

Diversity and security of gas supply in Europe, 2020

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Key headlines

Europe is a large consumer of natural gas, consuming 541 billion cubic metres (bcm) in 2020. European indigenous production could have met over two fifths of demand in 2020, largely due to substantial production by Norway, one of the largest gas-producing countries globally.

The UK continues to produce large amounts of natural gas; UK indigenous production could have met more than half of demand in 2020. Considering the supply index of European countries, the UK ranked as the third highest scoring country for diversity and security of supply, owing to substantial indigenous production and a diverse range of import sources.

An extensive pipeline network provides the infrastructure for much of the gas trade across Europe. However, in recent years Liquefied Natural Gas (LNG) has come to play an important role in balancing both UK and European gas markets. In 2020, imports met 51 and 58 per cent of European and UK demand respectively.

Introduction

Demand for natural gas is met through supply, which is calculated as indigenous production¹ plus imports. In 2020, indigenous production met 43 and 52 per cent of demand in Europe and the UK respectively. The remainder of supply consisted of natural gas imports, which arrive via pipelines or as shipments of Liquefied Natural Gas (LNG). In 2020, pipeline imports met just over a third of demand in both Europe and the UK, whereas LNG imports met almost a fifth of demand in Europe, and almost a quarter of demand in the UK.

This article assesses the diversity and security of gas supply in Europe and the UK. The data to complete this article was sourced from the International Energy Agency (IEA)², and countries included are those which supply the IEA with natural gas data³. This includes the majority of Europe. European countries without data in the IEA database include Andorra, Kosovo, Liechtenstein, Monaco, San Marino, and Vatican City. Cyprus, Iceland, and Montenegro were excluded from this analysis as they did not produce or consume natural gas in 2020. Given the contribution of Russian gas imports to European demand, Russia has not been included as part of Europe for this analysis. Previous versions of this article used data from the UK and EU member states, other than this the methods used remain the same.

Methods

This article uses three indicators to analyse diversity and security of natural gas supply.

Self-sufficiency: The country's ability to meet its natural gas demand through indigenous production alone. This is calculated by dividing the volume of indigenous production by demand. Countries with a self-sufficiency score of 0 did not produce natural gas. Countries with a score greater than 0 and less than 1 meet some demand through indigenous production and the remainder through imports, making them a net importer of gas. Countries with a score of exactly 1 produced as much gas as used. Countries with a score greater than 1 produced more gas than they used, making them a net exporter of gas. In general, high self-sufficiency means that natural gas supply is secure.

¹ Indigenous production refers to marketable production within national boundaries, including offshore production.

