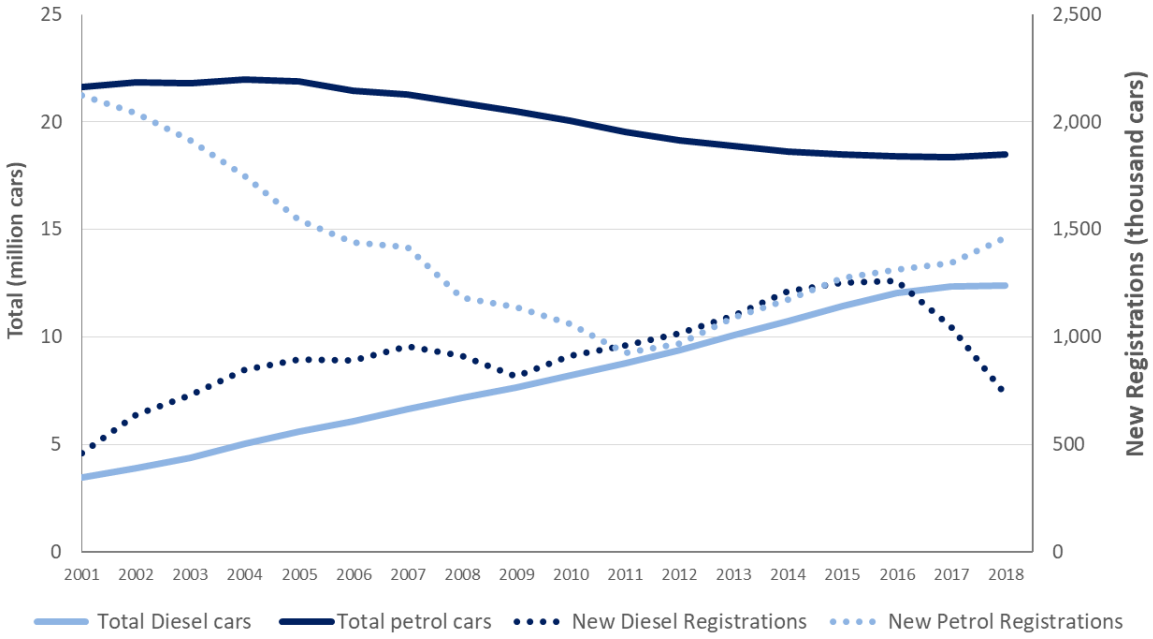
Cars and Vans

In 2001 when petrol vehicles formed 79 per cent of the fleet (Chart 1), a reduction in excise duty was introduced for vehicles with lower emissions of carbon dioxide. Diesel vehicles therefore became cheaper because they tend to be more efficient than their petrol equivalents, meaning they emit less carbon dioxide. The immediate impact was felt in a 38 per cent increase in the number of new diesel registrations in 2002[4] (Chart 2).

[2] Table TSGB0101, Passenger transport: by mode, annual from 1952; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/762074/tsgb0101.ods
[3] DfT Vehicle statistics: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01
[4] Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics)

A further policy, the Vehicle Scrappage Scheme for cars and vans, helped to boost registrations between May 2009 and April 2010 following the dip in new registrations during the 2008 recession (Chart 2). The scheme encouraged motorists to scrap their older models in favour of purchasing newer more environmentally friendly vehicles. At the time it was still considered that diesel engines emitted fewer pollutants because of their fuel-efficiency, and it can be seen from Chart 2 that subsequently diesel car registrations exceeded those of petrol cars for the first time in 2011.

Chart 2: New car registrations and size of the car fleet, 2001 to 2018



Source: DfT Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics)

These policies combined to encourage motorists to scrap their old car or van in favour of purchasing a new one, and to choose a diesel-fuelled engine when doing so. However, it has since become known that diesel engines emit nitrogen dioxide and particulates more heavily than petrol engines. The announcement in the Autumn 2017 Budget that diesel vehicles that did not meet new emissions testing criteria would be taxed more heavily was followed by a sharp fall in new registrations of diesel vehicles, down by nearly one-fifth in 2017 and nearly one-third in 2018 (Chart 2).

The fall in new diesel registrations has slowed the growth of the diesel car fleet, with a move towards increasing purchases of petrol cars. In 2018, the number of petrol cars increased for the first time since 2004 while growth of the diesel car fleet fell to its lowest in the past two decades.

A similar trend can be seen in the LGV, or van, fleet. Vans consistently form around 10 per cent of the total vehicle fleet and in 2001 around a fifth were petrol-fuelled; this had fallen to three per cent in 2018 (Chart 1). This was likely a result of efficiency improvements in diesel engines in addition to the 2001 budget, which introduced a new system of vehicle tax to make it cheaper for vehicles with lower emissions of carbon dioxide, resulting in lower VED rates for diesel vehicles.

