Department for Business, Energy & Industrial Strategy

Digest of UK Energy Statistics
Annual data for UK, 2021

About this release

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

In this release

Data tables

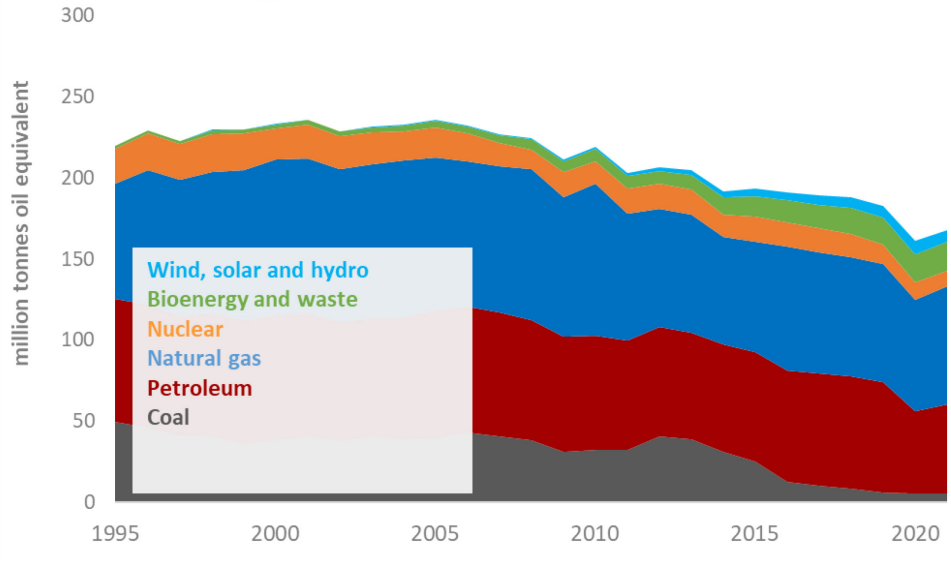
See the full list of tables and annexes for more information. Additional data are available online as part of the DUKES series:

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.

Energy consumption in 2021 remained low, up on 2020 but down 9 per cent on 2019. Consumption was low at the start of the year and increased from April as restrictions eased. Energy requirements for industrial use and services (e.g., shops, restaurants, offices) were up and returning to near pre-pandemic levels. Domestic demand remained higher than usual as people continued to spend more time at home.

Demand for energy in the UK, 1995 – 2021



Transport demand increased 7 per cent compared to last year but remains 23 per cent below 2019 levels. Whilst petrol and diesel consumption ended the year not far short of 2019 averages, **aviation fuel fell to a record low, down 8 per cent on last year, and down 62 per cent on 2019** despite trending up as we move further into 2022.

The UK's electricity generation landscape continued to evolve and move away from fossil fuels and towards renewable alternatives, although **renewable generation dropped to 39.6 per cent of generation from 43.2 per cent in 2020 due to less favourable weather conditions** for renewable generation.

Energy production was low, down 14 per cent compared to last year and the lowest level in over 50 years. Extensive maintenance in the North Sea, including the long-delayed upgrade to the Forties Pipeline System, reduced oil and gas output by 17 per cent. Nuclear output was also disrupted by maintenance, dropping to the lowest level since 1976. Coal reached another record low.

Net imports increased by 41 per cent to help meet demand. Imports increased by 8 per cent (though remain below the 10-year average) but a drop in exports (mainly oil and gas) to the lowest level in over forty years **increased the UK's net import dependency to 38 per cent**.

Chapter 1: Energy

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Key headlines

Energy production was low, down 14 per cent compared to last year and the lowest level in over 50 years. Extensive maintenance in the North Sea, including the long-delayed upgrade to the Forties Pipeline System, reduced oil and gas output by 17 per cent. Gas output reached a record low, with imports from Norway larger than net production. Nuclear output was also disrupted by maintenance, dropping to the lowest level since 1976. Coal reached another record low.

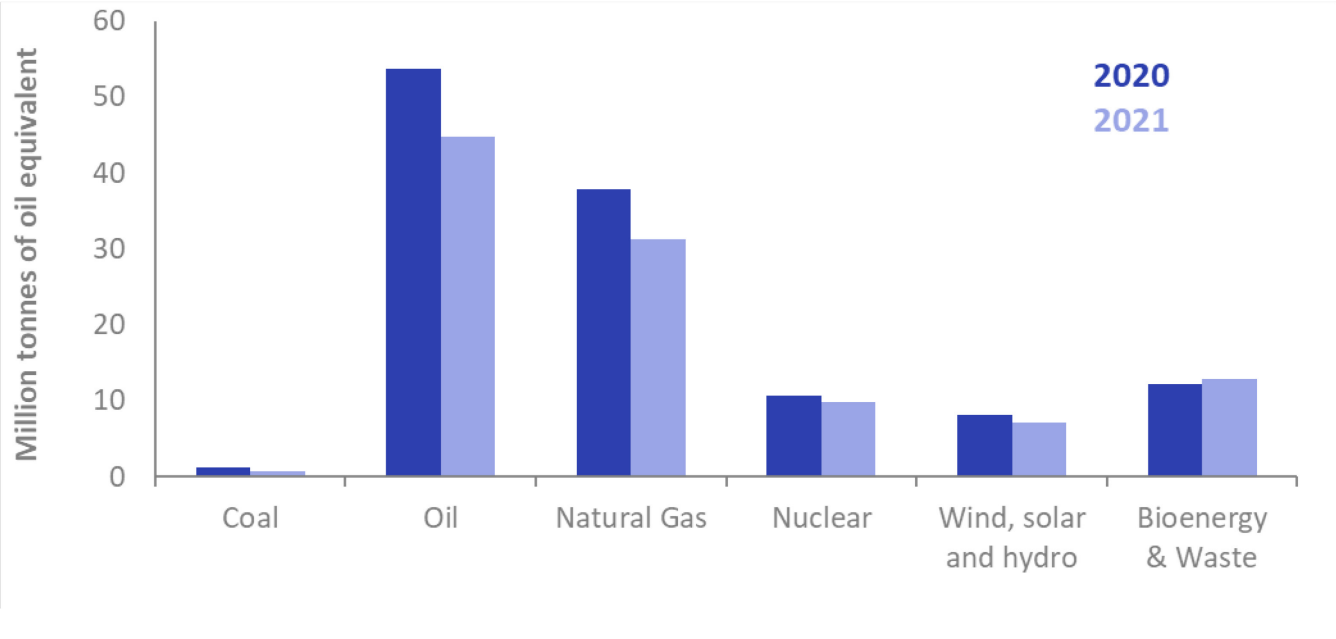
Energy consumption in 2021 remained low, up 4.6 per cent on 2020 but down 8.9 per cent on 2019. Consumption was low at the start of the year and increased from April onwards as restrictions eased. Energy requirements for industrial use and services (e.g., shops, restaurants, offices) were up and returning to near pre-pandemic levels. Domestic demand remained higher than usual as people continued to spend more time at home.

Transport demand increased 7.3 per cent compared to last year but remains 23 per cent below 2019 levels. Whilst petrol and diesel consumption ended the year not far short of 2019 averages, **aviation fuel fell to a record low**, down 8.2 per cent on last year, and down 62 per cent on 2019 despite trending up towards the end of 2021, and into 2022.

Net imports increased by 41 per cent to help meet demand. Imports increased by 8.2 per cent (though remain below the 10-year average) **but a drop in exports (mainly oil and gas) to the lowest level in over forty years** increased the UK's net import dependency to 38.0 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**. For the first time, **Norwegian imports of gas exceeded UK domestic production in 2021 and were equal to 63 per cent of total gas imports**. The largest share of oil imports also arrives from Norway, though the share is smaller at 25 per cent of total oil imports, with imports from the US coming in at 18 per cent and Russian imports at 13 per cent. In 2022, Russian imports of both oil and gas have shown very significant contractions.

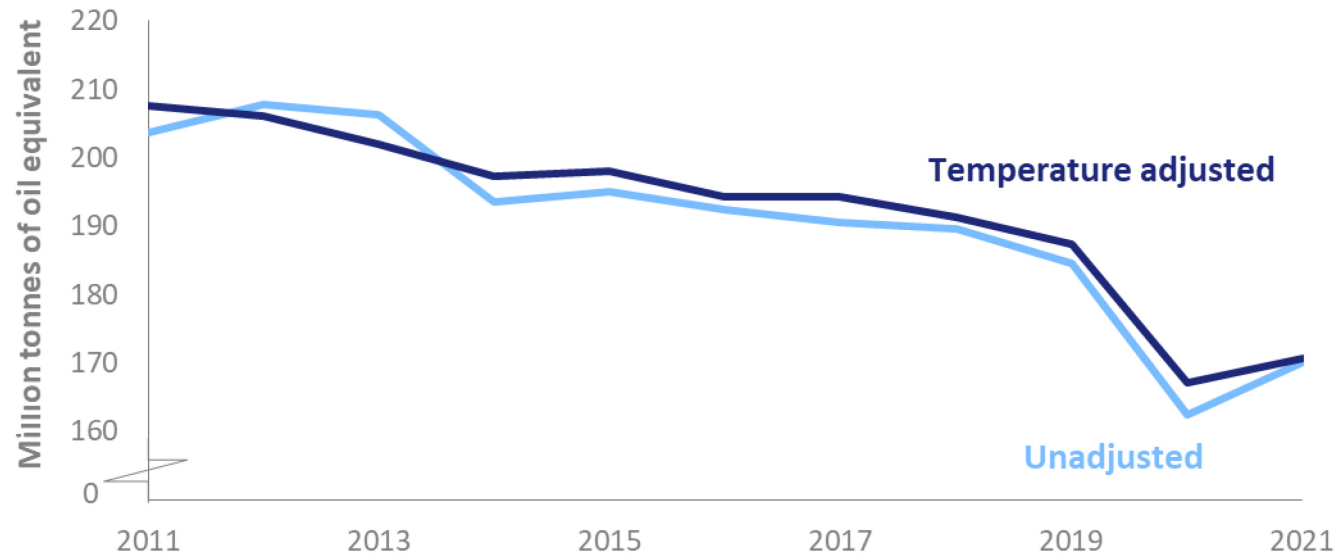
Chart 1.1 Production by fuels, 2020 and 2021 (DUKES table 1.1)



In 2021 total production was 106.6 million tonnes of oil equivalent (mtoe), 14 per cent lower than in 2020, and at the lowest level in the series commencing from 1970. Growth in renewable sources (bioenergy & waste) was offset by reduced fossil fuel and nuclear output, due to delayed North Sea maintenance activities caused by the Covid-19 pandemic, and numerous outages at UK nuclear power stations. UK production has fallen year on year since 2018, and production is now 64 per cent below the peak recorded in 1999.

In 2021 coal production fell by 36 per cent to a record low level, whilst output from oil & gas fell by 17 per cent to a record low level due to extensive maintenance activities being undertaken, which had been delayed from 2020 due to the Covid-19 pandemic. Nuclear output fell by 7.6 per cent to a record low level due to numerous outages throughout the year which reduced operational capacity at the UK's nuclear power stations. Wind, solar and hydro output fell by 14 per cent despite increases in capacity, due to less favourable weather conditions. In 2021 the average wind speed was 7.9 knots, 1.2 knots lower than in 2020; five named storms affected the UK during the year, including Storm Arwen in November 2021. Production of bioenergy and waste rose by 5.7 per cent.

Chart 1.2 Primary energy consumption, 2011 to 2021 (DUKES tables 1.1 and 1.1.4)

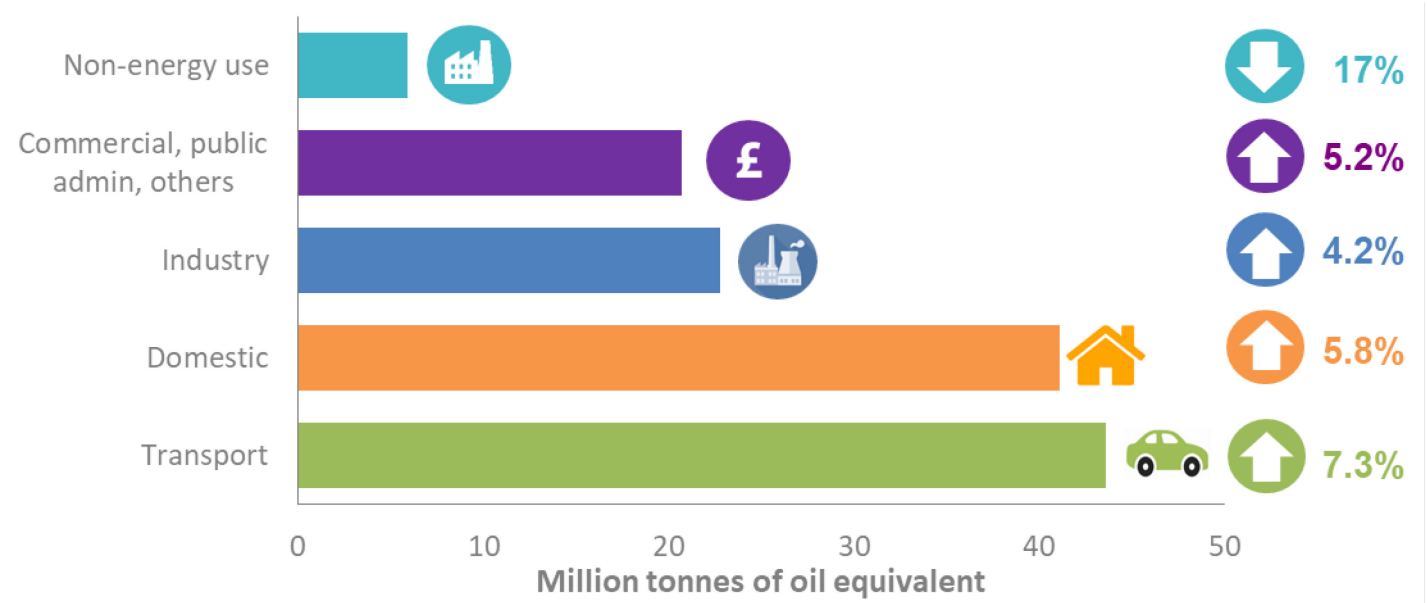


In 2021 total primary energy consumption was 170.1 mtoe, 4.7 per cent higher than in 2020, but 7.8 per cent lower than in 2019 (pre-pandemic).

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 170.7 mtoe, 2.1 per cent higher than in 2020.

In 2021 total primary energy consumption levels recovered as Covid-19 lockdown restrictions were eased, with a noticeably sharp increase in petroleum consumption as demand for road transport fuels rose, however demand for air transport fuel remained low as international travel corridors remained closed. Consumption of oil rose by 7.7 per cent, with sales of petrol and diesel returning to near normal levels by the end of the year, but aviation fuel sales remaining muted. Consumption of coal and other solids rose by 4.0 per cent, whilst natural gas consumption rose by 6.2 per cent as electricity generators made more use of fossil fuels to offset reduced renewable generation. Consumption of bioenergy & waste rose by 3.3 per cent. Primary electricity consumption fell by 10 per cent, within which nuclear fell by 7.6 per cent to a record low level due to numerous outages during 2021, and wind, solar and hydro fell by 14 per cent, despite increases in capacity due to less favourable weather conditions.

Chart 1.3 Final energy consumption by sector, 2021 (DUKES table 1.1)



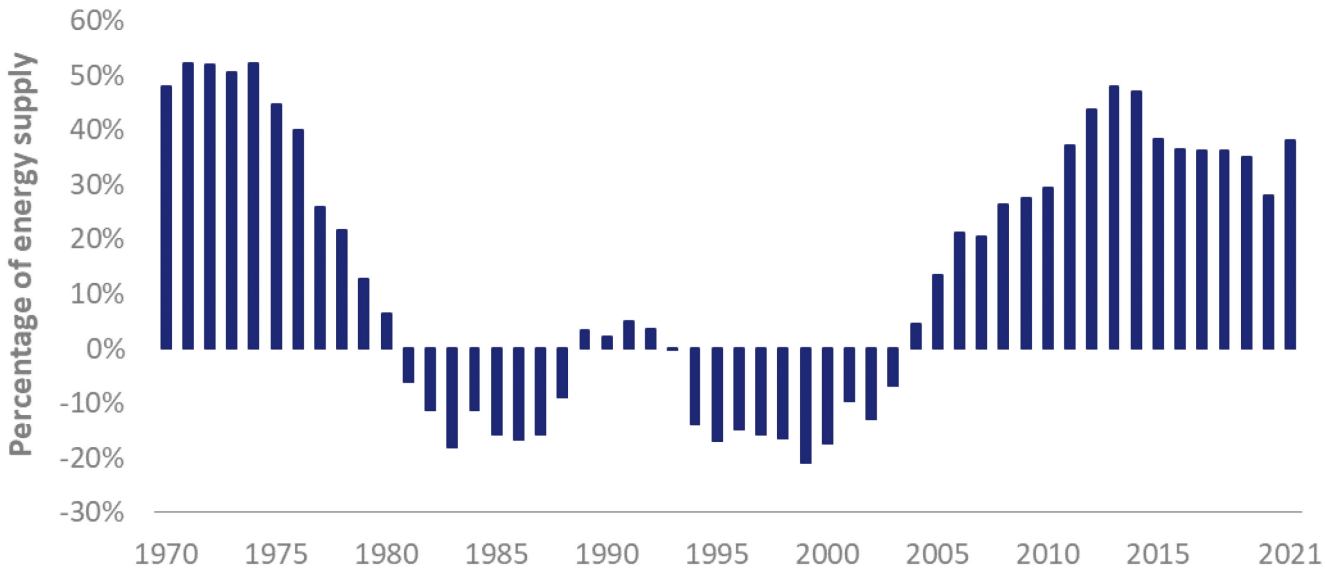
In 2021 total final energy consumption including non-energy use was 134.1 mtoe, 4.6 per cent higher than in 2020, but 8.9 per cent lower than in 2019 (pre-pandemic).

Consumption levels in 2021 all recovered from the low levels of 2020 as the Covid-19 pandemic lockdown restrictions were eased. Consumption was also increased by cooler temperatures in 2021 with the average number of heating degree days up from 5.1 to 5.5.

Domestic sector consumption rose by 5.8 per cent due to increased home working, whilst transport sector consumption rose by 7.3 per cent due to the easing of travel restrictions, with road transport consumption rising by 10 per cent but air consumption falling by 8.2 per cent. Industrial sector consumption rose by 4.2 per cent and service sector consumption rose by 5.2 per cent as factories, shops, offices and schools were all re-opened.

Final energy consumption excluding non-energy use also rose by 5.9 per cent, whilst on a temperature corrected basis consumption rose by 3.9 per cent. Domestic consumption on a temperature corrected basis rose by 0.1 per cent.

Chart 1.4 Net import dependency, 1970 to 2021 (DUKES table 1.1.3)



In 2021 net import dependency was 38.0 per cent[1], 10.1 percentage points higher than in 2020, and at the highest level since 2015.

Imports in 2021 at 132.7 mtoe were 8.2 per cent higher than in 2020, but still 26 per cent lower than their peak in 2013. The UK imported more fuel to meet increased demand in 2021 due to the easing of the Covid-19 lockdown restrictions as well as reduced UKCS production due to maintenance, with rises in imports of coal, primary oil, petroleum products, gas and electricity. The rise in imports of primary oil led to the UK becoming a net importer of primary oil again after becoming a net exporter in 2020 for the first time since 2004. Exports in 2021 at 65.0 mtoe were 13 per cent lower, with falls recorded by all fuels, and at the lowest level in over forty years.

Net imports at 67.6 mtoe were 41 per cent higher than in 2020 and accounted for 38.0 per cent of consumption in 2021, up from 27.9 per cent in 2020.

With net imports up, the UK increased its use of fossil fuels. The main fossil fuel sources in the UK are coal, gas and oil. In 2021, the share of primary energy consumption from fossil fuels increased to 78.3 per cent from the record low of 76.8 per cent in 2020, whilst that from low-carbon sources decreased to 19.4 per cent from the record high of 21.2 per cent last year due to reduced nuclear and renewables output, but still 9.3 percentage points up from 2010.

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

Chapter 2: Solid Fuels and Derived Gases

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Key headlines

Demand for coal rose slightly in 2021, by 2.8 per cent to 7.3 million tonnes compared to 2020. This was driven by an increase in consumption by electricity generators from last year's record low when strong winds and lower electricity demand reduced the need for fossil-fuelled generation.

Consumption of coal for electricity generation rose 14 per cent to 2.7 million tonnes in 2021, although this was from a record low baseline in 2020. The increase was partly due to a fall in renewable electricity generation under less windy conditions and maintenance outages in nuclear plants. This was a temporary deviation from the prevailing downward trend in coal-fired electricity as the generation mix has shifted towards other fuels and the Government remains committed to phasing out coal-fired generation by October 2024.

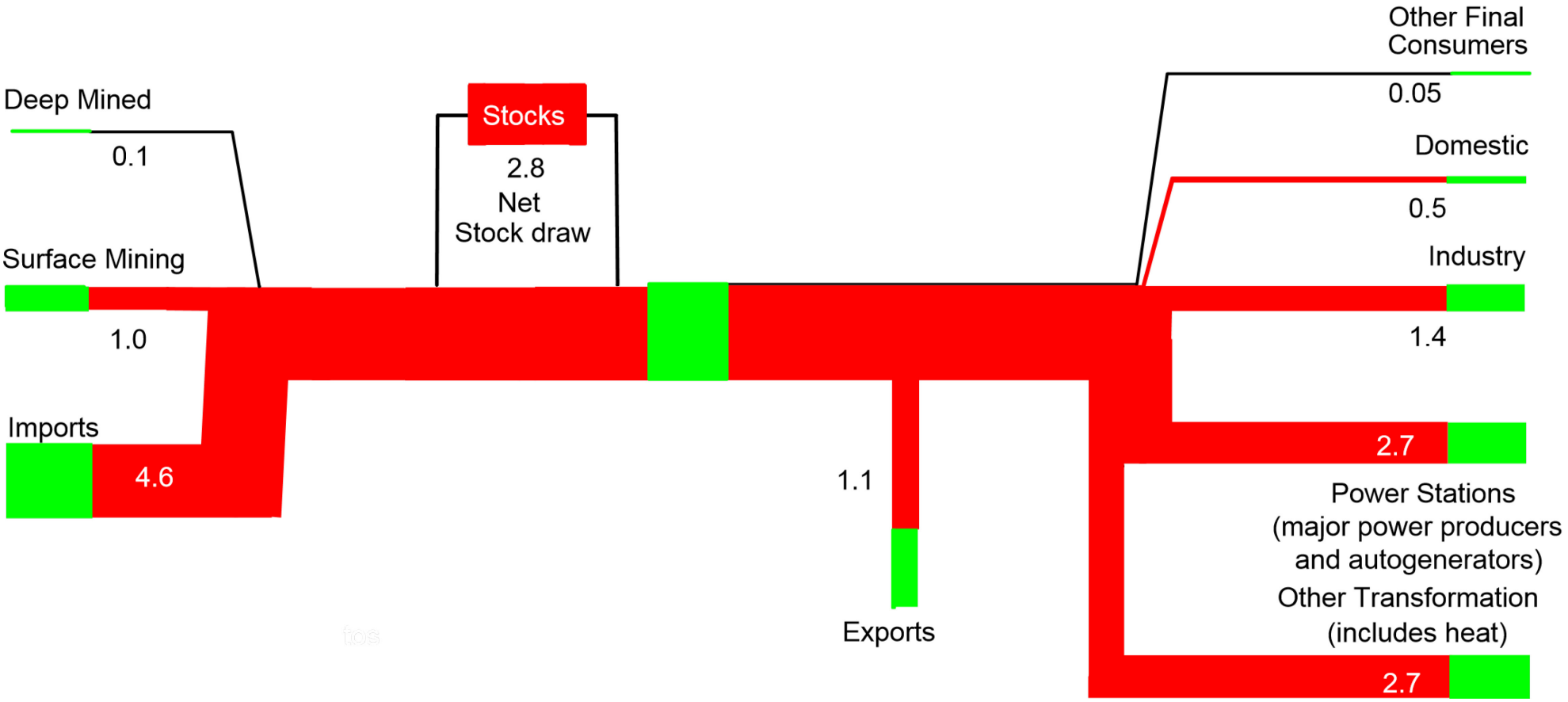
Production of coal fell to another record low, down 37 per cent from 2020 to 1.1 million tonnes. Surface mining production fell to a record low of 1.0 million tonnes due to mine closures, production restrictions due to Covid-19 and flooding. In the last ten years, UK coal production has fallen by 94 per cent.

Coal imports rose 1.7 per cent in comparison with 2020 to 4.6 million tonnes in 2021. Net imports accounted for 48 per cent of supply in 2021. Three countries accounted for 78 per cent of total coal imports: Russia (43 per cent), the USA (24 per cent) and Australia (11 per cent).

In 2021, coal comprised 2.8 per cent of UK energy demand, down slightly from 2.9 per cent in 2020 as demand for other fuels contracted more sharply due to the Covid-19 pandemic. 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 chart on the next page 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).

