

Diversity of supply for oil and oil products in OECD countries in 2021

Izzy Andrewes 0792 759 3579 oil-gas.statistics@beis.gov.uk

Key headlines

The UK remained self-sufficient in the supply of petrol and was a net exporter as consumption was only three quarters of indigenous production in 2021. The UK was one of 17 other OECD countries who were self-sufficient in the supply of petrol.

The UK returns to being reliant on imports to meet crude supply as scheduled maintenance on the Forties Pipeline System and delayed maintenance from 2020 disrupted indigenous production. Four of 38 countries in the OECD were self-sufficient in their supply of crude, far fewer than oil products. Norway was the most self-sufficient, producing almost eight times what it consumed, and was the only country in the OECD that was self-sufficient in all four oil types.

The UK continues to import oil and oil products from a diverse pool of countries staying above OECD diversity averages for all fuel types.

Background

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

2021 saw changes to demand, production and the security of supply across OECD countries. This was due to continued Covid-19 restrictions on travel and guidance altering transport fuel balances. In the UK, demand for petroleum products increased by 4.1 per cent following 2020 lows. Demand for road fuels, petrol and diesel, increased by 11 and 10 per cent respectively as Covid-19 restrictions eased from April. On the other hand, demand for jet fuel remained muted as international travel restrictions stayed in place for much of the year. UK production of primary oils fell to a 7 year low, at 41 million tonnes, due to an extensive planned maintenance schedule including shutdown of the Forties Pipeline System which serves a substantial proportion of the UKCS. This article seeks to unpack these changes in relation to other OECD countries and trends.

Charting oil self-sufficiency and diversity of supply

- **Self-sufficiency** is the proportion of a country's demand that could be met through indigenous production (as shown on the vertical axis). A score of one indicates that a country produces as much oil as it uses, a score of 0 indicates that no demand was met with indigenous production.
- **A diversity score** is calculated using the number of sources in which a country imports oil, and their respective political stability – defined by the World Bank's governance indicators (See appendix 3 for methodological note).
- **Consumption** is represented by the circle or bubble, the area of which indicates the level of consumption for 2021 for each OECD country.

Bubble charts show the relationship between consumption (size of the bubble), indigenous production (self-sufficiency) and the diversity and political stability of import sources.

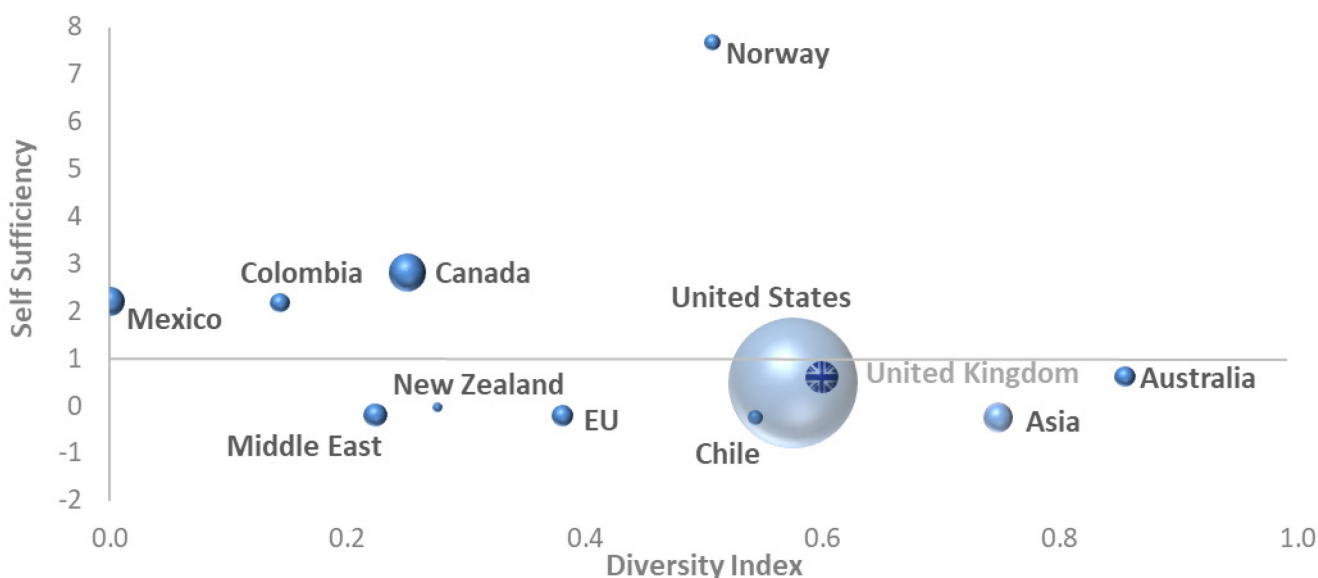
Bar charts provide a means of comparing OECD countries by self-sufficiency and diversity of imports. The sum of these two components is used as a simplified metric for security of supply, and thus does not represent

a full description of security of supply beyond import diversity, stability and self-sufficiency. Appendix 2 shows the underlying data.

Choropleth maps show a visual representation of where OECD countries' oil imports come from. Variable quantities are shown according to colour; darker shades represent a higher proportion of imports originate from that country.