Other vehicles

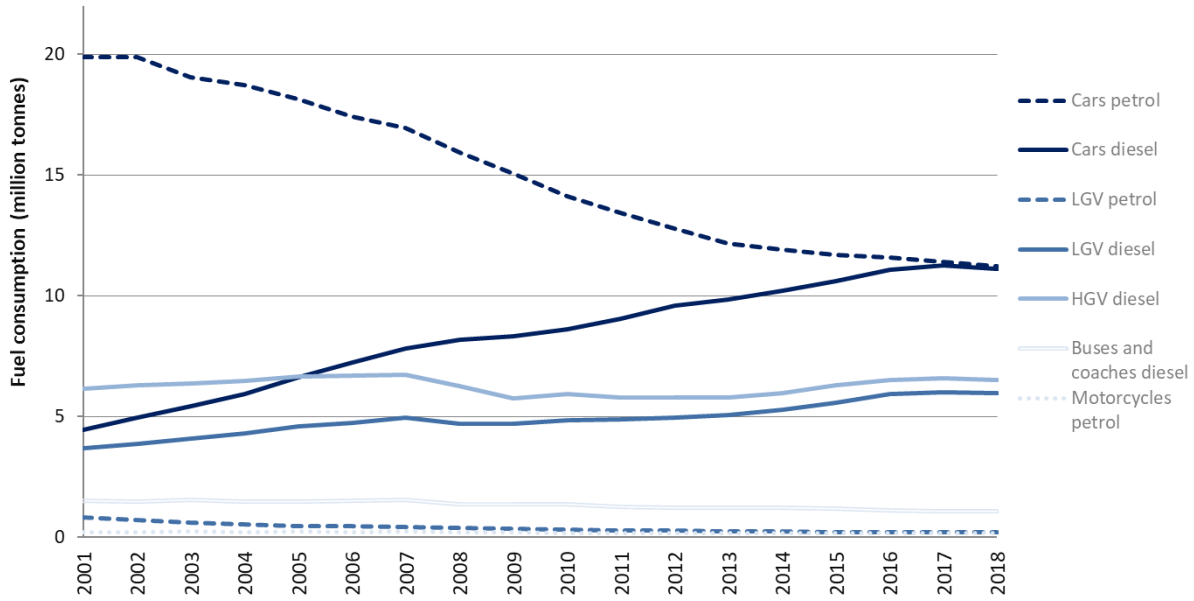
Numbers of buses, coaches and HGVs, which use exclusively diesel owing to the amount of torque which can be generated at lower speeds and their fuel efficiency, have remained relatively constant since 2001. Almost all motorcycles consume petrol owing to diesel engines having a high compression ratio which requires a stronger, sturdier and thus heavier engine. Motorcycles in the UK have increased by around 28 per cent to 1.2 million since 2001.

Changing patterns in road fuel demand

Total demand for road fuels been relatively stable over the last two decades at an average 37 million tonnes, except for a slight downturn in 2008 during a period of economic recession (covered in more detail under section 'Miles travelled'). Overall demand has grown by 2.3 per cent, but within this the rise in the number of diesel-powered vehicles means that diesel demand has increased by 60 per cent to reach 25.6 million tonnes and the decline in the number of petrol vehicles has resulted in a reduction of demand by 40 per cent to reach 12.2 million tonnes.

Given that cars and vans comprise more than 90 per cent of the UK vehicle fleet, changes to the numbers of these vehicles unsurprisingly affects the demand for fuel types (Chart 3).

Chart 3: Fuel consumption by vehicle type



Source: BEIS DUKES Table 3B, Estimated consumption of road transport fuels by vehicle class;
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/729403/Ch3.pdf

