

## OIL: AN ISSUE FOR THE 21ST CENTURY

The developed world at the beginning of the 21st century is highly technologically advanced. Its wealth and prosperity depend on oil.

The car is the dominant mode of travel – convenient, fast and generally reliable – and for longer journeys, the world is criss-crossed with airline routes to every conceivable destination. Plastics, paints, pharmaceuticals, agricultural chemicals and even the tar on the roads come from the world's most prized and most essential raw material – oil. Every modern manufacturing process, the majority of propelled transport and a good proportion of our electrical energy needs rely on oil. The extent of our reliance on oil and oil products was highlighted by events in September 2000. Within a matter of days the UK was brought to a near standstill by hauliers and farmers picketing fuel depots in protest at the government's fuel taxes.

So far all predictions of imminent exhaustion have been disproved by the finding of new fields, or improved production techniques. The up and coming developing countries of the world have an accelerating need for

oil to fuel their economic development programmes. Will there be enough oil to go round, and for how long?

### Oil reserves and production

World oil resources are not uniformly distributed; indeed they are very unevenly distributed, with 64% controlled by the Middle Eastern OPEC (Organisation of Petroleum Exporting Countries) states such as Saudi Arabia and Iraq. OPEC controls the release of oil from its reserves and therefore can influence the price of oil. To meet future demand over the next 15 years OPEC would have to increase production by 15%, something that is unlikely to happen. The Middle East can be a politically unstable area (Figure 1). (It should be borne in mind, however, that the world's current largest oil producer, Russia, is not a member of OPEC.)

It took the planet approximately one million years to create each year's supply of oil. Already it is estimated that one third of the world's 2,330 billion barrels estimated reserves have been used. The UK and the USA have predicted production spans of only

another 10 years. The countries with the greatest long-term potential are grouped around the Persian Gulf (Figure 2).