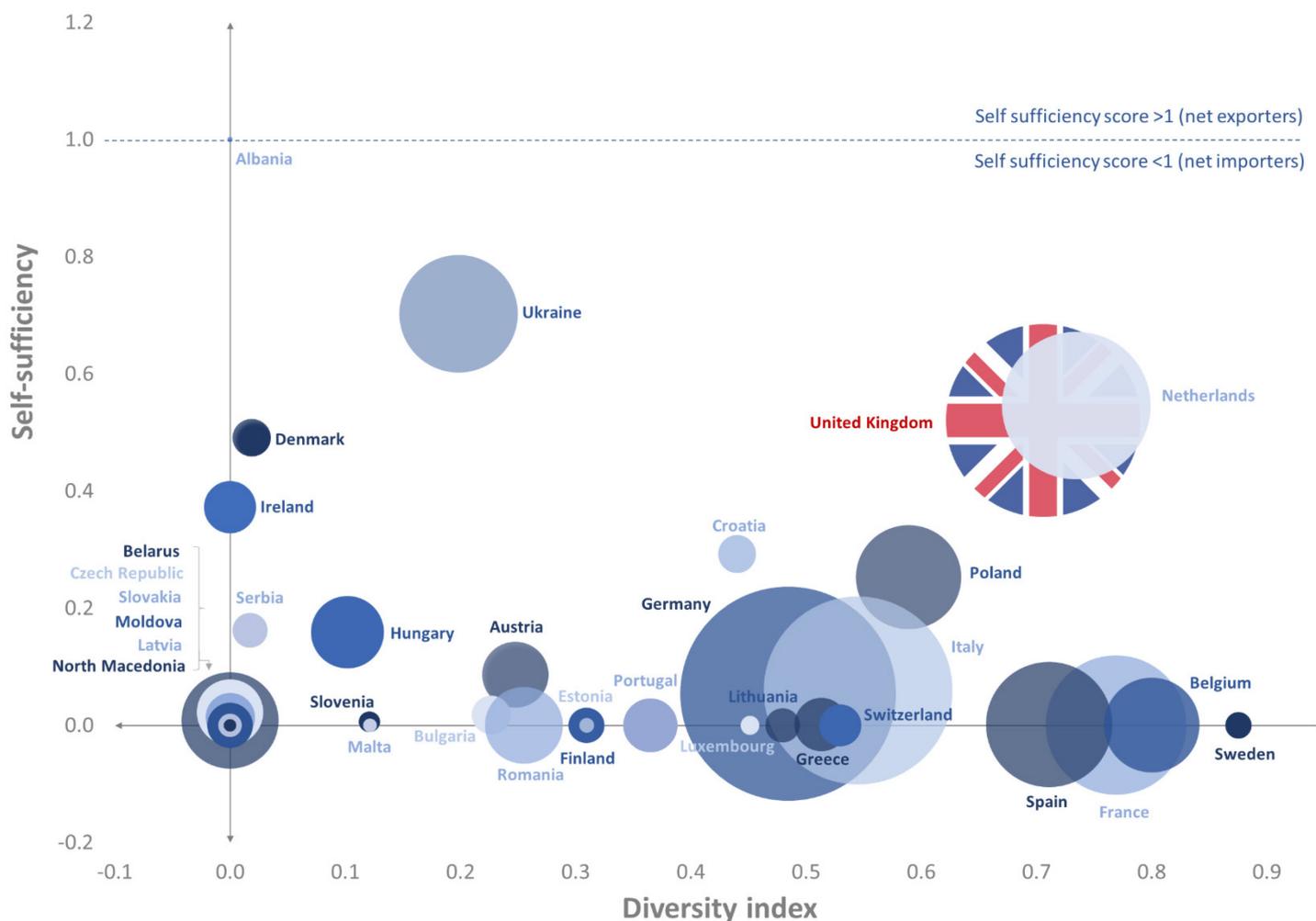
² Data sourced from <http://www.iea.org/data-and-statistics>

³ Requirements for inclusion in the IEA database can be found in the IEA Database Documentation: http://wds.iea.org/wds/pdf/WORLDBAL_Documentation.pdf

Diversity index: The number of import sources for a given country, weighted by each source country's political stability⁴. A country with many import sources of high political stability will have a high diversity index. Conversely, a country with few import sources of low political stability will have a low diversity index. In general, a diverse source of imports means gas supply is more secure. This is further improved if the source countries are politically stable.

Supply index: The sum of a country's self-sufficiency score and diversity index score. This is a simple indication of security of supply. A supply index of 0 indicates that a country has no indigenous production and only one import source.

Chart 1: Self-sufficiency and diversity index of European countries, 2020



Bubble size equates to demand for natural gas, Norway has been excluded from the graph, see Appendix 1 for underlying data.

Chart 1 shows the relationship between a country's self-sufficiency score and diversity index. The size of the bubble equates to each country's demand for natural gas.

In 2020, most countries had a supply index between 0 and 1.5. The only country outside of this range was Norway, which had a supply index of 23.5. This large supply index is a result of its high self-sufficiency score of 22.9, meaning it had high indigenous production relative to consumption. Norway is one of the largest producers of natural gas globally. Due to the difference in scores between Norway and the other European countries, Norway has been excluded from Charts 1 and 2.

⁴ Data sourced from World Bank governance indicators, see Appendix 1 for underlying data and Appendix 2 for method.

