

7. Oil

7.1 Introduction

7.1.1 The UK is already heavily involved in the global oil market, as both an importer and exporter, with the balance moving towards increased import dependency over the medium and long term. As a result, both the demand and the supply side of the UK oil industry face new challenges. This chapter, therefore, focuses on both UK and global supply and demand conditions, as these are the main determinants of oil availability and prices.

7.2 UK Oil Demand

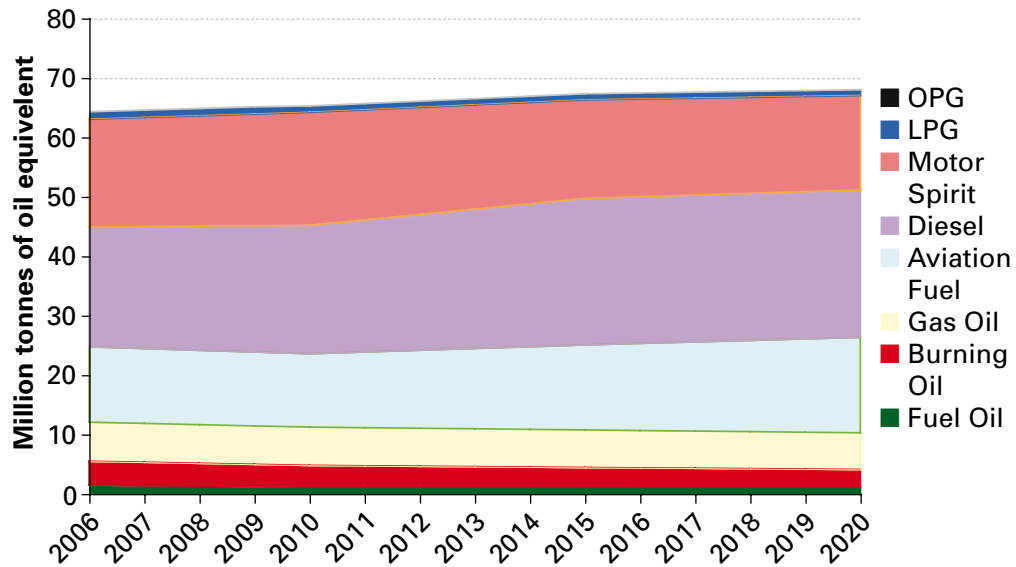
7.2.1 The UK's oil intensity, at around 0.2 to 0.3 bbl/\$1000, is around half that of the US and the world average⁷³, one of the lowest amongst the G7 countries, and is in further decline. Demand for oil in the transport sector is still robust (approx 70% of total UK oil consumption) and projected to increase in the short to medium term. However, demand in the industry and domestic sectors is declining.

7.2.2 As seen in Chart 7.1, while consumption of petrol in the UK is forecast to fall, demand for diesel and aviation fuel is expected to continue to rise, as is total oil demand, in absolute terms.⁷⁴

⁷³ Figure obtained from DECC analysis of IEA and IMF data (2007).

⁷⁴ *IEA Medium-Term Oil Market Report*, July 2008.

Chart 7.1: Forecast UK oil demand by petroleum product type



Source: BERR forecast model

7.2.3 Consumption of diesel fuel steadily increased from 2001 to surpass deliveries of motor spirit in 2005, while consumption of motor spirit in 2006 was 25% lower than the peak of 24m tonnes in 1990. The increase in UK demand for diesel is expected to continue to be driven by improvements in diesel engine technology, which have encouraged motorists to switch to more fuel-efficient diesel powered cars.

7.2.4 Developments are also expected in the market for marine fuel oil. The International Maritime Organization (IMO) has recently proposed amendments to the MARPOL Annex VI regulations to reduce harmful emissions from ships. The main changes are to:

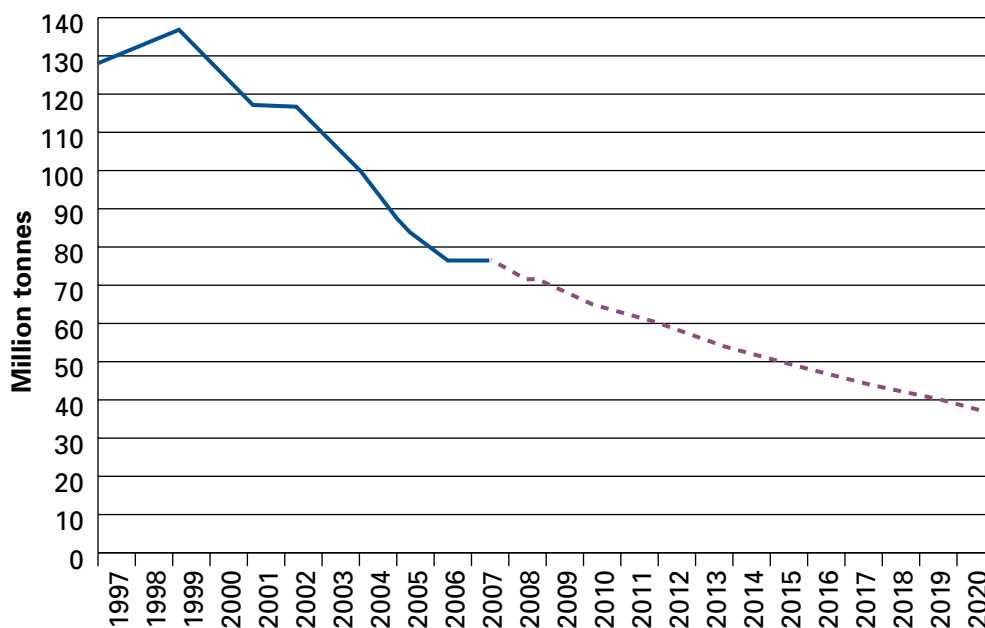
- mandate a progressive reduction in sulphur oxide emissions, with stepped reductions in permitted sulphur levels for marine fuel oil to 3.5% (from the current 4.5%), effective from 1 January 2012; with a further reduction to 0.5%, effective from 1 January 2020, subject to a feasibility review to be completed no later than 2018; and
- reduce limits applicable in Sulphur Emission Control Areas (SECAs) to 1%, beginning on 1 March 2010 (from the current 1.5%), being further reduced to 0.1% from 1 January 2015. In the current Annex VI, there are two SECAs designated; the Baltic Sea and the North Sea area, which includes the English Channel.

The effect of these changes is likely to reduce fuel oil demand from 2015 onwards, with a corresponding increase in demand for marine gas oil. With UK refineries configured to meet historic demand for petrol and fuel oil, more investment will be required to realign production with demand for middle distillate products.

7.3 UK Supply: Indigenous Production

7.3.1 Oil production from the UK continental shelf peaked in 1999. Buoyed by production from the large Buzzard Field, UK oil production rose slightly in 2007, but the decline of previous years is expected to resume, albeit at a slower rate given the high levels of investment. The chart below is based on DECC's latest published projections of UK oil production⁷⁵ through to 2013 with an assumption of a decline rate of 5.5% per annum thereafter.

