

Electricity generation and supply in Scotland, Wales, Northern Ireland, and England, 2017 to 2021

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Introduction

This article examines the variation of electricity generation and consumption in the four nations of the United Kingdom. It updates and extends the previous version, published in December 2021. The UK data in this article is taken from chapters 5 and 6 of the Digest of United Kingdom Energy Statistics (DUKES) 2022; the definitions therefore match those in DUKES. The main text covers the latest five years of data and the corresponding timeseries (including latest revisions) for 2004 to 2021 can be found in the accompanying excel spreadsheet.

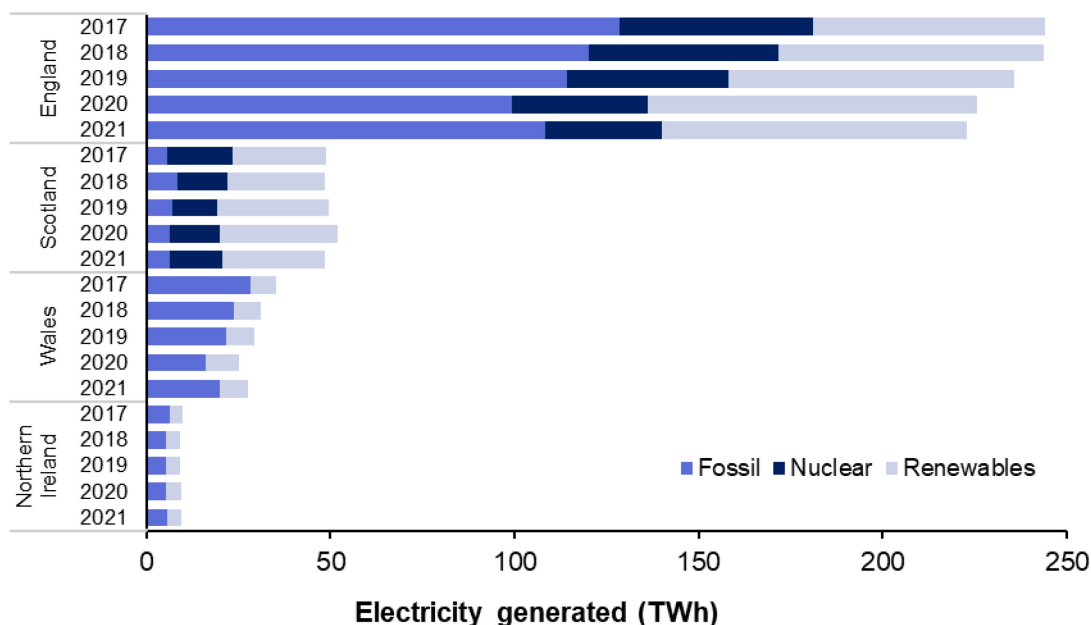
Key headlines

- UK total electricity generation in 2021 was 309 TWh, the lowest value in the published time series, and a decrease of 1.2 per cent compared to 2020. This continues the trend of electricity generation declining year on year. Electricity demand though was up 1.2 per cent from 2020, with record net imports accounting for the difference
- Shares of generation and demand by country remained similar to 2020, with England having the largest share. England's share of demand is larger than its generation share, so it continues to transfer electricity from Scotland and Wales, as well as import electricity from continental Europe.
- UK fossil fuel generation increased 11 per cent in 2021 as higher demand for electricity and lower renewable generation increased the need for fossil fuel generation. Wales and England both saw increases in fossil fuel generation, but these remained below 2019 levels. Northern Ireland was the only nation where fossil fuel generation increased compared to 2019 levels.
- Renewable generation fell in all four nations in 2021, though was from record levels in 2020. This was driven by less favourable weather conditions for wind, hydro and solar generation. As these technologies account for a higher proportion of Scotland's capacity, its renewable generation fell by 14 per cent.
- UK nuclear generation fell by 8.7 per cent compared to 2020, to the lowest level of nuclear generation in more than twenty years. Nuclear generation fell by 15 per cent in England but rose by 8.0 per cent in Scotland where fewer outages took place.
- Despite declines in renewable and nuclear generation, the low carbon share of total UK generation stood at its second highest value on the time series at 54.5 per cent, with a 51.4 per cent share in England, 86.9 per cent in Scotland, 27.5 per cent in Wales, and 40.8 per cent in Northern Ireland

Generation, consumption, and trade

During 2021 the UK generated 309 TWh of electricity, a decrease of 1.2 per cent on 2020 and the lowest value in the published time series. This contrasted with a 1.2 per cent increase in electricity demand, with record net imports accounting for the difference. Electricity demand had been on a downward trend since 2015, but increased in 2021 relative to 2020 with the lifting of Covid-19 restrictions. In total, 2021 saw UK generation down by 9.0 per cent from its peak in 2016. From 2020 to 2021, Wales was the only nation to experience a considerable rise in generation, an increase of 11 per cent on 2020, due to increased gas generation. Generation in Scotland, England, and Northern Ireland fell by 7.0 per cent, 1.2 per cent, and 0.6 per cent respectively. Chart 1 shows total electricity generation by country, between 2017 and 2021, with generation divided by fossil fuel, nuclear and renewable technologies.

Chart 1: Total electricity generation by country (all generating companies), 2017 to 2021.



