

Refining

For oil companies to invest in new refining and conversion capacity, favorable conditions over time are required. In other words, refining margins must remain high and demand sustained over a long period. That was the situation prevailing before the onset of the financial crisis in the second half of 2008. The economic conjuncture has taken a substantial turn for the worse since then and the forecasts for 2009 do not look bright. Oil demand is expected to decrease in the OECD countries and to grow much more slowly in the emerging countries. It is anticipated that refining margins will fall in 2009—in 2008, they slipped significantly in the United States—as a result of increasingly sluggish demand, especially for light products. The next few months will probably be unfavorable to investment. In addition to a gloomy business outlook, there may also be a problem of access to sources of financing. As for investment projects, a mainstream trend has emerged in the last few years: a shift away from the regions that have historically been most active (the OECD countries) towards certain emerging countries, mostly in Asia or the Middle East. The new conjuncture will probably not change this trend.

Overview of the downstream sector

The global economic crisis is impacting the level of world demand for energy in general and for oil and petroleum products in particular.

In 2008, oil consumption was down by 300,000 bbl/d/year on year, according to forecasts issued in December by the International Energy Agency (IEA).

According to the latest predictions, demand in 2009 will be close to the 2007 figure. At the same time, supply is increasing in the wake of three or four years of heavy exploration-production activity. The oil and gas industry at large is starting to feel the effects of the collapse of the barrel price in the second half of 2008.

Even before the financial crisis worsened, the refining sector was reporting lower levels of economic performance, but the situation differed from region to region. In the US, a drop in demand that had started well before the summer, in reaction to rising petroleum product prices and the economic slowdown, brought refining margins down. In Europe, the stagnation of demand did not have any apparent effect on margins. On

the contrary, demand in Asia continued to grow at a high rate, which ensured good refining profits and a healthy level of investment. Thanks to Asia and, to a lesser extent, the Middle East, a fragile equilibrium was preserved between global refining capacity and product demand.

The oil price climbed sharply during the first part of 2008. As a result, refinery product sales fell in the United States and Europe, and oil majors posted lower earnings for their downstream operations. A decline in the refinery utilization rate, mostly in the industrialized countries, in conjunction with the cost of services and feedstocks weighed on refining margins and affected corporate earnings.

In 2008, conditions continued to be favorable to an increase in capital investment in the refining sector, especially in regions outside North America and Europe. Several key trends were apparent in November 2008:

- there was a timid increase in the number of projects likely to reach completion and operate at industrial scale (e.g. projects to provide new distillation capacity at new refineries),

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- there were fewer projects to add distillation capacity at existing installations,
- there was a large increase in the number of projects to boost conversion capacity.

For oil companies to invest in new refining and conversion capacity, favorable conditions over time are required. In other words, refining margins must remain high and demand sustained over a long period to make up for the investment lag.

But, since the summer, the business environment has seen big changes: the financial crisis in the United States, its transmission to the real economy and propagation to every part of the world, the credit crunch, the increased risk of investment and, more generally, a loss of confidence within the energy sector, confirmation of falling demand in the OECD countries and a slowdown in those parts of the world where the impact had not been as great... until now. Uncertainty is high and analysts still lack sufficient perspective, so it is difficult to make a forecast. However, the economic slump can be expected to put an abrupt end to the increase in refining investment of the last two or three years. In 2009, investment in the downstream sector will probably slow down.

Refining capacity: a tight market with regional differences

In 2007, like the year before, world refining capacity went up by 1.4% to reach 87.9 Mbbl/d (+1.2 Mbbl/d). For the second year in a row, refining capacity was under pressure, then demand seemed to slacken a bit and the surplus rose from 2.4 Mbbl/d in 2006 to 2.7 Mbbl/d in 2007. This was due to another decrease in the rate at which demand was growing (+1.0%) and a greater increase in refining capacity. The world utilization rate fell again in 2007, to 85.9%.