Coal Flow Chart 2021 (million tonnes)

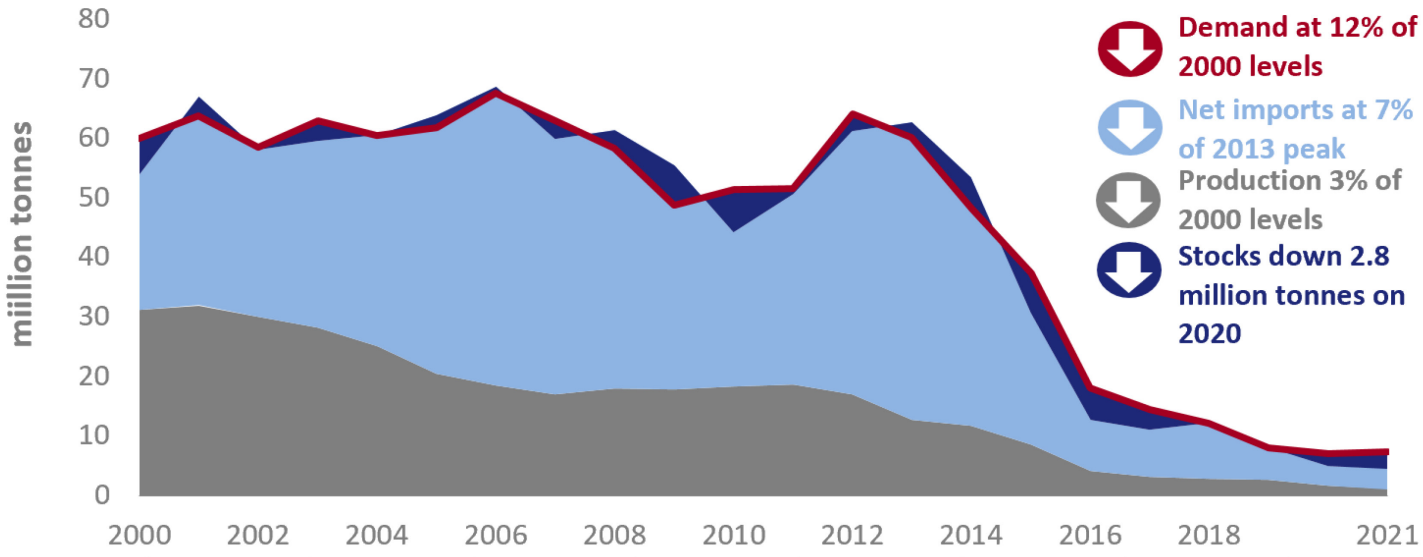


Note:

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.

Reduced demand for coal drove a substantial contraction in supply, with UK coal production down 94 per cent in the past ten years. In 2021, coal production fell to a record low of 1.1 million tonnes, down 37 per cent on 2020 (Chart 2.1). In that period 14 per cent of demand was met by domestic production, 48 per cent by net imports and 38 per cent was drawn from stocks.

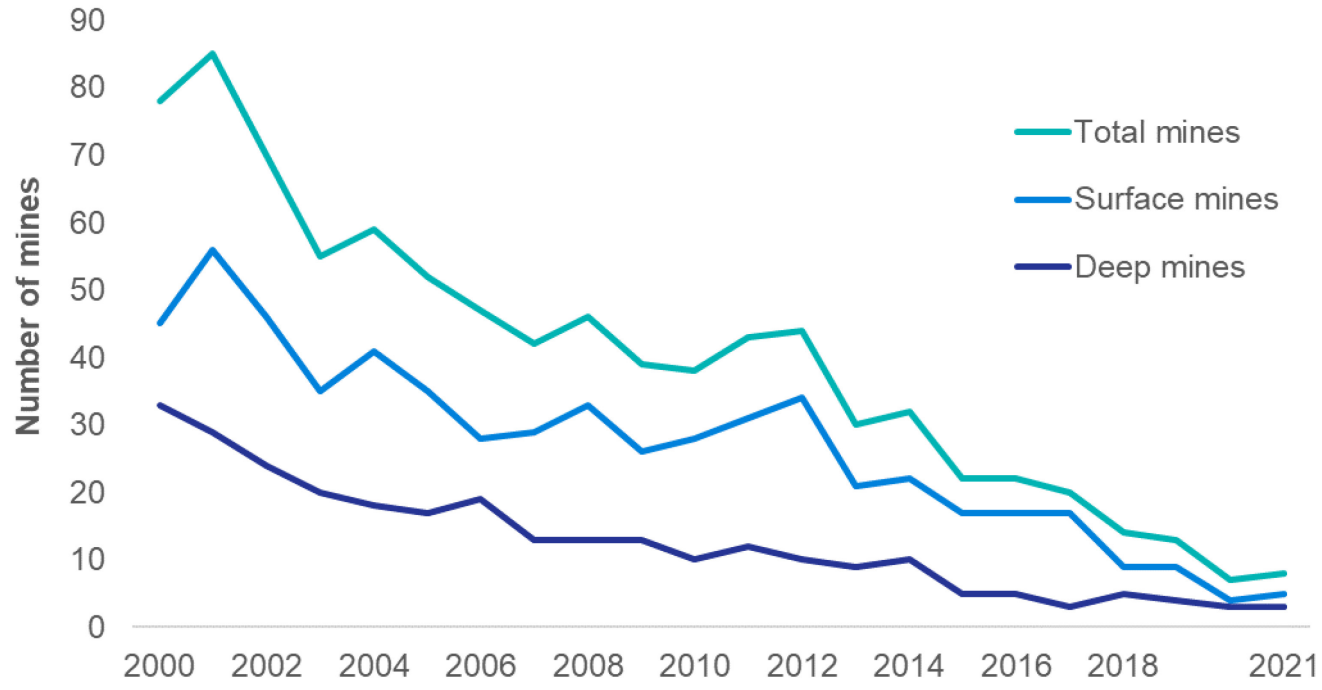
Chart 2.1 UK coal supply and demand, 2000 – 2021 (Table 2.1)



Deep mined production fell to 94 thousand tonnes, comprising 8.9 per cent of production in 2021. Eight deep mines remained open after one closed in 2021 and another was under care and maintenance. Five deep mines reported coal production in 2021. 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.

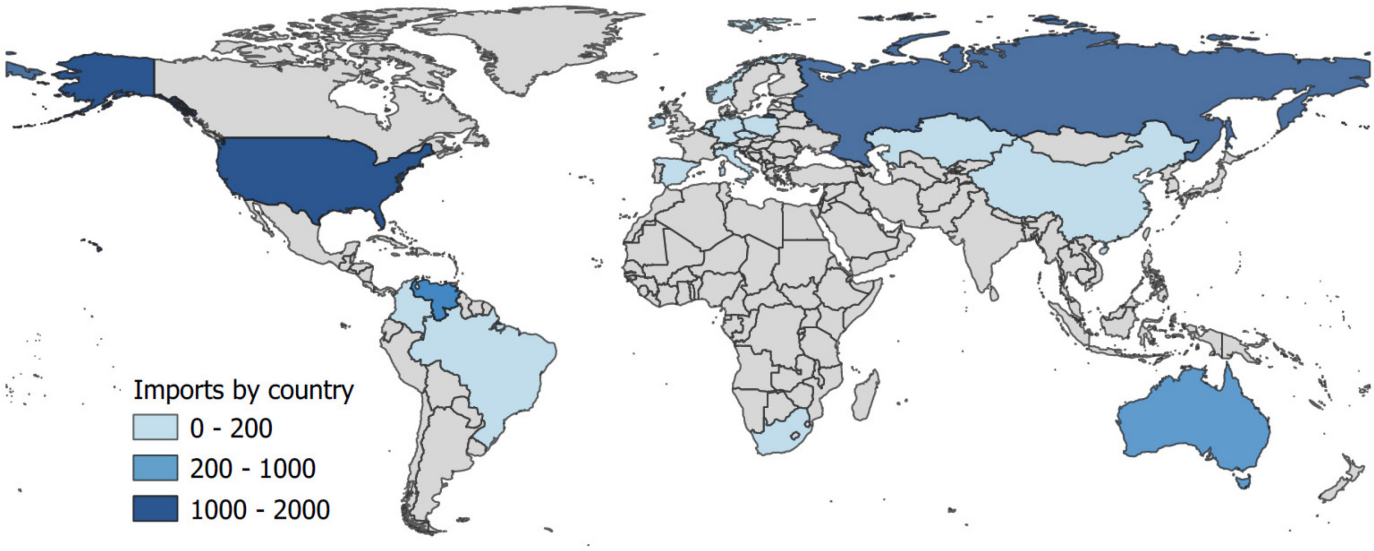
Surface mine production was down 39 per cent to a new record low of 1.0 million tonnes due to mine closures, production restrictions due to Covid-19 and flooding. Just three surface mines are still operating in the UK.

Chart 2.2 Number of coal mines producing in the UK, 2000 – 2021 (Table 2.5)



Net imports of coal also fell substantially, down 93 per cent from the peak in 2013. This is again a result of the sharp fall in demand for coal. In 2021, net imports rose by 7.9 per cent from 2020 levels to 3.5 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 2021 net imports accounted for 48 per cent of the UK's supply, up 10 percentage points from the proportion in 2000.

Map 2A showing UK Coal Imports in 2021 (thousand tonnes)



For more detail on coal imports and exports see DUKES tables 2.7, 2.8

Steam coal imports were 1.0 per cent higher at 2.4 million tonnes in 2021 compared to 2020. Russia was the largest provider of UK's steam coal (46 per cent), followed by the USA (16 per cent) and Venezuela (13 per cent). Steam coal accounted for 53 per cent of total coal imports. Coking coal imports were up 2.6 per cent at 2.1 million tonnes compared to 2020. The increase was mainly due to the 60 per cent rise from Australia.

Coal stocks continued to decline year-on-year. In line with much of what we see with coal, the main change to coal stocks came post 2014 when stocks began to decline each year and power plants closed. Coal stocks fell to 1.7 million tonnes in 2021, which was 62 per cent lower than in 2020.

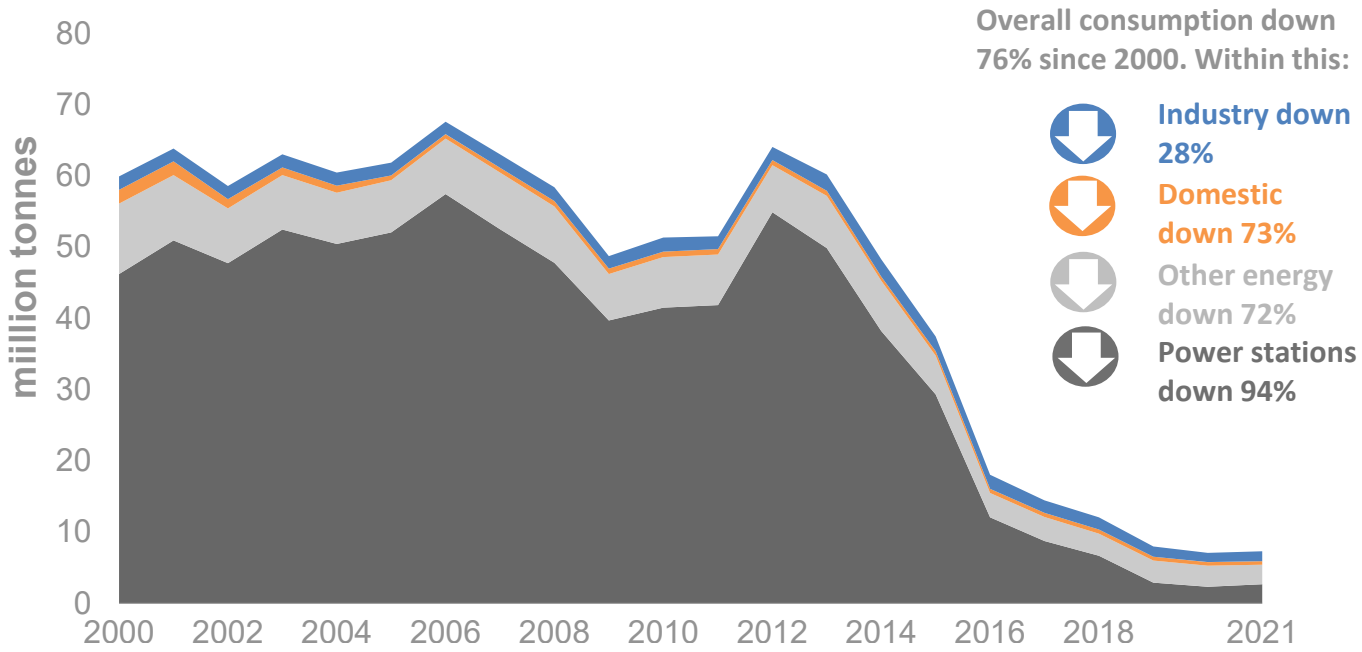
As of June 2022, the Coal Authority estimates that overall there are 3,814 million tonnes of coal resources, including prospects (Table 2.6). Of the economically recoverable and minable coal resource in current operations (including those in the planning or pre-planning process), 986 million tonnes is in underground mines and 46 million tonnes in surface mines. Overall England had an 84 per cent share of UK current mines and licenced resources, followed by Scotland with 9 per cent and Wales 7 per cent.

In prospects, there were 2,050 million tonnes suitable for underground mining and 778 million tonnes suitable for surface mining. Table 2.6 gives details of the resource assessment by England, Scotland and Wales as at 21 June 2022.

Demand for coal rose by 2.8 per cent to 7.3m tonnes in 2021, compared to 2020 (table 2.2). Much of this increase was driven by the 14 per cent rise in coal-fired generation to 2.7 million tonnes, although this was from a low baseline following record periods without coal generation in Great Britain in 2020. Less favourable weather conditions for renewable generation alongside maintenance outages in nuclear plants contributed to the mild rise in coal use. This is a temporary deviation from the prevailing downward trend as the electricity generation fuel mix has shifted towards other sources of fuel as coal is being phased out. Final consumption by industry rose by 4.7 per cent, and transformation for coke manufacture and in blast furnaces fell by 6.3 per cent.

Despite the increase in coal generation in 2021, the longer-term 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 and the Drax coal units were mothballed at the end of March 2021, leaving just three coal plants operational in the UK. 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.

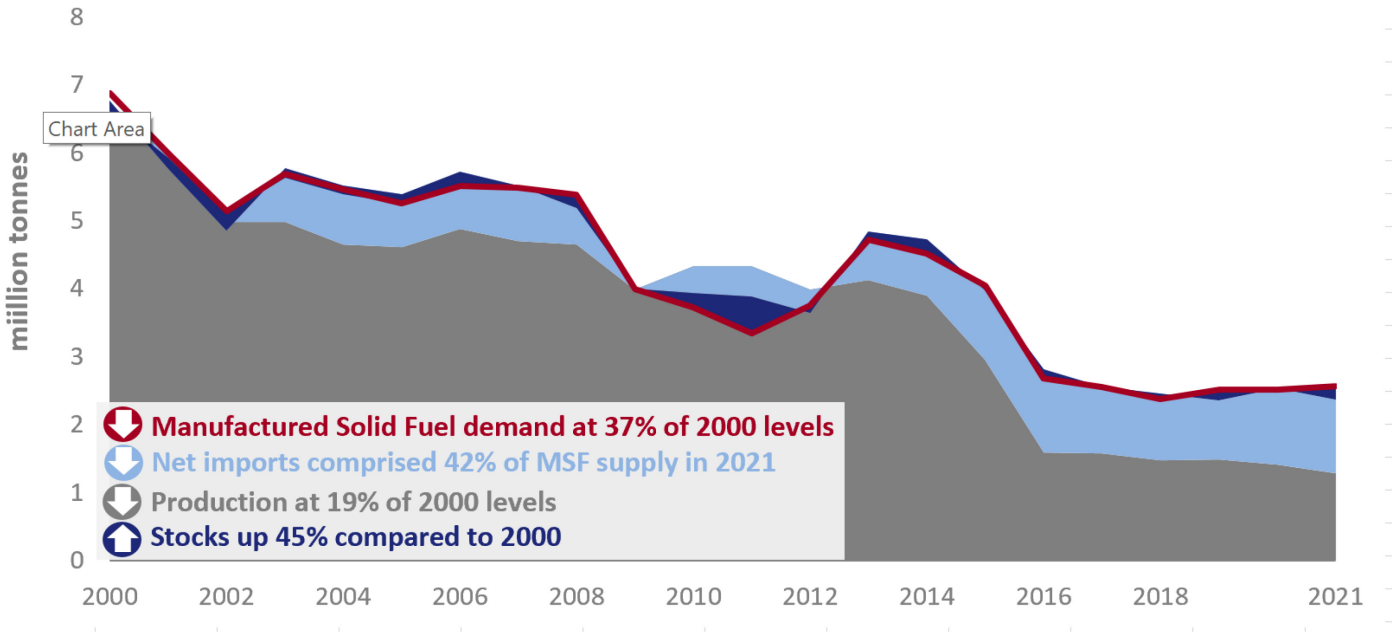
Chart 2.3 Coal consumption, 2000 – 2021 (Table 2.2)



The iron and steel industry is one of the main non-generation users of coal, for coke manufacture, blast furnaces and direct consumption. In 2021 it used 2.6 million tonnes of coal, half of what it used in 2015 (5.2 million tonnes). In terms of total share, it comprised 36 per cent of UK coal consumption in 2021, up from 14 per cent in 2015.

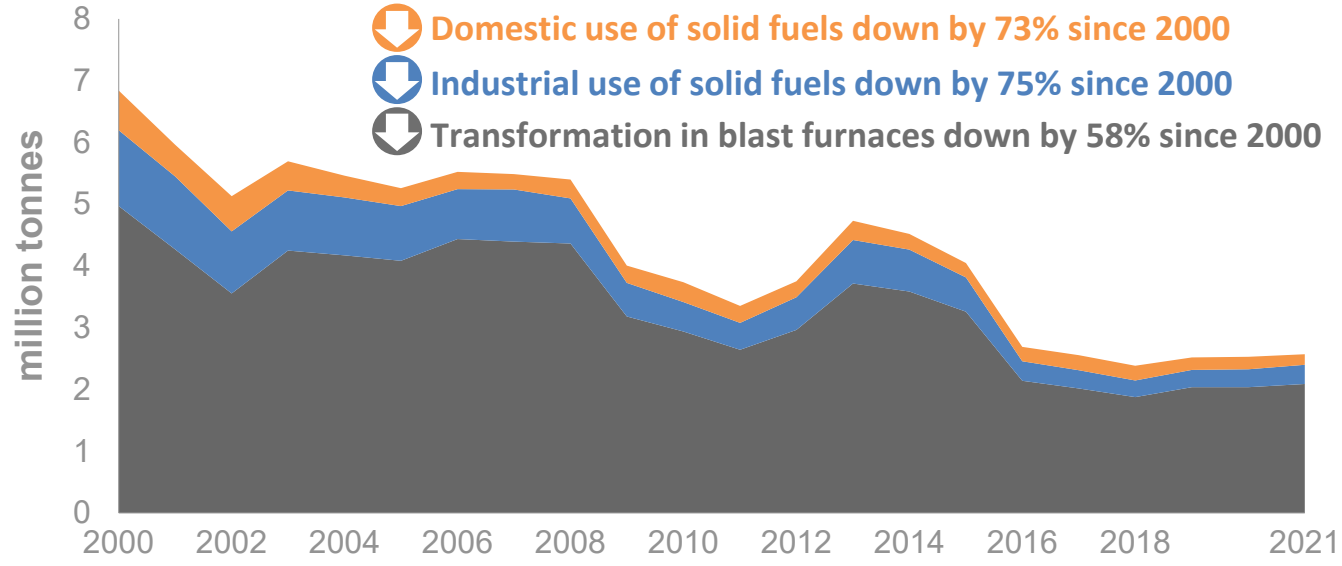
In addition to coal production and consumption, the UK has significant (but decreasing) supply and demand for a range of manufactured solid fuels that are used for domestic, industrial and transformation processes. Coke is the solid product obtained from the carbonisation of coal, principally coking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

Chart 2.4 Total manufactured solid fuels supply and demand, 2000 - 2021 (Table 2.3)



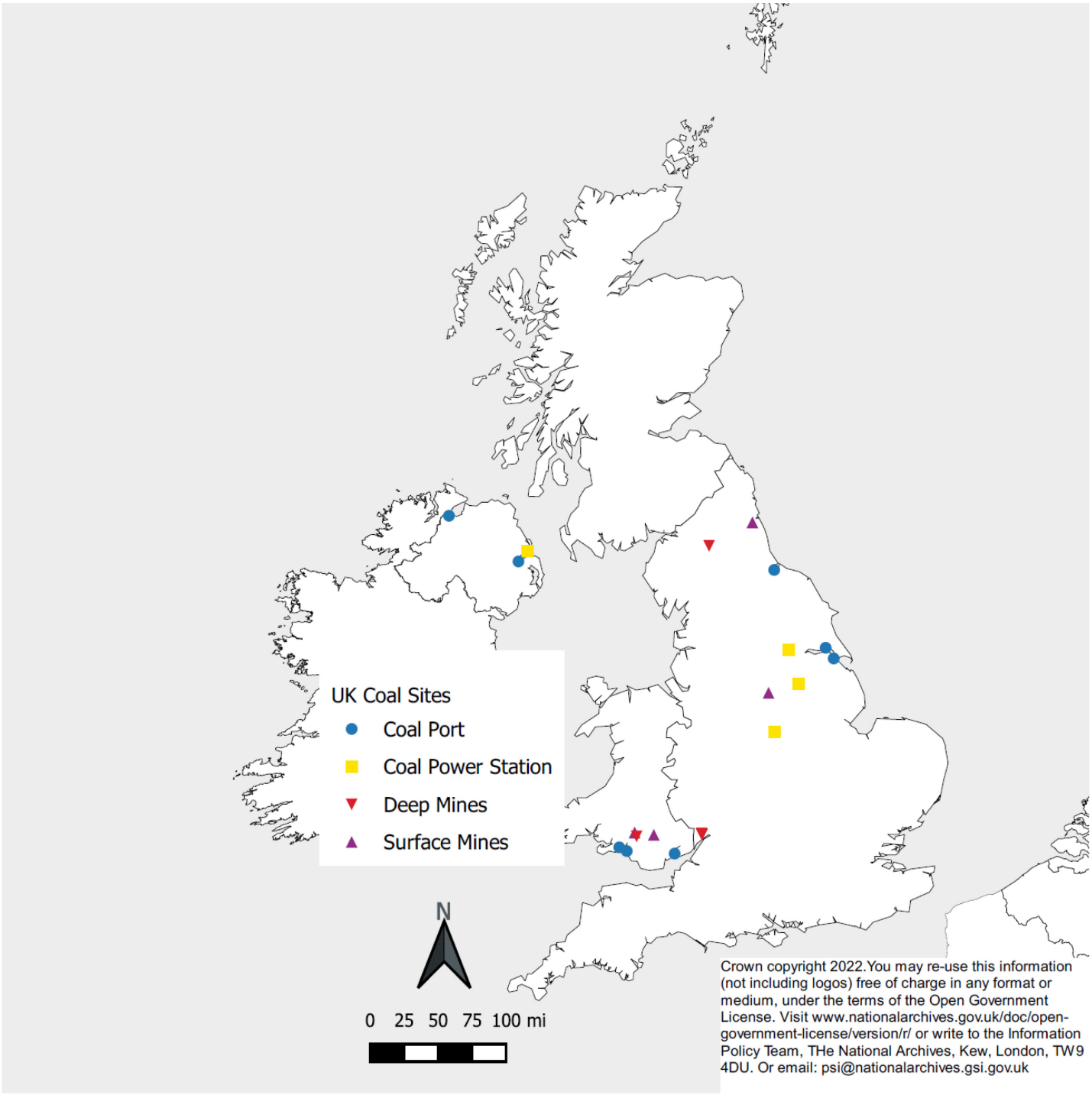
In 2021, indigenous coke oven coke fell by 8.2 per cent to 1.1 million tonnes compared to 2020 (Chart 2.5). It has been relatively stable in the last four years. Monckton Coke and Chemicals, the only dedicated coke plant in the UK closed in December 2014. There has been a fall in steel production in 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 fell 3.9 per cent to 15 thousand tonnes. Other manufactured solid fuels (patent fuels) fell by 14 per cent to 171 thousand tonnes.

Chart 2.5 Total manufactured solid fuels consumption in the UK, 2000 – 2021 (Table 2.3)



In 2021, coke oven coke comprised 74 per cent of demand for manufactured solid fuels, with coke breeze at 19 per cent and other manufactured solid fuels at 7 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 2021



Chapter 3: Oil and Oil Products

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Key headlines

Oil formed just under a third of total energy demand in 2021, similar to 2020 but low compared with 2019. Following 2020 lows, demand for petroleum products increased by 4.1 per cent in 2021, with much of this growth coming from the transport sector as Covid-19 restrictions eased. Demand for key road fuels grew, with petrol and diesel demand up 11 and 10 per cent respectively.

In 2021, UK production of primary oils fell to a 7 year low at 41 million tonnes, this was 17 per cent lower than in 2020, and the UK returned to being a net importer of primary oils, at 7.9 million tonnes. Low production was a result of several factors, including maintenance of the Forties Pipeline System and delayed maintenance in 2020.

Refinery production remained stable on last year, following refinery maintenance and delays to maintenance in 2020.

Most sectors showed signs of recovery following the 2020 lows, as final consumption increased by 4.4 per cent. Whilst overall growth was seen in industry, up 4.4 per cent, the chemical sector fell 11 per cent and vehicle manufacturing fell 5.6 per cent. Non-energy use fell 17 per cent following reduced demand for Naphtha.

