Chapter 5: Electricity

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Key headlines

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

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

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

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

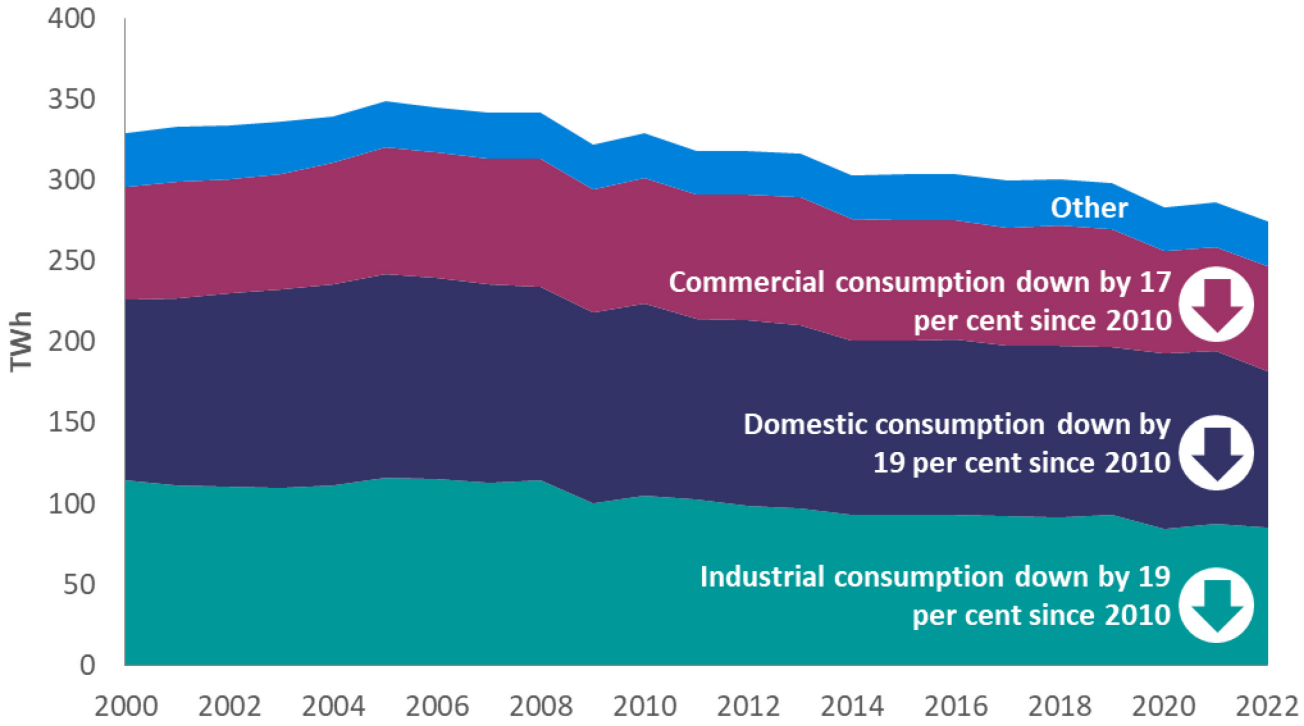
Fossil fuel generation increased 0.9 per cent in 2022 to 132.8 TWh, with more generation from gas. Coal generation continued to fall, down to the second lowest value on the published data series.

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

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

Electricity demand reached a record low in 2022 of 320.7 TWh, down by 3.8 per cent from 2021. Electricity demand has declined year-on-year since 2015, apart from a slight increase between 2020 and 2021 with as demand recovered from the effects of the Covid-19 pandemic. The decrease this year is larger than in previous years since 2015, with the exception of the drop in 2020 due to the pandemic, and was driven primarily by rising prices and the record high annual average temperature. In line with the decrease in demand, final consumption fell by 4.3 per cent compared to 2021. 'Final consumption' refers to electricity consumption by end users, excluding electricity consumed in the process of generation and transmission or distribution losses.

