

Diversity and security of gas supply in the EU, 2019

Key headlines

The EU and UK are large consumers of natural gas. In 2019 the EU, including the UK, consumed 496 billion cubic metres (bcm). In 2019 production met nearly one-quarter and one-half of supply for the EU and UK, respectively, with the remainder being met by imports. Pipeline imports made up one-half and one-third of supply for the EU and UK, respectively, with the remainder from imports of Liquefied Natural Gas.

Using a metric to assess diversity of supply we examine the security of supply to each EU country, including the UK, in 2019. The UK ranked as the third highest scoring country in the EU for diversity and security of supply in 2019 owing to our substantial production of gas and range of import supply sources.

Introduction

The EU is a large consumer of natural gas. In 2019, the EU (1) consumed 496 billion cubic metres (bcm). Demand for natural gas is met through indigenous production (2) and trade. The key metric in this article is total supply, which is production plus imports. In 2019, production met 23 and 46 per cent of supply for the EU and UK, respectively. The rest of supply is made up of imports, which can be via pipeline or via shipments of liquefied natural gas (LNG). In 2019, pipeline imports made up 55 and 33 per cent of supply for the EU and UK, respectively. Imports of LNG have increased in recent years; in 2019, LNG made up 22 and 21 per cent of supply for the EU and UK, respectively.

Using statistics from the International Energy Agency (IEA) (3) This article updates a long running series that compares the security of gas supply in the UK with that of neighbouring countries in the EU. Although the UK has now left the EU the comparisons remain illustrative and we will look to widen our comparisons beyond the EU going forward.

Methods

Three indicators were used to analyse the diversity and security of natural gas supply in this article.

Self-sufficiency

Self-sufficiency is a country's ability to meet its natural gas demand through indigenous production alone. It 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 must meet some demand through imports; countries with a score of 1 produced as much gas as used; and countries with a score greater than 1 produced more gas than they used so are likely net exporters. In general, high self-sufficiency means natural gas supply is secure.

1. EU-27 + 1 (2019 data). Following the UK's departure from the EU the method for this article will be reviewed ahead of publication in 2021 for 2020 data.

