

*The following member country profile is an excerpt from Chapter 4 of the publication Energy Supply Security 2014 and is not intended as a stand-alone publication.*

### CHAPTER 4: Emergency response systems of individual IEA countries

The ability of the International Energy Agency (IEA) to co-ordinate a swift and effective international response to an oil supply disruption stems from the strategic efforts of member countries to maintain a state of preparedness at the national level. Energy security is more than just oil, as the role of natural gas continues to increase in the energy balances of IEA countries. The most recently completed cycle of Emergency Response Reviews (ERRs) reflected this change by assessing, for the first time, the member countries' exposure to gas disruptions and their ability to respond to such crises. This chapter provides general profiles of the oil and natural gas infrastructure and emergency response mechanisms for 29 IEA member countries.

Each country profile is set out in the following sequence:

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# United Kingdom

## Key data

Table 4.28.1 Key oil data

	1990	2000	2005	2010	2011	2012	2018*
<b>Production (kb/d)</b>	1 939.9	2 694.4	1 838.2	1 360.6	1 114.8	950.8	1 003.8
<b>Demand (kb/d)</b>	1 775.9	1 765.4	1 819.5	1 621.5	1 583.8	1 502.7	1 442.7
<i>Motor gasoline</i>	562.8	498.8	435.2	349.5	333.6	319.7	-
<i>Gas/diesel oil</i>	414.4	511.5	557.3	568.8	567.5	574.7	-
<i>Residual fuel oil</i>	269.7	80.7	89.3	66.0	63.8	47.7	-
<i>Others</i>	529.0	674.6	737.7	637.1	618.9	560.5	-
<b>Net imports (kb/d)</b>	- 164.0	- 929.0	- 18.7	260.9	469.0	551.9	438.9
<b>Import dependency (%)</b>	- 9.2	- 52.6	- 1.0	16.1	29.6	36.7	30
<b>Refining capacity (kb/d)</b>	1 831.0	1 784.7	1 825.4	1 925.0	1 925.0	1 925.0	-
<b>Oil in TPES** (%)</b>	37	33	33	31	32	31	-

\* Forecast.

\*\* TPES data for 2012 are estimates.

Table 4.28.2 Key natural gas data

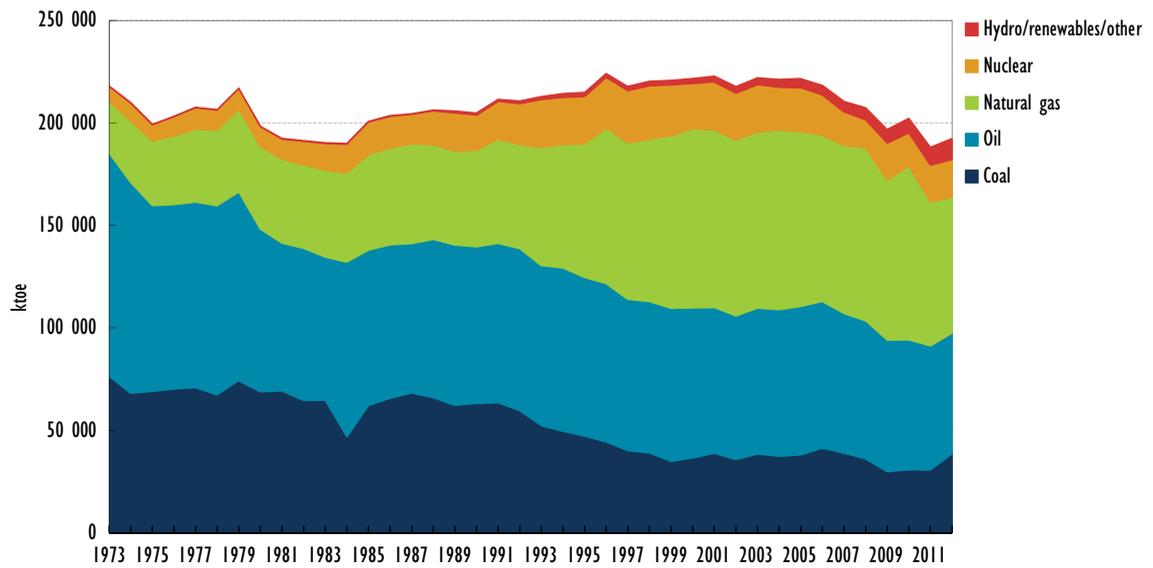
	1990	2000	2005	2010	2011	2012*	2018**
<b>Production (mcm/y)</b>	49 672	115 386	92 805	59 776	47 670	41 054	35 606
<b>Demand (mcm/y)</b>	58 312	101 812	99 643	98 944	82 428	78 083	78 277
<i>Transformation</i>	1 374	31 641	32 048	35 972	30 098	0	-
<i>Industry</i>	14 754	17 831	14 418	11 744	12 051	0	-
<i>Residential</i>	28 677	33 451	34 275	35 252	26 638	0	-
<i>Others</i>	13 507	18 889	18 902	15 976	13 641	0	-
<b>Net imports (mcm/y)</b>	8 640	- 13 574	6 838	39 168	34 758	37 029	42 672
<b>Import dependency (%)</b>	14.8	- 13.3	6.9	39.6	42.2	47.4	55
<b>Natural gas in TPES (%)</b>	23	39	39	42	37	34	-

\* 2012 data are estimates.

