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.

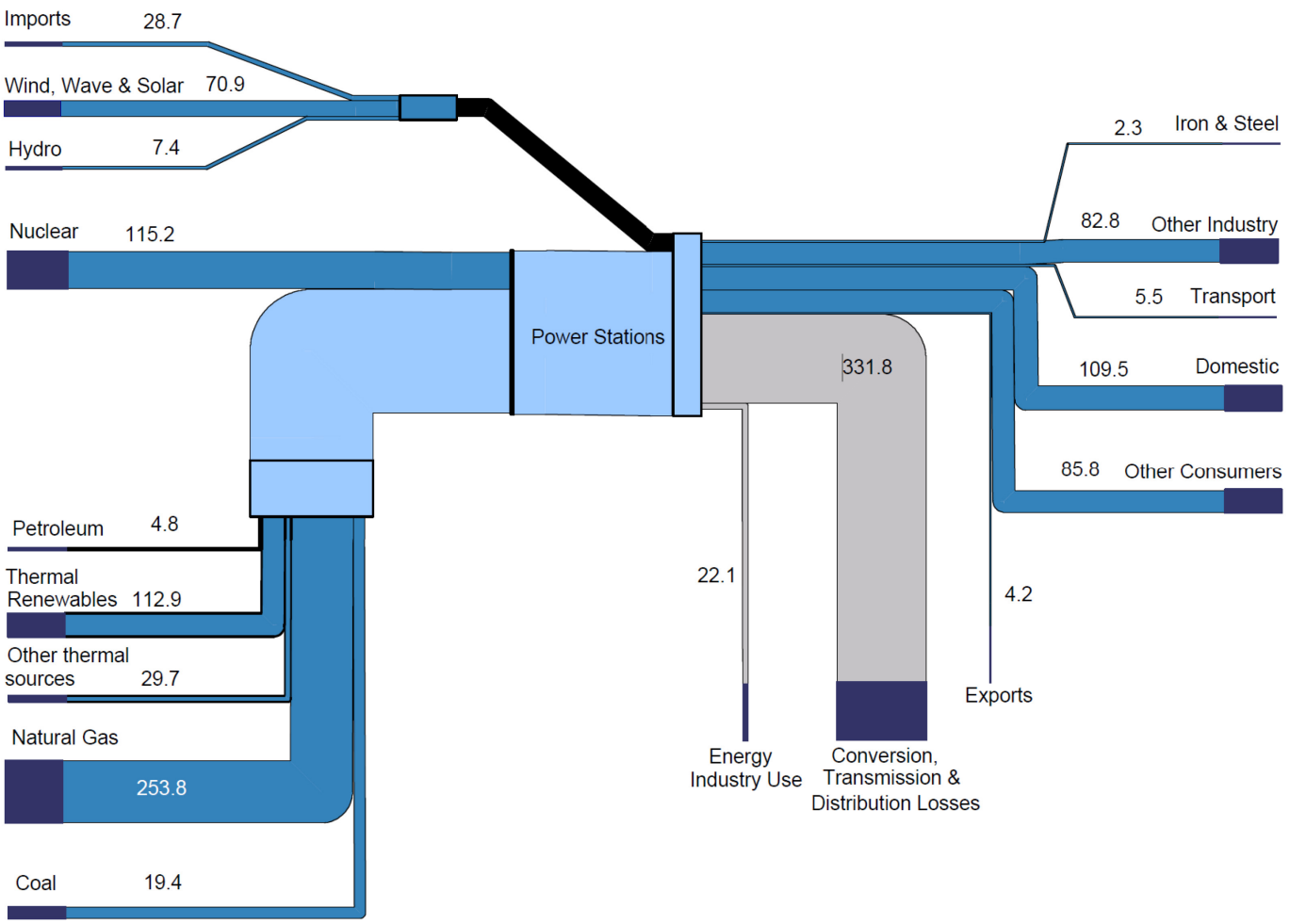
Fossil fuel generation increased 11.0 per cent in 2021 to 131.4 TWh. Increased demand for electricity and lower renewable generation increased the need for fossil fuel generation.

