

# Diversity of supply for oil and oil products in OECD countries in 2020

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## Key headlines

Within the OECD, three of the five net exporters of crude oil were the same as the previous year: Canada, Norway, and Mexico. **This year the UK joins these four countries by exporting 1.2 per cent more than demand**, as does Columbia who joined the OECD in 2020. Other OECD countries met their demand at least partially through imports, with ten countries not producing any crude oil indigenously.

**Eighteen of the OECD countries - including the UK - could meet their petrol demand through indigenous production**, four more than last year, with much of Western Europe being net exporters. Subsequently petrol also achieved the highest average diversity index and achieving the highest average security of supply score.

**Twelve of the OECD countries were self-sufficient in kerosene production.** The self-sufficiency average continues to be greatly increased by the high contributions from Lithuania (meeting 14 times demand).

**Fourteen of the OECD countries were self-sufficient in diesel production;** Greece, Korea, the Netherlands, and Finland remaining in the top four, the same as in 2018 and 2019. Greece remained the most self-sufficient OECD country for diesel, producing over three times the amount consumed.

## Introduction

Countries meet their oil needs through a combination of indigenous production and trade. This article is a comparative assessment of how OECD countries manage their crude oil and transport fuel demand using data from the International Energy Agency (IEA) database. The aim is to determine how the UK compares with other OECD countries in terms of how it secures oil supplies.

This year the Covid-19 pandemic has had a profound impact on demand, production and trade of oil and oil products across the globe, with nations taking different measures to curb the spread. These measures have had a notable impact on oil demand, and therefore also on supply. Rather than compare extensively to 2019, this article looks at 2020 supply within the OECD.

Whilst the UK more than met its demand for crude through indigenous production the UK fell to 6th place in security of supply as Columbia and Australia take 4th and 5th respectively. The UK was more than able to meet their demand for petrol through indigenous production, placing in the top half for security of supply. For jet fuel, the UK continues to remain in the lower half of the OECD in terms of indigenous production scores, even though consumption was the third highest. However, with a diversity score of 0.78 the UK remained in the top 50 per cent in terms of security of supply. On diesel, the UK had a self-sufficiency score of 0.59 and was sixth highest for diversity and remains in the top half of OECD countries for security of supply.

## Charting oil self-sufficiency and diversity of supply

### Bubble charts

The bubble charts demonstrate the relationship between demand, indigenous production, diversity of gross imports and the political stability of import sources. This year we have continued to group the OECD countries in Asia, the Middle East, and the EU, using the average scores. See Appendix 1 for a list of the countries included in each of these categories. The profiles show:

- **Self-sufficiency** is the proportion of a country's demand that could be met through indigenous production is shown on the vertical axis. A score of 1 indicates a country produces as much oil as it uses, a score of 0 indicates that no demand was met with own production.

- **A diversity score** is calculated using diversity and political stability – defined via the World Bank’s governance indicators - of a country’s gross imports is shown on the horizontal axis (see Appendix 3 for a methodological note).
- **Consumption** is represented by the circle or bubble, the area of which indicates the level of consumption for 2019 for each OECD country.

**Bar charts**

The bar charts provide a means of comparing OECD countries by self-sufficiency and diversity of imports. These profiles combine the proportion of demand that could be met through indigenous production with the diversity and political stability of import origins. The sum of these two components is used as a simplified metric for security of supply, and thus does not represent a full description of security of supply beyond import diversity, stability, and self-sufficiency. Appendix 2 shows the underlying data.

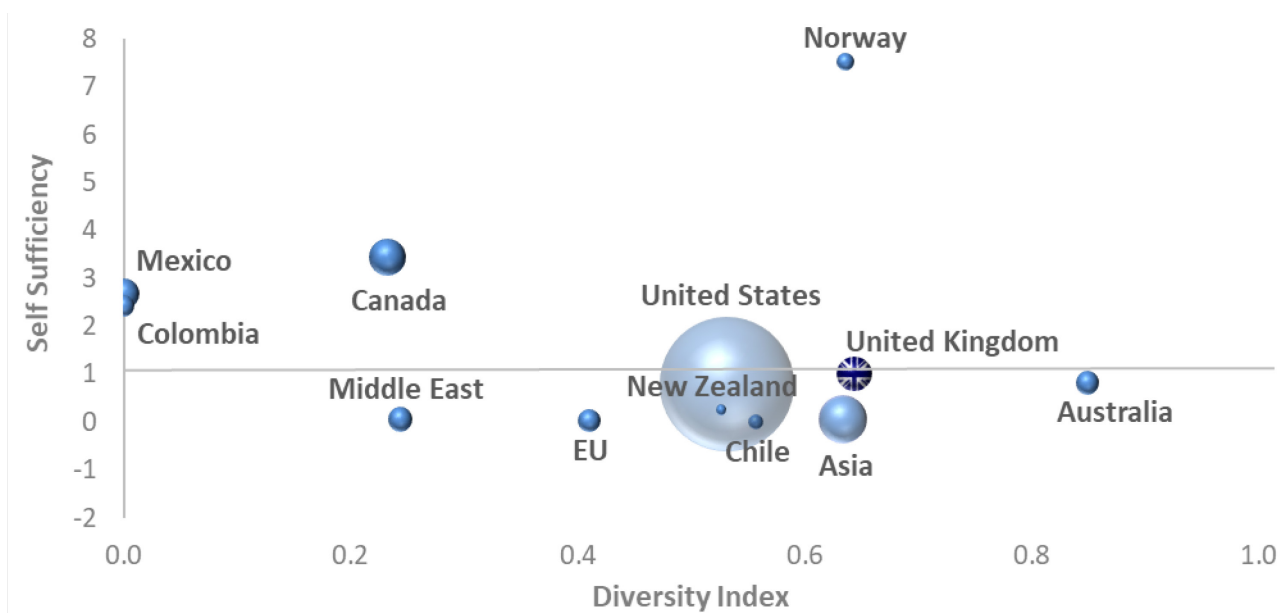
**Choropleth map**

These maps indicate a visual representation of the source countries and quantities of exports for each product. A darker shade represents that a high proportion of the world’s exports originated from that country, whereas lighter shades indicate that fewer exports originated in that country.