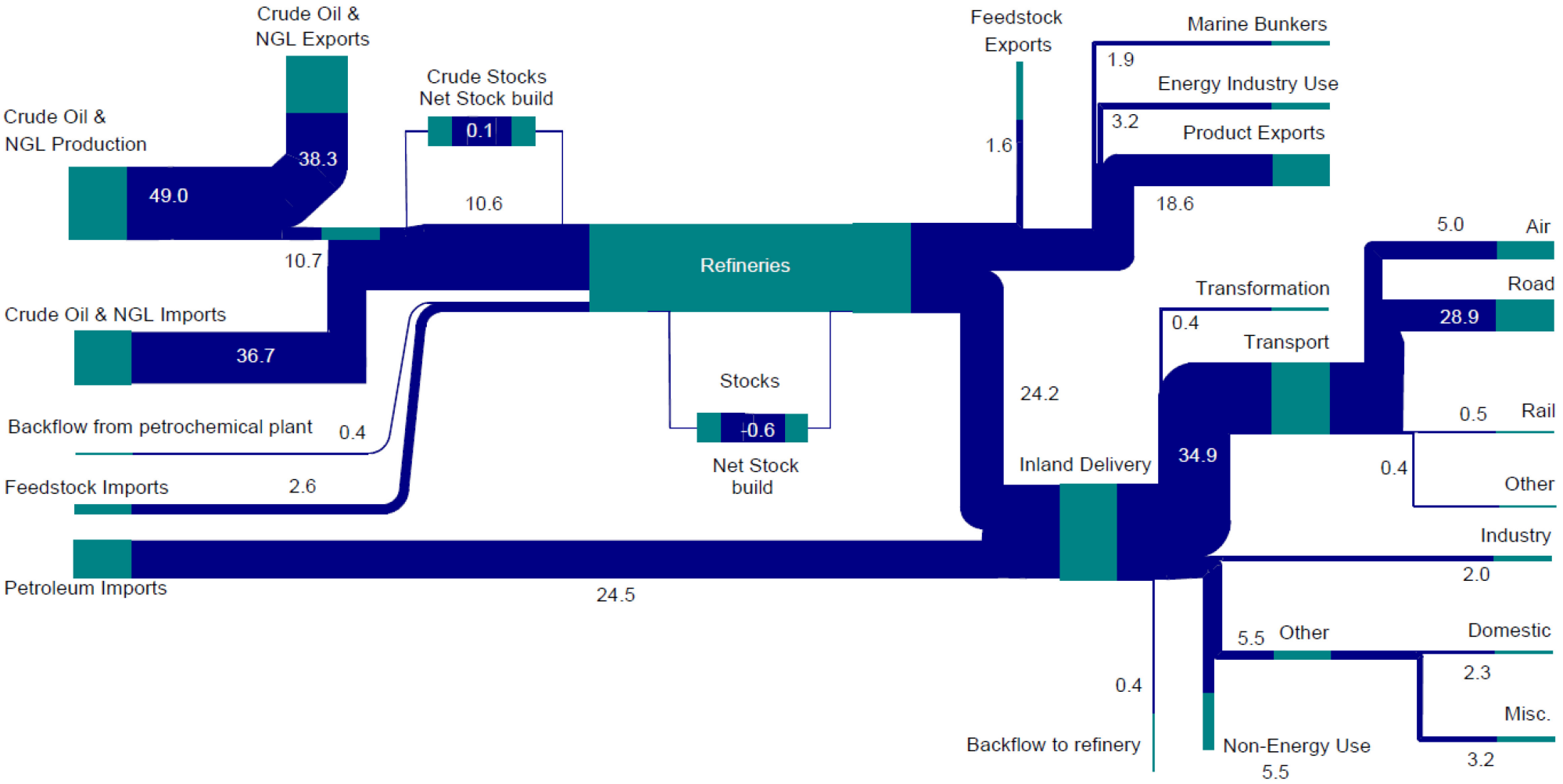
Domestic consumption increased by 3.9 percent following lower temperatures and the agricultural sector grew 8.7 per cent as 2021 offered more favourable growing conditions than in 2020.

Jet fuel demand continued to be heavily impacted by Covid-19 restrictions and fell to its lowest point since 1983. Global restrictions on international travel were slower to ease and demand dropped 8.4 per cent on the 2020 low.

The UK held 10.3 million tonnes of oil stock, which is the equivalent of over 900 days of oil imports, significantly exceeding the 90 days required by the International Energy Agency (IEA). **The UKs stocks of oil decreased by 32 per cent,** following the UKs exit from the European Union (EU) and transition to only IEA mandated stocking requirements.

The flow chart on the following page 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.

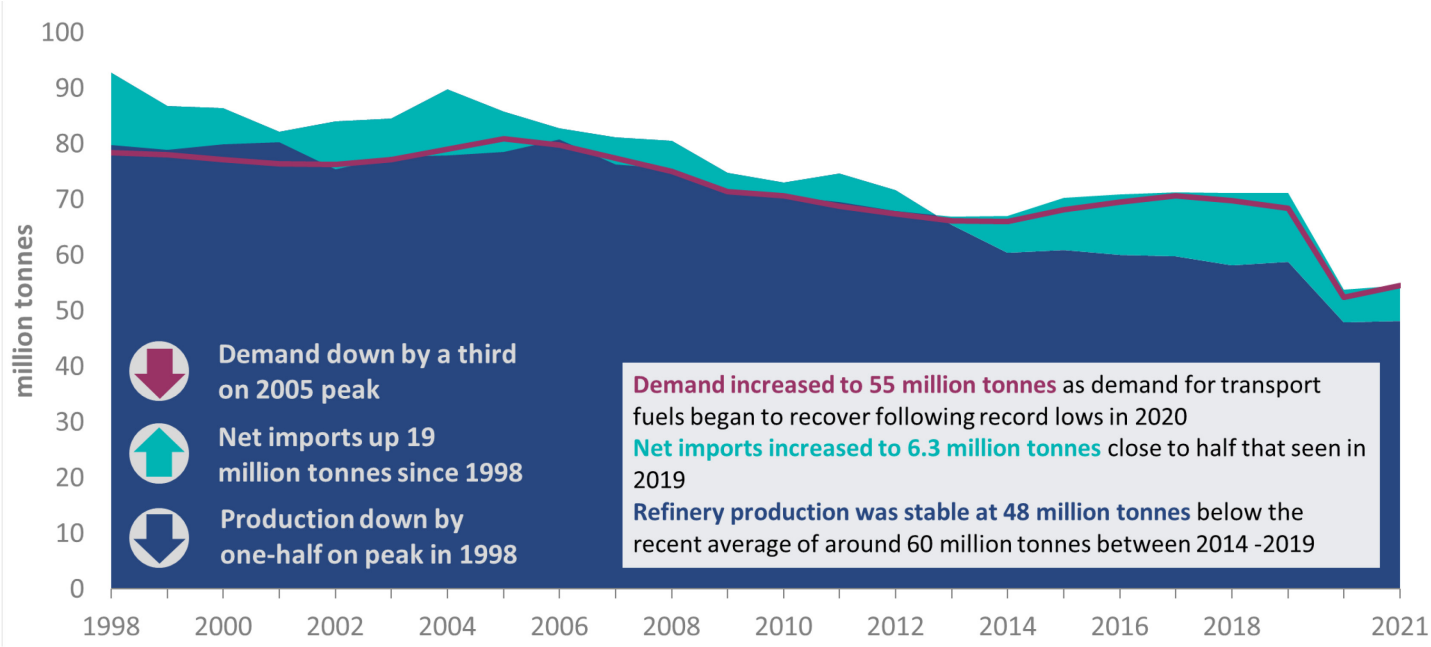
Petroleum flow chart 2021 (million tonnes)



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.

Chart 3.1 Supply and demand for petroleum products, 1998 – 2021 (DUKES Table 3.2)



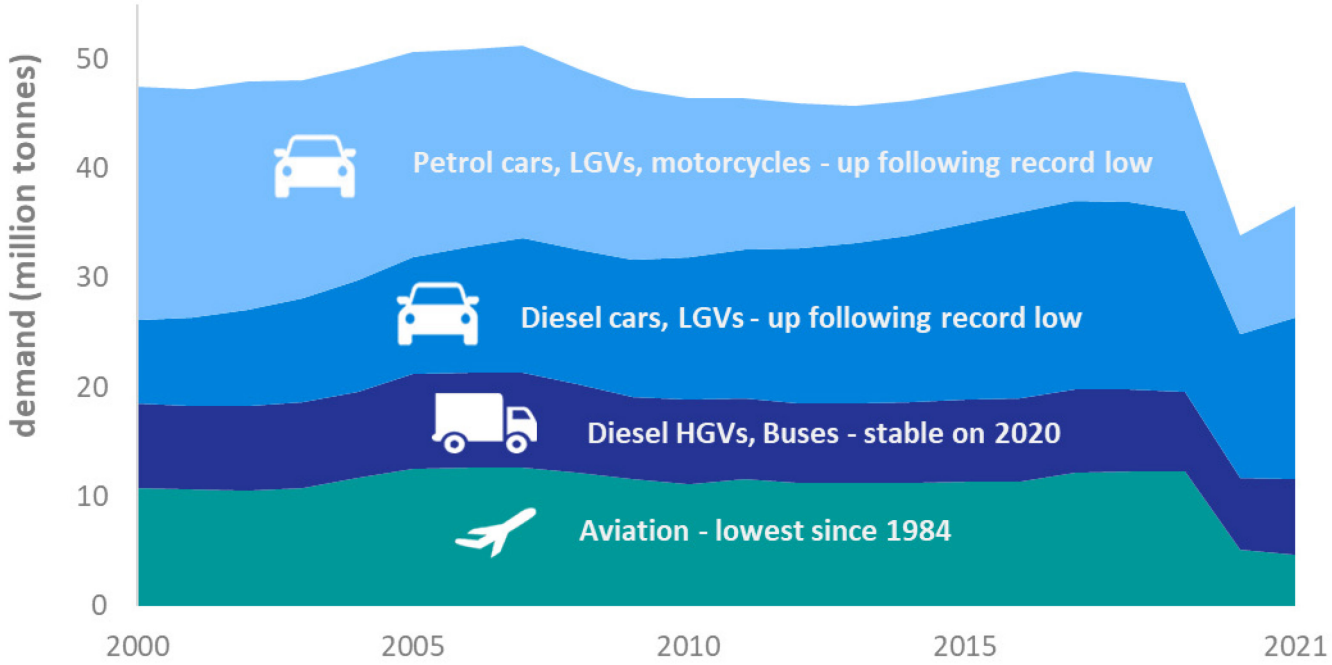
In 2021, primary demand for petroleum products increased by 4.1 per cent as Covid-19 related restrictions were lifted from April 2021. Much of this growth was due to increased demand in the transport sector, as restrictions on domestic travel were lifted and demand for key road fuels increased. Overall demand for petroleum products in 2021 remained lower than pre pandemic levels, down a quarter compared with 2019, at 54.6 million tonnes.

In 2021, refinery production was stable compared to 2020 up just 0.6 per cent, remaining down by almost a fifth compared to 2019[1]. Whilst demand increased refinery production remained low for several reasons including continued restrictions in early 2021 and maintenance following delays in 2020.

The UK remained a net importer of products at 6.4 million tonnes, 0.5 million tonnes higher than in 2020. Overall, product imports remained stable on the previous year and exports dropped 1.9 per cent, however, trade remains muted compared with pre pandemic levels, with imports and exports down 25 and 11 per cent respectively compared to 2019.

[1] For further detail on the UK's refineries and nameplate capacity, please see Annex 2 and the map of UK refineries and major import terminals in the methodology note.

Chart 3.2 Annual demand for transport fuels since, 2000 - 2021[2]

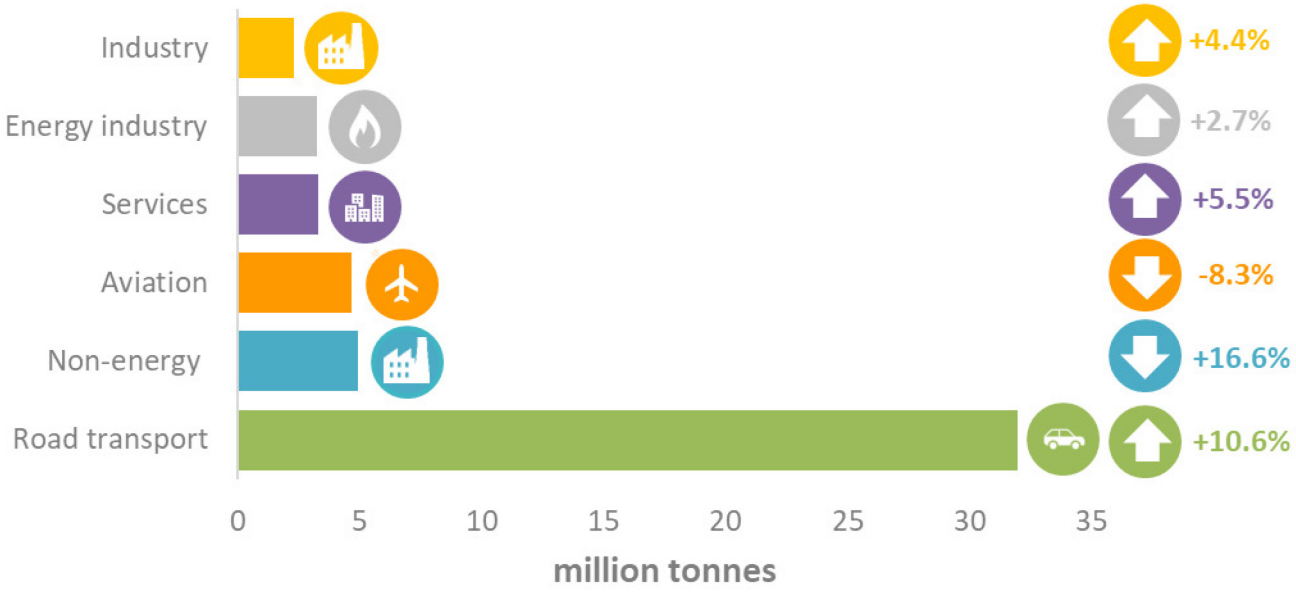


The transport sector is the primary use for petroleum products in the UK, in 2021, demand for road fuels increased by 11 per cent compared to record lows in 2020. This follows fewer domestic travel restrictions compared to 2020 and the end of all restrictions by the summer of 2021. Demand for petrol increased by 11 per cent and diesel increased by 10 per cent. In recent years demand for diesel has been around twice that of petrol, as commercial fleets tend to use diesel-engine vehicles. In Quarter 1 2021, demand for petrol reached its second lowest level since 1998, as strict Covid-19 related restrictions were in place. However, by Quarter 3 2021 demand was comparable with that seen before the pandemic (for further information on quarterly trends see Energy Trends Table 3.4).

Demand for jet fuel was the most severely impacted by Covid-19 related restrictions continuing to fall in 2021, down 8.4 per cent on 2020. This follows both national and international restrictions on international travel throughout the year. Demand for jet fuel was just 4.7 million tonnes, the lowest level since 1983 and 62 per cent lower than that seen in 2019.

[2] For further detail on breakdown of fuel consumption by vehicle type, please see UK Energy in Brief, Page 22.

Chart 3.3 Oil consumption in the UK, 2020 to 2021 (DUKES Table 3.2)



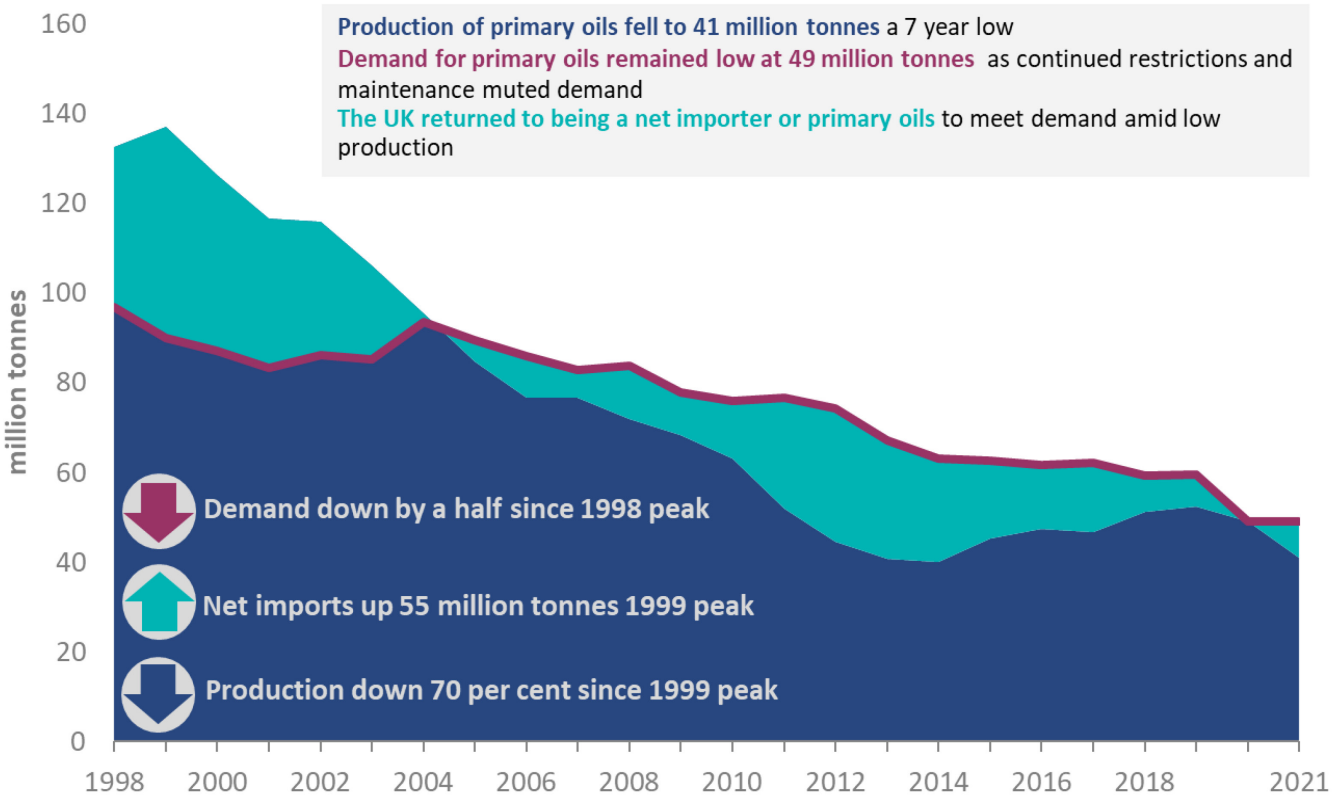
In 2021, demand by industry increased by 4.4 per cent compared to 2020, in line with increased production in the sector following the pandemic. However, use of oil products in the chemical and vehicle manufacturing industries decreased by 11 and 5.6 per cent respectively. Fuel use in vehicle manufacturing has primarily been impacted by supply chain issues, specifically the global shortage of computer chips and factory closures. Chemical industry use has also fallen as plants have closed and production has been halted at several sites following maintenance.

In 2021, demand for oil by the commercial sector increased by 6.3 per cent compared with 2020. This follows the reopening of many businesses and return to office working particularly in the second half of the year. There was also growth seen in the agricultural sector, which was up 8.7 per cent, following favourable growing conditions for cereals and other crop products[3] . In 2021, domestic consumption increased by 3.9 per cent on 2020, in line with colder temperatures (Energy Trends Weather Statistics).

Non-energy use of oil products was down by 17 per cent compared to 2021, much of this fall was due to the fall in demand for Naphtha, a core component in the manufacturing of ethylene and propylene, as a major plant was shutdown for maintenance throughout the final quarter of the year.

[3] see DEFRA Total Factor Productivity Statistics

Chart 3.4 Supply and demand for primary oils, 1998 – 2021 (DUKES Table 3.1)

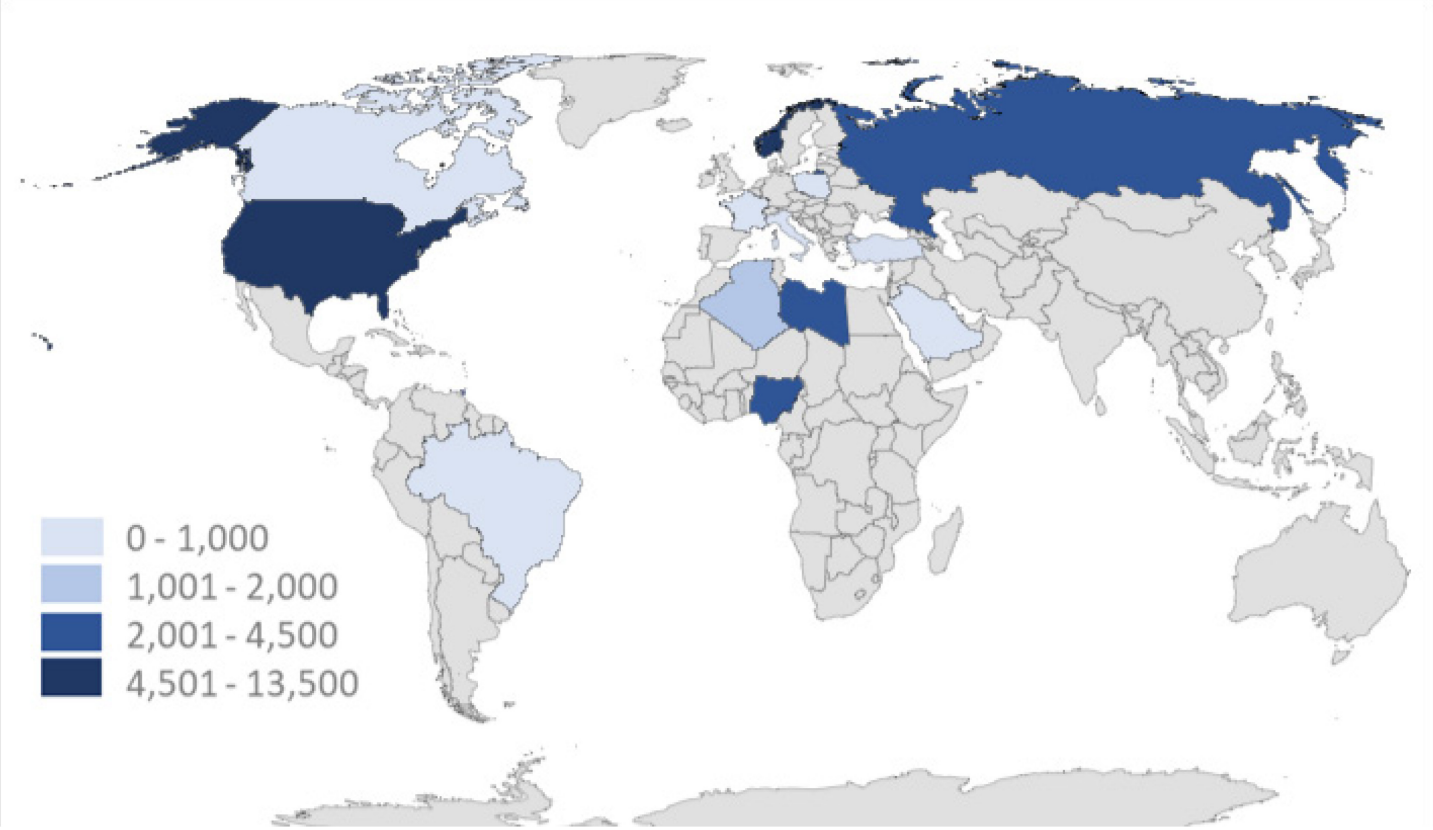


In 2021, UK production of primary oils fell to a 7 year low at 41 million tonnes, this was 17 per cent lower than in 2020. Contributing factors included an extensive planned maintenance schedule including the shutdown of the Forties Pipeline System (FPS), which serves for a significant portion of UK oil and gas production. In addition, further maintenance which was delayed in 2020 was carried out.

Demand for primary oils remained stable on last year, up 1.2 per cent due to continued restrictions and refinery maintenance but remains down 18 per cent on 2019. In 2021, exports decreased 15 per cent and imports increased by 5.6 per cent on 2020 to help meet demand amid low production. The UK returned to being a net importer of primary oils at 7.9 million tonnes. Despite this increase imports remain 19 per cent lower than those seen in 2019.

In 2021, refineries took receipt of 6.8 million tonnes of crude produced from the UK Continental Shelf (UKCS), meeting 14 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.

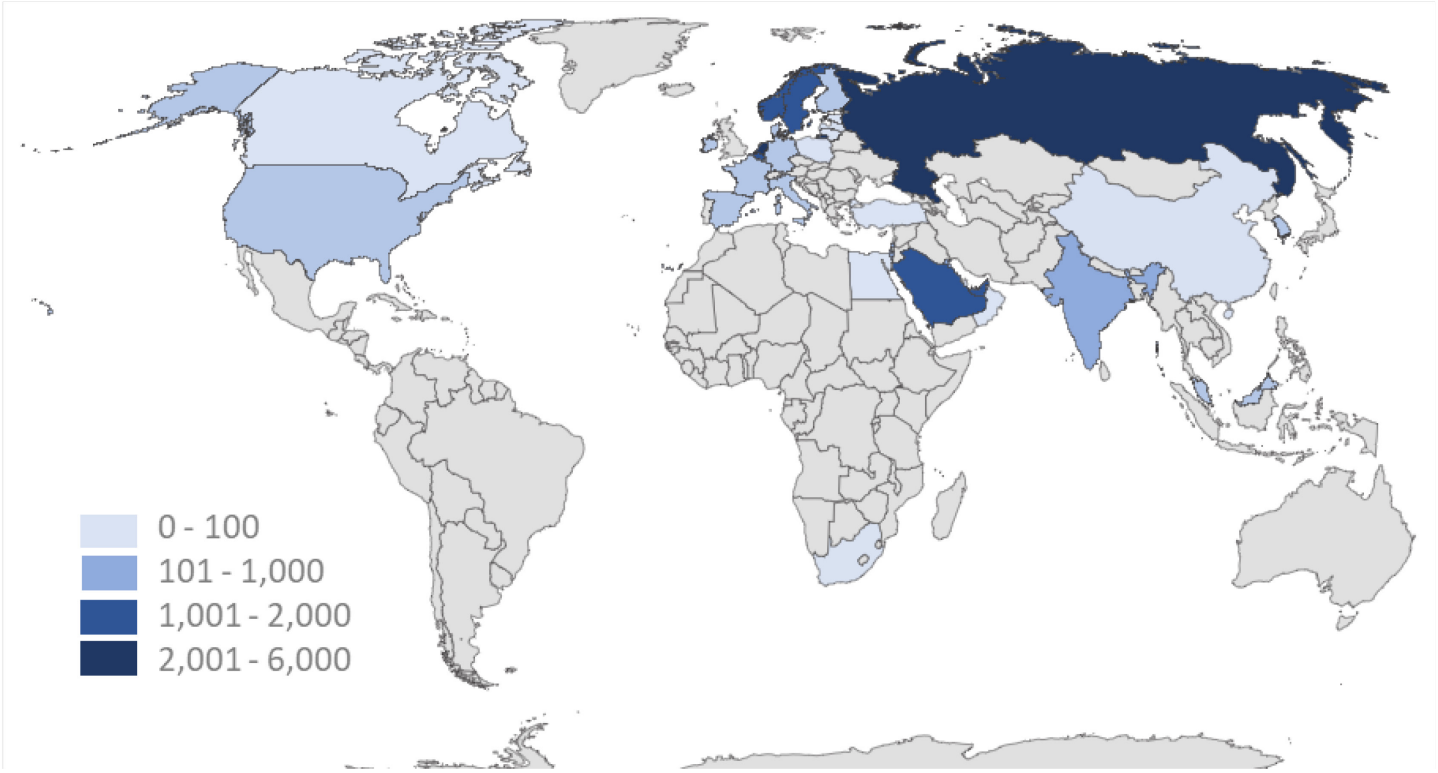
Map 3A Sources of UK crude oil imports 2021 (thousand tonnes, DUKES Table 3.7)



Sources of crude imports are shown in Map 3A and Table 3.7. **Norway remains the largest import source of crude due to its proximity and shared infrastructure in the North Sea.** Imports from Norway were up 11 per cent compared with 2020, accounting for 36 per cent 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. Imports of crude from the US have increased in recent years, accounting for 30 per cent of total crude imports in 2021.