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)



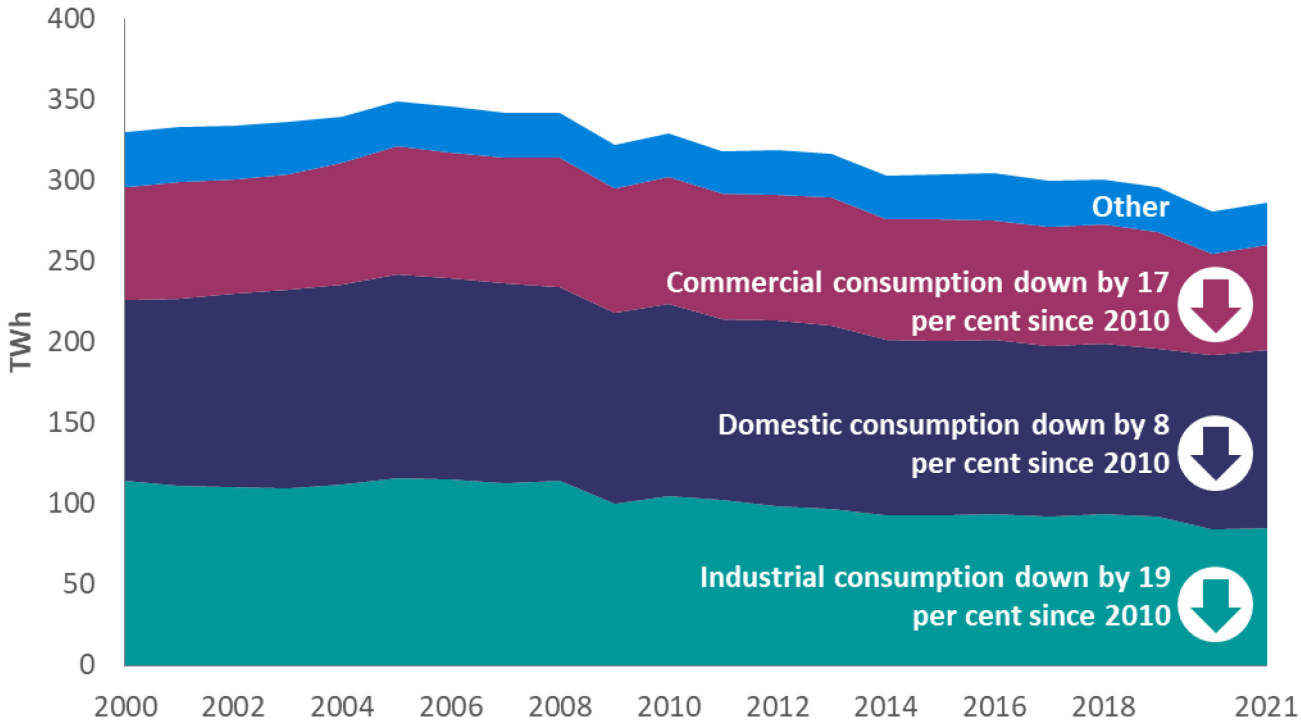
Notes on flow chart

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)

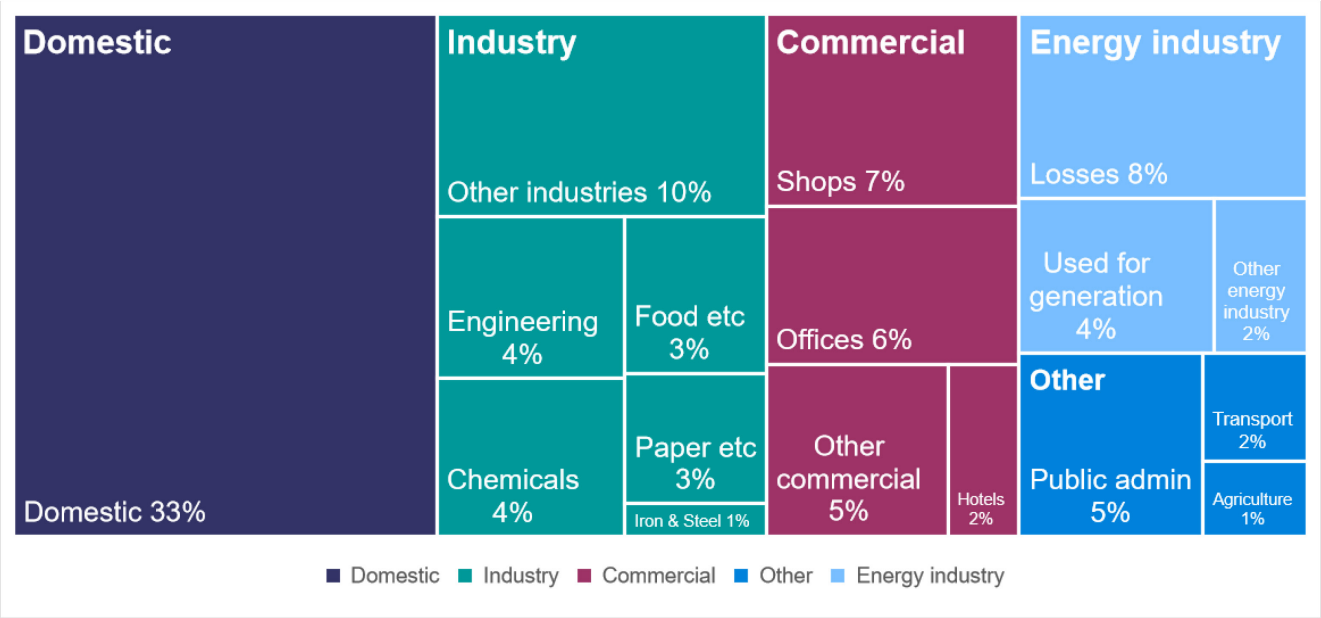


Demand increased in all sectors recovered in 2021 compared to 2020. The reduction of restrictions in response to Covid-19 led to an increase in industrial