**Crude Oil**

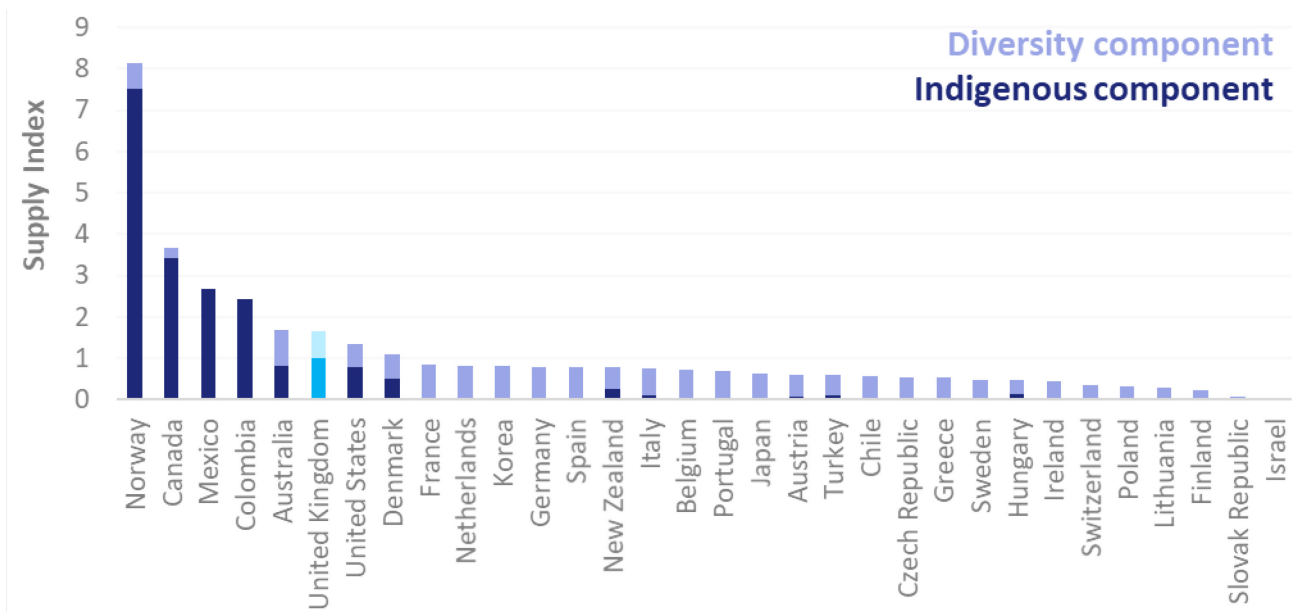
Five OECD countries were self-sufficient for crude oil in 2020 (Chart 1). Norway again by far had the highest self-sufficiency score, producing over seven and a half times its own consumption. With a self-sufficiency score of 1.01, the UK’s score has increased on last year and the UK is self-sufficient in 2020, remaining above the OECD average of 0.54 and ranked fifth overall out of all OECD countries. Similarly, the UK’s diversity score of 0.66 was above the average score of 0.41.

**Chart 1 Diversity and self-sufficiency of crude oil for OECD countries, 2020**



Most OECD countries showed diversity and political stability scores that reflect a strong trading element, with a relatively small contribution from indigenous production. Chart 2 shows that the UK placed highly in the ranking of OECD countries being one of only a few countries with substantial oil production.

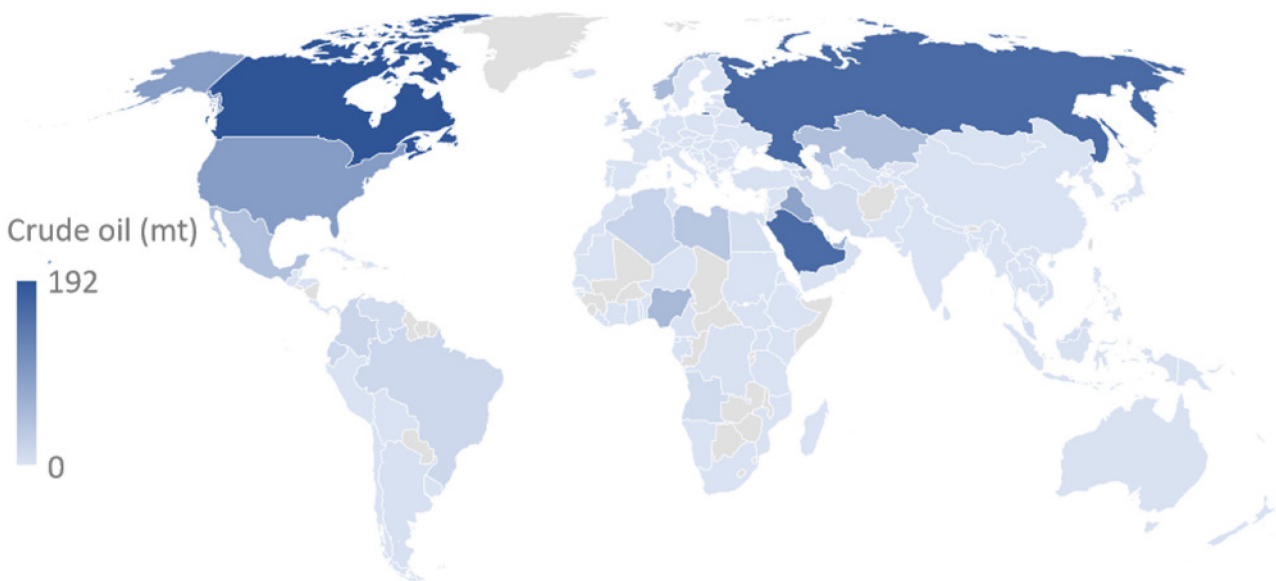
**Chart 2 Security of supply of crude oil for OECD countries, 2020**



Note: Data not available for Estonia, Iceland, Israel, Latvia, Luxembourg, and Slovenia

Map 1 is an illustration of where crude oil exports originated in 2020. Canada, Russia, and Saudi Arabia are the biggest exporters of crude in the world. Within the OECD, the UK was the fifth largest exporter.