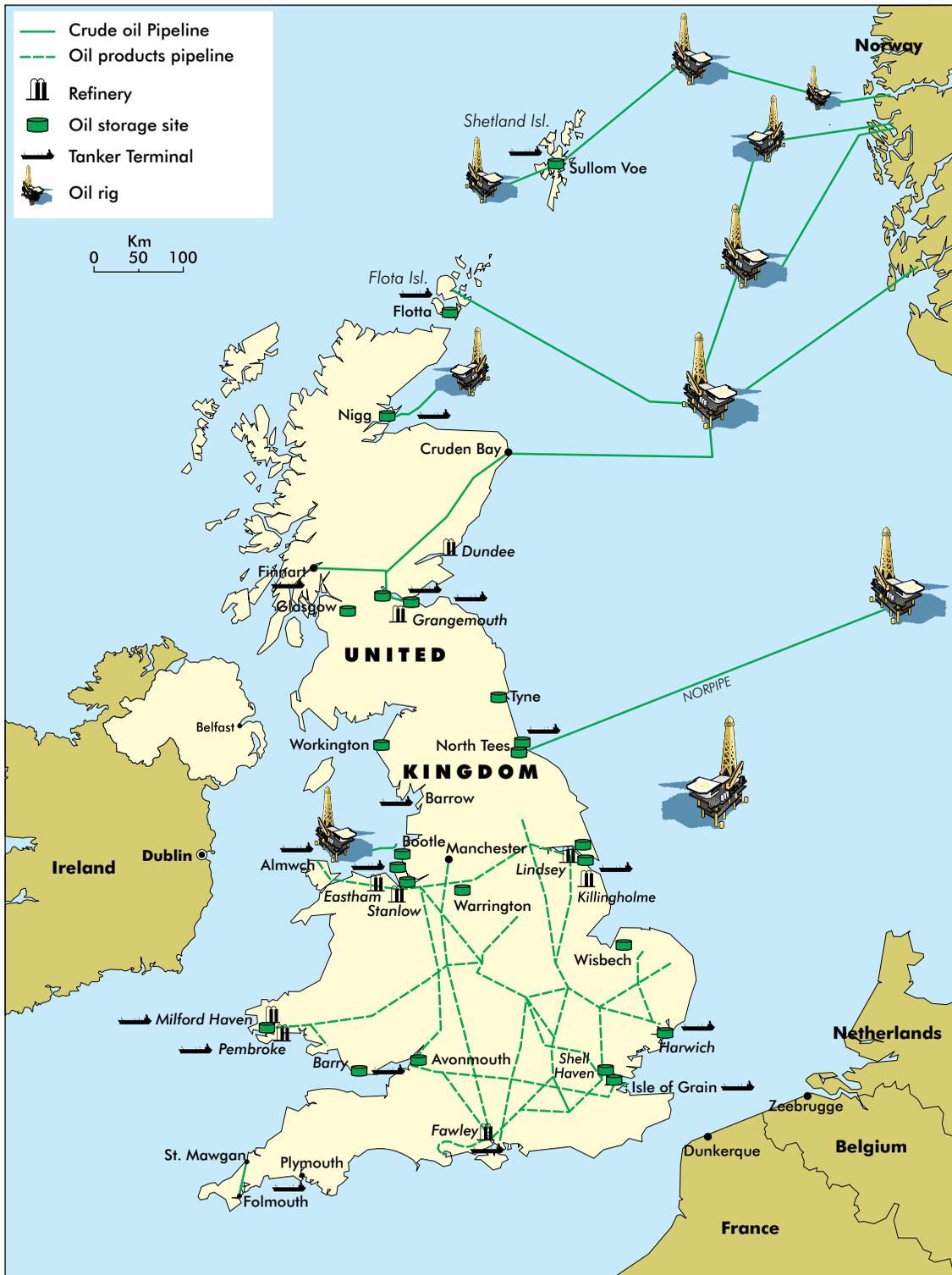
\*\* Forecast.

Note: This section on the emergency response systems of individual member countries was written by the IEA. All countries provided valuable information and comments. All opinions, errors and omissions are solely the responsibility of the IEA.

Figure 4.28.1 Total primary energy source (TPES) trend, 1973-2012



Map 4.28.1 Oil infrastructure of the United Kingdom



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Map 4.28.2 Gas infrastructure of the United Kingdom



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## Country overview

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Oil has been one of the dominant – although declining – energy sources in the United Kingdom, accounting for 32% of the country's total primary energy supply (TPES) in 2012. The United Kingdom has significant levels of domestic crude oil production, although production has declined, on average, by 7% per year since peaking at 2.9 million barrels per day (mb/d) in 1999. The country became a net importer of oil in 2005.

