

## Diversity and security of gas supply in the EU, 2018

### Introduction

The EU is a large consumer of natural gas. In 2018, the EU consumed 480 bcm of natural gas. Demand for natural gas is met through indigenous production<sup>1</sup> and trade. In 2018, one quarter (120 bcm) of EU demand was met through indigenous production, the remainder was imported. Approximately 90 per cent of EU imports arrive via pipelines; however, imports of Liquefied Natural Gas (LNG) are increasingly important.

Using International Energy Agency (IEA) Statistics<sup>2</sup> this article assesses the diversity and security of gas supply in the EU and the UK. It provides comparative analysis of the UK compared to other EU countries.

### Methods

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

#### Self-sufficiency score

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. If a country has a self-sufficiency score of 1 it produced as much gas as it used. A value below 1 means a country must meet demand at least partially through imports. A value above 1 means a country can meet more than its own demand through production and is therefore a net exporter. In general, high self-sufficiency means natural gas supply is more secure.

#### Diversity index

Diversity is used to describe the number of import sources of a given country. This is combined with the political stability<sup>3</sup> 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.

### Security of gas supply for EU countries, 2018

The EU had an average security index of 0.57. Denmark had the highest score at 1.75, and the UK ranked in third place with a score of 1.26, behind the Netherlands. Estonia and Latvia had a supply index of zero indicating they had no indigenous production and one import source, which was Russia.

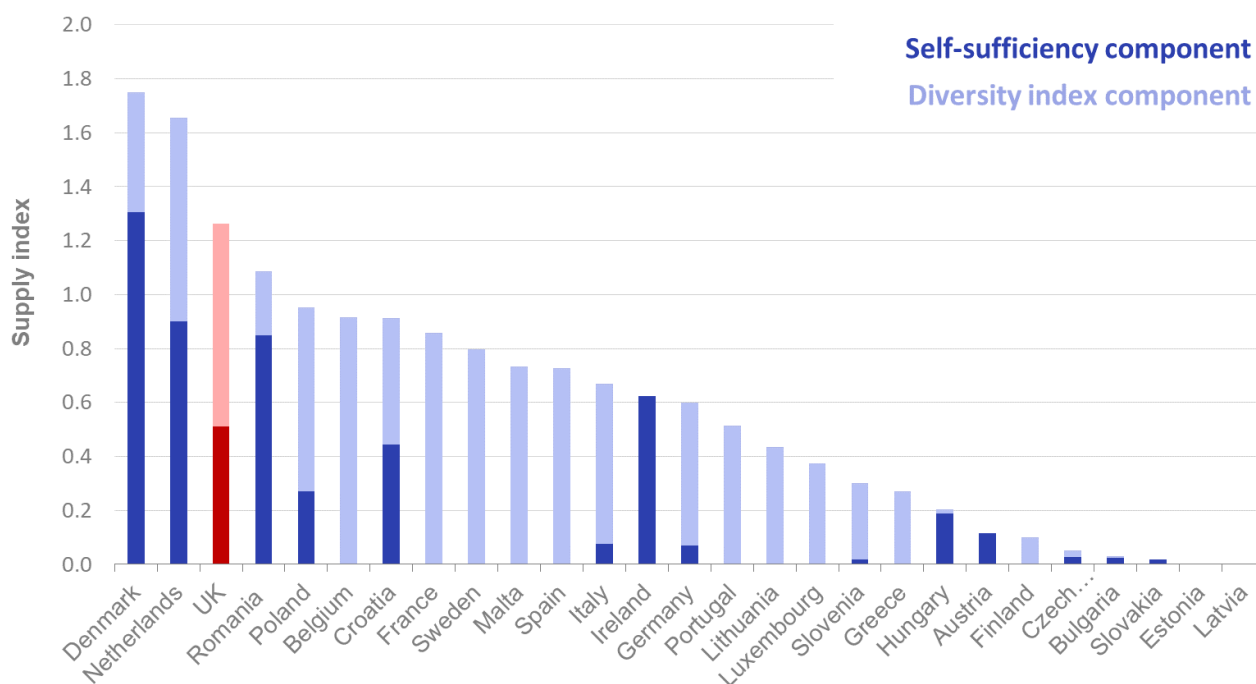
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<sup>1</sup> Marketable production within national boundaries, including offshore production

