



Department for
Energy Security
& Net Zero

About this release

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

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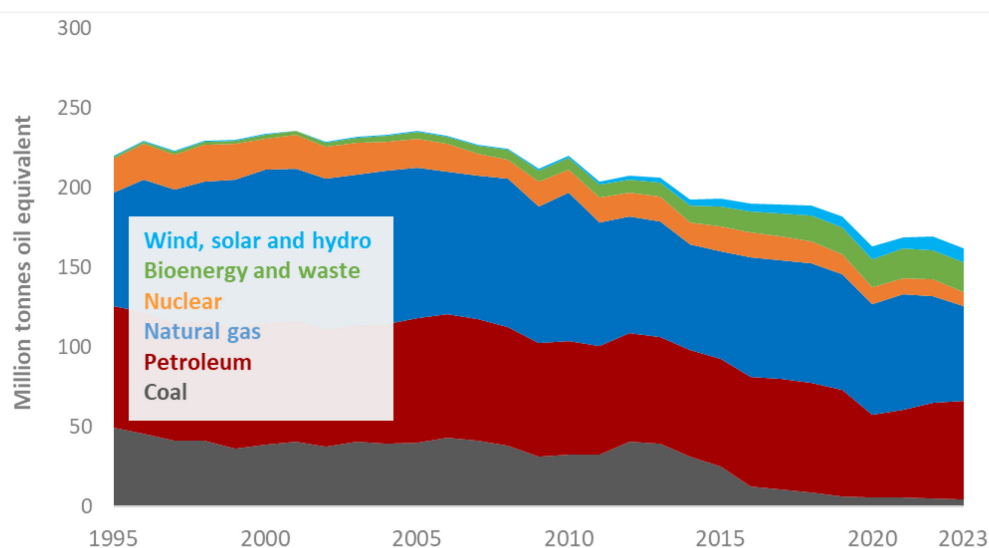
This publication is based on a snapshot of survey data from energy suppliers. New data are incorporated in line with the [revisions policy](#).

Digest of UK Energy Statistics

Annual data for UK, 2023

Overall energy demand dropped to levels last seen in the 1950s due to sustained high temperatures and high energy and other prices. Industrial and household use of energy dropped on last year to the lowest levels in over 50 years. Transport demand grew by 4 per cent driven by growth in aviation fuel sales but these remain below pre-pandemic levels.

Demand for energy in the UK, 1995 – 2023



UK energy production dropped to a new record low, down 8 per cent on 2022 with many fuels reaching record lows. Oil production is at a record 21st century low, down 11 per cent on last year and 36 per cent on 2019, and gas production is at a near record low as output from the UK's continental shelf continues to drop. Nuclear output also hit a record low down 15 per cent due to plant closures and maintenance outages. Output from wind, solar and hydro reached a record high but forms under 10 per cent of UK production.

Production from renewable technologies broadly matched the previous highs of 2020 and 2022 and renewables share of electricity generation increased to a record 46.4 per cent up from 41.7 per cent last year, largely due to wind and solar generation shares reaching new record highs. Wind generation hit a record high share of 28.1 per cent of generation. Generation from fossil fuels fell to a record low of 36.7 per cent although generation from gas remained the principal form of UK generation at 34.7 per cent.

Net imports of energy rose, to 40.8 per cent from 37.0 per cent. Exports of crude oil reached a successive record low as a result of reduced production, but gas trade decreased as a result of lower demand from Europe to make good the shortfall caused by countries moving away from Russian gas. Electricity imports also reached a record high and reduced the need for domestic generation, particularly gas generation.

Chapter 1: Energy

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Key headlines

Energy production fell by 8.3 per cent to a record low level. Oil production fell by 11 per cent to the lowest level since the late 1970s and is down by 36 per cent on pre-pandemic (2019) levels. Nuclear output fell by 15 per cent, to levels last seen in the 1960s, due to reduced capacity and outages and coal reached another record low. Wind, solar and hydro output rose by 2.2 per cent to a record high level due to increased capacity and output from offshore wind and solar.

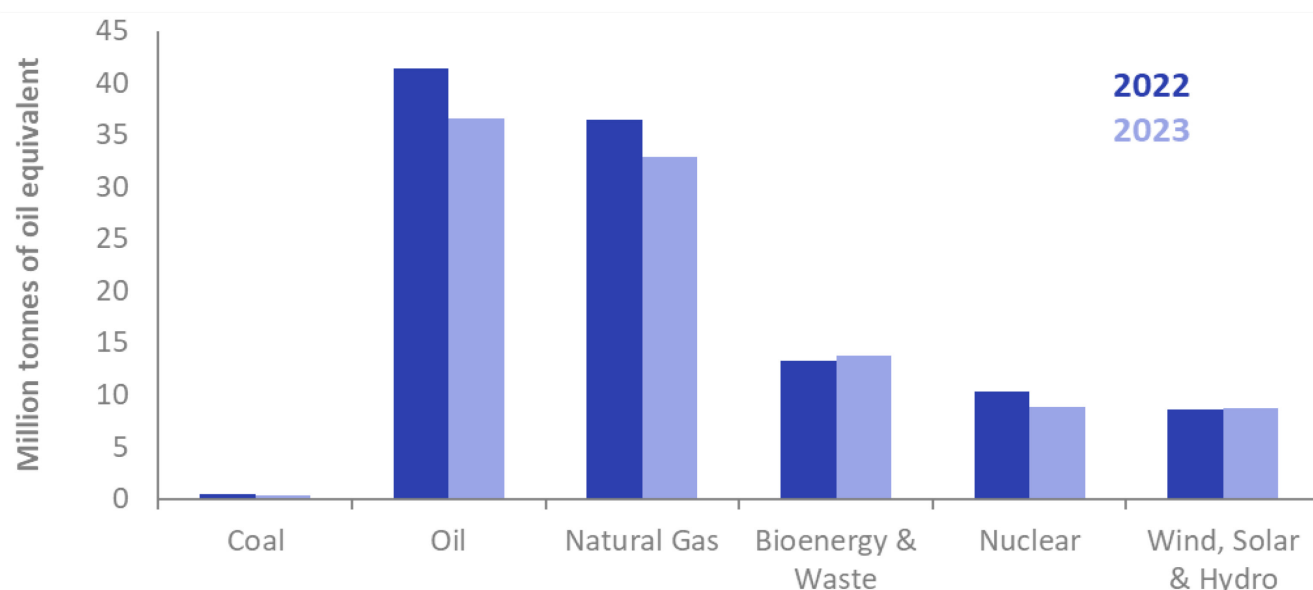
Energy consumption in 2023 remained low, down 1.1 per cent on 2022 and down 11 per cent on 2019. Consumption levels in 2023 fell for all sectors except for transport due to warm weather as well as the impact of higher energy and other prices. Domestic sector consumption fell by 6.0 per cent and industrial sector consumption fell by 1.1 per cent, with both sectors at levels not seen in over fifty years.

Transport demand rose by 3.6 per cent compared to last year but remains 6.5 per cent below pre-pandemic (2019) levels. **Aviation fuel demand rose by 16 per cent**, but is still 7.2 per cent below 2019 levels.

Net imports rose by 6.8 per cent. Imports fell by 6.5 per cent with electricity imports at a record high level, and exports fell by 17 per cent with crude oil exports at a record low level. The UK reverted to being a net importer of electricity in 2023 after being a net exporter in 2022 for the first time in over 40 years. The UK's net import dependency stood at 40.8 per cent, up from 37.0 per cent in 2022.

The bulk of the UK's energy imports, over 90 per cent, comprise oil and gas and **Norway is the UK's primary supplier of energy imports**. The largest share of oil imports in 2023 arrived from the United States, whilst Norway provides the largest share of gas imports.

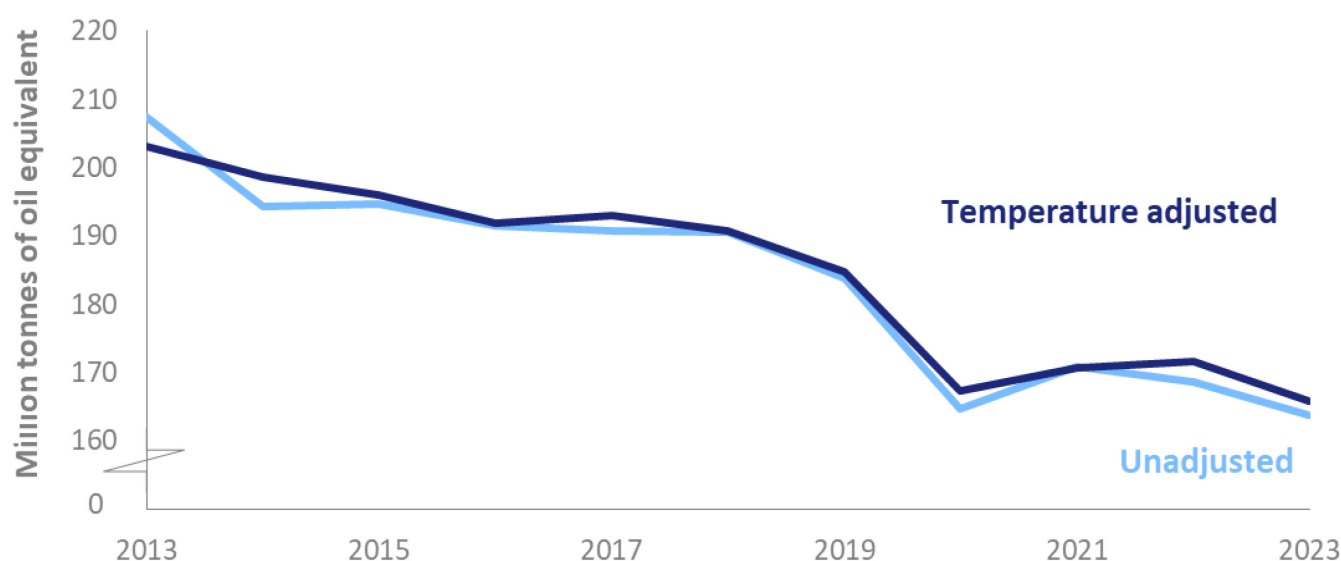
Chart 1.1 Production by fuels, 2022 and 2023 ([DUKES Table 1.1](#))



In 2023 total production was at a record low level of 101.2 million tonnes of oil equivalent, 8.3 per cent lower than in 2022, and 21 per cent lower than pre-pandemic levels. Production levels for all fuels except bioenergy & waste and wind, solar & hydro are down on 2022, with **coal, oil and nuclear output at record lows for this century. UK production is 66 per cent below the peak recorded in 1999.**

In 2023 coal production fell by 21 per cent to a record low level, whilst production of oil fell by 11 per cent to a record low level, with output down by 36 per cent on pre-pandemic (2019) levels. Natural gas production fell by 9.6 per cent and is down 12 per cent on pre-pandemic levels, whilst nuclear output fell by 15 per cent to a record 21st century low due to reduced capacity and numerous outages throughout 2023 across the UK nuclear fleet. Production of bioenergy and waste rose by 3.4 per cent, **whilst wind, solar and hydro output rose by 2.2 per cent to a record high level** due to increased offshore wind and solar output and capacity.

Chart 1.2 Primary energy consumption, 2013 to 2023 ([DUKES Tables 1.1 and 1.1.4](#))



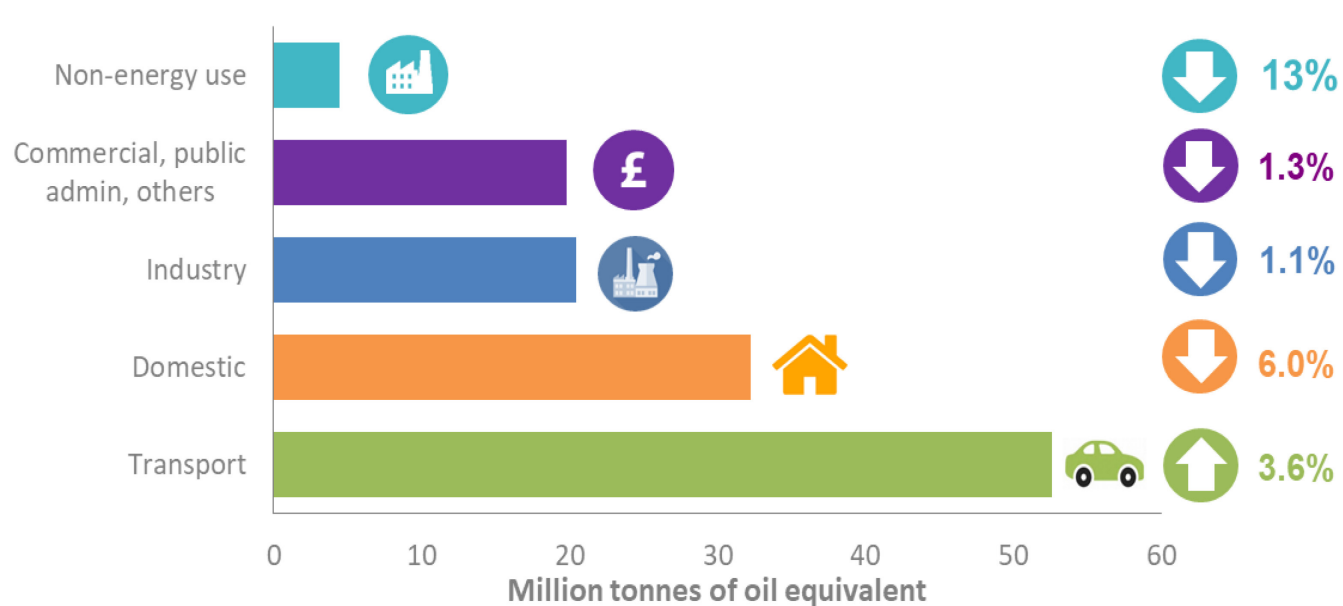
In 2023 total primary energy consumption was 163.8 mtoe, 2.9 per cent lower than in 2022, with near record high temperatures and higher energy and other prices a key factor in the reduced consumption levels.

Primary energy consumption includes use by consumers, fuel used for electricity generation and other transformation activities. On a seasonally adjusted and annualised rate that removes the impact of temperature on demand, consumption was 165.9 mtoe, 3.3 per cent lower than in 2022. Consumption levels on both an unadjusted and adjusted basis were lower than in 2020, when consumption levels were severely impacted by the Covid-19 pandemic.

In 2023 total primary energy consumption levels fell for all fuels except oil, bioenergy & waste, wind, solar and hydro and imports of electricity. Consumption of oil rose by 2.4 per cent, with sales of petrol and diesel down around 10 per cent on (2019) levels. Aviation fuel sales were up significantly on 2022 but remain below pre-pandemic levels. Consumption of bioenergy & waste rose by 1.1 per cent. Primary electricity consumption rose by 6.5 per cent, within which nuclear fell by 15 per cent due to outages, wind, solar and hydro rose by 2.2 per cent, and net imports rose significantly as the UK reverted to being a net importer of electricity after being a net exporter in 2022 for the first time in more than 40 years.

Consumption of coal and other solids fell by 14 per cent due to limited demand from electricity generators, whilst natural gas consumption fell by 10 per cent as electricity generators made more use of renewable sources and households reduced consumption for heating due to higher energy and other prices and warm temperatures.

Chart 1.3 Final energy consumption by sector, 2023 ([DUKES Table 1.1](#))



In 2023 total final energy consumption including non-energy use was 129.5 mtoe, 1.1 per cent lower than in 2022, and 11 per cent lower than pre-pandemic (2019) levels.

Except for transport, consumption levels in 2023 all fell due to continued high temperatures and high energy and other prices.

Domestic sector consumption fell by 6.0 per cent to the lowest level in over 50 years, with average temperatures in 2022 broadly similar to the record temperatures seen in 2022 as well changes in consumer behaviour arising from higher prices. Transport sector consumption rose by 3.6 per cent, with road transport (petrol and diesel) consumption rising by 0.2 per cent and air consumption rising by 16 per cent, but still remaining 7.2 per cent below pre-pandemic (2019) levels. Industrial sector consumption fell by 1.1 per cent, again to the lowest level in at least 50 years, and service sector consumption fell by 1.3 per cent with the impact of higher energy and other prices likely a key factor in the reduced consumption levels.

Final energy consumption excluding non-energy use fell by 0.6 per cent, whilst on a temperature corrected basis consumption fell by 2.1 per cent with falls in all sectors except transport. Domestic consumption fell by 7.8 per cent, industrial consumption fell by 5.1 per cent, and other services consumption fell by 2.2 per cent; transport consumption rose by 3.5 per cent.

Chart 1.4 Net import dependency, 1970 to 2023 ([DUKES Table 1.1.3](#))



In 2023 net import dependency was 40.8 per cent¹, 3.8 percentage points higher than in 2022.

Imports in 2023 at 137.4 mtoe were 6.5 per cent lower than in 2022, and 24 per cent lower than their peak in 2013. Gas imports fell 20 per cent from the record levels seen in 2022. Pipeline imports fell 16 per cent as the interconnectors to Belgium and the Netherlands were used to export rather than import for the majority of the year, whilst Liquefied Natural Gas (LNG) imports fell 24 per cent. In 2022 the UK's substantial LNG regasification infrastructure had operated as a land-bridge for increased imports, which were then exported to mainland Europe to help reduce its dependence on Russian gas.

Exports in 2023 at 68.0 mtoe were 17 per cent lower than 2022 but are still 3.3 per cent higher than the record 21st century low level of 2021. Electricity exports more than halved in 2023, with the UK a net importer again after being a net exporter for the first time in over 40 years in 2022 to help meet demand in France from reduced nuclear output there.

Net imports at 69.5 mtoe were 6.8 per cent higher than in 2022 and accounted for 40.8 per cent of consumption in 2023, up from 37.0 per cent in 2022 and at the highest share level since 2014.

Despite net imports rising, the UK decreased its use of fossil fuels. The main fossil fuel sources in the UK are coal, gas and oil. In 2023, the share of primary energy consumption from fossil fuels fell to 76.8 per cent from 78.3 per cent in 2022, whilst that from low-carbon sources stood at 20.7 per cent, down marginally on 2022.

¹ Net imports as a proportion of primary supply (including an addition for the energy supplied to marine bunkers).

Chapter 2: Solid Fuels and Derived Gases

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Key headlines

Demand for coal fell in 2023, by 26 per cent to 4.5 million tonnes compared to 2022. The fuel mix has shifted towards other sources of fuel, particularly for electricity generation.

Consumption of coal for electricity generation fell 35 per cent to 1.5 million tonnes in 2023. Three of the four remaining UK coal power plants closed in 2023, with Drax and West Burton ceasing generation in Spring, having remained open to ensure security of supply over Winter 2022/23. Kilroot in Northern Ireland closed in September 2023. Just one coal plant, Ratcliffe-on-Soar, remains operational in the UK, with plans to close by October 2024.

Production of coal fell to another record low, down 22 per cent from 2022 to 506 thousand tonnes. Surface mining production fell to a record low of 425 thousand tonnes with UK production over the last year being further affected by mine closures and declining demand for coal use. In the last ten years, UK coal production has fallen by 96 per cent.

Coal imports fell 45 per cent in comparison with 2022 to 3.4 million tonnes in 2023. In 2023 the USA was the largest exporter of coal to the UK with a share of 45 per cent. This was followed by the Australia with 13 per cent and the European Union with 11 per cent.

In 2023, coal comprised 2.4 per cent of UK energy demand, down from 2.7 per cent in 2022. Over a longer period, the trend reflects the transition away from coal in the UK's energy mix; coal demand has fallen from a 16 per cent share of UK energy demand in 2000. Most of this coal is used for electricity generation, coke manufacture, or in blast furnaces in the steel industry.

The Sankey diagram at the end of this chapter shows flows of coal from production and imports through to consumption. It is a way of visualising the figures that can be found in the commodity balance for coal in Table 2.4. The chart illustrates the flow of coal from the point of supply (on the left) to its eventual final use (on the right).

Reduced demand for coal drove a substantial contraction in supply, with UK coal production down 96 per cent since 2013. In 2023, coal production fell to a record low of 506 thousand tonnes, down 22 per cent on 2022 (Chart 2.1).

Deep mined production rose to 81 thousand tonnes and comprised 16 per cent of production in 2023. Nine deep mines remained open, and another was under care and maintenance. Six deep mines reported coal

production in 2023. This compares to 2015 when deep mined production provided nearly a third of total coal production, and when the last three large deep mines closed – Hatfield, Thoresby and Kellingley.

Surface mine production was down 28 per cent to a new record low of 0.4 million tonnes due to mine closures and declining demand for coal use.

Chart 2.1 UK coal supply and demand, 2000 – 2023 (DUKES Table 2.1)

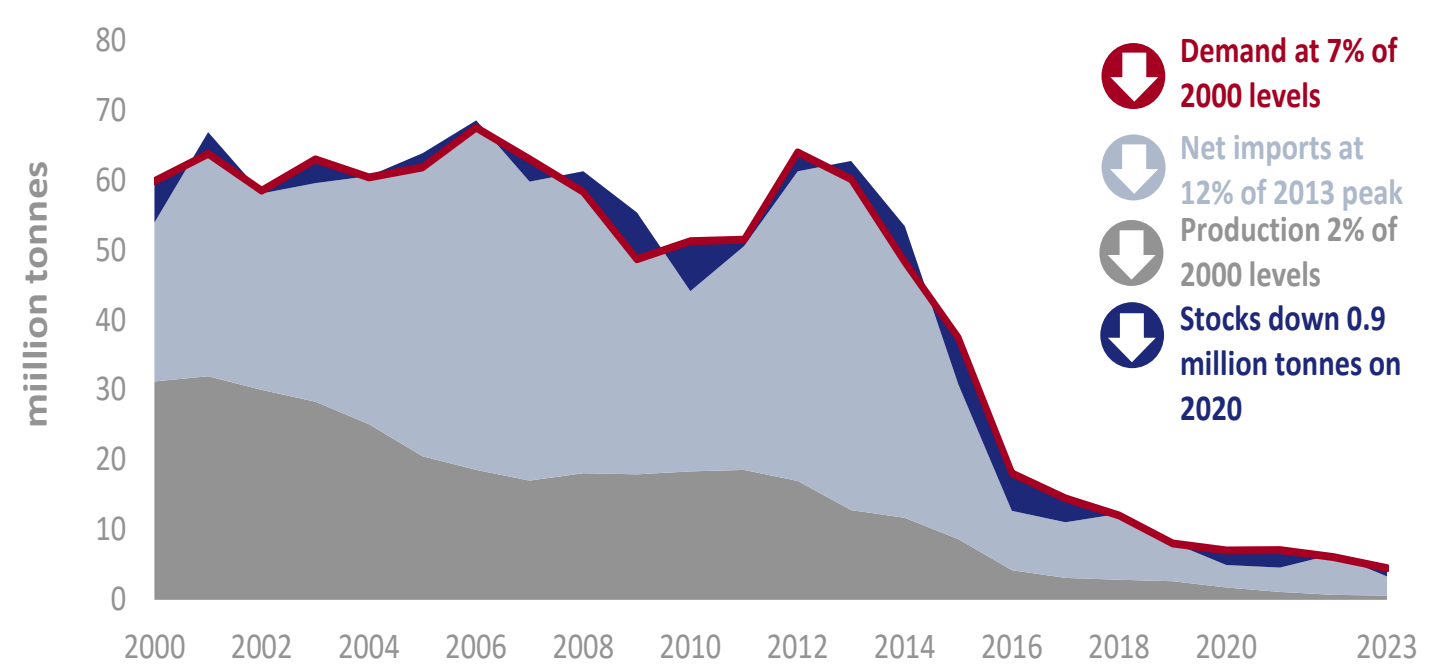
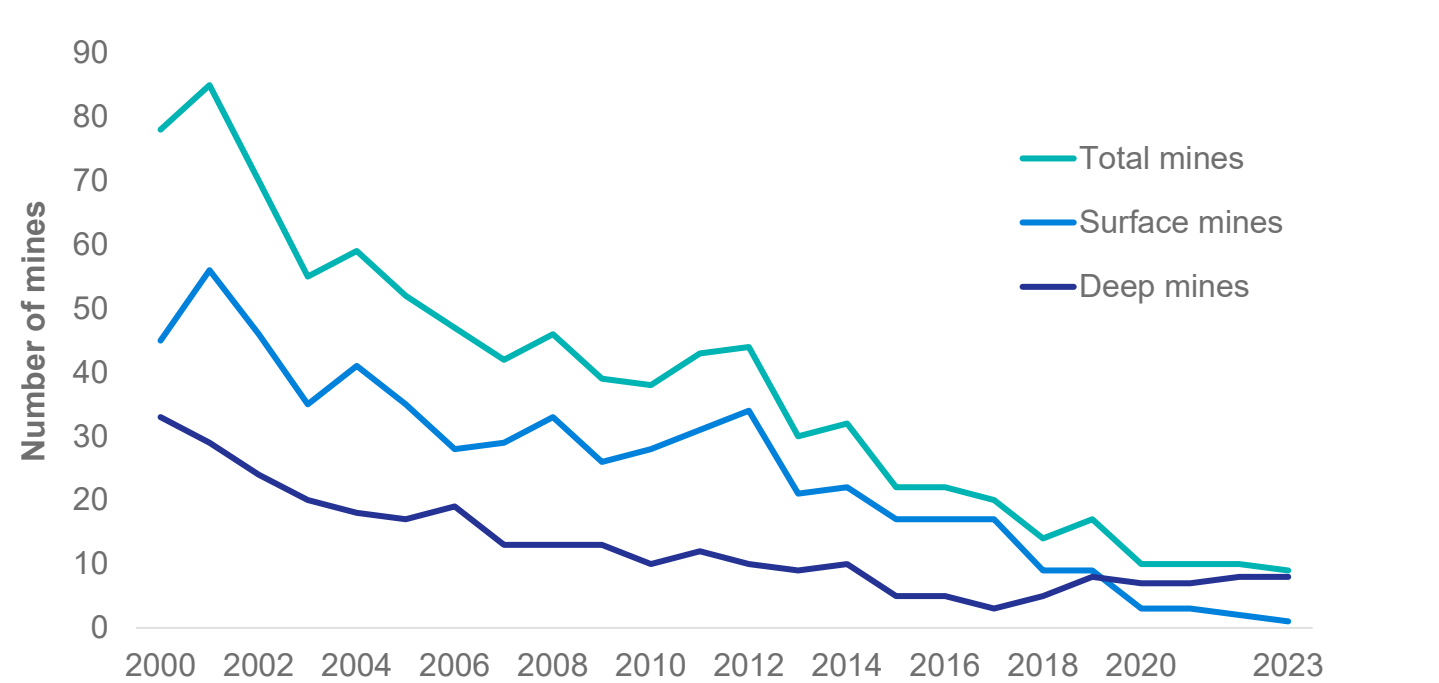
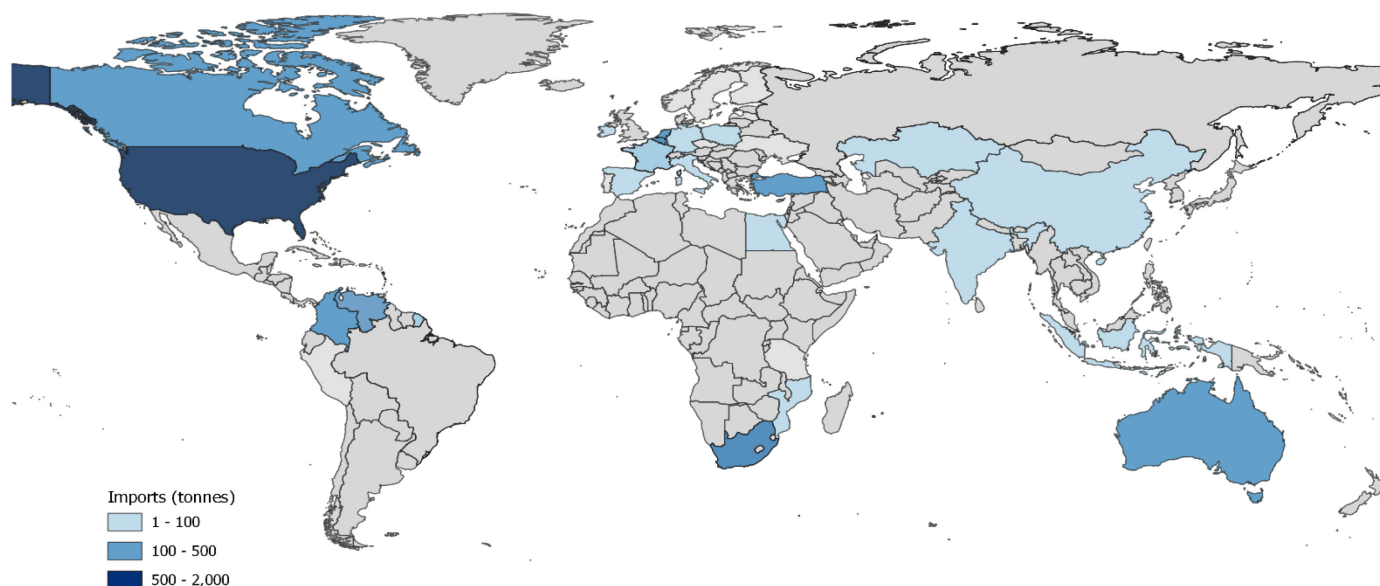


Chart 2.2 Number of coal mines producing in the UK, 2000 – 2023 (DUKES Table 2.5)



Net imports of coal also fell substantially, down 94 per cent from the peak in 2013. This is again a result of the sharp fall in demand for coal. However, in 2023, net imports fell by 52 per cent from 2022 levels to 2.8 million tonnes. This reduction in imported coal occurred at a slower pace than the reduction in domestic production, leading to the proportion of net imports in the UK coal supply increasing over the past 20 years. In 2023 net imports accounted for 62 per cent of the UK's supply.