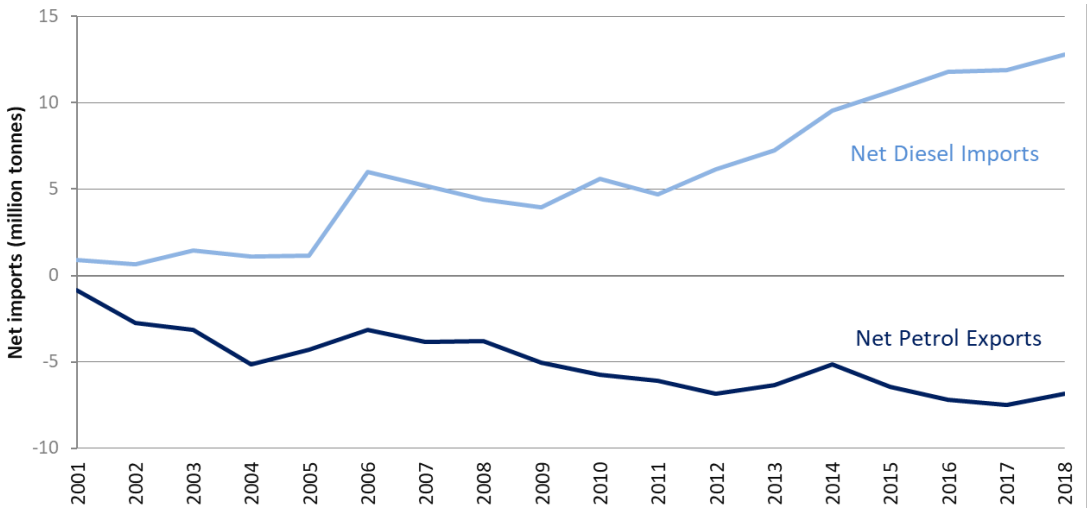
The switch to diesel by almost all the LGV fleet has driven an increase in demand for diesel of two-thirds. Conversely, demand for petrol by LGVs fell by three-quarters and now stands at only 0.2 million tonnes. Demand by HGVs and buses has remained relatively stable, aside from the downturn in 2008 during the recession.

Changing patterns of road fuel supply

Road fuel demand in the UK is met by a combination of imports and indigenous production from UK refineries. The UK has some of the largest refineries, and one of the largest total refining capacities in the EU but changing demand for different fuels has led to a shortfall in certain products from UK refineries. Global prices have led to downward pressure on refinery margins; the refining sector has been rationalised to six major refineries and two smaller refineries, following the closure of the Coryton refinery in 2012 and Milford Haven in 2014. Refinery production of both petrol and diesel has decreased by almost a quarter since 2001, meaning that the UK has become increasingly reliant on imports to meet demand.

Investment in UK import capacity has been strong, and the UK is a net importer of diesel (Chart 4). Diesel imports have nearly trebled between 2005 and 2018, with nearly half coming from EU member countries[5]. This meant that by 2018, 59 per cent of demand was met by imports compared to 16 per cent in 2005.

Chart 4: Net trade of road fuels



Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)

With regards to petrol, UK refinery output has outstripped petrol demand despite falling demand, leading to a surplus of petrol. As such, the UK is a net exporter of this fuel (Chart 4). Exports have more than doubled since 2001[6] and petrol exports comprise almost a half of all product exports, particularly to countries such as the United States, Netherlands and Belgium.

A key dissociation since the end of 2001 has been the increase in road fuel demand by 2.3 per cent despite the substantially larger increase in the total fleet size by more than a quarter. This could be due to the combination of changes to road fuel prices, miles travelled, and efficiencies.

Prices

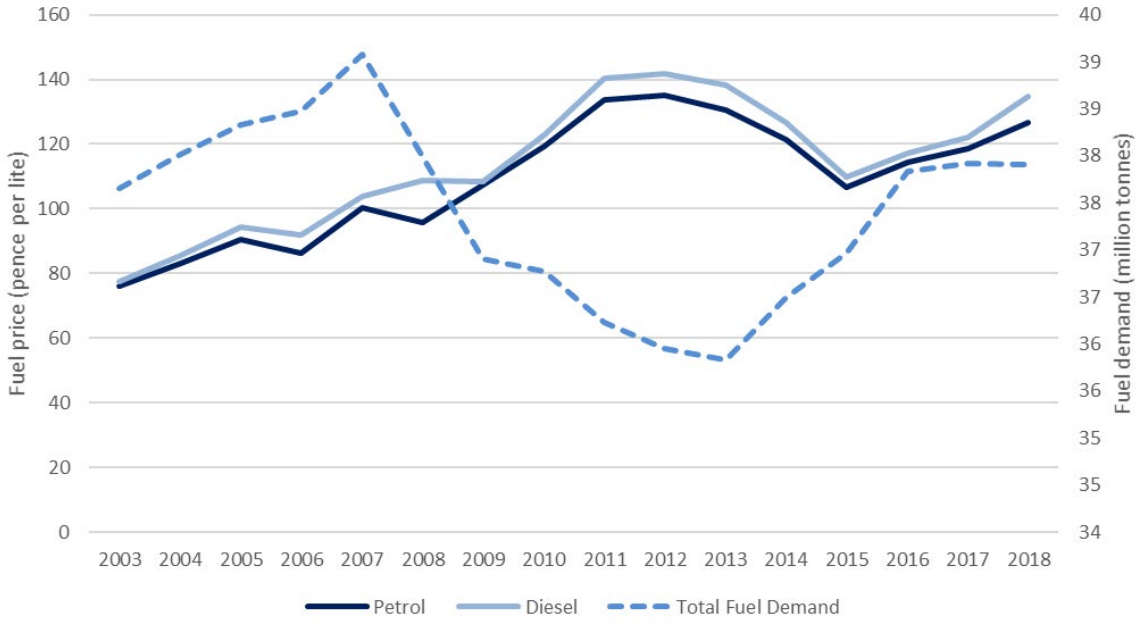
The price of road fuels tends to be correlated with global crude oil prices, and as such major disruptions to global supply dictate UK prices. The price of diesel per litre increased by two-thirds and petrol by three-quarters between the end of 2003 and 2018[7], but the trend is complicated by the impact of the 2008 recession on demand. Demand for fuel fell in 2008, and prices continued to increase until 2013. Chart 5 shows that there is some relationship between changes to prices and demand, but the direction of causation cannot be inferred; it is possible that either higher prices mean people travelled less in their cars, or that prices were higher because demand was reduced by other factors (exploration of which is outside the scope of this article).