Generation Shares

Shares of electricity generated by nation remained broadly stable compared to the previous year, with England having the largest share of electricity generation at 72.2 per cent, decreasing by 0.1 percentage points relative to 2020. Scotland accounted for the second largest share, at 15.7 per cent, though down 0.9 percentage points against 2020. Wales increased its share by 1.0 percentage points to 9.0 per cent of generation, making it the only nation to have increased its share of generation. Northern Ireland, the nation with the lowest share, remained responsible for 3.1 per cent of total generation. Scotland's reduction in generation share reflects lower renewable generation as less favourable weather conditions for wind, solar and hydro reduced renewable generation, which make up a higher percentage of Scotland's generation (57.0 per cent of total generation compared to the rest of the UK at 39.6 per cent). Wales meanwhile experienced the opposite, with an increased generation share resulting from greater fossil fuel generation, particularly gas, which constituted 63.8 per cent of Welsh generation compared to the UK average of 39.9 per cent. England and Northern Ireland both maintained consistent shares of generation, as decreases in renewable generation were offset by increased generation from fossil fuels.

Fossil Fuels

UK fossil fuel generation increased by 11 per cent between 2020 and 2021, though remained 6.6 per cent below 2019 levels. As a share of generation fossil fuels stood at 42.6 per cent, up 4.6 percentage points on 2020 due to less favourable weather conditions for renewables. The year on year rise in fossil fuel use reflects lower renewable generation as well as increased demand as the UK emerged from Covid-19 lockdown restrictions, under which many businesses and industries had seen their activities severely limited. Wales experienced the largest year on year rise in fossil fuel generation, up 30.0 per cent, though compared to 2019 this was a 5.7 per cent decline. England similarly experienced a year on year rise of 9.6 per cent between 2020 and 2021, but was still 6.8 per cent lower than in 2019. Northern Ireland was the only nation to see a rise in fossil fuel generation since 2019, up 9.7 per cent (8.2 per cent greater than in 2020). Though much of the increase in fossil fuel generation in Northern Ireland was led by coal (up 39 per cent on 2019), in the UK as a whole coal generation fell 5.8 per cent compared to 2019. This means that coal generation accounted for just 2.1 per cent of total UK generation in 2021, down from a fifth in 2015.

Nuclear

UK-wide nuclear generation fell by 8.7 per cent in 2021 to 45.9 TWh, its lowest level since 2008, accounting for a 14.9 per cent share of total generation. Much of the decline is the result of the UK's aging nuclear infrastructure requiring more frequent maintenance outages. Nuclear generation fell by 15 per cent in England but rose by 8.0 per cent in Scotland where fewer outages took place. 2021 also saw the decommissioning of Dungeness B in England, however the site had been unable to generate since 2018 so does not represent a

material reduction in capacity. Since the closure of Wylfa in Wales during 2015, there has been no nuclear generation within Wales or Northern Ireland.

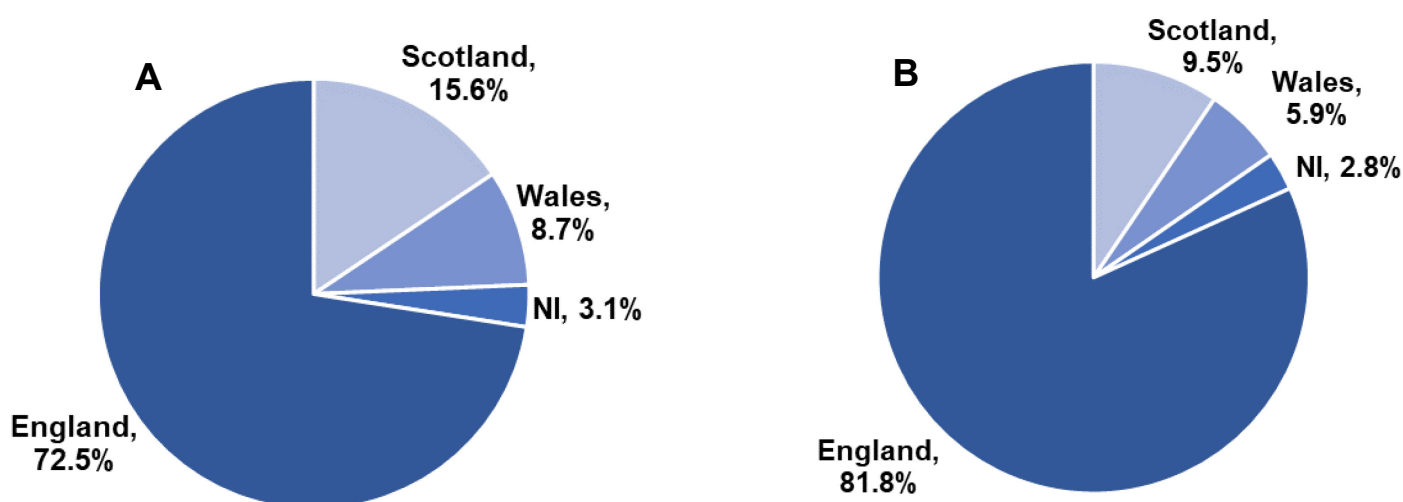
Renewables

Though renewable generation fell by 9.3 per cent for the UK in 2021, it is still the second highest year on record, at 122 TWh. The renewable share of generation was 39.6 per cent, down 3.6 percentage points compared to 2020, and was lower than the share of generation from fossil fuels (42.6 per cent), a contrast to the previous year. This was driven by decreased wind generation, because of unusually low average wind speeds across most of 2021. Weather conditions were also less favourable for hydro and solar generators. This impacted Scotland the most as it has a larger share of these technologies and so Scotland's renewable generation fell by 14 per cent.