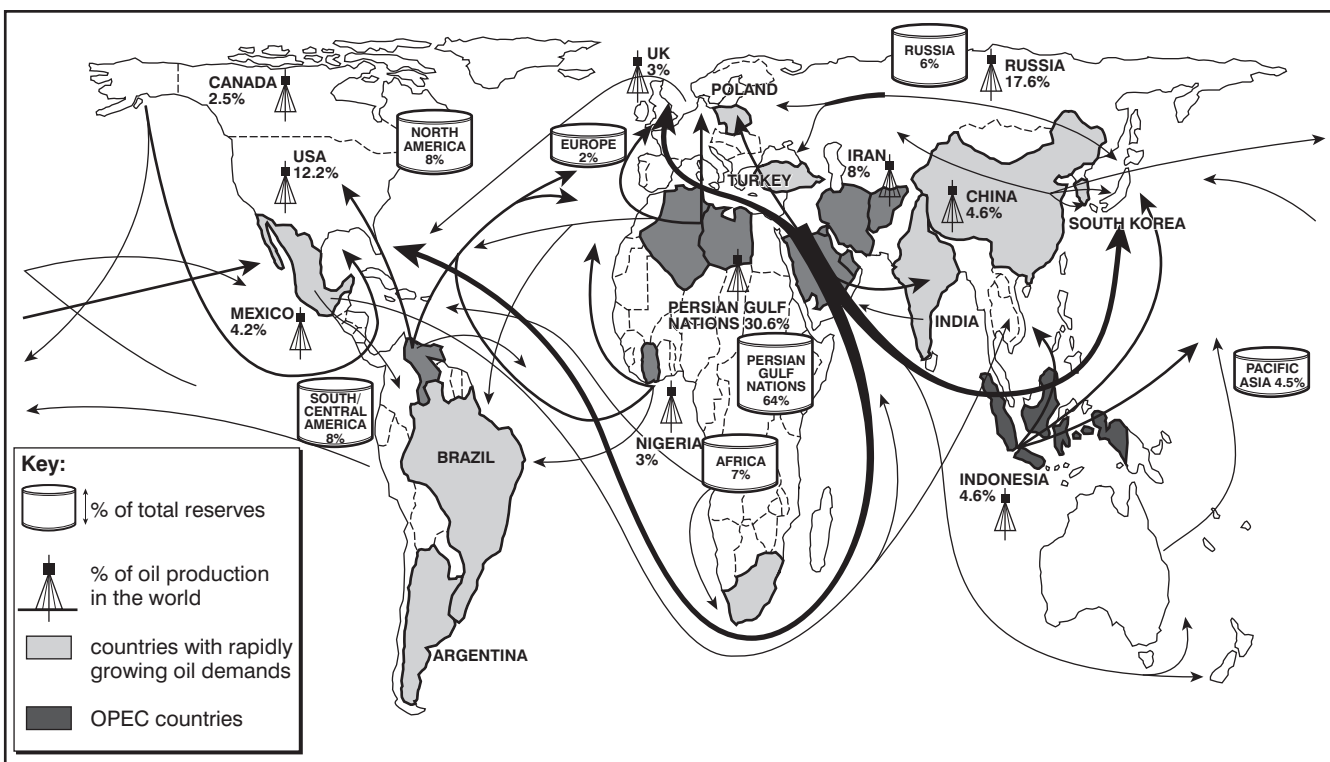
### World demand

The IEA (International Energy Agency) project that the world's demand for oil will increase from 76 million barrels per day (b/d) in 2001 to 94 million b/d by 2010. If this increase happens and substantial new reserves are not found, the IEA predict that the necessary level of production will be sustainable for only another 10–15 years before production would have to decrease due to dwindling reserves.

Just as the global distribution of oil reserves is highly uneven, so is the pattern of its consumption:

- the world's developed countries use 77% of the world's oil production but have only 23% of the world's population
- the USA consumes 25% of the world's production
- Europe consumes 20%
- Japan consumes 8% (the country relies totally on oil imports)

Figure 1: World oil distribution, reserves, production and movement



- USA, Japan, Germany, France, Italy are the world's largest importers, accounting for 60% of oil imports.

Ten countries have been identified as having the highest growth in demand for oil (Figure 1). These countries are trying to industrialise, develop their economies and improve their overall economic success. To do this quickly they will use current technologies for manufacturing, power and transport, which all rely on oil. As oil reserves dwindle and prices rise over the next 50 years, their rates of growth may falter as the price of oil rises.

Figure 3 compares world population growth with past and predicted oil production. The peak of oil production is around 2020, when the world's population is likely to be still growing dramatically, especially in LEDCs. At present 7% of the world's oil production is consumed by China and India combined, but this level could increase as their economies and technology develop. India currently requires 1 barrel/day/person; in comparison the US uses 41! (Figure 4).

### Economic and political factors

Fluctuations in the price and supply of oil are closely linked to major political events (Figure 5). The Gulf War (1990) was fought when Iraq invaded Kuwait – two of the world's largest oil producers. The rest of the world could not allow such large reserves to be in hostile hands. The Iran/Iraq war in the early 1980s, and the Iranian revolution before that, all caused major fluctuations and nervousness in the world's oil markets. Over the past 30 years or so, the greatest single global influence on the price of oil has been OPEC. Increase in supply can drop the oil price, and similarly decreases in supply can raise oil prices.

### Environmental factors

The environmental consequences of the world's reliance on oil are well documented. First, there is disruption and destruction of natural habitats when oil is extracted; for instance, in Alaska. Next, there is the problem of transporting oil, either by sea or by pipeline. Every year, some 3 million tonnes of oil enters the sea from accidental spills, tankers flushing their tanks, discharge from rigs or run-off from land-based oil

