Electricity interconnectors in the UK since 2010

Adam Deaney **020 7215 4321** Adam.Deaney@beis.gov.uk

Scope: UK Electricity trade statistics

The Digest of UK Energy Statistics (DUKES) and UK Energy Trends present statistics on energy supply, demand and trade in the UK. Statistics on electricity trade are published in DUKES table 5.13 and Energy Trends table 5.6. These publications consider electricity imports and exports at UK borders and define electricity supplied between the four UK regions as transfers.

The UK is covered by two electricity markets: Great Britain (England, Scotland and Wales) and the Single Electricity Market (Northern Ireland + Republic of Ireland). Two interconnectors link the markets: the Scotland-Northern Ireland Moyle interconnector and the Wales-ROI East-West interconnector.

This article focuses on international trade so excludes internal UK trade over the Moyle interconnector.

Key headlines

Between 2010 and 2021, electricity imports to the UK increased almost ten-fold to 28.7 TWh, while electricity exports remained broadly level with exports of 4.2 TWh in 2021. Since 2010, electricity imports' share of the UK's electricity supply has increased, up from 2.0 per cent in 2010 to 9.1 per cent in 2021.

As of March 2022, the UK has seven international interconnectors with a total capacity of 7,440 MW, an almost three-fold increase in capacity since 2010. In the 2020 Energy White Paper, the Government set an ambition of 18 GW of interconnector capacity by 2030, with new interconnectors set to connect the UK to Germany and Denmark.

The UK's electricity exports follow seasonal trends, with higher exports in Quarter 4 than in the rest of the year due to a greater availability of renewable electricity to export. There are no clear seasonal patterns for imports or net imports.

During 2021, most of the UK's electricity imports came from France (52.7 per cent), with the remainder from Belgium (24.3 per cent), the Netherlands (15.1 per cent), Norway (4.8 per cent) and the Republic of Ireland (3.0 per cent). The majority of the UK's exports were to the Republic of Ireland (58.9 per cent), followed by France (35.5 per cent), Belgium (3.3 per cent), and the Netherlands (1.9 per cent).

Utilisation rates show that on average (excluding NSL), around 60 per cent of available interconnector capacity was used during 2021, with considerably higher utilisation for the interconnectors with France, Belgium and the Netherlands and lower utilisation for the interconnectors with the Republic of Ireland.

Background

Electricity interconnectors are high-voltage cables that enable the trade of electricity between connecting countries. In the UK, electricity interconnectors are an increasingly important component of the electricity system, with interconnectors helping to balance the grid by importing electricity at times of high demand or lower domestic generation and exporting surplus electricity when demand is lower. This also helps to balance periods of high or low generation from intermittent renewables sources which are particularly dependent on weather conditions, such as wind and solar generation.

The UK's first electricity interconnector to the continent commenced operations in 1961, with a 160 MW high-voltage direct current (HVDC) cable connecting the UK and France until 1986 when it was replaced by the current IFA interconnector. Since 1970, the UK and the Republic of Ireland have historically traded electricity via Northern Ireland through the North-South interconnector, though trade ceased in 1975 before being reinstated at 540 MW in 1995. As of March 2022, the UK has seven international interconnectors with a total capacity of 7,440 MW, connecting the UK to France, the Republic of Ireland, Belgium, Norway, and the Netherlands.

In line with the UK's net zero targets, the UK Government's ambition is to increase Great Britain's interconnector capacity to at least 18 GW by 2030 (Energy White Paper, 2020). Plans include new interconnectors linking the UK to Denmark and Germany.

UK Electricity interconnector capacity

Between 1986 and 2010, the UK had two operational interconnectors: the IFA interconnector (2,000 MW) connecting England to France and the North-South interconnector (540 MW) connecting Northern Ireland to the Republic of Ireland. Additionally, from 2001 the Moyle interconnector (500 MW) has connected the Single Electricity Market (SEM) of the island of Ireland to Great Britain (GB). The Moyle interconnector links Northern Ireland and Scotland, transferring electricity within the UK.

