



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.

### In this release

[Total energy](#)

[Solid fuels and derived gases](#)

[Oil and oil products](#)

[Gas](#)

[Electricity](#)

[Renewables](#)

[Combined Heat and Power](#)

[Data tables](#)

[Annexes](#)

[Additional information](#)

[Technical information](#)

[National Statistics and user engagement](#)

[Related publications](#)

### Data tables

See the [full list of tables](#) and [annexes](#) for more information. Additional data are available online as part of the DUKES series:

[Total energy](#)

[Coal and derived gases](#)

[Oil and oil products](#)

[Gas](#)

[Electricity](#)

[Renewables](#)

[CHP](#)

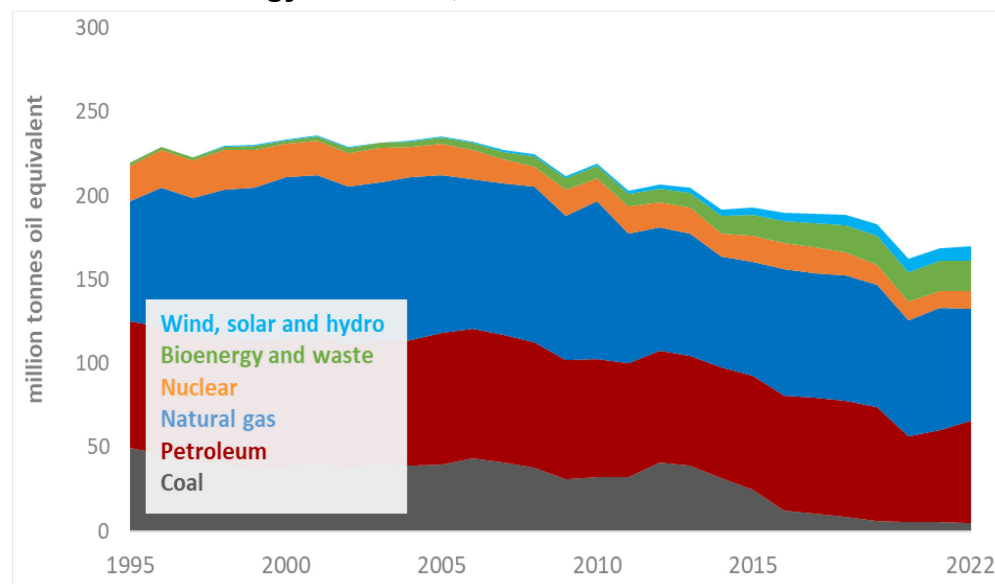
This publication is based on a snapshot of survey data from energy suppliers. New data are incorporated in line with the [revisions policy](#).

# Digest of UK Energy Statistics

## Annual data for UK, 2022

**Overall energy demand was stable on last year**, as transport demand continued to recover, up 15 per cent on last year, but still lower than pre-pandemic levels due to low demand for air travel. Demand for households and industrial use fell on the back of record temperatures in 2022 and higher energy and other prices. The fall in household demand was most notable in the final quarter of 2022, which showed a drop of 14 per cent for gas and 11 per cent for electricity despite similar temperatures to the previous year.

### Demand for energy in the UK, 1995 – 2022



**UK energy production recovered slightly** from last year's record low but remains down 14 per cent on pre-pandemic levels. Oil and coal production hit record lows, with oil down nearly 30 per cent on 2019, the last full year before the Covid-19 pandemic. Gas production is up on last year and at near pre-pandemic levels whilst output from wind, solar and hydro reached a record high. Nuclear output was up on last year's record low despite smaller operational capacity.

**Production from renewable technologies broadly matched the previous record high of 2020** and renewables share of electricity generation increased to 41.5 per cent from 39.6 per cent last year, largely due to wind and solar generation reaching new record highs. Wind generation hit a record high share of 24.7 per cent of generation. Generation from fossil fuels fell slightly (down to a share of 40.8 per cent) but generation from gas remained the principal form of UK generation at 38.4 per cent.

**Energy trade was affected by several factors.** Exports of crude oil reached a record low, but exports of gas reached a record high as the UK operated as a land-bridge for transfers of gas arriving into the UK and onto the continent. Electricity exports also hit a record high and helped make good the shortfall caused by outages in the French nuclear fleet. Imports from Russia decreased throughout the year and dropped to zero by December.

# Chapter 1: Energy

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## Key headlines

**Energy production rose by 3.1 per cent compared to the record low level of 2021.** Oil production fell to a record low level and remains down by 28 per cent on pre-pandemic (2019) levels. Gas output rose by 16 per cent, nuclear output rose by 4.6 per cent despite reduced operational capacity, but coal reached another record low. Wind, solar and hydro output rose to a record high level due to increased capacity and more favourable weather conditions.

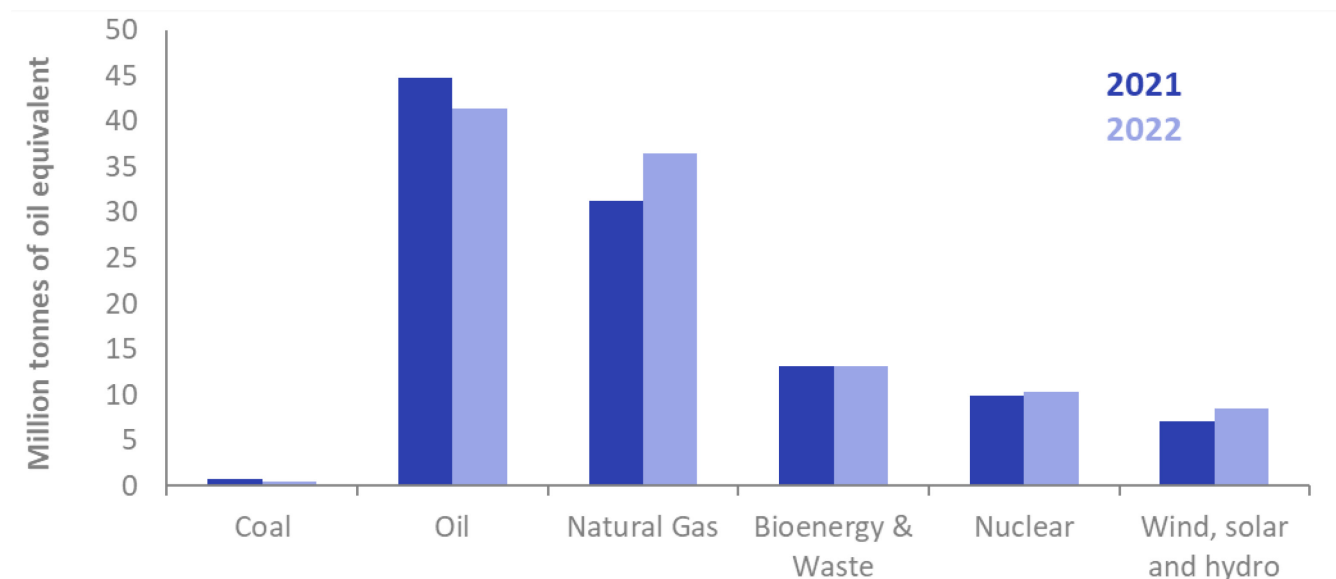
**Energy consumption in 2022 remained low**, down 0.9 per cent on 2021 and down 11 per cent on 2019. Consumption levels in 2022 fell for all sectors except for transport due to warmer weather as well as the impact of higher prices towards the end of the year; industrial sector consumption fell by 3.8 per cent to a record low level.

**Transport demand increased 15 per cent compared to last year** but remains 11 per cent below pre-pandemic (2019) levels. **Aviation fuel demand almost doubled in 2022**, but is 21 per cent below 2019 levels, whilst petrol and diesel consumption in 2022 was broadly similar to 2019 averages.

**Net imports fell by 2.6 per cent.** Imports increased by 11 per cent with gas imports at a record high level, and exports increased by 24 per cent with gas and electricity exports at record high levels, with the **UK a net exporter of electricity for the first time in over 40 years. The UK has played a key role in supplying gas to Europe as it looks to move away from Russian gas.** The UK's net import dependency stood at 37.3 per cent.

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 arrives from the US, whilst Norway provides the largest share of gas imports. **Russian imports of oil and gas reduced significantly in 2022** and ceased by the end of the year, and accounted for 2.6 per cent of total imports down from 9.6 per cent in 2021.

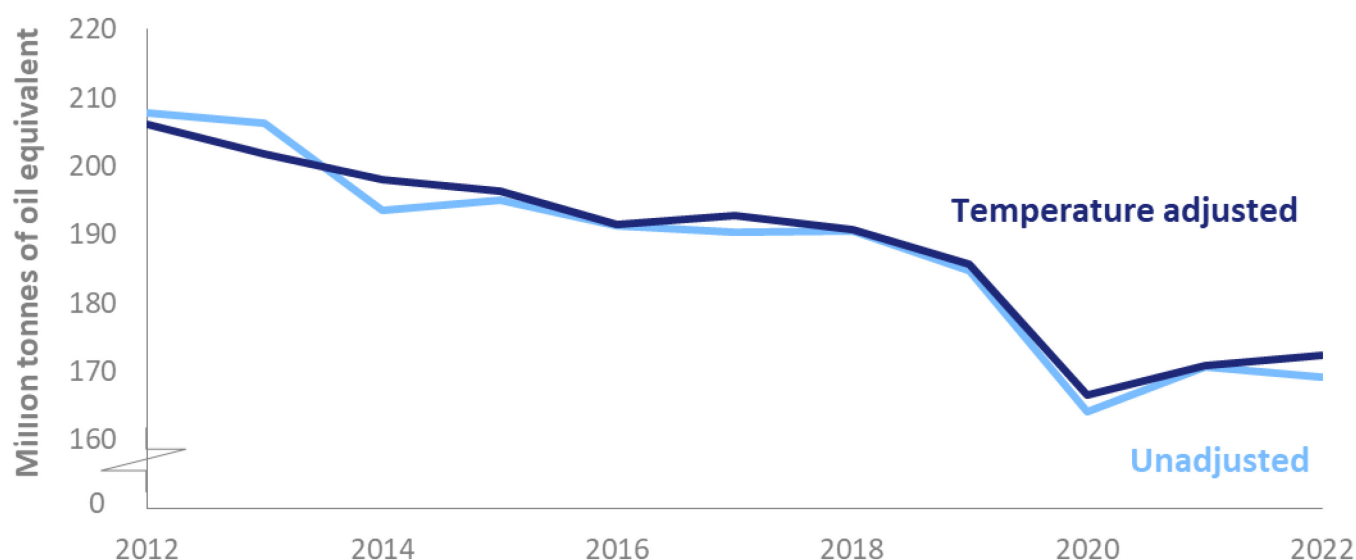
**Chart 1.1 Production by fuels, 2021 and 2022 ([DUKES table 1.1](#))**



**In 2022 total production was 110.2 million tonnes of oil equivalent, 3.1 per cent higher than the record low level of 106.8 million tonnes of oil equivalent in 2021.** Production levels for all fuels except coal, oil and bioenergy & waste are up on 2021, with **oil output at a record 21st century low level.** UK production had fallen year on year since 2018 before the rise in 2022, and production is now 63 per cent below the peak recorded in 1999.

In 2022 coal production fell by 39 per cent to a record low level, whilst production of oil fell by 7.6 per cent to a record low level, with output down by 28 per cent on pre-pandemic (2019) levels, conversely production of natural gas rose by 16 per cent and is down just 3.0 per cent on pre-pandemic levels. Production of bioenergy and waste fell marginally, whilst nuclear output rose by 4.6 per cent despite operational nuclear capacity having decreased following the closure of Hunterston B in January 2022 and Hinkley Point B starting the defueling phase from August 2022. Wind, solar and hydro output rose by 21 per cent to a record high level due to increased wind and solar capacity and more favourable weather conditions. In 2022 the average wind speed was 8.5 knots, 0.7 knots higher than in 2021, and there were 4.9 sun hours per day in 2022, 0.8 sun hours higher than in 2021.

**Chart 1.2 Primary energy consumption, 2012 to 2022 ([DUKES tables 1.1 and 1.1.4](#))**

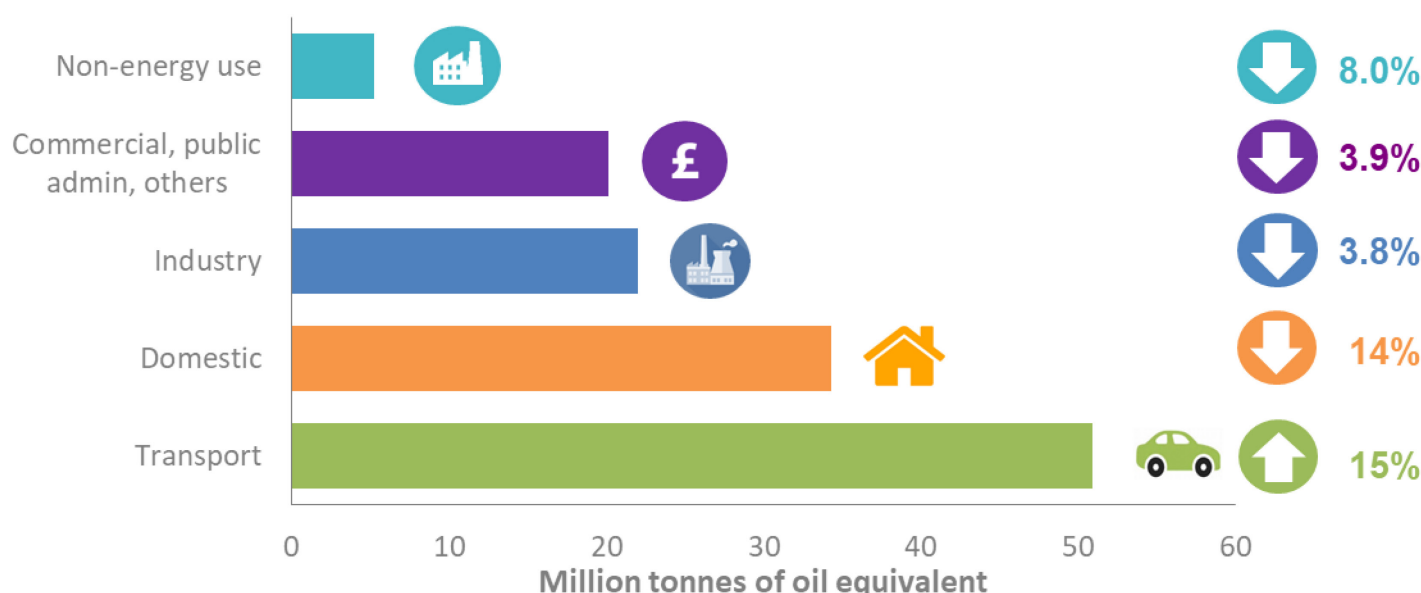


**In 2022 total primary energy consumption was 169.2 mtoe, 0.8 per cent lower than in 2021, with record high temperatures and higher energy and other prices a key factor in the reduced consumption levels.**

Primary energy consumption includes use by consumers, fuel used for electricity generation and other transformation. On a seasonally adjusted and annualised rate that removes the impact of temperature on demand, consumption was 172.3 mtoe, 0.9 per cent higher than in 2021.

In 2022 total primary energy consumption levels fell for all fuels except oil. Consumption of oil rose by 11 per cent, with sales of petrol and diesel broadly similar to pre-pandemic (2019) levels, and aviation fuel sales up significantly on 2021. Consumption of coal and other solids fell by 9 per cent due to limited demand from electricity generators, whilst natural gas consumption fell by 8.6 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 warmer temperatures. Consumption of bioenergy & waste fell by 1.5 per cent. Primary electricity consumption fell by 3.3 per cent, within which nuclear rose by 4.9 per cent, wind, solar and hydro rose by 21 per cent, but net imports fell significantly as the UK reverted to being a net exporter of electricity for the first time in more than 40 years.

**Chart 1.3 Final energy consumption by sector, 2022** ([DUKES table 1.1](#))



**In 2022 total final energy consumption including non-energy use was 132.6 mtoe, 0.9 per cent lower than in 2021, and 10 per cent lower than pre-pandemic (2019) levels.**

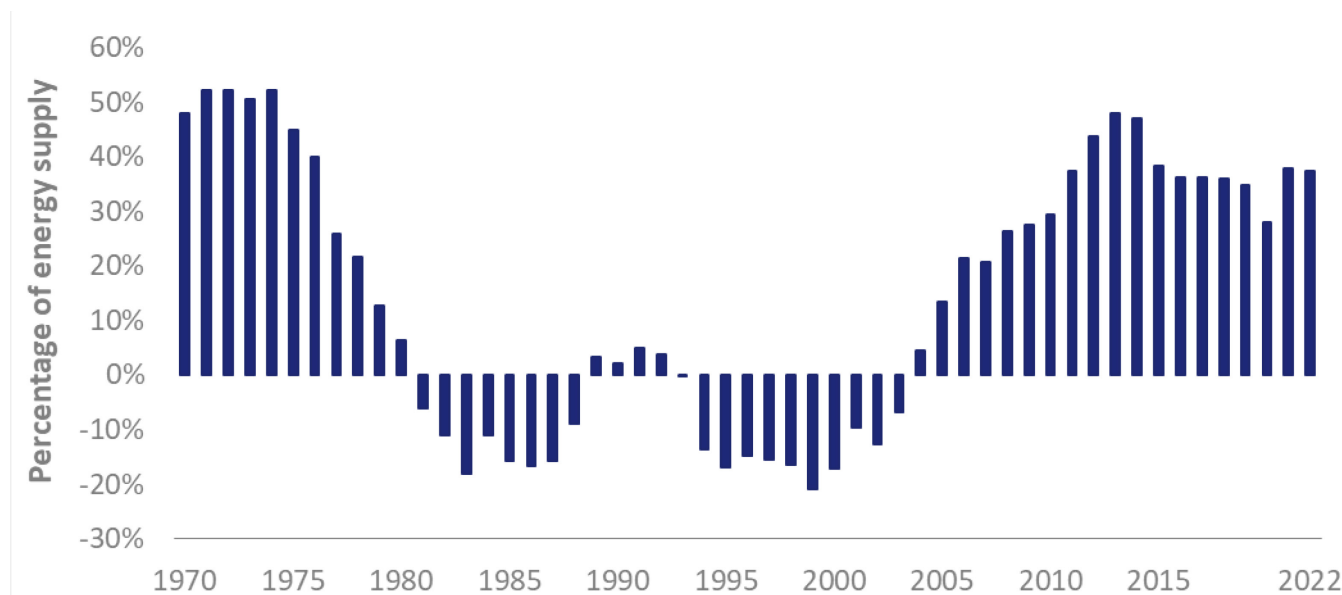
Consumption levels in 2022 all fell except for transport due to warmer weather as well as the impact of higher energy and other prices towards the end of the year.

Domestic sector consumption fell by 14 per cent due to average temperatures in 2022 reaching a record high as well as changes in consumer behaviour arising from higher prices. Transport sector consumption rose by 15 per cent, with road transport (petrol and diesel) consumption rising by 3.0 per cent and air consumption almost doubling on 2021 levels but remaining 21 per cent below pre-pandemic (2019) levels. Industrial sector consumption fell by 3.8 per cent to a near record low level and service sector consumption fell by 3.9 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 fell by 0.6 per cent, whilst on a temperature corrected basis consumption rose by 1.6 per cent (the latter mainly due to increased transport demand (up 14 per cent) as consumption in all other sectors fell on a temperature corrected basis with domestic consumption falling by 7.9 per cent and industrial consumption falling by 3.2 per cent.



**Chart 1.4 Net import dependency, 1970 to 2022 (DUKES table 1.1.3)**



**In 2022 net import dependency was 37.3 per cent<sup>1</sup>, 0.6 percentage points lower than in 2021.**

Imports in 2022 at 147.8 mtoe were 11 per cent higher than in 2021, but still 18 per cent lower than their peak in 2013. Gas imports were at a record high level, up 10 per cent on 2021. Pipeline imports fell 15 per cent as the interconnectors to Belgium and the Netherlands were used to export rather than import for the majority of the year, but LNG imports rose 74 per cent to a record high level; the UK's substantial LNG regasification infrastructure has meant that it operated in 2022 as a land-bridge for increased imports, mainly from Qatar and the US, which were then exported to mainland Europe to help reduce its dependence on Russian gas.

Exports in 2022 at 81.9 mtoe were 24 per cent higher than the record low level of 2021, with both gas and electricity exports at record high levels. Electricity exports increased almost five-fold, with the UK a net exporter for the first time in over 40 years to help meet demand in France from reduced nuclear output there.

Net imports at 65.9 mtoe were 2.6 per cent lower than in 2021 and accounted for 37.3 per cent of consumption in 2022, down from 37.9 per cent in 2021.

Despite net imports falling, the UK increased its use of fossil fuels. The main fossil fuel sources in the UK are coal, gas and oil. In 2022, the share of primary energy consumption from fossil fuels increased to 78.5 per cent from 78.1 per cent in 2021, whilst that from low-carbon sources increased to 20.7 per cent from 19.6 per cent in 2021 due to increased nuclear and renewables output.

<sup>1</sup> 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 2022, by 14 per cent to 6.1 million tonnes** compared to 2021. The fuel mix has shifted towards other sources of fuel as coal is being phased out.

**Consumption of coal for electricity generation fell 15 per cent to 2.3 million tonnes in 2022.** Wind generation was up 25 per cent due to higher-than-average wind speeds. Total renewable generation was up by 13 per cent in 2022, while gas and nuclear energy were also up (see Energy Trends table 5.4). Just four coal plants remained operational in the UK throughout 2022. Drax and West Burton had planned to close in Spring 2022 but remained available to ensure security of supply if needed over the winter. Coal use for electricity generation is expected to cease completely by October 2024.

**Production of coal fell to another record low, down 38 per cent from 2021** to 651 thousand tonnes. Surface mining production fell to a record low of 588 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.

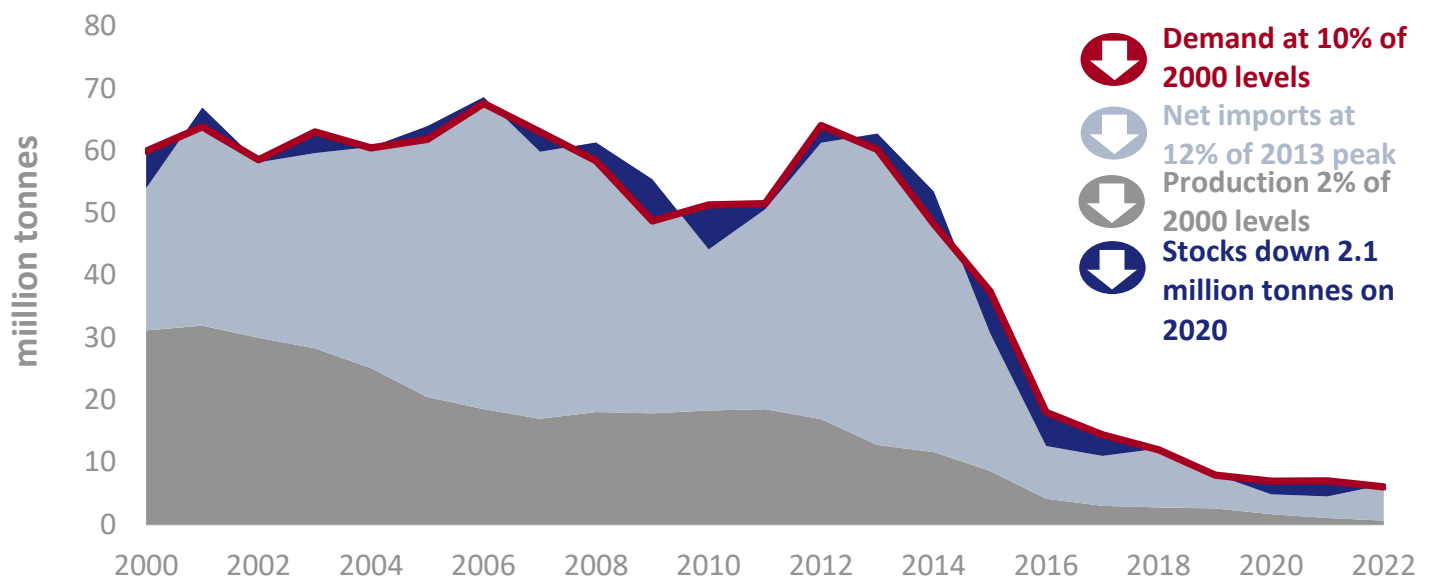
**Coal imports rose 38 per cent in comparison with 2021** to 6.4 million tonnes in 2022 as generators rebuilt stocks in the event that they were called on to secure the electricity supply over winter. In 2022 the USA was the largest exporter of coal to the UK with a share of 39 per cent. This was followed by the Russia with 16 per cent. Russia's proportion of total coal imports had fallen from 43 per cent in 2021. The UK banned Russian coal imports in August 2022.

In 2022, coal comprised 2.4 per cent of UK energy demand, down from 2.7 per cent in 2021. 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 in the past ten years.** In 2022, coal production fell to a record low of 651 thousand tonnes, down 38 per cent on 2021 (Chart 2.1).

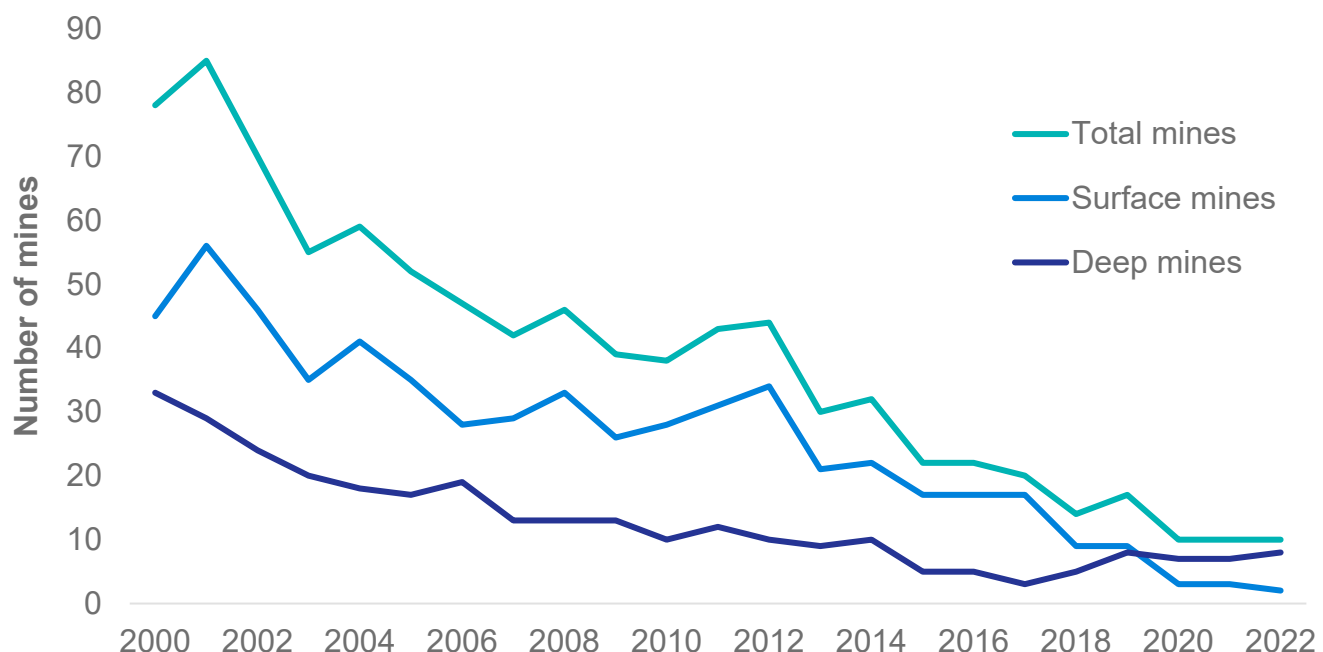
**Chart 2.1 UK coal supply and demand, 2000 – 2022** ([Table 2.1](#))



Deep mined production fell to 63 thousand tonnes and comprised 10 per cent of production in 2022. Eight deep mines remained open and another was under care and maintenance. Six deep mines reported coal production in 2022. 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.

