

Refining and Petrochemicals

The year 2005 saw a new improvement in refining margins that continued during the first three quarters of 2006. The restoration of margins in the last three years has allowed the refining sector to regain its profitability. In this context, the oil companies reported earnings for fiscal year 2005 that were up significantly compared to 2004, and the figures for the first half-year 2006 confirm this trend. Despite this favorable business environment, investments only saw a minimal increase in 2005 and the improvement expected for 2006 should remain fairly limited. Looking to 2010-2015, it would appear that the planned investment projects with the highest probability of reaching completion will be barely adequate to cover the increase in demand. Refining sector should continue to find itself under pressure. As for petrochemicals, despite a steady uptrend in the naphtha price, the restoration of margins consolidated a comeback that started in 2005. All in all, capital expenditure remained fairly low in both the refining and petrochemicals sectors, but many projects are planned for the next ten years

Business environment

The fast-growth cycle that started in 2002 was still underway in 2005. Although **economic growth** slowed in 2005, it remained vigorous (+4.8% of GDP). However, it continued to be unequally distributed, being primarily located in the United States, more than any other industrialized country, and in emerging countries and especially China (Table 1).

Table 1
Growth in the volume of GDP (variations as %)

	2003	2004	2005	2006 (f)	2007 (e)
World	4.1	5.3	4.8	4.9	4.7
United States	2.0	3.3	2.7	3.0	2.8
European Union	1.3	2.5	1.8	2.4	2.3
China	10.0	10.1	9.9	9.5	9.0

Source: IMF; (f): forecast; (e): estimated.

The IMF has just revised its 2006 growth forecasts upwards from 4.9% (April) to 5.1% (September). 2007 should bring a slight slowdown reducing world growth to 4.9%. China is expected to keep growing at a rate of about 10% in 2006 and 2007, whereas the IMF predicts a slowdown for the U.S. economy starting in 2007.

Oil market trends

Overall trends are influenced by the **price per barrel**, which has been on an upswing since 2003. During the first eight

months of 2006, the Brent price averaged over \$67 bbl, then peaked at \$78 bbl in August and fell sharply, dropping under the \$60 threshold.

World oil demand increased substantially in 2004, then slowed in 2005 (+1.1 Mb/d year on year) to a rate comparable to pre-2003 trends (Table 2). All world regions experienced this slowdown except the Middle East, which maintained a high rate of increase. The United States and Asia, especially China, which accounts for over 44% of world oil demand, also reported low growth.

This trend should be confirmed in 2006: demand is expected to increase by 1.2 Mb/d to 84.8 mb/d. Growth should maintain the same pace in 2007, with additional demand of 1.4 mb/d bringing total demand to 86.2 Mb/d. The IEA recently lowered its forecasts for 2007 (-200,000 b/d).

The parallel uptrend in oil production did not restore available residual capacity to its pre-2002 level.

Table 2
Petroleum products: World demand, supply and stock variations (in Mb/d)

	2003	2004	2005	2006 (f)	2007 (f)
World demand	79.2	82.5	83.6	84.8	86.2
Variation [n - (n-1)]	+1.5	+3.3	+1.1	+1.2	+1.4
World supply	79.7	83.2	84.5	85.5*	-
Variation [n - (n-1)]	+2.8	+3.5	+1.3	+1.0	-
Stock variations	+0.5	+0.7	+0.9	-	-

Source: Oil Market Report (IEA); (f): forecast. *Average for the first two quarters.

Refining and Petrochemicals

The current slackening of world demand cannot last indefinitely. The slowdown in world demand and OPEC's policy of sustained production have helped major consuming countries replenish their **stocks**. The comfortable level of crude stocks enabled the market to deal with several serious disturbances, such as the loss of production in Nigeria and the interruption of flows from Alaska due to problems affecting the pipeline network serving the field at Prudhoe Bay. However, the oil market remains exposed to a rapid drop in stock levels, given that surplus capacity is so low.

More specifically, world **refining** is late in adjusting to increasing demand for light products produced from increasingly heavy crudes. This **mismatch between refining plant and demand** puts pressure on product prices.

Refining

Overall trends

The refining sector is currently reporting good economic performance levels. Refining margins are still high because oil demand remains strong despite the elevated petroleum product prices.

Although the business conditions are conducive to renewing investments in this sector, especially in new capacity, the bulk of expenditure is being allocated to the expansion of existing refineries or the improvement of their performance (quality and conversion). World refining capacity, still growing at a moderate rate of 0.8%, reached 85.7 mb/d in 2005 with utilization rates rising further. Under these conditions, the market remains exposed to the risk of occasional severe supply shortages, especially in the event of an unplanned drop in available capacity.

This being said, **2006 saw a sharp increase in projects to invest in new refineries or expand existing ones**, which promises to relieve the tension between supply and demand somewhat, but not before three or four years.

