



Department for
Energy Security
& Net Zero

Energy Trends

UK, October to December 2023 and 2023

About this release

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

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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 annual change from 2022, primary energy basis

(Mtoe basis)	Production	Imports	Exports	Demand
Total energy	-8.9%	-6.7%	-17%	-3.5%
Coal	-21%	-44%	+21%	-25%
Primary oil	-11%	-2.1%	-11%	-5.8%
Petroleum products	-6.8%	+6.9%	-11%	+1.4%
Gas	-10%	-20%	-32%	-11%
Electricity	-7.2%	+115%	-55%	-7.2%

Energy consumption reduced in 2023, led by a fall in household consumption for both gas and electricity with overall household consumption lower than at any point in the last fifty years. Demand for transport increased 3 per cent on last year but remains down on pre-pandemic levels despite an increase in aviation demand on 2022. Consumption by industrial users also dropped on 2022 and like household consumption is at its lowest level in over 50 years.

UK energy production in 2023 dropped 9 per cent to the lowest level since records began in 1948, and is down 36 per cent on 2010, and 66 per cent on 1999 when UK production peaked. Oil production reached a record low whilst gas production reached the second lowest output on record. Nuclear output, following both plant closure and maintenance outages, also hit a record low and is down 62 per cent on 1998 when output peaked. Production from wind, solar and hydro increased by 2 per cent but these renewable technologies contribute less primary energy than fossil fuels.

Production from renewable technologies matched the previous record high of 2022 but **renewables' share of electricity generation increased to a record 47.3 per cent**. Wind generation hit a record high share of 28.7 per cent of generation, up from 2.7 per cent in 2010. **Generation from fossil fuels fell to a record low**, a share of 36.3 per cent but generation from gas remained the principal form of UK generation at 34.3 per cent. Low carbon generation (renewables & nuclear) increased to a record high share of 61.5 per cent.

Despite lower energy demand, reduced energy production meant **that net import dependency increased to 41.1 per cent in 2023 from 37.3 per cent in 2022**, with electricity imports increasing significantly on 2022. Norway and the US were the principal sources of UK's imported energy in 2023.

Section 1: UK total energy

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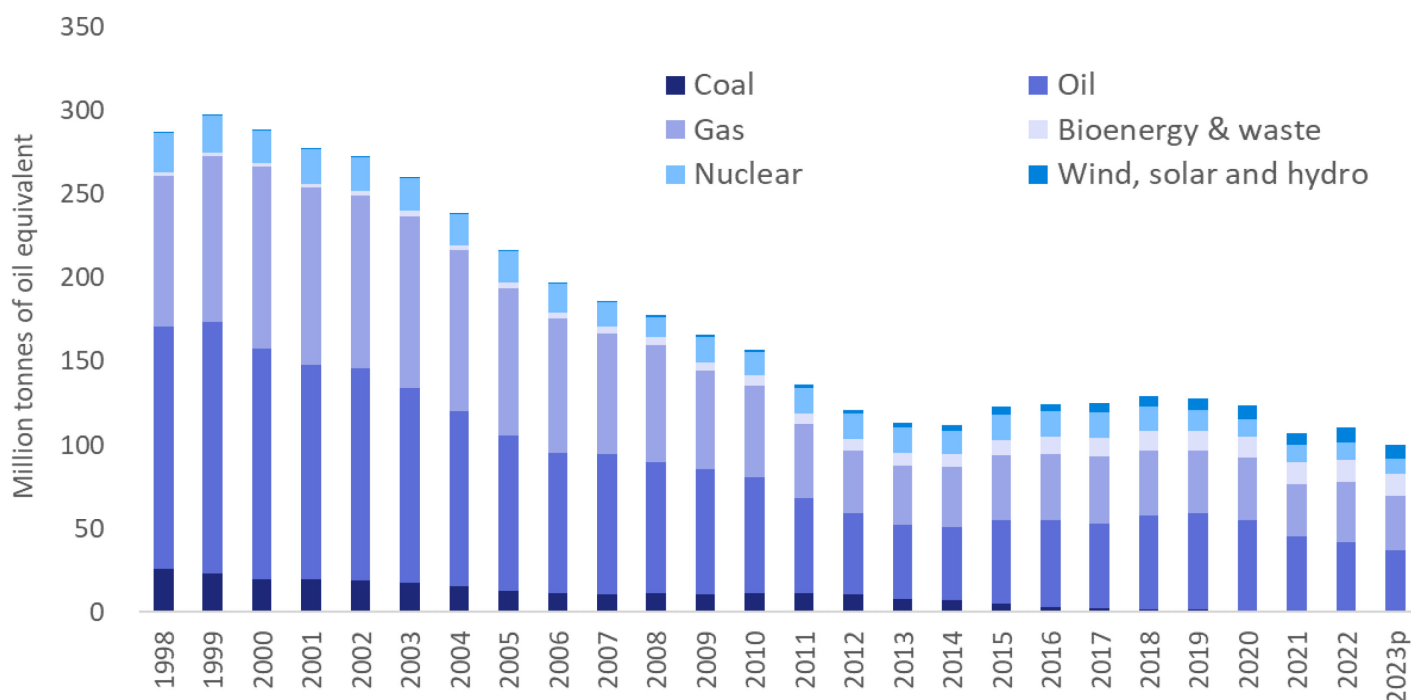
Key headlines

In 2023 total production was 100.4 million tonnes of oil equivalent, 8.9 per cent lower than in 2022 and at a record low level in the published series, and 66 per cent lower than in 1999 when UK production peaked. Production levels for all fuels except wind and solar are down on 2022, with coal, oil and nuclear output all at record lows, whilst output from wind, solar and hydro was at a record high. Production in the fourth quarter of 2023 was 9.2 per cent lower than the same period in 2022, despite increased output from wind and solar due to increased capacity.

Energy consumption in 2023 was 1.6 per cent lower than in 2022 likely reflecting the impact of higher energy and other prices. Transport consumption rose by 3.1 per cent, despite jet fuel demand remaining below pre-pandemic averages. Domestic consumption fell by 6.5 per cent to a record low level in the published series, industrial consumption fell by 3.4 per cent also to a record low level and other final users' consumption fell by 3.0 per cent.

Energy consumption in the domestic, industrial and other final users sectors all fell in the fourth quarter of 2023 reflecting the continued impact of higher energy and other prices. Domestic consumption fell by 1.8 per cent despite warmer temperatures than the same period the previous year and reached a record low for the fourth quarter of a year in the published series. Industrial consumption fell by 2.4 per cent, also to a record low for the fourth quarter. On a seasonally and temperature adjusted basis, final energy consumption fell by 0.4 per cent, with falls in all sectors except transport.

Chart 1.1 UK production ([Energy Trends Table 1.1](#))

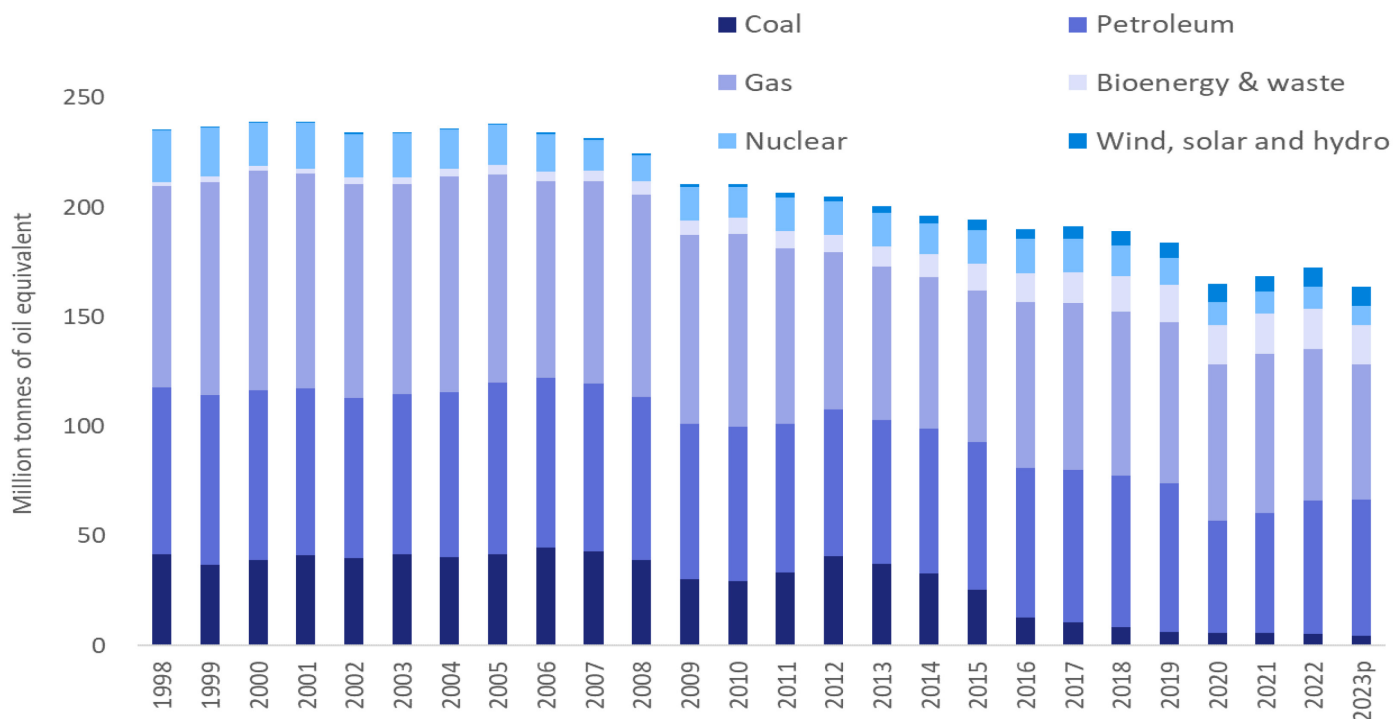


In 2023 total production was 100.4 million tonnes of oil equivalent, 8.9 per cent lower than in 2022 and at a record low level in the published series, and 66 per cent lower than in 1999 when UK production peaked. Production levels for all fuels except wind and solar are down on 2022, with coal, oil and nuclear output all at record lows. Production of oil fell by 11 per cent to a record low level, whilst natural gas fell by 10 per cent. Electricity produced from nuclear fell by 15 per cent to a record low level due to reduced capacity and

a series of outages throughout 2023. Electricity produced from wind, solar and hydro rose by 1.5 per cent to a record high level, due to record high levels of offshore wind and solar output resulting from increased capacity offsetting falls in onshore wind and hydro output.

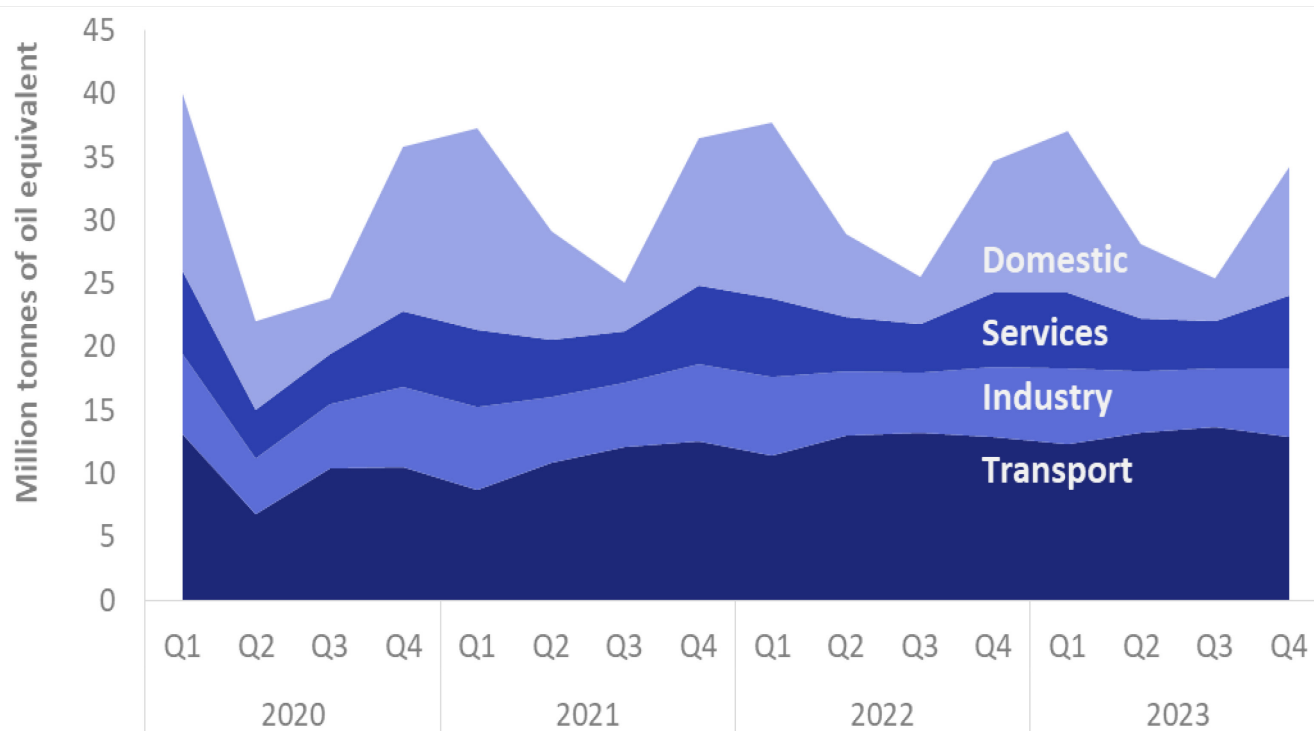
In the fourth quarter of 2023 total production was 25.5 million tonnes of oil equivalent, 9.2 per cent lower than in the fourth quarter of 2022. Production of all primary fuels fell except for coal, bioenergy & waste, and wind and solar which rose due to increased capacity.