Map 2A showing UK Coal Imports in 2023 (thousand tonnes)



For more detail on coal imports and exports see [DUKES tables 2.7 and 2.8](#)

Steam coal imports were 54 per cent lower at 2.1 million tonnes in 2023 compared to 2022. The USA was the largest provider of UK's steam coal (37 per cent). This was followed by Colombia (16 per cent) and the European Union (14 per cent). Steam coal accounted for 60 per cent of total coal imports. Coking coal imports were down 23 per cent at 1.3 million tonnes compared to 2022. The USA was the largest provider of UK's coking coal (59 per cent). This was followed by Canada (16 per cent). Coking coal accounted for 38 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.

Coal stocks fell in 2023 continuing its downward trend. In line with much of what we see with coal, the main change to coal stocks came post 2014 when stocks began to gradually decline and power plants closed. There was a temporary rise in coal stocks in 2022, as generators rebuilt their stocks so that coal could be used for electricity if needed during winter 2022/23. However, stocks fell again in 2023.

As of June 2024, the Coal Authority estimates that in total there were 187 million tonnes of economically recoverable coal resources (Table 2.6). Of the economically recoverable and minable coal resource in current operations (including those in the planning or pre-planning process), 145 million tonnes are in underground mines and 42 million tonnes in surface mines. Overall Scotland had a 46 per cent share of UK current mines and licenced resources, followed by Wales with 34 per cent and England 20 per cent.

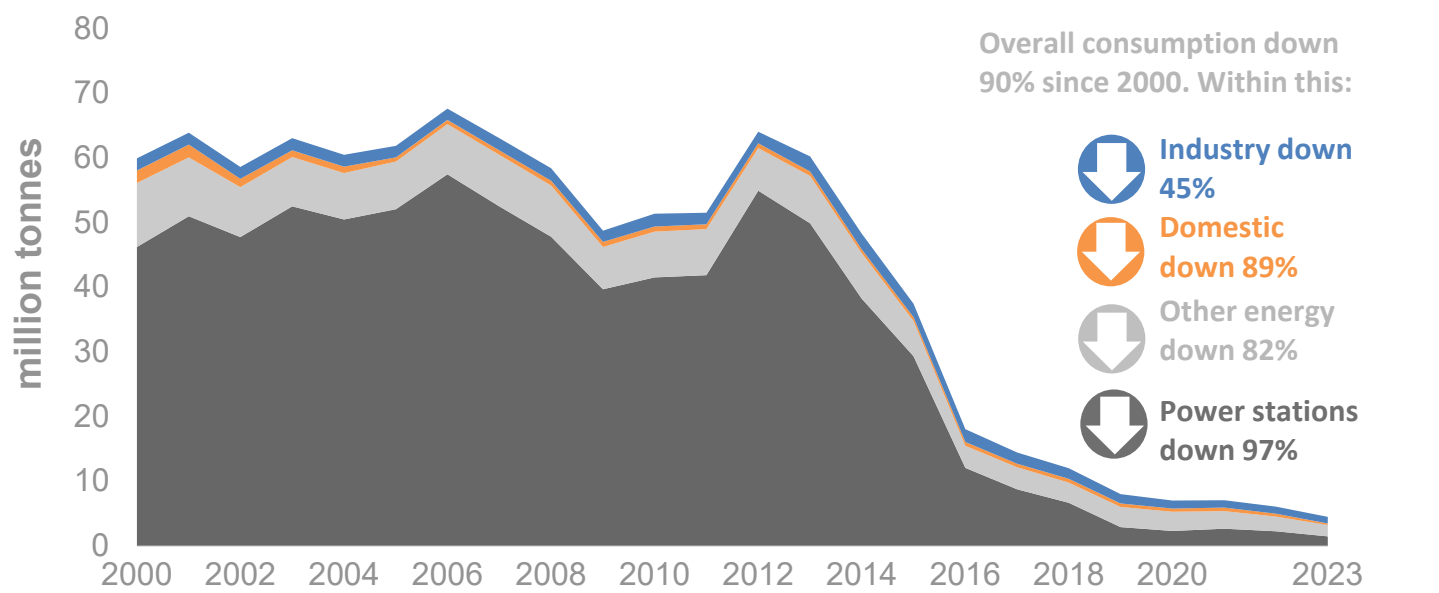
The reduction of underground figures is due to the decline of the industry. An additional 2,050 million tonnes of prospects for underground mines and 778 million tonnes of prospects for surface mines were estimated in

June 2022. Table 2.6 gives details of the resource assessment by England, Scotland and Wales as at June 2024.

Demand for coal fell by 26 per cent to 4.5m tonnes in 2023, compared to 2022 (table 2.2). Much of this decrease was driven by the 35 per cent fall in coal-fired generation to 1.5 million tonnes as other fuels were favoured for electricity generation. Electricity generation for major power producers as a whole fell by 9.9 per cent in 2023, with wind generation being the only fuel recording an increase. Wind generation was up 2.2 per cent to a record 73.7 TWh due to increased capacity.

A decrease in coal generation in 2023 as the downward trend continues. A reduction in generation capacity contributed to the downwards trend in coal consumption. Most of the UK’s coal-fired power plants have closed in recent years. Just one coal plant Ratcliffe-on-Soar remains operational in the UK, with plans to close by October 2024. Coal use has declined since the early 1970’s as new fuels (gas and renewables) entered the market.

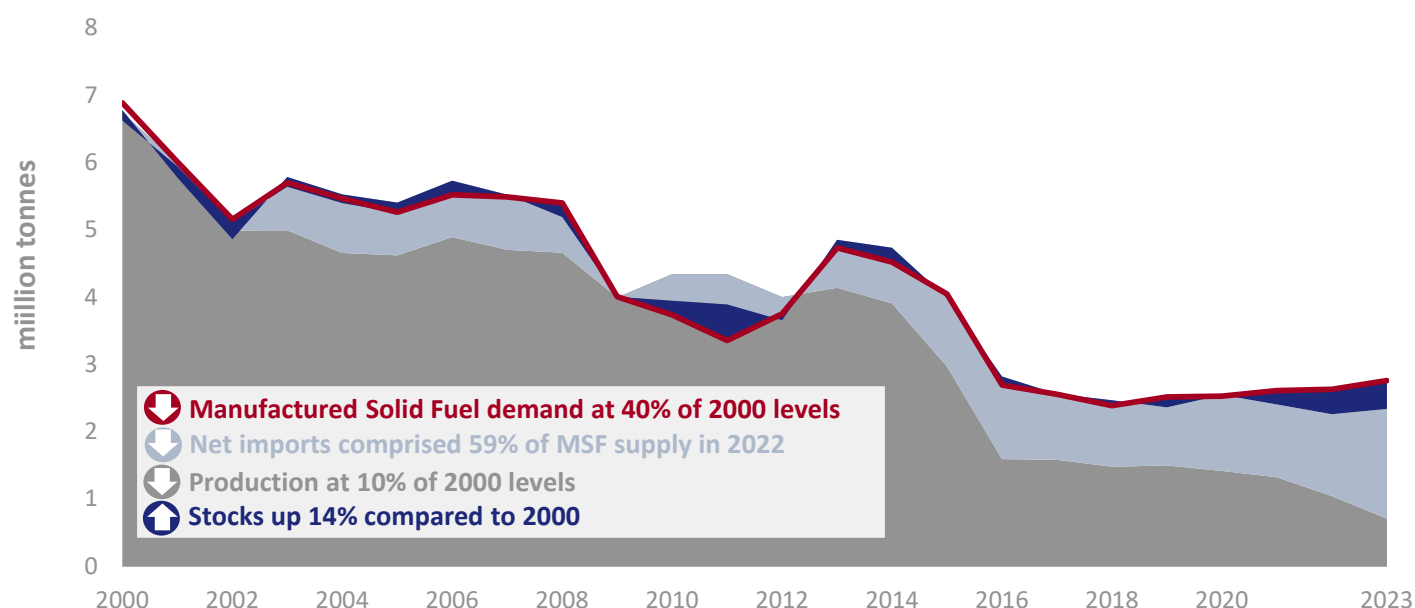
Chart 2.3 Coal Demand, 2000 – 2023 ([DUKES Table 2.2](#))



The iron and steel industry is one of the main non-generation users of coal, for coke manufacture, blast furnaces and direct consumption. In 2023 it used 1.6 million tonnes of coal, less than a third of what it used in 2015 (5.2 million tonnes). In terms of total share, it comprised 36 per cent of UK coal consumption in 2023, up from 14 per cent in 2015.

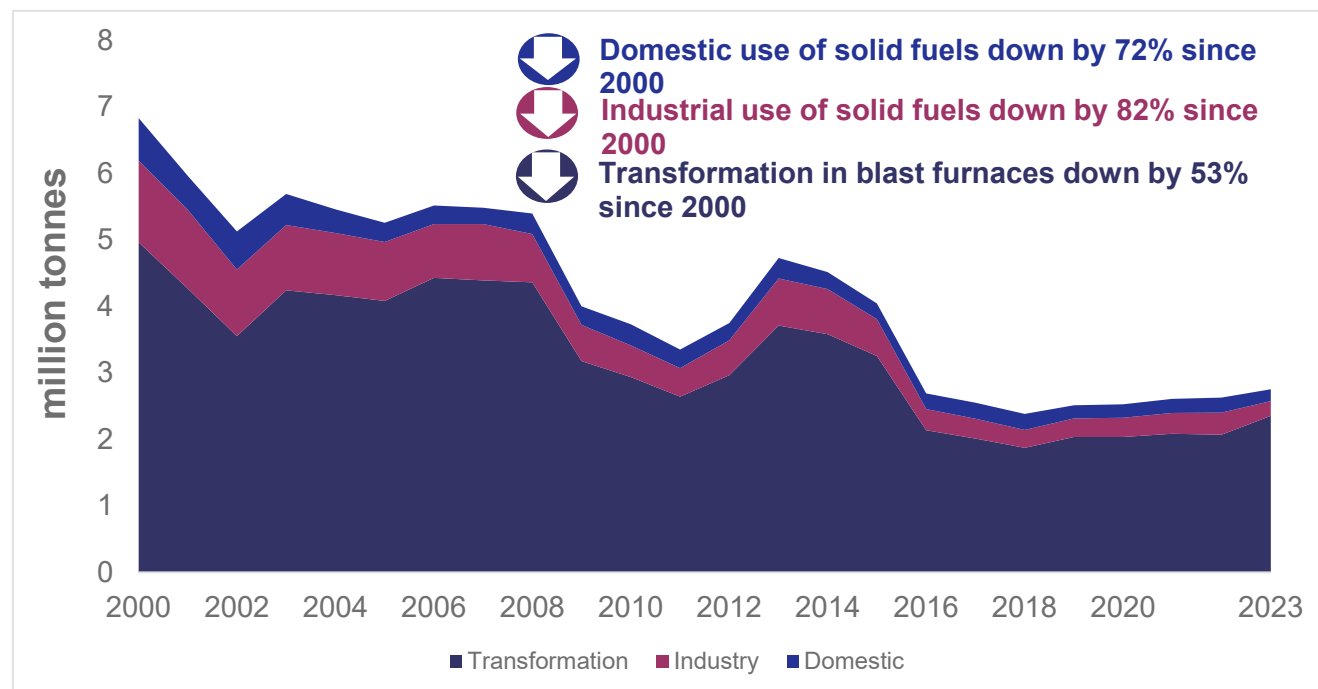
In addition to coal production and consumption, the UK has significant (but decreasing) supply and demand for a range of manufactured solid fuels that are used for domestic, industrial and transformation processes. Coke is the solid product obtained from the carbonisation of coal, principally coking coal, at high temperature and is used for smelting iron and steel.

Chart 2.4 Total manufactured solid fuels supply and demand, 2000 - 2023 ([DUKES Table 2.3](#))



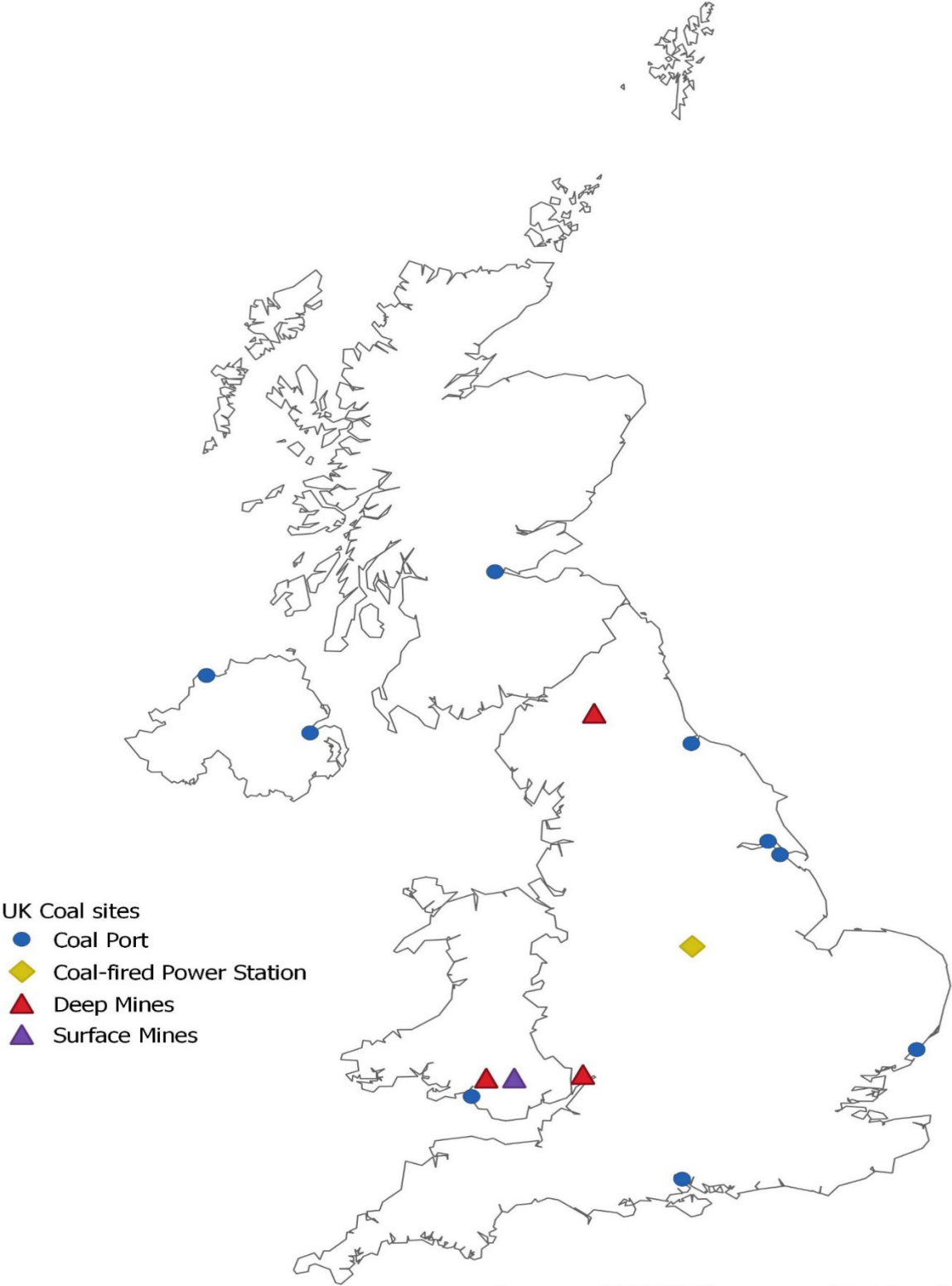
In 2023, indigenous coke oven coke fell by 39 per cent to 0.5 million tonnes compared to 2022 (Chart 2.5). Monckton Coke and Chemicals, the only dedicated coke plant in the UK closed in December 2014. There has been a fall in steel production in the UK since 2015. Notably, SSI steelworks at Redcar ceased production in mid-September 2015 (with the subsequent closure in October). Scunthorpe steelworks closed on 12 June 2023. Coke production continued at other sites and is used at steelworks, mainly Port Talbot. Coke breeze production rose 22 per cent to 21 thousand tonnes. Other manufactured solid fuels (patent fuels) fell by 11 per cent to 182 thousand tonnes.

Chart 2.5 Total manufactured solid fuels consumption in the UK, 2000 – 2023 ([DUKES Table 2.3](#))



In 2023, coke oven coke comprised 69 per cent of demand for manufactured solid fuels, with coke breeze at 25 per cent and other manufactured solid fuels at 6 per cent. Almost all coke oven coke and coke breeze in the UK is used in blast furnaces for steelmaking. Volumes have been broadly stable in recent years.

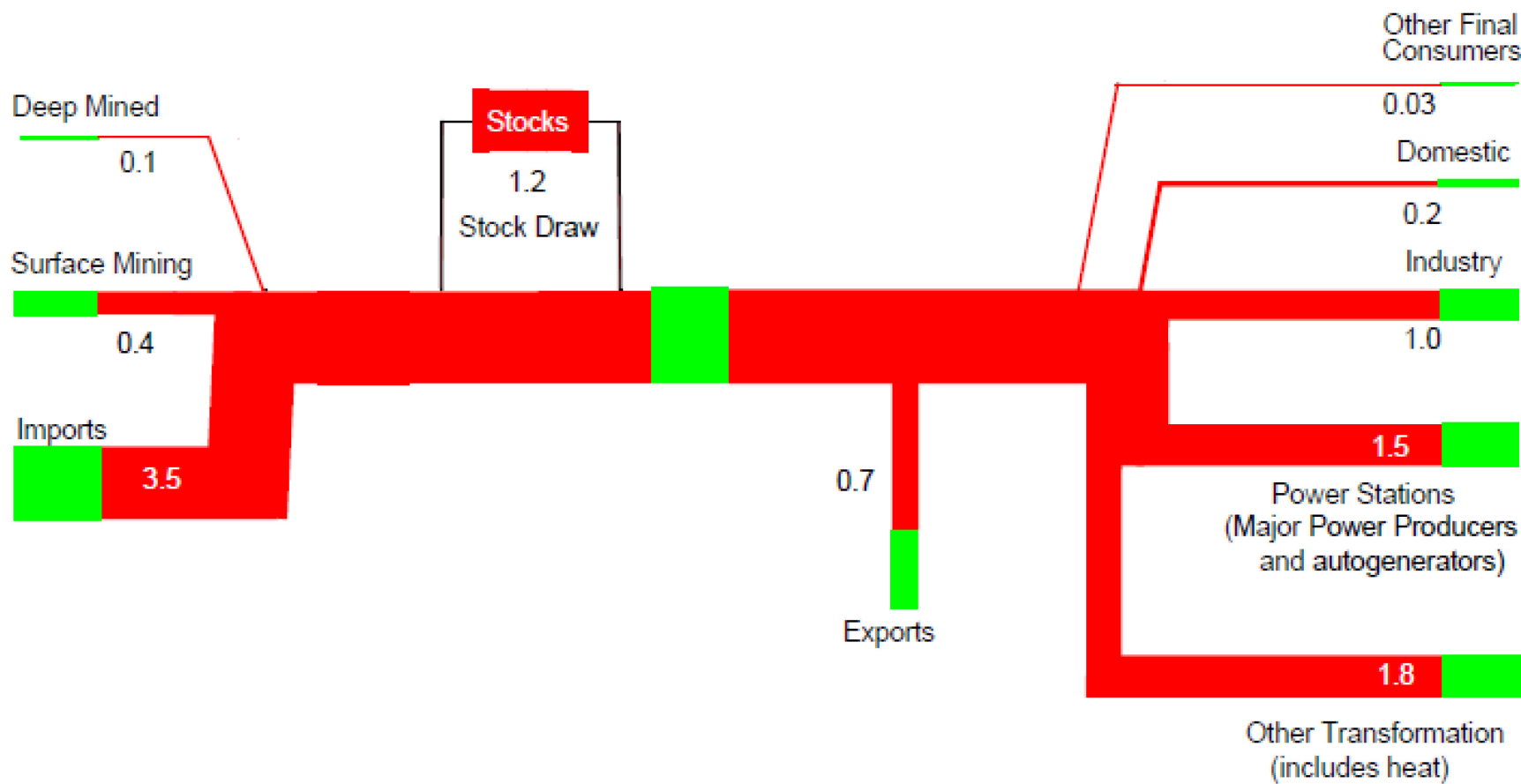
Map 2B Location of UK coal production sites and ports as at end 2023



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Note:
Only ports that imported more than 10,000 tonnes are shown

Coal Flow Chart 2023 (million tonnes)



Note:
This flow chart is based on the data in Tables 2.1 and 2.2.
The numbers on either side of the flow chart will not match due to losses in transformation.

Chapter 3: Oil and Oil Products

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Downstream oil | Alasdair Campbell | 07511 164 502

Key headlines

In 2023, UK production of primary oils fell another 11 per cent to an all-time low of 34 million tonnes, continuing the ongoing pattern of decline from the mature North Sea basin and resulting in new record low exports. Net imports of primary oils increased by 15 per cent to 18 million tonnes.

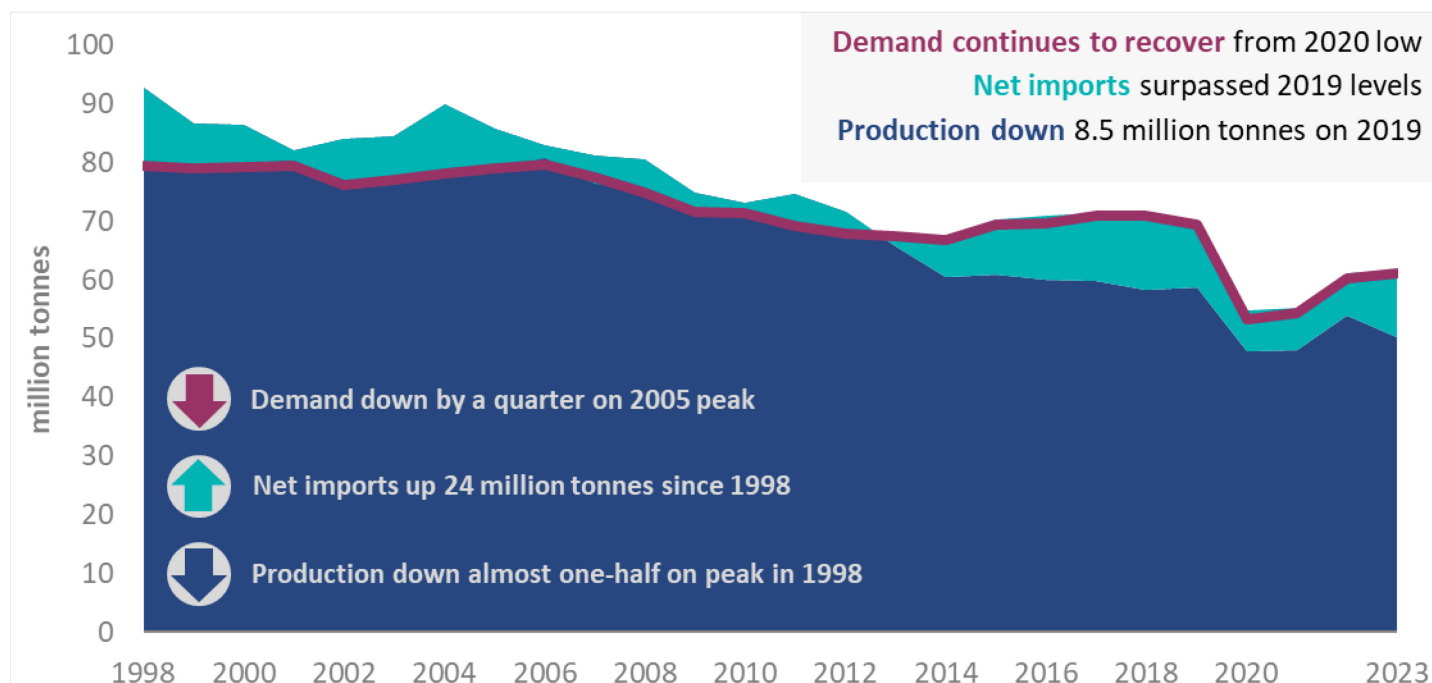
Refinery production decreased by 6.9 per cent on 2022 to 50 million tonnes, around half of the peak production in 1998. The UK was a net importer of products by 11.5 million tonnes in 2023, up by 60 per cent on 2022 and the third highest figure since the UK became a net importer in 2013.

Oil formed 39 per cent of total energy demand in 2023, with overall demand for products up by 1.6 per cent compared to 2022. As air travel continues its recovery following Covid-19, aviation demand saw an annual increase of 16 per cent but at 11 million tonnes remained 8.2 per cent lower than levels in 2019 before the Covid-19 pandemic. Domestic sales increased by 8.4 per cent while industry, commercial, and agriculture demand remained stable.

The UK held 9.6 million tonnes of oil stocks, the equivalent to around 140 days of net imports and exceeding the 90 days required by the International Energy Agency (IEA). **UK oil stocks increased by 10 per cent compared to 2022** as stocks were re-built from a record annual low in 2022 following an IEA-coordinated release of oil stocks in March and April 2022 due to the Russian invasion of Ukraine.

In 2023, total demand for petroleum products increased by 1.6 per cent on 2022 (total demand includes energy industry use and transformation). Much of this growth was from an increased demand in transport, which was up by 1.1 million tonnes (2.7 per cent) in 2023. Demand for jet fuel and petrol increased by 16 per cent and 4.4 per cent, respectively, while diesel demand for road use dropped by 4.2 per cent.

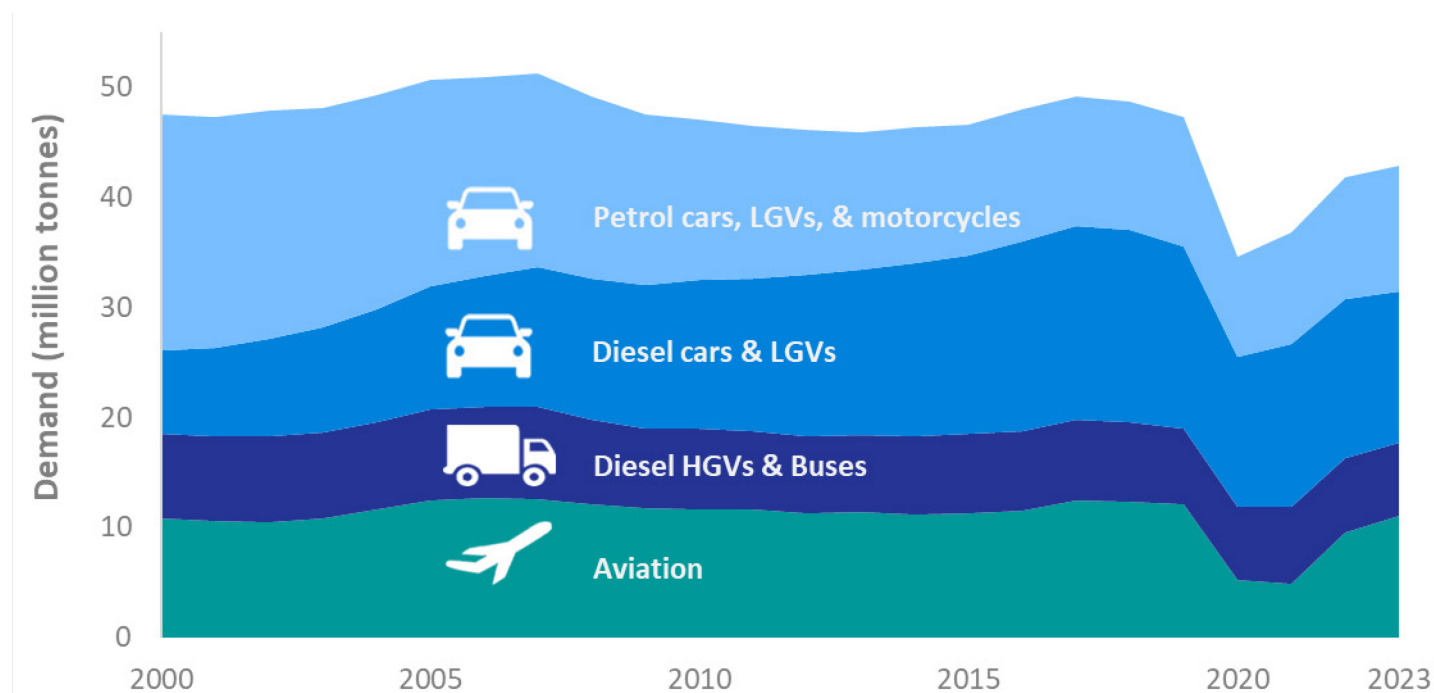
Chart 3.1 Supply and demand for petroleum products, 1998 – 2023 ([DUKES Table 3.2](#))



Refinery production was down 6.9 per cent compared to 2022 at 50 million tonnes, half of the peak production seen in 1998¹. This is below the average of around 60 million tonnes seen between 2014 and 2019 and remained low partially because of significant maintenance at the end of 2023.