Figure 2: Projected duration of oil reserves

Less than 10 Years	Less than 50 Years	Less than 100 Years	More than 100 Years
United States	Ecuador	Saudi Arabia*	Iraq*
Canada	China	Russia	UAE*
United Kingdom	Nigeria*	Iran*	Kuwait*
Indonesia*	Algeria*	Venezuela*	Kazakhstan
Norway	Malaysia	Mexico	Turkmenistan
Egypt	Colombia	Libya*	Tunisia
Argentina	Oman	Brazil	Uzbekistan
Australia	India	Azerbaijan	
	Qatar*	Trinidad	
	Angola		
	Romania		
	Yemen		
	Brunei		

\*OPEC Nations

Source: US National Council for Science and the Environment

Figure 3: Population, oil production and demand for the future

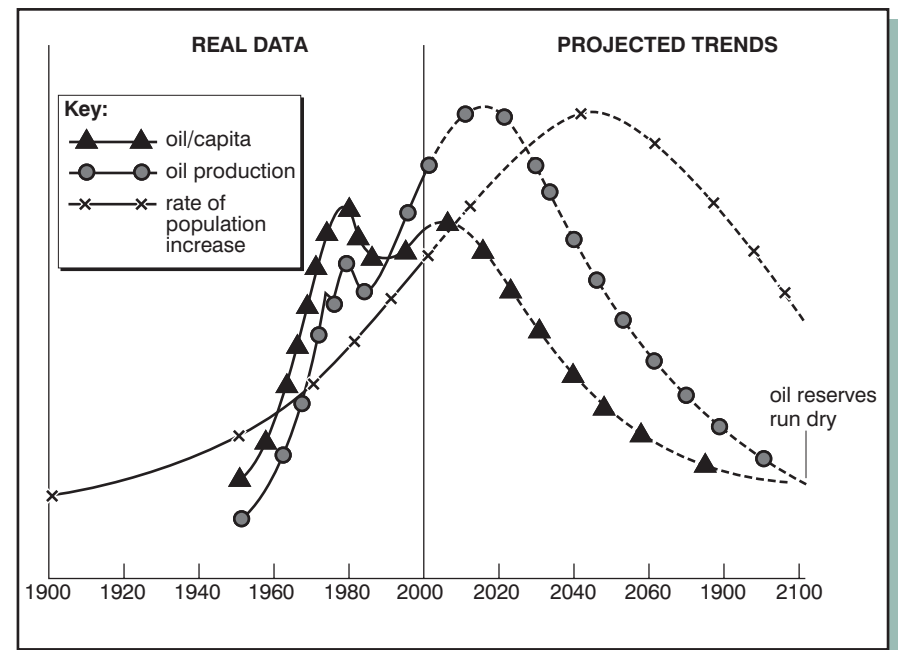
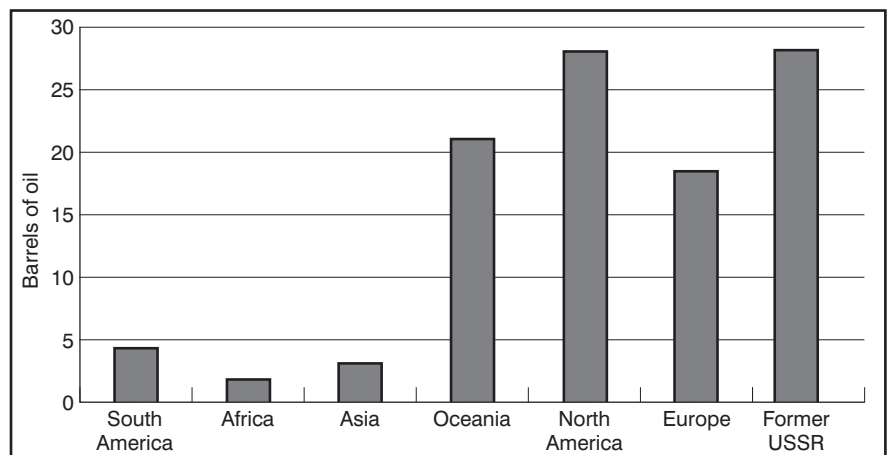