Total UK oil demand has also gradually declined since 2005. In 2012 average demand was 1.5 mb/d, down from 1.8 mb/d in 2005. The transport sector accounted for 71% of total oil consumption in 2011 – up from 66% in 2000. UK oil imports averaged 504 kb/d in 2012, accounting for 37% of the country's oil demand in 2012. The United Kingdom has relatively diversified crude import sources, with 46% of imports in 2012 coming from Norway, followed by Nigeria with 13% and the Russian Federation with 12%.

The Department of Energy and Climate Change (DECC) is responsible for co-ordinating the country's response to oil supply emergencies. The United Kingdom meets its International Energy Agency (IEA) stockholding obligation through a compulsory stockholding obligation (CSO) on oil companies. Refining companies are required to hold stocks equivalent to 67.5 days of their supplies during the previous four quarters, while importing companies must hold stocks equivalent to 58 days. There are no public stocks and the country does not have a public stockholding agency.

The UK held about 83 mb of oil and product stocks at the end of July 2013, equal to 224 days of 2012 net imports. Around 40% to total stocks were held in the form of crude and 60% as finished product.

Natural gas as a proportion of TPES has been in decline in the United Kingdom in recent years, dropping to 34% of TPES in 2012 from 42% in 2010. In 2012 total natural gas production was 41 bcm, considerably less than half of the level in 2000. Gas demand was 78 bcm in 2012, down from 82 bcm in 2011 and 98 bcm in 2010. In 2011, the transformation and residential sectors each accounted for about 36% of total gas consumption. Natural gas is the largest single source of fuel for electricity generation in the country, accounting for 40% of total power generation inputs in 2011.

UK natural gas imports amounted to 37 bcm in 2012 – around 47% of its requirements. The country's imports are relatively diversified, with significant imports from Norway (54% of total imports), Qatar (26%) and the Netherlands (15%). It has also expanded and diversified its gas import infrastructure to compensate for the ongoing decline in domestic production.

Three pipelines with a combined capacity of 47 bcm link the UK gas network to Norway, and two other pipelines with a combined capacity of 46.5 bcm link the United Kingdom to Europe via Belgium and the Netherlands. The United Kingdom also has four liquefied natural gas (LNG) import terminals with a combined capacity of 30.4 bcm.

The working natural gas storage capacity of the United Kingdom is approximately 4.7 bcm. The maximum daily delivery from storage is 135 million cubic metres per day (mcm/d). This is around a quarter of the peak-demand estimate of the National Grid (511 mcm/d for winter 2013/14) and 29% of the highest actual demand (465 mcm/d) recorded in January 2010. On average, gas storage makes up about 10% of the overall gas supply mix over the winter period.

UK natural gas security of supply relies primarily on diversification of import sources and infrastructure and supply routes, backed up by substantial gas storage facilities.

# Oil

## Market features and key issues

### Domestic oil production

The United Kingdom has significant levels of domestic crude oil production and ranks fourth among the IEA countries, after the United States, Canada and Norway. However, UK oil production has declined on average by 7% per year since peaking at 2.9 mb/d in 1999; the country became a net importer of oil in late 2005.

In 2012 domestic UK oil production averaged 951 kb/d – down from 1.36 mb/d in 2010 and 1.84 mb/d in 2005. According to government figures, production is expected to continue to decline for the foreseeable future – falling below 800 kb/d around 2020. IEA forecasts are slightly more optimistic, with domestic production expected to rebound to around 1 mb/d in 2018.

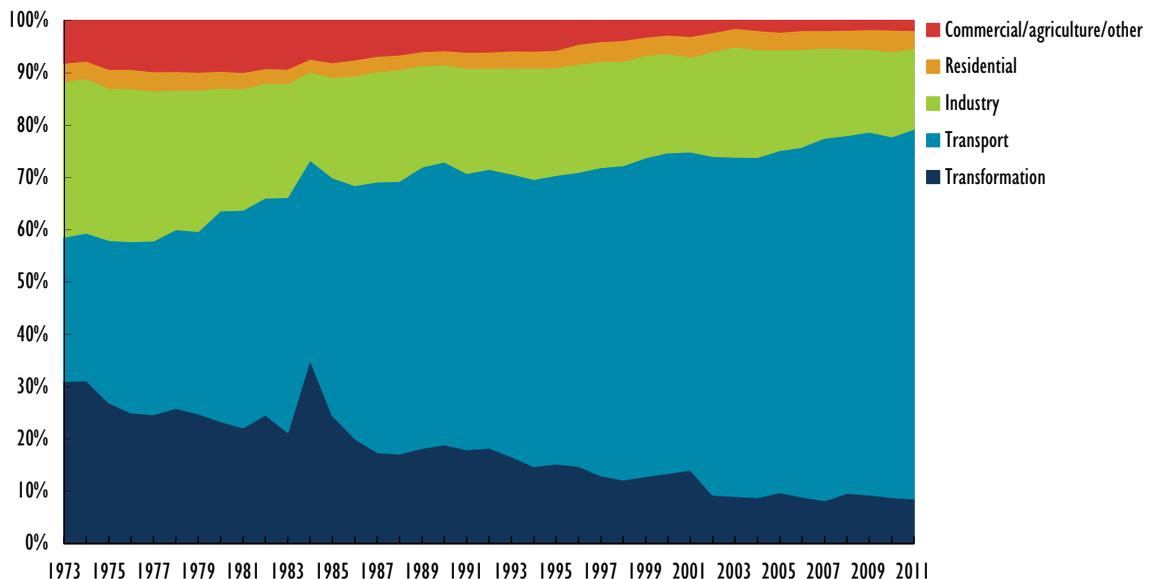
Almost all UK oil is produced from offshore fields, mainly in the North Sea.

