CPB Memorandum

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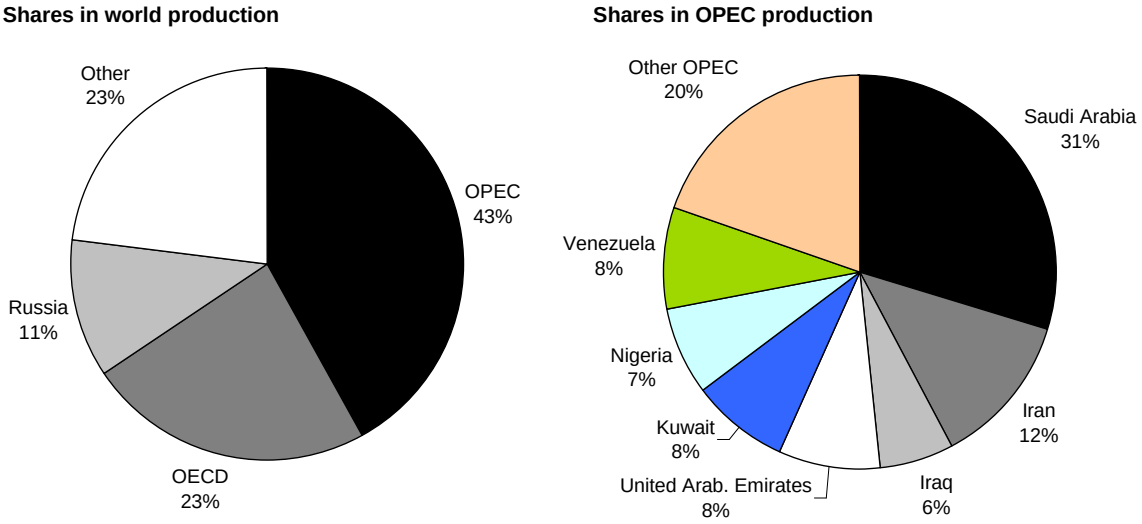
FAQs about oil and the world economy

In this memorandum, the following frequently asked questions are answered about oil and the world economy:

1 Who are the main oil producers?

In 2006, 85 million barrels[1] of oil were produced worldwide. Slightly more than forty percent of this total was produced by OPEC[2], almost a quarter by member states of the OECD[3], slightly more than ten percent by Russia and the rest by various other countries (Figure 1.1). Saudi Arabia is by far the biggest producer of the OPEC members, accounting for almost a third of the OPEC production.[4] Russia, however, is currently the biggest single oil producer.

Figure 1.1 Shares in oil production, 2006



Source: International Energy Agency, Oil Market Report, March 2007.

The production pattern has changed considerably since the seventies (Figure 1.2). In the first half of the seventies more than half of the world production was done by OPEC-members. The OPEC share declined to about 30% in 1985. As OPEC aimed at higher prices by restraining production, high prices induced production outside OPEC and the authorities of OECD-countries strived for less dependence on OPEC oil.

Production shares of individual OPEC members mainly changed because of war and internal turmoil.[5] For instance, the Iranian share in the OPEC production declined from 20% in 1975 to

[1] A barrel is 159 litres.

[2] At the moment the OPEC (Organisation of the Petroleum Exporting Countries) has 12 member states: Saudi Arabia, Iran, Iraq, Kuwait, United Arab Emirates, Qatar, Nigeria, Angola, Libya, Algeria, Venezuela and Indonesia. Ecuador was a member of OPEC until 1992, while Gabon left OPEC in 1995. Angola joined the OPEC in 2007. In this memorandum, historical data for the OPEC are based on the current members, unless otherwise stated.

[3] The most important oil producing countries in the OECD are the US (8% of world production), Mexico (4%), Canada (4%) and Norway (3%).

[4] The production from the Neutral Zone is divided between Saudi Arabia and Kuwait on a fifty-fifty basis.

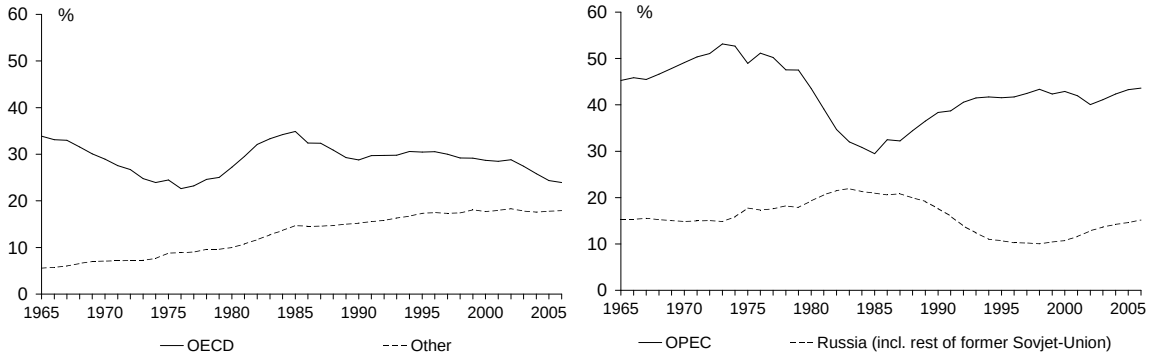
[5] The importance of Venezuela declined significantly in the mid seventies because of the nationalization of the oil industry. Its share in OPEC production decreased from 24% in 1965 to just 7% in 1978. The Venezuelan production share increased thereafter to about 10% but fell back recently to around 8%.

5% in 1980 because of turmoil at the end of the shah regime and the Iran-Iraq war. Since 1982 the Iranian share amounts to some 12%. In 1988[6] the share of Iraq was 13%. Three years later it was only 1% because of the first Gulf war. The Iraqi share recovered to 8% in 1999 but deteriorated again to some 4% because of the second Gulf war. During these periods, Saudi Arabia acted as 'swing-producer' to offset the production changes elsewhere.

The oil production in the OECD increased after 1975 mainly because of the higher production in the North Sea area (especially in the United Kingdom and Norway). The share of the OECD in world production increased from about a quarter in the mid-seventies to a third in the mid-eighties. Subsequently, the OECD share declined again to about a quarter. The share of the US in world production showed a continuous decline, from about 28% in 1965 to 8% in 2006.

During the period 1985-1995 the share of Russia and the other former Soviet republics declined sharply after the split-up of the Soviet Union. Their share in world production decreased from somewhat above 20% to 10% in the second half of the nineties. Thereafter, their share showed a clear increase again, to 15% in 2006. Exports to the rest of the world hardly suffered from these production decreases as the drop was absorbed by declining domestic consumption. In 2006 Russia produced slightly more than 10% of world production whereas the other countries from the former Soviet Union produced about 4%.

Figure 1.2 Shares in world production, 1965-2006[a]



[a] The years 1965-2005 are based on the Statistical Review of World Energy; 2006 is added based on the growth rates taken from the Oil Report.

Sources: British Petroleum, Statistical Review of World Energy, 2006, International Energy Agency, Oil Market Report, March 2007.

[6] In 1981 the Iraqi share declined to only 4% of OPEC production because of the war with Iran.

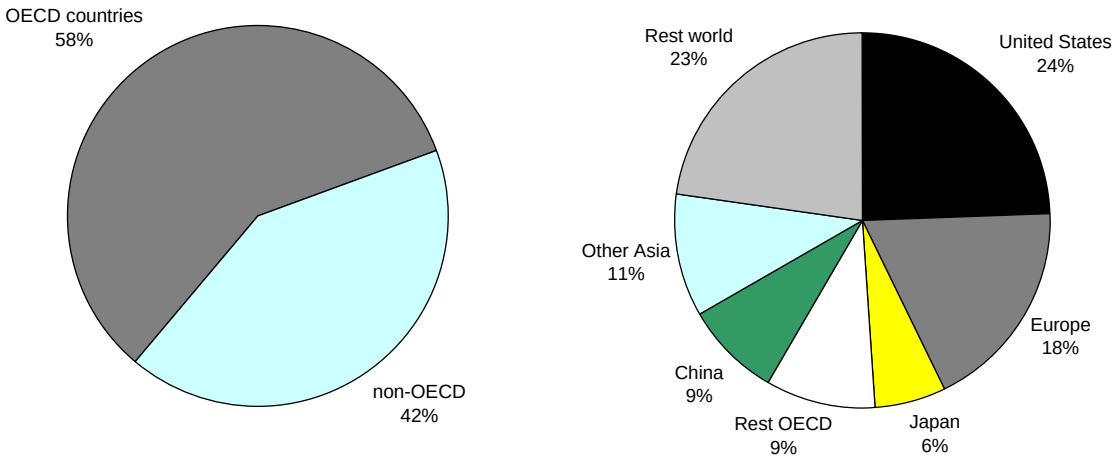
The production share of the rest of the world (countries outside OECD, OPEC and former Soviet Union) more than tripled since the sixties (from 6% in 1965 to 18% in 2006). The main increase occurred in China, the non-OPEC countries in the Middle East (Oman, Syria and Yemen), Brazil, and Malaysia.

2 Where is the oil used? How fast is consumption growing?

Although less than 20% of the world population is living in member countries of the OECD, the OECD share in oil consumption amounts to almost 60% (Figure 2.1). The US on its own consumes about a quarter of the world production. In countries outside the OECD the oil intensity, measured as oil consumption per unit of GDP, is twice as high as in OECD countries (Figure 2.2). Oil consumption per head, however, is still very low outside the OECD because of the low GDP per head in these countries. The same conclusions can be drawn for total energy consumption (Figure 2.3). A higher oil intensity outside the OECD does not imply in itself that oil is used in an inefficient manner, but that the composition of GDP is oil-intensive (more (heavy) industry and transport and less services).

