

Chapter 5: Electricity

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Key headlines

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

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

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

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

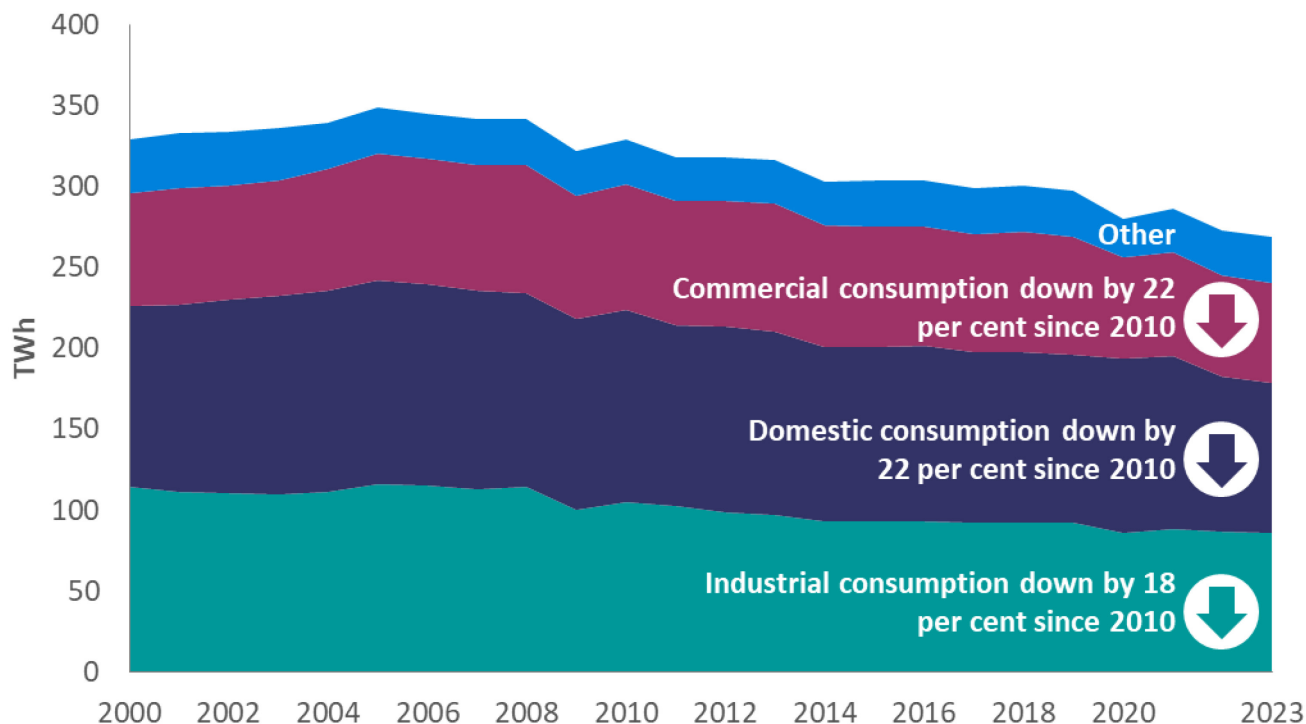
Fossil fuel generation decreased by a fifth in 2023 to 107.3 TWh. Gas remained the largest single fuel, providing 101.7 TWh of generation. Coal generation continued to fall, down to a record low.