and commercial electricity consumption, whilst cooler temperatures increased domestic consumption. When comparing 2021 to 2020, industrial use of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

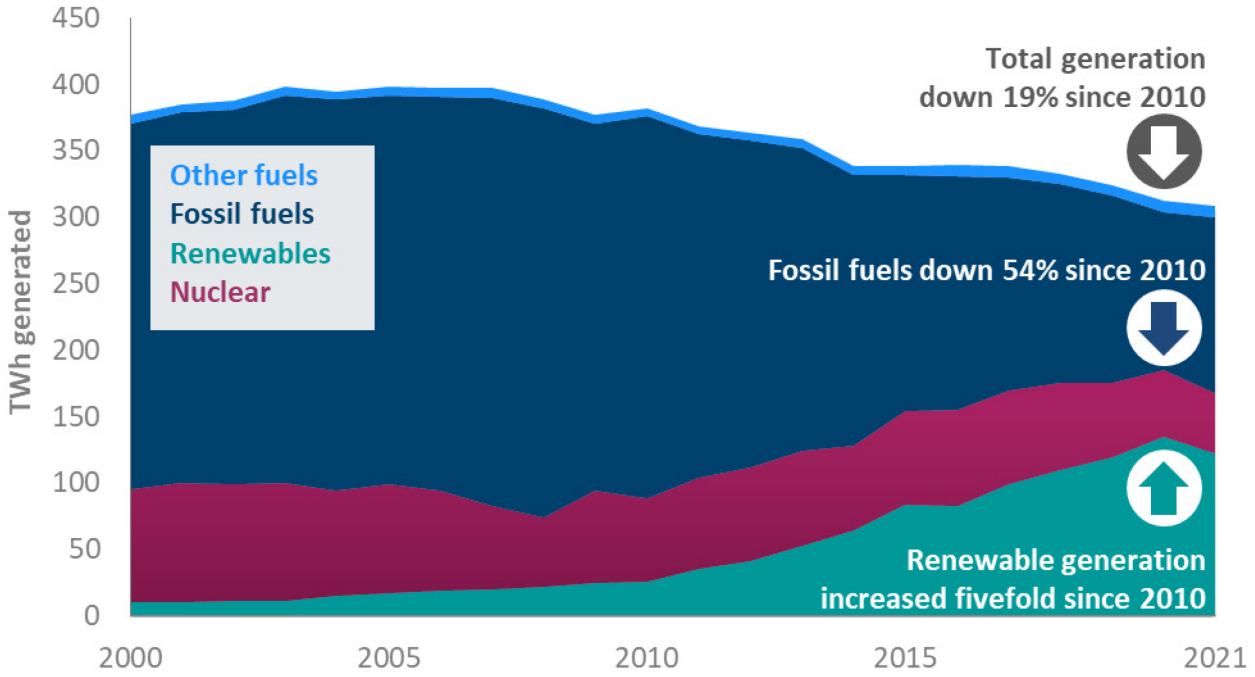
Chart 5.2 Share of total electricity demand split by sector, 2021 (Table 5.2)



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.