Consumption

Despite the UK beginning its recovery from Covid-19, shares of annual electricity consumption of the respective UK nations did not vary much from 2020 (which itself did not significantly differ from 2019). The overwhelming majority of demand came from England (81.8 per cent), 9.5 per cent from Scotland, 5.9 per cent from Wales, and 2.8 per cent from Northern Ireland. This reflected minimal difference from the average across the previous extent of the time series (2004-2020), where average consumption shares were 81.8 per cent, 9.9 per cent, 5.7 per cent, and 2.6 per cent respectively. Chart 2 shows shares of electricity supply and demand in the UK by country in 2021.

Chart 2: Shares of electricity supply (A) and demand (B) in the UK by country in 2021.



Transfers

To offset the difference between England's electricity generation and demand, net positive transfers were received from Scotland and Wales, as well as from continental Europe via the France, Netherlands, Belgium, and Norway interconnectors (the Norway interconnector came online in October 2021). During 2021, these sources provided 20.0 per cent of England's total electricity consumption, up 2.7 percentage points from 2020. In 2021, Scotland exported 33 per cent of its generation in net transfers to England and Northern Ireland, down from the record level of 37 per cent in 2020. This was in line with lower generation in Scotland (due to lower renewable output), though Scotland's electricity demand also decreased (down 1.7 per cent). Wales exported 13 per cent of its generation in net transfers to England, up 10.2 percentage points from the 2020 value which was the lowest proportion in the time series. Total generation in Wales has fallen 35 per cent since its peak in the time series in 2016, predominantly due to the reduction of coal and gas fired-fired generation. A flow chart illustrating electricity generation, consumption and trade in the UK nations is provided in Appendix A.

Electricity generation by fuel

In recent years, the closure of coal and gas fired power stations and an increase in the capacity of renewable generators has shifted the UK's generation mix from fossil fuels towards renewables. Between 2017 and 2021 the fossil fuel share has fallen 5.0 percentage points to 42.6 per cent of UK total generation. Simultaneously, the renewable share has risen 10.4 percentage points to 39.6 per cent of UK total generation. Wales, England, and Northern Ireland all saw substantial decreases in fossil fuel generation, with the decrease largest for Wales at 30 per cent since 2017. Scotland was the only nation to have experienced an increase in fossil fuel generation over the period, with generation from fossil fuels up 15 per cent. Scotland does however remain the nation with the lowest fossil fuel generation share in the UK at 10.9 per cent.

Though for the UK as a whole the share of renewables did decline by 3.6 percentage points from 2020, 2021 still featured the second highest share for renewables on record.

Coal

The introduction of the Carbon Price Floor (CPF) in April 2013 has resulted in the swift decline of coal generation, which accounted for 39.2 per cent of the UK generation mix in 2012, but was only 2.1 per cent in 2021, up slightly from the record low of 1.8 per cent in 2021. Just four coal-fired power stations remain in the UK as the UK works towards net zero emissions by 2050. There were no further closures in 2021 following the closure of both Aberthaw B in Wales and Fiddler's Ferry in England in 2020. The closure of Aberthaw B ended over 125 years of coal generation in Wales, joining Scotland as the only two UK nations with no coal generation. This meant that the increase in coal generation came from England (18 per cent up on 2020) and Northern Ireland (20 per cent up on 2020). Northern Ireland still relies on coal for a 13.2 per cent share of its total generation. In England coal constitutes a 2.4 per cent share of generation.

Gas

Gas largely replaced coal in the generation mix since the introduction of the CPF, and since 2017 has fluctuated around an average of a 39.3 per cent share of generation. Overall, the share of UK gas generation rose to 39.9 per cent in 2021, up 4.2 percentage points since 2020. This was however a drop of 0.8 percentage points against 2019, as Covid-19 restrictions still in place in 2021 reduced the demand for electricity generation. That the share of gas generation was down versus 2019 is the result of an increased share of generation from renewables, up 2.7 percentage points on their 2019 share. Wales remains the UK nation most reliant on gas generation, with gas generation accounting for 63.8 per cent of the total, with an increase of 1.9 percentage points since 2019 making Wales the only UK nation to have increased its share of gas generation since then. England and Scotland both saw falls in the share of gas generation since 2019. Northern Ireland saw its share of gas generation stay the same.

Nuclear

The UK's overall nuclear generation fell for the fifth consecutive year, decreasing by 8.7 per cent since 2020, with much of the decline attributable to the UK's aging nuclear infrastructure requiring more frequent maintenance outages. This meant that 2021 saw the UK's nuclear generation at its lowest level in more than twenty years, as all of the UK's nuclear plants were on outage at times during the year. Between 2020 and 2021 nuclear generation fell by 15 per cent in England but rose by 8.0 per cent in Scotland. The rise in Scotland reflects fewer maintenance outages in 2021 than 2020, whilst England experienced more. Since the closure of Wylfa in 2015 there has been no nuclear generation in Wales.