Chart 7.2: UK crude oil and natural gas liquids production 1997-2020



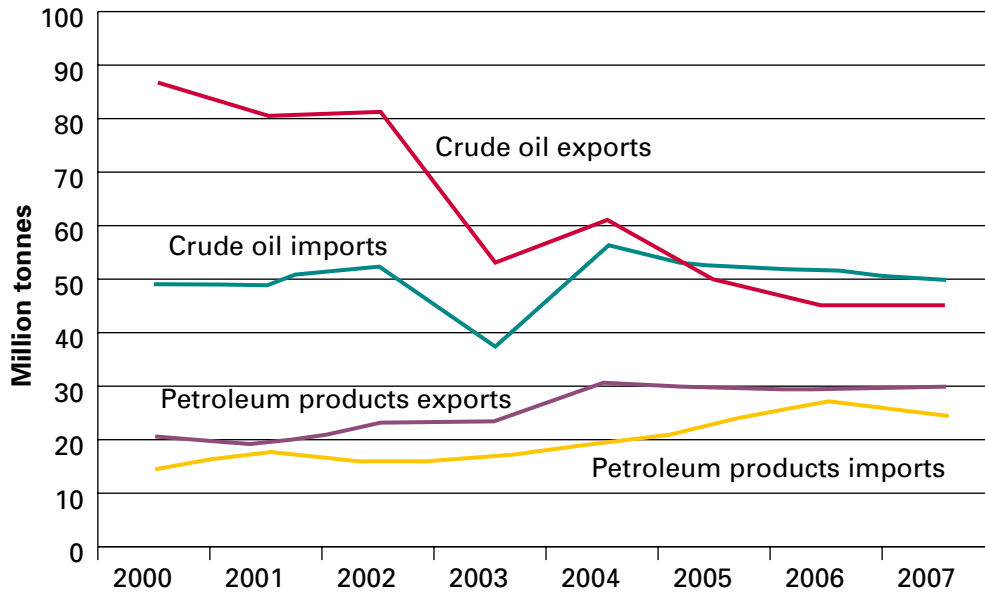
Source: DECC

7.4 UK supply: UK Imports

7.4.1 While the UK has become a net importer of crude, we still remain and expect to continue to be net exporters of petroleum products.

⁷⁵ Further information available at https://www.og.berr.gov.uk/information/bb_updates/chapters/Section4_17.htm

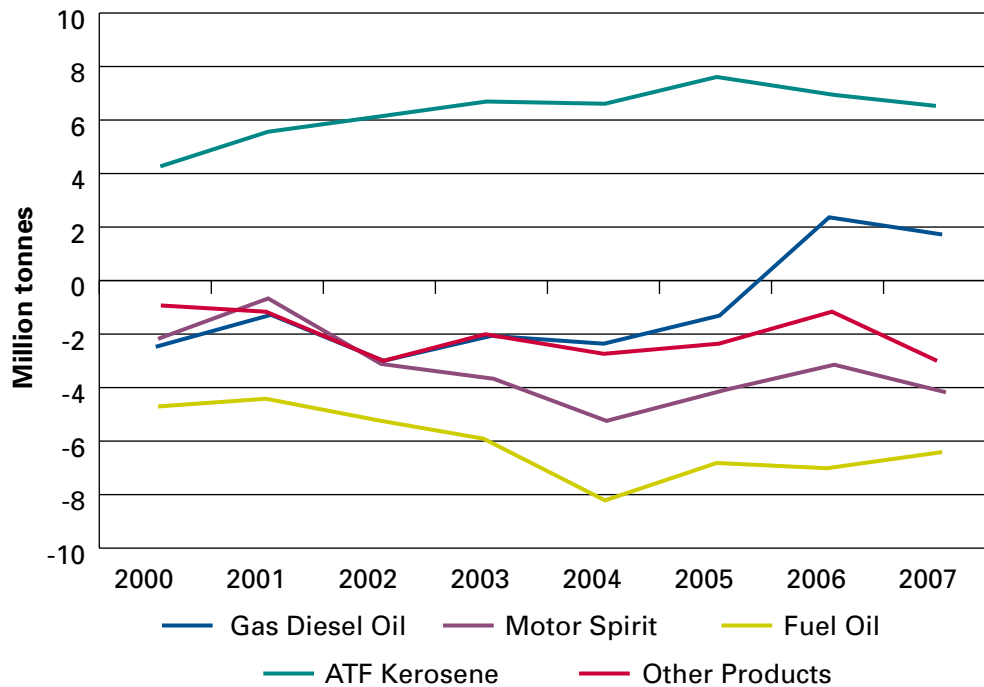
Chart 7.3: Imports and exports of crude oil and petroleum products



Source: BERR: DUKES Chart 3.4

7.4.2 In 2007, nearly 33% of total UK product demand was met through imports, an increase of 13% from 2000 levels. Demand differences between product types explain why the UK imports petroleum products when there is an overall surplus available for export. For instance, gas/diesel oil exports from the UK tend to be of lower grades for use as heating fuels in countries with less stringent sulphur restrictions, while imports tend to be of higher-grade gas/diesel oil with low sulphur content. The UK imports jet fuel (mainly from the Middle East) and diesel (mainly from Russia) to cover a deficit in these products, and exports surplus petrol (mainly to the USA) and fuel oil. The US remains one of the key markets for UK exports of oil products, accounting for 19% of total UK exports of oil products in 2006.