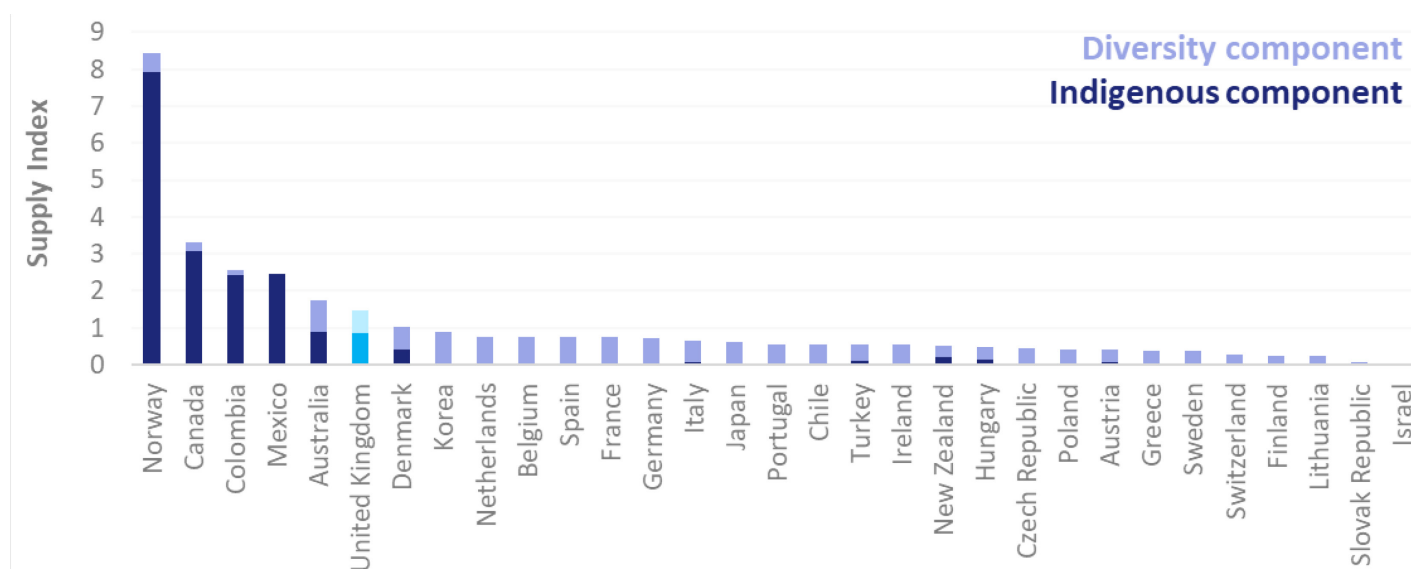
Crude Oil

Chart 1: Diversity and self-sufficiency of crude oil for OECD countries, 2021



With an average self-sufficiency score of 0.51, OECD countries were generally reliant upon imports of crude to meet refinery demand in 2021. Chart 1 shows that in 2021, four OECD countries were self-sufficient in terms of crude oil production. Norway remained a net exporter of crude oil and the most self-sufficient country producing almost eight times its consumption. With a self-sufficiency score of 0.86 (down 15 per cent on the previous year), the UK returned to being a net importer of crude in 2021. This was due to increased demand compared to 2020 alongside a decline in indigenous production due to a significant planned maintenance schedule. This included the shutdown of the Forties Pipeline System, as well as delayed maintenance from 2020. Despite this, the UK ranked sixth out of all OECD countries and was above the average of 0.51. The UK had a diversity score of 0.60 which is also above the OECD average of 0.39.

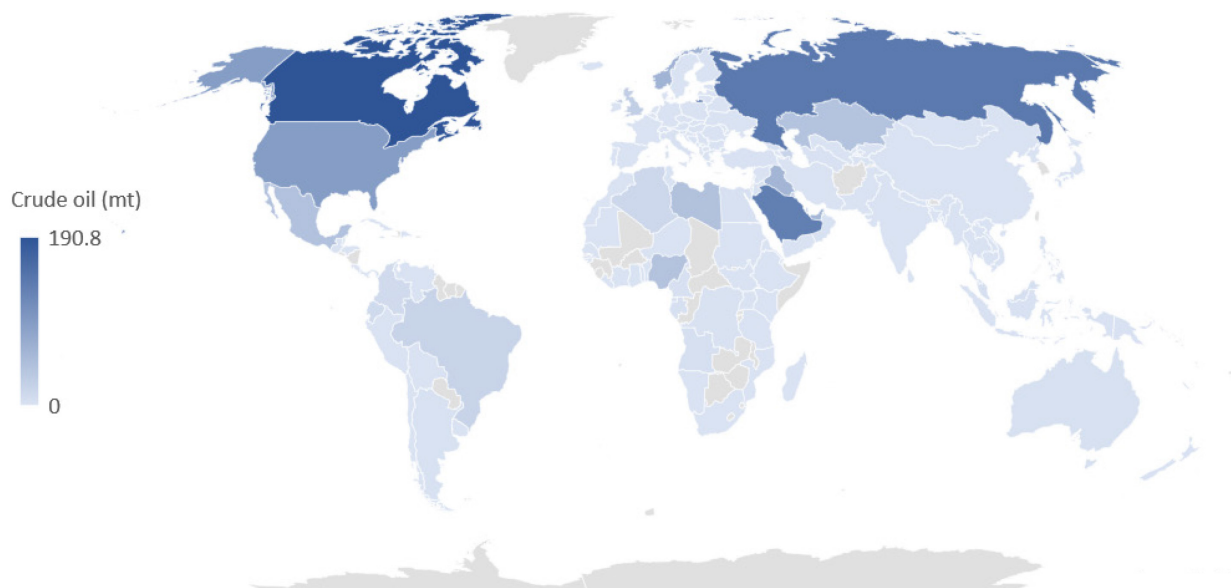
Chart 2: Security of supply of crude oil for OECD countries, 2021



Data not available for Costa Rica, Estonia, Iceland, Latvia, Luxembourg and Slovenia

The simplified security index of supply shows that most OECD countries fulfil supply of crude oil through trade, with a relatively small contribution from indigenous production; almost one third of all OECD countries have no indigenous component to their crude oil supply. Chart 2 shows that the UK has substantial indigenous crude production; in 2021, over half of gross supply was produced domestically.