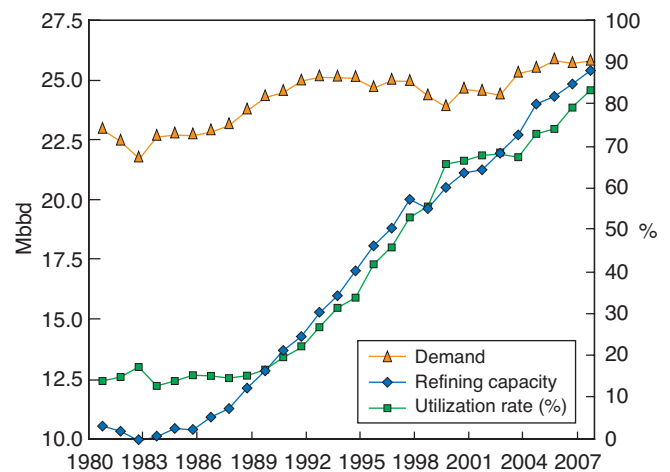
The slowdown in demand can be attributed to stagnating demand in the United States (+0.1%) and a significant downturn in Europe (-2.4%). The supply of products was sustained by a significant increase in refining capacity in the Asia Pacific region (+3.3%) and in the Middle East (+3.5%).

For years, the United States has run a capacity deficit, which hit a record high in 2004 and has been falling ever since. In 2007, it slipped from 3.6 Mbbl/d in 2004 to 3.1 Mbbl/d (+0.5 Mbbl/d). This is not due to investment in new capacity, but to the fact that demand is slowing while capacity rising slowly, thanks to investments undertaken to boost capacity at existing installations. Given this structural deficit, it is surprising to note that

the refinery utilization rate fell for the third consecutive year. In 2007, it dropped to 86% following a series of incidents and scheduled maintenance shutdowns, compared to 90% in 2003 and 2004.

In Europe, where a fragile balance between supply and demand for petroleum products had prevailed for many years, consumption fell while refining capacity remained stable, bringing a little relief to the tight market. Surplus capacity rose from 0.4 Mbbl/d in 2006 to 0.73 Mbbl/d in 2007. The utilization rate went down for the second consecutive year, from 91% in 2005 to 88% in 2007.

Fig. 1 - Oil demand and refining capacity in the Asia Pacific region



Source: IFF, based on the BP Statistical Review of World Energy 2008

In the Asia Pacific region, the increase in demand was accompanied by a rise in refining capacity. The capacity deficit for this region was not resorbed but grew progressively smaller. Within three years, it fell from 1.4 Mbbl/d (2005) to 0.8 Mbbl/d (2007) for a gain of 0.6 Mbbl/d. Since 2005, demand is up by 4.4% and refining capacity by 7.2%. For several years, the utilization rate has been very high, in the vicinity of 90% (Figure 1).

In the past, surplus refining capacity in the Middle East could easily cover the increase in demand. Over the years, as demand has surged, this has become less true. In 2007, thanks to new investment in the region, the decline in excess capacity stopped and leveled off.

On the world market, there remained tensions between refining capacity and oil demand, although the situation has improved in the last two years. Thanks to the development of new units in the Asia Pacific region and the Middle East, world capacity showed a small surplus.

Forecasts for 2008 have been lowered many times. According to a December forecast by the IEA, world

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demand will decrease by 0.3 to 0.4%. This net decline was caused by a very significant drop in demand in North America and the flat level of demand registered in Europe. World oil consumption was sustained by the Middle East, Latin America and the Asia Pacific, especially China. Production capacity should increase as projects reach completion, and new distillation and conversion units come onstream. According to forecasts for 2008, projects will add nearly 1.6 Mbbld of distillation capacity and 4.2 Mbbld of conversion capacity.

The financial crisis, which became more acute in the second half of the year, will impact projects already undertaken and those in the planning. The effects are not yet very perceptible in 2008, but 2009 will no doubt tell a very different story. Companies already thinking about postponing or cancelling a project are likely to do so sooner rather than later. Today, visibility is still very poor, making it extremely difficult to predict how the balance between refining demand and capacity will evolve in the next few months. The slowdown in demand expected in 2009 and its impact on industrial activity justifies real pessimism for the months to come.