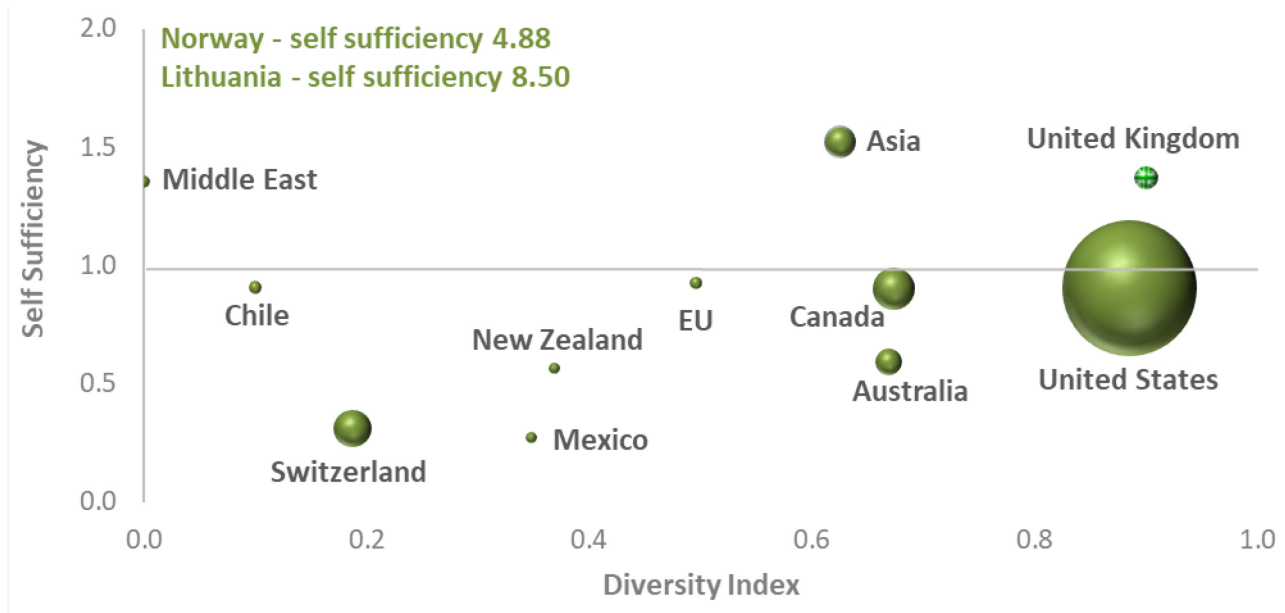
**Map 1 Worldwide crude oil exports (million tonnes), 2020**



**Petrol**

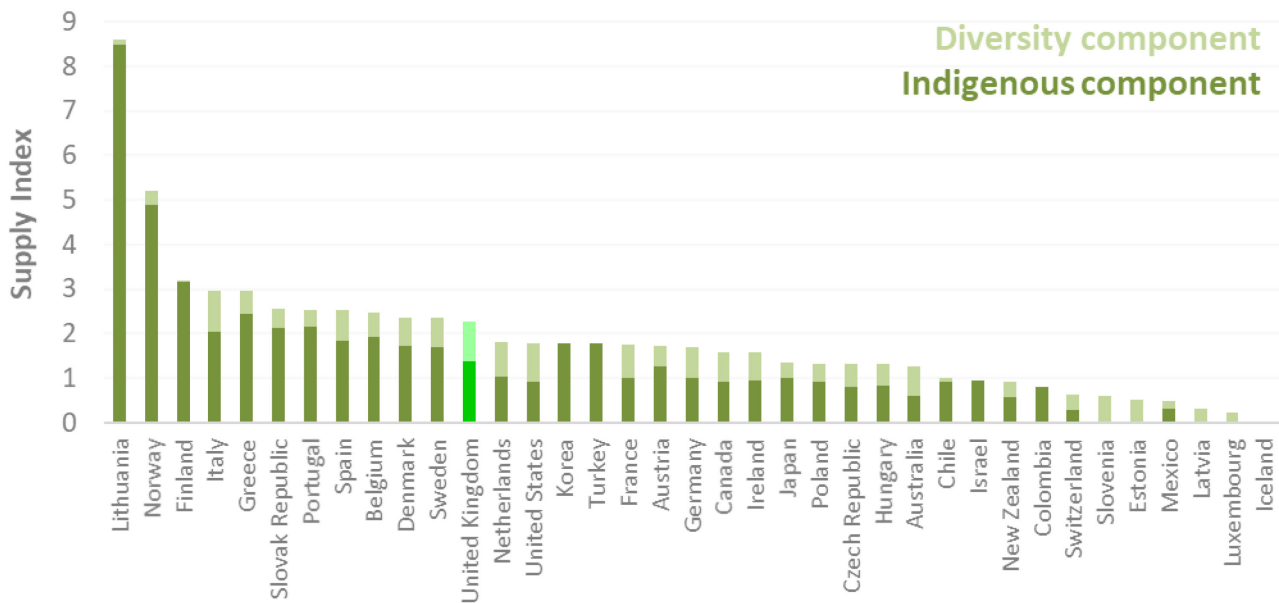
The profiles for petrol are different to that of crude. Eighteen of the 37 OECD countries were self-sufficient in 2020. Lithuania had a self-sufficiency score of 8.50, making it by far the highest ranking in this regard. The OECD average self-sufficiency score was 1.41, compared to 1.42 in 2019. Consumption in the US continues to dwarf that of other OECD countries at just over 60% of total OECD consumption. The UK had a self-sufficiency score of 1.37, meaning we were more than able to meet demand for petrol in 2020. The UK’s diversity score of 0.90 was much higher than the OECD average of 0.43 and was second only to Italy with 0.91. The US has dropped from first last year to third in 2020 with a score of 0.88.

