Department for Energy Security & Net Zero

Energy Trends

UK, April to June 2023

About this release

Information on energy production, trade, and consumption in the UK for total energy and by specific fuels.

In this release

Data tables

Additional data are available online as part of the Energy Trends series:

Total energy
Coal and derived gases
Oil and oil products
Gas
Electricity
Renewables

This publication is based on a snapshot of survey data from energy suppliers. New data are incorporated in line with the revisions policy.

Percentage change from Quarter 2 2022, primary energy basis (Table 1.3)

(mtoe basis)	Production	Imports	Exports	Demand
Total energy	**-11%**	**-8.3%**	**-15%**	**-4.4%**
Coal	**-37%**	**-47%**	**+46%**	**-17%**
Primary oil	**-13%**	**-1.6%**	**-10%**	**-7.7%**
Petroleum products	**-8.5%**	**-0.3%**	**-13%**	**0.0%**
Gas	**-8.7%**	**-23%**	**-20%**	**-13%**
Electricity	**-17%**	**+308%**	**-73%**	**-17%**

- **UK energy production during April to June was down 11 per cent on the same period last year and at a near record low.** Natural gas production decreased by 9 per cent and petroleum production by 13 per cent on the same period last year. Whilst solar generation hit a record high as a result of sunny conditions and increased capacity, overall renewable production fell due to stiller weather affecting wind generation. Nuclear output fell due to lower operational capacity and maintenance outages at four of the five remaining plants.
- **Total final energy consumption was 2.7 per cent lower** than in the second quarter of 2022, with an 8 per cent contraction in household demand despite similar temperatures to last year. Transport consumption rose slightly mainly as a result of increased demand for aviation fuel.
- The fall in gas output meant that **despite reduced output from renewable and nuclear technologies, the share of generation attributable to these technologies increased**. Renewable generation share rose 3.5 percentage points to 42.1 per cent and low carbon generation rose 2.7 per cent to 57.8 per cent. Fossil fuels comprised 38.8 per cent of total electricity generation, down 3.0 percentage points.
- **Renewable electricity generation capacity grew by 6 per cent** on the same quarter last year, with offshore wind growing by 9 per cent, and solar growing at 8 per cent, the highest rate of quarter-on-quarter growth since the second quarter of 2017. At 15 GW of capacity, solar PV is now nearly double the total of all renewable capacity from the same quarter of 2010. Solar PV generated a record 5.5 TWh of electricity, exceeding total renewable generation from all technologies during the same quarter of 2010.

Section 1: UK total energy

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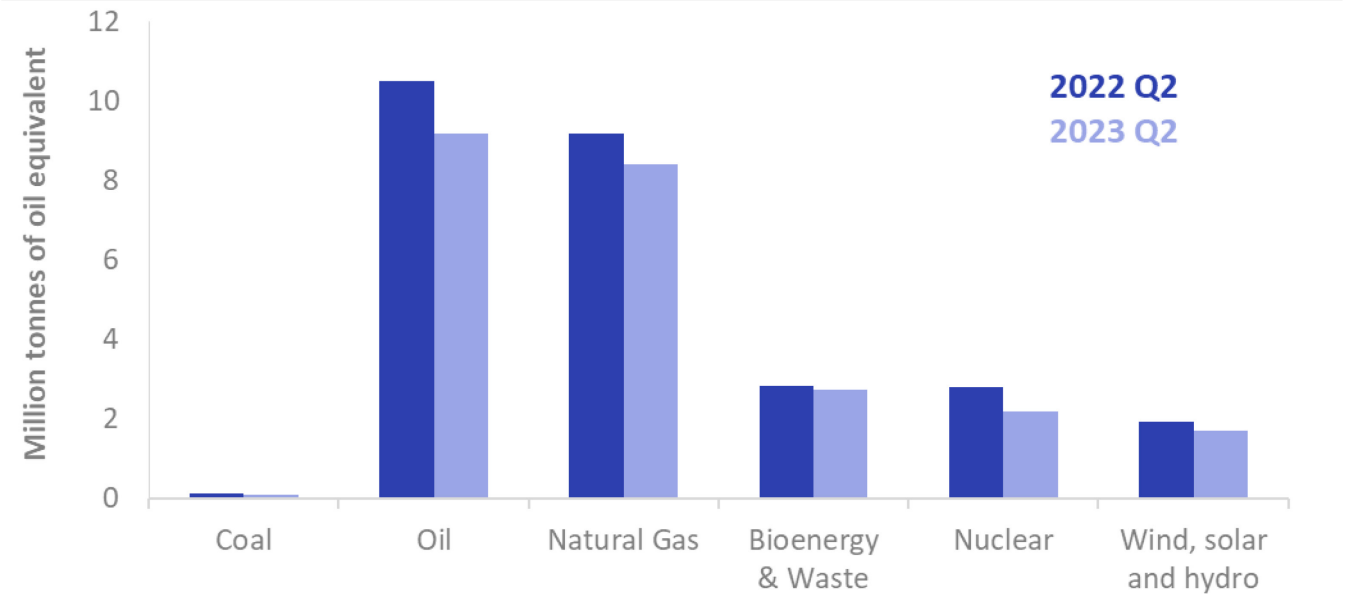
Key headlines

In the second quarter of 2023 **total energy production was 24.3 million tonnes of oil equivalent, 11 per cent lower** than in the second quarter of 2022, with falls in all primary fuels except solar.

Total primary energy consumption for energy uses fell by 5.0 per cent, with petroleum consumption for road vehicles returning to pre-pandemic levels but reduced demand from electricity generators and higher energy prices reducing gas consumption. When adjusted to take account of weather differences, primary energy consumption fell by 5.9 per cent.

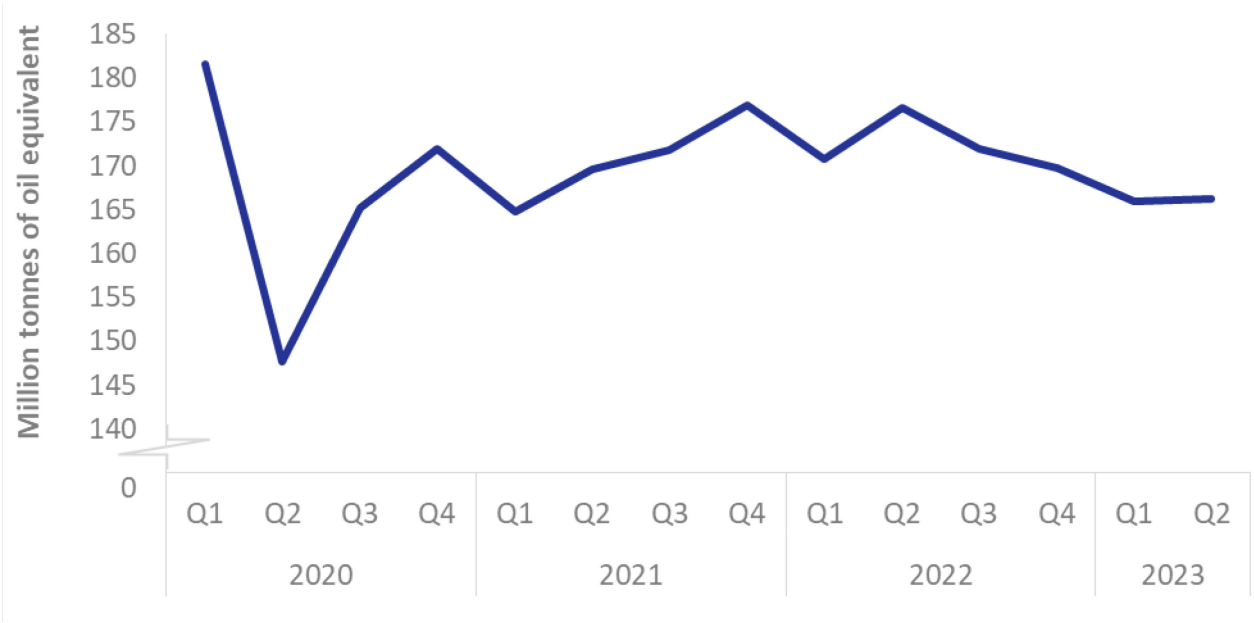
Total final energy consumption (excluding non-energy use) was 2.7 per cent lower compared to the second quarter of 2022, with consumption levels impacted by higher energy and other prices. Transport consumption rose by 0.5 per cent, but domestic consumption fell by 8.3 per cent, industrial consumption fell by 3.2 per cent and other final users (mainly from the service sector) consumption fell by 3.0 per cent. On a seasonally and temperature adjusted basis, final energy consumption fell by 4.2 per cent, with falls in all sectors except transport which rose by 1.2 per cent.

Chart 1.1 UK Primary energy production (Energy Trends Table 1.1)



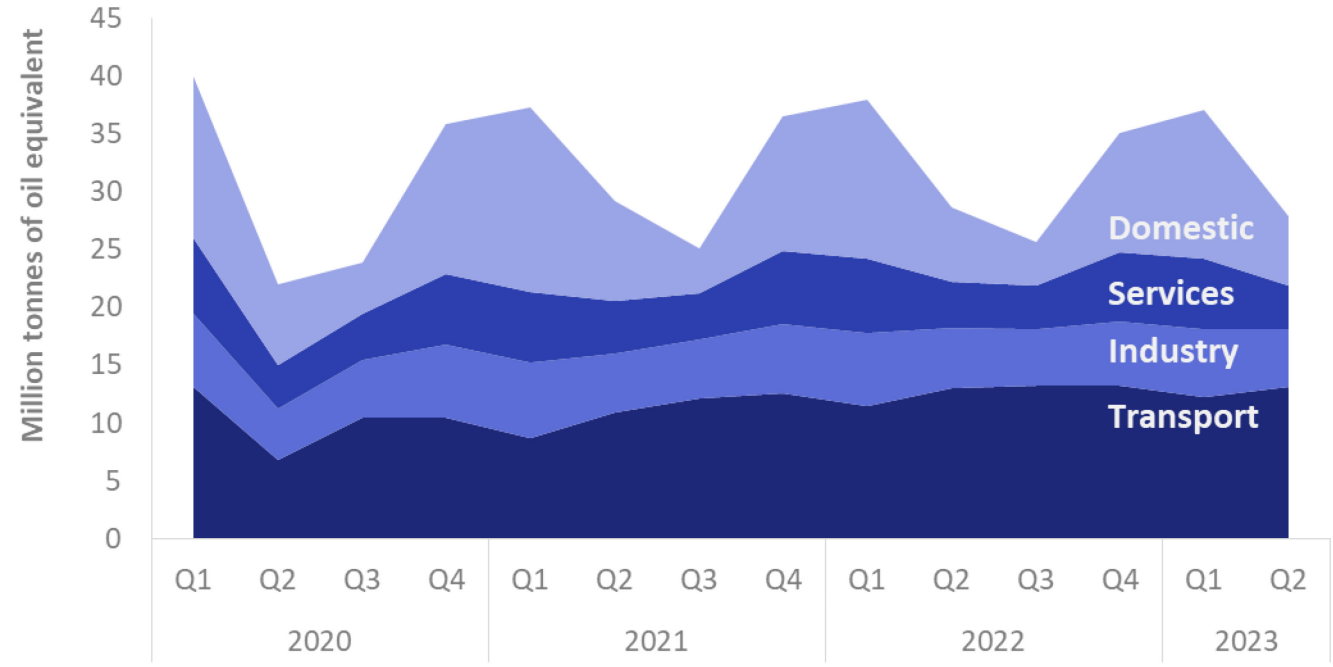
In the second quarter of 2023 **total production was 24.3 million tonnes of oil equivalent, 11 per cent lower** than in the second quarter of 2022 with falls in all primary fuels except solar. Production from fossil fuels fell with oil falling by 13 per cent and gas by 8.6 per cent. Although production levels have increased since the planned maintenance schedule in early summer 2021, total oil and gas production is still 25 per cent below pre-pandemic (2019) levels. Nuclear output fell by 22 per cent due to planned outages at four out of the five of the UK's operational nuclear plants, whilst wind, solar and hydro output fell by 11 per cent with increased solar output due to increased capacity and more sun hours offset by falls in wind and hydro output due to less favourable weather conditions.

Chart 1.2 Annualised and seasonally adjusted inland consumption (primary fuel input basis) (Energy Trends Table 1.2)



In the second quarter of 2023 total inland consumption over the last year (including not only fuel used by consumers, but for electricity generation and other transformation) was 166.3 million tonnes of oil equivalent, 5.9 per cent lower than in the second quarter of 2022. This is on a seasonally adjusted and annualised rate that removes the impact of temperature on demand. Consumption of all primary fuels fell, except for petroleum, solar and net imports of electricity, with higher energy and other prices likely a key factor.

Chart 1.3 Final energy consumption by user (Energy Trends Table 1.3)



In the second quarter of 2023 **total final energy consumption (excluding non-energy use) was 2.7 per cent lower** than in the second quarter of 2022. Transport consumption rose by 0.5 per cent with petrol and diesel consumption returning to pre-pandemic levels. Jet fuel consumption also increased but still lies below pre-pandemic levels. Domestic sector energy consumption fell by 8.3 per cent, whilst industrial consumption fell by 3.2 per cent and service sector consumption fell by 3.0 per cent. The falls in consumption levels can be attributed in part to the impact of higher energy and other prices, resulting in domestic and services consumption levels being the lowest recorded for the second quarter of the year this century.

Section 2: Coal and derived gases

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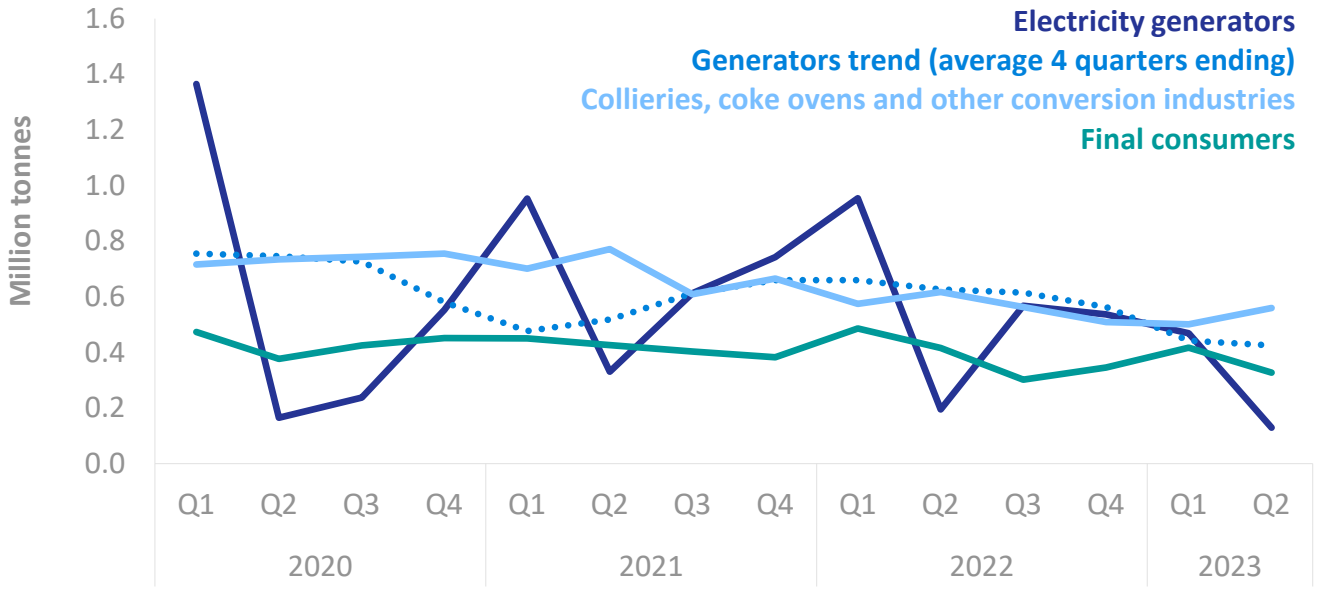
Key headlines

In the second quarter of 2023, **demand for coal by electricity generators fell to 129 thousand tonnes**, 34 per cent lower than in Quarter 2 2022 (Chart 2.1).

Overall coal production fell to 120 thousand tonnes, down 37 per cent on the second quarter of 2022. Surface mining production fell to 105 thousand tonnes. Mine closures and a pattern of generally falling demand contributed to lower production.

Coal imports fell to 696 thousand tonnes during the quarter, the lowest since the 1970s and 49 per cent down on the same period last year. The USA was the largest supplier of coal into the UK at 59 per cent of total imports. This was followed by Colombia (19 per cent) and the European Union (9 per cent).

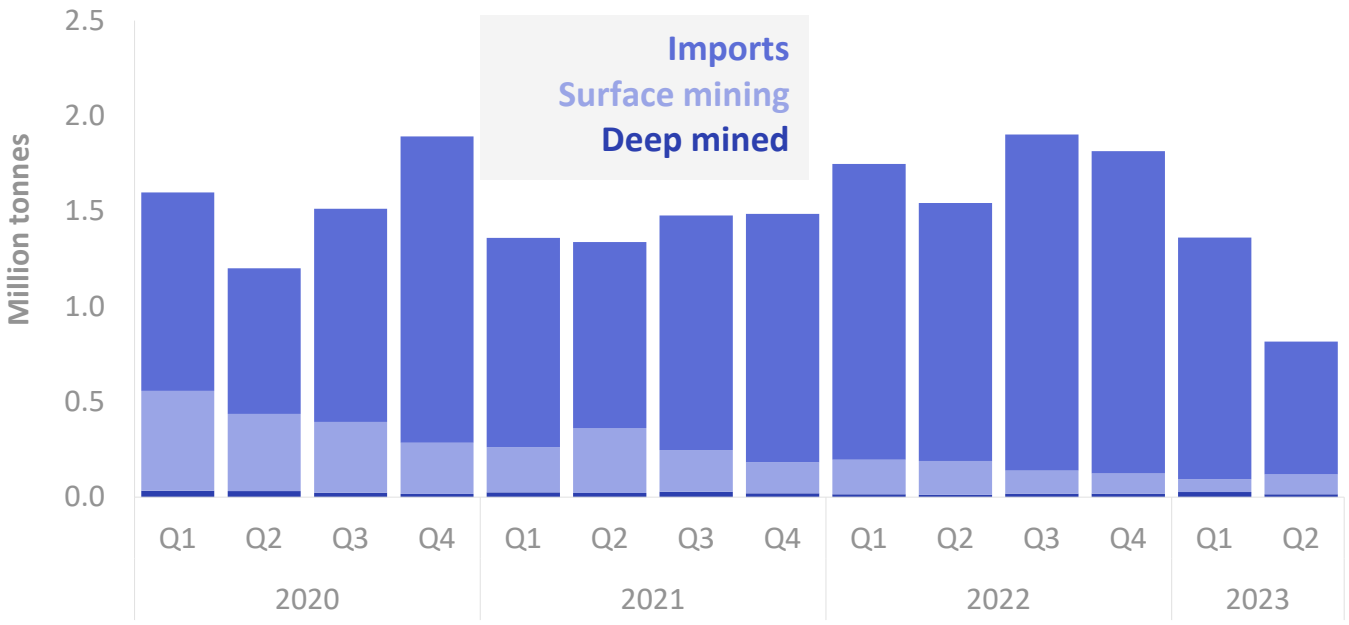
Chart 2.1 Coal Consumption (Energy Trends Table 2.1)



Coal demand for coal-fired electricity generation fell from 195 thousand tonnes in Quarter 2 2022 to 129 thousand tonnes in Quarter 2 2023. As coal use is being phased out, electricity generation favours gas, nuclear and renewables and, more recently, imported electricity. During this period overall electricity demand fell (see Energy Trends 5.4 for information on generation). Only two coal-fired power plants are operational in the UK, Ratcliffe-on-Soar and Kilroot. West Burton closed on 31 March 2023 and Drax closed on 25 April 2023 after remaining available over last winter to ensure security of supply if needed. The government remains committed to ending coal use for electricity generation by October 2024.

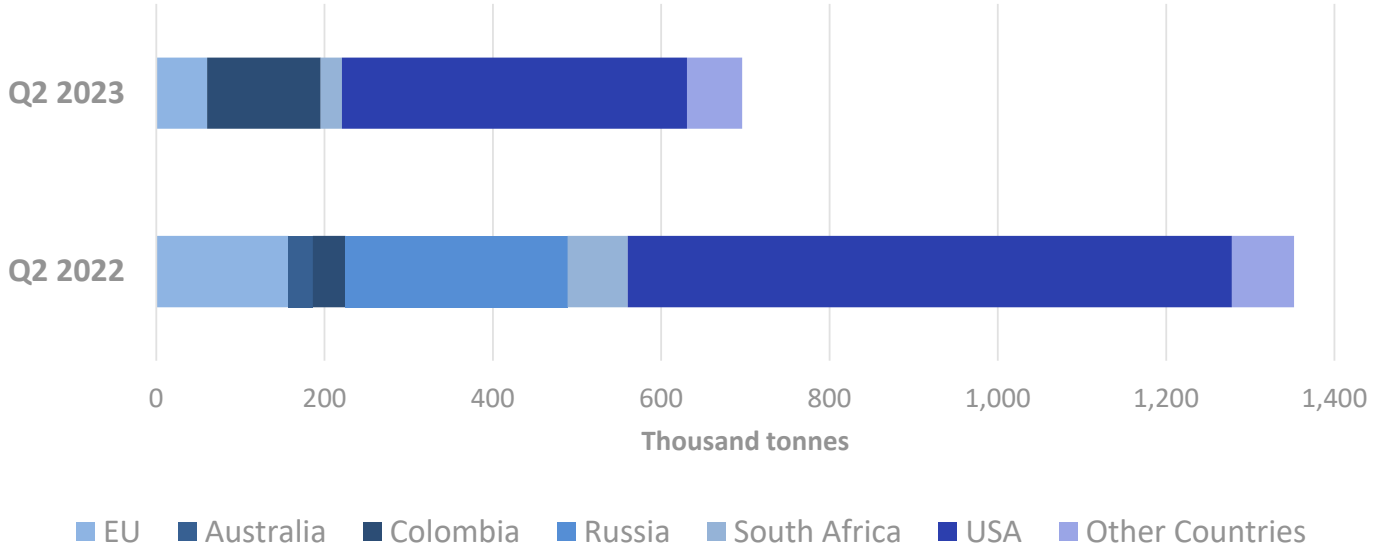
Demand for coal-fired generation is seasonal, peaking in winter when conditions are cold and dark; these peaks have declined as coal-fired generation became less competitive economically and gas and renewable sources displaced it.

