

*Rush hour in Kolkata (formerly Calcutta), India. Between 1990 and 2000, the number of motor vehicles per capita more than doubled in four Asia-Pacific nations: South Korea, the Philippines, India, and China.*  
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## Foreword

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**Fereidun Fesharaki**

Concerns about energy security affect economic performance and political stability all over the world. Yet nowhere is the issue more critical than in Asia and the Pacific. In particular, rising fuel consumption to support the region's rapid economic growth has led to a worrying degree of dependence on oil imports from the Middle East.

As of 2005, Asia and the Pacific accounted for 30 percent of the world's total oil consumption but only 10 percent of global oil production (see Figure 1.10). The importance of the region is reflected not so much in its share of total consumption, however, as in its share of consumption growth. Since 1990, well over one-half of the annual growth in global oil consumption has originated from Asia and the Pacific (Table F.1). In 2004, China alone accounted for nearly one-third of the growth in oil consumption in the entire world. This rapid growth in consumption has increased imports into the region dramatically, contributing to price volatility on the global market. Coupled with emerging supply limitations, the Asia-Pacific region's increasing demand for oil raises fears of tensions among Asian nations and between Asia and the West.

Natural-gas consumption is relatively modest in Asia and the Pacific. In 2005, the region accounted for only 14 percent of the world's total consumption. The Asia-Pacific region produces more than 90 percent of the natural gas it consumes, but a trend toward rapidly increasing consumption will lead to a greater dependence on imports and will also contribute to the globalization of gas markets. Expanding trade in natural gas—both across the region and at the global level—will require enormous capital investments and elaborate networks of international agreements.

Apart from the region's role in global oil and natural-gas markets, energy consumption in Asia and the Pacific has a large and growing effect on the global environment. Coal is widely used in the region for electricity generation, domestic heating, and manufacturing. Given the level of technology currently in use, coal combustion tends to produce harmful air pollution, with effects on human health and global climate change. Several Asia-Pacific countries also use nuclear power, primarily to generate electricity. Safety and environmental issues are growing concerns.

### *The global oil market*

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The years 2004 and 2005 brought several firsts to the global oil market. In 2004, consumption grew at the fastest rate observed over the previous 25 years. Oil

**Table F.1. Annual growth in oil consumption in the Asia-Pacific region and the rest of the world, 1990–2005 (thousand barrels per day)**

Year	Thousand barrels per day		
	Asia-Pacific	Rest of world	Total
1990	716	-386	330
1991	620	-210	410
1992	907	-347	560
1993	753	-423	330
1994	914	-74	840
1995	938	462	1,400
1996	867	763	1,630
1997	783	717	1,500
1998	-182	602	420
1999	982	638	1,620
2000	491	189	680
2001	65	625	690
2002	267	363	630
2003	817	733	1,550
2004	1,073	2,107	3,180
2005	445	605	1,050
Total	10,456	6,364	16,820

Sources: OECD/IEA (2006); FACTS Global Energy (2006).

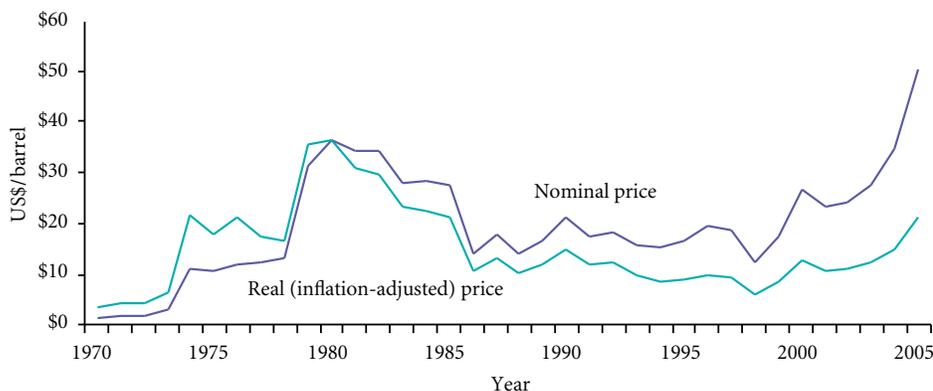
prices in the United States reached an average of more than US\$40 per barrel in 2004 and more than US\$55 per barrel in 2005—the highest nominal prices in history. During 2004, oil consumption in China increased by some 800,000 barrels per day (b/d), compared with an average increase of just over 300,000 b/d between 2000 and 2003. This was the fastest annual growth in oil consumption ever recorded in any country. The high nominal price of oil did not seem to have any significant impact on consumption growth.