Since 2010, the UK's interconnector capacity has nearly trebled from 2,540 MW in 2010, to 7,440 MW in 2021. In 2011, the 1,000 MW BritNed interconnector became operational with 160 miles of HVDC cables connecting the Isle of Grain in England to the Maasvlakte in the Netherlands. The second interconnector between the UK and Republic of Ireland opened in October 2012, with the 500 MW East-West connecting Wales to the Republic of Ireland. In 2019 the UK's electricity interconnector capacity increased further when the GB-Belgium interconnector (Nemo Link) opened. In 2021, two new interconnectors became operational, with the second GB-France interconnector (IFA 2) opening in January and the GB-Norway interconnector North Sea Link (NSL) commencing operation in October.

These new interconnectors increased the UK's diversification between its connecting countries. In 2010, 78.7 per cent of the UK's total interconnector capacity was between GB and France with the remainder connecting to the Republic of Ireland. By the end of 2021, there were operational interconnectors to five different countries and France's interconnector capacity share had dropped to 40.3 per cent, despite increased capacity from the IFA 2 interconnector. The NSL interconnector with Norway commenced operations in October 2021, marking the first time that the UK has traded electricity with a non-EU member state.

Chart 1: UK electricity interconnector capacity, 2010-2021

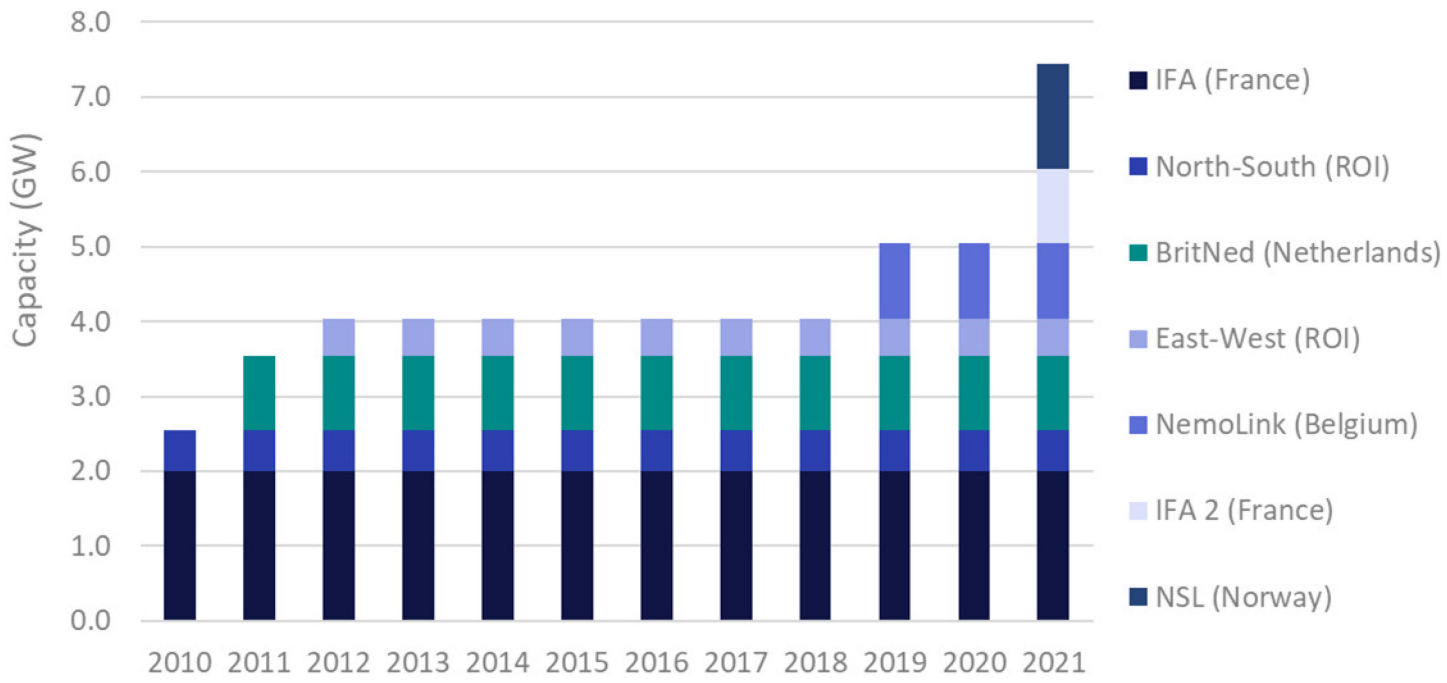


Table 1: UK electricity interconnectors

Interconnector Name	Connecting Country	Capacity (MW)	Year Commissioned
IFA	France	2,000	1986
North-South	Republic of Ireland	540	1995 [Note 1]
Moyle	within the UK	500	2001 [Note 2]
BritNed	Netherlands	1,000	2011
East-West	Republic of Ireland	500	2012
Nemo Link	Belgium	1,000	2019
IFA 2	France	1,000	2021
North Sea Link (NSL)	Norway	1,400	2021

[Note 1] Trade through the North-South interconnector originally started in 1970, though the interconnector was shut in 1975 due to damage but was reopened in 1995.

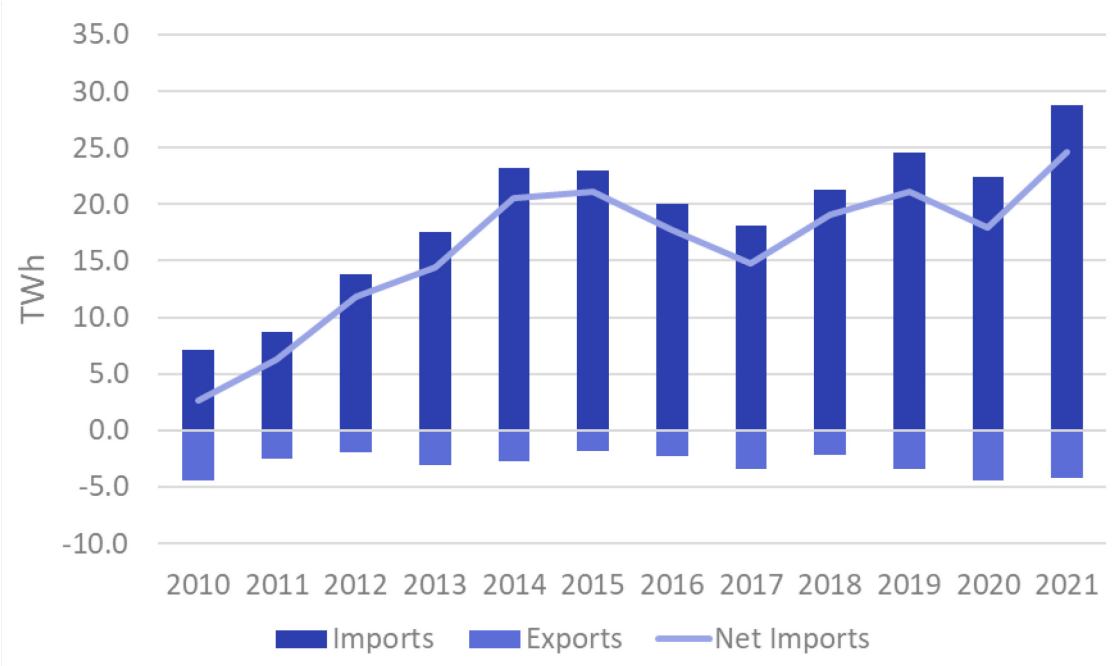
[Note 2] The Moyle interconnector links the island of Ireland's Single Electricity Market (SEM) and the GB market. It connects Northern Ireland to Scotland and is not included in UK import/export statistics in this report as it operates within the UK.