### Oil demand

Total UK oil demand has gradually declined since 2005. Oil demand in 2012 averaged 1.5 mb/d, down from 1.6 mb/d in 2010 and 1.8 mb/d in 2005. The downward trend is expected to continue, and is forecast to reach 1.4 mb/d by 2018; this is largely because of a declining demand for gasoline.

Oil accounted for 32% of the country's TPES in 2012. The largest area of oil consumption in the United Kingdom is the transport sector, which accounted for 71% of total oil consumption in 2011 – up from 66% in 2000 and 58% in 1990. Industry was a distant second at 15%.

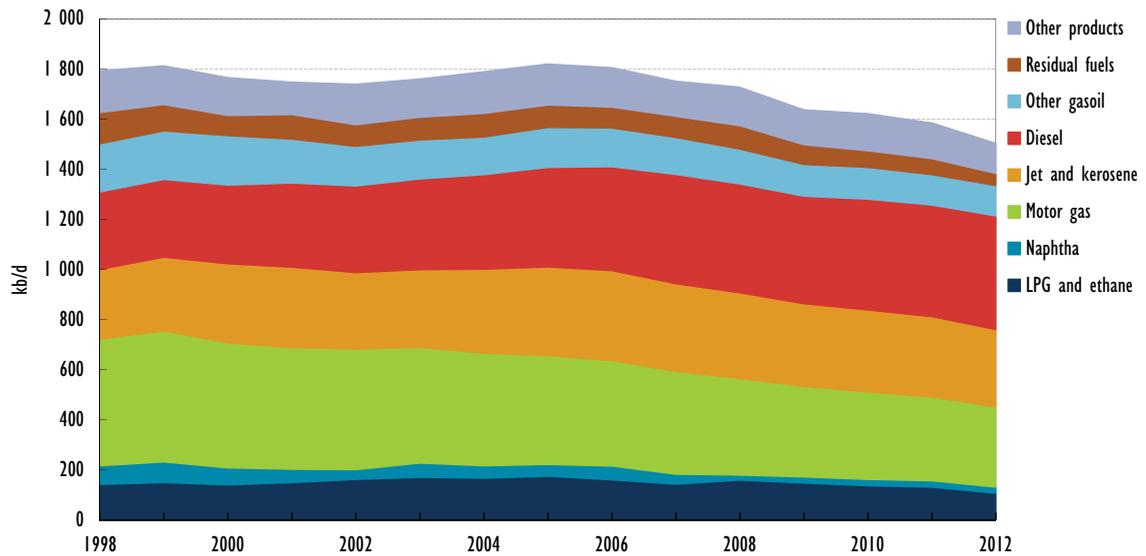
Figure 4.28.2 Oil consumption by sector, 1973–2011



Reflecting the dominance of the transport sector in UK oil consumption, the main oil products used are diesel, gasoline and jet fuel and kerosene. Diesel alone accounted for

30% of total oil demand in 2012, followed by motor gasoline at 21% and jet fuel and kerosene also at 21%.

**Figure 4.28.3** Oil demand by product, 1998-2012

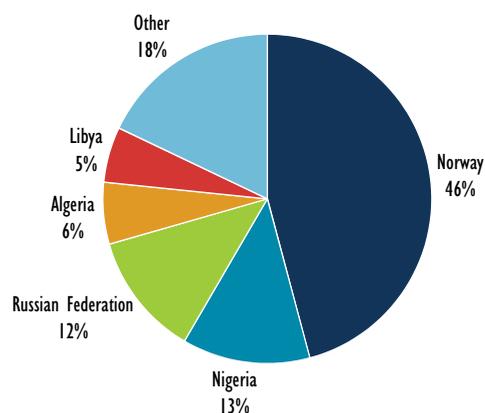


### Imports/exports and import dependency

In 2012 net UK crude oil imports averaged 504 kb/d. The United Kingdom has been a net importer of oil since 2006, with imports accounting for 37% of the country's oil demand in 2012 – up from 30% in 2011 and 16% in 2000.

UK crude import sources are relatively widely diversified, with 46% of imports in 2012 coming from Norway, followed by Nigeria with 13% and Russia with 12%.

**Figure 4.28.4** Crude oil imports by origin, 2012



The United Kingdom is also a significant producer of refined product, with refining capacity of 1.9 kb/d, and is a net product exporter – albeit in limited quantities (29 kb/d in 2012 and 89 kb/d in 2011).

## Oil company operations

There are more than 200 companies involved in the distribution and marketing of oil products in the United Kingdom – ranging from oil companies, supermarkets and retail chains to small, independent retailers.