Chart 2.2 Coal Supply (Energy Trends Table 2.1)



Domestic coal production has fallen steadily because of mine closures and reduced demand. Imports filled the gap but have gradually fallen from the peak of 13.4 million tonnes in the second quarter of 2013 as overall demand dropped. In the second quarter of 2023, imports of coal were 0.7 million tonnes.

Chart 2.3 Coal Imports (Energy Trends Table 2.4)



As coal's place in the UK's generation mix has diminished, imports have decreased significantly. In the second quarter of 2012, the UK imported 11.8 million tonnes of coal, falling to 1.4 million tonnes in the second quarter of 2022. In the second quarter of 2023 this fell to 0.7 million tonnes, the lowest since the 1970s. This comprised 0.3 million tonnes of steam coal (44 per cent of imports), 0.4 million tonnes of coking coal (55 per cent of imports) and 0.01 million tonnes of anthracite (1 per cent of imports).

In Quarter 2 2023 the largest provider was the USA (59 per cent). This was followed by Columbia (19 per cent) and the European Union (9 per cent). The UK banned Russian coal imports in August 2022. This reflects a decreasing reliance on Russian energy in line with that seen for both oil and gas.

Section 3: Oil and oil products

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Key headlines

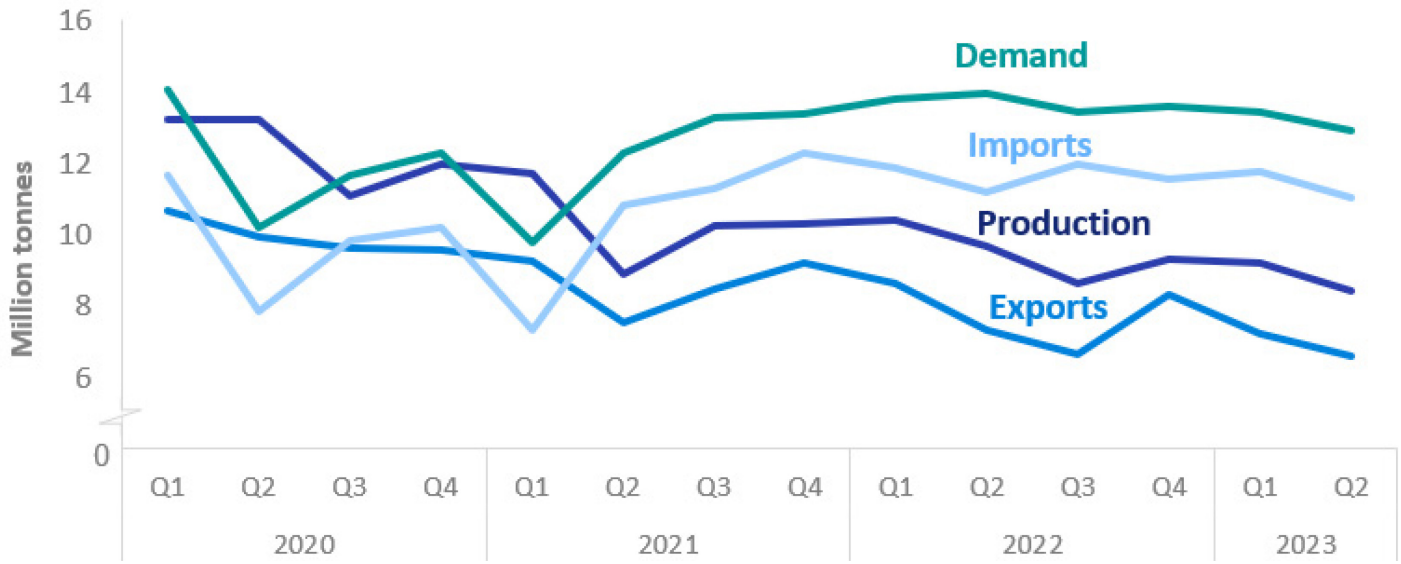
In Quarter 2 2023, production of primary oils fell to a near record low of 8.5 million tonnes following reports of lowered investment in recent years.

Imports of primary oils rose to meet demand amid low production as exports decreased by 10 per cent, in line with the drop in production.

Demand for petroleum products remained stable. Production decreased by 8.5 per cent but demand was met through decreased exports of 13 per cent whilst imports remained stable.

Oil stocks fell by 6.7 per cent, partially due to the UK's recent contribution to the International Energy Agency (IEA) coordinated stock release. At the end of Quarter 2 2023, the UK held over 120 days of net imports as stocks, well above the IEA requirement to hold 90 days.

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

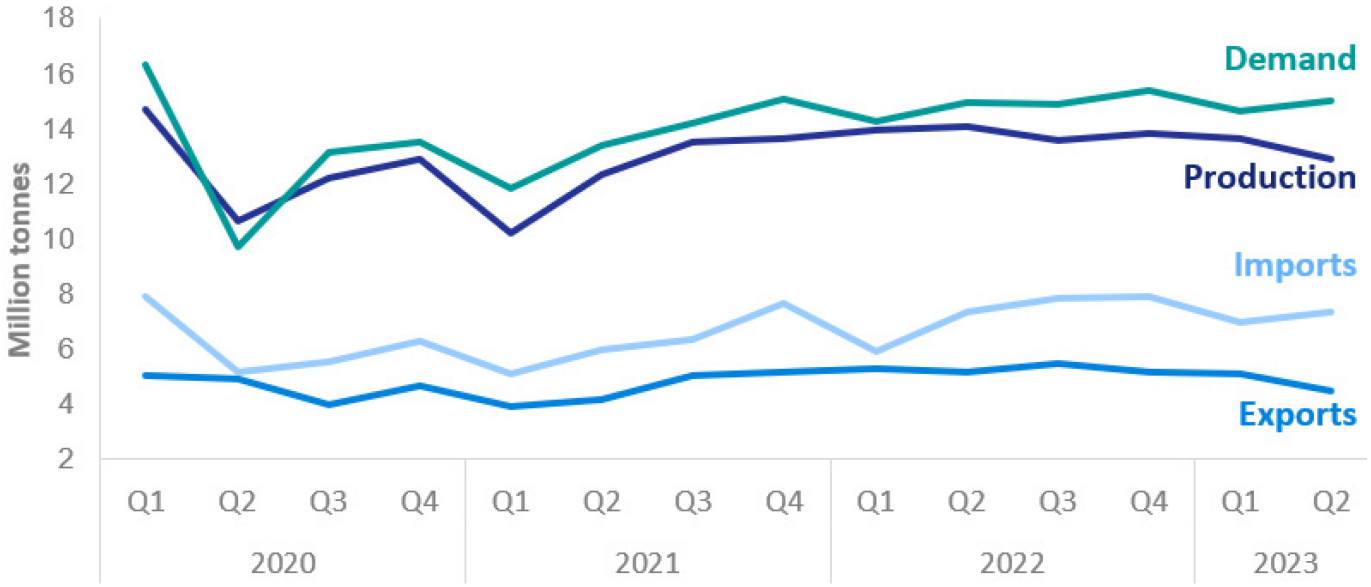


Production of primary oils fell to 8.5 million tonnes, a near record low and dropping by 13 per cent in Quarter 2 2023 compared to the same period in 2022. There has been a sustained decline in offshore oil production in recent years, averaging around 10 million tonnes per quarter in 2021 and 2022 compared with roughly 12 million tonnes per quarter in the prior five-year period. This decline follows low investment levels in recent years, although reports have suggested that the trend in investment will be positive until 2025.

Refinery demand fell by 7.8 per cent compared with the same period in the previous year following maintenance during the second quarter of 2023.

Net imports of primary oils increased by 15 per cent compared with Quarter 2 2022; while imports remained stable, exports fell by 10 per cent in line with the decrease in production.

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



Demand for petroleum products remained stable in Quarter 2 2023, compared to the same quarter in 2022. As production decreased by 8.5 per cent, demand was met though a decrease in exports by 13 per cent, whilst imports remained stable. The UK remained a net importer of 2.8 million tonnes, an increase of 31 per cent on the same period last year.

Final consumption remained stable, with the most prominent changes seen in a drop in non-energy use by 3.4 per cent, countered by an increase in domestic consumption of 3.4 per cent and other industries of 6.6 per cent. Energy industry use dropped marginally, and the transport sector remained stable.

Transport fuel demand increased with mixed product trends. Demand for jet fuel continued to increase, up by 10 per cent in Quarter 2 2023 compared to the same period in the previous year. Road fuels saw a more stable trend, with petrol demand increasing by 4.1 per cent, countered by a 3.2 per cent decrease in demand for diesel. Biofuel demand continued to grow with bioethanol and biodiesel demand up by 16 and 19 per cent respectively. Sales through supermarkets dropped for both petrol and diesel in Quarter 2 2023 by 8.9 and 13 per cent respectively. Supermarket share of all sales was 31.7 per cent in Quarter 2 2023, down from 35.5 in the same period in the previous year.

The UK held 8.7 million tonnes of stock at the end of Quarter 2 2023, 6.7 per cent lower than the previous year. During Quarter 2 2023, the UK continued to participate in the coordinated stock release by the International Energy Agency (IEA) in response to Russia's invasion of Ukraine. **UK stocks were equivalent to over 120 days of net imports**, well above the IEA requirement to hold 90 days' worth of net imports.

Section 4: Gas

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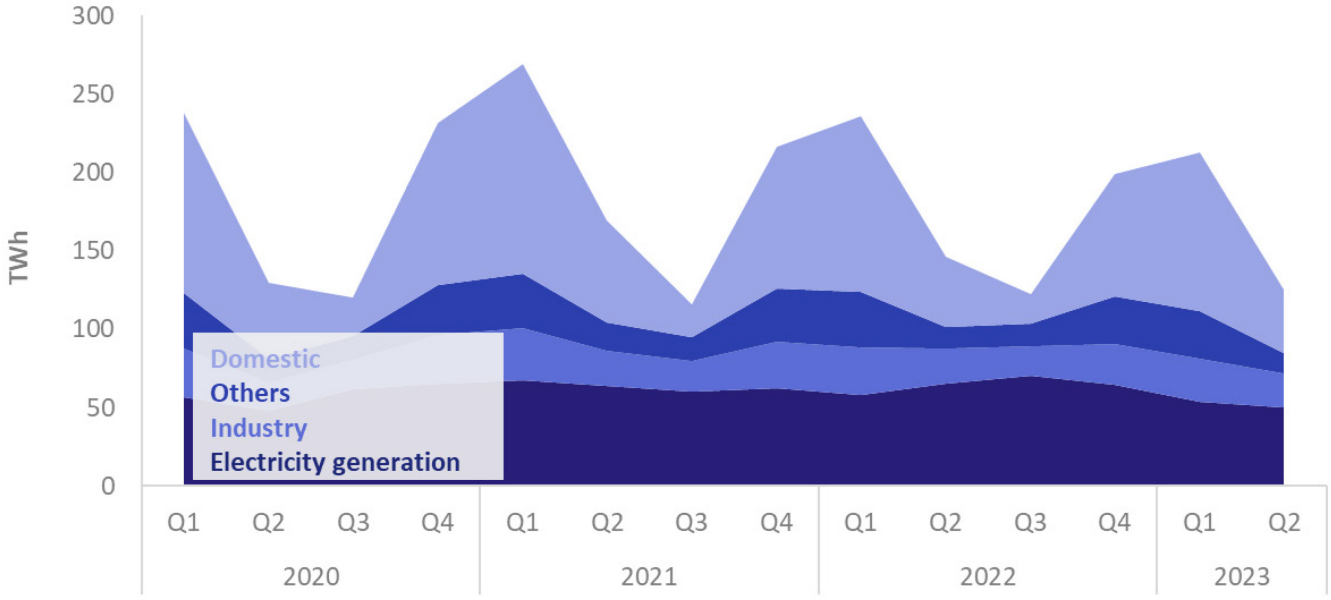
Key headlines

In Quarter 2 2023 gas demand fell by 13 per cent compared with the same period last year, driven by reduced demand for gas generation and lower domestic demand. Gas used for generation had the largest fall due to reduced electricity demand as a result of both record high electricity imports and reduced demand for electricity. Consumption of gas by final consumers also fell across all sectors, with household demand falling the most, down by 9.3 per cent compared to Quarter 2 2022. Given broadly similar temperatures, the fall in domestic consumption is likely a result of increased energy and other household costs.

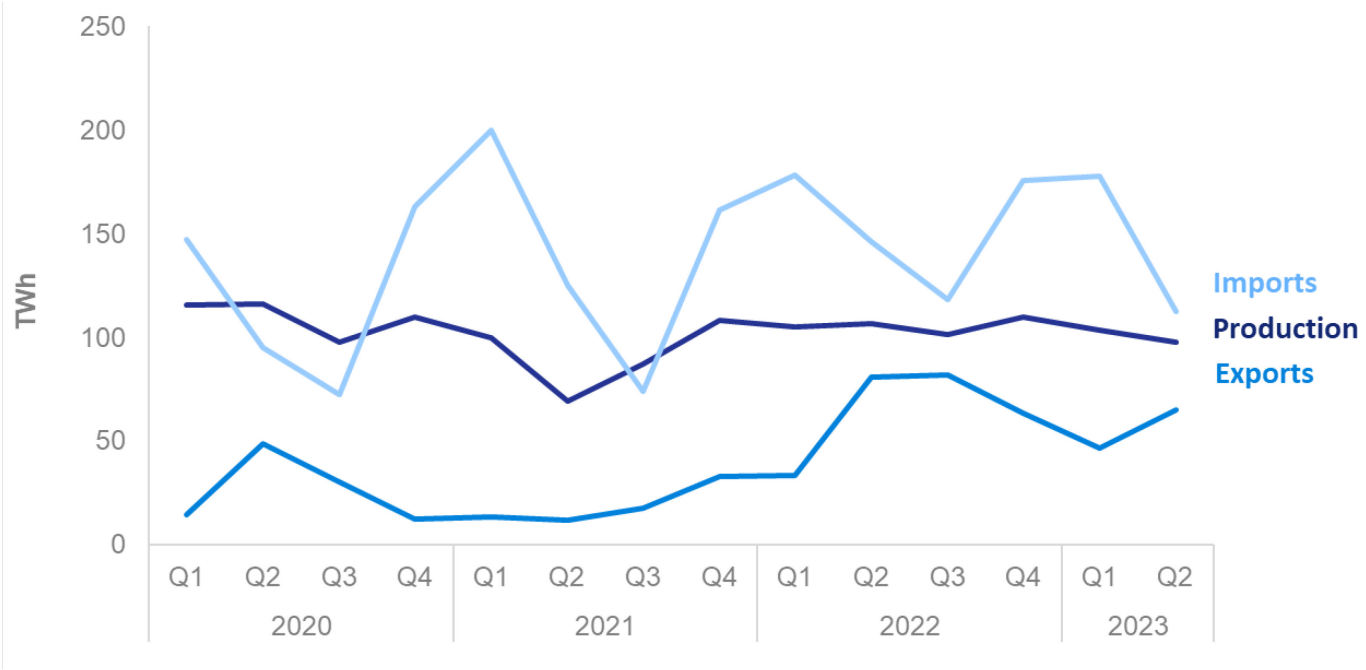
Imports and exports down 23 and 20 per cent respectively compared to Quarter 2 2022 following consistently high exports in 2022 as the UK supported European efforts to move away from Russian gas. The drop in imports was mainly driven by a large fall in pipeline imports due to facility issues at a Norwegian plant throughout most of the quarter. Liquified Natural Gas (LNG) imports were slightly down overall and a mixed picture by origin: Qatari LNG imports more than halved in Quarter 2 2023 and US imports were up 60 per cent when compared to Quarter 2 2022.

Chart 4.1 UK demand for natural gas (Energy Trends Table 4.1)



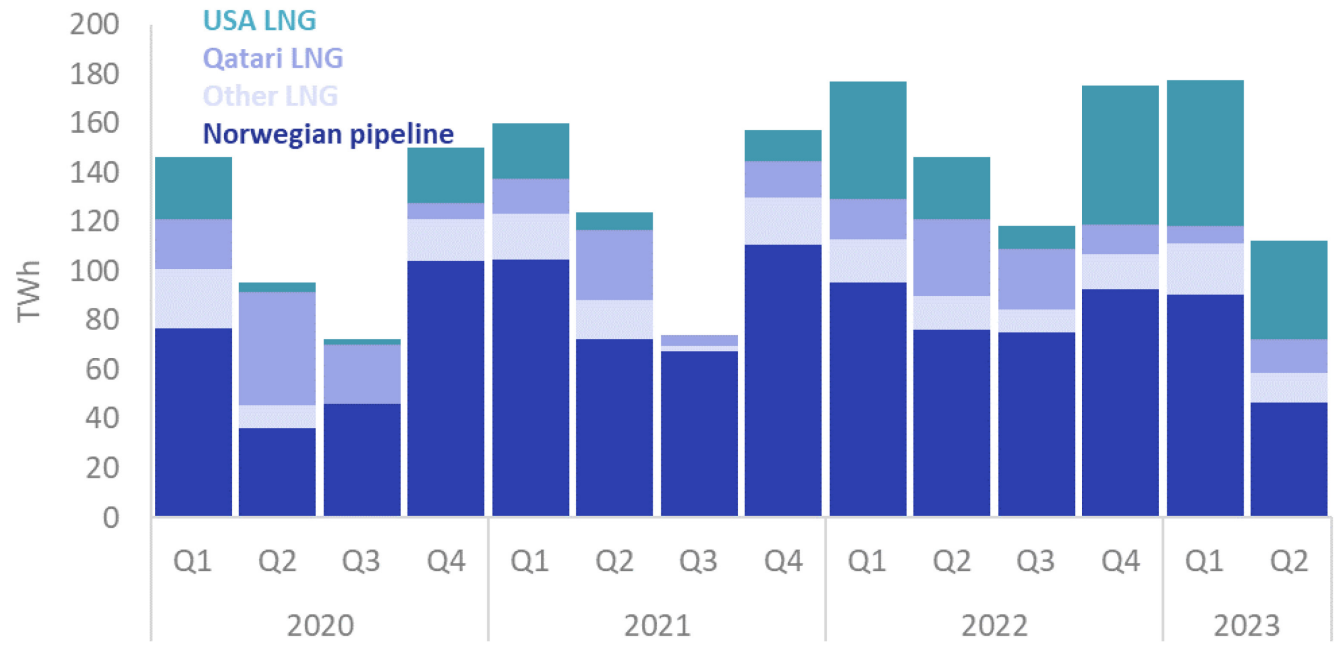
Demand for natural gas fell by 13 per cent in Quarter 2 2023, compared with Quarter 2 2022. The largest component of the demand drop was electricity generation, down 23 per cent compared to the same period in the previous year as a result of both lower electricity demand and record electricity imports (see Energy Trends Table 5.1). Final consumption was down 7.5 per cent, reflecting reduced demand for gas across all sectors. Domestic (household) demand had the largest decrease of the sectors, down 9.3 per cent compared to the same period in the previous year, likely due in part to increased energy and other household costs as temperatures were broadly similar over the period. Demand by other final users (which is largely made up of commercial and public administration) and industry also fell, down 7.8 and 4.1 per cent respectively.

Chart 4.2 Production and trade of natural gas (Energy Trends Table 4.2)



Imports and exports were down on a year of consistent highs. Exports in Quarter 2 2023 were down a fifth on the same period in the previous year, following consistently high exports since early 2022 as the UK supported European efforts to move away from Russian gas. Despite this, exports were equivalent to 31 per cent of gross supply (the total of production and imports) which remains higher than average levels seen in the last 5 years. Imports were down 23 per cent and indigenous production was down 8.3 per cent in Quarter 2 2023 compared to Quarter 2 2022.

Chart 4.3 Imports by origin (Energy Trends Table 4.4)



Pipeline imports down while US Liquified Natural Gas (LNG) imports remain high in Quarter 2 2023, compared to the same period last year**.** Pipeline imports, which all came from Norway, were down 39 per cent, which was driven by a substantial drop in imports via the Langeled pipeline, a result of facility issues at a plant throughout most of the quarter. Imports of LNG were down 6.1 per cent, with Qatari imports more than halving compared to Quarter 2 2022. This was largely offset by imports from the US, which were up by 60 per cent. This is a continuation of recent import trends from the US, which made up over 60 per cent of the total LNG for the period and over a third of imports.

Section 5: Electricity

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Key headlines

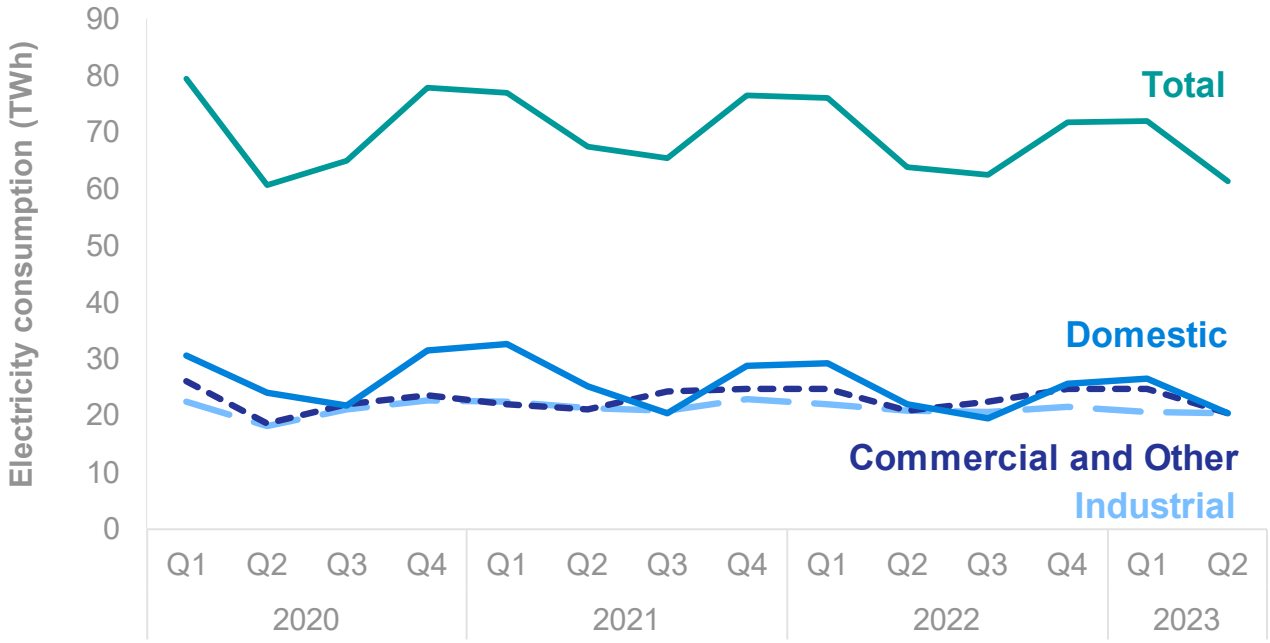
Quarter 2 of 2023 saw the highest net imports of any second quarter in the recorded data series, at 7.6 TWh. This came as generation fell 18 per cent compared to Quarter 2 of 2022 to 64.6 TWh, while demand fell by just 3.3 per cent to 72.3 TWh in the same period.