Chart 1.2 Total inland consumption (primary fuel input basis) ([Energy Trends Table 1.2](#))



In 2023 total inland consumption (this includes not only fuel use by consumers, but fuel used for electricity generation and other transformation) was 165.8 million tonnes of oil equivalent, 3.5 per cent lower than in 2022, and down 11 per cent on pre-pandemic (2019) levels (on a seasonally adjusted and annualised rate that removes the impact of temperature on demand) with warm temperatures and high energy and other costs contributing to the decrease. **In the fourth quarter of 2023** consumption fell by 1.7 per cent (on an unadjusted basis) on the fourth quarter of 2022, with gas consumption down 8.2 per cent despite warmer weather particularly in December 2023, with higher energy and other prices likely a key factor.

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



In **2023 total final energy consumption** (excluding non-energy use) was 1.6 per cent lower than in 2022. Transport consumption rose by 3.1 per cent, despite jet fuel demand remaining low. Domestic consumption fell by 6.5 per cent to the lowest level in at least 50 years reflecting the continued impact of higher energy and other prices on consumer behaviour. Industrial consumption fell by 3.4 per cent to a record low level in the published time series and other final users consumption fell by 3.0 per cent, with reductions in use likely reflecting higher energy and other prices.

In the fourth quarter of 2023 total final energy consumption was 1.3 per cent lower than in the fourth quarter of 2022 with average temperatures 0.2 degrees Celsius warmer than last year, and average temperatures in December 2023 being notably warmer than last year. Transport consumption was broadly unchanged, but industrial consumption fell by 2.4 per cent, other final users consumption fell by 2.3 per cent and domestic consumption fell by 1.8 per cent. Industrial and domestic consumption were at the lowest level recorded for the fourth quarter of the year in the published series reflecting the continued impact of higher energy and other prices.

Section 2: Coal and derived gases

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Key headlines

Total coal demand in 2023 fell to 4.6 million tonnes, 25 per cent lower than in 2022, mainly due to a 35 per cent fall in coal for electricity generation as it continues to be displaced by renewables and gas.

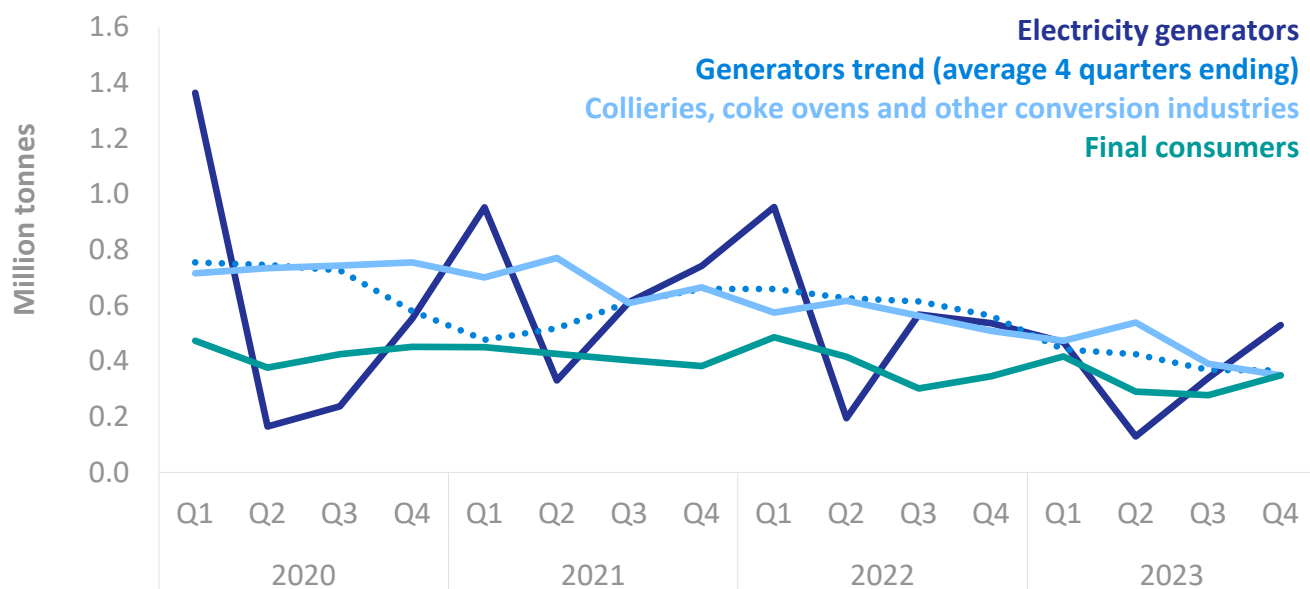
Coal production in 2023 fell to a record low of 0.5 million tonnes, down 22 per cent compared with 2022. Surface mining production fell to a record low of 425 thousand tonnes as the last large surface mine closed in November 2023. In the last ten years UK coal production has fallen by 96 per cent.

Coal imports fell to 3.5 million tonnes in 2023, 45 per cent down compared with 2022. Major importers were the USA (45 per cent share), Australia (13 per cent) and the EU (11 per cent).

In the fourth quarter of 2023, demand fell 12 per cent to 1.2 million tonnes. Power station demand fell to 0.5 million tonnes and coke oven demand halved to 0.1 million tonnes. **Imports in the fourth quarter of 2023 fell to 1.0 million tonnes**, 44 per cent down on Q4 2022.

Total coal demand in 2023 fell to 4.6 million tonnes, 25 per cent lower than in 2022. Much of this decrease was due to the 35 per cent fall in coal used for electricity generation, to 1.5 million tonnes. The fuel mix has shifted towards other fuels as coal moves out of the UK's generation mix in favour of renewables. Just one coal plant, Ratcliffe-on-Soar, remains operational in the UK, due to close in autumn 2024. Coal use has declined since the early 1970s as more fuels, principally gas, entered the market. In the last ten years UK coal consumption has fallen by 92 per cent.

Chart 2.1 Coal Consumption ([Energy Trends Table 2.1](#))

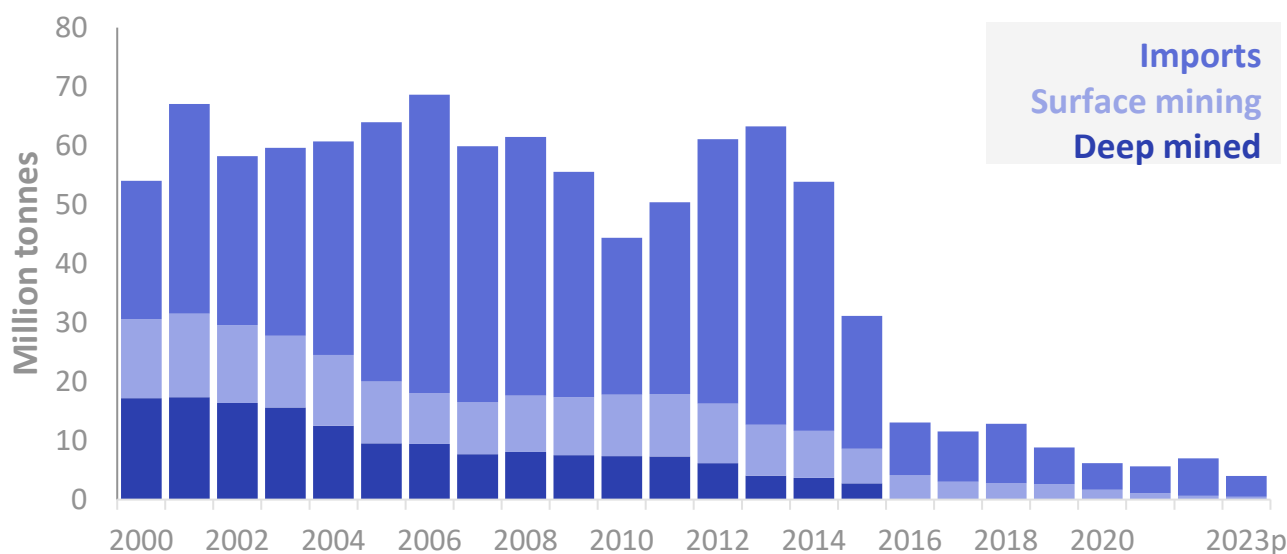


In the most recent quarter, coal demand for electricity generation fell from 537 thousand tonnes in Q4 2022 to 530 thousand tonnes in Q4 2023, a decrease of 1.3 per cent. During this period overall electricity demand fell and there was a record high in low carbon electricity (see Energy Trends 5.4 for information on generation). 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 was displaced by gas and renewable sources.

Domestic coal production has fallen steadily because of coal mine closures and reduced demand. However, **in Q4 2023, UK coal production rose to 148 thousand tonnes**, a 20 per cent rise compared to Q4 2022. This

increase was from a low base and mining is a very variable operation and dependent on geology, weather and numerous other factors. However, production was down 22 per cent as a whole for 2023 compared to 2002. The last large surface mine, Ffos-y-Fran, ceased mining coal in November 2023.

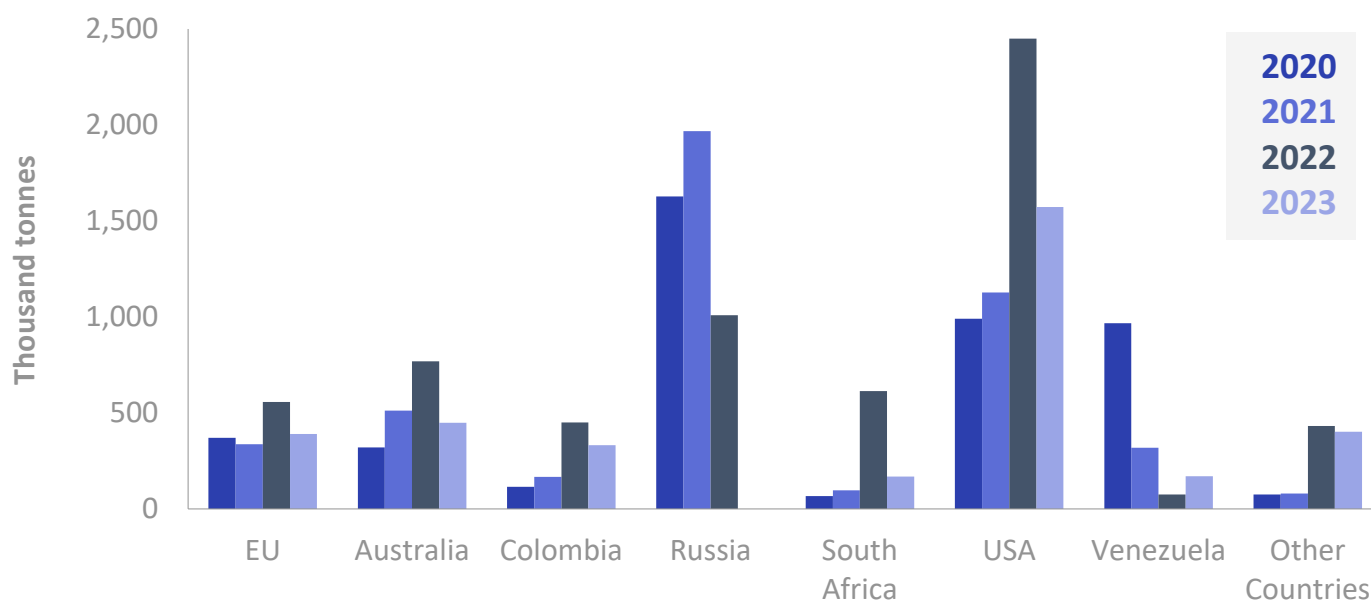
Chart 2.2 Coal Supply ([Energy Trends Table 2.1](#))



Coal imports fell to 3.5 million tonnes in 2023, 45 per cent down compared with 2022. Volumes remained historically low due to a steep fall in UK demand for coal. Imports had peaked at 50.6 million tonnes in 2013. In 2022 the USA was the largest exporter of coal to the UK with a share of 45 per cent. This was followed by Australia with 13 per cent and the European union with 11 per cent.

In Q4 2023, coal imports fell to 953 thousand tonnes, 44 per cent down on Q4 2022. The USA (43 per cent), Australia (18 per cent) and the European Union (13 per cent) accounted for 74 per cent of total coal imports. 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.

Chart 2.3 Coal Imports ([Energy Trends Table 2.4](#))



Section 3: Oil and oil products

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Key headlines

In 2023 primary oil production at 34 million tonnes reached the lowest level since North Sea production was established in the 1970s. Refinery production at 51.5 million tonnes reached a near record low.