2. Marketable production within national boundaries, including offshore production.

3. www.iea.org/data-and-statistics

4. World bank governance indicators, see Appendix 1 for underlying data and Appendix 2 for method.

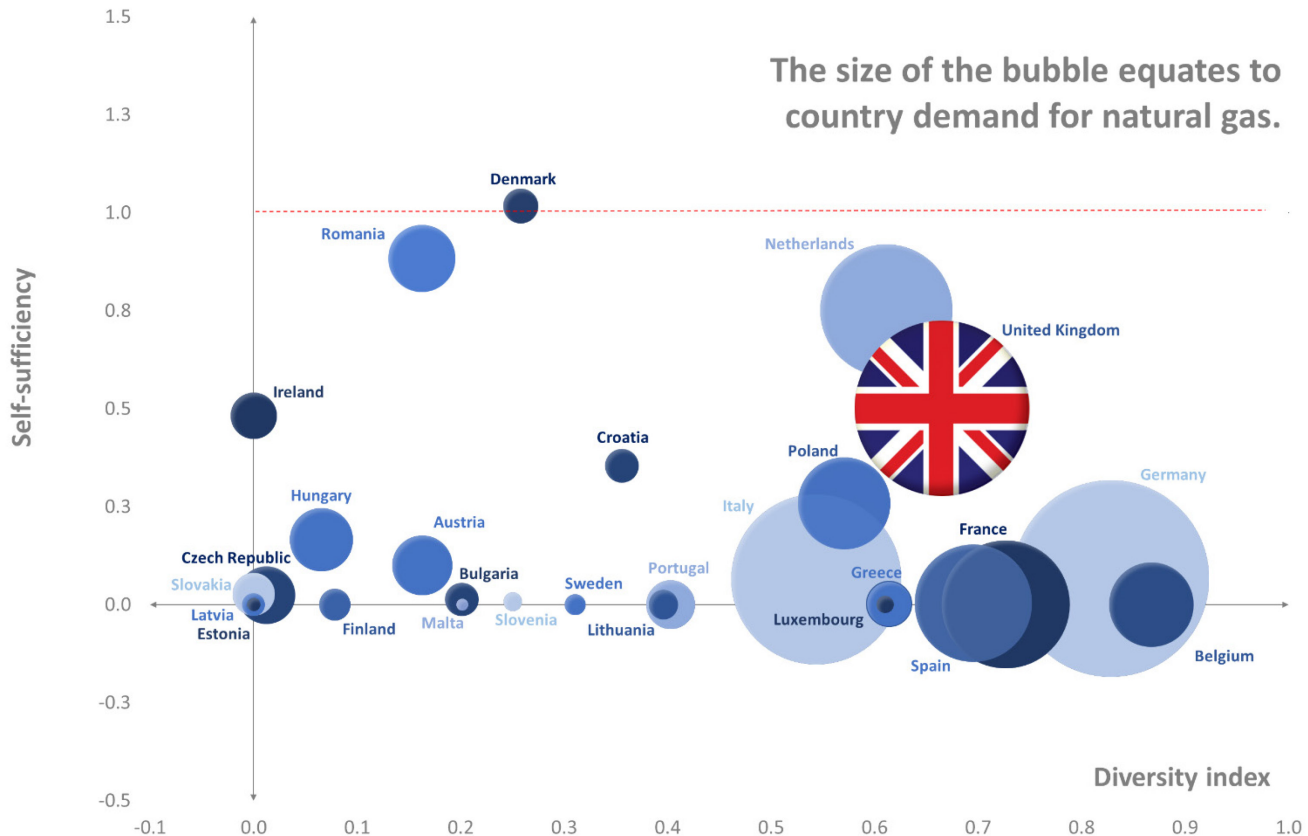
Diversity index

Diversity is used to describe the number of import sources of a given country. This is used along with the political stability (4) of the source country to provide a weighted metric of diversity. This means that a country with many import sources of high political stability will have a high diversity index. Conversely few import sources of low political stability results in 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 supply index combines the self-sufficiency score and diversity index. It is a simple indication of security of supply. A supply index of zero indicates that a country has no indigenous production and only one import source.

Chart 1: Self-sufficiency and diversity index for EU countries, 2019



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 indicates each country's demand.