UK Electricity imports and exports

Between 2010 and 2021 net electricity imports (imports minus exports) to the UK increased substantially, from 2.7 TWh in 2010 to 24.6 TWh in 2021. In this time electricity imports rose from 7.1 TWh, to 28.7 TWh, while electricity exports stayed broadly level at an average of 3.0 TWh.

Notably, net electricity imports fell by almost 16 per cent between 2015 and 2016, before falling a further 17 per cent between 2016 and 2017. The reduction in net imports was primarily caused by lower operational capacity at the IFA interconnector, with chart three showing the impact of long-term outages on the IFA interconnector between October 2016 and February 2017 due to damage caused by a ship's anchor. This was compounded by nuclear outages in France from late 2016 to early 2017 and then again in late 2017 which reduced the amount of electricity available for UK imports and increased the demand for electricity exports to France.

Chart 2: Annual UK electricity imports and exports since 2010



Between 2019 and 2020 net electricity imports to the UK fell by 15 per cent, with imports down 9 per cent and exports up 32 per cent. 2020 was a record-breaking year for UK renewables, with favourable weather

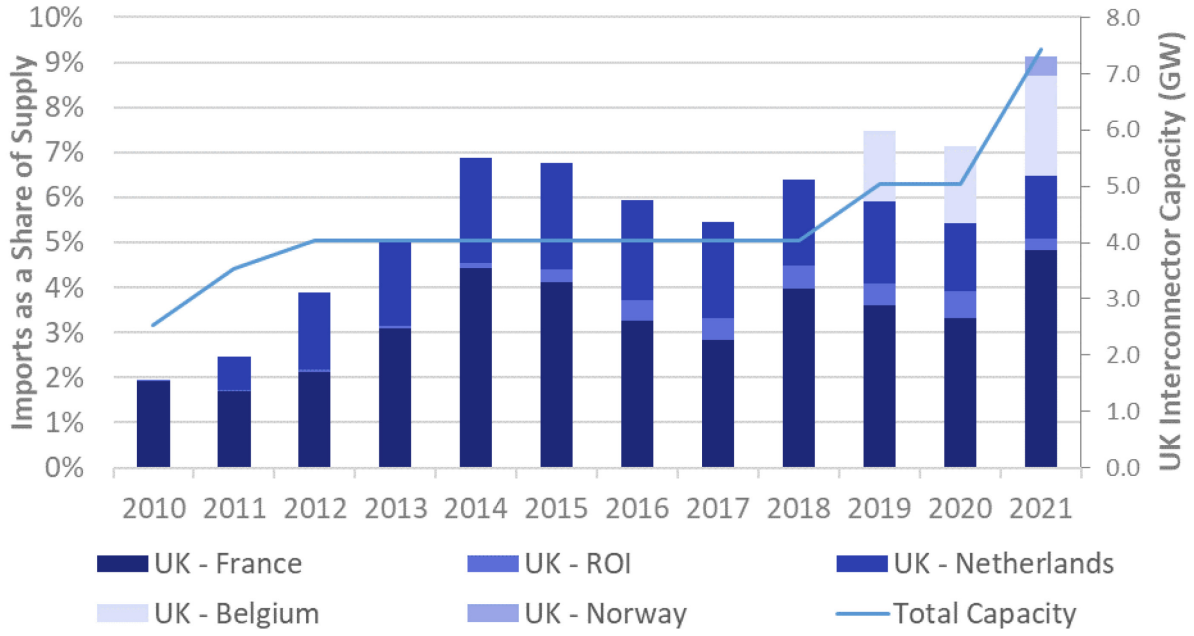
conditions across the year fuelling record generation by the UK's wind, solar and hydro assets. This meant that fewer imports were needed to meet demand and increased opportunity for exports.