A slight widening can be seen between diesel and petrol prices in 2018. Diesel had cost roughly 2 to 3 pence per litre more than petrol since 2015, but towards the end of 2018 the differential widened to see diesel being approximately 8 pence per litre more expensive. This was because supermarket forecourts competed to reduce petrol prices to draw in customers towards the end of 2018.

[5] DUKES Table 3.9, Imports of crude oil & petroleum products by country of origin: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/728478/DUKES_3.9.xls
[6] Energy Trends: https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends
[7] BEIS weekly road fuel prices: https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-weekly-statistics

In 2018, supermarkets (Asda, Morrisons, Sainsbury's and Tesco) provided 47 per cent of all petrol, and 30 per cent of diesel.

Chart 5: Fuel price and road fuel demand



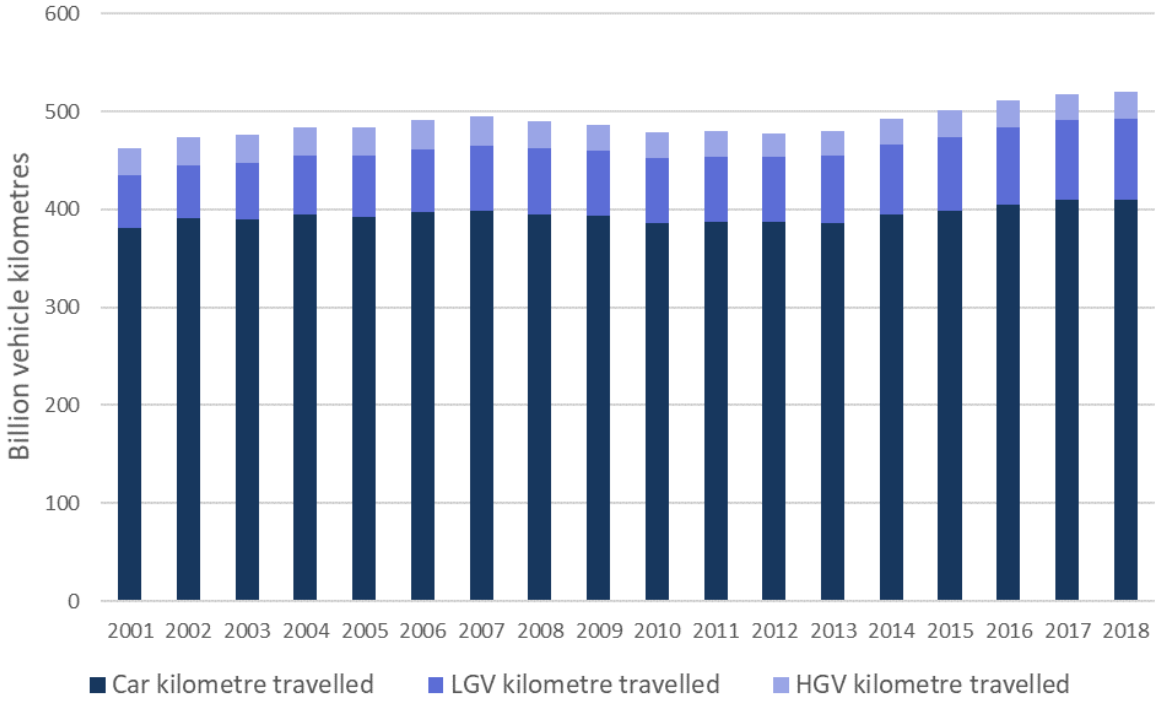
Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)
DfT Road traffic statistics: (https://www.gov.uk/government/collections/road-traffic-statistics)

Miles travelled

Vehicle distance travelled by all road vehicles has increased by 12 per cent since 2001. The main contributors have been an increase of 29.2 and 28.6 billion kilometres in annual distance travelled for cars and LGVs respectively, with LGVs increasing their annual distance driven by over a half.

The effect of the recession can be seen between 2008 and 2010, during which time distances travelled by all vehicles fell. This indicates that both discretionary and business travel fell.