Chart 5.1 Electricity consumption by sector, 2000 to 2022 (Table 5.1)

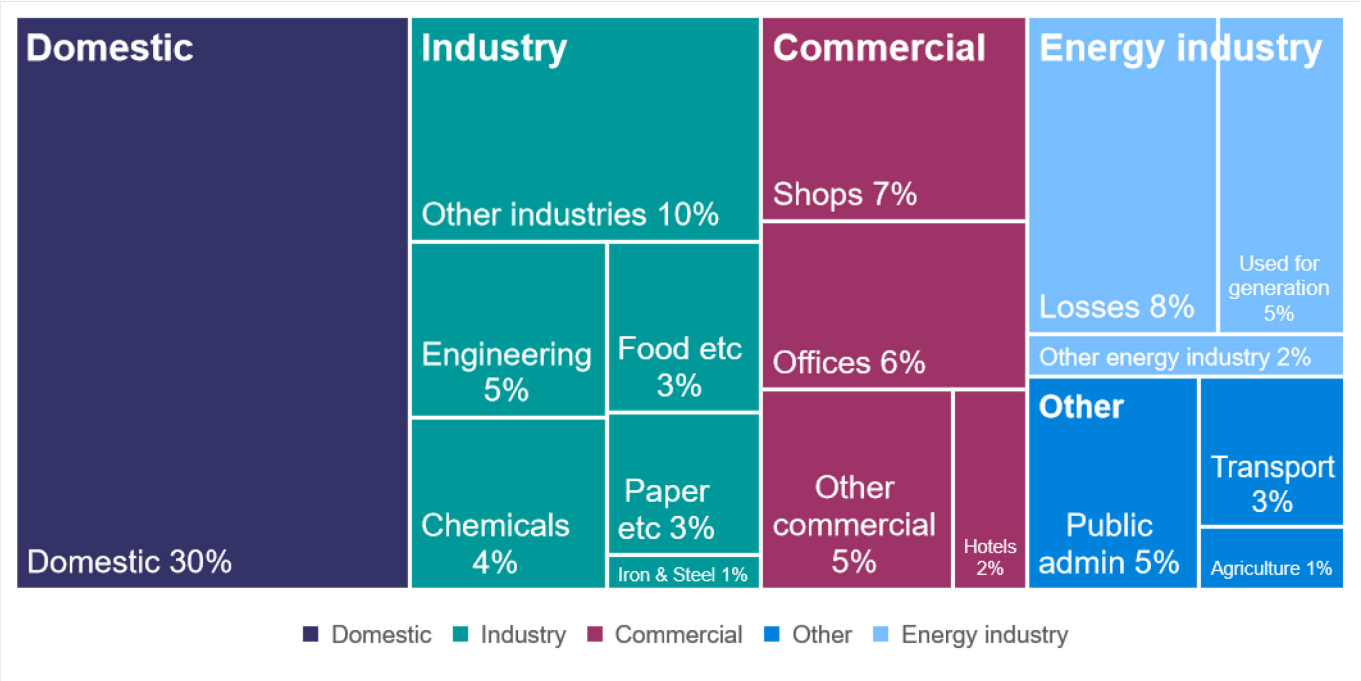


Rising prices and higher average temperatures led to a record low domestic consumption, with industrial consumption also decreasing. In 2022, domestic consumption fell 10 per cent compared to 2021 to 96.2 TWh while industrial consumption was down 2.7 per cent. The record low domestic consumption reflects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