Refining capacity

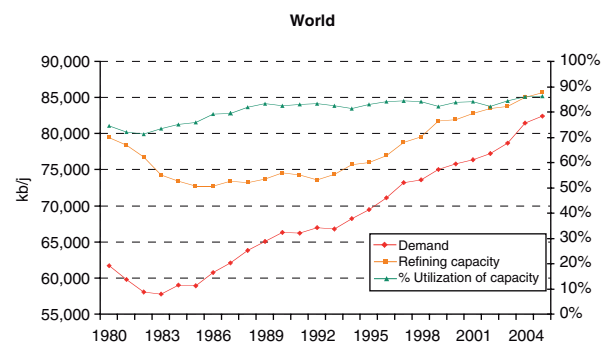
In 2005, refining capacity stood at 85.7 mb/d with additional capacity of 0.7 mb/d, down from 1.2 Mb/d in 2004. The world refinery utilization rate, after rising for three years straight, remained at a record high (+0.4%), standing at 86.3% in 2005 (Figure 1).

For about twenty years, the United States has seen a **large deficit** in refining capacity, with demand rising faster than the installation of new capacity. In 2005, this deficit amounted to 3.3 Mb/d, down slightly from the 2004 record of 3.5 Mb/d. In the United States, the refinery utilization rate declined from 91% in 2004 to only 87.7% in 2005. This can be attributed to

planned maintenance shutdowns and especially to the impact of the hurricanes on refining plant in the Gulf of Mexico area. These events in the United States had an adverse effect on the average world utilization rate.

At the same time, Europe found itself with a **precarious balance** characterized by refining capacity that has been virtually stable for about ten years and a slow growth rate.

Fig. 1 Oil demand and refining capacity worldwide



Source: IFP based on data from BP Statistical Review of World Energy 2006.

In the last few years, refining capacities have increased in the United States and Europe, as a consequence of policies to modernize existing equipment and install units to produce higher grade products.

Capacity at refineries for producing light products from relatively heavy crudes is reaching saturation. This results in a gasoline deficit in the U.S. that is offset by a gasoline surplus in Europe, which nevertheless is still running a deficit of middle distillates. The fact that refinery plant cannot cover demand is due to many years of low investment in new capacity.

In the **Asia-Pacific region**, demand has progressed for about fifteen years, accompanied by an increase in refining capacity. Today, the latter is insufficient to cover a rising deficit that reached 1.3 Mb/d in 2005, down from the previous year.

Given the tensions between refining capacity and demand, and despite forecasts of a relative slowdown in demand, the refinery utilization rate will stay high in 2006, but will probably dip slightly compared to 2005. For the first few months of 2006, regional utilization rates were as follows: 88.4% (Europe of Fifteen), 93.6% (Asia/Pacific) and 87.7% (the U.S.).

Price trends for crude and petroleum products

In 2004, the price of dated Brent in London and of WTI (1st month) in New York averaged USD 54.38 and 56.44 per barrel, respectively. Prices escalated steadily in 2005 from USD 47.50/bbl (first quarter) to 56.90/bbl (fourth quarter) for

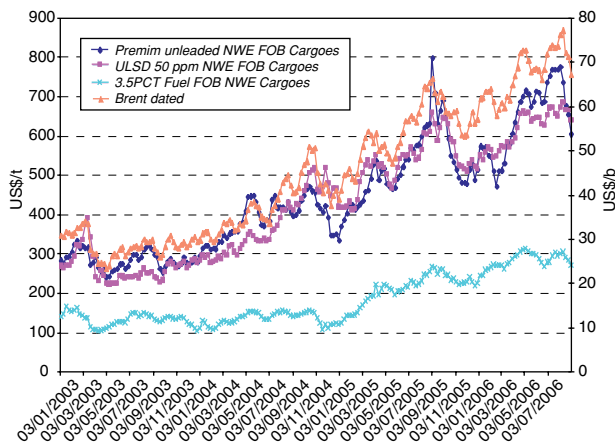
Refining and Petrochemicals

the Brent, and from USD 49.70 to 60.00 per barrel for the WTI (Figure 2).

This trend persisted in 2006. The Brent price climbed from USD 61.56/bbl (first quarter) to 73.38/bbl (third quarter), while the WTI rose from USD 63.07/bbl (first quarter) to 73.69/bbl (third quarter).

Between 2004 and 2006, the North West zone saw the price of gasoline and diesel follow the uptrend in crude. The price spread between the Brent and petroleum products progressively widened. Conversely, the price of fuel oil diverged significantly from those of the Brent and light products.

Fig. 2 Quotes for Brent (USD/bbl) and petroleum products (USD/t): Premium Unleaded NWE Cargoes, ULSD 50 ppm NWE Cargoes and FO 3.5 NWE Cargoes



Source: Platt's.

Trends in refining margins

2005 confirmed the restoration of margins. The first three quarters of 2006 saw very high margins in various parts of the world, continuing the uptrend noted in recent years.