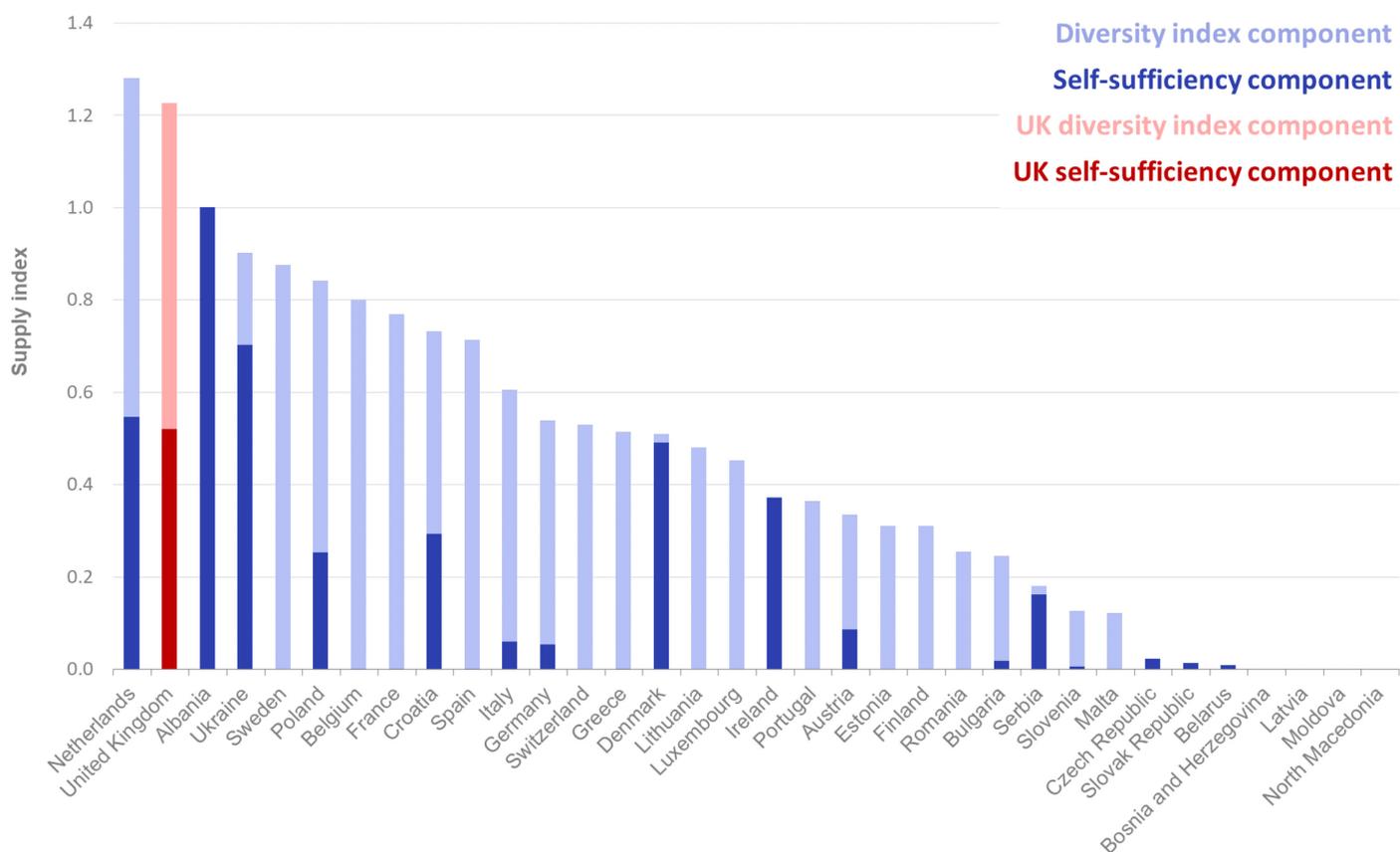
Self-sufficiency

On average, 43 per cent of Europe's demand was met through indigenous production. In 2020, only one European country, Norway, was a net exporter of natural gas. Previously, Denmark has been a net exporter of natural gas, however the temporary closure of Tyra, the country's largest natural gas field, in 2020 led to a large reduction in their indigenous production. In 2020, UK indigenous production could have met just over half of demand with the remainder being met by imports. This has decreased in the last decade, down from the 58 per cent in 2010. The UK has maintained a self-sufficiency score of around 0.5 since 2016.

Diversity index

Countries use imports to meet any shortfall in supply from indigenous production. The UK and other European countries import gas from many sources. In 2020, the UK had a diversity index of 0.71, this is higher than the European average which was 0.32. The UK's high score is due to the receipt of gas from many import sources, some of which are very politically stable. The UK's proportion of total demand from imports has fluctuated between 40 and 60 per cent since 2010.

Chart 2: Supply index of European countries, 2020



Norway has been excluded from the graph, see Appendix 1 for underlying data

Chart 2 shows the supply index for European countries in 2020. The self-sufficiency score and diversity index have been stacked, indicating the relative contribution of these components to the security of supply ranking.