The UK remained a net importer of products at 11.5 million tonnes in 2023, an increase of 60 per cent on 2022. This is the first time that net imports have risen above 10 million tonnes since pre-pandemic 2019 and, at the third highest level on record, surpassed the 5-year pre-pandemic average by around 2.1 per cent. The UK became a net importer in 2013 and had peak net imports in 2018 at 13 million tonnes. Overall, in 2023 product imports increased by 7.5 per cent and exports decreased by 10 per cent compared to the previous year.

Chart 3.2 Annual demand for transport fuels since, 2000 - 2023²



Petroleum products are mainly used for transport in the UK, with transport accounting for almost three quarters of product demand in 2023. Within transport, almost three quarters of demand was for road fuels. Demand for all transport fuels dipped during travel restrictions put in place to curb the spread of Covid-19; from 2019 to 2020, transport demand dropped by 13 million tonnes and petrol demand dropped below 10 million tonnes for the first time since 1970. Since 2020, transport fuel has recovered by almost a quarter, but remains 9.4 per cent down on pre-pandemic 2019.

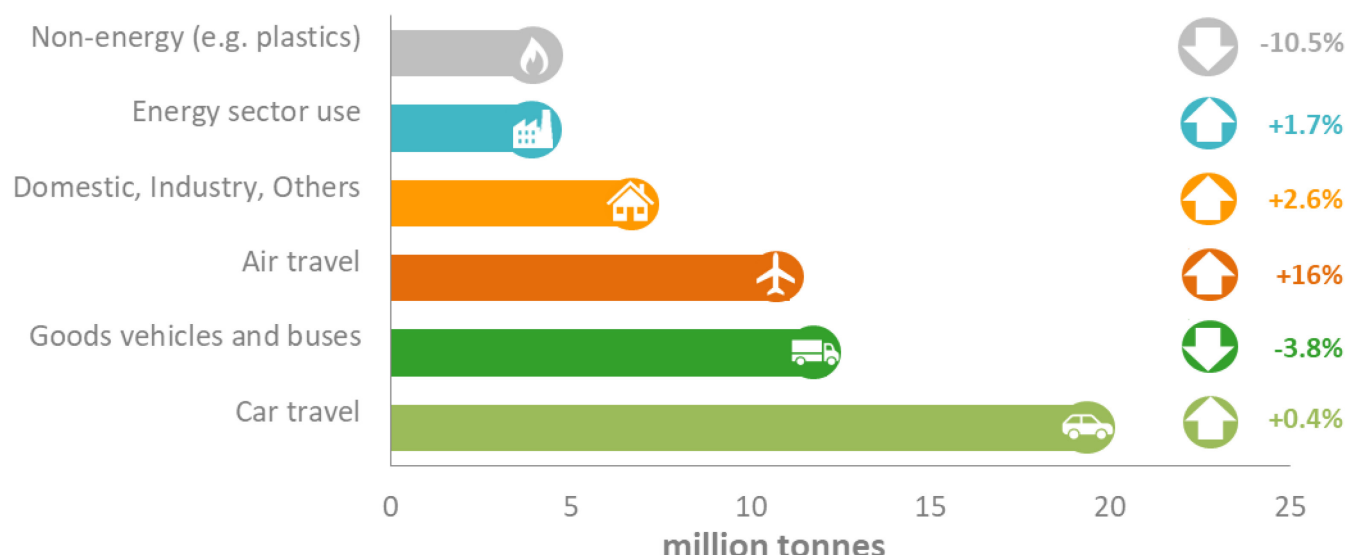
Almost half of transport fuel demand is accounted for by diesel vehicles. Despite this, the trend over the last three decades of increasing diesel demand looks to be reversing. From 2000 to 2017, demand from diesel vehicles increased by 63 per cent. From 2017 to 2023, demand fell by almost a fifth. This is likely due to motorists switching to other transportation types, such as electric vehicles, due to environmental concerns.

Demand for jet fuel increased by 16 per cent in 2023 compared to 2022, reflecting the continuing recovery of air travel after Covid-19. Demand for jet fuel reached 11.1 million tonnes, which was 8.2 per cent below the pre-pandemic levels of 2019 but twice that seen during the pandemic years of 2020 and 2021 when demand was at the lowest since 1984.

¹ See Annex 2 for a map and further detail on UK refinery nameplate capacities in the [methodology note](#)

² See UK [Energy in Brief](#) for detailed breakdown of fuel consumption by vehicle type

Chart 3.3 Oil consumption in the UK, 2023 ([DUKES Table 3.2](#))



Demand for petroleum products in 2023 increased overall by 1.6 per cent with increases in most sectors.

Most notably sales of heating oil to households (domestic demand) were up by 8.4 per cent despite temperatures being comparable to the year before. Domestic demand for heating oil, which is typically purchased in bulk for extended use, has fluctuated in recent years primarily due to price changes rather than temperature variations. In 2020, low prices prompted many households to refill their tanks, resulting in a 4.6 per cent decrease in deliveries the following year. Demand dropped further in 2022, by one-fifth, as prices surged post-Ukraine invasion and the UK experienced record temperatures. However, with a one-fifth price reduction in 2023, demand rebounded by 8.4 per cent.

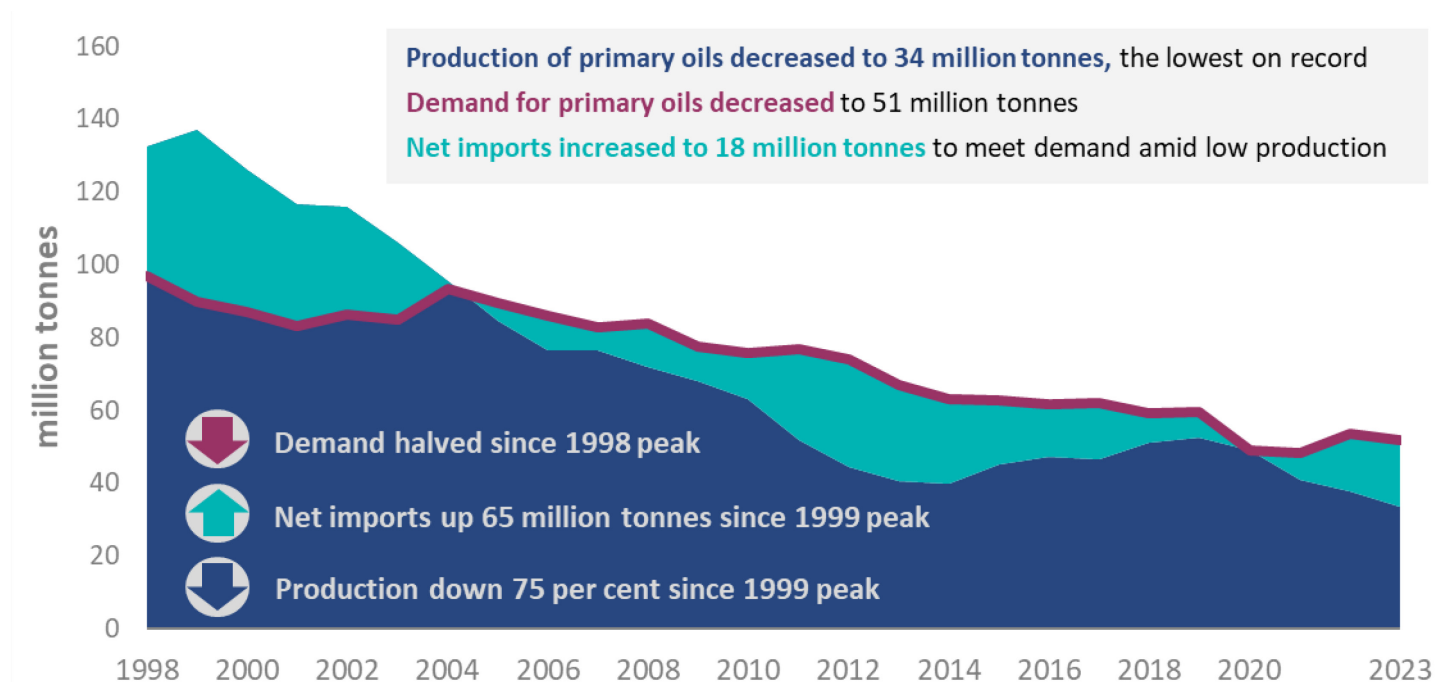
Industry demand remained relatively stable, up just 0.6 per cent, with commercial and agricultural demand also stable compared to 2022. Non-energy use was down by 11 per cent. Petrochemical sector demand for naphtha remains low, since the closure of the plant at Teesside that has now attracted investment for it to run on hydrogen³.

Offshore production in 2023 reached a new record low of 34 million tonnes, down 11 per cent on 2022. The overall trend in production is one of continued decline over time from this mature basin, with 2023 production at just a quarter of the peak in 1999.

Demand for primary oils fell by 7.0 per cent compared to 2022 due to continued low refinery production and extensive refinery maintenance. Exports of primary oils fell by 11 per cent to a new record low of 27.7 million tonnes, a third of the peak exports of 93 million tonnes in 2000. Imports of primary oils fell by 2.1 per cent in 2023 but the UK remained a net importer of primary oils at 18 million tonnes, the highest level since 2014.

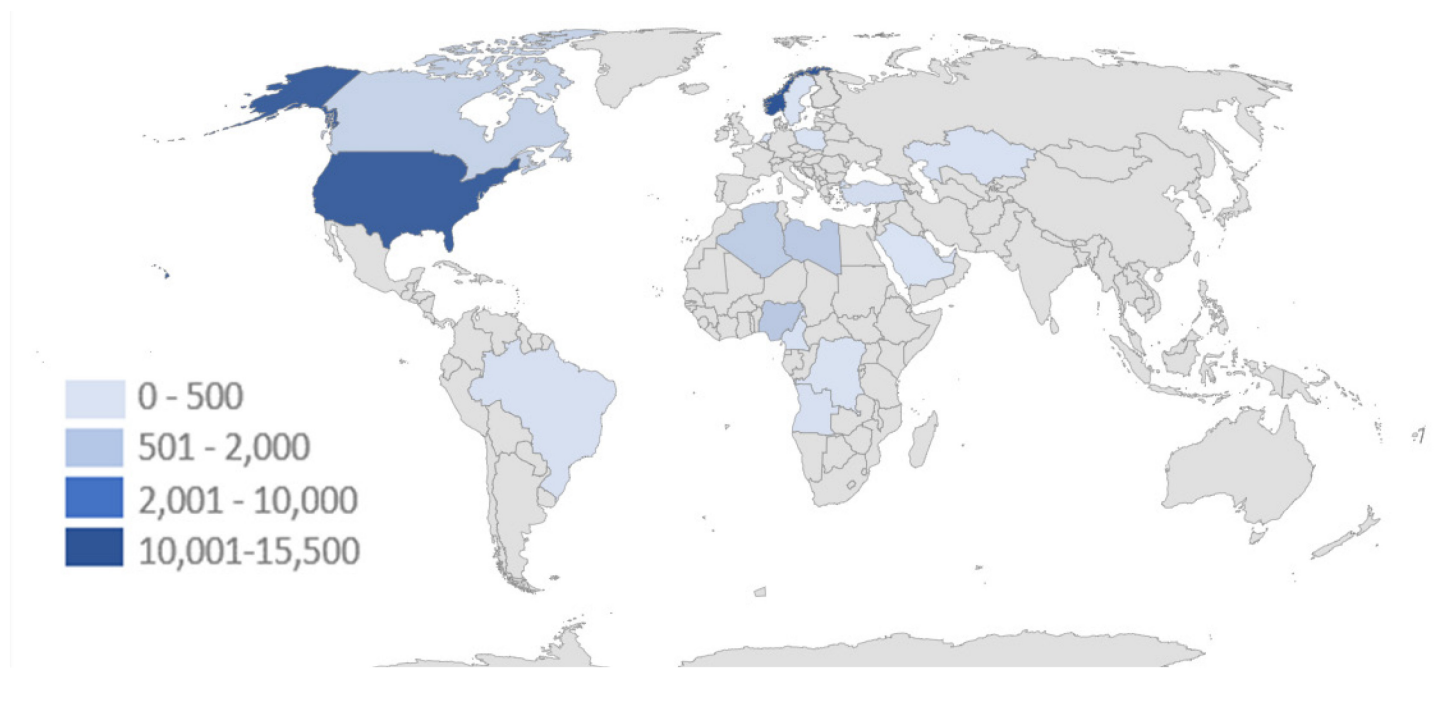
³ Sabic, Annual Report 2021: <https://www.sabic.com/en/reports/annual-2021/strategic-report/future-plans-and-investment>

Chart 3.4 Supply and demand for primary oils, 1998 – 2023 ([DUKES Table 3.1](#))



In 2023, refineries took receipt of 3.6 million tonnes of crude produced from the UK Continental Shelf, nearly halving compared to 2022 and meeting just 7.0 per cent of refinery demand in 2023 compared to 14 per cent in 2022⁴. Historically UK refineries took receipt of more North Sea crude as a share of their total supply. However, the sulphur content of crude from the North Sea means in recent years it has been less cost effective to process in the UK partly because of changes to rules on maritime shipping fuel since 2020⁵. Global markets have also played a role with North Sea crude attracting a good price in markets in the Middle East meaning it is exported there, making US crude an attractive prospect for UK refiners and meaning the US is the second largest exporter of crude to the UK.

Map 3A Sources of UK crude oil imports 2023 (thousand tonnes, [DUKES Table 3.7](#))



⁴ See [Energy Trends Table 3.10](#)

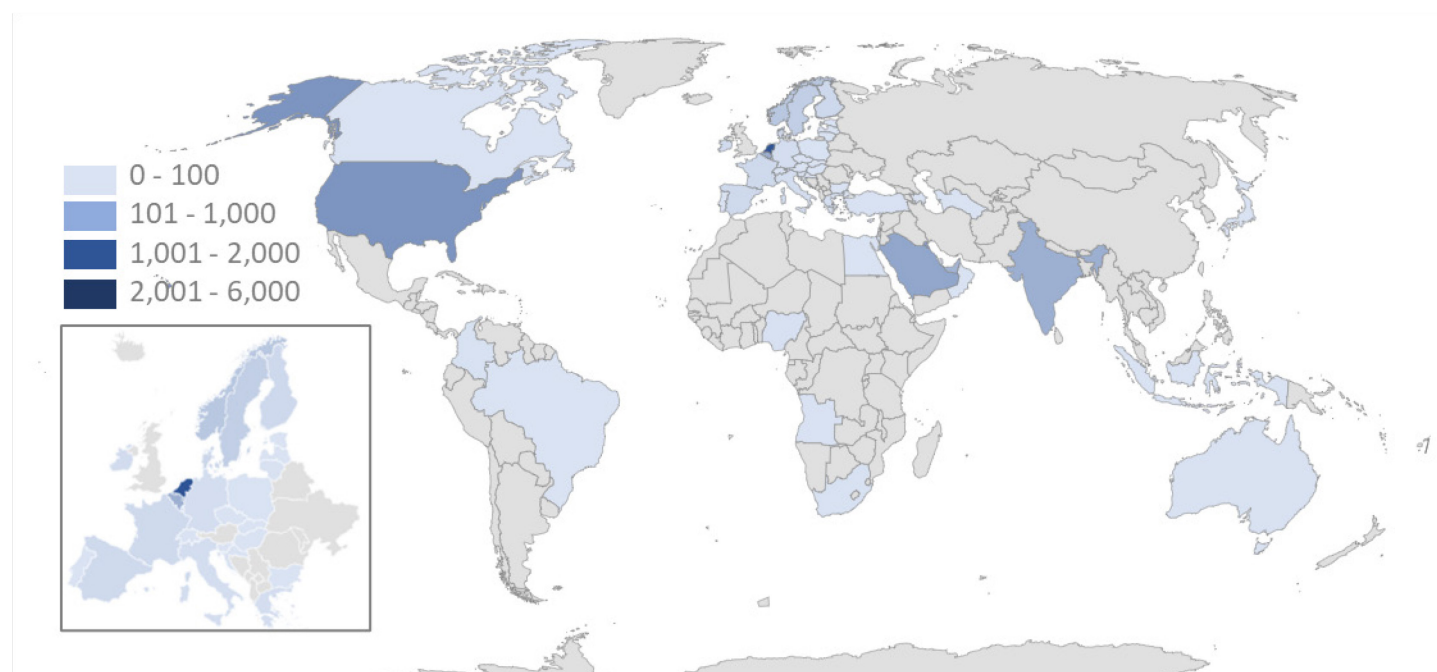
⁵ [International Maritime Organization 2020, cutting sulphur oxide emissions](#)

In 2023, Norway took back its position from the US as the number one exporter of crude oil to the UK by more than a million tonnes. Imports from Norway were up 6.3 per cent on 2022 and accounted for over a third of all crude oil imports in 2023, largely due to the shared infrastructure in the North Sea. However, Norway's share of crude imports has decreased in recent years from the high of 62 per cent in 2016.

The United States was the second largest import source of crude, down 11 per cent compared with 2022 but still accounting for a third of total crude imports.

After the ban against Russian oil introduced on 5th December 2022, importers sought different crude sources from a wider selection of countries. The UK did not import any oil from Russia in 2023. As a result, total imports from current OPEC countries increased by 30 per cent on last year and accounted for 20 per cent of the UK's crude imports in 2023. The UK exports a substantial amount of crude oil, however this decreased by 11 per cent in 2023 to a record low compared with 2022, in line with reduced production (Table 3.8).

Map 3B Sources of UK petroleum product imports 2023 (thousand tonnes, [DUKES Table 3.7](#))

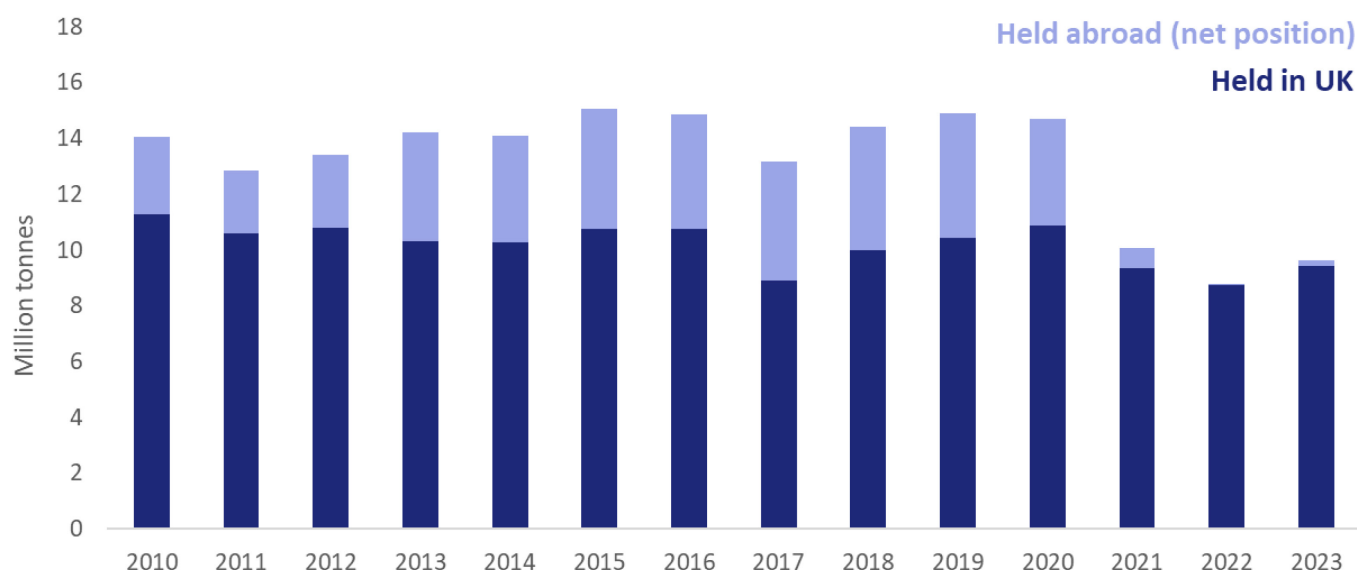


The Netherlands is a major oil trading hub and as such is the principal source of product imports for the UK. Map 3B shows UK imports of petroleum products by source in 2022. Whilst the Netherlands remained the largest import source of products at 22 per cent, the United States was the second largest import source, representing 12 per cent of product imports, replacing Belgium which was second largest in 2022. Imports of products from Australia, Brazil, China, Denmark, Greece and Qatar have all more than doubled as importers find new sources of petroleum products after the ban on Russian oil.

Imports of petroleum products increased 7.5 per cent in 2023 compared to 2022, reflecting the increase in demand and decrease in production. Diesel held the largest share of product imports, making up 42 per cent of the total. Historically Russia was the main major import source for diesel but since the sanctions suppliers have found alternative sources. In 2023 the Netherlands, the United States, and Belgium, made up 60 per cent of diesel imports collectively.

Imports of jet fuel, which are a one-third share of product imports, increased by 27 per cent in 2023. Imports were used to meet a 16 per cent increase in demand as international travel continued to recover after the travel restrictions in place to curb the spread of Covid-19. The main imports source for jet fuel were Kuwait, India and the United Arab Emirates.

Chart 3.5 UK oil stocks, 2010 – 2023 ([DUKES Table 3.5](#))



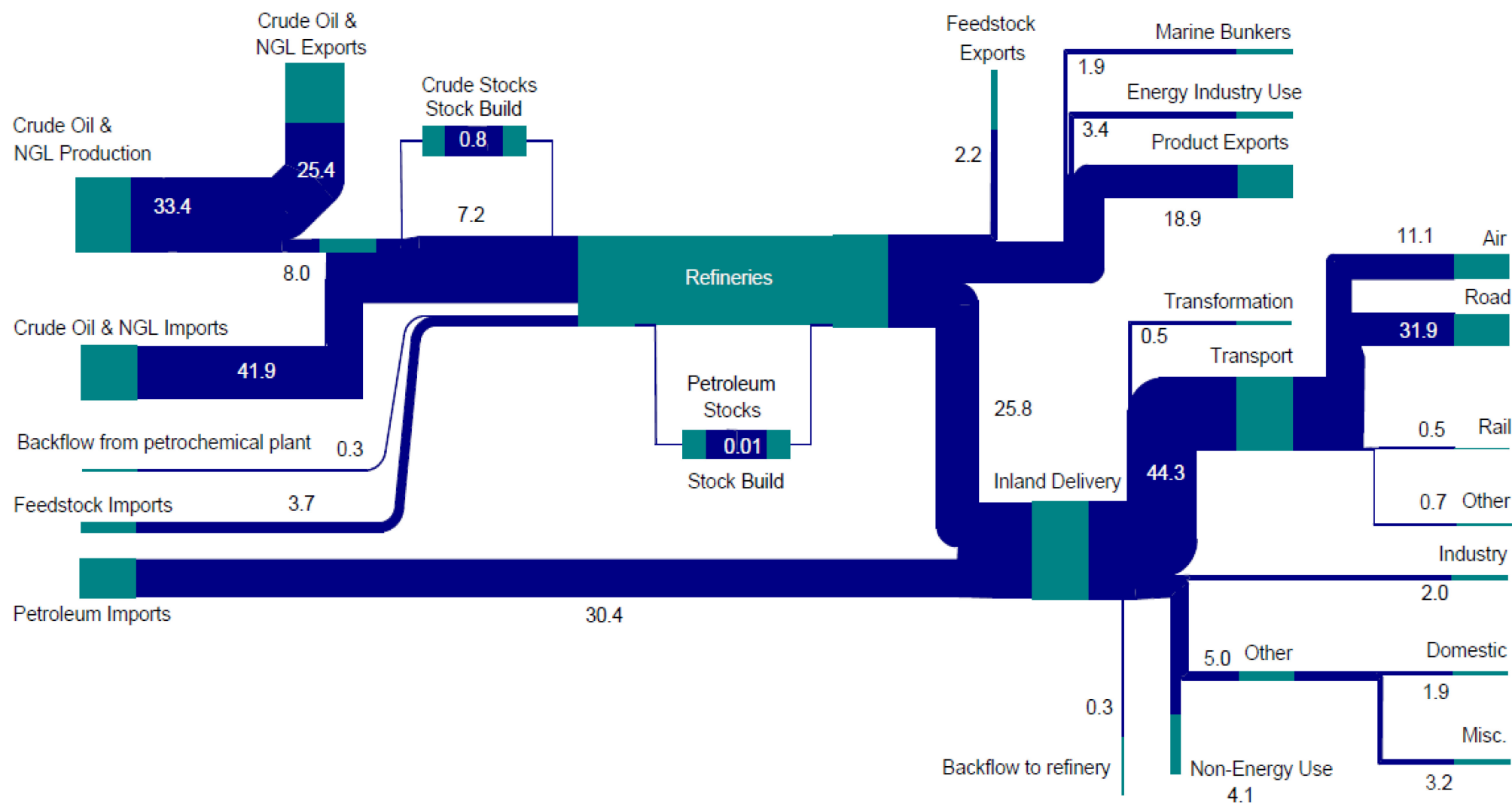
The UK government is required to hold stocks of oil which can be released in the event of severe disruption to global supply. The UK receives this obligation as a member of the International Energy Agency (IEA) and meets the obligation by directing industry to hold minimum levels of stocks. In March and April 2022, the UK participated in an IEA co-ordinated release of oil stocks in response to Russia's invasion of Ukraine. This led UK obligations to be lowered by 6.6 million barrels. Prior to this, the UK has released stocks following agreement between IEA Members only three times: in the lead up to the Gulf War in 1991; following the impact of Hurricanes Rita and Katrina in the US in 2005; and during civil disruption in Libya in 2011.

At the end of 2023, the UK held 9.6 million tonnes of stocks ([DUKES Table 3.5](#)) the equivalent of around 140 days of net imports, which is substantially higher than the required 90 days of net imports set by the IEA. This represented a 10 per cent rebound from the record annual low of 2022 when the UK released oil stock as part of the IEA's collective actions. Companies may choose to hold stocks within the UK or abroad via legal agreements with other countries.

The record annual low in 2022 followed a previous fall in stock levels between 2020 and 2021. This reflected the UK's move from being obligated to hold stocks as a member of both the IEA and European Union (EU), to holding stocks as a member of the IEA only. The IEA stocking obligation is historically lower than that of the EU, as it is based on imports rather than consumption. As such companies have since been directed to hold less stock. For further details and more recent data, please see [Energy Trends Table 3.11](#).

The flow chart below shows the movement of primary oils (on the left) into refineries which are then transformed and consumed by various sectors of the UK economy (on the right), in addition to trade. The widths of the bands are proportional to the size of the flow they represent.

Petroleum flow chart 2023 (million tonnes)



Note:

This flow chart is based on the data in Tables 3.1 and 3.2.
The numbers on either side of the flow chart will not match due to losses in transformation.
Biofuels are not included.

Chapter 4: Natural Gas

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Key headlines

UK gas demand continued to fall in 2023, down 10 per cent on 2022, consumption was at the lowest level since 1992. This fall was due to a substantial decline in gas demand for electricity generation and continued lower demand from consumers.

Gas demand for electricity generation was down 20 per cent in 2023 compared to 2022 reaching the lowest level in a decade due to lower electricity demand and increased electricity imports.

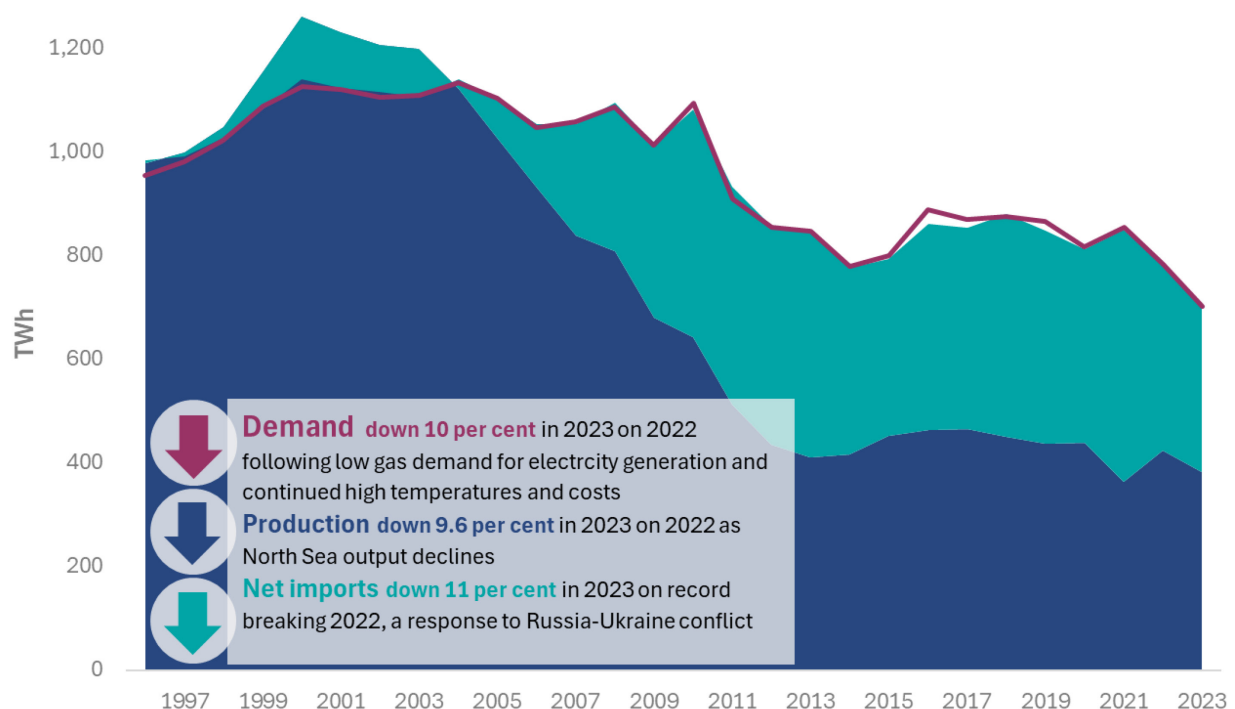
Demand from domestic consumers continued to fall, down by 8.5 per cent in 2023 compared to 2022. This followed a 19 per cent drop in 2022 compared to 2021 the result of record high temperatures and high energy and other costs which continued in 2023. Domestic demand reached lows last seen in the 70s when coal was the predominant household fuel. Demand by other sectors stayed flat on 2022 lows when industry and businesses adapted to higher gas prices.