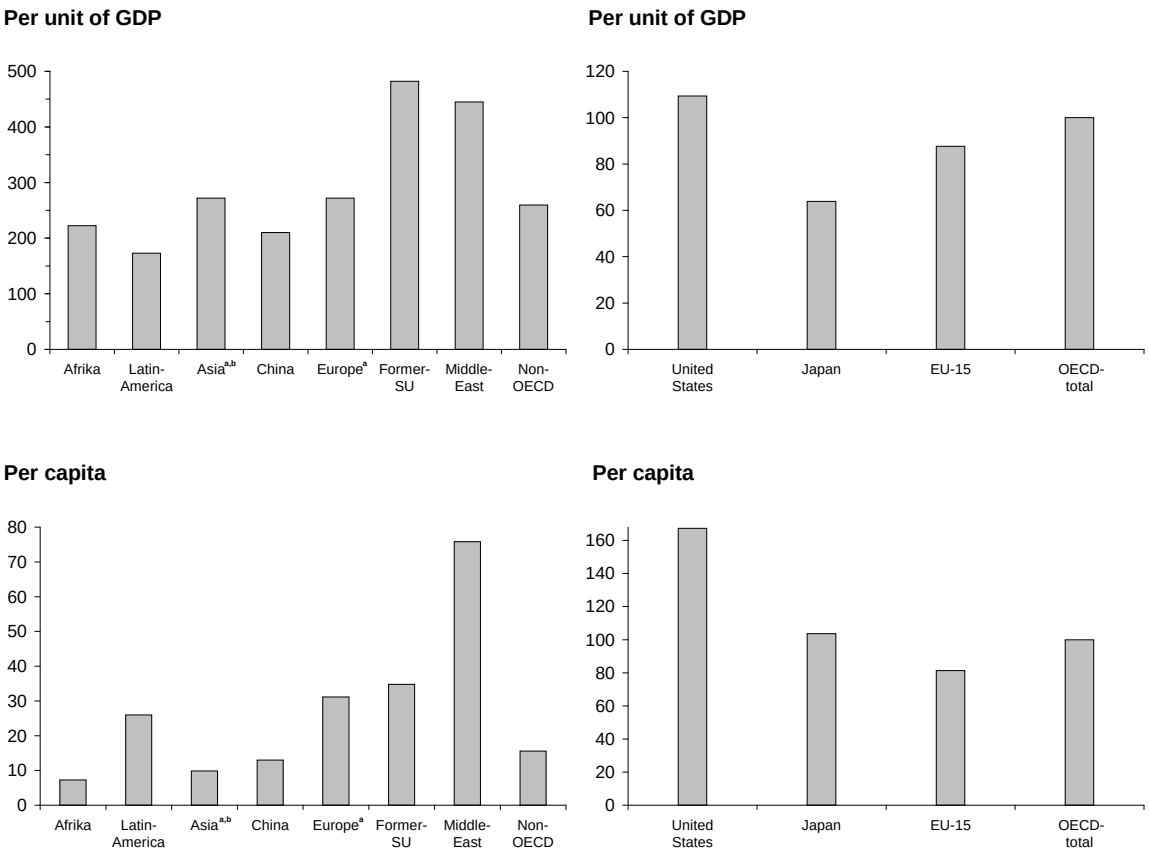
In the US oil consumption per unit of GDP as well as consumption per head is higher than in Japan and the European Union. The main reason for this are the relatively low taxes on oil products in the US (see question 13: How important are taxes?).

Figure 2.1 Shares in world oil consumption, 2006



Source: International Energy Agency, Oil Market Report, March 2007.

Figure 2.2 Oil consumption (OECD = 100), 2004

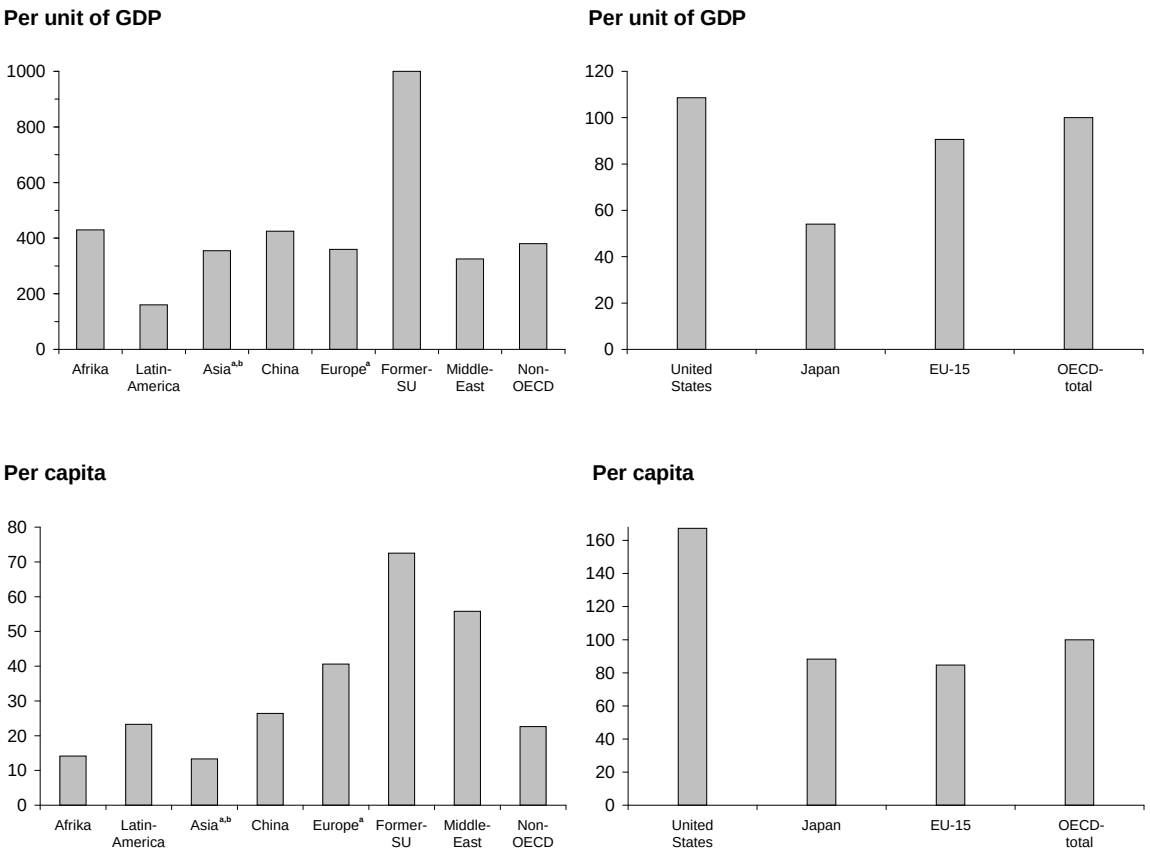


[a] Excluding OECD-countries.

[b] Excluding China.

Source: International Energy Agency, Energy balances of non-OECD countries 2003-2004, 2006, International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

Figure 2.3 Energy consumption (OECD = 100), 2004

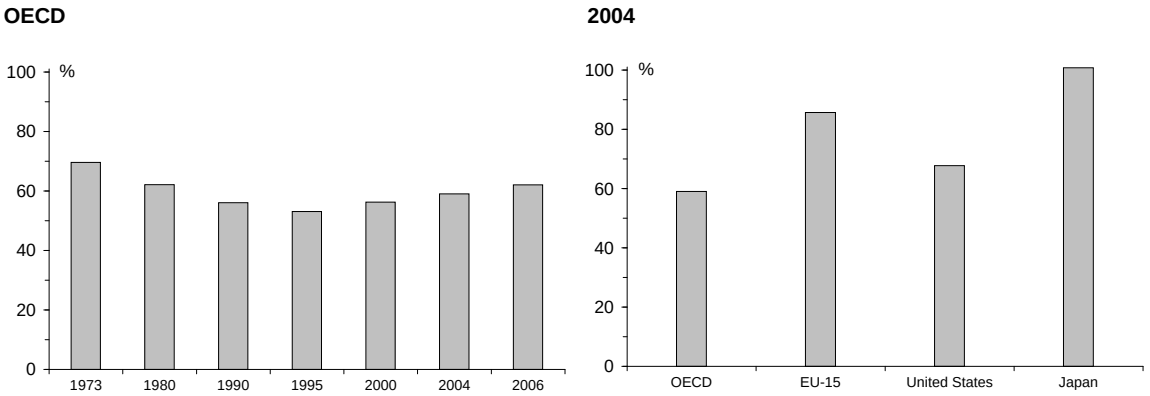


[a] Excluding OECD-countries.

[b] Excluding China.