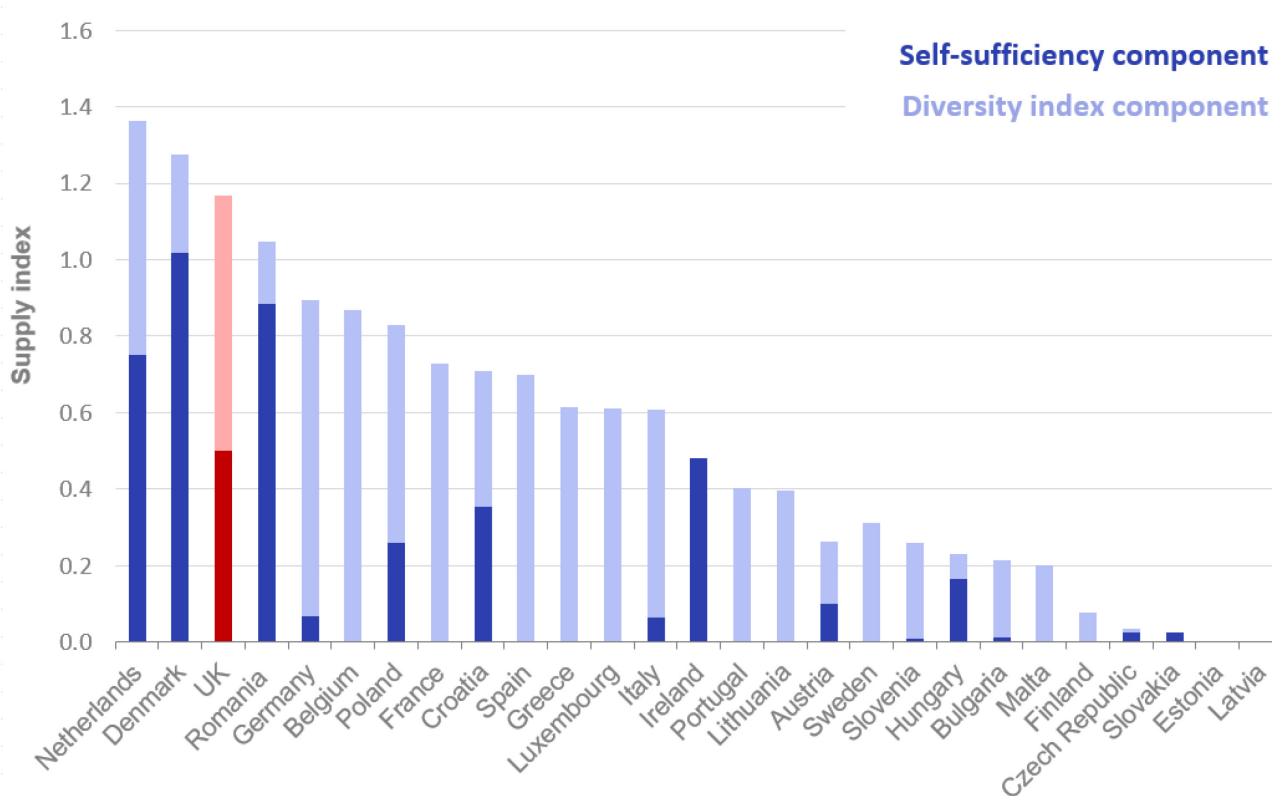
Self sufficiency

On average, 17 per cent of EU demand was met through indigenous production. In 2019, of the EU countries Denmark was the only net exporter of natural gas, exporting to Sweden, the Netherlands, Germany, and Italy via pipeline. All other countries met demand through imports, other than Cyprus which has no natural gas demand and therefore has not been included. Indigenous production met half of UK demand in 2019. This has decreased in the last 10 years, down from two-thirds in 2009. The UK has maintained a self-sufficiency score of around one half since 2016.

Diversity index

To meet the shortfall in supply, the EU and UK import gas from a variety of sources. In 2019, the UK had a diversity index of 0.67, higher than the EU average of 0.34. This high score is because the UK has a high number of import sources, with some high political stability scores. The UK's proportion of total supply from imports has fluctuated between 40 and 60 per cent since 2009. It settled at just over 50 per cent in 2014 and has remained there since; in 2019 imports accounted for 54 per cent of total UK supply of gas.

Chart 2: Supply index of EU countries, 2019



See Appendix 1 for underlying data

Chart 2 shows the supply index for EU countries in 2019. 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

The EU had an average supply index of 0.51. The Netherlands had the highest score at 1.36 and the UK ranked in third place with a score of 1.17, behind Denmark. Estonia and Latvia had no indigenous production and only one import source so have a supply index of zero.

Import Sources: Pipeline and LNG

In 2019, the EU met 77 per cent of supply through imports. Most imports arrive via pipeline because the infrastructure is well-established, and this is a cost-effective way of transporting gas. Pipeline infrastructure means it is often convenient to import gas from neighbouring countries. Therefore, Central and Eastern European countries receive most of their gas imports from Russia. Russia acts as a transit country for gas from Kazakhstan and Turkmenistan, so it should be noted that the origin of this gas is not necessarily all Russian. Twenty EU countries imported gas from Russia in 2019. For Estonia, Latvia and Slovakia, Russia was the only import source.

LNG is natural gas that has been cooled to a liquefied state, making it easier to store and transport. It can then be re-gasified at import terminals or processing facilities before being transferred to the pipeline system. The UK has three LNG import terminals, the Isle of Grain, South Hook and Dragon. Following several years of decline, imports of LNG to the EU and UK have been increasing since 2018 and this trend continued in 2019 when LNG imports to the EU met 22 per cent of supply in 2019 compared to 10 per cent in 2018. For the UK this was 9 per cent of supply in 2018 compared to 21 in 2019.