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

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

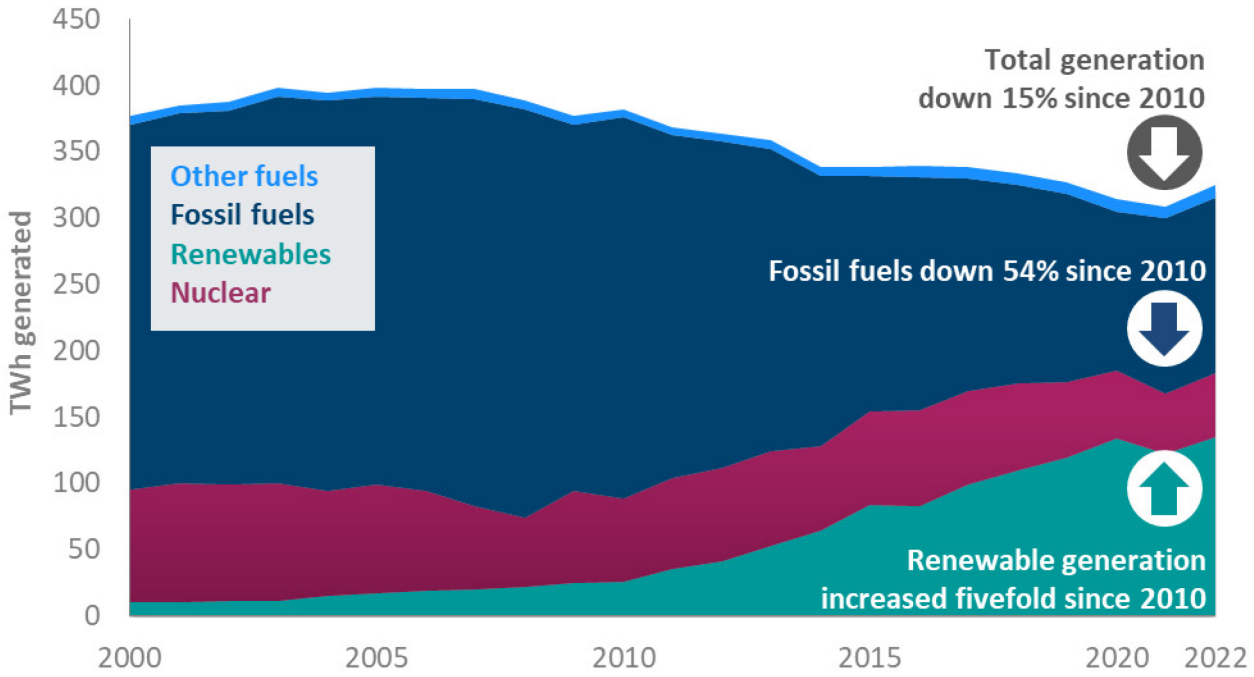
Chart 5.2 Share of total electricity demand split by sector, 2022 (Table 5.2)



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

Electricity generation and supply increased in 2022 despite lower demand for electricity, as the UK became a net electricity exporter for the first time in more than 40 years. Electricity generation measures what is generated while electricity supply measures what was supplied to the grid, excluding the electricity used in the process of generation or consumed on site by the generator. Total electricity supplied plus imports matches with demand as electricity is supplied until demand is met. Demand for electricity is usually met by UK generation and supplemented with imports from Europe when price differentials are favourable. This changed in 2022 as outages in the French nuclear fleet meant that large amounts of electricity were exported via the France-UK interconnectors, leading to the UK being a net exporter. This led to increased UK generation and supply, despite lower demand in the UK. Total electricity supplied in 2022 was 319.9 TWh, with net exports of 5.3 TWh.

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



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

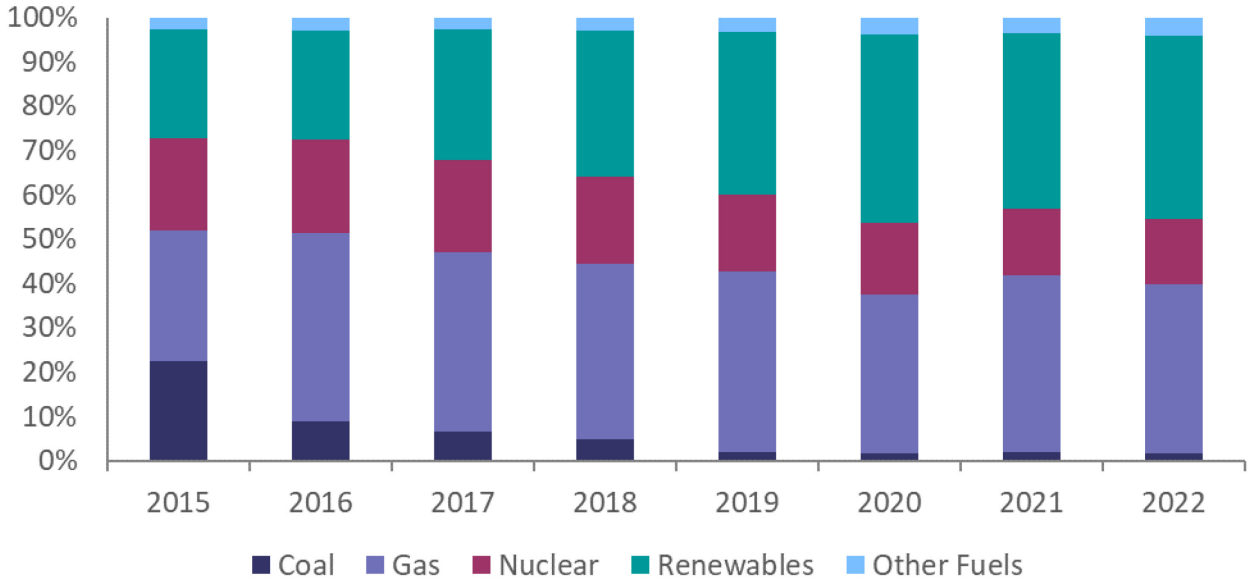
Renewable generation reached record high levels in 2022, increasing 10 per cent to 135.0 TWh, driven by high output from wind and solar generators. Capacity increases and wind speeds returning to more normal levels after 2021's unusually low values led to wind generation increasing 24 per cent on 2021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