Chart 7.4: Net UK Imports of Petroleum products



Source: BERR Digest of UK Energy Statistics

7.4.3 With increasing dependency on imports of aviation turbine fuel (ATF) and gas/diesel oil, a number of import terminals are reaching capacity, and additional investment will be required in import terminals and related storage and distribution infrastructure. There is currently a shortage of middle distillates (ATF, heating oil, diesel and gas oil) in North West Europe. Although product is currently available from Russia, the Middle East and India, North West Europe competes for these imports with demand from rapidly developing markets such as China and India, and the market is anticipated to remain tight, with prices remaining robust and with increased risks to supply security.

7.5 UK Refining and Distribution: Key Challenges

Investment

7.5.1 UK refineries face the twin challenges of changes both in product demand and in crude oil supply. On the demand side, there is a declining market opportunity to export petrol to the United States. Figures from the US Department of Energy show a waning demand due to the economic downturn and the higher petrol prices experienced over the last few years. In June 2008, miles

driven in the U.S. were down 4.7 % from the same period in the previous year. Further, demand for jet and diesel/gas oil is increasing with the UK competing with the rest of Europe for imports. Significant changes in demand for marine fuels are also anticipated following changes in IMO regulations to reduce harmful emissions from ships. This will pose a challenge to the industry, with the potential requirement for significant investment to adapt the existing product mix to process more low sulphur products.

- 7.5.2 Falling North Sea oil production will mean that UK refiners will increasingly have to source their supplies from elsewhere. The closest alternative major supply source is from Russia, whose oil is of lower quality than present sources and so would require refiners to invest in adapting existing or acquiring new processing equipment in order to process significant quantities of crude oil from this source. Alternatively, they can source crude similar in grade to the North Sea from Africa and the Mediterranean, entailing higher delivery costs.

Competitiveness

- 7.5.3 The UK refineries face the challenge of improving their competitiveness in the European refining market. They are presently mid to low performers⁷⁶ within the EU peer group, so do not attract discretionary investment. UK refiners are also challenged by an ageing workforce and shrinking pool of available talent to replace those scheduled to retire from the sector. The sector has experienced problems recruiting domestically and has had increasingly to look overseas for qualified workers.

Biofuels

- 7.5.4 The recent introduction of the Renewable Transport Fuels Obligation (RTFO) requires companies selling transport fuels into the UK market to ensure that a certain percentage of their total sales are renewable fuels (paragraph 9.2.8 discusses biodiesel supply). These changes will impact the UK future product balance by:

⁷⁶ Review of UK oil refining capacity, Wood Mackenzie, May 2007. www.berr.gov.uk/files/file39390.pdf

- increasing the petrol surplus; the future UK petrol product surplus is likely to increase by the amount of ethanol being introduced into the UK market, 0.77 mt of ethanol in 2015. The additional surplus petrol will need to be exported, increasing the market challenge faced by UK refiners who will increasingly need to target other markets, or invest in the production of alternative products – such as middle distillates, where Europe is expected to be in deficit;⁷⁷
- delaying the UK entering a net deficit in the diesel/gas oil balance from 2008 until 2011 and then assisting the UK to return to a net surplus position once again in 2017 (see Chart 1.4 above).