Net electricity imports rose to record levels in 2021, with imports rising to 28.7 TWh and exports falling to 4.2 TWh. This is the opposite of what occurred between 2019 and 2020, both in terms of the cause and the result. Weather conditions during 2021 were much less favourable for renewables, with lower-than-average wind speeds and rainfall suppressing generation, meaning that imports were increasingly used to meet demand. This was exacerbated during Quarter 3, with record gas prices increasing the cost of gas generation and increasing import demand. After record electricity imports of 8.5 TWh during Quarter 3, imports fell to 6.2 TWh during Quarter 4, with less electricity available to import from France due to French nuclear outages and reduced IFA interconnector capacity following a fire.

Chart 3: Quarterly UK Electricity imports and exports since 2016

UK electricity exports broadly follow seasonal trends, with exports up during Quarter 4 compared to the rest of the year. This correlates with seasonal weather patterns, when weather conditions are typically most favourable for wind generation, increasing opportunity for exports. There is no clear seasonal trend for imports or net imports.

Chart 4: Annual electricity imports as a share of total electricity supply, 2010-2021



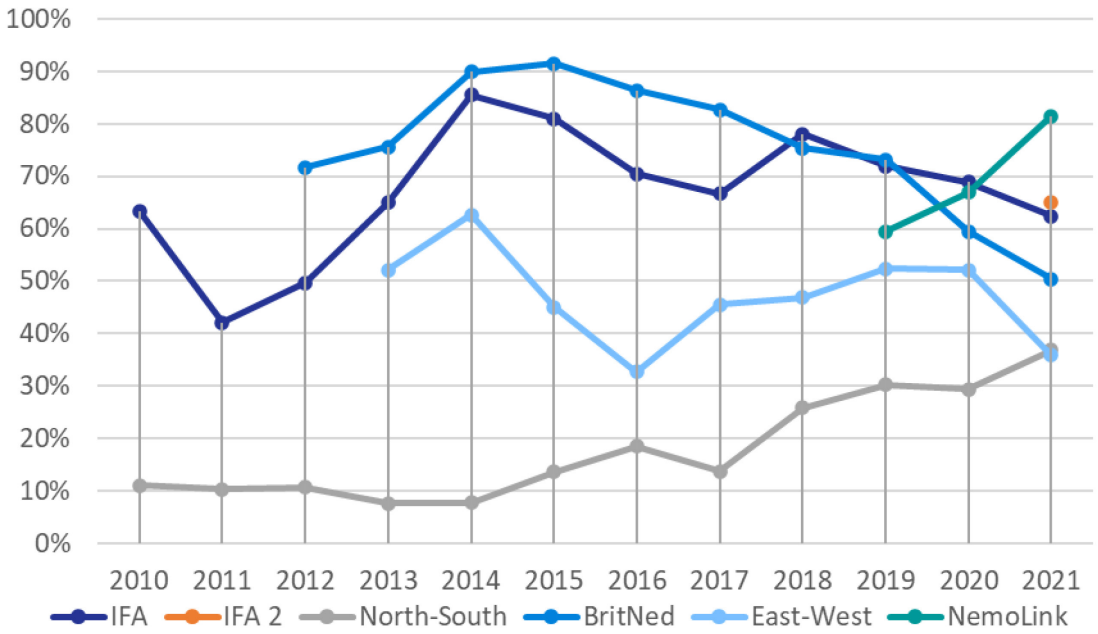
Since 2010, electricity imports' share of UK electricity supply rose. Electricity imports as a share of supply increased from a low baseline of 2.0 per cent in 2010 to 6.9 per cent in 2014, before gradually falling to 5.4 per cent in 2017, then rising to a record 9.1 per cent in 2021. This trend of rising imports as a share of supply is broadly in line with the increase in interconnector capacity, with additional capacity being used as it comes online.