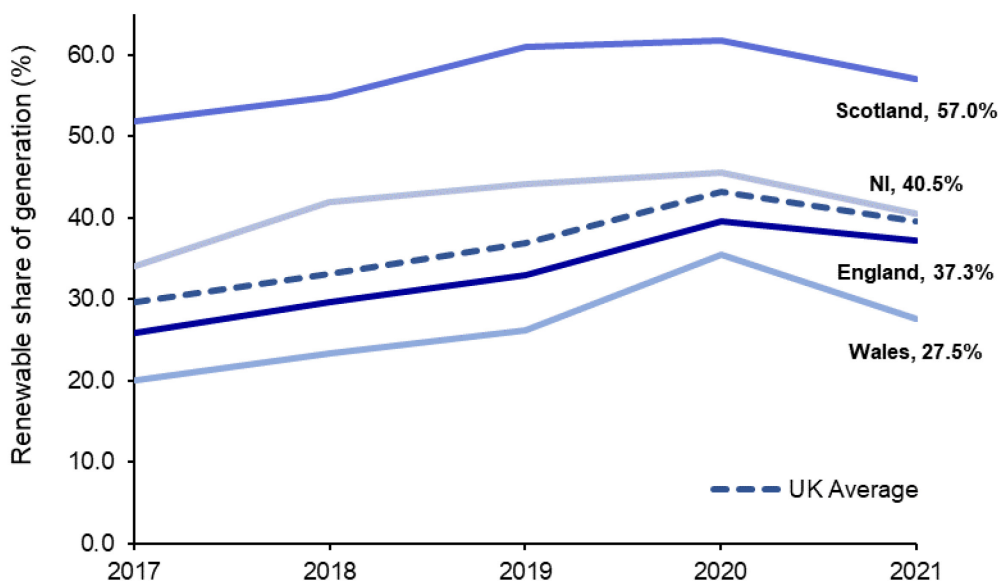
Low Carbon (nuclear and renewable)

Lower renewable generation compared to 2020 meant that the low carbon shares of generation fell in all UK nations from record highs set in 2020, representing an overall decline of 4.8 percentage points year on year. The low carbon share did improve against 2019 however, up 0.2 percentage points overall, meaning that in 2021 low carbon generation was at its second highest share in the time series. In 2021 the low carbon share of generation England stood at 51.4 per cent, 86.9 per cent in Scotland, 27.5 per cent in Wales, and 40.8 per cent in Northern Ireland. Wales and Northern Ireland both have lower low carbon generation shares since neither nation has nuclear capacity, as well as both nations having lower proportions of renewable capacity when compared to England and Scotland.

Renewables

Renewable generators saw their share of generation decrease to 39.6 per cent (down 3.6 percentage points on 2020) as the UK experienced less favourable weather conditions for renewable generation. Unusually low average wind speeds across most of 2021 meant that despite increased capacity wind generation fell 14 per cent. 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 fell by 5.9 per cent. This meant that all four nations experienced a decline in their shares of renewable generation, though Wales and England did both record their second highest shares on the time series. Scotland remains the UK leader for renewable generation. Chart 3 shows the renewable share of total electricity generation in each UK country from 2017 to 2021, in comparison to the UK average.

Chart 3: Renewable share of electricity generation by country, 2017 to 2021.

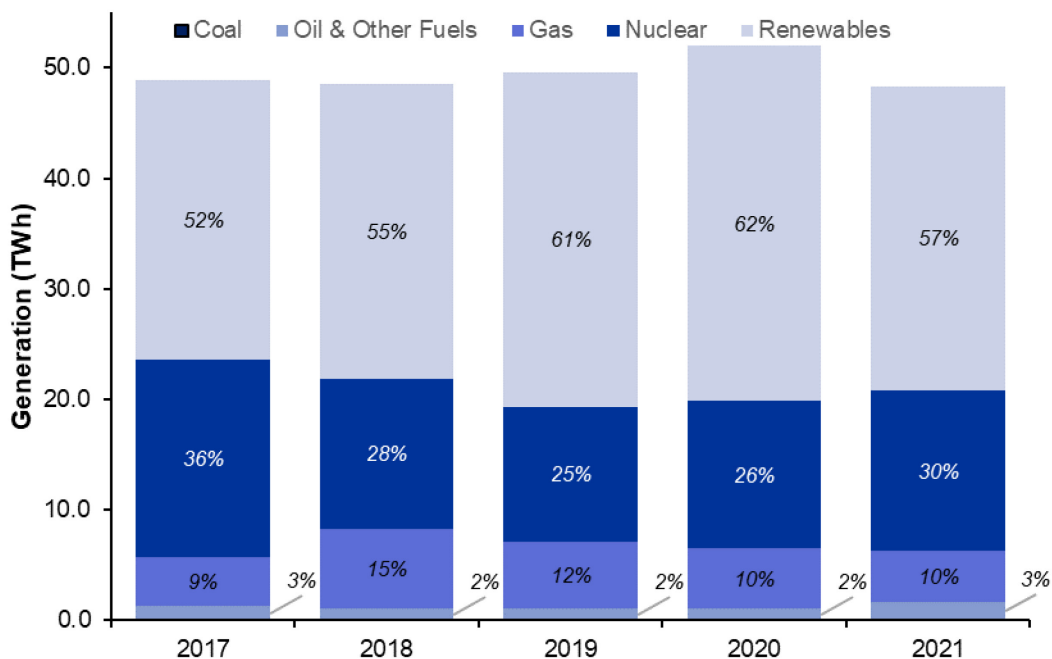


A map illustrating the distribution of Major Power Producers in Scotland, Wales, Northern Ireland and England is provided in Appendix B.