Margins were kept high by certain factors, including strong demand for gasoline in emerging countries, limited refining capacity and the impact of Hurricanes Rita and Katrina on crude processing capacity in the United States. The resulting imbalance between gasoline supply and demand translated into higher prices and margins.

After the effect of the hurricanes, the margins, expressed in monthly averages (Figure 3), dropped substantially between November 2005 and February 2006: the Brent NWE, LLS US Gulf and Dubai Singapore decreased by USD 2.46/bbl, USD 0.68/bbl and USD 1.03/bbl, respectively. Market tensions related to the production capacity of U.S. refineries eased in November, the main reasons being a higher refinery utilization rate and improved efficiencies. Price pressure lessened, stocks were replenished and margins fell.

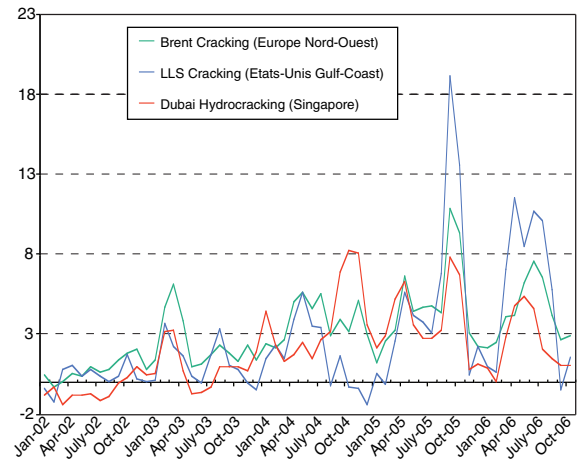
Table 3 Complex refining margins (Annual average in USD/bbl)

	1998	1999	2000	2001	2002	2003	2004	2005	2006 (p)**
Brent-Cracking (NW Europe)	1.58	0.70	3.37	2.05	0.75	2.34	3.77	4.98	4.26
LLS* Cracking (Gulf Coast, U.S.)	0.50	-0.32	1.29	1.36	0.31	1.12	1.69	5.37	5.59
Dubai-Hydrocracking (Singapore)	0.14	-0.66	0.89	-0.20	-0.56	0.82	3.74	3.96	2.38

* Louisiana Light Sweet. - ** Averages for the first 10 months of the year.

Source: Oil Market Report (IEA).

Fig. 3 Variations in complex refining margins (in USD/bbl)



Source: Oil Market Report (IEA).

After first quarter 2006, the margins returned to significantly higher levels. For the first ten months of the year, they averaged USD 4.26/bbl (Brent), 5.59/bbl (LLS) and 2.38 bbl (Dubai).

Corporate earnings and mergers/acquisitions

In 2005, with refining margins at high levels, key oil majors reported earnings for their refining-distribution businesses that were up significantly year-on-year. The exceptions were BP and Chevron Texaco, whose bottom line was lower in 2005 than in 2004 (Table 4). BP was affected by accidents at the Texas City refinery and the costs of reorganization programs it had undertaken in 2005. Chevron had to bear losses in connection with the property damage caused by hurricanes in the second half of 2005.

For many U.S. and European majors, earnings for the first half of 2006 still looked good. On the other hand, Shell,

Refining and Petrochemicals

Repsol and especially ENI reported 2006 earnings that were down compared to the same period of 2005. In spite of encouraging financial results, oil companies are postponing investment decisions for several reasons: volatile margins, higher costs (equipment and engineering) and the uncertainties surrounding the outlook for the medium term.

The high price of oil and the improvement in refining margins means more available cash. This gives the industry significant margin for maneuver and greatly enhances the value of refining assets. This has resulted in a new wave of mergers and acquisitions, with many M&A transactions taking place in 2005.

Table 4
Net earnings reported by refining-distribution companies
(in millions of dollars)

	2005	2004	Variations
Total	4917	3237	x 1.5
BP	4405	5240	x 0.8
ENI	2313	1343	x 1.7
Repsol-YPF	3341	1972	x 1.7
Shell	7532	6592	x 1.1
Statoil	988	457	x 2.2
ChevronTexaco	2766	3250	x 0.8
ConocoPhillips	4173	2743	x 1.5
ExxonMobil	7992	5706	x 1.4

Source: Annual reports and BIP.

The most outstanding transactions took place in the United States, where the Number Three U.S. refining company, Valero Energy, made a takeover bid for Premcor was confirmed in September 2005. This transaction consolidated 19 refineries in the United States and the equivalent of 3.3 mb/d. The new entity became the Number One refiner in the United States in terms of crude processing capacity, exceeding that of ExxonMobil (which remains the Number One worldwide) and ConocoPhillips. Valero Energy then pursued its planned expansion by acquiring the Corpus Christi refinery (capacity: 100,000 b/d).