**Chart 3 Diversity and self-sufficiency of petrol for OECD countries, 2020**



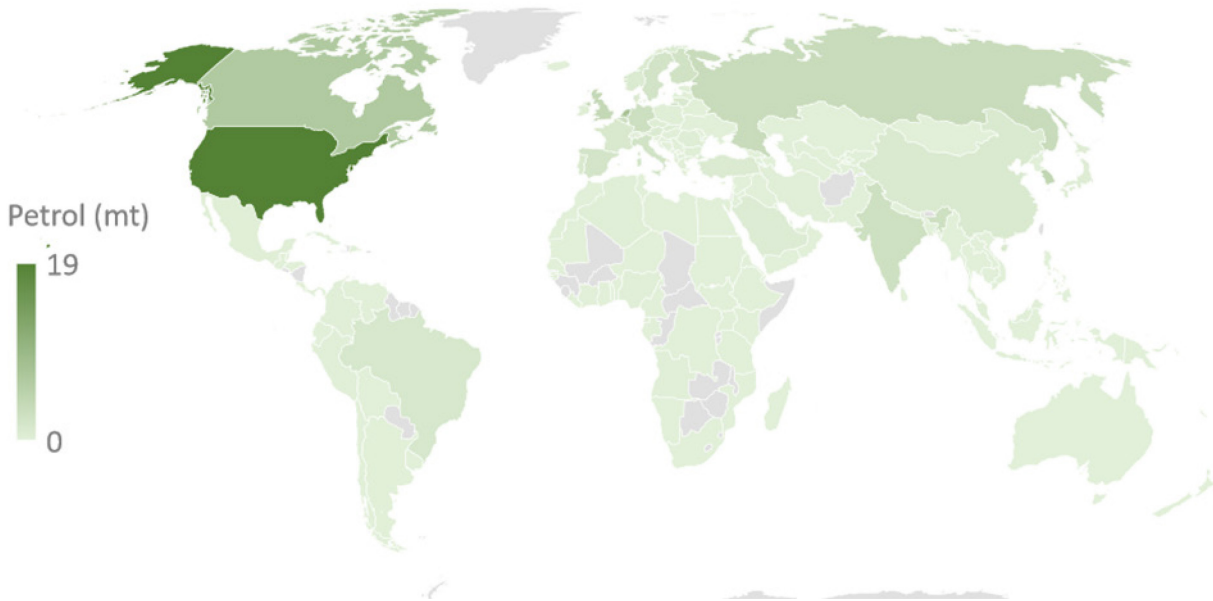
The simplified security of supply index (Chart 4) shows how most countries produce enough petrol to meet their needs and the amount of petrol trade amongst the OECD countries. The UK ranks 12th out of the 37 OECD countries for security of supply of petrol and Lithuania ranks first due to its large production figure.

**Chart 4 Security of supply of petrol for OECD countries, 2020**



The main exporter of petrol around the world is North America, exporting almost three times the amount of Canada, the third biggest exporter. Europe is also shown on the map to be a very significant exporter of petrol to the rest of the world, notably including the United Kingdom, Belgium and specifically the Netherlands; the second largest exporter, exporting two-fifths of the amount exported by the United States. Many large economies such as Australia, Japan, and China export comparatively low quantities of petrol.

**Map 2 Worldwide petrol exports (million tonnes), 2020**



**Jet fuel**

In 2020 there were 12 countries that were self-sufficient in jet fuel production the top three were Lithuania, Korea, and Greece, with six countries not producing any jet fuel. Notably, Lithuania’s self-sufficiency score almost doubled on last year, at fourteen times more than its demand. Lithuania’s refining capacity stands at approximately 10 million tonnes a year and has a relatively low demand. This accompanied by a 50 per cent reduction in demand, most likely caused by the Covid-19 pandemic, and the relatively steady production compared with 2019 has driven up the OECD average to 1.15.

**Chart 5 Diversity and self-sufficiency of jet fuel for OECD countries, 2020**

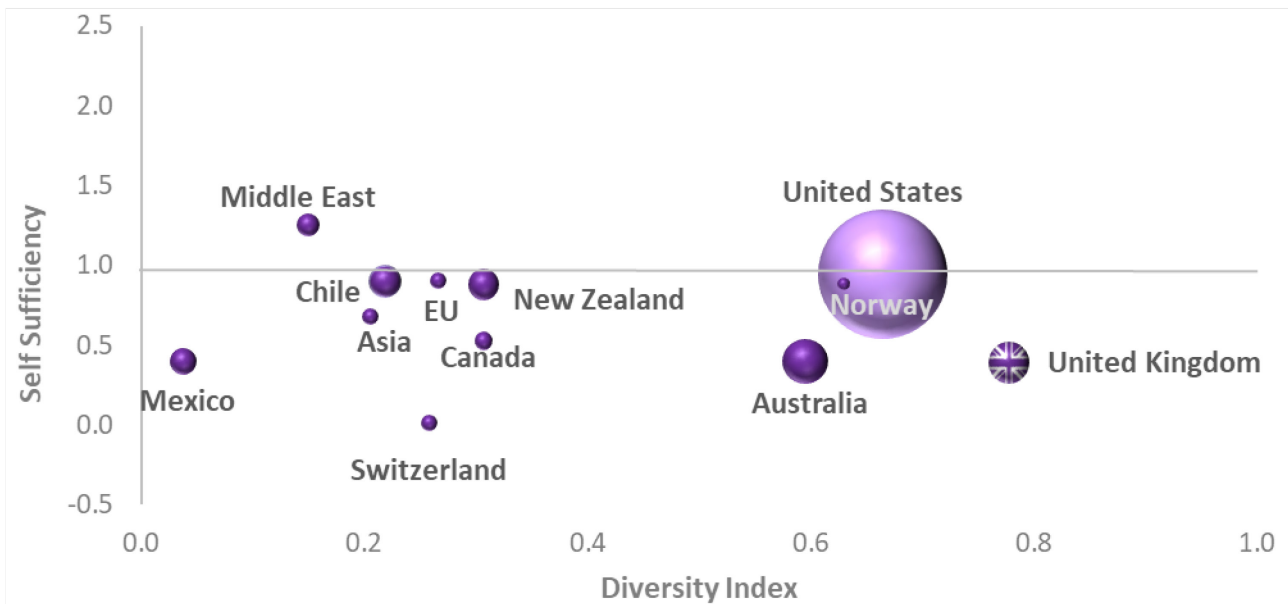
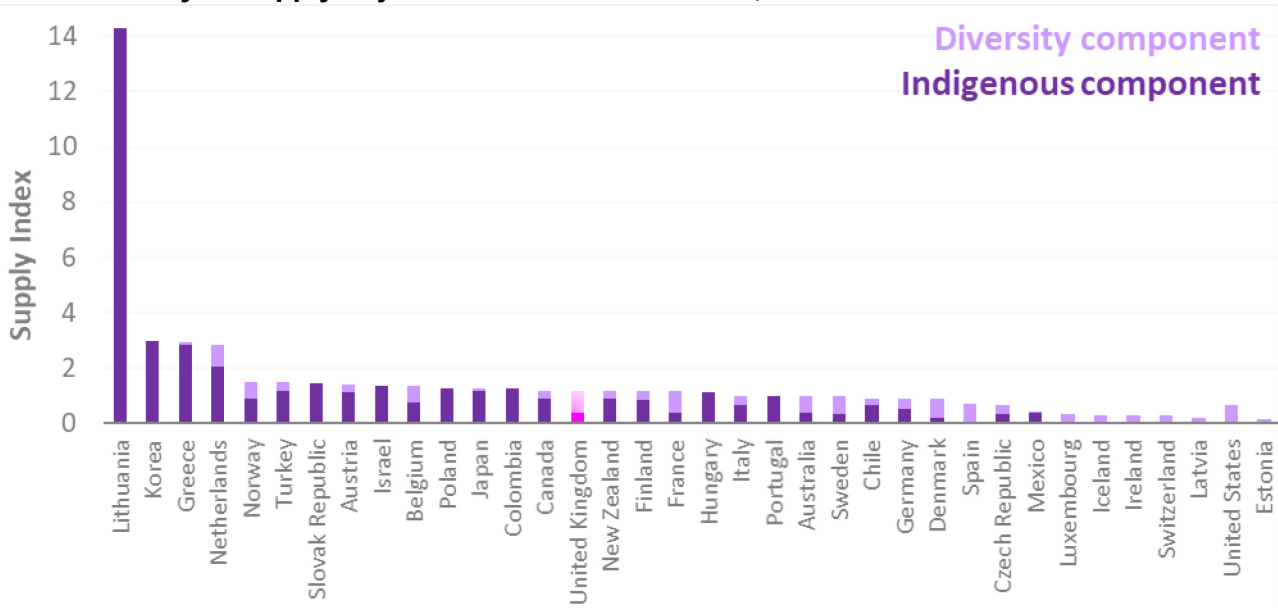