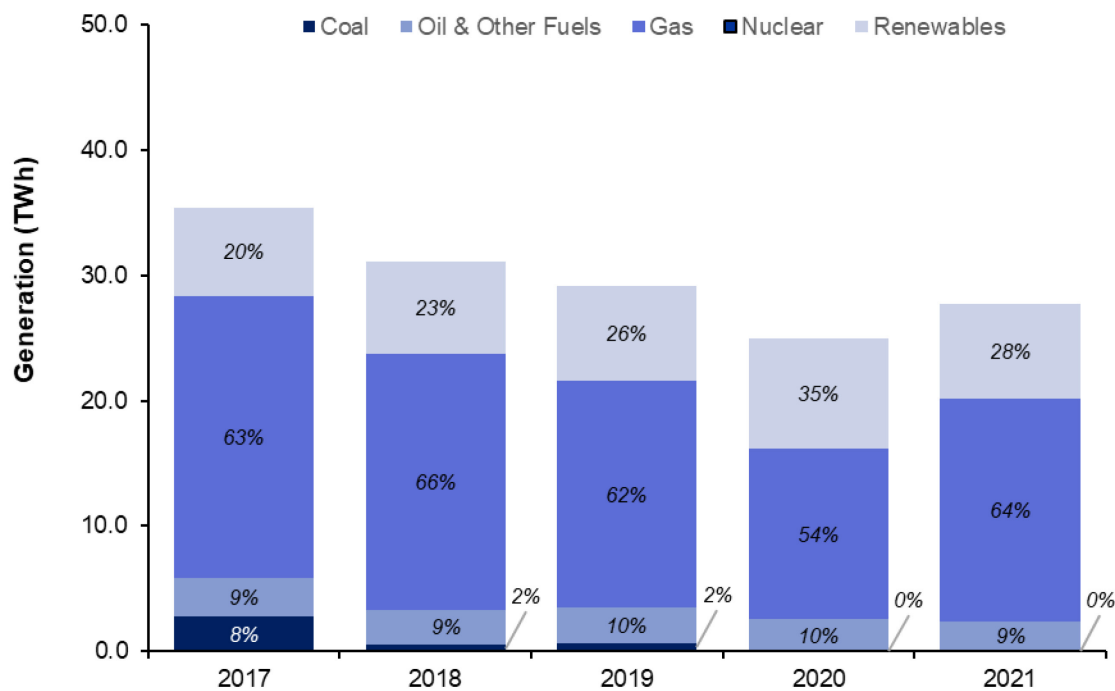
Chart 4 shows electricity generation by fuel (in all generating companies) in each UK country for the period 2017 to 2021. To illustrate the generation mix in each country, shares of electricity generated by fuel are shown as data labels.

Chart 4: Electricity generation by fuel (with shares of electricity generated) in all generating companies, in Scotland (A), Wales (B), Northern Ireland (C) and England (D), 2017 to 2021.