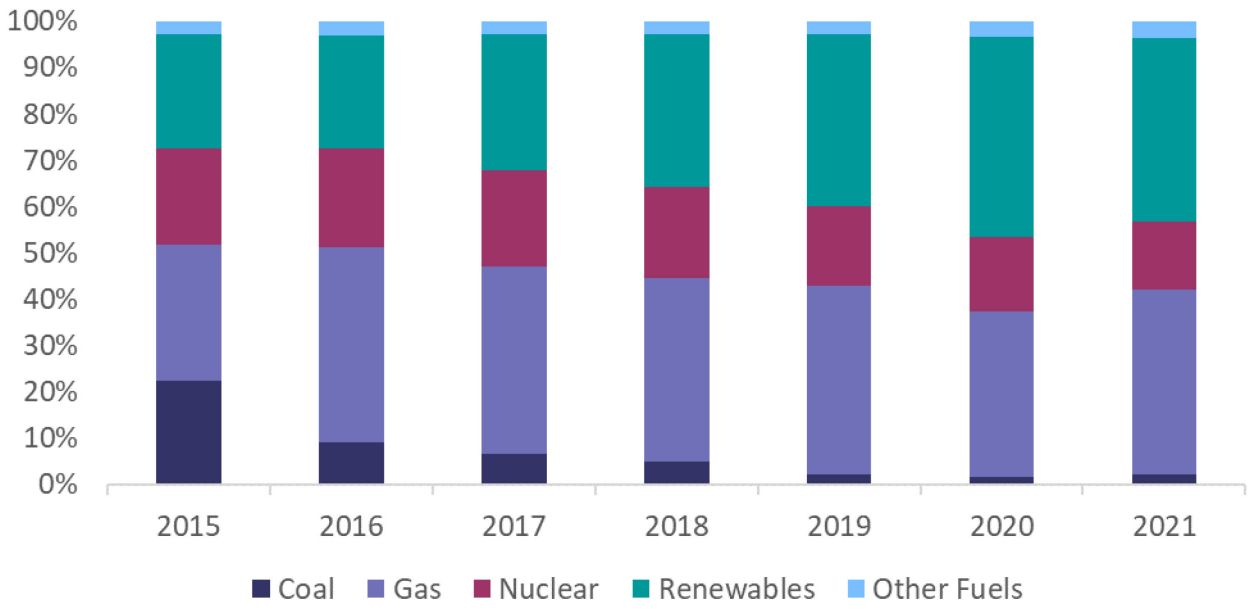
Generation from renewable sources decreased 9.3 per cent to 122.2 TWh in 2021. This was driven by decreased wind generation, which was 64.7 TWh in 2021, down 14 per cent despite increased capacity. This was because of unusually low average wind speeds across most of 2021. Weather conditions were also 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].