Chart 3: Sources of gas supply for the EU, 2019

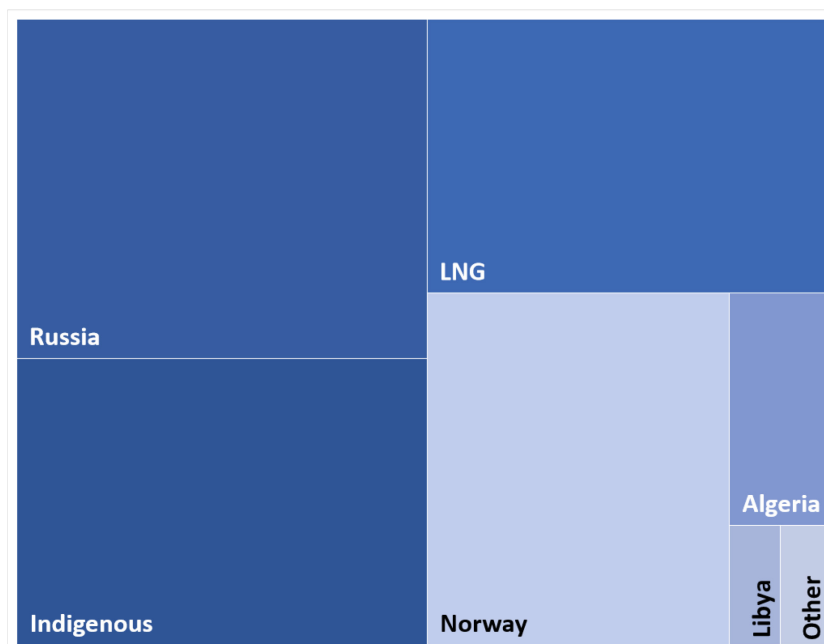


Chart 3 shows the main sources of natural gas for the EU, with pipeline imports broken down by country of origin. When considering EU countries together, imports from Russia were the largest single source, accounting for 27 per cent of supply. Small quantities of gas imports have been grouped together as 'Other'; this includes Ukraine, Turkey, and Switzerland, as well as Non-specified/ Other.

Chart 4: Direct sources of gas supply for the UK, 2019

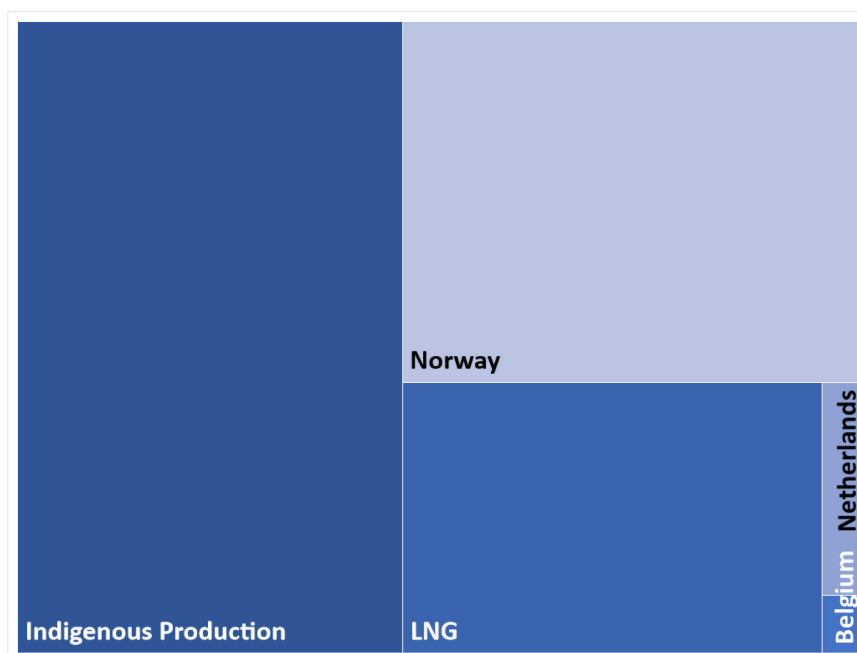


Chart 4 shows for the UK the largest single source of natural gas was indigenous production. This was followed by pipeline imports from Norway which accounted for 31 per cent of supply. This is largely because of the UK's proximity to Norway and shared infrastructure in the North Sea. Norway has a high political stability rating; therefore, these imports are beneficial to the UK's diversity index. The UK imports natural gas from Russia indirectly via the Netherlands and Belgium. The UK receives very small quantities of gas from Russia via pipeline (the central estimate for this is 0.3 per cent of supply but see Appendix 2 for detailed methodology).