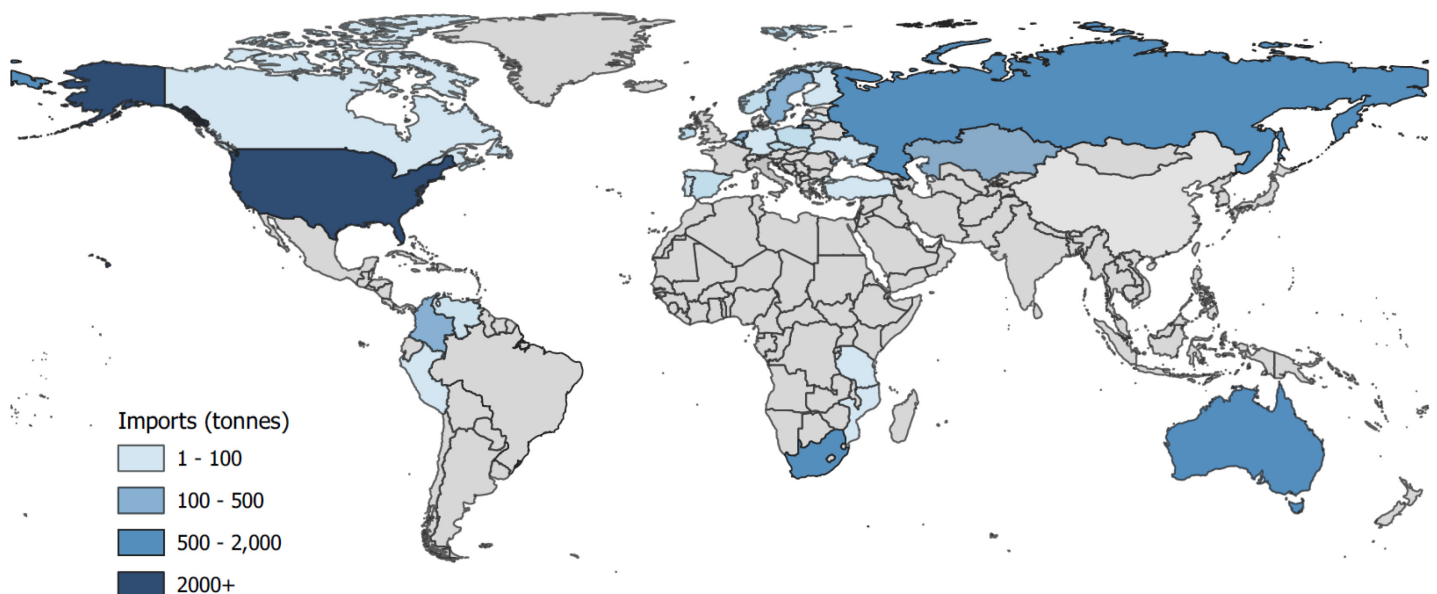
Surface mine production was down 39 per cent to a new record low of 0.6 million tonnes due to mine closures and declining demand for coal use. In 2022 just three surface mines produced coal in the UK.

**Chart 2.2 Number of coal mines producing in the UK, 2000 – 2022** ([Table 2.5](#))



**Net imports of coal also fell substantially, down 88 per cent from the peak in 2013.** This is again a result of the sharp fall in demand for coal. However, in 2022, net imports rose by 66 per cent from 2021 levels to 5.8 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 2022 net imports accounted for 92 per cent of the UK's supply. The continued decline in domestic coal production had led to imports increasing in 2022 so generators could rebuild their stocks to be available if needed in the winter.

**Map 2A showing UK Coal Imports in 2022 (thousand tonnes)**



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

Steam coal imports were 87 per cent higher at 4.5 million tonnes in 2022 compared to 2021. The USA was the largest provider of UK's steam coal (29 per cent). This was followed by Russia (22 per cent) and South Africa (14 per cent). Steam coal accounted for 71 per cent of total coal imports. Coking coal imports were down 17 per cent at 1.7 million tonnes compared to 2021. The USA was the largest provider of UK's coking coal (65 per cent). This was followed by Australia (19 per cent). Coking coal accounted for 27 per cent of total coal imports.

Russia's proportion of total coal imports have fallen from 43 per cent in 2021 to 16 per cent in 2022. 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 rose in 2022 after years of decline.** 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. However, coal stocks rose to 1.9 million tonnes in 2022, which was 10 per cent higher than in 2021. This is likely a temporary rise as generators rebuilt their stocks so that coal could be used for electricity if needed during winter 2022/23.

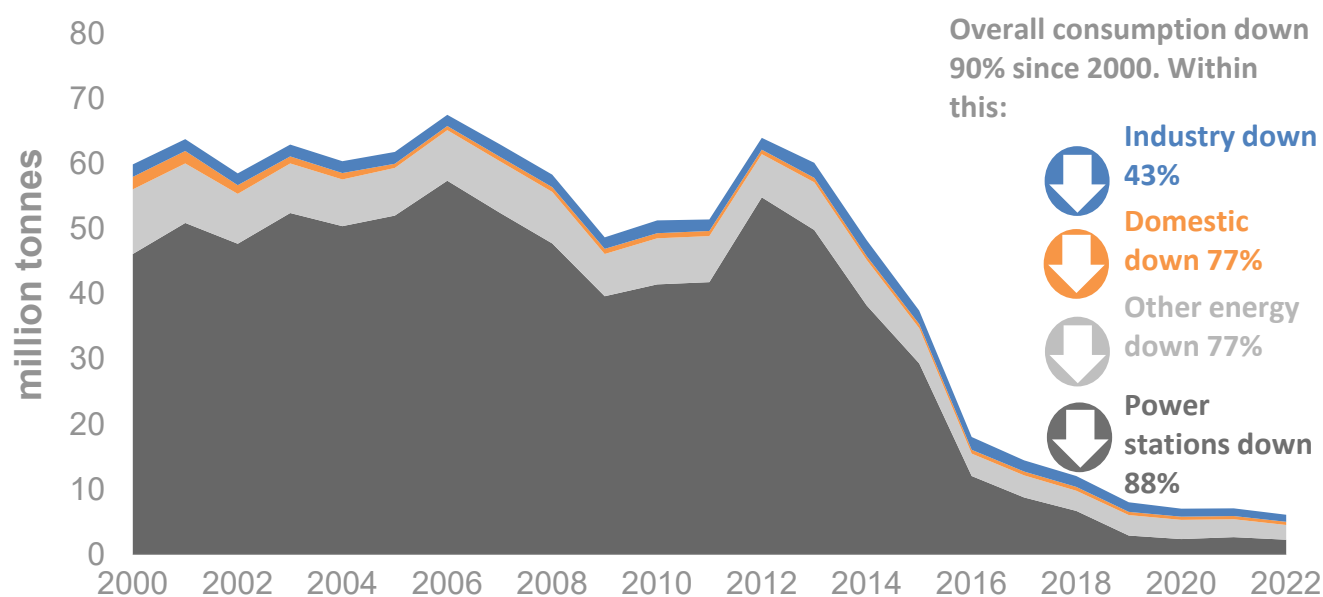
**As of June 2023, the Coal Authority estimates that in total there were 187 million tonnes of economically recoverable coal resources (Table 2.6).** Of the economically recoverable and minable coal resource in current operations (including those in the planning or pre-planning process), 145 million 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 2023.

**Demand for coal fell by 14 per cent to 6.1m tonnes in 2022, compared to 2021 (table 2.2).** Much of this decrease was driven by the 15 per cent fall in coal-fired generation to 2.3 million tonnes as other fuels were favoured for electricity generation. Wind generation was up 25 per cent due to higher-than-average wind speeds. Total renewable generation was up by 13 per cent in 2022, while gas and nuclear energy were also up. Final consumption by industry fell by 6.5 per cent, and transformation for coke manufacture and in blast furnaces fell by 19 per cent.

**A decrease in coal generation in 2022 as the trend remains downwards.** 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 four coal plants remained operational in the UK throughout 2022. Drax and West Burton had planned to close in Spring 2022 but remained available to ensure security of supply if needed over the winter. Coal use has declined since the early 1970's as new fuels (gas and renewables) entered the market and coal use for electricity generation is expected to cease completely by October 2024.

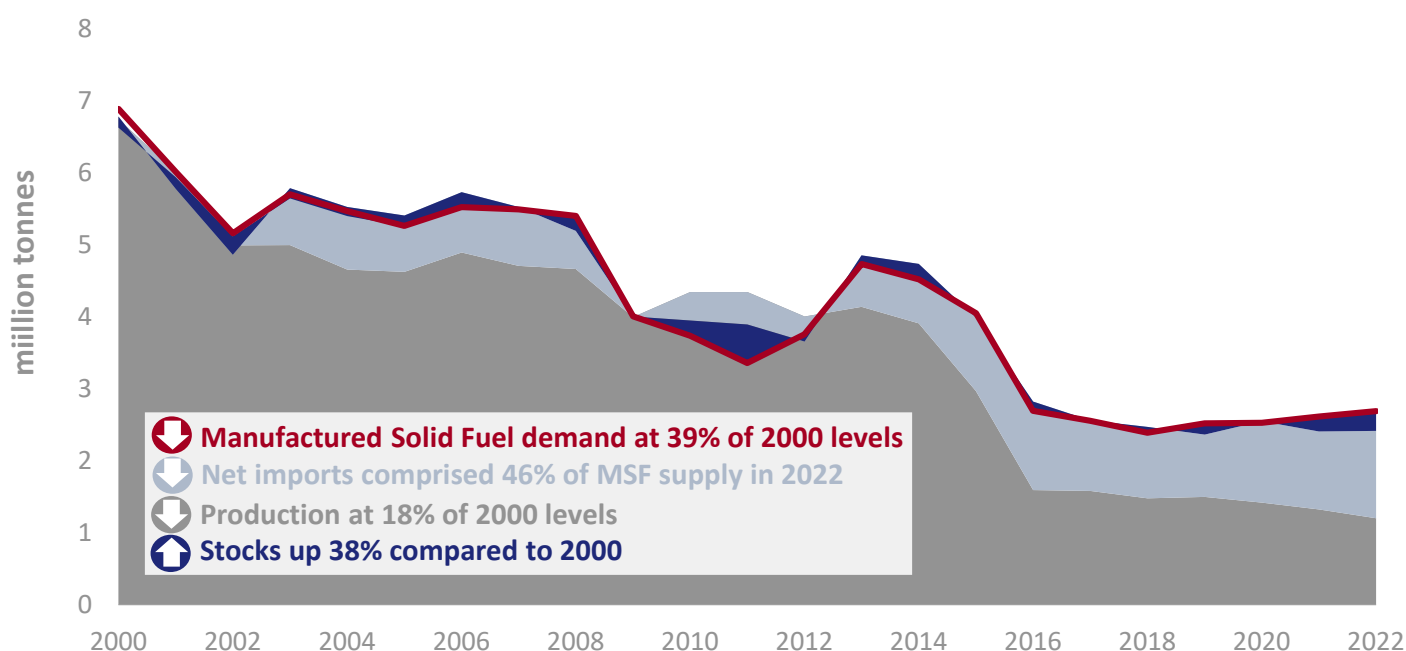
**Chart 2.3 Coal Demand, 2000 – 2022** ([Table 2.2](#))



The iron and steel industry is one of the main non-generation users of coal, for coke manufacture, blast furnaces and direct consumption. In 2022 it used 2.1 million tonnes of coal, less than half of what it used in 2015 (5.2 million tonnes). In terms of total share, it comprised 35 per cent of UK coal consumption in 2022, up from 14 per cent in 2015.

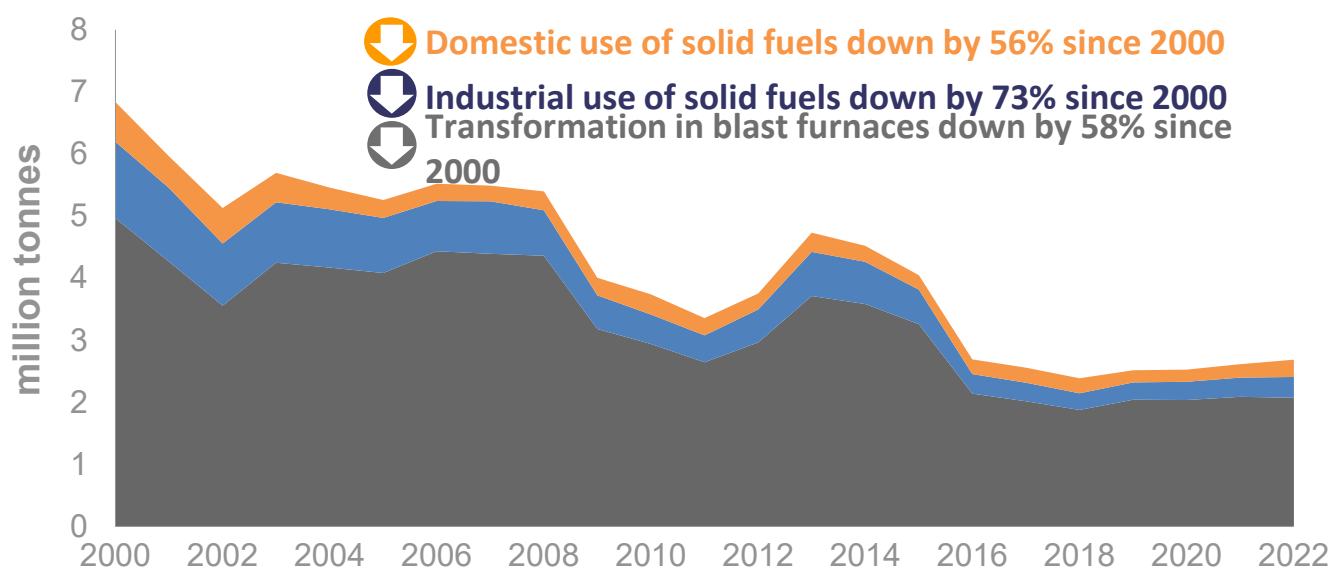
In addition to coal production and consumption, the UK has significant (but decreasing) supply and demand for a range of manufactured solid fuels that are used for domestic, industrial and transformation processes. Coke is the solid product obtained from the carbonisation of coal, principally coking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

**Chart 2.4 Total manufactured solid fuels supply and demand, 2000 - 2022** ([Table 2.3](#))



In 2022, indigenous coke oven coke fell by 15 per cent to 0.9 million tonnes compared to 2021 (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). Coke production continues at other sites and is used at steelworks, mainly Port Talbot and Scunthorpe. Coke breeze production rose 13 per cent to 17 thousand tonnes. Other manufactured solid fuels (patent fuels) rose by 21 per cent to 244 thousand tonnes.

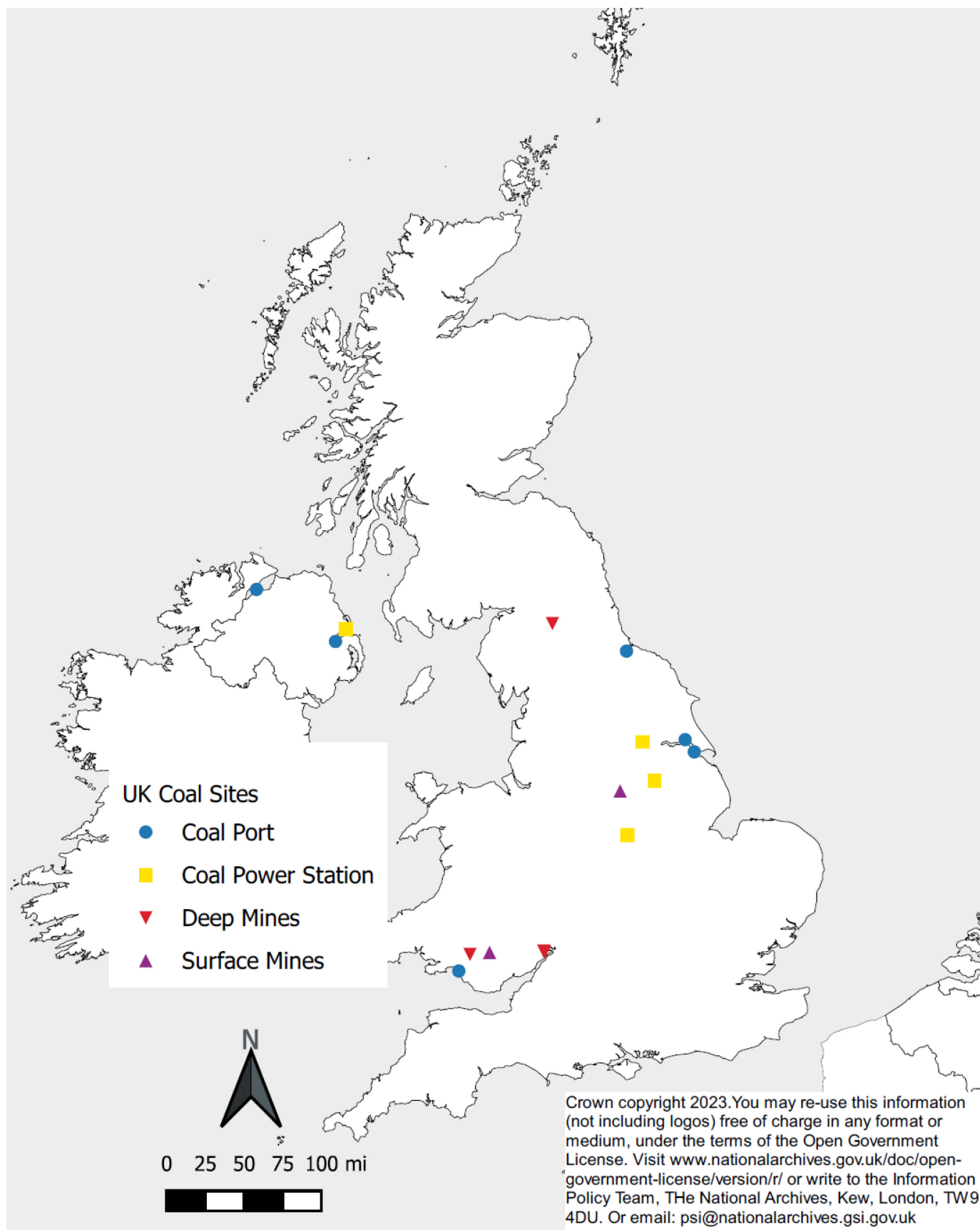
**Chart 2.5 Total manufactured solid fuels consumption in the UK, 2000 – 2022** ([Table 2.3](#))



In 2022, coke oven coke comprised 69 per cent of demand for manufactured solid fuels, with coke breeze at 21 per cent and other manufactured solid fuels at 10 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.



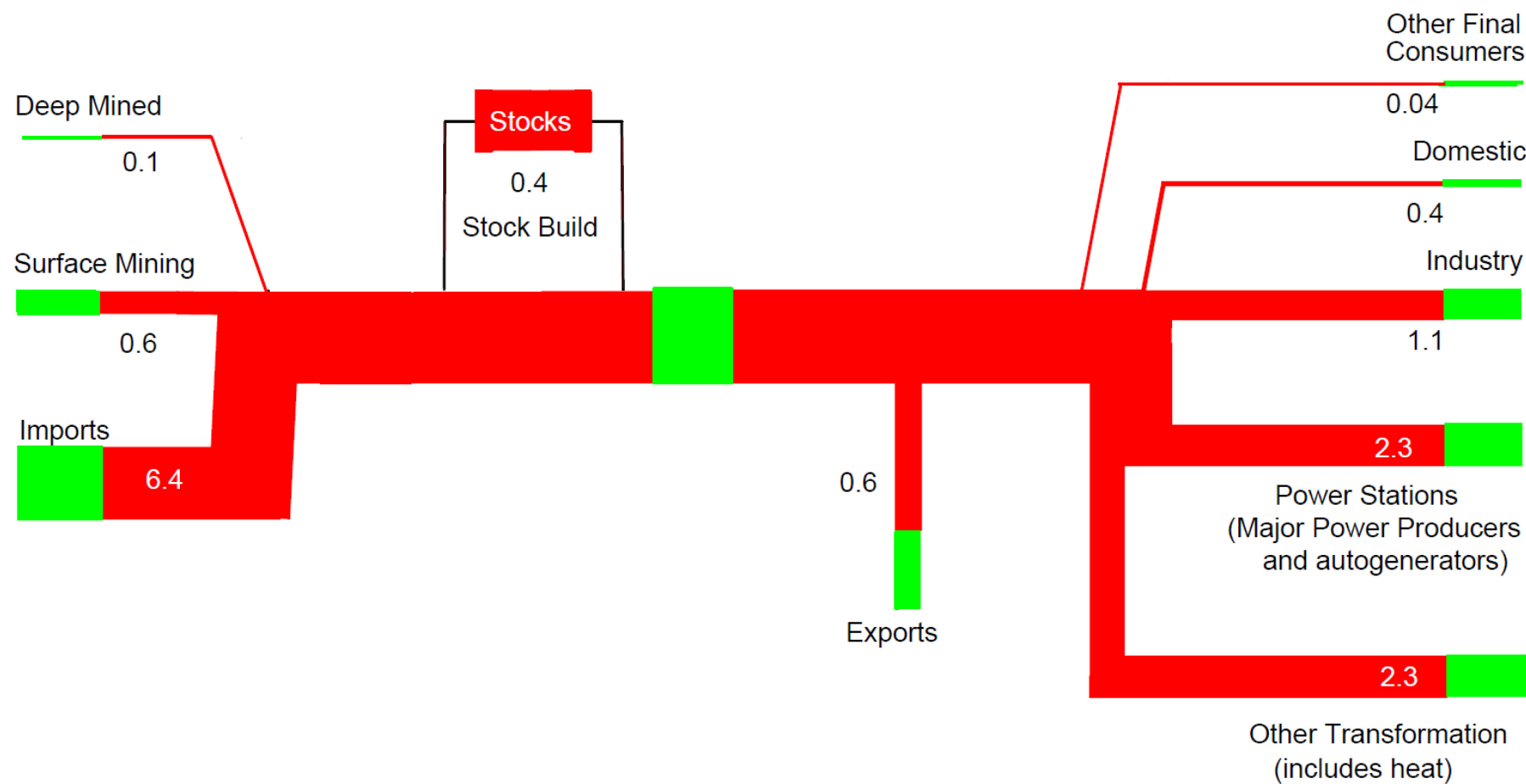
## Map 2B Location of UK coal production sites and ports as at end 2022



### Note:

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

Coal Flow Chart 2022 (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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## Key headlines

**Oil formed 38 per cent of total energy demand in 2022.** Following the upward trend since lows in 2020, demand for petroleum products increased by 10 per cent in 2022 compared to 2021. Much of this growth came from the transport sector, with road fuels accounting for a fifth of all UK energy demand in 2022.

**In 2022, UK production of primary oils fell to an all-time low at 38 million tonnes.** This was 8 per cent lower than in 2021 and the UK continued being a net importer of primary oils, at 16 million tonnes, the highest since 2015. Low production was a result of several factors, including extensive summer maintenance, and in 2022 the UK had record low crude oil exports.

**Refinery production increased by 12 per cent on last year at 54 million tonnes.** However, this remains half of the peak production in 1998.

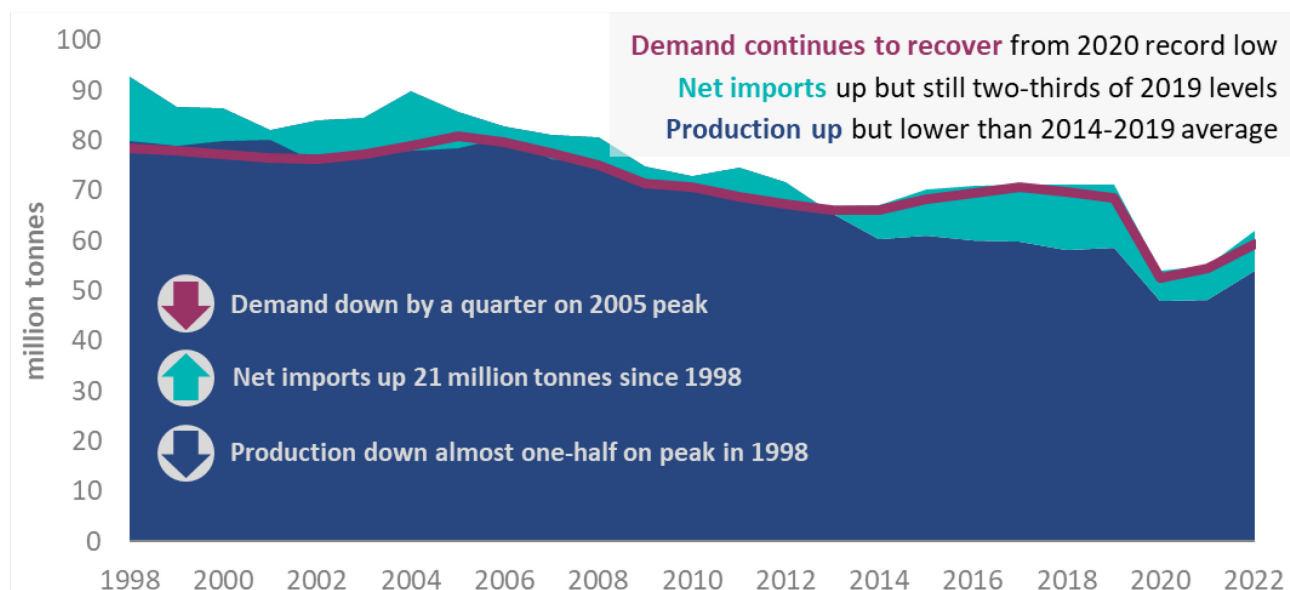
**Oil product demand grew by 9.2 per cent in 2022, with trends mixed by sector.** Whilst overall industry demand fell, the sectors most impacted by the Covid-19 pandemic saw increases in demand. The food and beverage industry increased by 11 per cent as more people ate out, car fuel use increased by 3.3 per cent, and jet fuel demand doubled as people travelled more.