Chart 5 shows that the UK, with a self-sufficiency score of 0.39, was well below both the self-sufficiency threshold of 1 and the OECD average 1.15 for jet fuel. However, the UK’s import diversity score of 0.78 was far higher than the average for all OECD countries of 0.30 and only second to the Netherlands but followed closely by France at 0.77.

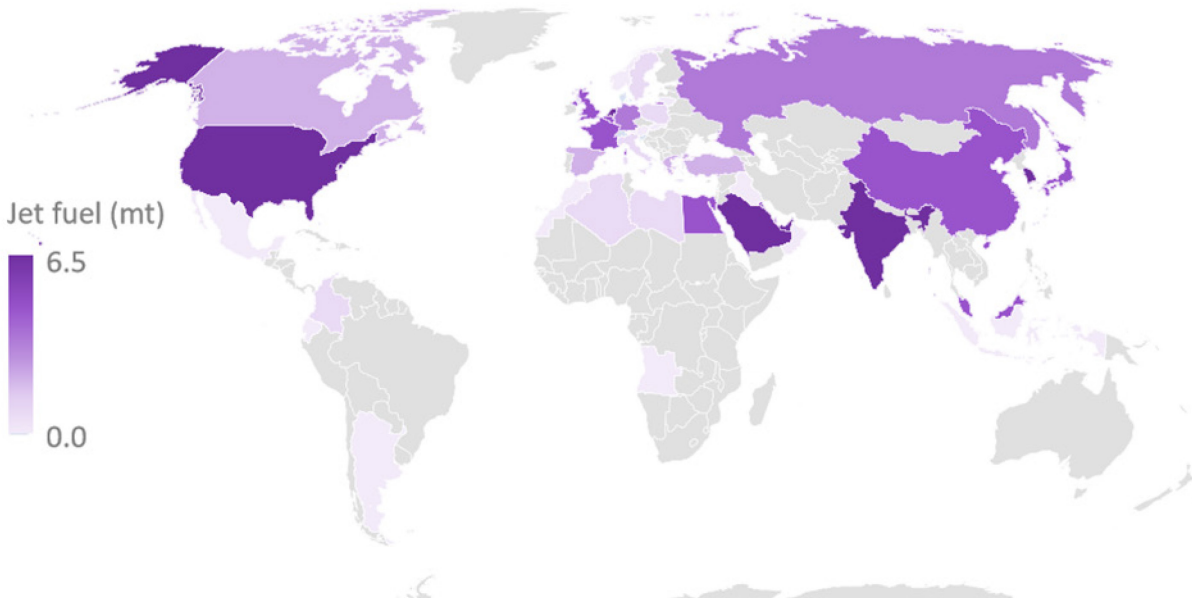
**Chart 6 Security of supply of jet fuel for OECD countries, 2020**



Note: Data not available for Slovenia

The UK's low capacity to meet demand through indigenous production is of the largest deficits in the OECD, significantly lower than the OECD and EU average. However, Heathrow (being the busiest airport in Europe), causes the UK to have the third highest demand for jet fuel behind Australia and the United States, whose demand is ten times that of the UK. The UK's security of supply is 1.17 for jet fuel, the sixteenth highest score out of the 37 OECD countries.

**Map 3 Worldwide jet fuel exports (million tonnes), 2020**



Jet fuel is only exported in significant quantities in a few countries around the world with Korea, the Netherlands, the United States, Saudi Arabia, and the United Arab Emirates exporting the most in 2020 which was the same in 2019. The Netherlands is a trading hub for many oil products, with large amounts of imports 're-exported' and not used for the country's own consumption. Europe exports relatively small amounts of jet fuel (excluding the Netherlands), as does Canada and North Africa.

## Road diesel

In 2020, the OECD average self-sufficiency was 0.85 compared to 0.84 in 2019. Fourteen countries were self-sufficient with Greece, France, Korea, and the Netherlands taking the top four spots and seven countries did not produce any diesel.