In and before 2010, almost all the UK's electricity imports came from France, with the small remainder imported from the Republic of Ireland to Northern Ireland. In 2021 the share of imports from France dropped to 52.7 per cent, a decrease of 45 percentage points compared with 2010. This reflects the growth in interconnector capacity to other countries. The remainder of the UK's imports in 2021 came from Belgium (24.3 per cent), the Netherlands (15.1 per cent), Norway (4.8 per cent) and the Republic of Ireland (3.0 per cent). In contrast to imports, the majority of outward UK electricity trade is to the Republic of Ireland (58.9 per cent), followed by France (35.5 per cent), Belgium (3.3 per cent), and the Netherlands (1.9 per cent). The UK is typically a net exporter to the Republic of Ireland, but a net importer from France, Belgium and the Netherlands. In addition, the new interconnector with Norway has been a net importer for the first three months of its operation. With growth in renewable electricity generation, particularly offshore wind, the UK is expected to become a net electricity exporter.

UK Electricity interconnector utilisation

Utilisation compares an interconnector's maximum potential imports and exports with its actual usage. The potential is measured by multiplying capacity by the number of hours it has operated for, which is then compared with the total amount of electricity imported or exported during this time. During 2021, the UK's electricity interconnectors operated at an average utilisation of 60 per cent (excluding data for the NSL interconnector that opened mid-year), which is broadly level with the average interconnector utilisation between 2010 and 2020. Since its first year of full operation in 2012, the BritNed interconnector with the Netherlands has typically operated at the highest utilisation of the UK's interconnectors, averaging 76 per cent between 2012 and 2021. However, BritNed's utilisation has dropped gradually in recent years, from a high of 91 per cent in 2015, to 73 per cent in 2019 and then to 50 per cent in 2021. The IFA interconnector with France typically has the second highest utilisation with an average utilisation of 67 per cent between 2010 and 2021. The UK-ROI interconnectors normally operate at lower utilisations than those to continental Europe, with the North-South interconnector operating at an average utilisation of 18 per cent between 2010 and 2021 and the East-West interconnector operating at an average utilisation of 47 per cent between 2013 and 2021. Since starting operations in 2019, the Nemo Link interconnector with Belgium has risen to a utilisation of 81 per cent in 2021, the highest of all the UK interconnectors.