Supply index

Europe had an average supply index of 1.1. The supply index of European countries excluding Norway ranged between 0 and 1.28. The supply index of European countries excluding Norway ranged between 0 and 1.28. The UK ranked in third place with a score of 1.23, behind Norway and the Netherlands.

Bosnia and Herzegovina, Latvia, Moldova, and North Macedonia had no indigenous production and only one import source, so had a supply index of zero.

Import sources: Pipeline and Liquefied Natural Gas (LNG)

In 2020, Europe met 51 per cent of demand through imports. Most imports arrive via pipeline as the infrastructure is well-established, and it is an efficient method of gas transportation. Pipeline infrastructure means it is often convenient to import gas from neighbouring countries. Because of this, Western European countries tend to import gas from Norway whilst central and Eastern European countries import most of their gas from Russia. 28 European countries imported gas from Russia in 2020. It should be noted that Russia acts as a transit country for gas from Kazakhstan and Turkmenistan, so the origin of this gas is not necessarily entirely Russian. For Bosnia and Herzegovina, Latvia, Moldova, and North Macedonia, Russia was their only import source. For all countries excluding the UK, Russian imports are included as reported by the IEA. In the interest of transparency, the proportion of UK imports from Russia have been adjusted to include an estimate for Russian pipeline imports via the Netherlands.

In addition to pipeline imports, gas can be transferred by ship. LNG is natural gas that has been cooled to a liquefied state, making it easier to store and transport. It can then be regasified at import terminals or processing facilities, before being transferred to the pipeline system. The UK has three operational LNG import terminals: Dragon, the Isle of Grain and South Hook. Imports of LNG to the UK and Europe have been increasing since 2018. In 2020, LNG imports met 17 per cent of demand in Europe, and 24 per cent of demand in the UK.

Chart 3: Sources of gas supply for Europe, 2020

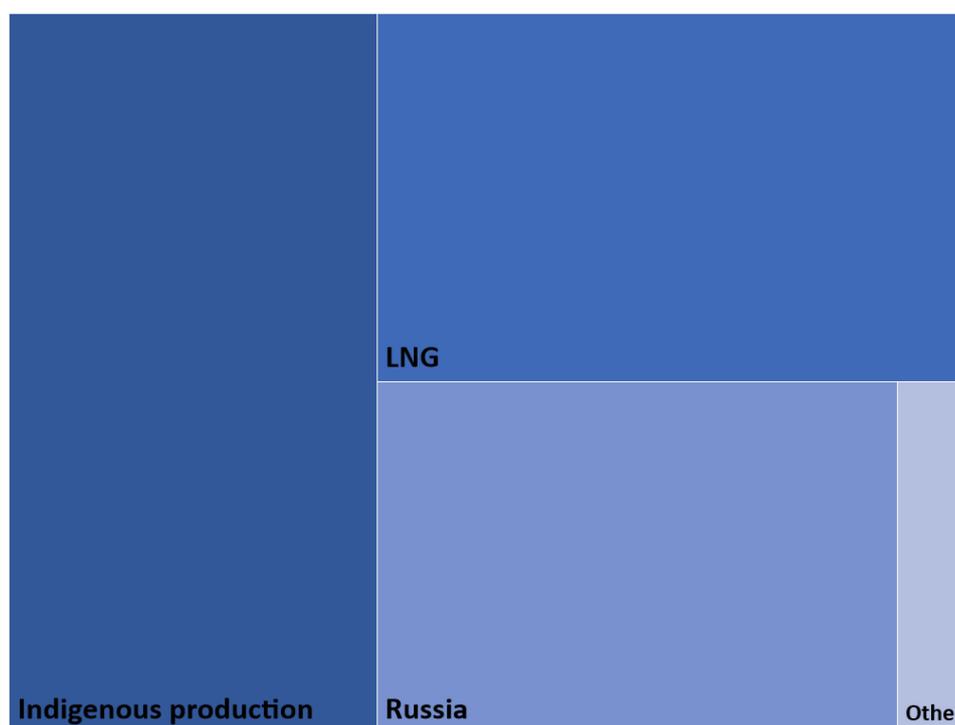


Chart 3 shows the main sources of natural gas for Europe, with sources of supply broken down by country of origin.