Refining margins take a turn for the worse

Generally speaking, refining margins reflect the tensions between supply and demand in a particular refining capacity situation. If capacity is insufficient to cover demand, margins tend to rise. Fifteen years of underinvestment in the refining sector combined with a sharp upsurge in oil demand—aggravated by two natural catastrophes in 2005, Hurricanes Rita and Katrina—increased the tension between supply and demand and pushed refining margins up for structural reasons. From 2003 to 2007, the curve of the refining margins for Brent Cracking—and the other crudes—illustrated this trend. The annual average rose from US\$0.74/bbl in 2002 to 5.09/bbl in 2007 (except in 2006, when the refining margin did go down but nevertheless remained reasonably high).

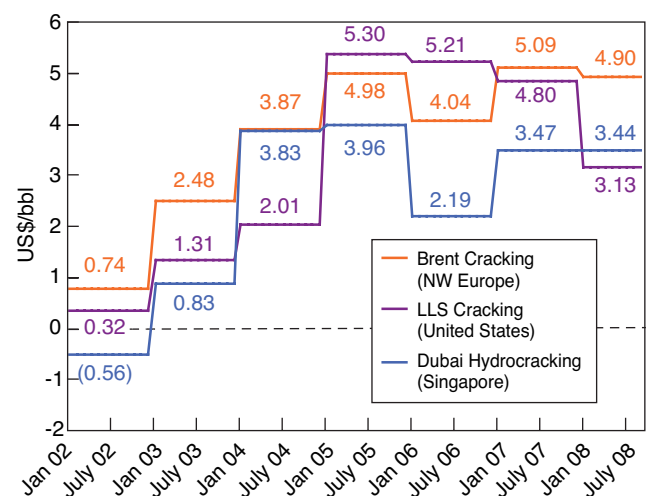
Thanks to high demand and inadequate refining capacity, 2007 margins attained very high levels, especially in the United States. The annual average for the USGC LLS Cracking margin reached US\$5.44/bbl. In the first half of the year, the margins neared US\$15/bbl (May). The picture looked very different in the second half of the year. As the oil price rose sharply, margins plunged until they reached a negative number in December 2007. The prices of refinery products rose but not enough to cover feedstock costs. US companies were not able to pass on the entire increase in the oil price to refinery products, especially in the case of gasoline.

This situation continued in 2008 as crude prices kept climbing higher. But other factors also contributed to the deterioration of margins. First of all, demand for gasoline fell significantly starting in the first quarter (the usual “driving season effect” did not occur), due to the price pressure and a general aggravation of the economic situation. The addition of ethanol to gasoline helped reduce the consumption of petroleum products. Gasoline stocks swelled; by the end of the first quarter, they found themselves at levels that had not been reached in a long time.

All in all, 2008—coming after a good year in 2007—saw a clear deterioration of margins, which stood at US\$3.13/bbl for the first nine months of the year, *i.e.* US\$2.31/bbl less than in 2007. The significant decrease in demand for gasoline, which causes the gasoline price to fall, is expected to continue, which will further erode margins for this product. At the same time, diesel fuel margins are still satisfactory, which means that refiners equipped with hydrocracking installations can post higher earnings.

In Europe, margins stayed high in 2007 in spite of a mild winter (US\$5.09/bbl for Brent Cracking NW Europe). Even though crude prices were soaring, refiners managed to preserve high margins thanks to the selling price of their products. The structural tensions on the market for jet fuel and diesel fuel kept prices high enough to cover the increase in feedstock costs. In 2008, margins showed a slight decrease—much smaller than in the US—mainly caused by a drop in demand for petroleum products. Nine months into the year, the margin for Brent Cracking stood at US\$4.9/bbl, which is still perfectly reasonable. The price differential between

Fig. 2 - Complex refining margins, monthly and annual



Sources: Oil Market Report (IEA), IFP

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distillates (especially gasoil 0.1%, ULSD 10 ppm and jet kero) and crude, which was up in the first half of the year, dipped briefly then began to climb again, despite the fall in the crude price. However, the trend at year-end 2008 was headed down, although not as steeply as in other regions.