Total consumption of electricity fell to its lowest value since Quarter 2 2020, when the first Covid-19 lockdown substantially reduced demand. Consumption in all sectors fell in line with this change, with the domestic sector being the most affected, down 7.7 per cent to 20.4 TWh. This continues the recent run of lower consumption figures that accompanied increased household costs, including higher energy costs.

Quarter 2 of 2023 saw record levels of solar generation, however low wind speeds led to an overall reduction in generation from renewables. Renewable generation fell 11 per cent compared to the same period last year, reaching 27.2 TWh and contributed 42.1 per cent of the UK's generation share.

The share of electricity generated from low carbon sources rose 2.7 percentage points to 57.8 per cent. This reflects large reductions in fossil fuel usage, which fell 24 per cent to 25.1 TWh in the same period.

. **Chart 5.1 Electricity consumption by sector** (Energy Trends Table 5.2)

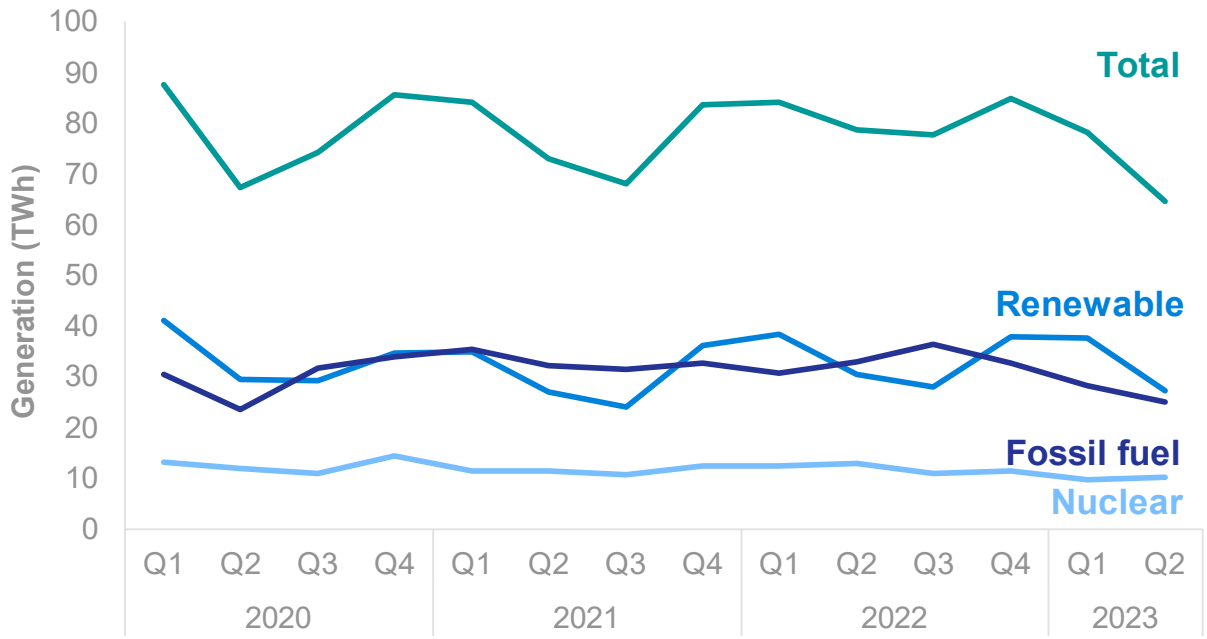


Total consumption of electricity was 61.3 TWh in Quarter 2 2023, the lowest quarterly value in this timeseries with the exception of Quarter 2 of 2020 when the first Covid-19 lockdown substantially reduced demand. This was a 4.0 per cent decrease compared to Quarter 2 of 2022. This change was reflected in all sectors, with all seeing reductions in consumption.

Domestic consumption was 20.4 TWh in Quarter 2 of 2023, the lowest Quarter 2 value in the recorded data series. This is 7.7 per cent lower than the same period last year. As temperatures were broadly similar to the same quarter last year, this likely reflects the influence of higher consumer prices, including energy prices.

Both non-domestic sectors saw reduced consumption levels in Quarter 2 2023 compared to the same period in 2022. Industrial consumption fell by 2.0 per cent to 20.5 TWh, while consumption by other final users (including commercial consumers) fell 2.2 per cent to 18.4 TWh.

Chart 5.2 Electricity generated, by fuel type (Energy Trends Table 5.1)



Quarter 2 2023 saw the highest net imports of any second quarter at 7.6 TWh due to increased interconnector capacity and advantageous price differentials, with lower UK electricity generation. Electricity generation fell 18 per cent (to a new record low) compared to the same period last year reaching 64.6 TWh, while demand reduced by 3.3 per cent to 72.3 TWh with imports making up the difference. The record high levels of Quarter 2 net imports observed this year contrast with same period last year when the UK was a net exporter of electricity for the first time in more than 40 years.

Renewable electricity generation in Quarter 2 2023 fell 11 per cent to 27.2 TWh compared to the same period last year, despite record levels of solar generation. Solar generation increased by 12 per cent to 5.5 TWh, the highest value in the published data series. This increase was outweighed by decreases in generation from all other renewable technologies, particularly wind which fell 16 per cent to 13.7 TWh due to unusually low average wind speeds. Due to reductions in fossil fuels, the share of electricity coming from renewables increased 3 percentage points to 42.1 per cent.

Fossil fuels generated 25.1 TWh in Quarter 2 2023, falling 24 per cent on the same period last year. This is in line with the demand for electricity, which also fell during this period. Gas continued to be the generation method with the greatest output at 24.2 TWh, 37 per cent of total generation. Coal generation continued to decline reaching 0.3 TWh, 46 per cent lower than the same period in the previous year.

Nuclear generation fell 22 per cent in Quarter 2 2023 compared to the same period last year, reflecting the effects of outages and closures. Since the second quarter of 2022, Hinkley Point B has ceased production as it begins decommissioning. Additionally in Quarter 2 of 2023, all but one of the UK's remaining nuclear sites experienced outages at some point. Despite this reduction, the overall share of low carbon sources rose by 3 percentage points to 57.8 per cent of the total due to the greater reduction in fossil fuel generation.

Section 6: Renewables

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Key headlines

In Quarter 2 2023, Solar PV generated a record 5.5 TWh, a 12 per cent increase on 2022. Total renewable generation however fell by 11 per cent to 27.2 TWh, with lower wind speeds subduing generation from both onshore and offshore wind. Generation from plant biomass continues to be volatile with the impact of ongoing maintenance outages reducing generation by 17 per cent compared to Quarter 2 2022.

Since Quarter 2 2022 there was 3.0 GW of new renewable capacity, of which 1.2 GW was offshore wind, 1.1 GW solar PV, and 0.7 GW onshore wind. This represents a 5.8 per cent increase over the last year.

Renewables' share of electricity generation was 42.1 per cent in Quarter 2 2023, higher than the same quarter last year (38.7 per cent) and higher than fossil fuels' share of generation (38.8 per cent). Fossil fuel generation was lower than usual, caused both by record imports of electricity and decreased demand for electricity (see Table 5.1 for further details).

Chart 6.1 Change in renewable generation and capacity between Q2 2022 and Q2 2023 (Energy Trends Table 6.1)

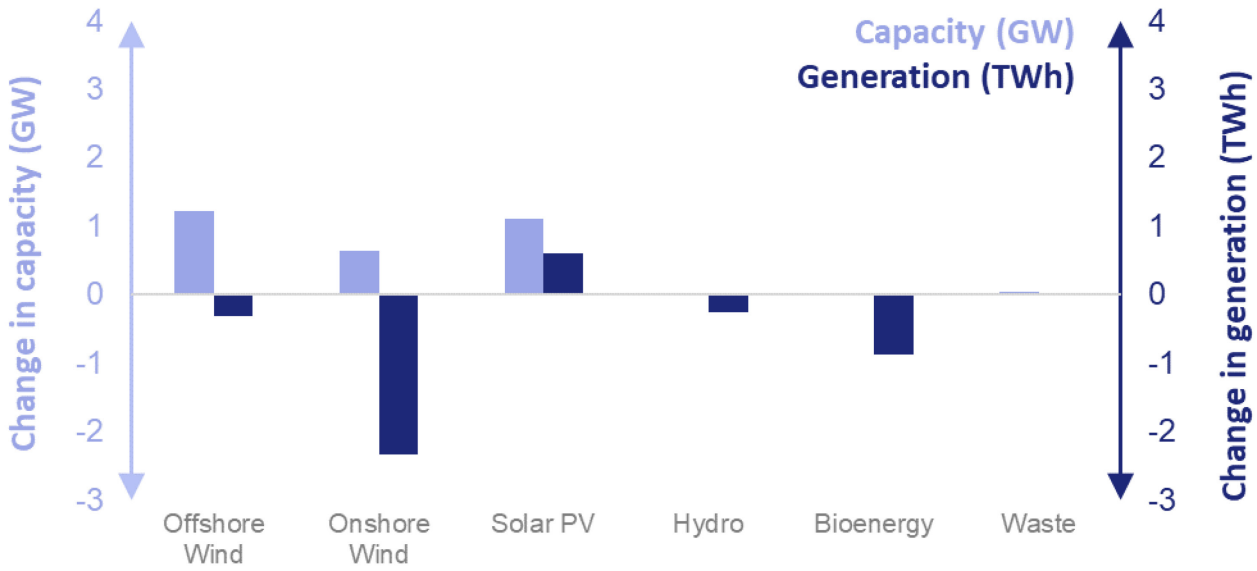


Chart 6.1 shows that since Quarter 2 2022, generation from both onshore and offshore wind has fallen. Although there was some new capacity added during the year, this was insufficient to offset the effect of unusually low wind speeds during Quarter 2 2023. At 6.9 knots, it is well below the long-term average for a second quarter (8.2 knots). The fall in offshore wind is less than for onshore partly due to less new capacity for onshore. Wind speeds are also often higher offshore, and the turbines tend to be taller compared to onshore. The increase in solar PV generation is in response to both additional and longer hours of sunshine compared to Quarter 2 2022, resulting in an all-time record in solar PV generation. Overall generation from bioenergy fell significantly with the small increase in capacity being outweighed by reductions in generation from maintenance outages.

Of the 3.0 GW new capacity installed since Quarter 2 2022, 1.2 GW cent was offshore wind, which was mostly installed during Quarter 3 2022 and Quarter 2 2023. New solar PV accounted for almost as much as offshore wind but was split more evenly across the quarters as would be expected with more numerous, smaller residential schemes.

Chart 6.2 Added capacity since 2019 for the leading technologies (Energy Trends Table 6.1)

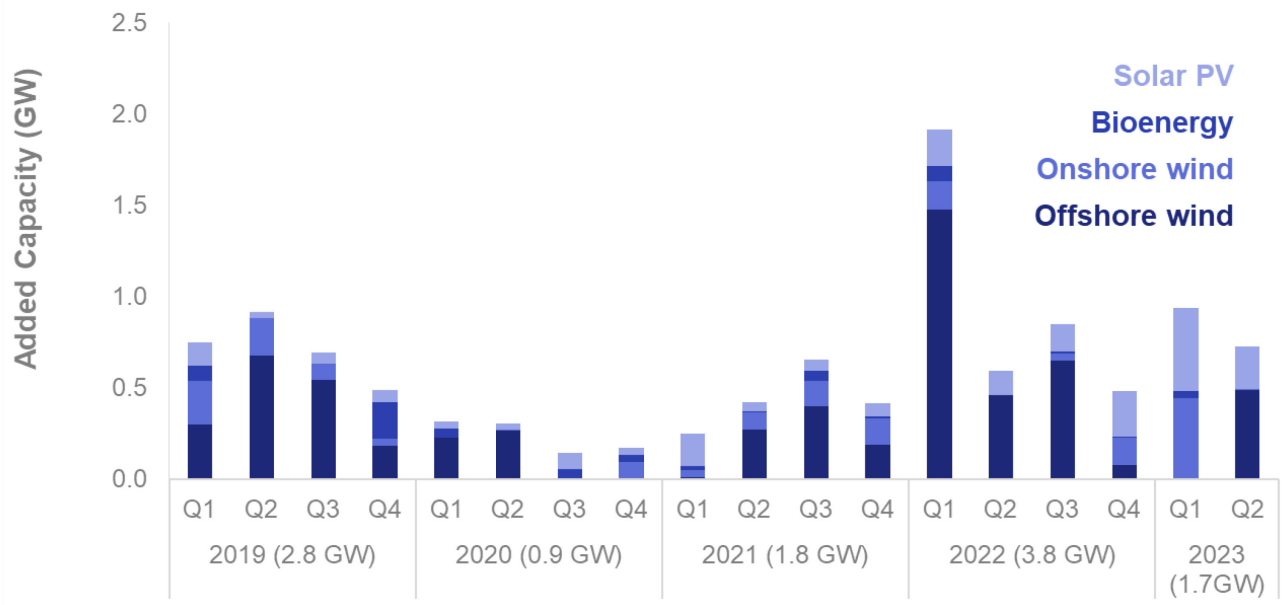
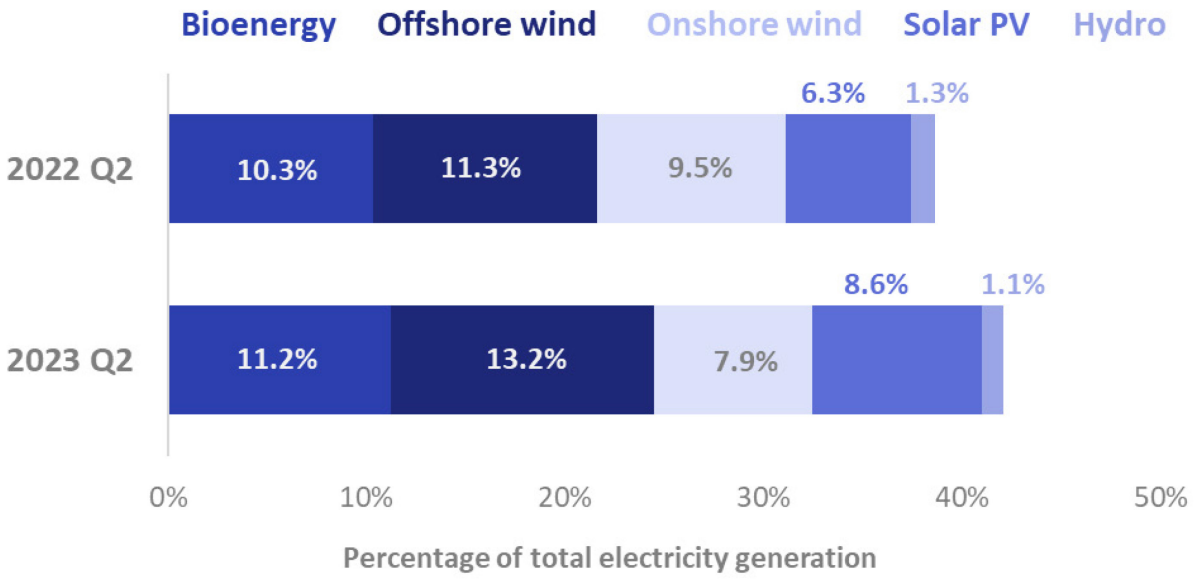


Chart 6.3 Renewables' share of electricity generation – Q2 2022 and Q2 2023 (Energy Trends Table 6.1)



In Quarter 2 2023, renewables' share of generation was 42.1 per cent, 3.5 percentage points higher than Quarter 2 2022, and 10.1 percentage points higher than in 2018. The share of renewables in the current quarter was also higher than for fossil fuels (38.8 per cent). Although overall, renewable generation was down, total electricity generation (including fossil fuels) fell to a greater extent, inflating renewables' share. With lower renewable and fossil fuel generation, the shortfall in demand was met through higher imports. Only solar PV and offshore wind saw their share of total generation increase this quarter, by 2.3 and 2.0 percentage points respectively.

Data tables and special articles

Data in this release

Data are collected by DESNZ through surveys of energy suppliers. This publication highlights key stories in energy in the UK for the specified period. Additional data are available in the quarterly and monthly statistical tables for each fuel and total energy. The tables are generally in commodity balance format, showing the flow from the sources of supply through to final use.

Special articles

Special articles that explore current topics of interest are available alongside this summary report. Included in this publication are:

Competition in UK electricity markets, 2022

Competition in UK gas supply, 2022

Diversity of supply for oil and oil products in OECD countries in 2022

Regional renewable electricity in 2022

Statistical tables*

Data tables available as part of the Energy Trends series:

Total energy

Solid fuels and derived gases

Oil and oil products

Gas

Electricity

Renewables

The full range of special articles is available here: https://www.gov.uk/government/collections/energy-trends-articles

Additional sources of information

Index of Production, published by the Office for National Statistics:
https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofproduction/previousReleases

Index of Services, published by the Office for National Statistics:
https://www.ons.gov.uk/economy/economicoutputandproductivity/output/bulletins/indexofservices/previousReleases

Detailed annual Digest of UK Energy Statistics:
http://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Tables showing foreign trade flows of energy:
https://www.gov.uk/government/statistics/dukes-foreign-trade-statistics

Weather tables produced by DESNZ using Met Office data:
https://www.gov.uk/government/collections/weather-statistics

Information on Energy Prices:
http://www.gov.uk/government/collections/quarterly-energy-prices

*Hyperlinks will open the most recently published table. If you require a previously published version of a table, please contact DESNZ at: kevin.harris@energysecurity.gov.uk

Technical information

Methodology and revisions

More detailed notes on the methodology used to compile the figures and data sources are available on the collection pages for each fuel. The figures have not been adjusted for temperature or seasonal factors except where noted.

Percentage changes relate to the corresponding period a year ago. They are calculated from unrounded figures. They are shown 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 North Sea Transition Authority at https://www.nstauthority.co.uk/

Table of conversion factors

To	ktoe	TJ	GWh	million therms	To	toe	GJ	kWh	therms
From	Multiply by				**From**	Multiply by			
ktoe	1	41.868	11.63	0.39683	**toe**	1	41.868	11,630	396.83
TJ	.023885	1	0.27778	0.0094778	**GJ**	0.023885	1	277.78	9.4778
GWh	.085985	3.6	1	0.034121	**kWh**	0.000085985	0.0036	1	0.034121
million therms	2.52	105.51	29.307	1	**therms**	0.00252	0.105510	29.307	1

ktoe = thousand tonne of oil equivalent toe = tonne of oil equivalent

Sector breakdowns

Categories for final users are defined by Standard Industrial Classification 2007:

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 (part*)
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

* Note – transport sector includes only energy used for motion/traction purposes. Other energy used by transport companies is classified to the commercial sector.

Revisions policy

Figures for the latest periods are provisional and are liable to subsequent revision. The DESNZ statistical revisions policy sets out the revisions policy for these statistics, which has been developed in accordance with the UK Statistics Authority Code of Practice for Statistics.

Glossary

Tonne of Oil Equivalent

A common unit of measurement which enables different fuels to be compared and aggregated, and equal to 41.868 joules. Usually expressed in Trends as KTOE (thousand tonnes of oil equivalent) or MTOE (million tonnes of oil equivalent).

Indigenous production

The extraction or capture of primary fuels: for oil this includes production from the UK Continental Shelf, both onshore and offshore. Production by fuel is shown in Table 1.1. As with all data in Tables 1.1 to 1.3, these data are presented in either Million Tonnes of Oil Equivalent or Thousand Tonnes of Oil Equivalent. Various conventions are involved in the presentation of these data (e.g. for nuclear production the energy input is the heat content of the steam leaving the reactor) and these conventions are detailed in the Table notes and methodology documents (see link at end of glossary).

Primary supply

Primary supply is the sum of production, other sources, imports (+), exports (-), stock change, marine bunkers and transfers. A breakdown of supply by fuel is shown in Table 1.3.

Primary demand

Primary demand is the sum of the transformation, energy industry use, losses and final energy consumption by the industry sectors including non-energy use. A breakdown of demand by fuel is shown in Table 1.3.

Primary inland energy consumption

The sum of primary supply less non-energy use (Table 1.2).

Final energy consumption

Energy consumption by final user, i.e., which is not being used for transformation into other forms of energy. Final energy consumption is shown by sector and for individual fuels in Table 1.3.

Non-energy use

Includes fuel used for chemical feedstock, solvents, lubricants, and road making material, see Table 3.2.

Imports

Goods entering the UK, e.g. via pipeline from Norway or LNG cargoes from Qatar and the US for gas (Table 4.3) and interconnectors for electricity from The Netherlands (Table 5.6).

Exports

Goods leaving the UK, e.g. via LNG regassification cargoes to Europe for gas (Table 4.3) and interconnectors for electricity to France (Table 5.6).

Transformation

Transformation covers those activities that transform fuels into a form which is better suited for specific uses. Most of the transformation activities correspond to particular energy industries whose main business is to manufacture the product associated with them. Certain activities involve transformation to make products that are only partly used for energy needs (e.g. coke and oven coke) or are by-products of other manufacturing processes (e.g. coke oven and blast furnace gases). A breakdown of transformation by fuel is shown in Table 1.3.

Seasonally and temperature adjustment

The temperature corrected series of total inland fuel consumption, Table 1.2 indicates what annual consumption might have been if the average temperature during the year had been the same as the average for the years 1991 to 2020. Table 1.3 shows seasonal and temperature adjusted final consumption.