Map 1: Worldwide crude oil exports to OECD countries (million tonnes), 2021

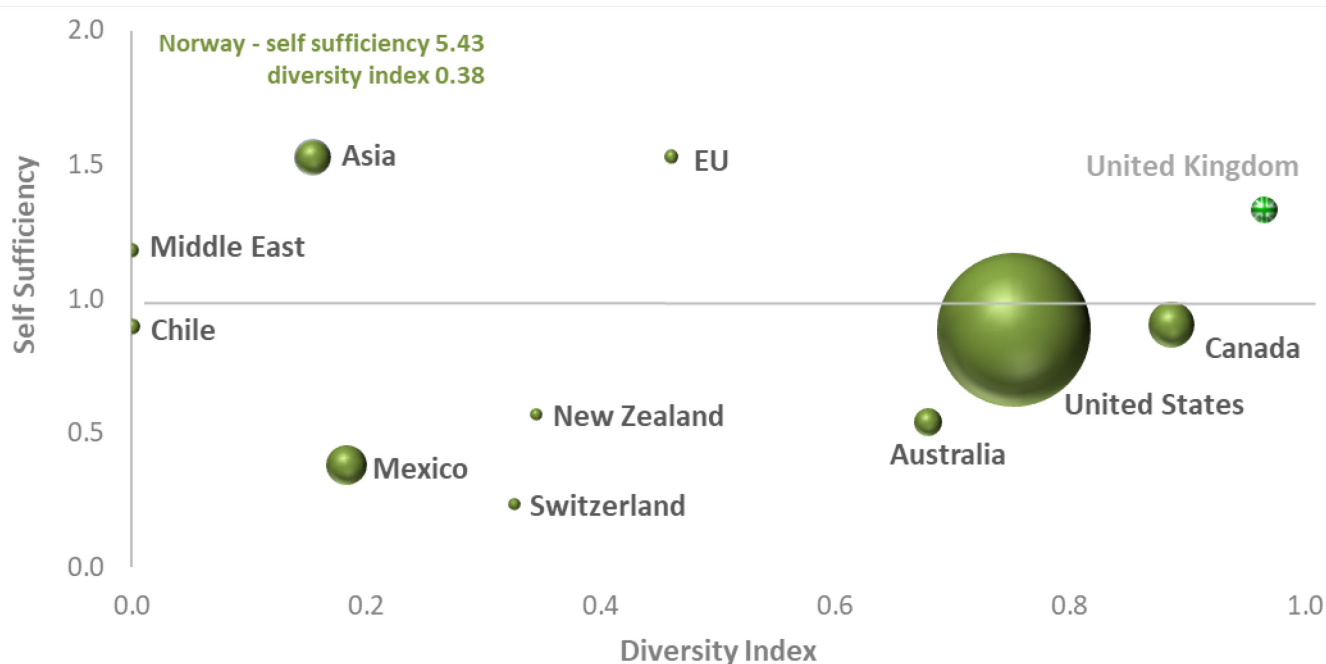


Map 1 illustrates where crude oil exports originated in 2021. Canada, Russia and Saudi Arabia were the largest exporters of crude to OECD countries; Canada exporting the most at 191 million tonnes. Of OECD countries alone, UK exports were fourth highest at 26 million tonnes.

In 2021, the UK imported crude oil from 14 countries, the largest being Norway (36 per cent), the US (30 per cent) and Libya (7.8 per cent). In 2021, the UK imported less than 4 per cent of its crude oil supply from Russia. Following Russia’s invasion of Ukraine and subsequent announcements of sanctions this dropped substantially in the first half of 2022. [For more information on Energy Imports from Russia please see the Energy trends special feature article.](#)