Imports from current OPEC countries have decreased following the peak in 2013 and accounted for 20 per cent of the UK's crude imports in 2021, this is a 60 per cent increase compared with the previous year's low. The UK exports a substantial amount of crude oil, however this decreased by 16 per cent in 2021 compared with 2020 in line with reduced production (Table 3.8).

Map 3B Sources of UK petroleum product imports 2021 (thousand tonnes, DUKES Table 3.7)



Imports of petroleum products were stable in 2021 compared to 2020, increasing just 0.4 per cent. Trends in imports are in line with trends in demand for example muted demand for aviation was reflected in a 18 per cent fall in imports of jet fuel whilst stronger demand in road fuels saw increases in both petrol and diesel imports, the latter up 14 per cent.

The UK has been a net importer of petroleum products since 2013 and continues to be in 2021. Domestic supply and demand are not matched on a product-by-product basis. The UK's refineries were developed to produce petrol and as such the UK is a net exporter of petrol by 5.3 million tonnes in 2021. Conversely, to meet domestic demand, the UK is one of the larger importers of diesel and jet fuel in the OECD.

Map 3B shows UK imports of petroleum products by source in 2021. **The Netherlands is a major oil trading hub and as such is the principal source of product imports for the UK** (whilst refining might have taken place elsewhere). Imports of diesel accounted for almost half of all product imports in 2021, with Russia, the Netherlands, Belgium, and Sweden accounting for almost three quarters of total diesel imports. In 2021, Russian imports of diesel accounted for a third of total diesel imports. However, following Russia's invasion of Ukraine the UK will end all dependency on Russian coal and oil by the end of 2022, and end imports of gas as soon as possible thereafter. Recent data shows a notable decline in Russian oil imports in recent months (see Energy Trends Table 3.14 for further information).

The UK government is required to hold stocks of oil which could be released in the event of severe disruption to global supply. The UK achieves this obligation by directing companies to hold minimum levels of stocks. Before 1 January 2021, the UK was obligated to hold oil stocks as a member of both the European Union (EU) and International Energy Agency (IEA). From 2021, following the UK's exit from the EU, the UK was only obligated to hold stocks as a member of the IEA. 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.

At the end of 2021, the UK held 10.3 million tonnes of stocks (DUKES Table 3.5) the equivalent of 905 days of net imports, which is substantially higher than the required 90 days of net imports set by the IEA. This was a fall of 32 per cent when compared with 2020. Companies may choose to hold stocks within the UK or abroad via legal agreements with other countries. Following the reduction in stocking requirements many companies chose to reduce their stocks held abroad. In 2021, 7.0 per cent of stocks were held abroad, this compares to 24 per cent in 2020. For further details and more recent data, please see Energy Trends Table 3.11.

Chapter 4: Natural Gas

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Key headlines

In 2021, natural gas demand increased by 5.9 per cent on 2020 to 861 TWh, as restrictions to curb the spread of Covid-19 were eased.

Gas demand increased for electricity generation and across domestic, industrial and service sectors. Gas used for electricity generation increased by 9.3 per cent, largely due to reduced renewable output. Domestic demand increased by 7.4 per cent, as colder temperatures in the beginning of the year coincided with increased time spent at home due to restrictions. Consumption by industry and other final users (including commercial and public administration use) increased by 7.2 and 7.3 per cent respectively.

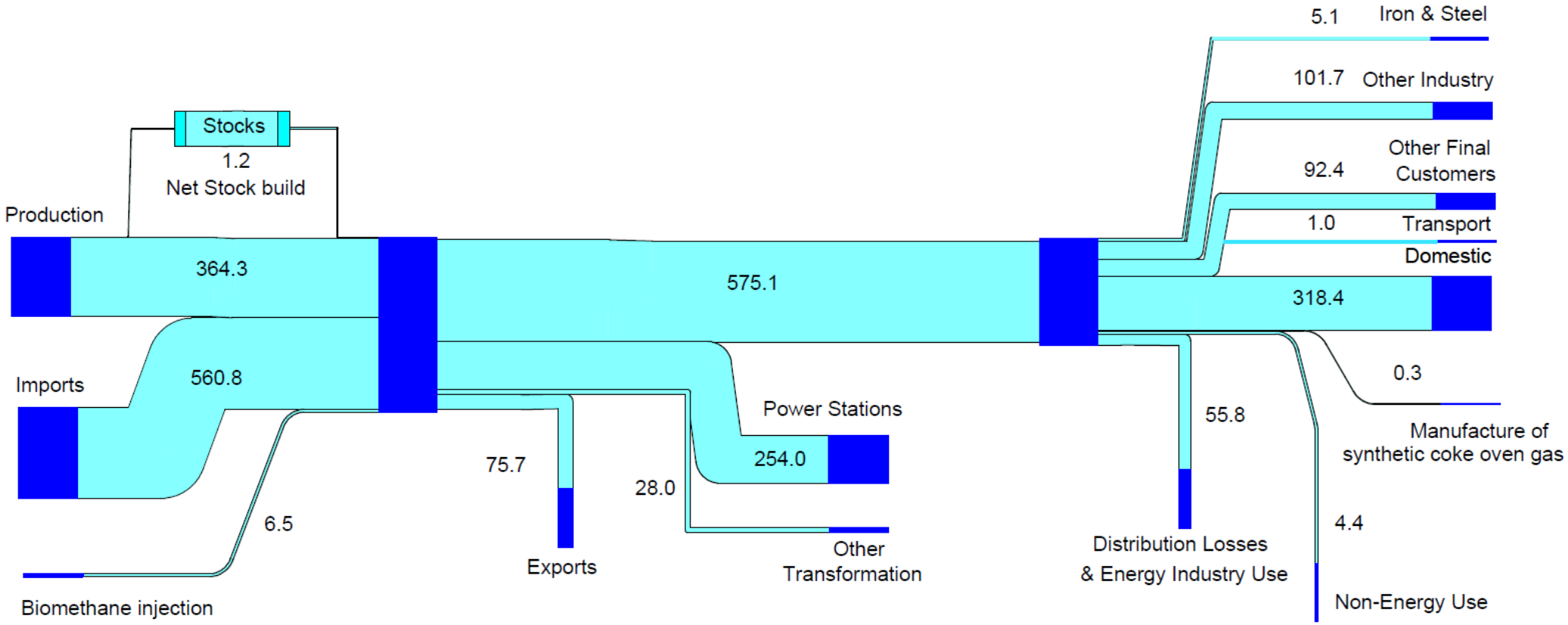
Gross gas production reached a record low of 364 TWh. This was due to an extensive planned maintenance schedule, as well as some delays to maintenance in 2020 which were carried into 2021. Several major terminals were shutdown including the Forties Pipeline System (FPS) which serves a significant proportion of UK oil and gas production.

Net imports increased by 30 per cent in 2021, to meet demand amid low production. Imports increased by 17 per cent, with large increases in pipeline imports from Norway, Belgium and the Netherlands. Additionally, exports of natural gas fell 29 per cent reaching the lowest level since 1998.

Liquefied Natural Gas (LNG) imports fell by one fifth compared with high levels in 2020. The reduction reflected constrained global availability due to elevated demand in Asia at the beginning of 2021. This led the UK to source LNG cargoes from further afield, such as Peru, Algeria and Russia.

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.

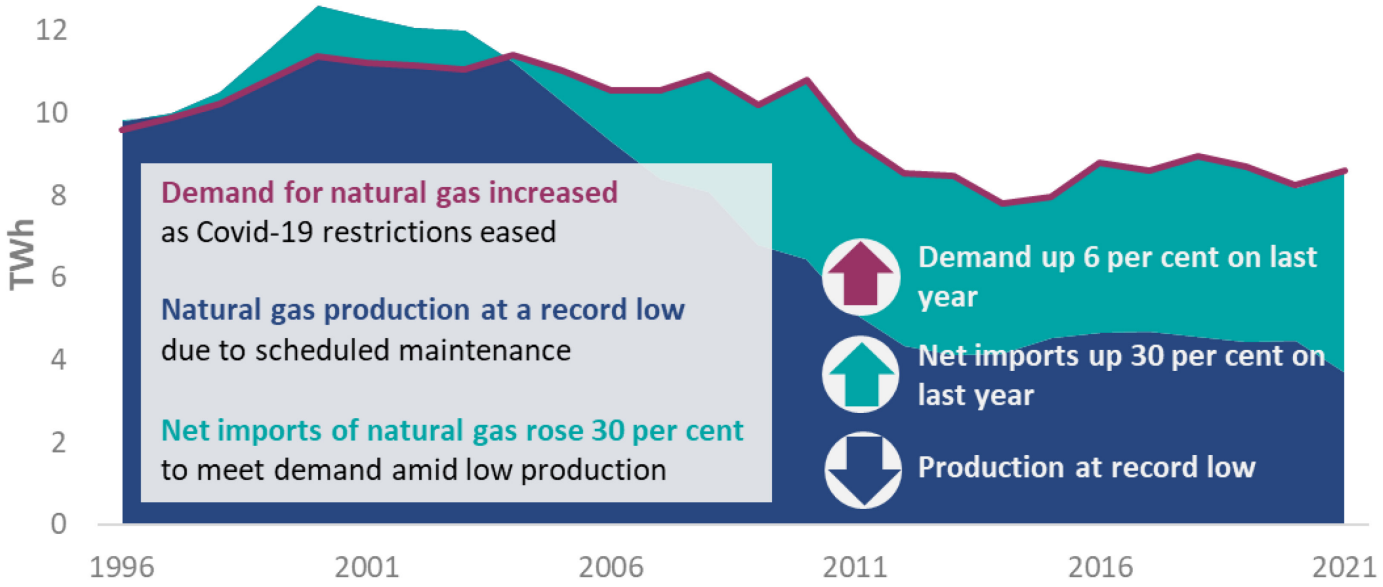
Natural Gas Flow Chart 2021 (TWh)



Note:

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

Chart 4.1 Supply and demand for natural gas, 1996-2021 (DUKES Table 4.1)



Natural Gas is an important part of the UK energy mix, accounting for nearly 29 per cent of production and 42 per cent of demand in 2021.

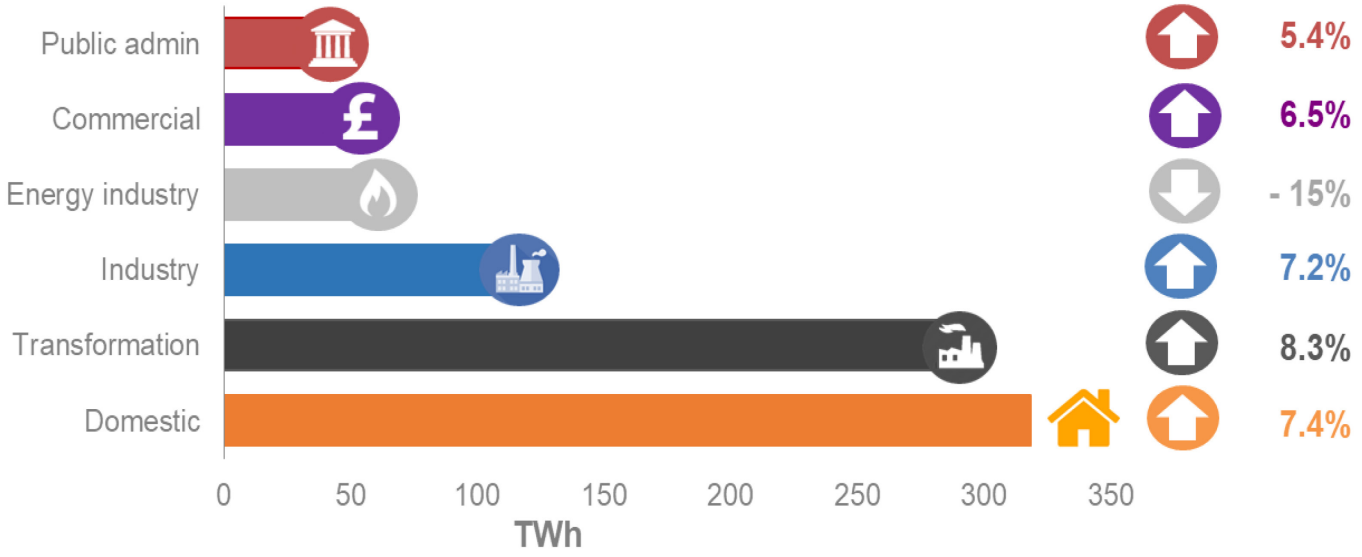
UK gas demand increased by 5.9 per cent in 2021 compared with 2020, largely due to the easing of restrictions in place to curb the Covid-19 pandemic, coupled with weaker performance from renewable generation and colder temperatures. Despite the overall increase, demand remained slightly below pre-pandemic levels and varied by sector.

In 2021, UK gas production reached a record low due to maintenance. Production fell to 364 TWh, which was 47 TWh below the previous record low in 2013 and over 70 per cent lower than the peak in 2000. Gas production had been broadly stable for close to a decade following several years of decline since 2000. However, in 2021 an extensive summer maintenance schedule across North Sea infrastructure saw a 17 per cent fall in production compared with the previous year. Several major terminals were shutdown, including the Forties Pipeline System (FPS) which serves a significant proportion of UK oil and gas production. Low production was furthered by delayed maintenance in 2020.

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.

Indigenous production met 42 per cent of demand in 2021, with the remainder supplied via imports. This was only the second time on record (the first being in 2013), that indigenous production met less than half of demand. Net imports of natural gas increased by 30 per cent in 2021 compared with the previous year. Imports increased 17 per cent, whilst exports fell 29 per cent reaching the lowest level since 1998.

Chart 4.2 Sectoral consumption of natural gas, 2020 to 2021 (DUKES Table 4.1)



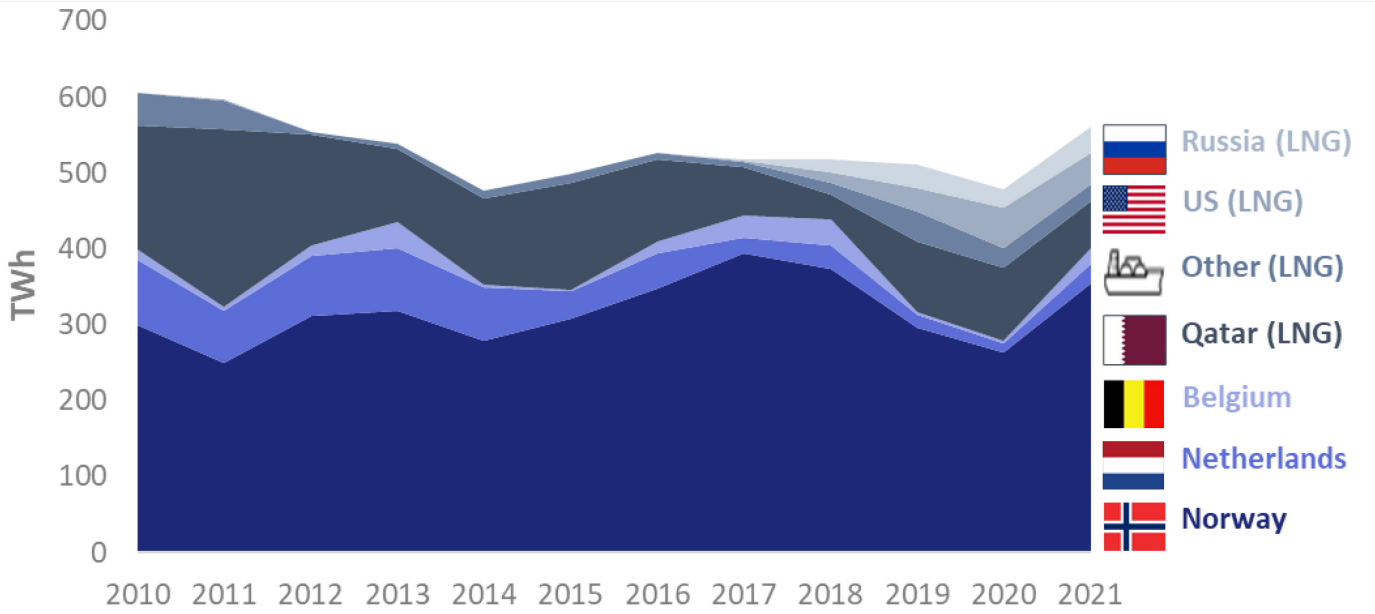
Domestic demand increased by 7.4 per cent in 2021, compared with 2020. Domestic gas consumption is used for space and water heating as well as for appliances such as ovens and hobs. This increase was due to colder temperatures coinciding with lockdown restrictions early in the year resulting in more time spent at home. Overall, natural gas met two-thirds of total domestic energy demand in 2021.

Gas used for electricity generation increased 9.3 per cent due to a fall in renewable output. This was due to less windy conditions and a reduction in nuclear output, and amplified by an increase in electricity demand as lockdown restrictions eased (see Chapter 5 for more information).

Industrial demand increased by 7.2 per cent, compared with 2020. This follows a return to pre-pandemic levels of gas consumption by industry, reflecting substantially fewer restrictions on operations in 2021 compared with 2020. However, this trend was not uniform across industrial sectors with falls in consumption in the chemicals sector due to several plant closures, and the paper and printing sector.

Gas demand by other final users increased by 7.3 per cent as lockdown restrictions eased. This included gas demand by the commercial sector, which increased by 6.5 per cent on 2020 as non-essential retail and hospitality venues reopened. Demand by public administration increased by 5.4 per cent. Despite increased demand in comparison with 2020, lockdown restrictions at the beginning of the year meant both remained slightly below 2019 levels.

Chart 4.3 Imports of natural gas, 2010-2021 (DUKES Table 4.5)

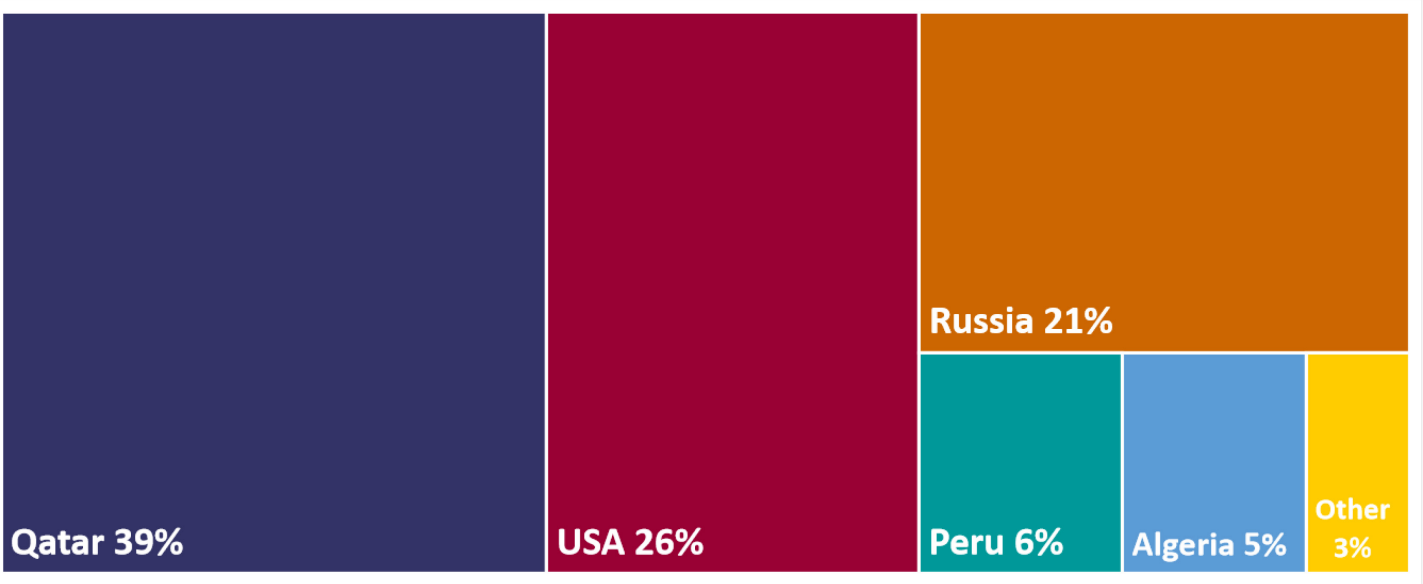


In 2021, natural gas imports increased by 17 per cent compared with 2020. This was due to reduced indigenous production and increased demand compared with the previous year. Imports arrive via pipeline; the UK imports natural gas via pipeline from Norway, Belgium and the Netherlands, or as Liquefied Natural Gas (LNG) via ship.

Norway remained the largest import source, accounting for 38 per cent of net supply. Net supply is calculated as gross production plus imports. Norway has historically been a large import source to the UK, due to the close geographical proximity and shared infrastructure in the North Sea. At 355 TWh, the amount of gas imported from Norway was greater than net production in 2021 for the first time. Norwegian natural gas imports accounted for 63 per cent of total imports and increased by around a third in comparison with 2020.

LNG imports fell by one fifth compared with high levels in 2020. LNG imports are largely linked to economic factors, with UK imports being influenced by major consumers of LNG, such as Asia. In 2021, a cold winter in Asia significantly increased the region's demand consequently reducing availability elsewhere, including the UK. This meant the share of LNG imports fell from 22 per cent of net supply in 2020, to 17 per cent in 2021. For more information on the supply of LNG see the special feature article.

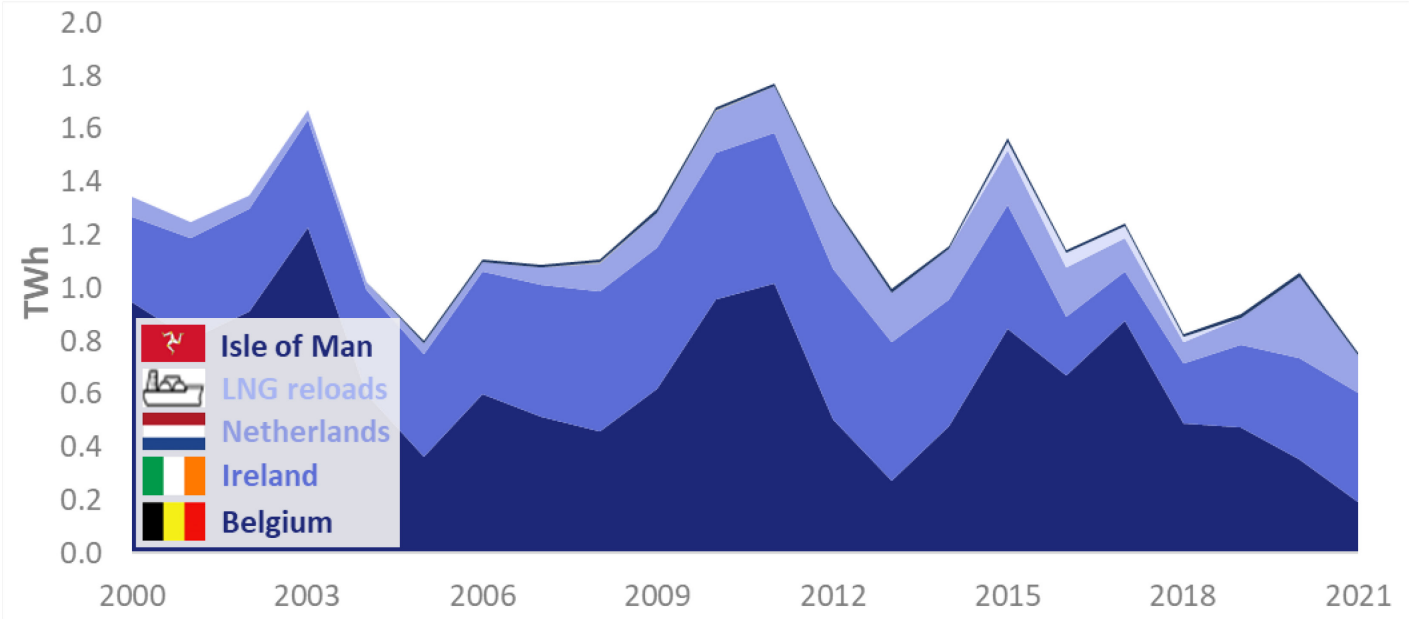
Chart 4.4 UK LNG import sources, 2021 (DUKES Table 4.5)



LNG import sources diversified, as the UK sourced cargoes from further afield. Historically, a large proportion of LNG imports have come from Qatar, peaking at 98 per cent of total LNG imports in 2011. However, Qatari imports accounted for just under two fifths of total LNG imports in 2021, the lowest in over a decade, and almost 75 per cent lower than in the 2011 peak. This reflects increasing diversification of LNG import sources to bolster the UK's security of supply. The UK imported LNG from nine countries in 2021, with increased imports from further afield including Peru and Algeria.

Imports from the USA and Russia have increased considerably since 2018, accounting for 26 and 21 per cent of total LNG imports respectively in 2021. However, following Russia's invasion of Ukraine the UK will end all dependency on Russian coal and oil by the end of 2022, and end imports of gas as soon as possible thereafter. Recent data shows a notable decline in Russian LNG imports in recent months (see Energy Trends Table 4.4 for further information).

Chart 4.5 Exports of natural gas, 2000-2021 (DUKES Table 4.5)



Exports fell by almost 30 per cent in 2021 reflecting low production. At 76 TWh, exports reached the lowest level recorded since 1998. This was largely due to low indigenous production following maintenance. Particularly large reductions were seen in exports to the Netherlands, down 55 per cent on 2020, and to Belgium, down 46 per cent. Only exports to the Republic of Ireland showed an increase, continuing growth seen over the past 5 years.

Chapter 5: Electricity

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Key headlines

Electricity demand increased in 2021 to 334.2 TWh, up by 1.2 per cent from 2020. The increase was primarily a result of the response to the Covid-19 pandemic, which severely restricted the activity of business and industry in 2020 but had a smaller effect in 2021.

Demand increased in all sectors in 2021 compared to 2020. The reduction of restrictions in response to Covid-19 led to an increase in industrial and commercial electricity consumption, whilst cooler temperatures increased domestic consumption.