In the Asia Pacific region, margins are often lower than in other parts of the world because demand for light products is not as high. However, the strength of demand enabled margins to reach high levels and stay there. In 2007, refining margins were up over previous years: the average margin for Dubai Hydrocracking stood at US\$3.58. For the first three quarters of 2008, margins remained stable at US\$3.44/bbl, a value that is perfectly satisfactory from a refiner's perspective. However, margins shrank considerably in the last quarter of the year.

What impact will the current economic crisis have on margins? The present situation, characterized by a slackening of oil demand that will probably relieve some of the pressure on refining capacity, does not seem very conducive to high margins despite the spectacular fall in the crude price. The decrease in US gasoline consumption is expected to persist in 2009, which will not only keep margins low in the US, but also affect the European refining sector. A decrease in gasoline imports from Europe is likely to create a gasoline surplus in the European Union, which in turn will affect margins. In this scenario, Asia will become the destination of surplus gasoline, with a risk of oversupply. Gasoline seems to be at the heart of disequilibrium problems in the refining sector.

Lower net earnings and more mergers and acquisitions

Corporate earnings

In 2007, the economic performance of the downstream sector continued to deteriorate. European and US companies saw net earnings for their refining operations fall from 2006 to 2007 (Table 1). Nearly all of the companies considered (except Repsol-YPF, Shell, ConocoPhillips and ExxonMobil) reported lower earnings for 2007. This was primarily due to the increase in the oil price, which weighed on refining margins (especially in the U.S.), and an across-the-board decline in refinery product sales both in the US and Europe. Other factors included lower utilization rates in the US and Europe and higher costs (services and feedstocks).

The unfavorable business environment was not the only reason for the poor results reported by BP. Two of its

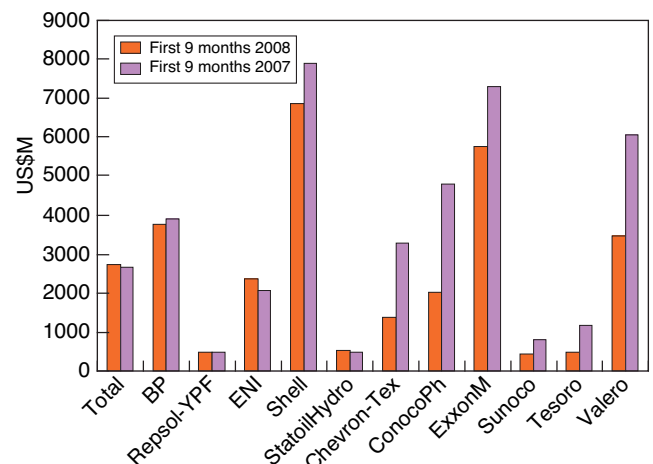
Table 1

Net earnings reported by refining-distribution companies (millions of US\$)

	2007	2006	Variations %
Total	3475	3497	-0.6
BP	2617	5283	-50.5
ENI	437	790	-44.7
Repsol-YPF	944	307	+207.5
Shell	6951	7027	+30.2
StatoilHydro	485	748	-2.5
Chevron-Texaco	3502	3973	-11.9
ConocoPhillips	5923	4481	+32.2
ExxonMobil	9573	8454	+13.2
Sunoco	841	957	-12.1
Tesoro	1180	1455	-18.9
Valero	7604	8364	-9.1

Sources: Annual reports and BIP

Fig. 3 - Net earnings reported by refining-distribution companies



Source: IFP

largest installations in the United States, Texas City and Whiting, ran at 50% capacity in 2007 following serious incidents in 2005 (explosion and fire). As for ENI, earnings were down because of very unsatisfactory margins, especially at complex refineries—the fact that these plants are supplied with more sulfurous crudes offsets the advantage of using a low-cost feedstock—as well as the €/US\$ exchange rate. The three refining specialists (Sunoco, Tesoro and Valero) were also adversely affected by the conjuncture, reporting lower earnings than in the previous financial year.