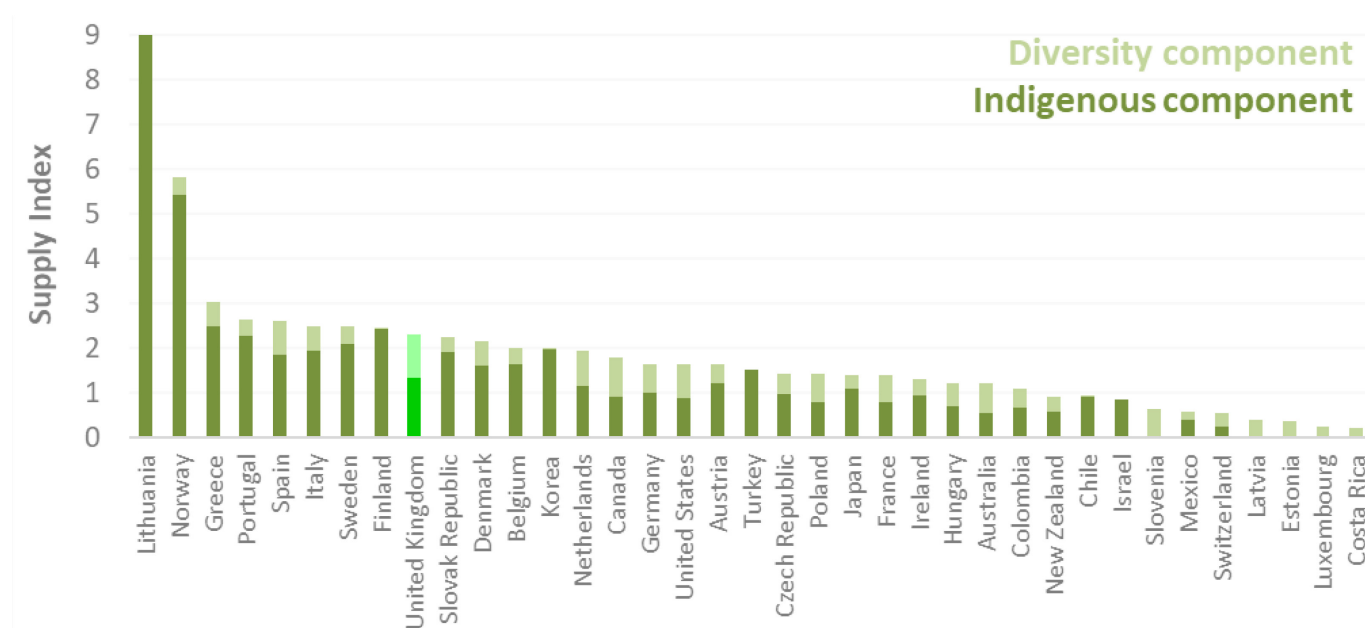
Petrol

Chart 3: Diversity and self-sufficiency of petrol for OECD countries, 2021



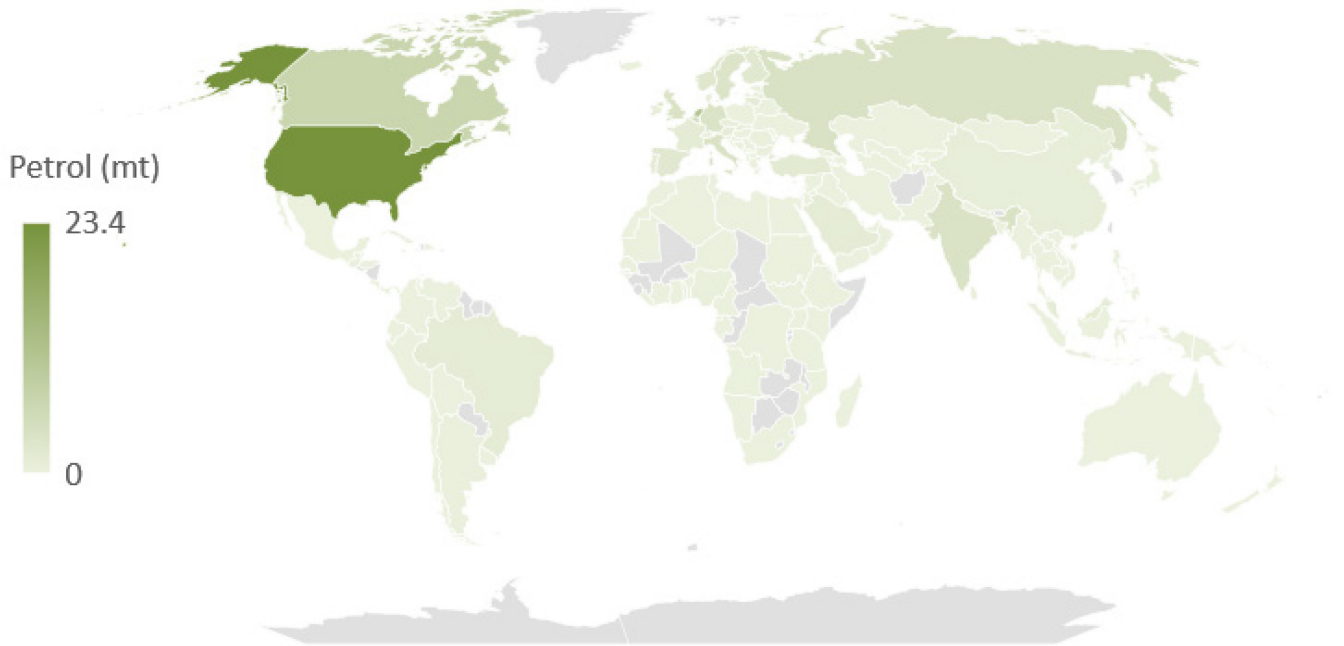
OECD countries were generally self-sufficient in petrol, with an average score of 1.38, above the self-sufficiency threshold of one. Of all oil types, petrol imports were the most diverse with an average score of 0.42. Chart 3 shows that, unlike crude, 17 of the 38 OECD countries were self-sufficient in terms of petrol supply. Lithuania had the highest self-sufficiency score of 9.42 showing that it produced more than 9 times the amount of petrol it consumed. The US constituted 64 per cent of total OECD petrol consumption, dwarfing that of other countries, furthermore, it was one of seven countries that were not self-sufficient in 2021. The UK had a self-sufficiency score of 1.33, meaning that the UK was able to meet demand with indigenous production in 2021.

Chart 4: Security of supply of petrol for OECD countries, 2021



Unlike crude, Chart 4 shows that most OECD countries produce a large proportion of the petrol they consume. The UK ranks ninth for security of petrol supply; but despite being a net exporter undertakes more trade than similarly ranked countries.

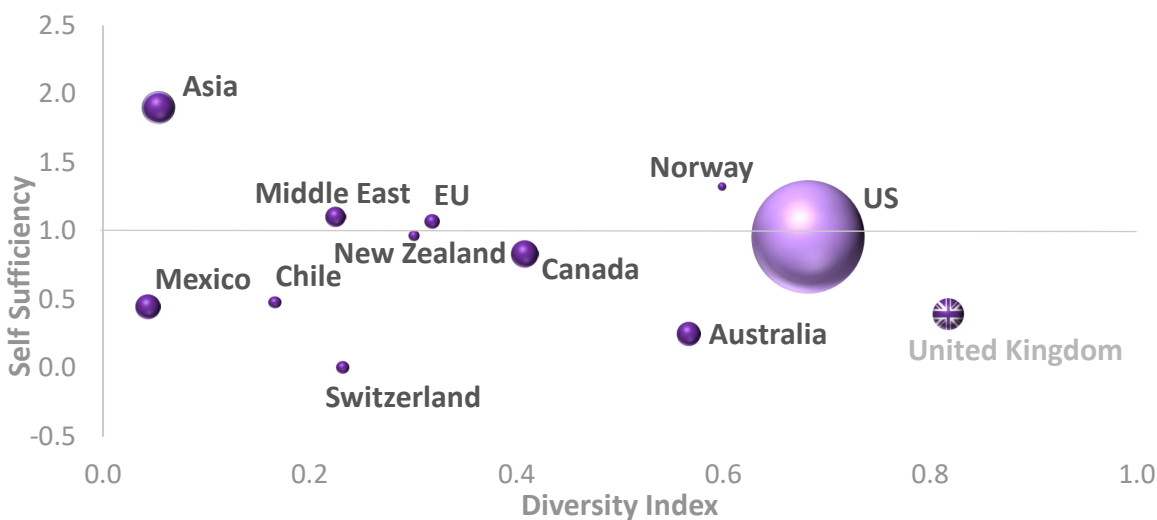
Map 2: Worldwide petrol exports to OECD countries (million tonnes), 2021



The largest exporter of petrol to OECD countries globally was the US, exporting 23.4 million tonnes of petrol in 2021; the US made up almost 30 per cent of OECD petrol imports and 18 per cent of global petrol imports. EU countries also play a significant role exporting petrol; in 2021 EU countries exported 38.2 million tonnes, almost half of the OECD total petrol exports of 81 million tonnes. The Netherlands is one of the largest global oil trading hubs, exporting 11 million tonnes of petrol in 2021. The UK is the seventh largest exporter of petrol in the OECD, exporting 3.5 million tonnes to other OECD countries. Globally, the UK exports almost 8 million tonnes of petrol.