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

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

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

Chart 5.4 Shares of electricity generation by fuel, 2015 to 2022 (Table 5.6)



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

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

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

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

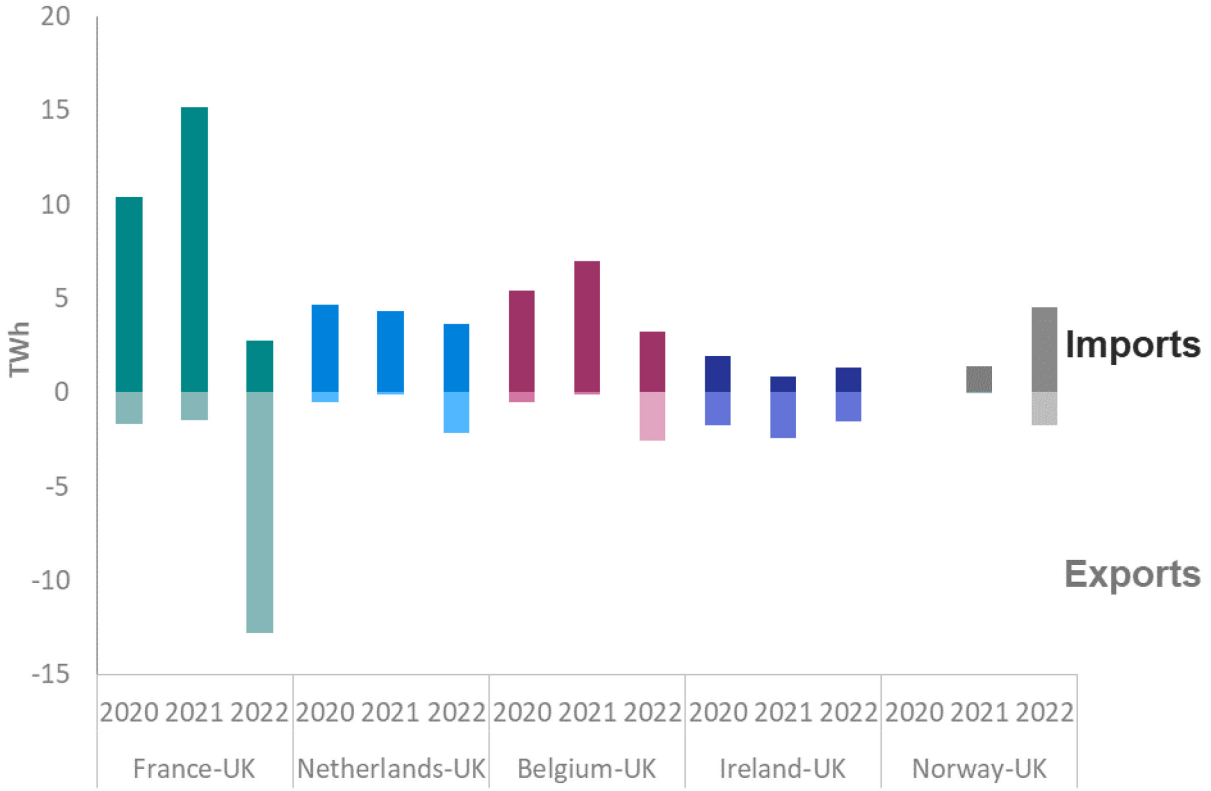
Trends in fuel used broadly mirror those in electricity generation, with a small increase in the amount of fossil fuel and nuclear fuel use, decreased bioenergy and other fuel used and large increases in assumed fuel used by wind and solar generators. Gas continues to dominate the UK generation mix,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

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

The UK was a net electricity exporter in 2022 for the first time in more than 40 years, with net exports totalling 5.3 TWh. Total imports reduced to 15.5 TWh, standing at half of 2021 levels. Meanwhile total exports increased fivefold compared to 2021, reaching 20.8 TWh. The primary reason for these changes was the widespread outages in the French nuclear fleet, increasing the demand for exported electricity to France. Historically, France has been the primary exporter of electricity to the UK making this change more pronounced.