Chart 5: Annual interconnector utilisation, 2010-2021



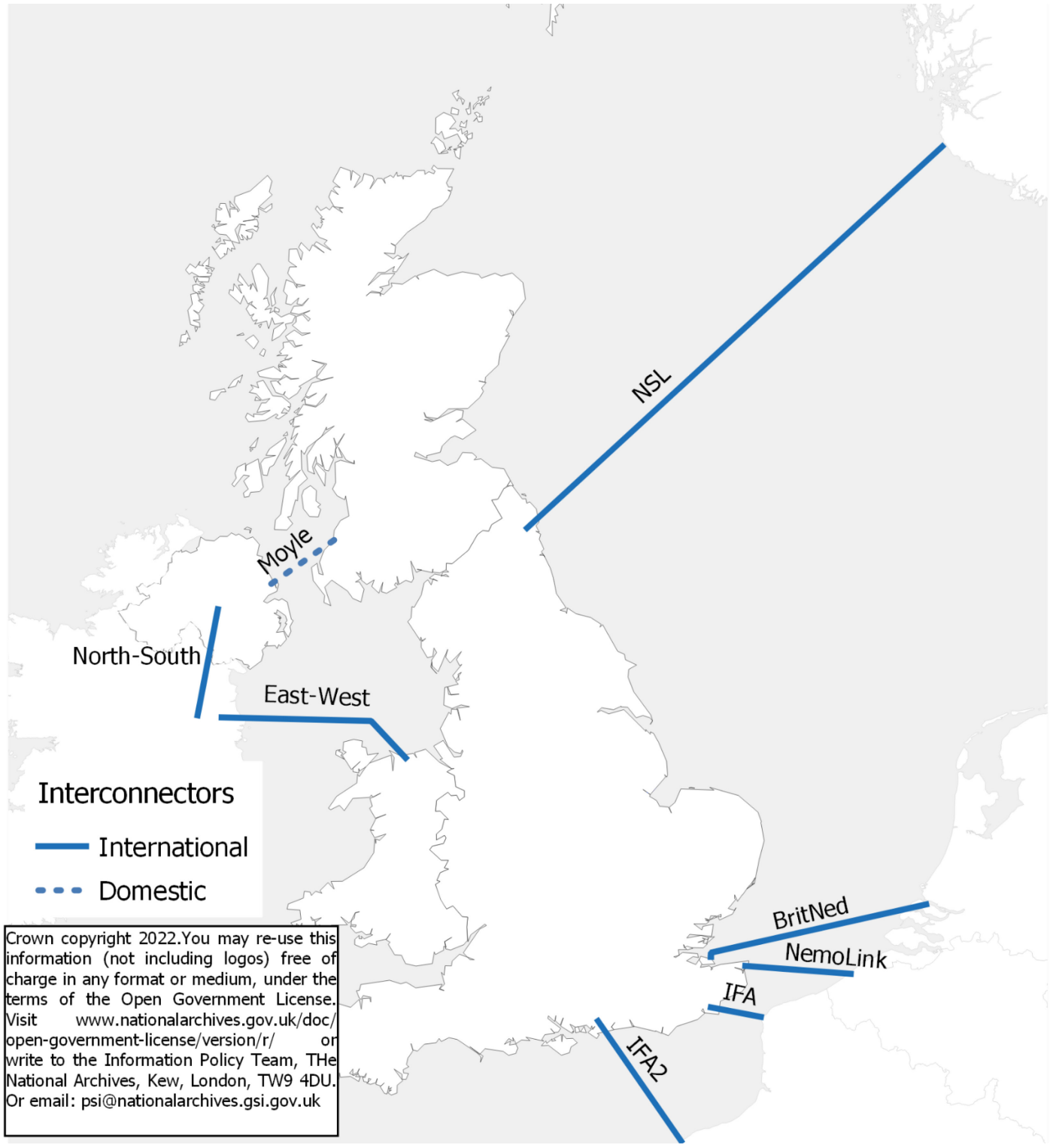
Appendix 1: Interconnector availability

This table collates interconnector asset availability for the interconnectors owned by National Grid and reported in its annual statements. Other interconnectors are outside the scope of the C17 license condition and do not report availability and reliability.

Year	IFA	BritNed	NemoLink
2011	0.598363014	0.671000822	[x]
2012	0.609502732	0.978749454	[x]
2013	0.758839726	0.968475616	[x]
2014	0.913560548	0.960838630	[x]
2015	0.899465479	0.973341370	[x]
2016	0.840430601	0.981328142	[x]
2017	0.919210959	0.979155616	[x]
2018	0.938287671	0.980840274	[x]
2019	0.916775616	0.985394521	0.961602192
2020	0.962880328	0.913892896	0.991674863
Lifetime Average (from 2011 to 2020)	0.835705831	0.963043868	0.976659097

Source: [National Grid ESO, Transmission System Performance Reports]

Appendix 2: UK Electricity interconnector map (correct as of June 2022)



[Note 1] – Interconnectors on this map are a representation only. Cables do not follow these exact paths.

[Note 2] – Moyle is an intra-UK interconnector and trades electricity between the National Grid in Scotland and the Single Electricity Market in Northern Ireland. This article focuses on international trade so excludes internal UK trade over the Moyle interconnector.

[Note 3] – The North-South interconnector is not a traditional interconnector as it is situated within the Single Electricity Market of the island of Ireland, but is treated as an interconnector for this article as it focuses on international trade.

Data for this article

The data used to produce this article can be found in the Digest of UK Energy Statistics (DUKES) chapter 5 and Energy Trends chapter 5 (see references below).

References

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

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

Energy Trends – Electricity (Chapter 5):

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

Energy Trends – Weather (Chapter 7):

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

Energy White Paper: Powering our net zero future

https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

This publication is available from: https://www.gov.uk/government/collections/energy-trends

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