Map 1 illustrates the diversity of import supply, as well as the complexities of inter-EU 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: www.iea.org/gtff/.

Map 1: Physical gas flows in Europe, 2019

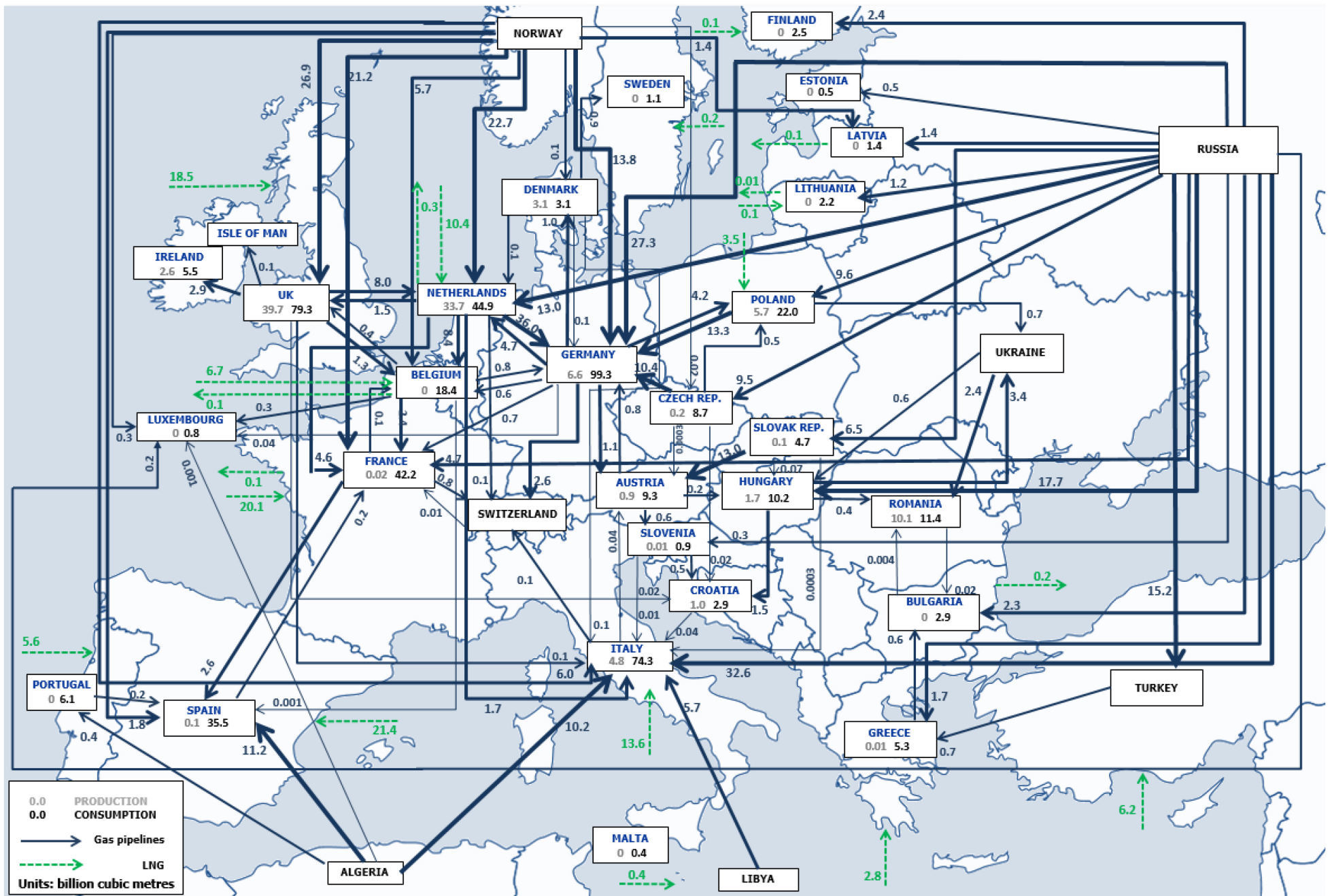


Chart 5: Sources of EU LNG imports, 2019

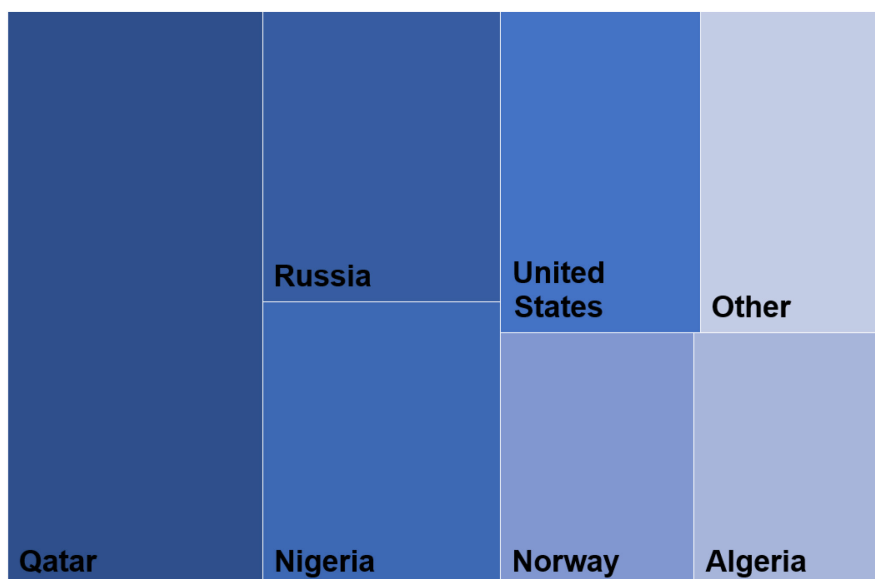


Chart 5 shows the main sources of LNG Imports for the EU. Historically, Qatar has been the largest source of LNG imports for the EU and UK. For the EU, the share of total LNG imports from Qatar has fallen to 29 per cent in 2019 compared to 50 per cent in 2011. The EU received LNG cargoes from more than 20 countries. The second largest LNG imports sources were Russia and Nigeria, each accounting for 14 per cent. The 13 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, 2019