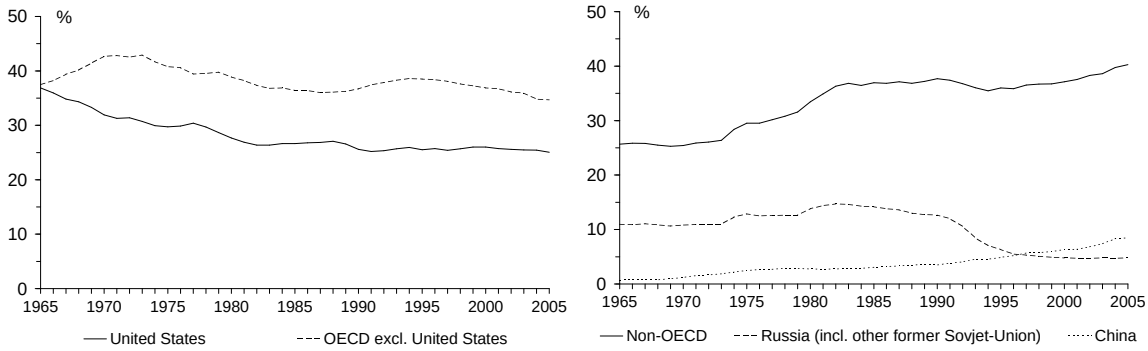
Source: International Energy Agency, Energy balances of non-OECD countries 2003-2004, 2006, International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

Figure 2.4 Import shares in total consumption



Source: International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

Figure 2.5 Shares in world consumption of oil, 1965-2005



Source: British Petroleum, Statistical Review of World Energy, 2006.

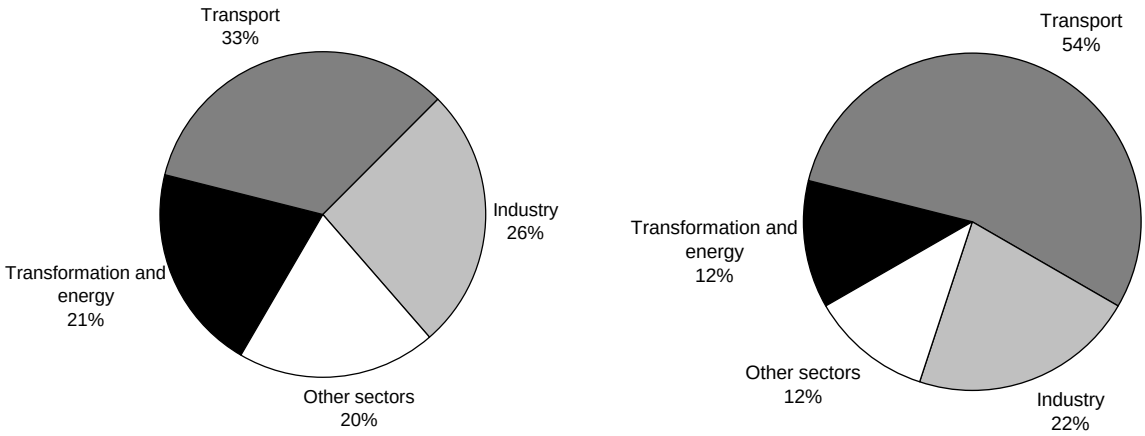
Despite relatively high oil consumption, the oil import dependence of the US is lower than for the other countries due to more domestic production (Figure 2.4).

Since 1970 there have been some considerable shifts in the regional consumption of oil (Figure 2.5). The share of the US showed a decline, whereas the share of the other OECD countries remained more or less the same. Despite a significant decline in the Russian share, the share of the world outside the OECD increased somewhat. In the second half of the nineties the Chinese share surpassed the Russian share.

In the OECD the highly price-inelastic transport sector is by far the largest user of oil. During the last twenty years its share in oil consumption increased from around one third to more than one half (Figure 2.6).

Figure 2.6 Oil consumption per sector in the OECD

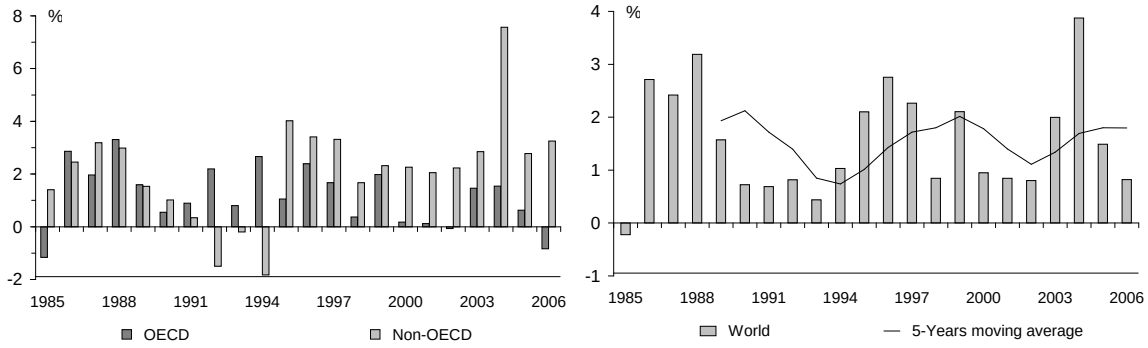
1973 **2004**



Source: International Energy Agency, Oil Information 2006, 2006.

Global oil consumption has increased by 1.6% per annum in the past 20 years. Annual growth has fluctuated widely, from 0.4% in 1993 to 3.9% in 2004 (Figure 2.7). These fluctuations are closely linked to fluctuations in global economic growth.

Figure 2.7 Global oil demand, 1987-2006



Source: International Energy Agency, Oil Market Report, March 2007.

3 What about oil reserves?

There are many estimates of the amount of proven world oil reserves and those estimates vary widely. Proven reserves are known reserves that with reasonable certainty can be produced profitably under current assumptions about economic conditions and technological developments.

Public domain figures bearing to proven oil reserves are for example those from BP[7], OPEC[8], Oil and Gas Journal (OGJ)[9] and Gulf[10]. At the end of 2005, the highest proven reserves estimate was 1293 billion (bn) barrels published by OGJ. The smallest proven reserve was 1120 bn barrels estimated by Gulf. The estimates of BP and OPEC of 1200 bn barrels and 1154 bn barrels respectively, lie in between. [11]

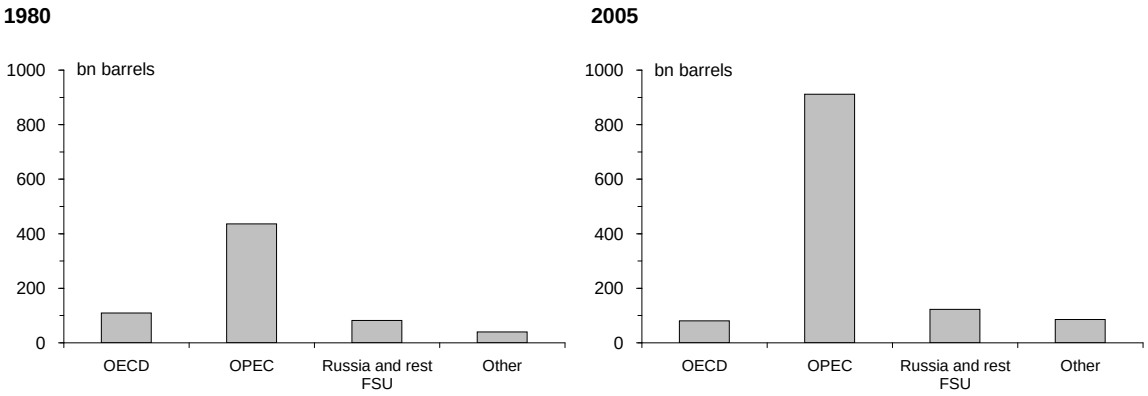
Based on BP estimates, the current volume of proven reserves is sufficient to satisfy almost 40 years of current world oil demand or 30 years of world demand growing at the same pace as during the past decade.[12]

Notwithstanding a yearly production of 85 million barrels per day (mbd), the volume of proven reserves is still expanding.[13] During the period 1980-2005 the volume of proven reserves showed an annual increase of 2¼%. The increases in proven reserves were to a major extent the result of a significant reduction in supply costs.[14] New technologies, the use of information technology and a global restructuring of the industry provided for a decrease in finding, development and lifting costs. Oil discoveries were less important than technological progress. The amount of oil discovered in new oilfields has fallen sharply over the past four decades, because of reduced exploration activity in regions with the largest reserves, and because of a fall in the average size of fields discovered (IEA, 2006).

The largest increase in reserves has occurred in the OPEC countries (Figure 3.1). Three-quarter of the proven reserves is located in these countries. However, in current circumstances, these reserves may not be exploited in the medium term due to underinvestment as investment in key OPEC countries is not allocated according to market forces.

[7] British Petroleum, Statistical Review of World Energy 2006.
[8] OPEC, Annual Statistical Bulletin 2005.
[9] Oil and Gas Journal, Worldwide look at Reserves and Production, December 18, 2006.
[10] World Oil, Gulf Publishing Company, Volume 227, September 2006, cited in: http://www.eia.doe.gov/emeu/international/reserves.html.
[11] The highest figure from OGJ can to a large extent be explained by the volume of Canadian tar sands. Since 2002 Oil and Gas Journal includes the volume of oil sands in the figure for Canada. BP, on the other hand, only includes oil sands 'under active development'. As a consequence, the BP estimate for Canada is 16.5 bn barrels, whereas the OGJ one is 178.8 bn barrels.
[12] Coal and gas reserves are bigger: proven reserves are equal to 64 years of current consumption of gas and 164 years of coal (IEA, 2006).
[13] At the same time demand is increasing.
[14] International Energy Agency, World Energy Outlook 2001, 2001.

Figure 3.1 Distribution of proven oil reserves in 1980 and 2005



Source: British Petroleum, Statistical Review of World Energy, 2006.