The commercial sector increased by 5.8 per cent on 2021, but domestic consumption decreased by 4.0 per cent due to warmer conditions. Despite the increased productivity in 2022, the agricultural sector saw a decrease in demand of 3.3 per cent. This was due to the increase in energy cost which saw a decrease in use of fertiliser, a product which is energy intensive to produce.

**Jet fuel demand doubled in 2022 compared to 2021, when it was at its lowest point since 1983 following the Covid-19 pandemic restrictions.** Most global restrictions on international travel had been lifted by the start of 2022, causing an increase in demand for flights. However, demand remains down over a fifth compared to pre-pandemic levels.

**The UK held 8.7 million tonnes of oil stock**, which is the equivalent of over 188 days of net imports, exceeding the 90 days required by the International Energy Agency (IEA). **UK stocks of oil decreased by 13 per cent compared to 2021** to a record annual low following an IEA-coordinated release of oil stocks in March and April 2022 due to the Russian invasion on Ukraine.

**Chart 3.1 Supply and demand for petroleum products, 1998 – 2022** ([DUKES Table 3.2](#))

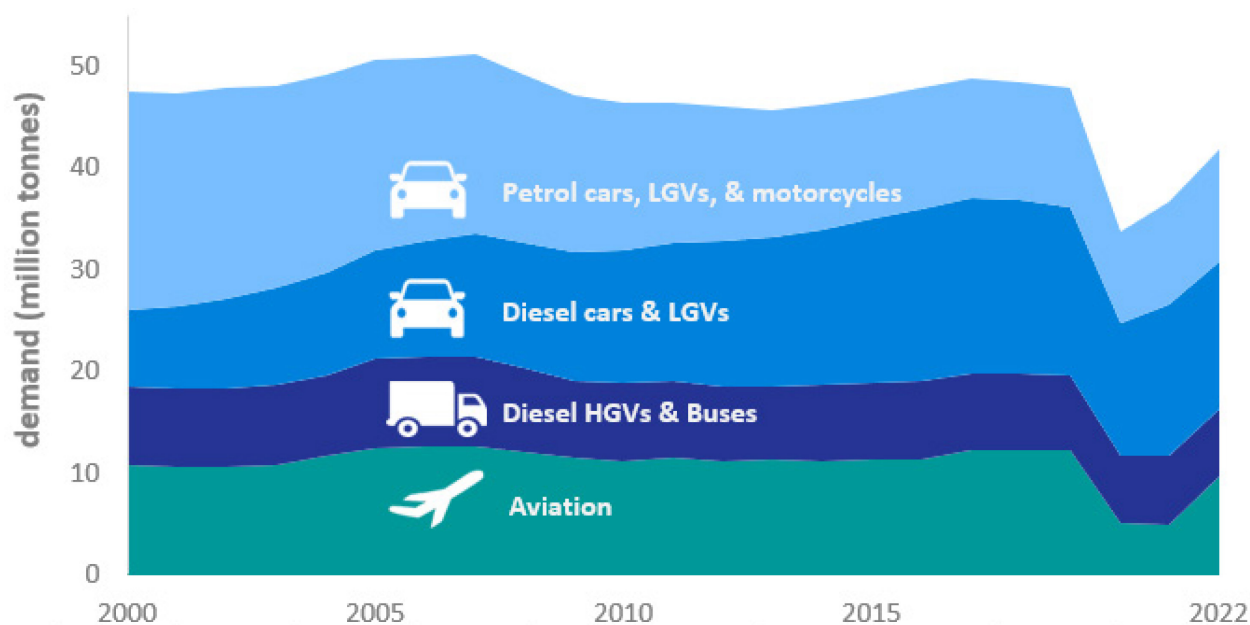


**In 2022, total demand for petroleum products increased by 10 per cent on 2021** (total demand includes energy industry use and transformation). Much of this growth was from an increased demand in the transport sector, which was up 15 per cent on 2021, as demand for key road fuels increased and jet fuel demand doubled due to a year of no Covid-19 restrictions.

**In 2022, refinery production was up 12 per cent compared to 2021, at 54 million tonnes, but nearly halved since peak production in 1998<sup>1</sup>.** This is below the average of around 60 million tonnes between 2014 and 2019. Whilst demand increased refinery production remained low for several reasons including significant maintenance in the summer of 2022.

**The UK remained a net importer of products at 7.9 million tonnes in 2022,** 1.1 million tonnes higher than in 2021. The UK became a net importer in 2013 and had peak net imports in 2018 at 13 million tonnes. Overall, product imports and exports increased in 2022 by 16 and 15 per cent respectively compared to 2021.

**Chart 3.2 Annual demand for transport fuels since, 2000 - 2022<sup>2</sup>**



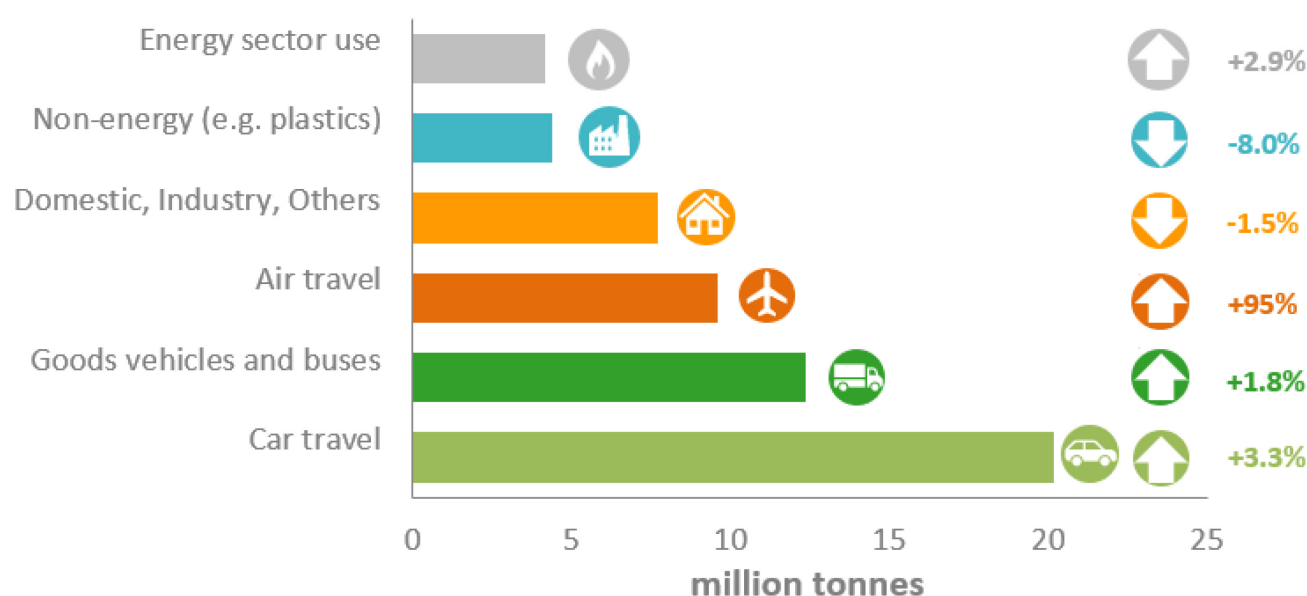
<sup>1</sup>See Annex 2 for a map and further detail on UK refinery nameplate capacities in the [methodology note](#).

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

**The transport sector is the primary use for petroleum products in the UK, in 2022, accounting for almost three quarters of product demand.** Demand for petrol increased by 7.7 per cent and diesel remained stable compared to 2021. Overall fuel use by cars has increased by 2.5 per cent in 2022 and heavy good vehicles and bus fuel demand has remained stable<sup>2</sup>.

**Demand for jet fuel doubled in 2022 compared to 2021, reflecting the increase in demand for international travel.** Whilst 2021 saw some Covid-19 international travel restrictions, most international restrictions had been lifted for the whole of 2022. Demand for jet fuel reached 9.6 million tonnes, up on the 4.9 million tonnes in 2021, which was the lowest level since 1984. However, demand is still down 22 per cent compared to pre-pandemic levels in 2019.

**Chart 3.3 Oil consumption in the UK, 2022** ([DUKES Table 3.2](#))



**Oil consumption trends in 2022 were mixed across sectors, despite the 9.2 per cent increase in total oil product demand.** In 2022 most minor sectors saw a decrease in oil consumption, but this was countered by a larger increase in demand in sectors such as energy use, including petroleum refineries, oil and gas extraction, and transport. Whilst overall industrial consumption fell, there were increases in some sectors such as the food and beverage sector (up 11 per cent), and construction (up 5.8 per cent). Chemical industry use was down by 9.8 per cent because plants have closed, and production has been halted at several sites following maintenance. Vehicle manufacturing has been impacted by supply chain issues, specifically the global shortage of computer chips, as well as factory closures, leading to a 4.0 per cent fall in energy used.

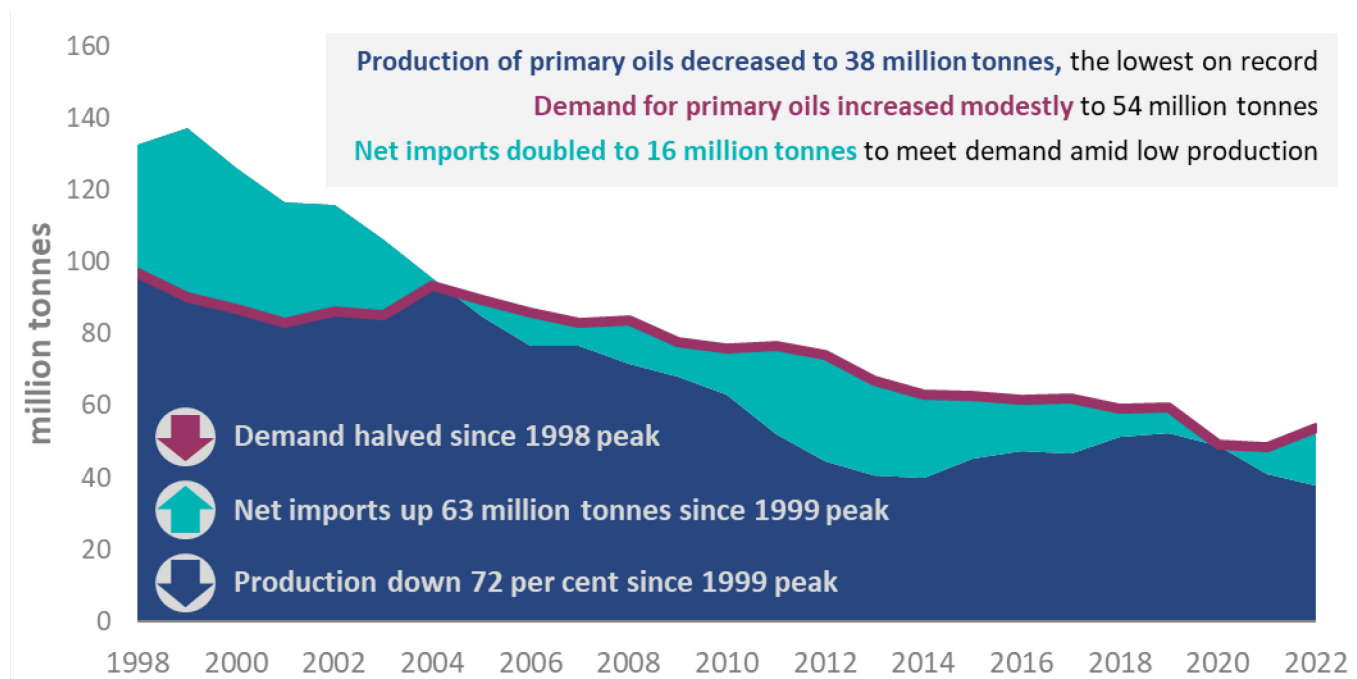
**In 2022, demand for oil by the commercial sector increased by 5.8 per cent compared with 2021.** This reflects the lack of operating restrictions on UK businesses in 2022 compared to 2021 where there were restrictions due to Covid-19 in the first half of the year. Despite favourable growing conditions for cereals and other crop products, the agricultural sector saw a decrease in demand of 3.3 per cent due to an increase in energy prices which impacted fertiliser sales<sup>3</sup>. In 2022, domestic consumption decreased by 4.0 per cent, in line with warmer temperatures ([Energy Trends Weather Statistics](#)).

In 2022, non-energy use of oil products was down by 8.0 per cent, following the sharp decrease also seen last year. While non-energy demand for propane and butane remains relatively stable, demand for naphtha remains suppressed, and in 2022 ethane fell by 38 per cent to 375 thousand tonnes. Reduced demand for

<sup>3</sup> see [DEFRA Total Factor Productivity Statistics](#)

these petrochemical feedstocks is the result of a 2-year closure of a major plant at Teesside, which has now attracted investment for it to run on hydrogen following national and international Net Zero policies<sup>4</sup>.

**Chart 3.4 Supply and demand for primary oils, 1998 – 2022 (DUKES Table 3.1)**



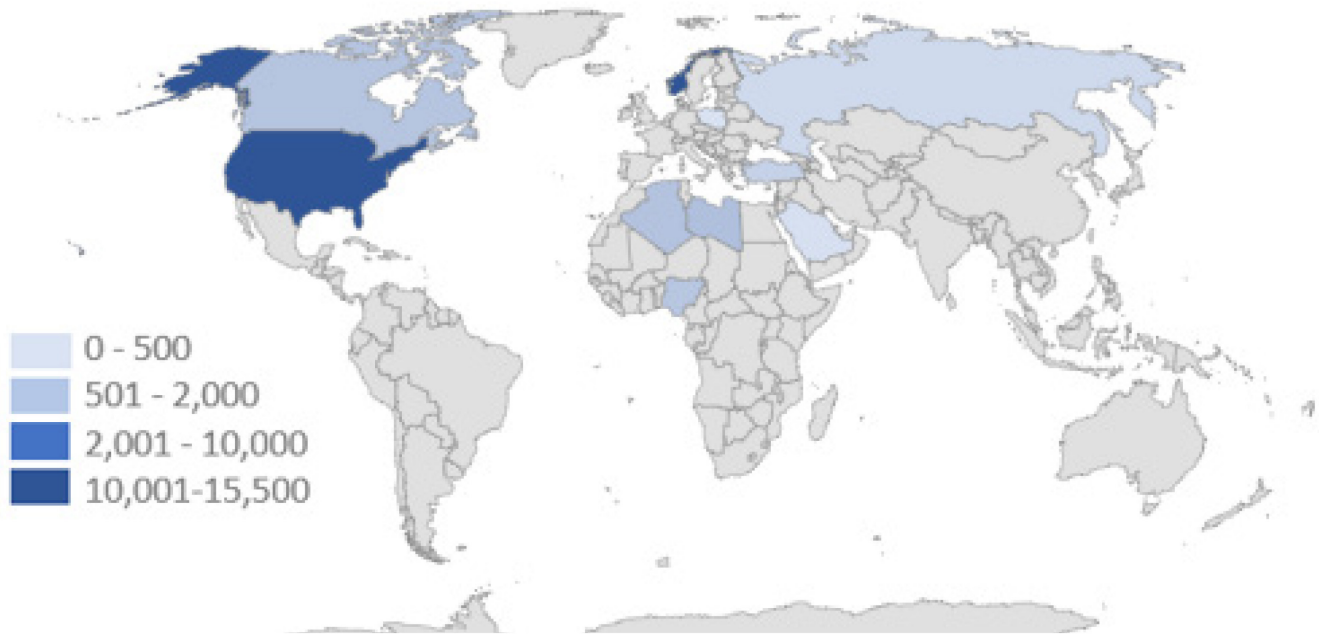
**In 2022, UK production of primary oils fell to an all-time low at 38 million tonnes**, this was 8 per cent lower than in 2021. Contributing factors included extensive summer maintenance in 2022 which reduced production volumes for the remainder for the year.

Demand for primary oils increased by 12.4 per cent compared to 2021. Due to continued low production and refinery maintenance, exports decreased by 10 per cent to 31 million tonnes, compared to peak exports of 90 million tonnes in 2000. Imports increased by 12 per cent on 2021 to help meet demand. The UK returned to being a net importer of primary oils at 16 million tonnes, the highest net imports of primary oil since 2015.

**In 2022, refineries took receipt of 7.1 million tonnes of crude produced from the UK Continental Shelf (UKCS)**, meeting 13 per cent of refinery demand. (see [Energy Trends Table 3.10](#)). The UK is reliant on imports to meet refinery demand for specific crude types.

<sup>4</sup> Sabic, Annual Report 2021 <https://www.sabic.com/en/reports/annual-2021/strategic-report/future-plans-and-investment>

**Map 3A Sources of UK crude oil imports 2022 (thousand tonnes, [DUKES Table 3.7](#))**



**Crude oil imports increased by 16 per cent in 2022 compared with 2021**, as demand for oil increased and production decreased. Crude import levels remain 4.5 per cent lower than pre-pandemic levels in 2019.

**In 2022, the United States overtook Norway as the UK's largest crude import source.** Imports from the United States were up 37 per cent on 2021, as global oil trade reconfigured itself to replace Russian oil imports due to sanctions introduced at the end of 2022 following Russia's illegal invasion of Ukraine. Crude imports from the United States accounted for over a third of all crude oil imports in 2022.

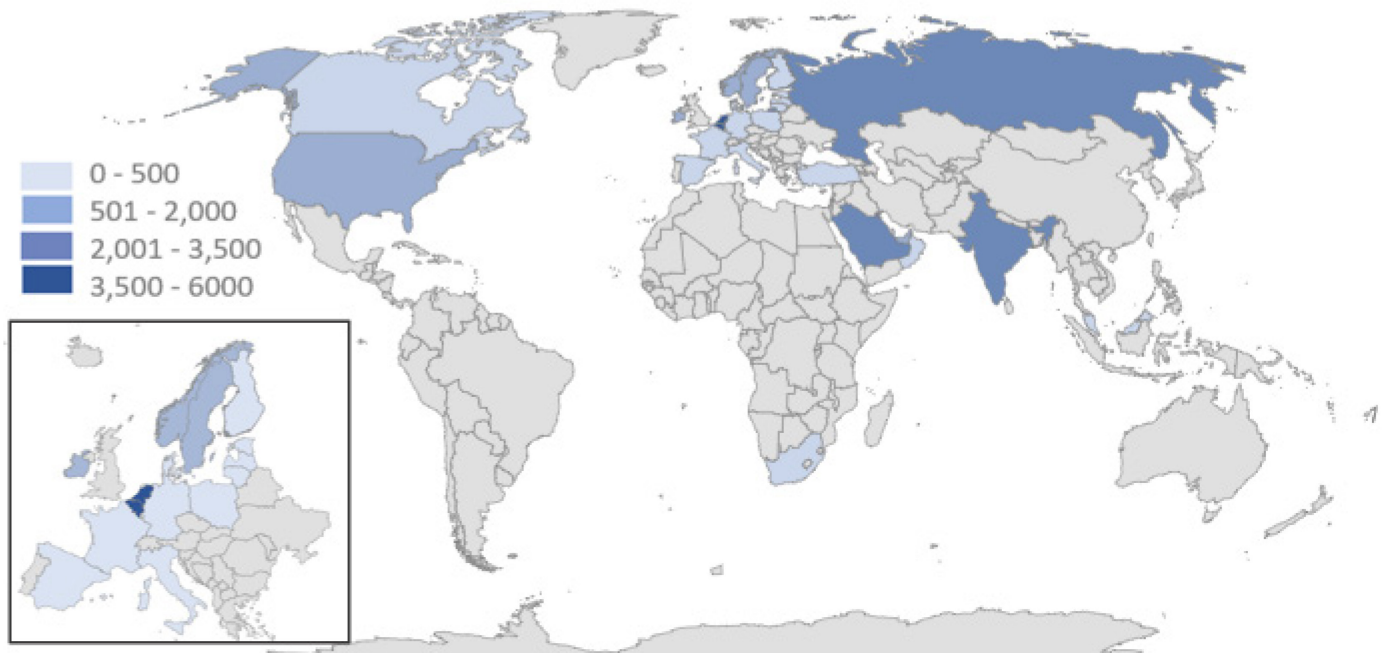
**Norway was the second largest import source of crude due to its proximity and shared infrastructure in the North Sea.** Imports of crude from Norway were up 5.6 per cent compared with 2021, accounting for a third of total crude imports. However, Norway's share of crude imports has decreased in recent years from the high of 62 per cent in 2016.

Prior to the ban against Russian oil introduced on 5<sup>th</sup> December 2022, importers sought different crude sources. Russian crude oil imports dropped by 82 per cent in 2022 and made up only 1.2 per cent of crude imports in 2022 compared with 7.7 per cent in 2021.

Imports from current OPEC countries have decreased following the peak in 2013 and accounted for 15 per cent of the UK's crude imports in 2022, decreasing by 5.3 per cent on 2021. The UK exports a substantial amount of crude oil, however this decreased by 10 per cent in 2022 compared with 2021, in line with reduced production (Table 3.8).



**Map 3B Sources of UK petroleum product imports 2022 (thousand tonnes, [DUKES Table 3.7](#))**

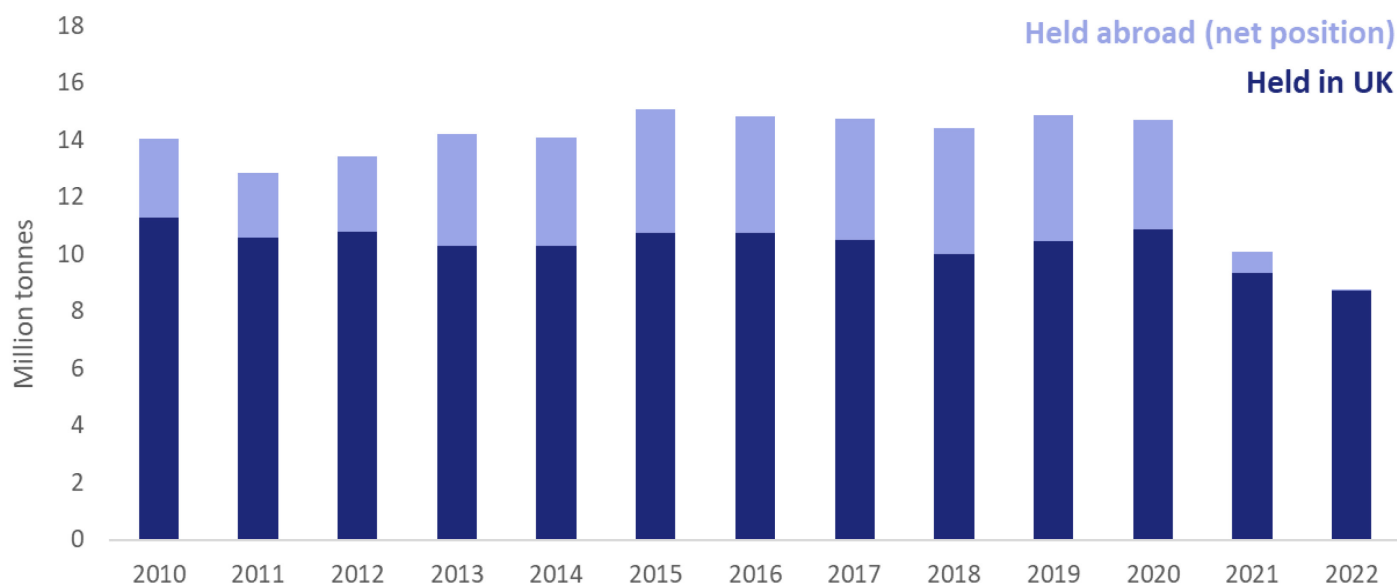


Map 3B shows UK imports of petroleum products by source in 2022. **The Netherlands is a major oil trading hub and as such is the principal source of product imports for the UK.** Whilst the Netherlands remained the largest import source of products at 19 per cent, Belgium was the second largest import source, representing 13 per cent of product imports, replacing Russia who was second largest in 2021. Russian imports have dropped from 22 per cent of the total imports to 6.8 per cent in 2022 and decreased to zero by the end of the year. Indian imports have more than doubled as importers find new sources of petroleum products.

**Imports of petroleum products increased 16 per cent in 2022 compared to 2021, reflecting the increase in demand and decrease in production.** Diesel held the largest share of product imports, making up 46 per cent of the total product imports and quantities have increased by 10 per cent on 2021. Russia was a major import source for diesel before the invasion of Ukraine, making up over a third of diesel imports in 2019. In 2022, Russia made up only 15 per cent of diesel imports ahead of the ban implemented in December, and subsequently indigenous production of diesel increased by 14 per cent in 2022 compared to 2021. Petrol imports increased by 4.1 per cent in 2022.

**Imports of jet fuel, the second largest share of product imports, increased by 78 per cent in 2022 as demand for international travel continued to recover.** Jet fuel made up a quarter of all product imports in 2022, as demand for jet fuel doubled in the UK. The main imports source for jet fuel were Gulf Cooperation Council countries such as Kuwait, United Arab Emirates, and Saudi Arabia.