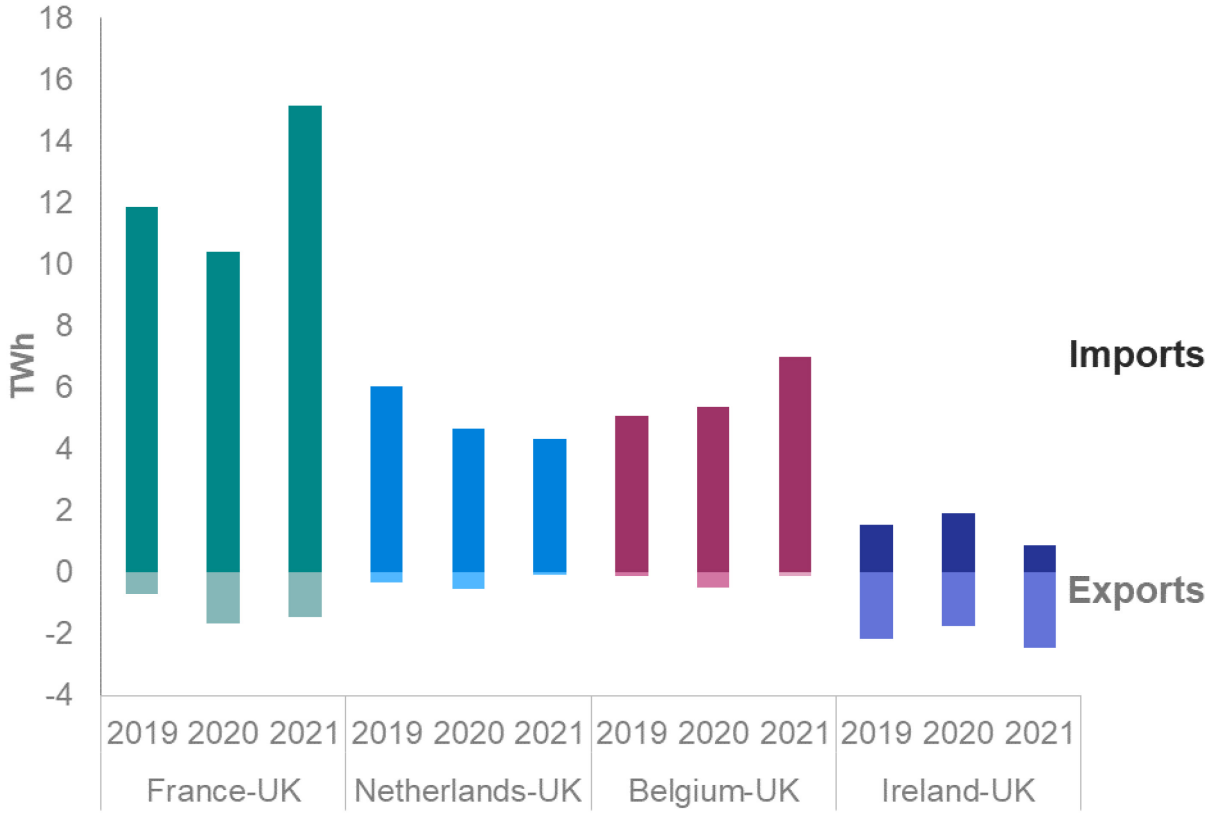
Trends in fuel used mirror those in electricity generation, with increases in the amount of fossil fuel used, record low use of nuclear fuel and decreases for fuel used by renewable generators. Gas continues to dominate the UK generation mix, with 21.8 Mtoe used in 2021, and coal use increased to 1.7 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.