<sup>2</sup> [www.iea.org/data-and-statistics](http://www.iea.org/data-and-statistics)

<sup>3</sup> World bank governance indicators, see Appendix 1 for underlying data and Appendix 2 for method

**Chart 1: Supply index as a proportion of demand for EU countries, 2018**



See Appendix 1 for underlying data

Chart 1 shows the supply index for EU countries in 2018. The self-sufficiency score and diversity index have been stacked, indicating the relative contribution of these components to the security of supply rankings.

Indigenous production met one half of UK demand 2018. This has decreased over the last 10 years, down from two-thirds in 2008. The UK has maintained a self-sufficiency score of around one-half since 2016. As an average, one-quarter of EU demand was met through production.

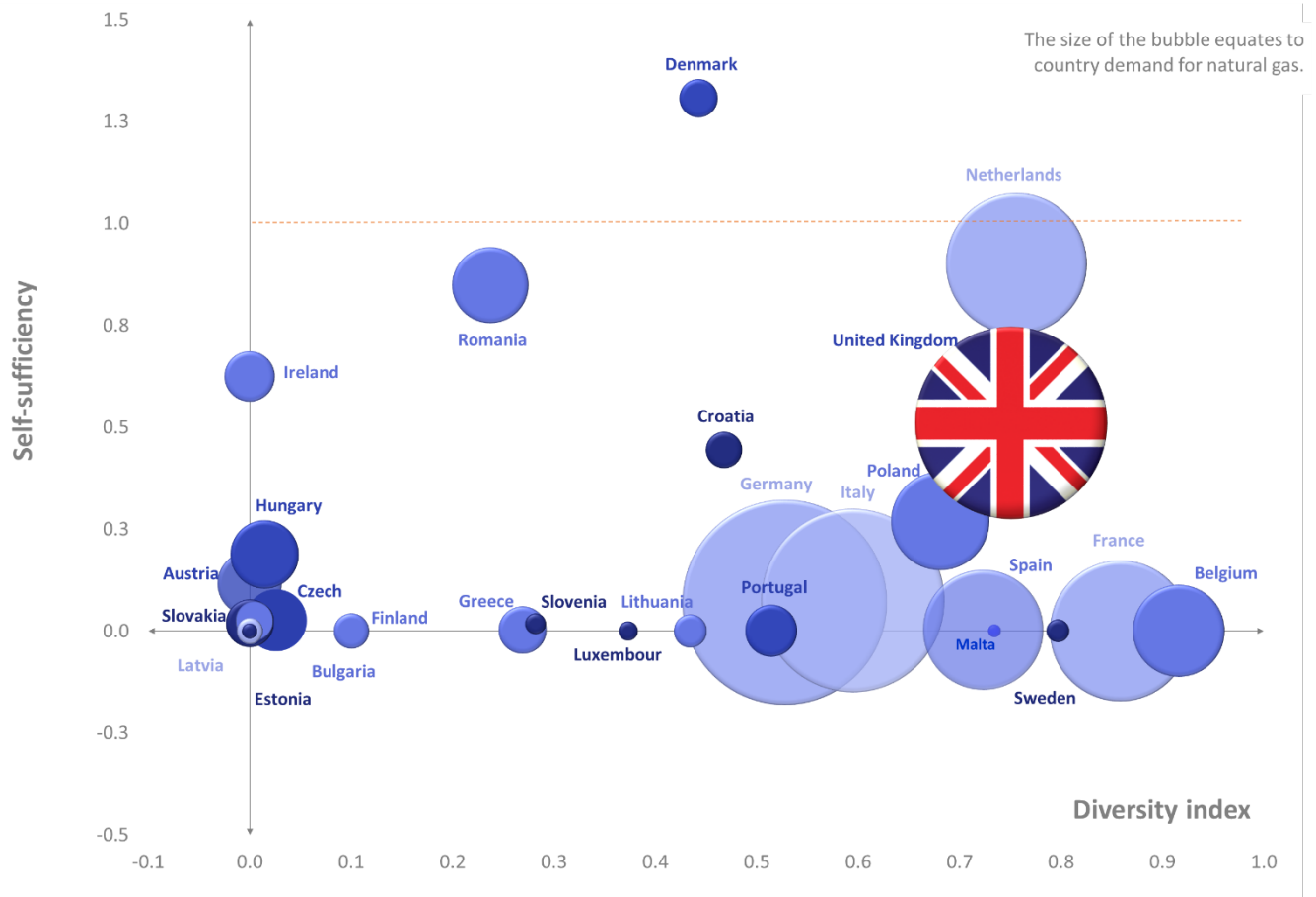
To meet the shortfall in supply the EU and UK import gas from a variety of sources. The UK's proportion of total supply<sup>4</sup> from imports has been broadly stable over the last 10 years, fluctuating between 40 and 60 per cent since 2009. This settled to just over 50 per cent in 2014 and has remained there since; in 2018 imports comprised 54 per cent of total UK supply of gas.