**Chart 3.5 UK oil stocks, 2010 – 2022 ([DUKES Table 3.5](#))**



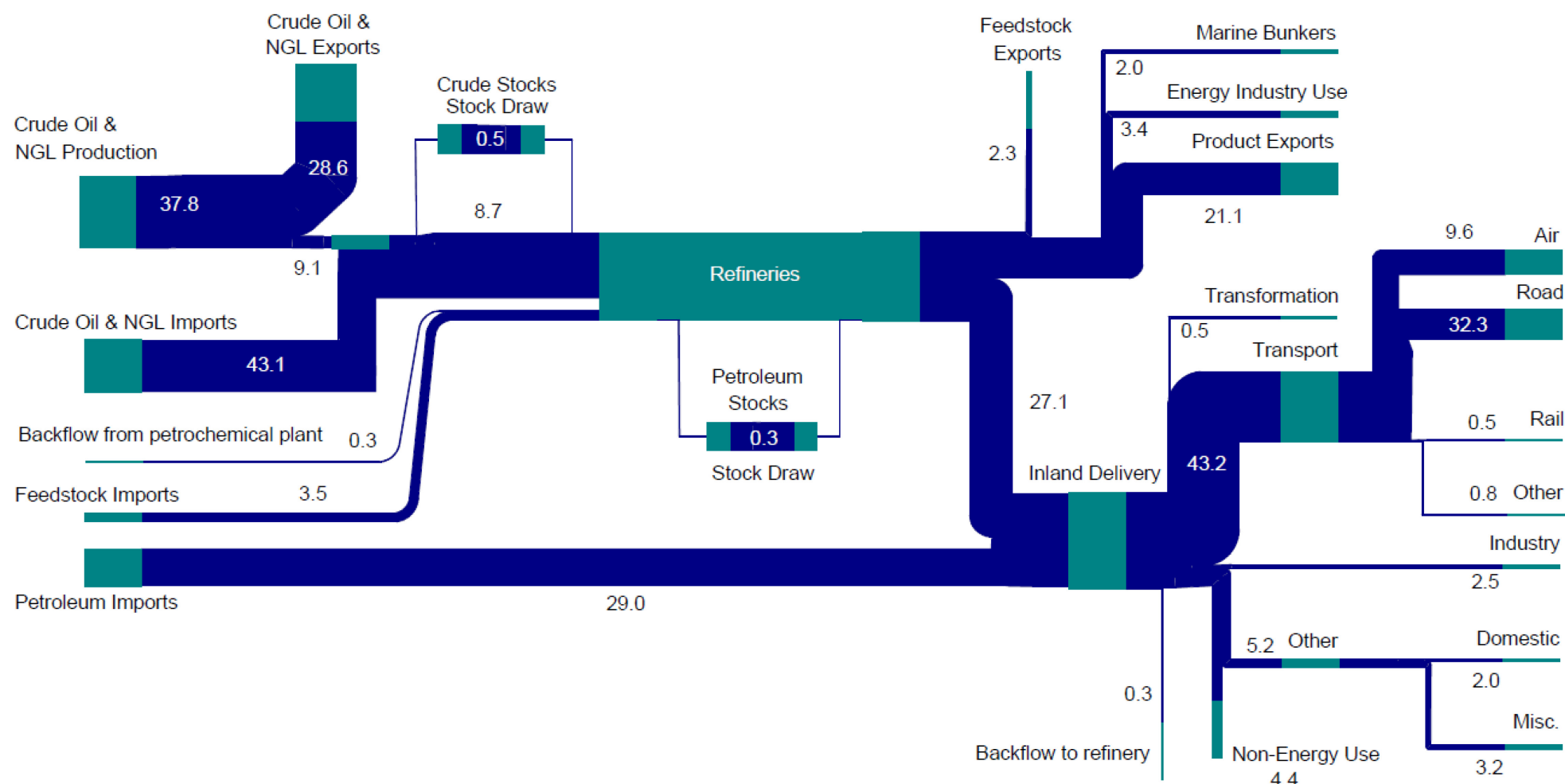
**The UK government is required to hold stocks of oil which can be released in the event of severe disruption to global supply.** The UK receives this obligation as a member of the International Energy Agency (IEA) and meets the obligation by directing companies to hold minimum levels of stocks. In March 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 2022, the UK held 8.7 million tonnes of stocks ([DUKES Table 3.5](#)) the equivalent of 188 days of net imports**, which is substantially higher than the required 90 days of net imports set by the IEA. However, this represented a record annual low as 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. A large component of the fall in UK stock was the release of volumes held elsewhere in Europe.

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 were 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 2022 (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

**Natural gas made up 38 per cent of total energy demand** and close to two thirds of domestic demand in 2022 and continues to play an important role in the UK energy mix.

**UK gas demand decreased by 7.9 per cent in 2022 compared with 2021**, due to the warmest year on record, higher prices impacting on consumer behaviour, and record renewable output.

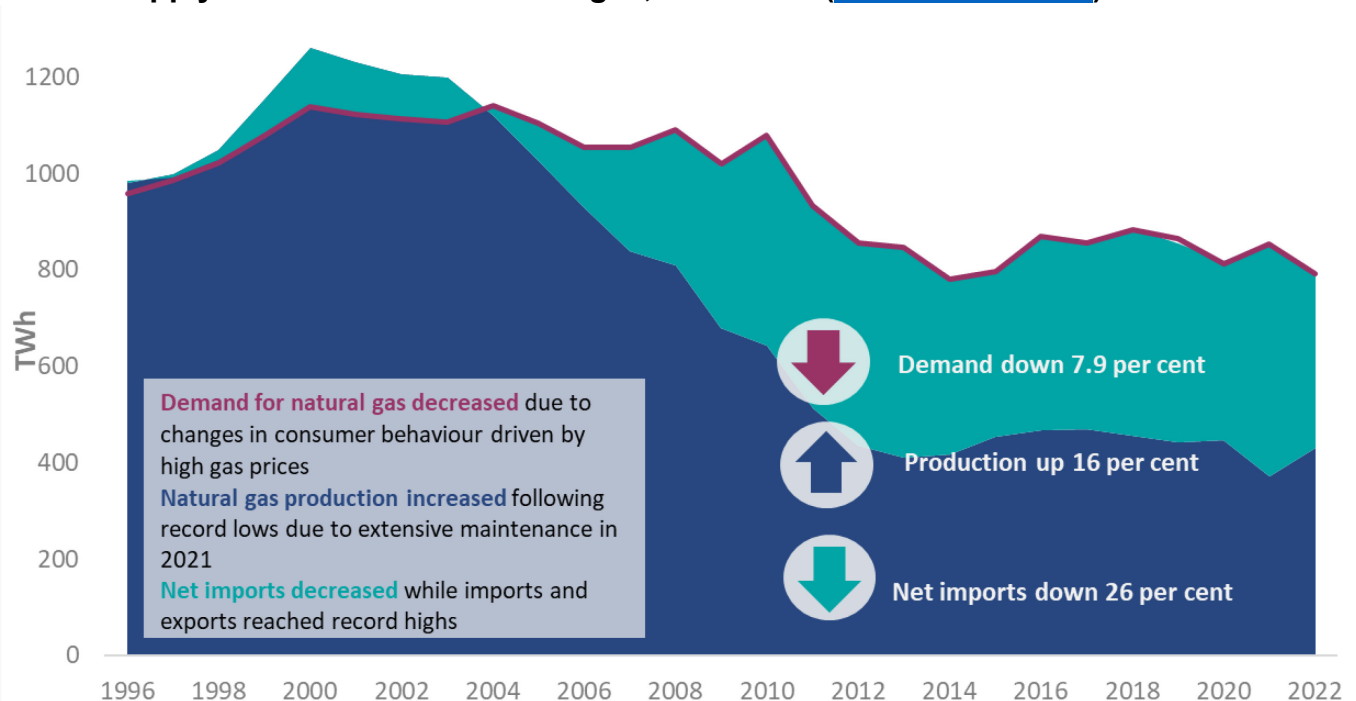
**Both domestic and industrial demand reached levels last seen in the 1970s** as, for the first time, households and businesses changed their behaviour in response to cost. Final consumption was down 14 per cent in 2022 compared with 2021, with the most significant reduction in the domestic sector which saw a drop of 18 per cent in the same period. Demand was reduced across the board with industry down 4.7 per cent and services (including sectors like commercial and public admin) down 9.7 per cent.

**Exports tripled in 2022 compared to 2021 reaching a record high.** Disruption to global gas supply following Russia's illegal invasion of Ukraine saw substantial shifts in UK trade patterns. Imports also reached a record high, up 10 per cent, and driven by a significant increase in **imports of LNG, up 74 per cent in the same period.** The UK has the second largest LNG regasification infrastructure in Europe (after Spain); this was utilised to support European efforts to move away from Russian gas. The UK operated as a land bridge using interconnectors for exports to Belgium and the Netherlands.

**LNG accounted for almost half of total imports with imports of LNG from the US overtaking those from Qatar for the first time.** American LNG was equivalent to half of total LNG imports and 22 per cent of total imports. LNG was also imported from a record 13 countries and from further afield with Peruvian imports more than doubling compared to the previous year.

**Gross gas production increased by 16 per cent in 2022** compared with a record low in 2021 when an extensive summer maintenance schedule saw shutdowns at several major terminals. Production in 2022 was just a little short of output in 2019, the last full year before the Covid-19 pandemic.

**Chart 4.1 Supply and demand for natural gas, 1996-2022** ([DUKES Table 4.1](#))



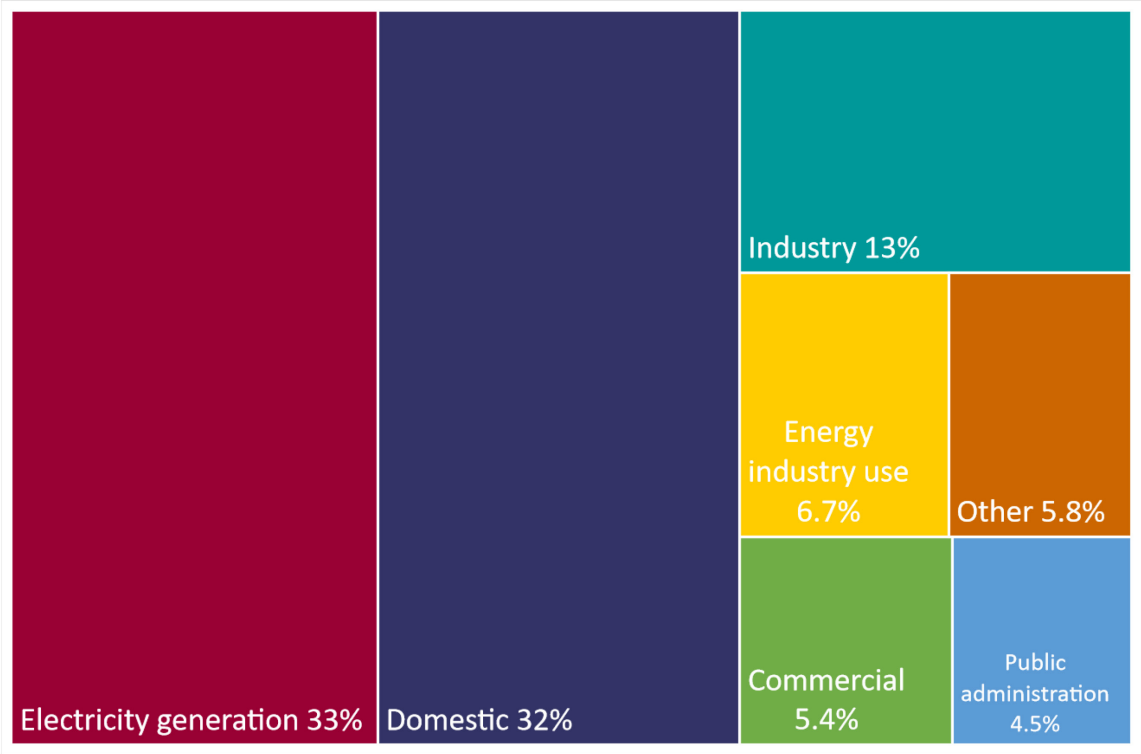
**Natural gas accounted for 33 per cent of total energy production and 38 per cent of total energy demand in 2022** and is an important part of the UK energy mix. Demand for natural gas is met through indigenous production and imports. The UK is a net importer of natural gas but continues to export; mostly via pipeline to mainland Europe and historically more so in the summer when demand is low.

**Gas production increased 16 per cent, to 423 TWh, in 2022 following a record low in 2021.** This follows extensive summer maintenance on North Sea infrastructure in 2021 when several major terminals, including the Forties Pipeline System (FPS), were shutdown. Gas production recovered in 2022 and was 3 per cent below pre-pandemic levels.

**Indigenous production of gas was equivalent to over half of demand in 2022**, with the remainder met via imports. Indigenous production has been equivalent to around half of demand for over a decade, reaching 54 per cent in 2022 due to notably low demand.

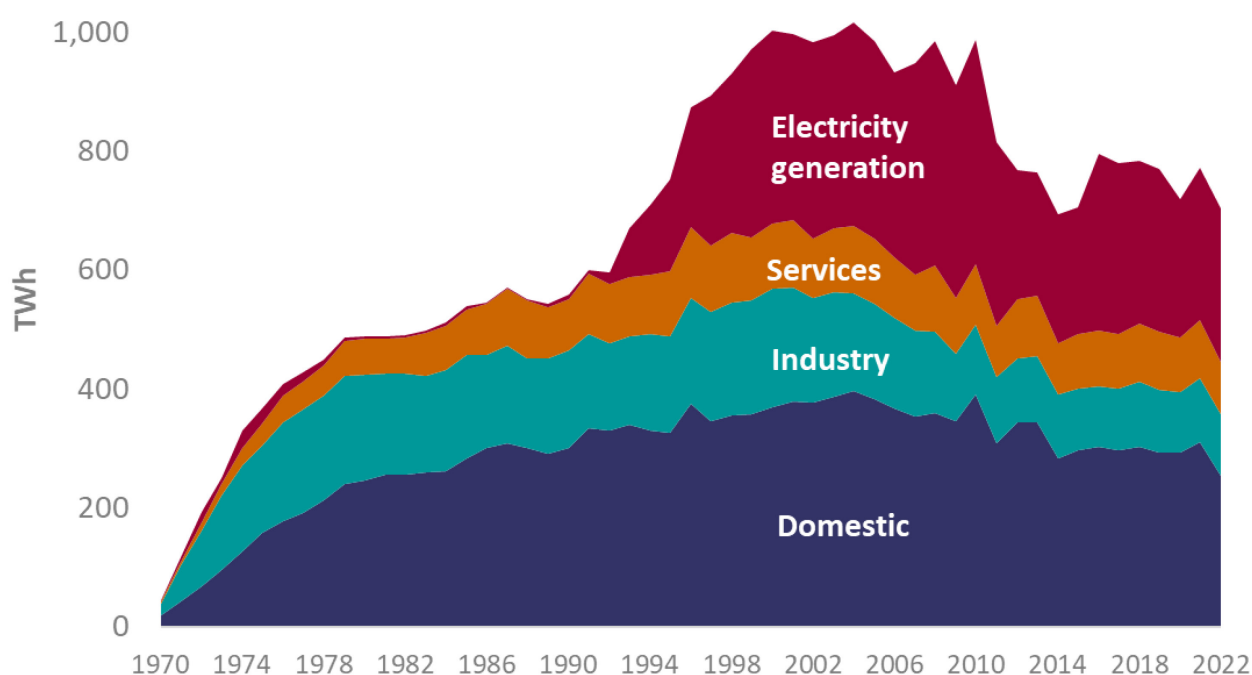
The North Sea Transition Authority (NSTA, previously the Oil and Gas Authority (OGA)) produces analysis on oil and gas reserves which can be found [in the Oil and Gas reserves publication](#).

**Chart 4.2a Sectoral consumption of natural gas, 2022 (DUKES Table 4.1)**



**Demand for natural gas decreased by 7.9 per cent in 2022 compared with 2021.** Gas is used across many sectors in the UK. In general gas used for electricity generation, domestic consumption, and other sectors (including industrial consumption) each make up around a third of demand. Gas used for electricity generation remained stable compared to 2021, up 1.5 per cent. This was the result of reduced nuclear and wind output compared to previous years (see Chapter 5 for more information). Reduced demand was driven by final consumers due to record high temperatures and increased prices. Wholesale gas prices reached record highs in 2022 as the Russia-Ukraine conflict intensified strained market conditions.

Chart 4.2b Sectoral consumption of natural gas, 1970- 2022 ([DUKES Table 4.1.1](#))

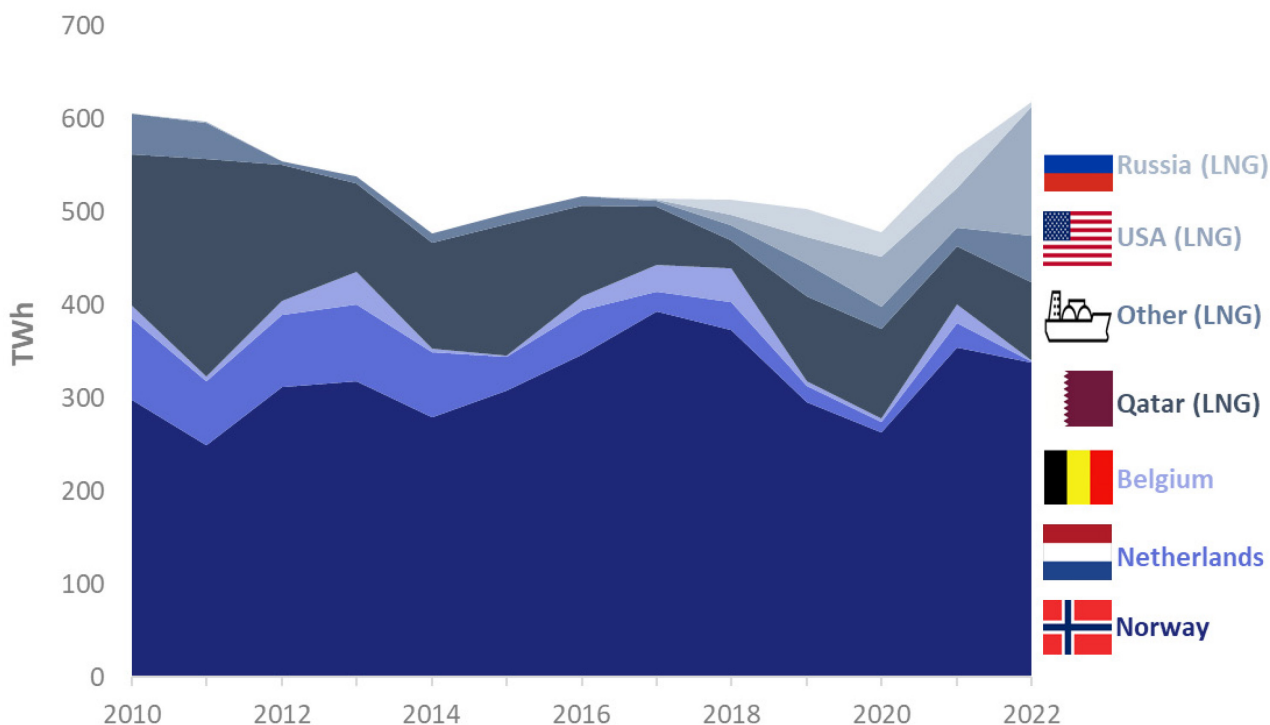


**Domestic demand was down by 18 per cent in 2022 compared with 2021, reaching levels last seen in the early 1970s when coal was the main household fuel.** Domestic gas consumption is used for space and water heating as well as for appliances such as ovens and hobs. Temperatures will have reduced demand for heating in addition, gas prices are a likely factor in changing consumer behaviour and reducing consumption levels. Overall, natural gas met almost two-thirds of total domestic energy demand in 2022 (See Table 1.1 for further details).

**Industrial demand also dropped to levels last seen during the Covid-19 pandemic and in the early 1970s.** Industrial demand fell 4.7 per cent in 2022 compared to 2021, due to reduced industrial output, some of which will have been driven by higher energy and other prices. The trend varied slightly across the industrial sectors with the highest falls in the chemicals and the paper and printing sectors.

**Gas demand by public administration and commercial sectors also fell, down 10.2 and 9.8 per cent respectively.** Other services which includes sectors such as agriculture also saw declines as high prices likely impacted consumer behaviour numerous sectors of the economy.

**Chart 4.3 Imports of natural gas, 2010-2022 ([DUKES Table 4.5](#))**



The Russian invasion of Ukraine and subsequent sanctions on Russian commodities saw significant changes to trade patterns. **This resulted in record high imports and exports in 2022.**

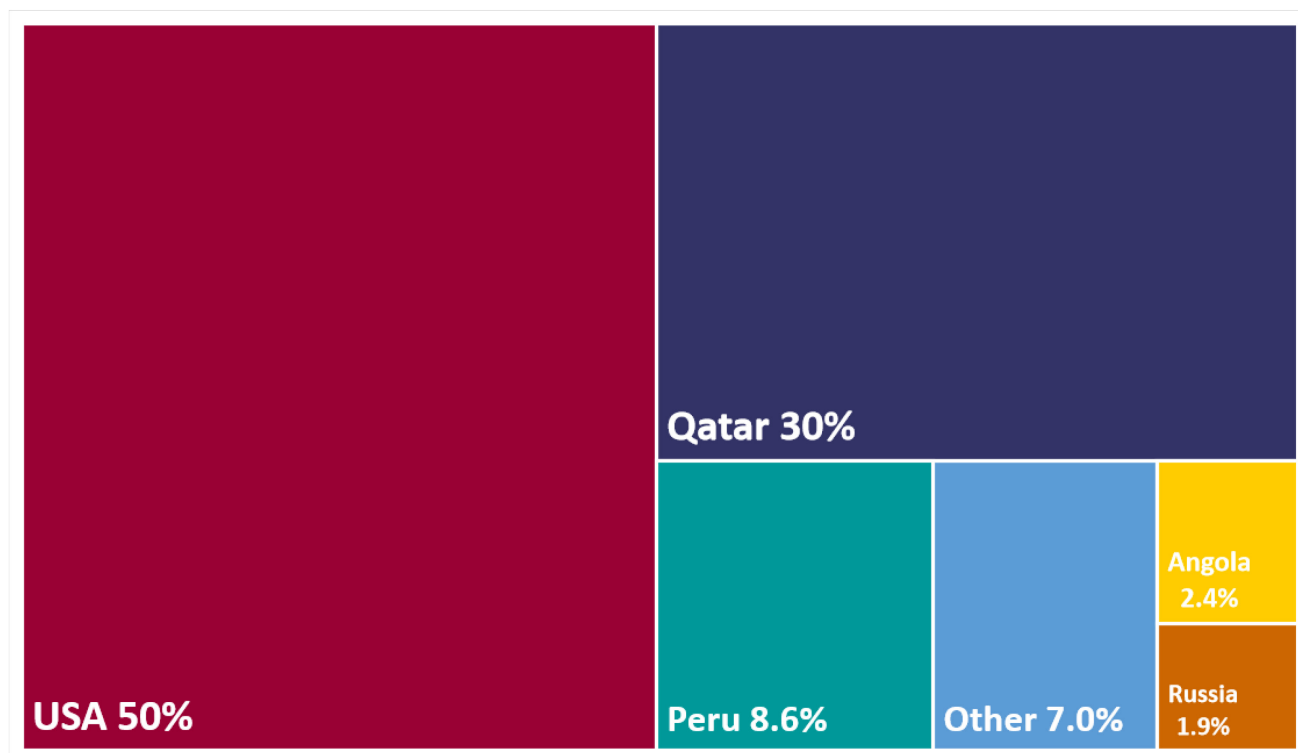
**Natural gas imports increased by 10 per cent.** The largest increase was of liquified natural gas (LNG) which reached an annual record high of 278 TWh, up 74 per cent in 2022 compared to 2021. The UK has the second largest LNG regasification infrastructure in Europe and operated as a land bridge to support European efforts to move away from Russian gas. For more information on the [supply of LNG see the special feature article](#). UK imports also arrive via pipeline from Norway, Belgium, and the Netherlands.

**Norway remained the UKs largest import source, accounting for 33 per cent of gross supply.** Gross supply is calculated as production plus imports. Norway has historically been the UKs largest import source due to proximity and shared infrastructure in the North Sea. Norwegian gas imports accounted for 55 per cent of total imports and whilst substantial were down 4.6 per cent in 2022 compared to 2021. 2022 saw large drops in Belgian and Dutch imports as interconnectors<sup>1</sup> were mainly used for exports.

<sup>1</sup> Interconnectors are pipelines which can be used to import or export gas.



Chart 4.4 UK LNG import sources, 2022 ([DUKES Table 4.5](#))

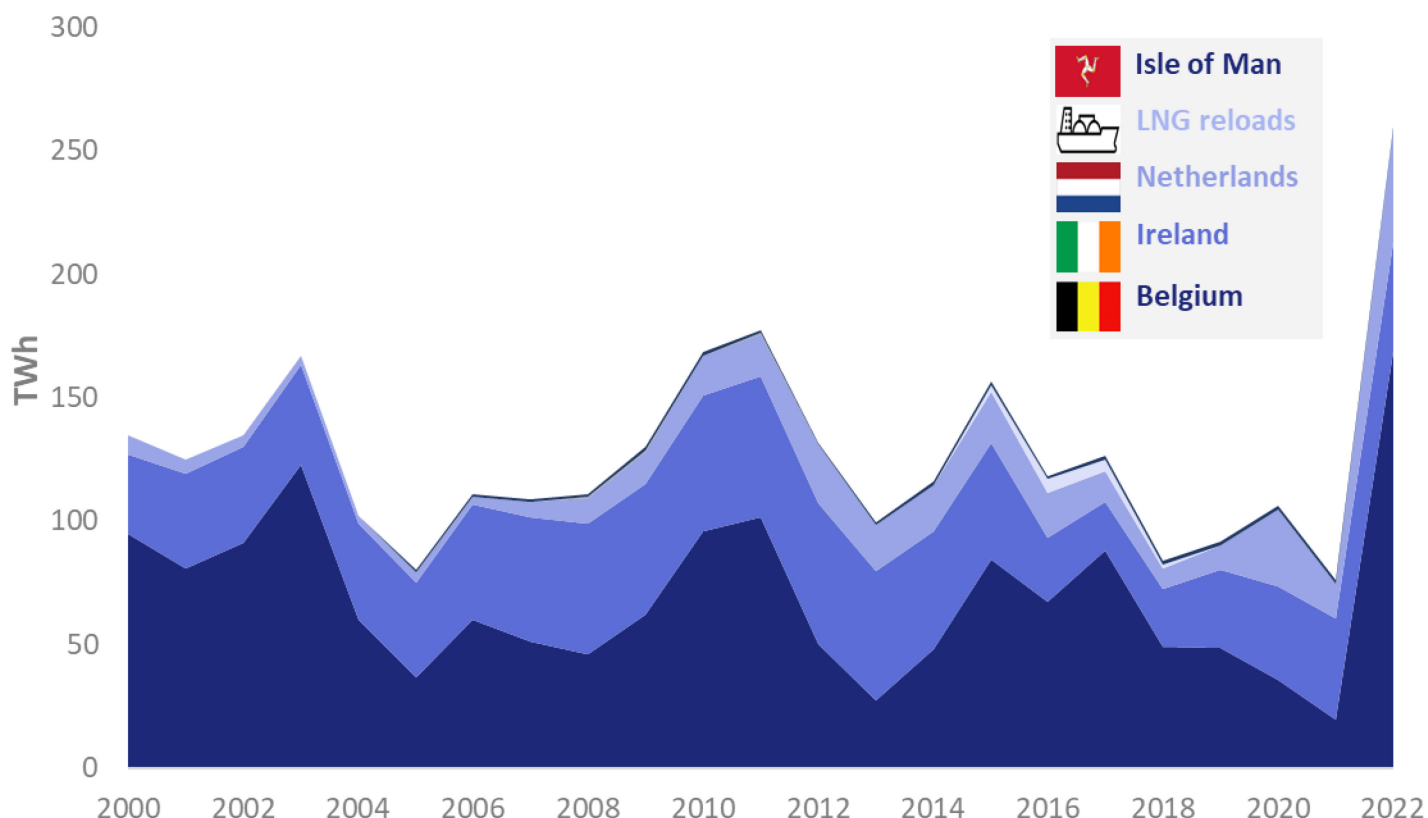


**Imports from the USA tripled making the US the largest source of LNG to the UK for the first time.** Imports of LNG from the USA accounted for 50 per cent of total LNG imports and 22 per cent of total imports. LNG from the US has been increasing considerably since the first import in 2017 reflecting increases to their liquification capacity. Recent provisional data indicates that in the first five months of 2023, US LNG imports have accounted for almost two-thirds of total LNG imports (see [Energy Trends Table 4.4](#) for further information).