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

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

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

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

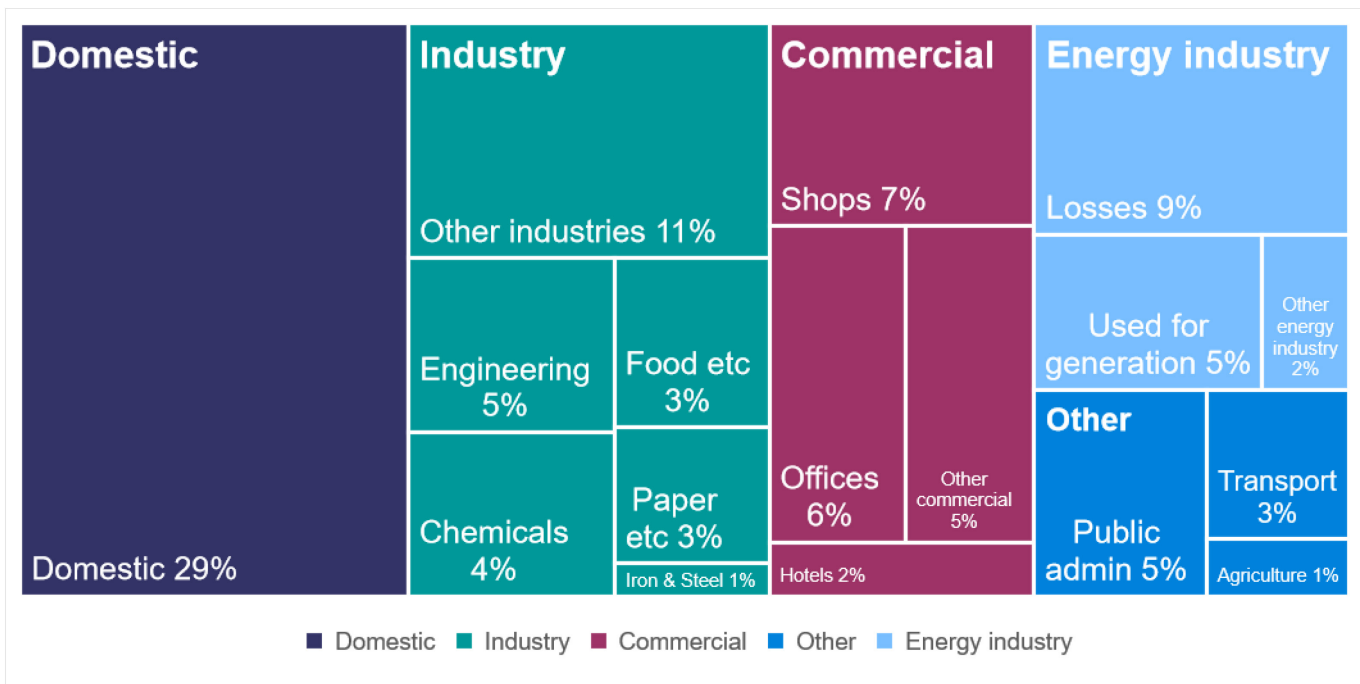


Continued high prices and higher average temperatures led to the lowest domestic consumption since 1990, with industrial consumption also decreasing. In 2023, domestic consumption fell 3.0 per cent compared to 2022 to 92.6 TWh while industrial consumption was down 0.9 per cent. The low domestic consumption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

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

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

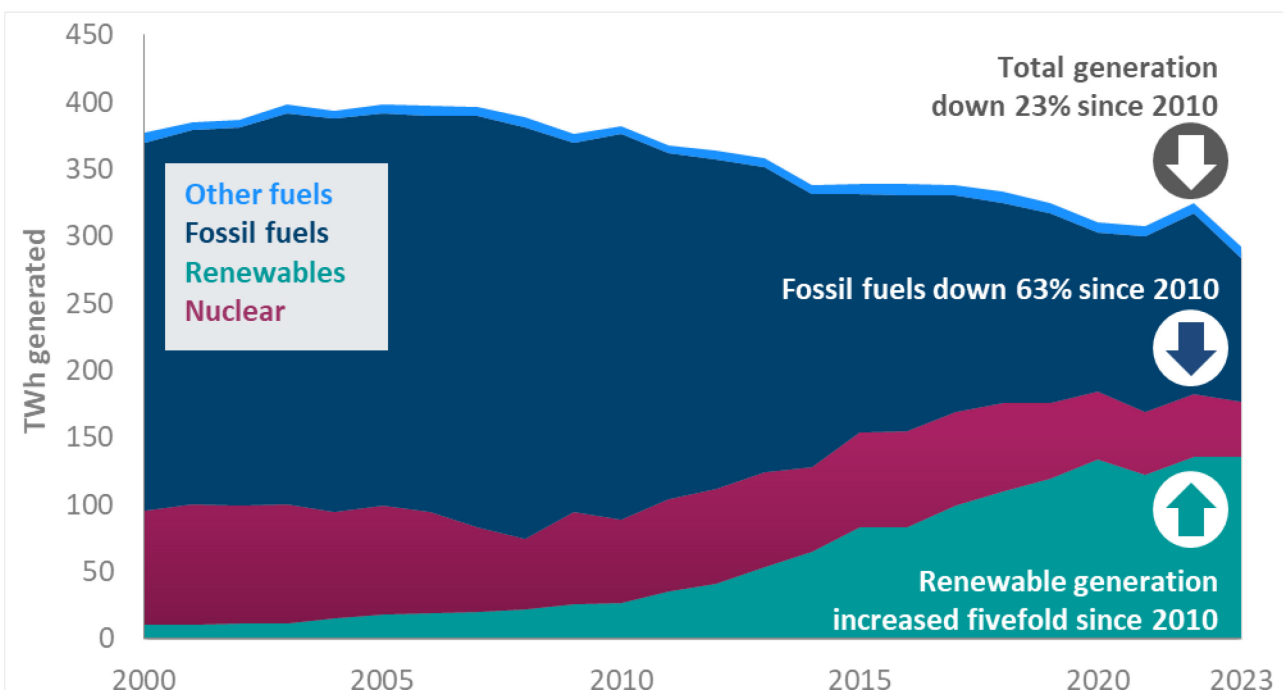
Chart 5.2 Share of total electricity demand split by sector, 2023 ([DUKES Table 5.2](#))



