

## Contents

### What Direction for Oil Prices?

- Oil prices on record level
- Coupling gas prices to oil prices no longer appropriate
- Long-term factors affecting the oil market
- How will oil prices move in the medium to long term?
- Conclusion

## Editorial Board

Klaus F. Zimmermann  
Tilman Brück  
Dörte Höppner  
Claudia Kemfert  
Georg Meran  
Bernhard Seidel  
Viktor Steiner  
Alfred Steinherr  
Gert G. Wagner  
Axel Werwatz  
Christian Wey

## What Direction for Oil Prices?

Claudia Kemfert and Manfred Horn

The price of crude oil goes up and up – most recently driven by hurricane Katrina, which had a catastrophic effect on the US oil industry, and was followed by hurricane Rita. In September 2005 the price of Brent crude reached a new record at US \$ 66 per barrel. The agreement by member states of the International Energy Agency (IEA) to release crude oil and petroleum products from their strategic reserves has brought prices down again slightly, but it is very questionable whether this will calm the upward drive for long.

Crude oil prices have been rising continuously since 2003, largely as a result of increased demand, particularly from China. The high level of capacity utilization in oil extraction creates risks that are reflected in rising prices on the forward markets. The rise in oil prices since 2003 is around US \$ 30 per barrel, and this is probably mainly due to short-term effects and resultant speculative buying.

In view of the high stocks of oil the current prices do seem excessive. Sooner or later they will normalize on a lower level, but in the long term higher prices for oil than the average of recent decades must be expected. Model simulations up to the year 2025 show that in a scenario of adequate resources real oil prices (price base 2000) of between US \$ 30 and US \$ 40 per barrel are to be expected. In a scenario of more limited resources, however, prices could rise to just under US \$ 80 per barrel in real terms, which is up to US \$ 160 nominally.

### Oil prices on record level

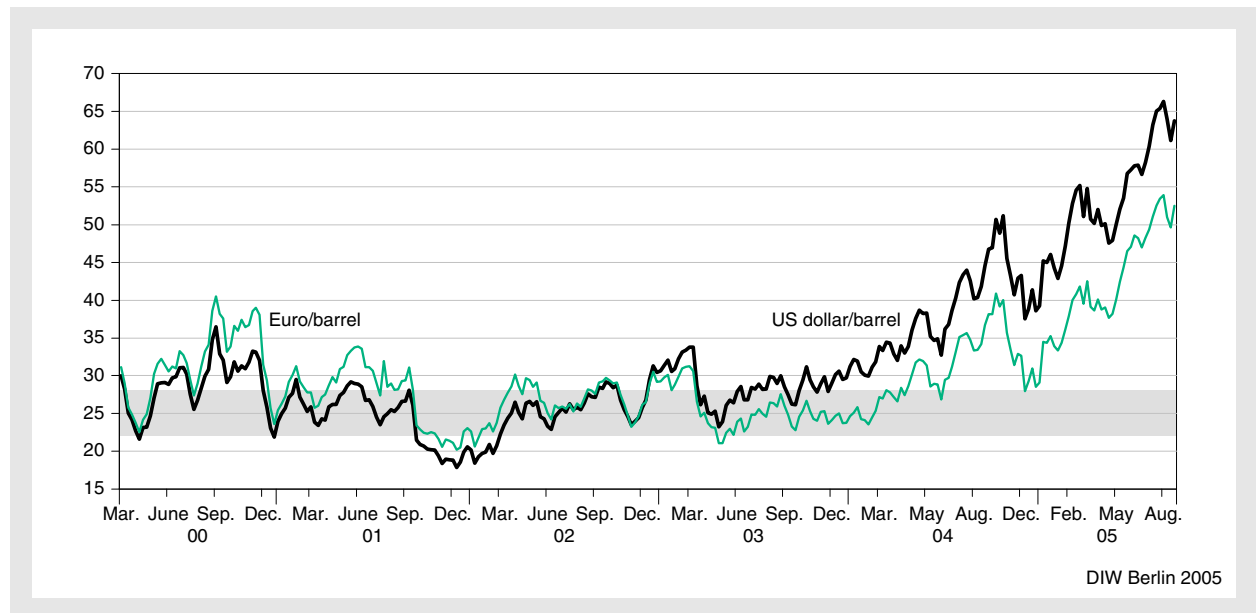
In the last four years the price of Brent crude has roughly tripled (cf. figure 1). In nominal terms it is much higher than in the previous record year, 1981. In real terms, that is, taking into account the fall in the value of money due to the general rise in prices, the price of oil has come back very close to that year's level of around US \$ 70 per barrel (cf. figure 2). This has also affected other energy prices, especially gas prices (see box).<sup>1</sup>