In Europe, several transactions took place on a smaller scale:

- Royal Dutch Shell PLC combined two refineries (DEA Mineraloel AG in Wesseling and Deutsche Shell AG in Godorf) into a single operating unit in Rheinland named Deutsche Shell AG, for a total capacity of 345,000 b/d.
- Shell Oil Products announced the signature of an agreement to sell the Bakersfield refinery in California to Big West Oil LLC, a company owned by Flying J Inc.
- The Lithuanian government also would like to see a foreign investor purchase a 53.7% stake held by Yukos in the

Mazeikiu oil company. The Russian oil company is ready to sell its holdings to the Polish company PKN Orlen. No decision has been made yet.

- Facing fierce competition on the European refining market and aiming to "manage a small European network of profitable refineries", BP put its Coryton refinery (172,000 b/d) up for sale. It is negotiating with a number of possible buyers, including Lukoil, which has indicated its interests.
- The Dutch refiner Petroplus acquired the Amsterdam refinery (115,000 b/d) from European Petroleum Holdings and decided to buy the Ingolstadt refinery in Germany (110,000 b/d) from ExxonMobil.
- To boost its presence in Europe, ConocoPhillips finalized its takeover of the Wilhemshaven refinery in Germany.
- Lyondell Chemical Company and Citgo (PDVSA) announced that they are selling their jointly owned refinery in Houston (268,000 b/d).

Expenditure in the world refining sector

In 2005, even though margins stood at high levels, world refining investment rose by only 1.6%. Maintenance expenses (+2.6%) and capital expenses (1.8%) account for most of this increase (Table 5).

Table 5
Expenditure in the refining industry worldwide
(in billions of dollars)

	2003	2004	2005	2006 (f)
Capital expenditure	17.0	17.0	17.3	17.5
Maintenance*	18.5	19.1	19.6	20.6
Catalysts and chemicals	12.4	12.8	12.8	14.0
Total	47.9	48.9	49.7	52.1

* 40% spent on equipment, 60% on labor and services.

Source: IFP based on data from HPI Market Data - (f): forecast.

This expenditure, especially in the United States, Europe and Japan, was primarily intended to adapt production to specifications and expand capacity through debottlenecking operations at existing refineries. The strategy here is to improve product quality and reinforce the competitiveness and reliability of existing production plant.

For 2006, expenditure is expected to show an increase of 4.8%, a record yearly high. Maintenance expenses (+5.1%) and spending on catalysts and chemicals (9.4%) were largely responsible; investment spending should only increase by 1.2%. If these trends are confirmed, refining will be even more of a bottleneck in 2007.

Refining and Petrochemicals

If one looks at the trends for the last decade or so, it becomes apparent that capital expenditure has remained more or less flat while maintenance spending has steadily climbed (it exceeded capex from 2000 onwards), in line with the trend for total spending.

Project proliferation

Improved margins and profitability in the refining sector led to the announcement of greater numbers of investment projects in 2005 and especially in the last few months.

These numerous projects can be categorized by project status. The projects announced were either "Phase II" projects (design, engineering or construction) or "Phase I" projects (preliminary design or inception). The former have a higher probability of reaching completion. One must also distinguish between projects to build new refineries and those to extend existing ones.

Projects in the design/engineering/construction phase are under consideration in Africa, Asia, Australasia, the CIS countries, the Middle East and even the United States (Table 6). Based on the data available in 2006, it is expected that 14 new refineries will be built worldwide by 2010-2015.

These projects represent total distillation capacity of 2.1 Mb/d, with the Middle East and the Asia-Pacific region accounting for 76% of new refineries in the world by the end of the decade. Among the 14 new refineries listed below, six are currently under construction, representing a total of 0.65 Mb/d.

Next come CIS countries such as Kazakhstan and Ukraine. In Europe and Latin America are not known to have any new units at this stage of development.

The extension project category also includes Phase II refineries with distillation capacity of 1.6 Mb/d. This concerns 27 refineries worldwide (Table 7).

North America, Asia and the Middle East contain 81% of the extension projects (1.2 Mb/d). Among these 27 extension projects, nine are under construction (0.55 Mb/d). The remaining 19% of projects worldwide (0.84 Mb/d) are in South America, CIS countries and Africa.

In the future, new capacity could be added if certain programs, still at the stage of **preliminary design or inception**, are eventually developed. Starting in 2005 but especially in 2006, there was a strong increase in downstream oil projects.