**Chart 7 Diversity and self-sufficiency of diesel for OECD countries, 2020**

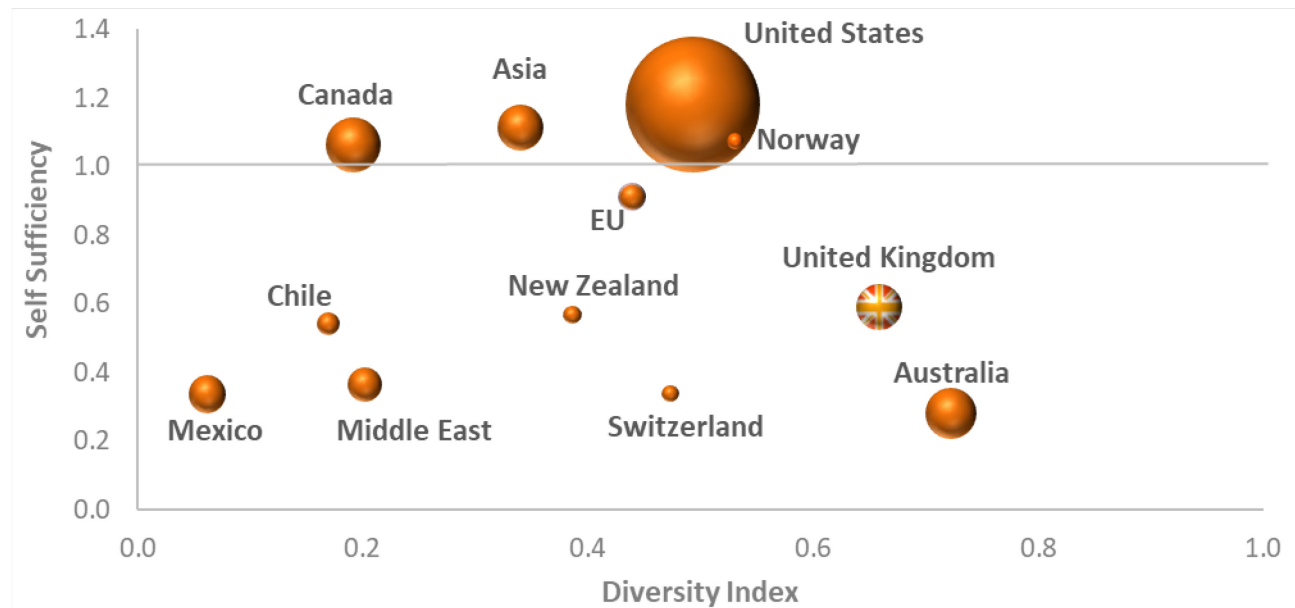
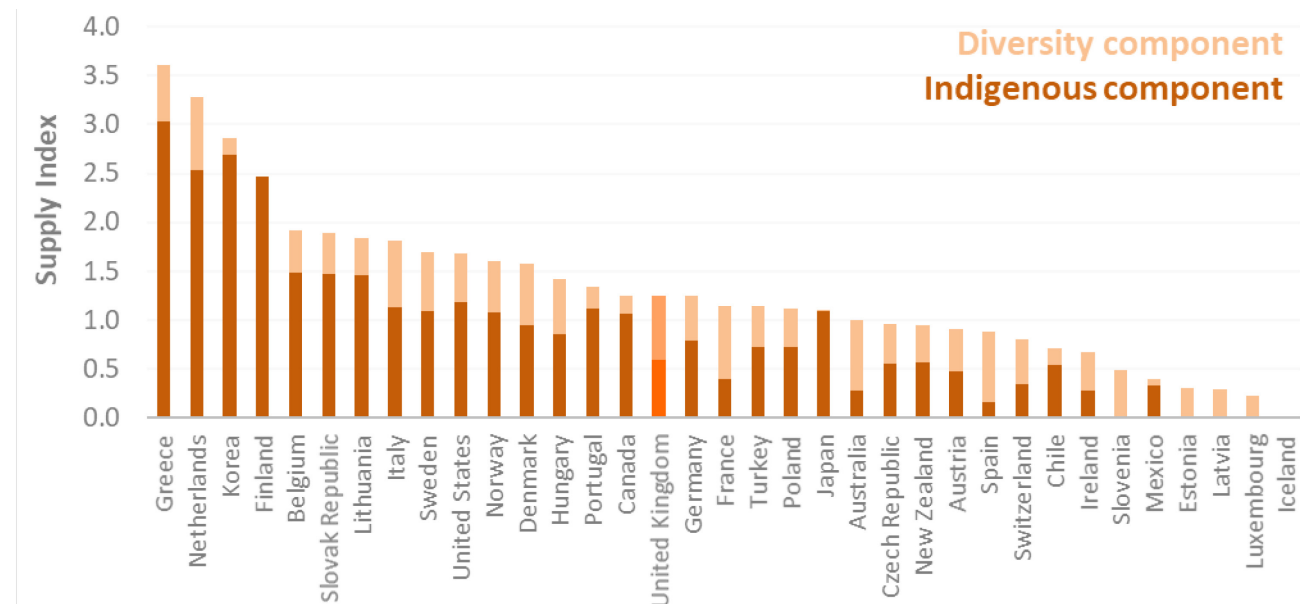


Chart 7 shows at 0.59 on the self-sufficiency axis the UK was still below the average OECD self-sufficiency score of 0.83. However, the score was an improvement from 0.54 in 2019. The UK was in a more favourable position in terms of diversity and political stability of imports. The UK's diversity score, at 0.66, was substantially above the OECD average of 0.39, making it the sixth highest. France has the highest diversity index at 0.77, surpassing the Netherlands with 0.76.