Imports and exports were down compared to record highs in 2022 when trade patterns changed as a result of the Russia-Ukraine conflict. Unlike 2022 when 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 were facilitated by low UK demand.

The US remained the second largest import source behind Norway, after overtaking Qatar in 2022. Liquefied Natural Gas (LNG) imports fell but remained substantial, the US increasing in the share of total LNG imports as its liquification capacity grows.

Gas production fell 9.6 per cent in 2023 compared to 2022, just 4.5 per cent higher than the record low in 2021 when substantial infrastructure was shut down for maintenance.

Chart 4.1 Supply and demand for natural gas, 1996-2023 ([DUKES Table 4.1](#))



Demand for natural gas continued to fall in 2023 making up 36 per cent of total energy demand. This was only slightly lower than 2022 as total energy demand reached a record low in 2023 (see Chapter 1 for more information). Demand for natural gas is met through production and imports.

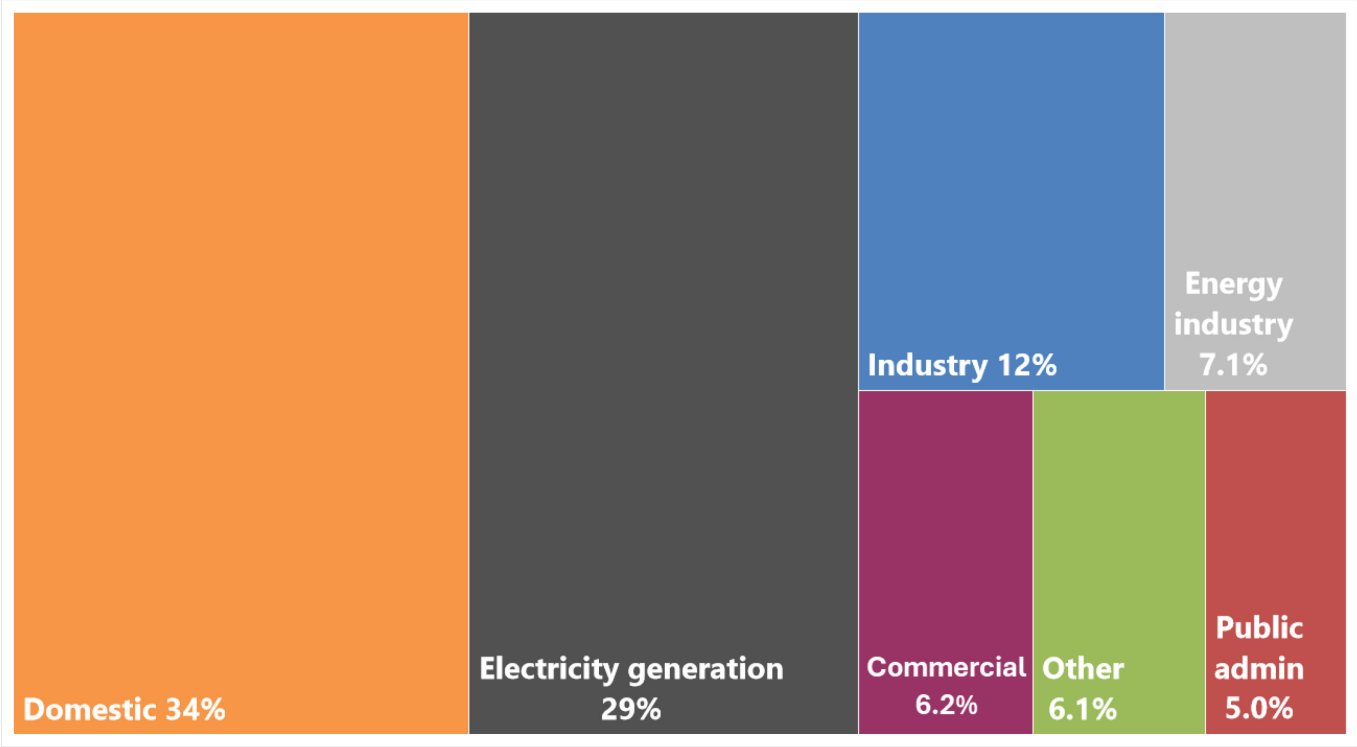
UK production of natural gas fell in 2023, down 10 per cent compared to 2022 as North Sea output declines. Production remained just above the 2021 record low caused by extensive maintenance. Indigenous production has been equivalent to around half of demand for over a decade, reaching 55 per cent in 2023 due to notably low demand. Natural gas made up 33 per cent of total energy production in 2023, stable on 2022 as total energy production fell to a record low (see Chapter 1 for more information).

For more information on oil and gas reserves see [Reserves and Resources report as at end 2022](#).

Whilst substantially smaller in scale than natural gas production, biomethane injections into the grid increased by 11 per cent in 2023 compared to 2022 as new production facilities came online (see Chapter 6 for more information).

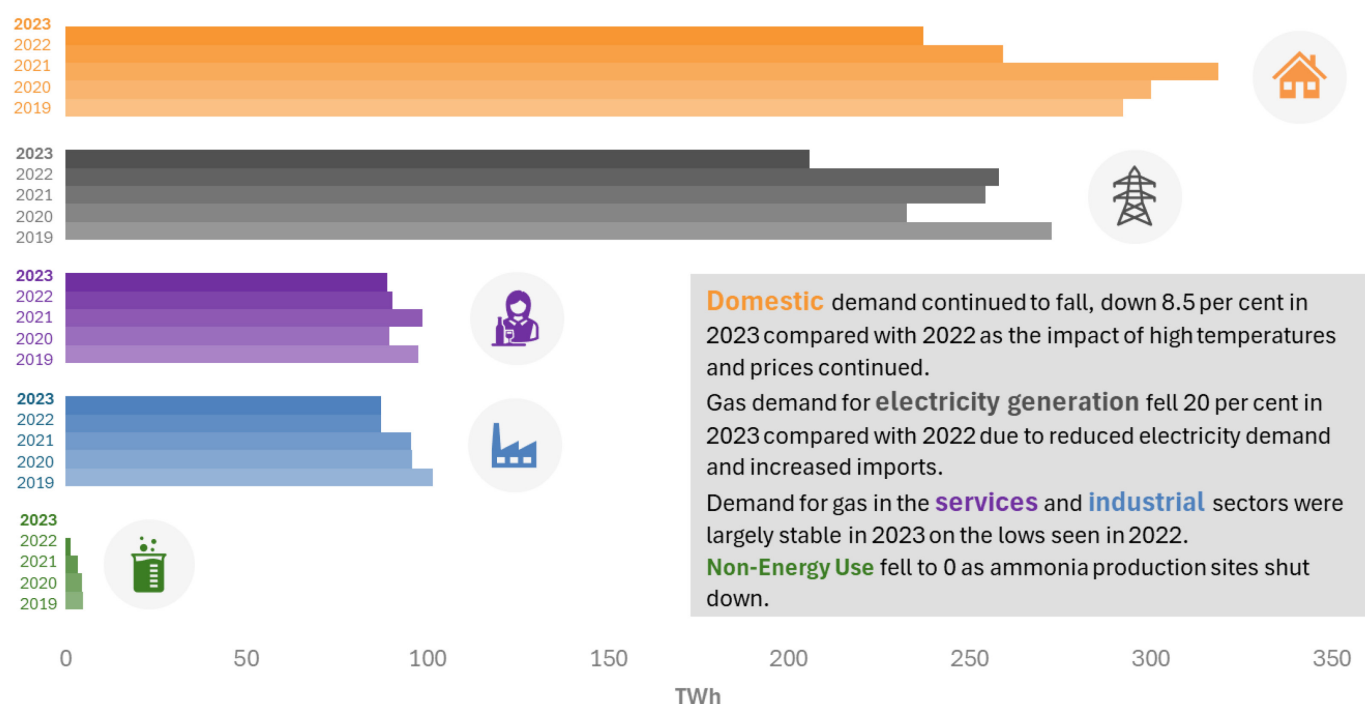
In 2023, net imports fell by 11 per cent with substantial drops in both imports and exports compared to record highs in 2022. The UK has been a net importer (imports greater than exports) of natural gas since 2004.

Chart 4.2 Sectoral consumption of natural gas, 2023 ([DUKES Table 4.1](#))



Demand for natural gas fell by 10 per cent in 2023 compared to 2022. This was largely driven by a substantial fall in gas demand for electricity generation. Gas is used across many sectors in the UK. In general gas used for electricity generation, domestic consumption, and by other sectors (including industry) each make up around a third of demand. Domestic consumption fell by 8.5 per cent in 2023 compared to 2022 whilst demand in other sectors was generally flat on 2022 lows. Demand by final consumers was down nearly 20 per cent in 2023 on longer term trends (2011-2021).

Chart 4.3 Sectoral consumption of natural gas, 2019- 2023 ([DUKES Table 4.1.1](#))



Gas demand for electricity generation fell by 20 per cent in 2023 compared to 2022. This large drop was the result of reduced demand for electricity and record high levels of electricity imports (see Chapter 5 for more information).

Domestic demand decreased by 8.5 per cent in 2023 compared to 2022, to levels not seen since the early 1970's. 2022 saw record high temperatures and record high gas prices resulting in domestic consumers changing their behaviour, and a 19 per cent reduction in domestic consumption compared to 2021. In 2023, temperatures were similar to the highs seen in 2022, this further reduction more likely attributable to high energy and other household costs. Domestic use of gas includes space and water heating, as well as gas powered appliances such as ovens and hobs.

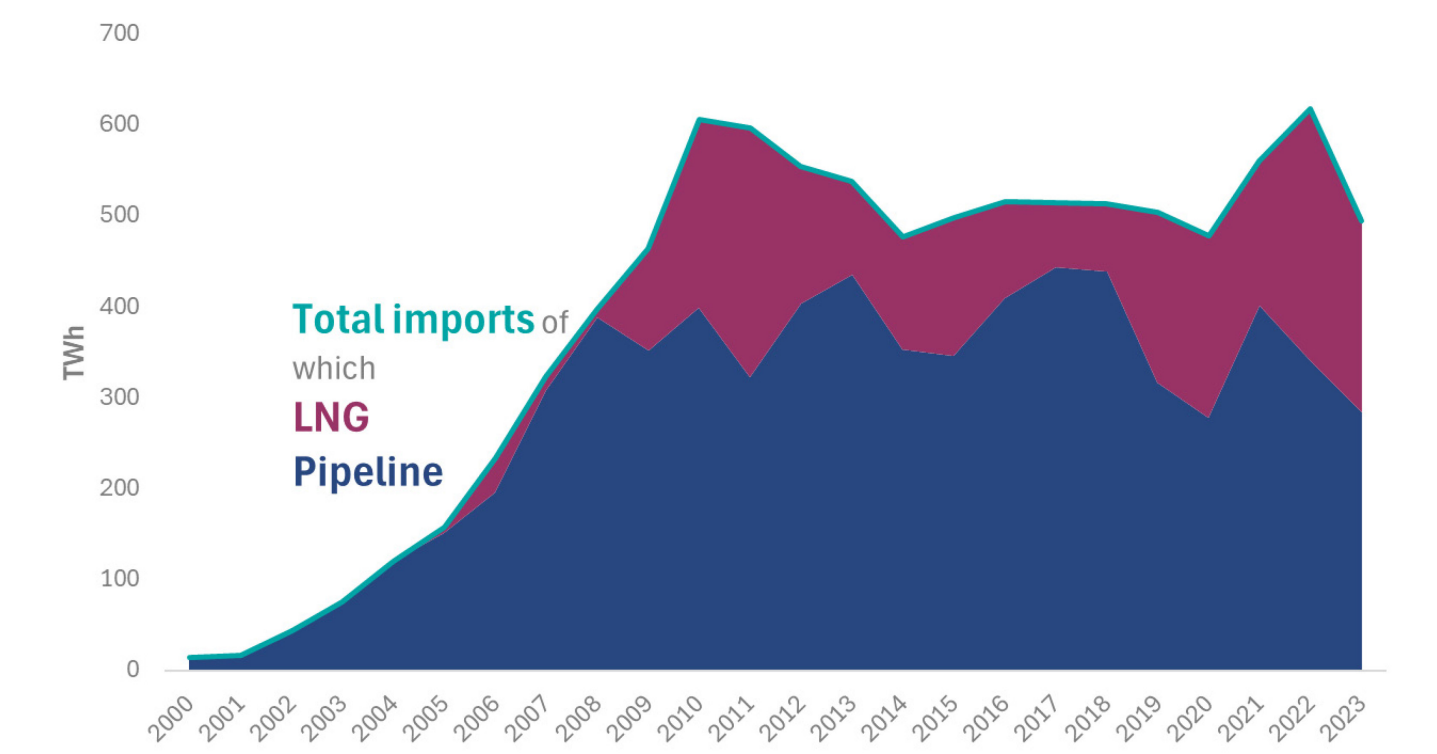
Industrial demand was stable in 2023 on 2022s record low¹. Industrial demand has declined following the Covid-19 pandemic and high gas prices from the end of 2021. This reduction in industrial demand has been seen throughout industrial subsectors, albeit to different extents.

Services which includes commercial and public administration sectors was also largely stable in 2023 on 2022. Demand for gas by services sectors also responded to high prices reaching lows similar to those seen during the pandemic when many businesses were closed. Commercial and public administration sectors consumption of gas fell 0.9 and 1.6 per cent respectively in 2023 compared to 2022.

Gas demand for non-energy use (ammonia production) fell to 0 in 2023 as remaining ammonia production sites were permanently closed¹.

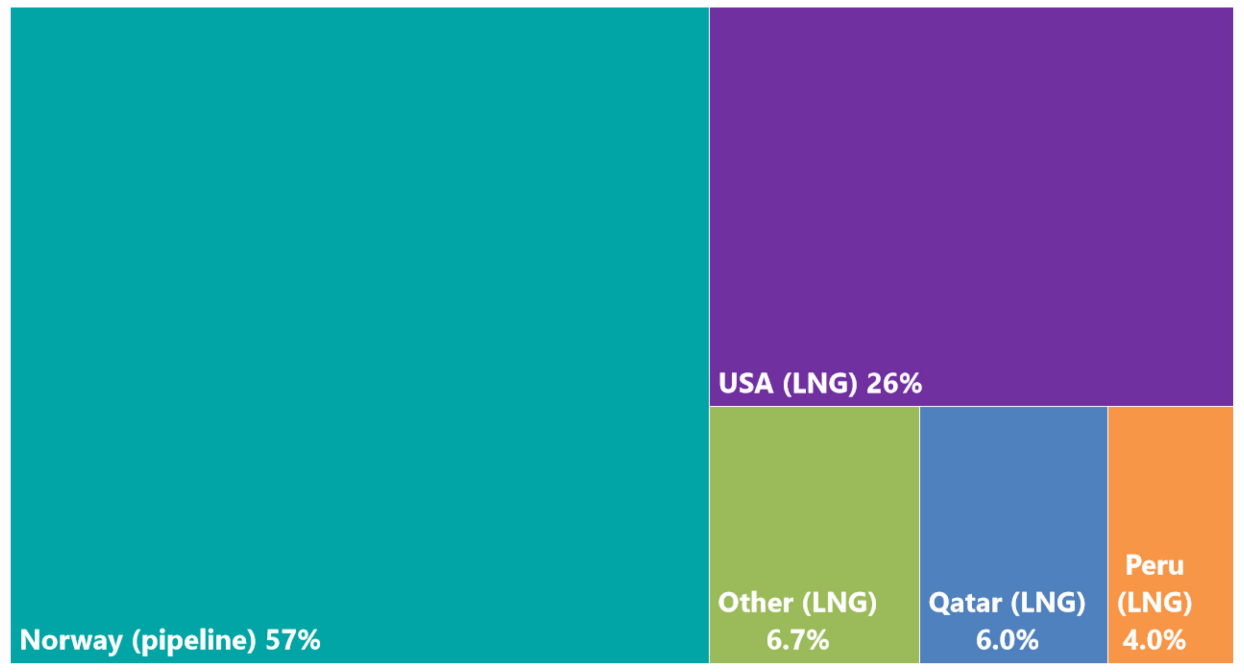
¹ Industrial and non-energy demand has been revised, see [Methodology changes to Oil, Gas and Electricity balances](#) for more information

Chart 4.4 Imports of natural gas, 2000-2023 (DUKES Table 4.5)



Natural gas imports fell by 20 per cent in 2023 compared to record highs in 2022. Trade in 2022 reached record highs when the UK supported European efforts to move away from Russian gas. Pipeline and liquefied natural gas (LNG) imports fell by 17 and 24 per cent respectively. LNG imports peaked in 2022 when substantial regasification infrastructure meant the UK acted as a land bridge increasing exports to the continent.

Chart 4.5 Imports of natural gas by country of origin, 2023 (DUKES Table 4.5)



Norway² remained the UK's largest import source in 2023 accounting for 57 per cent of total imports, equivalent to 40 per cent of demand. The UK imports substantial amounts of gas from Norway due to proximity and shared infrastructure in the North Sea. Despite this, Norwegian imports fell 16 per cent in 2023 compared to 2022 in line with reduced demand. The UK also imports gas by pipeline from Belgium and the Netherlands, however these interconnectors³ continued to be used largely for exports throughout 2023 with imports from both falling to record lows.

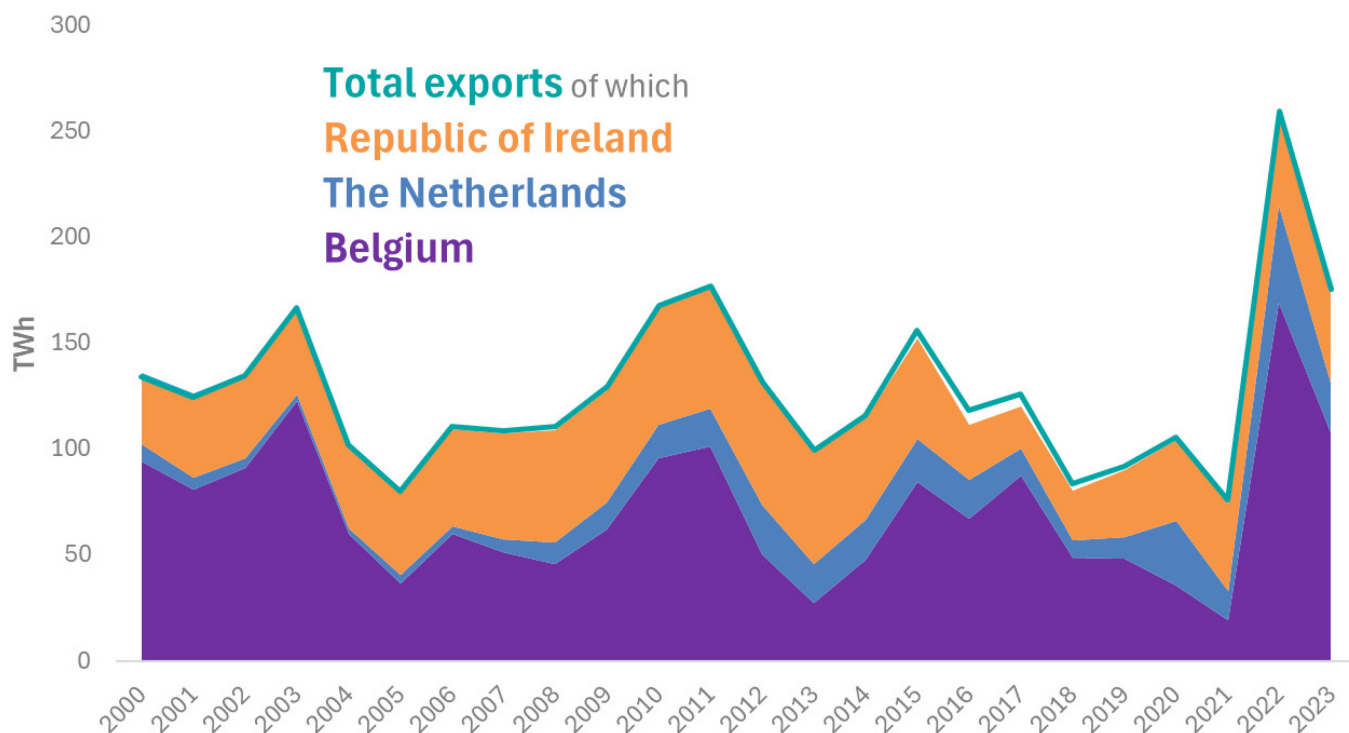
The US remained the second largest import source and largest source of LNG for the second year in a row. US imports of LNG made up 61 per cent of total LNG imports (up from 50 per cent in the previous year), 26 per cent of total imports and were equivalent to 18 per cent of demand. Historically, a large proportion of LNG has come from Qatar, peaking at 98 per cent of total LNG imports in 2011. Qatar remained the second largest LNG import source, but imports continued to fall with Qatari LNG accounting for just 14 per cent of total LNG imports in 2023. These changes reflect increased liquification capacity in the US and Qatar primarily focusing on long-term supply to the Asian market.

The UK imported LNG from ten countries in 2023, down from a record high of thirteen in 2022. Peruvian imports remained high but fell compared to 2022 with increased imports from other sources including Angola, Trinidad and Tobago and Egypt. Imports of LNG from Chile, Oman and Russia (following sanctions) dropped to zero in 2023. Prior to the Russia-Ukraine conflict the UK imported LNG from Russia with the last cargo received in March 2022.

² Norwegian pipeline imports only

³ Interconnectors are pipelines which can be used to import or export gas

Chart 4.6 Exports of natural gas, 2019-2023 ([DUKES Table 4.5](#))

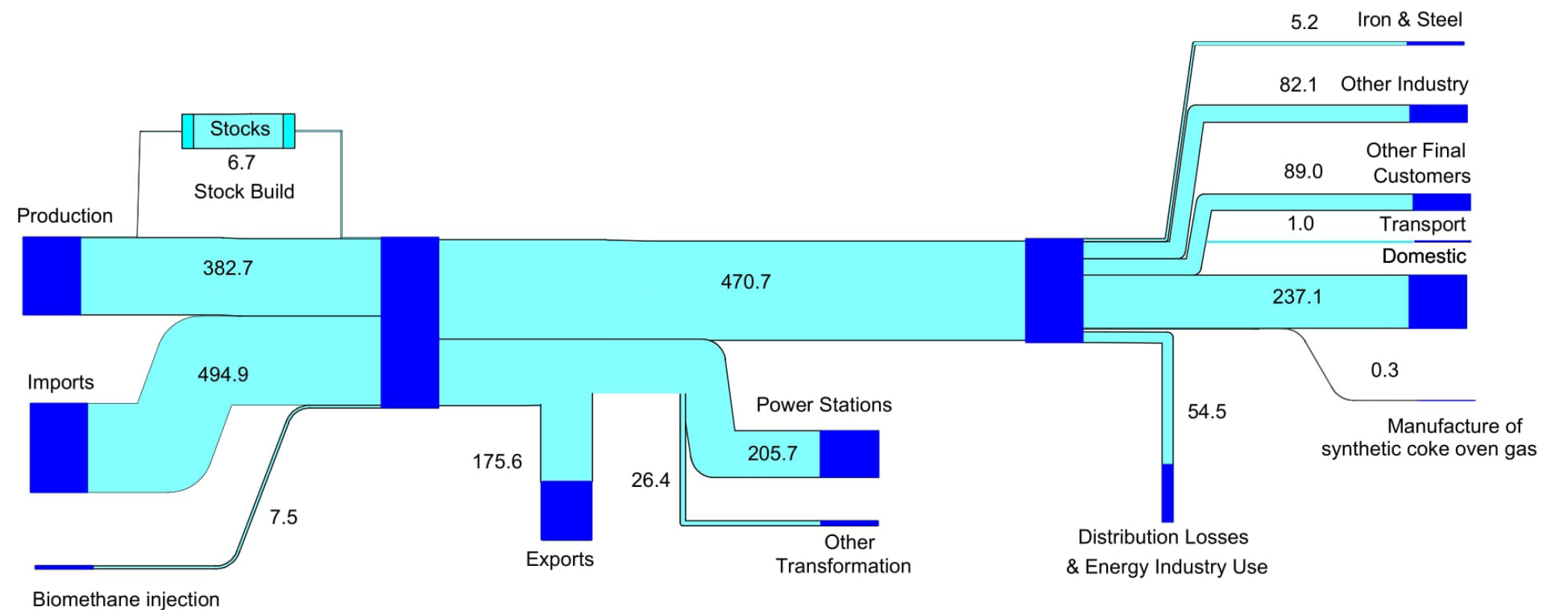


Note the gap between exports to the Republic of Ireland, Netherlands and Belgium and total exports is due to exports to the Isle of Man and LNG reloads.

Natural gas exports decreased 32 per cent in 2023 compared to record highs in 2022. Trade in 2022 reached record highs when the UK utilised substantial LNG regasification capacity and shared infrastructure with mainland Europe to support efforts to move away from Russian gas. Despite this drop, exports remained large and substantially higher than the post 2010 average. In 2023, exports were facilitated by declining UK demand rather than high imports as in 2022. Exports to mainland Europe (Belgium and the Netherlands) fell 36 and 49 per cent respectively. The UK also exports gas to the Republic of Ireland and Isle of Man.

Natural Gas Flow Chart 2023 (TWh)

The flow chart shows the flows of natural gas from production and imports through to consumption. It illustrates the flow of gas from the point at which it becomes available from indigenous production or imports (on the left) to the final use of gas (on the right), as well as that transformed into other forms of energy or exported. The widths of the bands are proportional to the size of the flow they represent.



This flow chart is based on data that appear in Table 4.1, excluding colliery methane.

Chapter 5: Electricity

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Key headlines

Electricity demand decreased in 2023 to 316.8 TWh, down by 1.1 per cent from 2022, to levels last seen in the 1980s. This was likely driven by a continuation of 2022's high prices and similarly high annual average temperatures which reduced demand for heating.

High energy and other prices and high average temperatures led to the lowest domestic consumption since 1990, with industrial and commercial consumption also down. Domestic consumption fell 3.0 per cent to 92.6 TWh while industrial consumption was down 0.9 per cent and commercial consumption was down 2.9 per cent.

Electricity generation fell by a tenth in 2023 as record electricity imports, lower UK demand and lower exports compared to 2022 reduced the UK generation needed to meet demand. Electricity generation fell to 292.7 TWh, 9.9 per cent lower than 2022. The UK returned to being a net electricity importer as total imports rose to a record 33.3 TWh and total exports fell back to 9.5 TWh, giving net imports of 23.8 TWh.

Renewable generation in 2023 was similar to 2022, narrowly reaching a record 135.8 TWh, 0.3 per cent higher than 2022. Wind generation rose 2.2 per cent to a record 82.3 TWh and solar generation rose 4.1 per cent to a record 13.9 TWh. This was driven by increases in wind and solar generation capacity which offset slightly less favourable weather conditions. Bioenergy generation decreased 4.9 per cent to 34.1 TWh, as outages continued at key bioenergy sites.