The current surge in prices for crude oil has been caused by increased demand and production shortfalls, against the background of oil extraction

<sup>1</sup> See also Jochen Diekmann, Manfred Horn, Claudia Kemfert and Uwe Kunert: 'Upward Movement in Energy Prices'. In: *DIW Berlin Economic Bulletin*, vol. 41, no. 12, December 2004.

Figure 1

## Brent Crude Oil Price Trends, March 2000 to September 2005

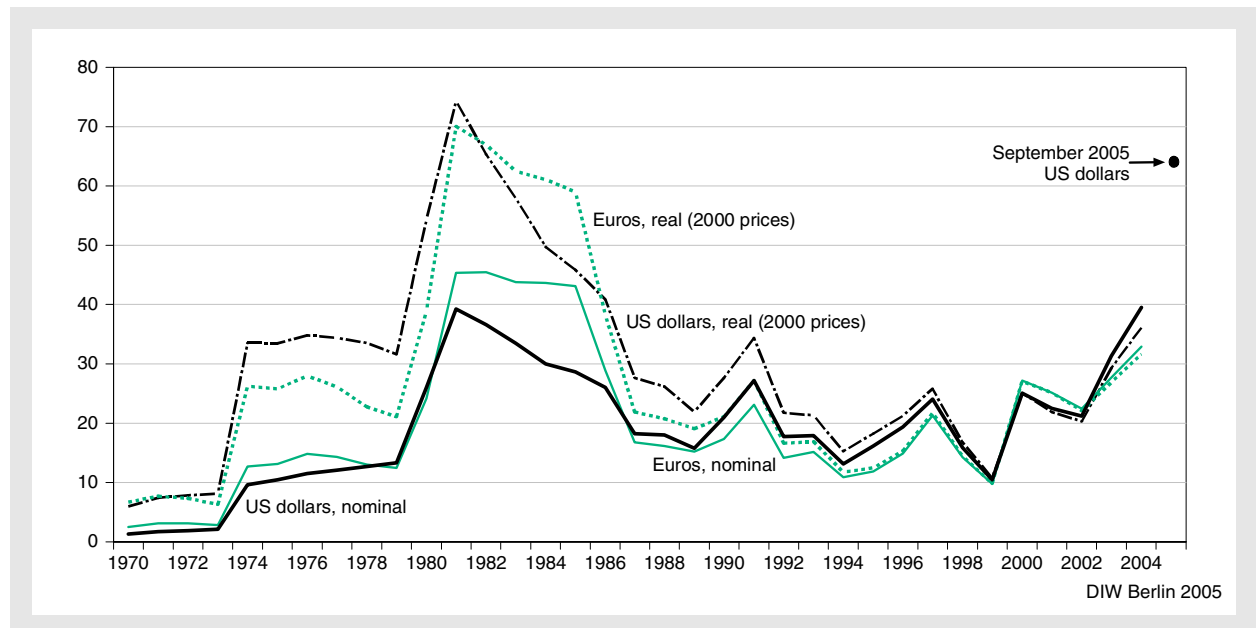


capacities working at full stretch world wide; speculation on the forward markets has fuelled the upward movement.

Demand for oil has grown markedly all over the world in recent years, with an increase of 3.5% in 2004 alone. China's consumption of crude oil has risen partic-

Figure 2

## Price of Brent Crude Oil<sup>1</sup> per Barrel, 1970 to 2004<sup>2</sup>



<sup>1</sup> Until 1979 Saudi Arabian Light. — <sup>2</sup> Estimated for 2004.