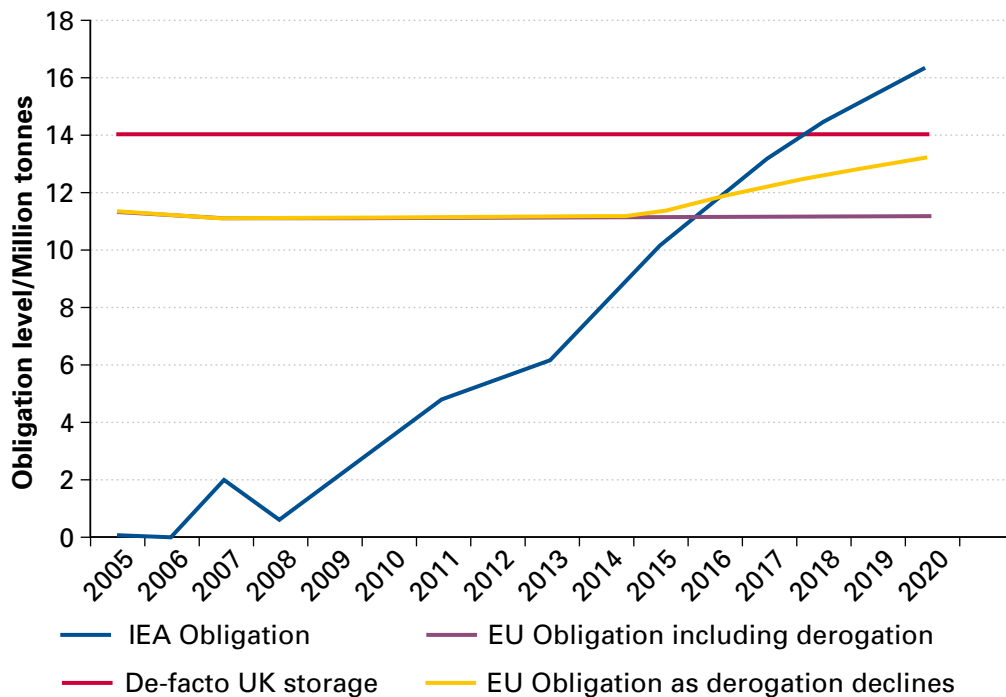
7.6 UK supply: Oil Stocks

- 7.6.1 Both the International Energy Agency and the European Union require their member states to hold stocks of oil, but the same stocks can be used to meet both obligations. To meet these obligations, the UK directs companies to hold stocks of oil for use in the event of disruption to global supplies.⁷⁸
- 7.6.2 The EU obligations are based on consumption and the IEA obligations are based on net imports. Currently, the EU requirements are above the IEA requirements; however, the UK's obligations under the IEA requirements are set to increase further as the UK increasingly becomes a net-importer of oil.

77 Review of UK oil refining capacity, Wood Mackenzie, May 2007 www.berr.gov.uk/files/file39390.pdf

78 Further details about the IEA's emergency responses procedures can be found at http://www.iea.org/textbase/nppdf/free/2007/fs_response_system.pdf.

Chart 7.5: Modelled forecast of UK Oil Stocking Obligations



Source: DECC

7.6.3 Between about 2016 and 2018 the IEA obligation is expected to overtake the EU obligation. Thereafter, the UK obligation for stock holdings will begin to increase steeply from its current level of 67.5 days’ consumption to an eventual total of 99 days’ consumption. At the same time the total UK obligation is likely to exceed the UK storage capacity available to hold these stocks.⁷⁹ More stocks and storage capacity will therefore be required to meet the overall UK stocking obligation.

7.6.4 In February 2007 and following an extensive stakeholder consultation, the Government announced changes to the operation of the UK’s industry-based compulsory stocking regime⁸⁰. One aspect of this decision was judicially reviewed in February 2008, when the High Court found in the Government’s favour. However, permission to appeal was granted and the Court of Appeal heard the case in December 2008.

7.6.5 In late April 2008, the EU Commission launched a public consultation on modernising the emergency oil stock regime. The consultation suggested closer alignment and

79 Further information is available at <http://www.berr.gov.uk/whatwedo/energy/international/oil-stocking/page28385.html>

80 Further information is available at <http://www.berr.gov.uk/whatwedo/energy/international/oil-stocking/page28385.html>

co-ordination between the EU and IEA stocking systems together with changing data reporting requirements and strengthening government control. The consultation closed in mid June and stakeholder responses can be viewed on the Commission's website⁸¹.