Primary oil

Crude oil, natural gas liquids and feedstocks. (Table 3.1)

Petroleum products

Motor spirit, diesel, gas oil, aviation turbine fuel, fuel oils, petroleum gases, burning oil and other products. (Table 3.4)

Transport fuels

Motor spirit and diesel for road and aviation turbine fuel for aviation. (Table 3.4)

Electricity generation

Electricity generation represents the quantities of fuels burned for the generation of electricity. The activity is divided into two parts, covering the Major Power Producers such as those generating electricity for sale, as their main business activity, and autogenerators such as those generating electricity for their own needs but who may also sell surplus quantities (Table 5.1).

Fossil fuels

Coal, oil and natural gas. The percentage share of electricity generation by fossil fuels is shown in Table 5.1.

Renewables

Renewable energy includes solar power, wind, wave and tidal, and hydroelectricity. Solid renewable energy sources consist of wood, straw, short rotation coppice, other biomass and the biodegradable fraction of wastes. Gaseous renewables consist of landfill gas and sewage gas. The percentage share of electricity generation by renewables is shown in Table 5.1.

Low carbon

Nuclear and renewables. The percentage share of electricity generation by low carbon sources is shown in Table 5.1.

Additional information

A more detailed glossary is available in The Digest of United Kingdom Energy Statistics (DUKES), Annex B, whilst the energy balance methodology note provides background detail on the compilation of an energy balance, as well as an explanation of each of the key energy balance flows. Notes in individual Energy Trends tables provide further detail.

Related publications

Recent publications of interest

Smart Meters
Statistics on the roll-out of Smart Meters in Great Britain, covering meters operating and meters installed: www.gov.uk/government/collections/smart-meters-statistics

Household Energy Efficiency
Statistics on the Energy Company Obligation (ECO), Green Deal and homes insulated. Monthly updates of ECO measures and quarterly updates of in-depth ECO statistics, carbon savings and the Green Deal schemes: www.gov.uk/government/collections/household-energy-efficiency-national-statistics

Renewable Heat Incentive
Statistics on deployment data for the domestic and non-domestic Renewable Heat Incentive (RHI) to support the uptake of renewable heat: www.gov.uk/government/collections/renewable-heat-incentive-statistics

Energy Consumption in the United Kingdom (ECUK)
Detailed data on end use estimates of energy in the UK: www.gov.uk/government/collections/energy-consumption-in-the-uk

Sub-national total final energy consumption
Findings of the sub–national energy consumption analysis in the UK for all fuels, for the period covering 1 January to 31 December, with gas consumption covering the annual period from mid-May: www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level

Sub-national electricity consumption
Electricity consumption by consuming sector for Great Britain and devolved administration areas. Data are based on the aggregation of Meter Point Administration Number readings as part of DESNZ's annual meter point electricity data exercise: www.gov.uk/government/collections/sub-national-electricity-consumption-data.

Sub-national gas consumption
Gas consumption by consuming sector for Great Britain, and devolved administration areas. Data are based on the aggregation of Meter Point Reference Number readings throughout Great Britain as part of DESNZ's annual meter point gas data exercise. Data are subject to a weather correction factor to enable comparison of gas use over time: www.gov.uk/government/collections/sub-national-gas-consumption-data.

Sub-national road transport consumption
Road transport fuels consumption in the UK at regional and local authority level. Data is modelled and provided to DESNZ by Ricardo Energy & Environment, with estimates based on where the fuel is consumed, rather than where it is purchased.
www.gov.uk/government/collections/road-transport-consumption-at-regional-and-local-level

Sub-national consumption of residual fuels
Non-gas, non-electricity and non-road transport fuels consumption in the UK. Includes coal, petroleum, solid fuels, and bioenergy not for generation or road use: www.gov.uk/government/collections/sub-national-consumption-of-other-fuels

Further information

National statistics

This is a National Statistics publication. National Statistics status means that our statistics meet the highest standards of trustworthiness, quality, and public value, and it is our responsibility to maintain compliance with these standards.

The Office for Statistics Regulation confirmed continued designation of Energy Trends as National Statistics in 2018 following a compliance check. A full assessment against the Code of Practice was last conducted in June 2014.

Pre-release

Some ministers and officials receive access to these statistics up to 24 hours before release. Details of the arrangements for doing this and a list of the ministers and officials that receive pre-release access to these statistics can be found in the DESNZ statement of compliance with the Pre-Release Access to Official Statistics Order 2008.

User engagement

Users are encouraged to provide comments and feedback on how these statistics are used and how well they meet user needs. Comments on any issues relating to this statistical release are welcomed.

This publication is available from: https://www.gov.uk/government/collections/energy-trends

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Competition in UK electricity markets, 2022

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Key headlines

Following privatisation in 1990, the number of UK major electricity suppliers has increased from 16 in 1989 to 32 in 2022. In 2022, 3 companies DESNZ surveyed which were over the 0.1% market share threshold in 2021 discontinued supply, while 1 rose above the threshold.

In 2022, market concentrations remained relatively stable. This goes against the trend seen from 2019 to 2021, when electricity market concentration increased across all sectors as more companies entered the market.

The market share of smaller suppliers (outside the top nine) has risen from 2.7 per cent in 2010 to 19.0 per cent in 2022, as new smaller suppliers took market share from the large companies.

The number of major power producers (MPPs) has increased from 6 in 1989 to 54 in 2017, where it has to date remained stable.

The top nine MPPs' share of generation decreased to 75.5 per cent in 2022, down 1.8 percentage points on 2021 levels. Their share of capacity additionally decreased from 37.2 per cent to 31.6 per cent, primarily due to the decommissioning of nuclear power sites.

This article includes information relating to competition in the UK electricity market, formerly published as part of UK Energy Sector Indicators. The article examines the two parts of the industry where there is competition for provision: generation and sales. For both markets, the article describes the number of companies operating, and the market concentrations. The Herfindahl-Hirschman measure (see explanation in methodology notes at the end of this article) is used to provide the market concentration as it provides extra emphasis on the contribution of participants with the largest shares. For electricity sales, this article covers the major suppliers surveyed by DESNZ comprising approximately 96% of the market. Major electricity suppliers are classed as those which sold over 0.1% of traded electricity in the reference year (see further information in methodology notes at the end of this article).

Background to changes in the electricity market

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

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

Competition in electricity sales

The number of electricity suppliers rapidly increased following privatisation, from 16 in 1989 to an early peak of 21 in 2004. From 2004 to 2010, the number of companies reduced to 13, as despite new market entrants, other companies were either taken over or bought additional power stations to add to their portfolios. After 2010, the number of companies increased again, reaching their highest level in 2018 of 38 companies. This reflected new market entrants and DESNZ engaging with new, smaller companies to maintain coverage in the more fragmented market.

From 2021 to 2022, sharply rising wholesale gas prices significantly increased the cost of generation for electricity. This led to widespread disruption in the UK electricity market and contributed to the discontinuation of 3 energy suppliers with over 0.1 per cent of the market share, reducing the number of companies to 32.

The number of companies supplying electricity to each sector is given for selected years between 1996 and 2022 in Table 1.

Table 1: Number of companies supplying electricity [note 1]

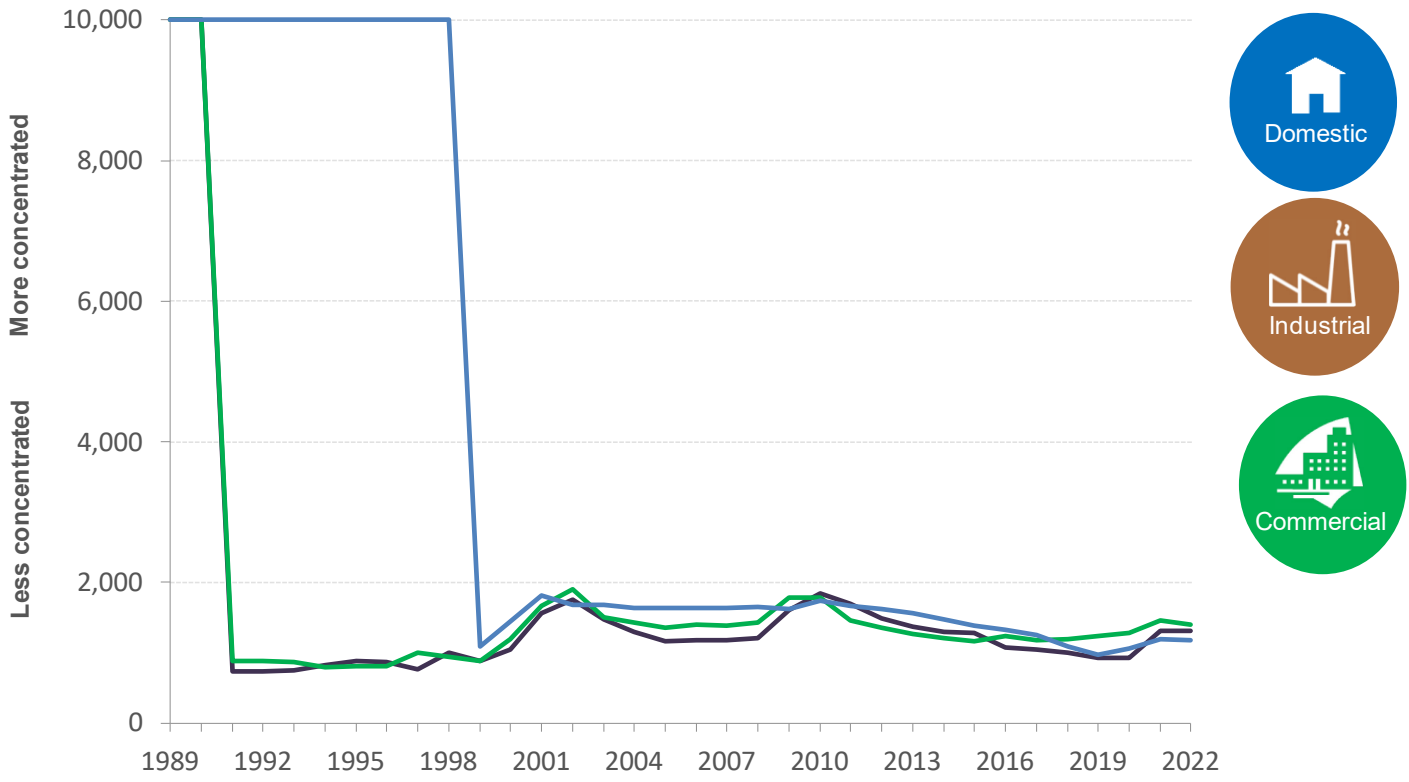
	1996	2000	2004	2006	2008	2010	2012	2014	2016	2018	2020	2021	2022
Domestic Sector	1	11	10	9	9	8	11	16	19	28	27	23	20
Commercial Sector	17	13	17	12	13	11	16	21	25	28	29	25	25
Industrial Sector	18	17	20	16	15	12	20	20	24	24	26	24	25
Total	18	18	21	19	18	13	20	26	33	38	38	34	32

[note 1] Companies can supply into more than one market and are counted in each market they supply to. Only includes companies that sold over 0.1% of traded electricity in the reference year.

In 2022, no new electricity suppliers were surveyed by DESNZ which supplied over 0.1 per cent of the market share. Three companies discontinued supply, while one supplier increased market share to above the 0.1 per cent threshold required for inclusion. Two of the discontinued companies supplied only the domestic market, while the remaining company supplied both commercial and domestic customers. The supplier which increased its market share to above the 0.1 per cent threshold supplied the industrial and commercial markets.

Chart 1 below shows the market concentration as expressed through the Herfindahl-Hirschman Index. In the chart, higher numbers show more concentration while lower numbers indicate a more diverse market. Further information on the Herfindahl-Hirschman index can be found at the end of this article.

Chart 1: Herfindahl-Hirschman Index for electricity sales market concentration, 1989 to 2022



Following privatisation in 1989, the industrial and commercial market concentrations saw initial sharp decreases followed by rises between 1998 and 2002, caused primarily by a spate of mergers. The domestic market's concentration remained at 10,000 before 1999, being dominated by the Regional Electricity Companies (RECs) which each had regional monopolies on the market. Market concentration fell in 1999 as domestic sales became more competitive, then rose until 2001 due to mergers between former RECs. Between 2002 and 2008 there was little variation in the domestic market's index, however the industrial and commercial indexes fell in this period. The market concentration of all sectors then rose in 2008 spurred by the closure of several market participants. From 2010 to 2019, market concentration declined in the domestic and industrial sectors as many new smaller suppliers entered the market.

From 2019 to 2021 both the domestic and commercial market concentration increased due to mergers between large suppliers and suppliers exiting the market. The industrial market concentration remained stable between 2019 and 2020, however sharply increased in 2021 due to mergers between large suppliers and another exiting the market. From 2021 to 2022, all market concentrations remained relatively stable. The commercial market saw the most notable change, reducing by 57 points primarily motivated by a fall in market share of the largest companies as their smaller competitors grew.

Electricity supplied to all consumers by aggregated shares

Table 2 shows how the market share of the largest companies have changed since 2010. The market share of the top nine suppliers peaked in 2010 but had steadily fallen to 76.8 per cent in 2020. A major merge caused this share to increase dramatically from 2020 to 2021. Between 2021 and 2022, the aggregated share of the top six suppliers fell 0.8 percentage points from 67.0 per cent to 66.2 per cent. When compared to 2010, the aggregated top six share for 2022 is 24.9 percentage points lower.

As the number of companies supplying electricity has increased, as evidenced in Table 1, the share of these suppliers outside the top nine has grown. The share of those outside of the top nine rose from 2.7 per cent in 2010 to a peak of 23.2 per cent in 2020. This reflected the fragmentation of the market from new entrants taking market share from the larger companies. In 2021 the decrease in share of suppliers outside the top 9 reflected two companies within the top 9 suppliers merging, and rising wholesale electricity prices caused smaller suppliers to discontinue.

From 2021 to 2022 the share of suppliers outside the top 9 remained relatively stable, decreasing by 0.4 percentage points as three smaller suppliers ceased trade. The most significant changes came from within the top 9 where aggregated share of the top 6 fell by 0.9 percentage points while the share of other suppliers in the top 9 grew by 1.3 percentage points.

Table 2: Percentage shares of total electricity supplied to all consumers

	Market Share (%)								
Electricity Suppliers	2010	2012	2014	2016	2018	2019	2020	2021	2022
Aggregated share of top 3 suppliers	55.4	49.1	47.0	43.7	41.8	40.9	38.9	48.9	47.7
Aggregated share of next 3 suppliers	35.6	36.7	33.9	31.7	29.0	27.5	23.7	18.1	18.4
Aggregated share of next 3 suppliers	6.3	6.2	8.9	10.9	12.0	11.6	14.2	13.6	14.8
Aggregated share of top 9 suppliers	**97.3**	**92.0**	**89.9**	**86.3**	**82.9**	**80.1**	**76.8**	**80.6**	**81.0**
Other suppliers	2.7	8.0	10.1	13.7	17.1	19.9	23.2	19.4	19.0

Electricity generation competition

Table 3 shows the number of companies that are counted as Major Power Producers (MPPs). The number of companies increased rapidly, from six before privatisation up to an early peak of 36 in 2001, before mergers caused numbers to fall back to 29 in 2006. Starting in 2007, several renewable generators were reclassified as MPPs, leading to an increase in the number of MPPs to 34; this remained stable through to 2009. Since 2010, the number of MPPs has steadily increased as new generators came online, reaching a peak in 2017 of 54. This has remained stable up to 2022.

Table 3: Number of Major Power Producers

Year	Number	Number producing at least 5% of total generation
1989	6	[x]
1991	11	[x]
1993	20	[x]
1995	25	[x]
1997	27	[x]
1999	30	[x]
2001	36	6
2003	34	6
2005	30	7
2007	34	8
2009	34	8
2011	41	7
2013	44	7
2015	53	6
2017	54	4
2018	54	5
2019	54	6
2020	54	6
2021	54	7
2022	54	6

Table 4 shows the MPPs aggregated share of generation and aggregated share of capacity for 2017 to 2022. The market share of the top 9 generators in this period peaked in 2013 at 86.7 per cent declining to 74.8 per cent in 2018, as new smaller companies entered the market. This share increased in 2019 and 2020, before decreasing again for the past two years, reaching 75.5 per cent in 2022. The top 9 generators held a lower share of capacity (69.2 per cent in 2022) compared to generation. This indicates a greater proportion of their generation came from non-renewable sources, which are able to operate closer to full capacity as they are not limited by environmental factors. The top 3 companies aggregated share in generation and capacity decrease between 2017 and 2022 was predominantly due to decommissioned nuclear sites.

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

	Share in Generation (%)						**Share in Capacity (%) [note 1]**					
	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
Aggregated share of top 3 companies	50.7	49.0	48.3	46.4	45.4	45.8	35.3	33.8	42.5	42.2	37.2	31.6
Aggregated share of next 3 companies	15.0	16.6	17.6	21.2	19.0	18.8	22.2	21.4	20.3	15.5	20.2	24.5
Aggregated share of next 3 companies	9.2	9.2	11.6	10.2	13.0	10.9	8.8	11.9	9.2	12.4	14.0	13.1
Aggregated share of top 9 companies	**75.0**	**74.8**	**77.5**	**77.8**	**77.3**	**75.5**	**66.4**	**67.1**	**72.1**	**70.1**	**71.5**	**69.2**
Other major power producers	25.0	25.2	22.5	22.2	22.7	24.5	33.6	32.9	27.9	29.9	28.5	30.8

[note 1] Of the same companies in each band in generation terms.

Data for this article

The data used to produce this article can be found in Tables 1 to 6 of associated Competition in UK Electricity Markets workbook. Revisions to data in this article are noted here.

Further Sources of Information on competition in UK electricity markets

Ofgem release their own statistics on competition in GB generation and the domestic suppliers' market.

Ofgem list all companies that hold licenses in generation and supply.

The Competition and Markets Authority published a report on competition in energy.

Methodology notes

In this article, **'electricity supplier'** refers to the major electricity suppliers surveyed by DESNZ, covering approximately 96% of all UK electricity sales in 2018. '**Major electricity suppliers'** include suppliers that sold over 0.1% of traded electricity in the reference year, this was 245 GWh in 2022. This differs from previous editions of this article where all suppliers surveyed by DESNZ were included. The change allows DESNZ to increase its survey coverage whilst still presenting comparable trends in this article. Please see the DESNZ Electricity statistics data sources and methodologies for more details.

The Herfindahl-Hirschman measure attempts to measure market concentration. It places extra emphasis on the contributions of participants with the largest shares. The measure is commonly used to assess whether mergers should go ahead and whether they will significantly affect the balance of the market in a particular sector. It is expressed by the following equation: Herfindahl-Hirschman measure = the square of each participant's market share added together across all participants in the market. Values vary between zero, which signifies a perfectly competitive industry, and ten thousand, for a pure monopoly.

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Competition in UK gas supply, 2022

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Key headlines

In 2022, the number of large gas suppliers increased to 28, following a drop to 25 in 2021 the result of significant increases in wholesale gas prices forcing market exits. The 2022 figures reflect a return to the general trend seen in recent years.

Consequently, in 2022 the top nine suppliers accounted for 77 per cent of the market – a decrease compared to 2021 but higher than levels seen in 2016-2019. The market share occupied by the three largest suppliers remained stable at 41 per cent.

The number of large suppliers to the commercial sector fell from nine to seven in 2022, with the sector reaching its highest level of concentration since the 1990s. The domestic and industrial sectors remained relatively stable, with minimal change to the number of large suppliers between 2021 and 2022.

Background

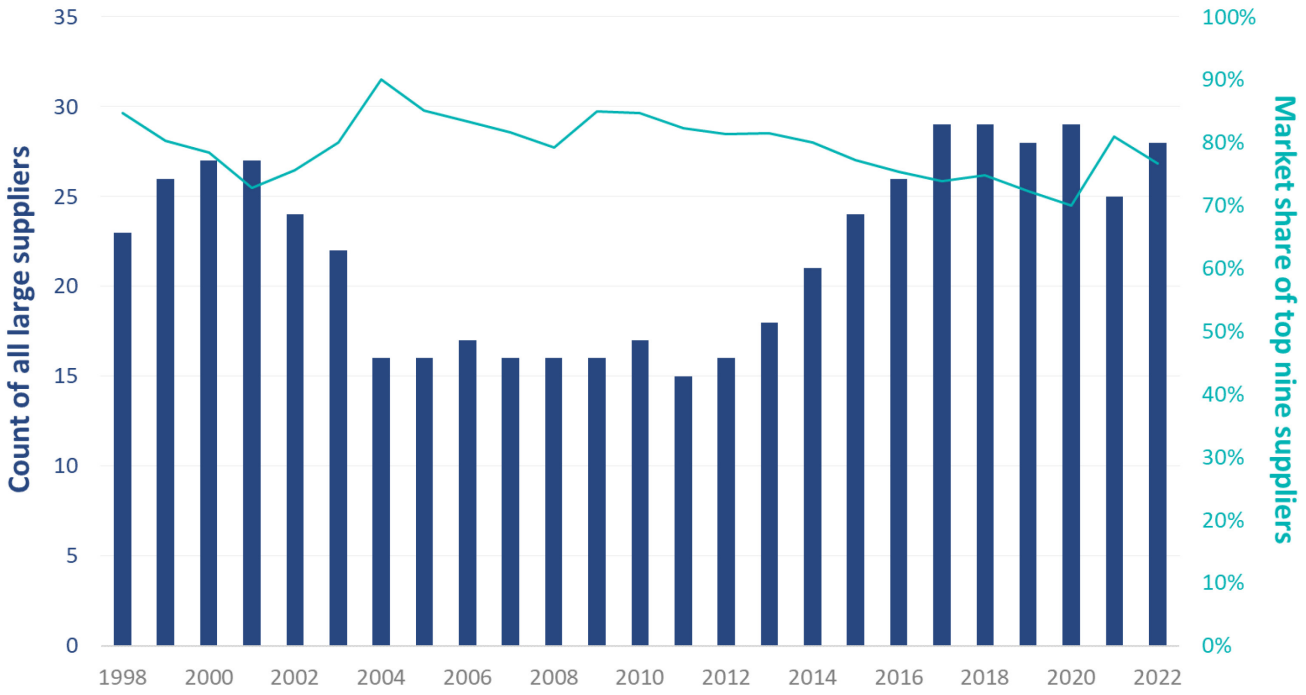
The Department for Energy Security and Net Zero (DESNZ) define gas suppliers as large or small based on how much gas they supply. A large supplier is one who supplies more than 1,750 GWh per year, and a small supplier is one who supplies less than this. DESNZ collect data from companies who are licensed to supply gas. Large suppliers are mandated to provide monthly data. A sample of small suppliers are asked to provide data annually.