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

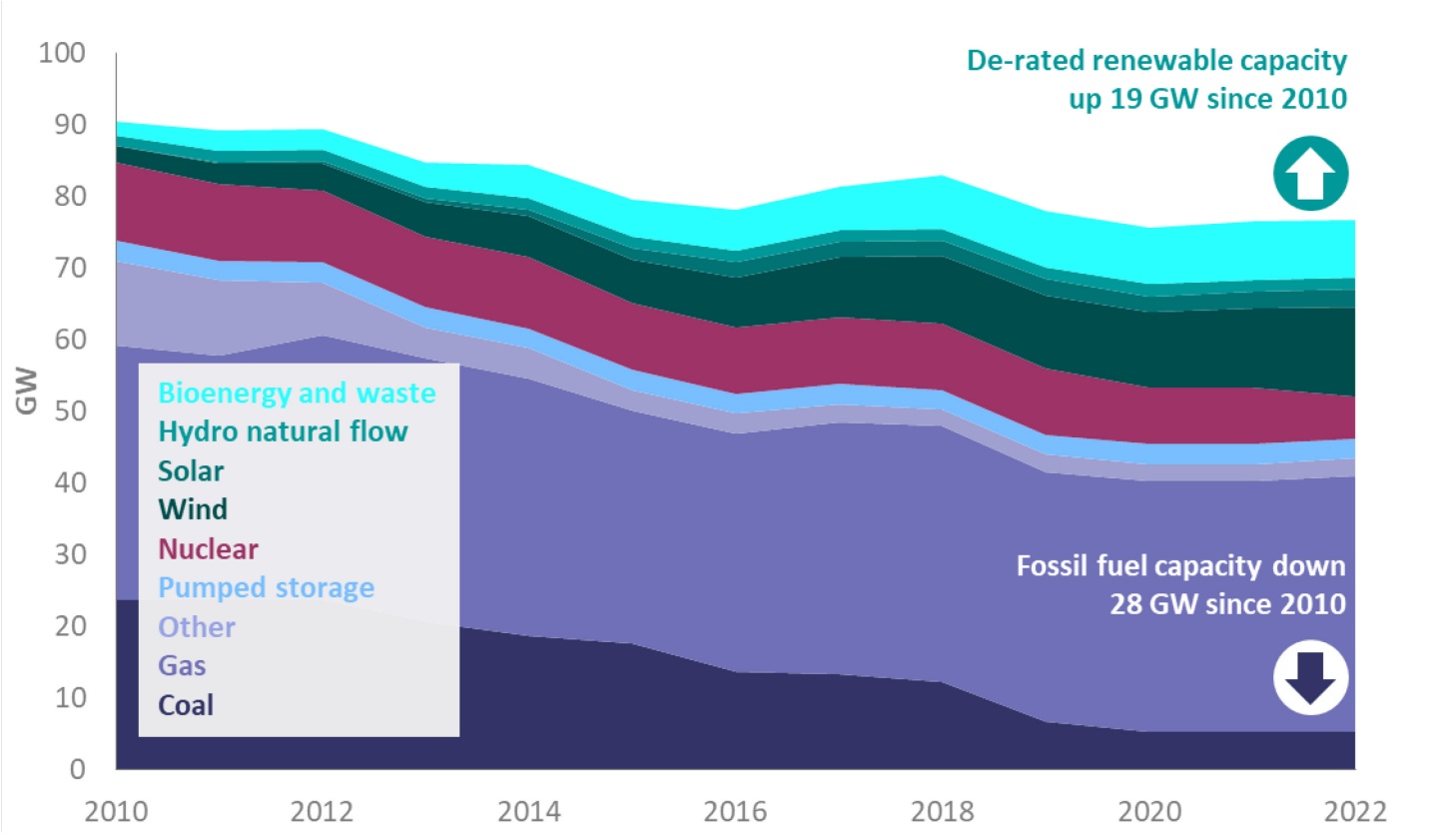
Chart 5.5 Electricity imports and exports by country, 2020 to 2022 (Table 5.13)