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

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

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



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

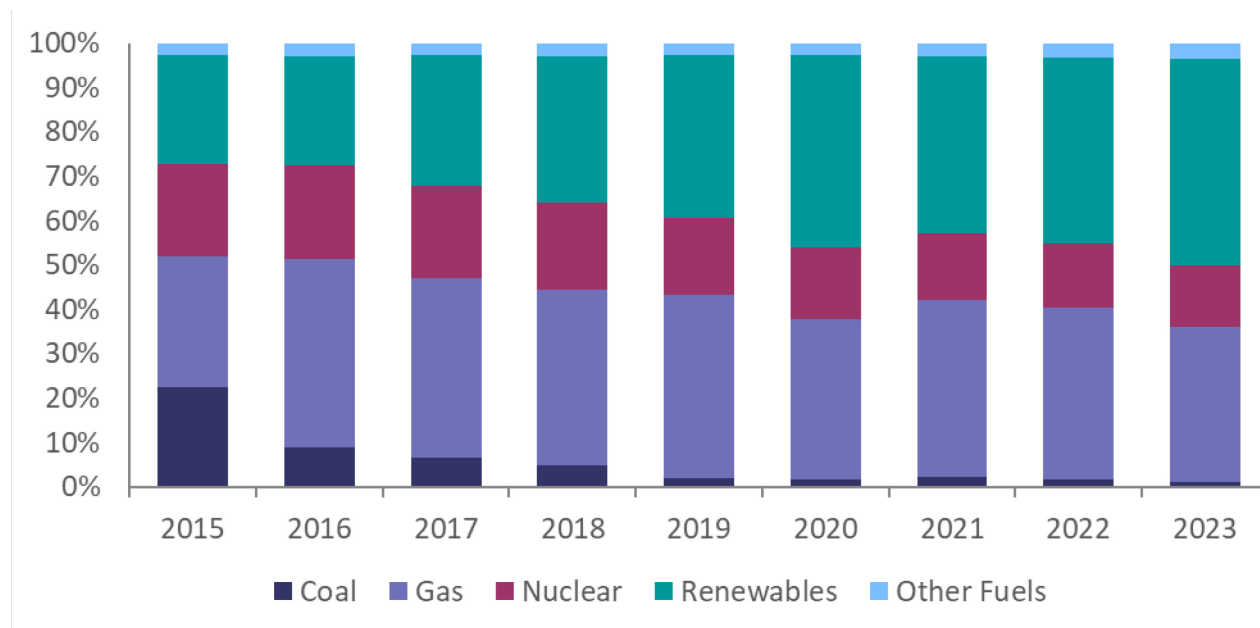
Renewable generation in 2023 was broadly similar to 2022, increasing 0.3 per cent to narrowly reach a new record high of 135.8 TWh, driven by record high output from wind and solar generators. For wind, capacity increases offset slightly lower wind speeds leading to wind generation increasing 2.2 per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