The retail market covers fuels mainly sold from the country's 8 600 filling stations (as of the end of 2012). The number of filling stations has more than halved since 1990. The major suppliers (BP, Esso, Texaco and Shell) have over 4 000 branded stations though many of these are operated by independent dealers. The market is a complex one with over 2 000 sites operated and owned by companies and a further 5 000 operated by independent dealers. At the end of 2012, the four largest supermarkets owned over 13 000 stations and supplied over 40% of the retail fuel market.

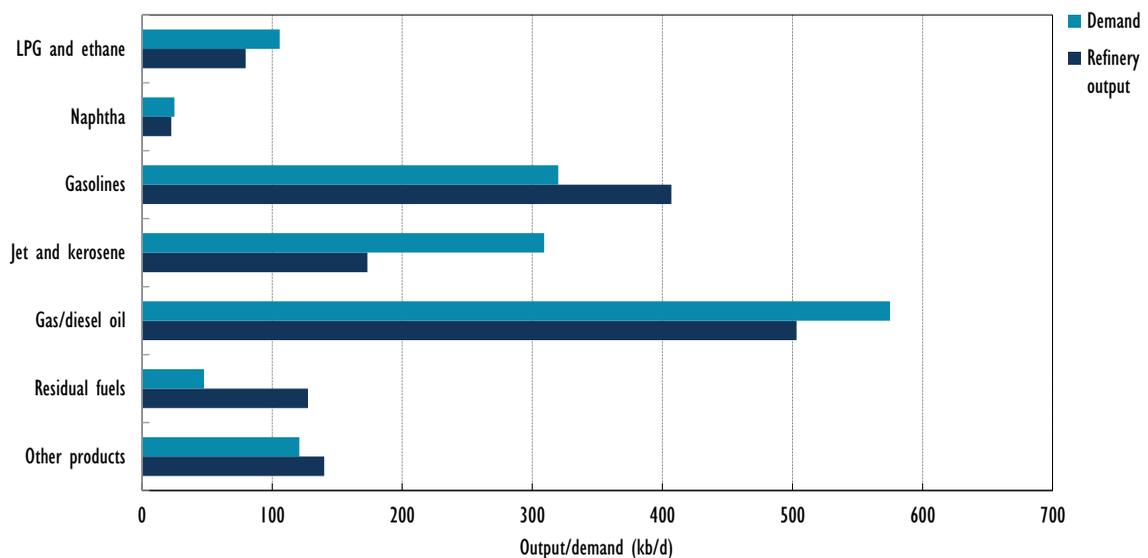
## Oil supply infrastructure

### Refining

There are seven major refineries operating in the United Kingdom, with a combined output of around 1.5 mb/d in 2012. Together, these refineries supply over 90% of the inland market demand for oil products. The country also has three smaller petrochemical refineries producing specialty products such as solvents, process oils and bitumen.

The UK refining sector, in common with other European countries, faces a number of challenges, including weak refining margins, increasing global refining capacity and overcapacity, increasing environmental and regulatory burdens and an increasing supply/demand imbalance of refined products. With regard to this imbalance, the United Kingdom imported a net 189 kb/d of middle distillates in 2012, and exported 85 kb/d of motor gasoline.

Figure 4.28.5 Refinery output vs. demand, 2012



Vertically integrated international oil companies (IOCs) have traditionally dominated the refining sector. However, in response to challenging conditions in European countries and to opportunities elsewhere, the IOCs have reduced their presence in the domestic refining business. For example, BP withdrew from the domestic refining sector after the sale of its Grangemouth and Coryton refineries in 2007. Shell also exited in 2007

after selling its Stanlow refinery to Essar Energy, and Chevron Texaco sold its Pembroke refinery and related assets to Valero Energy Corporation that same year. In January 2011, Ineos announced a joint venture agreement with Petrochina for the Grangemouth refinery and its related assets. Finally, and most significantly, the Coryton Refinery closed in June 2012 following the bankruptcy of Petroplus.

### **Ports and pipelines**

The United Kingdom has a 4 800 km oil pipeline network – including the pipelines connecting onshore oil terminals to the North Sea oil fields. Around half of the pipeline network is privately owned and the other half is government owned.

The privately owned sections of the domestic pipeline network carry a variety of oil products around the country – from road transport fuels to heating oil and aviation fuel. This includes the provision of jet fuel for some of the major airports, including Heathrow, Gatwick, Manchester and Birmingham. The government operates a separate oil pipeline system – the Government Pipeline and Storage System (GPSS) – supplying a number of military airfields and with connections to some commercial airports, such as Stansted and Manchester.

The United Kingdom also has four major land-based terminals through which about two-thirds of the country's crude oil production flows. They are Sullom Voe (Shetlands), Flotta (Orkneys), Kinneil (at the end of the Forties Pipeline System) and Teeside on the east coast. Hamble, another mainland terminal, deals with oil coming from several onshore oilfields in the south of England. These terminals supply more than one-third of total crude to UK refineries.