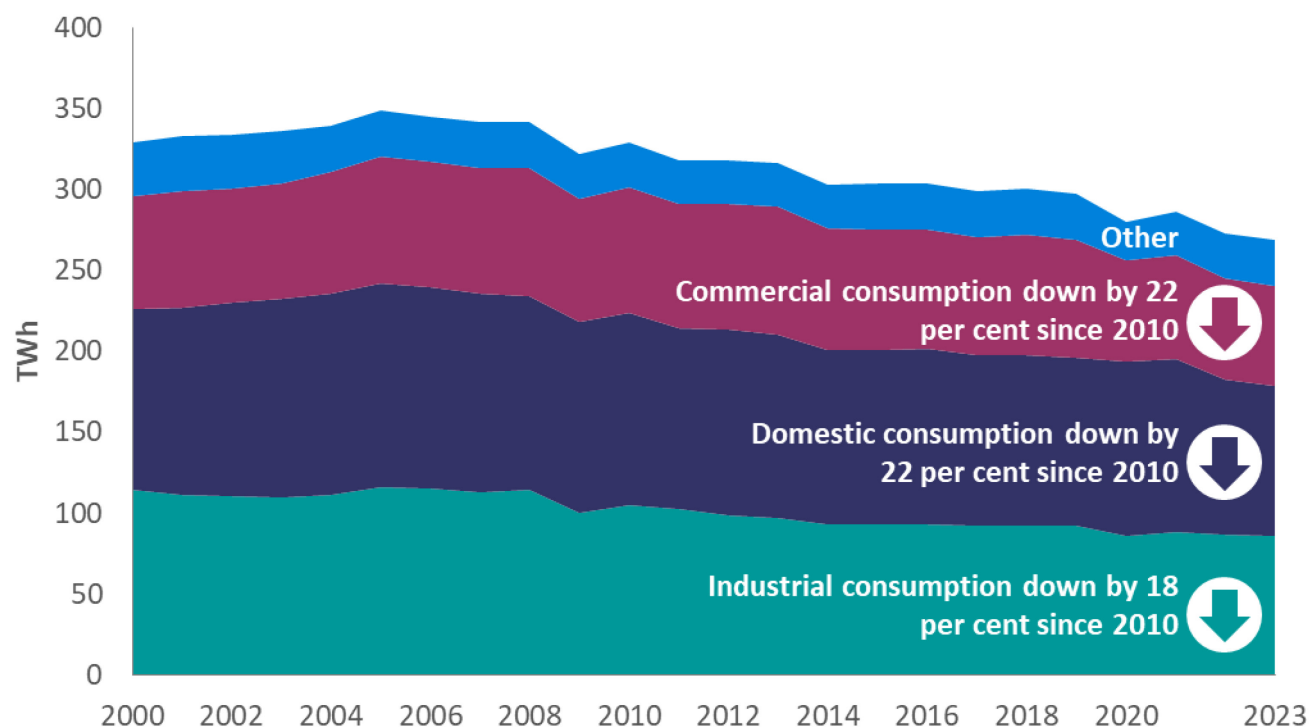
Fossil fuel generation decreased by a fifth in 2023 to 107.3 TWh. Gas remained the largest single fuel, providing 101.7 TWh of generation. Coal generation continued to fall, down to a record low.

The share of generation coming from low carbon sources rose to a record 60.3 per cent in 2023, as stable renewable generation combined with lower overall generation. The lower total generation also helped the renewable generation share to a record 46.4 per cent, exceeding the share from fossil fuels (36.7 per cent) for the third time in four years.

Total de-rated generation capacity decreased to 74.8 GW in 2023, 2.6 per cent lower than in 2022. Capacity for renewable technologies increased by 4.0 per cent to 25.6 GW, fossil fuel capacity decreased 6.8 per cent to 40.5 GW with the closures of three of the UK's four remaining coal-fired power stations, Drax, West Burton and Kilroot.

Electricity demand reached a record low in 2023 of 316.8 TWh, down by 1.1 per cent from 2022 as high energy prices and other costs, as well as warmer than usual temperatures, continued into 2023. Electricity demand has declined year-on-year since 2015, apart from a slight increase between 2020 and 2021 as demand recovered from the effects of the Covid-19 pandemic. In line with the decrease in demand, final consumption fell by 1.2 per cent compared to 2022. ‘Final consumption’ refers to electricity consumption by end users, excluding electricity consumed in the process of generation and transmission or distribution losses.

Chart 5.1 Electricity consumption by sector, 2000 to 2023 ([DUKES Table 5.1](#))

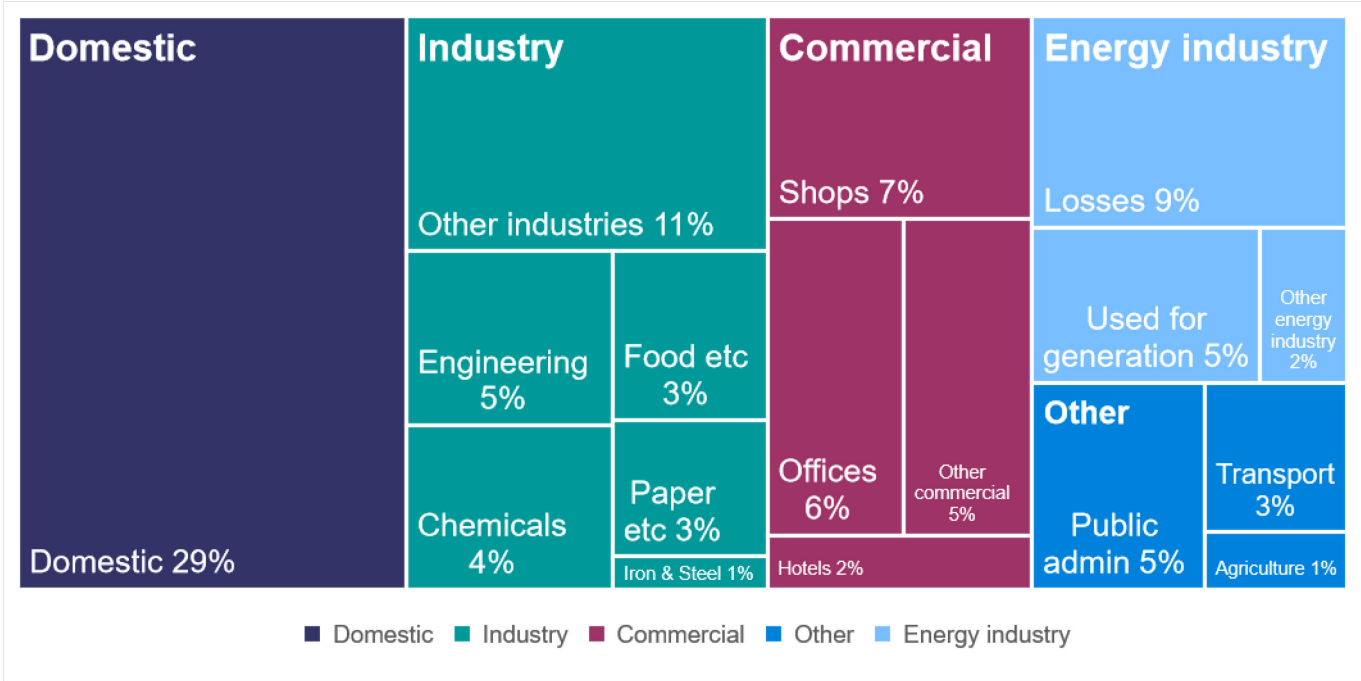


Continued high prices and higher average temperatures led to the lowest domestic consumption since 1990, with industrial consumption also decreasing. In 2023, domestic consumption fell 3.0 per cent compared to 2022 to 92.6 TWh while industrial consumption was down 0.9 per cent. The low domestic consumption followed continued higher energy and other prices alongside near record high temperatures.

Commercial consumption fell by 2.9 per cent in 2023, with the moderate increase in commercial activity outweighed by continued high prices. Higher average temperatures continued from 2022, which reduced the demand for electricity for heating.

Total electricity demand is larger than electricity consumption. This is because total demand also accounts for electricity consumed in the process of generation or to produce fuel for generation, as well as for electricity lost in transmission or distribution from where it is generated to where it is consumed. The full breakdown of electricity demand is shown below.

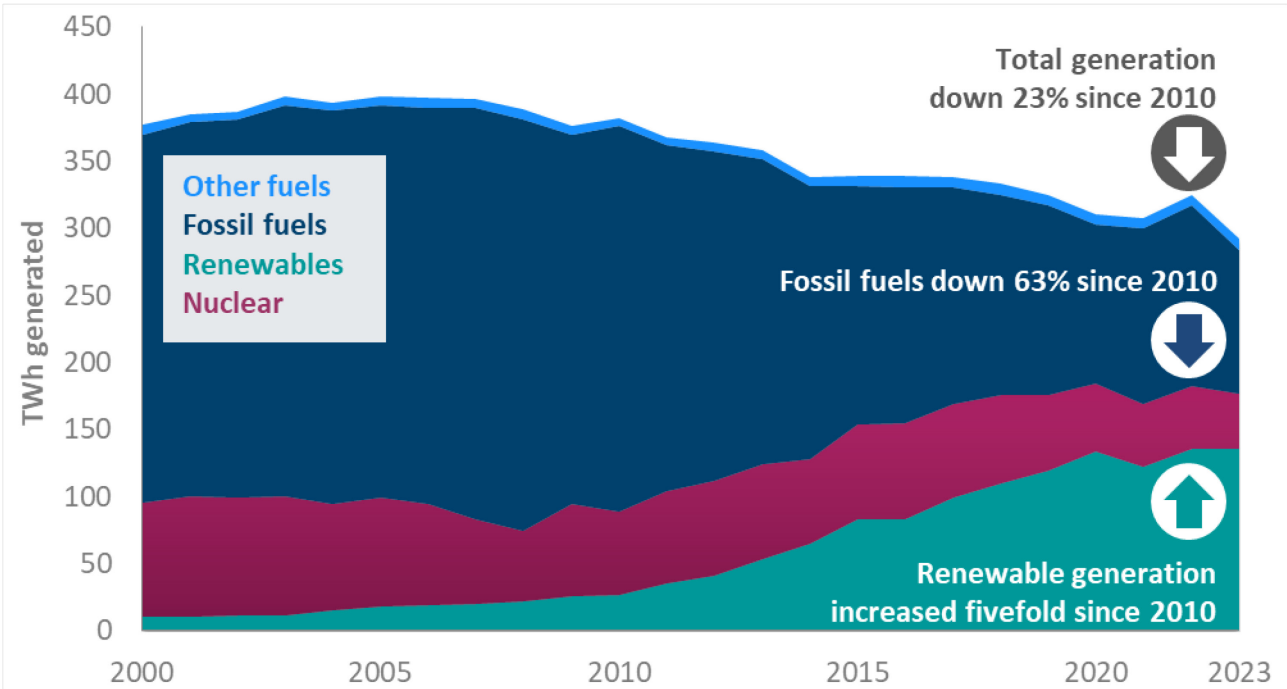
Chart 5.2 Share of total electricity demand split by sector, 2023 ([DUKES Table 5.2](#))



Domestic users accounted for the largest share of total electricity demand (29.2 per cent), though this is 0.6 percentage points below the 2022 share (29.8 per cent). Industrial consumption made up 27.2 per cent, increasing by 0.1 percentage points on the previous year's share, while commercial consumption accounted for 19.3 per cent, down by 0.4 percentage points.

Electricity supply decreased 1.0 per cent in 2023 in line with lower demand for electricity. Electricity generation fell by 9.9 per cent, as record electricity imports reduced the need for UK generation. Electricity generation measures what is generated while electricity supply measures what was supplied to consumers, excluding the electricity used in the process of generation or consumed on site by the generator. Total electricity supplied plus imports matches with demand as electricity is supplied until demand is met. Demand for electricity is usually met by UK generation and supplemented with imports from Europe when price differentials are favourable. This differed in 2022 as outages in the French nuclear fleet meant that large amounts of electricity were exported via the France-UK interconnectors, leading to the UK being a net exporter. This led to increased UK generation and supply, despite lower demand in the UK. Total electricity supplied in 2022 was 319.6 TWh, with net exports of 5.3 TWh.

Chart 5.3 Electricity generated by fuel, 2000 to 2023 ([DUKES Table 5.6](#))



Electricity generation fell to 292.7 TWh in 2023, down 9.9 per cent compared to 2022. This was due to lower UK demand, increased electricity imports and lower demand for exports to Europe. Major Power Producers (MPPs) generated 237.8 TWh, down 12 per cent compared to 2022, while generation from autogenerators and other generators increased slightly, up 0.4 per cent to 54.9 TWh. The share of generation from MPPs decreased by 1.9 percentage points to 81.2 per cent.

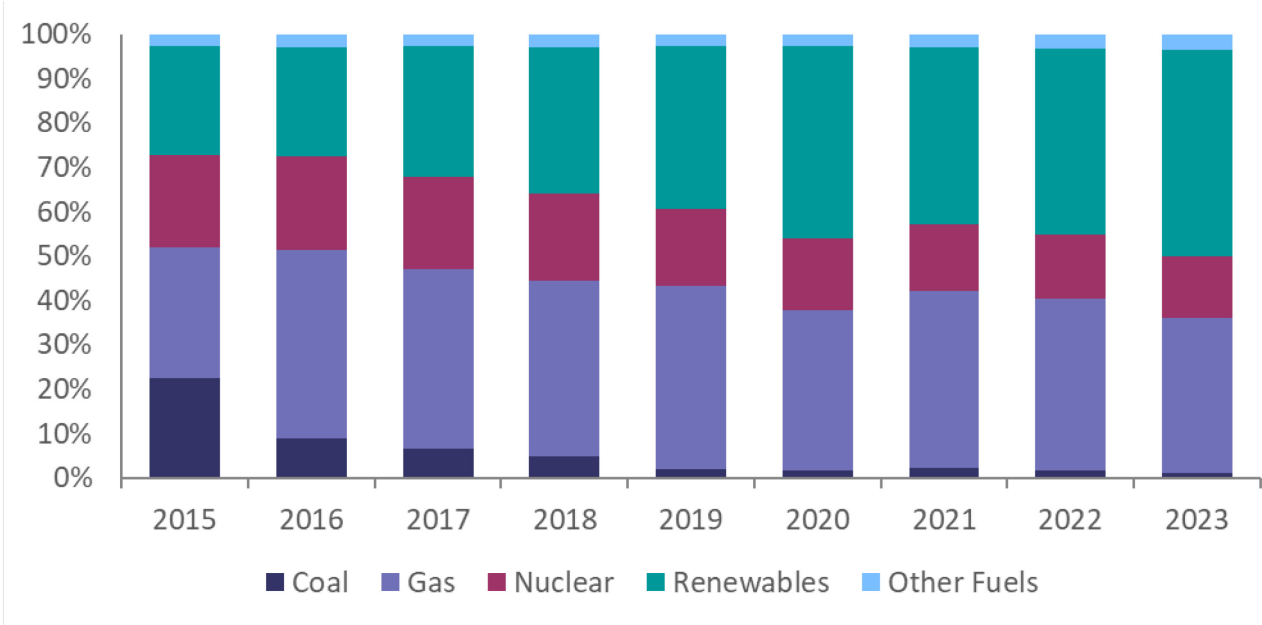
Renewable generation in 2023 was broadly similar to 2022, increasing 0.3 per cent to narrowly reach a new record high of 135.8 TWh, driven by record high output from wind and solar generators. For wind, capacity increases offset slightly lower wind speeds leading to wind generation increasing 2.2 per cent on 2022 levels, to 82.3 TWh. Solar capacity also increased and despite reduced average sun hours, solar generation rose 4.1 per cent to 13.9 TWh. Both wind and solar generation have increased rapidly in recent years. Compared to ten years ago, wind generation in 2023 was nearly three times 2013's value and solar generation nearly seven times 2013 levels. Rainfall below the 20-year average in key hydro areas saw a 2.2 per cent drop in generation. Outages at key bioenergy sites caused a reduction in generation of 4.9 per cent to 34.1 TWh.

Fossil fuel generation decreased 19.8 per cent in 2023 to 107.3 TWh, a level last seen in the mid-1950s when electricity demand was a third of today's requirement and over 95 per cent fuelled by coal and oil-fired generation. In 2023, most fossil fuel generation continued to come from gas, which fell 19 per cent to 101.7 TWh. Coal generation continued to decrease, down 36 percent to a record low 3.8 TWh. Three of the UK's four coal-fired power plants ceased operation in 2023, with commitments in place to close the last, Ratcliffe-on-Soar, by October 2024.

Nuclear generation fell 14 per cent to 40.6 TWh in 2023. Whilst the UK's operational nuclear capacity remained unchanged, all nuclear plants experienced outages throughout 2023. These included outages for refuelling as well as planned and unplanned maintenance.

As well as absolute generation, it is also useful to consider the overall shares of generation, which are less affected by changes in demand. This allows trends in different fuels to be examined, including the share of electricity generated from low carbon sources.

Chart 5.4 Shares of electricity generation by fuel, 2015 to 2023 ([DUKES Table 5.6](#))



Renewable sources accounted for 46.4 per cent of generation in 2023, exceeding the annual share of generation from fossil fuels for the third time in the published data series. The renewable share rose by 4.7 percentage points compared to 2022 levels. Wind generation accounted for more than a quarter of generation in 2023, up 3.3 percentage points to a record 28.1 per cent share, while the share for solar rose to

a record 4.7 per cent. Bioenergy increased 0.6 percentage points to an 11.6 per cent share. Hydro remained at similar levels to 2022, at 1.9 per cent share.

The share of generation from fossil fuels fell 4.5 percentage points to record low of 36.7 per cent, as favourable weather conditions for renewables and increased imports reduced the need for fossil fuel generation. Gas accounted for the vast majority of the fossil fuel share, standing at 34.7 per cent of total generation and down 3.8 percentage points on 2022 levels. The share of generation from coal reached a new low of 1.3 per cent as coal generation continued to decline.

Nuclear generation accounted for 13.9 per cent of generation in 2023, down 0.7 percentage points on 2022 levels and the lowest level since 2008. This reflects lower operational capacity, as two nuclear plants closed in 2022, as well as outages. Despite the decrease in the share from nuclear, the share of generation coming from low carbon sources (nuclear plus renewables) rose to 60.3 per cent in 2023, the highest value on the published data series and 4.0 percentage points higher than in 2022.

The total fuel used for electricity generation decreased by 12.4 per cent in 2023 to 47.4 million tonnes of oil equivalent (Mtoe). This was driven by a 9.9 per cent fall in UK generation due to increased electricity imports. The decrease in fuel used was greater than the drop in overall electricity generated due to growth in non-thermal renewables which do not incur conversion losses¹. Fuel used for electricity has fallen 37 per cent in the last ten years.

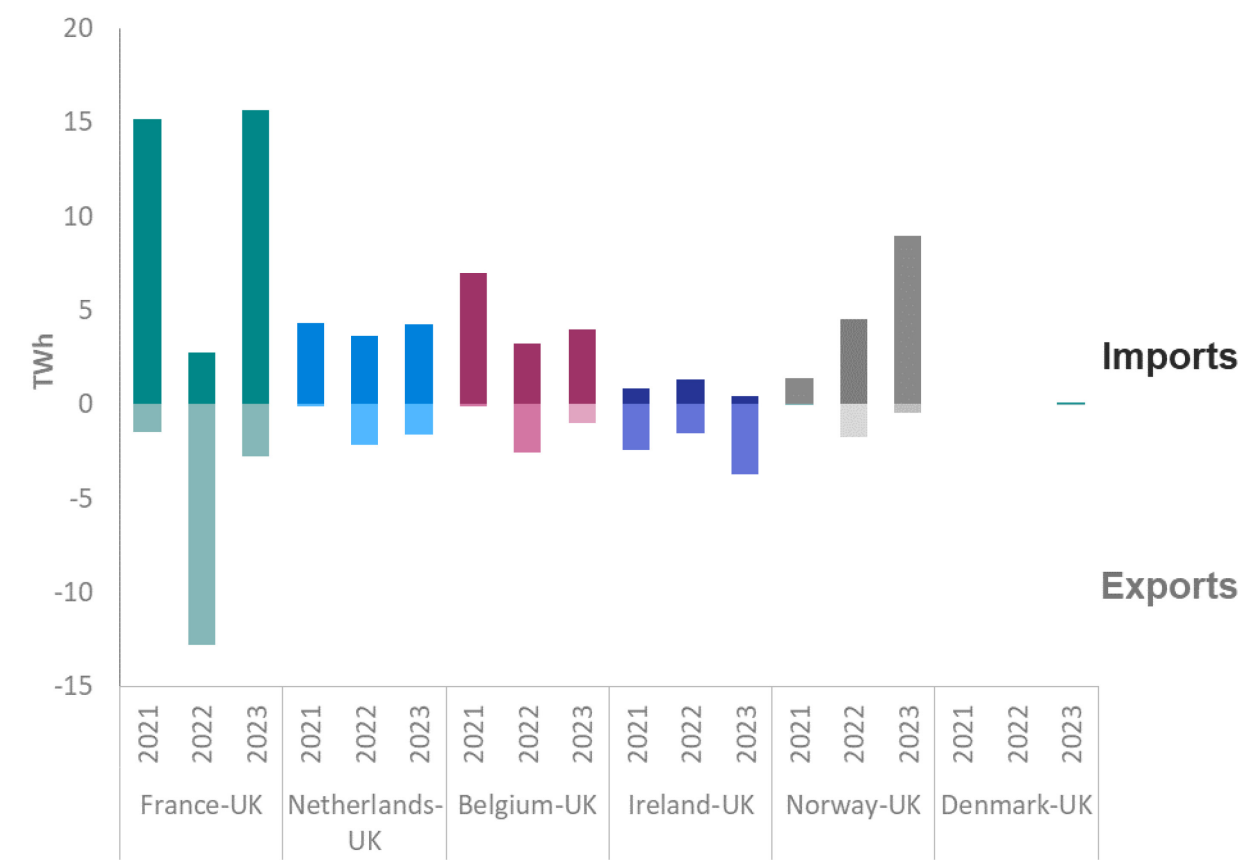
Trends in fuel used broadly mirror those in electricity generation, with decreases in the amount of fossil fuel and nuclear fuel use, a small drop in bioenergy and increases in assumed fuel used by wind and solar generators. Gas continues to dominate the UK generation mix, with 17.7 Mtoe used in 2023, while coal use decreased to 0.9 Mtoe, the lowest value on the published data series.

¹ For wind, hydro and solar, in line with [international reporting standards](#), primary production of energy is defined as extraction of energy products in a useable form from natural sources. For wind this is the electricity generated by the wind turbine. Therefore, for these technologies, the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred. Therefore, for example, if one unit of electricity produced from coal is switched to wind, the fuel used will show a fall from around three units (as coal's thermal efficiency is around one-third) to one unit.

The UK returned to being a net electricity importer in 2023, with net imports totalling a record 23.8 TWh. Total imports recovered to a record 33.3 TWh, more than double 2022 levels. Meanwhile total exports halved compared to 2022, reaching 9.5 TWh, but were still the second highest annual figure. In 2022, the UK had been a net exporter for the first time in more than 40 years, with net exports totalling 5.3 TWh. The primary reason for this atypical situation was the widespread outages in the French nuclear fleet, increasing the demand for exported electricity to France.

With price differentials returning to more usual patterns in 2023, the UK was a net importer from all interconnected countries except the Republic of Ireland, which is connected to the UK through land connections from Northern Ireland and an interconnector cable from Wales. The France-UK interconnectors accounted for 12.9 TWh of net imports, followed by Norway-UK with 8.5 TWh of net imports. The interconnectors with both France and Norway supplied record imports in 2023. The Belgium-UK interconnector accounted for 3.0 TWh of net imports and the Netherlands-UK interconnector 2.7 TWh. More electricity was exported to the Republic of Ireland than was imported from there to the UK, leading to net exports from the UK. The Ireland-Wales interconnector saw net exports of 1.7 TWh and the Northern Ireland-Ireland interconnector contributed 1.6 TWh of net exports to the total. The Denmark-UK interconnector commenced operation in the last full week of December.

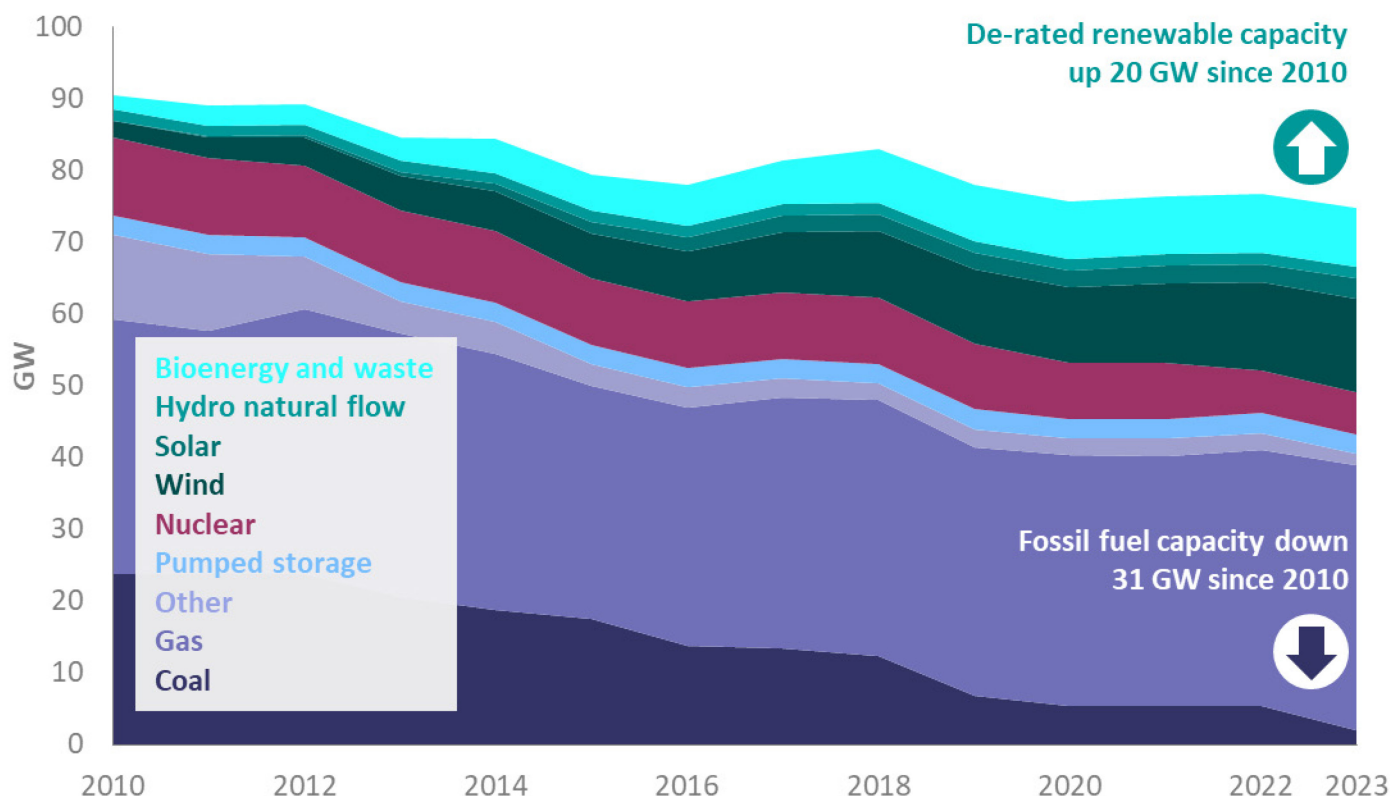
Chart 5.5 Electricity imports and exports by country, 2020 to 2023 ([DUKES Table 5.13](#))



UK electricity is generated from a range of technologies and fuels are used at different times in response to demand and changes in weather. Monitoring capacity along with load factors (the proportion of potential generation that is realised in the year) can highlight how the capacity is being used to monitor the security of electricity supply.

In this section, wind, small scale hydro and solar PV capacity is de-rated to account for intermittency, to enable direct comparison with conventional fuels which are less dependent on the weather. Total installed capacity figures (not de-rated) are available in [DUKES Table 5.12](#).

Chart 5.6 De-rated capacity of UK electricity generation assets by fuel, 2010 to 2023 ([DUKES Table 5.7](#))

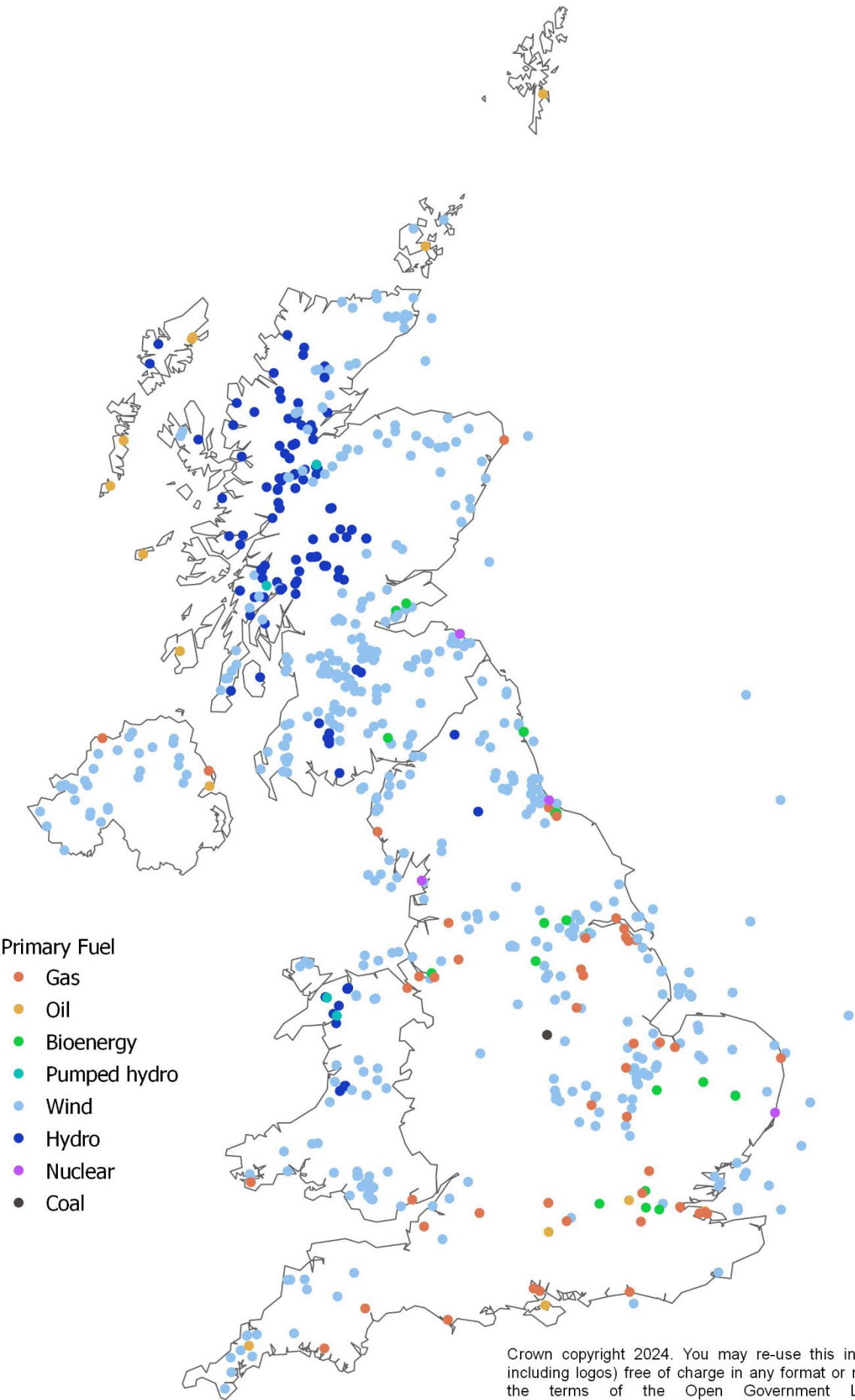


Total de-rated generation capacity decreased to 74.8 GW in 2023, down 2.6 per cent compared to 2022. This was due to closures of two large coal-fired plants, Drax and West Burton. The reduction was partly offset by increases in offshore wind, solar and bioenergy capacity, as well as the opening of gas-fired Keadby 2. Capacity for renewable technologies increased by 4.0 per cent to 25.6 GW while fossil fuel capacity decreased 6.8 per cent to 40.5 GW. The peak demand in winter was slightly down, by 0.7 per cent, compared to the equivalent figure in 2022 at 48.3 GW. As Major Power Producer (MPP) capacity fell by 3.1 per cent in 2022, the peak represented 77.4 per cent of MPP capacity, 1.9 percentage points higher than 2022.