As for 2008, the results of the first nine months confirmed the deterioration of corporate earnings in the refining sector. A comparison of the first three quarters

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of 2008 with the same period of 2007 shows that most of the companies considered saw a net decrease in earnings (Figure 3). The performance of companies in the US, ranging from -21% (ExxonMobil) to -60% (Tesoro), was clearly poorer than those in Europe, where Shell turned in the worst performance with -13%. Chevron, ConocoPhillips and the three refining specialists (Sunoco, Tesoro and Valero) reported net earnings that were down by between 40% and 60%, year on year. Total saw earnings decrease by 29% (in US\$) in the first half of 2008, which was also due in part to lower contributions from equity affiliates, essentially Wepec in China and CEPESA. Total rallied strongly in the third quarter, managing to obtain a positive number for the first nine months of the year (+2%). Repsol-YPF and StatoilHydro saw their earnings improve in 2008 (+13% and +11%, respectively).

Mergers and acquisitions

In recent years, the M&A scene has featured new players specialized in downstream activities, including Sunoco, Tesoro and Valero in the US and Petroplus in Europe. At the same time, some large integrated oil companies have tended to scale down refining activities to concentrate on E&P operations, which yield higher levels of profitability in spite of the improvement in margins in the last few years. The latter encourage the "specialists" to acquire assets that are "abandoned" by integrated companies.

The total worth of reported mergers and acquisitions occurring between the fourth quarter of 2007 and year-end 2008 comes to an estimated US\$14 billion. These transactions were very spread out, geographically. The United States topped the list with 42% of the total, followed by Russia with 25% (one large deal with Rosneft/Gazprom), then Europe with 19%. The remaining 14% was divided up between the Middle East, Latin America and Africa.

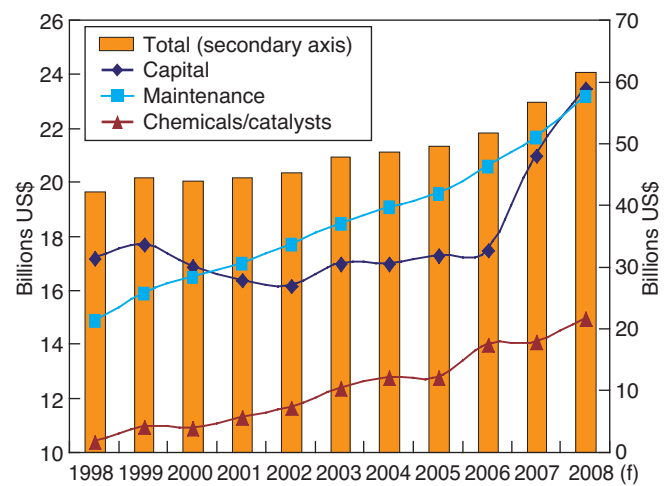
The new economic situation will have more serious repercussions on small companies, which are likely to find themselves soon in a vulnerable position due to the credit crunch and lower margins. A new wave of consolidation in the refining sector is highly probable, with powerful firmstaking over smaller ones or those most in debt, which have become highly vulnerable. The gloomy outlook for margins may put the brakes on this trend.

Expenditure is up in the refining industry, but...

Starting in 2005, spending on investment, maintenance and refining catalysts/chemicals, *i.e.* expenses that help boost capacity, saw a significant increase. Since then, total expenditure has gone up by 24% compared to only 12% between 2000 and 2005. Higher refining margins

led to more new projects which, combined with the higher cost of industrial feedstocks and services, translated into a strong increase in capital expenditure (Figure 4). The rise in unit cost accounts for the bulk of this increase. Globally, the increase in expenditure is largely due to the increase in the unit cost, an indicator published by CERA, which has gone up by more than 60% since 2005 in the refining sector.

Fig. 4 - History of spending in the refining sector worldwide



Source: IFR, based on HPI Market Data; (f) forecast

Prior to 2005, the increase in costs was due to chemicals/catalysts (+17%) and maintenance (+19%) while capital spending remained fairly stable, inching up by no more than 2% in five years.

From 2005 to 2008, spending on maintenance and chemicals/catalysts continued to grow at the same pace (in the vicinity of 17-19%) while capital expenditure surged by 36% for the period.