Table 6
New refineries - Distillation capacity - Phase 2: Design, Engineering, Construction

Region/Country	Status	Company	Location	Capacity bbl/d	Initial
Africa					
Algeria	Engineering	Naftec	Sbaa, Adrar	12 500	2006
Nigeria	Engineering	Amakpe	Eket, Akwa Ibom	6 000	2008
Nigeria	Construction	Amakpe	Eket, Akwa Ibom	6 000	2006
Asia					
China	Engineering	Sinopec	Heinan Island	160 000	2006
Vietnam	Engineering	PetroVietnam	Dung Quat, Quang Ngai	130 000	2009
China	Construction	Sinopec	Qingdao, Shandong	200 000	2008
India	Construction	Essar Oil	Vadinar (Sika), Jamnagar, Gujarat	210 000	2006
Australasia					
Indonesia	Construction	Jambi	Jambi	100 000	2006
CIS					
Kazakhstan	Engineering	AgipKCO	Kashagan	300 000	2008
Ukraine	Construction	Azovskaya Oil Co	Mariupol	16 000	2005
Middle East					
Kuwait	Engineering	KNPC	Al-Zour	615 000	2010
Qatar	Engineering	QGPC	Ras Laffan	146 000	2008
Oman	Construction	Oman	Raysut, Salalah (Sohar)	116 400	2006
North America					
Canada	Engineering	OPTI Canada	Long Lake Upgrader, Fort McMurray, Alberta	70 000	2007
Total				2 087 900	

Source: IFP

Refining and Petrochemicals

This is especially true in the Middle East, which contains 17% of the world's Phase I projects. By 2015, the Iranian program aims to boost refining capacity by more than 0.96 Mb/d by building new installations and extending existing ones. Saudi Arabia is giving consideration to an investment program calling for capacity of 400,000 b/d at Yanbu and 400,000 b/d to develop the Rabigh refinery. Finally, Qatar plans to build a new refinery (200,000 b/d) with start-up in 2015.

In Africa, Algeria's national company Sonatrach, working jointly with CNPC (China), expects to build a new condensate processing unit in Skikda (5 million tons a year). All of the Algerian projects under study represent total capacity of 0.44 mb/d. In addition, Egypt is looking into the possibility of building two refineries (total capacity: 0.48 Mb/d) by 2012-2015.

Asia contains 36% of the world's Phase I projects, of which two-thirds are to be found in China and India. India's program calls for 3.7 additional Mb/d by 2012-2015. Among the projects that have been announced, the most impressive aims to boost capacity at the Jamnagar refinery from 660,000 to 1.2 Mb/d by 2010. China plans to add 1.3 Mb/d of capacity by 2010.

In Australasia, Indonesia has also announced a large-scale program (1.55 Mb/d by 2015).

In North America, which represents 14% of the world's Phase I projects or 3.1 Mb/d, Canada plans to add 1.6 Mb/d by 2012-2015 and the United States 1.1 mb/d after 2010.

In the United States, Motiva Enterprise – the joint venture formed by Shell Oil and Saudi Refining (Aramco) – is planning

Table 7
Refinery extensions - Distillation capacity - Phase 2: design, construction, engineering

Region/Country	Status	Company	Location	Capacity bbl/d	Initial
Africa					
Morocco	Engineering	Samir	Mohammedia		2008
Sudan	Construction	Concorp	Shajarah, Khartoum	30 000	2006
Asia					
China	Engineering	Sinopec	Quanzhou (Xiaocuo), Fujian	160 000	2008
Thailand	Engineering	Thai Oil	Sriracha	50 000	2007
China	Engineering	CNPC	Dushanzi, Xinjiang	80 000	2007
Pakistan	Construction	Attock	Rawalpindi	20 000	2006
India	Construction	Hindustan	Mahul, Bombay, Maharashtra	48 000	2006
India	Construction	Hindustan	Visakhapatnam, Andhra Pradesh	17 000	2006
India	Construction	IOC	Panipat, Harayana	120 000	2006
CIS					
Russian Federation	Engineering	Surgutneftegaz	Kirishi, North West	120 000	2006
Kazakhstan	Construction	KazakOil	Atyrau		2006
Middle East					
Iran	Design	NIOC	Abadan	150 000	2008
Oman	Engineering	Oman	Mina Al Fahal	21 000	2006
Saudi Arabia	Engineering	Aramco	Rabigh	80 000	2008
North America					
United States	Engineering	Premcor	Port Arthur, Texas	75 000	2006
Canada	Engineering	Petro-Canada	Edmonton, Alberta	135 000	2008
United States	Engineering	Sunoco	Philadelphia, Pennsylvania	25 000	2007
United States	Engineering	ConocoPhillips	S.F. (Rodeo/Sta Maria), California	10 000	2006
United States	Engineering	Chevron	Pascagoula, Mississippi	12 000	2006
United States	Engineering	ConocoPhillips	Borger, Texas	18 000	2006
United States	Engineering	Wynnewood	Wynnewood, Oklahoma	15 000	2007
Canada	Construction	Suncor	Suncor Upgrader, Fort McMurray, Alberta	35 000	2006
Canada	Construction	Syncrude Canada	Syncrude Upgrader, Fort McMurray, Alberta	2 17 000	2006
South America					
Jamaica	Engineering	Petrojam	Kingston	13 000	2008
Aruba	Engineering	Valero	San Nicolas	50 000	2007
Costa Rica	Engineering	Recopetrol	Limon	10 000	
Colombia	Construction	Ecopetrol	Cartagena, Bolivar	65 000	2006
Total				1 576 000	

Source: IFP

Refining and Petrochemicals

to add 320,000 b/d of extra capacity at the Port Arthur refinery, whose capacity currently stands at 235,000 b/d. This will more than double the refinery's capacity. Marathon Oil Corp. wants to extend capacity at its refinery near Garyville, Louisiana from 245,000 to 425,000 b/d (+180,000 b/d).