Historically, a large proportion of LNG has come from Qatar, peaking at 98 per cent of total LNG imports in 2011. Qatari imports were the second largest source in 2022 accounting for just under one-third of total LNG imports, having previously held the highest share between 2009 and 2021. This reflects substantial increases to LNG imports and increasing diversification of import sources. The UK imported LNG from thirteen countries in 2022, the highest on record. Peruvian LNG imports more than doubled compared to 2021, as well as increased African imports which included Angola, Egypt, and Nigeria.

Following Russia's invasion of Ukraine and subsequent sanctions (and self-sanctioning) the last cargo of Russian LNG was received in March 2022. In 2022 Russian imports of natural gas made up 0.9 per cent of total gas imports, this compares to 6.2 per cent in 2021.

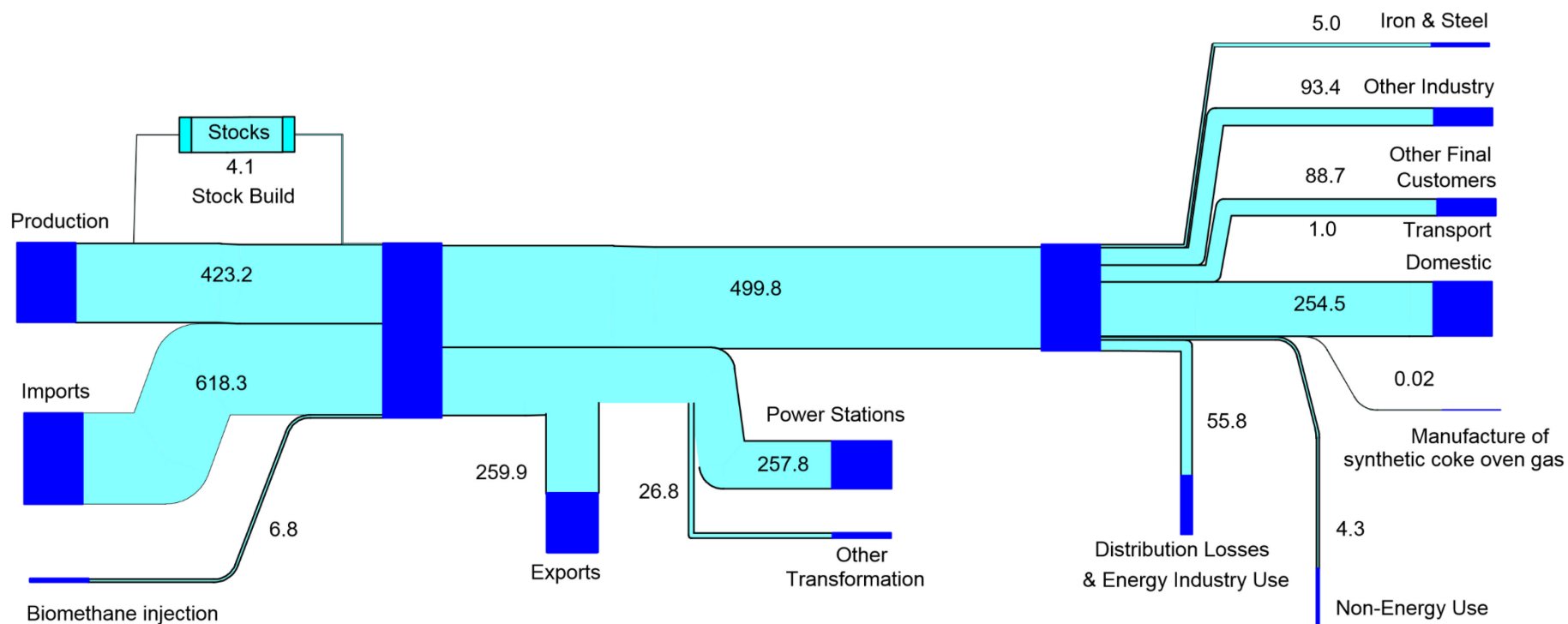
**Chart 4.5 Exports of natural gas, 2000-2022 ([DUKES Table 4.5](#))**



**Natural gas exports more than tripled in 2022 compared to 2021.** At 260 TWh, exports reached the highest level on record, 47 per cent higher than the previous record set in 2011. The UK supported European efforts to move away from Russian gas, utilising substantial LNG regasification and shared infrastructure with mainline Europe. Increased exports were driven by increased supply to Belgium and the Netherlands in 2022, with exports to Belgium almost nine times higher than levels seen in 2021.

The flow chart on the following page 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.

## Natural Gas Flow Chart 2022 (TWh)



### Note:

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 2022 to 320.7 TWh, down by 3.8 per cent from 2021.** This is a larger year-on-year fall than in most recent years, driven by higher prices and the record high annual average temperature.

**Rising energy and other prices and higher average temperatures led to a record low domestic consumption, with industrial and commercial consumption also decreasing.** Domestic consumption fell 10 per cent to 96.2 TWh while industrial consumption was down 2.7 per cent and consumption by other users (primarily commercial users) was down 0.7 per cent.

**Electricity generation rose in 2022 despite the low UK demand, as demand from Europe saw the UK switch to being a net exporter of electricity for the first time in over 40 years.** Electricity generation rose to 325.3 TWh, 5.3 per cent higher than in 2021. Total imports fell to 15.5 TWh, half of 2021 levels. Meanwhile total exports increased fivefold compared to 2021, reaching 20.8 TWh, giving net exports of 5.3 TWh.

**Renewable generation reached record high levels in 2022, rising 10 per cent to 135.0 TWh, due to high output from wind and solar generators.** This was driven by substantial increases in wind generation capacity and more favourable weather conditions compared to 2021. Bioenergy was the only renewable technology where generation decreased, as outages continued at key bioenergy sites.

**Fossil fuel generation increased 0.9 per cent in 2022 to 132.8 TWh, with more generation from gas.** Coal generation continued to fall, down to the second lowest value on the published data series.

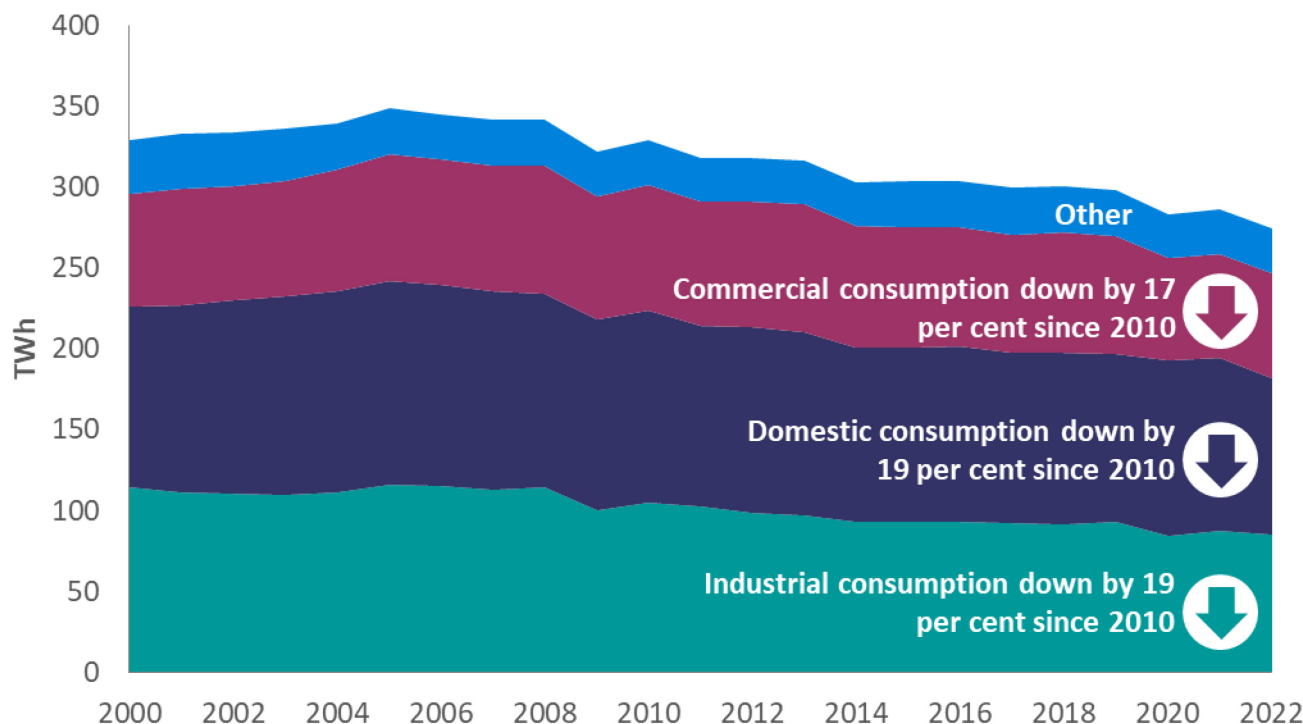
**The share of generation coming from low carbon sources rose to 56.2 per cent in 2022, the second highest value on the published data series.** This came as the share of generation from renewable sources (41.5 per cent) exceeded the share from fossil fuels (40.8 per cent) for the second time.

**Total de-rated generation capacity increased to 76.7 GW in 2022, 0.4 per cent higher than in 2021.** Capacity for renewable technologies increased by 6.2 per cent to 24.6 GW, fossil fuel capacity increased 1.9 per cent to 43.5 GW and nuclear capacity decreased 25 per cent to 5.9 GW.

### Electricity demand reached a record low in 2022 of 320.7 TWh, down by 3.8 per cent from 2021.

Electricity demand has declined year-on-year since 2015, apart from a slight increase between 2020 and 2021 with as demand recovered from the effects of the Covid-19 pandemic. The decrease this year is larger than in previous years since 2015, with the exception of the drop in 2020 due to the pandemic, and was driven primarily by rising prices and the record high annual average temperature. In line with the decrease in demand, final consumption fell by 4.3 per cent compared to 2021. '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 2022** ([Table 5.1](#))

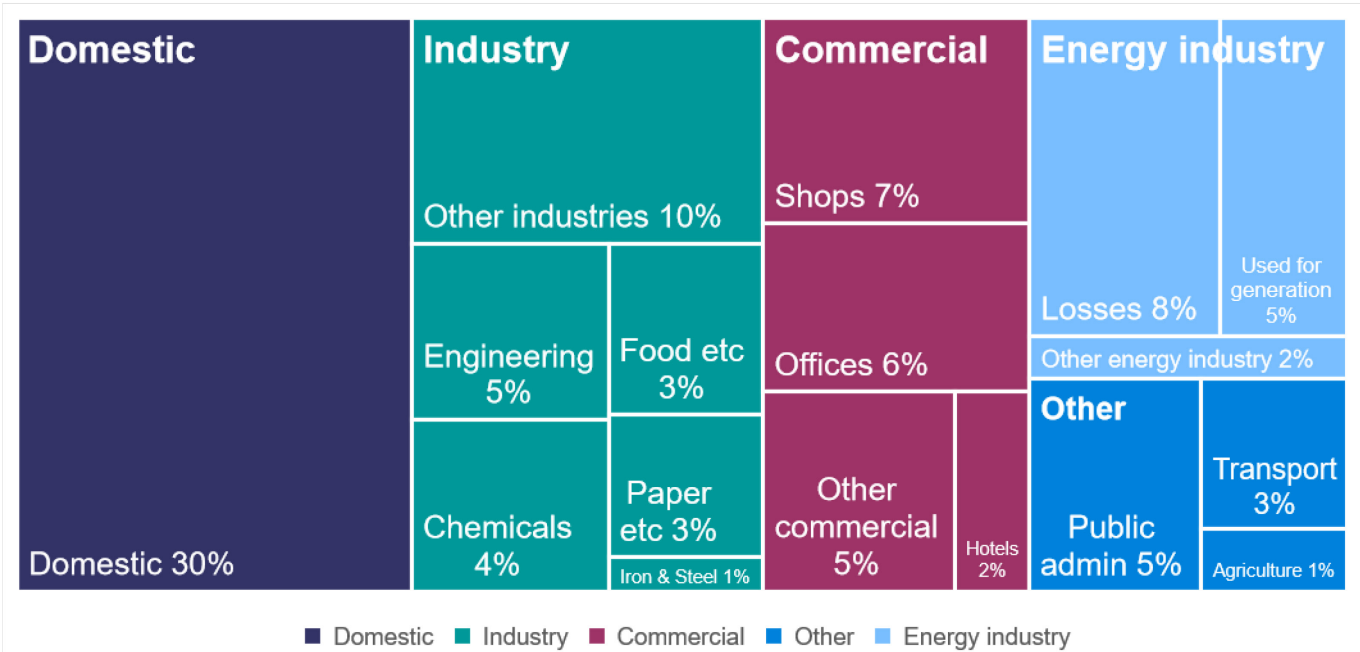


**Rising prices and higher average temperatures led to a record low domestic consumption, with industrial consumption also decreasing.** In 2022, domestic consumption fell 10 per cent compared to 2021 to 96.2 TWh while industrial consumption was down 2.7 per cent. The record low domestic consumption reflects consumers reducing their consumption in response to higher prices, along with record high temperatures reducing demand.

**Commercial consumption rose by 0.9 per cent in 2022.** Commercial activity increased in 2022 compared to 2021 as Covid-19 restrictions were removed, though higher average temperatures reduced the demand for electricity for heating. Commercial consumers' response to higher prices may also have partly mitigated the increase in electricity demand.

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.

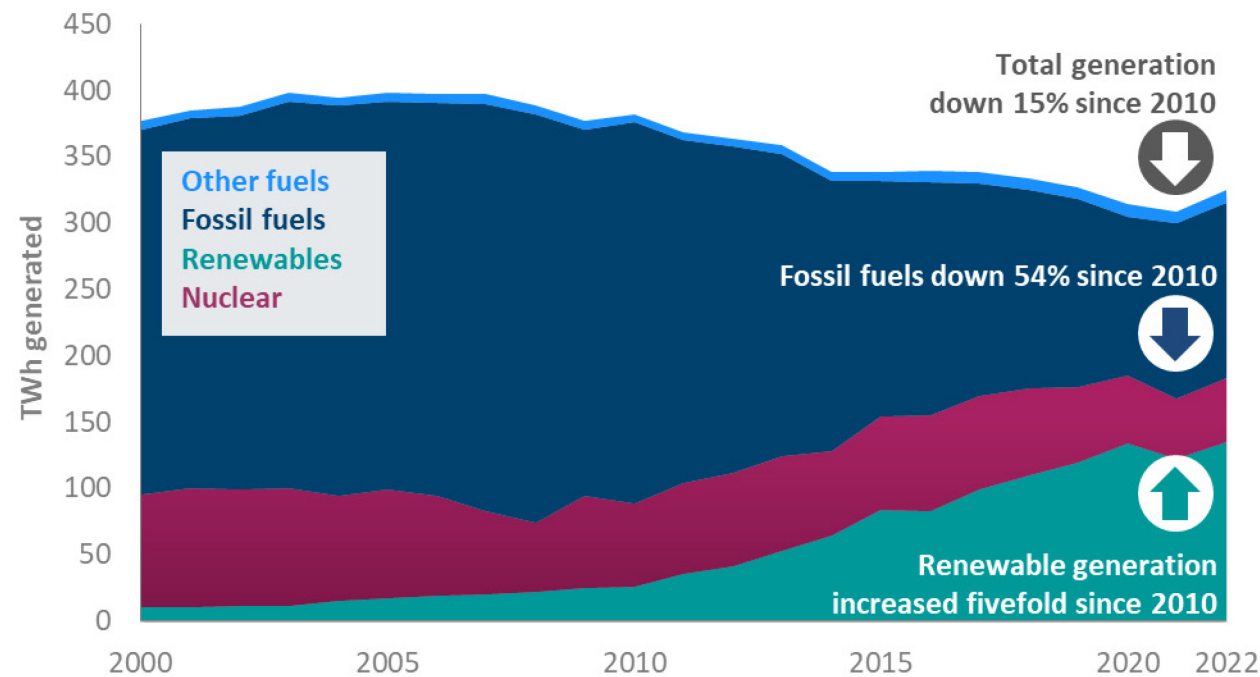
Chart 5.2 Share of total electricity demand split by sector, 2022 ([Table 5.2](#))



**Domestic users accounted for the largest share of total electricity demand (30.0 per cent), though this is 2.1 percentage points below the 2021 share (32.1 per cent).** Industrial consumption made up 26.5 per cent, increasing by 0.3 percentage points on the previous year's share, while commercial consumption accounted for 20.3 per cent, up by 1.0 percentage points.

**Electricity generation and supply increased in 2022 despite lower demand for electricity, as the UK became a net electricity exporter for the first time in more than 40 years.** Electricity generation measures what is generated while electricity supply measures what was supplied to the grid, 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 changed 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 319.9 TWh, with net exports of 5.3 TWh.

Chart 5.3 Electricity generated by fuel, 2000 to 2022 ([Table 5.6](#))



**Electricity generation rose to 325.3 TWh in 2022, up 5.3 per cent compared to 2021.** While electricity demand in the UK fell, higher demand from Europe led to a rise in UK generation to feed electricity exports. Major Power Producers (MPPs) generated 269.2 TWh, up 5.7 per cent compared to 2021, while generation from autogenerators and other generators also increased, up 3.2 per cent to 56.0 TWh. The share of generation from MPPs increased by 0.3 percentage points.

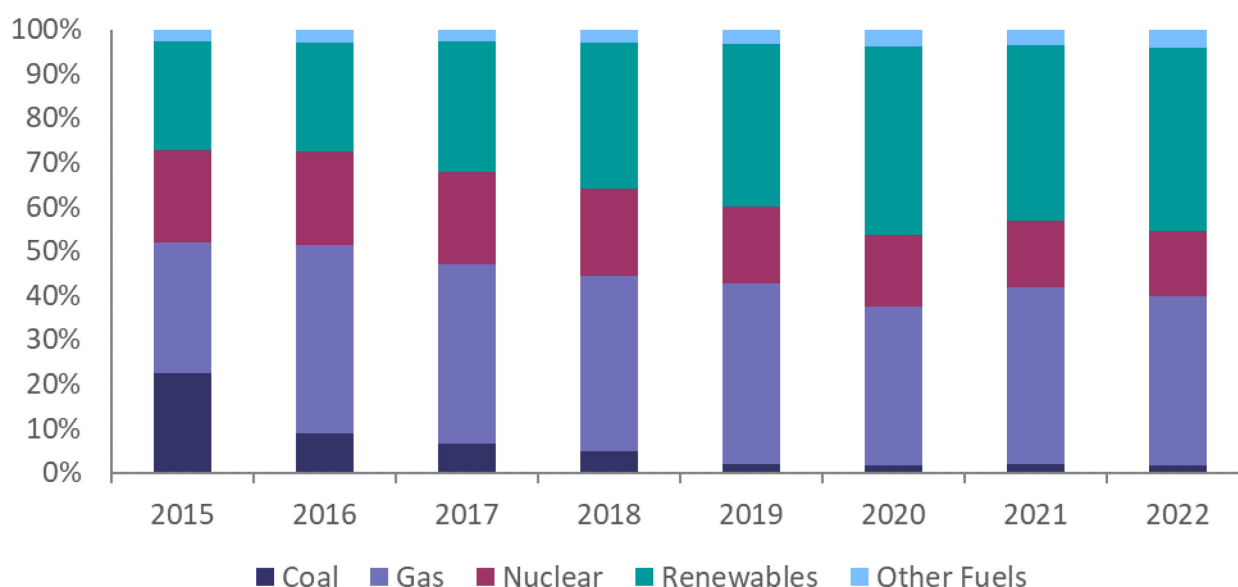
**Renewable generation reached record high levels in 2022, increasing 10 per cent to 135.0 TWh, driven by high output from wind and solar generators.** Capacity increases and wind speeds returning to more normal levels after 2021's unusually low values led to wind generation increasing 24 per cent on 2021 levels, to 80.3 TWh. Solar capacity also increased and combined with higher average sun hours led to solar generation rising 10 per cent to 13.3 TWh. Weather conditions were also favourable for hydro generators, with increased average rainfall producing a 4.5 per cent rise in generation. Outages at key bioenergy sites produced a reduction in generation of 11 per cent to 35.8 TWh, causing this to be the only form of renewable generation to see a fall compared to 2021 levels.

**Fossil fuel generation increased 0.9 per cent in 2022 to 132.8 TWh.** Most fossil fuel generation continued to come from gas, which increased 1.5 per cent to 125.0 TWh. Coal generation continued to decrease, down 14 per cent to 5.6 TWh, the second lowest value on the published data series. Only four coal-fired power plants were in operation in the UK in 2022, with commitments in place to phase these out by October 2024.

**Despite a reduction in operational capacity in 2022, nuclear generation rose 4.0 per cent to 47.7 TWh.** This reflected higher utilisation of the UK's remaining nuclear plants, as January 2022 saw the closure of Hunterston B, while Hinkley Point B began defueling in August 2022 ceasing all electricity production and entering the first stage of its decommissioning process.

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 2022** ([Table 5.6](#))



**Renewable sources accounted for 41.5 per cent of generation in 2022, exceeding the share of generation from fossil fuels for the second time in the published data series.** The renewable share rose by 2.0 percentage points compared to 2021 levels. Bioenergy was the only renewable technology to see a fall in its share, however this was offset by gains in other technologies. Wind generation accounted for just under a quarter of generation in 2022, up 3.7 percentage points to a 24.7 per cent share, while the shares for solar and hydro remained at similar levels to 2021.



**The share of generation from fossil fuels fell 1.8 percentage points to 40.8 per cent, as favourable weather conditions for renewables reduced the need for fossil fuel generation.** Gas accounted for the vast majority of the fossil fuel share, standing at 38.4 per cent of total generation and down 1.4 percentage points on 2021 levels. The share of generation from coal reached a new low of 1.7 per cent as coal generation continued to decline.

**Nuclear generation accounted for 14.7 per cent of generation in 2022, down 0.2 percentage points on 2021 levels and the lowest level since 2008.** This reflects relatively small increases in generation as operational capacity was reduced by the closure of two nuclear plants in 2022. Despite the decrease in the share from nuclear, the share of generation coming from low carbon sources (nuclear plus renewables) rose to 56.2 per cent in 2022, the second highest value on the published data series and 1.8 percentage points higher than in 2021.

**The total fuel used for electricity generation increased by 2.1 per cent in 2022 to 54.3 million tonnes of oil equivalent (Mtoe).** This was driven by a 5.3 per cent rise in UK generation due to increased export demand. Despite the increase in overall electricity generated, fuel used for electricity increased by a smaller proportion and has fallen 30 per cent in the last ten years, due to decreasing demand for electricity and growth in non-thermal renewables which do not incur conversion losses<sup>1</sup>.

Trends in fuel used broadly mirror those in electricity generation, with a small increase in the amount of fossil fuel and nuclear fuel use, decreased bioenergy and other fuel used and large increases in assumed fuel used by wind and solar generators. Gas continues to dominate the UK generation mix, with 22.2 Mtoe used in 2022, while coal use decreased to 1.4 Mtoe, the lowest value on the published data series.

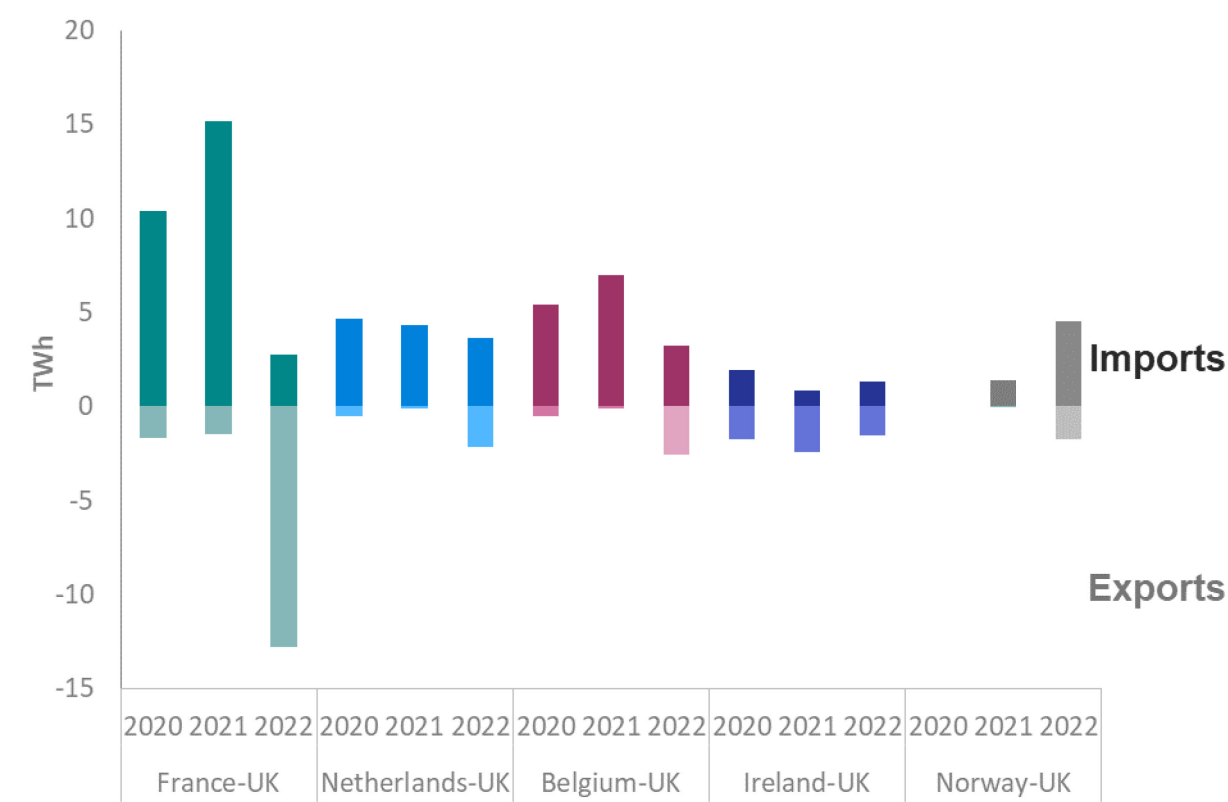
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<sup>1</sup> For wind, hydro and solar, in line with [international reporting standards](#), primary production of energy is defined as extraction of energy products in a useable form from natural sources. For wind this is the electricity generated 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 was a net electricity exporter in 2022 for the first time in more than 40 years, with net exports totalling 5.3 TWh.** Total imports reduced to 15.5 TWh, standing at half of 2021 levels. Meanwhile total exports increased fivefold compared to 2021, reaching 20.8 TWh. The primary reason for these changes was the widespread outages in the French nuclear fleet, increasing the demand for exported electricity to France. Historically, France has been the primary exporter of electricity to the UK making this change more pronounced.