Gas supply can be broadly described by key sectors: domestic, industrial, commercial and gas supply for electricity generation. This article considers domestic, industrial and commercial sectors.

This article describes the number and size of companies supplying gas to the UK, as well as the market concentration of the domestic, industrial and commercial sectors. Market concentration is assessed using the Herfindahl-Hirschman index; further details on this measure can be found in the methodology note at the end of this article.

Number of UK gas suppliers

Chart 1: Number of large gas suppliers and market share of the top nine suppliers, 1998 to 2022



The process of denationalising UK gas supply began in 1986, continuing for a period of 6 years until 1992. This restructuring of the gas market led to increasing numbers of gas suppliers until 2000. Following this the number of suppliers decreased driven by company mergers. From 2008, market conditions saw numbers generally increase until they reached a peak of 29 in 2017. From 2017, total supplier numbers have been declining although the number of large suppliers remained relatively stable until 2021, when the number of large suppliers dropped to 25 due to market exits caused by unprecedented wholesale gas prices. In 2022, this figure increased to 28, consistent with the pre-2021 trend.

From 2017, the market share occupied by the top nine suppliers gradually declined reaching a low of 70 per cent in 2020. This trend was reversed in 2021 when the market share of the top nine suppliers reached 80 per cent, the highest since 2013. This was the result of a number of market exits, with substantial customer numbers being transferred to the companies still supplying the market and hence increasing their market share. In 2022, the market share of the top nine suppliers decreased slightly to 77 per cent as several small suppliers grew their market share or moved up into the large supplier category.

Table 1: Gas supplied to consumers by aggregate market shares, 2017 to 2022

	2017	2018	2019	2020	2021	2022
Aggregate market share of top 3 suppliers	36.9%	36.5%	38.1%	35.0%	41.1%	40.5%
Aggregate market share of next top 3 suppliers	21.1%	22.4%	18.6%	21.0%	22.4%	21.0%
Aggregate market share of next top 3 suppliers	15.8%	15.9%	15.5%	14.0%	16.9%	15.1%
Aggregate market share of top 9 suppliers	**73.9%**	**74.8%**	**72.3%**	**70.1%**	**80.4%**	**76.7%**
Other suppliers	26.1%	25.2%	27.7%	29.9%	19.6%	23.3%

The gas market has been traditionally dominated by a few major suppliers and in recent years, the market share occupied by the top three suppliers has been fairly stable except for 2021, when the share increased to 41 per cent as customers were transferred to large suppliers when others closed. In 2022, the aggregate market share of the top three suppliers remained stable at 41 per cent. The next six largest suppliers returned to similar market share levels seen between 2017 to 2020, which reflects growth in newer suppliers who have increased their customer numbers in recent years.

Table 2: Number of large gas suppliers by sector, 2002 to 2022

	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020	2021	2022
Domestic	12	7	6	6	7	7	9	12	16	16	12	12
Commercial	10	10	7	6	8	8	9	11	11	11	9	7
Industry	15	10	9	8	8	7	11	11	11	9	9	10

In the domestic sector, the number of large suppliers steadily decreased between 2005 to 2020 as smaller suppliers entered the market and gained market share. However, in 2021 the number of large domestic suppliers fell to 12 from 16, leading to an increase in the market share of the top nine suppliers. This number remained stable in 2022, with the top nine suppliers accounting for 94 per cent of the market and the top three accounting for 52 per cent.

The number of large suppliers in the commercial sector has also grown in the last ten years. Similar to the domestic sector, in 2021 this was no longer the case as the number of commercial suppliers fell to nine from 11 in 2020 and in 2022, this fell further to seven suppliers. This was followed by a decrease in market share for the top three commercial suppliers, down from 69 per cent in 2021 to 67 per cent in 2022 reflecting an increase in small commercial gas suppliers. The nine largest commercial suppliers in 2022 accounted for 88 per cent of the market.

The number of large suppliers to industry remained relatively stable, increasing from nine to 10 in 2022. The market share occupied by the top three industrial suppliers increased, from 54 per cent to 56 per cent, though there was a decrease in the market share of the top nine industrial suppliers from 94 per cent in 2021 to 87 per cent in 2022.

Competition in UK gas sales

To assess the competitiveness of a market, it is useful to examine standardised measures of market concentration. One such metric is the Herfindahl-Hirschman index, where higher numbers show more concentration and lower numbers indicate a more diverse market. Further information on the Herfindahl-Hirschman index can be found at the end of this article.

Chart 2: Herfindahl-Hirschman Index for market concentration, 1986 to 2022

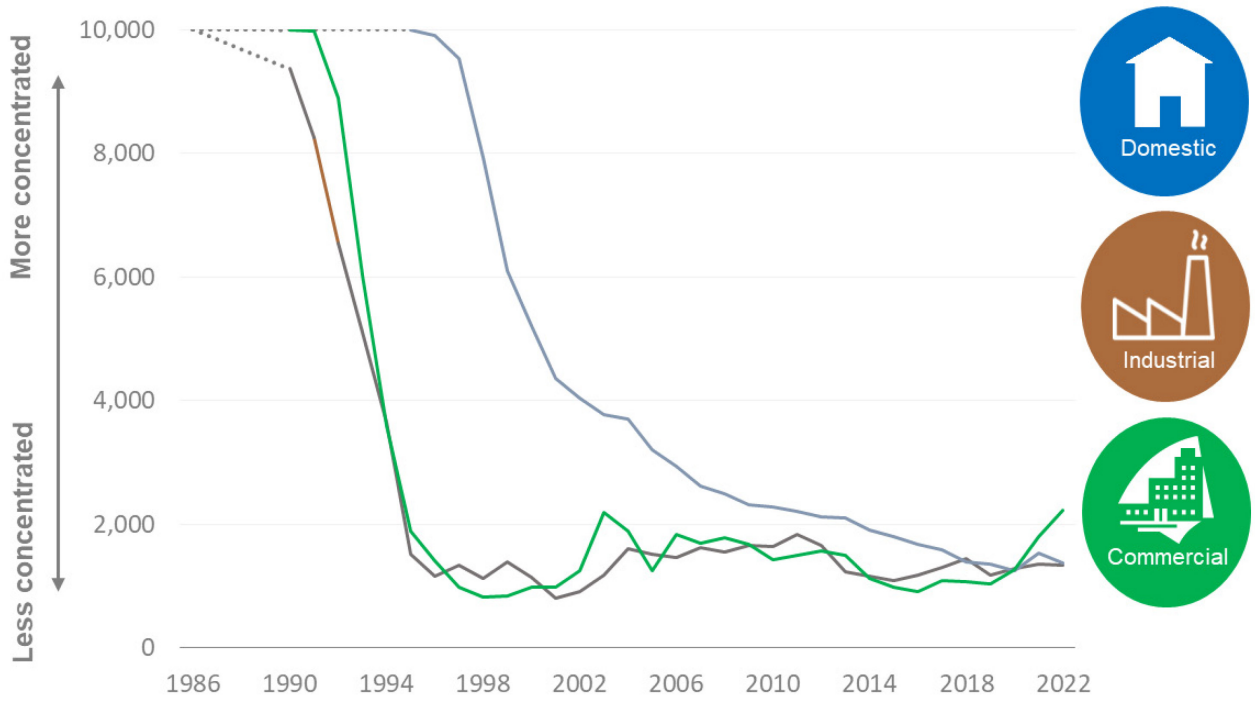


Chart 2 shows gas market concentration as expressed through the Herfindahl-Hirschman index, across the domestic, industrial and commercial sectors. Following the denationalisation of the gas market from 1986 there has been a substantial reduction in market concentration across all three sectors considered here.

The domestic sector saw a consistent year-on-year decrease in concentration until 2021, when the concentration of the domestic market increased reflecting market exits and increased market share of large suppliers. In 2022, the concentration decreased again and is now consistent with the trend over recent years.

The commercial sector has been increasing year-on-year since 2019 and in 2022, the sector reached its highest Herfindahl-Hirschman score since the 1990s, reflecting a drop in large suppliers from nine to seven.

Conversely, the concentration of the industrial sector was relatively stable between 2021 and 2022. This matches the general trend over recent years, which has shown limited year-on-year variation.

Methodology Note: The Herfindahl-Hirschman index

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

It is expressed by the following equation:

Herfindahl-Hirschman index = the square of each participant's market share added together across all participants in the market.

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

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Diversity of supply for oil and oil products in OECD countries in 2022

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Key headlines

Security of supply in 2022 was affected by two key factors – the full impact of trade sanctions announced by some countries against Russia affecting trade patterns, as well as increases in demand because of fewer restrictions in place to curb the spread of COVID-19.

The UK remained self-sufficient for petrol. Demand was less than three quarters of indigenous production making the UK a net exporter in 2022, one of 15 OECD countries who were self-sufficient for petrol.

The UK continues to be reliant on imports of crude, producing 70 per cent of demand in 2022. Five of 38 countries in the OECD were self-sufficient for crude, far fewer than for oil products. Norway was the most self-sufficient, producing more than 11 times that consumed.

There was not a country in the OECD that was self-sufficient in all four oil types.

The UK continues to import crude and oil products from a diverse range of countries staying above OECD diversity averages for all fuel types.

Background

Countries meet their oil needs through a combination of indigenous production and trade. This article compares how OECD countries manage crude oil and transport fuel demand using data from the International Energy Agency (IEA). The aim is to determine how the UK compares with other OECD countries in how it secures oil supply.

A key change in 2022 was the implementation of sanctions against Russia following the illegal invasion of Ukraine (sanctions were announced by several countries including the UK and EU). In the UK there was a sharp decline and then a cessation of imports from Russia; the Government declared its intention to end imports of oil from Russia shortly after the invasion and worked with an industry task force to implement this. A statutory ban on the import of oils from Russia came into effect in December 2022: https://www.gov.uk/government/publications/uk-ban-on-russian-oil-and-oil-products/uk-ban-on-russian-oil-and-oil-products..

The last cargo of primary oils to arrive in the UK from Russia was in October 2022 and the last cargo of finished products was in November 2022. Russian crude oil imports dropped from 7.4 per cent of the total in 2021 to 1.2 per cent in 2022, and Russian product imports dropped from 22 per cent to 6.9 per cent. More recent data on oil imports to the UK are published in Energy Trends Table 3.14.

In addition to the impacts of the sanction on supply, 2022 saw further recovery in demand across OECD countries following the ending of Covid-19 restrictions on travel. In the UK transport demand bounced back in a period where the UK did not have travel restrictions, with road fuel demand up by 1.3 per cent and a near doubling of aviation demand. UK production of primary oils fell to a record low of 38.0 million tonnes amid reports of low investment in recent years. This article seeks to unpack these changes in relation to other OECD countries and trends.

Charting oil self-sufficiency and diversity of supply

- **Self-sufficiency** is the proportion of a country's demand that could be met through indigenous production (as shown on the vertical axis). A score of one indicates that a country produces as much oil as it uses, a score of 0 indicates that no demand was met with indigenous production.
- **A diversity score** is calculated using the number of sources in which a country imports oil, and their respective political stability – defined by the World Bank's governance indicators (See Appendix 3 for methodological note).
- **Consumption** is represented by the circle or bubble, the area of which indicates the level of consumption for 2022 for each OECD country.

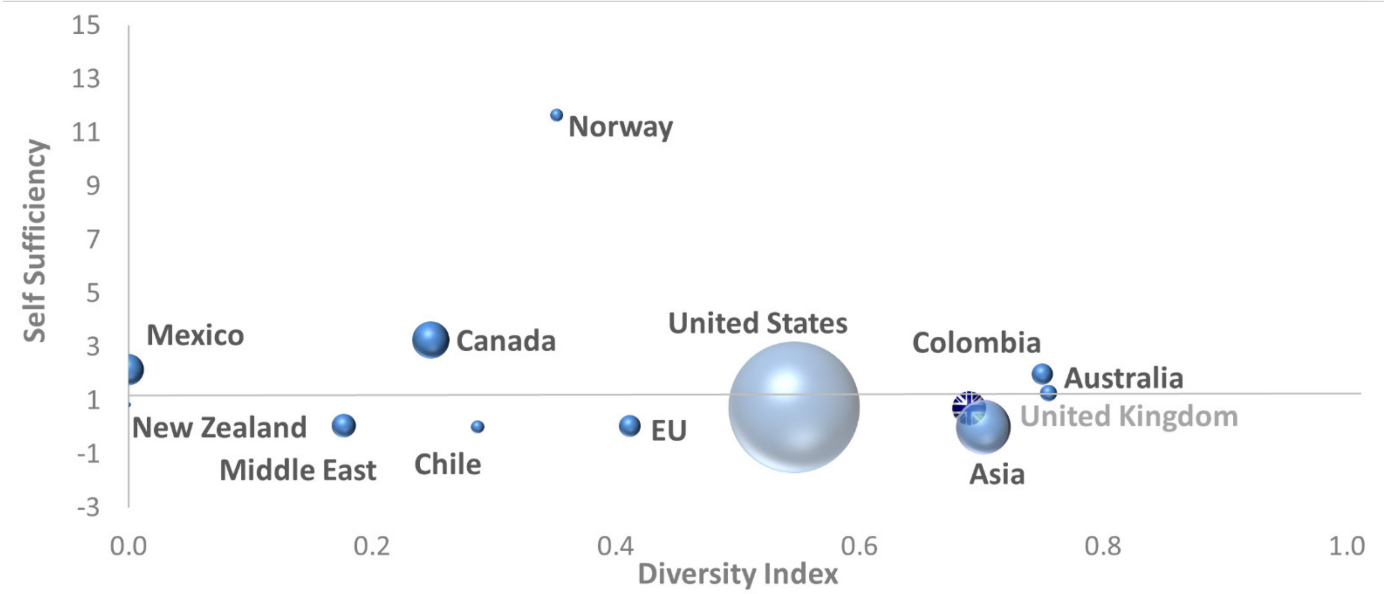
Bubble charts show the relationship between consumption (size of the bubble), indigenous production (self-sufficiency) and the diversity and political stability of import sources.

Bar charts provide a means of comparing OECD countries by self-sufficiency and diversity of imports. The sum of these two components is used as a simplified metric for security of supply, and thus does not represent a full description of security of supply beyond import diversity, stability and self-sufficiency. Appendix 2 shows the underlying data.

Choropleth maps show a visual representation of where OECD countries' oil imports come from. Variable quantities are shown according to colour; darker shades represent a higher proportion of imports originate from that country.

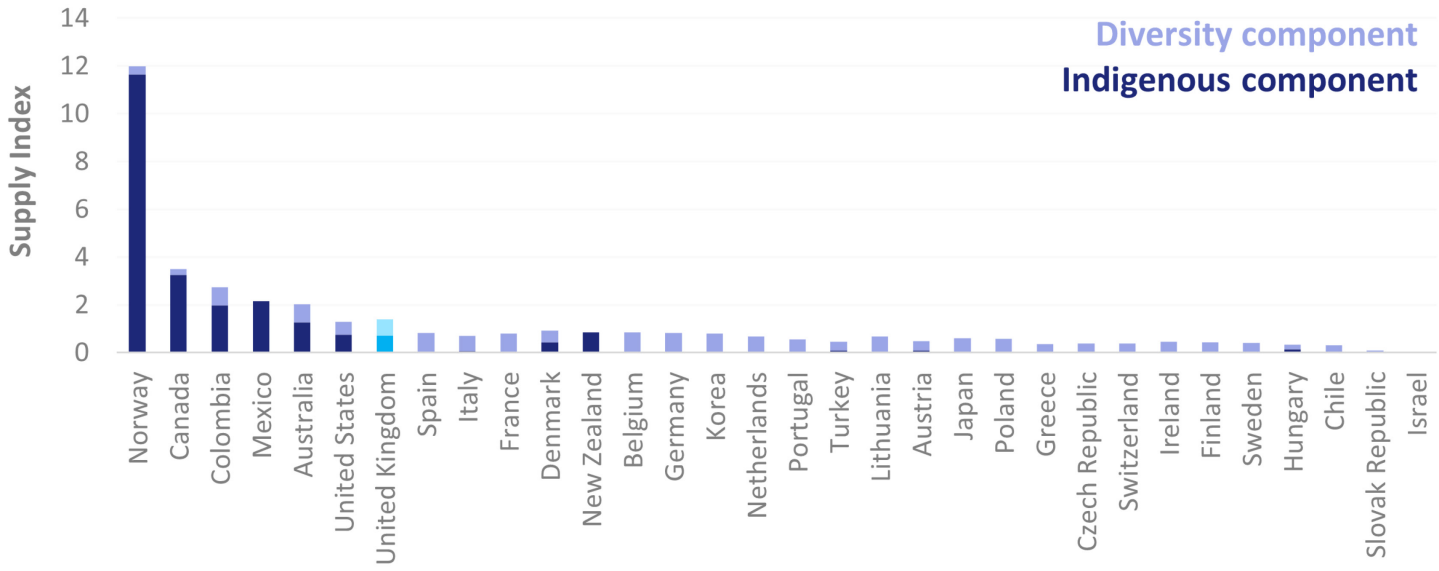
Crude Oil

Chart 1: Diversity and self-sufficiency of crude oil for OECD countries, 2022



With an average self-sufficiency score of 0.62, OECD counties were generally reliant upon imports of crude to meet refinery demand in 2022. Chart 1 shows that in 2022, five OECD countries were self-sufficient in terms of crude oil production. Norway remained a net exporter of crude oil and the most self-sufficient country producing more than eleven times its consumption. With a self-sufficiency score of 0.70, down 19 per cent on the previous year, the UK continued to be a net importer of crude in 2022. This was due to increased demand compared to 2021 alongside a continued decline in indigenous production as reports suggest decreased investment in recent years. Despite this, the UK ranked eight out of all OECD countries and was above the average of 0.62. The UK had a diversity score of 0.69 which is also above the OECD average of 0.40.

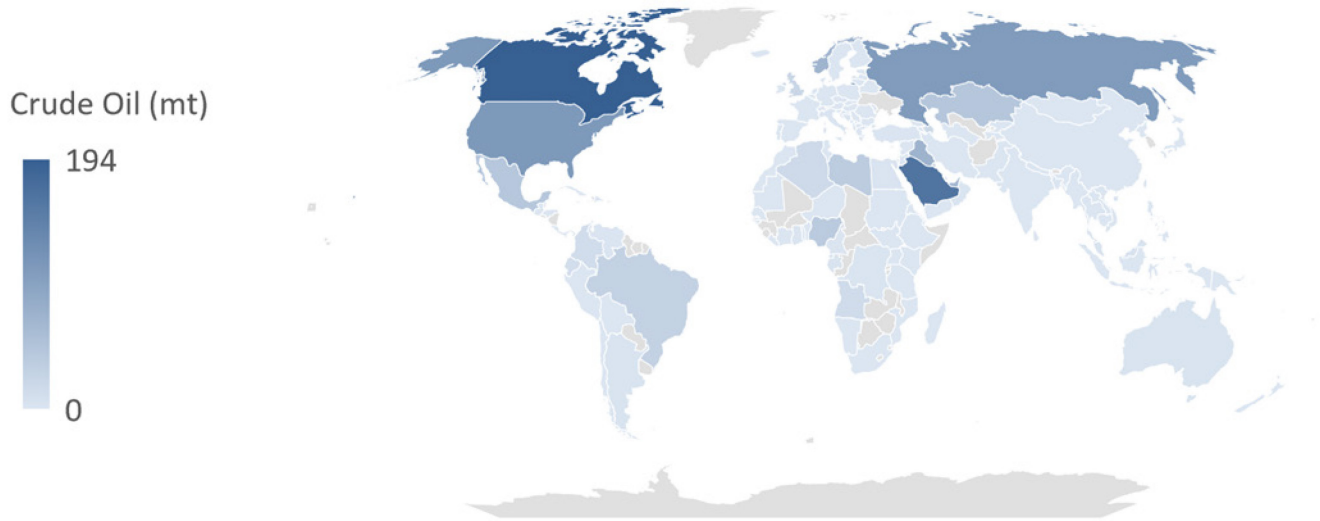
Chart 2: Security of supply of crude oil for OECD countries, 2022



Data not available for Costa Rica, Estonia, Iceland, Latvia, Luxembourg and Slovenia

The simplified security index of supply shows that most OECD countries fulfil supply of crude oil through trade, with a relatively small contribution from indigenous production; six of the 32 OECD countries for which data was available had no indigenous component to their crude supply (13 including countries with missing data). Chart 2 shows that the UK has substantial indigenous crude production. In 2022, just under half of the UK's gross supply was produced indigenously.