Figure 4: Consumption of oil (barrels per capita/year) for world regions



Source: Annual Energy Review

production. Cleaning up after major oil spills at sea can take months and even years. The Braer oil spill in 1993 off Shetland, and the Exxon Valdez Spill in Alaska in 1989, both caused

great concern at the time about the wisdom of transporting oil in remote areas. Onshore oil spills in Siberia and Nigeria have also alarmed environmentalists. Finally, there are

Figure 5: The oil price and world events, 1970—2000

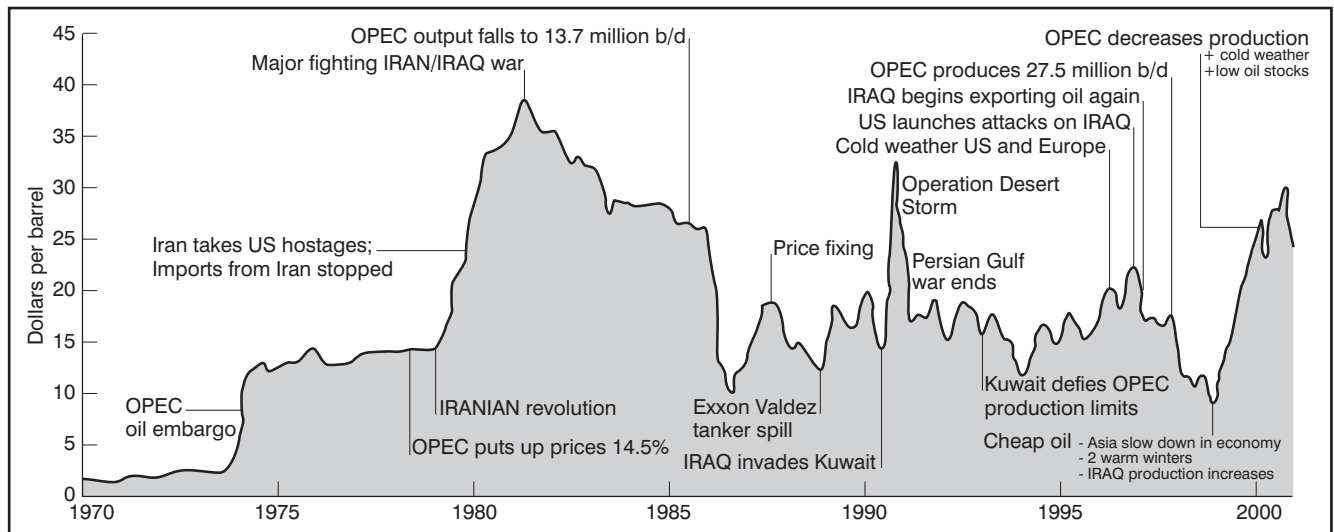


Figure 6: Oil spill hotspots since 1960 (number of reported incidents)

- Gulf of Mexico (267)
- North east USA (140)
- Mediterranean (127)
- Persian Gulf (108)
- North Sea (75)
- Japan (60)
- Baltic Sea (52)
- UK (49)
- Malaysia (39)
- Atlantic France/Spain (33)
- Korea (32)

Source: NOAA

the consequences of burning oil products, in the form of air pollution, emission of carbon dioxide and potential global warming.

The UK has had three spills of over 20 million gallons, the largest of which was the Torrey Canyon spill off the coast of Cornwall in 1967 (36.6 mill.gall.) The largest oil spill of all has been in Kuwait and was caused by deliberate Iraqi damage to tanks, wellheads and pipelines during the 1991 Iraqi invasion and ensuing Gulf War.

The Rio Earth Summit in 1992 was a voluntary agreement setting out guidelines for countries to cut carbon dioxide emissions. The issue of global warming has been addressed by the Kyoto Protocol and commits 174 countries to reducing their carbon dioxide emissions by 5.7% from 1998 levels over the period 2008—2012. In Britain, 28 million tonnes of carbon dioxide are released every year by transport. The USA alone produces 25% of the world's greenhouse gases by the burning of fossil fuels.