The UK’s net exporter status was driven by two interconnections through which UK exports exceeded imports, as well as reductions in imports through other routes. The France-UK interconnectors accounted for 10.0 TWh of net exports, while the Northern Ireland-Ireland interconnector contributed 0.8 TWh of net exports to the total. Both the Netherlands-UK and Belgium-UK interconnectors reached historic lows of net imports, the first reducing by two-thirds on 2021 levels to 1.5 TWh, and the second reducing by 90 per cent to 0.7 TWh. The Norway-UK interconnector net imports doubled on 2021 levels as the interconnector saw its first full calendar year of usage.

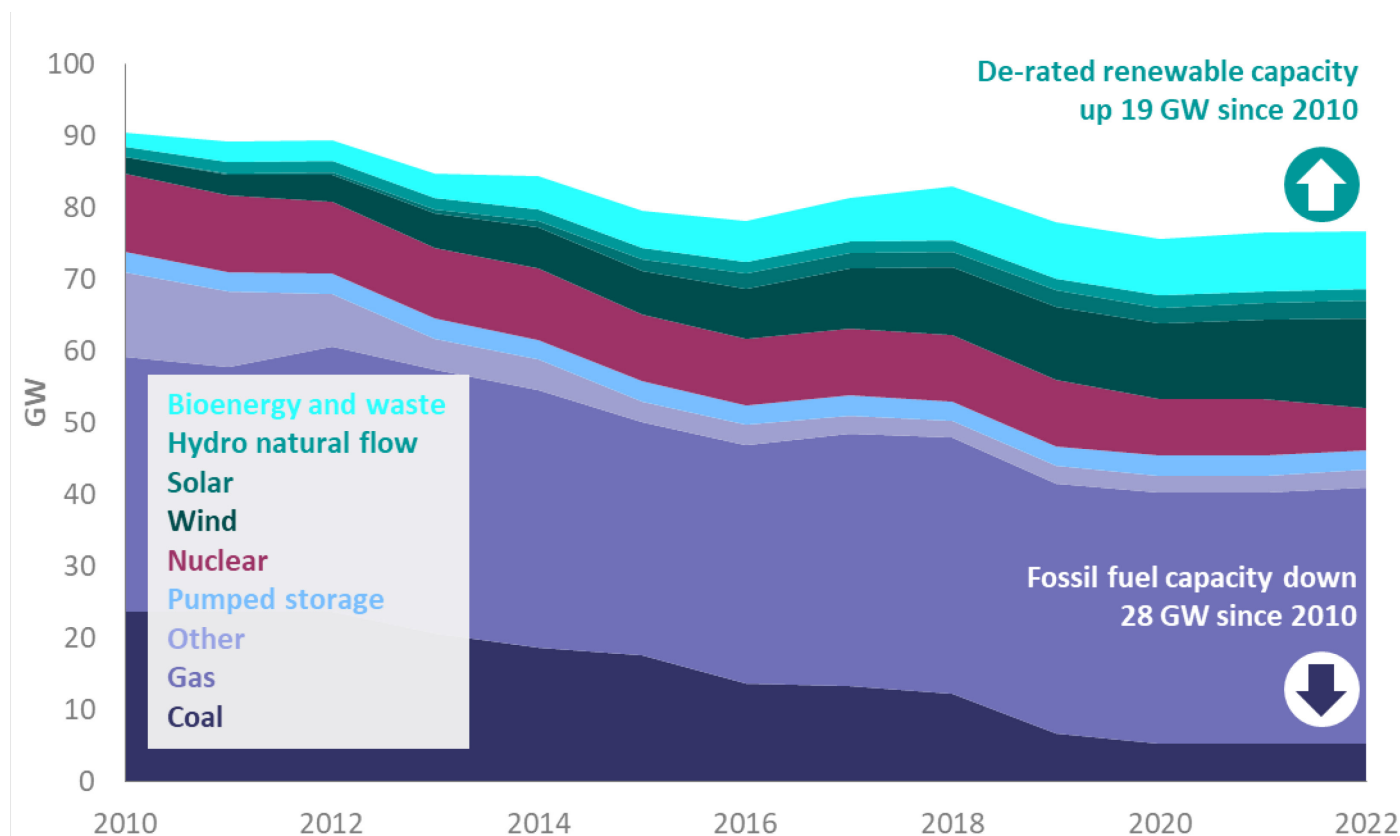
**Chart 5.5 Electricity imports and exports by country, 2020 to 2022** ([Table 5.13](#))



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 [Table 5.12](#).

**Chart 5.6 De-rated capacity of UK electricity generation assets by fuel, 2010 to 2022 ([Table 5.7](#))**

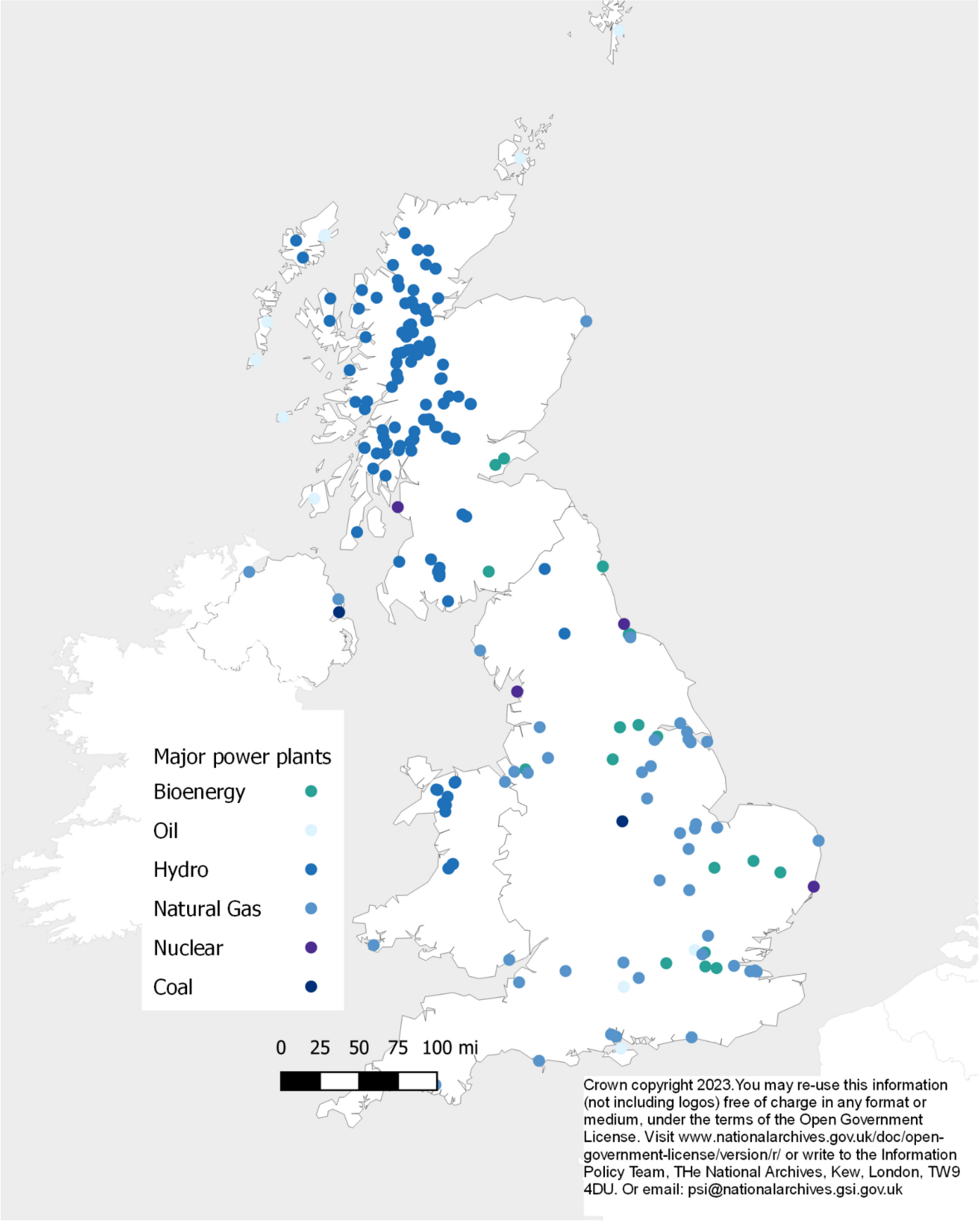


**Total de-rated generation capacity dropped to 76.7 GW in 2022, similar to 2021.** Capacity for renewable technologies increased by 6.2 per cent to 24.6 GW while fossil fuel capacity increased 1.9 per cent to 43.5 GW and nuclear capacity decreased 25 per cent to 5.9 GW. The peak demand in winter was similar to the equivalent figure in 2021 at 48.6 GW. As Major Power Producer (MPP) capacity fell by 1.1 per cent in 2022, the peak represented 75.5 per cent of MPP capacity, 0.7 percentage points higher than 2021.

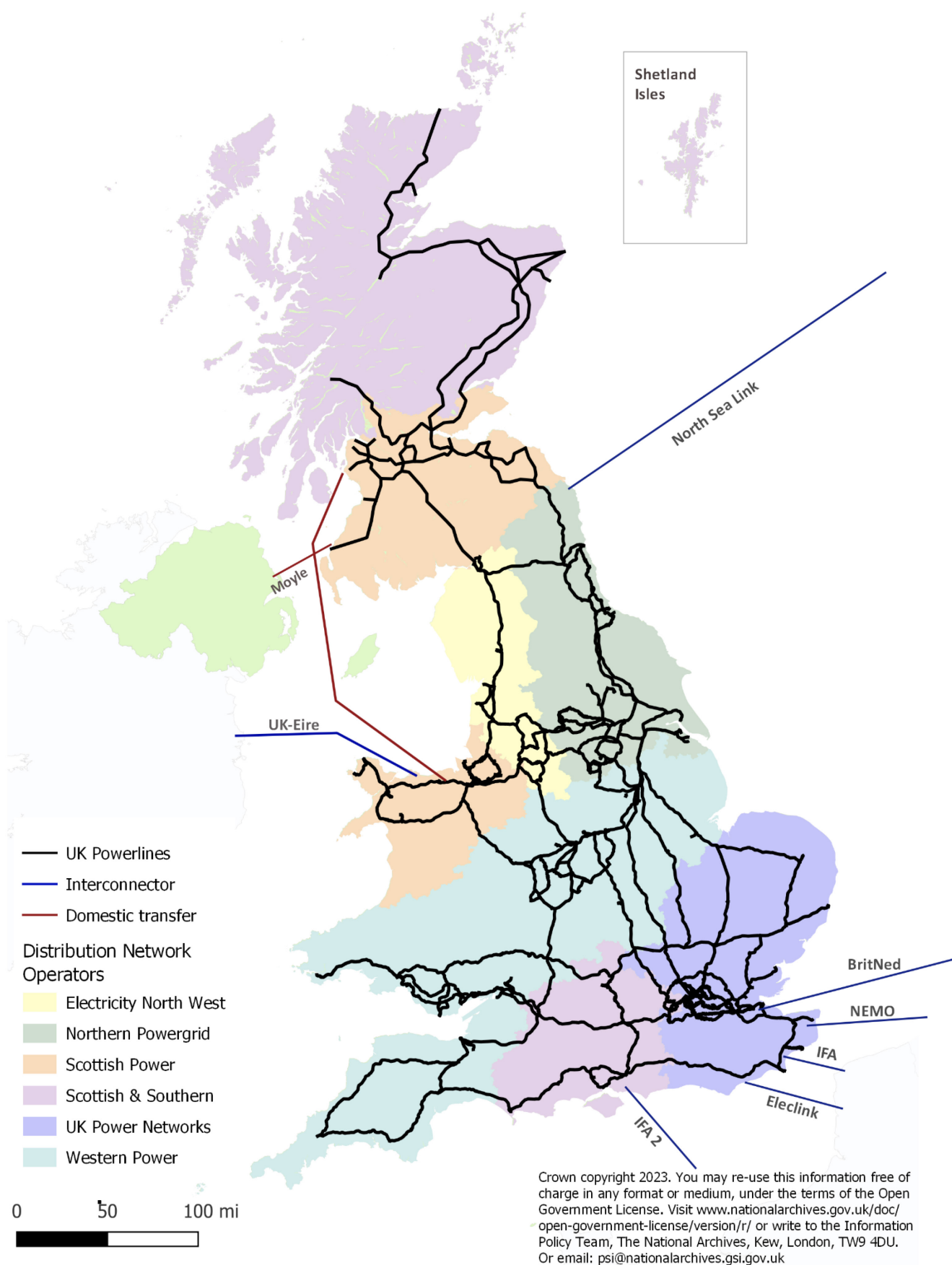
**Renewable capacity increased, driven by a large increase in offshore wind capacity.** Wind capacity increased by 12 per cent to 12.4 GW with a 2.4 per cent increase for onshore wind and a 24 per cent increase for offshore wind, including 0.9 GW at Moray East and 1.4 GW added to Hornsea Wind Farm. Solar capacity also saw an increase of 5.3 per cent to 2.5 GW.

**Major Power Producers' power plants were more intensively deployed than they were last year, with a load factor of 43.0 per cent ([Table 5.10](#)).** Load factors indicate the proportion of the time the plant is producing electricity and increased by 1.7 percentage points compared to 2021, in line with reduced capacity for Major Power Producers. Load factors vary by technology, with nuclear stations the highest at 72.2 per cent and the lowest being pumped storage hydro at 8.3 per cent. Full load factors for renewable generation are given in [Table 6.3](#).

Map of Major Power Producers in the UK (operational May 2023)



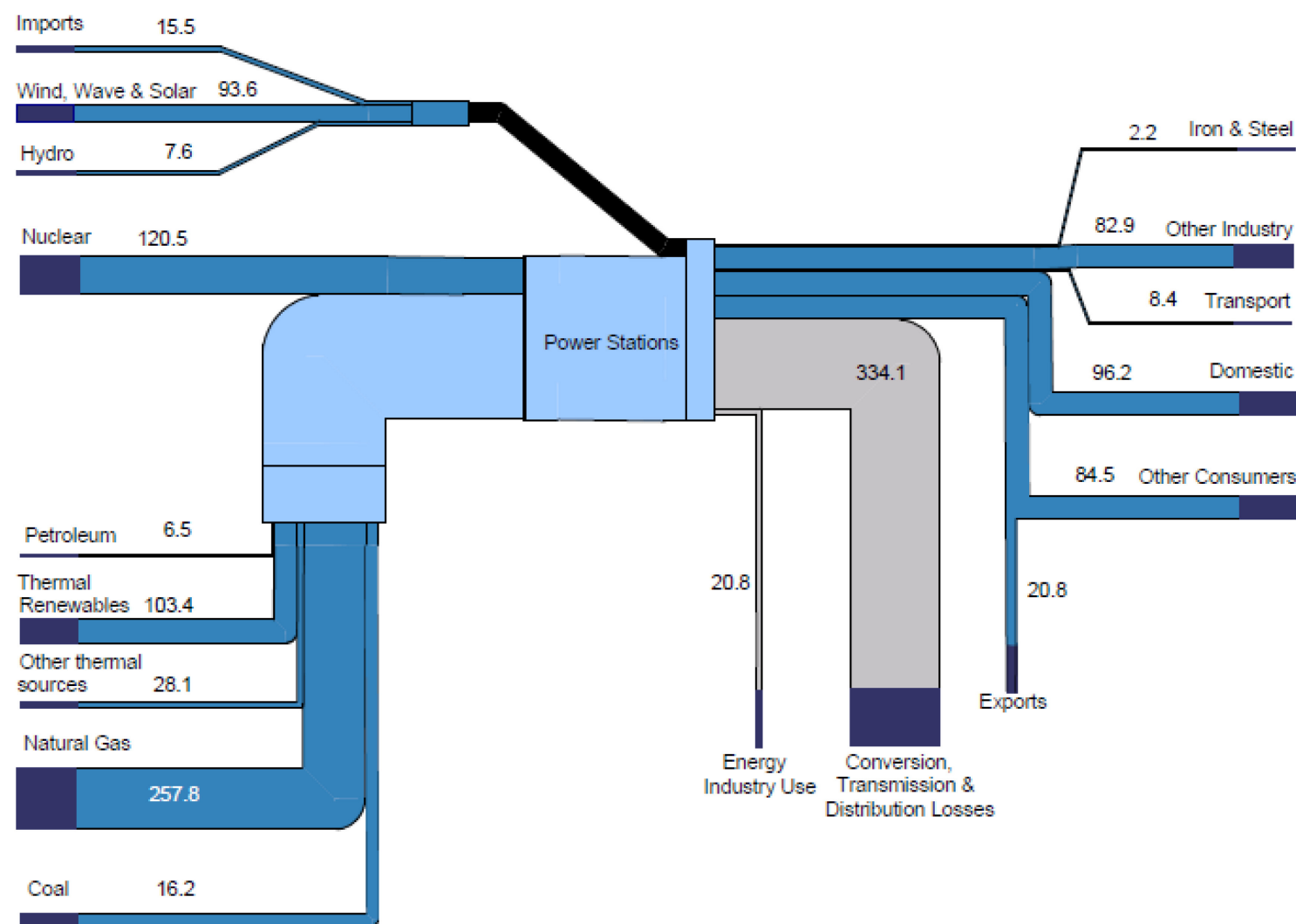
# UK Distribution Network Operating Areas and GB Power Lines Map



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

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

# Electricity Flow Chart 2022 (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 increased by 10 per cent in 2022 to a new record of 135.0 TWh.** This was just 0.5 per cent higher than the previous record set in 2020 when unusually favourable weather conditions hit the UK. The key driver in 2022 was new capacity and an improvement in weather conditions compared to 2021. Within the technologies, records were set for onshore and offshore wind, solar PV, and anaerobic digestion.

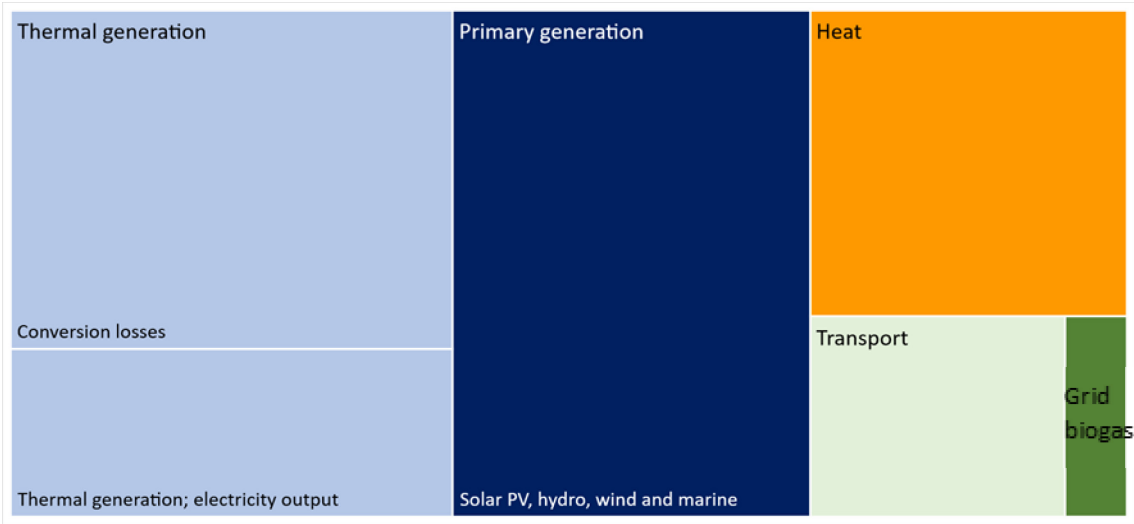
**Renewable capacity increased by 7.7 per cent (3.8 GW), the highest growth rate since 2018 and just below the 3.9 GW installed in that year.** This remains lower than the average annual growth rate between 2012 and 2018 which was 20 per cent. Of the 3.8 GW new capacity in 2022, 2.7 GW was in offshore wind, 0.7 GW in solar PV, and 0.3 GW in onshore wind.

**Renewable heat increased by just 1.1 per cent;** increases in heat pumps and plant biomass were somewhat offset by a fall in bioliquids (newly reported in 2023).

**As a share of gross final consumption, overall renewables accounted for 14 per cent, an increase of 0.8 percentage points on 2021,** a combination of increases in renewable electricity generation and use of biofuels in transport, 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 72 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 per cent and 2 per cent respectively. Chart 6.1 below shows the demand for all renewable fuels including losses from the conversion process.

Chart 6.1 Renewable fuel<sup>1</sup> demand, 2022 ([Table 6.4](#))



<sup>1</sup> Including non-biodegradable waste

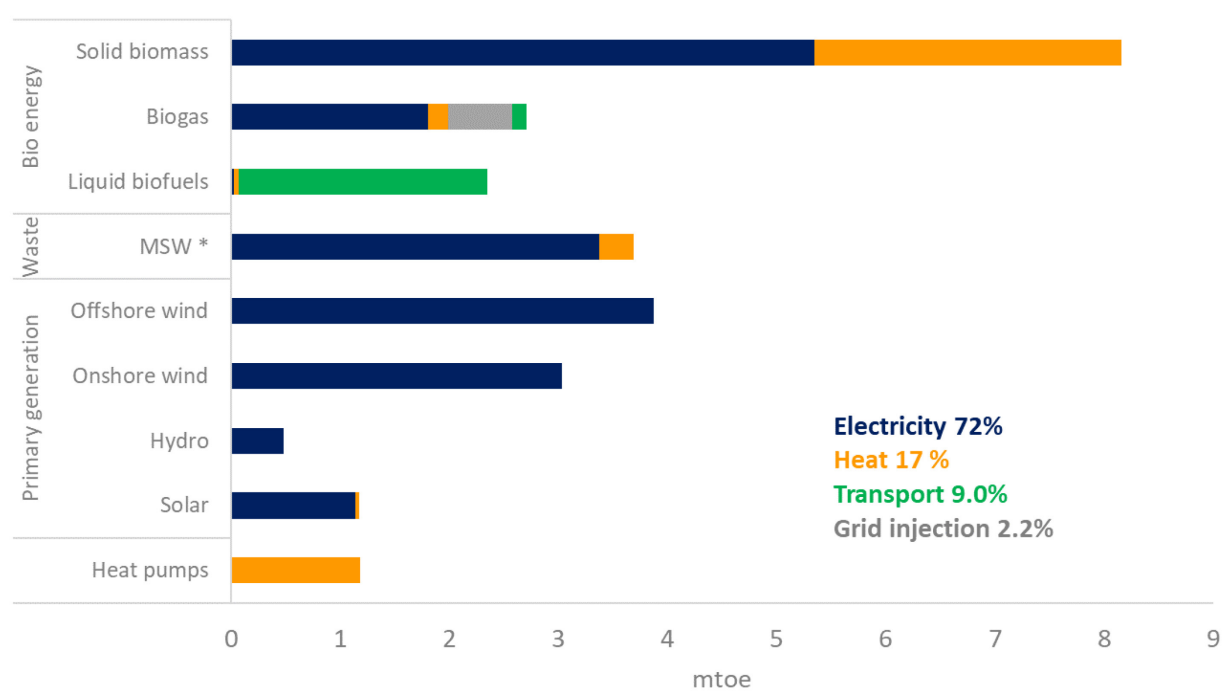


The chart replicates data included in Table 6.4; where this differs to Table 6.2 is the latter includes electricity generation only, i.e. primary generation and thermal generation after losses. The amount of conversion losses depends on the efficiencies of fuels which for renewables varies at around 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.

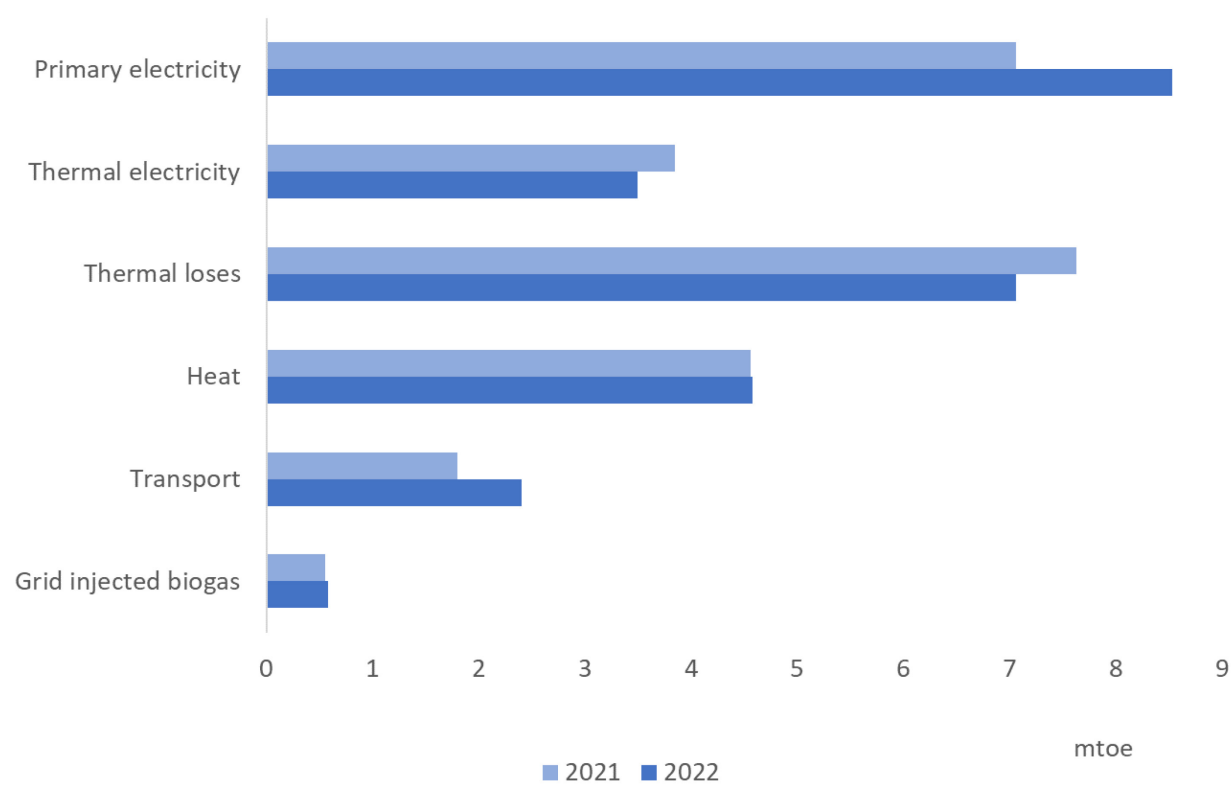
Chart 6.2 shows how the individual fuels and technologies are consumed across the end uses (note: thermal fuels include losses incurred during conversion).