### **Storage capacity**

A total of 83 mb of oil and product stocks were held on UK territory as of July 2013. The main storage facilities for crude and oil products in the United Kingdom are located at refineries. A number of major product distribution terminals also serve as self-contained, separate storage and distribution facilities. Altogether, the refinery and stand-alone terminals comprise a total of 59 primary distribution terminals. They are collectively supplied by pipeline (51% by volume), rail (15%), and sea (34%) from UK refineries and – in some cases – from overseas.

## *Decision-making structure*

The DECC is responsible for co-ordinating the country's response to oil supply emergencies. Within the department, the Energy Resilience Team (ERT) serves as the national emergency strategy organisation (NESO). This team is responsible for maintaining and implementing emergency response measures in an oil supply disruption, and also for supervising the guidelines that companies are required to follow with regard to security of natural gas supplies.

The legal basis for DECC's authority to function as the NESO during an oil supply disruption is the Energy Act 1976. The act provides powers, subject to an order in council, for the Secretary of State for Energy and Climate Change to regulate or prohibit the production, supply, acquisition or use of fuel in a domestic oil supply emergency, or in order to enable the United Kingdom to meet its international obligations in the event of an IEA collective action.

In the event of an emergency – once the NESO has been activated – the UK government has two primary emergency response policy options: 1) draw down oil stocks by lowering the CSO on industry; and 2) instigate demand restraint measures.

The government's preferred option for responding to an emergency is to draw down oil stocks – and there is a six-stage process in place to activate this option. During the IEA collective action in 2005 following Hurricane Katrina and again in 2011 during the Libyan crisis, the United Kingdom met its IEA obligations by reducing the CSO on industry and drawing down oil stocks.

## Stocks

### Stockholding structure

The United Kingdom meets its IEA stockholding obligation through a CSO on oil companies. There are no public stocks, and the country does not have a public stockholding agency.

Section 6 of the Energy Act 1976 allows the Secretary of State for Energy and Climate Change to direct companies that produce, supply or use petroleum products within the UK market to hold minimum levels of oil stocks (and to release them to the market in an emergency). Accordingly, refining companies must hold stocks equivalent to 67.5 days of their supplies during the previous four quarters, while importing companies must hold stocks equivalent to 58 days. Other stocks, predominantly those held off shore, also contribute towards the UK total.

As the country's oil production is decreasing, net imports are set to rise significantly in the short to medium term and, consequently, its stockholding obligations to the IEA and the EU are expected to rise progressively. Under the EU Directive of 14 September 2009 on crude oil and petroleum product stockholding obligations (Council Directive 2009/119/EC), the United Kingdom is obliged to hold "90 days of average daily net imports or 61 days of average daily inland consumption, whichever of the two quantities is greater". The country's 90-day IEA/EU obligation is not expected to overtake the consumption-based EU obligation until the early to mid-2020s. Once this takes place and the United Kingdom switches to calculating its minimum stockholding requirements on the basis of the IEA/EU 90-day obligation, the country will need to hold progressively more stocks than it has previously as the proportion of imports continues to grow.

### Crude or products

Approximately 40% of the stocks held in the UK are in the form of crude oil.

### Location and availability

There are no restrictions on the location of compulsory stocks in the United Kingdom. However, companies must report, on a monthly basis, the location of all stocks that count towards their obligation. Compulsory stocks are often commingled with company operating stocks.

Compulsory stocks can be held in three ways: by the company itself in the United Kingdom, by third parties, on behalf of the company within the United Kingdom, or by the company, by an affiliate or by third parties in another EU member state, provided that the affected stocks are held under a bilateral agreement between the United Kingdom and the relevant member state.

### Monitoring and non-compliance

Oil companies and importers are required to submit monthly oil returns to the DECC. A compliance report detailing any inconsistencies in the data is forwarded to each

company monthly. All stock data, and physical stocks, are subject to audit if required. In cases where a company fails to comply with its obligations, the DECC is empowered under Schedule 2 of the Energy Act 1976 to investigate and, if necessary, to prosecute.

### **Stock drawdown and timeframe**

During the implementation stage of a stockdraw, companies are obliged to develop an implementation plan and notify the DECC. Stocks would be expected to be drawn down within an agreed timeframe – usually one month. The DECC's preference is for implementation plans to be made on a voluntary basis, but in the event that acceptable company-specific implementation plans cannot be agreed on, the DECC would use its legal authority to direct companies to release stock.

### **Financing and fees**

The costs of compulsory oil stocks are financed by the companies operating in the market, and thus implicitly passed on to consumers through market prices.

## *Other measures*

### **Demand restraint**

The transport sector accounts for the majority of UK oil consumption – representing 71% of total consumption in 2011. Therefore, the most effective demand restraint measures – and consequently the most likely to be used in an emergency – would be targeted towards the use of transport fuels.

Under the Energy Act 1976, the UK government has the authority to control the production, supply, acquisition and use of oil and oil products as it deems necessary. In principle, the government prefers to allow market mechanisms to resolve temporary disruptions to the greatest extent possible. In a disruption requiring government action, light-handed measures are preferred; more heavy-handed demand restraint and allocation measures would be unlikely. However, should a serious crisis emerge, these could be introduced as necessary.