Figure 7: Top ten oil spills since 1989

Date	Location	Source	millions of gallons
1991	Kuwait. Persian Gulf	Damage caused by Gulf War	240
1992	Uzbekistan	Oil Well	88
1991	Genoa, Italy	Tanker	42
1994	Kharygaga-Usinsk, Siberia	Pipeline	30.7
1993	Shetland Islands, UK	Tanker Braer	25
1992	Spain, Mediterranean	Tanker	21.9
1996	Milford Haven, UK	Tanker Sea Empress	21.3
1991	Atlantic Ocean off Angola	Tanker	15.05
1992	South Africa off Durban	Tanker	15
1989	Prince William Sound, Alaska	Tanker Exxon Valdez	11

Source: Oil Spill Intelligence report

President Bush has made it clear that he does not intend to stick to the Kyoto agreement, which he feels will hinder his country's progress. With the current political situation and tension in the Middle East he is even more likely to push forward exploration in the remoter areas of the USA, such as the wildlife refuge areas in Alaska.

Oil will continue to be transported by pipeline and tanker, and oil spills will continue to occur. As existing reserves are depleted, exploration will push into more remote and hostile areas and fragile environments to find and extract new reserves. The Falkland Islands in the South Atlantic, and the Kamchatka peninsula in the Siberian Far East are both future areas of oil production in previously pristine environments.

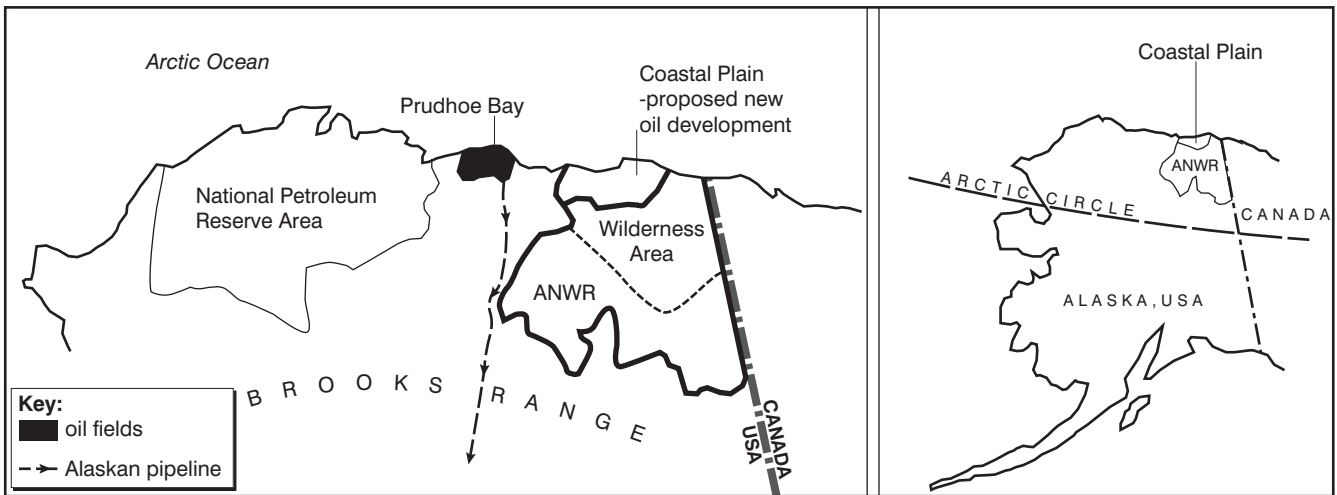
### Alaska: ANWR (Arctic National Wildlife Refuge)

The ANWR was established in 1980 to protect the unique and delicate

region above the Arctic Circle in Alaska. A landscape frozen for most of the year, the area is an important habitat for caribou, musk ox and polar bear. A combination of increasing tension in the Middle East, dwindling US oil reserves, US overdependence on OPEC producers and the Bush presidency has put the Refuge under the spotlight for oil exploration. The area of interest is the 1.5 million acres of the coastal plain in the far north of the refuge.