De-rated renewable capacity increased 4.0 per cent, driven by increases in offshore wind and solar capacity. Wind capacity increased by 4.9 per cent to 13.0 GW with a 3.9 per cent increase for onshore wind and a 5.9 per cent increase for offshore wind, including 0.5 GW at Seagreen. De-rated solar capacity also saw an increase of 10.8 per cent to 2.8 GW.

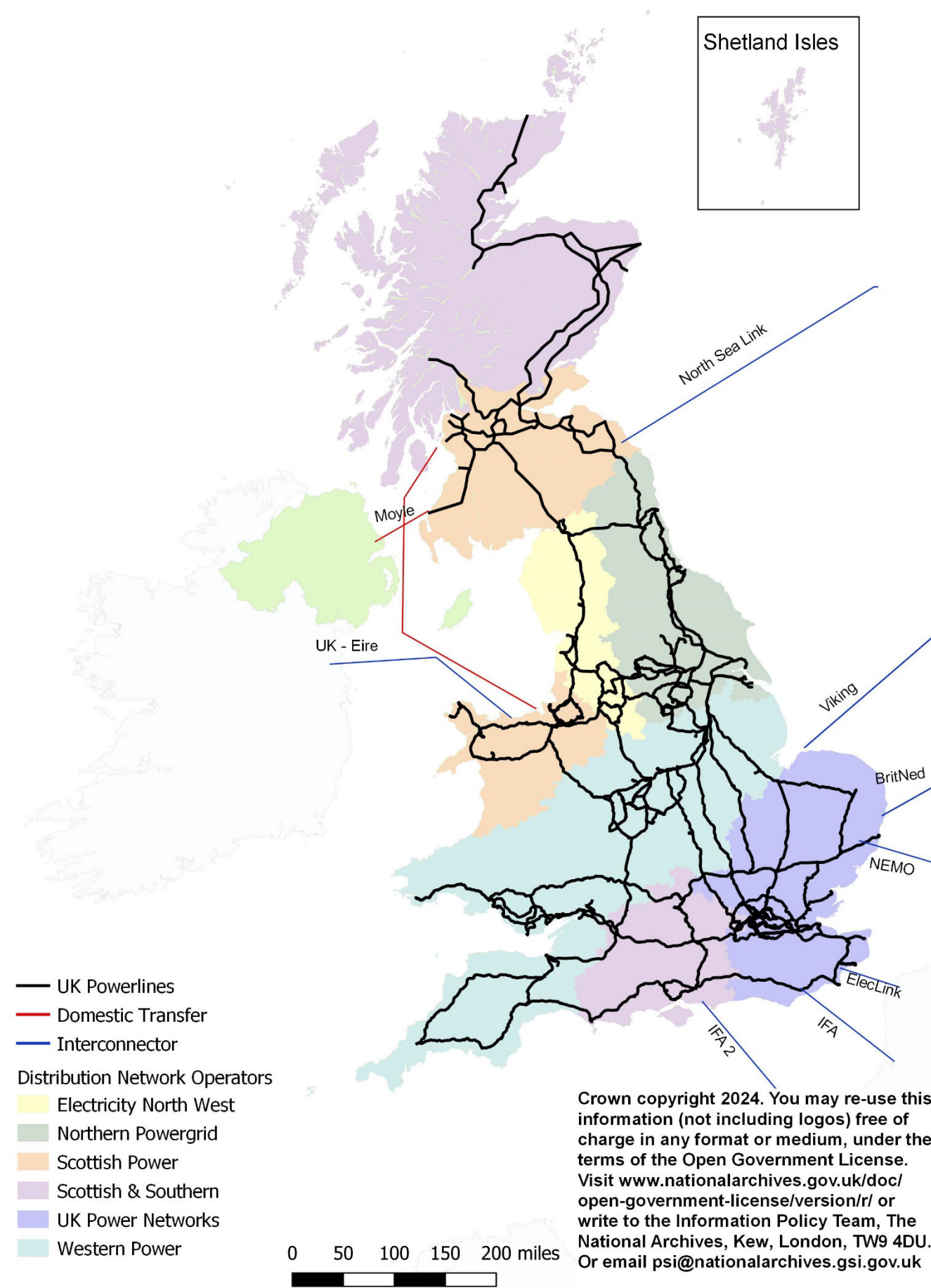
Major Power Producers' power plants were less intensively deployed than they were last year, with a load factor of 39.2 per cent ([DUKES Table 5.10](#)). Load factors indicate the proportion of the time the plant is producing electricity and decreased by 4.4 percentage points compared to 2022, in line with reduced generation by Major Power Producers due to increased electricity imports. Load factors vary by technology, with nuclear stations the highest at 72.4 per cent and the lowest being pumped storage hydro at 9.8 per cent. Full load factors for renewable generation are given in [DUKES Table 6.3](#).

Map of Major Power Producers in the UK (operational May 2024)



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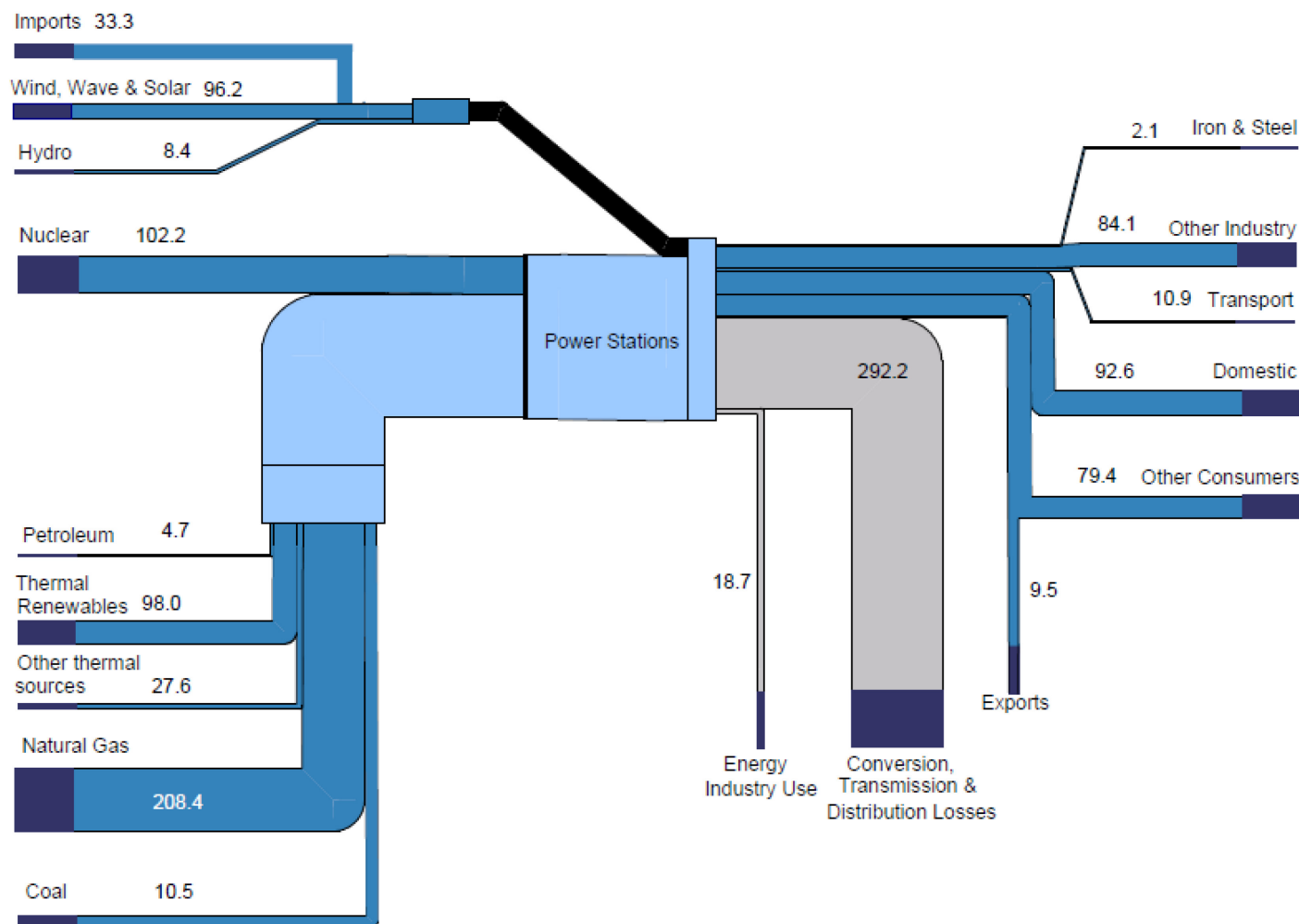
UK Distribution Network Operating Areas and GB Power Lines Map



Trade connections are representations of the route, not the actual locations.

Data sources: National Grid Transmission Network (www.nationalgrid.com/uk); DESNZ Distribution Network Operator Data; DESNZ Country Boundary Data.

Electricity Flow Chart 2023 (TWh)



Notes on flow chart

- This flow chart is based on the data in Tables 5.1 (for imports, exports, use, losses and consumption) and 5.6 (fuel used).
1. Hydro includes generation from pumped storage while electricity used in pumping is included under Energy Industry Use.
 2. Conversion, Transmission and Distribution Losses are calculated as fuel used (Table 5.6) minus generation (Table 5.6) plus losses (Table 5.1).

Chapter 6: Renewable sources of energy

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Key headlines

Renewable generation in 2023 exceeded the current 2022 record marginally (by 0.3 per cent) to 135.8 TWh. The effect of less favourable weather conditions for wind and solar PV was more than offset by an increase in capacity for both technologies. Within the technologies, records were set for offshore wind, solar PV, energy from renewable waste, and anaerobic digestion.

Renewable capacity increased by 5.2 per cent (2.8 GW). Although this is higher than during the slowdown in new capacity observed between 2019 and 2021, it is lower than 2022 and the years prior to 2019 (the average growth in capacity between 2012 and 2018 was 20 per cent). Half the new capacity installed in 2023 was accounted for by wind (0.8 GW offshore and 0.6 GW onshore) with the remainder being mostly accounted for by solar PV (1.3 GW) and a small addition for energy from waste (less than 0.1 GW).

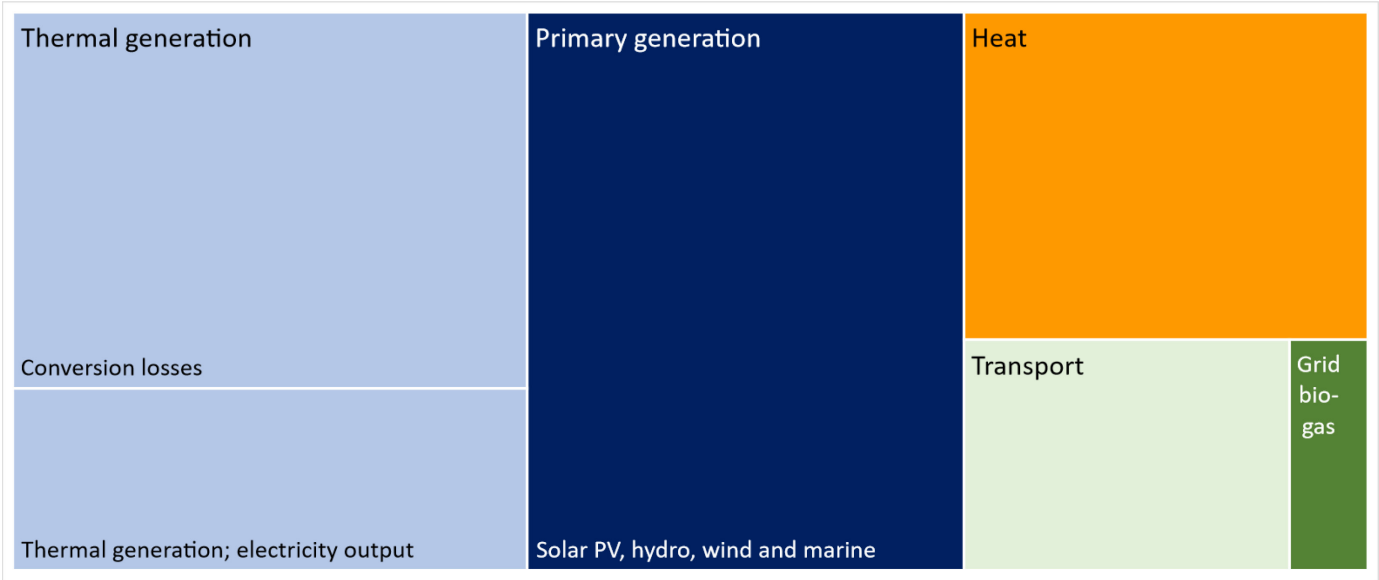
The share of renewable electricity generation in 2023 was 46.4 per cent, a new record. Despite a small increase in renewable generation, this was 4.7 percentage points up on 2022 and 3.4 percentage points up on the previous record set in 2020. The increase was driven by a fall in total electricity generation, see Chapter 5 for more details.

Renewable heat increased by 2.9 per cent; with almost two thirds of the increase being accounted for by domestic wood consumption and a third by heat pumps. With average temperatures in 2023 only marginally lower than in 2022, the increase is due to an increase in the stock of domestic wood appliances and heat pumps.

As a share of gross final consumption, overall renewables accounted for 15.5 per cent, an increase of 1.3 percentage points on 2022, a combination of increases in renewable electricity generation and renewable heat, combined with a slight fall in total gross final consumption.

Renewable fuels include primary energy such as wind, solar, and hydro, and thermal fuels (solid biomass, biogases, and liquids). Thermal fuels are combusted to produce energy and in the case of electricity generation, some is lost during this conversion process. Around 70 per cent of renewable fuels are used for electricity generation, a third of which is lost in the conversion process. Heat accounts for 17 per cent with transport and grid injected biogas accounting for 9.9 per cent and 2.4 per cent. Chart 6.1 below shows the demand for all renewable fuels including losses from the conversion process.

Chart 6.1 Renewable fuel¹ demand, 2023 ([DUKES Table 6.4](#))



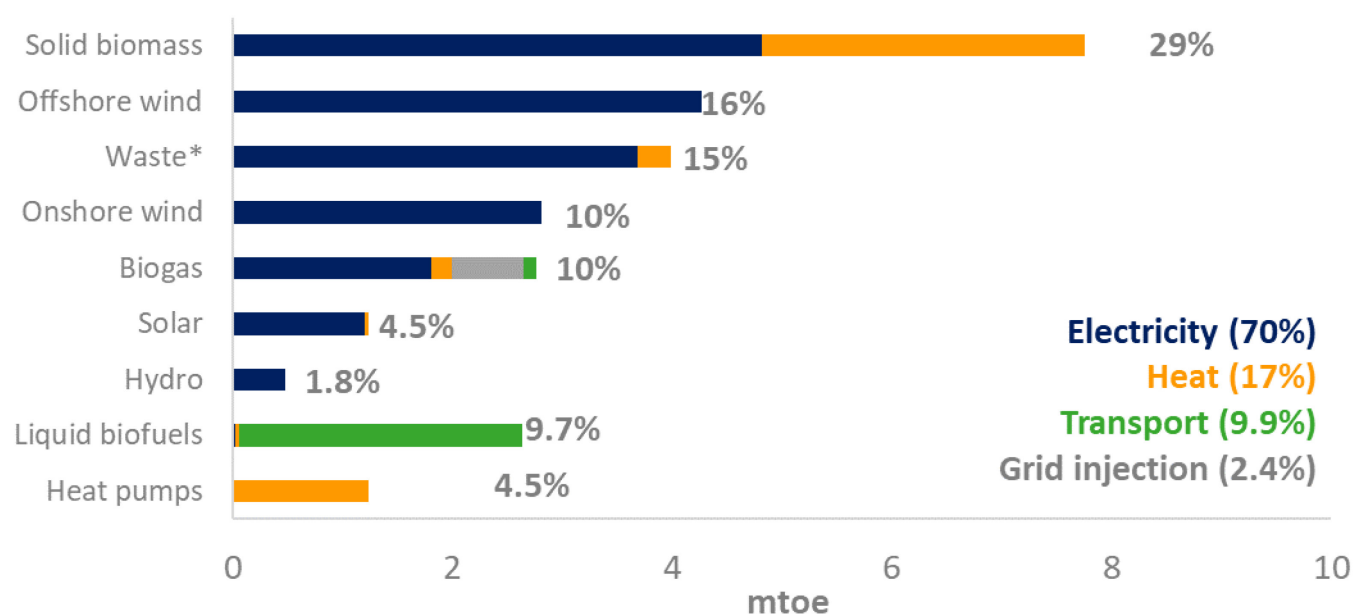
The chart replicates data included in Table 6.4; where this differs to Table 6.2 is the latter includes electricity generation only, i.e. primary generation and thermal generation after losses. The amount of conversion losses depends on the efficiencies of fuels which for renewables varies between around 35 to 40 per cent, with the remainder being lost in conversion. This compares with an efficiency of around 48 per cent for natural gas and around 34 per cent for coal and oil generation.

Some renewable fuels are more versatile than others such as biogases; historically demand had been dominated by electricity generation, but it is now increasingly used for heat generation, injection into the National Grid, and most recently small amounts are consumed within the transport sector. Conversely, primary energy sources such as wind and hydro are consumed solely by the electricity sector and although solar is primarily used in generation, small amounts of solar thermal are used for space and water heating.

Chart 6.2 shows how the individual fuels and technologies are consumed across the end uses (note: thermal fuels include losses incurred during conversion).

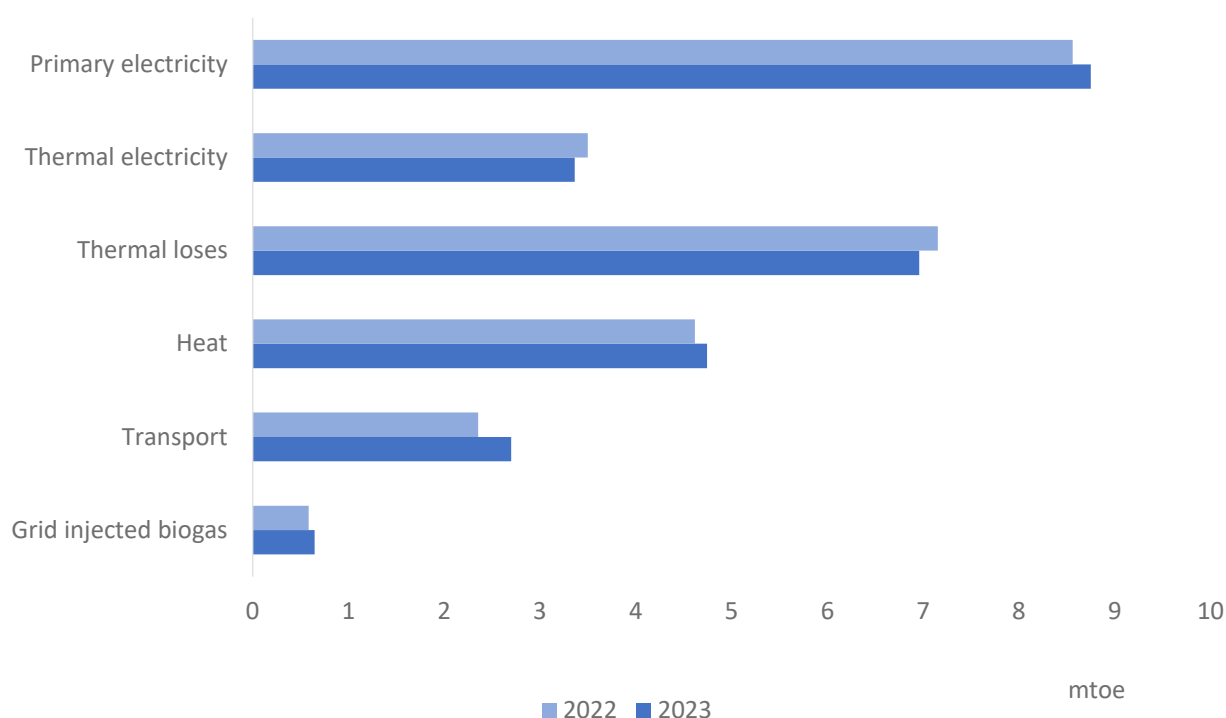
¹ Including non-biodegradable waste

Chart 6.2 Use of renewable fuels, 2023 ([DUKES Table 6.4](#))



Between 2022 and 2023, overall renewable fuel demand increased by 1.5 per cent with the majority of the increase being from offshore wind generation, transport fuels, and energy from waste. Generation from thermal renewables fell along with the associated conversion losses. Renewable heat demand increased by 2.7 per cent due to strong growth in heat pumps and domestic wood consumption. Chart 6.3 shows how each component of fuel demand changed between 2022 and 2023.

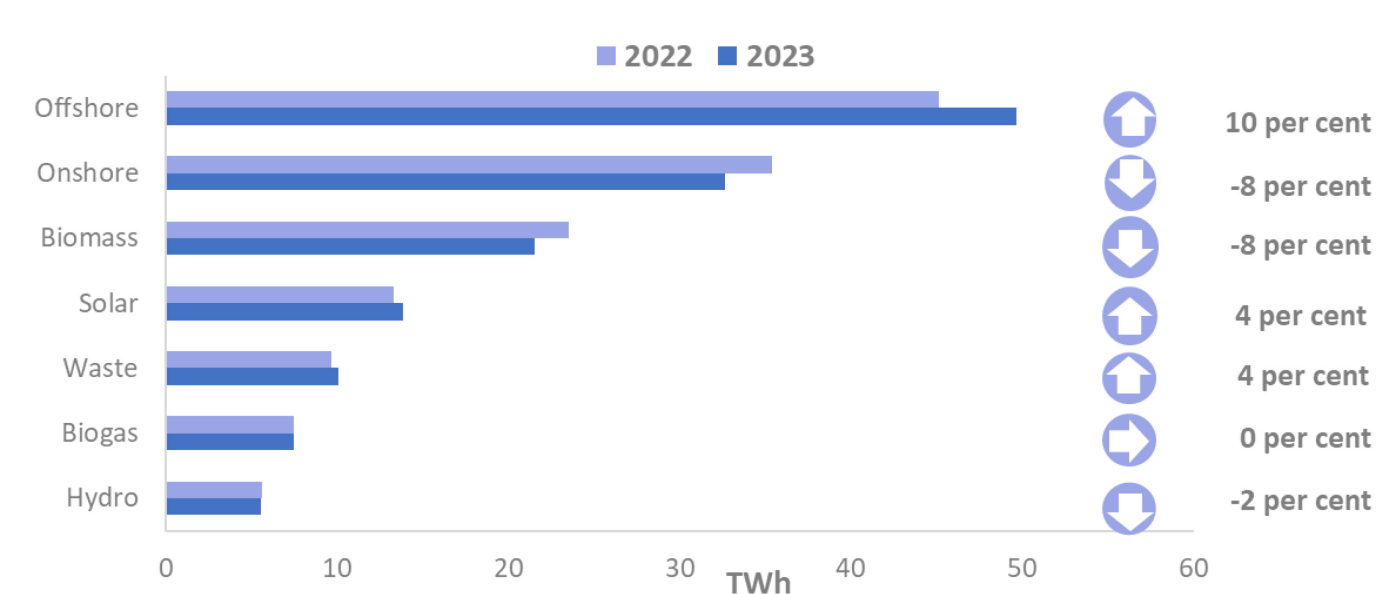
Chart 6.3 Change in renewable fuel demand 2022 to 2023 ([DUKES Table 6.4](#))



At 135.8 TWh, overall renewable generation marginally exceeded the current record, set in 2022, by just 0.3 per cent. With less favourable weather conditions in 2023 (lower wind speeds and fewer sun hours), generation was boosted by new capacity for onshore and offshore wind, and solar PV.

Chart 6.4 shows the change in generation between 2022 and 2023 across the technologies both in absolute and percentage terms.

Chart 6.4 Electricity generation by fuel, 2022 – 2023 (DUKES Table 6.2)



Offshore wind reached a new record in 2023, increasing by 10 per cent on 2022. Average wind speeds were down on the previous year but generation was boosted by 0.8 GW of added capacity, including new capacity at Seagreen in Scotland where the first phase is now complete, totalling 1.1 GW. Conversely, onshore wind generation fell in 2023, by 7.9 per cent, with the impact of additional capacity being subdued by outages, in combination with lower wind speeds.

Similarly solar PV exceeded its previous record from 2022. As with offshore wind generation, new capacity contributed to the new record despite average sun hours being lower in 2023 compared to 2022. This resulted in a 4.1 per cent increase in generation on 2022.

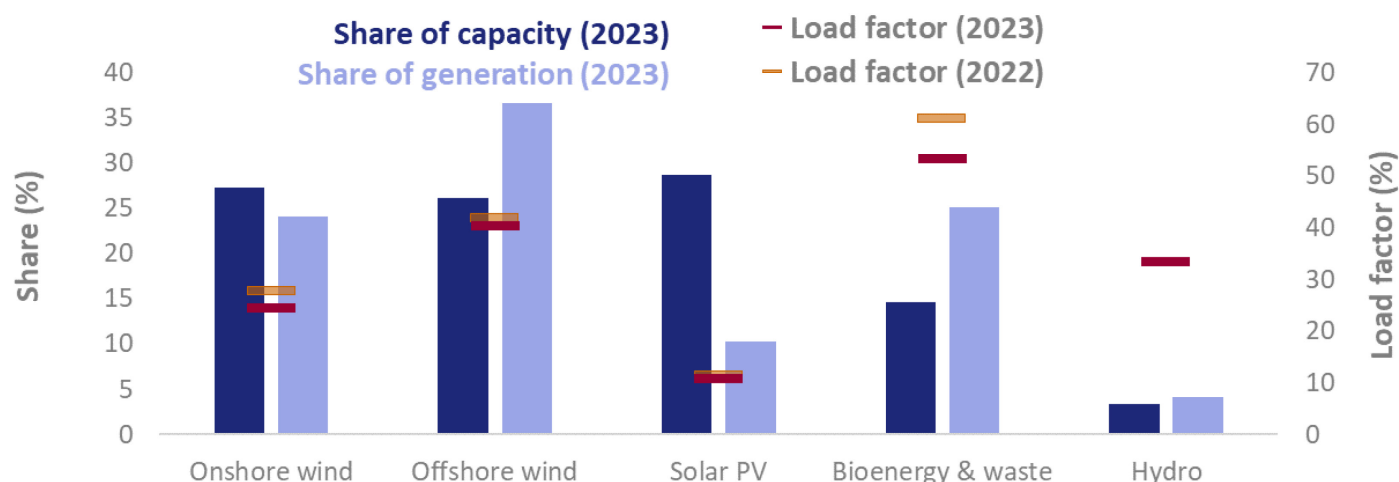
Hydro generation decreased by 2.2 per cent in 2023 to 5.5 TWh, average rainfall was at a similar level to 2022 and there was no new capacity. Hydro is an established technology and there has been little new capacity in recent years.

Overall, bioenergy generation fell by 4.9 per cent to 34.1 TWh, the lowest since 2017. This is largely due to outages at two large power stations suppressing demand for plant biomass (mostly wood pellets). Generation from landfill gas continues to decrease, by 3.5 per cent, in line with falling yields. **Only anaerobic digestion and energy from waste saw increases in 2023**, with both reaching new records in 2023; 3.5 TWh for anaerobic digestion and 5.0 TWh for energy from waste.