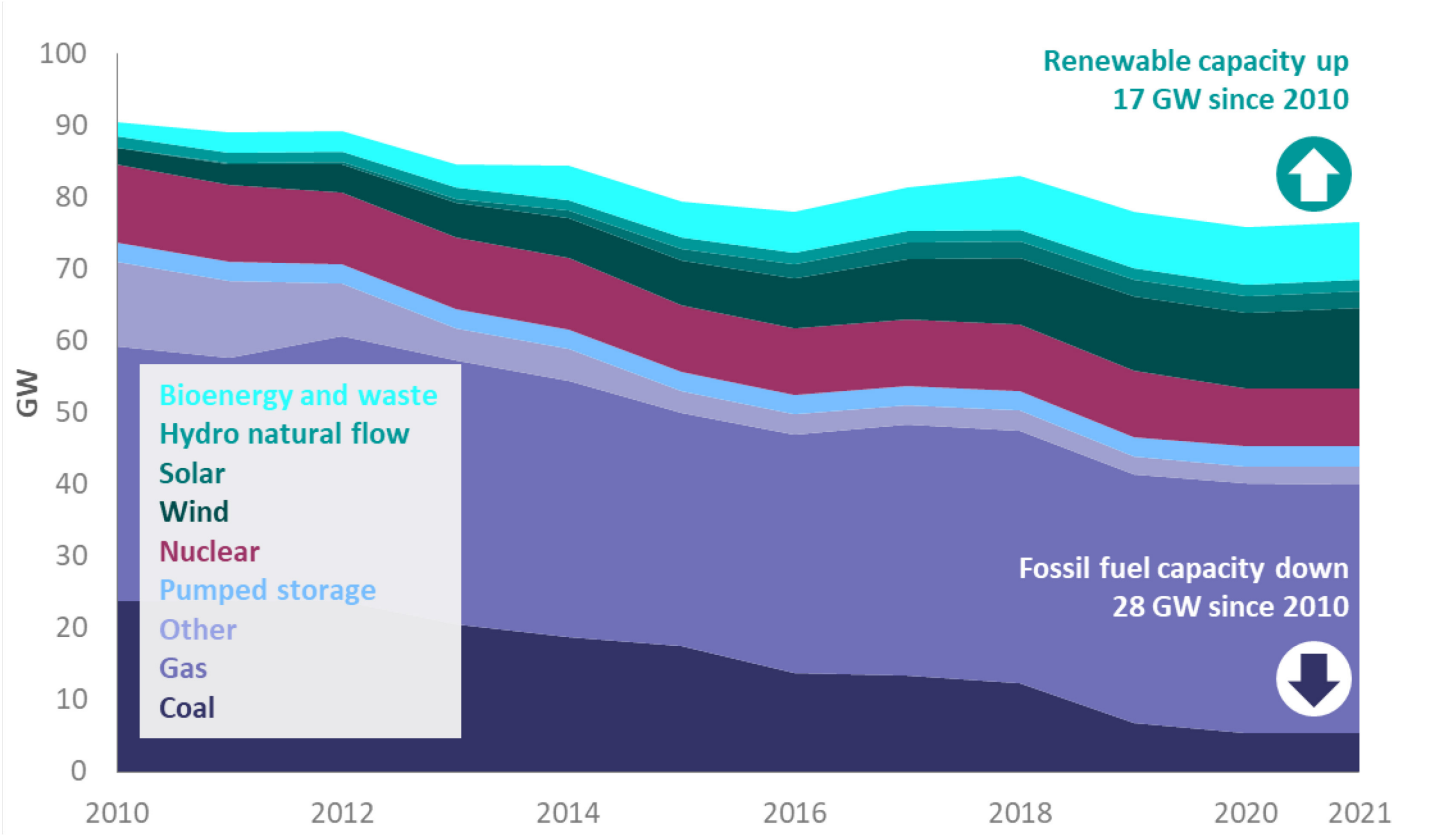
[1] For wind, hydro and solar, the fuel used is assumed the same as the electricity generated, unlike thermal generation where conversion losses are incurred. Therefore, for example, if one unit of electricity produced from coal is switched to wind, the fuel used will show a fall from around three units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