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

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

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

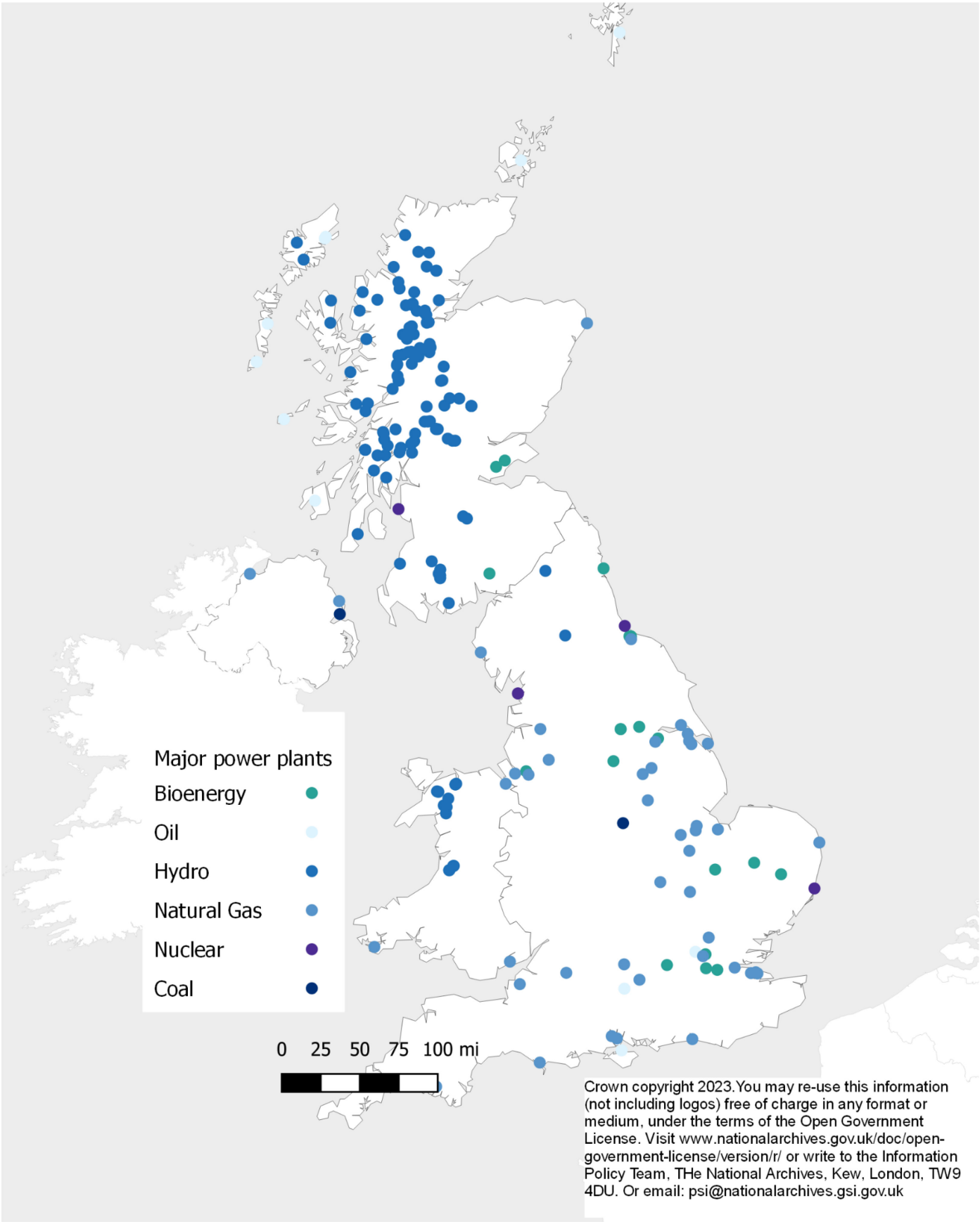


Total de-rated generation capacity dropped to 76.7 GW in 2022, similar to 2021. Capacity for renewable technologies increased by 6.2 per cent to 24.6 GW while fossil fuel capacity increased 1.9 per cent to 43.5 GW and nuclear capacity decreased 25 per cent to 5.9 GW. The peak demand in winter was similar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