In addition to proven reserves, there is a comparable volume of reserves where production is less certain, the so-called 'probable reserves'. In due time, with improvements in technology or with higher prices, these reserves can probably be added to the volume of proven reserves. Possible future increases in oil reserves are estimated by the United States Geological Survey (USGS).[15] In its survey the USGS describes the possible future increase in proved reserves as the result of newly discovered resources and of reserve growth

An opposite (minority) view on the future development of the volume of reserves has been presented by M. King Hubbert. According to the views of Hubbert[16] and his adherents the current volume of proven reserves is given and there are hardly any possibilities for future increases. In this view there is very limited place for economic and technological developments to increase the now known volume of reserves. As a consequence, without these additions to the current volume of reserves Hubbert et al. expect global oil production to peak during the first decade of the twenty first century.

4 How important is oil as energy carrier? What about alternative energy?

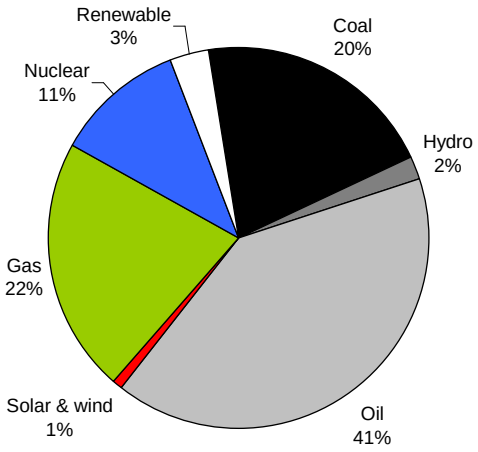
Oil certainly is the most important energy carrier. The share of oil in worldwide primary energy consumption is slightly more than a third (Figure 4.1). In the OECD this share is even somewhat higher. As far as transport is concerned, oil is basically the one and only source of

[15] USGS, US Geological Survey World Petroleum Assessment 2000, http://pubs.usgs.gov/dds/dds-060/index.html#TOP.
[16] See for example www.hubbertpeak.com .

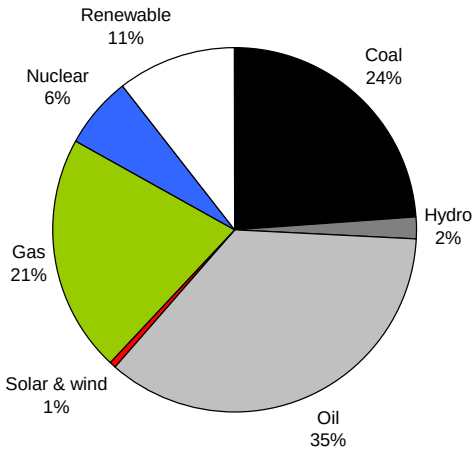
energy, with a share of 97% in the OECD area.[17] The share of oil in energy consumption in the industry sector is 15%. The share of oil in power production has declined to 8%.

Figure 4.1 Shares in primary energy consumption

OECD, 2004



World, 2003



Source: International Energy Agency, Energy balances of non-OECD countries 2003-2004, 2006, International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

Alternative energy (renewable, solar and wind) cover 12% of world energy consumption and 4% of OECD energy consumption. Solar and wind (including geothermal, tide and wave energy) cover only 1%. With a share of almost 20%, renewable energy (mostly fuelwood) is highly important for the non-OECD region. In developing countries, 80% of the rural population rely on biomass resources as their primary fuel for cooking (IEA, 2006). Although fuelwood is renewable in principle, the current harvest is clearly unsustainable.

5 Is oil crucial for the world economy?

Indeed. Without oil (and oil products) the world economy of today would be brought to a halt. But the same applies to grain or some metals. It is therefore more interesting to analyse what will happen if the supply of oil is significantly reduced. Such a reduction will probably have a larger negative impact than a corresponding reduction in the supply of grain or metals.

In the past (1974 and 1979), strong increases in the oil price were followed by lower economic growth. Whether these price increases were exogenous shocks or the results of

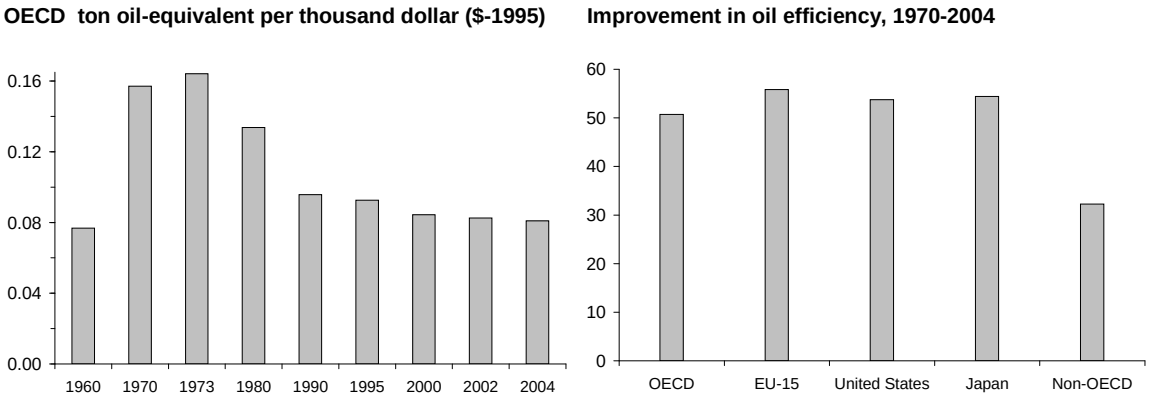
[17] International Energy Agency, Energy Balances of OECD countries 2003-2004, 2006.

economic developments and economic policies is still an issue under debate.[18] Expansionary monetary policy may have led to a strong rise in money supply causing a rise in commodity prices.

6 Has oil become less important?

Yes, the relative importance of oil for the world economy has diminished. Compared to the first half of the seventies, oil consumption per unit of GDP has decreased significantly (Figure 6.1). For the most part, this decrease in oil intensity (or: the increase in oil efficiency) occurred in the second half of the seventies and in the eighties. Only a small part of the reduction in oil consumption has been compensated for by a higher consumption of other energy carriers. That is why the overall energy efficiency has also improved substantially since the mid seventies (Figure 6.2).[19] The improvement in energy efficiency was most pronounced in the US, although the oil consumption per unit of GDP remained higher than in the rest of the OECD area (Figure 2.2).

Figure 6.1 Oil consumption per unit of GDP, 1960-2004[a]



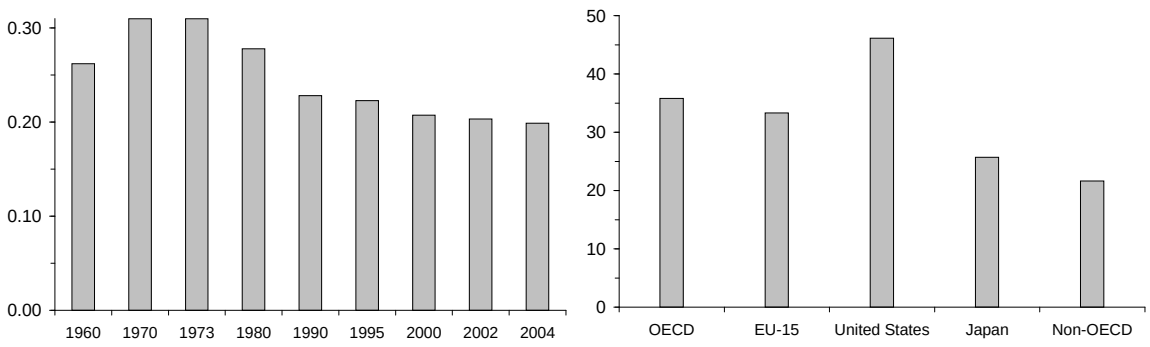
[a] No OECD data available for the period1960-1973. Therefore, for this period the development in the OECD is set equal to the development in EU-15.

Source: International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

[18] See Barsky, R. and L. Killian, Oil and the macroeconomy since the 1970s, CEPR discussion paper, no 4496, 2004, Financial Times, Too much money to blame for rising prices of oil, economists claim, August 18, 2004.

[19] Since the early seventies imports of semimanufactures into the OECD has increased substantially. The energy intensity of production outside the OECD area is higher than within OECD. These two factors imply that the energy intensity of consumption inside OECD has probably declined less than the energy intensity of production.

Figure 6.2 Energy consumption per unit of GDP, 1960-2004[a]



[a] No OECD data available for the period1960-1973. Therefore, for this period the development in the OECD is set equal to the development in EU-15.

Source: International Energy Agency, Energy balances of OECD countries 2003-2004, 2006.

Although the relative oil consumption has been reduced, the vulnerability of the world economy to supply disruptions is probably higher than during the first oil crisis. Production of goods is more dispersed nowadays (nationally as well as internationally), which means that transportation problems will have a bigger impact.

7 What determines the price of oil?

Supply and demand. It is important to note that oil can be stored and production can be postponed. This implies that not only the supply-demand balance of today is important, but also the expected balance in the future.