Sources: Petroleum Intelligence Weekly, diverse issues; Deutsche Bundesbank; US Department of Labor, Bureau of Labor Statistics; Consumer Price Index, Washington D.C., 1 October 2004; DIW Berlin calculations.

### Coupling gas prices to oil prices no longer appropriate

For more than three decades the price of gas has been contractually fixed to the oil price. This is firstly to ensure that the heavy investment in the infrastructure needed to supply gas (pipelines) can be financed, and secondly to ensure that gas remains competitive on the heating market. In addition, the gas suppliers were initially hoping to avoid strong fluctuations in the price of gas by tying it to the price of oil.

Certainly, heavy investment is still needed in the gas infrastructure, as the latest decision to lay a gas pipeline from Russia to Germany shows, but that in itself does not justify tying the gas price to the oil price. The reasons for increases in the oil price do not directly affect conditions on the gas market, and it is now difficult to explain why the gas price should follow the strong fluctuations in the oil price, as is inevitable when the two are tied.

Where oil and natural gas are competing on individual markets – and that is mainly the case on the heating market – oil and gas prices will be linked, even under competitive conditions. But they will be linked through substitution competition, and not because they are contractually tied, which limits competition between oil and gas. In view of the big market share of gas contractual coupling with the oil price is no longer appropriate.

Liberalizing the electricity and gas markets in Europe is intended to intensify competition in these areas. Admittedly, the gas market, unlike the electricity market, has very few sup-

pliers, but in the long term the number could rise noticeably if more liquidized gas (LNG) is consumed, as it can be transported over long distances at relatively low cost.<sup>1</sup>

By opening the European gas market the European Commission has helped to ensure that prices on the gas market can in future move freely in response to market forces.<sup>2</sup> In Germany competition can initially also be intensified by shortening the periods covered by contracts between natural gas suppliers and distributors (local authority utilities enterprises).

But even without contractual coupling of the gas price to the oil price, and with more intensive competition – as in Britain – there can be considerable price fluctuations. A strong increase in demand and the clear domination of the world's biggest supplier of gas, Russia, could cause a marked rise in prices. Even if more intensive competition does not in every case guarantee falling prices it is desirable for big suppliers as well (including Russia) to comply with the rules of the market and so also increase substitution competition with oil.

<sup>1</sup> Cf. Christian von Hirschhausen, Claudia Kemfert and Franziska Holz: 'Russian Energy and Climate Policy Remains Inconsistent – Challenges for the EU', in: *DIW Berlin Weekly Report*, no. 11/2005.

<sup>2</sup> The European Commission insists on this in its latest status report, cf. 'Communication from the Commission to the European Parliament and the Council – Annual Realisation of the Single Electricity and Gas Market', Com (2004) 863, Brussels, 5 January 2004.

ularly strongly. However, after an increase of 14% in 2004 the growth rate this year is expected to be lower (cf. table 1).<sup>2</sup> The IEA assumes that demand in China will rise by 5% in 2005 and by 7% in 2006 (cf. table 2).

As in 2004, more oil was produced than consumed in the first half of 2005; the second quarter actually showed a surplus of 2.7 million barrels a day (mbd). So crude oil stocks in the OECD countries have risen and they are now back above the average of the last five years. For the period from the beginning of 1998 to the end of 2004 a negative correlation can be shown between the level of crude oil stocks in the OECD and oil prices. According to this, with the present level of stocks in the OECD (977 million t in July 2005) crude oil prices should be at most US \$ 20 to US \$ 30 per barrel; in fact they are two to three times higher.

As a result of hurricane Katrina and the flooding in the southern states large parts of US oil production in the Gulf of Mexico have ceased to operate. Ninety per cent of the US oil extraction capacities have been damaged, causing a loss of output of 1.4 mbd. A month's loss is about 2.1% of US annual production. At least part of the big increases in oil prices which resulted is to

be reversed by releasing 60 million barrels of the IEA countries' oil reserves (corresponding to 2 mbd for 30 days). Germany has joined the initiative and released 3.6 million barrels. Should more hurricanes hit the United States the IEA would consider releasing more oil reserves.