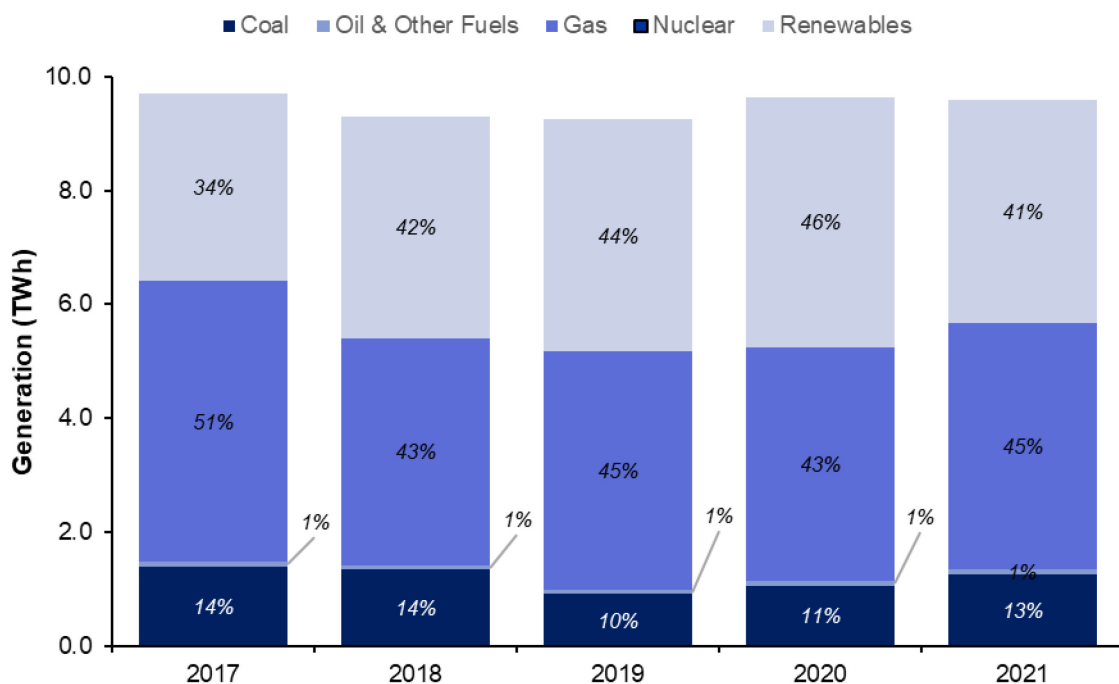
A - SCOTLAND



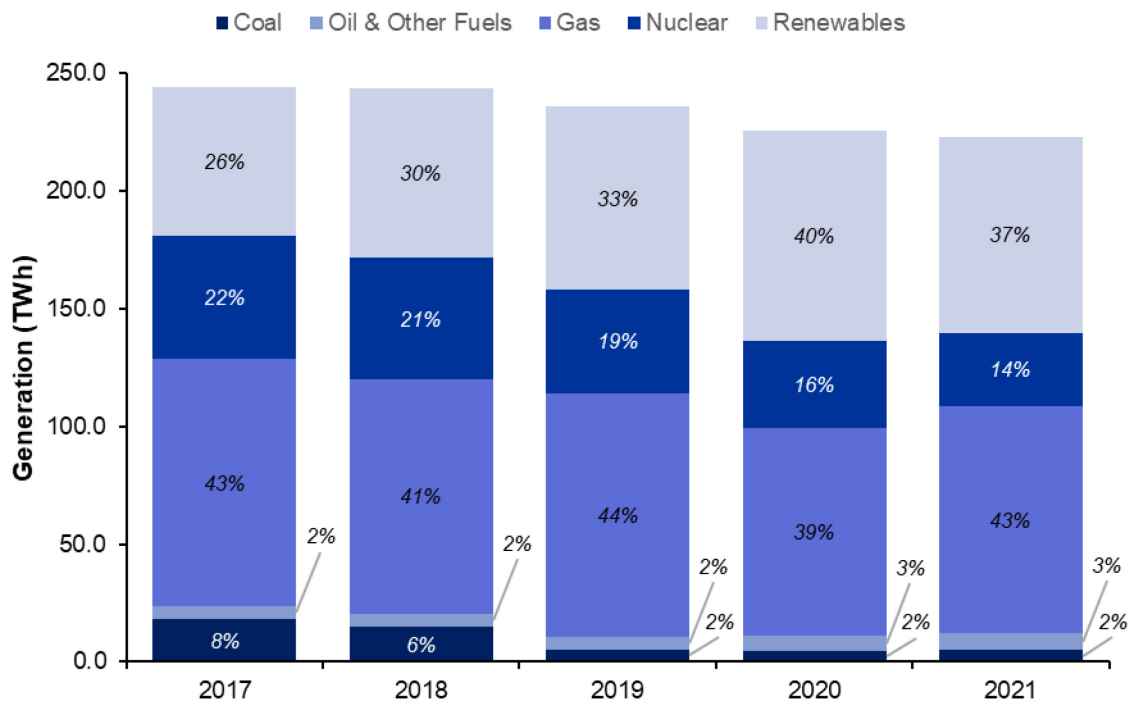
B - WALES



C – Northern Ireland



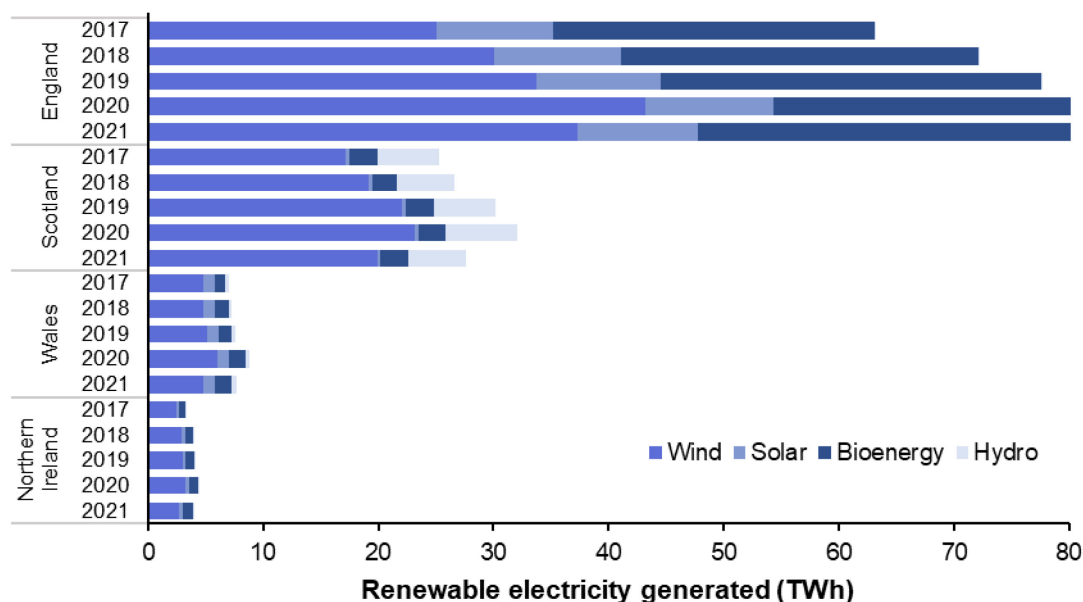
D – England



Low carbon and renewable electricity

Renewable electricity generation and capacity has increased dramatically in recent years, as the UK strives towards a cleaner future, working towards its goal to achieve net zero carbon emissions by 2050. In 2019, the UK became the [first global economy to enshrine this commitment in law](#). Chart 5 shows electricity generation by renewable technology in each UK nation between 2017 and 2021.

Chart 5: Renewable electricity generation by technology, in each UK nation between 2017 and 2021.



Since 2017 renewable generation has increased by 24 per cent, and though renewable generation did decrease between 2020 and 2021, this was largely due to less favourable weather conditions. 2021 saw renewable capacity increased substantially with new wind and solar sites. UK wind installed capacity increased by 5.3 per cent to 25.7 GW, with a 3.0 per cent increase in onshore wind, and an 8.4 per cent increase for offshore wind. 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.

Wind

Wind has the largest generation of the renewable technologies, with UK wind generation increasing 30 per cent from 2017 to 2021. Wind power accounted for 41.2 per cent of Scotland's generation in 2021, the greatest proportion of any nation and more than double the proportion of English and Welsh wind generation (16.7 per cent and 17.2 per cent respectively). Wind was however down for all four nations in 2021 against 2020, and only England saw an increase in wind generation against 2019. However, this decline in generation is largely the result of unusually low average wind speeds, down 14 per cent against 2020, and down 11 per cent on the 20-year mean. Total installed capacity for wind increased 5.3 per cent to 25.7 GW in 2021, notably including the opening of Triton Knoll off the coast of Lincolnshire, adding 0.9 GW of capacity. The UK is committed to increase its installed capacity for offshore wind generation to 40 GW by 2030, increasing overall wind capacity to over 50 GW, in line with the commitment to achieve net zero carbon emissions by 2050.