Jet Fuel

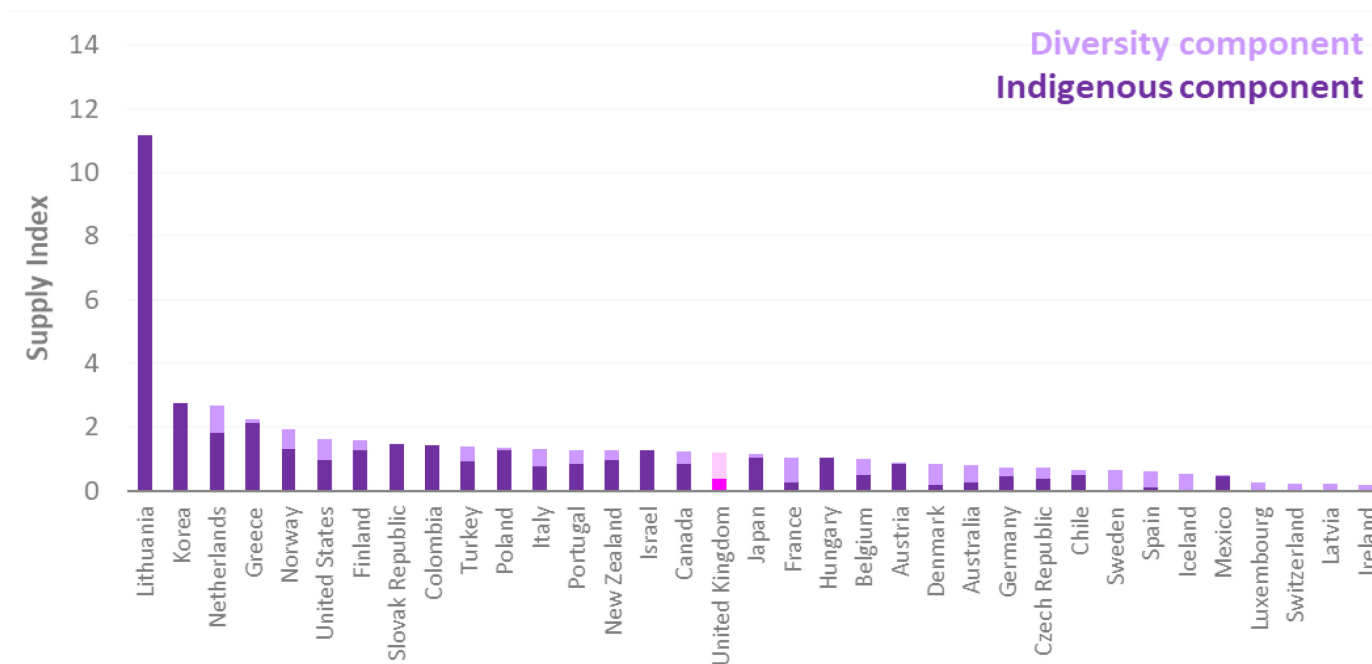
Chart 5: Diversity and self-sufficiency of jet fuel for OECD countries, 2021



Jet fuel imports were the least diverse of the four oil types with an average score of 0.31 as fewer countries produce and export jet fuel in large quantities. As demand for jet fuel increased, the average self-sufficiency score dropped to 0.99 compared to 1.12 in 2020. Lithuania was the most self-sufficient with a score of 11.17 meaning it produced more than 11 times its own consumption, followed by Korea with a score of 2.75 and Greece at 2.13. The UK’s self-sufficiency score remained at 0.39, lower than the OECD average. However,

the UK's import diversity score of 0.82 was higher than the OECD average of 0.31. US demand for jet fuel in 2021 made up more than half of total OECD demand increasing by 27 per cent on the previous year, now using more than ten times any other country alone.

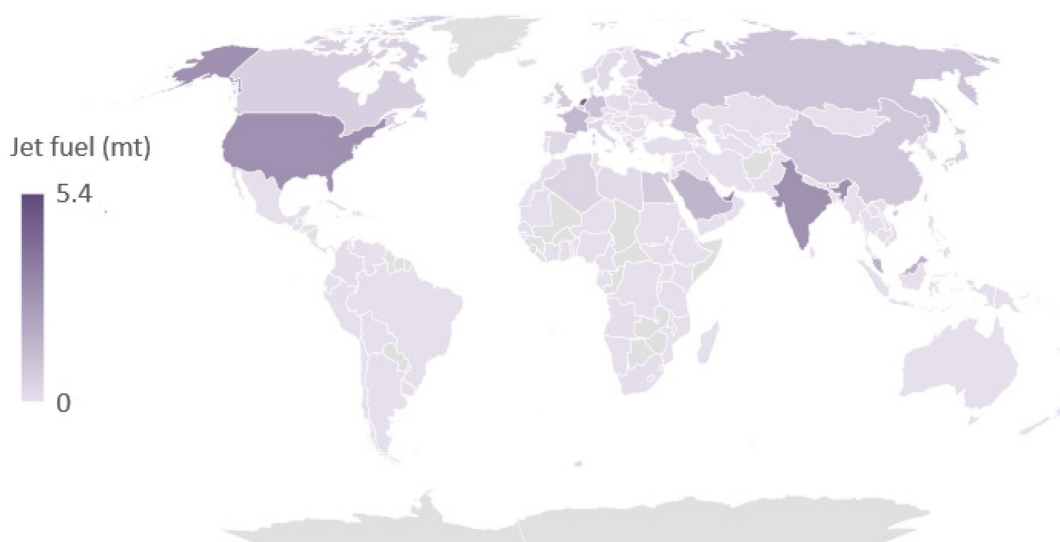
Chart 6: Security of supply of jet fuel for OECD countries, 2021



Data not available for Costa Rica, Estonia and Slovenia

Heathrow is one of the busiest airports in Europe, contributing to the UK's high demand for jet fuel. The UK had the fourth highest demand in 2021, behind the US, Japan and Germany. The UK's small indigenous production results in a small self-sufficiency score of 0.39, below the OECD and EU average.