The speculation on the oil forward markets is ultimately due to the present high capacity utilization in OPEC. If the grounds for this speculation are to be removed and the price of crude oil brought down for the long term, the OPEC countries must convince the international public that they will greatly increase their production capacities in the next few years and soon bring their reserve capacities back to a more reassuring level. The OPEC countries stated at their meeting on 20 September in Vienna that they will increase their production capacities by 5.5 mbd, to 38 mbd by 2010.

It could also help to calm the market if the general public could be more convinced that the state-controlled oil stocks of the OECD countries are sufficient to meet any serious disruption to supply. Any information policy to improve market transparency would also need international agreement (the G8).

However, as long as the increases in production have not materialized price risks will persist. Moreover, the

<sup>2</sup> IEA: Oil Market Report, Paris, 11 August 2005.

Table 1

# World Oil Consumption and Extraction and Changes in Stocks from 2002 to 2005 according to the IEA<sup>1</sup>

In million barrels a day (mbd)

	2002	2003	2004					2005				
			I	II	III	IV	Year	I	II	III	IV	Year
Oil consumption												
OECD	48.0	48.6	50.1	48.2	49.1	50.4	49.5	50.6	48.6	49.6	51.1	49.9
North America	24.1	24.5	25.2	25.1	25.4	25.7	25.4	25.5	25.2	25.8	26.1	25.7
Europe <sup>2</sup>	15.3	15.4	15.6	15.2	15.6	16.0	15.6	15.5	15.3	15.6	16.0	15.6
Pacific	8.6	8.7	9.3	7.9	8.2	8.8	8.5	9.5	8.1	8.2	9.0	8.7
Others	29.7	30.6	32.0	32.8	32.6	33.3	32.7	33.3	33.2	33.7	34.8	33.8
Former Soviet Union	3.5	3.6	3.5	3.7	3.8	4.0	3.7	3.7	3.6	3.7	4.1	3.8
Europe	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7
China	5.0	5.6	6.3	6.5	6.3	6.6	6.4	6.5	6.4	6.8	7.2	6.7
Rest of Asia	8.0	8.0	8.4	8.7	8.3	8.7	8.5	8.7	8.8	8.6	9.0	8.8
Latin America	4.8	4.7	4.7	4.9	5.0	4.9	4.9	4.8	5.0	5.1	5.0	5.0
Middle East	5.2	5.3	5.5	5.5	5.8	5.6	5.6	5.8	5.7	6.1	5.9	5.9
Africa	2.7	2.7	2.8	2.8	2.7	2.8	2.8	2.9	2.9	2.8	2.9	2.9
World	77.7	79.2	82.1	80.9	81.7	83.8	82.1	83.9	81.8	83.3	85.9	83.7
Oil extraction <sup>3</sup>												
OECD	21.9	21.6	21.8	21.5	20.8	21.0	21.3	20.9	21.0	20.6	21.3	20.9
North America	14.5	14.6	14.8	14.7	14.5	14.4	14.6	14.4	14.6	14.5	14.9	14.6
Europe <sup>2</sup>	6.6	6.3	6.4	6.2	5.7	6.0	6.1	5.9	5.8	5.5	5.8	5.7
Pacific	0.8	0.7	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.6
Others without OPEC	24.5	25.6	26.5	26.8	27.3	27.5	27.0	27.5	27.7	28.2	28.6	28.0
Former Soviet Union	9.4	10.3	10.9	11.1	11.4	11.5	11.2	11.4	11.5	11.7	11.8	11.6
Europe	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
China	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6
Rest of Asia	2.5	2.6	2.7	2.7	2.8	2.8	2.8	2.7	2.6	2.7	2.8	2.7
Latin America	3.9	4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.4	4.4	4.4	4.3
Middle East	2.1	2.0	2.0	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8
Africa	3.0	3.0	3.3	3.3	3.5	3.5	3.4	3.6	3.6	3.8	4.0	3.7
OPEC	28.8	30.7	32.2	32.3	33.4	33.9	33.0	33.5	34.0	.	.	.
Crude oil	25.1	26.8	27.9	28.1	29.1	29.5	28.6	28.8	29.3	.	.	.
Natural gas liquids (NGLs)	3.7	3.9	4.3	4.3	4.3	4.4	4.3	4.7	4.7	4.8	4.9	4.8
World	76.9	79.7	82.3	82.5	83.3	84.2	83.1	83.7	84.5	.	.	.
Oil extraction minus oil consumption	-0.8	0.5	0.2	1.6	1.6	0.4	1.0	-0.2	2.7	.	.	.
Change in stocks <sup>4</sup>												
OECD	-0.3	0.3	-0.4	0.9	0.5	-0.2	0.2	0.1	1.4	.	.	.