In 2005, by contrast, the growth of world demand for oil slowed down considerably, partially because of high prices. In China in particular, the annual increase in oil consumption fell below 300,000 b/d.

Oil price estimates in the United States are based on the price of West Texas Intermediate (WTI) crude oil traded in the New York Mercantile Exchange (NYMEX). In Asia and the Pacific, however, oil prices are based on Dubai crude, which remained at an average of US\$34 per barrel during 2004 but soared to US\$61 per barrel in 2006. In the Asia-Pacific market, the real price (adjusted for inflation) was far below the peak reached in 1979 (Figure F.1).

In the late summer of 2005, oil prices marked another historic record. The WTI price went above US\$70 per barrel, and the Dubai price went above

Figure F.1. Trend in price of Arab light crude oil, 1970–2005: Nominal and real (inflation-adjusted) 1980 prices (U.S. dollars per barrel)



Source: FACTS Global Energy (2006).

US\$60 per barrel. Natural-gas prices were also at an all-time high. In 2006, oil prices continued to be high, while natural-gas prices in the United States began falling off at the end of the 2005 hurricane season.

In real terms, the price of Dubai crude is projected to reach about US\$80 per barrel by 2014 according to the East-West Center's base-case scenario. Price projections for 2015 range from more than US\$100 per barrel (high scenario) to US\$50 per barrel (low scenario), but not lower. The base-case price will still be lower in real terms (adjusted for inflation) than the 1979 peak.

In the short term, global oil prices might decline temporarily as demand slows down and inventory builds up (Figure F.2). Higher prices have triggered some degree of conservation, and the unprecedented growth of oil consumption in 2004 slowed down in 2005 and 2006. A deliberate effort by the Chinese government, coupled with a slowdown in the U.S. economy, has reduced the global increase in oil consumption to 1.1 million b/d in 2005 and 1.0 million b/d in 2006, compared with an increase of more than 3 million b/d in 2004. But despite the slowdown in consumption growth, there is a fundamental floor below which prices are unlikely to fall.

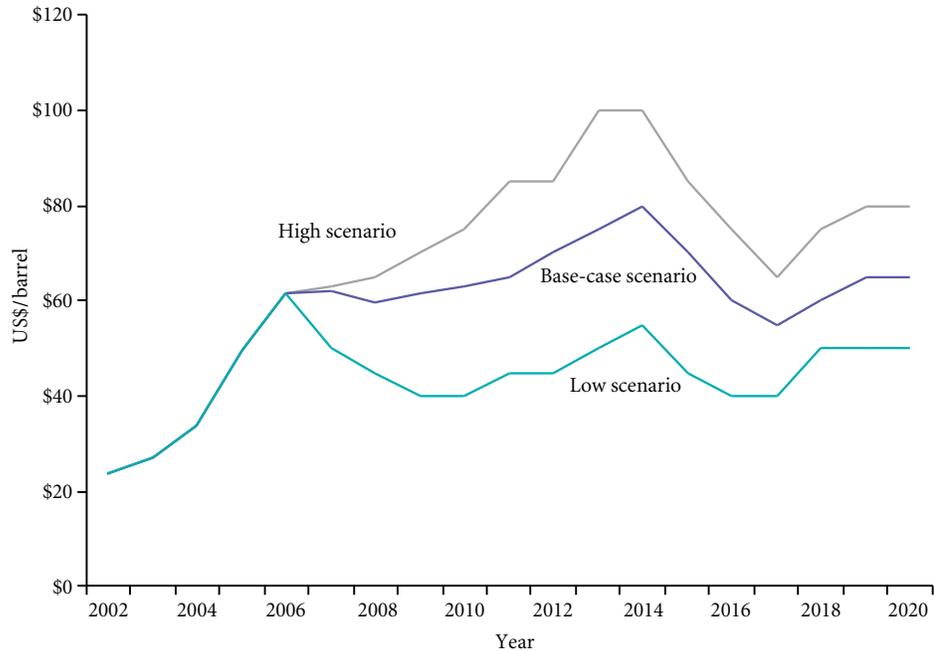
Our base-case projection is that the price of Dubai crude will go down slightly in 2007, return to its current level some time in 2008, and rise steadily after that. The trend toward higher oil prices is based on fundamentals of supply and demand and must be considered long term. Toward the end of the current decade, prices are likely to be higher, not lower, under our scenario.