### Diversity of gas supply for EU countries, 2018

In 2018, the UK had a diversity index of 0.75, higher than the EU average of 0.32. This high score is because the UK has high number of import sources, some of which are very politically stable. The UK also has a high self-sufficiency score; one half of supply was met by indigenous production. On average one-fifth of EU supply is met though indigenous production. Denmark was the only EU country which was a net exporter of natural gas; exporting to the Netherlands, Italy and Sweden via pipeline. All other countries met demand through imports.

<sup>4</sup> Production plus imports

**Chart 2: Demand, self-sufficiency and diversity index for EU countries, 2018**



See Appendix 1 for underlying data

Chart 2 shows the relationship between a country’s demand, self-sufficiency score, and diversity index. The size of the bubble indicates each country’s demand. Cyprus has no natural gas demand and therefore no need for indigenous production or imports.

### Import sources of EU and UK gas

In 2018, the EU met 80 per cent of supply through imports; for the UK this was 54 per cent. 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. Nineteen EU countries imported gas from Russia. For Estonia, Latvia and Slovakia, Russia was the only import source. Approximately, 10 per cent of imports are sourced through pipelines from Northern Africa.

**Chart 3: Sources of gas imports for the EU and UK, 2018**

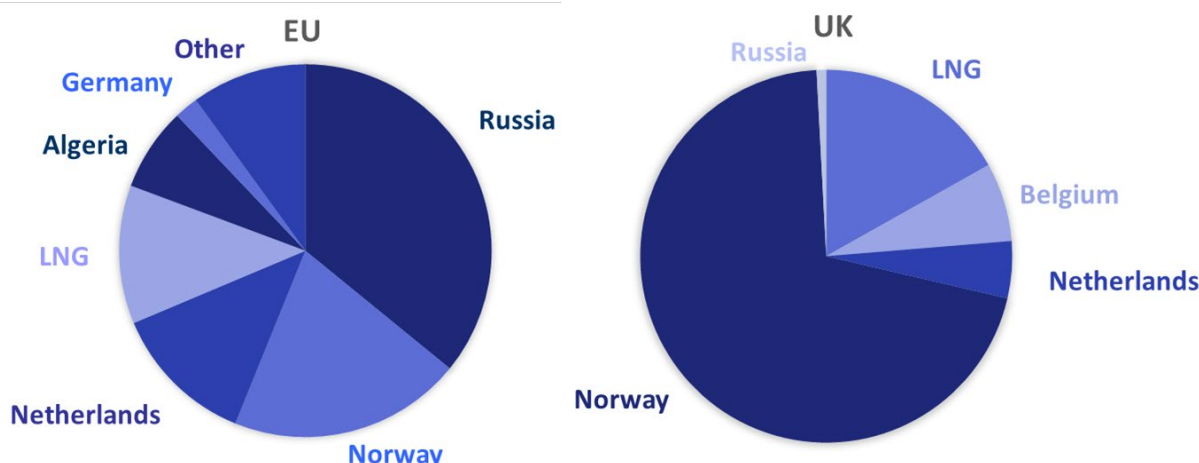


Chart 3 shows the main import sources of natural gas for the EU and UK. When considering EU countries together, imports from Russia were the largest source of supply of natural gas. The UK received 0.8 per cent of imports from Russia via pipeline indirectly through the Netherlands<sup>5</sup> and a further 3.2 per cent as LNG, together accounting for 1.7 per cent of total UK supply.