Chart 6: Road traffic journey distances



Source: DfT Road Traffic statistics (https://www.gov.uk/government/collections/road-traffic-statistics)

Efficiencies

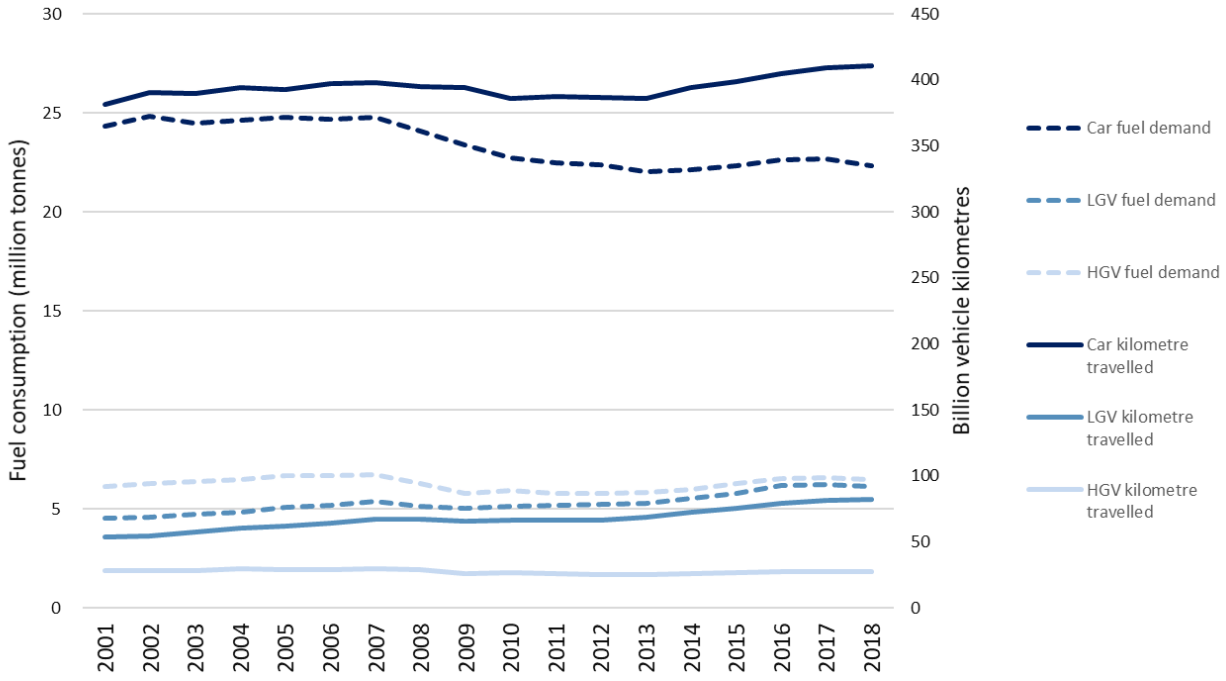
The relatively small increase in road fuel demand between 2001 and 2018 compared to the increase in the vehicle fleet by a quarter cannot be explained by miles travelled because this also increased by 12 per cent in the same period. Specifically, for car travel, demand for both road fuels has decreased by 8.2 per cent, while distance travelled has increased 7.7 per cent in line with an increase to the car fleet of more a quarter.

Energy intensity is the amount of fuel required for a kilometre of distance travelled. Distance travelled and fuel demand are not perfectly correlated because of changes to the efficiency of engines and vehicle design. The energy intensity of car travel has decreased as cars are able to travel further with less fuel (Chart 7).

Data available for cars shows that average miles per gallon achieved in new petrol cars has increased substantially since 2001[8]. New diesel cars are on average 34 per cent more efficient and able to achieve 61 miles per gallon, while new petrol cars increased in efficiency by 44 per cent and can attain 52 miles per gallon in 2018. There have been some efficiency improvements to specific types of HGVs[8], most notable an 8.7 per cent increase in miles per gallon achieved by HGVs between 3.5 and 7.5 tonnes between 2015 and 2016. However, real world efficiencies will further depend on driving conditions and styles.

