

## Oil Supply and Demand

By Olivier Rech\*

*The year 2004 saw a change in the oil market paradigm that was confirmed in 2005. Despite a calmer geopolitical context, prices continued to rise vigorously. Driven by world demand, they remain high as a result of the saturation of production and refining capacity. The market is still seeking its new equilibrium.*

Before reviewing the situation for 2005, let's take a brief look at the exceptional nature of the previous year, which justified thinking that a change in the oil market paradigm had occurred.

### 2004: The Paradigm Starts to Change

Although at one time overproduction had been forecast for the end of 2003, it did not materialize for several reasons. The failure by Iraq to make a comeback on the international oil scene coincided with economic factors that worked to sustain world consumption and with several judicious decisions by OPEC to adjust its quotas. Instead of slackening as expected, the market tightened starting early in 2004 until, in some ways, it recalled the decade of the 1970s. Surplus production capacity dropped sharply, affecting all of the players along the oil supply chain that have been delivering security of supply along with relative price stability for the last twenty years.

The world economy grew, stimulated by particularly low interest rates. As a result, oil consumption increased at a rate of nearly 2.6 Mb/day, more than twice the average for the last twenty years. All continents contributed to this acceleration in the wake of the Chinese market (up 0.86 Mb/day), where temporary demand for petroleum products as a replacement energy during electricity shortages amplified the structural effects of exponential economic growth. The American market consolidated its leading world position with an increase of 0.7 Mb/day, generated mostly by motor fuels, despite a level of per-capita consumption that is already especially high.

Facing this sharp upturn in the rate of demand, OPEC progressively mobilized virtually all of its capacity. According to estimates, the surplus capacity available in October 2004 fell below 1 Mb/day. The crude price then broke a symbolic record, exceeding the \$50 threshold for a few days. It became critical to rely on OPEC production due to the low short-term price elasticity of non-OPEC production, not yet benefitting from these favorable business conditions. With a contribution of 0.7 Mb/day (total: nearly 1.1 Mb/day), Russia continued to represent the bulk of the increase in non-OPEC production. The other non-OPEC producers registered limited growth of about 0.4 Mb/day, in sharp contrast to the requirements and vitality of the world market.

The price hike — over which OPEC had entirely lost control due to the lack of available capacity — was aggra-

vated by a similar situation in the refining industry, where utilization rates were reaching historic highs all over the world. The pressure exerted on capacity was also aggravated by the fact that the quality of the last barrels of crude to be put on the market did not match the needs of refiners. Very high sulfur heavy crudes were offered by OPEC as a last resort, but they did not provide a satisfactory short-term response to demand for very low sulfur motor fuels.

Figure 1  
Crude Price Variations in 2004 and 2005 (\$/b)



Source: PLATTS.

As demand pursued its frenetic upward course, stocks continued to deteriorate despite the mobilization of all production and refining capacity. In 2004, OECD stocks coverage of petroleum and refinery product consumption was at its lowest since full market deregulation in 1986. Due to the combined effects of low stocks and saturated production capacity, the (Brent) crude price rose \$30 early in the year to reach over \$50 during the last quarter.

### 2005: A Market in Search of Equilibrium

Although the symbolic price threshold of \$40 then \$50 were exceeded, the current situation does not have many points in common with the 1970s. The first and second oil shocks involved a sudden cut-off of the oil supply in a time of geopolitical turmoil and uncertainty. Prices are rising today because of industrial bottlenecks emerging for reasons related to demand and investment.