Total net imports of oil increased to offset low production, and reached 30 million tonnes in 2023, a record high since North Sea oil production was established. The driver was a sharp reduction in exports which were down by 10 per cent compared to 2022, and nearly 30 per cent compared to pre-pandemic 2019. In contrast, imports were up by just 1.4 per cent on 2022, and were down by 9.8 per cent compared to 2019.

In 2023 demand for oil products remained stable compared to 2022, but was 12 per cent down on 2019.

In 2023, UK oil stocks recovered by 0.9 million tonnes from the record low of 2022, to 9.6 million tonnes. This was mainly driven by a 20 per cent increase in stocks of primary oils.

The final quarter of 2023 showed a similar trend to the year as a whole. Indigenous production of primary oils remained low and was down 11 per cent compared to the same period in 2022, while production of oil products hit a post-pandemic low of 11.1 million tonnes, marking the third lowest quarterly production since quarterly records began in 1999. To compensate, net imports of products reached the highest level since Quarter 2 2019 and an increase of almost a third on the same period the year before. Demand was down 1.0 per cent, with non-energy use hitting a quarterly record low of 0.9 million tonnes.

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

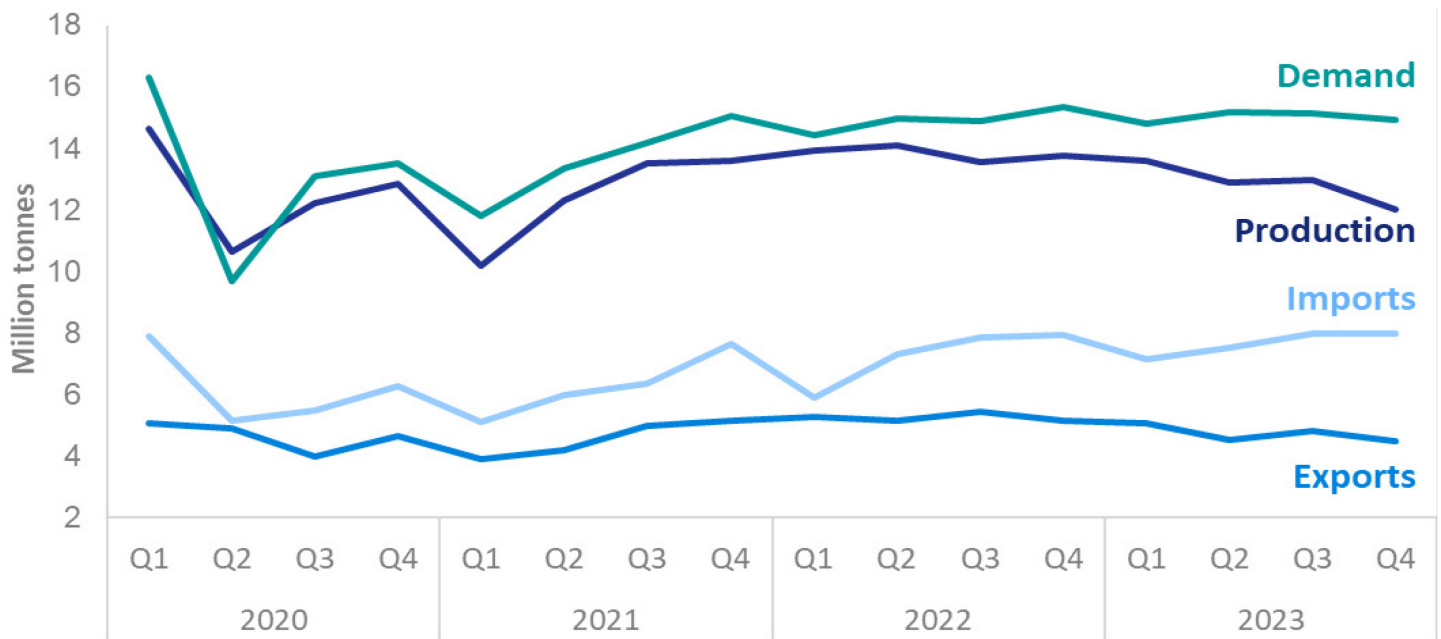


Indigenous production and exports of primary oils fell to the lowest levels since North Sea production began in the 1970s, each down by 11 per cent in 2023 compared to 2022. Compared to pre-pandemic in 2019, production was down by 36 per cent and exports by 38 per cent. In the final quarter of 2023, production was again 11 per cent lower compared with the same period in the previous year with exports remaining low. Three of the four lowest ever quarterly export figures were seen in Quarters 2, 3, and 4 2023.

In 2023, demand for primary oils fell by 7.0 per cent compared to 2022. As a result, and combined with record low production, 35 per cent of gross primary oil supply was met with imports, the highest proportion since 2014. Although annual imports fell slightly compared to 2022, the UK remained a net importer of primary oil by 18 million tonnes, up 15 per cent compared to 2022.

The composition of imports changed, with Russian crude oil imports dropping from 3 million tonnes in 2022 to zero in 2023, following the ban on imports of Russian oil at the end of 2022. While total imports only increased 1.4 per cent compared to 2022, the countries those imports originated from changed drastically. Imports from the Netherlands increased 60 per cent to 9.0 million tonnes, while imports from Kuwait increased by 44 per cent to 3.0 million tonnes.

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

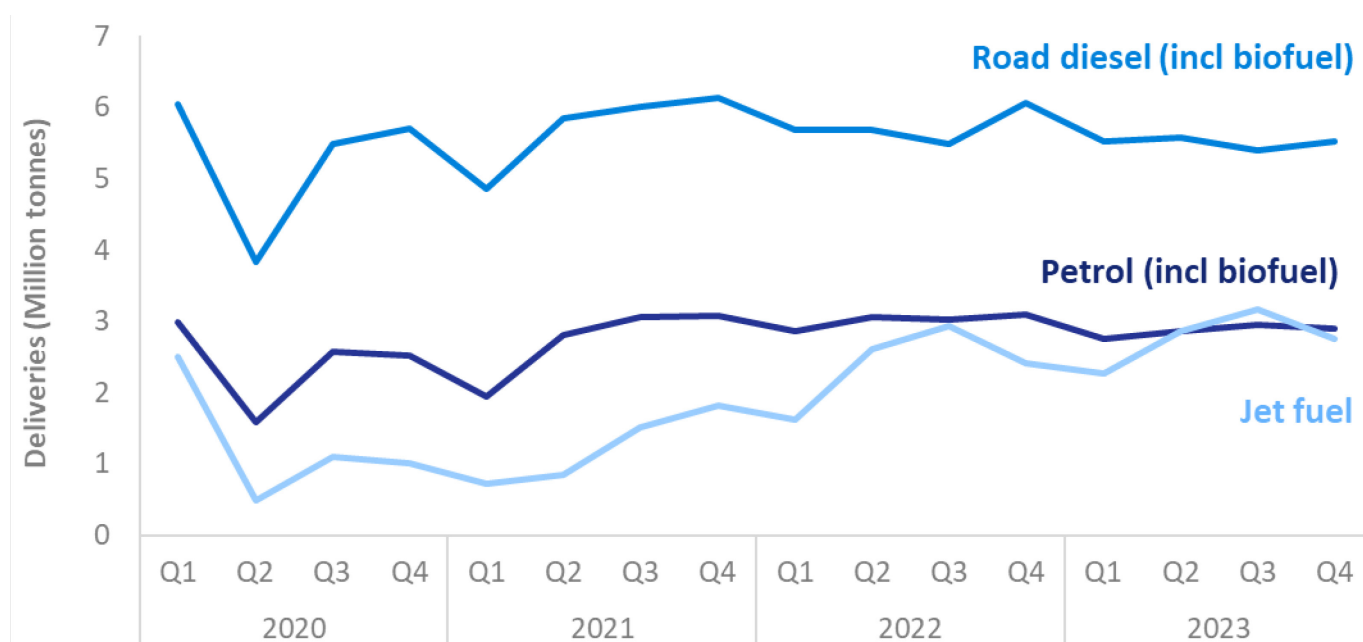


In 2023, indigenous production of petroleum products reached a near record low of 51.5 million tonnes and was down by 7.1 per cent on 2022 and 15 per cent on 2019. In contrast demand remained relatively stable, being 1.5 per cent up on 2022. To compensate for this reduced production, imports increased by 6.9 per cent and exports decreased by 10 per cent. Demand for gas oil (red diesel) was down almost a third following the duty change in April 2022 meaning that many industries were required to switch to white diesel. Non-energy use reached an all-time low, down by 7.8 per cent on 2022 to 4.0 million tonnes, as conversion of the hydrocarbon cracker at Teesside continues conversion work to hydrogen.

Demand for jet fuel continued its post-pandemic recovery, increasing 16 per cent on 2022, but remains 10 per cent down on 2019. Despite the increase in demand, indigenous production was down 5.0 per cent, so demand was met by a 27 per cent increase in net imports.

Total demand for road fuels in 2023 remained stable (up 0.2 per cent) compared with 2022 and remains 8.4 per cent down on pre-pandemic 2019. Road diesel demand was down 2.3 per cent, with biodiesel sales increasing 12 per cent on 2022. The percentage of total diesel sold in supermarket forecourts decreased from 28 per cent in 2022 to 26 per cent in 2023. Petrol sales increased 4.8 per cent, with sales of bioethanol increasing by 5.3 per cent.

Chart 3.3 Deliveries of transport fuels ([Energy Trends Table 3.5](#))



In Quarter 4 2023, refinery production of petroleum products fell by 13 per cent on the same period in 2022. This was driven by reductions of around a quarter each in the production of white diesel, gas oil and jet fuel. Subsequently exports were down 13 per cent, with exports of white diesel down by nearly three-quarters to just 0.2 million tonnes.

Demand for petroleum products in Quarter 4 2023 decreased 0.9 per cent on Quarter 4 2022, largely driven by a 4.6 per cent reduction in white diesel demand and an 18 per cent reduction in gas oil demand. Demand for jet fuel continues its recovery since the pandemic, being 14 per cent up on Quarter 4 2022, but remains 5.5 per cent down on Quarter 4 2019.

More broadly on road fuels, total demand for road fuels decreased in Quarter 4 2023 by 2.8 per cent compared to the year before. This was driven by a 5.4 per cent fall in diesel demand, more than offsetting a 2.0 per cent increase in petrol demand. Compared to Quarter 4 2022, sales of bioethanol were down 6.6 per cent, while sales of biodiesel were down 1.4 per cent.

Section 4: Gas

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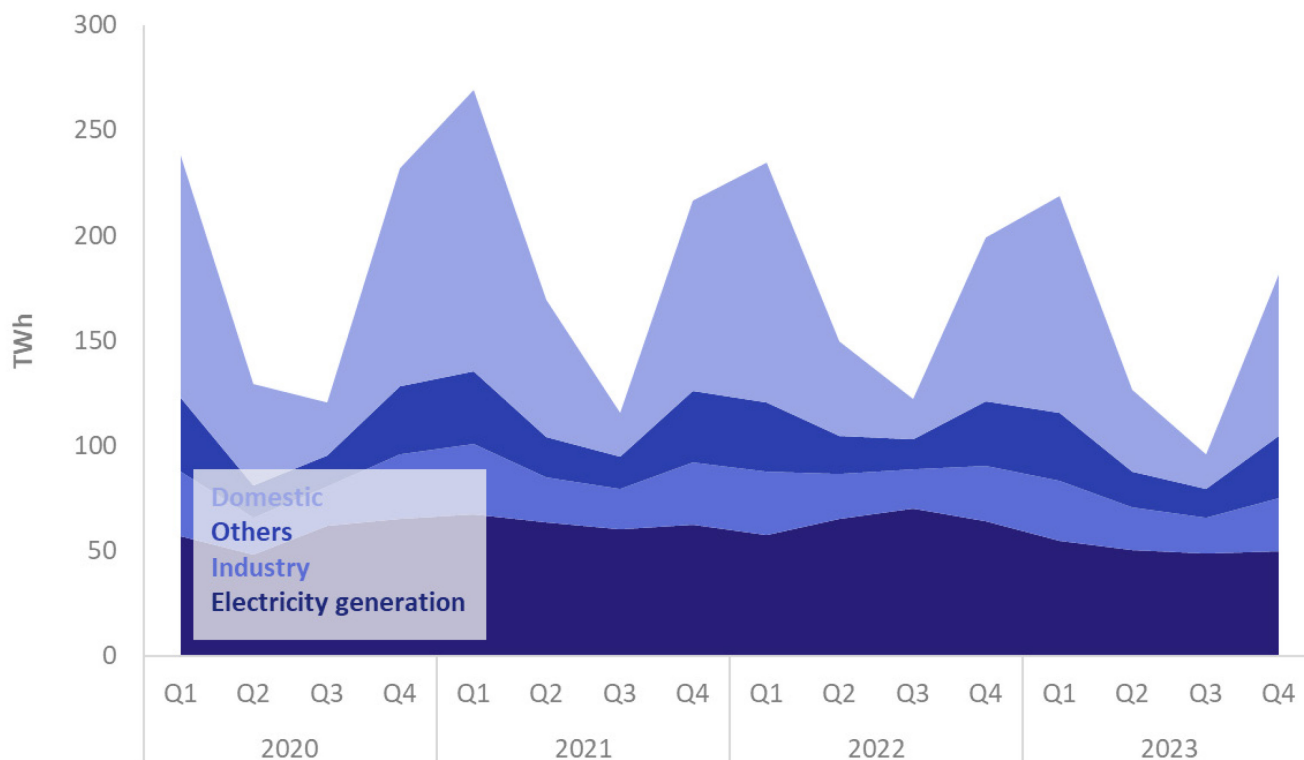
Key headlines

In 2023, UK gas demand fell to the lowest level since 1992, down 10 per cent compared with 2022, a reduction of 82 TWh. This was largely due to reduced demand for gas for electricity generation and by households although falls were seen across most sectors. **Household demand remained at levels not seen since the 1970s**, a trend also observed in 2022, reflecting high energy and other costs and sustained higher than average temperatures.