When considering European countries together, pipeline imports from Russia were the largest single import source, accounting for 29 per cent of total demand. Small quantities of gas imports have been grouped together as 'Other'; this includes Libya, Turkey, Azerbaijan as well as non-specified imports.

Chart 4: Sources of gas supply for the UK, 2020

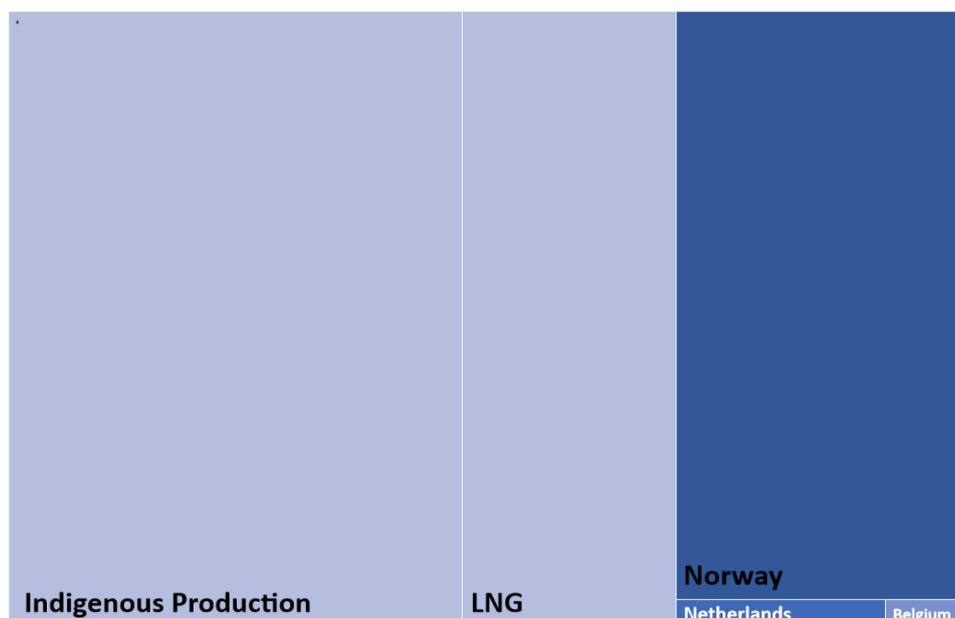


Chart 4 shows the equivalent chart for sources of supply of natural gas to the UK.

The UK receives direct imports via pipeline from Belgium, the Netherlands and Norway. The UK also receives imports as LNG, accounting for 24 per cent of demand in the UK in 2020. This maintains the high levels of LNG imports seen in 2019, and is consistent with trends seen across Europe. The LNG market is one of the fastest growing commodity markets globally. This growth is expected to continue as several prominent commentators are confident in sustained demand in the medium to long term despite the impacts of Covid-19. LNG is analysed in more detail in the special feature article [LNG Trends in Trade](#).

The UK has been historically reliant on pipeline imports due to its proximity to Norway and shared infrastructure in the North Sea. However, fast growth in the LNG market is supported by plans for large infrastructure projects across the world including in North America and Asia, as well as planned expansion in liquefaction capacity in Qatar and Russia.