Deviations in sums due to rounding.

1 IEA = International Energy Agency. — 2 Including Turkey. — 3 Including condensates, natural gas liquids, unconventional oils, net volumetric gains in the refinery process and liquid energy sources based on alcohol or hard coal. — 4 Net, without miscellaneous balancing items.

Quelle: International Energy Agency: Oil Market Report. Paris, 11. August 2005.

reduction in the OECD oil stocks can be interpreted by speculators as a further shortage, and this could drive prices up even further.

## Long-term factors affecting the oil market

Contrary to what is often maintained, there is not, at present, any shortage of crude oil. Extraction of conven-

tional oil (not including heavy oils, oil sand and oil slate) will reach its peak world wide in 15 years at the earliest; then it will start to decline (cf. figure 3).

But that need not necessarily involve rising oil prices. The Energy Information Administration (EIA) and the IEA are optimistic that oil will be available at relatively favorable prices in the next quarter century, namely at between US \$ 30 to US \$ 35 per barrel,<sup>3</sup> although if energy policy remains unchanged demand for oil and natural gas will rise strongly by 2030 –

Table 2

**World Oil Consumption and Extraction 2005 and Prognosis for 2006<sup>1</sup>**

In million barrels a day (mbd)

	2005	2006				
		I	II	III	IV	Year
Oil consumption						
OECD	50.0	51.0	48.9	50.1	51.5	50.4
North America	25.7	25.9	25.6	26.2	26.4	26.0
Europe <sup>2</sup>	15.6	15.6	15.3	15.7	16.0	15.6
Pacific	8.7	9.5	8.1	8.3	9.1	8.7
Others	33.8	34.6	34.7	35.1	36.1	35.1
Former Soviet Union	3.8	3.8	3.6	3.8	4.1	3.8
Europe	0.7	0.8	0.7	0.7	0.8	0.7
China	6.8	7.0	7.1	7.4	7.6	7.3
Rest of Asia	8.8	9.0	9.2	8.9	9.3	9.1
Latin America	5.0	4.9	5.1	5.2	5.1	5.1
Middle East	5.9	6.1	6.1	6.4	6.2	6.2
Africa	2.9	3.0	3.0	2.9	3.0	3.0
World	83.7	85.6	83.7	85.2	87.6	85.5
Oil extraction <sup>3</sup>						
OECD	20.9	21.3	20.8	20.6	20.9	20.9
North America	14.6	14.9	14.8	14.7	14.8	14.8
Europe <sup>2</sup>	5.7	5.8	5.5	5.3	5.5	5.5
Pacific	0.6	0.6	0.6	0.6	0.6	0.6
Others without OPEC	28.0	28.8	29.0	29.3	29.7	29.2
Former Soviet Union	11.6	11.9	11.9	12.2	12.4	12.1
Europe	0.2	0.2	0.2	0.2	0.2	0.2
China	3.6	3.6	3.6	3.6	3.6	3.6
Rest of Asia	2.7	2.9	2.9	2.9	2.9	2.9
Latin America	4.3	4.4	4.5	4.5	4.6	4.5
Middle East	1.8	1.8	1.8	1.7	1.7	1.7
Africa	3.7	4.1	4.2	4.3	4.4	4.3
Demand for OPEC oil	34.8	35.5	33.9	35.3	37.0	35.4
Crude oil <sup>4</sup>	30.0	30.4	28.8	30.1	31.7	30.2
Natural gas liquids (NGLs)	4.8	5.1	5.1	5.2	5.3	5.2
World	83.7	85.6	83.7	85.2	87.6	85.5

Deviations in sums due to rounding.