Offshore wind continues to be the leading renewable technology in 2023 for generation, accounting for 60 per cent of all wind generation and 37 per cent of all renewable generation in 2023. Offshore first outstripped onshore generation in 2019, and although offshore capacity still lags onshore, the gap has closed. The discrepancy between capacity and generation can be explained by a combination of stronger and more consistent coastal wind speeds, and offshore turbines tend to be newer and larger than onshore, often yielding a higher load factor.

Technologies with a high share of capacity do not necessarily have the highest share of generation because **generation is dependent on the load factor**. Load factors are the ratio of how much electricity was generated as a proportion of the total generating capacity. Within renewables, load factors can be heavily influenced by weather conditions: such as wind speeds, sun hours and, to a lesser extent, rainfall. Chart 6.5 compares the key technologies' share of capacity and generation for 2023. The load factors for both 2022 and 2023 have been added where the impact of less favourable weather in 2023 can be seen in the lower load factors.

Chart 6.5 Relative share of capacity and generation and load factors 2023 ([DUKES Table 6.3](#))



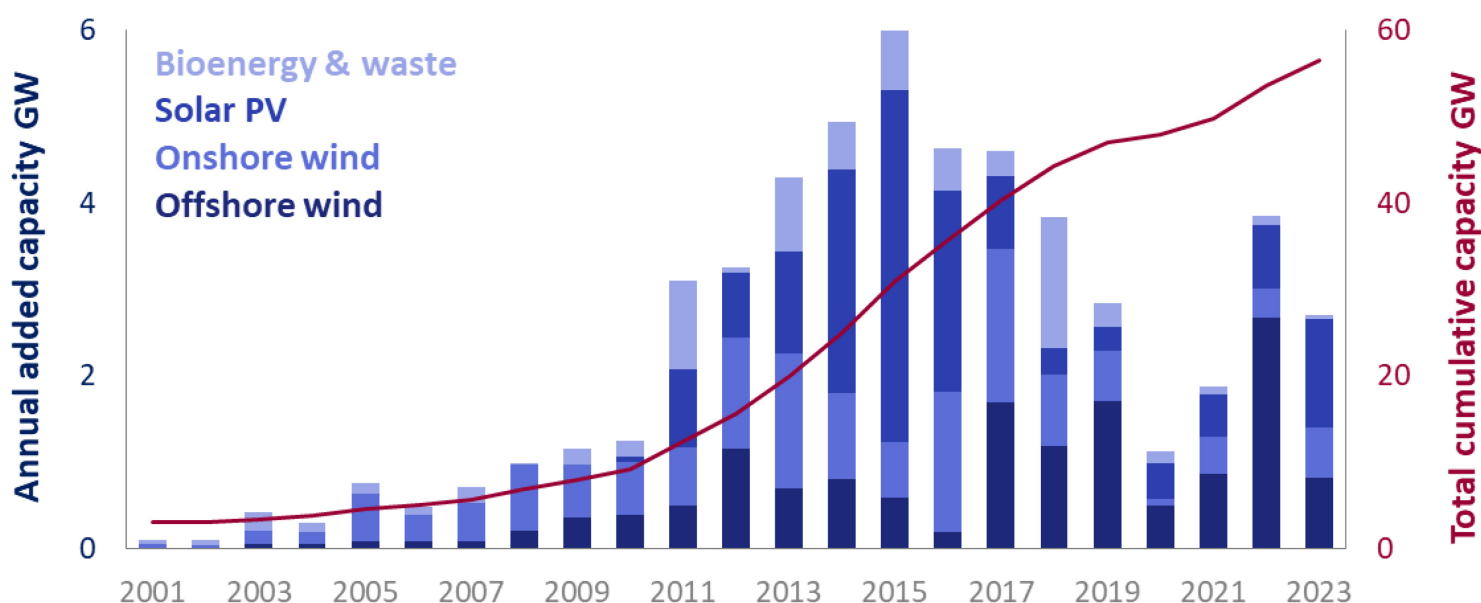
Thermal generation such as bioenergy and waste tend to have high, stable load factors varying only when outages occur at major power plants. Conversely, solar PV has a very low load factor due to limited hours of sunlight in the UK.

On an unchanged configuration basis, where only sites operating for the full year are included, the load factor for overall renewables in 2023 was 32.0 per cent. This was 6.0 percentage points lower than in 2022 and the lowest since 2019. The load factors were depressed by lower average wind speeds, shorter average sun hours and relatively low output at major biomass plants. Load factors for landfill gas continue to decline as extraction rates decrease.

Chart 6.6 shows the historic growth in capacity highlighting the stark slowdown over 2020 and 2021 (some projects may have been delayed in 2020 due to Covid-19 restrictions). New capacity was much higher in 2022 (3.8 GW) but was lower in 2023 (2.7 GW). Capacity growth was driven by the expansion at Seagreen in Scotland (offshore wind), which added around 0.8 GW.

New capacity peaked in 2015 when 6.0 GW was installed, 4.1 GW of which was in solar PV. New installations began to tail off during 2018 (3.8 GW), reaching a recent low of 1.1 GW in 2020.

Chart 6.6 Annual added capacity 2001 to 2023 ([DUKES Table 6.2](#))



Prior to the launch of the Feed-in Tariff (FiT) in 2010, solar PV represented just 1.0 per cent of renewable generation capacity, but by the end of 2023, its share had increased to 28.7 per cent, with the majority (78 per cent) being installed between 2011 and 2017. Following the closure of The Renewable Obligation to new entrants in 2016, growth began to slow in 2017 further exacerbated by the FiT closure in April 2019. Growth has since improved and during 2023 there were more domestic solar panels installed than in any year since 2015².

Growth in new wind sites has been more stable, particularly onshore wind, though it has slowed over recent years with just 0.6 GW added in 2023 (an increase of 3.9 per cent) and 0.3 GW added in 2022. Offshore wind has seen much higher levels of new capacity in recent years with 64 per cent of total capacity being installed since 2016. This has included several large plants supported by Contracts for Difference (CfD) such as Hornsea 1 and 2, Triton Knoll, Moray East and Seagreen. Wind now represents around 53 per cent of installed renewable capacity (see wind map at the end of this chapter showing location by capacity).

Chart 6.7 Trends in generation by technology 2001 to 2023 (DUKES Table 6.2)

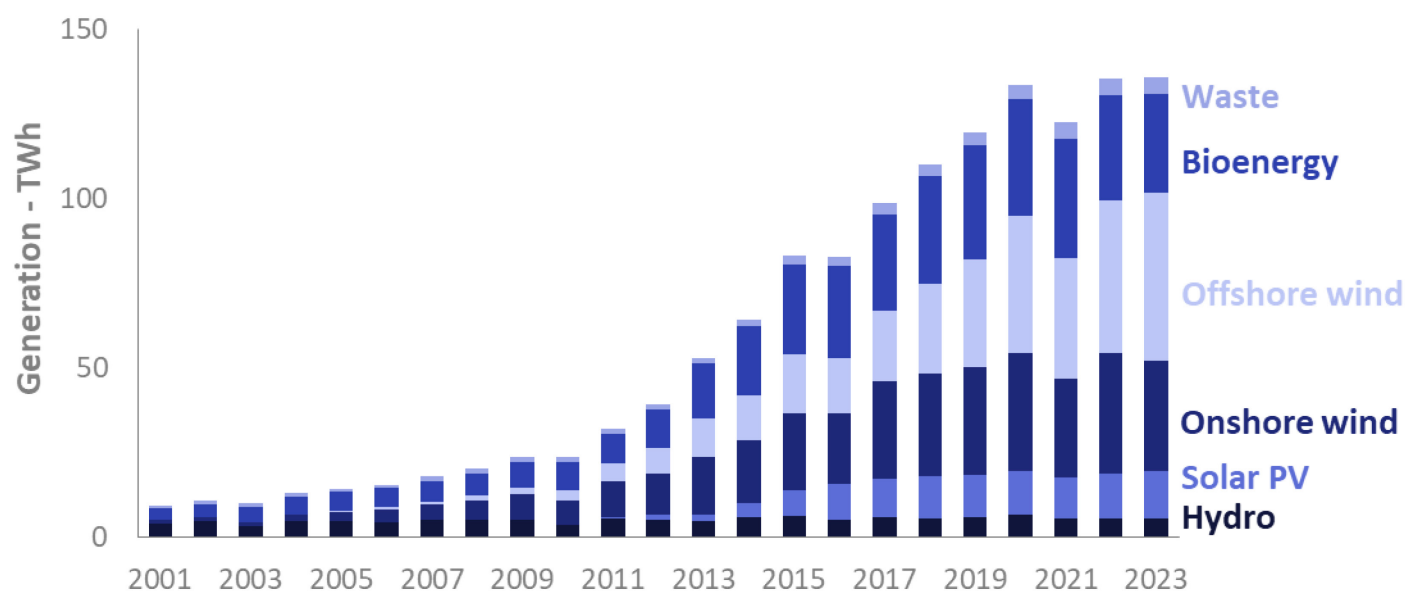


Chart 6.7 shows the changes in electricity generation fuel mix since 2001. The overall upward trend in generation is driven by increasing cumulative capacity. However, there are year-on-year fluctuations due to weather conditions. For example, despite the record capacity installed in 2015, generation for 2016 remained similar to 2015. This can also be seen with a fall in generation in 2021. Generation in 2023 is the highest on record but only marginally higher than in 2020 and 2022.

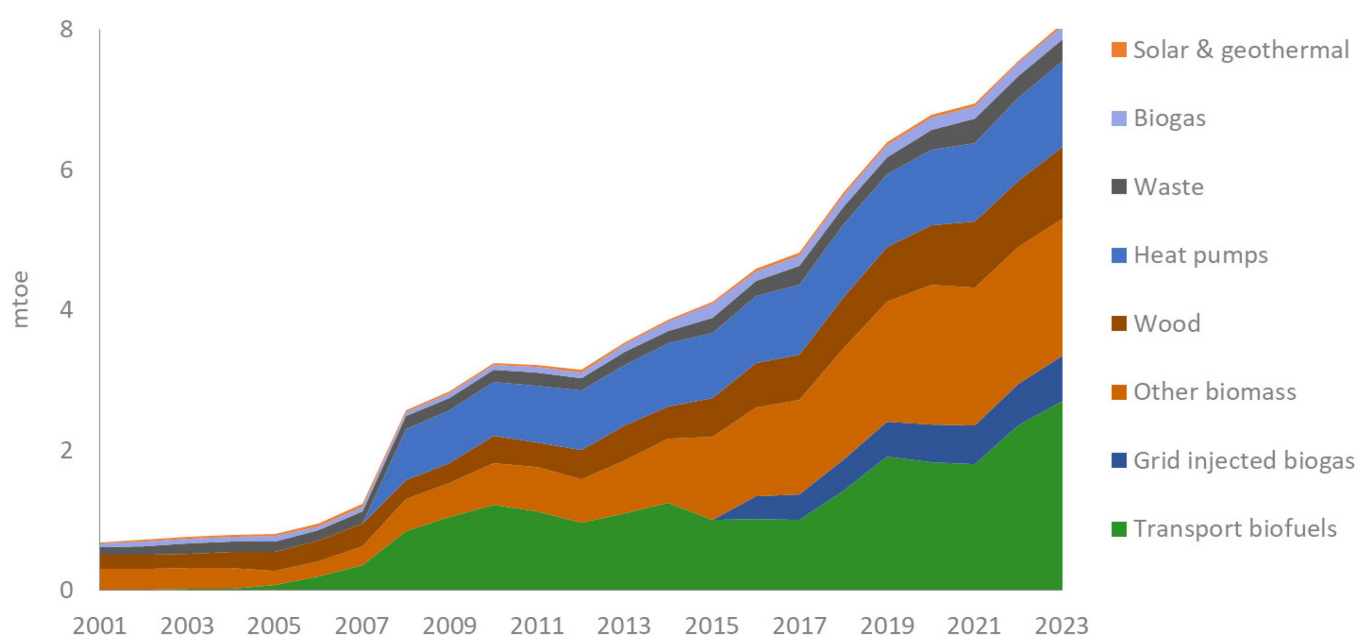
Hydro is a mature technology and generation tends to fluctuate from year-on-year in line with rainfall. In contrast, solar PV generation has increased rapidly since 2011 reflecting the surge in new capacity incentivised via the Feed in Tariff (FiT) support scheme. As a result, solar PV’s share of renewable generation increased from just 0.7 per cent in 2011 to 10.2 per cent in 2023.

² For more information see the solar deployment tables at: <https://www.gov.uk/government/statistics/solar-photovoltaics-deployment>

Bioenergy has seen rapid growth over the last ten years as several large power stations converted from coal to plant biomass (mainly wood pellets). Generation has roughly doubled during this time. However, outages have dampened generation over the last two years. At 20.8 TWh, plant biomass generation remains lower than the record seen in 2021 (27.0 TWh). Generation from landfill gas peaked at 5.3 TWh in 2011 but has fallen in each year since then as extraction rates have declined at landfill sites. This fall was more than offset increases in anaerobic digestion since 2011.

Whilst electricity generation represents the largest share (70 per cent) of renewable fuel demand, heat also accounts for a sizable proportion (17 per cent), followed by transport biofuels (9.6 per cent) and biogas injected into the gas grid (2.4 per cent).

Chart 6.8 Other renewable fuel uses³; heat, transport, and grid injected biogas ([DUKES Table 6.4](#))



³ Including non-biodegradable waste

Renewable heat demand⁴ is largely met by solid biomass, accounting for 62 per cent of fuel for heat in 2023, with the next largest share being heat pumps (26 per cent). The remainder is largely made up of wastes and biogases (6.6 per cent and 4.0 per cent respectively), with primary sources (such as active solar heating and geothermal) accounting for around 0.8 per cent. Renewable heat demand increased in 2023 by 2.7 per cent; although average temperatures were fairly similar, an increase in heat pump installations and domestic wood stoves boosted renewable heat⁵.

Renewables used in transport are liquid and gaseous biofuels, supplied either as additives or as a replacement (“drop-in”) for fossil fuels. Among liquid biofuels, biogasoline and biodiesel dominate the fuel mix, together representing 91 per cent of renewable transport demand. Since 2018, small but rapidly increasing amounts of new biofuels became available in the UK. In 2023, 4.6 per cent of renewable transport fuels were biogases, up from less than 1 per cent in 2018, while bio-LPGs (bio propane and bio butane) accounted for 0.3 per cent, though supply is particularly volatile. Bio-jet fuel accounts for 4.5 per cent of all transport renewables but only 1.0 per cent of aviation demand.

When compared to 2022, demand for transport biofuels grew by 15 per cent to 2,697 ktoe; biodiesel increased by 14 per cent while biogasoline grew by 9.6 per cent, the latter being driven by the introduction of E10 petrol (i.e. up to 10 per cent bio content) at the pump as well as the general increase in transport fuel use.

⁴ Including non biodegradable waste

⁵ Preliminary results of a new domestic wood survey undertaken by The Department for Environment, Food and Rural Affairs (Defra) have been incorporated this year. Field work for the survey took place between July 2022 and June 2023 with the results being seasonally adjusted to achieve calendar year estimates for 2022 and 2023. A similar adjustment was undertaken with further allowances for changes in the stock of appliances to produce a historic series. This produced no discernible step change in the series confirming the results are in line with Defra’s previous survey undertaken in 2018 therefore the series published in [DUKES 6.4](#) has been revised back to just 2020. Defra intend to publish the results on [Defra Search Science](#) in due course at which stage this will be reviewed and a longer-term revision will be considered.

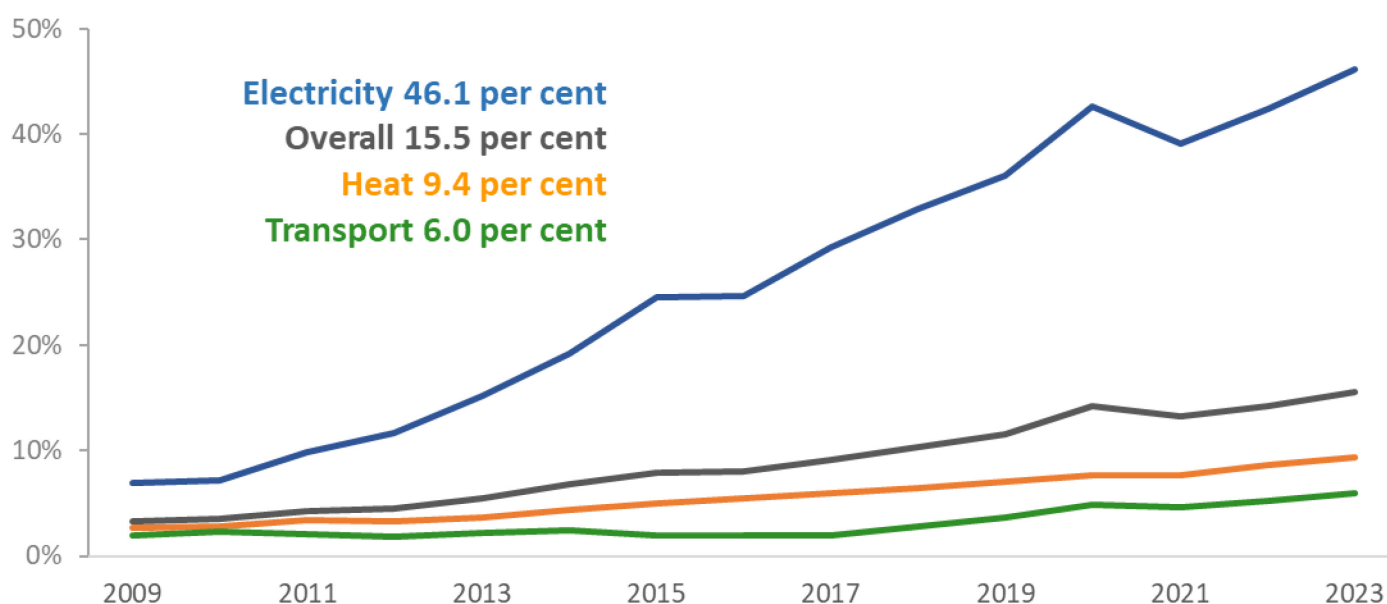
Indigenous production of bioliquids increased by 7.9 per cent in 2023. Overall capacity increased by 3.7 per cent due to biodiesel capacity; bioethanol capacity has remained stable at 504 ktoe per annum for the most recent three years.

Biogas injected into the National Grid increased by 11 per cent in 2023 driven by sewage gas which has almost doubled since 2022 due to several new sites coming online. Biogas from anaerobic digestion, however, still dominates grid injected biogas representing 85 per cent of the total.

To place renewable energy in context, [DUKES Table 6.5](#) provides a measure for the share of renewables across the various energy flows, as well as estimates for the renewable proportion of **Gross Final Consumption (i.e. before losses) for electricity and heat**. The renewable share of transport fuels is on an actual basis as presented in the final consumption by sector chart (Chart 6.9).

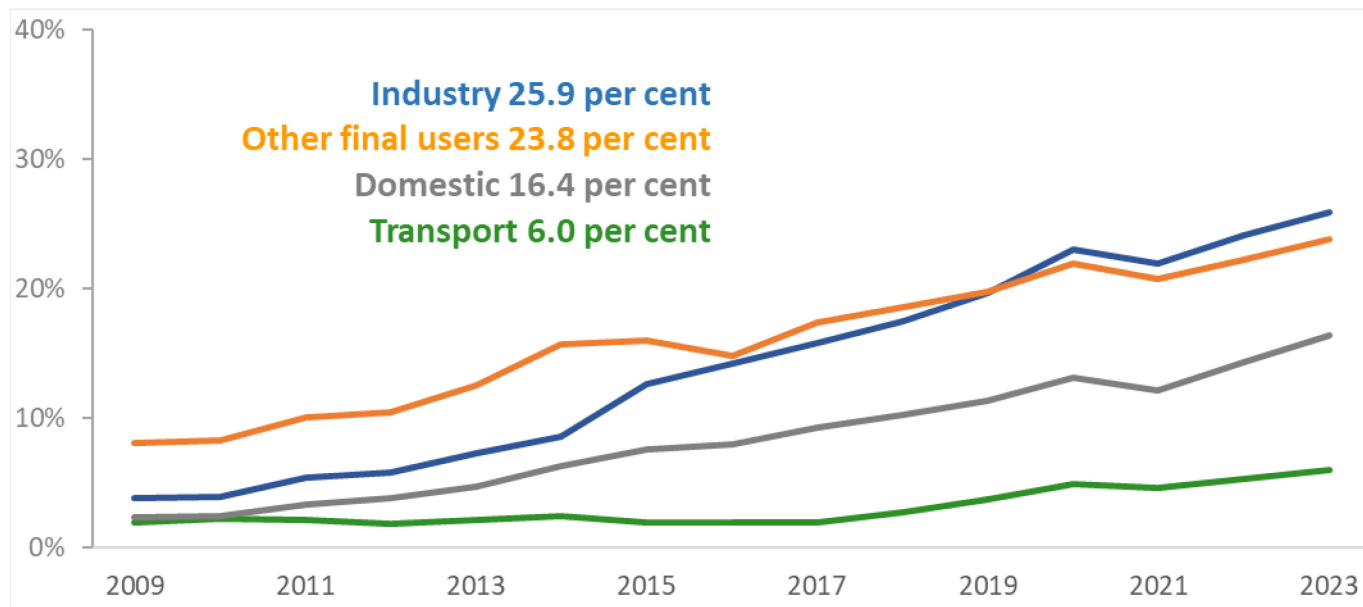
The proportion of electricity from renewables differs to that for generation and supply in that it excludes generation ultimately consumed in transport which is allocated to the transport measure. The underlying trend is however similar in that weather impacts are visible particularly between 2020 and 2021. Weather influences can also be seen between 2015 and 2016; despite this being a period of strong renewable capacity growth, generation was flat for the year with lower wind speeds, sun hours and rainfall. The heat measure is based on renewable fuels allocated to heat in Table 6.4; although some electricity will be consumed for heating purposes, this is allocated to electricity. Although over time, renewable fuels used in transport and heat have increased, both remain modest when compared with renewable electricity.

Chart 6.9 Renewable energy as a proportion of total gross final consumption ([DUKES Table 6.5a](#))



The renewable proportion of fuels consumed by sectors, regardless of end use, varies depending not only on the proportion of thermal fossil fuels and bioenergy, but also on the share of electricity consumption which has seen its renewable proportion dramatically increase over the time period. Chart 6.10 below shows the changing proportion of renewables for each consuming sector.

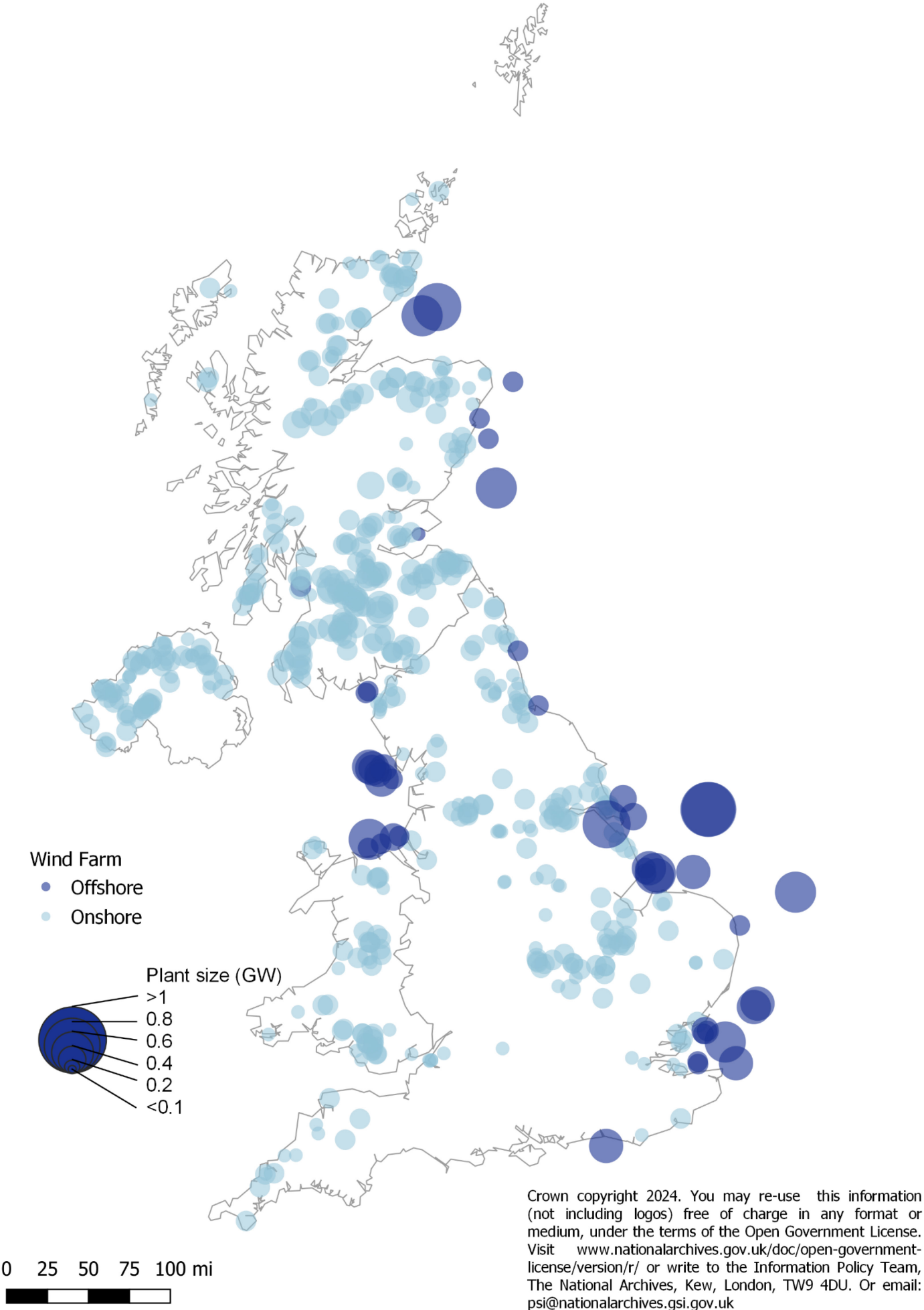
Chart 6.10 Renewables' share of final energy consumption by sector ([DUKES Table 6.5b](#))



All sectors show an increase in their share of renewable consumption, in line with an increase in renewable electricity supply. Between 2016 and 2019, the proportion of renewables consumed by industry fell in line with that for other final consumers, though remained slightly lower. This historic trend was driven by the shift from the high-grade heat requirements of heavy industry to lighter, less energy intensive industries. In 2019, industry's share of renewables exceeded other users' share for the first time. Although the fuel switching within sectors over this period is subtle, it has largely been driven by a relatively higher increase in the share of bioenergy and electricity consumption in industry combined with a fall in the share of natural gas, compared to an increase for other sectors. The domestic sector also saw a notable increase in 2023 due to higher levels of wood and plant biomass consumption combined with an increase in heat pump usage.

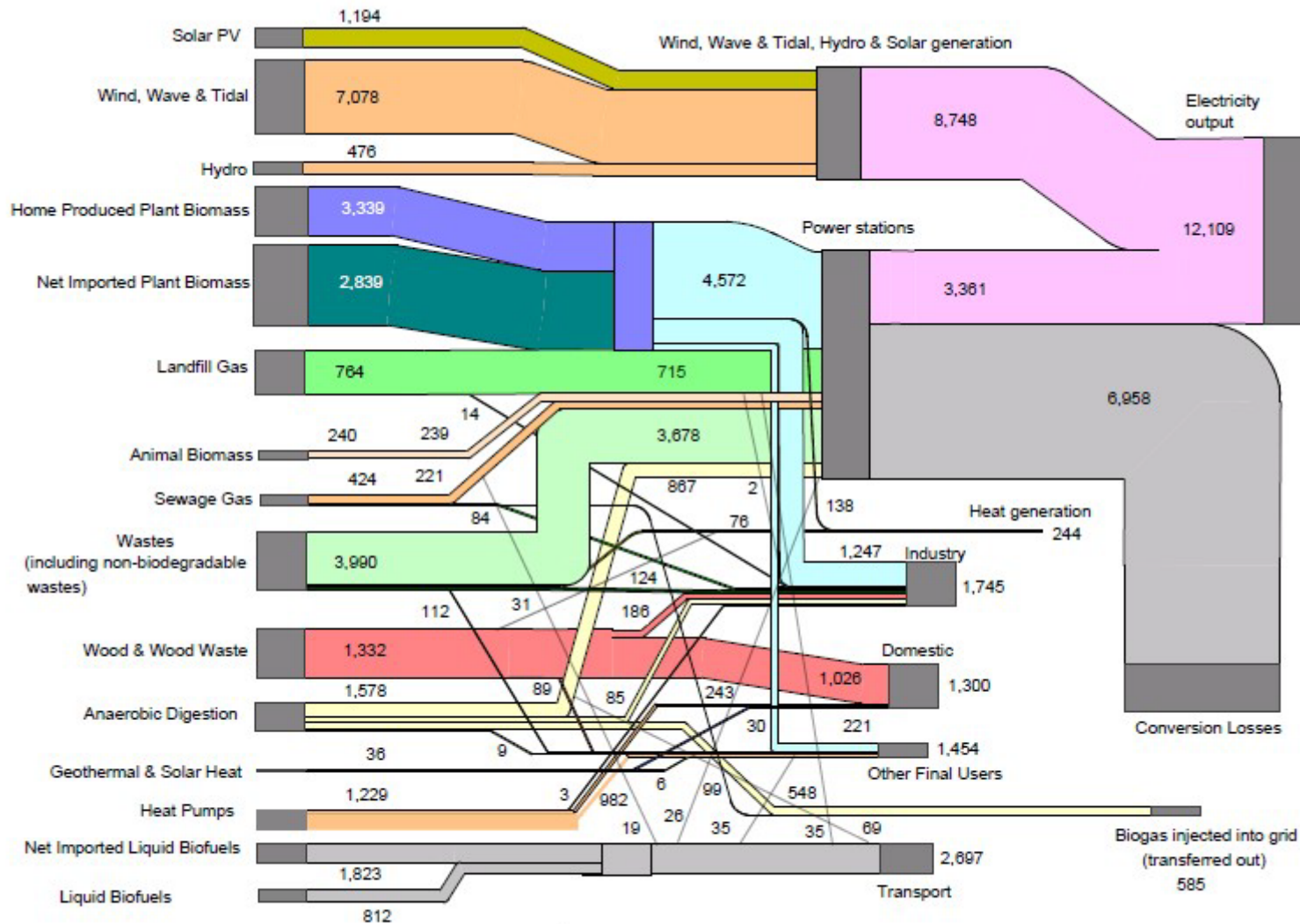
The map below shows UK wind farms that were operational at the end of 2023 with a capacity 5 MW or more; there are around 9,000 sites below this threshold and other sites are excluded due to a lack of precise location data. The locations are representative and not exact.