Bioenergy

Bioenergy had the second largest share of the renewables in 2021, at 12.9 per cent of total generation. The majority (88.1 per cent) occurred in England. Since the conversion of coal units at Lynemouth and Drax to biomass in 2018, the majority of biomass generation by major power producers takes place at these two sites, which are both in England. Biomass capacity continued to grow in 2021, rising 1.3 per cent to 8.1 GW in 2021, now representing over a tenth of UK generation capacity. Bioenergy generation increased in all four countries against 2020, with the largest increase in Northern Ireland (up 10 per cent), followed by Scotland (up 4.2 per cent), Wales (up 3.5 per cent), and England (up 0.9 per cent).

Solar

Solar generation, like wind, fell in 2021 due to less favourable weather conditions. Average daily sun hours were down 12 per cent against 2020, and down 6.6 per cent against the 20-year mean. Overall, this meant that UK solar generation fell 5.9 per cent in 2021, despite 2.8 per cent additional capacity. Wales was the only UK nation to experience an increase in solar generation (an increase of 1.2 per cent on 2020), meanwhile England, Scotland, and Northern Ireland all saw solar generation reduced (down by 6.6 per cent, 11 per cent, and 1.8 per cent respectively).

Hydro

The vast majority of the UK's hydro generation assets are in Scotland, however low average monthly rainfall (down 30 per cent on 2021, and down 15 per cent on the 20-year mean) meant hydro generation decreased 21 per cent. In turn, UK hydro generation fell by 20 per cent in 2021. Total installed hydro capacity remained broadly level over this period.

Further Details

For further detailed renewable statistics on a sub-national and regional basis, please refer to the [special feature article](#) published in the September 2022 issue of Energy Trends. For weather data, weighted by location of renewable resources, refer to [Energy Trends section 7: weather](#).

Note that previous versions of this article included reference to renewable generation under the Renewables Obligation (RO). This is no longer included since the RO closed to new generating capacity in March 2017, with a grace period ending in 2018. Since this date, the expansion of renewable capacity renders renewable generation under the RO less significant.

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Revisions

Previous versions of the data in this article remain available online for comparison at:

www.gov.uk/government/collections/energy-trends-articles

References

Digest of UK Energy Statistics 2022 (DUKES) – Electricity (Chapter 5):

<https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes>

Electricity Statistics: data sources and methodologies

<https://www.gov.uk/government/publications/electricity-statistics-data-sources-and-methodologies>

Electricity generation and supply article and accompanying data for Scotland, Wales, Northern Ireland and England, 2016 to 2020:

<https://www.gov.uk/government/publications/energy-trends-december-2021-special-feature-articles>

UK electricity generation and consumption (Energy Trends 5.1 to 5.6):

<https://www.gov.uk/government/statistics/electricity-section-5-energy-trends>

Renewable electricity generation and capacity (Energy Trends 6.1):

<https://www.gov.uk/government/statistics/energy-trends-section-6-renewables>

Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2021:

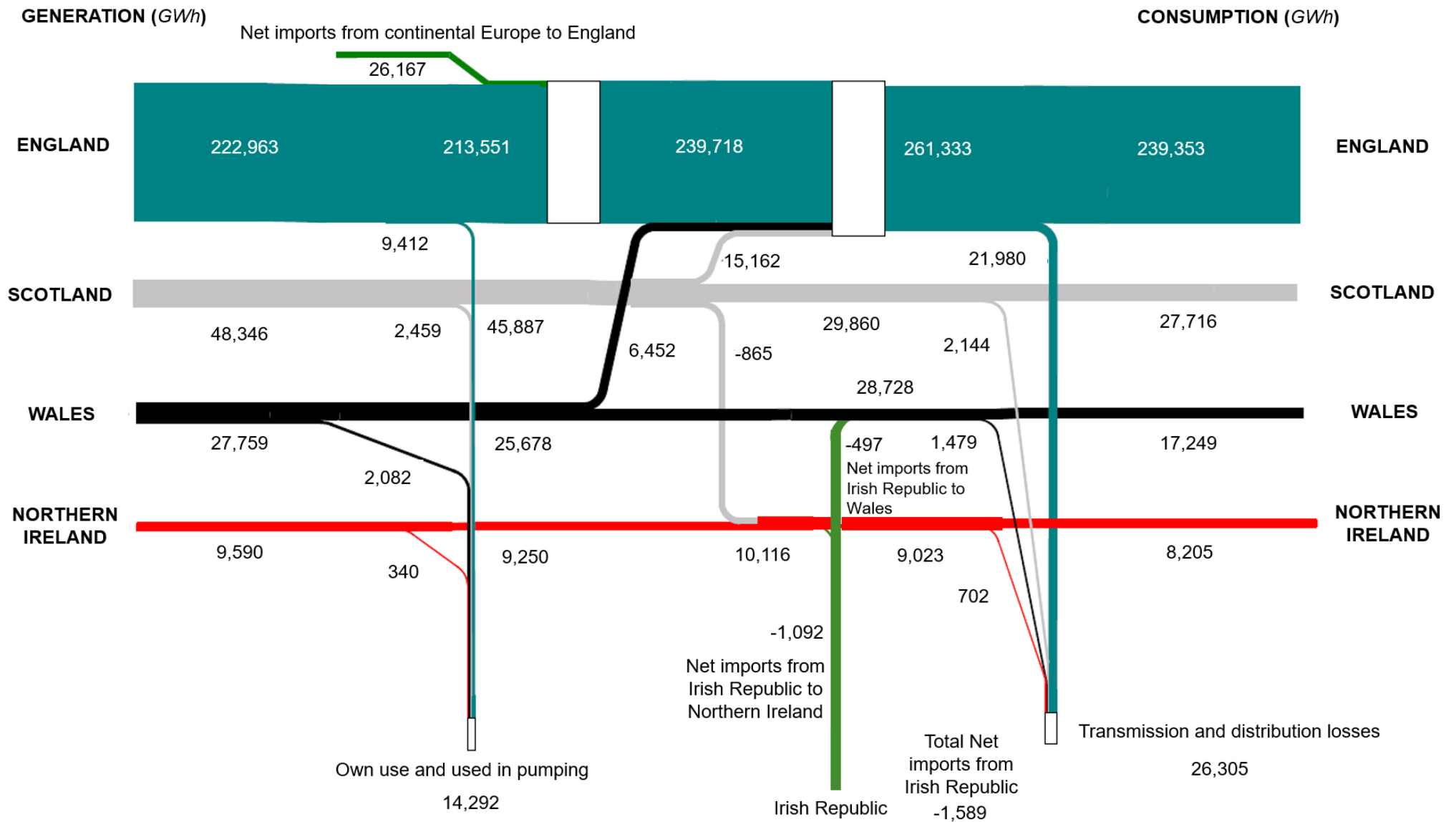
<https://www.gov.uk/government/publications/energy-trends-september-2022-special-feature-articles>