Electricity supply increased in 2021, due to higher demand for electricity, but UK generation fell with higher supply from net imports. Total electricity supplied in 2021 was 333.2 TWh, with net imports of 24.6 TWh, 7.4 per cent of electricity supplied. Electricity generation fell to a record low of 308.7 TWh in 2021, 1.2 per cent less than in 2020.

Generation from renewable sources decreased 9.3 per cent to 122.2 TWh in 2021. This was driven by less favourable weather conditions for wind, hydro and solar generation. In particular, wind generation dropped to 64.7 TWh in 2021, down 14 per cent despite increased capacity. This was because of unusually low average wind speeds across most of 2021.

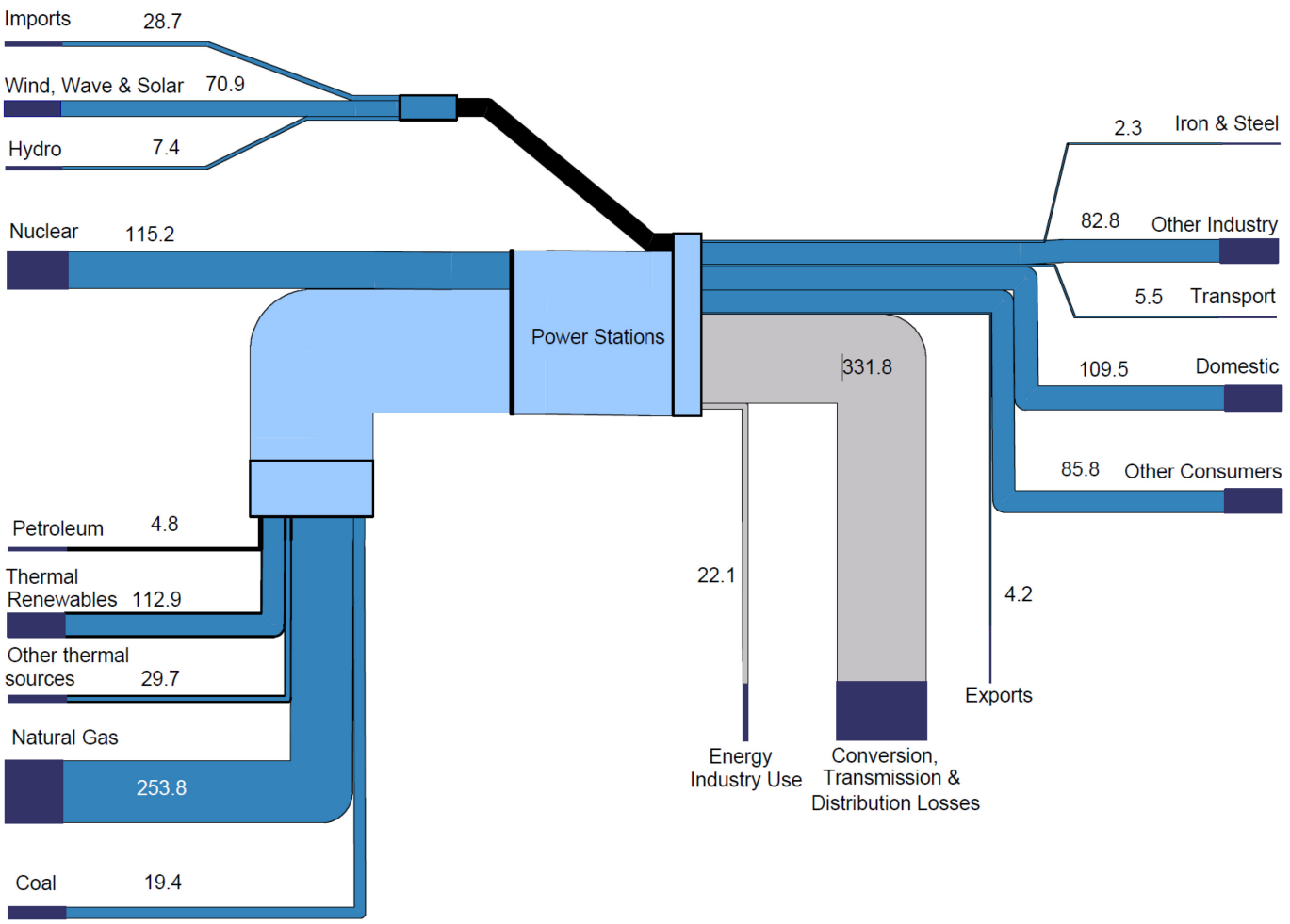
Fossil fuel generation increased 11.0 per cent in 2021 to 131.4 TWh. Increased demand for electricity and lower renewable generation increased the need for fossil fuel generation.

The proportion of electricity generation coming from renewable sources fell in 2021 but was still the second highest share on the published data series. The renewable share was 39.6 per cent, down by 3.6 percentage points compared to 2020, lower than the share of generation from fossil fuels (42.6 per cent), a contrast to the previous year. Decreased nuclear and renewable electricity generation meant the share of generation from low carbon sources was 54.5 per cent in 2021, down from 59.3 per cent in 2020.

Total net imports were a record 24.6 TWh in 2021. Total imports were 28.7 TWh in 2021, up 28.4 per cent compared to 2020, while total exports were down 7.0 per cent on 2020 to 4.2 TWh. Interconnector capacity rose to 7.4 GW in 2021 with new operational cables between the UK and Norway (North Sea Link), and a second link to France (IFA 2).

Total de-rated generation capacity rose to 76.6 GW in 2021, a 1.0 per cent increase on the 75.9 GW capacity in 2020. Capacity for renewable technologies increasing by 3.2 per cent to 23.2 GW while fossil fuel capacity remained unchanged at 42.5 GW and nuclear capacity unchanged at 8.1GW.

Electricity Flow Chart 2021 (TWh)



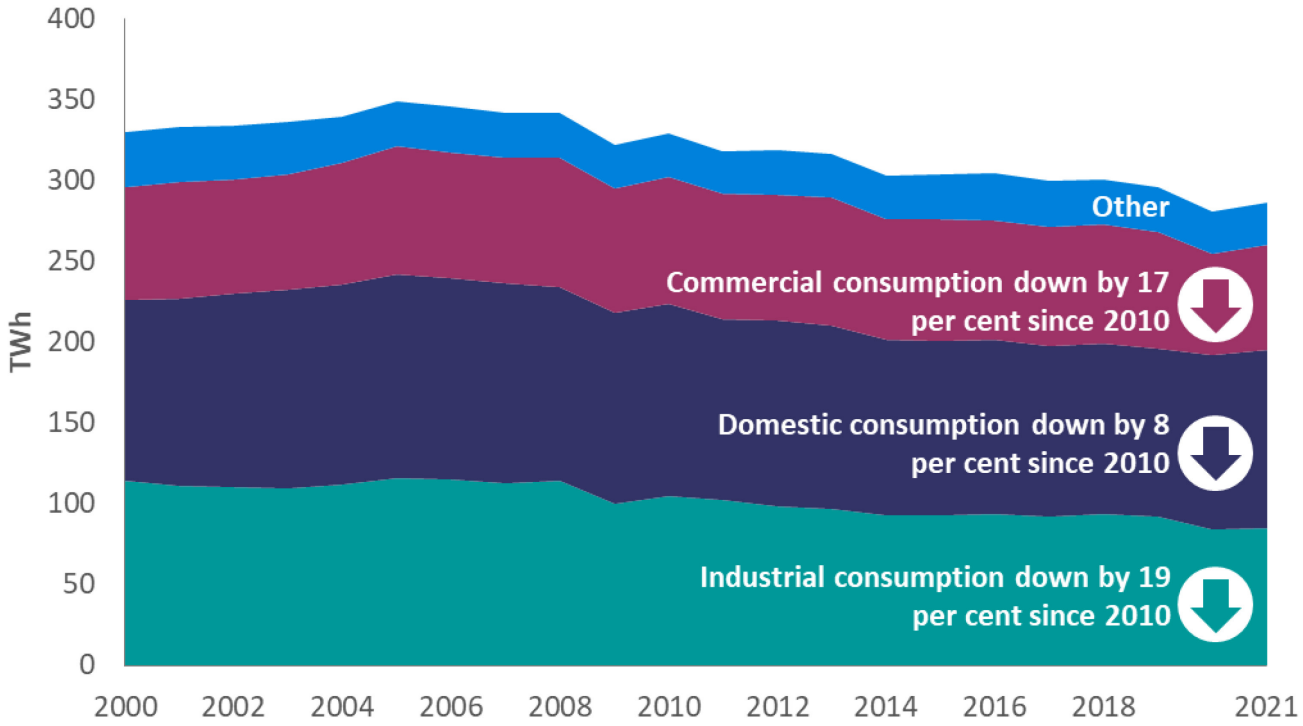
Notes on flow chart

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).

Electricity demand increased in 2021 to 334.2 TWh, up by 1.2 per cent from 2020. Though electricity demand had been declining year on year since 2015, the increase seen in 2021 was primarily a result of the response to the Covid-19 pandemic, which severely restricted the activity of business and industry in 2020 but had a smaller effect in 2021. Despite the increase in 2021, electricity demand remained below 2019's electricity demand. In line with the increased overall demand, there was a 1.9 per cent increase in final consumption of electricity compared to 2020. '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 2021 (Table 5.1)

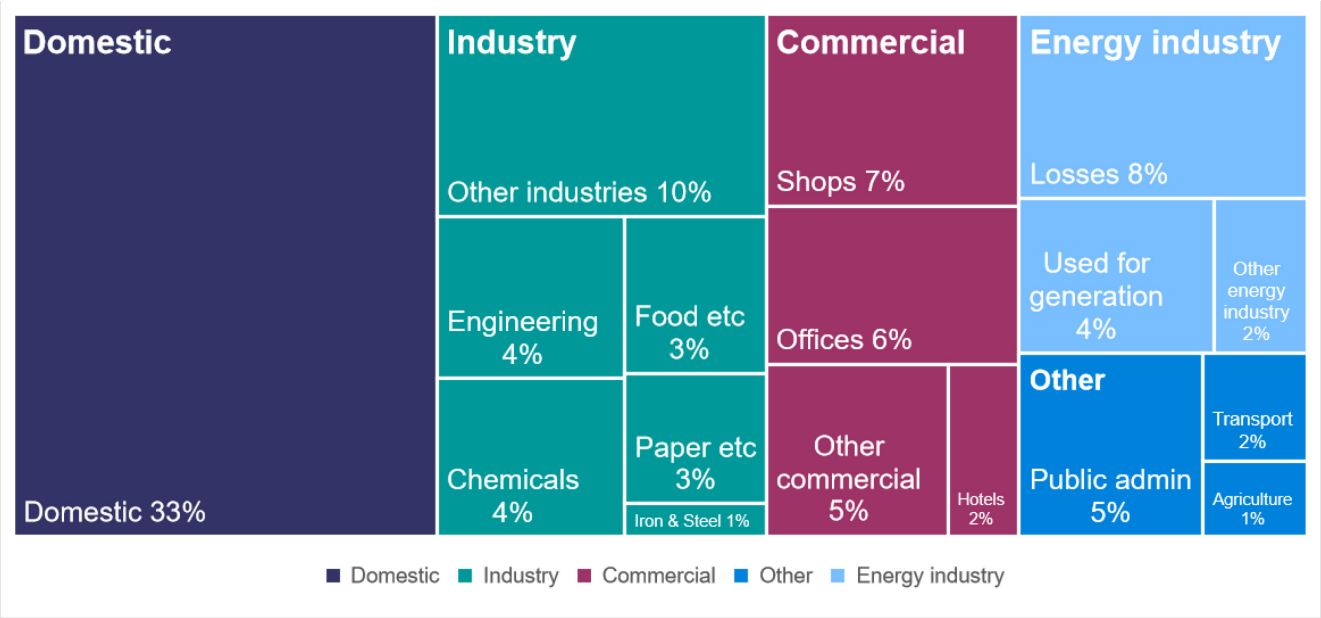


Demand increased in all sectors recovered in 2021 compared to 2020. The reduction of restrictions in response to Covid-19 led to an increase in industrial and commercial electricity consumption, whilst cooler temperatures increased domestic consumption. When comparing 2021 to 2020, industrial use of electricity, including iron and steel, increased 1.7 per cent, while consumption by other final non-domestic users, including the commercial sector, increased by 2.8 per cent. Despite these increases, consumption in both sectors remained below 2019 levels, with warmer average temperatures in the second half of the year reducing the potential increase when Covid-19 restrictions were lifted.

Domestic consumption increased by 1.4 per cent in 2021. This reflected cooler temperatures increasing electric heating demand, particularly in the first half of the year when Covid-19 restrictions meant that people continued to spend time at home, including working from home. It may also reflect voluntary changes in behaviour even once restrictions were lifted, for example increased working from home or businesses introducing hybrid working.

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.

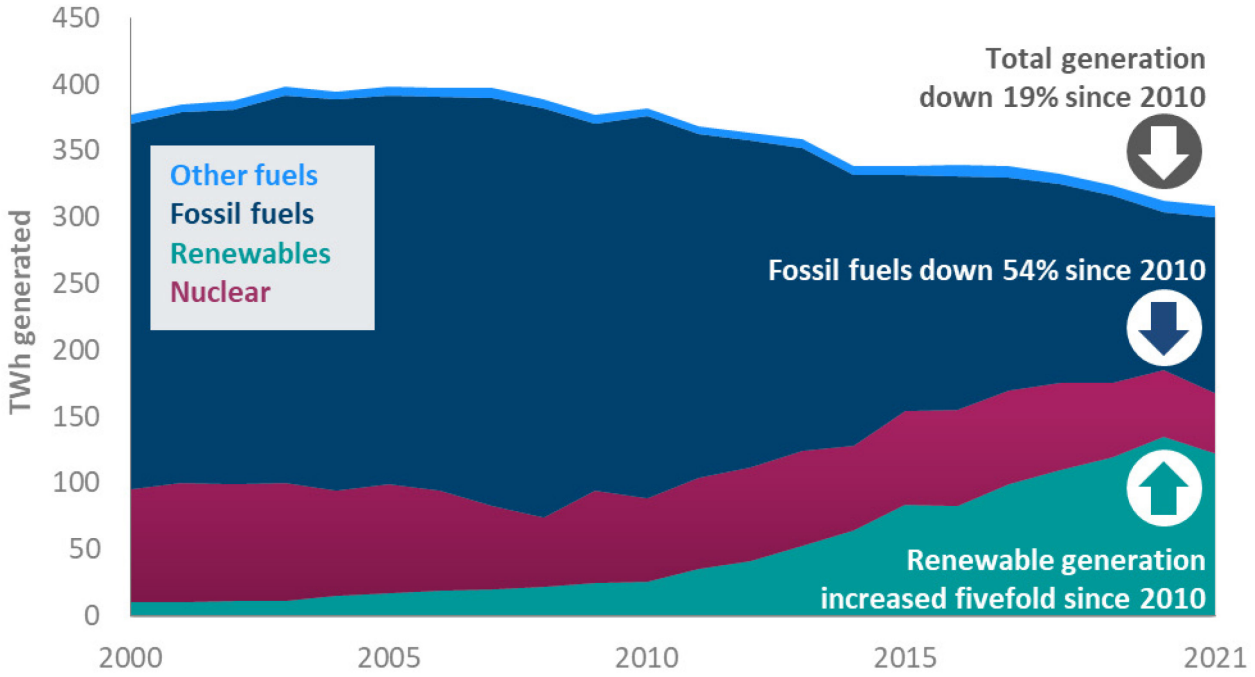
Chart 5.2 Share of total electricity demand split by sector, 2021 (Table 5.2)



Domestic users accounted for almost a third (32.7 per cent) of total electricity demand in 2021. Consumption by industry represented 25 per cent and commercial consumption represented 20 per cent. Compared to 2020, the domestic share increased 0.1 percentage point, the industrial share increased 0.1 percentage point and the commercial share by 0.5 percentage points, with fewer Covid-19 restrictions impacting industries and businesses.

Electricity supply increased in 2021, due to higher demand for electricity, but UK generation fell with higher supply from net imports. Demand for electricity is mainly met by UK generation and supplemented with imports from Europe when price differentials are favourable. 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 needs to match with demand to ensure there is always enough electricity available. Total electricity supplied in 2021 was 333.2 TWh, with net imports of 24.6 TWh, 7.4 per cent of electricity supplied.

Chart 5.3 Electricity generated by fuel, 2000 to 2021 (Table 5.6)



Electricity generation fell to a record low of 308.7 TWh in 2021, 1.2 per cent less than in 2020. This was despite the increase in demand as Covid-19 restrictions were partly lifted, with high net imports accounting for

the difference. The generation by Major Power Producers (MPPs) was the lowest value on the published data series, down 0.3 per cent on 2020 to 254.7 TWh. This continues a trend for lower MPP generation, with the emergence of greater numbers of smaller renewable sites, and higher net imports. Generation from autogenerators and other generators decreased by 5.0 per cent to 54.0 TWh in 2021, as less favourable weather conditions limited generation from smaller renewable sites.

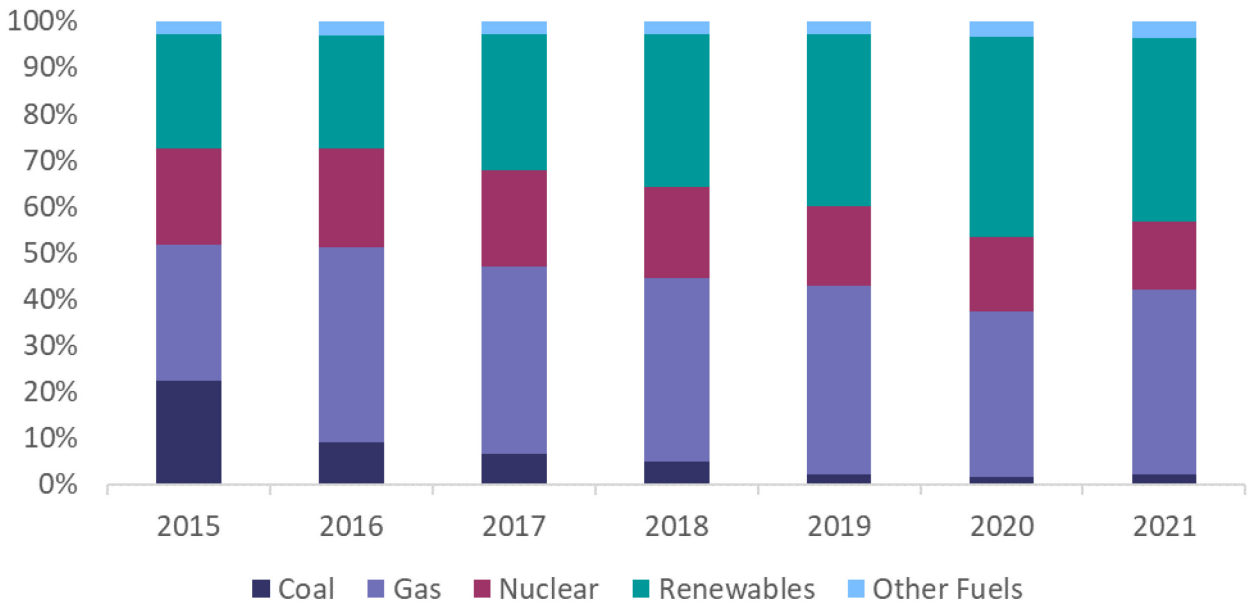
Generation from renewable sources decreased 9.3 per cent to 122.2 TWh in 2021. This was driven by decreased wind generation, which was 64.7 TWh in 2021, down 14 per cent despite increased capacity. This was because of unusually low average wind speeds across most of 2021. Weather conditions were also less favourable for hydro and solar generators, with lower than average rainfall leading to a 20 per cent decrease in hydro generation and lower average sun hours meaning that solar generation decreased by 5.9 per cent. In contrast, there was a 1.3 per cent increase in generation from bioenergy to 39.9 TWh.

Fossil fuel generation increased 11.0 per cent in 2021 to 131.4 TWh. Increased demand for electricity and lower renewable generation increased the need of fossil fuel generation. Gas continued to be the dominant fossil fuel, generating 123.2 TWh of electricity in 2021, an increase of 11 per cent from 2020. There was also an increase of 19 per cent in coal generation to 6.5 TWh, from the record low value in 2020. Just four coal-fired power stations remain in the UK, with plans to phase these out by October 2024.

Nuclear electricity generation was 45.9 TWh in 2021, down 8.7 per cent compared to 2020. This was the lowest amount in more than twenty years as all of the UK's nuclear plants were on outage at times during the year. 2021 also saw the decommissioning of Dungeness B, which had been unable to generate since 2018.

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 is important with the changes in demand year on year resulting from Covid-19 restrictions, and to monitor targets for low carbon electricity generation.

Chart 5.4 Shares of electricity generation by fuel, 2015 to 2021 (Table 5.6)



The proportion of electricity generation coming from renewable sources decreased in 2021, but was still the second highest share on the published data series. The renewable share was 39.6 per cent, down by 3.6 percentage points compared to 2020. This was lower than the share of generation from fossil fuels (42.6 per cent), a contrast to the previous year. The reduced share for renewables was driven by a decreased share of generation from wind, as average wind speeds were unusually low for most of 2021. The share of wind generation was 20.7 per cent, 3.5 percentage points lower than in 2020. Shares of generation were similar in 2020 and 2021 for hydro, solar and bioenergy.

The fossil fuel share of generation was 42.6 per cent, up 4.7 percentage points due to less favourable weather conditions for renewables. The large majority of UK generation is from gas, which generates 39.9 per cent of the total in 2021, up 4.2 percentage points from 2020. The fall in the use of fossil fuels has largely been driven by a significant reduction in coal generation, which has fallen from a fifth of generation in 2015 to just 2.1 per cent in 2021.

Nuclear share of electricity generation fell to its lowest level since 2008, accounting for 14.9 per cent of generation in 2021, down 1.2 percentage points from 2020. Decreased nuclear electricity generation meant the share of generation from low carbon sources was 54.5 per cent in 2021, down from 59.3 per cent in 2020.

The total fuel used for electricity generation increased by 2.2 per cent in 2021 to 55.1 million tonnes of Oil Equivalent (Mtoe). This slight increase is in contrast to the previous trend of year on year decreases from 2012 and 2020, and came as demand increased with the reduction in Covid-19 restrictions at the same time as less favourable weather reduced generation from non-thermal renewables. Despite the increase, fuel used for electricity remained low and has fallen 28 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[1].

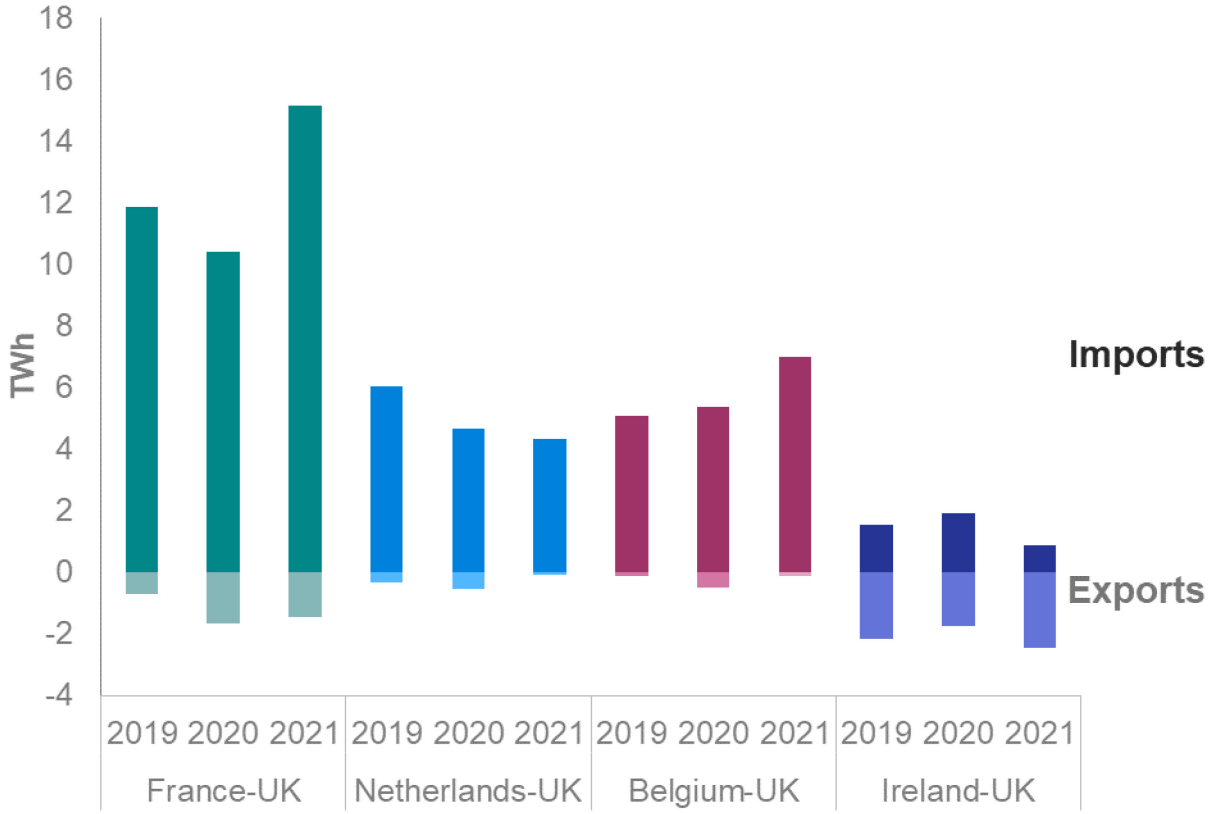
Trends in fuel used mirror those in electricity generation, with increases in the amount of fossil fuel used, record low use of nuclear fuel and decreases for fuel used by renewable generators. Gas continues to dominate the UK generation mix, with 21.8 Mtoe used in 2021, and coal use increased to 1.7 Mtoe, up by 14 per cent from the record low seen in 2020. Despite this increase, coal use remained 93 per cent lower than in 2010.