For the UK, the largest source of supply of natural gas was indigenous production, followed by imports from Norway. This is largely because of the UK's proximity to Norway and shared infrastructure in the North Sea. Norway has one of the highest political stability ratings of all countries, therefore these imports are beneficial to the UK's diversity index. In 2018 the EU and UK received 9.6 and 9.0 per cent of imports via LNG shipments respectively (see Liquefied Natural Gas section).

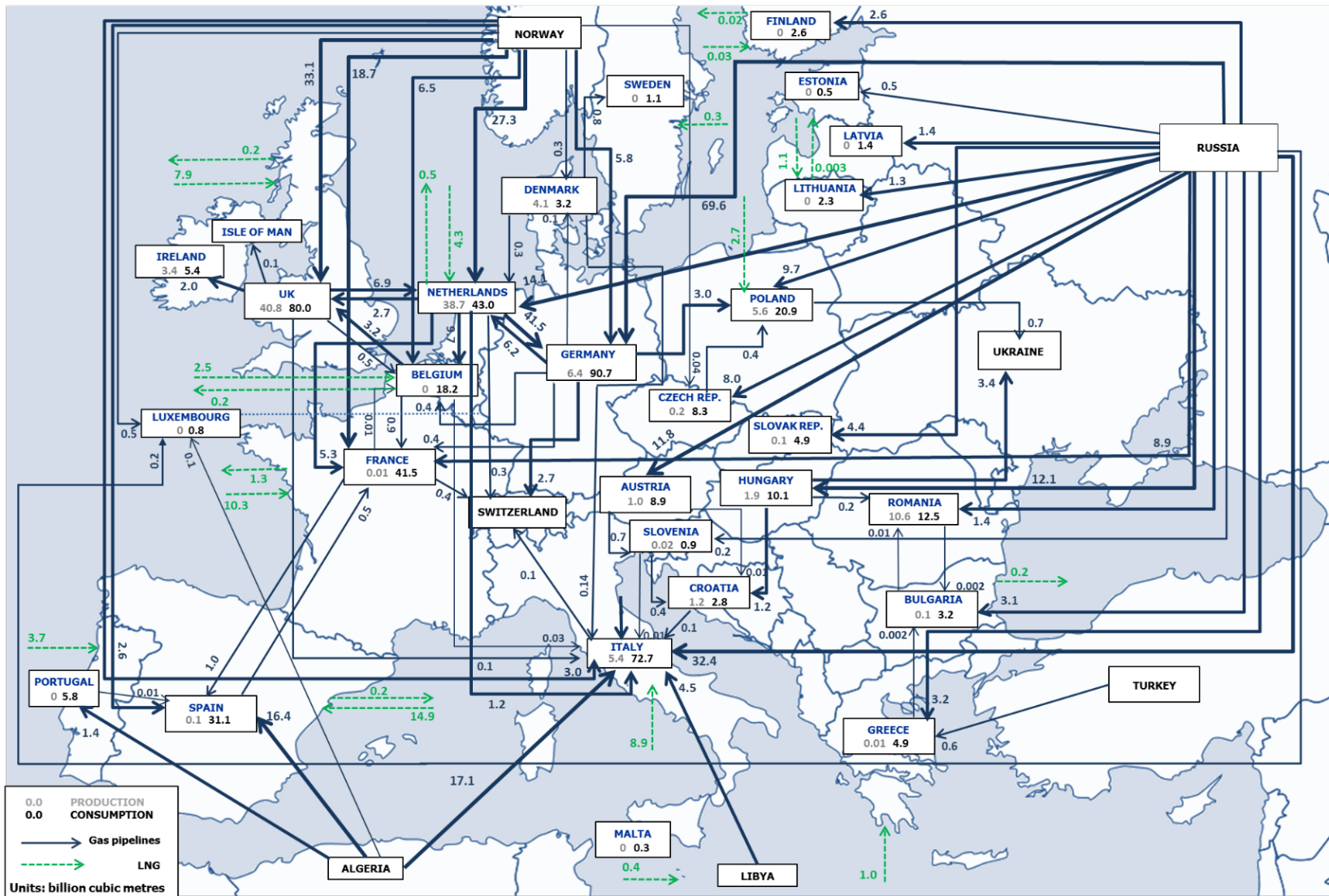
In Chart 3 small quantities of gas imports have been grouped together as 'other'; this includes 16 countries<sup>6</sup>. Chart 3 shows the diversity of imports into the EU. Map 1 also reflects this diversity of supply, as well as the complexities of inter-EU gas trade.