Imports and exports were down compared to record highs in 2022, at 494 and 176 TWh respectively. Unlike 2022 where high exports to Europe were facilitated by increased imports into the UK, 2023 saw imports return to more typical levels and higher than normal exports facilitated by low UK demand.

Gas production fell by 10 per cent in 2023 compared to 2022, the second lowest output on record. Production remained equivalent to around half of demand in 2023 (due to notable low demand).

Chart 4.1 Demand for natural gas ([Energy Trends Table 4.1](#))



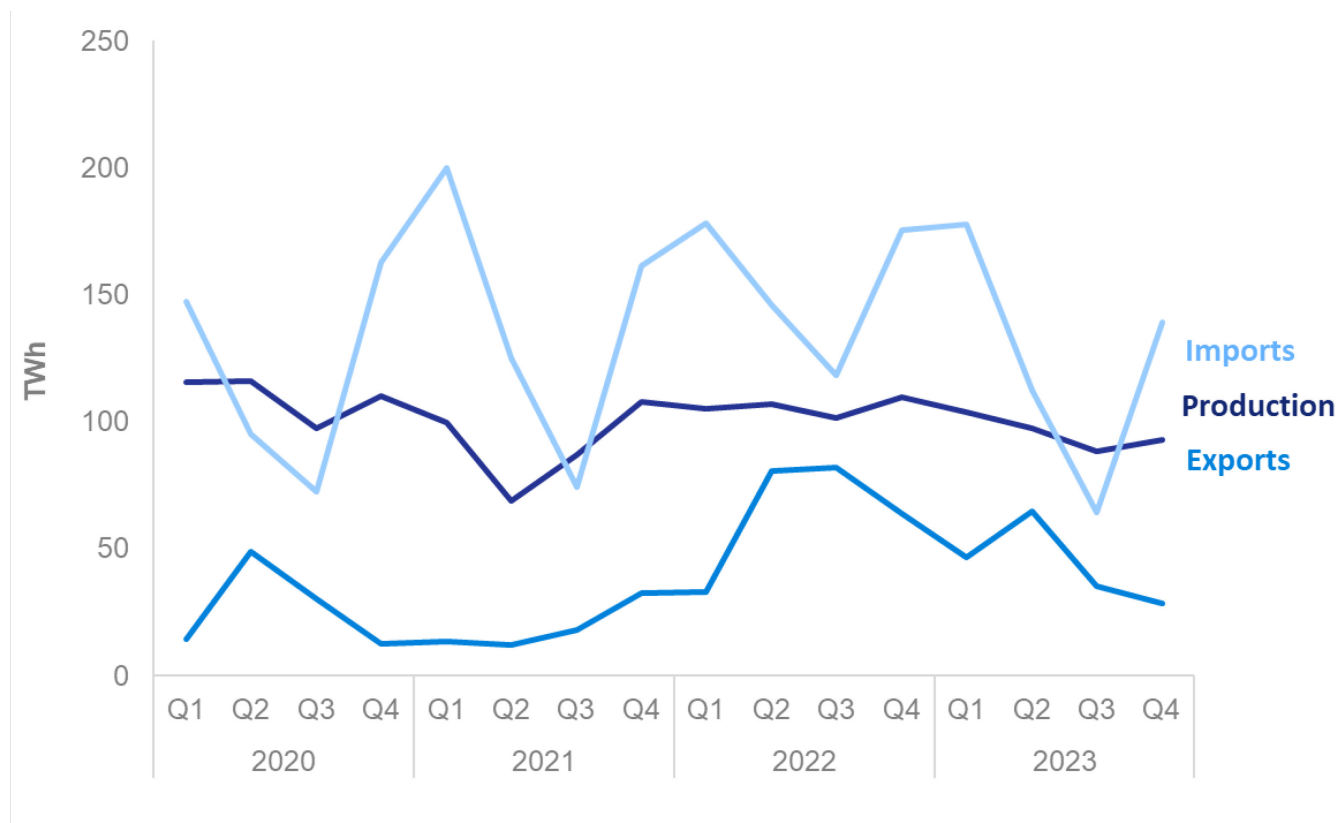
Demand for gas fell by 10 per cent in 2023 compared to 2022, the lowest level since 1992. This was driven by falls in demand for gas from final consumers and for electricity generation.

Much like 2022, consumers in 2023 reduced energy use likely reflecting high energy and other costs and similar and relatively high temperatures over 2022 and 2023. Domestic and industrial consumption fell to levels not seen since the 1970s when coal was the predominant household and industrial fuel. Domestic demand fell by 7.6 per cent whilst industrial demand was down 4.8 per cent. Declining demand was also seen across most other sectors for example in commercial and public sector buildings.

Gas demand for electricity generation also fell to the lowest level since 1996, down 21 per cent as a result of lower electricity demand and increased imports of electricity (see Chapter 5 for more information).

Similar trends were observed throughout the year with demand in Quarter 4 2023 down 8.6 per cent compared to Quarter 4 2022. Demand by final consumers fell 2.1 per cent and demand for electricity generation 23 per cent in the same period.

Chart 4.2 Production and trade of natural gas ([Energy Trends Tables 4.2](#))

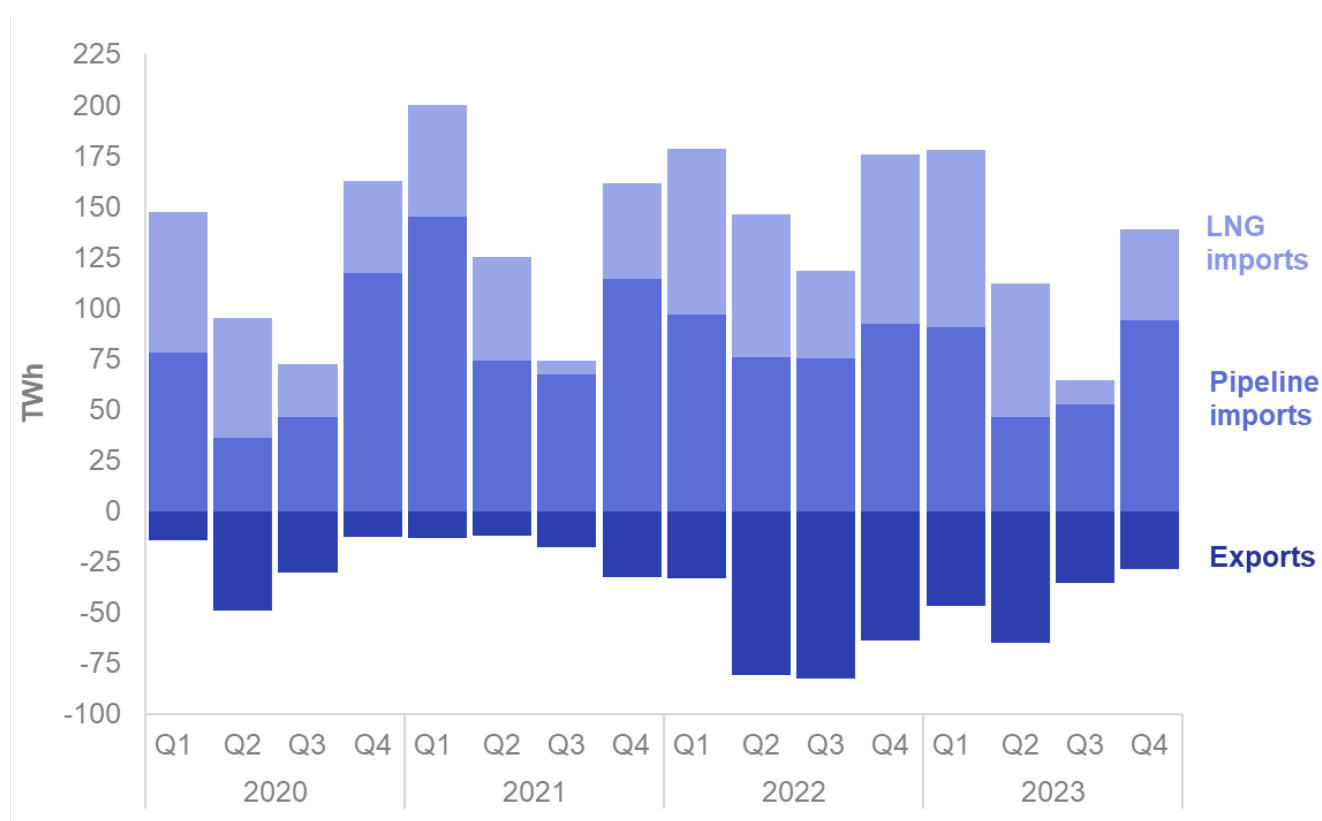


Imports and exports fell in 2023 compared to the record highs seen in 2022 when the UK supported European efforts to move away from Russian gas. Imports fell by 20 per cent, returning to typical annual levels. Exports fell by 32 per cent but remained substantial (and close to pre-2022 record highs). In 2023, substantial exports were facilitated by low UK demand rather than the high imports seen in 2022.

Gas production fell in 2023, down 10 per cent compared to 2022 and UK gas production was equivalent over half of demand in 2023, with the remainder met via imports. Indigenous production has been equivalent to around half of demand for over a decade and stayed at 54 per cent in 2023 despite the decrease in production due to lower than usual demand.

Similar trends were observed throughout the year with imports in Quarter 4 2023 down 21 per cent and exports down 55 per cent compared to Quarter 4 2022. Production was down 15 per cent in the quarter.

Chart 4.3 Trade in natural gas ([Energy Trends Table 4.3](#))



Both pipeline and liquified natural gas (LNG) imports fell in 2023, down 17 and 24 per cent respectively. Norway remained the UK's largest import source of natural gas (and provided almost all pipeline imports), accounting for 57 per cent of imports and equivalent to 40 per cent of demand. LNG imports, whilst down on 2022, remained substantial accounting for 42 per cent of imports and equivalent to 30 per cent of demand. Trends in LNG trade shifted in 2022 as a result of the Russia-Ukraine conflict. The UK has not imported LNG from Russia since March 2022, previously Russian LNG made up a small proportion of total imports for example this was 6 per cent in 2021.

The US remained the largest source of LNG after overtaking Qatar for the first time in 2022. Imports of LNG from the US made up 61 per cent of LNG imports, 26 per cent of total imports and 18 per cent of demand. Qatar remained the second largest LNG import source, but Qatari imports fell by 64 per cent in 2023 compared to 2022. Peru was the third largest import source of LNG and imports from the US, Qatar and Peru made up 85 per cent of total LNG imports in 2023.

Similar trends were observed throughout the year with imports down by a fifth in Quarter 4 2023 compared to Quarter 4 2022. Pipeline imports were stable in the quarter, but LNG imports fell by 46 per cent with declines seen in all import origins except Peru.

Section 5: Electricity

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Key headlines

Total electricity demand was 310.0 TWh in 2023, down slightly on last year to levels last seen in the 1980s. Consumption levels fell in each sector. Domestic consumption decreased by 4.1 per cent to 92.3 TWh, the lowest since 1989. Industrial use of electricity was down 1.3 per cent to 81.0 TWh, lowest since the mid-1980s. Consumption by other final users, including commercial use, fell to 81.1 TWh, 3.6 per cent lower than in 2022.

Total electricity generation fell 11 per cent to 285.6 TWh in 2023, the lowest value since 1983 as high net imports reduced the need for UK generation, in contrast to 2022 when the UK was a net exporter for the first time in forty years due to French nuclear outages.

Renewable generation matched 2023 but lower total UK generation meant that this represented a record share of 47.3 per cent. In particular, electricity generated from wind increased to more than a quarter of the UK's electricity in 2023. Generation from fossil fuels fell 22 per cent in 2023 to 103.8 TWh, the lowest value since the 1950s.