### *The global market for natural gas*

World consumption of natural gas is growing even more quickly than consumption of oil. Between 2000 and 2025, global natural-gas consumption is projected to increase by 72 percent, significantly faster than growth in consumption of any other energy source.

As of early 2005, natural-gas prices were at an all-time high, led by the market

Figure F.2. Actual and projected prices of Dubai crude oil using low, base-case, and high forecast scenarios, 2002–2020 (U.S. dollars per barrel)



Source: FACTS Global Energy (2006).

Note: Data for 2002–2006 are actual; data for 2007–2015 are forecasts based on 2007 U.S. dollars.

in the United States. After decades of prices staying in the range of US\$2 per million British thermal units (mm Btu), natural-gas prices in the United States reached US\$7–8/mm Btu in late 2004, a nearly fourfold increase. By late summer 2005, prices were in the range of US\$10/mm Btu. Comparing annual averages, the price of natural gas at Henry Hub (a natural-gas pipeline hub in Louisiana) went up from US\$1.9/mm Btu in 1995 to US\$4.2/mm Btu in 2000, US\$5.9/mm Btu in 2004, and US\$8.8/mm Btu in 2005—more than a fourfold increase in 10 years. While natural-gas prices have since come down somewhat, we believe that in the longer term prices will be in the range of US\$6–7 per mm Btu.

How does this compare with the cost of oil? Natural-gas prices of US\$7–8/mm Btu correspond to WTI prices of well over US\$45–50 per barrel. Thus the relationship has changed: Natural gas used to be much cheaper than oil, but in the future, the costs of these two energy sources will be closer. This will be true even though competition from coal tends to hold the cost of natural gas down. This change in the relative prices of oil and natural gas is comprehensive and supported by fundamentals in both the oil and gas markets.

There is a clear trend toward globalization of the market for natural gas, with prices shifting upward in line with global oil prices. Because the United States is the world’s largest consumer of natural gas, the global gas market will be dominated by futures prices in the United States. Indeed already, the wholesale price at Henry Hub serves as a benchmark spot price (as a floor) for liquefied natural gas (LNG) no matter where the gas originated or where it is sold.

## *The future of oil production*

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The global oil market today is driven more by supply than demand. Consumption is affected by economic conditions, prices (including taxes), and regulatory controls. But given current price levels and the current state of technology, we are simply reaching a limit on our capacity to produce oil, and this is the most important factor affecting the market.

Of course the issue is not quite so simple. In the world as a whole, proven reserves—the oil supplies that could be extracted, refined, and delivered to customers using current technology—are estimated at 1.2 trillion barrels (BP 2006). With the technical innovations in oil exploration and extraction already envisaged, total reserves may increase, but we are approaching the technical limits, which are defined by natural declines in oil production and smaller discoveries of new sources. Global oil production, which now stands at about 85 million b/d, might increase to 100 or perhaps even 105 million b/d, but it cannot go up indefinitely.

The problem is that three-quarters of the world's proven oil reserves are owned by members of the Organization of the Petroleum Exporting Countries (OPEC). And the OPEC countries are not willing—or able—to change their policies to encourage higher production to keep up with global demand. OPEC members are Algeria, Angola, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates (Abu Dhabi and Dubai), and Venezuela. Among these, only Saudi Arabia has excess production capacity today, and this excess capacity is limited.

In fact, OPEC oil producers experienced a natural decline in production of 1.2 million b/d in 2005, and this natural decline is projected to deepen in the near future. This means that OPEC producers must increase production capacity by 6 million b/d over the next five years just to keep production at current levels. For key OPEC nations, the problem with increasing—or even maintaining—production levels is not a resource constraint, but rather a policy constraint.