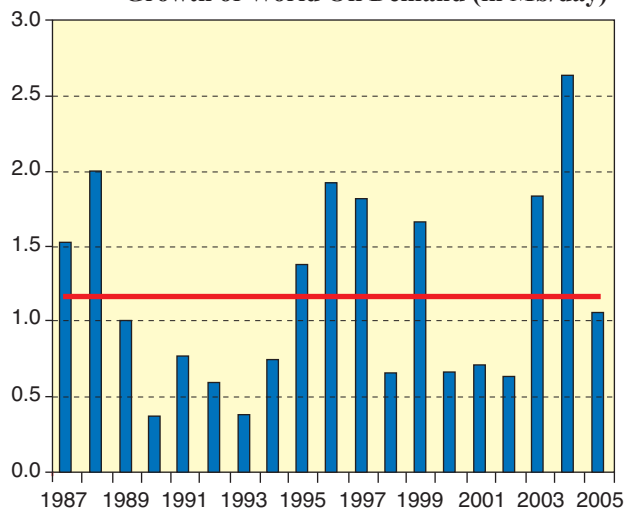
### World Oil Demand is Resilient

World demand was revised upwards significantly several times in 2004, but a series of estimates made for 2005 indicated some slackening. World market growth, initially projected to be 1.8 Mb/day, will apparently not exceed 1.2 Mb/day. Slowing considerably compared to 2004, an exceptional year, the growth rate is expected to return to the same level as the average for the last two decades. Non-OECD countries, which account for 40% of world consumption, are

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responsible for 75% of its growth (about 0.9 Mb/day). For the OECD zone, growth was more modest (0.3 Mb/day) and located mostly in North America.

**Figure 2**  
**Growth of World Oil Demand (in Mb/day)**



Source: IEA.

In 2005, there were no particular events to generate major negative impacts on the market. This helped world oil demand return to normal, a trend consistent with the macro-economic situation. In all likelihood, world economic growth should top 4%. Emerging countries are expected to grow by over 6% versus 2.5% for all of the industrial countries. Despite great disparities, especially among the so-called emerging countries, overall economic performance provides a satisfactory explanation for the trend in oil demand.

In a context of high international prices, the world oil market continued to grow steadily. This leads one to question whether demand is capable of responding to price signals. To put it schematically, the representative level of motor fuel taxation in OECD countries helped cushion the impact when the crude barrel price doubled (from \$30 to \$60); the price at the pump went up about 25 to 30%. The situation of consumers in emerging countries is less uniform; domestic price regimes vary considerably, depending on whether the country is a net exporter or importer. According to estimates, 25 to 30% of non-OECD oil consumption is covered by policies that subsidize the price paid by end users. In absolute terms, therefore, these prices are lower than international market prices. Furthermore, on a market like this, there is no parallel between retail price fluctuations and prices.

In fact, the resilience of world oil demand to high crude prices can be attributed to the fact that there are no replacement products available in the short term to replace petroleum products, especially in the transport sector. Another reason is that international price variations are not transmitted properly to domestic markets due to heavy, unproportional taxation in the more developed countries and to different degrees of subsidization in

many emerging countries, including some producing countries. Motor fuel demand is responsible for nearly all growth in oil demand. We will come back to this later.

#### **Non-OPEC Production: Striking Contrasts**

For the first time, non-OPEC production is expected to average over 50 Mb/day. Yet performance remains low, with an increase of no more than 0.2 Mb/day. Only two years in the last decade (1998 and 1999) posted lower growth figures, but the economic situation at that time was completely different, with the price per barrel below \$20. It's true that heavy infrastructure damage by hurricanes Rita and Katrina in the Gulf of Mexico played a part in reducing overall production volume by about 0.25 Mb/day (annual average). Nevertheless, this does not change the basic diagnosis: the rate at which non-OPEC production is growing has slowed substantially.

Since 2001, the bulk of production growth has occurred in the countries of the Former Soviet Union (FSU). 2005 is no exception: production is about to set a new record at over 11.60 Mb/day, or an increase of nearly 0.4 Mb/day, with Russia accounting for about 60%. In countries outside OPEC and the FSU, production was down by about 0.2 Mb/day. Even if the south of the United States had not been hit by a series of exceptionally violent hurricanes, the countries outside OPEC and the FSU would not have shown growth of more than 0.05 Mb/day, at best.