**Chart 8 Security of supply of diesel for OECD countries, 2020**



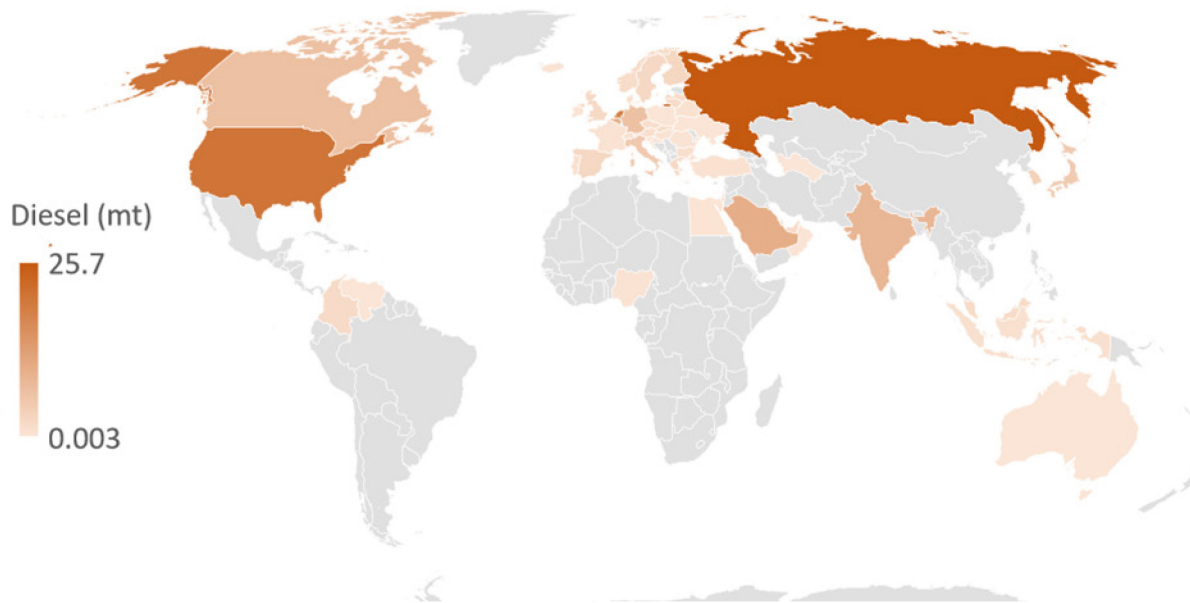
Note: Data not available for Columbia and Israel

Most countries either met demand through indigenous production or by a combination of production and diverse imports. The profile shows that although the UK's self-sufficiency score is reasonably low at 1.25 it has ranked in the top half of OECD countries for security of supply owing to its high diversity component (Chart 8).

Map 4 shows that Russia and the United States are the most significant exporters of diesel. There are limited quantities of exports from Asia and South America, with Europe and Canada exporting diesel in moderate

quantities. The UK was the 12th largest exporter out of the 37 OECD countries in 2020, one place higher than in 2019.

**Map 4 Worldwide diesel exports (million tonnes), 2020**



### Summary

The overall picture reflects a higher security of supply for products than for crude oil. This pattern is driven by higher levels of refinery production compared to crude extraction, leading to increased self-sufficiency for transport fuels. However, the scores for transport fuels are dependent on refining crude oil, and as such cannot be decoupled easily from crude oil security of supply. With an average self-sufficiency score of 0.54, OECD countries are very much dependent on imports of crude oil to meet refinery demand. Despite this, in 2020 crude ranked joint highest on diversity score with petrol, suggesting that supply is comparatively secure.

Total petrol production was less than total consumption with only 95 per cent of consumption being met by production, and 5 countries did not produce any petrol. However, 18 of the 37 OECD countries were self-sufficient; particularly notable were Lithuania, Norway, and Finland, with Lithuania producing more than eight times its demand and Norway almost five times its demand. With an average self-sufficiency score of 1.41 the OECD is well-placed to meet demand for petrol.

For diesel, fourteen of the OECD countries were self-sufficient in 2020. Greece notably produced just over three times the amount it consumed, and seven countries produced nothing. However, with the second lowest average scores for self-sufficiency (0.85) and diversity (0.39) the security of supply for diesel was second from last out of the four oils.

Jet fuel imports amongst OECD countries have led to an average diversity score of 0.30, in part because a few countries such as Saudi Arabia, United Arab Emirates and the US are the key suppliers of jet fuel to the global market. Jet has the lowest diversity score, but OECD countries could have met more than total demand with own production. The UK scored second highest on the diversity index, after only the Netherlands.

The UK compares well with other OECD countries for both self-sufficiency and diversity, with strong diversity scores for all oil types. The UK scored 0.66 on the diversity score for crude compared to the 0.45 OECD average. The UK ranks strongly amongst OECD countries for self-sufficiency; in petrol and crude the UK more than met its 2020 needs from indigenous production. Conversely, the UK relies on imports to meet its requirements for jet fuel and road diesel because its refineries do not produce sufficient volumes to meet increasing demand. Despite this, with diversity scores of 0.78 and 0.66, for jet fuel and road diesel respectively, the UK compares favourably with the OECD averages of 0.30 and 0.39.



## Appendix 1 – List of OECD countries in category averages

### Asia

Japan  
Korea

### EU (excluding UK)

Austria  
Belgium  
Czech Republic  
Denmark  
Estonia  
Finland  
France  
Germany  
Greece  
Hungary  
Iceland  
Ireland  
Italy  
Latvia  
Lithuania  
Luxembourg  
Netherlands  
Poland  
Portugal  
Slovak Republic  
Slovenia  
Spain  
Sweden