Map 1: Worldwide crude oil exports to OECD countries (million tonnes), 2022

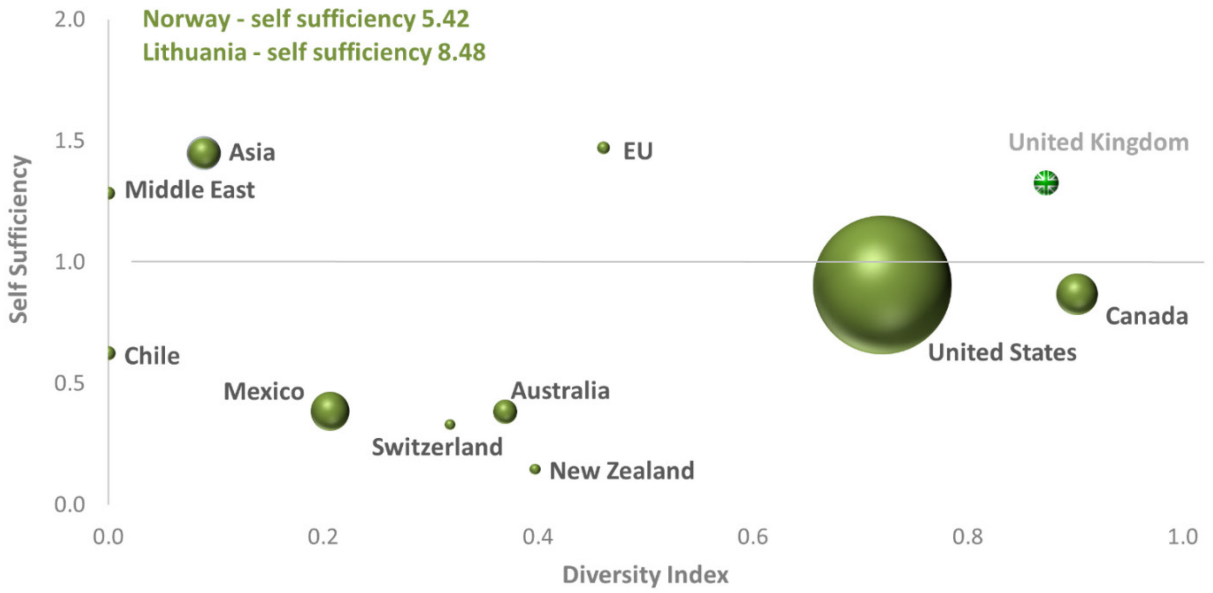


Map 1 illustrates where crude oil exports originated in 2022. Canada, Saudi Arabia, and the US were the largest exporters of crude to OECD countries; Canada exporting the most at 194 million tonnes. Of exporters to OECD countries, the UK ranked seventh, supplying 21 million tonnes.

In 2022, the UK imported crude oil from 23 countries (an increase from 14 in 2021). For the first time the US overtook Norway as the UK's largest import source, at 35 per cent and 32 per cent, respectively. Following Russia's illegal invasion of Ukraine, Russian crude oil imports were banned in the UK from the 5th of December 2022 and the UK has not imported Russian crude oil since April; in 2022, the UK imported just 1.2 per cent of its crude oil supply from Russia. For more information on energy imports from Russia please see Energy Trends Table 3.14.

Petrol

Chart 3: Diversity and self-sufficiency of petrol for OECD countries, 2022



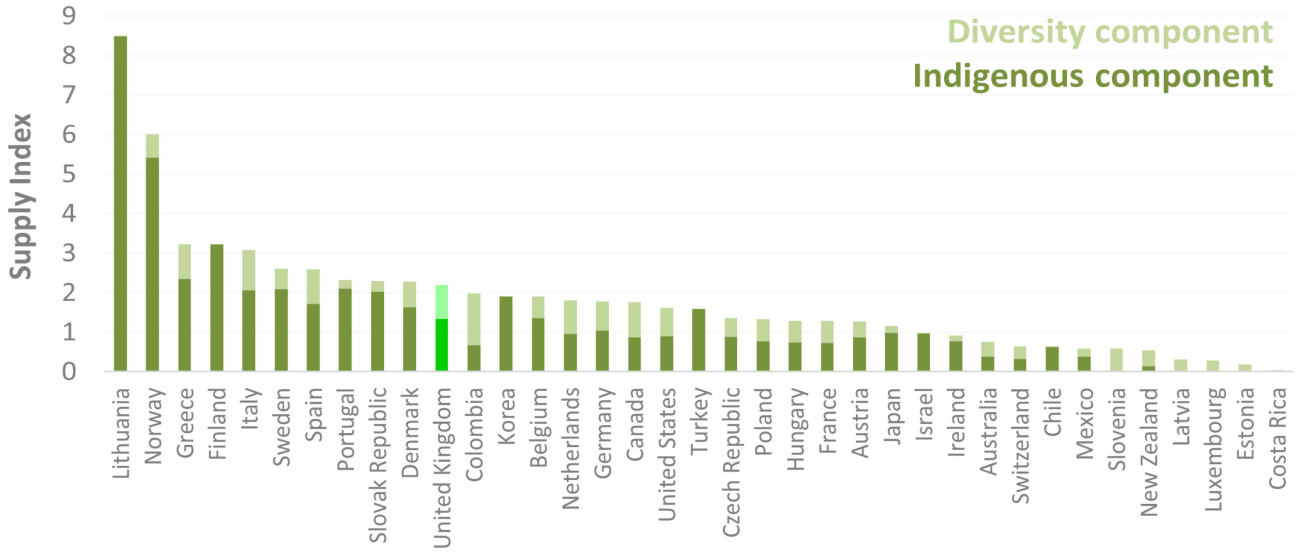
No Diversity Index data available for Middle Eastern countries, Israel, and Turkey.

OECD countries were generally self-sufficient in petrol, with an average score of 1.33, above the self-sufficiency threshold of one. Of all oil types, petrol imports were the most diverse with an average score of 0.43. Chart 3 shows that, unlike crude, 15 of the 38 OECD countries were self-sufficient in terms of petrol supply.

Lithuania had the highest self-sufficiency score of 8.48 showing that it produced more than eight times the amount of petrol it consumed. Lithuania's Mazeikiai refinery is the only one in the Baltic region and has capacity to produce oil products well in excess of domestic demand, making Lithuania a net exporter of refined products, principally to neighbours (e.g., Latvia, Ukraine, Poland, and Estonia) but also further afield (e.g., the Netherlands and the United States)[1].

The US constituted 63 per cent of total OECD petrol consumption and 60 per cent of total OECD petrol production, but despite this it wasn't self-sufficient in 2022 with a score of 0.90. The UK had a self-sufficiency score of 1.33, meaning that the UK more than met demand with indigenous production in 2022.

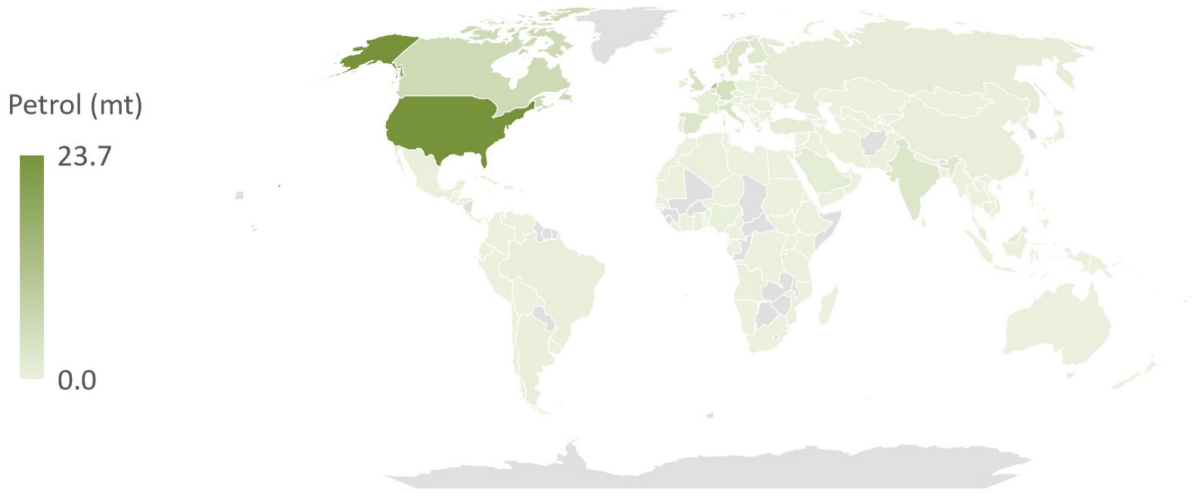
Chart 4: Security of supply of petrol for OECD countries, 2022



[1] https://www.iea.org/articles/lithuania-oil-security-policy

Chart 4 shows that most OECD countries produce a large proportion of the petrol they consume, unlike the pattern for crude. The UK ranks eleventh for security of petrol supply in this simplified index.

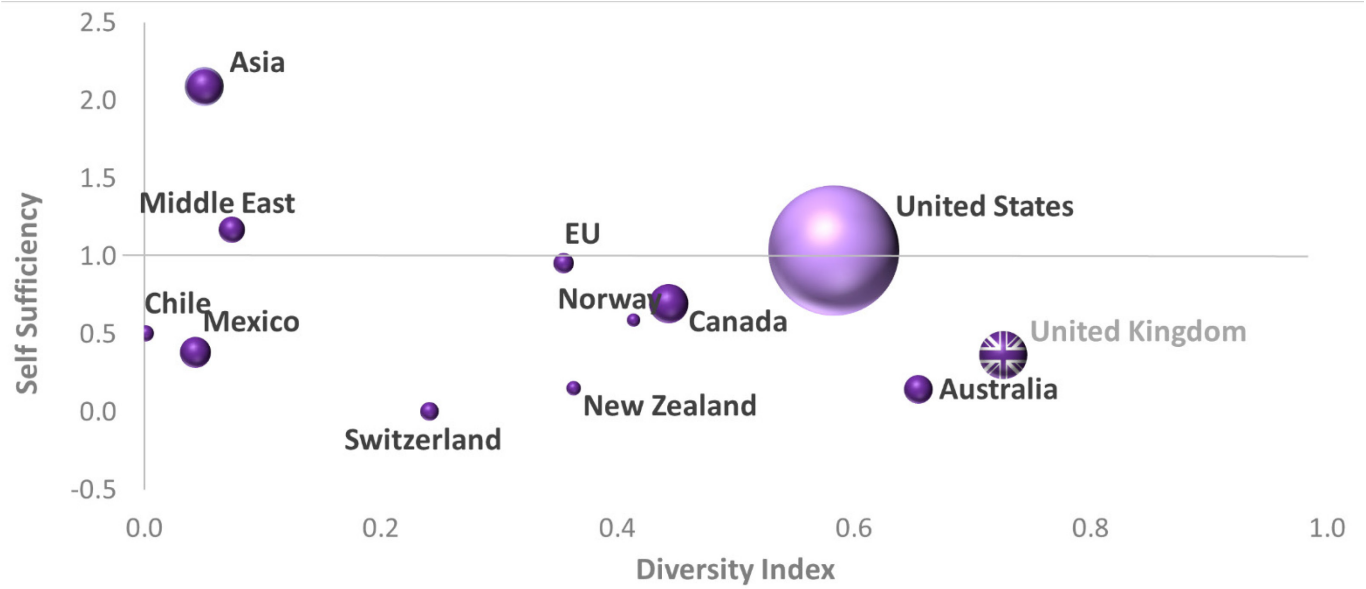
Map 2: Worldwide petrol exports to OECD countries (million tonnes), 2022



The largest exporter of petrol to OECD countries globally was the US, exporting 23.7 million tonnes of petrol in 2022; the US made up almost 30 per cent of OECD petrol imports and 17 per cent of global petrol imports. EU countries also play a significant role exporting petrol; in 2022 EU countries exported 36.9 million tonnes, almost half of the OECD total petrol exports of 78.4 million tonnes. The Netherlands is one of the largest global oil trading hubs, exporting 10 million tonnes of petrol in 2022. The UK is the seventh largest exporter of petrol in the OECD, exporting 3.6 million tonnes to other OECD countries. Globally, the UK exports 9 million tonnes of petrol.

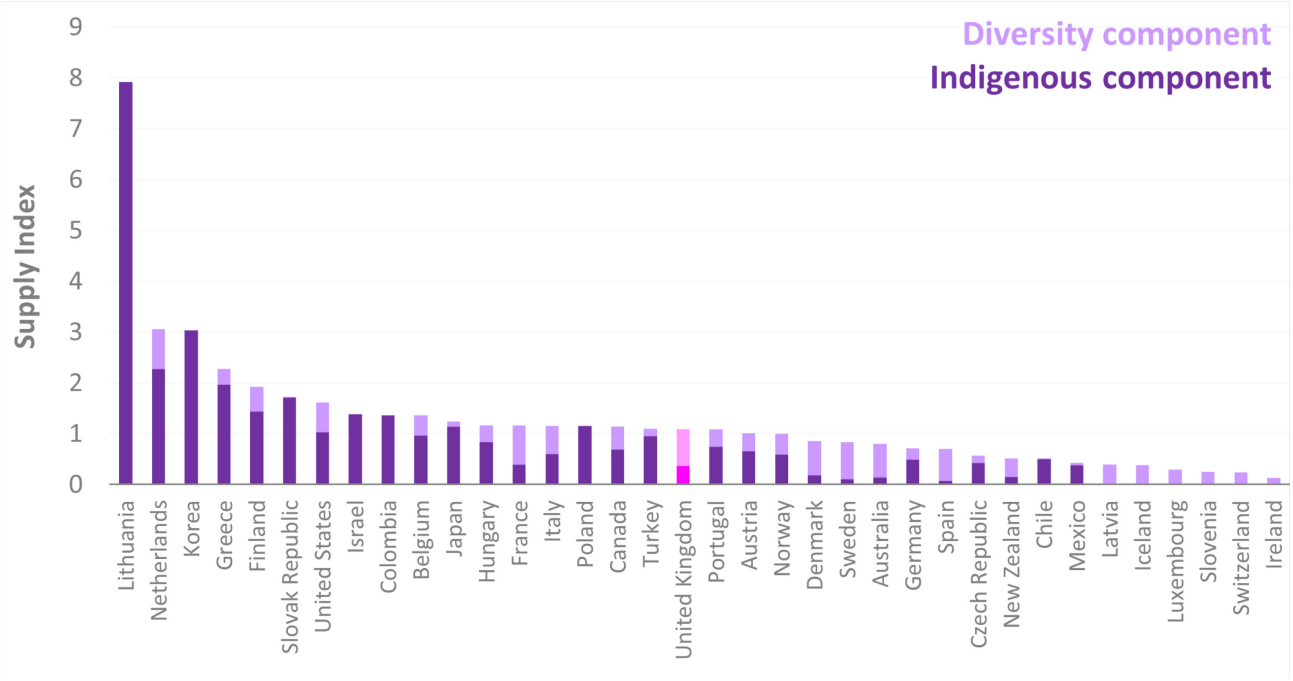
Jet Fuel

Chart 5: Diversity and self-sufficiency of jet fuel for OECD countries, 2022



Jet fuel imports were the least diverse of the four oil types because fewer countries produce and export jet fuel in large quantities. Demand for jet fuel increased in 2022 following fewer restrictions due to COVID-19, meaning that the average self-sufficiency score continued to drop, falling to 0.89 compared to 0.99 in 2021. Lithuania was again the most self-sufficient with a score of 7.92 meaning it produced almost eight times its own consumption, followed by Korea and the Netherlands. After increasing by 27 per cent between 2020 and 2021, US demand for jet fuel in 2022 decreased slightly, still making up more than half of total OECD demand.

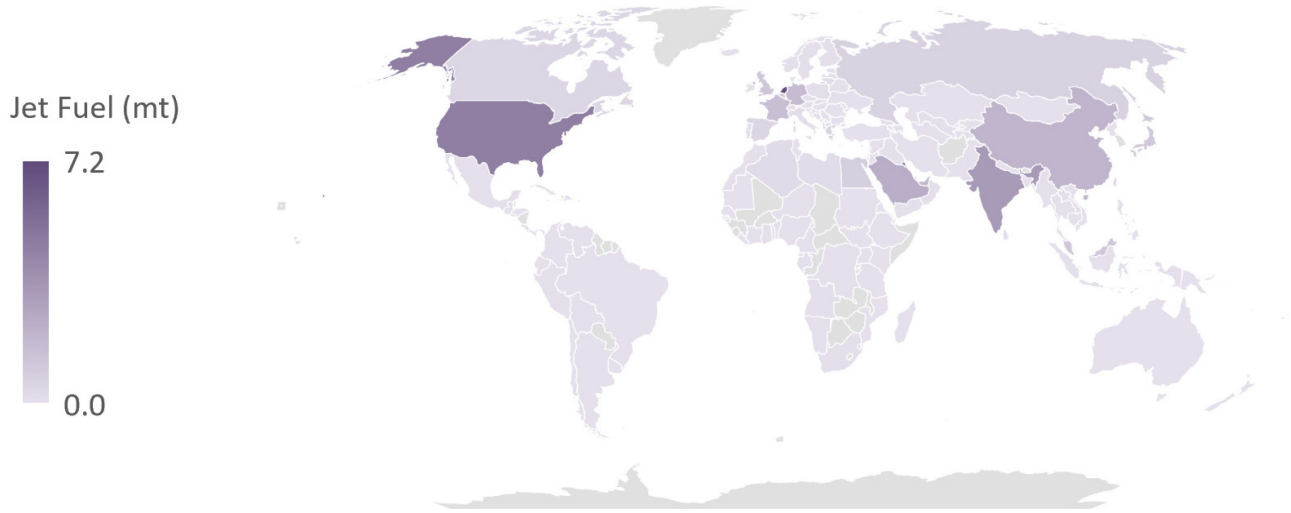
Chart 6: Security of supply of jet fuel for OECD countries, 2022



Data not available for Costa Rica and Estonia

Heathrow is one of the busiest airports in Europe, contributing to the UK's high demand for jet fuel. The UK had the second highest demand in 2022, behind only the US. The UK's small indigenous production results in a relatively small self-sufficiency score of 0.36, down from 0.39 in 2021, but this is secured with imports from a diverse range of stable countries, evidenced in the UK diversity score of 0.73 compared to the average of 0.31.

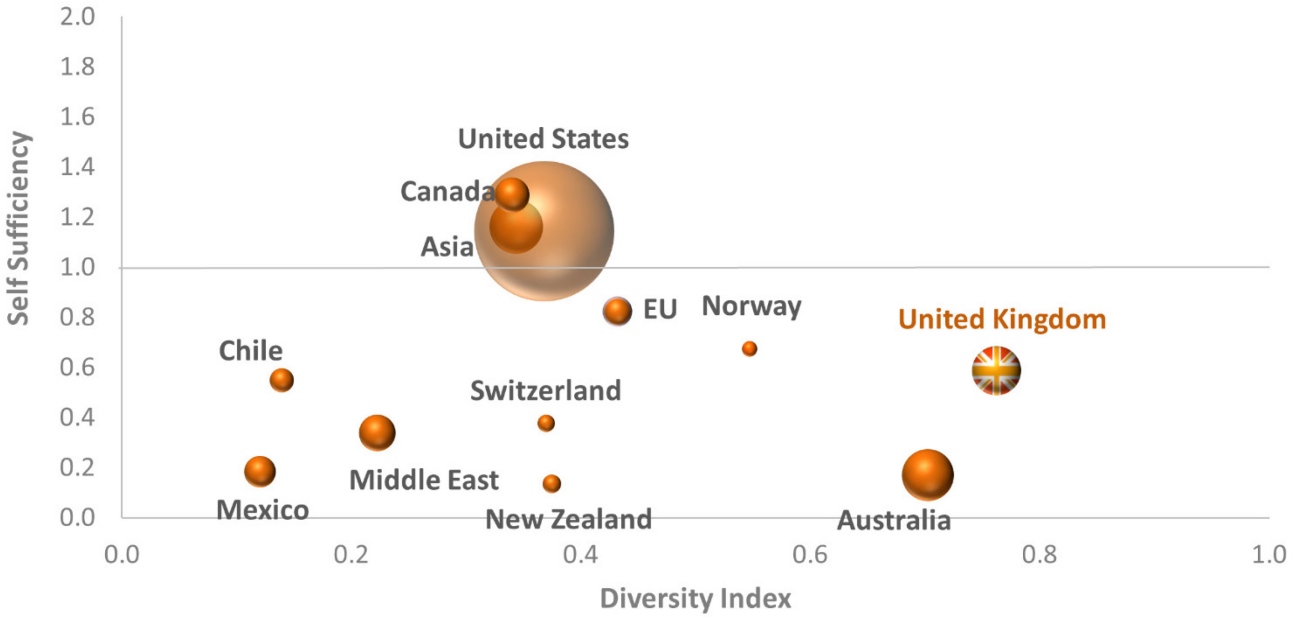
Map 3: Worldwide jet fuel exports (million tonnes), 2022



Unlike crude and petrol, very few countries export jet fuel in large quantities. The largest exporters to OECD countries were the Netherlands, Korea, and the US. The Netherlands exported 7.2 million tonnes in 2022, followed by Korea who exported 6.3 million tonnes. The UK exported 1.1 million tonnes of jet fuel to other OECD countries and was the twelfth largest exporter.

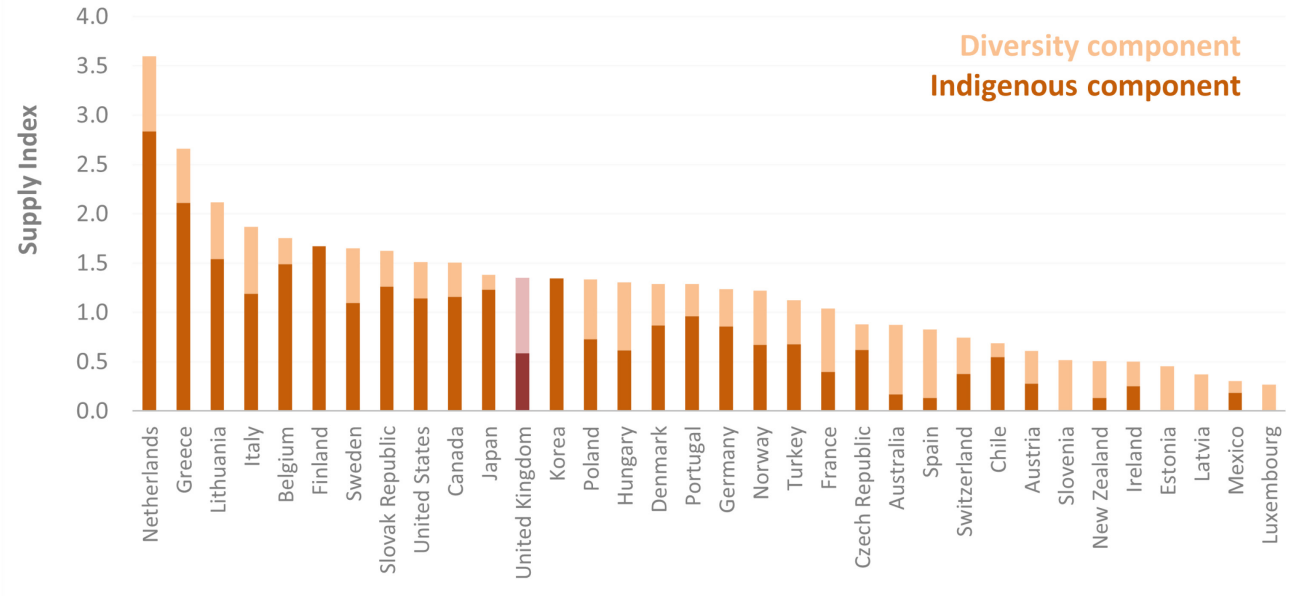
Road Diesel

Chart 7: Diversity and self-sufficiency of diesel for OECD countries, 2022



OECD countries remain reliant on imports to meet demand for diesel, with the average self-sufficiency score of 0.71 falling by seven percentage points compared to 2021. The average diversity score for the OECD was 0.38, a slight increase from 0.37 in 2021. In 2022, 12 countries were self-sufficient in terms of diesel supply, and eight countries did not produce any diesel at all. Chart 7 shows that the UK's self-sufficiency score of 0.59 remained below the OECD average, EU average and below the self-sufficiency threshold of 1. Despite this, the UK had a diversity index of 0.76, the highest in the OECD in 2022.