This stagnation arises from a situation presenting striking contrasts and distinct trends. First of all, this slowdown seems to confirm the decline of the North Sea, often announced only to be contradicted. For the third straight year, production has dropped by almost 0.3 Mb/day. The cumulative decrease since 2002 has already reached nearly 1 Mb/day, for current production of about 5.7 Mb/day. The United Kingdom is the country most affected by this trend. Norwegian production has condensate fields to compensate for the decline in oil production. Secondly, significant uptrends were observed in Latin America and Africa, driven by two leading offshore producers: Brazil (+0.2 Mb/day) and Angola (+0.26 Mb/day). Finally, a number of announcements were made in 2005 concerning projects to recover oil from the tar sands of Canada, but there has been no effect on production thus far.

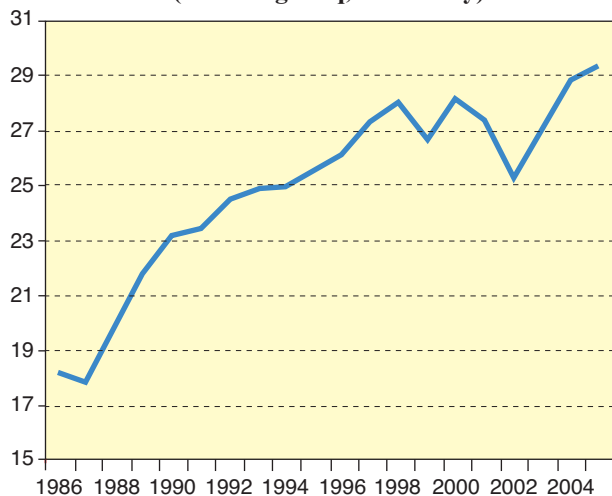
As regards the market equilibrium, 2005 brought confirmation of the situation that appeared in 2004. Although impressive offshore successes are compensating for the decline of mature regions, net growth is no longer sufficient to cover the increase in world demand, even at the moderate average rate noted for the last two decades and the past year.

#### **OPEC**

In the face of steep, rapid growth in market demand and the low short-term response capability of non-OPEC producers, OPEC was obliged to make several important decisions during the second half of 2004. It raised quotas by 3.5 Mb/day to 27 Mb/day at the beginning of 2005. The price per barrel stayed above \$50, prompting the organization to fix the official production ceiling at its highest level ever: 28 Mb/day. OPEC did this in two steps. The first increase took place on March 15 at its 135th meeting in

Ispahan, and the second on June 15 at the 136th meeting in Vienna. OPEC's obvious determination to keep the market equilibrium and price trend under control rapidly came up against the ultimate barrier of production capacity, which relegated quota issues to the sidelines. Official production (excluding Iraq) came to 27.45 Mb/day. In recent months, OPEC members showed a level of quota compliance that, in the not-so-distant-past, would have constituted an impressive show of discipline, since the organization does not always present a united front. The fact that there was 100% compliance during the first ten months of year is misleading and gives cause for concern in two respects.

**Figure 3**  
**Total OPEC Production**  
**(including Iraq, in Mb/day)**



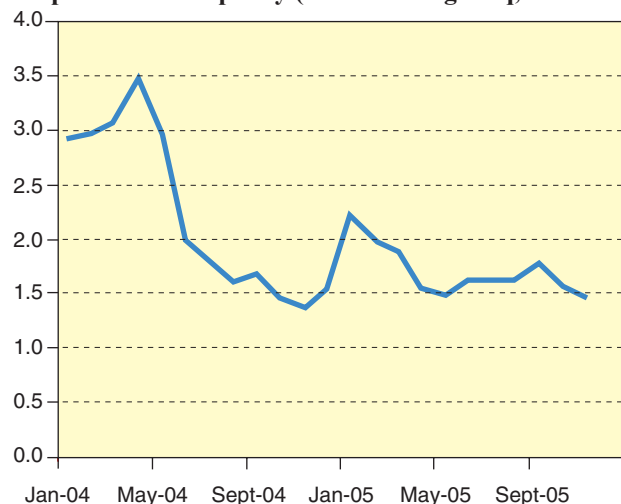
Source: IEA.