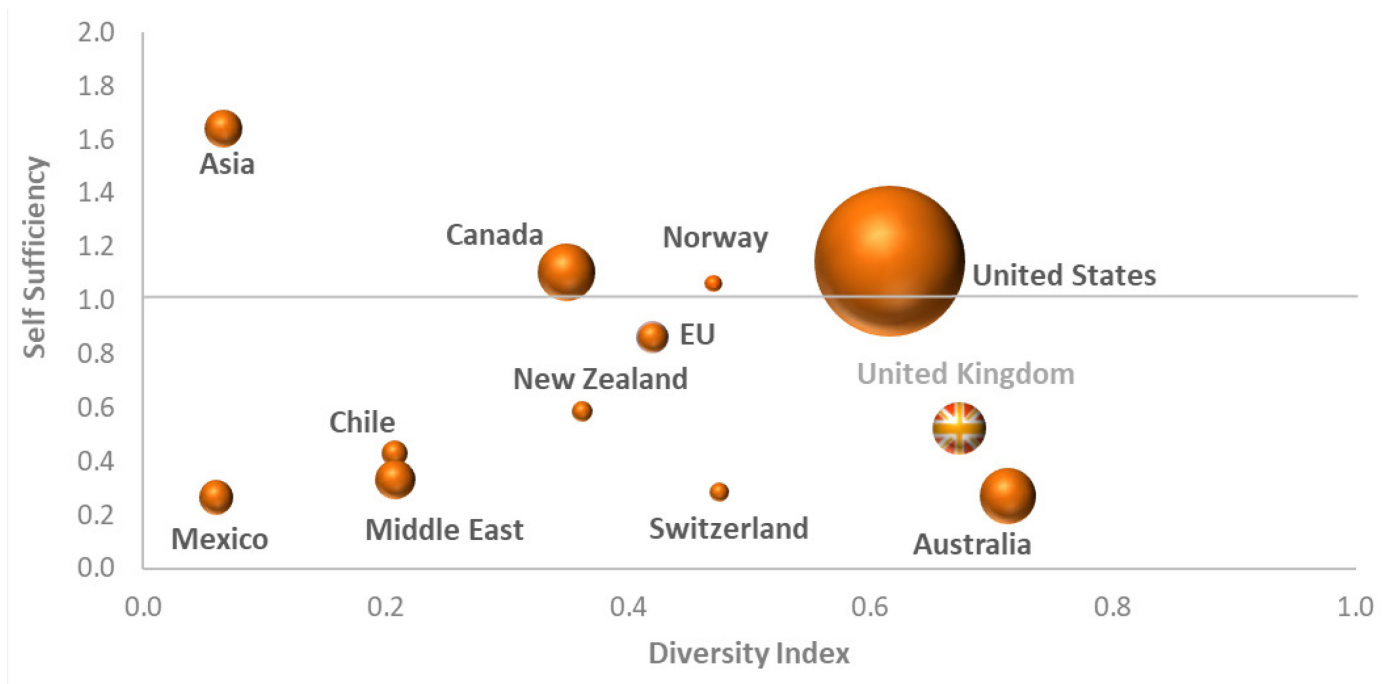
Map 3: Worldwide jet fuel exports (million tonnes), 2021



Unlike crude and petrol, very few countries export jet fuel in large quantities. The largest exporters to OECD countries were Korea, the Netherlands and the US. Korea exported 5.4 million tonnes in 2021, followed closely by the Netherlands who exported 4.6 million tonnes. The UK exported 0.7 million tonnes of jet fuel to other OECD countries and was the seventh largest exporter.

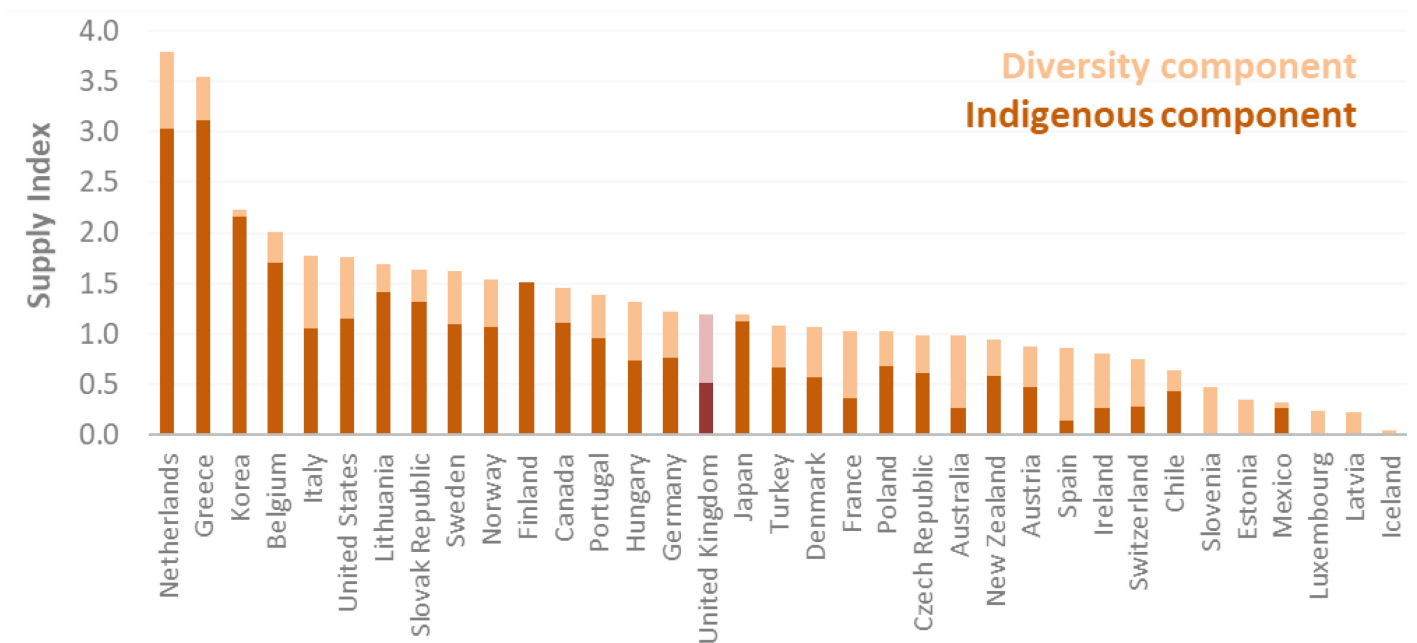
Road Diesel

Chart 7: Diversity and self-sufficiency of diesel for OECD countries, 2021



Diesel was the least secure transport fuel in 2021, with an average self-sufficiency score of 0.78, down nine per cent on 2020. The average diversity score for the OECD was 0.37, down four per cent. In 2021, 13 countries were self-sufficient in terms of diesel supply, and eight countries didn't produce any diesel at all. Chart 7 shows that the UK's self-sufficiency score of 0.52 remained below the OECD average, EU average and below the self-sufficiency threshold of 1. Despite this, the UK had a diversity index of 0.67 higher than the average of 0.37 and the fifth largest in the OECD.