Constraints in OPEC countries shift the emphasis to the one-quarter of global oil reserves owned by non-OPEC members. The main non-OPEC oil producers are the United States, China, the United Kingdom, Mexico, Russia, and countries in Central Asia. Over the past 10 years, oil production from non-OPEC countries has grown at an annual rate of more than 1.5 million b/d. This growth rate is projected to slow down, however. Over the next five years, annual increases in oil production from non-OPEC countries are likely to decrease to half the previous rate, and production is likely to peak in the early part of the next decade. While production in Russia and Central Asia will rise, this will be offset by declines in the North Sea and other regions. This means that rapidly growing oil consumption in the Asia-Pacific region and elsewhere in the world will have to be supplied by OPEC.



*Natural-gas production platform in the Gulf of Thailand. Expanding the use of natural gas offers one option for reducing dependence on imported oil. © Hanan Isachar/Corbis*

Apart from questions of politics and legal restrictions, the amount of oil actually available from OPEC member countries, particularly the major ones in the Middle East—Saudi Arabia, Iran, Iraq, Kuwait, and the United Arab Emirates—is frequently debated. Some observers claim that reserves in the Middle East are overstated and there will be a collapse in production, leading to a drop of oil production globally. Others argue that oil supplies in the Middle East and other parts of the world will grow indefinitely. The truth lies somewhere between these two extremes.

Estimates of Middle-Eastern oil reserves are not certified, and some are very likely overstated. There will be no collapse in production, however, and with application of new technologies, it should be possible to recover, refine, and market most of the oil claimed to be in the region's reserves. But we cannot expect production to continue increasing as it has in the past. Somewhere between about 2015 and 2020, global oil production may reach its peak, limited either by the resources available or the policies of oil-producing nations.

### *The American oil and gas markets*

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The United States is by far the largest consumer of oil and natural gas in the world. All of Europe combined uses less oil and gas than the United States. China—with a population four times larger—uses less than one-third of the oil consumed in the United States. Japan, the largest importer and consumer of LNG in the world, uses only one-seventh as much natural gas as the United States.

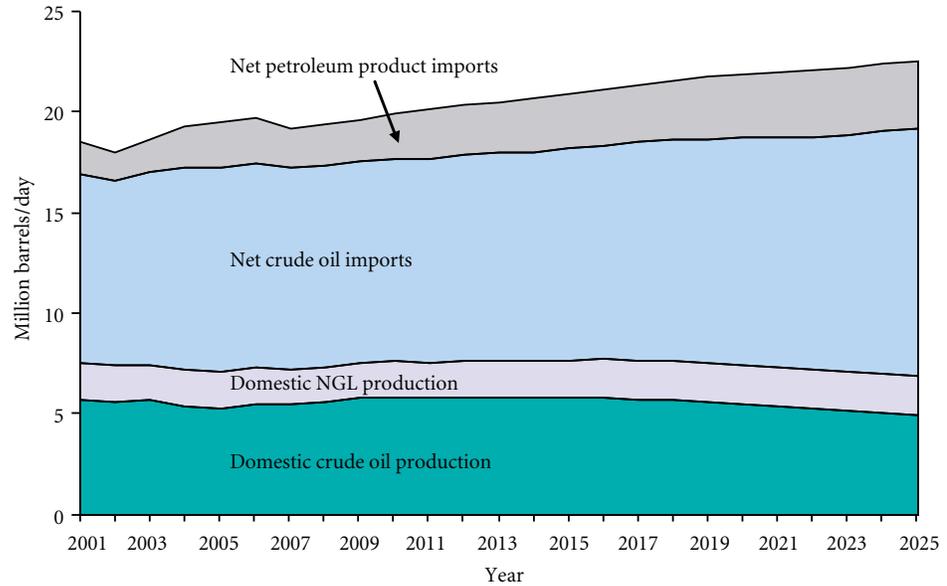
In addition to being the largest oil consumer, the United States (along with China) has accounted for most of the global growth in oil consumption in recent years. And while consumption has been growing, domestic production in the United States has been shrinking, resulting, inevitably, in an increasing dependence on imported oil (EIA 2006) (Figure F.3).