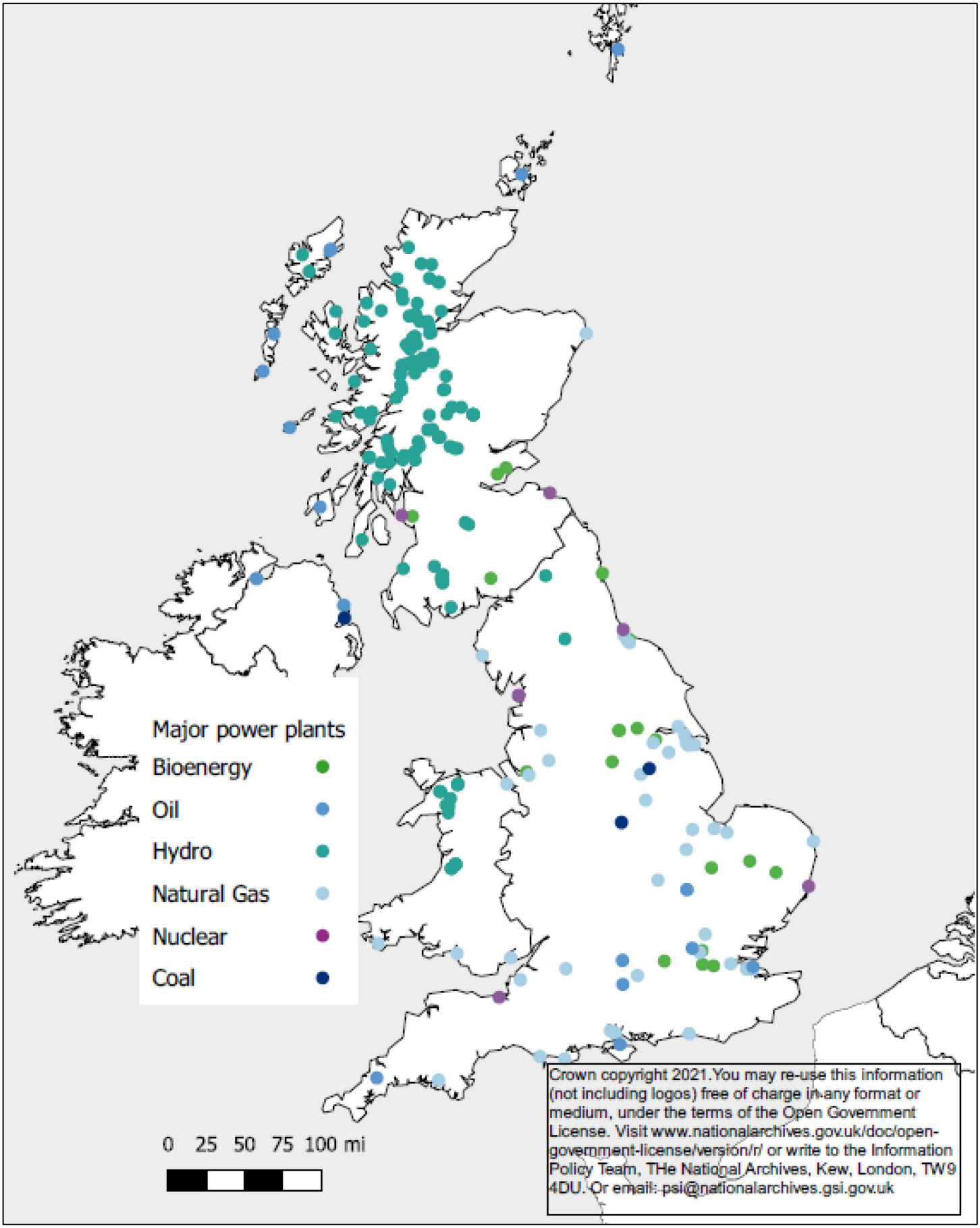
Total de-rated generation capacity increased to 76.6 GW in 2021, a 1.0 per cent rise on the 75.9 GW capacity in 2020. Capacity for renewable technologies increased by 3.2 per cent to 23.2 GW while fossil fuel capacity remained unchanged at 42.5 GW and nuclear capacity unchanged at 8.1 GW. The peak demand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

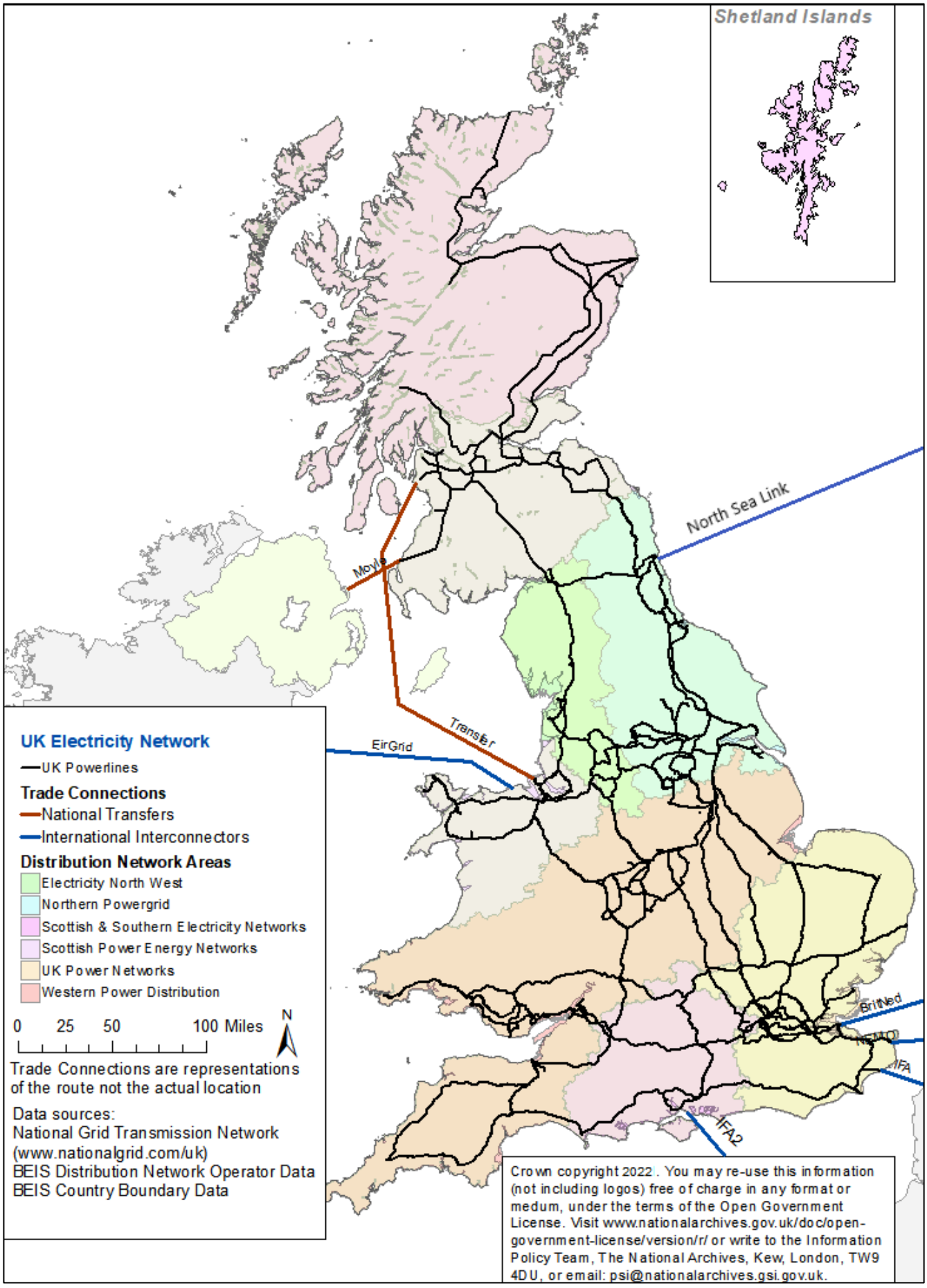
Alongside increased capacity, the MPP power plants were less intensively deployed than they were last year, with a load factor of 41.2 per cent. Load factors indicate the proportion of the time the plant is producing electricity and decreased by 0.5 percentage points compared to 2020. Load factors vary 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



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