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

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

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

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



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

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

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

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

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

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

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

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

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

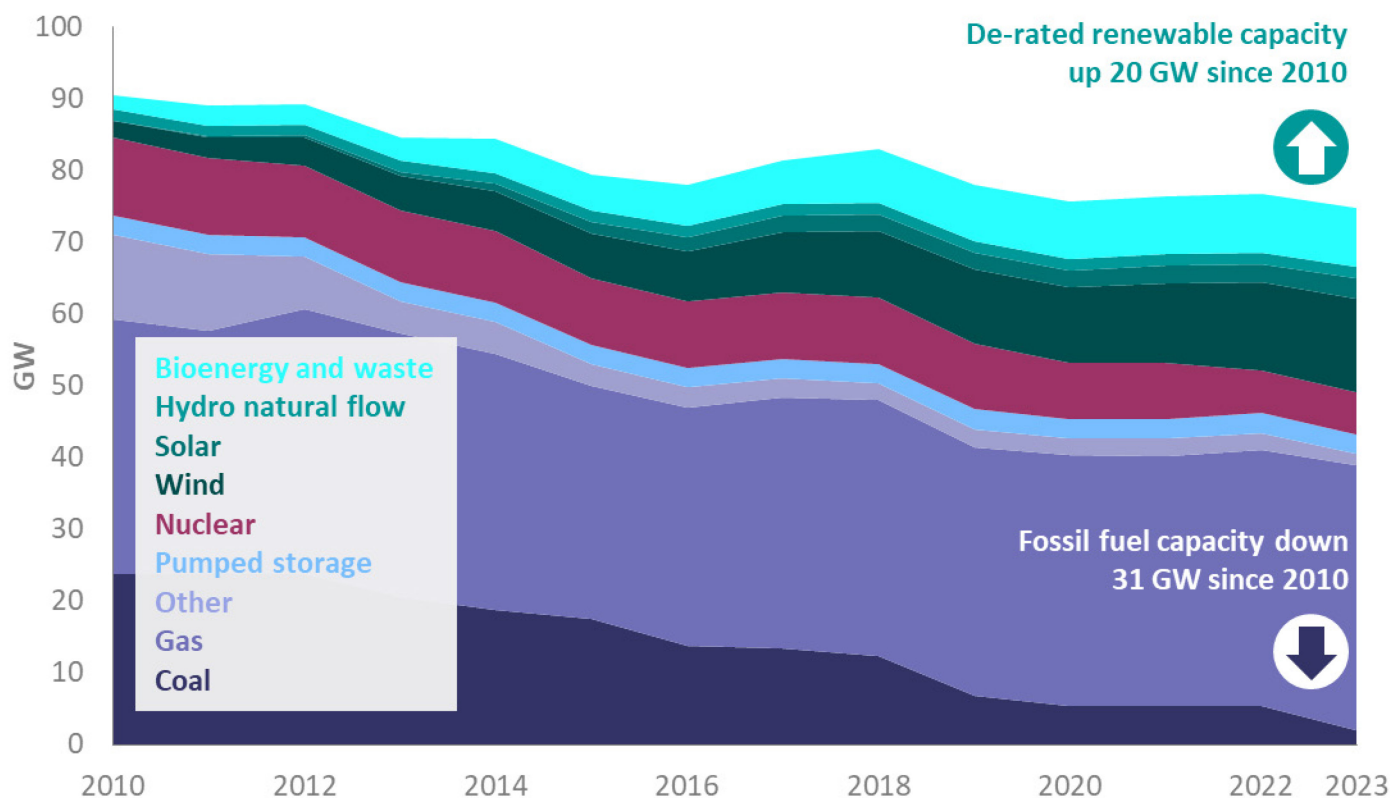
Chart 5.5 Electricity imports and exports by country, 2020 to 2023 (DUKES Table 5.13)