First of all, not all OPEC members could contribute to the production increase. Specifically, Venezuela, Indonesia and Iran could not implement OPEC policy or fully honor their assigned quota despite a very favorable business environment. Venezuelan production fell by an average of 0.07 Mb/day over 2004, apparently a consequence of the internal dispute at PDVSA at the end of 2002. The decrease in Indonesian output was on the same order of magnitude (0.02 Mb/day) but, although production did slow to some extent, it is following a decline curve that started about ten years ago. Iranian production merely stagnated, which limits the potential for crude exports, already under pressure from fast-growing domestic demand. Iraq, although still excluded from quota allocations, could not maintain the same level of production as in 2004 (1.86 Mb/day); output dropped by about 0.15 Mb/day. The second problem is that since the 1970s and until recently, OPEC production capacity (including Saudi capacity) had never been completely saturated, except under exceptional circumstances in 1990 and 1991 during the Gulf War. Suddenly, in the last fifteen months, it has found itself at full saturation. It is thought that surplus production capacity held by OPEC members, excluding Iraq, fell under 2 Mb/day at mid-year 2004 and stayed below this figure throughout 2005.

Under these conditions, there was no way that price-

moderating signals emitted by OPEC could have the intended effect. At its 137th meeting on September 20, after heavy infrastructure damage had occurred in the Gulf of Mexico, the organization decided to pool residual production capacity, officially estimated to be 2 Mb/day, and make it available to the market for the last quarter of 2005. By doing so, it lent credence to market analysis whereby the tension is lasting and structural, justifying emergency measures. The relative slackening of prices in October (they fell by about \$8) can be attributed much more to the fact that a part of the strategic reserves held by the members of the International Energy Agency was immediately mobilized and to the strong decrease — or what looked like a strong decrease — in domestic oil demand in the United States, than to the measures taken by OPEC on the supply side.

**Figure 4**  
**Surplus OPEC Capacity (not Including Iraq, in Mb/day)**



Source: IEA.

#### Refining Capacity Still Saturated

The virtual disappearance of OPEC's surplus crude production capacity is not the only reason for the strong price increases that have occurred since early 2004. After two difficult decades and painful rationalization, the world refining industry is also seeing saturated capacity in the face of vigorous demand. In 2005, tensions not only failed to ease but became more acute. The estimated utilization rate is approaching 95% for distillation capacity and 100% for cracking and conversion capacity for the Atlantic Basin and Asia. Units are operating at close to their maximum load.

Tensions between refinery product supply and demand peaked after hurricanes Katrina and Rita swept the Gulf of Mexico in late August and late September. In the following days, lost refining capacity, mostly in Louisiana and Texas, totaled 4 Mb/day due to property damage and the interruption of the electric power supply. The situation gradually returned to normal: impaired capacity, which totaled 1.6 Mb/day in

mid-October, will apparently remain in the neighborhood of 0.8 Mb/day until the beginning of 2006. This number is equivalent to 5% of total U.S. refining capacity.

The aggravation of tensions is illustrated by variations in OECD stocks, measured in the number of days of consumption covered. Although this indicator showed a slight improvement over 2003 and 2004, it hit a level (52 days, on average) that ranks among the lowest in the last 15 years. But the high level of prices cannot be explained by low stocks alone. First and foremost, these prices integrate present and future problems related to the evolution of production capacity.

### The Outlook

It seems certain that price escalation, which began in 2003, was confirmed in 2004 and intensified in 2005, is not just a passing phenomenon but represents a break with the past, marking a shift in the market equilibrium. Forward barrel price quotes for deliveries in a few years' time have exceeded \$50. This shows that, in the short run, spring forces cannot act as effectively as, up until recently, it was commonly thought they could.