1 IEA data base. — 2 Including Turkey. — 3 Including condensates, natural gas liquids, unconventional oils, net volumetric gains in the refinery process and liquid energy sources based on alcohol or hard coal. — 4 Difference between world demand for oil on the one side and OPEC production of NGLs and oil extraction by the other regions on the other side.

Sources: IEA: Oil Market Report, Paris, 11 August 2005; DIW Berlin calculations.

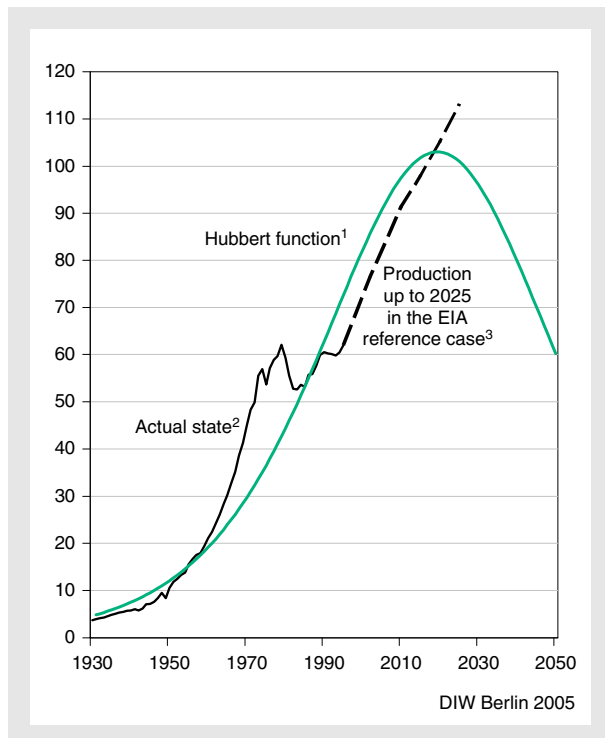
according to the IEA by 70%. To meet the growing demand the IEA estimates that investment of up to US \$ 100 billion a year will be needed.

Two thirds of the oil fields that are known today and still unopened are in the Middle East, mainly Saudi Ara-

bia, Iran and Iraq. The Middle East countries' reserves are seven times higher than those of the western OECD states, but they are investing very much less in extraction. Exploration in Europe and North America is much more expensive than in the Middle East. In addition, the Canadian oil sands contain more oil than all the currently known reserves. Open cast mining of these deposits was already commercially viable even before the rise in oil prices from 2003. However, extracting oil from oil sand is very energy-intensive, especially if the deposits

<sup>3</sup> Some researchers, however, assume that maximum output has already been reached and that this is the explanation for the surge in prices. Cf. Colin J. Campbell: 'Oil Crisis', Multi-Science Publishing Co., Ltd., Oxford, 1st edition 1995, new ed. 2005.

Figure 3  
The Trend of Crude Oil Extraction in Different Scenarios  
In million barrels a day (mbd)



1 The Hubbert function is a logistic function from which a bell-shaped course of oil extraction can be deduced. The peak of production is passed when half the total resources are consumed (cf. Oil & Gas Journal, 17 April 2000). — 2 Without heavy oil. — 3 Without heavy oil and other unconventional oils (e.g. oil sand). Sources: Energy Information Administration (EIA); International Energy Outlook 2005; DIW Berlin calculations.

are very deep.<sup>4</sup> Oil products can also be made from natural gas, coal and biomass, and oil consumption can be reduced, for example through technical improvements. In view of these factors the price level for crude oil should be clearly below the present level in the long term.

## How will oil prices move in the medium to long term?

It is difficult to estimate how oil prices will move in the next few years, owing to the considerable uncertainty

<sup>4</sup> Oil sand is a mixture of clay, sand, water and bitumen. Bitumen can be converted to synthetic crude oil. The oil sand is extracted from deeper layers by feeding steam into the seams to liquidize the bitumen. The disadvantages of this process are the huge consumption of water, the energy needed to create the steam, the problem of waste water disposal and possible environmental damage below ground.

caused by the current scarcity of oil extraction capacities and the resultant speculations on the forward markets for oil.