Even more important are the small values of the short-term (within 1 or 2 years) price elasticities of supply and demand. These values imply that a small variation in supply or demand has a large impact on the price of oil. Based on elasticities found in the literature, an unexpected increase in world demand or an unexpected decrease in world supply of 1% will in the short term lead to a price increase of around 15%.[20]

[20] These calculations are based on a price elasticity of – 0.04 of world consumption and a price elasticity of non-OPEC production of 0.04. The values of both elasticities are relatively high. See e.g. D. Gately, OPEC's incentives for faster output growth, *Energy Journal*, vol. 25, no. 2, 2004. The calculations do not take into account the negative effects of the high oil price on GDP and the resulting effects on oil demand. See also OECD, Oil price developments: drivers, economic consequences and policy responses, chapter IV, *OECD Economic Outlook*, No. 76, December 2004; A. Brook et al, Oil price developments: drivers, economic consequences and policy responses, OECD Economics Department Working Paper 412 , 2004. IEA (2006) reports for crude oil a price elasticity -0.03 in the short run and -.15 in the long run.

Finally, needless to mention, the policy of the OPEC is crucial to the oil price development, especially in the medium and long run. There is, however, no consensus on the optimal strategy of the OPEC cartel (see also question 11 How powerful is OPEC?).

8 How important is it that oil prices are in dollars?

Economic theory indicates that the currency ('numeraire') used to express the oil prices on world markets is not very relevant for developments in the longer term. It is global supply and demand that matter for the oil price and both are in the longer term not very sensitive to changes in dollar exchange rates.

As a consequence, one has to expect that a depreciation of the US dollar will lead in the long term to a rise of the oil price measured in US dollars and a broadly unchanged oil price measured in a basket of currencies (for instance SDR's).

9 Is the oil price at a record high?

That depends. In nominal terms, the oil price reached an 'all time high' in July last year of 74 dollar per barrel Brent (monthly average)[21], much higher than the nominal oil price during the first or second oil crisis (Figure 9.1). The rise has been more gradual this time, but also more persistent. Currently (early June 2007), it is only slightly below the record high of August last year. The high nominal oil price was accompanied by low oil stocks in the OECD countries and low reserve capacity in the OPEC (Figure 9.2).

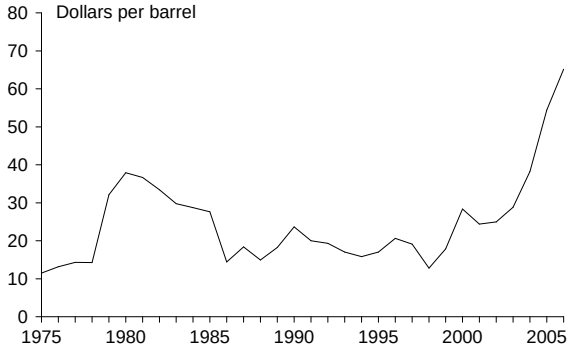
However, it is the real (or relative) price that counts economically. For a consumer in the highly developed countries, the real oil price (based on deflating the nominal oil price with the consumer price index) remained last year below the all time high reached in 1980. But for an oil producer, the real oil price (based on deflating the nominal oil price with the world price of manufactured goods) reached a record high last year. The cause of the different outcome for the two real oil prices is the strong price rise of (labour-intensive) services.

Volatile prices have negative effects on investment decisions by the oil industry as the uncertainty of future returns of such investments increases. The recent oil price hike has, however, not been accompanied by more volatility (Figure 9.3). In the years 1997 up to 2001, volatility increased significantly. This can be attributed to the change in OPEC's production policy, a reduction in spare capacity and lower level of inventories (Figure 9.2). This tighter market is more vulnerable to supply disruptions (real and perceived). Changes in demand need be met by a change in prices rather than a change in production or delivery from stocks. After 2001, however, volatility declined gradually, but without returning to the low level of 1996.

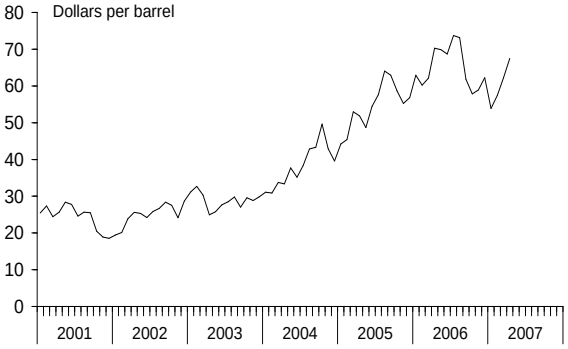
[21] On the daily basis, the record high is 78.7 dollar per barrel reached 8 August 2006.

Figure 9.1 Oil price, 1975-2006

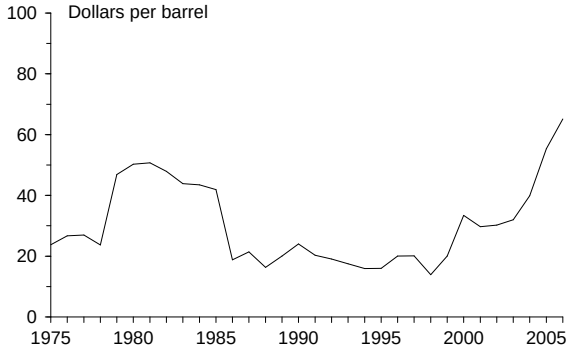
Brent



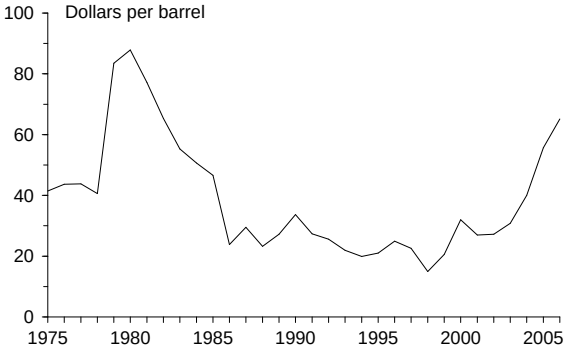
Brent



Real Brent[a]



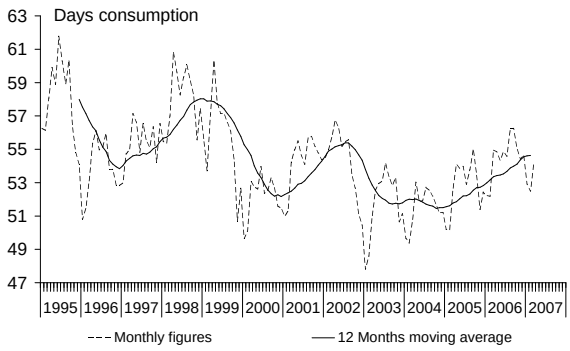
Real Brent[b]



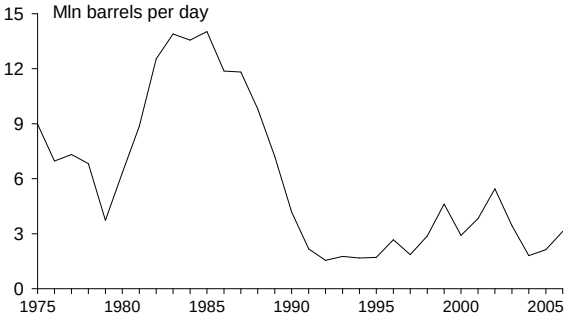
[a] Price level 2006. World price of manufactures In dollars.
[b] Price level 2006. CPI from G3 used as deflator (G3: US, euro area and Japan).

Figure 9.2 Oil inventories and reserve capacity

Industrial oil stocks OECD countries

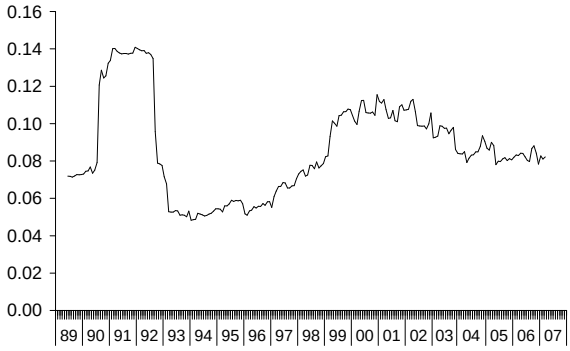


Reserve capacity OPEC[a]



[a] Capacity that can be implemented within 30 days; 2004 is the average of the first ten months.

Figure 9.3 Brent oil price volatility[a]



[a] Volatility is measured as the standard deviation of changes in monthly log-prices over a moving period of 2 years.

10 Is there only one oil price?

Certainly not, and this leads to confusion from time to time. Each important production region has its own oil price. This price largely depends on the quality of the oil in question (measured by sulphur content and density) and the proximity of major regions of consumption. The most widely quoted oil prices are Dubai, Brent and West Texas Intermediate (WTI).[22] Under normal circumstances Dubai is on average 2 dollars lower and WTI 1½ dollar higher than Brent.

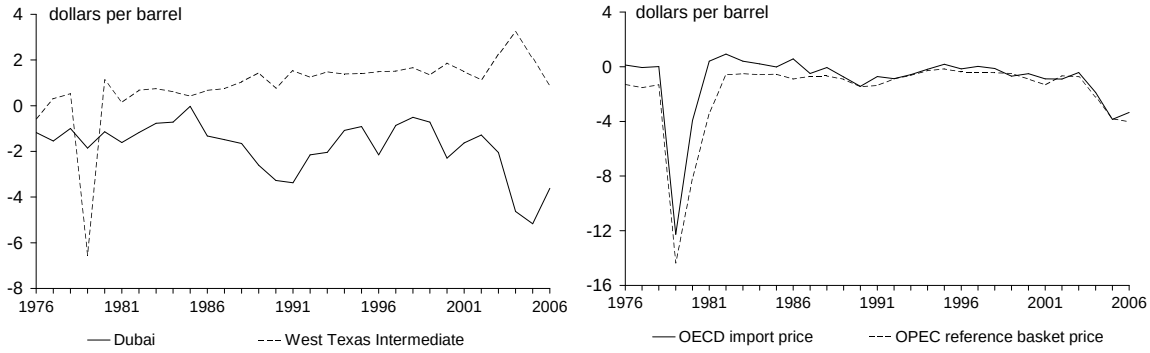
Two other prices are also important: the import price of the OECD countries (on average 1 dollar lower than Brent) and the average OPEC price (OPEC Reference Basket, on average 1 dollar lower than Brent). The price differences between the various types are, however, not constant over time (Figure 10.1).[23] Since 2004, price dispersion is substantially above the historical average.