[8] DfT Energy and Environment statistics (https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env)

Chart 7: Energy intensity of cars, LGVs and HGVs



Source: DUKES Table 3B: https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes
DfT Road traffic statistics (https://www.gov.uk/government/collections/road-traffic-statistics)

Outlook for demand and supply of fossil road fuels in the UK

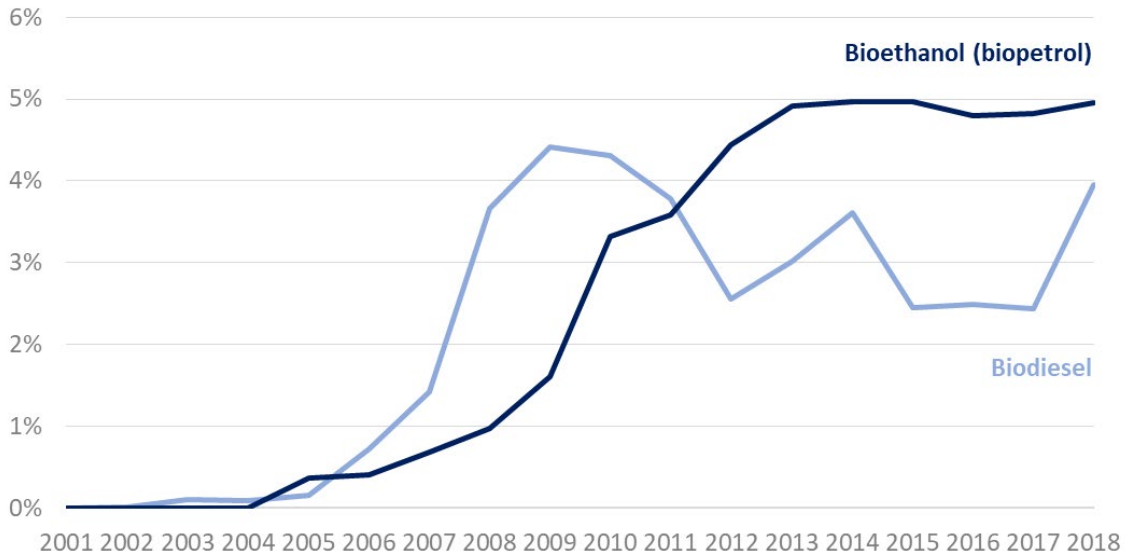
In the immediate to medium-term future the UK will continue to be reliant on imports to meet road diesel demand. In the period from 1999 to 2018, UK refinery production has fallen by a quarter (4.0 million tonnes) following closures and rationalisation in the sector in the last 10 years. In the same period demand has increased by 10 million tonnes to reach 25.6 million tonnes in 2018, with imports more than quadrupling from 3.4 million tonnes in 1999 to 14.4 million tonnes in 2018.

The story is very different for petrol. While production has fallen by a third, demand has fallen by nearly one-half meaning that the UK produces 35 per cent more petrol than is used here; exports of petrol comprise nearly half of all UK product exports. In recent developments, increased utilisation of refining capacity in the US resulting from extraction of tight oil has meant that this traditional export market has been contracting in recent years. In 2018 surplus petrol has instead been exported to alternative destinations, including a 60 per cent increase (to reach 3.0 million tonnes) to the Netherlands, which is then likely shipped elsewhere, as well as increasing volumes to the African market.

Within the UK itself, there is an emergent reversal of the trend of declining demand for petrol. Early indications in 2019 suggest that petrol demand is increasing and demand for diesel beginning to fall in the wake of media attention surrounding the fact that diesel engines emit particulates and nitrous oxides more heavily than petrol engines. Whereas diesel cars accounted for nearly half of all new registrations in 2016, by 2018 this had fallen to less than one-third. In 2018 we also saw the first increase in new petrol registrations, up 9 per cent. In the same year the proportion of the fleet that was diesel fuelled fell to 39 per cent from the peak in 2017 of 40 per cent as registrations of petrol and alternative fuel cars increased.

In the UK, road transport is responsible for about a quarter of greenhouse gas (GHG) emissions source, with passenger cars and vans accounting for 70 per cent of road transport emissions and nearly one-fifth of total emissions[9]. To support the government's policy to reduce pollution and emissions of greenhouse gases the Renewable Transport Fuel Obligation mandates suppliers of road fuels to meet minimum levels of biofuels in petrol and diesel supplied to the UK market[10]. Biofuels must be from renewable and sustainable sources, and the levels required by the obligation increase each year so that by 2032 around 12 per cent of total road fuel should be from sustainable sources.

Chart 8: Proportions of total petrol and diesel that came from a renewable and sustainable source, 2001 to 2018



Source: Energy Trends (https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends)

It can be seen from Chart 8 that the proportion of biofuel blended into petrol (bioethanol) has generally been steadily increasing as a share of total petrol since 2004. The series for biodiesel is much more volatile and appears to be more susceptible to changes in prices, the taxes imposed, and implementation of the Renewable Energy Directive in 2011, which restricts the proportion of biofuels that can be crop-derived[11].