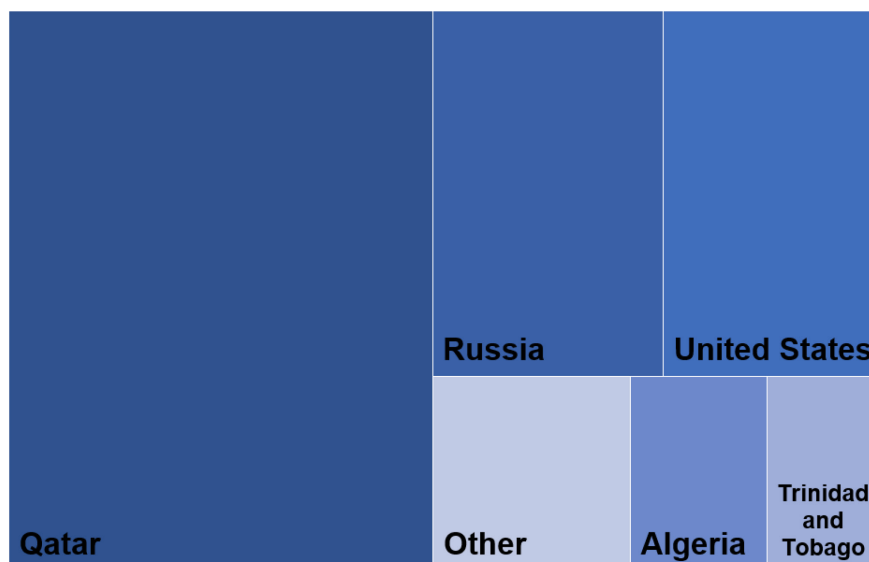


Chart 6 shows the main sources of LNG imports for the UK. Imports of LNG to the UK peaked in 2011 at 25 bcm, and 85 per cent of this was from Qatar. In 2019, the Qatari share of LNG has fallen to just under half. The UK received LNG cargoes from 12 countries. In 2019, 17 per cent of total UK LNG imports were from Russia, with 16 per cent from the United States (up from 6 per cent in 2018). 'Other' included three countries that were new from 2018; Nigeria, Angola, and Cameroon (see Appendix 1 for a full list of countries included in 'Other').

In recent years, the number of LNG import sources has increased as several new LNG projects have come onstream globally. This growth in the global LNG market 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. Large projects are planned across the world including in North America, East Africa, and Asia, in addition to planned expansion in liquefaction capacity in Qatar and Russia.

In 2019, LNG made up roughly a fifth of supply to both the EU and UK, up from approximately 10 per cent in 2018. The growth in European LNG imports from 2018 is largely attributable to market effects. Increasing supply in conjunction with weaker than expected global LNG demand growth saw an oversupplied market. Europe and the UK have competitive and liquid gas markets enabling them to absorb the excess. LNG is analysed in more detail in the special feature article [LNG Trends in Trade](#) which is due to be updated in March 2021.

Chart 7: Sources of EU and UK supply, 2019

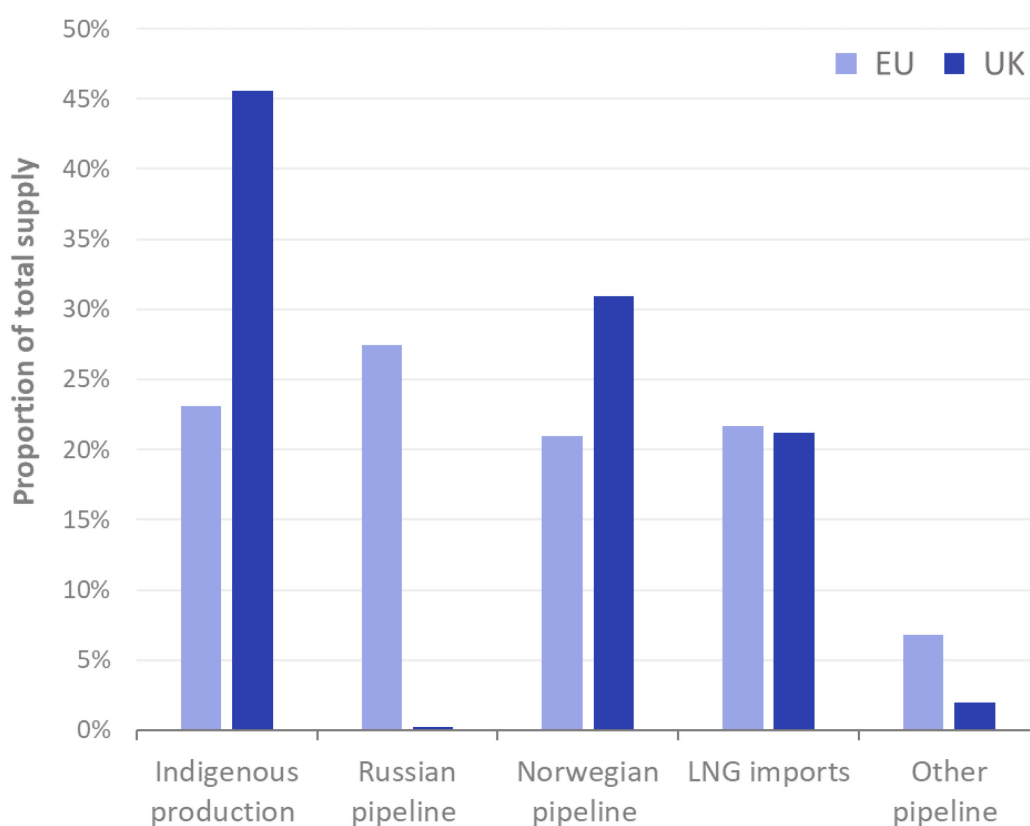


Chart 7 compares gas supply from key sources. The share of supply met by production in the UK is more than double that of the EU total, and the UK imports most of its gas through pipelines from Norway. However, for both the EU and UK, imports of LNG are becoming increasingly important. In 2019, LNG imports made up roughly a fifth of total supply, as shown in Chart 7.