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/gtf/](http://www.iea.org/gtf/).

<sup>5</sup> Central point estimate see Appendix 2 for method

<sup>6</sup> United Kingdom, Libya, Belgium, Hungary, Denmark, France, Austria, Turkey, Spain, Slovenia, Czech Republic, Croatia, Portugal, Bulgaria, Romania, Greece (listed in order of volume imported)

Map 1: Physical gas flows in Europe



## Liquefied Natural Gas

Liquefied Natural Gas (LNG) is natural gas that has been cooled to a liquefied state, making it easier to store and transport – usually by ship. It can then be regasified 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.

Historically, Qatar has been the largest source of LNG imports for the UK and EU. In 2011, UK imports of LNG reached a peak at 25 bcm and formed 25 per cent of total supply (and 46 per cent of imports). Nearly all (97 per cent) of this was from Qatar.

However, in recent years the number of LNG projects coming onstream has increased rapidly, increasing the number of import sources. Following a sharp increase in US production, LNG imports from the US to EU countries increased in 2018. The increased diversification of supply sources of LNG is expected to continue. Large projects are planned, including the expansion of LNG production in Qatar and new projects planned in the US, Canada and Russia.

**Chart 4: sources of EU and UK LNG imports, 2018<sup>7</sup>**

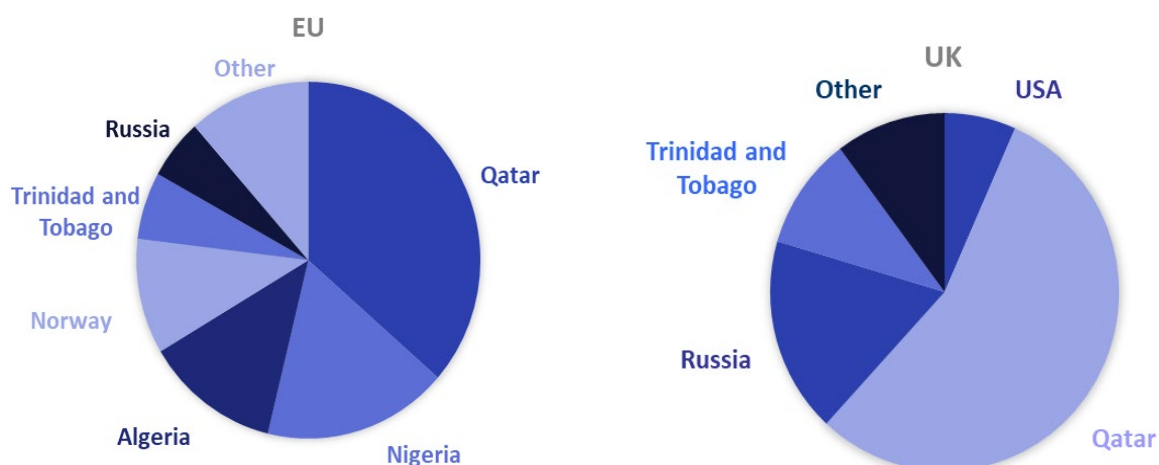


Chart 4 shows the proportion of LNG imports from different countries for the EU and UK. While Qatar remains a major supplier, in 2018 the EU received LNG cargoes from more than 20 countries and the UK from 10 countries. The Qatari share of LNG has fallen to just over a third for the EU and to just over half for the UK.