Alternative propulsion engines

Among increasing concerns over the impact of road travel pollution on air quality and subsequent negative impacts on health, in 2017 Government announced a ban on all new conventional petrol and diesel cars and vans by 2040 as part of a wider plan to tackle emissions[12]. The Road to Zero strategy, published in July 2018, lays out ambitions to prompt growth in alternative fuel vehicles including ultra-low emission vehicles[13]. These include reducing emissions from existing vehicles (e.g. by increasing the use of low carbon fuels and retrofitting new technology as well as influencing driver

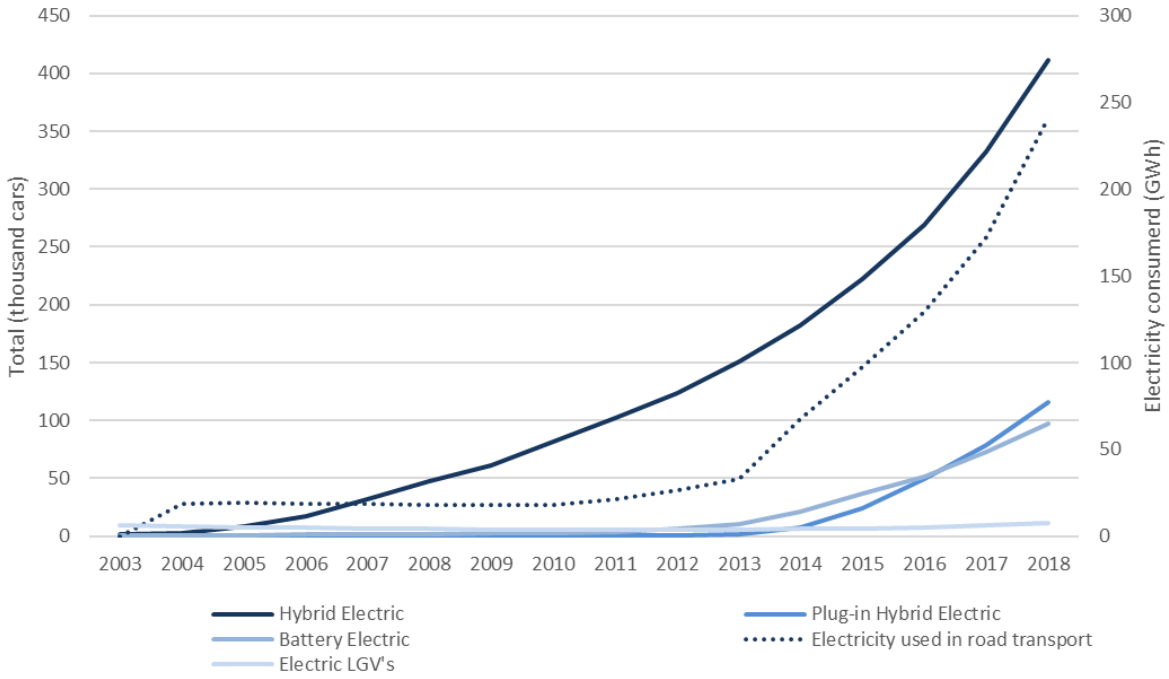
[9] https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2017
[10] Renewable Transport Fuel Obligation https://www.gov.uk/guidance/renewable-transport-fuels-obligation
[11] Renewable Transport Fuel Obligation Process Guidance year 11
[12] Plan for roadside NO2 concentrations https://www.gov.uk/government/news/plan-for-roadside-no2-concentrations-published
[13] https://www.gov.uk/government/news/government-launches-road-to-zero-strategy-to-lead-the-world-in-zero-emission-vehicle-technology

behaviour); encouraging uptake of Ultra Low Emissions Vehicles (ULEVs); and developing the UK's Electric Vehicle (EV) charging infrastructure.

It is anticipated that EV sales will overtake diesel and petrol by the late 2030s, but to achieve the ambitions set out in the Road to Zero strategy the Government's response to the Business and Industrial Strategy Parliamentary Committee reported that investment will need to be promoted to overcome the obstacles to EV and ULEV adoption, including the relatively higher costs, the lack of charging infrastructure, and consumer concerns around having sufficient charge to complete a journey[14].

Nonetheless, the impact of government policies on vehicle registrations has already been seen in the overall fall in new car registrations over the last two years, and the sharp decreases in diesel registrations since 2017. New registrations of alternative fuel cars have been rapidly increasing since 2014.

Chart 9: Electricity consumed and the electric vehicle fleet



Source: DUKES Table 5.2 (https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes)
DfT Vehicle licensing statistics (https://www.gov.uk/government/statistics/vehicle-licensing-statistics-2018)

While still forming a relatively small proportion of the vehicle fleet (around 0.5 per cent), in 2018 there were 620,000 licensed alternative fuel cars of which 200,000 were ULEVs. This sector has been rapidly growing and there were nearly 40 per cent more ULEVs at the end of 2018 compared to 2017 after 64,000 new registrations in 2018 – up one-fifth on the year before. The majority of these are plug-in hybrid electric or battery electric vehicles (Chart 9), and many of these purchases were supported by the Plug-In Car Grant[15].