Furthermore, there are spot prices and futures. A spot price is the price of oil for immediate delivery whereas a future is the price of a contract for delivery on a future date. The futures price will be above the spot price if market participants expect that the price of oil in the future will be higher than the current price.

[22] In the Middle East price quotations most of the times refer to the Dubai-price, whereas in Europe the Brent price and in the US the WTI are the most important price quotations.

[23] The exceptional price difference in 1979-1980 was the result of price measures in the US which had been introduced after the first oil crisis. Under these measures the price of a part of the domestically produced oil was limited from above. Between the first oil crisis and the Iran/Iraq crisis oil prices were relatively stable and these measures had little or no influence. In 1979 international prices rose strongly because of the crisis. The result was a large difference between US (WTI) and world prices. After the abolition of the measures in 1980 prices returned to 'normal' levels.

Figure 10.1 Price differences with Brent, 1976-2006



Source: British Petroleum, Statistical Review of World Energy, 2006, International Energy Agency, Oil Market Report, March 2007.

During the recent price hike, the so-called 'risk premium' in the oil price has often been subject of debate. The buyer of an oil future is prepared to pay a 'risk premium' because of the uncertainty of future oil supply. A premium in the range of 5 and 10 dollars per barrel is often mentioned. However, the basis of these estimates remains vague.

11 How powerful is OPEC?

Statements by the Secretary-General of OPEC or by a government official from an important OPEC member can have large impacts on the daily price of oil. This is an illustration of the large influence OPEC has on the oil market. The market power of OPEC is also illustrated by the fact that the price of oil has been above marginal production costs for long time periods.

Nevertheless, like any other oligopoly, OPEC is instable. For each member state it pays off to cheat and produce more than its agreed quota. In practice, many OPEC countries try to produce as much oil as possible. In such a case the power of OPEC can only be guaranteed if there are other member states that are prepared to lower their production if needed. In the past, Saudi Arabia has often taken the role as 'swing producer': it compensated for the production increases of other members and thus prevented the oil price from falling.[24]

The power of OPEC is not unlimited. Saudi Arabia has in various ways ties with the US and the US government is not very fond of high and increasing oil prices. Secondly, high oil prices will negatively affect demand and lead to an increase in exploration and development of alternative oil supplies, e.g. Canadian tar sands. In the longer term lower demand and alternative supplies will undermine the position of OPEC. There is, however, no consensus on

[24] However, in 1986 Saudi Arabia was not willing to compensate any longer for the increasing production of fellow OPEC members. This probably has made the other OPEC members more cautious about future cheating.

the optimal strategy of the OPEC cartel. The IEA has stressed that a high oil price strategy is inferior as it leads to lower output and revenues, but Gately draws the opposite conclusion.[25]

In March 2000 OPEC introduced a target price interval from 22 to 28 dollar per barrel for its OPEC Reference basket price. However, later, when oil prices started to rise steeply, OPEC abandoned stating explicit targets for the price of its OPEC Reference basket. At the moment the aspired price level can only be derived from statements by OPEC members. It is now widely believed that the comfort zone for OPEC's price level is somewhere near 55 dollars per barrel.

12 What is the role of speculators?

Economic theory is much more sympathetic towards speculation than the man in the street. In theory speculation provides for a fast and complete incorporation of all new information in market prices.[26] Additionally, speculators[27] who are trading in futures markets provide the opportunity for market participants to hedge against price risk. In this way financial markets make it possible to divert risk to those parties that are best suited to bear it.[28] On the other hand it cannot be excluded that the physical oil market may have been vulnerable in recent years to manipulation due to low stocks and low excess capacity (Domansky and Heath, 2007). Moreover, the substantial inflows of funds into commodity markets in recent years may have contributed to the oil price rise.

The volume of speculative activity is often judged by the net position of speculators on the future market of New York (net non-commercial long position in NYMEX WTI futures). An increase in this position will probably lead to an increase in the price of futures[29] but the influence on the spot price is unclear.[30] It is quite well possible that speculation will lead to overshooting of the price, without affecting the underlying long term price level.

[25] D. Gately, OPEC's incentives for faster output growth, *Energy Journal*, vol. 25, no. 2, 2004.

[26] See also Ben S. Bernanke, Oil and the Economy, remarks at the Distinguished Lecture Series, Darton College, Albany, Georgia, October 21, 2004 and OECD, The impact of speculation, box IV.2 in OECD Economic Outlook, no. 76, December 2004.

[27] Also known as 'paper traders' and financial investors.

[28] See also: IMF, An introduction to energy trading markets, Global Financial Stability Report, September 2004, pages 58-64.

[29] Although the net position was much smaller in August 2004 (about one half of that in May 2004), the futures price was much higher.

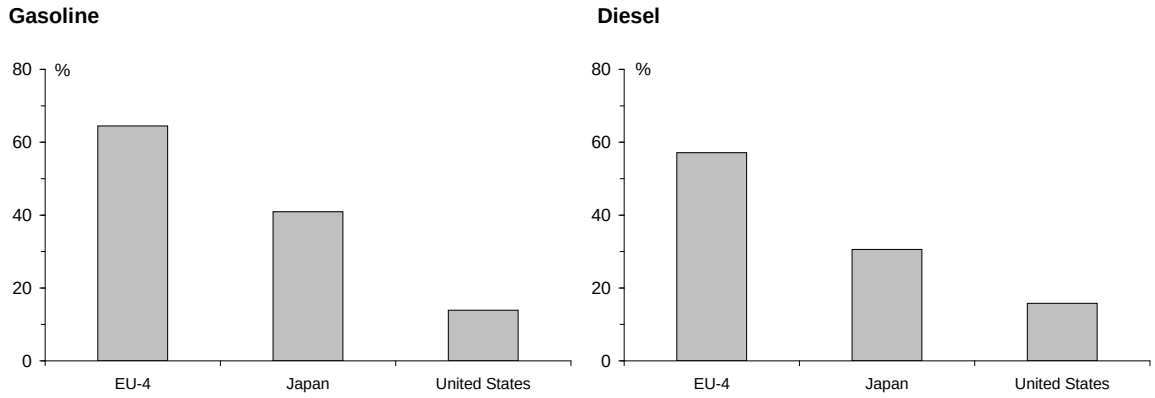
[30] See e.g. D.R Sanders., K. Boris and M. Manfredo, Hedgers, funds, and small speculators in the energy futures market: an analysis of the CFTC's Commitments of Traders report, *Energy Economics*, vol. 26, 2004, pages 425-445 and Fleming, J. and B. Ostdiek, The impact of energy derivatives on the crude oil market, *Energy Economics* 21, 1999, pages 135-167.

13 How important are taxes?

In Europe, taxes make up a significant part of end user prices of oil products. For instance, their share in the pump prices of gasoline and diesel is much larger than in the US[31] (Figure 13.1). Because of these high taxes, the influence of an increase in the price of crude oil on the CPI is more subdued in Europe.[32]

In most cases, taxes (like excise duties) are a fixed amount per litre and do not fluctuate with the cost price.[33] On the other hand, VAT is a percentage of the cost price (including other taxes). Due to the fact that part of the taxes is a fixed amount per litre and due to government measures, the share of taxes in pump prices has dropped during the recent price hike.

Figure 13.1 Share of taxes in pump prices, fourth quarter 2006



EU-4: Germany, France, Italy en United Kingdom; non-weighted average.

Source: International Energy Agency, Energy Prices and Taxes, Quarterly statistics, fourth quarter 2006.

14 Is the oil price higher in winter?

It is a widespread misconception that the oil price is higher in winter. Econometric tests show that oil price series do not have a statistically significant seasonal pattern. Thus, the price of oil is not higher during the Northern Hemisphere winter. On the other hand, time series of oil stocks in OECD countries do show a significant seasonal pattern. During the second and third quarter oil stocks increase, whereas they are used up during the first and the fourth quarter (see Figure 14.1). Oil companies set off seasonal fluctuations in oil demand by accommodating their stocks. Therefore these fluctuations in demand have no influence on the price.

[31] Type of taxes and composition differ between countries.