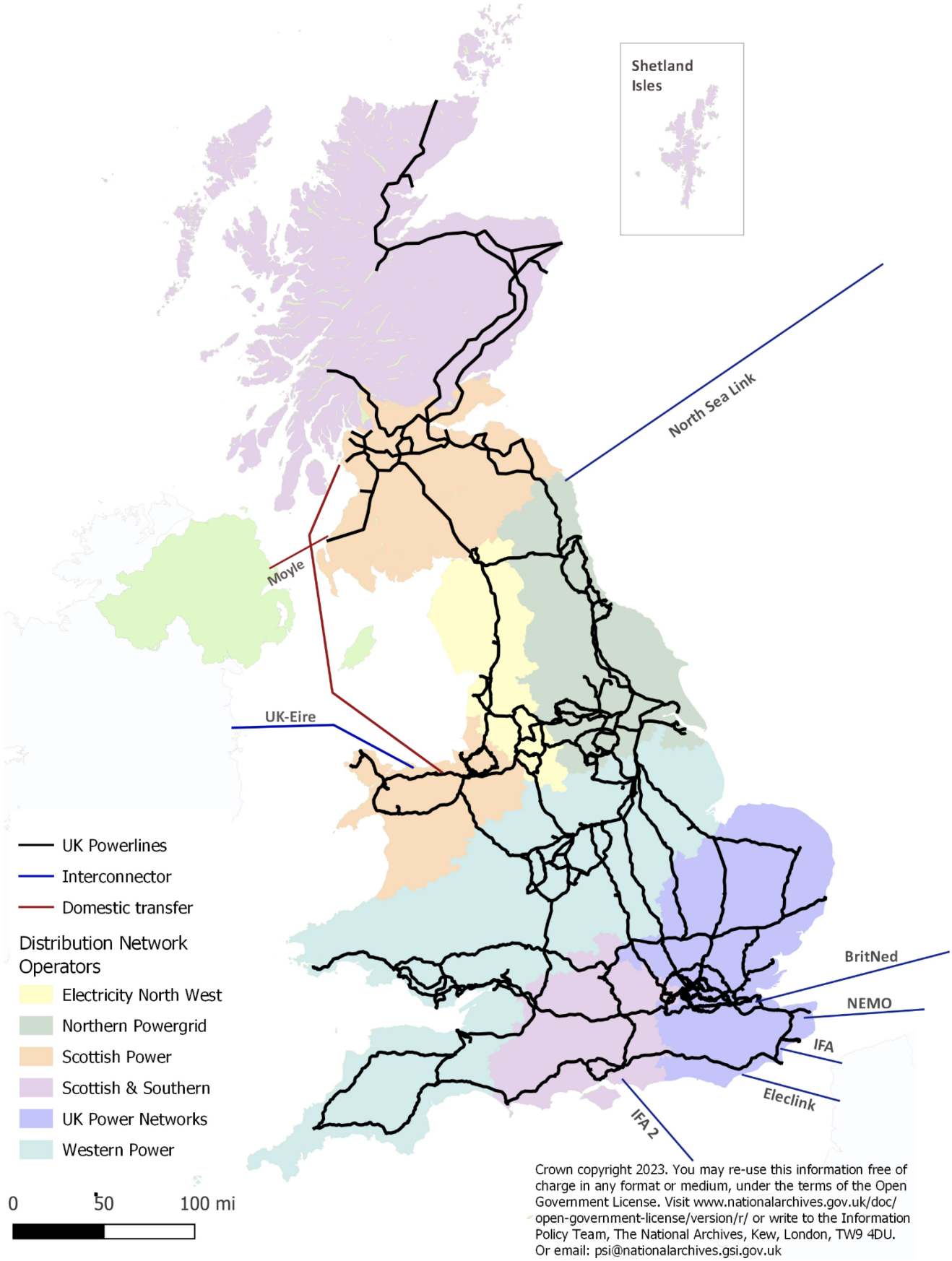
Renewable capacity increased, driven by a large increase in offshore wind capacity. Wind capacity increased by 12 per cent to 12.4 GW with a 2.4 per cent increase for onshore wind and a 24 per cent increase for offshore wind, including 0.9 GW at Moray East and 1.4 GW added to Hornsea Wind Farm. Solar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