Demand restraint measures in the United Kingdom are set out in the National Emergency Plan for Fuel (NEP-F). A number of measures can be considered as part of an emergency response to any situation involving fuel supply disruption, ranging from light-handed measures to the allocation and rationing of oil products.

### **Fuel switching**

This is not a viable option at present. Oil-fired electricity generation in the United Kingdom is minimal (less than 1% in 2013), so the scope for fuel switching is limited. However, around 15 combined-cycle gas turbine (CCGT) power stations have stocks of middle distillate to provide backup generation sufficient to keep functioning for up to seven days in the absence of natural gas supplies.

### **Other**

The UK government is unlikely to consider surge production as an emergency response measure as this could damage oil fields and reduce their long-term viability. However, the government does have the power to require this measure under the Energy Act 1976.

# Gas

## Market features and key issues

### Gas production and reserves

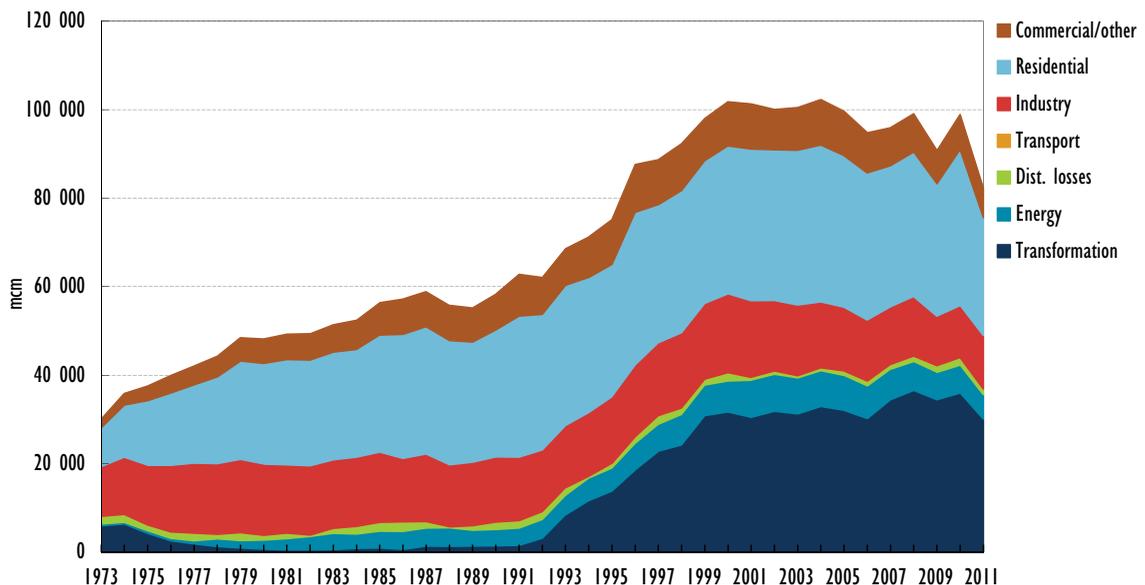
UK natural gas production comes primarily (99.9%) from offshore fields – mostly from the North Sea but also from the Irish Sea. Production peaked in 2000 at 115 bcm, and has declined quickly since then at a rate of about 6% per year. In 2012, total gas production was 41 bcm – less than half of the level in 2000. The decline is expected to continue and gas production is expected to drop to just over 35.5 bcm by 2018.

### Gas demand

Natural gas demand in the United Kingdom was 78 bcm in 2012, down from 82 bcm in 2011 and 98 bcm in 2010. Natural gas as a proportion of TPES has also been in decline in recent years, dropping to 34% of TPES in 2012, from 37% in 2011 and 42% in 2010. The decline in natural gas demand is expected to plateau in the short to medium term, with demand rising slightly to 78.3 bcm by 2018.

UK natural gas demand peaks during the winter months. The record peak natural gas demand experienced on the UK gas network was 465 mcm/d in January 2010.

Figure 4.28.6 Natural gas consumption by sector, 1973–2011



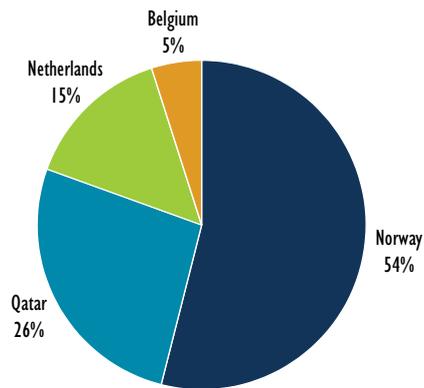
The biggest areas of natural gas consumption in the United Kingdom are the transformation and residential sectors, each accounting for a 36% share of total demand. Natural gas is the largest single source of fuel for electricity generation in the country, accounting for 40% of total power generation inputs in 2011.

### Gas import dependency

The United Kingdom has been a net importer of gas since 2004, and in 2012 the country imported fully 47% of its requirements from overseas. This figure is up sharply from 42%

in 2011, 40% in 2010, and 7% in 2005. This trend is expected to continue, with natural gas imports forecast to meet 55% of total demand in 2018.