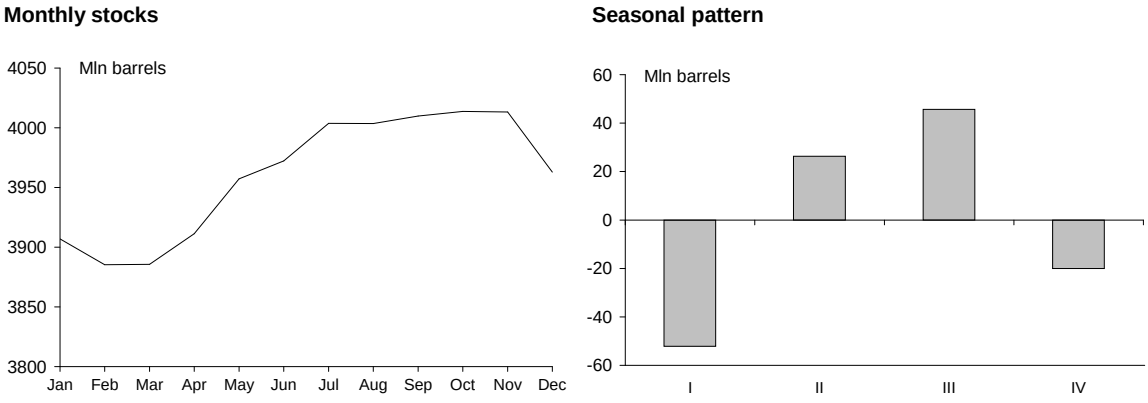
[32] In Europe, as elsewhere, the impact of crude oil on the CPI is also dampened by the relatively constant distribution costs.

[33] European Commission, Quarterly Report on the Euro Area, July 2004.

The absence of a price effect only relates to an average seasonal pattern. Extra oil demand because of a very cold winter will lead to a larger than average decrease in stocks and will thus lead to higher oil prices.

The absence of a seasonal component in the price of oil is corroborated by the findings of the ECB and the BLS. The ECB did not find a seasonal component in the energy part of the consumer price index for the euro area, whereas the BLS found similar results for the US.[34]

Figure 14.1 Oil stocks (crude oil and oil products), OECD countries (average 2000-2006)



15 What implies a higher oil price for the world economy?

According to IEA simulation results based on the OECD Interlink model, an increase in the oil price of 10 dollars per barrel would reduce the GDP volume of the OECD area in the short term with 0.4%. Inflation would show a temporary increase of 0.5% in the first year.[35,36] These figures broadly correspond to those provided by other institutes.[37] However, the most recent

[34] European Central Bank, Seasonal patterns and volatility in the euro area HICP, Monthly Bulletin, June 2004, pages 45-47; US Bureau of Labour Statistics, Seasonal adjustment in the CPI, 2004, http://stats.bls.gov/cpi/cpisapage.htm .

[35] International Energy Agency, Analysis of the Impact of High Oil Prices on the Global Economy, May 2004, www.iea.org.

[36] In these calculations the oil price is increased from 25 dollars in the base case to 35 dollars per barrel, an increase of 40%. The oil price used is the average import price of OECD.

[37] Barrell, R and O. Pomerantz, Oil prices and the world economy, NIESR discussion paper, nr. 242, 2004, Dalsgaard, T. et al, Standard shocks in the OECD INTERLINK model, OECD Economics Department working paper, no. 306, 2001; Hunt, B. et al, The Macroeconomic Effects of Higher Oil Prices, IMF working paper 01/14,2001; IMF, The Impact of Higher Oil Prices on the Global Economy, 2000; OECD, Oil price developments: drivers, economic consequences and policy responses, chapter IV, *OECD Economic Outlook*, No. 76, December 2004; ECB, Oil prices and the euro area economy, ECB Monthly Bulletin, November 2004; IMF, Understanding the link between oil prices and the world economy, box 1.1, World Economic Outlook, April 2007.

OECD calculations show a somewhat lower impact on GDP.[38] The same holds for recent IMF estimates.[39]

Higher oil prices have a negative effect on real disposable household income and therefore on private consumption. Lower consumption will lead to lower investment spending. As oil is a production factor as well, higher production costs are also detrimental to investment. Production decreases because of lower consumption and lower investments, having a further negative impact on consumption and investment (multiplier-accelerator mechanism). Because in other OECD countries expenditures are also decreasing, exports to these countries will decline. However, as the oil revenues from OPEC countries increase and lead to extra expenditures and imports, exports of OECD countries to OPEC countries will increase. The revenues from OPEC will increase by approximately 150 billion dollar in case of a 10 dollar oil price rise.

Table 15.1 Economic consequences of a permanent 10 dollar oil price increase

	First year	Second year
	Cumulative deviations in %	
OECD area		
GDP	– 0.4	– 0.4
Consumer price index	0.5	0.6
Unemployment (% of labour force)	0.1	0.1
Current account (billion dollars)	– 32	– 42
GDP		
United States	– 0.3	– 0.5
Euro area	– 0.5	– 0.5
Japan	– 0.4	– 0.4
Consumer price index		
United States	0.5	0.6
Euro area	0.3	0.3
Japan	0.5	0.6
Unemployment (% of labour force)		
United States	0.1	0.2
Euro area	0.1	0.2
Japan	0.0	0.0

Source: IEA (2004b)

[38] According to the OECD, a sustained increase in the oil price of 15 dollar per barrel would reduce the GDP volume of the OECD area with 0.45% in the short-run.

[39] Based on their Global Economic Model, a 100% rise in the oil price leads to a world GDP fall of 1.4%-points and a rise in global inflation of 1.5%-points (IMF, 2006).

The effects in the euro area will be larger than the effect in the US as the oil import share of the euro area is larger than the import share of the US. Although Japan imports all its oil, the effect on the Japanese economy is relatively small as the oil intensity of the Japanese economy is smaller than its euro area counterpart (Figure 2.2).

For poor oil-importing countries the negative effect on production will be larger than for the euro area as the oil import share for low-income countries and the oil intensity are both higher (Figure 2.2). The effect on GDP for poor, highly indebted countries without domestic oil production is estimated at 1.6% of GDP.

16 Are these calculations on oil price shocks without qualification?

Certainly not. The negative effects of a 10 dollar oil price increase on economic growth could be larger than mentioned in the previous paragraph. The main reasons are:

A negative effect on consumer and producer confidence

The calculations referred to in the previous paragraph only take into account the effects on disposable income and the indirect effect on investment expenditure (multiplier-accelerator mechanism). However, consumer confidence might be negatively affected which could lead to a more pronounced decrease in private consumption and housing investment. Also, producer confidence may decrease which would lead to lower business investments.

Less additional expenditure by oil exporting countries

The figures in Table 15.1 are based on the assumption that the oil exporting countries will spend three quarter of their additional revenues on extra imports within three years. Such behaviour of the oil exporting countries corresponds to their behaviour in the past. The negative effect on GDP growth in OECD countries will be larger if oil exporters spend less than three quarter or spend it at a slower pace.[40] The chances of this to happen are real as the foreign reserves of oil exporting countries have deteriorated during the nineties.

An increase in the price of other energy carriers

In the calculations the prices of other energy carriers like natural gas and coal are not increased. As these prices will probably go up with the oil price, the negative effects of an increase in the price of oil will be larger.

[40] The same applies to the extra oil revenues in OECD countries. A smaller part of these revenues might be spent because not all extra revenues will be diverted to share holders. These share holders may save a larger proportion or it may take more time to invest the extra revenues.

Stronger increase in interest rates by central banks

It is assumed that central banks will temporary increase nominal interest rates as a reaction to higher inflation and that real interest rates do not change. However, it is possible that central banks will increase real interest rates in order to stem inflation. This could lead to a larger negative GDP effect, especially in the second year.

No carry-over from higher inflation into wages

In the calculations it is assumed that wages respond with a time lag to higher price inflation. If this does not happen, e.g. because wage increases have been committed on in previous central labour agreements, the negative effect on consumption will be larger, whereas the positive effect on inflation will be smaller. Both effects relate to the short term, especially to the second year.

A financial crisis in one or more emerging economies

Because of higher oil prices the current account of oil importing emerging economies will deteriorate. These countries will have to decrease their import volumes accordingly which will negatively effect the exports of OECD countries. The effect on current account balances might lead to a decrease in creditworthiness of these emerging economies. Fewer possibilities to borrow might even cause a financial crisis which would even more harm the export possibilities of OECD countries.

However, there are also reasons why the negative impact on the economic growth in OECD countries might be smaller. The main reasons are:

Expansionary budgetary policy and/or no interest increase by central banks

The calculations are based on the assumption that real government outlays do not change because of the increase in the price of oil. Governments could however mitigate the negative production effects by increased government spending.[41]

It is also possible that central banks will not increase nominal interest rates as higher oil prices are regarded as only temporary. Simulations published by the OECD show that the negative impact of a higher oil price will be substantially smaller in case of no interest rate reaction by the central banks.[42] The OECD comes with a second-year GDP effect of a sustained 15 dollar oil price increase of −0.45% in case of constant real interest rates and of −0.25% in case of constant nominal interest rates.

[41] For governments it is difficult to implement discretionary policies in a timely manner. Besides, such policies could induce higher capital market interest rates which would partly off set the intended increase in expenditures.

[42] See OECD, Oil price developments: drivers, economic consequences and policy responses, chapter IV, *OECD Economic Outlook*, No. 76, December 2004.

Lower household savings

Households could lower their savings ratio when they think that the increase in oil price is only temporary (so-called consumption smoothing).

Oil price rise caused by a demand shock

The analysis above is based on a supply shock with oil-exporting countries restricting the supply. The impact is very different in case of a demand shock. For instance, a significant upward shift in the productivity trend of oil-importing countries that permanently raises global growth by ½ of a percentage point causes a substantial rise in oil demand and in the oil price in case of low spare oil capacity (IMF, 2006). Thus, in this case, a strong rise of the oil price is accompanied by a rise of global GDP.