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

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



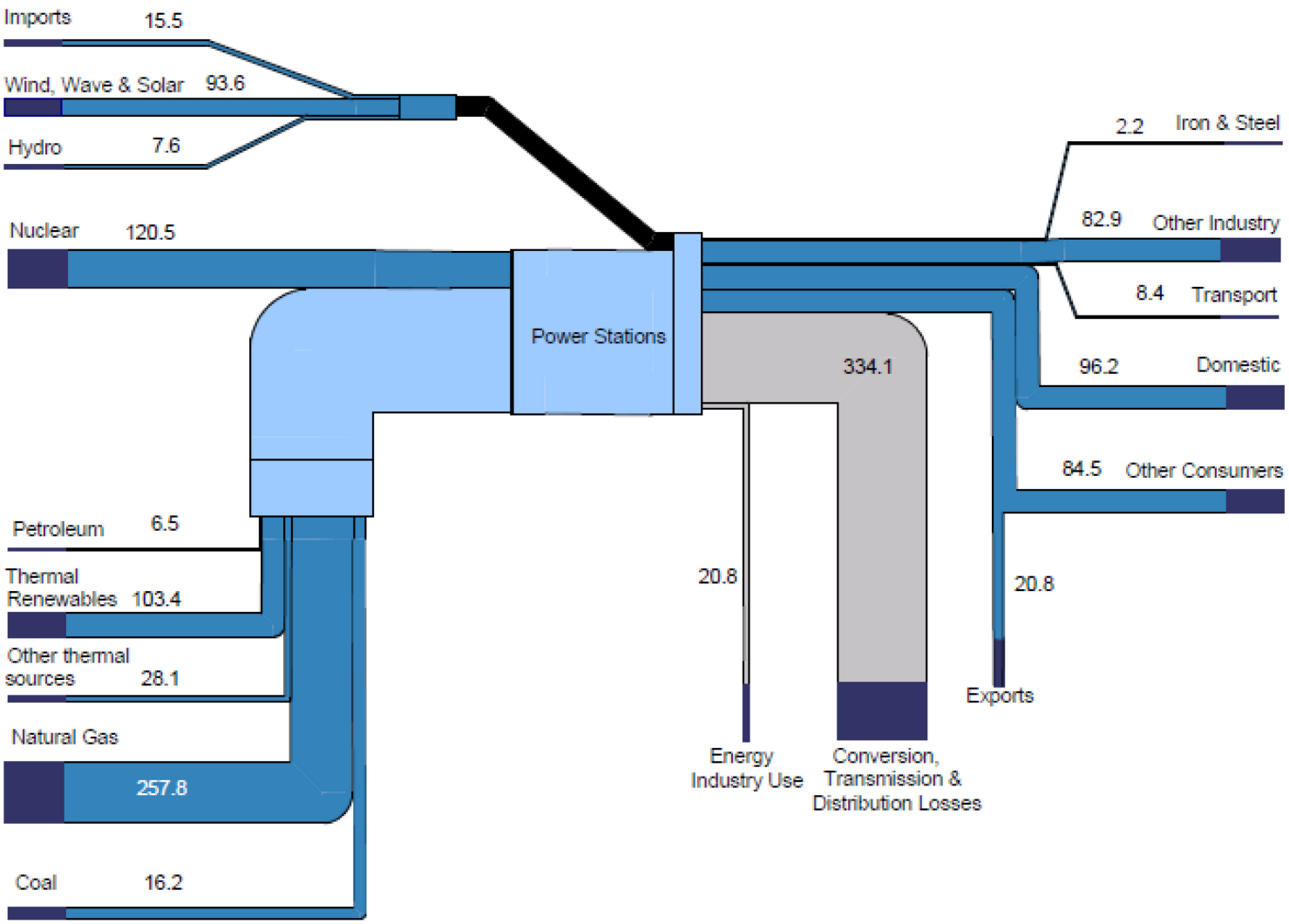
UK Distribution Network Operating Areas and GB Power Lines Map



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

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

Electricity Flow Chart 2022 (TWh)



Notes on flow chart

This flow chart is based on the data in Tables 5.1 (for imports, exports, use, losses and consumption) and 5.6 (fuel used).

1. Hydro includes generation from pumped storage while electricity used in pumping is included under Energy Industry Use.
2. Conversion, Transmission and Distribution Losses are calculated as fuel used (Table 5.6) minus generation (Table 5.6) plus losses (Table 5.1).

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