Demand for petroleum products and projects

Phase I projects – those still at the stage of preliminary design or inception – represent 22.3 Mb/d of supplementary capacity and 86% of all projects announced. The total for all projects announced (Phase I and Phase II) comes to 26.0 Mb/d. It is important to realize that many of these projects will not be carried out within the initial time frame and some will never be carried out at all.

Phase I projects represent 15.9 Mb/d and account for 88% of all of known new refinery projects. The total for all projects (Phase I and Phase II) comes to 18 Mb/d.

Known extension projects represent a total capacity of 8 Mb/d. This includes Phase I projects, which represent 6.4 Mb/d and 80% of all extension projects.

By 2015, the increase in refining capacity (projects to build new refineries and extend existing ones) could be more or less in line with forecast for the increase in demand. According to the IEA reference scenario (Figure 4), this increase could approximate 15 Mb/d by 2015, provided that a certain number of projects now in Phase I are actually implemented. **In the future, a tight supply situation should persist**, especially since there is no guarantee that engineering firms have sufficient capacity to cover demand for additional projects.

The new capacity to be provided in future will have to process heavier crudes and supply higher-grade products.

Investment will have to include conversion projects to meet this type of demand.

In 2006, all projects worldwide represent 5.6 Mb/d of additional conversion capacity including 1.85 Mb/d for Phase II projects. The latter are not distributed evenly in geographic terms: Asia accounts for one-quarter of capacity, followed by the Middle East and North America. These three regions represent 72% of the world's conversion projects (1.3 Mb/d). Africa, the CIS countries and the European OECD countries account for a small percentage of conversion projects (equivalent to 0.29 Mb/d for all three regions).

Refining capacity forecasts made by Petroleum Economics Ltd. confirm the need for conversion. Between 2004 and 2008, conversion capacity will grow at a significantly higher rate (14%) than distillation capacity (+6%).

Petrochemicals

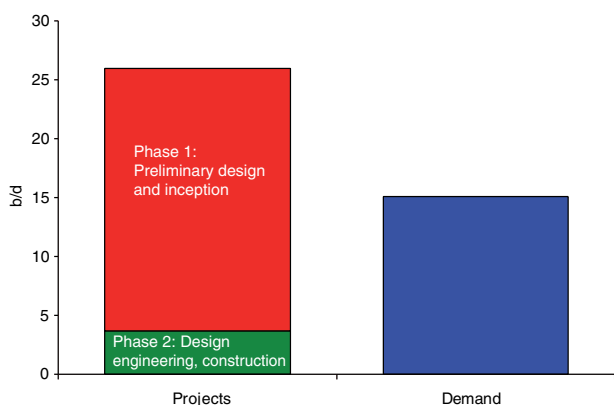
Business environment

The comeback, much awaited after a four-year slump, started in 2005 and was confirmed in 2005 and 2006. The outlook is bright, sustained by a healthy economy and encouraging prospects maintained by sustained demand in the United States and emerging countries (China and India). Delays in the delivery of a number of large cracking complexes in the Middle East only emphasize the current limits to supply. The resulting tension between supply and demand for petrochemicals (which varies according to product) ensures that margins will stay high. Therefore, **in 2007, profitability in this sector will continue to be good.**

The economic performance of the petrochemicals and heavy chemicals sector confirms that it has recovered in the last three years: the sector as a whole reported a return on investment of 12.6% in 2004 and 13.7% in 2005. The chemicals branches at oil companies posted earnings higher than those of chemicals companies, which obtained a return on investment of 5.7% in 2004 and 7.1% in 2005. Although this is the best performance since 1995 (Figure 5), it nevertheless marks a significant shift in trend.

The increase in the price of oil and, subsequently, that of gas, led to an increase in the price of the energy and raw materials needed to produce petrochemical products, one of them being naphtha, the most important raw material in the production of olefins and aromatics in most parts of the world, i.e. in the Asia-Pacific region, Latin America and Europe.