Summary

The EU consumed 496 bcm of natural gas in 2019. One-fifth of this demand was met with indigenous production. Comparatively, the UK met half of its demand through indigenous production. When considering the supply index, the UK had the third most secure supply of EU countries. As well as the comparatively high self-sufficiency score, the UK also had a high number of import sources, many of which have high political stability ratings. These countries include Norway, which provided 31 per cent of all UK natural gas supply. A third of UK supply was met through pipeline imports. Whilst the well-established pipeline infrastructure provides a relatively stable supply story for the EU and UK, LNG provides an increasingly important role in meeting EU and UK 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 EU, global capacity is rapidly increasing, providing a greater number of import sources. Historic trends and the current supply mix of UK and EU imports of LNG are explored in further detail in the special feature article [LNG Trend in Trade](#) which is due to be updated in March 2021.

Appendices

Appendix 1: Underlying data for Chart 1 and Chart 2, 2019

EU Country	Self-sufficiency	Diversity Index	Supply Index	Demand (mcm)
Austria	0.10	0.16	0.26	929
Belgium	0.00	0.87	0.87	0
Bulgaria	0.01	0.20	0.21	39
Croatia	0.35	0.36	0.71	1,029
Cyprus	0.00	0.00	0.00	0
Czech Republic	0.02	0.01	0.04	209
Denmark	1.02	0.26	1.28	3,133
Estonia	0.00	0.00	0.00	0
Finland	0.00	0.08	0.08	0
France	0.00	0.73	0.73	16
Germany	0.07	0.83	0.90	6,612
Greece	0.00	0.61	0.62	9
Hungary	0.17	0.07	0.23	1,700
Ireland	0.48	0.00	0.48	2,647
Italy	0.06	0.54	0.61	4,800
Latvia	0.00	0.00	0.00	0
Lithuania	0.00	0.40	0.40	0
Luxembourg	0.00	0.61	0.61	0
Malta	0.00	0.20	0.20	0
Netherlands	0.75	0.61	1.36	33,704
Poland	0.26	0.57	0.83	5,669
Portugal	0.00	0.40	0.40	0
Romania	0.88	0.16	1.05	10,062
Slovakia	0.03	0.00	0.03	124
Slovenia	0.01	0.25	0.26	7
Spain	0.00	0.70	0.70	134
Sweden	0.00	0.31	0.31	0
UK	0.50	0.67	1.17	39,689
EU average	0.17	0.34	0.51	3,947

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

Countries included in 'Other' in Chart 5: EU 'Other' includes Trinidad and Tobago, Egypt, Peru, Angola, Equatorial Guinea, Netherlands, Cameroon, Latvia, France, Belgium, Saudi Arabia, Gibraltar and Lithuania (listed in order of volume imported)

Countries included in 'Other' in Chart 6: UK 'Other' includes Nigeria, Norway, Peru, Equatorial Guinea, Angola, Cameroon and the Netherlands. For a full breakdown see Energy Trends Table 4.4

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 indices

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/wgi/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, 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 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 2019, for Austria, France, Germany, Hungary, Luxembourg, Romania and Sweden at least 5 per cent of imports were reported as Non-Specified/ Other. For Austria and Romania, 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 and Belgium via pipeline. For transparency, the volume of these indirect imports is estimated. In 2019, the UK sourced 3.5 per cent of its natural gas imports through pipeline from the Netherlands and 0.8 per cent from Belgium. In turn Russian imports comprised 14 per cent of total supply to the Netherlands and 7.1 per cent to Belgium. The proportion of Netherlands' and Belgium's supply from Russia has been applied to UK pipeline imports from the Netherlands and Belgium to derive the UK share of indirect pipeline imports from Russia.



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