While the UK is one of the world leaders in terms of developing technologies to reduce emissions, in particular from road transport, existing barriers to EV and ULEV adoption make it likely that petroleum fuels will continue to play a fundamental role in transport in the near to medium term

[14] https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/383/383.pdf
[15] https://www.gov.uk/plug-in-car-van-grants

future, with estimates that around 90 per cent of energy needs in this sector will still be met by petroleum fuels in 2035[16].

User Feedback

Please send any comments or queries regarding this analysis to the contact details below:

Nick Jesson

Oil&Gas.Statistics@beis.gov.uk

Tel: 0300 068 5346

Main data Sources

Road fuel consumption figures are published monthly in Energy Trends Table 3.13: https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends

Consumption of road transport fuels by vehicle class are published in DUKES, Table 3B in Chapter 3: https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes

Vehicle licences, registrations and kilometres travelled are published by the Department of Transport; VEH0101, VEH0253, VEH0203; VEH0403; TRA0201:

https://www.gov.uk/government/collections/vehicles-statistics

https://www.gov.uk/government/collections/road-traffic-statistics

[16] Energy emission projections, Annex F: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2018

Recent and forthcoming publications of interest to users of energy statistics

Smart Meters quarterly statistics

This publication provides estimates of the number of Smart Meters installed and operating in homes and businesses in Great Britain. The latest release, covering estimates of the number of Smart Meters deployed up to the end of March 2019, was published on 30 May 2019 at: www.gov.uk/government/collections/smart-meters-statistics

Annual Fuel Poverty statistics report and sub-regional data

This annual publication details the latest statistics on fuel poverty. The 2019 edition, detailing the 2017 statistics, was published on 13 June 2019, along with a series of detailed data tables, at: www.gov.uk/government/collections/fuel-poverty-statistics. Data for 2017 at sub-regional level is available at: www.gov.uk/government/collections/fuel-poverty-sub-regional-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 20 June 2019 at:
www.gov.uk/government/collections/household-energy-efficiency-national-statistics

Local Authority carbon dioxide emissions

This annual publication provides estimates of local authority carbon dioxide emissions in the United Kingdom. Data for 2017 was published on 27 June 2019 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 2017 was published on 27 June 2019 at:
www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level

National Energy Efficiency Data-framework 2019

This publication presents analysis from the National Energy Efficiency Data-Framework (NEED). It provides updated domestic energy consumption results to include 2017 gas and electricity consumption data. It also includes updated estimates of the impact of installing energy efficiency measures on a household's gas consumption for measures installed between July 2016 and June 2017, along with longitudinal estimates of savings from earlier installations. The latest edition was published on 27 June 2019 at:
www.gov.uk/government/collections/national-energy-efficiency-data-need-framework.

Digest of United Kingdom Energy Statistics (DUKES)

This annual publication provides essential information for everyone involved in energy, from economists to environmentalists, and from energy suppliers to energy users. The 2019 edition will be published on 25 July 2019. With extensive tables, charts and commentary covering all the major aspects of energy, it provides a detailed and comprehensive picture of energy production and use over the last 5 years. It will be available (along with additional annexes and key series back to 1970) at: www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

UK Energy in Brief

This annual publication summarises the latest statistics on energy production, consumption, prices and climate change in the United Kingdom. The figures are primarily taken from the Digest of United Kingdom Energy Statistics (see above). The 2019 edition will be published on 25 July 2019 at: www.gov.uk/government/collections/uk-energy-in-brief

Energy Flow Chart

This annual publication illustrates the flow of primary fuels from home production and imports to their eventual final uses. The flows are shown in their original state and after being converted into different kinds of energy by the secondary fuel producers, and are measured in million tonnes of oil equivalent, with the widths of the bands approximately proportional to the size of the flows they represent. The 2019 edition of the chart, showing the flows for 2018, will be published on 25 July 2019 at: www.gov.uk/government/collections/energy-flow-charts

Energy Consumption in the United Kingdom (ECUK)

This annual publication provides additional insights into energy consumption data sourced from DUKES and by combining with other data sources, provides insights into energy intensity, primary consumption (i.e. before transformation), and additional information on consumption by certain electrical products. Longer term trends are included; where possible from 1970, though for some series data are only available for more recent years. As energy consumption characteristics vary depending on the consuming sector, analysis focusses on each separately (i.e. overall energy, transport, domestic, industry, and services). The 2019 edition will be published on 25 July 2019 at: www.gov.uk/government/collections/energy-consumption-in-the-uk

Sub-national consumption of other fuels

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

Sub-national total final energy consumption

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

Sub-national electricity and gas consumption in Northern Ireland

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

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