This trend will continue. In 2005, the United States consumed an estimated 20 million b/d of oil but produced only 8 million b/d, leaving a shortfall of 12 million b/d to be filled by imports of crude oil and petroleum products. By 2025, the projections are for 27 million b/d of consumption, compared with only 7 million b/d of production, leaving a shortfall of 20 million b/d.

The United States is also reaching the limit of its refining capacity. Although some existing refineries are being expanded, stringent environmental regulations impede the construction of new refineries. This means that imports of refined petroleum products are increasing more quickly than imports of crude oil. In 2005, an estimated 15 percent of all U.S. oil imports were in the form of refined petroleum products. In 2025, refined products will account for an estimated 20 percent of oil imports.

The same high environmental standards also impose tight quality restrictions on the choice of petroleum products that may be imported. Given these constraints, the American market is finely balanced. Any problem—such as

Figure F.3. Projected trend in production and imports of crude oil and petroleum products in the United States, 2001–2025 (million barrels per day)



Source: EIA (2006).

Note: NGL is natural-gas liquid, a byproduct of natural-gas production that can be refined into petroleum products. Data for 2001–2005 are actual, data for 2006 are preliminary, and data for 2007–2015 are forecasts.

an accident in a key refinery or a hurricane—can lead to significant supply uncertainty and large price spikes.

### *Predicting the future*

Much of future oil consumption will be closely linked to economic growth, which is notoriously difficult to predict. It is reasonable to project, however, that global demand for oil will grow in the range of 1 to 2 million b/d each year. Will there be enough oil production around the world to supply this demand? The answer is “no.”

Today, OPEC countries are experiencing an annual natural decline in oil production capacity of about 1.2 million b/d. In the future, small increases are plausible, but a big capacity increase outside of Iraq is unlikely. Production in non-OPEC countries will peak in the next few years and then start to decline. Thus, at some time in the next decade, global oil production will reach a plateau, and today’s rapid consumption growth will become unsustainable.

The key agencies responsible for long-term forecasting of oil production and consumption are the Organization for Economic Cooperation and Development’s International Energy Agency (OECD/IEA), which represents 26 industrialized nations, and the Energy Information Administration (EIA) of the United States Department of Energy. The OECD/IEA (2005) predicts very large growth in oil consumption, while the EIA has recently revised its long-term forecast substantially downward. According to the EIA’s most recent forecast (EIA 2006),

global oil consumption will rise from 84 million b/d in 2005 to 111 million b/d in 2025, which is 8 million b/d lower than the forecast made in 2005 (EIA 2005). The 2006 EIA forecast assumes that imported crude oil will cost \$48 per barrel by 2025, significantly higher than the \$35 per barrel assumed in 2005.

Both the OECD/IEA and the EIA forecast very large increases in oil production from OPEC members, but this does not mean that such production will actually be forthcoming. The forecasts show only that OPEC production must reach a certain level to balance the level of consumption that is projected.

The only alternative is for oil consumption to stop growing. This can happen as a result of higher prices, economic recession, taxation, or other regulatory mechanisms. It may also happen as a result of technological breakthroughs that allow switching to other energy sources.

The world has used oil for more than a century without paying serious attention to future availability. In many countries today, environmental regulations have complicated the production, refining, and transport of oil. In the United States, for example, some 100 different grades of gasoline and diesel fuel are required in specific localities. At the same time, investment in new production and refining capacity has been limited.

What does all this mean? In the absence of any other factors to reduce demand, high prices are inevitable. Higher prices will lead to lower demand, but prices may have to reach US\$100 per barrel before demand slows down. Lower demand may eventually nudge prices downward, but the price of oil is not likely to drop below US\$55–65 per barrel.

High prices for energy impose a strong brake on economic growth. For countries in Asia and the Pacific that expected to follow the pattern of energy-intensive growth seen in the West, the challenge ahead is daunting. They need energy, they need low prices, but they have arrived at the development gate at an inauspicious time. They will need to devise new strategies for economic growth based on more efficient use of oil and natural gas, continuing or even increasing dependence on domestic supplies of coal, and ultimately turning, at least in part, to alternative sources of energy.