Chart 8: Security of supply of diesel for OECD countries, 2021

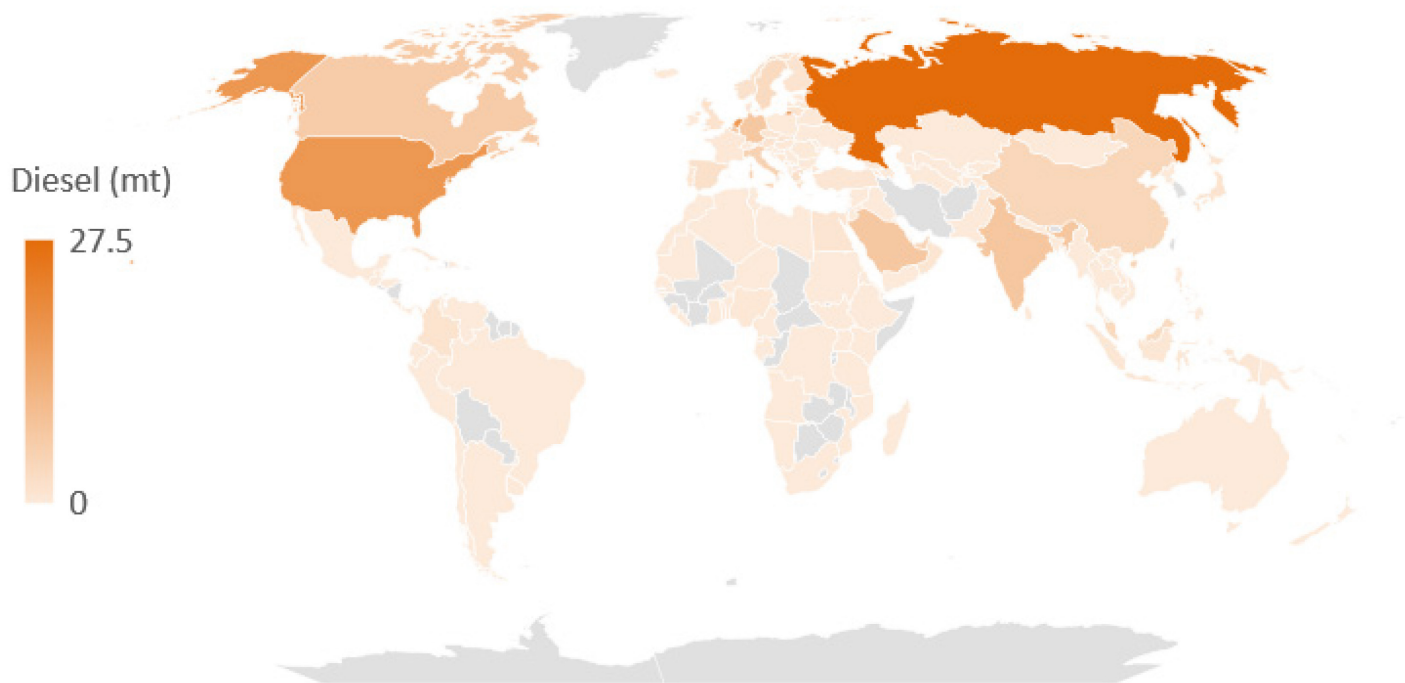


Data not available for Colombia, Costa Rica and Israel

Chart 8 shows that a large proportion of diesel demand was met through indigenous production, but many countries relied upon a combination of both indigenous and diversity components. Finland did not import any

diesel and Korea and Japan imported just three and five per cent of supply respectively. The UK ranked sixteenth out of all OECD countries for security of diesel supply with a score of 1.2, just below the OECD average of 1.3.

Map 4: Worldwide diesel exports to OECD countries (million tonnes), 2021



In 2021, Russia was the largest exporter of Diesel, exporting 27.5 million tonnes followed by the US and the Netherlands each exporting 17.9 million tonnes. Following Russia's invasion of Ukraine many countries including the EU and UK have announced sanctions on Russian energy imports which will come into force in 2022. For more recent data on Russian oil imports to the UK please see [Energy Trends Table 3.14](#).

Summary

The OECD as a whole has a higher security of supply for oil products compared to crude oil. This is because of higher levels of refinery production compared to crude extraction. Nevertheless, the scores for transport fuels are dependent on refining crude oil and therefore should only be considered independently with caution. The average self-sufficiency score for crude oil was 0.51 which shows OECD countries are dependent on imports of crude oil to meet refinery demand. The diversity score for crude oil of 0.39 was much more comparable to transport fuels showing that the OECD has a consistent, wide range of sources of imports.

Out of the three transport fuels, the supply of petrol was the most secure on average for OECD countries. 17 of the 38 were self-sufficient and the average self-sufficiency score of 1.38 suggests that OECD countries are well-placed to meet demand for petrol. The supply of diesel was the least secure transport fuel in 2021. 13 OECD countries were self-sufficient, and the average self-sufficiency score was 0.78 which is below the sufficiency threshold of 1. As demand increased on the previous year, self-sufficiency scores fell by nine per cent on average across all OECD countries.

OECD countries were on average almost self-sufficient in jet fuel supply, with a score of 0.99. However, jet fuel had the lowest diversity score of all fuel types largely due to fewer countries exporting jet fuel at high quantities. Change to demand for jet fuel was varied in 2021 due to differing Covid-19 restrictions on travel. On average, demand increased by 16 per cent driven by large increases for some countries such as 27 per cent in the US, 44 per cent in Mexico and 46 per cent in Japan.

The UK consistently has diversity scores higher than the OECD average for all oil types considered here. The UK is self-sufficient in petrol and a net exporter consuming 71 per cent of indigenous production. The UK is not self-sufficient in diesel or jet fuel supply and relies upon a diverse pool of imports to meet demand. The UK was self-sufficient in crude supply in 2020, due in part to the low demand seen during the Covid-19 pandemic. Conversely, in 2021 a significant planned maintenance schedule, including the shutdown of the Forties Pipeline System and delayed maintenance from 2020, saw a 16 per cent decrease in UK primary production which meant the UK was no longer self-sufficient in crude production.