**Figure 5**

**Forward Price Quotations for WTI Crude Deliveries in 2010-2011 (NYMEX, \$/b)**



Source: NYMEX.

### Structural Adjustments in the Face of Price Hikes

In the first place, the strength of oil demand reflects world economic growth (between 3 and 4%), reinforced by integrating major players like China and India in international trade. But the effect of the rise in per-capita income is amplified by the development of mobility requirements. A given income (expressed in constant money terms) will generate oil consumption in transport that has been estimated to be 50% higher than in the early 1970s. The need for mobility, for passengers and freight alike, is growing independently of the rise in income. Emerging countries outside the OECD, which already generate three-quarters of growth on the world oil market, account for most of the mobility requirements that will

have to be satisfied in the future. Even if petroleum-based fuels have lost market share for stationary uses in industry and the residential/service sectors, demand for motor fuels should keep the oil market growing at least at the same pace as in the last two decades, i.e., 1 to 1.5 Mb/day (annual average).

International prices have been high for two years, but oil demand has not shown any significant reaction. There are several reasons for this: the lack of energy and technological replacement solutions in the short term and the exposure of most of the world population to a mode of development based on mobility, not to mention price and energy policies that are dictated by considerations other than economic or environmental considerations and which subsidize the price paid by the end user. With respect to the latter point, 2005 may mark a turning point and give rise to structural adjustments with a number of consequences. The cost of subsidization systems in some of the largest oil-consuming countries outside the OECD (e.g., India, Indonesia, Thailand and Egypt) has been multiplied by a factor of between two to five, depending on the instance. Countries that have retained this type of system must now choose between overloading the public budget or implementing a policy based on real prices whose postponement only makes it more painful for the population and more fraught with risk for the government when it is eventually implemented. In point of fact, in recent months, most net importing countries seem to be opting for the second alternative, implementing this type of policy at a rate that they deem feasible. This has led to some very large price increases, especially for motor fuels, sometimes of more than 50% compared to 2004. Some increases have already had a fast, visible impact in bringing down domestic consumption (e.g., in Thailand). The Chinese market is a special case that is more complex. For the least prosperous and largest component of the population, the regulation of retail prices — which are imposed on the local refining industry in China like in India — offers real protection, which is what subsidization programs are supposed to do. But vigorous development in the most dynamic provinces is generating industrial requirements and purchasing power such that price ceilings inhibit consumption; there are fewer deliveries on the domestic market, because they are not profitable. It is expected that the next price increases will accelerate the growth of Chinese oil demand.

The structural adjustments made by emerging net importing countries, which are irreversible, could modify the rate of growth in demand. This would confirm one conclusion of empirical studies that oil price-demand elasticity, low in the short term, is much greater over the long term. Net exporting countries, with the notable exception of the United Arab Emirates and Nigeria, have maintained a policy of low, stable prices that shield consumers from international market variations. One consequence is that domestic demand rises in the short term at an artificial rate, to the detriment of export volumes. Furthermore, looking at a longer time frame, the cost of subsidies jeopardizes the financing needed to invest in production capacity.