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

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

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

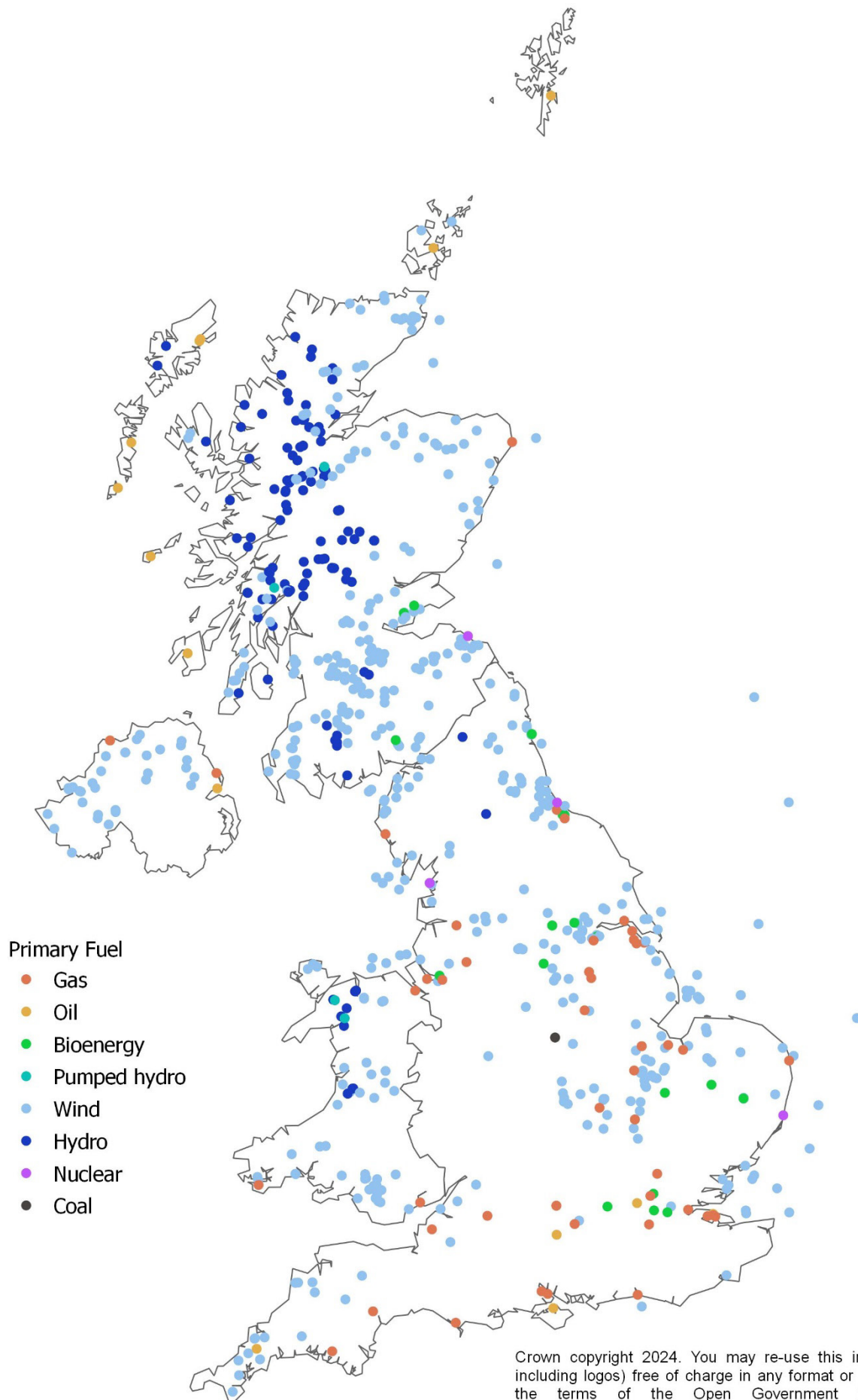


Total de-rated generation capacity decreased to 74.8 GW in 2023, down 2.6 per cent compared to 2022. This was due to closures of two large coal-fired plants, Drax and West Burton. The reduction was partly offset by increases in offshore wind, solar and bioenergy capacity, as well as the opening of gas-fired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