The UK continued to support its own generation by importing electricity from Europe to meet demand when price differentials were favourable, with total net imports at a record 24.6 TWh in 2021. This represented 7.4 per cent of electricity supply, up by 2.0 percentage points compared to 2020. Net imports in 2021 increased by 37 per cent as less favourable weather conditions reduced renewable generation in the UK. Total imports were 28.7 TWh in 2021, up 28.4 per cent compared to 2020, while total exports were down 7.0 per cent on 2020 to 4.2 TWh.

Interconnector capacity increased to 7.4 GW in 2021 with new operational cables between the UK and Norway (North Sea Link), and a second link with France (IFA 2). France was the source for more than half the UK's imported electricity (53 per cent, up from 47 per cent in 2020), with Belgium the second highest at 24 per cent then the Netherlands at 15 per cent. The new North Sea Link interconnector with Norway became operational at the start of October 2021 and provided 5 per cent of total electricity imports despite only being in operation for 3 months.

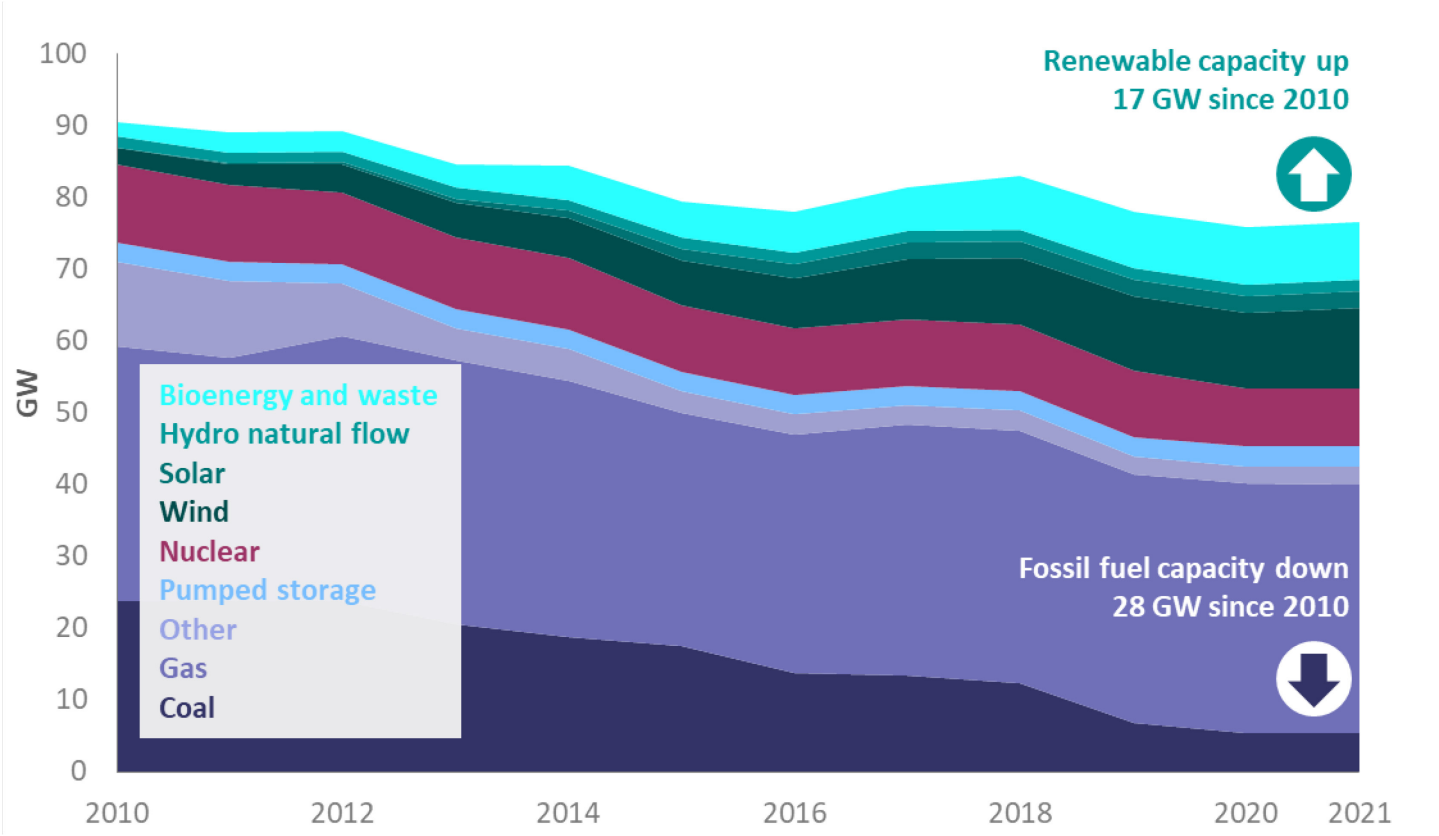
[1] For wind, hydro and solar, the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred. Therefore, for example, if one unit of electricity produced from coal is switched to wind, the fuel used will show a fall from around three units (as coal's thermal efficiency is around one-third) to one unit.

Chart 5.5 Electricity imports from Europe (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 2021 (Table 5.7)



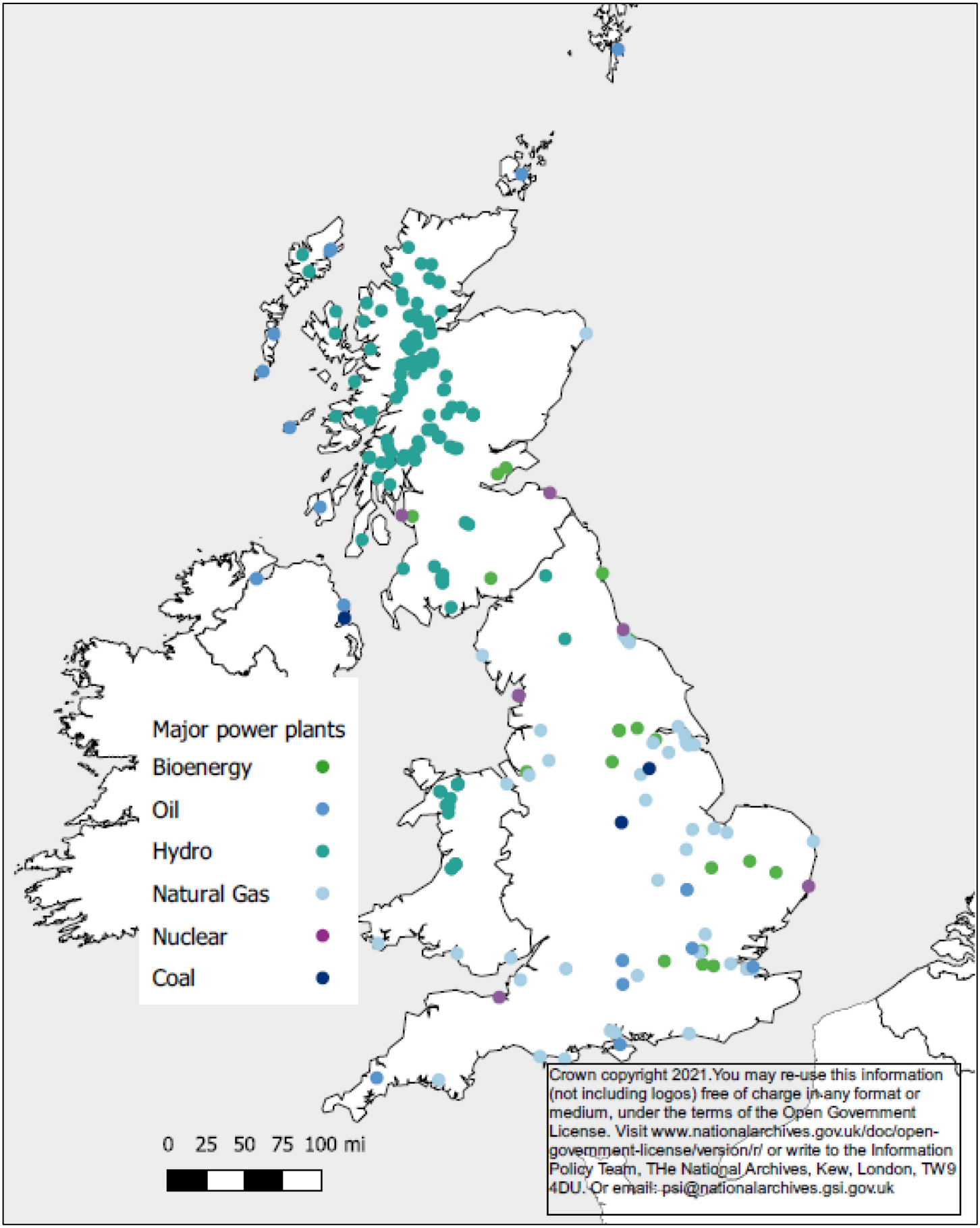
Total de-rated generation capacity increased to 76.6 GW in 2021, a 1.0 per cent rise on the 75.9 GW capacity in 2020. Capacity for renewable technologies increased by 3.2 per cent to 23.2 GW while fossil fuel capacity remained unchanged at 42.5 GW and nuclear capacity unchanged at 8.1 GW. The peak demand in winter was slightly lower than the equivalent figure in 2020 at 48.76 GW[2], 0.6 per cent lower. As Major Power Producer (MPP) capacity increased slightly, by 0.8 per cent, the peak represented 74.5 per cent of MPP capacity, 1.0 percentage points lower than 2020.

Renewable capacity increased, with substantial new wind and solar sites. Wind capacity increased by 5.3 per cent to 11.1 GW with a 3.0 per cent increase for onshore wind and an 8.4 per cent increase for offshore wind, including 0.9 GW at Triton Knoll. Solar capacity also saw an increase of 2.8 per cent to 2.4 GW. Generation capacity for bioenergy and waste rose by 1.3 per cent to 8.1 GW in 2021.

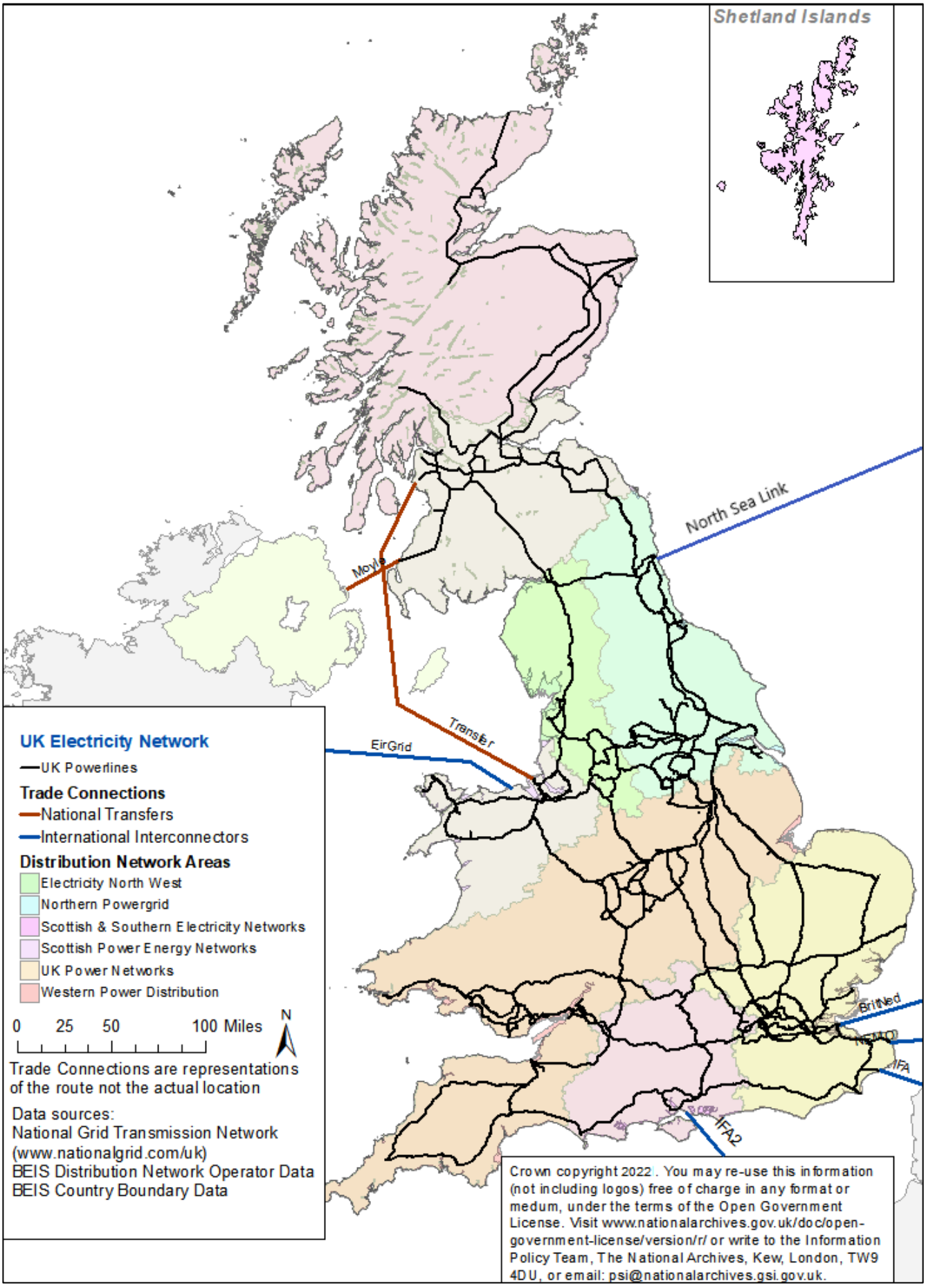
Alongside increased capacity, the MPP power plants were less intensively deployed than they were last year, with a load factor of 41.2 per cent. Load factors indicate the proportion of the time the plant is producing electricity and decreased by 0.5 percentage points compared to 2020. Load factors vary by technology, with nuclear stations the highest at 58.5 per cent and the lowest being pumped storage hydro at 7.9 per cent. Full load factors for renewable generation are given in Table 6.3.

[2] 7th December 2021 in the half hour ending 17.30

Map of Major Power Producers in the UK (operational May 2022)



UK Distribution Network Operating Areas and GB Power Lines Map



Chapter 6: Renewable sources of energy

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Key headlines

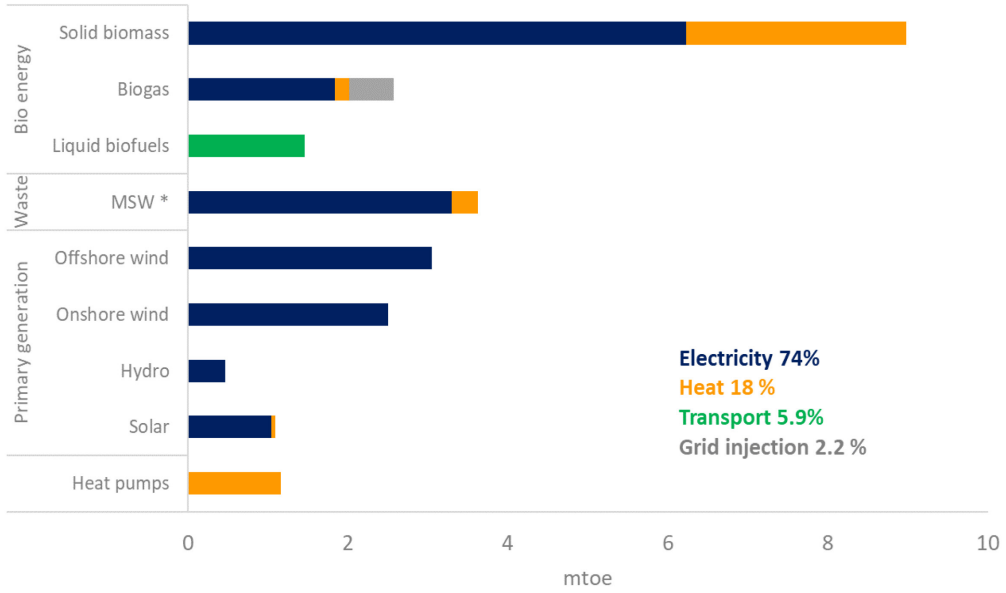
Following a record high in 2020, renewable generation fell by 9.3 per cent though 2021 is still the second highest on record. The decrease is mostly the result of less favourable weather conditions (particularly wind speeds but also sun hours and rainfall). **Renewables' share of electricity generation was similarly impacted by the weather conditions falling to 39.6 per cent in 2021**, again, second only to the record 43.2 per cent in 2020.

Although new renewable capacity remains modest with 1.8 GW installed in 2021, it is higher than the 0.9 GW installed in 2020, when some projects are likely to have been delayed due to Covid-19 restrictions. Overall, installed capacity grew by 3.7 per cent in 2021.

Total renewable fuel use decreased by 0.7 mtoe (2.8 per cent), largely due to the fall in electricity generation which accounts for the bulk of renewable fuel used (73 per cent). **Renewable heat increased by 0.2 mtoe (4.4 per cent) and grid injected biogas increased by 2.4 per cent, though the latter remains relatively low in absolute terms (0.6 mtoe).**

Renewable fuels include primary energy such as wind, solar, and hydro and thermal fuels including solid fuels, biogases, and liquids. Around three quarters of fuels are used for electricity generation with heat accounting for the next largest share (18 per cent). The remainder is accounted for by liquid biofuels, mostly used in transport, and biogas injected into the National Grid. The latter accounts is a relatively small part of renewable fuels but it has been increasing steadily since 2016. Chart 6.1 shows the demand for each fuel by end use.

Chart 6.1 Use of renewable fuels, 2021 (Table 6.4)



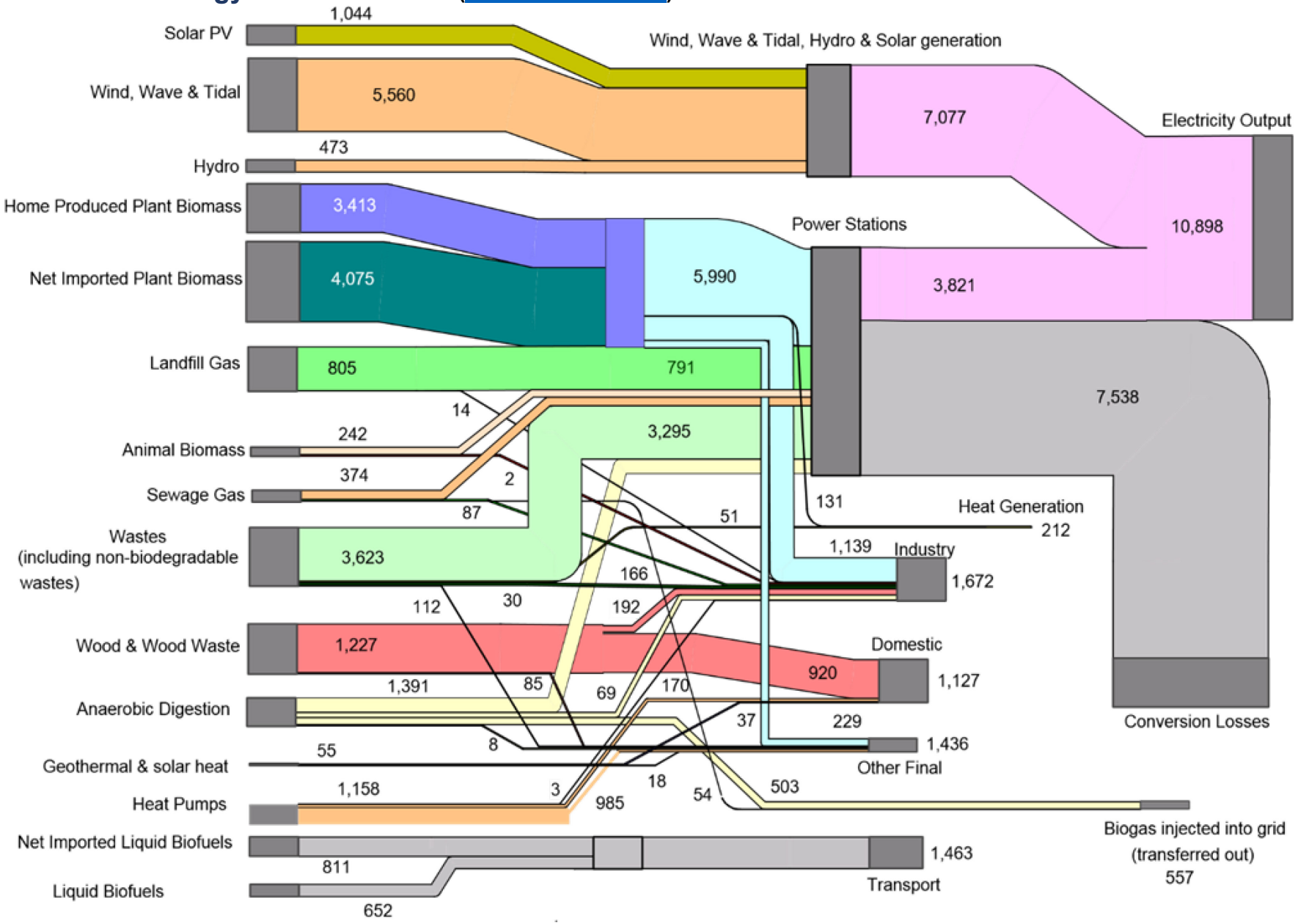
**Including non-biodegradable waste*

Solid biomass, including wood, waste wood, animal and plant biomass, represented 36 per cent of total renewable demand in 2021 with nearly 70 per cent being used in electricity generation and the remaining 30 per cent to produce heat. Biogas (landfill and sewage gas, and anaerobic digestion (AD)) has historically been used for electricity generation and heat but has more recently been injected into the gas grid. However, over 71 per cent is still being used for electricity generation, 22 per cent is being injected into the grid (up from 11 per cent in 2016, the first year data became available) with the remaining 7 per cent being used for heat.

Although solid biomass accounts for the largest share of renewable fuel, on an electricity output basis (i.e. generation after conversion losses in thermal generation), offshore and onshore wind show a higher share at 29 per cent and 24 per cent respectively in 2021.

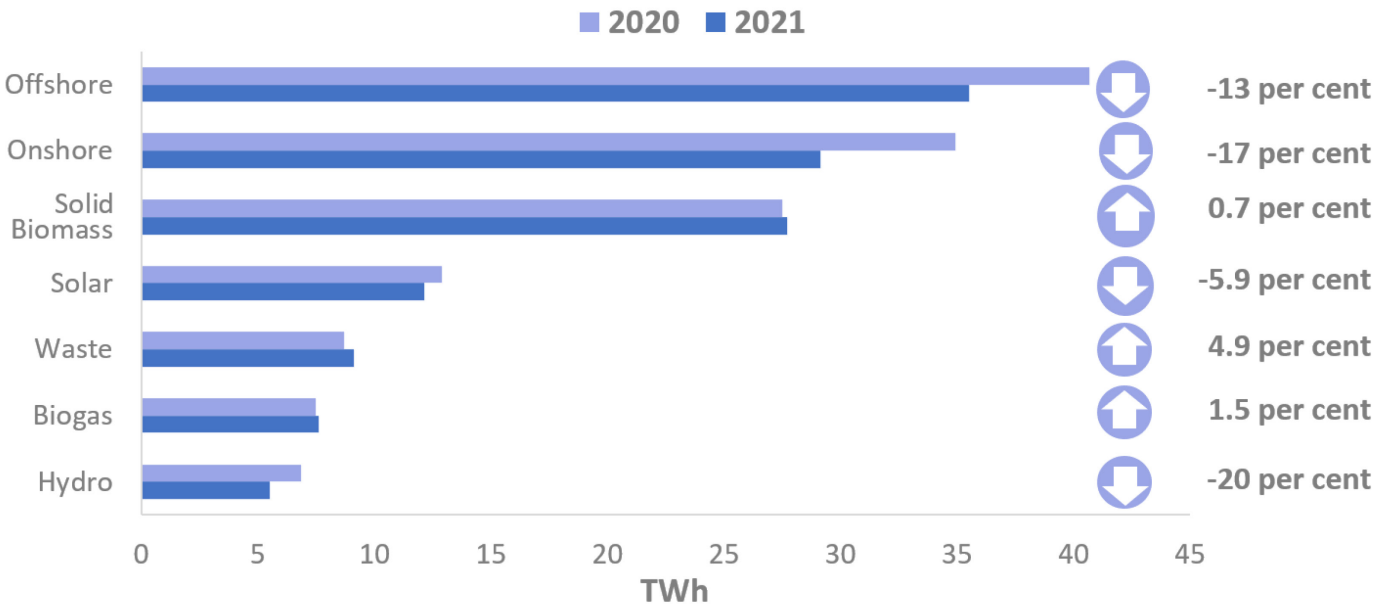
Where Chart 6.1 shows renewable fuel demand, not all fuels are produced domestically, though due to the local nature of primary generation, just a small proportion of renewables is imported or exported. The bulk of net imports is represented by imported biomass (specifically wood pellets) used for electricity generation in large power stations. 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.

Renewable energy flow chart 2021 (Tables 6.1 and 6.2)



Renewable generation fell in 2021 by 9.3 per cent; with limited new capacity coming online, the main impacts on generation were the less favourable weather conditions, notably slower wind speeds, fewer hours of sunlight and lower rainfall. **Overall generation fell by 12.6 TWh** to 122.2 TWh, though generation in 2020 was boosted by exceptionally high wind speeds (Storms Ciara and Dennis), and 2021 remains the second highest on record. There was some new capacity for both onshore and offshore wind (0.4 GW and 0.9 GW respectively), but this was insufficient to offset the lower wind speeds. Generation could potentially have been boosted in 2021 too by another notable storm (Storm Aiden), though this had a negative effect due to its ferocity causing outages. Of the 12.6 TWh fall in generation, 11.0 TWh was due to lower wind generation (5.8 TWh for onshore and 5.2 TWh for offshore). Chart 6.2 shows the change in generation between 2020 and 2021 across the technologies both in absolute and percentage terms.