Chart 5: Sources of European LNG imports, 2020

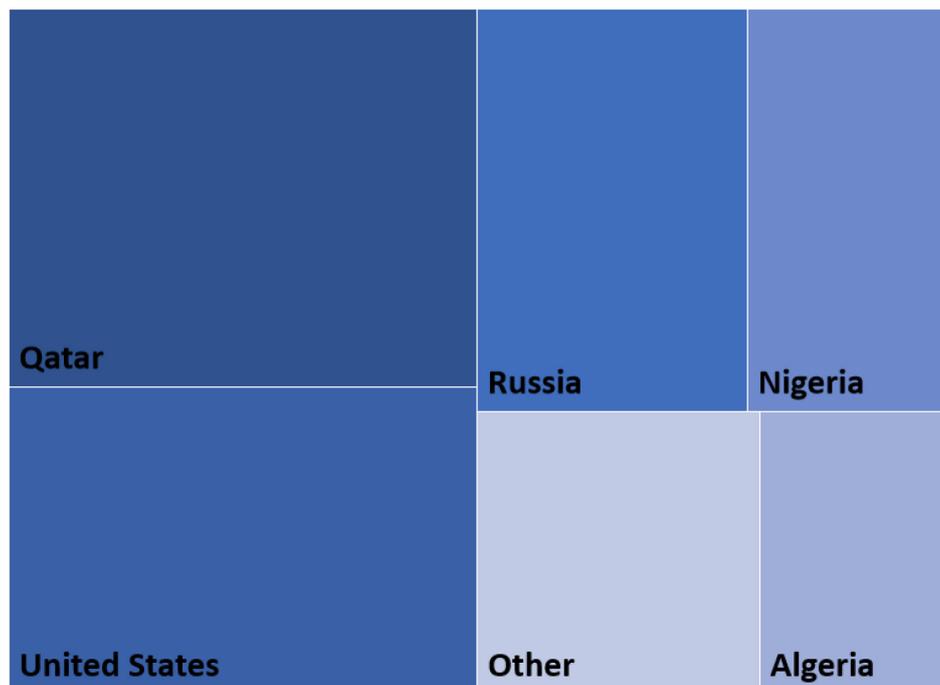


Chart 5 shows the main sources of LNG imports for Europe.

Historically, Qatar has been the largest source of LNG imports for Europe and the UK. In 2020, more than a quarter of LNG cargoes received originated from Qatar. Europe received LNG cargoes from 17 countries. The second largest LNG imports source was the United States. The 12 countries included in 'Other' accounted for 12 per cent of LNG imports (see Appendix 1 for a full list of countries included in 'Other').

Chart 6: Sources of UK LNG imports, 2020



Chart 6 shows the equivalent chart for LNG imports of natural gas to the UK.

Imports of LNG to the UK peaked in 2011 at 25bcm, and 85 per cent of this was from Qatar. In 2020, the Qatari share of LNG imports fell to just under half. The UK received LNG cargoes from 10 countries. In 2020, 27 per cent of total UK LNG imports were from the United States (up from 16 per cent on 2019), and 12 per

cent from Russia. 'Other' included 5 countries and accounted for 5 per cent of LNG imports (see Appendix 1 for a full list of countries included in 'Other').

Map 1 illustrates the diversity of import supply, as well as the complexities of European gas trade. For readers wanting a greater level of detail, the IEA have made available an interactive gas map, based on entry and exit points throughout Europe. This map is available free of charge at: <http://www.iea.org/gtf/>.

Summary

Europe consumed 541 bcm of natural gas in 2020, 43 per cent of this demand could have been met with indigenous production. Comparatively, the UK could have met just over half of demand through indigenous production. When considering the supply index, the UK had the third most secure supply. As well as a comparatively high self-sufficiency score, the UK also had a high number of import sources. Notably, Norway was the largest import source of natural gas in the UK, meeting 32 per cent of UK demand in 2020. Whilst well-established pipeline infrastructure provides a relatively stable supply story for Europe and the UK, LNG provides an increasingly important role in meeting natural gas demand.

Supply of LNG to the UK peaked in 2011 and had been in decline before the sharp growth seen in late 2018. Whereas Qatar has historically been the primary source of LNG supply to the UK and Europe, global liquification capacity is increasing, creating and expanding on new and existing import sources. Historic trends and the current supply mix of UK and European imports of LNG are explored in further detail in the special feature article [LNG Trends in Trade](#).