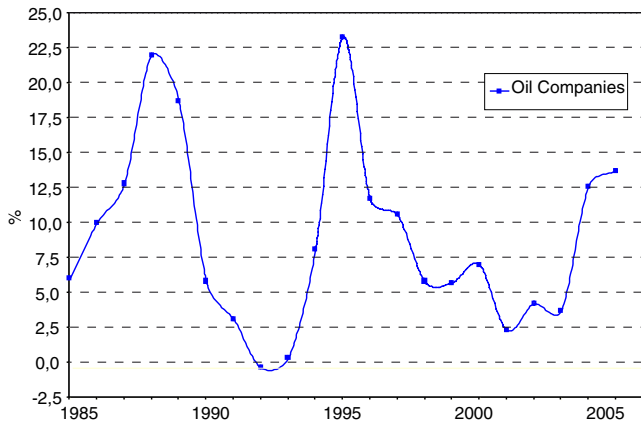
Fig. 4 Incremental demand and projects between 2005 and 2015
New refineries and extensions, by development phase



Source: IFP, IEA World Energy Outlook 2005.

Refining and Petrochemicals

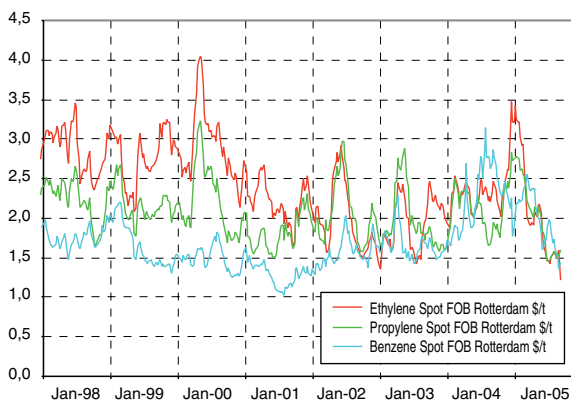
Fig. 5 Trend in the return on investment (%) for the petrochemicals branches of oil majors



Source: Petroleum Economist

The price of **naphtha** took off in 2005 and 2006, rising from USD 400/t early in the year to USD 645/t in July in the Europe North-West area before starting to fall in the summer, like the prices of other petroleum products, losing USD 100/t in two months. In 2005, the decrease in the ratio of the price of olefins (ethylene and propylene) and benzene to the price of naphtha illustrates how penalizing nature of this trend in the cost of raw materials. Starting in the second half of 2006, ethylene and propylene prices went up again while the naphtha price fell. More recently, this ratio has seemed to turn upwards (Figure 6).

Fig. 6 Variations in spot prices versus naphtha prices (NW Europe)



Source: Platt's.

Unlike the situation in Europe, the U.S. petrochemicals industry mainly requires **ethane**, a co-product of **natural gas**. The Henry Hub spot price oscillated between USD 8/Mbtu and 11/Mbtu in 2005, peaking at USD 14/Mbtu. In 2006, prices remained high, except early in the year when weather conditions were especially mild.

The Middle East, which is also a big producer of associated natural gas, possesses an abundance of one raw material, ethane, at very low prices. This region has the potential to achieve the world's lowest ethylene production cost.

In 2005, demand for petrochemical products – ethylene and propylene – saw a considerable increase despite a slowdown compared to 2004, especially in the United States and China, driven by economic growth. This new situation enabled American operators to boost the unit utilization rate and thus temporarily absorb their problematical surplus capacity.

On the export market, U.S producers got the benefit of the depreciation of the dollar against the euro in 2005. In 2006, the price of ethylene and its derivatives remained high while the U.S. export market shrank. In light of this situation, the international market will be targeting other geographic areas, especially Asian markets.

The petrochemicals sector in China is experiencing high growth. According to Nexant forecasts, demand for ethylene is expected to expand at a rate of 7.4%/year between now and 2015, growing from 6.3 Mt/year in 2004 to 14 Mt/year in 2015. Demand for polyethylene should also increase significantly in China (+13 Mt/year) between 2004 and 2015.

World demand for petrochemicals should continue to grow in the years to come. Forecasts¹ for the next five years predict that world demand for ethylene will grow at a rate of 4.3%/year and 4.8% for propylene.

Expenditure by the world petrochemicals industry

In a favorable business environment, investment remained stable in 2005 for the third straight year. For the most part, it was allocated to the construction of a few new installations and to overhauling and upgrading existing ones. Only maintenance expenditure increased, by USD 600 M (Table 8). This spending was necessary to boost reliability, flexibility and profitability at existing units.

In 2006, forecasts are predicting that investment will rally in the petrochemicals sector after remaining flat for many years. This being said, the increase will be relatively small (+1.3%), bringing total investment from USD14.9 billion in 2005 to 15.1 billion in 2006. Petrochemicals expenditure in 2006 should concentrate on the maintenance of industrial plant and on catalysts and chemicals (+4.7% and 10%, respectively).

(1) Chemical Market Associates Inc.

Refining and Petrochemicals

Table 8
Spending in the world petrochemicals industry (in billions of USD)

	2003	2004	2005	2006
Capital investment	14.9	14.9	14.9	15.1
Maintenance*	22.0	22.7	23.3	24.4
Catalysts and chemicals	21.9	21.8	21.8	24.0
Total	58.8	59.4	60.0	63.5

* 40% spent on equipment, 60% on labor and services

Source: IFP based on data from HPI Market Data ; (f): forecast.