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

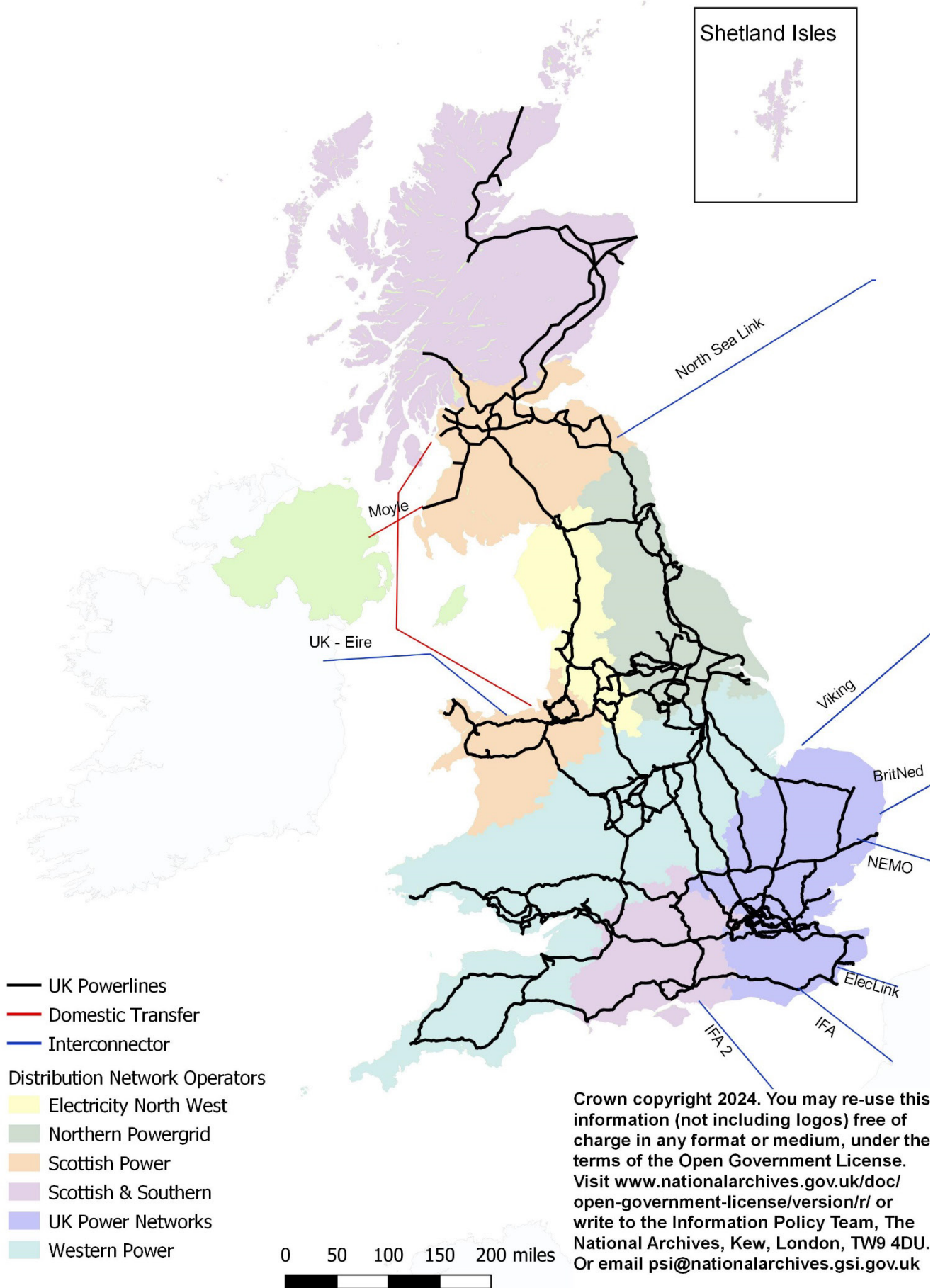
Major Power Producers' power plants were less intensively deployed than they were last year, with a load factor of 39.2 per cent ([DUKES Table 5.10](#)). Load factors indicate the proportion of the time the plant is producing electricity and decreased by 4.4 percentage points compared to 2022, in line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