### Middle East

Israel  
Turkey

## Appendix 2 – Provisional data for 2020

	CRUDE			PETROL			JET FUEL			DIESEL		
	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand
Australia	0.85	0.82	20,063	0.67	0.59	12,146	0.59	0.40	5,838	0.72	0.28	25,170
Austria	0.54	0.07	7,998	0.46	<b>1.25</b>	1,367	0.26	<b>1.13</b>	322	0.43	0.47	6,245
Belgium	0.71	0.00	27,189	0.54	<b>1.92</b>	1,620	0.60	0.73	1,139	0.44	<b>1.48</b>	5,582
Canada	0.23	<b>3.43</b>	51,349	0.67	0.90	32,235	0.31	0.88	2,815	0.19	<b>1.06</b>	29,535
Chile	0.56	0.01	7,626	0.10	0.91	2,916	0.20	0.68	723	0.17	0.54	4,672
Colombia	0.00	<b>2.43</b>	16,949	0.00	0.80	5,123	0.00	<b>1.24</b>	590	0.00	0.00	0.00
Czech Republic	0.51	0.02	6,068	0.51	0.81	1,468	0.31	0.33	147	0.40	0.55	4,719
Denmark	0.61	0.50	7,101	0.66	<b>1.71</b>	1,237	0.66	0.21	385	0.63	0.95	2,286
Estonia	0.00	0.00	0.00	0.50	0.00	217	0.15	0.00	26	0.30	0.00	514
Finland	0.24	0.00	10,943	0.04	<b>3.16</b>	1,332	0.30	0.85	354	0.00	<b>2.47</b>	2,332
France	0.81	0.02	33,046	0.76	1.00	7,544	0.77	0.38	3,804	0.76	0.39	32,639
Germany	0.77	0.02	84,245	0.70	<b>1.00</b>	19,607	0.34	0.54	4,700	0.45	0.79	34,646
Greece	0.52	0.00	22,242	0.51	<b>2.44</b>	1,904	0.11	<b>2.82</b>	580	0.57	<b>3.03</b>	2,312
Hungary	0.34	0.13	6,714	0.49	0.82	1,356	0.00	<b>1.14</b>	108	0.57	0.85	3,373
Iceland	0.00	0.00	0.00	0.01	0.00	103	0.30	0.00	87	0.00	0.00	412
Ireland	0.45	0.00	2,838	0.63	0.94	574	0.28	0.00	378	0.39	0.28	2,654
Israel	0.00	0.01	10,206	0.00	0.94	2,682	0.00	<b>1.35</b>	414	0.00	0.00	0.00
Italy	0.66	0.10	55,183	0.92	<b>2.03</b>	5,925	0.35	0.64	1,788	0.67	<b>1.14</b>	20,126
Japan	0.62	0.00	117,379	0.33	<b>1.01</b>	31,633	0.09	<b>1.15</b>	4,374	0.01	<b>1.09</b>	19,496
Korea	0.80	0.00	133,161	0.00	<b>1.79</b>	9,370	0.00	<b>2.97</b>	4,816	0.17	<b>2.69</b>	15,853
Latvia	0.00	0.00	0.00	0.32	0.00	186	0.21	0.00	57	0.29	0.00	781
Lithuania	0.28	0.00	7,848	0.11	<b>8.50</b>	251	0.00	<b>14.28</b>	62	0.39	<b>1.45</b>	1,699
Luxembourg	0.00	0.00	0.00	0.24	0.00	276	0.32	0.00	461	0.23	0.00	1,395
Mexico	0.00	<b>2.67</b>	33,124	0.19	0.31	25,789	0.04	0.40	2,011	0.06	0.34	13,567
Netherlands	0.80	0.02	49,089	0.77	<b>1.04</b>	3,703	0.80	<b>2.06</b>	2,165	0.75	<b>2.54</b>	5,951
New Zealand	0.52	0.25	3,794	0.36	0.56	2,180	0.26	0.90	707	0.38	0.57	3,031
Norway	0.64	<b>7.51</b>	11,234	0.31	<b>4.88</b>	726	0.63	0.88	422	0.53	<b>1.07</b>	2,405
Poland	0.29	0.04	25,599	0.41	0.90	4,406	0.00	<b>1.28</b>	460	0.39	0.72	16,822
Portugal	0.68	0.00	10,628	0.38	<b>2.15</b>	908	0.00	0.99	635	0.22	<b>1.12</b>	4,182
Slovak Republic	0.07	0.00	5,575	0.42	<b>2.13</b>	523	0.00	<b>1.46</b>	24	0.41	<b>1.48</b>	1,800
Slovenia	0.00	0.00	0.00	0.60	0.00	321	0.00	0.00	10	0.48	0.00	1,328
Spain	0.77	0.00	55,151	0.68	<b>1.84</b>	4,244	0.65	0.06	2,418	0.72	0.16	19,430
Sweden	0.47	0.00	17,410	0.66	<b>1.70</b>	2,099	0.65	0.31	391	0.60	<b>1.09</b>	4,837
Switzerland	0.34	0.00	2,814	0.34	0.27	2,072	0.26	0.01	706	0.47	0.34	2,728
Turkey	0.50	0.10	32,647	0.00	<b>1.77</b>	2,358	0.31	<b>1.16</b>	2,545	0.41	0.73	22,208
United Kingdom	0.64	<b>1.01</b>	44,519	0.89	<b>1.37</b>	9,608	0.78	0.39	4,983	0.66	0.59	21,046
United States	0.53	0.80	703,671	0.89	0.90	344,657	0.66	0.00	49,707	0.50	<b>1.18</b>	180,656
<b>OECD Asia average</b>	<b>0.71</b>	<b>0.00</b>	<b>125,270</b>	<b>0.16</b>	<b>1.40</b>	<b>20,502</b>	<b>0.05</b>	<b>2.06</b>	<b>4,595</b>	<b>0.09</b>	<b>1.89</b>	<b>17,674</b>
<b>OECD EU average</b>	<b>0.41</b>	<b>0.04</b>	<b>18,907</b>	<b>0.49</b>	<b>1.54</b>	<b>2,660</b>	<b>0.31</b>	<b>1.27</b>	<b>891</b>	<b>0.44</b>	<b>0.91</b>	<b>7,655</b>
<b>OECD Middle East average</b>	<b>0.25</b>	<b>0.05</b>	<b>21,427</b>	<b>0.00</b>	<b>1.35</b>	<b>2,520</b>	<b>0.15</b>	<b>1.25</b>	<b>1,480</b>	<b>0.21</b>	<b>0.36</b>	<b>11,104</b>
<b>OECD average</b>	<b>0.43</b>	<b>0.54</b>	<b>43,876</b>	<b>0.43</b>	<b>1.41</b>	<b>14,721</b>	<b>0.30</b>	<b>1.12</b>	<b>2,734</b>	<b>0.39</b>	<b>0.85</b>	<b>13,958</b>

Items in bold highlight those countries where indigenous capacity exceeded domestic consumption

DI = Diversity Index

S-S = Self-sufficiency

Demand is in thousand tonnes (kt)

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

## Appendix 3 – Methodology

### Data for crude oil and transport fuel self-sufficiency

Data for crude oil, petrol and jet fuel were extracted from the IEA database. For diesel, data were provided on request from the IEA. Self-sufficiency was determined from data on indigenous production and consumption (production (kt) ÷ consumption (kt)).

### Crude oil and transport fuel 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 fuel 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 2 represents a country with a wide range of import sources. The minimum value of zero denotes a country that has one imported fuel source or relies entirely on indigenous production.

A previous comparative study on import diversities in Energy Trends March 2011 used the Herfindahl Index as the basic diversity index. Although both of these indices have their advantages, the Shannon-Wiener was chosen here as this represents the data with less skew, as well as placing more weight on the diversity of contributions from smaller countries and lessening 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>)

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 for each petroleum product 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 all product, 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.



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