**Chart 6.2 Use of renewable fuels, 2022** ([Table 6.4](#))



Between 2021 and 2022, overall renewable fuel demand increased by 4.7 per cent with the majority of the increase being from primary electricity generation, particularly wind. Use of biofuels in transport also increased though generation from thermal renewables fell along with the associated conversion losses. Renewable heat demand increased marginally (by just 0.8 per cent); growth in heat pumps and plant biomass was offset by a fall in liquid biofuel consumption. Chart 6.3 shows how each component of fuel demand changed between 2021 and 2022.

Chart 6.3 Change in renewable fuel demand 2021 to 2022 (Table 6.4)



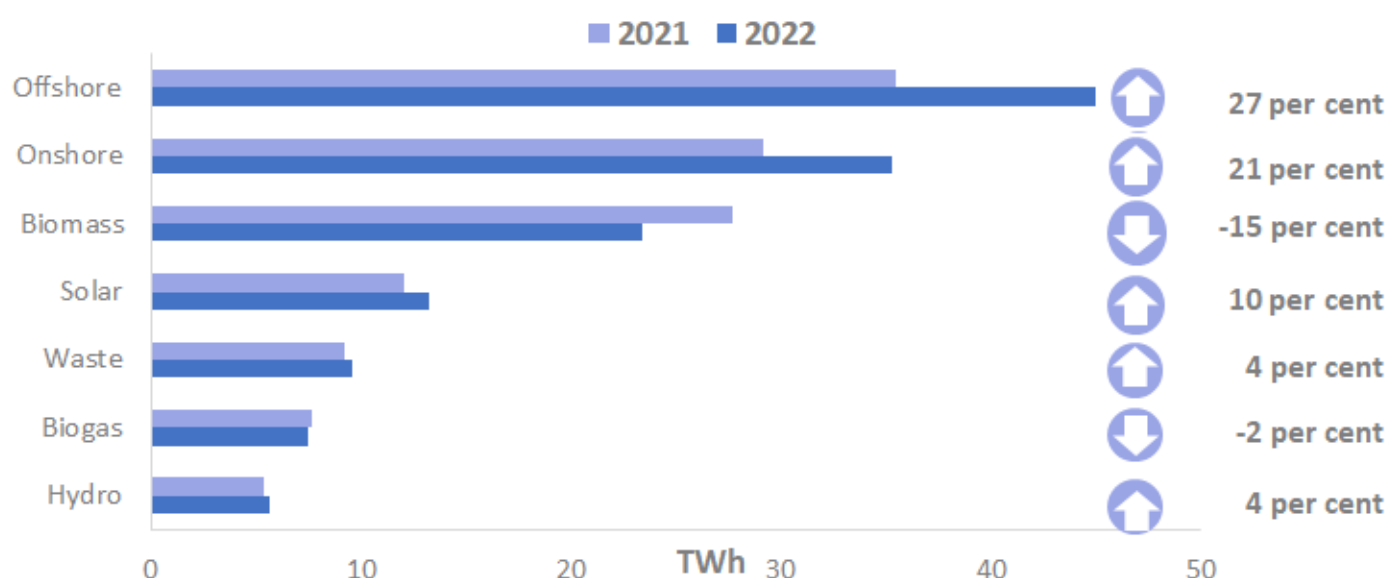
**At 135.0 TWh, overall renewable generation set a new record, beating the previous 2020 record by just 0.5 per cent.** Although weather conditions in 2022 were more favourable than in 2021, they were less extreme than those experienced in 2020 and it was the new capacity since 2020 that played a major part in achieving the new record.

**Both onshore and offshore wind achieved records in 2022;** generation from offshore wind increased by 27 per cent and onshore by 21 per cent. Although wind speeds were higher than in 2021, they were still lower than in 2020 and it was new capacity particularly in offshore wind (which increased by 24 per cent), contributed to the new record. At 45.0 TWh, offshore wind generation alone exceeded total renewable generation of ten years ago (41.2 TWh).

**Similarly solar PV exceeded its previous record from 2020.** As with wind generation, new capacity contributed to the new record but unlike wind speeds, sun hours were higher in 2022 compared to both 2021 and 2020. The impact on generation in 2022 is a 10 per cent increase on 2021 and 6.2 per cent compared to 2020.

Chart 6.4 shows the change in generation between 2021 and 2022 across the technologies both in absolute and percentage terms.

**Chart 6.4 Electricity generation by fuel, 2021 – 2022 ([Table 6.2](#))**



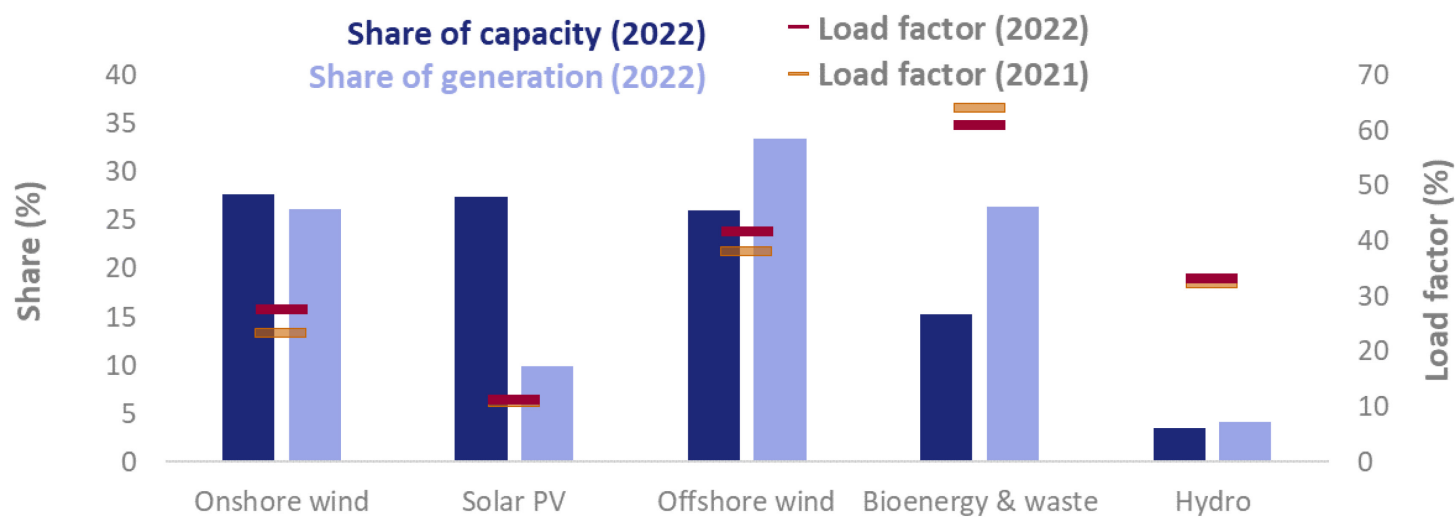
**Hydro generation increased by 4.5 per cent** in 2022 to 5.6 TWh, though remains lower than the previous record set in 2020 when the UK saw record levels of rainfall. Hydro is an established technology and there has been little new capacity in recent years.

**Overall, bioenergy generation fell by 12 per cent** to 31.1 TWh, the lowest since 2018. This is largely due to maintenance outages at three large power stations suppressing demand for plant biomass (mostly wood pellets). Generation from landfill gas continues to decrease in line with falling yields. **Only anaerobic digestion and energy from waste saw increases in 2022**; generation from anaerobic digestion was a record 3.4 TWh, a 3.5 per cent increase on 2021.

**Offshore wind continues to be the leading renewable technology in 2022 for generation**, accounting for 56 per cent of all wind generation and a third of all renewable generation in 2022. 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 2022. The load factors for both 2021 and 2022 have been added where the impact of more favourable weather in 2022 can be seen in the higher load factors.

Chart 6.5 Relative share of capacity and generation and load factors 2022 (Table 6.3)

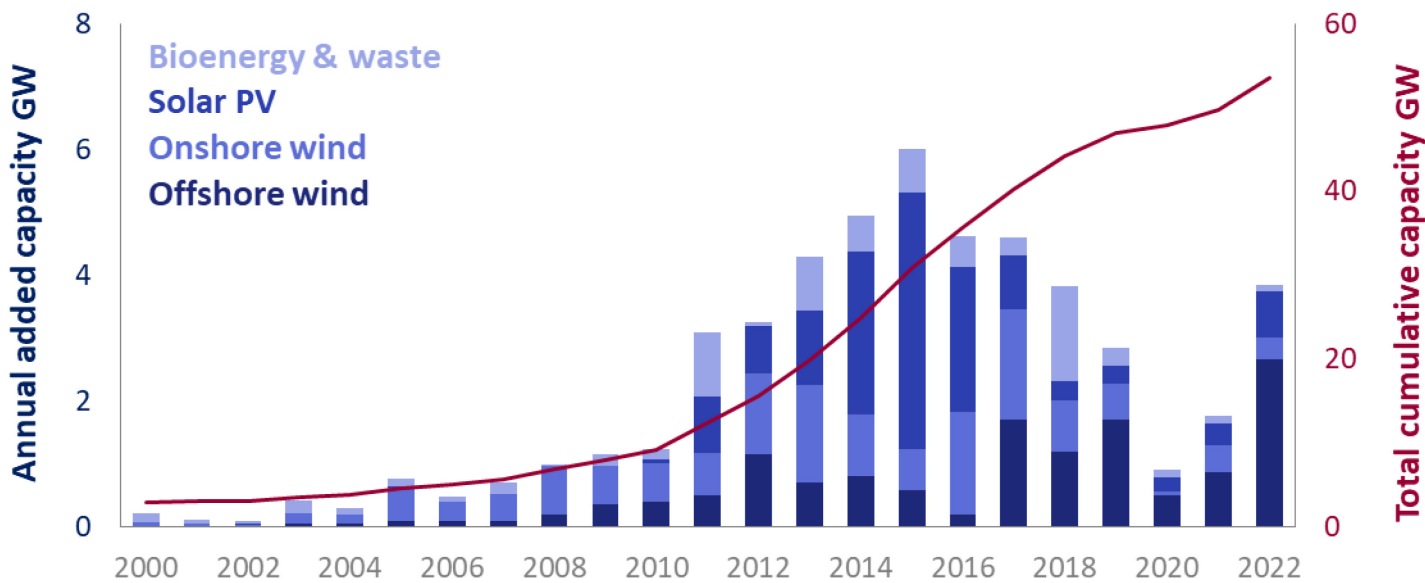


Thermal generation such as bioenergy and waste tend to have high, stable load factors varying only when outages occur at major power plants. Conversely, solar PV has a very low load factor due to limited hours of sunlight in the UK.

On an unchanged configuration basis, where only sites operating for the full year are included, the load factor for overall renewables in 2022 was 38.1 per cent. This was 0.8 percentage points higher than in 2021 and the second highest since 2015. The load factors were driven by more favourable weather conditions including higher average wind speeds and longer average sun hours. Load factors also increased for hydro and solar PV. This was partially offset by a fall in the load factor for bioenergy, particularly for plant biomass, which was the lowest since 2013, due to outages. 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 and was at a similar volume to that last seen in 2018, capacity growth was driven by three large offshore wind projects. New capacity began to slow after 2018 when 3.8 GW was installed falling to just 0.9 GW in 2020. New capacity reached a peak in 2015 when a total of 6.0 GW was installed, 4.1 GW of which was in solar PV.

Chart 6.6 Annual added capacity 2000 to 2022 (Table 6.2)



Since 2002, large scale solar PV was eligible for the Renewables Obligation (RO), however, up until 2010, when the Feed-in Tariff (FiT) was launched, solar PV still represented just 1.0 per cent of renewable generation capacity. In 2022, solar PV's share of renewable capacity stood at 27 per cent with the majority of new capacity (86 per cent) being installed between 2011 and 2017, when growth began to slow; the Renewable Obligation closed to new entrants in 2016 and the FiT in April 2019. Growth has since improved and during 2022 there were more domestic solar panels installed than in any year since 2015<sup>2</sup>.

Growth in new wind sites has been more stable, particularly onshore wind, though it has slowed over recent years with just 0.3 GW added in 2022 (an increase of 2.4 per cent) and 0.4 GW added in 2021. Offshore wind has seen much higher levels of new capacity in recent years with 62 per cent of total capacity being installed since 2016. Wind now represents around 54 per cent of installed renewable capacity (see wind map at the end of this chapter showing location by capacity). In 2022 there was 2.7 GW of new capacity, including three new plants: Hornsea 2 in England (1,386 MW), Moray East in Scotland (950 MW) and the first part of Seagreen, also in Scotland (270 MW at the end of 2022).

**Chart 6.7 Trends in generation by technology 2000 to 2022 (Table 6.2)**

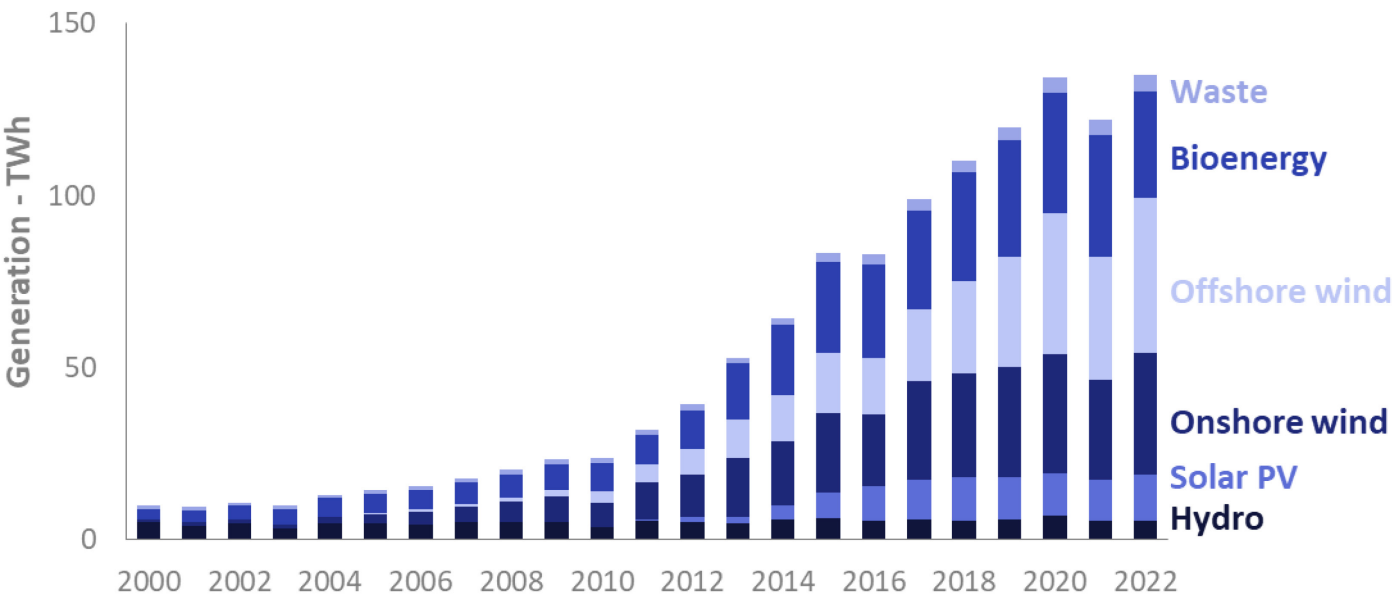


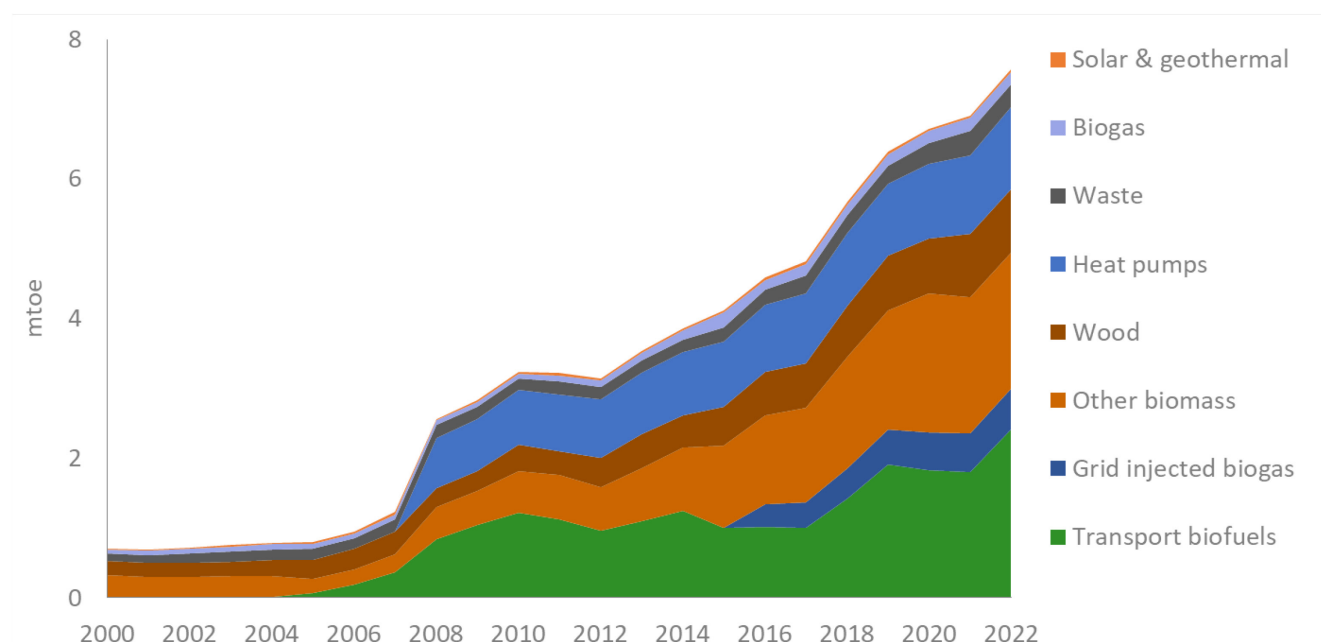
Chart 6.7 shows the changes in electricity generation fuel mix since 2000. The overall upward trend in generation is driven by increasing cumulative capacity. However, there are year-on-year fluctuations due to weather conditions. For example, despite the record capacity installed in 2015, generation for 2016 remained similar to 2015. This can also be seen with a fall in generation in 2021. Generation in 2022 is the highest on record but only marginally higher than in 2020.

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 9.8 per cent in 2022.

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

Bioenergy has seen rapid growth since 2012 as several large power stations converted from coal to plant biomass (mainly wood pellets), and although the outages suppressed generation in 2022, it remains almost five times higher than in 2012. 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 has been more than offset by a seven-fold increase in anaerobic digestion since 2012.

**Chart 6.8 Other renewable fuel uses<sup>3</sup>; heat, transport, and grid injected biogas (Table 6.4)**



Whilst electricity generation represents almost three quarters of renewable fuel demand, heat also accounts for a sizable proportion (17 per cent), followed by transport biofuels (9.0 per cent) and biogas injected into the gas grid (just above 2.2 per cent).

Renewable heat demand is largely met by biomass, mostly wood, accounting for 61 per cent of fuel in 2022, with the next largest share being heat pumps (26 per cent). The remainder is largely made up of wastes and biogases (6.9 per cent and 4.0 per cent respectively), with bioliquids and primary sources (such as active solar heating and geothermal) accounting for around 1 per cent each.

Renewables used in transport are liquid and gaseous biofuels, supplied either as additives or as replacement (“drop-in”) for fossil fuels. Among liquid biofuels, biogasoline and biodiesel dominate the fuel mix, representing 90 per cent of transport demand when combined. Since 2018, small but rapidly increasing amounts of new biofuels became available in the UK. In 2022, 5.4 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 0.6 per cent, though supply is particularly volatile. Bio-jet fuel is newly reported in this edition of DUKES with effect from 2021, and in 2022, accounts for 4.0 per cent of all transport renewables but only 1 per cent of aviation demand.

**When compared to 2021, demand for transport biofuels grew by 34 per cent to 2,406 ktoe**, driven by the rebound of transport sector after Covid-19 and by policy changes. Strong growth in bio gasoline (up 41 per cent in 2022) is 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.

<sup>3</sup> Including non-biodegradable waste

Consumption of biodiesel increased by 30 per cent in 2022 but this is likely an artificial trend observed after a depression in biodiesel supply during 2021, largely due to a shortage of used cooking oil (the main feedstock for biodiesel) during lockdowns. When compared with 2019, biodiesel demand has increased by less than 3 per cent.

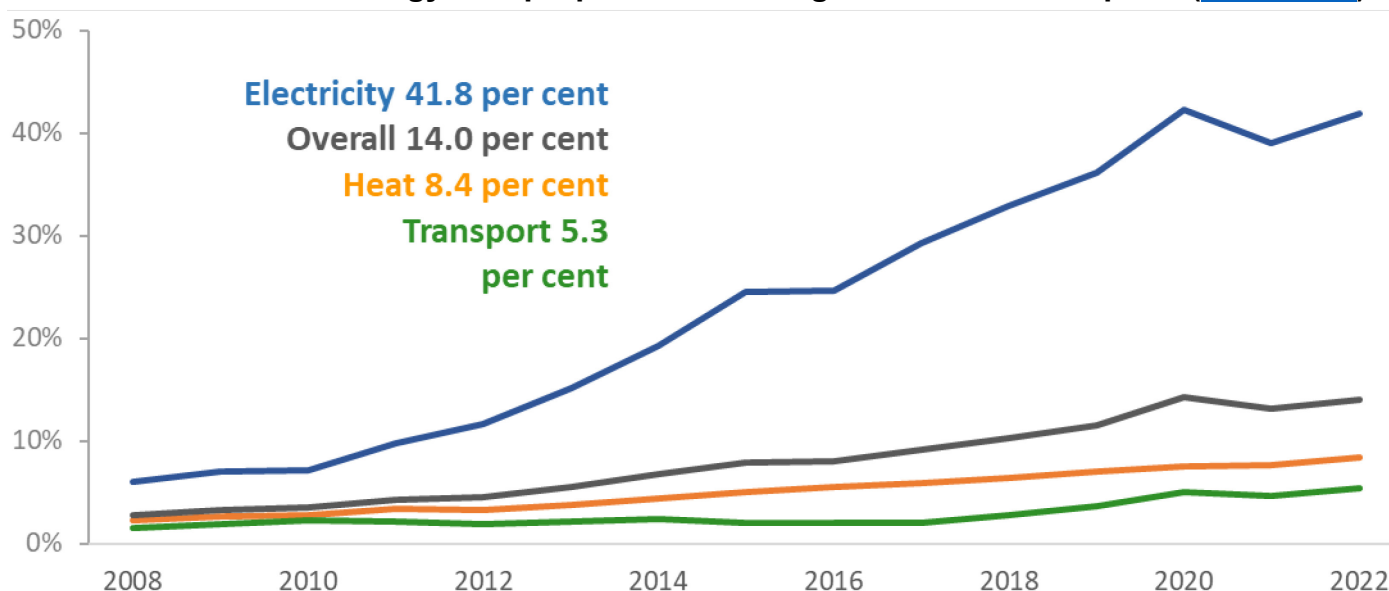
**Indigenous production of bioliquids increased in 2022, but still lags demand.** With capacity stable at 504 ktoe per annum and production of bioethanol being only 251 ktoe in 2022 (though 25 per cent higher than in 2021), imports met the excess demand. Biodiesel capacity, however, increased to 596 ktoe per annum but production stalled at 442 ktoe in 2022.

**Biogas injected into the National Grid increased by 4.9 per cent in 2022 driven by anaerobic digestion.** Until 2016, only minimal amounts of biogas from anaerobic digestion sites were injected into the grid but with support from the Renewable Heat Incentive, it has increased steadily, and since 2018, small quantities of sewage gas have also been injected.

To place renewable energy in context, [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. Demand for liquid biofuels (mostly consumed in transport) soared in 2022, driving the higher share of renewable consumption.

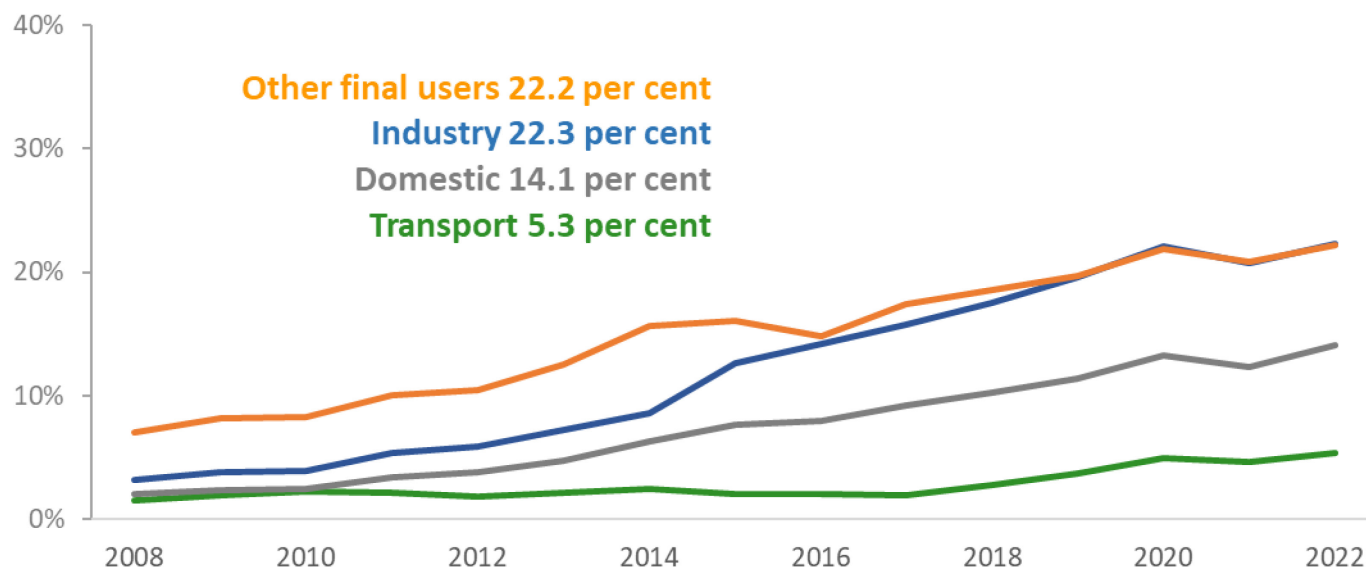
**Chart 6.9 Renewable energy as a proportion of total gross final consumption ([Table 6.5a](#))**



The renewable proportion consumed by sectors, regardless of end use, varies depending on the proportion of electricity consumed versus thermal fuels. Chart 6.10 below highlights how the proportion of renewables for industry has increased and, since 2016, has been in line with 'other' consumers (commercial and public administration). This reflects lower heavy industry consumption that requires higher grade heat usually provided by fossil fuels.