7.7 The Global Oil Market

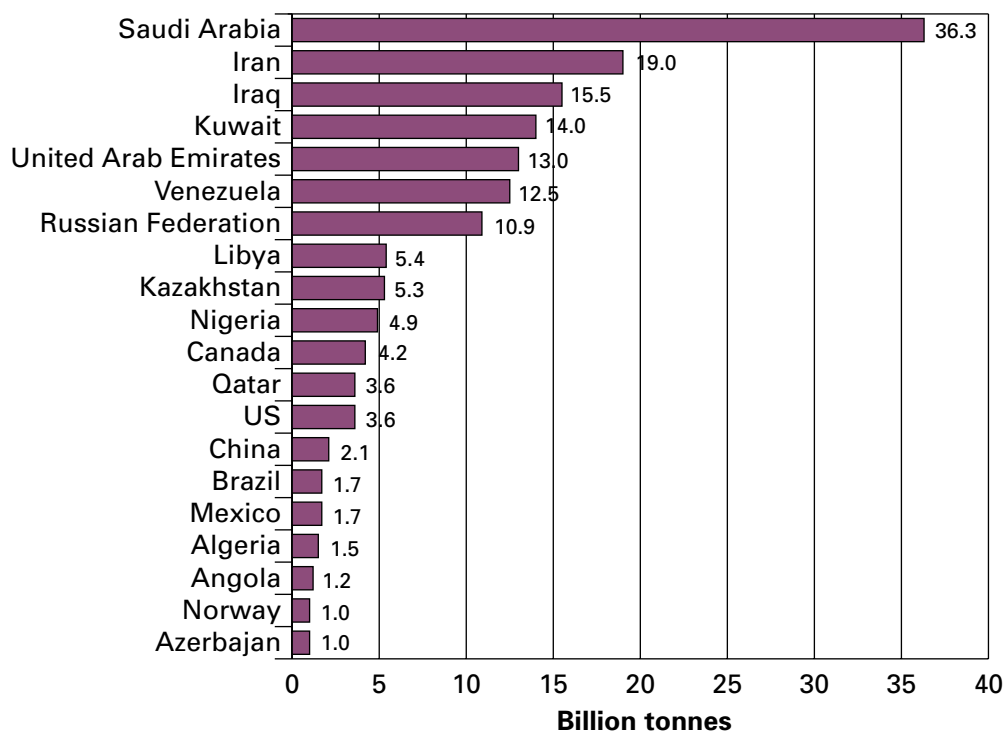
- 7.7.1 The UK acts as both buyer and seller in the global market, where prices and availability are determined by global supply and demand conditions; it is expected to become increasingly reliant on imports in the medium term.
- 7.7.2 Although prices have fallen significantly in recent months, 2008 saw oil prices hitting all-time highs, even in real terms. Unlike previous spikes, rising prices over the past year were largely the result of rapid demand growth, led by emerging economies like China and India, which caused tightness in both crude and product markets and raised concerns about the degree to which global supplies of crude oil and oil products are growing in line with global demand. Since their peak in July however, oil prices have fallen in excess of \$100/bbl as global demand for petroleum products has collapsed in the wake of economic slowdown.
- 7.7.3 The year's dramatic events have fostered considerable international efforts to improve the functioning of the oil market and, in June, Saudi Arabia hosted a meeting which brought together major producing and consuming countries, together with the IEA, IEF and OPEC. This meeting identified a number of areas where further work should be taken forward as part of an enhanced dialogue between producers and consumers to improve the functioning of the oil market and increase understanding. The UK is hosting a follow up meeting – The London Energy Meeting – on 19 December 2008 to continue this process and address the impact of the financial crisis on both demand and investment.
- 7.7.4 The rest of this chapter examines key risks to the future global supply of oil, particularly barriers to investment, both in the upstream and the downstream global oil markets, that may hinder the ability of the oil industry to respond to future demand trends.

81 Further details are available at http://ec.europa.eu/energy/oil/consultation/oil_stocks_en.htm

Global Resources and Reserves

7.7.5 Although estimates of economically recoverable reserves vary, the physical existence of oil is not the major concern.⁸² According to the *BP Statistical Review of World Energy 2008*⁸³, the world's proven reserves⁸⁴ of oil amounted to 193 billion tonnes (or 1390 billion barrels)⁸⁵ at the end of 2007, equivalent to 41.6 years of current production. The Middle East accounts for 54% of the world total, with Saudi Arabia alone accounting for 19%; while the UK ranks 28th globally in terms of its proven oil reserves.

Chart 7.6: Top twenty countries' proven oil reserves, end 2007



Source: *BP Statistical Review of World Energy 2008*

7.7.6 However, incentives for oil companies to invest significant sums in upstream exploration and development are constrained, particularly in regions affected by regulatory instability and security and political risks, and have been blunted by recent market volatility. Recent experiences in Venezuela and Russia, and continuing uncertainty within Iraq and Nigeria, underline the importance of stable and predictable regulatory frameworks, stability and security to provide a sound basis for investment.