Consumption patterns for Quarter 4 of 2023 broadly continued annual trends with total consumption by end users down 0.9 per cent compared to the previous year, in line with milder temperatures, particularly in December. Domestic consumption was down 0.3 per cent, industry down 0.7 per cent, and consumption by other users down 2.0 per cent. **The quarter also saw record renewable generation of 39.9 TWh, with wind generating more than gas for the first time.**

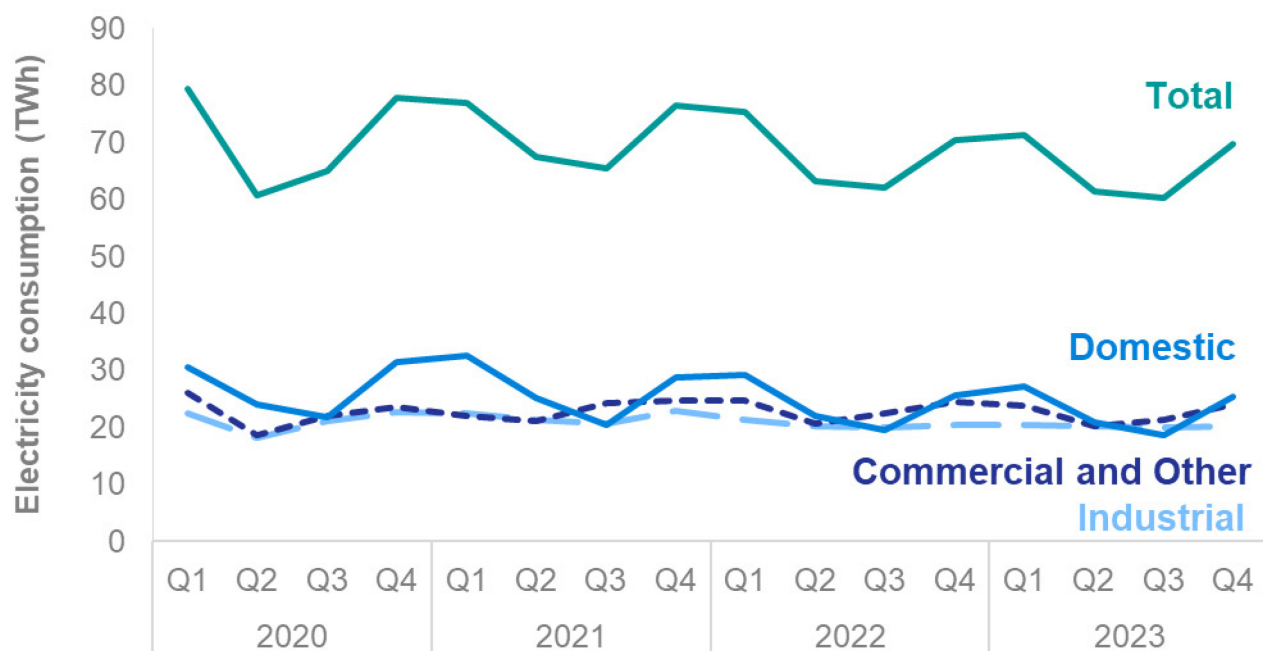
Total electricity demand remained low in 2023, decreasing slightly to 310.0 TWh (-2.2 per cent compared to last year) as high energy and other costs, as well as warmer than usual temperatures, continued into 2023. Similarly final consumption by end users fell 3.0 per cent to 262.9 TWh, the lowest since the late 1980s.

Consumption levels in each sector in 2023 were also at their lowest since the late 1980s. Industrial use of electricity, including iron and steel, was down 1.3 per cent from 2022 to 2023 at 81.0 TWh. Consumption by other final users, including commercial use, was 81.1 TWh, 3.6 per cent lower than in 2022. Domestic consumption decreased by 4.1 per cent to 92.3 TWh, likely to have been the sector most affected by the observed high prices.

Quarter 4 of 2023 saw total UK electricity demand rise 0.3 per cent compared to the same period in 2022, reaching 82.5 TWh, though this was the second lowest Quarter 4 value on the published data series. This was not reflected by increased consumption by end users, as Quarter 4 of 2023 was warmer on average than Quarter 4 2022, particularly in December when most demand for electricity used for heating usually occurs.

Domestic demand reduced by 0.3 per cent compared to Quarter 4 of 2023 to its lowest Quarter 4 value in the published data series. Both the warmer temperatures observed in December 2023 and high prices will have influenced this fall, though high prices were also observed in Quarter 4 of 2022. Industrial consumption decreased by 0.7 per cent over the same period. Consumption from other users, including commercial users, decreased by 2.0 per cent on Quarter 4 2022 levels, reflecting the warmer temperatures in December.

Chart 5.1 Electricity consumption by sector ([Energy Trends table 5.2](#))



Total electricity generation fell 11 per cent to 285.6 TWh in 2023, the lowest value since 1983 and a larger decrease than that seen for demand. The difference was a result of high net imports as the UK was a net importer of electricity in 2023, in contrast to 2022's notable net exports (the first time this was seen in more than forty years). Net imports reached 23.8 TWh, the second highest annual value in the timeseries, with imports more than doubling and exports more than halving.

Chart 5.2 Electricity trade and net imports ([Energy Trends Table 5.6](#))

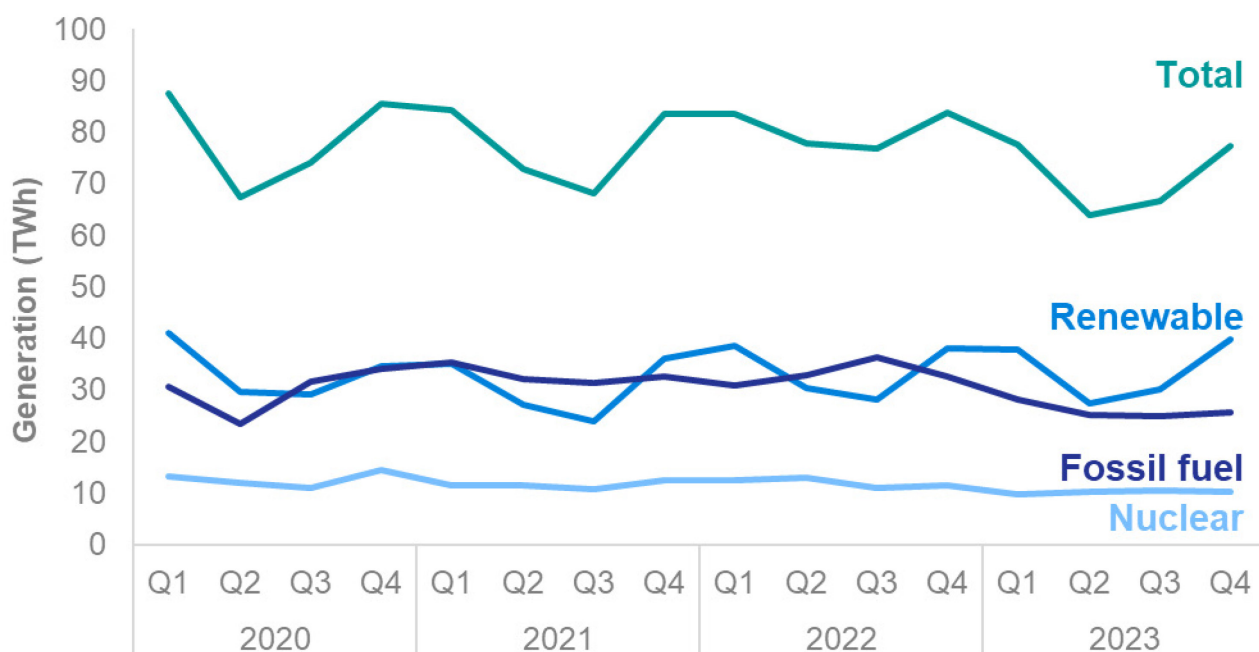


Renewable generation in 2023 matched the previous year's 135 TWh, but lower total generation meant that this represented a record share of 47.3 per cent. This is the highest in the reported time series and 10.9 percentage points higher than the share generated by fossil fuels. Electricity generated from wind increased despite lower average wind speeds, helped by additional generation capacity, and contributed more than a quarter of the UK's electricity in 2023. Generation by offshore wind reached a record high of 49.5 TWh and provided 17.3 per cent of the UK's electricity. Despite lower average daily sun hours across 2023, solar generation increased by 4.1 per cent to 13.8 TWh, the highest in the time series and reflecting increased solar capacity. In contrast, nuclear generation fell by 15 per cent to 40.7 TWh with all operational sites experiencing

outages throughout 2023. Despite the decreased nuclear generation, low carbon sources represented 61.5 per cent of generation in 2023, 4.8 percentage points higher than in 2022.

Generation from fossil fuels decreased by 22 per cent in 2023 to 103.8 TWh, the lowest value since the 1950s. Gas generation fell by 22 per cent to 97.9 TWh and coal by 37 per cent to 3.5 TWh. The decrease for gas reflected lower demand for UK-based generation as a result of high net imports while the decrease for coal was due to the closure of two of the remaining three Major Power Producer coal plants with the last one scheduled to close by the end of 2024. The share of electricity generated by fossil fuels was down by 4.9 percentage points to 36.3 per cent, but despite the decline in generation gas remained the single largest supplier of electricity at 97.9 TWh providing a third of the UK's electricity.

Chart 5.3 Electricity generated, by fuel type ([Energy Trends Table 5.1](#))



UK electricity generation totalled 77.3 TWh in Quarter 4 2023, a 7.8 per cent decrease compared with a year ago and in the opposite direction to the change in electricity demand, which increased 0.3 per cent compared to Quarter 4 2022. The difference between generation and demand trends is accounted for by an increase in net imports of electricity reducing the need for UK-based generation. This contrasts with Quarter 4 2022, where the UK was a net exporter of electricity due to French nuclear outages. A new interconnector with Denmark came online in December 2023.

Renewable generation totalled a record high 39.9 TWh in Quarter 4 2023, an increase of 4.9 per cent compared to the same period the previous year. All renewable technologies apart from hydro and shoreline wave/tidal had increased compared to the same period last year with particularly high generation from wind. Quarter 4 2023 saw wind generation increase 1.5 per cent to 26.4 TWh, the highest quarterly generation in the recorded time series. This was the first quarter where wind generated more electricity than gas and had the largest share of generation in the UK. This also meant the renewable share of electricity was greater than 50 per cent over the quarter for the first time and the share of generation from low carbon sources increased by 5.9 percentage points to a record high quarterly value of 64.8 per cent. This was despite lower nuclear generation which decreased to 10.3 TWh, reflecting outages at all of the UK's nuclear sites across the quarter.

UK fossil fuel generation totalled 25.5 TWh in the last quarter of 2023, a 22 per cent decrease compared with the same period a year ago. This is in line with high net imports and the high generation from renewables. Gas generation was down 23 per cent to 23.7 TWh and coal generation increased by 9.4 per cent to 1.3 TWh, but only represented 1.7 per cent of generation. The share of generation from fossil fuels was down to just one third of UK generation (33.0 per cent) in the last quarter of 2023.

Section 6: Renewables

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Key headlines

Renewable generation in 2023 was broadly in line with 2022, with new capacity more than offsetting less favourable weather conditions. Generation reached 135 TWh contributing to a record 47.3 share of total generation, driven by record offshore wind generation.

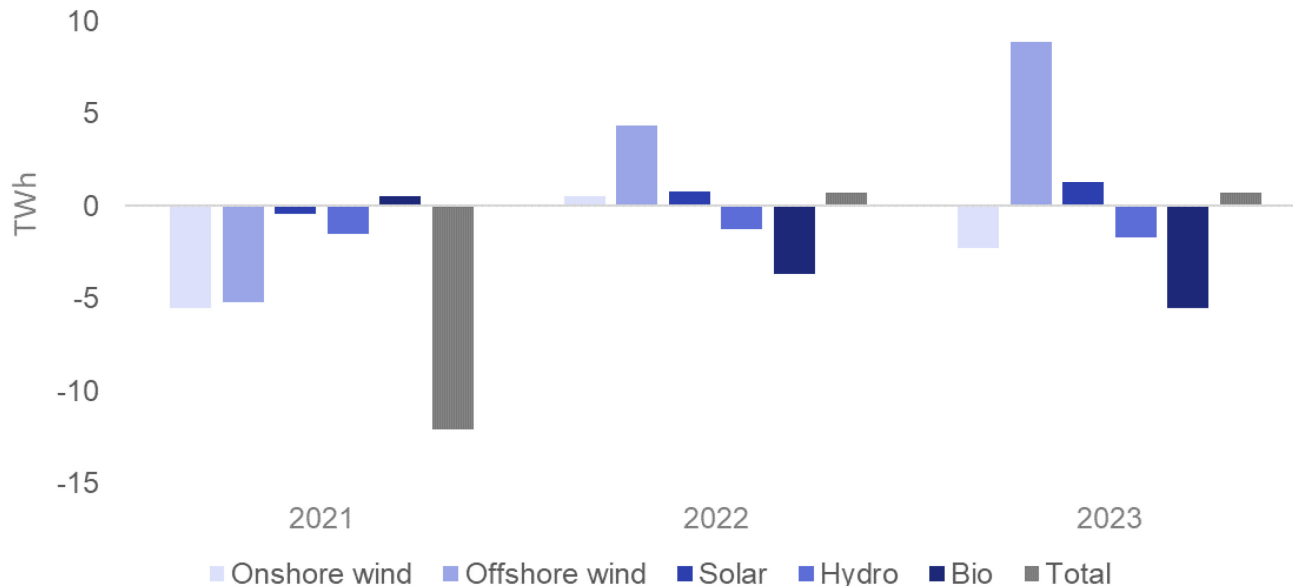
A total 2.7 GW of capacity was added in 2023 taking the total installed capacity to 56.3, up from 9.3 GW in 2010. Half the new capacity was wind (0.8 GW offshore and 0.5 GW onshore) and half solar PV (1.3 GW).