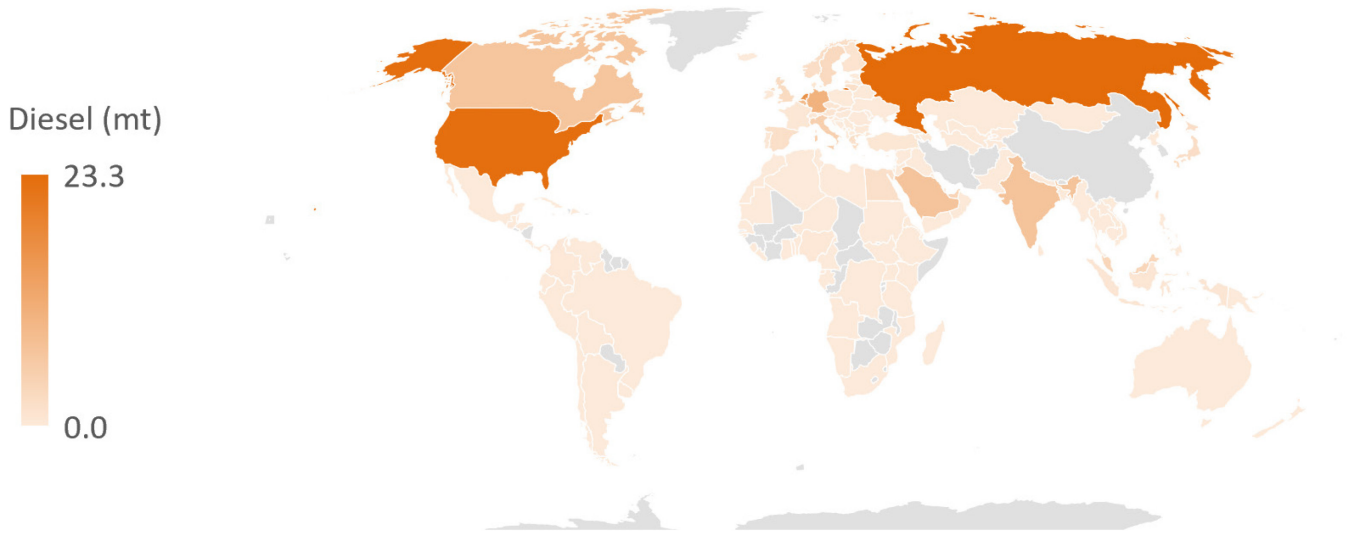
Chart 8: Security of supply of diesel for OECD countries, 2022



Data not available for Colombia, Costa Rica, Iceland and Israel

Chart 8 shows that a large proportion of diesel demand was met through indigenous production, but many countries relied upon a combination of both indigenous and diversity components. Finland and Korea did not import any diesel. The UK ranked twelfth out of all OECD countries for security of diesel supply with a score of 1.4, above the OECD average of 1.2.

Map 4: Worldwide diesel exports to OECD countries (million tonnes), 2022



Historically Russia has been a key supplier of diesel to the UK, EU, and OECD. In 2022 Russia remained the largest exporter of diesel to the OECD, exporting 23.3 million tonnes followed by the US (22.7 million tonnes) and the Netherlands (16.3 million tonnes).

However, although Russia was still the largest import source for the OECD, imports had dropped by just over four million tonnes in 2022 compared to 2021. Several countries implemented sanctions against Russian oil imports in 2022: the UK banned Russian oil imports on the 5th December 2021; Canada, Australia, and other members of the G7 banned Russian oil imports in March 2022 and imposed a price cap in December 2022[2]; and the EU imposed a ban and price cap on Russian crude oil in December 2022, and on products in February 2023[3]

To compensate, imports of diesel were up from the US by 4.4 million tonnes as the OECD sought alternative supply.

Summary

The OECD has a higher security of supply for oil products compared to crude oil. This is because of higher levels of refinery production compared to crude extraction. Nevertheless, the scores for transport fuels are dependent on refining crude oil and therefore should only be considered independently with caution. The average self-sufficiency score for crude oil was 0.62 which, despite increasing since 2021, shows OECD countries are still dependent on imports of crude oil to meet refinery demand. The diversity score for crude oil of 0.40 was much more comparable to transport fuels showing that the OECD has a consistent, wide range of sources of imports.

As demand continued to increase in 2022 compared to 2021, average self-sufficiency scores for transport fuels decreased. Out of the three transport fuels, petrol supply was the most secure with both the highest average self-sufficiency and diversity scores. Fifteen of the 38 members were self-sufficient and the average score of 1.33 suggests that OECD countries are well-placed to meet demand for petrol. The supply of diesel was the least secure transport fuel in 2022. Twelve OECD countries were self-sufficient, but the average self-sufficiency score was 0.71, which is below the sufficiency threshold of 1.

With the second highest average self-sufficiency score (0.89) of the oil types OECD countries were on average almost self-sufficient in jet fuel supply. However, jet fuel had the lowest diversity score of all fuel types

[2] https://www.canada.ca/en/department-finance/news/2022/12/g7-and-australia-move-forward-with-price-cap-on-russian-oil.html
[3] https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/#sanctions

largely due to fewer countries exporting jet fuel at high quantities. Jet fuel demand continued to rise across the OECD in 2022 as there were fewer travel restrictions in place to curb the spread of COVID-19, increasing by 31 per cent on average compared to 2021. Demand for jet in the UK nearly doubled, but with a diversity score of 0.73 the UK remains in a relatively secure position compared to the OECD average.

The UK consistently has diversity scores higher than the OECD average for all oil types considered here. The UK is self-sufficient in petrol (and a net exporter). The UK is not self-sufficient for crude oil, diesel or jet fuel, but meets its needs through a diverse range of import sources as well as indigenous production.

Appendix 1 – List of OECD countries in category averages

Asia
Japan
Korea

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

Middle East
Israel
Turkey

Appendix 2 – Provisional data for 2022

	CRUDE			PETROL			JET FUEL			DIESEL		
	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand
Australia	0.76	**1.26**	11,770	0.37	0.38	11,189	0.65	0.15	3,395	0.70	0.17	25,688
Austria	0.39	0.09	5,617	0.40	0.87	1,500	0.35	0.66	610	0.33	0.28	6,116
Belgium	0.84	0.00	27,763	0.55	**1.35**	2,241	0.40	0.97	1,695	0.26	**1.49**	5,832
Canada	0.25	**3.25**	60,557	0.90	0.87	33,273	0.44	0.70	6,306	0.34	**1.16**	26,211
Chile	0.29	0.01	7,318	0.00	0.62	3,779	0.00	0.51	1,035	0.14	0.55	4,734
Colombia	0.75	**1.99**	19,564	1.30	0.68	6,193	0.00	**1.37**	847	0.00	0.00	0
Costa Rica	0.00	0.00	0	0.04	0.00	926	0.00	0.00	176	0.00	0.00	995
Czech Republic	0.37	0.01	7,457	0.48	0.88	1,589	0.14	0.43	274	0.26	0.62	5,093
Denmark	0.48	0.44	7,212	0.65	**1.63**	1,273	0.67	0.19	765	0.42	0.87	2,454
Estonia	0.00	0.00	0	0.19	0.00	208	0.00	0.00	54	0.45	0.00	780
Finland	0.43	0.00	9,273	0.00	**3.22**	1,283	0.49	**1.44**	593	0.00	**1.67**	2,329
France	0.79	0.01	41,244	0.56	0.73	10,045	0.76	0.40	6,320	0.64	0.40	35,736
Germany	0.81	0.02	89,850	0.73	**1.04**	19,566	0.22	0.50	8,952	0.37	0.86	34,761
Greece	0.36	0.00	21,997	0.87	**2.35**	2,175	0.30	**1.97**	1,468	0.55	**2.11**	2,883
Hungary	0.19	0.14	6,416	0.54	0.75	1,533	0.32	0.84	261	0.69	0.62	3,852
Iceland	0.00	0.00	0	0.00	0.00	139	0.39	0.00	280	0.00	0.00	484
Ireland	0.45	0.00	2,983	0.13	0.77	690	0.13	0.00	966	0.25	0.26	2,980
Israel	0.00	0.01	13,700	0.00	0.98	3,195	0.00	**1.38**	901	0.00	0.00	0
Italy	0.62	0.07	65,581	1.00	**2.07**	7,929	0.55	0.60	3,820	0.68	**1.19**	23,543
Japan	0.61	0.00	133,219	0.18	0.99	34,580	0.10	**1.14**	7,523	0.15	**1.23**	20,555
Korea	0.79	0.00	139,229	0.00	**1.91**	10,376	0.00	**3.04**	5,101	0.00	**1.34**	20,168
Latvia	0.00	0.00	0	0.31	0.00	157	0.39	0.00	141	0.37	0.00	788
Lithuania	0.66	0.00	8,241	0.01	**8.48**	282	0.00	**7.92**	108	0.58	**1.54**	1,685
Luxembourg	0.00	0.00	0	0.28	0.00	345	0.30	0.00	554	0.27	0.00	1,209
Mexico	0.00	**2.15**	42,443	0.21	0.38	28,954	0.04	0.38	3,954	0.12	0.18	13,538
Netherlands	0.66	0.01	49,823	0.85	0.95	3,928	0.78	**2.27**	3,108	0.76	**2.84**	5,505
New Zealand	0.00	0.84	899	0.40	0.15	2,156	0.36	0.15	837	0.37	0.13	3,216
Norway	0.35	**11.64**	7,211	0.58	**5.43**	657	0.41	0.59	711	0.55	0.67	2,440
Poland	0.54	0.03	26,645	0.55	0.78	5,202	0.00	**1.15**	978	0.60	0.73	17,931
Portugal	0.56	0.00	10,142	0.22	**2.11**	1,054	0.34	0.75	1,513	0.33	0.96	4,408
Slovak Republic	0.08	0.00	5,394	0.26	**2.03**	628	0.01	**1.71**	43	0.36	**1.26**	2,121
Slovenia	0.00	0.00	0	0.59	0.00	423	0.25	0.00	21	0.52	0.00	1,656
Spain	0.81	0.00	63,394	0.88	**1.72**	5,751	0.63	0.07	5,872	0.69	0.13	22,156
Sweden	0.41	0.00	18,375	0.53	**2.09**	2,154	0.73	0.11	712	0.55	**1.10**	4,657
Switzerland	0.38	0.00	3,025	0.32	0.33	2,080	0.24	0.00	1,383	0.37	0.38	2,709
Turkey	0.35	0.10	36,670	0.00	**1.59**	3,250	0.15	0.96	4,935	0.44	0.68	24,555
United Kingdom	0.69	0.70	50,118	0.87	**1.33**	11,889	0.73	0.36	9,585	0.76	0.59	23,158
US	0.55	0.75	785,674	0.72	0.90	376,668	0.58	**1.04**	71,704	0.37	**1.14**	193,288
OECD Asia average	**0.70**	**0.00**	**136,224**	**0.09**	**1.45**	**22,478**	**0.05**	**2.09**	**6,312**	**0.08**	**1.29**	**20,361**
OECD EU average	**0.41**	**0.04**	**20,322**	**0.46**	**1.47**	**3,047**	**0.35**	**0.96**	**1,700**	**0.43**	**0.82**	**8,216**
OECD Middle East average	**0.18**	**0.05**	**25,185**	**0.00**	**1.28**	**3,223**	**0.07**	**1.17**	**2,918**	**0.22**	**0.34**	**12,277**
OECD average	**0.40**	**0.62**	**46,811**	**0.43**	**1.33**	**15,770**	**0.31**	**0.89**	**4,145**	**0.38**	**0.71**	**14,479**

Items in bold highlight those countries where indigenous production exceeded domestic consumption.

DI = Diversity Index
S-S = Self-sufficiency

Demand is in thousand tonnes (kt)

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

Appendix 3 – Methodology

Data for crude oil and transport fuel self-sufficiency

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

Crude oil and transport fuel diversity indices

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

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

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

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

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

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

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

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

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

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

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Regional renewable electricity in 2022

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Key headlines

Renewable generation in the UK increased by **10.5 per cent** from 122.0 TWh in 2021 to 134.9 TWh in 2022. This was a result of increased rainfall, wind and sunshine hours. Within this:

- Generation in England was **up 4.4 per cent**
- Generation in Northern Ireland was **up 16.4 per cent**
- Generation in Scotland was **up 29.4 per cent**
- Generation in Wales was **up 5.1 per cent**

Overall capacity increased by **7.7 per cent** from 49.7 GW at the end of 2021 to 53.5 GW at the end of 2022. Within this:

- Capacity in England was **up 6.9 per cent**
- Capacity in Northern Ireland was **up 0.7 per cent**
- Capacity in Scotland was **up 13.0 per cent**
- Capacity in Wales was **up 1.2 per cent**

Background

This article provides information and analysis on the amount of electricity from renewable sources, disaggregated below the UK level. It includes information on capacity, generation, and number of operational sites, as well as derived load factors, for the four UK countries, the nine English regions and, from 2014, UK Local Authorities. It updates the previously published figures in the September 2022 edition of Energy Trends.

These data are consistent with those published in the Digest of United Kingdom Energy Statistics 2023 (DUKES)[1], and use similar categories[2]. The UK totals published here are consistent with the figures published in Energy Trends.

The main difference between the data published here and the data published in DUKES / Energy Trends is that generation from **liquid biofuels** (biodiesel) is not included here. This is because there are a relatively small number of sites that generate from biodiesel and publishing their totals would be disclosive. In total there are:

- 55 sites that generate from biodiesel, with 53 of them in England
- Their total capacity is 36 MW
- In 2022, they generated 147 GWh in total (0.1 per cent of total renewable generation).

In addition, there are small differences between the totals published for England, Northern Ireland, Scotland and Wales published here and those published in ET 6.1. This is because some sites cannot be allocated to local authorities where it would disclose the electricity generated by individual schemes.

Time-series data are available as Excel spreadsheets at: www.gov.uk/government/statistics/regional-renewable-statistics. The regional tables include data for 2003 – 2022 and the Local Authority tables include data for 2014 – 2022. The spreadsheets include detailed data and additional charts for generation, capacity, number of sites, generation per GVA, and load factors.

[1] www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

[2] On occasion, it has been necessary to combine some renewable sources into categories so that information about individual sites provided in confidence (rather than from publicly available sources) to Ricardo and (DESNZ) is not disclosed.

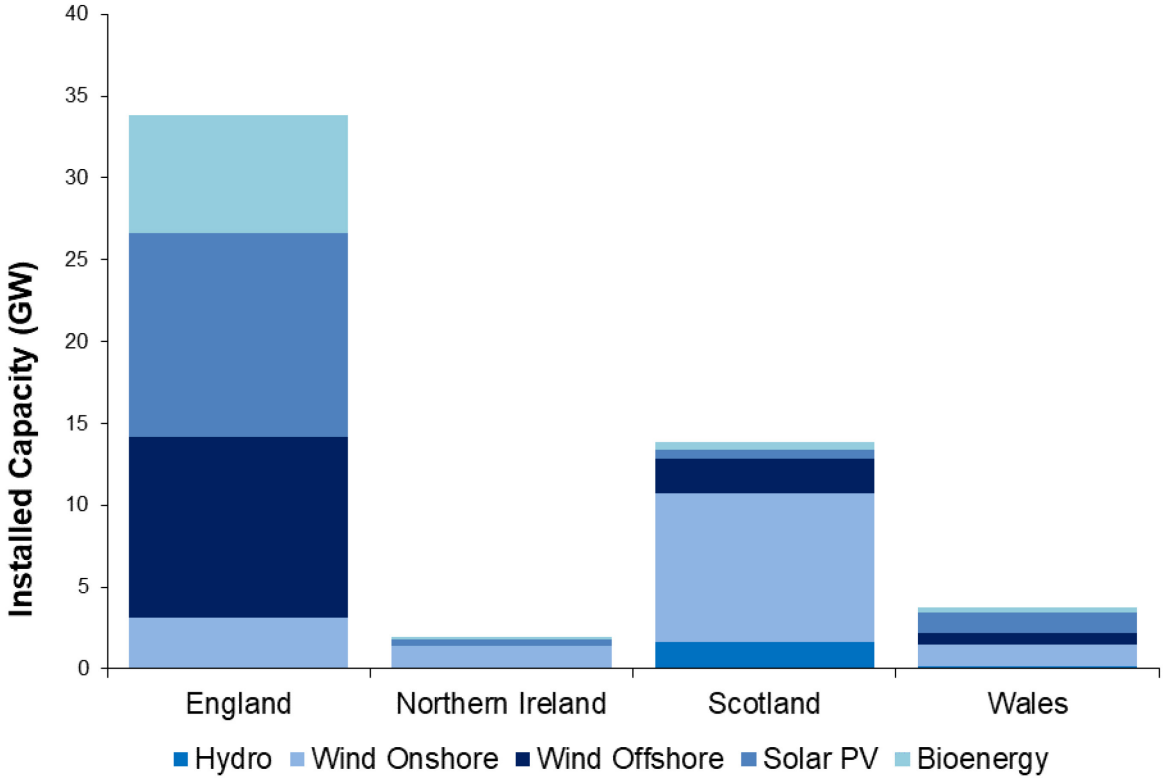
Changes from last year

This year, a District Level breakdown of the MCS (Microgeneration Certification Scheme) data was extended to include onshore wind data for Great Britain and solar PV data for Northern Ireland; this breakdown is from 2020 onwards. Further revisions are shown in the 'Revisions' section in Annex B.

Capacity

- England had the most renewable capacity and generation, nearly two and a half times that for Scotland. This is largely because England has 88 per cent of the UK's bioenergy capacity (mostly from four biomass units at Drax and the Ferrybridge Multifuel Power Station in Yorkshire and the Humber), 85 per cent of the solar PV capacity, and 79 per cent of the offshore wind capacity. Chart 1 shows a breakdown of capacity at the end of 2022 by technology and country.

Chart 1: Renewable capacity at the end of 2022 by technology and country



- The technology with the highest growth in capacity was **offshore wind**[3] (24 per cent) which accounted for 69 per cent of the total UK growth. The new offshore wind capacity was located mainly in the Yorkshire and the Humber (52 per cent), and Scotland (46 per cent). This was largely driven by Hornsea 2 and Moray East, with the addition of 1,386 and 950 MW capacity, respectively.

- **Solar PV** capacity grew by 5.3 per cent, 19 per cent of the total UK growth. The South West had the largest share (20 per cent) of the new capacity, primarily from South Farm Solar Park (40 MW).

- **Onshore wind** capacity grew by 2.4 per cent in the UK, accounting for 8.9 per cent of the total UK growth. 97 per cent of the new capacity was in Scotland - the largest schemes were Sandy Knowe (86 MW) and Kennoxhead Phase 1 (62 MW). The remaining 3 per cent of new capacity was in Wales.
- **Bioenergy** capacity grew by 1.2 per cent overall, 2.5 per cent of the total UK growth. England accounted for most of this, primarily from Rookery South ERF in East of England. Within this **AD**

[3] Offshore wind is allocated to the region to which its output is connected. The exceptions are Robin Rigg, which comes ashore at Seaton, Cumbria but whose generation is associated with Scotland, Burbo Bank, which comes ashore in Wales but whose generation is associated with the North West and Hornsea Project One which lands in the East Midlands but with grid connection in Yorkshire and the Humber.

(anaerobic digestion) capacity grew by 2.6 per cent, with 91 per cent of the new AD capacity being in England.

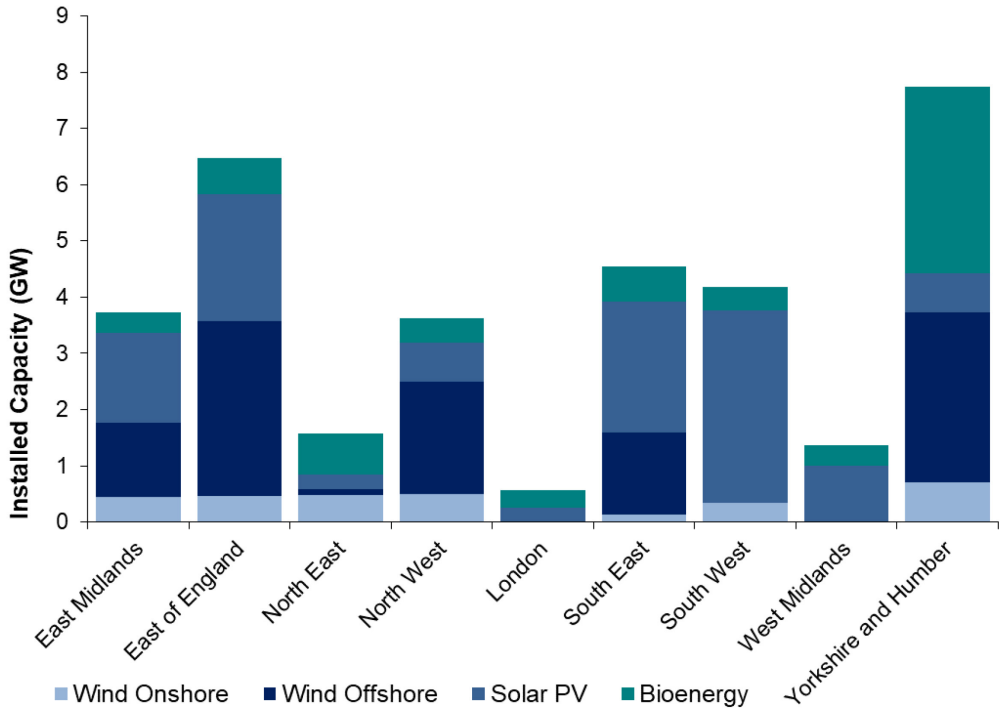
Table 1 - Largest new schemes (including capacity increases) in 2022:

Onshore wind	Blary Hill	Scotland	35 MW
	Glen Kyllachy	Scotland	49 MW
	Twentyshilling	Scotland	38 MW
	Kennoxhead Phase 1	Scotland	62 MW
	Sandy Knowe	Scotland	86 MW
Offshore wind	Hornsea 2	Yorkshire and the Humber	1,386 MW
	Moray East	Scotland	950 MW
	Seagreen (first phase)	Scotland	270 MW
	Triton Knoll (growth)	East Midlands	32 MW
Solar PV	Carland Cross	East of England	10 MW
	Thornham	East Midlands	21 MW
	Glebe Farm Solar Farm	West Midlands	32 MW
	Cirencester Solar Farm	South West	23 MW
	South Farm Solar Park	South West	40 MW
Biomass and waste	Rookery South ERF	East of England	60 MW
	Minworth STW Dual Fuel Generating station	West Midlands	10 MW
	Langleys Lane - Electricity Generation Plant	South West	6 MW
	Thornfield Energy (Waste AD)	West Midlands	5 MW

Within England, the breakdown of renewable capacity varies by region as shown in Chart 2. The regions with the highest capacity in England are:

- Yorkshire and the Humber – 7,751 GW (48 per cent from wind – the largest plants being Hornsea phase 1 and 2 and 41 per cent from biomass and waste - mostly from Drax and Ferrybridge).
- East of England - 6,470 GW (55 per cent from wind and 35 per cent from solar PV).
- South East - 4,558 GW (51 per cent from solar PV and 35 per cent from Wind).