Following several years of decline, imports increased in 2018. Interestingly half of all LNG imports for the year arrived in the final quarter of 2018. This was partially because the long-term contract on the UK-Belgium interconnector ended in October, which reduced pipeline flows. In addition, the global LNG market was well-supplied as new projects came onstream and low LNG demand growth was seen in Asia. As a result, global LNG prices fell, and excess LNG was available to other markets including Europe. Recent trends in LNG supply will be explored in a special gas article due to be published in Energy Trends in March 2020.

<sup>7</sup> EU 'Other' includes the US, Peru, Angola, Egypt, Equatorial Guinea, Cameroon, Bulgaria, Belgium, Netherlands, France, Finland, South Africa, Lithuania and Spain

UK 'Other' includes Egypt, Guinea, Norway, Peru, US and Algeria. For a full breakdown see Energy Trends Table 4.4

## **Summary**

The EU consumed 480 bcm of natural gas in 2018. One quarter of this demand was met with indigenous production. Comparatively the UK met half of its demand through indigenous production compared to two-thirds 10 years ago. 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 78 per cent of all UK natural gas imports. Nearly half (44 per cent) 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, developments in LNG capacity are expected to continue to grow.

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 and Qatar has been losing share as new projects come onstream. UK supply of LNG from Qatar had fallen from 97 per cent in 2011 to 55 per cent in 2018. Historic trends and the current supply mix of UK and EU imports of LNG will be explored in further detail in a special feature in Energy Trends March 2020.

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## Appendices

## Appendix 1: underlying data for chart 1 and chart 2, 2018

EU Country	Self sufficiency	Diversity Component	Supply index	Demand (mcm)
Austria	0.12	0.00	0.12	8,921
Belgium	0.00	0.92	0.92	18,178
Bulgaria	0.03	0.00	0.03	3,187
Croatia	0.44	0.47	0.91	2,771
Cyprus	0.00	0.00	0.00	0
Czech Republic	0.03	0.03	0.05	8,268
Denmark	1.31	0.44	1.75	3,151
Estonia	0.00	0.00	0.00	504
Finland	0.00	0.10	0.10	2,646
France	0.00	0.86	0.86	41,522
Germany	0.07	0.53	0.60	90,653
Greece	0.00	0.27	0.27	4,864
Hungary	0.19	0.01	0.20	10,051
Ireland	0.62	0.00	0.62	5,432
Italy	0.07	0.59	0.67	72,667
Latvia	0.00	0.00	0.00	1,431
Lithuania	0.00	0.43	0.43	2,307
Luxembourg	0.00	0.37	0.37	784
Malta	0.00	0.73	0.73	339
Netherlands	0.90	0.76	1.66	42,987
Poland	0.27	0.68	0.95	20,903
Portugal	0.00	0.51	0.51	5,757
Romania	0.85	0.24	1.09	12,495
Slovakia	0.02	0.00	0.02	4,912
Slovenia	0.02	0.28	0.30	896
Spain	0.00	0.72	0.73	31,135
Sweden	0.00	0.80	0.80	1,102
UK	0.51	0.75	1.26	80,012
EU average	0.19	0.38	0.57	17,067

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

**Bold** indicates self-sufficiency



## 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. The Shannon-Wiener index is of the form:

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

Where  $x$  is the proportion of total natural gas supply represented by the  $i^{\text{th}}$  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 as 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>)

Once Shannon-Wiener and political stability indices were determined, these 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). 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 2018 low volumes of imports were reported as Non-Specified/ Other, except for Austria where all imports were reported in this way. Because of this in for Austria, we used Border Point Data which is publicly available at [www.iea.org/gtf/](http://www.iea.org/gtf/). This data is collected by the IEA and shows gas flows in Europe on a monthly basis.

### **Calculation of Russian pipeline flows to the UK**

The UK sourced 5.8 per cent of its natural gas imports through pipeline from the Netherlands in 2018. In turn Russian imports comprised 14 per cent of total supply to the Netherlands (Russian imports to the Netherlands as a percentage of Netherlands' production plus total imports). For transparency purposes the proportion of Netherlands' supply from Russia was applied to UK imports from the Netherlands as an estimate of the volume of pipeline gas that the UK indirectly imports from Russia.