Chart 6.2 Electricity generation by fuel, 2020 – 2021 (Table 6.2)



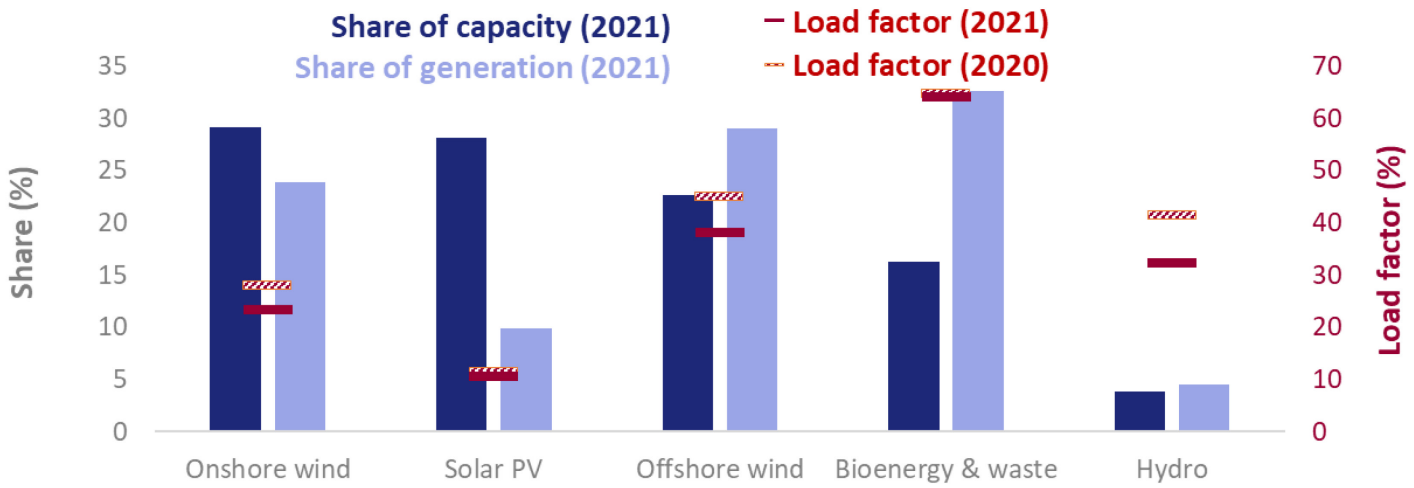
Lower rainfall in 2021 resulted in the largest fall for hydro in percentage terms of the key technologies at 20 per cent (1.4 TWh), and lower hours of sunlight. Solar PV generation also fell in response to fewer hours of sunlight in 2021.

Within bioenergy, only anaerobic digestion and energy from waste showed notable changes in 2021: a further 67 MW of AD capacity and 16 MW of energy from waste capacity boosted generation by 11 per cent and 4.9 per cent respectively.

Offshore continues to be the leading wind technology in 2021, accounting for 55 per cent of all wind generation in 2021. Offshore first outstripped onshore generation in 2019, although offshore capacity still lags onshore. Offshore wind plants benefit from coastal winds that generally blow at stronger speeds and for a longer period. Moreover, offshore turbines tend to be newer and larger devices, thus 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: wind speeds affect wind load factors, sun hours affect the load factor for solar PV and, to a lesser extent, rainfall affects the load factor for hydro. Chart 6.3 compares the key technologies' share of capacity and generation for 2021. The load factors for both 2020 and 2021 have been added where the impact of less favourable weather in 2021 can be seen in the lower load factors.

Chart 6.3 Relative share of capacity and generation and load factors 2021 (Table 6.3)

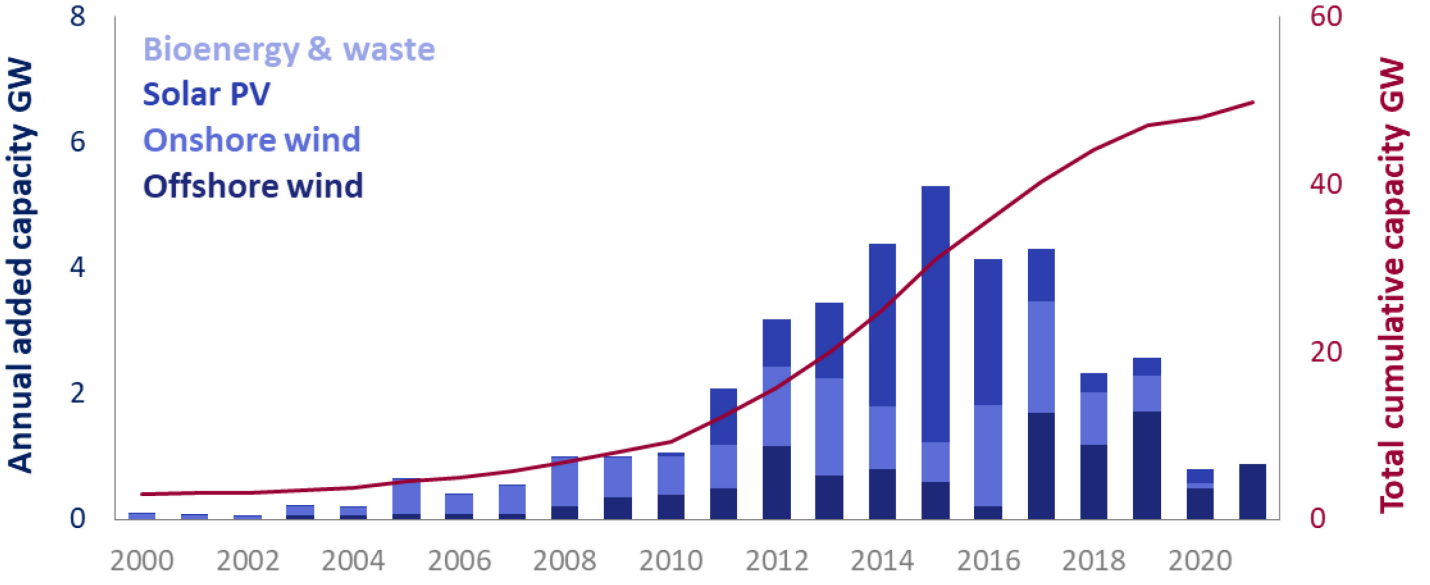


Thermal generation such as bioenergy and waste tend to have high load factors as indicated by the relatively high share of generation compared to capacity. It also tends to be fairly stable and generally varies should any outages occur at large plants. Conversely, solar PV has a very low load factor due to limited hours of sunlight.

On an unchanged configuration basis, where only sites operating for the full year are included, the load factor for overall renewables in 2021 was 37.3 per cent, more than 4 percentage points lower than in 2020 but still the second highest since 2015. Less favourable weather is the main driver for the large fall, with load factors for primary sources, especially wind, standing below their 10-year average. The load factor for thermal technologies also saw a decline, plant biomass decreased to 68.6 per cent but is closer to the long-term average. Load factors for landfill gas continue to decline as extraction rates decrease.

Chart 6.4 shows the historic growth in capacity highlighting the stark slowdown over 2020 and 2021 (though some projects may have been delayed in 2020 due to Covid-19 restrictions). New capacity began to slow after 2018 when 3.8 GW was installed falling to just 0.9 GW in 2020. In 2021, new capacity picked up with 1.8 GW added most of which was in offshore wind (0.9 GW). 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 6.4 Annual added capacity 2000 to 2021 (Table 6.2)



Prior to 2011, solar PV capacity formed a very small part of the renewable energy mix representing just 1.0 per cent of total capacity in 2010. However, between then and 2017, solar PV capacity increased significantly, thanks to the support of the Renewable Obligation (RO and the Feed-in Tariff (FiT) schemes, which closed to

new entrants in 2016 and 2019 respectively. Capacity added during those years accounts for 91 per cent of current installed capacity. Although growth has slowed since 2017, solar PV's share of renewable capacity stands at 28 per cent in 2021.

Growth in new wind sites has been more stable, particularly onshore wind, though it has slowed over recent years with just 0.4 GW added in 2021, an increase of 3 per cent. Offshore wind has seen higher levels of new capacity in recent years with more than half being installed since 2016. Wind now represents over half of installed renewable capacity (see wind map on next page showing location by capacity).

The map below shows UK wind farms that were operational at the end of 2021 with a capacity 0.5 MW or more. In addition, there are around 9,000 smaller sites that are not shown. The exact location of some plants could not be determined from the available data. In 2021, there was one new offshore wind plant (Triton Knoll) which accounted for nearly 95 per cent of the new capacity, the remainder consisted of an extension at Kincardine. In addition, there were 30 new onshore wind farms.

Map of UK wind capacity 2021

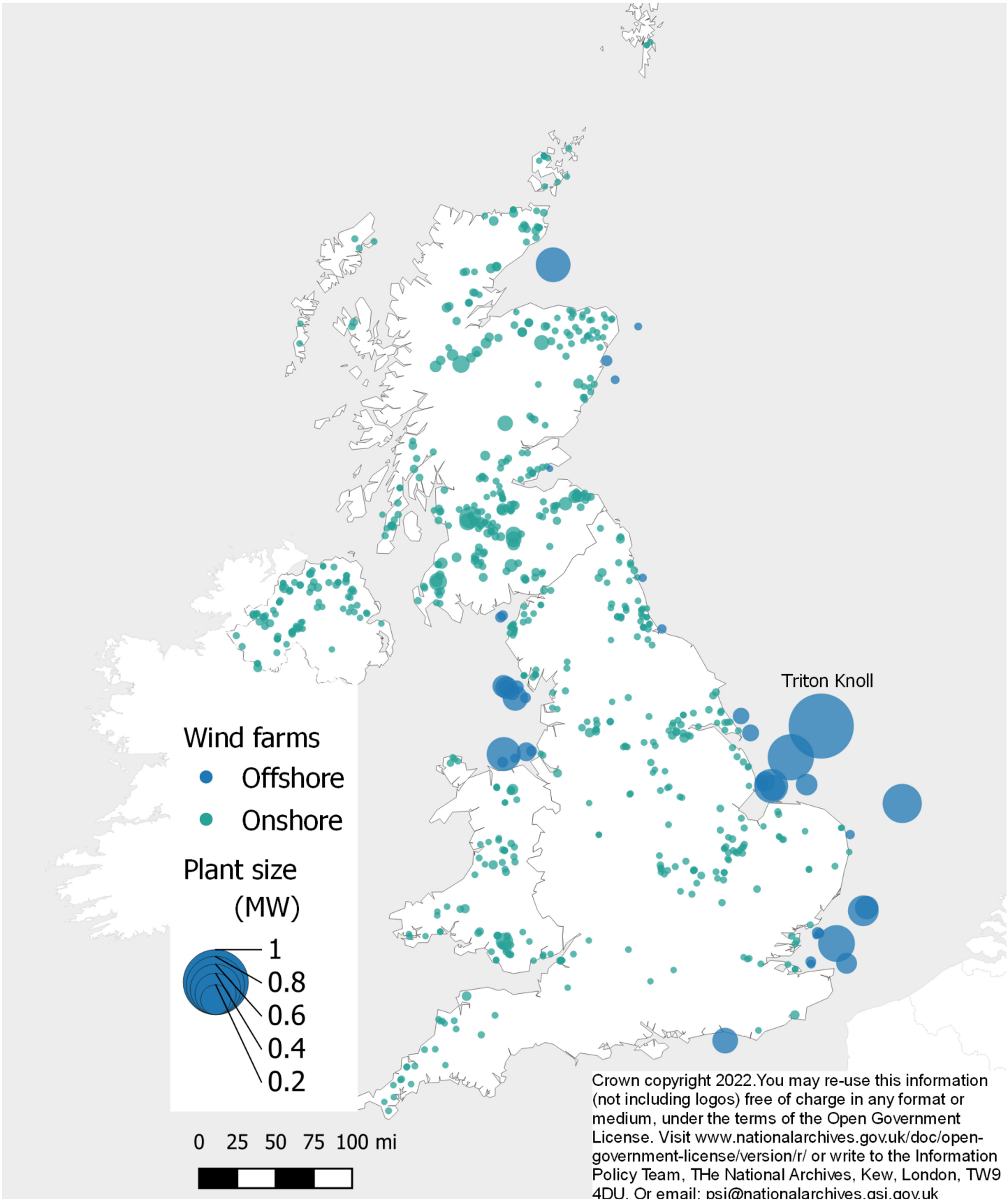


Chart 6.5 Trends in generation by technology 2000 to 2021 (Table 6.2)

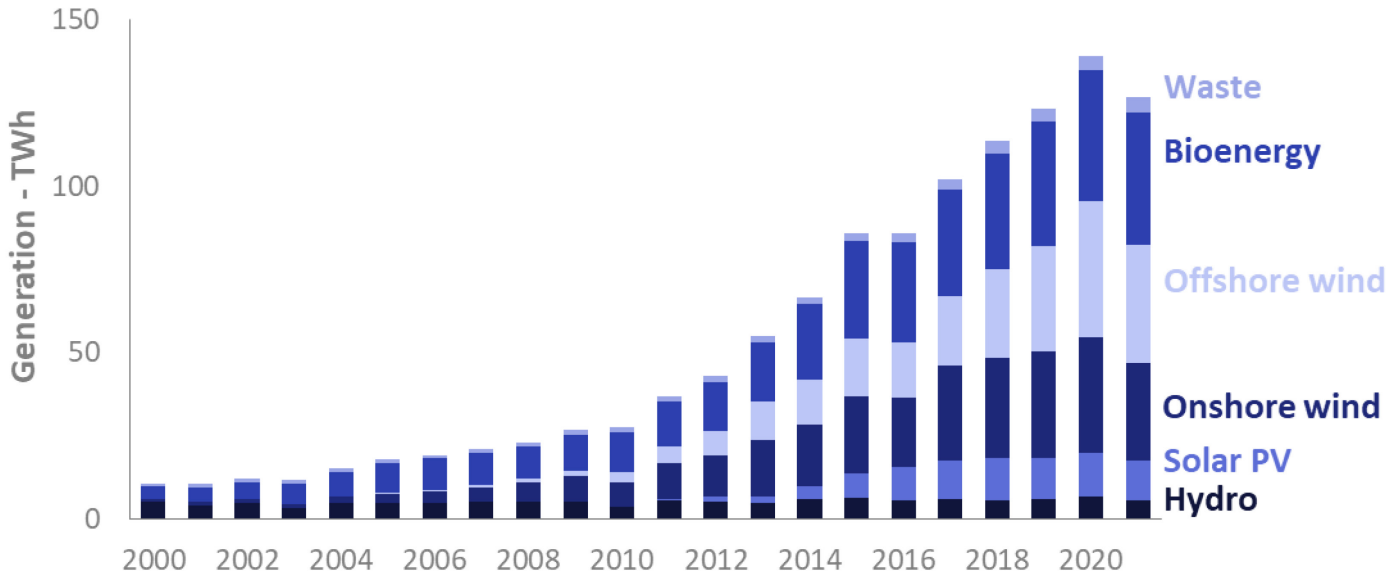
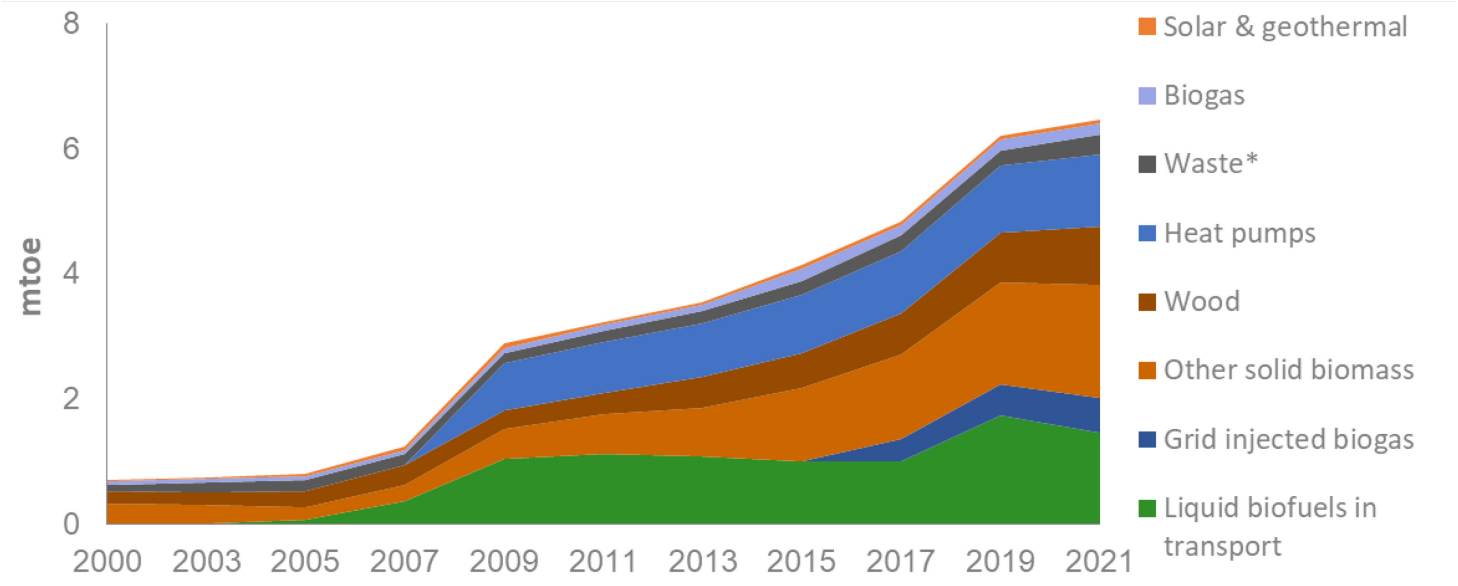


Chart 6.5 shows the changes in electricity generation fuel mix since 2000. The overall upward trend in generation is driven by increasing cumulative capacity. However, the impact of year-on-year fluctuations due to temperamental weather conditions can be seen in the above chart. For example, despite the record new capacity in 2015, generation for 2016 remained similar to 2015. Again, this can be seen between 2020 and 2021 with the fall in generation.

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 9.9 per cent in 2021.

Bioenergy has seen rapid growth since 2012 as several large power stations converted from coal to plant biomass (mainly wood pellets). 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 offset by an increase in generation from anaerobic digestion, up by 3.1 TWh since 2011 and 0.3 TWh in 2021, nearly 11 per cent.

Chart 6.6 Other renewable fuel uses; heat, transport, and grid injected biogas (Table 6.4)



**Including non-biodegradable waste*

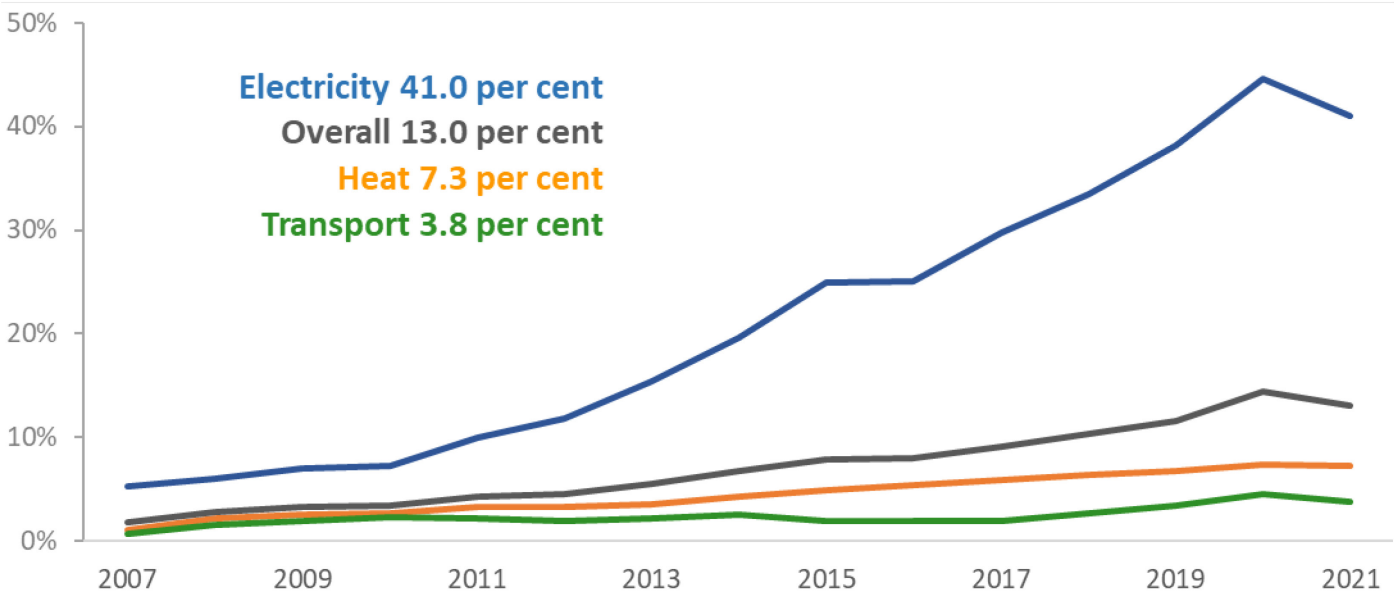
Whilst electricity generation represents nearly three quarters of renewable fuel demand, heat also accounts for a sizable proportion (18 per cent) with liquid biofuels (6.3 per cent) and of increasing importance, biogas injected into the grid (2.4 per cent). Between 2020 and 2021, renewable heat increased by 4.4 per cent with most of the increase in energy from waste and wood.

Renewables used in transport are liquid biofuels, which are blended with diesel and motor spirit (petrol). Demand for bioethanol increased 33 per cent in 2021 to 447 ktoe, as road fuels sales increased following the Covid-19 lockdown, and the introduction of E10 petrol at pumps (indicating up to 10 per cent bio content). Conversely consumption of biodiesel fell by 22 per cent to 1,017 ktoe largely due to high demand for used cooking oil (a large proportion of biodiesel) in jet fuel production, and reduced supply during lockdowns. With capacity stable at 522 ktoe and production of bioethanol being only 201 ktoe (a 9.2 per cent increase) in 2021, imports made up for the excess demand. Biodiesel, on the other hand, saw a sharp reduction (22 per cent) in consumption, to 1,017 ktoe. Capacity and production in 2021 remained stable, at 582 ktoe and 447 ktoe respectively.

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. Growth in 2021 slowed to 2.4 per cent compared to 9.0 per cent in 2020.

For this edition of DUKES, BEIS have brought forward the usual September Energy Trends article, '**Aggregated Energy Balances, of which renewables'**[1] to improve timeliness. These data are now available in Table 6.5] along with 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 6.8).

Chart 6.7 Renewable energy as a proportion of total gross final consumption (Table 6.5a)



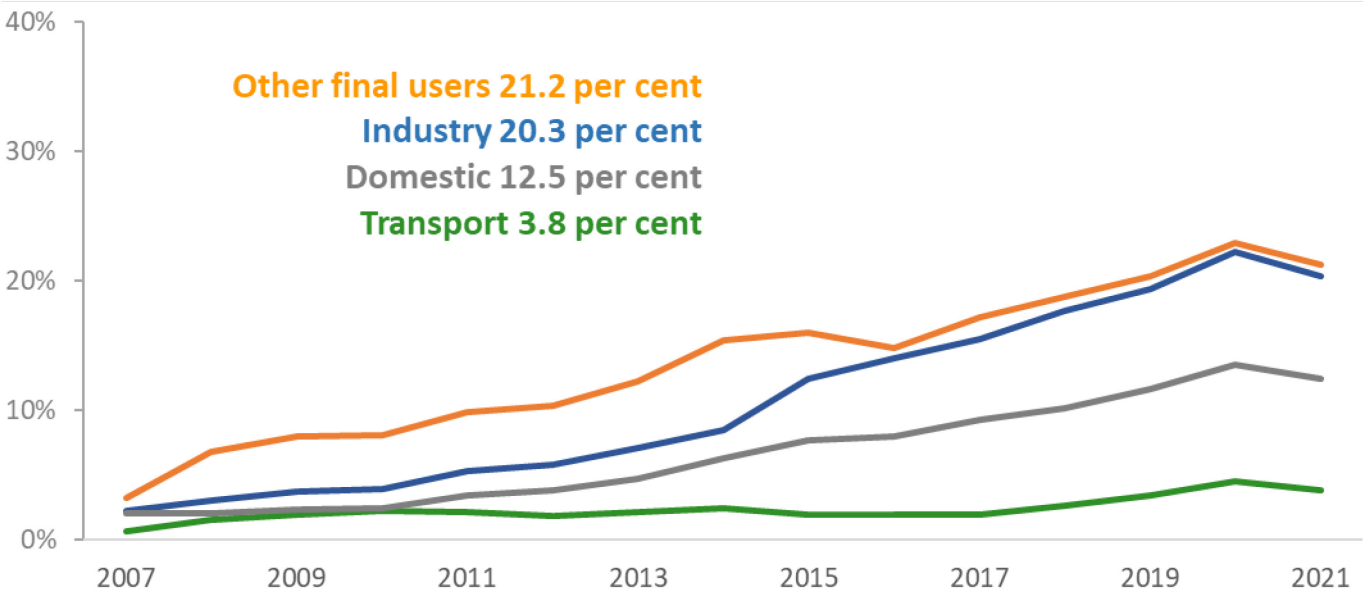
The proportion of electricity from renewables differs to that for generation and supply in that it excludes generation consumed in transport which is allocated to the transport measure. The underlying trend is however similar in that weather impacts are visible particularly between 2020 and 2021. Weather 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

[1] International Recommendations for Energy Statistics (IRES), Energy Trends article previously published at; https://www.gov.uk/government/publications/energy-trends-september-2021-special-feature-article-aggregated-energy-balances-showing-proportion-of-renewables-in-production-demand-and-final-c

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 fell (the majority of renewable fuels) in 2021, driving the lower share of renewable consumption.

The renewable proportion consumed by sectors, regardless of end use, varies depending on the proportion of electricity consumed versus thermal fuels. Chart 6.8 below highlights how the renewable proportion of renewables for industry has increased and, since 2016, has been in line with other consumers (mostly commercial and public administration). This reflects lower heavy industry consumption usually requiring higher grade heat usually provided by fossil fuels.

Chart 6.8 Renewables' share of final energy consumption by sector (Table 6.5b)



All sectors show a fall in their renewables' share in 2021 in line with lower supply of renewable electricity. The domestic sector also saw higher gas consumption due to lower average temperatures which further suppressed renewables' share.