Chart 2 – Renewable capacity at the end of 2022 by English region and technology



The table in Annex A summarises capacity growth, the key technologies in each region as well as the major sites.

The Feed in Tariff scheme (FiTs) closed to new entrants at the end of March 2019, small-scale solar PV installations that have come online since April 2019 are now recorded through the MCS (Microgeneration Certification Scheme).

Generation

- For similar reasons to capacity, generation from renewable sources in England was almost two and a half times that for Scotland but a decrease from three times higher in 2021. England has a lot of bioenergy and Scotland has a lot of onshore wind capacity; bioenergy tends to have higher load factors (see below) than wind, but this is offset by England having more solar PV capacity which has a lower load factor.

Number

- Excluding solar PV, England continues to have the largest number of renewable sites (6,024) followed by Scotland (4,692), Northern Ireland (1,217), and Wales (1,195). Wales has more sites than Northern Ireland when solar PV is included.

- Excluding solar PV, regions with the most sites in England are the South West, East of England, and Yorkshire and the Humber which each have over 1,000 installations. When solar PV is taken into consideration, the South East has the highest number of sites followed closely by the South West and the East of England.

Capacity and Generation per GVA

- Economic activity in each country or region is measured in terms of Gross Value Added (GVA)[4]. Scotland continues to show the largest capacity and generation from renewables per £ of GVA followed by Yorkshire and the Humber, Wales, and Northern Ireland.

Load Factors

Load factors are the ratio of how much electricity was generated as a proportion of the total generating capacity. UCLFs or "load factor on an unchanged configuration basis" describes the amount of electricity generated from schemes that have been operating throughout the whole of the calendar year with the same installed capacity configuration[5].

The UCLFs and load factors on a standard basis can be found in the load factor time-series spreadsheets. A summary by country is given in Table 3:

[4] GVA as published in Regional Gross Value Added (Income Approach), December 2015 at:
www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductuk/1998to2021
www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalandrealregionalgrossvalueaddedbalancedbyindustry

[5] The formula for calculating this is:

$$\frac{Elelctricity\ generated\ during\ the\ year\ (MWh)}{Installed\ capacity\ of\ schemes\ operating\ throughout\ the\ year\ with\ unchanged\ capacity\ configuration\ (MW) * hours\ in\ year}$$

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

	Onshore Wind	Offshore Wind	Solar PV	Hydro	Biomass and Waste
England	25.6%	40.1%	11.5%	30.1%	60.3%
Northern Ireland	26.8%	n/a	9.3%	33.1%	66.1%
Scotland	28.4%	32.9%	10.6%	34.9%	70.2%
Wales	27.4%	33.6%	10.9%	17.8%	73.9%
UK average	**27.6%**	**38.6%**	**11.3%**	**33.2%**	**61.2%**

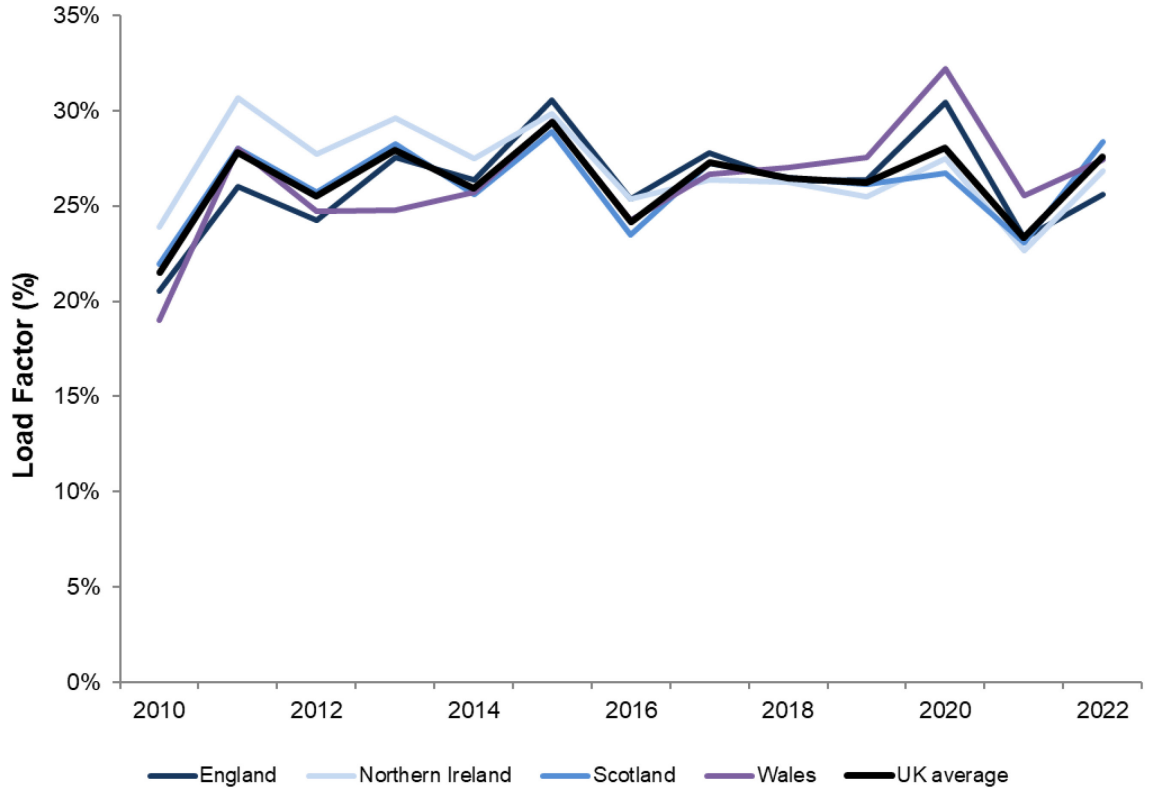
- Scotland has the highest **onshore wind** load factor, then Wales, followed closely by Northern Ireland (26.8 per cent) and England (25.6 per cent).

- England continues to have the highest load factor for **offshore wind** (40.1 per cent), followed by Wales (33.6 per cent) and Scotland (32.9 per cent). Regional differences exist for average wind speeds.

- England also continues to have the highest average load factor for **solar PV** (11.5 per cent), followed by Wales, Scotland, and Northern Ireland, which is in keeping with the relative solar irradiance in these countries.

- Load factors for other technologies and additional graphs are included in the related spreadsheets.

Chart 3 – Onshore wind Unchanged Configuration LFs since 2010 by UK country



Time series

Capacity and generation have grown at different rates in different regions for each technology, which is partly dependent on the available resource and the support mechanism.

Solar PV: following a period of rapid growth encouraged by the Renewables Obligation (RO) and FiT support mechanisms, the initial fast rate of growth has slowed down, which is also reflected in the corresponding generation figures; this is probably due to a combination of effects including the closure of the RO and FiT and the rapid exploitation of prime development sites. Similar patterns are seen for other technologies (onshore wind, landfill gas, sewage gas, and hydro). There continues to be growth from unsubsidised installations. The solar PV figures published here in Energy Trends include plants on our own survey of major power producers, all installations accredited on FiTs, RO and CfD, all those registered on MCS and any others that are recorded in the Renewable Energy Planning Database. However, there are likely to be some unsubsidised installations that are not covered by these sources. We have reviewed this issue with solar analysts at the University of Sheffield, our figures are consistent with theirs and we believe the capacity that we are missing is likely to be small. We will continue to explore new data sources going forward such as embedded capacity registers that are published by DNOs (Distribution Network Operators) with the aim of improving coverage.

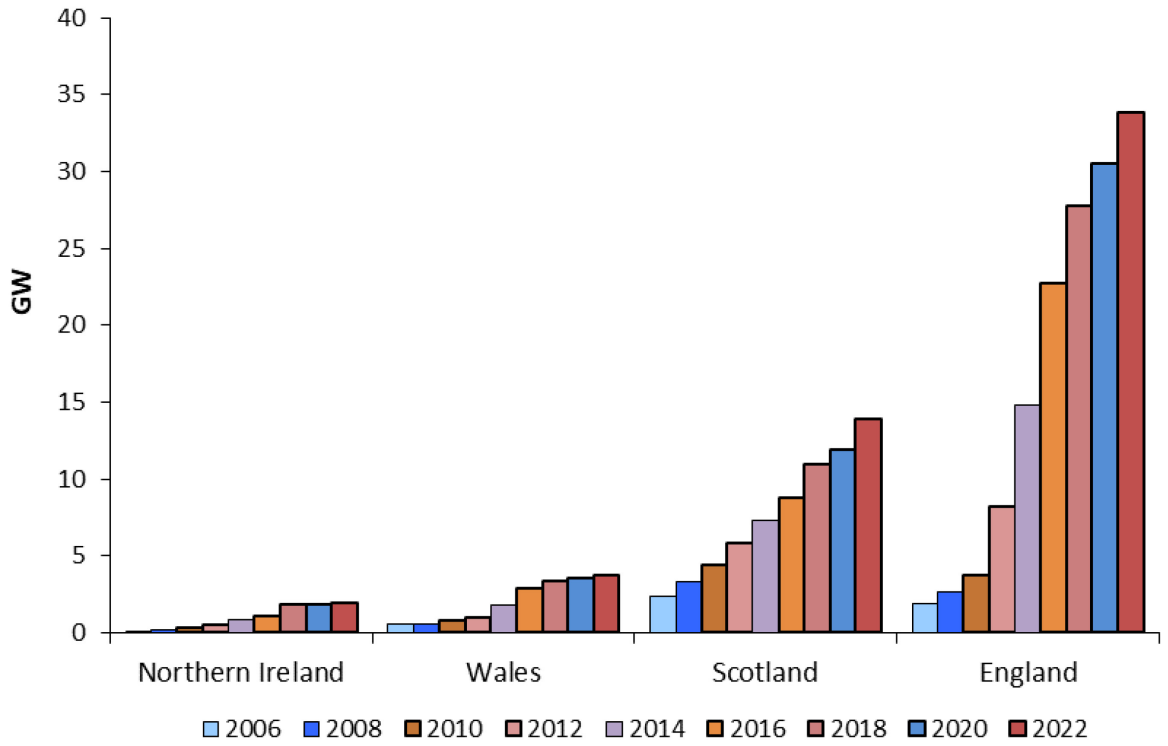
Offshore wind continues to grow. In total, offshore wind capacity grew by 24 per cent, accounting for more than two thirds of the new capacity in 2022. All of the offshore wind plants that came online in 2022 are accredited on the Contracts for Difference (CfD) support scheme. More than half of this new capacity came from one site alone – Hornsea 2 in Yorkshire and the Humber. Offshore wind capacity has grown more than fourfold in England and nearly fivefold in Wales over the last ten years. Offshore wind capacity in Scotland more than doubled in 2022 and is now more than eleven times higher than it was ten years ago.

Bioenergy: most of the new growth this year (1.2 per cent) again came from biomass and waste, the majority of this within England.

Landfill gas: the rate of exploitation of prime sites reached saturation more than a decade ago but there is no similar plateauing of generation data which instead decreases with time. This is because biogas production rates reduce with time as the biodegradable resource gets exploited.

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

Chart 4 – Total renewable capacity by country 2006 – 2022



Local authority analysis

- Tables 4 to 6 rank the top five Local Authorities[6] (LAs), per: number of installations, installed capacity, and generation for key technologies.

- **Number of sites:** are summarised in Table 4. Cornwall remains the top-ranked (23,069), reflecting the large number of solar PV schemes installed in the South West. The Orkney Islands has the most onshore wind sites. Highland has the most hydro sites. Mendip has the most bioenergy sites including the most plant biomass sites.

- **Capacity**: data are summarised in Table 5. North East Lincolnshire is the top ranked local authority, primarily from offshore wind. This is followed closely by Highland, which has more hydro and onshore wind capacity and generation than any other LA.

- **Generation**: data are summarised in Table 6. Selby is the top ranked local authority, primarily from plant biomass, including Drax, the largest biomass plant in the UK.

- For other technologies, the top ranking LAs for both capacity and generation are Cornwall (solar PV), Shropshire (anaerobic digestion) and Selby (plant biomass). Thurrock has the most landfill gas capacity while Buckinghamshire has the most generation.

- Cornwall and Wiltshire continue to have large numbers of solar PV sites with correspondingly high capacity and generation which represents the installation of large solar farms. These are followed closely by Aberdeenshire, Dorset, and Leeds which, between them, have an unusually large number of solar PV sites. However, they have

[6] Where disclosure of confidential generation data was likely at the site level, this has been addressed, where possible, by replacing this with data from publicly available sources. Where this is not possible, the data have been removed, and added to the unallocated row at the bottom of the Local Authority listings.

significantly lower capacities and generation (with the exception of Dorset) and probably represents the uptake of domestic installations.

- Highland's overall capacity and generation is driven by the construction of large-scale, onshore wind farms. Whilst the Orkneys has the highest number of wind sites (almost three times that of Highland) it has much smaller capacity and generation, suggesting these tend to be smaller projects meeting local needs.

Shropshire continues to show the highest number, capacity and generation of anaerobic digestion facilities. In terms of number, Shropshire is followed closely by Armagh City, Banbridge and Craigavon, while East Cambridgeshire and Mid Ulster are the next largest in terms of capacity and generation. This probably reflects the availability of AD feedstock due to the high levels of farming undertaken here.

Table 3: Local Authority: Number of sites generating electricity from renewable sources, 2022[a]									Number
Onshore Wind		**Solar PV**		**Hydro**		**Bioenergy**		**Total [b]**	
Orkney Islands	802	Cornwall	23,069	Highland	307	Shropshire	52	Cornwall	**23,536**
Aberdeenshire	586	Wiltshire	13,390	Argyll & Bute	127	Armagh City, Banbridge and Craigavon	44	Wiltshire	**13,422**
Cornwall	432	Aberdeenshire	12,589	Gwynedd	120	Dumfries and Galloway	40	Aberdeenshire	**13,209**
Dumfries & Galloway	316	Dorset	11,746	Perth & Kinross	90	Herefordshire, county of	38	Dorset	**11,800**
Highland	275	Leeds	10,698	Dumfries & Galloway	84	Mendip	37	County Durham	**10,784**
UK Total	**9,601**		**1,249,511**		**1,576**		**1,954**		**1,262,707**

Table 4: Local Authority: Installed capacity of sites generating electricity from renewable sources, 2022[a]									MW
Onshore Wind		**Solar PV**		**Hydro**		**Bioenergy**		**Total [b]**	
Highland	1,954	Cornwall	612	Highland	813	Selby	2,668	North East Lincolnshire	**2,869**
South Lanarkshire	1,305	Wiltshire	554	Argyll & Bute	300	Northumberland	456	Highland	**2,838**
Dumfries & Galloway	928	Dorset	334	Perth & Kinross	278	Wakefield	192	Selby	**2,723**
South Ayrshire	672	South Cambridgeshire	283	Dumfries & Galloway	151	Bedford	131	Moray	**2,080**
Scottish Borders	641	Shropshire	225	Stirling	86	Halton	127	East Suffolk	**1,745**
UK Total	**14,835**		**14,651**		**1,890**		**8,177**		**53,503**

Table 5: Local Authority: Generation of electricity from renewable sources, 2022[a]									GWh
Onshore Wind		**Solar PV**		**Hydro**		**Bioenergy**		**Total [b]**	
Highland	5,140	Cornwall	578	Highland	2,948	Selby	10,757	Selby	**10,843**
South Lanarkshire	3,179	Wiltshire	527	Perth & Kinross	820	Fife	536	Highland	**8,313**
Dumfries & Galloway	2,127	Dorset	287	Argyll & Bute	612	Breckland	524	Lancaster	**3,626**
Scottish Borders	1,657	South Cambridgeshire	285	Dumfries & Galloway	326	North Lincolnshire	480	South Lanarkshire	**3,310**
South Ayrshire	1,589	Shropshire	204	Stirling	323	Thurrock	406	East Suffolk	**3,199**
UK Total	**35,237**		**13,283**		**5,640**		**35,673**		**134,864**

Totals include offshore wind sites allocated to nearest Local Authority

Annex A – Regional capacity growth

Table 6 shows the main capacity changes for each region in 2022:

Table 6: Regional capacity growth

Region	Key Technology	Growth (MW)	Key Schemes
East Midlands	AD	4	Pebble Hall Farm
	Solar PV	83.8	High Leas, Thornham,
	Offshore Wind	32	Triton Knoll (expansion)
East of England	AD	0.1	
	Biomass and Waste	72.0	Rookery South ERF, Goosey Lodge CHP Plant
	Landfill gas	-1.2	Arlesey (Closed)
	Solar PV	177.8	Fambridge Road/Canewdon Road, Carland Cross, Canewdon CIC
North East	Solar PV	34.1	Land at Woodhouse Farm, Lumley Water Treatment Works - Solar Panels
	Onshore Wind	-3.4	Red Gap Moor Wind Farm (capacity revision)
North West	Landfill gas	-1.0	Bidston Moss Landfill (Closed)
	Hydro	0.2	
	Solar PV	94.5	Amazon Omega Business Park
	Onshore Wind	1.0	Wythegill Wind Turbine
London	Sewage gas	1.0	Kenley
	Solar PV	116.1	Twin Tumps Way - Solar Panels
	Onshore Wind	0.1	
South East	AD	1.2	Ramsgate Road AD
	Biomass and Waste	-2	
	Solar PV	228.0	West End Farm, Worstead Farm, West End Farm
South West	AD	3.5	Evercreech Junction, Willow Farm (Avonmouth
	Biomass and Waste	-0.7	Capacity revisions
	Hydro	-0.9	
	Landfill gas	6.0	Langleys Lane - Electricity Generation Plant
	Solar PV	220.1	MCS, FIT revisions, Nether Mill Farm (resubmission), Trefullock Solar Farm, Cirencester Solar Farm, South Farm Solar Park, Bulkworthy Solar Park
West Midlands	AD	5.5	Lower Drayton Farm, Thornfield Energy
	Biomass and Waste	0.1	Ridby Court
	Sewage gas	9.7	Minworth STW Dual Fuel Generating station

	Solar PV	141.5	Willows Farm Solar Limited, Keele University, Glebe Farm Solar Farm, Ling Hall
	Onshore Wind	0.1	
Yorkshire and the Humber	AD	4.4	Railway Farm AD, Key Growers, Lanes Farm AD
	Biomass and Waste	-1.0	capacity revisions
	Solar PV	83.1	Cottingham - Solar Farm
	Onshore Wind	2.6	Blackstone Edge, Tedder Hill
	Offshore Wind	1386.0	Hornsea 2
Northern Ireland	AD	1.3	Bowtown Road, Granville
	Solar PV	13.3	MCS, Laurelhill
	Onshore Wind	0.9	Torrard Turbine (Replacement), Kingsmill Road (Replacement)
Scotland	AD	0.1	Wester Clockeasy Farm
	Biomass and Waste	-2.1	capacity revisions
	Hydro	6.1	
	Solar PV	142.9	Cupar Wastewater Treatment Works Solar Farm
	Onshore Wind	334.1	Blary Hill, Glen Kyllachy, Twentyshilling, Kennoxhead, Sandy Knowe, Hadyard Hill, Gordonbush (extension)
	Offshore Wind	1220.0	Moray East, Seagreen
Wales	AD	82.6	Derwyn Farm, Maesgwyn, Fferm Penglais, Crumps Yard
	Onshore Wind	13.2	y Wal, Graig Fatha Farm, Parc Stormy

Annex B - Revisions

Historic revisions this year were carried out to the 2020 and 2021 datasets which have resulted in changes to both capacity and generation in all regions. These are due to several reasons including the reassignment of unknown FiT and MCS data from the 'Other' category to identified regions. There have also been capacity revisions in several data sources: the MPP (Major Power Producers) survey, ROCs (Renewable Obligation Certificates), and the MSIW (Municipal Solid & Industrial Waste) survey. Other changes include the identification and removal of duplicates. These revisions are summarised in Table 7:

Table 7: Historic capacity and generation revisions by country

Year	2020		2021	
	Capacity (MW)	Generation (GWh)	Capacity (MW)	Generation (GWh)
England	381	-46	548	402
East Midlands	3	-59	16	9
East of England	62	18	88	72
North East	13	-1	17	22
North West	38	-17	51	37
London	75	45	89	51
South East	81	53	119	85
South West	37	-53	69	66
West Midlands	41	7	58	41
Yorkshire and the Humber	31	-38	42	20
Northern Ireland	1	2	2	9
Scotland	68	-72	100	-8
Wales	35	-36	50	11
Other	-510	-457	-746	-551
TOTAL	-24	-608	-47	-138

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