Renewables' share of total generation achieved both an annual record (47.3 per cent) and a quarterly record, which at 51.5 per cent is the first time over half of all generation came from renewable sources. Both records were partially due to a fall in overall electricity demand and reduced domestic generation due to higher imports of electricity.

A quarterly record was set in Quarter 4 2023 for offshore wind generation; with wind speeds only marginally higher than in 2022, this was largely driven by the 0.8 GW in new capacity. Although Solar PV generation didn't achieve an all-time quarterly record, a fourth quarter record was set.

Overall renewable generation was 4.9 per cent higher than in Quarter 4 2022 and at 39.9 GWh, was second only to Quarter 1 2020, when Storms Ciara and Dennis hit the UK.

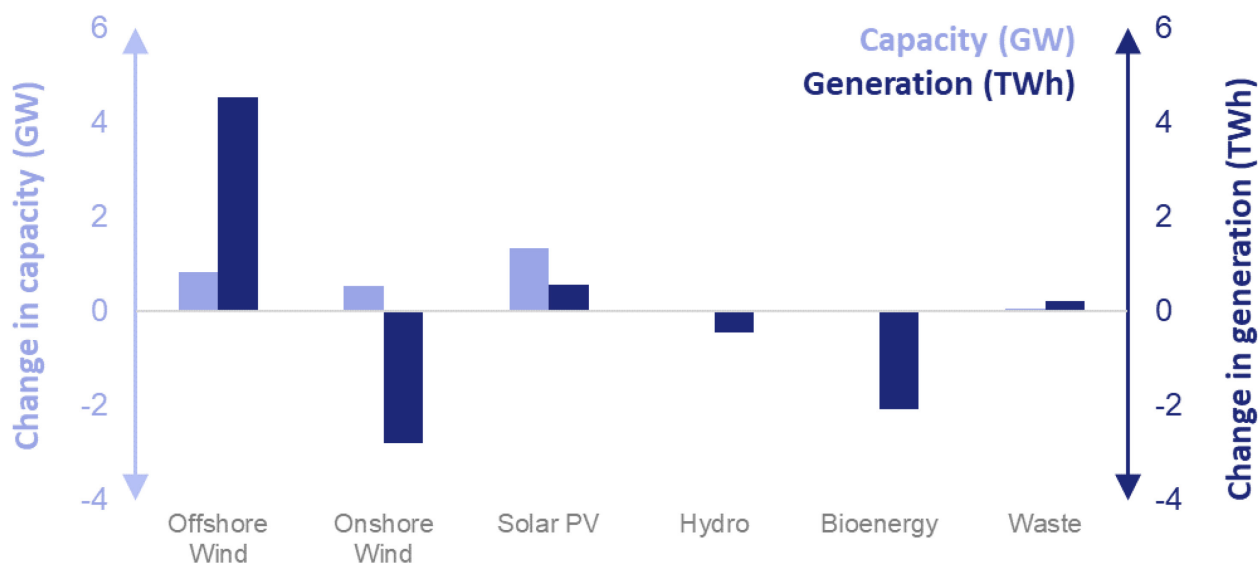
Chart 6.1 Changes in renewable generation compared to 2020 ([Energy Trends Table 6.1](#))



With the exception of 2021, renewable generation has been largely stable since 2020, a year notable for very strong winds, high rainfall and higher than average sun hours. The drivers of changes in generation are complex for renewables with the impact of new capacity interacting with variable weather conditions, and more recently outages at large biomass power stations. Chart 6.1 shows change in generation for 2021 to 2023 compared to 2020. The favourable weather conditions in 2020 were reversed in 2021 driving down generation for all weather dependent technologies. Wind speeds and rainfall also remained lower in 2022 but new offshore wind capacity more than offset this impact. Similarly for solar PV, high growth in capacity compensated for the lower sun hours in 2023 compared to 2020.

Chart 6.2 shows in more detail the trends between 2022 and 2023.

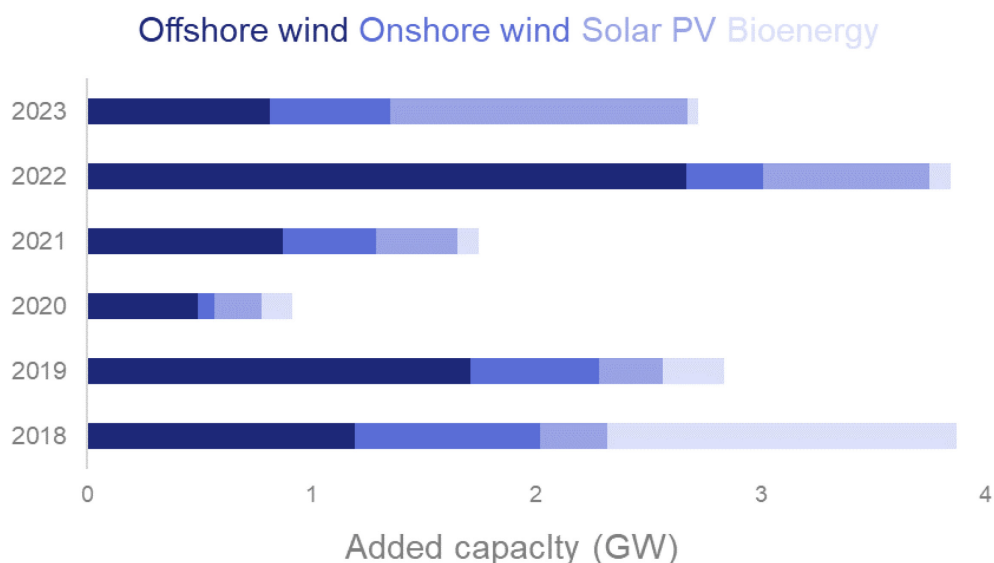
Chart 6.2 Change in renewable generation and capacity 2022 and 2023 ([Energy Trends Table 6.1](#))



The trends in wind generation are striking in comparing onshore and offshore wind; although both saw an increase in capacity, only onshore wind displayed a decrease in generation (by 7.9 per cent, compared with a 10.1 per cent increase in offshore generation). There were some known onshore wind outages for a small number of major power producers (MPPs) but variations between onshore and offshore winds may have contributed. Overall, the increase in offshore wind resulted in record generation for 2023 and was sufficient to ensure a record for overall wind generation. Solar PV generation also achieved a record with a 9.2 per cent increase in installed capacity more than offsetting fewer sun hours. The 1.3 GW of new capacity was the largest added since 2017. Hydro generation fell by 7.9 per cent despite a slight increase in rainfall. Bioenergy also fell, by 5.1 per cent. Since reaching a record in 2021, generation has decreased by 15 per cent largely due to continuing outages at some large power stations, though generation picked up in the second half of the year.

Although new capacity added in 2023 was lower than in 2022, it remained higher than in 2021 or 2020 which saw the least new capacity since 2007. Since 2020, new offshore wind represented around a half the total installed with solar PV accounting for 29 per cent and onshore wind, the bulk of the remainder.

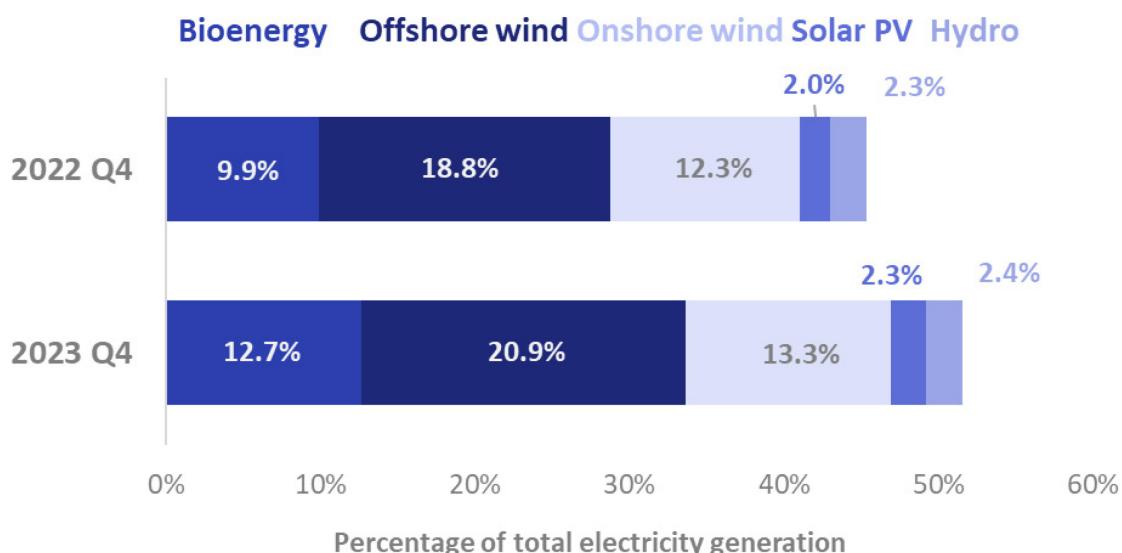
Chart 6.3 Added capacity since 2018 for the leading technologies ([Energy Trends Table 6.1](#))



In 2023, new solar PV capacity represented almost half of the total which in 2022, had been dominated by offshore wind. Whereas offshore wind sites tend to be few in number but large scale, the growth in solar PV has been dominated by numerous installations of less than 50 kW, including 172,000 new domestic installations in 2023, the most in a calendar year since 2015. For more details see the [solar deployment tables](#) ([opens in a new window](#)).

In the fourth quarter, 0.5 GW of new capacity was installed, almost two thirds of which was accounted for by the final stage of Seagreen Offshore Wind Farm which now stands at 1.1 GW. Although growth in solar PV capacity for the year was strong (9.2 per cent), the new capacity added in the fourth quarter was lower than the preceding three quarters. There was no new onshore wind capacity in the fourth quarter, the majority for the year was installed in the first quarter and included South Kyle in Scotland (240 MW).

Chart 6.4 Renewables' share of electricity generation – Q4 2022 and Q4 2023 ([Energy Trends 6.1](#))



In 2023 Quarter 4, renewable's share of generation was 51.5 per cent, a record and the first time renewables' share has exceeded 50 per cent. This was 6.2 percentage points higher than 2022 Quarter 4 and was partially driven by lower total electricity generation. All technologies increased their share with bioenergy's being the most notable with a 2.8 percentage point increase. This marks a turnaround in generation following a period of maintenance and other outages at large power stations. Solar PV's share increased by 0.3 percentage points to 2.3 per cent, clearly lower than the summer peak of 8.8 per cent in the second quarter of the year.

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:

Updates to Energy Trends monthly gas tables

Location of major UK electricity generation capacity since 1920

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: energy.stats@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	0.023885	1	0.27778	0.0094778	GJ	0.023885	1	277.78	9.4778
GWh	0.085985	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	0.10551	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, 49-51 (part*), 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 gigajoules. 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, tidal, hydroelectricity, and bioenergy. Solid biomass includes wood and wood pellets, straw, short rotation coppice, and the biodegradable component of wastes (the non-biodegradable component is shown as a memo item in [Table 6.1](#)). Liquid biofuels include bio diesel and bioethanol, along with new and emerging fuels such as bio LPG (liquified petroleum gas). Biogases include landfill gas, sewage gas, and anaerobic digestion. 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

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

National Statistics are [accredited official statistics](#). Accredited official statistics are called National Statistics in the Statistics and Registration Service Act 2007.

These accredited official statistics were independently reviewed by the Office for Statistics Regulation (OSR) in June 2014. They comply with the standards of trustworthiness, quality and value in the [Code of Practice for Statistics](#) and should be labelled 'accredited official statistics'.

Our statistical practice is regulated by the Office for Statistics Regulation.

OSR sets the standards of trustworthiness, quality and value in the Code of Practice for Statistics that all producers of official statistics should adhere to.

You are welcome to contact us by emailing energy.stats@energysecurity.gov.uk with any comments about how we meet these standards.

Alternatively, you can contact OSR by emailing regulation@statistics.gov.uk or via the [OSR website](#).

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.



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Updates to Energy Trends monthly gas tables

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The Department currently publishes Energy Trends Table 4.2 (Natural gas production and supply), a monthly table which includes some limited data on the ‘downstream’ gas industry such as gas transmitted by the National Transmission System. We also publish monthly Table 4.3, Natural gas imports and exports and Table 4.4 Natural gas imports which shows a greater disaggregation of monthly import data.

As part of work to improve our data quality and dissemination, this month, we have also published new versions of Tables 4.2, 4.3 and 4.4.

The new version of Table 4.2 includes new monthly data from gas suppliers on sales to domestic, industrial and services (e.g. commercial and public admin) sectors. We have also taken the opportunity to align the methodology used in this monthly table with that used in quarterly and annual tables. For more information on the methodology see [Natural gas statistics: data sources and methodologies](#).