The list of qualifications with regard to the results presented in Table 15.1 could be extended with the possible consequences on the foreign exchange markets. The US dollar might appreciate because the negative effects on the current account of the US is smaller than the effects for the euro area and Japan, and because the additional revenues of the oil exporting countries will for a large part be held in US dollars (petro-dollar effect). As a result, the effect on GDP in the US will be more negative, whereas the effects on GDP of the euro area and Japan will be less negative than shown in Table 15.1.[43] Small changes in exchange rates will probably induce offsetting changes within the OECD area and will leave the average effect unchanged. However, large changes in exchange rates could through unrest on financial markets lead to a larger negative effect for the OECD as a whole.

Given the remarks mentioned, it is clear that many qualifications can be made with regard to the consequence of the oil price hike presented in Table 15.1. Furthermore, one should make the standard qualification that the model results are based on historical relations between economic variables. Current and future relations might deviate from those historical ones. Increased labour and product market flexibility may have led to a smaller impact on the economy now compared with the past.[44] It is also argued, especially by monetary authorities, that increased credibility of monetary policy has reduced the impact of oil price hikes. Finally, an additional source of uncertainty is that there is some evidence of asymmetric and non-linear effects of higher oil prices on the economy.

Nevertheless, a negative effect of close to ½%-point on GDP-growth in the OECD area as a result of an increase in the oil price of 10 dollar per barrel seems most plausible and the best rule of thumb for policymakers.

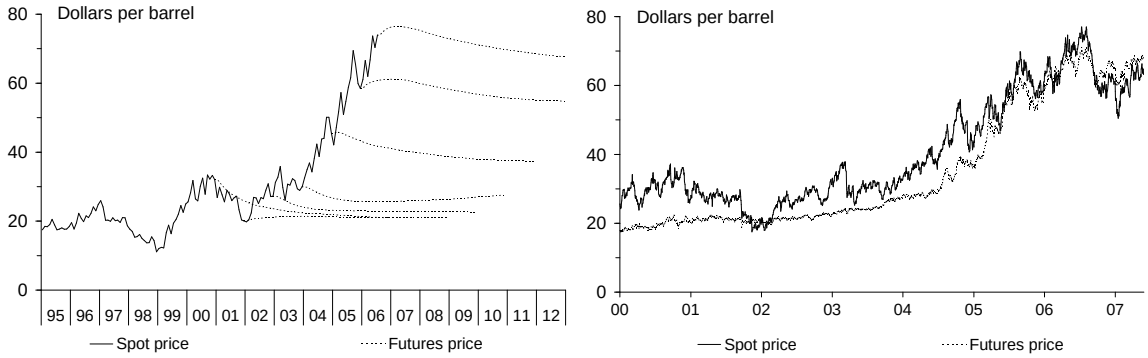
[43] Model outcomes are based on the assumptions of unchanged exchange rates.

[44] ECB, Oil prices and the euro area economy, ECB Monthly Bulletin, November 2004.

17 Are futures good predictors for prices in the near future?

Unfortunately not. To quote the IEA: “Historically, future curves are poor as a ‘predictive’ indicator of future prices”.[45] Oil price forecasts could be based on convergence towards the distant future price during the projection period.[46]

Figure 17.1 WTI spot and futures prices



18 What will bring the future?

Concerning the medium and longer term, the IEA has in its Reference Scenario of its 2006 World Energy Outlook some oil price drop in the medium-term as the recent oil price rise is still influencing supply positively and demand negatively. The real oil price is slightly falling to 48 dollar per barrel in 2015; this means a nominal price of 60 dollar per barrel. With demand continuing to rise, the oil price rises somewhat after 2015, reaching 55 dollar per barrel in 2030 in real terms (and 97 dollar per barrel in nominal terms).[47] Those future oil prices are substantially above recent estimates of marginal production costs outside the OPEC Middle East area (IEA2005b and Figure 18.1).

[45] International Energy Agency, Oil Market Report, August 2004.

[46] See also A. Greenspan, Oil, speech to the National Italian American Foundation, Washington, D.C, October 15, 2004; OECD, Oil price developments: drivers, economic consequences and policy responses, chapter IV, *OECD Economic Outlook*, No. 76, December 2004.

[47] Final energy price changes may diverge from crude oil prices due to changes in energy taxes and changes in the price of CO_2 emissions. A price tag of 50 dollar per tonne CO_2 would raise the US petrol price by 15% and the US electricity price by 35% (Economist, 31 May 2007). However, this calculation does not take into account the likely dampening impact of higher CO_2 emission prices on the crude oil price.

In its Reference Scenario, the IEA has a remarkable shift in the relevance of the various oil producers. By 2030, the OECD is importing two-thirds of its oil needs, up from 56% today. Much of the additional increase will come from the Middle East.

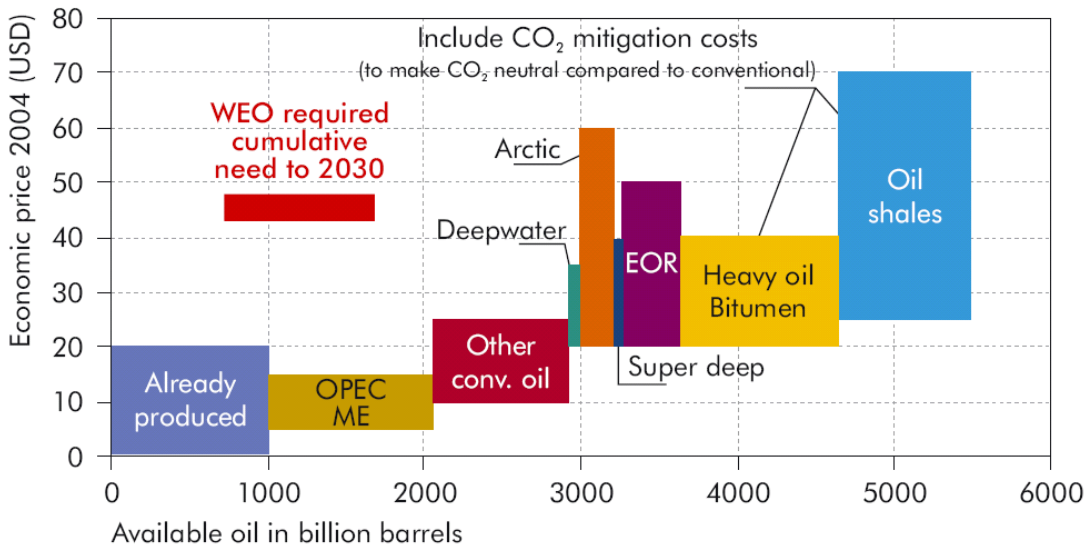
In its Reference Scenario, the IEA assumes that very substantial energy investments – over 20,000 billion dollars (in 2005 prices) – will be made. With restrictions on investment by private companies in major oil producing countries, there is no guarantee, however, that those investments will be made. According to the IEA, lower investments in the OPEC countries would reduce oil supply and demand by 6% in 2030 and would push up oil prices by one-third compared with the reference scenario.

Much more attention is currently paid to the environmental consequences of oil consumption. According to the IEA, without additional policy measures, global energy-related carbon-dioxide emissions are likely to increase by 1.7% per annum in the period 2004-2030. As the relative importance of coal is rising, emissions will no longer be increasing less than energy consumption. According to the IEA, policy measures causing more efficient cars and more efficient use of electricity could cut emissions by 16% relative to the reference scenario. This may lead to a lower crude oil price while at the same time increasing energy costs of end-users.

Recent World Energy Outlooks of the IEA have shown remarkable strong upward revisions in long-term oil prices (Figure 18.1). The same holds for the long-term scenarios of the EIA. Thus, a substantial rise in current oil prices is accompanied by a substantial upward revision of long-term oil prices. This is somewhat disturbing and underlines the big uncertainty about the oil price in the long term.[48] It raises the questions whether, like after the second oil shock, the long-term oil price is overpredicted. For instance, at the top of the price peak in 1981, the US Department of Energy forecasted a price of 140 dollars a barrel for the year 2000 (Lynch, 2002; Bollen et al., 2004). This overprediction followed mainly from underestimation of the price elasticity of both oil consumption and the oil supply from non-OPEC countries.

[48] Kay concludes from this uncertainty that we should eschew forecasts. See J. Kay, 2007., Energy wisdom is knowing that you do not know, *Financial Times*, 28 May.

Figure 18.1 Oil supply curve



Source: International Energy Agency, Resources to Reserves, Oil&Gas Technologies for the Energy Markets of the Future, 2005.

Table 18.1 Oil prices in reference scenarios (in real terms) in successive World Energy Outlooks (International Energy Agency)[a] and Annual Energy Outlooks (Energy Information Administration)[b]

	2010	2020	2030	
	Dollars per barrel			In prices of:
WEO 2000	16.5	22.5		$1990
WEO 2002	21.0	25.0	29.0	$2000
WEO 2004	22.0	26.0	29.0	$2000
WEO 2005	35.0	37.0	39.0	$2004
WEO 2006	51.5	50.0	55.0	$2005
AEO2000	21.0	22.0		$1999
AEO2001	21.4	22.4		$2000
AEO2002	23.4	24.7		$2001
AEO2003	24.0	25.5		$2002
AEO2004	24.2	26.0		$2003
AEO2005	25.0	28.5		$2004
AEO2006	47.3	50.7	57.0	$2005
AEO2007	57.5	52.0	59.1	$2006

[a]: IEA crude oil imports.
[b]: until 2005 Average Refiner Acquisition Cost for imported crude oil, thereafter, Average Price of Imported Low Sulfur Light Cruce Oil.

Source: World Energy Outlook (International Energy Agency) and Annual Energy Outlook (Energy Information Administration), various issues.

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