The latest increase of 2 mbd in OPEC output quotas has not produced any noticeable relaxation on the oil market. If oil extraction capacities were to be markedly increased, and the increase in demand prove to be more moderate than in the last two years, it would be quite conceivable for the market price of oil to fall to a medium-term trend of US \$ 30 to US \$ 35 per barrel in real terms. But if demand continues to rise at the present strong rate crude oil prices could remain on the present high level for some time, as in that case building up the reserve capacities needed to calm the market would take longer. More unusual events like political unrest, or natural disasters like the recent hurricanes, could drive the price up even further, at least temporarily.

With their strong market position the OPEC countries will continue to exert a strong influence on the development in oil prices. Their scope for price movements will largely depend on how big the oil resources really are and whether production can be increased enough – as the IEA, for example assumes – or whether more pessimistic estimates that worldwide oil extraction has already passed its peak, or will do so in the next few years, prove correct.

To mark out the range of possible developments model calculations were carried out in which it was assumed that OPEC will orient their production to the objective of maximizing their export earnings over the long term. The model calculations indicate that crude oil prices will be between US \$ 30 and US \$ 40 per barrel in real terms by 2025 (in year 2000 prices) if resources are adequate, but if their availability is restricted real oil prices could reach just under US \$ 80 per barrel (that would be up to US \$ 160 per barrel nominally, cf. table 3).

Should the OPEC countries try to keep prices on the present high level, even if resources are adequate, while production outside OPEC increases, as the IEA and the US Energy Information Administration expect, in a few years OPEC would be facing a dilemma, because demand for OPEC oil would fall to a level that would not be acceptable to Saudi Arabia.

## Conclusion

Once the oil production plant in the United States starts operating again and if OPEC, as announced, does increase its output again in the next few months, oil prices could fall back noticeably. If there are more natural disasters that prevent production or political crises

Table 3

Crude Oil Prices as Forecast by the EIA<sup>1</sup> and Scenarios by DIW Berlin

In US dollars (real, 2000 price base) per barrel

	2000	2010	2025	2010	2025
		Scenario A <sup>2</sup>		Scenario B <sup>3</sup>	
EIA 2005	27.6	31.0	35.0	35.0	48.0
Model calculations by DIW Berlin					
Reference <sup>4</sup>	27.6	34.4	38.3	69.2	77.2
Greater price elasticity of supply of non-OPEC oil <sup>5</sup>	27.6	25.4	28.4	61.7	68.8
Greater price elasticity of demand for oil products <sup>6</sup>	27.6	28.2	31.5	47.0	52.4
Internalisation of costs for environmental protection in the OECD <sup>7</sup>	27.6	30.5	34.0	66.7	74.4

1 Energy Information Administration. — 2 Variant without resource restrictions. — 3 Variant with resource restrictions. — 4 Price elasticity of demand for oil products = -0.5; price elasticity of supply of non-OPEC oil = 0.1. — 5 Price elasticity of supply of non-OPEC oil = 0.3. — 6 Price elasticity of demand for oil products = 0.7. — 7 US \$ 30 per barrel.

Sources: EIA; International Energy Outlook 2005, Washington D.C., 2005; Manfred Horn: 'Zur Preispolitik der OPEC in langfristiger Perspektive', in: Zeitschrift für Energiewirtschaft, vol. 4, 2004, pp. 285-292.

in major oil producing countries, then considerable surges in prices are possible, and releasing reserves would only partly reverse these.

At present oil prices do seem to be unjustifiably high. Sooner or later they will return to a more normal level. But a return to the average level of the last two decades is not to be expected in the long term. Model

simulations up to the year 2025 show that in a scenario of adequate resources real oil prices of between US \$ 30 and US \$ 40 per barrel (price base 2000) are to be expected. In a scenario where only limited resources are available, however, prices could rise to just under US \$ 80 per barrel in real terms, which would be up to a nominal price of US \$ 160 per barrel.