82 See sub-section on Peak Oil at the end of this chapter.

83 Further details are available at <http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622>

84 Proven Reserves of oil are generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

85 Total includes Canadian oil sands, remaining established reserves not under active development.

Resource Nationalism

- 7.7.7 The share of reserves that are now under the control of National Oil Companies⁸⁶ (NOCs) has been increasing since the 1970s and is expected to continue to do so. This has significantly limited the ability of International Oil Companies (IOCs) to develop new reserves, constraining the flow of both capital and technology into oil production.
- 7.7.8 In some cases, NOCs face constraints on both the level and complexity of production they can undertake, including competing domestic socio-economic priorities, which reduce the productive efficiency of the supply chain. A desire to save oil for future generations may also motivate slower investment in some countries, though this assumes that oil will act as a store of value over time, which may not be the case given the development of alternative energy sources. More generally, wider regulatory barriers such as obtaining planning permission and licences can also impact investment by preventing it, slowing it down, or increasing its cost.
- 7.7.9 The range of factors limiting access to low-cost reserves has increasingly led IOCs to focus on development of marginal fields, characterised by increasing geological complexity, and non-conventional sources of oil, both involving increased technological challenges and higher costs.

Demand Uncertainty

- 7.7.10 Oil-producing nations often refer to uncertainties over future oil demand in light of ongoing global climate negotiations, which act as a disincentive for further investment in oil supply. The lack of credible demand projections and robust and timely data on key oil market data, such as demand, supply, inventories, investment and reserves, exacerbates this uncertainty. The Joint Oil Data Initiative (JODI) is an international initiative between producers and consumers to improve transparency via routine publication of production and consumption data. Around ninety countries participate in JODI, representing well over 90 per cent of global supply and demand.⁸⁷

86 Companies under the direct control of national Governments and often managed on a political rather than commercial basis

87 For further details see <http://www.jodidata.org/>.

7.7.11 Furthermore, in a number of countries, administered prices for petroleum products have helped insulate consumers from price changes and therefore prevented demand from responding effectively to market price signals. Currently, half of the world's population experiences fuel subsidies, with around a quarter of the world's supply of petrol being sold below free market prices.⁸⁸ Whether these policies prevail or not is even more important given the growing share of transport demand in global oil demand, which is price-inelastic, and therefore makes the fiscal cost of subsidies increasingly variable. This increasing variability makes the timing, extent and impact of any change in subsidisation policy far less easy to predict and manage, rendering decisions about investment in new production and refining capacity much more difficult.

Cost inflation

7.7.12 In the recent past, productive capacity has not kept pace with the rise in demand. Key reasons for the slow response in supply are the time lag it takes to bring new supply to market, up to ten years in most instances, and rising production costs due to global shortages in skilled labour and specialist equipment. The cost of developing a new oil field is estimated to have doubled in the last four years.⁸⁹ As a result, the real value of investment into oil production has been eroded, reducing the number of barrels produced per dollar of investment. The cost increase and skills shortage is often related to rapidly increasing demand for construction materials and commodities from developing nations such as, for example, China and India.

7.7.13 In addition, there is an increasingly significant mismatch in the quality of global crude oil supply, which is becoming increasingly heavier, and existing refinery capacity, which at the global level is mostly designed to handle lighter crudes. To address this, investment in upgrading existing refining facilities and building new refineries will be needed.

⁸⁸ "Crude measures", *The Economist*, 29 May 2008.

⁸⁹ Upstream Capital Cost Index, Cambridge Energy Research Associates <http://www.cera.com/asp/cda/client/knowledgeArea/serviceDescription.aspx?KID=178>

7.8 Conclusions

- 7.8.1 Although the UK only recently became a net oil importer, we have long been active in the global oil market and therefore already have in place much of the infrastructure, contractual arrangements and commercial relationships needed to ensure the continued security of oil supplies for the UK from external sources. The UK also has a well-developed refinery sector to process crude oil, even though it is unlikely that domestic production will ever fully match consumption of the different oil products.
- 7.8.2 The UK has primary storage and transport infrastructure to distribute oil and oil products to end users. However, further investment will be required in some localities, such as the South-East, where storage and distribution disruptions have occurred in the past and demand for petroleum products, particularly aviation fuel, still maintains a high rate of growth. Finally, in case of supply emergencies, the UK, including through its membership of international institutions, has well established procedures in place to deal with disruptions. One example of this was the release of IEA stocks in the event of Hurricane Katrina and Rita. The downstream oil industry itself also has the flexibility to respond to a short-lived disruption of the UK oil supply.
- 7.8.3 Going forward, there are significant uncertainties as to whether the necessary investment in upstream and downstream supply capability will be forthcoming, with recent price volatility adding to the risk of a supply crunch. Both spare capacity and inventories provide important buffers to deal with supply shocks or swift increases in global oil demand, mitigating the risk of a physical supply disruption to consumers and price volatility while the supply-demand balance adjusts. Although the recent downturn in demand has already reduced pressure on supply and will lead to rising spare capacity in the immediate future, this trend is set to reverse before 2015. Without the required investment taking place in supply, refining and spare capacity, the risk of higher prices and greater price volatility increases.