Looking at the annual rate of increase, one sees that capital spending rose quickly between 2006 and 2007: it rose by 20% to US\$21 billion, up from 17.5 billion. Total expenditure went from US\$52 billion to 57 billion (+9%) in 2007 and then to 62 billion (8.6%) in 2008. The latter figure included 12% for capital spending (US\$24 billion).

This spurt in capital spending helped make up in part for the lag in refining investment to build new refineries or expand capacity at existing refineries.

In 2009, total spending (*e.g.* investment and maintenance) may fall slightly.

Trends in refining and investment

Generally, a further investment effort is necessary to respond to more stringent fuel specifications (*e.g.* sulfur

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content) as well as structural orientations dictated by demand (e.g. the importance of diesel in Europe):

- the refineries in Europe, which have always concentrated on catalytic cracking units, must face up to the fact of diesel penetration in the road transport sector, which calls for hydrocracking units. That supply and demand are mismatched was obvious, but European refineries could sell their excess gasoline on the US market. The very high cost of hydrocracking units and their impact on the hydrogen balance continue to inhibit their development,
- changes in the marine fuel regulations, now in the process of finalization at the International Maritime Organization, could bring deep conversion refining units (e.g. cokers and residue cracking installations) onstream more quickly. The sulfur content targets of 0.1 and 0.5% represent very great constraints,
- changes in the refining industry are also led by regulations that, increasingly, require refineries to implement emissions reductions techniques, which add significantly to the investment burden. The existing European regulations call for reducing the current levels of local pollution (e.g. SO₂, NO_x, PM, and CO) and atmospheric pollution (mostly CO₂ via allowance allocation plans and the ETS directive) at refineries.

Many planned projects announced

The data on which we base our statistics did not account for the impact of the crisis on projects. Its effects became perceptible in the second half of 2008 and are expected to intensify in 2009.

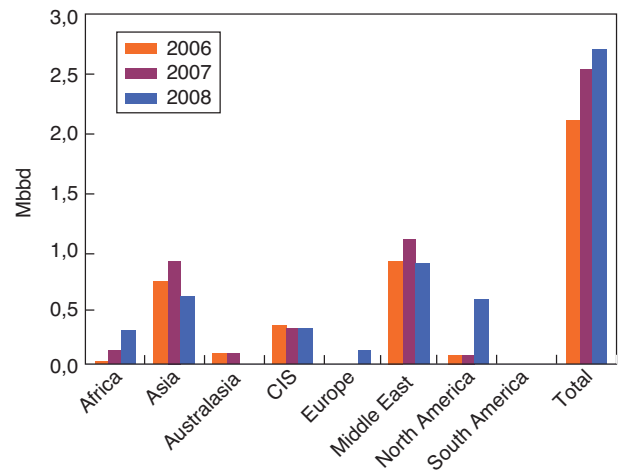
The conditions existing before the events of summer 2008 were still conducive to an increase in the number of announced refining investment projects this year, despite the fact that margins narrowed in the US in 2008.

Companies announce projects of two types: "Phase 2" (design, engineering or construction) or "Phase 1" (preliminary design or inception). The former have a higher probability of reaching completion.

Phase 2 projects: design, engineering or construction

- New refineries have been announced in different parts of the world: Africa, Asia, the CIS countries, the Middle East, Europe and North America. Based on the information available in 2008, it is thought that 21 new refineries will be built worldwide by 2010-2012. These projects represent aggregate distillation capacity of 2.7 Mbbl/d, up 6% over the previous year (Figure 5).

Fig. 5 - New refineries by region - Phase 2: design, engineering or construction



Source: IFP

The Middle East and the Asia Pacific region accounted for 53% of the new projects to be built in the medium term. There were six new Phase 2 projects this year in North America, especially tar sands development projects in Canada (aggregate capacity: 55,000 bbl/d). Of all the Phase 2 refinery projects, four were under construction (500,000 Mbbl/d).