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 2021

	CRUDE			PETROL			JET FUEL			DIESEL		
	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand
Australia	0.85	0.88	16,938	0.68	0.54	11,759	0.57	0.25	2,683	0.71	0.27	25,313
Austria	0.33	0.07	8,243	0.41	1.23	1,440	0.04	0.85	404	0.41	0.48	6,494
Belgium	0.77	0.00	28,736	0.37	1.64	1,974	0.53	0.49	1,458	0.30	1.71	5,979
Canada	0.25	3.06	62,082	0.89	0.91	32,566	0.41	0.84	3,670	0.35	1.11	27,127
Chile	0.54	0.01	9,568	0.00	0.90	3,734	0.17	0.48	766	0.21	0.43	5,301
Colombia	0.14	2.43	15,872	0.44	0.66	5,306	0.00	1.44	647	0.00	0.00	0
Costa Rica	0.00	0.00	0	0.20	0.00	926	0.00	0.00	175	0.00	0.00	994
Czech Republic	0.44	0.01	7,110	0.48	0.96	1,516	0.34	0.39	166	0.38	0.61	5,043
Denmark	0.59	0.43	7,603	0.56	1.60	1,309	0.66	0.20	462	0.50	0.57	2,676
Estonia	0.00	0.00	0	0.36	0.00	195	0.00	0.00	66	0.34	0.00	561
Finland	0.25	0.00	7,917	0.02	2.42	1,362	0.31	1.28	318	0.00	1.51	2,489
France	0.72	0.02	34,014	0.58	0.80	9,106	0.78	0.27	4,069	0.66	0.37	35,751
Germany	0.70	0.02	84,221	0.65	0.99	19,394	0.27	0.47	6,129	0.45	0.77	34,982
Greece	0.38	0.00	23,661	0.56	2.48	2,071	0.13	2.13	892	0.43	3.11	2,539
Hungary	0.34	0.13	6,724	0.52	0.71	1,515	0.00	1.04	135	0.57	0.74	3,518
Iceland	0.00	0.00	0	0.01	0.00	98	0.52	0.00	90	0.05	0.00	403
Ireland	0.53	0.00	3,025	0.38	0.93	588	0.19	0.00	418	0.53	0.27	2,813
Israel	0.00	0.01	11,672	0.00	0.84	3,036	0.00	1.27	530	0.00	0.00	0
Italy	0.58	0.08	60,925	0.54	1.95	7,412	0.55	0.78	2,194	0.71	1.06	22,785
Japan	0.62	0.00	125,618	0.31	1.10	30,453	0.11	1.05	6,406	0.06	1.13	20,865
Korea	0.87	0.00	130,445	0.00	1.96	9,966	0.00	2.75	4,454	0.07	2.16	18,547
Latvia	0.00	0.00	0	0.40	0.00	182	0.22	0.00	77	0.23	0.00	816
Lithuania	0.23	0.00	7,954	0.54	9.42	253	0.00	11.17	69	0.28	1.41	1,751
Luxembourg	0.00	0.00	0	0.25	0.00	336	0.26	0.00	504	0.24	0.00	1,439
Mexico	0.00	2.45	36,867	0.18	0.38	24,820	0.04	0.45	2,894	0.06	0.26	9,258
Netherlands	0.75	0.01	51,760	0.80	1.14	3,820	0.86	1.81	2,381	0.76	3.03	5,890
New Zealand	0.28	0.22	3,679	0.34	0.57	2,180	0.30	0.97	549	0.36	0.59	3,175
Norway	0.51	7.92	11,034	0.38	5.43	763	0.60	1.33	351	0.47	1.06	2,162
Poland	0.36	0.04	24,755	0.63	0.80	4,877	0.10	1.26	575	0.35	0.69	17,936
Portugal	0.56	0.00	9,287	0.34	2.28	969	0.43	0.84	793	0.43	0.96	4,208
Slovak Republic	0.08	0.00	5,507	0.35	1.90	553	0.00	1.47	26	0.31	1.32	2,014
Slovenia	0.00	0.00	0	0.64	0.00	369	0.00	0.00	10	0.48	0.00	1,353
Spain	0.75	0.00	56,922	0.78	1.84	5,244	0.52	0.09	3,358	0.72	0.14	21,813
Sweden	0.38	0.00	18,247	0.40	2.08	2,194	0.60	0.04	415	0.52	1.10	5,023
Switzerland	0.29	0.00	2,289	0.33	0.23	2,131	0.23	0.01	784	0.47	0.28	2,722
Turkey	0.45	0.10	34,413	0.00	1.52	3,029	0.45	0.94	3,512	0.42	0.66	24,952
United Kingdom	0.60	0.86	44,476	0.97	1.33	10,793	0.82	0.39	4,673	0.67	0.52	22,870
US	0.57	0.74	748,489	0.75	0.89	376,565	0.68	0.96	63,111	0.62	1.15	185,961
OECD Asia average	0.75	0.00	128,031	0.15	1.53	20,210	0.05	1.90	5,430	0.07	1.64	19,706
OECD EU average	0.38	0.04	19,418	0.46	1.53	2,903	0.32	1.07	1,087	0.42	0.86	8,186
OECD Middle East average	0.22	0.06	23,042	0.00	1.18	3,033	0.22	1.10	2,021	0.21	0.33	12,476
OECD average	0.39	0.51	44,738	0.42	1.38	15,390	0.31	0.99	3,164	0.37	0.78	14,145

Items in bold highlight those countries where indigenous production 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 ith 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 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 the country exporting. 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 5:1:1:1:1:1). This maximum diversity score then acted as our upper score of 1, with all other scores divided by this maximum to standardise the data.



© Crown copyright 2022

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit nationalarchives.gov.uk/doc/open-government-licence/version/3 or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: psi@nationalarchives.gsi.gov.uk.

Where we have identified any third-party copyright information you will need to obtain permission from the copyright holders concerned.

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

If you need a version of this document in a more accessible format, please email energy.stats@beis.gov.uk

Please tell us what format you need. It will help us if you say what assistive technology you use.