Energy Trends: weather

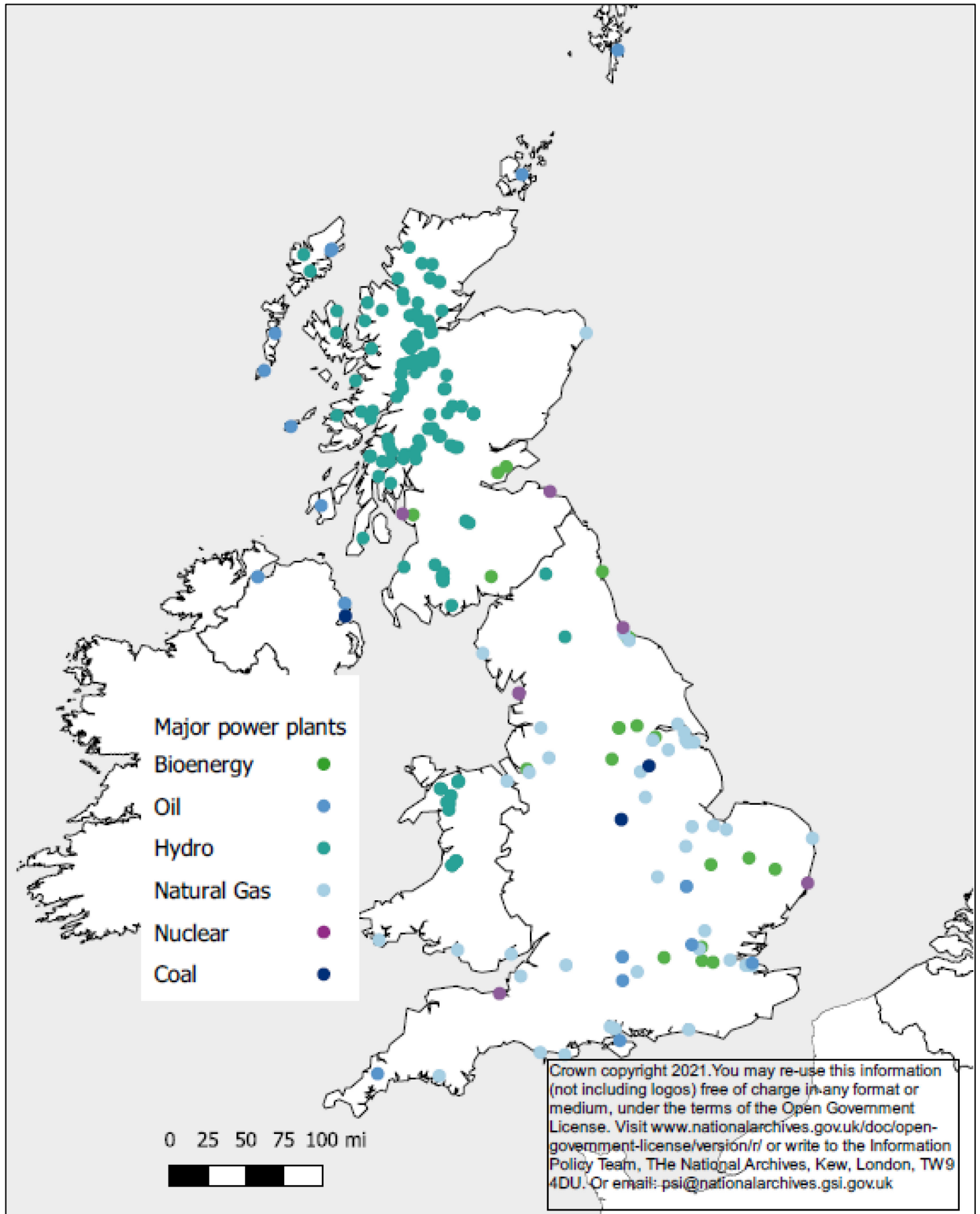
www.gov.uk/government/statistics/energy-trends-section-7-weather

Appendices

Appendix A: Electricity generation and consumption in Scotland, Wales, Northern Ireland and England



Appendix B: Distribution of Major Power Producers (MPPs) in the United Kingdom (As of May 2022)





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