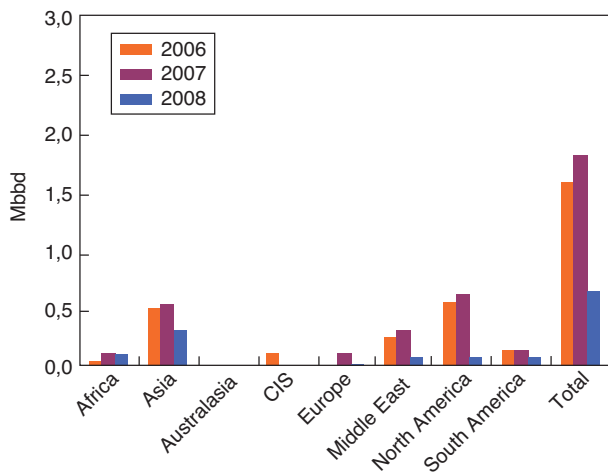
Compared to the previous year, there were twelve new Phase 2 projects (capacity: 1.37 Mbbl/d). Nine other projects still in progress represented 1.31 Mbbl/d. This does not count projects that have been delayed or postponed (1.27 Mbbl/d). Most of these projects were announced in the first half of 2008. The turnaround of the situation during the year and the strong slowdown in demand should have a notable impact on these projects. This should jeopardize projects in the design and engineering phase, but not those already under construction. In China and the Middle East, several postponements have been announced: some projects will come onstream later than planned (Petrochina), the construction of others will be delayed (Aramco) and others still involve the rationalization of refining plant with the closure of old refineries (China).

- There are 13 Phase 2 extension projects (distillation capacity: 0.65 Mbbl/d) which is down significantly compared to the previous year, with 28 projects representing 1.8 Mbbl/d (Figure 6).

All regions saw a drop in activity, with Africa being the least affected. For the second straight year, Asia topped the list despite a decrease of nearly 45% in projects of this type. Of the 13 extension projects, three are under construction (85,000 Mbbl/d) in Asia and nine others are in the engineering stage.

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Fig. 6 - Refinery extensions by region - Phase 2: design, engineering or construction



Source: IFP

Between 2006 and 2007, Phase 2 projects—new refineries and extension projects to expand distillation capacity—had seen an 18% increase from 3.7 to 4.3 Mbbl/d. However, in 2008, they decreased to 3.3 Mbbl/d. Investment was concentrated in the Middle East, Asia and, to a lesser extent, North America (Figure 7). But these projects can always be postponed in a proportion that remains uncertain.

Phase 1 projects: preliminary design and planning

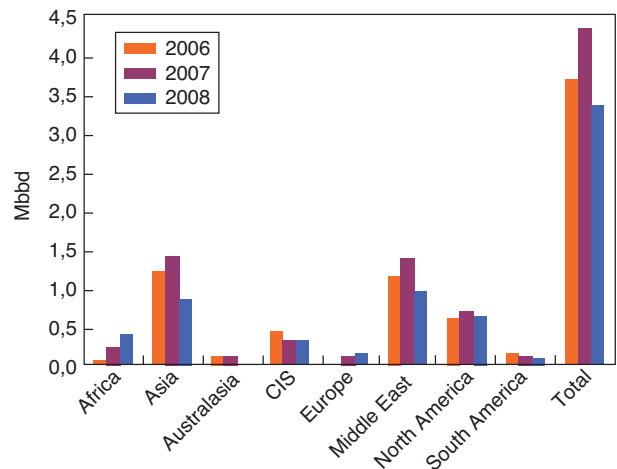
Many projects have been announced in the last two years. In November 2008, Phase 1 projects—i.e. projects in the design phase, the bulk of which will never be carried out—represented nearly 37.5 Mbbl/d of additional distillation capacity. Most of the projects announced were for new refineries but their chances of reaching completion, already low, are now even slimmer.

Demand for petroleum products and future projects

If one exclusively considers Phase 2 projects for new refineries or extension projects, nearly 3.3 Mbbl/d in additional capacity may come onstream by 2013. If so, world refining capacity will have increased by 3.8% between 2007 and 2013, up from 87.9 to 91.2 Mbbl/d. According to the latest IEA baseline scenario (Mid Term Review, December 2008), oil demand, an estimated 86.2 Mbbl/d in 2007, should grow by 6% between 2007 and 2013 to reach 91.3 Mbbl/d (Figure 8). The market is likely to become tight again at the end of this period, even if a slower rate of increase in demand relieves pressure in the short term.