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



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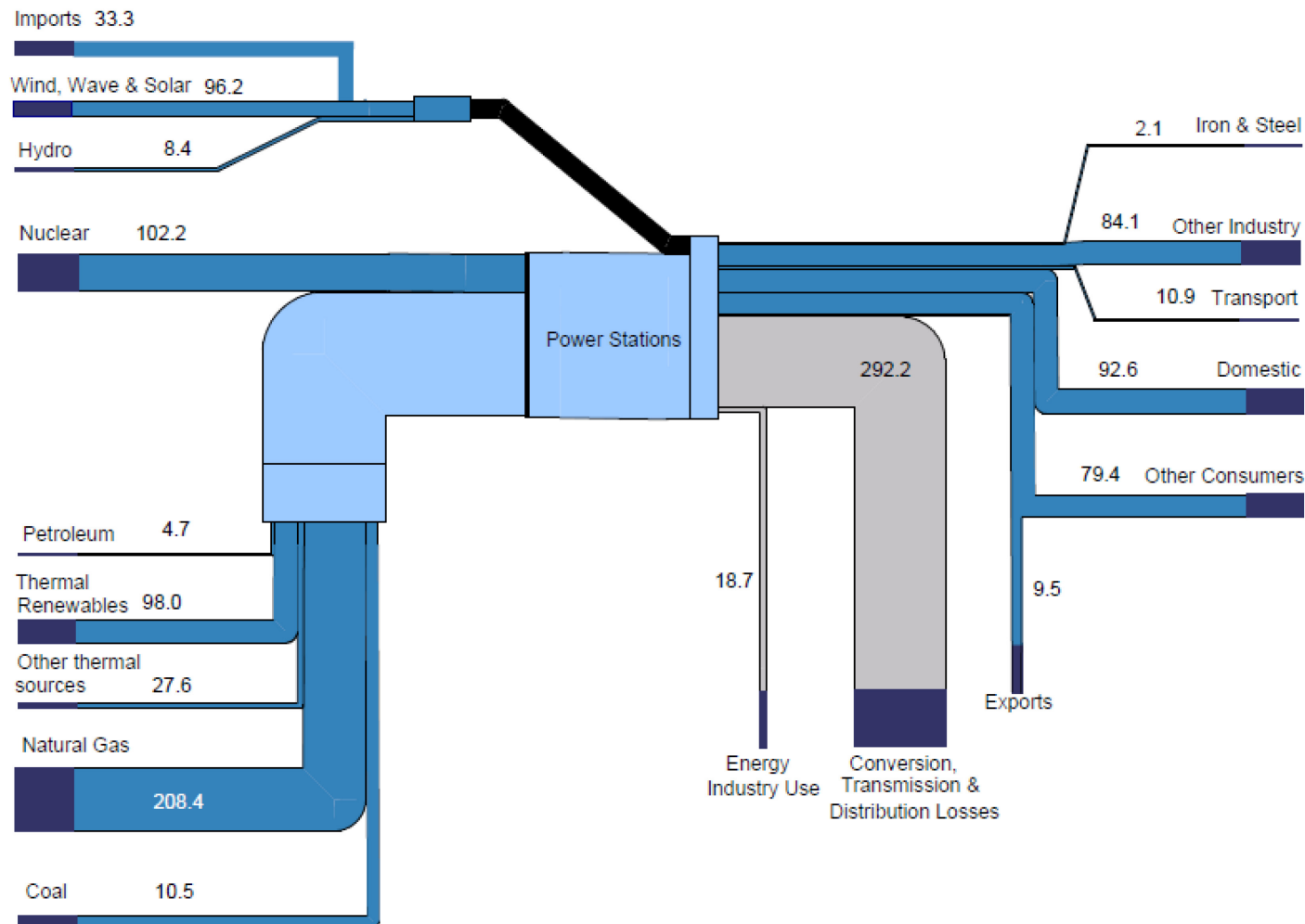
UK Distribution Network Operating Areas and GB Power Lines Map



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

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

Electricity Flow Chart 2023 (TWh)



Notes on flow chart

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

1. Hydro includes generation from pumped storage while electricity used in pumping is included under Energy Industry Use.

2. Conversion, Transmission and Distribution Losses are calculated as fuel used (Table 5.6) minus generation (Table 5.6) plus losses (Table 5.1).



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