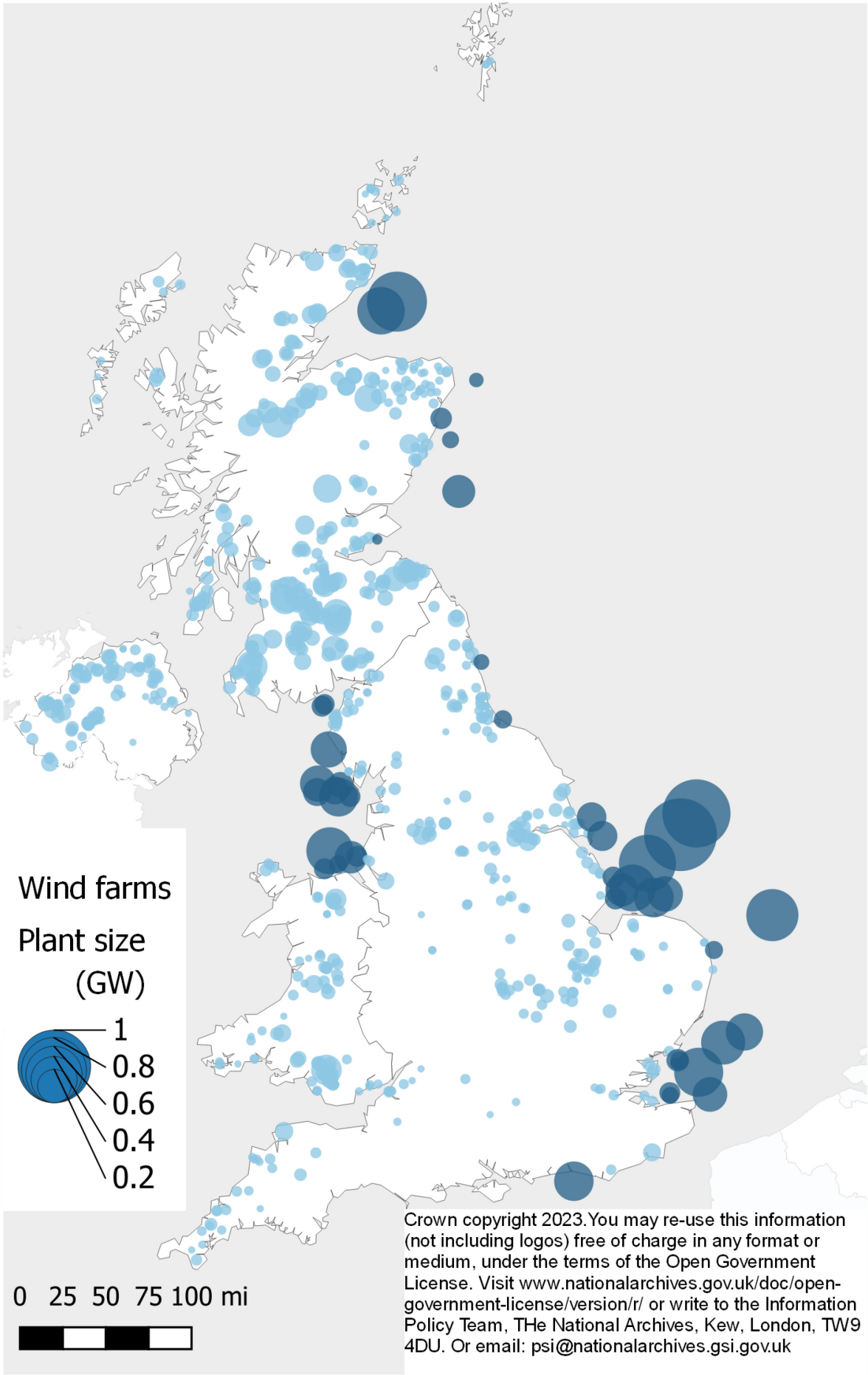
**Chart 6.10 Renewables' share of final energy consumption by sector ([Table 6.5b](#))**



All sectors show an increase, in line with an increase in renewable electricity supply. The domestic sector saw the largest increase in its renewable share of consumption (1.8 percentage points) which is likely driven by lower gas demand in households due to warmer weather during 2022 and changes in consumer behaviour driven by higher energy prices.

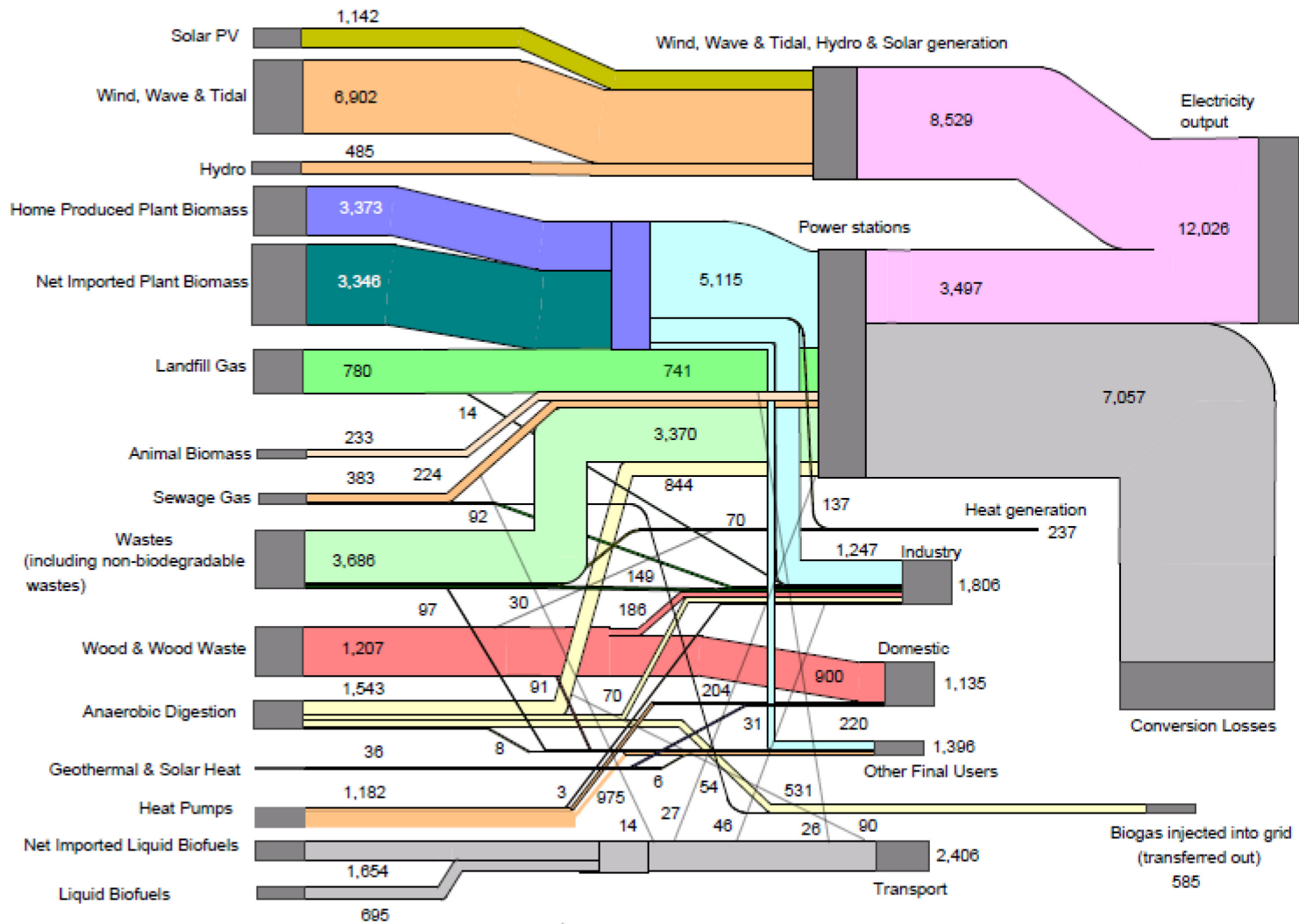
The map below shows UK wind farms that were operational at the end of 2022 with a capacity 0.5 GW or more; there are around 9,000 sites below this threshold and other sites are excluded due to a lack of precise location data. The locations are representative and not exact.

Map of UK wind capacity 2022



Renewable energy flow chart 2022 (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

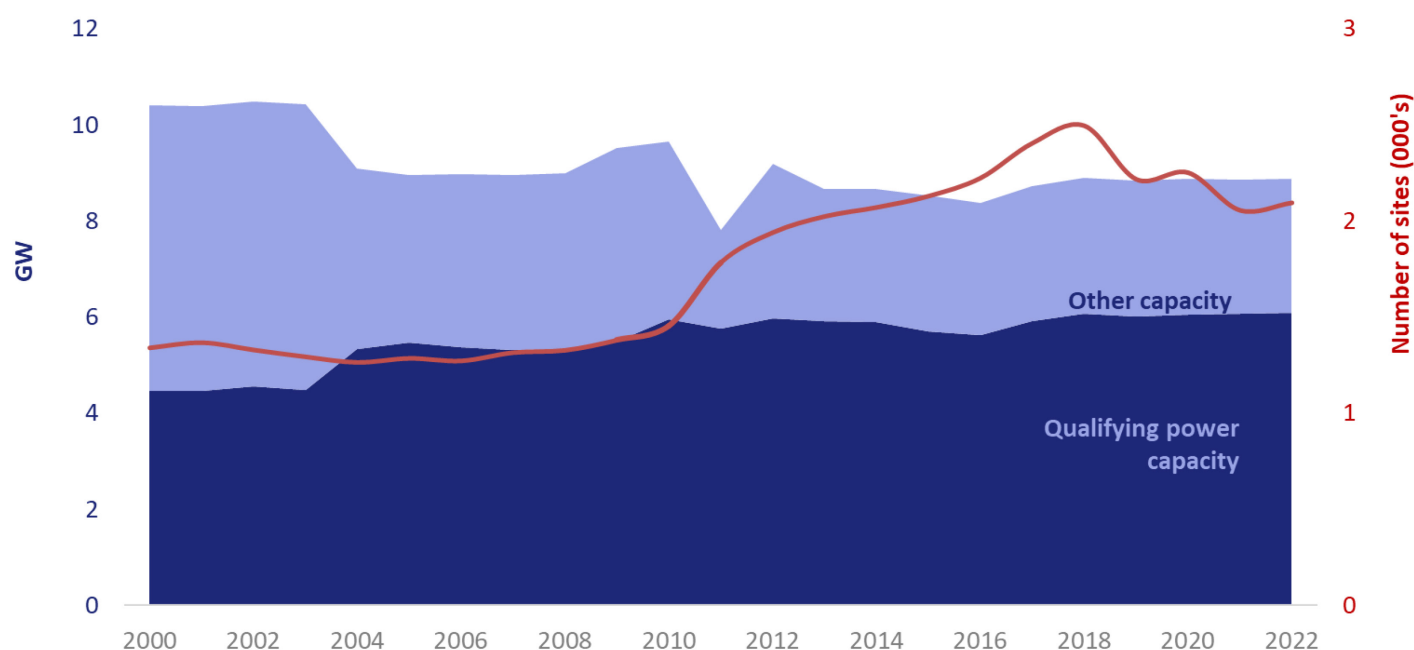
**In 2022, renewable fuels accounted for 17 per cent of total CHP fuel input, a new record.**

CHP qualifying output represented 7.0 per cent of total electricity generation, a proportion which has been stable for the past five years.

Gas continues to be the main fuel consumed in CHP plants (around two thirds of fuel input), representing 7.7 per cent of gas demand.

CHP, sometimes referred to as 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 ([Table 7.1.A](#))**

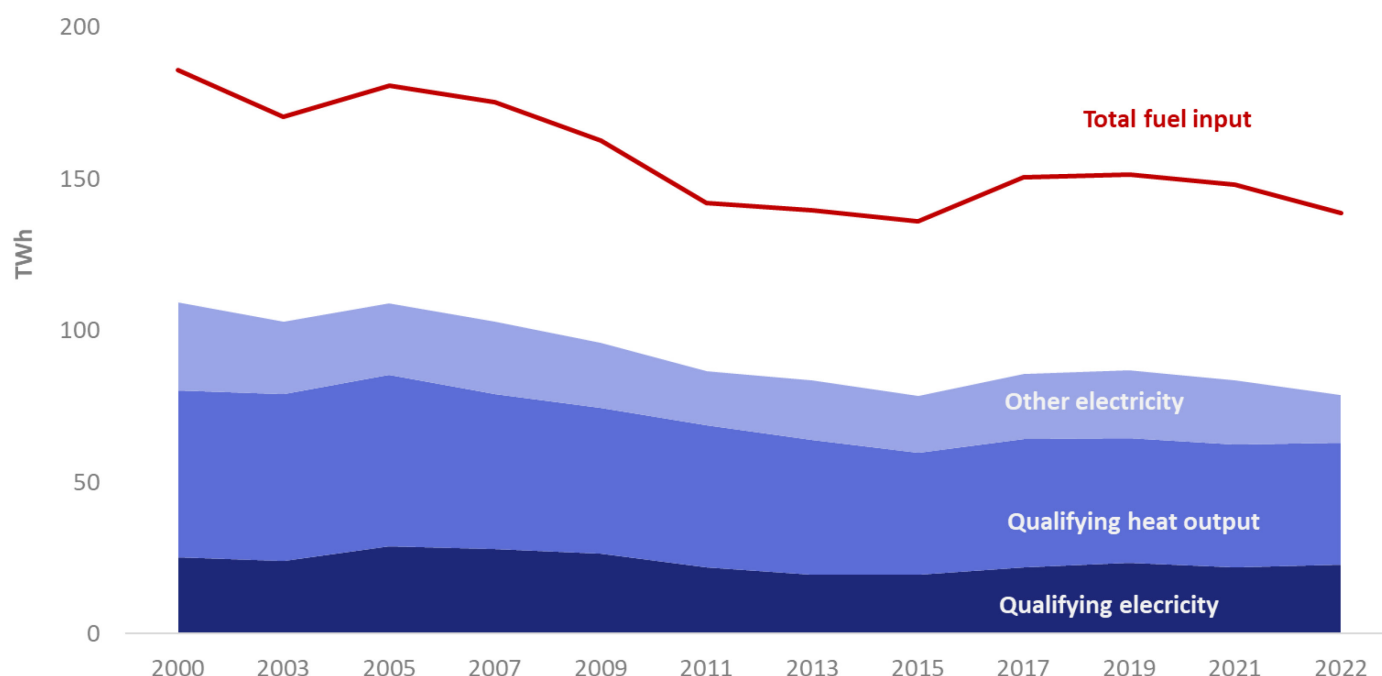


Since 2000, the number of sites remained steady until 2011 and 2012 when an additional data source was identified, and extra schemes were included in the database. The number of schemes then peaked in 2018, before falling by around 400 units between 2019 and 2022. This coincides with a decision taken 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 capacity has fallen by

15 per cent but qualifying capacity has increased by 37 per cent, resulting in its share increasing from 43 per cent in 2000 to 69 per cent in 2022.

In 2022, 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.

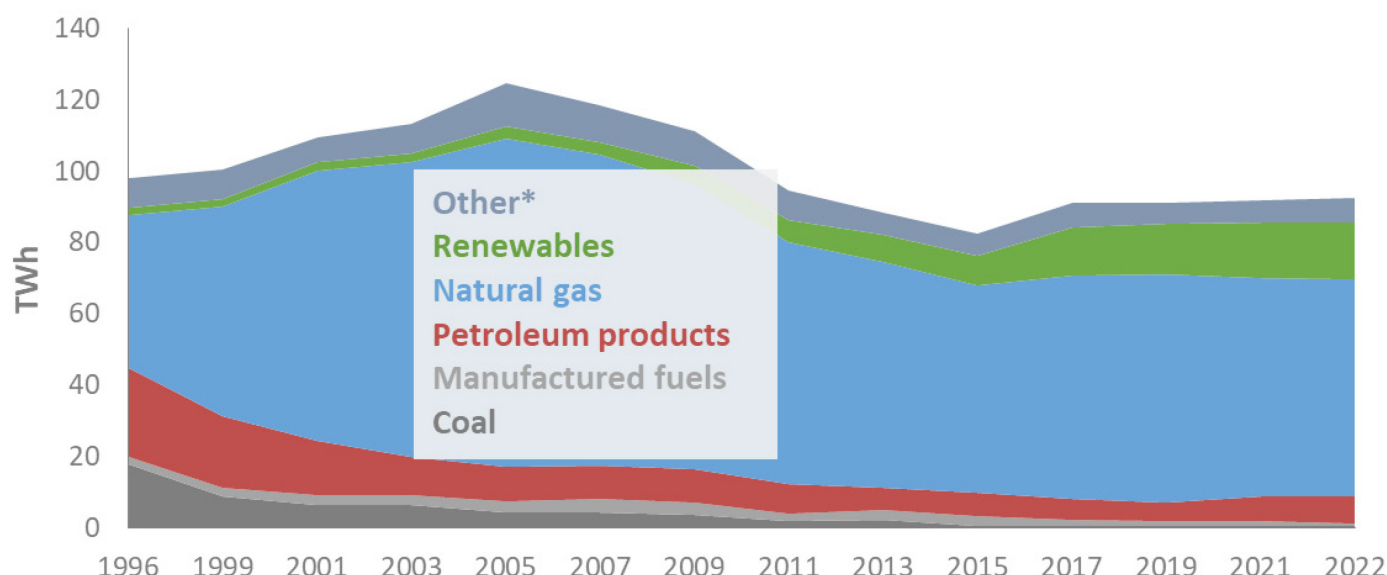
**Chart 7.2 Comparison of total fuel and CHP outputs from 2000 ([Table 7.1.A](#))**



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.

**Gas remains the main fuel consumed by CHP schemes representing 66 per cent of the total in 2022,** 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 2022. Chart 7.3 shows this long-term trend.

**Chart 7.3 Trends in fuel demand for CHP<sup>1</sup> 1996 to 2022 (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 over the last two years. Conversely, coal and manufactured fuels' share represented 20 per cent in 1996 but has plummeted to 1 per cent in 2022. 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 maximum of 17 per cent in 2022.

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 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 (Table 7.8.A) across the regions (11.4 MW, markedly higher than the next highest at 3.4 MW for the North East). Northern Ireland has the lowest average capacity (1.0 MW), and the region with the highest number of schemes is the South East (average capacity at 3.1 MW).

<sup>1</sup> Fuel demand for heat and qualifying electricity output

**Chart 7.4 Number of schemes and capacity by region in 2022** ([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 48 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 2022, 33 per cent of qualifying outputs (heat and electricity) were exported** with the remaining 66 per cent being used on site. Less than half of qualifying electricity is exported (45 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 (76 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](#)).



# Data tables in this release

## Chapter 1 Energy

- 1.1 Aggregate energy balance
- 1.2 Value balance of traded energy
- 1.3 Sales of electricity and gas by sector

### **Total energy long term trends**

- 1.1.1 Inland consumption of primary fuels and equivalents for energy use
- 1.1.2 Availability and consumption of primary fuels and equivalents (energy supplied basis)
- 1.1.3 Comparison of net imports of fuel with total consumption of primary fuels and equivalents
- 1.1.4 Primary energy consumption, gross domestic product, and the energy ratio
- 1.1.5 Energy consumption by final user (energy supplied basis)
- 1.1.6 Expenditure on energy by final user
- 1.1.7 Mean air temperatures (averages)
- 1.1.8 Mean air temperatures (deviations)
- 1.1.9 Mean heating degree days

## Chapter 2 Solid fuels and derived gases

- 2.1 Coal: Commodity balances
- 2.2 Supply and consumption of coal
- 2.3 Supply and consumption of coke oven coke, coke breeze, and other manufactured solid fuels
- 2.4 Supply and consumption of coke oven gas, blast furnace gas, benzole, and tars
- 2.5 Deep mines and surface mines in production, December 2022
- 2.6 Identified GB coal resource assessment, June 2023
- 2.7 Imports of coal
- 2.8 Exports of coal

### **Solid fuels long term trends**

- 2.1.1 Coal production and stocks
- 2.1.2 Inland consumption of solid fuels

## Chapter 3 Petroleum

- 3.1 Primary oil: Commodity balances
- 3.2 Petroleum products: Commodity balances
- 3.3 Supply and disposal of petroleum
- 3.4 Additional information on inland deliveries of selected products
- 3.5 Stocks of crude oil and petroleum products at end of year
- 3.6 Additional information on inland deliveries for non-energy uses
- 3.7 Imports of crude oil and petroleum products by country of origin
- 3.8 Exports of crude oil and petroleum products by country of destination

### **Oil long term trends**

- 3.1.1 Crude oil and petroleum products: production, imports, and exports
- 3.1.2 Inland deliveries of petroleum

## Chapter 4 Natural gas

- 4.1 Commodity balances
- 4.2 Supply and consumption of natural gas and colliery methane
- 4.3 UK continental shelf and onshore natural gas production and supply
- 4.4 Gas storage sites and import/export facilities in the United Kingdom, November 2022
- 4.5 Natural gas imports and exports
- 4.6 Liquefied Natural Gas imports by terminal

## **Gas long term trends**

### **4.1.1 Natural gas and colliery methane production and consumption**

## **Chapter 5 Electricity**

- 5.1 Commodity balances
- 5.2 Commodity balances, public distribution system and other generators
- 5.3 Fuel used in generation
- 5.4 Fuels consumed for electricity generation (autogeneration) by main industrial groups
- 5.5 Electricity supply, net electricity supplied, electricity available, electricity consumption, sales
- 5.6 Electricity fuel use, generation, and supply
- 5.7 Plant capacity – United Kingdom
- 5.8 Major Power Producers Plant capacity – England and Wales, Scotland, and Northern Ireland
- 5.9 Capacity of other generators
- 5.10 Plant loads, demand, and efficiency
- 5.11 Power stations in the United Kingdom, May 2023
- 5.12 Plant installed capacity, by connection - United Kingdom
- 5.13 Capacity, net imports and utilisation of interconnectors
- 5.14 Estimated carbon dioxide emissions from electricity supplied
- 5.15 CHP generation and capacity overview

## **Electricity long term trends**

- 5.1.1 Fuel input for electricity generation
- 5.1.2 Electricity supply, availability, and consumption
- 5.1.3 Electricity generated and supplied

## **Chapter 6 Renewable sources of energy**

- 6.1 Commodity balances
- 6.2 Capacity of, generation from renewable sources and shares of total generation
- 6.3 Load factors for renewable electricity generation
- 6.4 Renewable sources used to generate electricity and heat and for transport fuels
- 6.5 Renewables' shares of aggregated energy balances and gross final consumption for electricity, heat, transport, and overall renewables
- 6.6 Overseas trade of renewable fuels
- 6.7 Number of renewable electricity generating stations, December 2022

## **Chapter 7 Combined heat and power**

- 7.1 Overall CHP deployment, use and performance
- 7.2 CHP installations, electrical capacity and generation by size range
- 7.3 CHP fuel used, capacity and generation by fuel and technology types
- 7.4 CHP installations, capacity total fuel use and outputs, by sector and fuel type
- 7.5 Large scale CHP schemes in the United Kingdom, December 2022
- 7.6 Savings of carbon dioxide emissions through cogeneration
- 7.7 Exports of electricity and heat from CHP schemes
- 7.8 CHP in Scotland, Wales, Northern Ireland and the regions of England
- 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 and 2020 to 2022

A.2 Estimated average net calorific values of fuels, 1980, 1990, 2000, 2010 and 2020 to 2022

A.3 Estimated average density of fuels 2002 to 2022

## **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 2022

## **Annex J: Heat reconciliation**

J.1 Heat sold reallocation, 1999 to 2022

# 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 2022 (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                 | 10.0         |
| 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                                | 46.9         |
| Coke breeze                                          | 29.8         | Gas/diesel oil                        | 45.3         |
| Other manufactured solid fuel                        | 29.6         | Road diesel                           | 45.8         |
|                                                      |              | Fuel oil                              | 43.3         |
| Gases (MJ per cubic metre)                           |              |                                       |              |
| Natural gas (produced)                               | 40.4         |                                       |              |
| 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 2008 for renewables, 2016 for gas and 2018 for all other fuels.

### Revisions since DUKES 2022 for the 3 most recent years

| Thousand tonnes of oil equivalent | 2019 | 2020 | 2021  | Percentage revisions to 2021 data |
|-----------------------------------|------|------|-------|-----------------------------------|
| Production                        | -2   | 124  | 240   | 0.2%                              |
| Primary supply                    | 299  | 1619 | 398   | 0.2%                              |
| Primary demand                    | 460  | 685  | -319  | -0.2%                             |
| Transformation                    | 2    | 113  | -213  | 0.7%                              |
| Energy industry use               | 31   | 10   | -194  | -1.9%                             |
| Final consumption                 | 454  | 672  | -324  | -0.2%                             |
| Industry                          | -199 | 357  | 115   | 0.5%                              |
| Transport                         | 322  | 121  | 557   | 1.3%                              |
| Domestic                          | -112 | -423 | -1062 | -2.6%                             |
| Other users                       | 443  | 603  | 266   | 1.3%                              |
| Non energy use                    | 0    | 14   | -200  | -3.4%                             |

## 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.

## Acknowledgements

Acknowledgement is made to the main coal producing companies, the electricity companies, the oil companies, the gas pipeline operators, the gas suppliers, National Grid, the Institute of Petroleum, the Coal Authority, the United Kingdom International Steel Statistics Bureau, Ricardo Energy & Environment, the Department for Environment, Food and Rural Affairs, the Department for Transport, OFGEM, Building Research Establishment, HM Revenue and Customs, the Office for National Statistics, and other contributors to the enquiries used in producing this publication.

# National Statistics and user engagement

## National statistics

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

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the UK Statistics Authority: Code of Practice for Statistics.

The continued designation of these statistics as National Statistics was confirmed in September 2018 following a compliance check by the Office for Statistics Regulation. The statistics last underwent a full assessment against the Code of Practice in June 2014.

Designation can be broadly interpreted to mean that the statistics:

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

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

## 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](http://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](http://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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