The changes to Table 4.2 are shown in Annex 1. Information on data series which are to be discontinued is shown in Annex 2.

The new versions of Table 4.3 and Table 4.4 include changes based on feedback we have received to remove duplication across tables. The new tables also include data in a flat file format to aid secondary analysis.

These new tables will be published as Official Statistics in Development alongside the existing tables in the coming months, whilst we continue to quality assure the data and our processes. Whilst there are no new known limitations of the data being published, the introduction of a new data collection and processes may result in more than typical¹ revisions to the new monthly estimates of sectoral sales. This is being monitored and is not expected to have a significant impact on use of the data.

During this time, we encourage users of the data to provide feedback on the new tables. This feedback alongside the outcomes of continued work on data quality will determine what changes are made, and when any data that is currently published will be discontinued with a view to make permanent changes later this year.

To provide feedback on the new tables please email gas.stats@energysecurity.gov.uk.

¹ See [Quarterly total energy data revisions](#)

Annex 1 New Table 4.2 (Natural Gas Supply and Demand) and mapping from current Table 4.2 (Natural Gas Production and Supply)

Key **no change**, **discontinued**, **move within table**, **new**, **calculation**

Current 4.2 Natural Gas Production and Supply			New 4.2 Natural Gas Supply and Demand		
Upstream	Less	Gross gas production	Supply	Trade	Gross production
		Producers own use			Imports
	Exports	Exports			
	Imports	Net imports (Imports – exports)			
	Net imports	Stock change			
Downstream	Plus	Gas available at terminals	Transfers	Gas for synthetic gas plants	
		Biomethane injected		Biomethane to grid	
	Total gas available	Gross supply (Gross production + imports)			
	Gas input to transmission	Net supply (Gross production + imports – exports + stock change + transfers)			
	Less	Operators own use	Demand	Electricity generation	
		LNG own use			
		Storage own use			
	Stock change	Sales	Domestic		
	Metering differences		Industrial		
	Gas output from transmission	Energy industry	Services		
	Producer own use				
	Operators own use				
		LNG own use			
		Storage own use			
		Other			
		Demand (Electricity generation + sales + energy industry + other)			

Annex 2 Rational for data points currently published in Table 4.2 (Natural Gas Production and Supply) which are to be discontinued.

Data point	Rational
Gas available at terminals	Gas available at terminals is closely related to net gas supply which more closely follows established international reporting.
Total gas available	Total gas available is closely related to net gas supply which more closely follows established international reporting.
Gas input to transmission	Gas input to transmission is closely related to demand which more closely follows established international reporting.
Metering differences	Metering differences relate to gas input to transmission and gas output from transmission. Data on losses more closely follows established international reporting and is published on a quarterly basis in Table 4.1.
Gas output from transmission	Gas output from transmission is closely related to demand which more closely follows established international reporting.

For more information or to raise concerns regarding data that is being discontinued please contact gas.stats@energysecurity.gov.uk.



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Location of major UK electricity generation capacity since 1920

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Key headlines:

This article uses maps and location data to trace changes in the UK's electricity generation capacity since 1920 and to examine the relationship between fuel type and capacity location.

- In 1920 the majority of the UK's electricity capacity was coal power plants based in London, but sites are now found all over the UK and electricity is generated by a variety of fuels.
- The UK has diversified its electricity generation capacity. Coal dominated from 1920 until the mid-1970s; it was then overtaken by gas and more recently by renewable technologies. By the end of 2023 just one coal plant remained in the UK, scheduled for closure in 2024.
- Electricity generation has moved out of cities and into more rural areas. This is especially noticeable for London but seen to a lesser extent around Manchester and Liverpool.
- Since 2000 the UK has increased renewable capacity from 2GW to over 32GW with wind alone increasing by 23GW. The past few years have seen record levels of generation from renewables, with 202 TWh in 2022.

Introduction

This article uses maps to highlight key changes in the UK's major electricity generation capacity since 1920 at a regional level. It uses data from chapter 5 of the Digest of United Kingdom Energy Statistics (DUKES) as well as the 2023 Energy Trends article 'UK Electricity Capacity and Generation by Fuel between 1920 and 2020'. It focuses on the shift from coal dominance in 20th century to the rise in renewables in the 21st. The maps in the article demonstrate the relationship between different capacity types and their location within the UK, including the move out of cities to rural locations and the different location requirements of new renewable technologies.

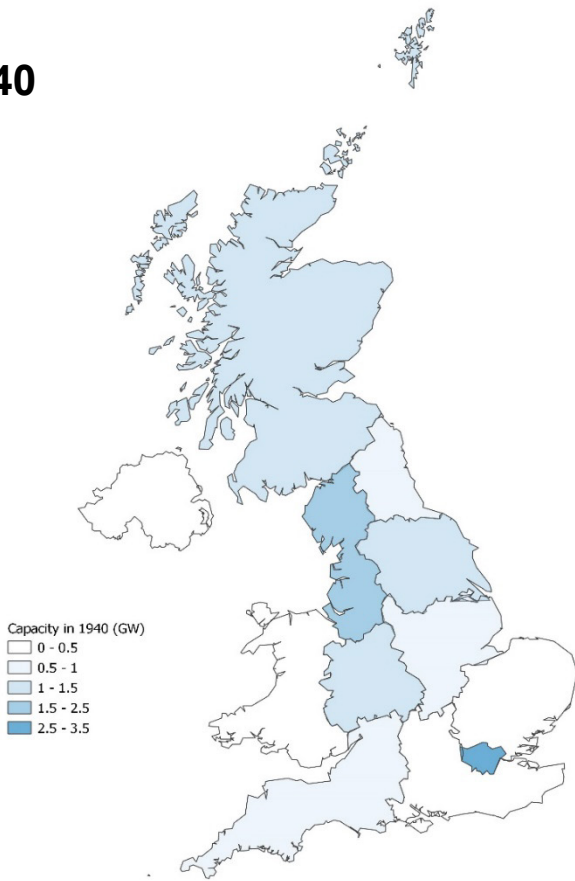
Methodology

The data in this article are taken from chapter 5 of DUKES 2023, previous capacity and generation articles and supplemented by desk and internet research. In particular, it builds on the historical dataset compiled for the 2023 Energy Trends article 'UK Electricity Capacity and Generation by Fuel between 1920 and 2020' and the 2021 Energy Trends article 'Capacity of UK Electricity Generation assets in the 21st Century, 2000 to 2019' which include detailed methodology notes. Data from the past was not as well documented as it currently is therefore estimates have been made throughout to provide a best approximation of the UK's capacity and generation mix throughout time. See accompanying spreadsheet for data used in production of the maps in this article. Full sets of maps can be found in the appendix.

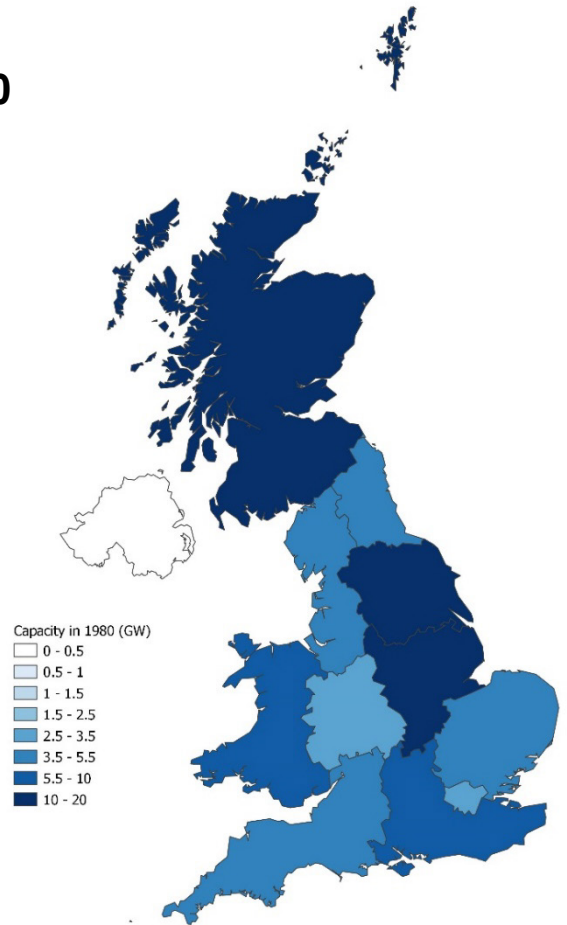
This article focuses on the major generation sites, excluding microgeneration such as domestic solar photovoltaics.

Chart 1: Heat maps to show major electricity generation capacity per region between 1940 and 2023

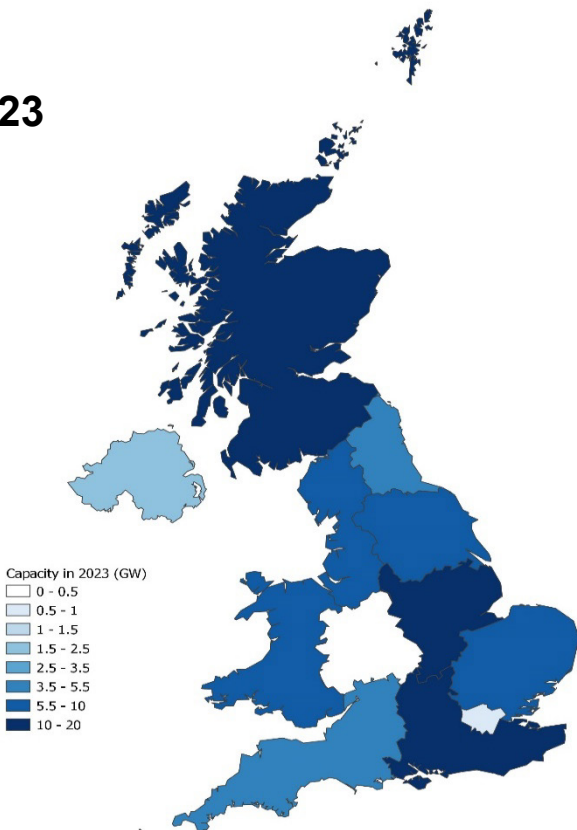
1940



1980



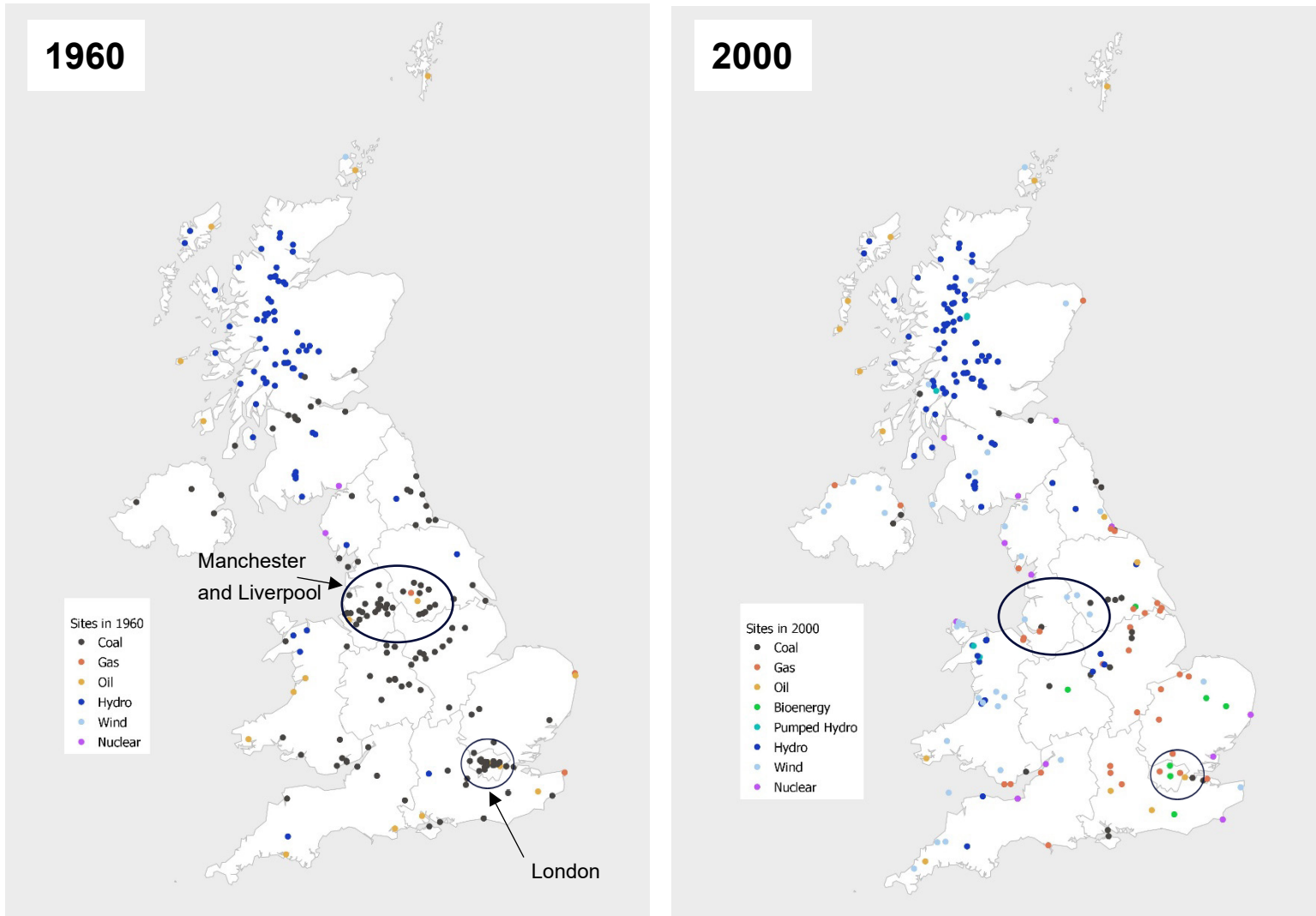
2023



How capacity has changed over time

In the 1940s, London had the largest capacity of any region in the UK due to the number of coal plants in the city. However, by the 1980s the London region's capacity had decreased with the closure of coal plants. Scotland, Yorkshire and the East Midlands now had the largest regional capacity, this is in part due to their proximity to coal fields as well as the opening of the 3.8 GW Drax coal plant in 1974 in Yorkshire. These regions have remained the largest with the addition of the South East due to the opening of a number of nuclear sites. The overall capacity of the UK has increased between 1980 and 2023 however at a slower pace compared to between 1940 and 1980.