Many projects to install new capacity are being planned for the years to come. Currently under construction or planned, most should not come onstream until 2009-2010. The initial start-up dates have been postponed as a result of capacity limitations in the engineering sector. The firms specialized in engineering, purchasing, construction and specialized equipment are currently overloaded with work, which means that projects are delayed and extra costs incurred. The availability of labor and, correlatively, the increase in the cost of labor, can act as a drag on the investment amount and on project profitability.

The bulk of investments to boost future capacity are located in the Middle East and the Asia-Pacific region, especially China. 120 Mt of new capacity (olefins, aromatics and key plastics) have been announced for the period 2006-2011, according to the SCOB², of which the Middle East and Asia-Pacific account for more than 90 Mt.

This year, Nankin, Shanghai and Huizhou complexes totaling 2.4 Mt in ethylene production capacity are scheduled to start up in China. In addition, ExxonMobil, Saudi Aramco and Fujian Petrochemicals are launching a project to build a new ethylene steam cracker (800,000 t/year), two polyethylene units (650,000 and 450,000 t/year) and an aromatics unit (1 Mt/year). BP Zhuhai Chemical Company is undertaking the construction of a petrochemicals complex (capacity: 0.9 Mt/year) that should come onstream by year-end 2007. This plant will produce purified terephthalic acid (PTA), used to make polyester fibers and plastics. Sinopec has announced that it will be building an ethylene plant in a joint undertaking with the Saudi petrochemicals giant SABIC. This project is at the stage of preliminary discussions. China will have to invest a great deal in the petrochemicals sector in the future to make its industry more competitive. The country must meet rising demand while reorganizing and modernizing the existing industrial structure, which currently consists of a large number of small units.

(2) French trade association for basic organic chemistry

Investment will also be concentrated in the Middle East, whose large natural gas reserves give it a large advantage over Europe and the United States. It will have to boost its steam cracking capacity. The objective is to boost ethylene production capacity by 23 Mt/year by 2010 for export to the Asia-Pacific (China), North America and Western Europe, its preferred export markets.

The United States will be concentrating on its current investment strategy based, not on new construction, but more on improving energy efficiency and the flexibility of raw materials for existing infrastructure.

As more and more products from the Middle East and Asia flow into Europe, the European petrochemicals industry finds itself facing fierce competition. Compared to competing regions, it bears a heavier burden in terms of labor, energy and raw material costs.

In response to these difficulties, the European petrochemicals industry is in the process of restructuring, as different transactions announced in the last year or two will show. Among them: The creation of Arkema (Total), the sale of BP's petrochemicals assets to Ineos, the disposal of the Shell-BASF subsidiary Basell, and the transfer of Statoil's interest in Borealis to Ipic. This wave of restructuring is expected to continue.

Conclusion

In 2005, the sustained rate of growth of the world economy, which slowed by 0.5 point, was accompanied by a modest increase in world demand for petroleum products (+ 1.1%) that is one-third as large as the year-on-year increase from 2003 to 2004.

In 2006, growth picked up gradually, gaining 0.3 point. At the same time, demand accelerated at the same pace as the previous year (1,2 Mb/d). 2007 is expected to confirm this slowdown in demand³, even though the economy is showing sustained growth.

In 2005, refining margins saw records highs in spite of elevated crude prices, especially thanks to the increase in petroleum product prices. In the second half of the year, margins grew, especially in the United States, where gasoline upgrade opportunities prompted refiners to concentrate on the production of gasoline. In Europe and in Asia, margins dipped slightly, but stayed high. The gradual restoration of margins in the last three years has allowed the refining sector to regain its profitability. In this context, oil company earnings for fiscal year 2005 were

(3) Impact of the high product prices, political determination to improve energy efficiency, increased interest in biofuels, etc.

Refining and Petrochemicals

up significantly over 2004, and the figures for the first half of 2006 confirm this trend.

Despite this favorable business environment, investments only saw a minimal increase in 2005. However, forecasts predict a significant acceleration starting in 2006. Looking to 2010-2015, it would appear that the planned investment projects with the highest probability of reaching completion will be barely adequate to cover the increase in demand. Refining plant should continue to find itself under pressure. The Middle East and Asia/Pacific are the two regions of the world where investments in new refineries have been made. In the United States, Europe and Japan, capital expenditure is concentrated on projects to optimize existing plant.

Spending on catalysts and maintenance, unlike investment, continued to grow in 2005, a trend that should persist in 2006 and can be attributed to the need to keep improving petroleum product quality and to ensure compliance with future standards.

The petrochemicals industry finally saw a comeback in 2004, but this good performance has not yet translated into significant investment in new capacity. Forecasts for 2006 show that, once again, the status quo will be maintained for investment. Although total spending is up significantly (investment, maintenance), catalysts and chemicals are primarily responsible for the increase.

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