Chapter 7: Combined Heat and Power (CHP)

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Key headlines

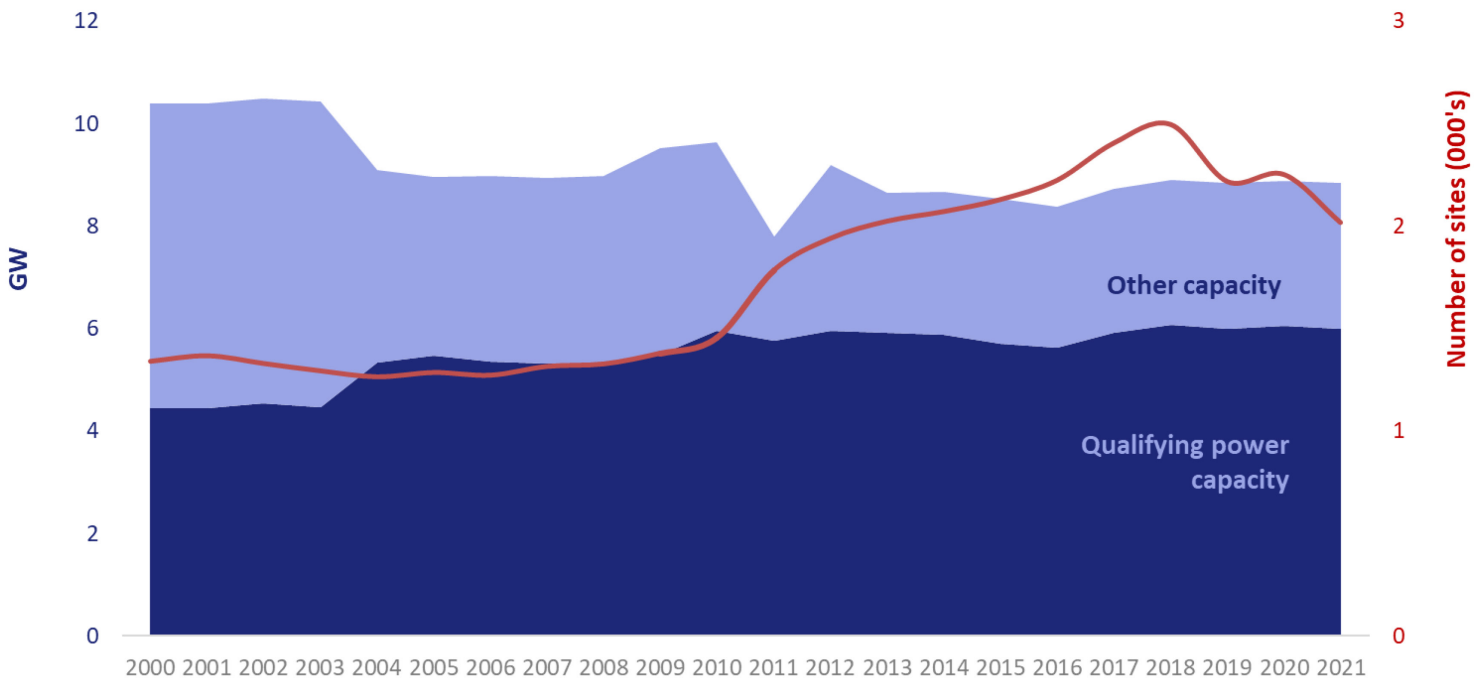
CHP qualifying output represented 7.0 per cent of total electricity generation, a 0.1 per centage point decrease when compared to 2020.

Gas continues to be the main fuel consumed in CHP plants (almost three quarters of fuel input), representing 7.2 per cent of gas demand.

In 2021, renewable fuel accounted for 15 per cent of total CHP fuel, similar to 2020 and 2019.

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)

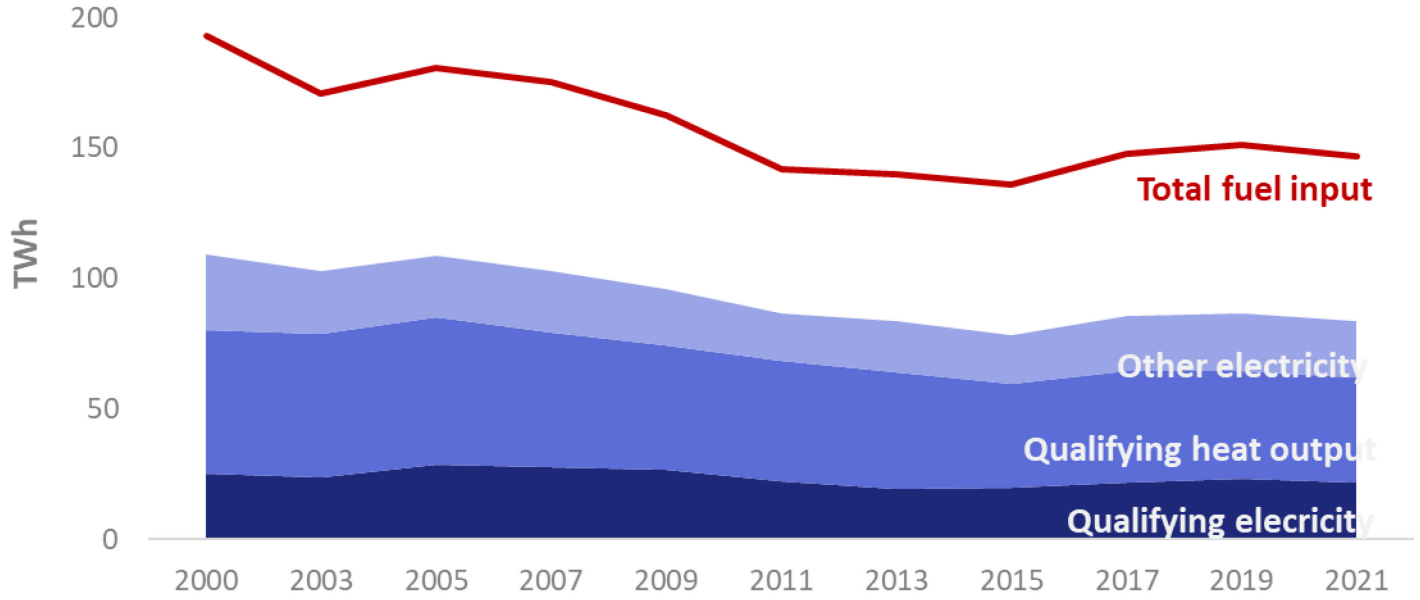


Since 2000, the number of schemes remained steady until 2011 and 2012 when the number was inflated by the inclusion of an additional data source. The numbers continued to rise reaching a peak in 2018. The number of CHP schemes decreased by more than 200 units (a 10 per cent fall) in 2021. BEIS have undertaken a review of the schemes included in the CHP database and have taken the step to remove schemes if no new data have been received for nine years or more. Since a sizable number of schemes were added in 2012, this has resulted in an apparent large fall for 2021. These schemes, however, were of small

capacities so the impact of their removal in electrical capacity terms is minimal. Over this timeline, capacity has fallen by 15 per cent, qualifying capacity has increased by 35 per cent, resulting in its share increasing from 43 per cent in 2000 to 68 per cent in 2021.

In 2021, almost three quarters 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)

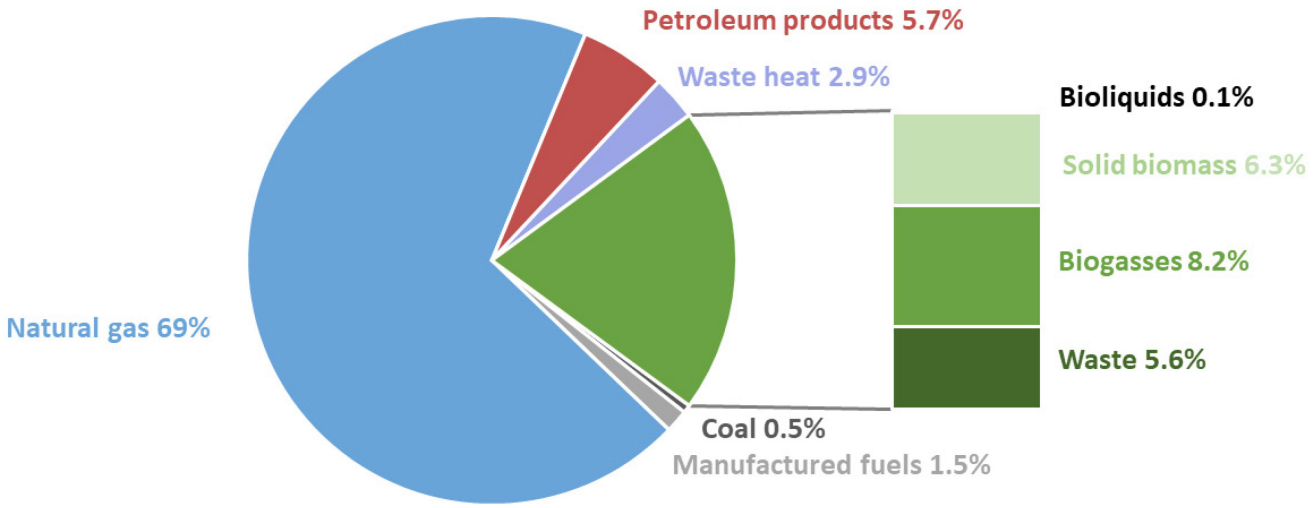


Although not a perfect relationship, CHP outputs tend to be driven by the underlying difference between the price of gas and electricity, the spark gap; the larger the gap, the cheaper gas is relative to electricity which makes cogeneration more economically viable. This explains the decline from 2006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

The efficiency of CHP schemes in 2021 is estimated at 69.1 per cent for qualifying electricity and heat. This compares with 50.5 per cent when taking into account qualifying electricity only, in line with the overall electricity efficiency for combined cycle gas turbines (Table 5.10).

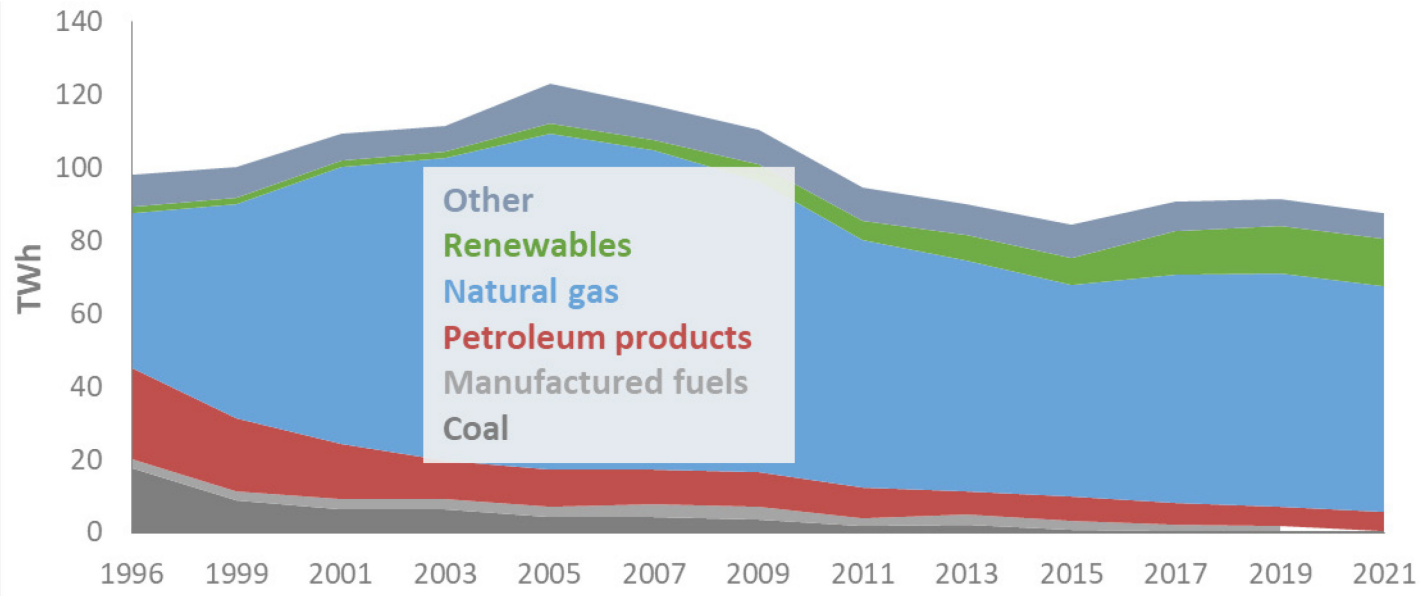
Gas remains the main fuel consumed by CHP schemes representing 69 per cent of the total in 2021, with renewables and waste accounting for the next highest share at 15 per cent. Fossil fuels other than gas now account for just 7.8 per cent. Wastes (such as industrial waste, hospital waste and municipal solid waste) and waste heat (such as exhaust heat produced by chemical processes) make up respectively for 6 per cent and 3 per cent of total fuel input.

Chart 7.3 Fuel mix in 2021 (Table 7.4.B)



Over the longer term, the fuel mix has changed little since 2000 following rapid changes between 1996 (the first year data became available) and 2000. Chart 7.4 shows this long-term trend with the increasing share of natural gas evident alongside the falling use of coal and, to a lesser extent, of petroleum products.

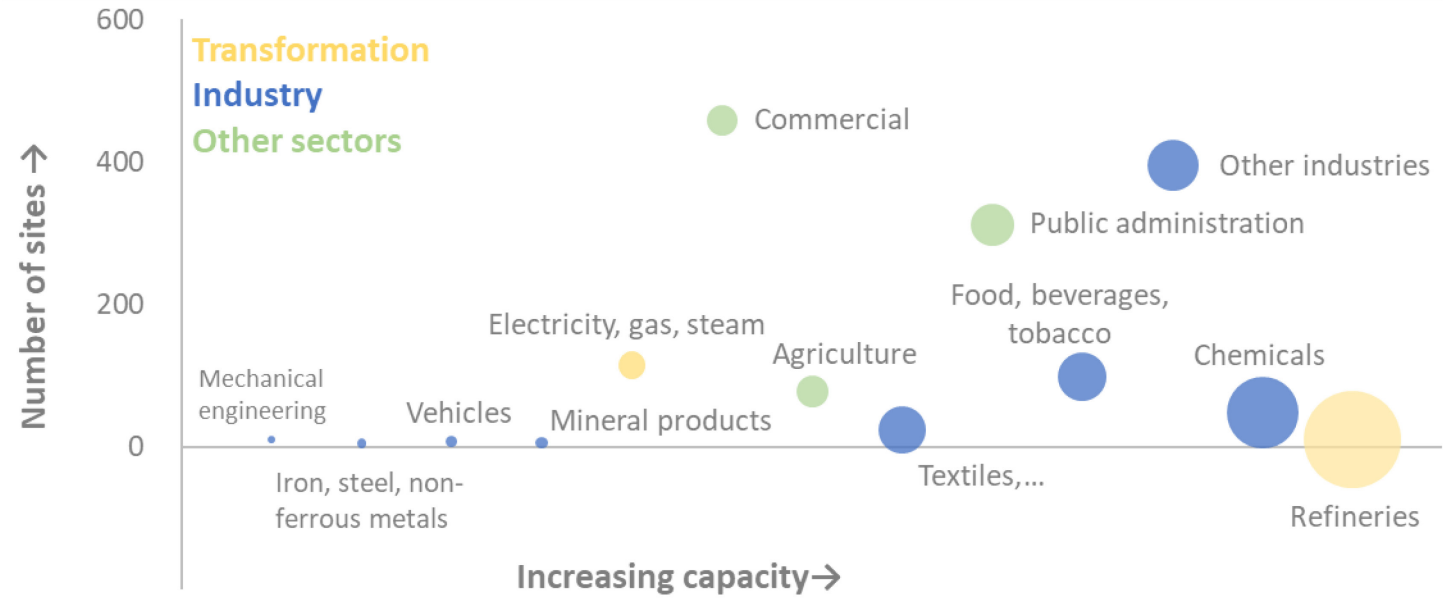
Chart 7.4 Trends in fuel demand for CHP 1996 to 2021 (Table 7.4.B)



In 1996, natural gas' share was just 44 per cent. By 2000, it had risen to 71 per cent and has remained fairly consistent since. Conversely, coal and manufactured fuels' share represented 20 per cent in 1996 but had plummeted to 2.1 per cent by 2021. Use of renewables was stable at around 2 per cent until as recently as 2007 but has steadily increased to a maximum of 15 per cent, where it currently stands since 2020.

CHP is deployed across a variety of sectors including power generation, refineries, industry and commercial. Chart 7.5 shows the relationship between capacity by sector and the number of schemes.

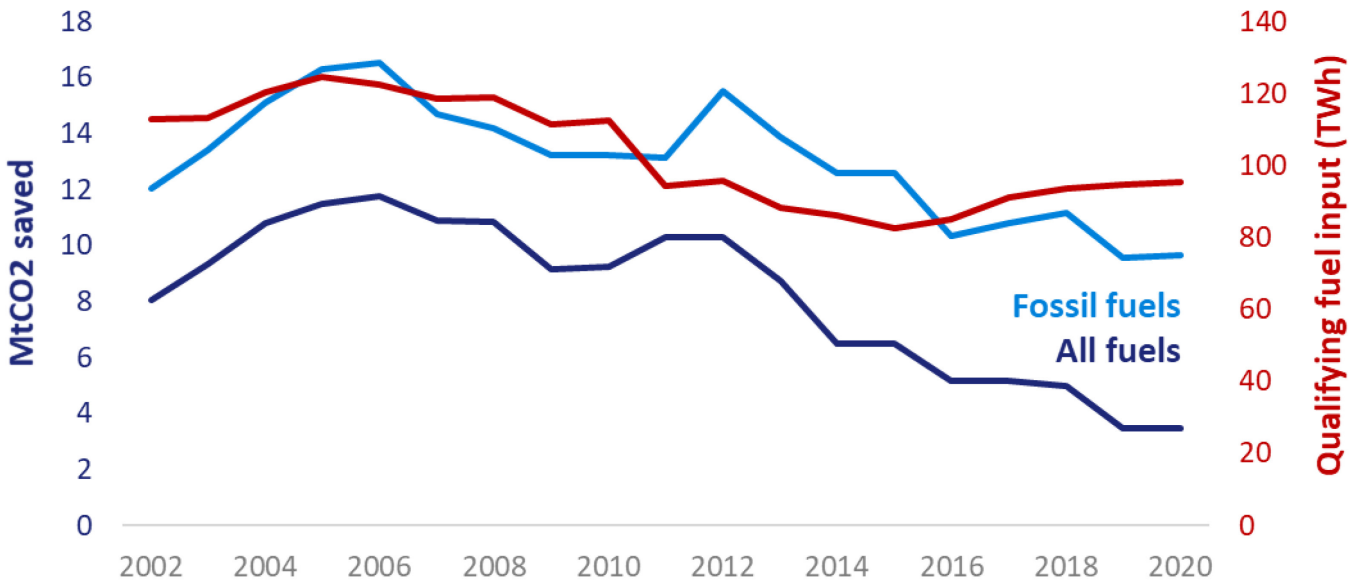
Chart 7.5 CHP capacity and proliferation by sector in 2021 (Table 7.4.A)



Although refineries account for the largest share of capacity, 35 per cent, it represents 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 3 per cent of the capacity.

The efficiency gains through cogeneration offer emissions savings, the key driver behind government support for CHP. An estimate of these savings is shown in Table 7.6. Total emissions from CHP are dependent on the fuel consumed by scheme. Emissions saved are estimated by calculating the emissions which would have occurred had grid electricity been consumed along with heat from a separate boiler. The carbon intensity of the grid is falling as clean generation (i.e. renewable and nuclear generation) now accounts for a larger proportion of the fuel mix. This in turn results in lower emissions saved as CHP schemes are limited to fuels producing heat as well as electricity, a higher proportion of which are fossil fuels.

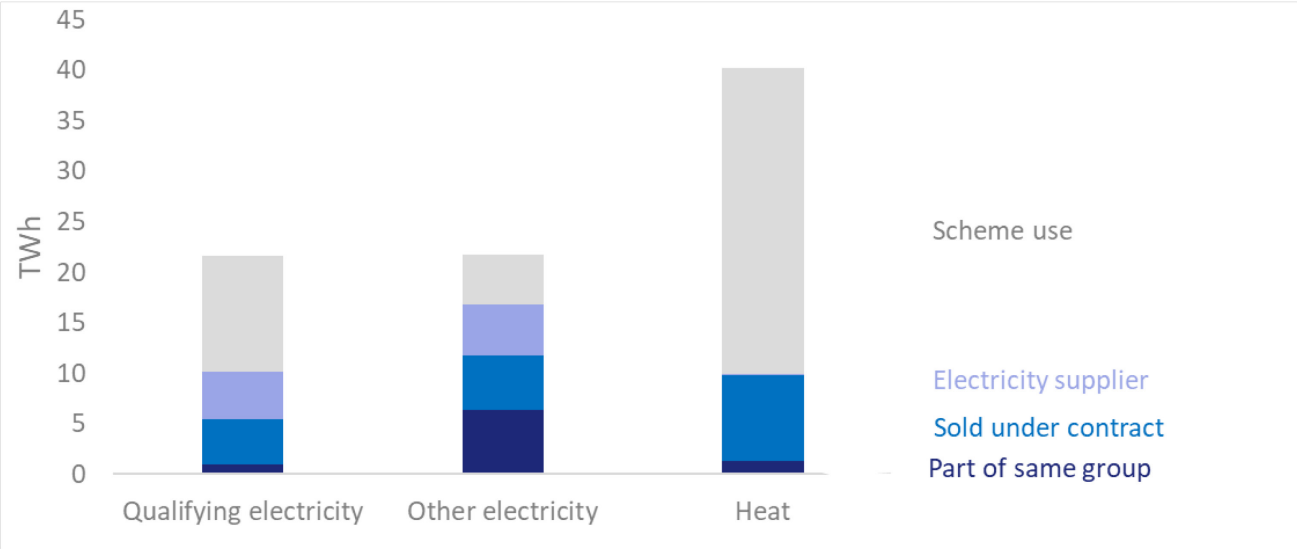
Chart 7.6 Emissions saved through qualifying CHP 2002-2020



Although to a lesser extent, carbon savings are also falling when compared to grid generation from fossil fuels only. This reflects the comparatively larger shift from higher to lower carbon content fossil fuels (such as from coal to gas) for grid generation relative to CHP fuels.

In 2021, 32 per cent of qualifying outputs (heat and electricity) were exported with the remaining 68 per cent being used within the same site. Exports are classified as being either exported to a consumer within the same qualifying group of companies, to an electricity supplier, or sold under contract (i.e., to a consumer not part of the same group). Chart 7.7 shows a comparison of exports and own use by heat, qualifying and other electricity generation.

Chart 7.7 CHP exports and own use 2021 (Table 7.7)



Less than half of qualifying electricity is exported (47 per cent) with the majority being split between power suppliers and sold under contract. Other generation, however, is mostly exported (77 per cent) with exports fairly evenly distributed across the output sectors. Heat is mostly consumed within the CHP scheme but of the heat which is exported, the majority is sold under contract (this heat is reported under the 'heat sold' column in DUKES Table 1.1).

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5.2 Commodity balances, public distribution system and other generators
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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
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Chapter 7 Combined heat and power

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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 2021
7.6 Savings of carbon dioxide emissions through cogeneration
7.7 Exports of electricity and heat from CHP schemes

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 2019 to 2021
A.2 Estimated average net calorific values of fuels, 1980, 1990, 2000, 2010 and 2019 to 2021
A.3 Estimated average density of fuels 2002 to 2021

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 2021

Annex J: Heat reconciliation

J.1 Heat sold reallocation, 1999 to 2021

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
Agriculture	01-03
Commercial	45-47, 52-53, 55-56, 58-66, 68-75, 77-82
Public administration	84-88
Other services	90-99
Domestic	Not covered by SIC, defined as deliveries to residential properties

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	.39683	toe	1	41.868	11.63	396.83
TJ	.023885	1	.27778	.0094778	GJ	.023855	1	277.78	9.4778
GWh	.085985	3.6	1	.034121	kWh	.000085985	.003600	1	.034121
million therms	2.52	105.51	29.307	1	therms	.00252	.105510	29.307	1

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

A selection of estimated average gross calorific values for 2021 (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
		Municipal solid waste	10.0
Iron and steel	30.4		
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)	46.2
Coke	29.8	Petrol	47.0
Coke breeze	29.8	Gas/diesel oil	45.3
Other manufactured solid fuel	29.6	Road diesel	45.8
		Fuel oil	43.5
Gases (MJ per cubic metre)			
Natural gas (produced)	40.2		
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 BEIS 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. BEIS's statements of compliance with the Code are available online, as well as the UK Statistics Authority reports on their regular assessments of BEIS's energy statistics. The authority's recommendations have been incorporated into this publication and other BEIS 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 2019.

Revisions since DUKES 2021

Thousand tonnes of oil equivalent	2019	2020	Percentage revisions to 2020 data
Production	-475	-470	-0.4%
Primary supply	-127	-318	-0.2%
Primary demand	-199	-329	-0.2%
Transformation	1090	760	-2.6%
Energy industry use	290	136	1.2%
Final consumption	597	656	0.5%
Industry	843	846	4.0%
Transport	-89	205	0.5%
Other	1	-886	-1.5%
Non energy use	-157	491	7.5%

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 BEIS, which complement work undertaken by BEIS. These chapters estimate the contribution made by renewable energy sources to energy and combined heat and power (CHP) production and consumption in the United Kingdom.

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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 BEIS 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 BEIS.

The Department for Business, Energy and Industrial Strategy (BEIS) reserves the right to revise or discontinue the text or any table contained in this Digest without prior notice.

Related statistics

The Department for Business, Energy and Industrial Strategy 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:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Energy prices
Monthly and quarterly prices by consumption sector and international comparisons of prices paid:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

Energy Flow Chart
Annual publication illustrating the flow of primary fuels from home production and imports to their eventual final uses. They are shown in their original state and after being converted by secondary fuel producers:
www.gov.uk/government/collections/energy-flow-charts.

UK Energy in Brief
Annual publication summarising the latest statistics on energy production, consumption, and prices in the United Kingdom. The figures are taken from this Digest of UK Energy Statistics:
www.gov.uk/government/collections/uk-energy-in-brief

Sub-National Energy Consumption
Annual publication supporting local and regional decision making to deliver national energy policy objectives:
www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics

UK Greenhouse Gas Emissions
Show progress against the UK's goals, both international and domestic, for reducing greenhouse gas emissions:
www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics

This publication is available from: https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

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