Peak Oil

Some analysts and scientists believe that the peak in global oil production is going to happen soon, with views ranging from imminently to within the next 10–15 years. They argue that there is relatively little oil left to be discovered, that reserves are overstated and that we have already nearly produced half of the world's original endowment of ultimately recoverable reserves.

While the amount of oil physically existing in the world is fixed by geology, the proportion of that total that is economically recoverable is not; it can be increased, for example, by technological developments and by increases in the price of oil that will make more reserves economical to recover.

Global proven reserves⁹⁰ (including Canadian oil sands) have more than doubled since 1980 despite production in the interim. Global proven reserves are also larger than the cumulative production needed to meet rising demand until at least 2030. However, more oil will need to be added to the proven category if global oil production is not to peak before then. In this respect, undiscovered resources, reserve growth from existing fields and technological developments will all help to increase the amount of oil that is ultimately recoverable. For example, the UK's remaining oil resources that might be ultimately recoverable are estimated to be between 1.0 and 3.3 billion tonnes, compared to current proven reserves of 0.5 billion tonnes.

However, the issues surrounding 'peak oil' are not restricted to the existence of resources and reserves, but also depend on the world's ability to convert these reserves into production now and in the long run. Thus, there are a number of other factors that also have an influence, such as:

- the level of investment that takes place in the energy supply chain;
- the extent to which open markets enable access to resources, reserves and the requisite capital;
- ongoing geo-political tensions and lack of security.

Maintaining growth in production capacity is a significant challenge given escalating costs of production as remaining reserves become more technologically challenging to extract (e.g. deep-sea reserves, oil sands), and other investment

⁹⁰ Proven Reserves of oil are generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

constraints such as the increasing costs of materials and decreasing availability of skilled labour in the sector. In 2008 the International Energy Agency (IEA) estimated that the oil industry needs to invest a total of \$6.3 trillion in 2007 dollars over the period 2007–2030 to deliver the growth in production capacity necessary to meet projected increases in demand levels^{91,92}.

Meanwhile, investment plans may change; projects may be cancelled, delayed or accelerated for various reasons. The opportunities and incentives for private and publicly-owned companies to invest are particularly uncertain. In addition, environmental policies could increasingly affect opportunities for building upstream and downstream facilities and their cost, especially in OECD countries.

Hence the timing of 'peak oil' in global oil production also crucially depends on turning reserves through investment into new production.

In any case, whatever the cause, the approach to oil production peaking is most likely to manifest itself in a tighter oil market, resulting in higher and volatile prices. However, high and volatile prices are likely to result in some demand destruction and increased elasticity of oil demand in the medium to long run leading to a more flexible market. In the short term, however, demand is relatively inelastic and unresponsive to high prices due both to lack of short-term alternatives in the transport sector and to crude prices only constituting a relatively low proportion of the final product price.

The UK may be in a better position to cope with higher oil prices than its international counterparts because, among the G7 countries and despite being an oil producer, the UK consumes the least amount of oil per \$1000 worth of output. Further, many of the policies currently being pursued in order to reduce the UK's CO₂ emissions from the transport sector, such as the Renewable Transport Fuel Obligation (RTFO), EU standards on vehicle emissions, research into electric and hybrid vehicles, etc. are likely to encourage the development and deployment of technologies that provide an alternative to petrol and diesel. As such, they are likely to improve the UK's resilience against "peak oil".

91 International Energy Agency *World Energy Outlook 2008*

92 International Energy Agency, *World Energy Outlook 2008, Upstream Investment Prospects*