The US government estimates there is a 50% chance of producing 10.1 billion barrels of oil from the area. With such reserves, ANWR may be the last, large undeveloped onshore oil prospect in the United States. President Bush's refusal to follow the Kyoto protocol and now his enthusiasm for exploring the Arctic refuge to push forward America's economic growth has angered environmentalists. Alaskans, however, see development of the ANWR as a second oil bonanza to replace the ageing Prudhoe Bay field to the west.

Figure 8: Alaska National Wildlife Refuge



When the Exxon Valdez oil spill occurred in Prince William Sound in 1989, the incoming presidency of Bill Clinton vetoed exploration of the refuge. With a change of presidency this has all changed, but whether Congress and public opinion agree with Bush remains to be seen.

**US government’s case for exploring the ANWR coastal plain**

- Only 8% of the ANWR would be developed – 2000 acres of the 1.5million acre coastal plain.
- 235,000—735,000 jobs would be created.
- US currently imports 55% of its oil costing \$50billion/year, slowing down the economy.
- Wildlife and oil production currently coexist successfully – the central Arctic caribou herd has grown from 3,000 to 20,000 in the past 20 years.
- More than 75% of Alaskans favour development.

**The future**

The future of the world’s oil supplies is uncertain. With a long history of political tension in the Middle East and dwindling reserves, the nations with influence, power and economic wealth will command the markets for oil. The developing nations of the world with ambitions to develop further and already burdened by debt may find their economies will falter. New areas will be explored as non-OPEC countries look for ways to reduce their oil import bills.

There will eventually be positive news for the environment if alternative energy sources to oil can be developed – for instance, renewable forms of

energy such as wind farms and tidal power. Less oil being burnt will mean fewer greenhouse gases and oil spills. Necessity is the mother of invention, and alternative energy sources will have to be developed as oil resources dwindle. Cars in urban areas will run on rechargeable batteries or hydrogen fuel cells, and already these are in production. In Brazil, cars run on alcohol fuel, which is made from sugar cane; although no cure for global warming, it reduces Brazil’s oil imports.

Improved methods of oil recovery will allow oil wells to be tapped a third time. At present up to 50% of oil remains in the ground after the initial extraction. By pumping carbon dioxide into the oil reservoir at pressure, this residual oil can be forced out at the wellhead (as well as taking carbon dioxide out of the atmosphere).

Large-scale air travel however may be severely affected; a solar-powered

jumbo jet is not currently an option! Businesses may come to rely more on new internet technologies, video-conferencing and virtual reality techniques to cut their international travel bills. Air travel may become increasingly expensive unless alternatives for ground transportation, petrochemicals and power generation are found. In the next 100 years the world will have to accept that the oil is running out.

**Websites and Sources**

- [www.BP.co.uk](http://www.BP.co.uk)
- [www.eia.doe.org](http://www.eia.doe.org) Energy Information Administration
- [www.BBC.co.uk](http://www.BBC.co.uk)
- [www.anwr.org](http://www.anwr.org) Arctic National Wildlife Refuge
- [www.dti.gov.uk/energy](http://www.dti.gov.uk/energy) Department of Energy
- [www.adn.com](http://www.adn.com) Alaskan Daily News

**F O C U S   Q U E S T I O N S**

1. a On a blank world map plot the countries from Figure 2 and add the data from the per capita usage graph in Figure 4.  
b How will the pattern and distribution of world oil change for the developed and developing countries of the world?  
c Describe and explain the fluctuations in the oil price from Figure 5.
2. a Produce a map to show the environmental consequences of oil transportation, using the data in Figure 7.  
b How eventually may the world benefit from less oil consumption?
3. The far north of Alaska is a wilderness area which has great oil potential. The Alaskans and President Bush want the area to be developed. Present the case for the environmentalists.
4. Investigate the possible new energy sources which may replace oil; address the issue of air travel.