Map of UK wind capacity 2023



Renewable energy flow chart 2023 [\(DUKES Tables 6.1 and 6.2\)](#)

The renewable energy flow chart overleaf summarises the flows of renewables including production, net imports through to final outputs by sector. It also shows the conversion losses associated with thermal renewable generation. The data are sourced from the commodity balance Table 6.1, and Table 6.2 for electricity outputs.



Chapter 7: Combined Heat and Power (CHP)

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Key headlines

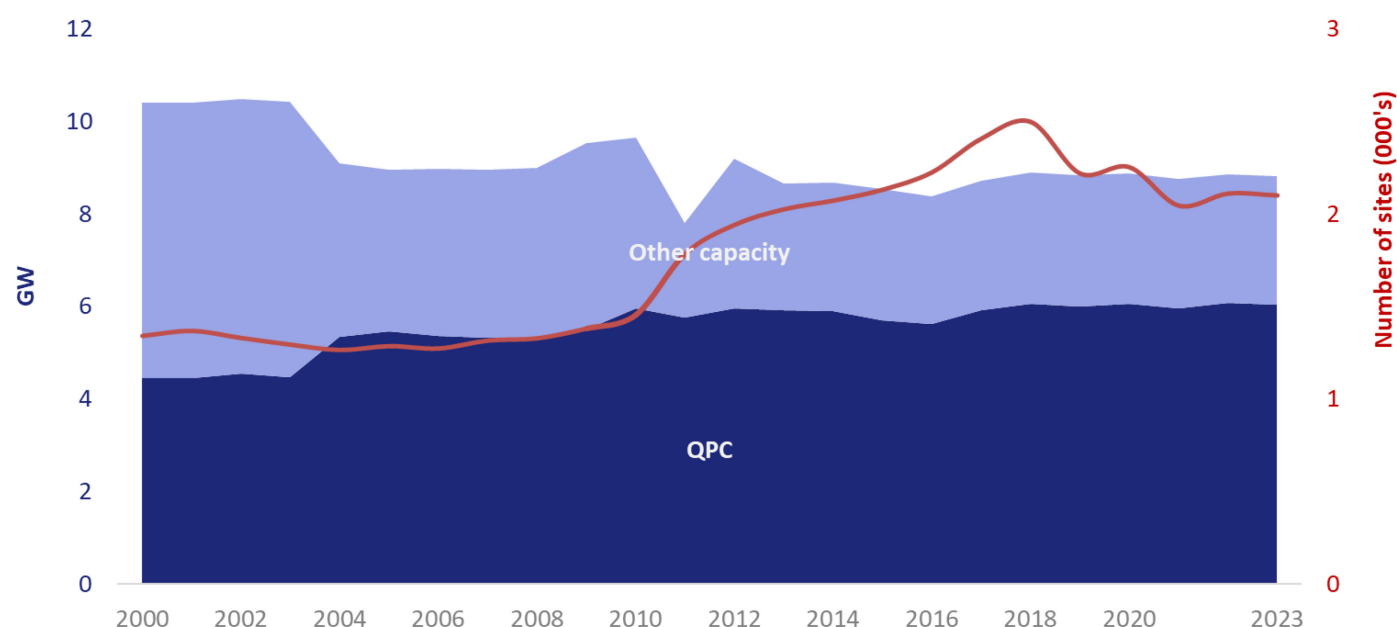
In 2023, renewable fuels accounted for 17 per cent of total CHP fuel input, a new record.

CHP qualifying output represented 7.6 per cent of total electricity generation, a 0.3 percentage increase on 2022; although CHP generation decreased, this was to a lesser extent compared to total UK generation.

Gas continues to be the main fuel consumed in CHP plants (around two thirds of fuel input), representing 8.4 per cent of gas demand.

CHP (or cogeneration) is the simultaneous generation of electricity and heat resulting in improved efficiencies when compared to meeting electricity and heat demands separately. The data for this section is primarily collected in support of the CHP Quality Assurance programme (CHPQA) but is supplemented with other sources to provide as comprehensive a picture as possible for UK CHP statistics. The CHPQA programme assesses and certifies schemes eligible for various incentives; not all output from a scheme is eligible, but where it is, it is referred to as 'good quality', or qualifying. Chart 7.1 shows the qualifying and other (non-qualifying) capacity compared to the number of schemes.

Chart 7.1 Comparison of total and qualifying electrical capacity from 2000 ([DUKES Table 7.1.A](#))

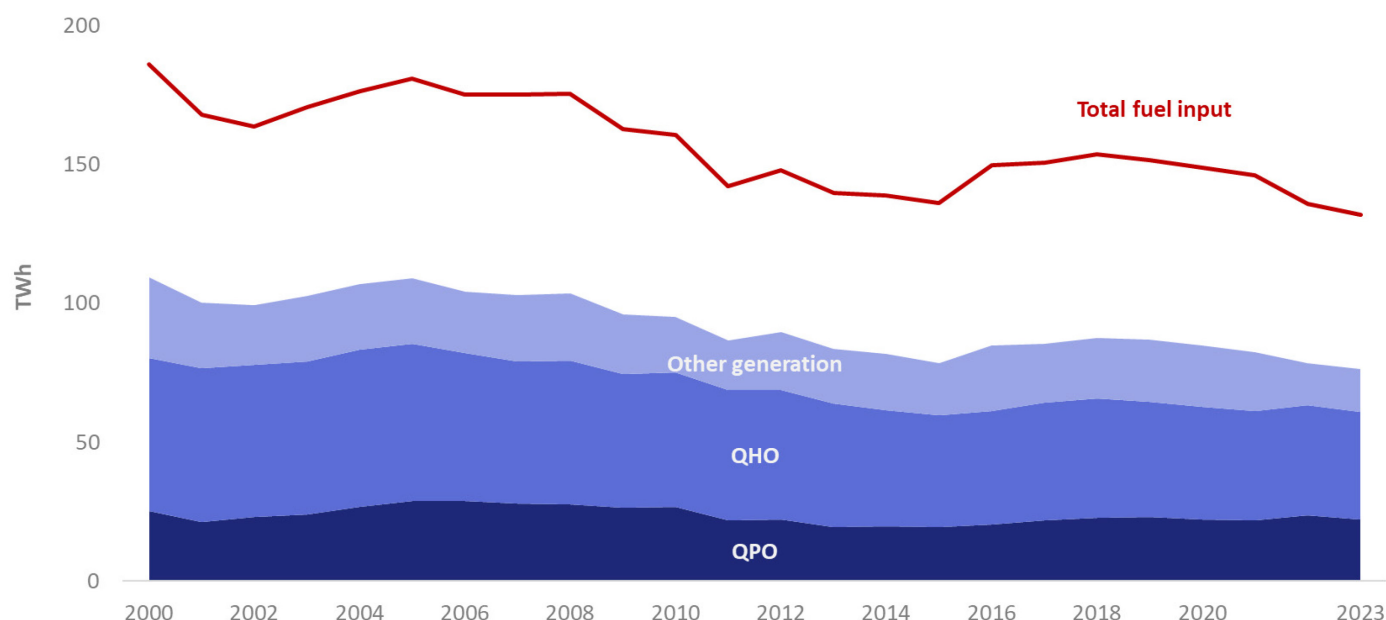


Since 2000, the number of sites remained steady until 2011 and 2012 when an additional data source was identified, and extra schemes were included in the database. The number of schemes then peaked in 2018, before falling by around 400 units between 2019 and 2023. This coincides with a decision taken by DESNZ to remove all schemes for which no new information had been obtained for at least nine years. Most of these

schemes were small scale (non CHPQA schemes) and whilst their removal is apparent in the time series for the number of schemes, the impact on capacity is barely discernible. Since 2000, total electrical capacity has fallen by 15 per cent but qualifying capacity has increased by 36 per cent, resulting in its share increasing from 43 per cent in 2000 to 68 per cent in 2023.

In 2023, 80 per cent of CHP outputs were deemed to be qualifying, around two thirds of which was heat. Chart 7.2 shows CHP outputs, qualifying and non-qualifying, compared to total fuel input.

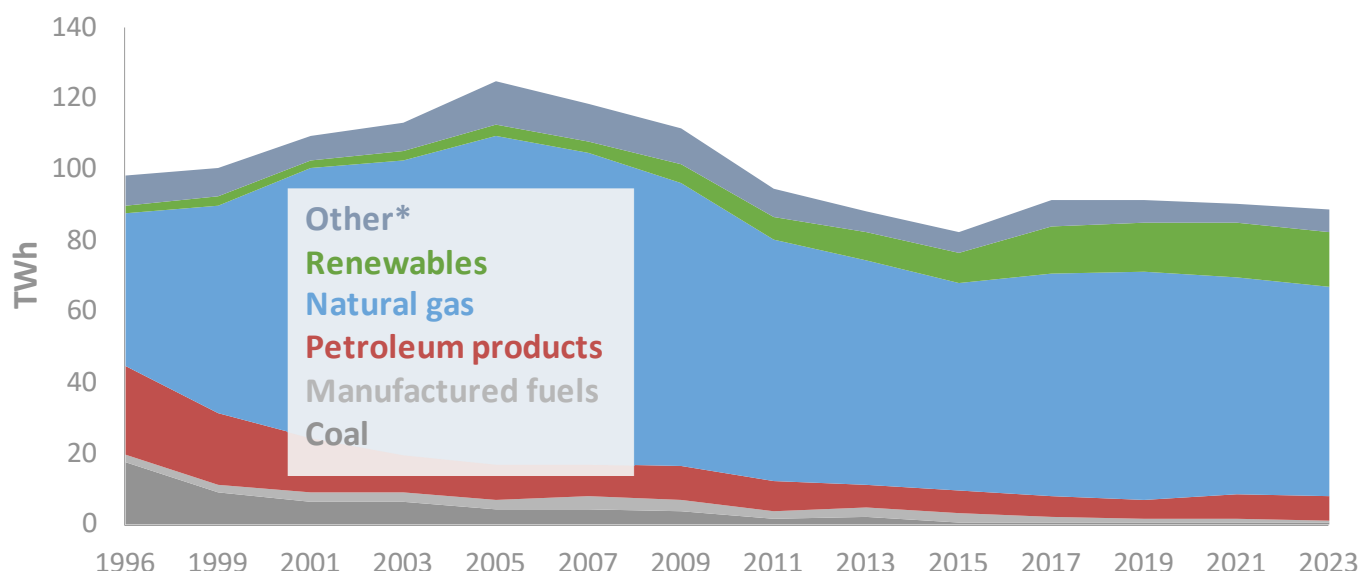
Chart 7.2 Comparison of total fuel and CHP outputs from 2000 ([DUKES Table 7.1.A](#))



Although not a perfect relationship, CHP outputs tend to be driven by the underlying difference between the price of gas and electricity, the spark gap; the larger the gap, the cheaper gas is relative to electricity which makes cogeneration more economically viable. This partly explains the decline from 2006 to 2015 and the subsequent turnaround following a widening of the spark gap in 2013.

Natural gas remains the main fuel consumed by CHP schemes representing 66 per cent of the total in 2023, although its share has fallen slightly over the most recent years. The use of coal and petroleum products continues to fall with renewables increasing its share to 17 per cent in 2023. Chart 7.3 shows this long-term trend.

Chart 7.3 Trends in fuel demand for CHP¹ 1996 to 2023 (DUKES Table 7.1.B)



In 1996, the share of natural gas was just 44 per cent but by 2005, it had reached a maximum of 74 per cent. Although its share then stabilised at around 70 per cent, it has fallen by around 4 percentage points since 2019. Conversely, coal and manufactured fuels' share represented 20 per cent in 1996 but has plummeted to 1.4 per cent in 2023. Use of renewables was stable at around 2 per cent until as recently as 2007 but has steadily increased to double digit figures since 2014, reaching a record high of 17 per cent in 2023.

CHP is deployed across a variety of sectors including power generation, refineries, industry, public administration, and commercial. Around two thirds of CHP sites operate in services (public administration and commercial), with industrial schemes making up for the remaining third. However, industrial CHPs are larger in terms of capacity, with refineries alone accounting for the largest share of electrical capacity, 35 per cent, but just 0.5 per cent of the number of sites. In contrast, the commercial sector has 23 per cent of the sites but accounts for just 4 per cent of the capacity.

The concentration and size of CHP schemes also varies across the UK, with the differences often mirroring the needs of the area's most developed economic sectors. Chart 7.4 shows Yorkshire and Humberside has the highest CHP capacity including the UK's largest scheme resulting in the highest average capacity per site (Table 7.8.A) across the regions (11.0 MW, markedly higher than the next highest at 3.5 MW for the South East). The South West has the lowest average capacity per site (0.9 MW), and the region with the highest number of schemes is the London (average capacity per site at 1.0 MW).

¹ Fuel demand for heat and qualifying electricity output

Chart 7.4 Number of schemes and capacity by region in 2023 ([DUKES Table 7.8](#))



Table 7.8.E shows the distribution of capacity across the different sectors and regions with London accounting for almost half of all capacity in the electricity, gas, steam and air conditioning supply sector which includes district and community heating schemes. The chemicals sector which, along with oil refineries, is suitable for CHP, is concentrated in the North East, the North West and Yorkshire and Humberside; taken together these regions account for over 80 per cent of CHP capacity in those sectors.

The large share of capacity employed in vehicle manufacture in the West Midlands is in line with the importance of this region to the automotive sector. More than a third of all capacity in the food and drink sector is in the Eastern region reflecting the large heat demands associated with sugar manufacture. The concentration of large horticultural sites (i.e. greenhouses) in South East England helps to explain the deployment of 44 per cent of all agricultural capacity in this region. The distribution of capacity serving public administration, mostly hospitals and education, tends to align with population density.

In 2023, 32 per cent of qualifying outputs (heat and electricity) were exported with the remaining 68 per cent being used on site. Less than half of qualifying electricity is exported (43 per cent) with the majority being split between power suppliers (i.e. exported to the grid) and sold under contract. Other generation, however, is mostly exported (77 per cent) with exports fairly evenly distributed across the output sectors. Heat is mostly consumed within the CHP scheme but of the heat which is exported, the majority is sold under contract (this heat is reported under the 'heat sold' column in [DUKES Table 1.1](#)).

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- 7.1 Overall CHP deployment, use and performance
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- 7.3 CHP fuel used, capacity and generation by fuel and technology types
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- 7.5 Large scale CHP schemes in the United Kingdom, December 2023
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- 7.7 Exports of electricity and heat from CHP schemes
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- 7.9 CHP in context

Symbols used in data tables

[x] is used to indicate data not available.

Individual entries in the tables are rounded independently and this can result in totals, which are different from the sum of their constituent items. Some of the data shown in this Digest may contain previously unpublished revisions.

Annexes and annex tables

Full annex documents and tables can be found by visiting [the DUKES collection page](#).

Annex A: Energy and commodity balances, conversion factors, calorific values and density of fuels

A.1 Estimated average gross calorific values of fuels 1980, 1990, 2000, 2010, 2020 and 2021 to 2023

A.2 Estimated average net calorific values of fuels, 1980, 1990, 2000, 2010, 2020 and 2021 to 2023

A.3 Estimated average density of fuels 2002 to 2023

Annex B: Glossary and acronyms

Annex C: Further sources of UK energy publications

Annex D: Major events in the energy industry

Annex E: Energy and the environment

E.1 Gas flared and vented by oil and gas fields and terminals

Annex F: Oil and gas resources

F.1 Crude oil and Natural Gas Liquids production

F.2 Gas production

F.3 Natural Gas Liquids net production

F.4 Disposals of crude oil

Annex G: Foreign Trade

G.1 Volume of imports and exports of fuels

G.2 Value of imports and exports of fuels

Annex H: Flow charts

Annex I: Energy balance net calorific values

I.1 Aggregate energy balance: net calorific values, 2004 to 2023

Annex J: Heat reconciliation

J.1 Heat sold reallocation, 1999 to 2023

Additional information

This section outlines the key principles when presenting energy statistics to help you understand the balance data tables. More information can be found in Annex A: Energy and commodity balances, conversion factors, calorific values and density of fuels. Annex B contains a glossary, which provides definitions of technical terms used. Annexes A and B can be accessed from [the main DUKES page](#).

Balance principles

Balances are divided into two types, each of which performs a different function:

1. **Commodity balance** - a balance for each energy type that uses specific measurement units usually associated with that commodity. It shows the flow of the commodity from its sources of supply through to its final use. Commodity balances are presented in the individual fuel chapters of this publication.
2. **Energy balance** - presents the commodity balances in a common unit and places them alongside one another in a manner that shows the dependence of the supply of one commodity on another. The energy balance format is used in Chapter 1.

Both types show the flow of the type of energy from its supply through to its final use. The following sections give an overview of the supply and demand flows shown in each type of balance.

Supply to the energy balances

Production

This covers indigenous production and generation or manufacture of energy using other energy sources as fuel (for example, heating water using gas to produce steam turbine electricity).

Other sources

This covers sources that do not represent “new” supply. These may be recycled products, recovered fuels (slurry or waste coal), electricity from pumped storage plants, or transfers of ethane, propane, and butane from gas stabilisation plants at North Sea terminals.

Imports and exports

These figures relate to energy moving into or out of the UK. Exported commodities are produced in the UK and imported commodities are for use within the UK. The figures thus exclude commodities that move into and out of HM Revenue and Customs bonded areas.

Marine bunkers

These are deliveries of fuels (usually fuel oil or gas oil) to ships of any flag for consumption during their voyage to other countries.

Stock changes

Additions to and withdrawals from stocks held by producers and transformation industries correspond to withdrawals from (- sign) and additions to supply (+ sign), respectively.

Transfers

A movement of a fuel out of one type is shown with a negative sign, to indicate that it has been withdrawn from supply. The movement into the other fuel is shown as a positive. The transfers row would ideally sum to zero, but differences in calorific values can result in non-zero values. There are several reasons why quantities may be transferred from one commodity balance to another:

- a commodity may no longer meet the original specification and be reclassified.
- the name of the commodity may change through a change in use.
- to show quantities returned to supply from consumers. These may be by-products rather than fuels.

The total supply available for national use is obtained by summing these flows in the balance.

Statistical differences

Any excess or shortfall in supply compared to demand is shown as a statistical difference. A negative figure indicates that demand exceeds supply. These arise because data has been gathered from a variety of independent sources and reflect differences in timing, in definition of activity or commodity. Differences also arise in the measurement of the flow of the commodity. A non-zero statistical difference is normal and, within reason, is preferable to a statistical difference of zero, which would suggest that a data provider has adjusted a figure to balance the account.

Demand in the energy balances

The demand section is divided into demand for transformation, for use in the energy industries, and a section covering uses by final consumers.

Transformation

This covers processes and activities that transform the original primary (and sometimes secondary) commodity into another type. Most transformation corresponds to an industry whose main business is to manufacture a particular type of energy such as electricity generators. Some activities produce another commodity as a by-product. All are included in the energy balances.

Electricity generation

Quantities of fuels burned for the generation of electricity. The activity is divided into two parts, covering the major power producers (for whom the main business is the generation of electricity) and autogenerators (who produce electricity as a by-product of another process). Where a generator uses combined heat and power plant, the figures include only the part of the fuel use corresponding to the electricity generated.

Heat generation

Quantities of fuel burned to generate heat that is sold under contract to a third party. This includes heat that is generated and sold by combined heat and power plants and by community heating schemes (also called district heating).

Petroleum refineries

Crude oil, natural gas liquids and other oils needed by refineries for the manufacture of finished oil products.

Coke manufacture and blast furnaces

Quantities of coal for coke ovens and all fuels used within blast furnaces. The consumption of fuels for heating coke ovens and the blast air for blast furnaces are shown under Energy industry use.

Patent fuel manufacture

Coals and other solid fuels used for the manufacture of solid patent fuels.

Other

Any minor transformation activities not specified elsewhere.

Energy industry use

Consumption by both extraction and transformation industries to support the transformation process (but not for transformation itself). Typical examples are the consumption of electricity in power plants, or the use of extracted gases on oil and gas platforms.

Losses

Intrinsic losses that occur during the transmission and distribution of electricity and gas (including manufactured gases). Other metering and accounting differences for gas and electricity are within the statistical difference, as are undeclared losses in other commodities.

Final consumption

This covers consumption of commodities for energy and non-energy uses. The energy disappears from the account after use. Final consumption for energy purposes is divided into use by sector of economic activity. The classification of consumers according to their main business follows, as far as practicable, Standard Industrial Classification codes (SIC 2007). The section on Sector breakdowns below shows the breakdown of final consumers used, and how this corresponds to SIC codes 2007.

Sector breakdowns

Categories for final consumption are defined by Standard Industrial Classification codes 2007:

Category of user	SIC 2007
Fuel producers	05-07, 09, 19, 24.46, 35
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*)
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 by SIC, defined as deliveries to residential properties

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

The qualifications to, and constraints on, use of the classification are described in [the energy balance methodology note](#).

Technical information

Methodology

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 very large. Figures relate to the United Kingdom unless otherwise indicated. Further information is available from the North Sea Transition Authority at <https://www.nstauthority.co.uk/>.

Standard conversion factors

This Digest uses the tonne of oil equivalent (toe) as the common unit of energy for comparing and aggregating fuels. The following table gives factors for converting between this unit and alternative units of energy found in this and other publications (see Chapter 1, Technical notes and definitions and Annex A).

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

A selection of estimated average gross calorific values for 2023 (see also Annex A)

Fuel category	GJ per tonne	Fuel category	GJ per tonne
Coal		Renewable sources	
All consumers (weighted average)	26.9	Domestic wood	16.3
Power stations (including imports; weighted average)	26.5	Industrial wood	20.3
Iron and steel	30.4	Municipal solid waste	10.1
Other industries (weighted average)	26.7	Petroleum	
Imported coal (weighted average)	28.4	Crude oil (weighted average)	45.7
Exported coal (weighted average)	28.0	Petroleum products (weighted average)	46.3
Coke	29.8	Petrol	47.0
Coke breeze	29.8	Gas/diesel oil	45.3
Other manufactured solid fuel	29.6	Road diesel	45.8
		Fuel oil	43.4
Gases (MJ per cubic metre)			
Natural gas (produced)	40.8		
Landfill gas	21-25		
Sewage gas	21-25		

Geographical coverage

The geographical coverage of the statistics is the United Kingdom. However, within UK trade statistics, shipments to the Channel Islands and the Isle of Man from the United Kingdom are not classed as exports. Supplies of solid fuel and petroleum to these islands, from the UK, are therefore included as part of United Kingdom inland consumption or deliveries.

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](#). DESNZ's [statements of compliance with the Code](#) are available online, as well as the [UK Statistics Authority reports on their regular assessments of energy statistics](#). The authority's recommendations have been incorporated into this publication and other DESNZ energy statistical publications and outputs.

DUKES tables contain revisions to some of the previously published figures. A table showing the size of revisions to key aggregates is shown below. Statistics on energy in this Digest are classified as National Statistics. This means that they are produced to high professional standards as set out in the UK Statistics Authority's Code of Practice for Official Statistics. The Code of Practice requires that all the public bodies that produce official statistics "Publish a revisions policy for those outputs that are subject to scheduled revisions, and provide a statement explaining the nature and extent of revisions at the same time that they are released". The following statement outlines the policy on revisions for energy statistics.

It is intended that any revisions should be made to previous years' data only at the time of the publication of the Digest. In exceptional circumstances previous years' data can be amended between Digest publication dates, but this will only take place when quarterly Energy Trends is published. The reasons for substantial revisions will be explained in the 'Cover sheet' worksheet of the table concerned.

Valid reasons for revisions of Digest data include:

- Revised and validated data received from a data supplier.
- The figure in the Digest was wrong because of a typographical or similar error.
- In addition, when provisional annual data are published in Energy Trends in March, growth rates are liable to be distorted if the prior year's data are constrained, when revisions are known to be required. In these circumstances the prior year's data will be amended for all affected tables in Energy Trends and all affected Digest tables will be clearly annotated to show that the data has been updated in Energy Trends.

All validated amendments from data suppliers will be updated when received and published in the next statistical release.

All errors will be amended as soon as identified and published in the next statistical release.

Data in energy and commodity balances format will be revised on a quarterly basis, to coincide with the publication of Energy Trends.

This year, the revisions window for DUKES has been opened back to 2009 for petroleum products, 2017 for electricity, 2018 for renewables and 2020 for coal, other solid fuels and gas and 2021 for primary oil. Details of the revisions to petroleum products and electricity are explained in an [Energy Trends article](#) published in June 2024.

Revisions since DUKES 2023 for the 3 most recent years

Thousand tonnes of oil equivalent	2020	2021	2022	Percentage revisions to 2022 data
Production	-157	138	157	0.1%
Primary supply	554	103	-677	-0.4%
Primary demand	810	160	-1066	-0.6%
Transformation	-182	-227	-203	0.7%
Energy industry use	-222	-44	14	0.1%
Final consumption	755	-48	-1706	-1.3%
Industry	-858	-1277	-1373	-6.2%
Transport	925	213	-108	-0.2%
Domestic	934	872	1	0.0%
Other users	-218	208	-138	-0.7%
Non energy use	-28	-63	-88	-1.7%

Background to the Digest

This issue of the Digest of United Kingdom Energy Statistics (DUKES) continues a series which commenced with the Ministry of Fuel and Power Statistical Digest for the years 1948 and 1949, published in 1950. The Ministry of Fuel and Power Statistical Digest was previously published as a Command Paper, the first being that for the years 1938 to 1943, published in July 1944 (Cmd. 6538).

The current publication consists of seven chapters and four annexes. The first chapter deals with overall energy. The other chapters cover the specific fuels, renewable sources of energy and combined heat and power. The annexes cover conversion factors and calorific values, a glossary of terms, further sources of information and major events in the energy industries.

Where necessary, data have been converted or adjusted to provide consistent series. However, in some cases changes in methods of data collection have affected the continuity of the series. The presence of remaining discontinuities is indicated in the chapter text or in footnotes to the tables.

Chapters 6 and 7 summarise the results of surveys conducted by Ricardo Energy & Environment on behalf of DESNZ, which complement work undertaken by DESNZ. These chapters estimate the contribution made by renewable energy sources to energy and combined heat and power (CHP) production and consumption in the United Kingdom.

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Accredited official statistics and user engagement

Accredited official statistics

These 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](#).

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.

Enquiries about statistics in this publication should be made to the contact named at the start of the relevant chapter. Brief extracts from this publication may be reproduced provided that the source is fully acknowledged. General enquiries about the publication, and proposals for reproduction of larger extracts, should be addressed to DESNZ.

The Department for Energy Security & Net Zero reserves the right to revise or discontinue the text or any table contained in this Digest without prior notice.

Related statistics

The Department for Energy Security & Net Zero make available other publications related to energy supply and demand that may be of interest. A full list of these and other related energy publications can be found in DUKES Annex C: Further sources of UK energy publications.

Energy Trends

More frequent monthly and quarterly data are available for total energy, solid fuels and derived gases, petroleum, gas, electricity, and renewables:

<https://www.gov.uk/government/organisations/department-for-energy-security-and-net-zero/about/statistics>

Energy prices

Monthly and quarterly prices by consumption sector and international comparisons of prices paid:

<https://www.gov.uk/government/organisations/department-for-energy-security-and-net-zero/about/statistics>

Energy Flow Chart

Annual publication illustrating the flow of primary fuels from home production and imports to their eventual final uses. They are shown in their original state and after being converted by secondary fuel producers:

www.gov.uk/government/collections/energy-flow-charts.

UK Energy in Brief

Annual publication summarising the latest statistics on energy production, consumption, and prices in the United Kingdom. The figures are taken from this Digest of UK Energy Statistics:

www.gov.uk/government/collections/uk-energy-in-brief

Sub-National Energy Consumption

Annual publication supporting local and regional decision making to deliver national energy policy objectives:

<https://www.gov.uk/government/organisations/department-for-energy-security-and-net-zero/about/statistics>

UK Greenhouse Gas Emissions

Show progress against the UK's goals, both international and domestic, for reducing greenhouse gas emissions:

<https://www.gov.uk/government/collections/uk-territorial-greenhouse-gas-emissions-national-statistics>



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