Chart 2: Maps of the UK showing electricity generation sites per primary fuel type in 1960 and 2000



Changes in the cities

Comparing the location of generation capacity between 1960 and 2000 shows that capacity has moved out of cities and into more rural areas. This is particularly noticeable for Manchester, Liverpool, and London, (see chart 3). In 1960 cities were well populated with power plants. This was due to a combination of plentiful work force, demand for a growing population as well as easy access to coal. As coal generation declined and awareness of the environmental effects of coal burning increased, coal plants moved out of cities or closed. Focusing on London, the maps show that the majority of coal stations have closed but some have been converted to gas or biomass sites, which have lower levels of pollutants. Some generation sites are still located in cities due to the higher levels of demand.

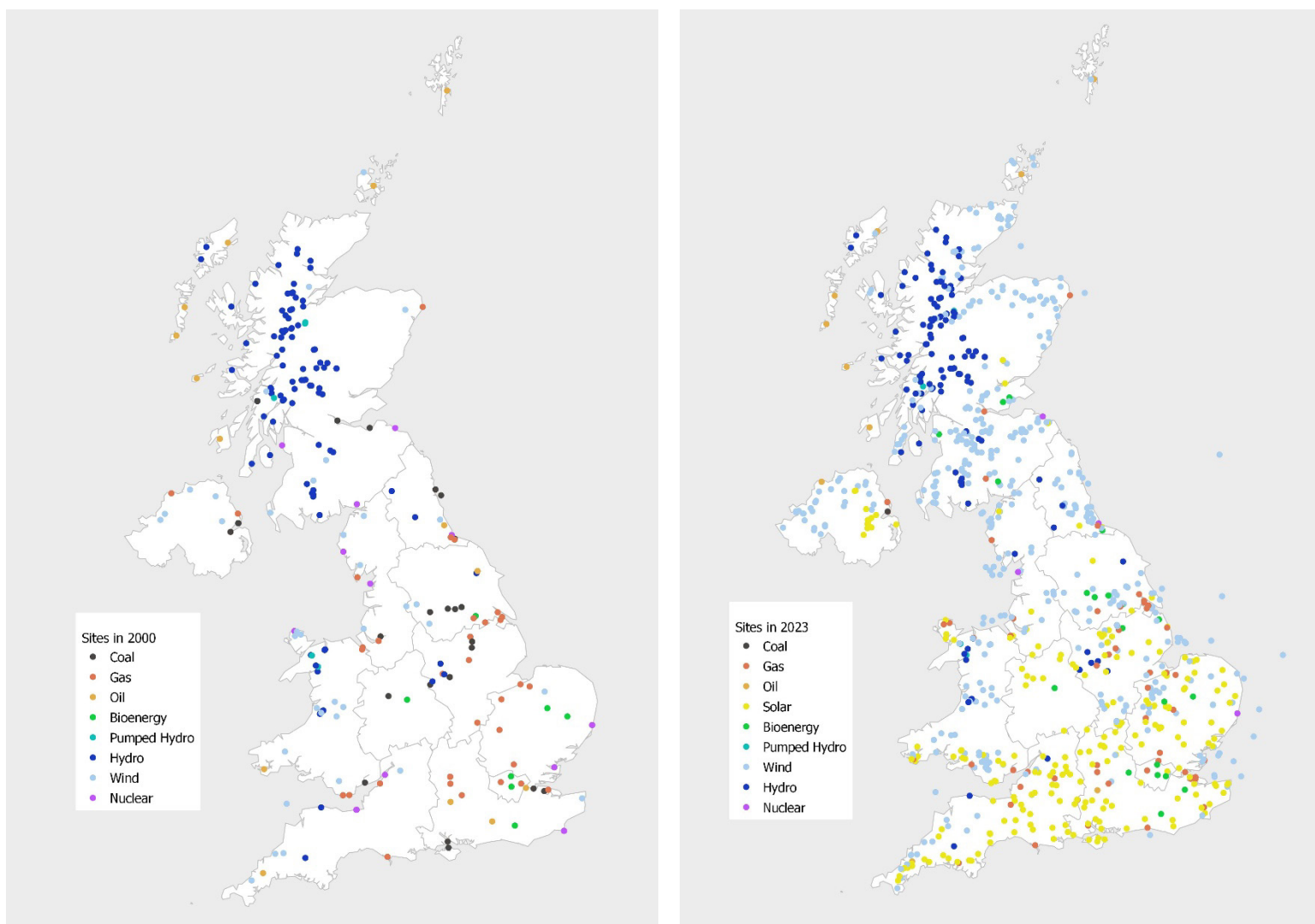
Different location requirements for new types of plant

Generation capacity diversified between 1960 and 1980, from 86% coal in 1960 to 68% coal, 13% oil, 7% gas and 13% low carbon sources in 1980, a trend which has continued. With a more diverse range of capacity types, more locations are needed. To maximise efficiency of power plants, they are generally located in areas which are best able to meet their needs. For example, coal plants were mostly found near coal fields. The major coal fields in the UK were in Durham, Scotland, and the Midlands. Therefore, it makes sense that a large amount of coal plants were located in these areas. Waterway and trainline links are important, this is how London coal plants got their fuel. Some coal sites were also then converted to gas or biomass, continuing in sites that were suitable for coal. Drax, the UK's largest biomass site was

converted from coal in 2013 and benefits from the railway to receive its fuel. In contrast, gas plants are often located next to gas terminals, such as Teeside in the Northeast and St Fergus in Scotland. Nuclear stations are built in isolated areas with low population density and close to a large water source, usually the sea, due to the need for water for cooling.

Non thermal renewables rely on weather conditions to generate and are therefore located where they are most likely to experience these conditions. Solar is most commonly found in the south of the UK as average solar intensity is greater in the South compared to the north of the UK. Wind farms are located in areas of high wind, onshore this could be on hillsides or fields and in areas with a low population. The UK has one of the largest offshore wind capacities in the world, due to the North Sea offering positive conditions for the construction of wind farms (in that it is one of the windiest places in the world, but it has shallow parts which make erecting turbines easier). Hydro and pumped hydro need a combination of hills and rain, this makes Scotland an ideal location. The large hills provide the energy needed to generate electricity when water is released from high reservoirs. North Wales has half of the UK's pumped hydro stations, as similarly to Scotland is has large mountains and high rainfall that this technology can utilise.

Chart 3: Maps of the UK showing electricity generation sites per primary fuel type in 2000 and 2023



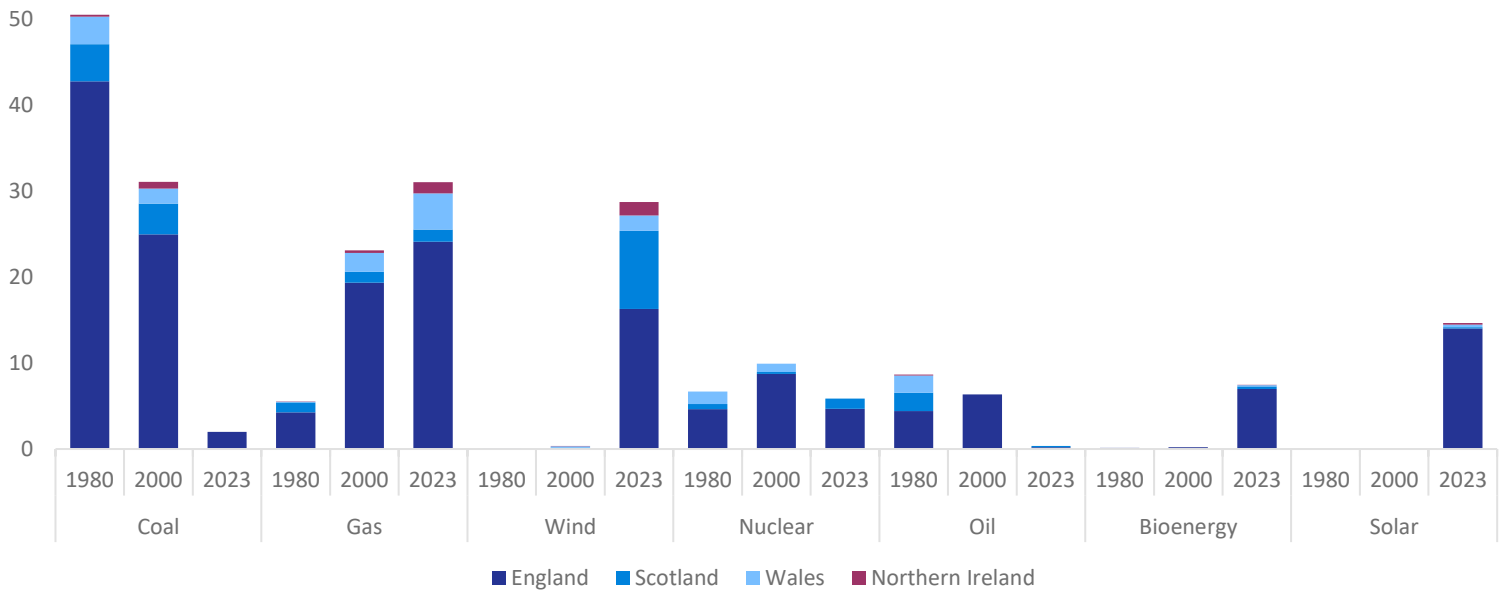
Rise in renewables

Since 2000 there has been a substantial increase in the number and capacity of renewable sites. In 2000 most of the UK's share of renewable capacity came from hydro power stations located in Scotland. By 2013 there were a handful of small solar sites dotted around the south of England, but by 2023 the number of solar sites has reached over 240. The largest site, Shotwick solar park, was added in North Wales in 2016 with an installed capacity of 72 MW. Capacity for wind generation shows a similar trend but tends to be located in the North of England and in Scotland. In 2000 there were less than 40 small scale wind farms; in 2023 there were over 460 with a combined capacity of over 25 GW. Not only have the number of sites increased, but the technology has also been advancing and increasing its capabilities, this means capacity of sites has been growing as well. Hydro sites are the exception to this trend as they had a major increase in the 40s and 60s with only 40 being built since 1980 compared to over 100 prior to that. Bioenergy sites do not have specific location requirements so are located around the country with many converted from old coal plants utilising existing infrastructure. The number of bioenergy sites tripled between 1999 and 2019.

Shares of capacity over time

The UK's electricity generation has diversified over the past 100 years, with coal generation replaced by a diverse mix of capacity, particularly gas and wind. The different location requirements for these technologies saw the generation mix change for the separate countries of the UK. All four countries have seen coal almost removed from the capacity mix, with the last coal site located in England. Coal and oil capacity fell to near zero in 2023 compared to 1980 when coal was dominant, the majority of UK coal was located in England however all regions have had coal plants. 2000 was a transition year as coal declined and gas increased. Like coal, the majority of gas plants are now in England with Wales having the second largest capacity. Nuclear has declined in the past 20 years as plants came to the end of their planned life; however, until recently nuclear consistently comprised the UK's third largest capacity, with sites based in England, Wales and Scotland. Now, only England and Scotland have nuclear plants. On the other hand, wind capacity has grown significantly and is now the UK's second highest generation capacity. Similarly to wind, solar has grown significantly predominantly in England to become the technology with the 3rd largest capacity after wind and gas. Bioenergy has seen a rise in capacity since the 2000s, though less pronounced than other renewables. The majority of bioenergy sites are located in England.

Chart 4: Capacity of major electricity generators, by fuel and UK region, 1980 – 2023 (GW installed)



Conclusion

Overall, the UK has seen significant changes in the way it generates its electricity over the past 100 years. The changes have been brought on by a variety of factors including increasing population, advancements in technologies and environmental awareness. Generation sites continue to be found all over the UK from isolated communities to busy cities. They are situated in areas that maximise their fuel, providing the greatest efficiency and stability for the electricity network.

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Appendix – Maps of major UK electricity generation capacity sites and heatmaps