Figure 4.28.7 Natural gas imports by source, 2011



### Gas company operations

The UK natural gas sector is privately controlled, including production, distribution and transmission. The largest gas supplier in the United Kingdom is Centrica, a spin-off of the assets of formerly state-owned British Gas. The National Gas Grid (NGG) controls the domestic gas transmission system.

## Gas supply infrastructure

### Ports and Pipelines

The United Kingdom has a natural gas pipeline distribution network that is around 285 000 km in length and provides services to almost 23 million users. In addition, the country has a 7 600 km high-pressure transmission pipeline network which transports gas from import points (pipeline or LNG terminals) to major centres of population as well as to some large users, such as gas-fired power plants. These pipeline networks comprise the National Transmission System (NTS), which is owned and operated by NGG.

In order to compensate for the decline in production, the United Kingdom has expanded and diversified its gas import infrastructure. Three pipelines with a combined capacity of 47 bcm link the country's gas network to Norway (incoming flows from North Sea fields). Two other pipelines link the United Kingdom to continental Europe. The first is the Interconnector UK, a two-way pipeline with a capacity to import up to 26.9 bcm to the United Kingdom, or export up to 20 bcm to Belgium. This pipeline is generally used for imports in winter and exports in summer. The other pipeline connecting the United Kingdom to continental Europe is the Balgzand to Bacton (BBL) pipeline. The BBL is a one-way pipeline with a capacity of 19.5 bcm used to import gas into the United Kingdom from the Netherlands.

The United Kingdom also has four LNG import terminals, namely Teesside GasPort (capacity 4 bcm), Isle of Grain (capacity 20.4 bcm), South Hook Milford Haven (21 bcm) and Dragon LNG (6 bcm). There are no UK import projects under construction; however there are six proposed projects with the potential to increase LNG capacity and diversity of supply.

## Storage

The working natural gas storage capacity of the United Kingdom is approximately 4.7 bcm. Historically, it has had less need of gas storage capacity than other major gas markets within the European Union because of “swing production capacity” provided by indigenous gas fields. As these fields continue to decline there is an increasing need for replacement “swing supply capacity” – including from additional import infrastructure and gas storage capacity.

The country has three types of gas storage: long-range storage, medium-range storage (typically salt caverns such as Aldbrough, and depleted fields such as Hatfield Moor), and short-range storage (peak LNG plants). Long-range storage is typically used for seasonal variations. Rough, the only such facility in the United Kingdom, represents three-quarters of the country’s storage capacity. It is owned and operated by former incumbent Centrica Storage.

The maximum daily deliverability from storage is 135 mcm/d following the expansion of the Aldbrough facility and the start-up of the E.ON facility at Holford. This is around one-quarter of the National Grid’s peak-demand estimate (511 mcm/d for winter 2013-14) and 29% of the highest actual demand (465 mcm/d) recorded in January 2010. On average, gas storage makes up about 10% of the overall gas supply mix over the winter period (October to March).

## *Emergency policy*

The United Kingdom has a market-based regulatory regime for the natural gas sector. In normal conditions the country relies on the market to maintain security of supply. The DECC, Ofgem and NGG work together to closely monitor gas security of supply.

In the event of an emergency, the country has a specific emergency response plan – the National Emergency Plan for Gas and Electricity (NEP-G&E). The NEP-G&E sets out the arrangements between the gas and electricity industries, and the DECC, for the safe and effective management of gas and electricity supply emergencies in the United Kingdom. (Separate arrangements are in place for Northern Ireland.) The NEP-G&E includes provision for the use of emergency powers under the Energy Act 1976, which would only be activated in significant emergencies. The plan applies to the two forms of supply:

- electricity supply network from generator to consumer’s meter or electricity supply terminal
- downstream gas supply network from reception terminal or storage site to customer isolation valve.

## Emergency response measures

In the event of a natural gas supply disruption, the Network Emergency Coordinator (NEC) would co-ordinate emergency response measures across the affected parts of the gas network. The NEC is an independent body that is also responsible for declaring a network gas supply emergency and for authorising the strategy proposed by the NGG to resolve the emergency. This is implemented under industry arrangements independent of the NEP-G&E. Large industrial gas users are directed to cease all use or, for protected sites under the Gas Priority User Arrangements, to reduce their gas demand significantly, with the aim of maintaining safe minimum pressures within the gas network. The last customers to be affected would be residences. A volume of gas must be maintained in storage to protect certain vulnerable customers, such as households and hospitals, against a “1 in 50” winter.

Fuel switching in power generation is the most common response to reductions in the natural gas supply. In these circumstances natural gas is generally replaced by coal or, where possible (as in the case of combined-cycle gas turbines) with distillate. Interruptible supply contracts in the industrial and commercial sectors also provided an estimated maximum daily interruptible gas capacity of about 36 bcm in 2010.

To complement these market procedures, commercial storage capacity has increased by around 25% in the past decade. Deliverability (the rate at which gas can be supplied to the network), has also increased from 100 mcm to 135 mcm/d. The United Kingdom has also enhanced and diversified its import infrastructure, and remains a large (although declining) producer.

The market is able to respond to periods of high demand by increasing imports and storage flows to meet demand without any intervention (such as from the National Grid).