### Contributions to the Development of Production Capacity

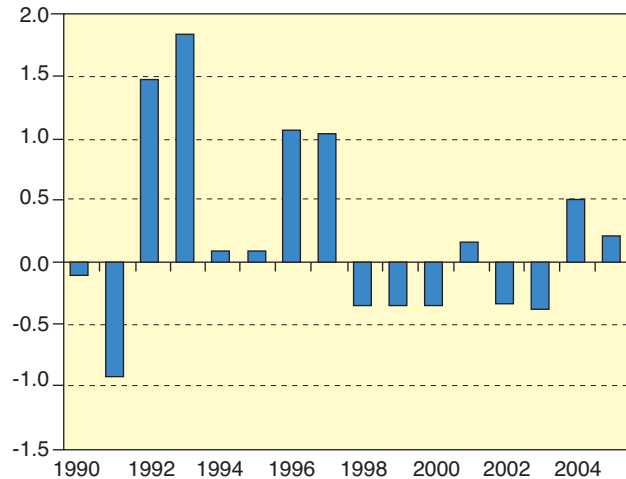
By 2008, new production capacity or major extensions will come onstream in the West African offshore sector (Angola, Nigeria and the Congo) and the Caspian Sea (Kazakhstan). These are substantial contributions: 500 kb/day for Kizomba B and C, 295 kb/day for Dalia, Rosa and Lirio, 800 kb/day for Azeri-Chirag-Gunashli, 450 kb/day for Tengiz and 370 kb/day for Kashagan. However, these large-scale developments, scheduled to come onstream in the near future, do not change the diagnosis: non-OPEC production has slowed considerably, which is why the tie between the barrel price, E&P investments and how they translate into terms of production growth, is weaker than it used to be. That Canada's tar sands have bright prospects has been confirmed, but the advantage of the abundance of the resources in place is offset by constraints that must be taken into account: the cost of the gas supply, the burden on water resources and the low availability of qualified labor. Finally, refinery products (diesel fuel for the most part) from gas-to-liquids facilities in Qatar and Nigeria should reach the market by 2009 (200 kb/day). The use of non-conventional resources is increasing but more slowly than world demand.

This being so, the only solution is for OPEC countries to boost production capacity. Projects currently under development are expected to translate into net growth of crude production capacity on the order of 2.5 Mb/day within the next three years. However, this estimate needs to be confirmed, because it contrasts sharply with the small scale of capacity variations in recent years, outside Saudi Arabia and Iraq. The steady rise in condensate production, which is not included in the quota system, is still making a non-negligible annual contribution of about 0.3 to 0.4 Mb/day. Beyond its announcements and intentions, OPEC is facing some very tough questions: What policy should it implement and what should the target price be? At its 135th meeting on March 15 in Ispahan, the organization suspended the target price range of \$22-28 that it had established in March 2000, which offers an initial indication. Now that the reference price range has become obsolete, the low price-demand elasticity on the world oil market and the non-OPEC supply situation militate, for the time being, in favor of a much higher target price that should be defended, if need be. In the longer term, the development of production capacity in the upstream sector, in conventional refining and in heavy crude prerefining projects cannot be disassociated from the financing capacity of the State-owned companies. Since 2003, producing states have seen an unprecedented improvement in their macroeconomic situation, owing to crude price hikes and record production figures. This should shed new light on the recurring question regarding the necessity of opening up oil and gas acreage to international investors.

Considering the persistence of great tensions between production capacity and demand, growing uncertainty on many fronts, and the fact that short- and long-term issues are inextricably linked, we conclude that the oil market is and will remain extremely vulnerable. The recent mobilization of strategic reserves to cope with upset conditions on the market

of a major importing country, the United States, and not an exporting country, is symptomatic. Major consuming countries, developed and emerging alike, must make their contribution to the search for sustainable balance on the oil market.

**Figure 6**  
**Variations in OPEC Capacity Outside Saudi Arabia and Iraq (in Mb/day)**



Source: IEA - IFP.

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### 9th IAEE/USAAE Session at the Allied Social Science Association Meeting Chicago, IL, USA – January 7 - 9, 2007

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The theme for the session will be:

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If you are interested in presenting please send an abstract of 200-400 words to Carol Dahl at (cdahl@mines.edu) by May 15, 2006. At least one member of each paper must be a member of the IAEE for the paper to be included in our session. The session along with discussion remarks will be published in the Papers and Proceedings of the next North American Meeting of the USAAE/IAEE. Preliminary decisions on papers presented and discussants will be made by July 1. The program including abstracts will be posted at [iaee@iaee.org](http://iaee@iaee.org) by September 1, 2006. Please send abstracts in electronic format that is easily converted into program information. Suggestions or volunteers for paper discussants are most welcome.

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