Appendix 1: Underlying data for charts

Table 1: Underlying data for Chart 1 and Chart 2

Country	Self sufficiency	Diversity index	Supply index	Demand (mcm)
Albania	1.00	0.00	1.00	57
Austria	0.09	0.25	0.33	8,807
Belarus	0.01	0.00	0.01	18,854
Belgium	0.00	0.80	0.80	18,281
Bosnia and Herzegovina	0.00	0.00	0.00	183
Bulgaria	0.02	0.23	0.24	3,020
Croatia	0.29	0.44	0.73	2,904
Czech Republic	0.02	0.00	0.02	8,823
Denmark	0.49	0.02	0.51	2,909
Estonia	0.00	0.31	0.31	436
Finland	0.00	0.31	0.31	2,561
France	0.00	0.77	0.77	39,538
Germany	0.05	0.48	0.54	93,488
Greece	0.00	0.51	0.51	5,834
Hungary	0.16	0.10	0.26	10,608
Ireland	0.37	0.00	0.37	5,477
Italy	0.06	0.55	0.60	71,507
Latvia	0.00	0.00	0.00	1,114
Lithuania	0.00	0.48	0.48	2,369
Luxembourg	0.00	0.45	0.45	709
Malta	0.00	0.12	0.12	378
Netherlands	0.55	0.73	1.28	44,122
Norway	22.90	0.58	23.47	5,062
Poland	0.25	0.59	0.84	22,106
Portugal	0.00	0.36	0.36	5,951
Moldova	0.00	0.00	0.00	4,098
North Macedonia	0.00	0.00	0.00	334
Romania	0.00	0.26	0.26	12,062
Serbia	0.16	0.02	0.18	2,481
Slovak Republic	0.01	0.00	0.01	4,877
Slovenia	0.01	0.12	0.13	903
Spain	0.00	0.71	0.71	32,091
Sweden	0.00	0.88	0.88	1,400
Switzerland	0.00	0.53	0.53	3,520
Ukraine	0.70	0.20	0.90	28,252
United Kingdom	0.52	0.71	1.23	75,568
Average	0.77	0.32	1.09	15019

Source: IEA (<http://data.iea.org/>)

Countries included in 'Other' in Chart 5: Trinidad and Tobago, Equatorial Guinea, Angola, Peru, Egypt, Argentina, Cameroon, Mexico, Gibraltar, South Africa, Ghana, and other sources in Africa.

Countries included in 'Other' in Chart 6: Nigeria, Norway, Egypt, France, and Algeria.

Appendix 2: Methodology

Self-sufficiency

Data for natural gas was extracted from the IEA database. Self-sufficiency was determined from data on indigenous production and demand (indigenous production (mcm) ÷ demand (mcm)).

Diversity index

The diversity index used here is a product of a standard diversity index and an index for political stability. As a basic index for measuring diversity, we used the Shannon-Wiener diversity index:

$$\sum_{i=1}^n -x_i \ln(x_i)$$

Where x is the proportion of total natural gas supply represented by the i^{th} source country and n represents the final source country. A value below 1 signifies a country that is dependent on a small range of import sources, a value above 1 represents a country with a wider range of import sources. The minimum value of zero denotes a country that has one imported fuel source or relies entirely on indigenous production (or a country with no imports). The Shannon-Wiener was chosen here because it places weight on the diversity of contributions from smaller countries and reduces the impact of larger nations.

Political stability was determined using data from the World Bank worldwide governance indicators. Specifically, the index reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. These data were standardised between 0 and 1.

Source: World Bank <http://info.worldbank.org/governance/wqi/index.aspx#home>

Shannon-Wiener and political stability indices were multiplied and summed:

$$\sum_{i=1}^n -x_i \ln(x_i) b_i$$

Where b is an index of political stability of producing country. This is called the SWNI (Shannon-Weiner-Neumann index), in line with previous work. Each SWNI index was normalised between 0 and 1, in order to have a standardised index. This was done by working out a maximum diversity score, by assuming maximum diversity was equivalent to importing products in line with proportional contributions of exporting countries (e.g., if a single country were responsible for exporting 50 per cent of all natural gas, and five other countries were responsible for 10 per cent each, we assumed maximum import diversity at a ratio of 5:1:1:1:1:1). This maximum diversity score then acted as our upper score of 1, with all other scores divided by this maximum to standardise the data.

Other sources of gas

Sometimes, due to a variety of reasons, countries may report an import of natural gas from a “Non-Specified/ Other” source country. In 2020, for Austria, France, Germany, Hungary, Luxembourg and Ukraine at least 5 per cent of imports were reported as Non-Specified/ Other. For Austria and Ukraine, all imports were reported in this way. To reallocate the imports of a non-specified origin we used Border Point Data, which is available at www.iea.org/gtf/. This data is collected by the IEA and shows monthly gas flows in Europe.

Calculation of Russian pipeline flows to the UK

In addition to LNG, the UK imports gas from Russia indirectly through the Netherlands via pipeline. For transparency, the volume of these indirect imports is estimated. In 2020, the UK sourced 2 per cent of its natural gas imports through pipeline from the Netherlands. In turn Russian imports comprised 14 per cent of total supply to the Netherlands. The proportion of Netherlands’ supply from Russia has been applied to UK pipeline imports from the Netherlands.



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