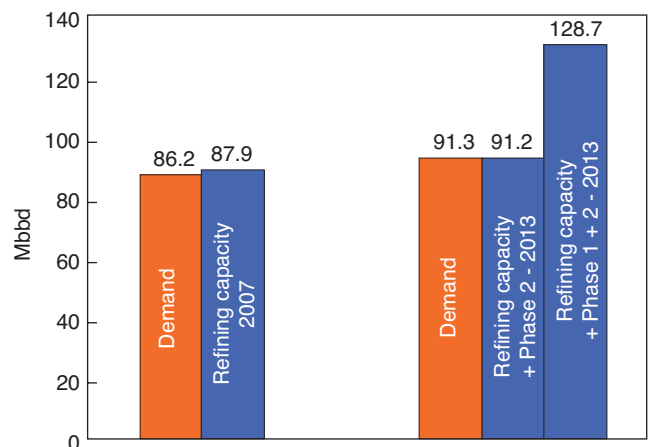
Investment included conversion and hydrodesulfurization projects (catalytic cracking, hydrocracking, viscosity

Fig. 7 - New refineries and extension projects to expand distillation capacity by region - Phase 2: design, engineering or construction



Source: IFP

Fig. 8 - Incremental demand and projects between 2007 and 2013 - New refineries and extensions, by development phase



Sources: IFP, IEA Mid Term Review, December 2008

breaking/thermal cracking and coking) to cover the upswing in demand¹.

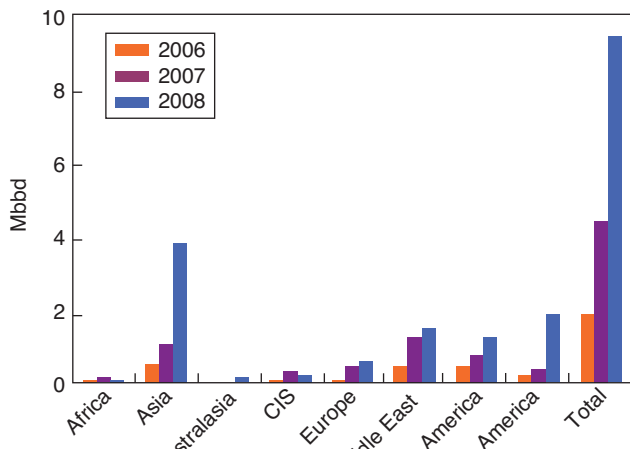
Here, refiners made a very substantial effort. Like 2007, the first part of 2008 was characterized by a proliferation of conversion projects (Figure 9).

In 2008, all Phase 2 projects together represented 9.4 Mbbl/d of additional conversion capacity. The biggest known conversion projects in 2008 were in Asia (planned capacity: 4.0 Mbbl/d or 42%), the Middle East (2.0 Mbbl/d or 22%) and North America (1.3 Mbbl/d or 14%). These three regions account for 78% of conversion projects worldwide with 7.3 Mbbl/d.

[1] The generalization of specifications imposing a reduction of the sulfur content to 10 ppm combined with the growing ratio of diesel to gasoline demand will mechanically impose an increase in the number of gasoil hydrocracking units.

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Fig. 9 - Conversion projects by region - Phase 2: design, engineering or construction



Source: IFP

Hydrocracker projects represented a large proportion (nearly 40%) of investment in this category, followed by coking units (35%) and catalytic crackers (25%).

In conclusion

New developments in distillation and conversion projects reveal a mainstream trend: investment is shifting away from the areas that have historically been the most active, the OECD countries, towards the emerging countries of Asia and the Middle East, in line with the trend in oil demand.

Looking exclusively at Phase 2 projects (*i.e.* in the design, engineering or construction phase), 2008 showed that more effort was devoted to the implementation of conversion projects. In contrast, the effort to expand distillation capacity seemed to be insufficient

and was even slowing. These Phase 2 projects would simply postpone the emergence of new tensions between supply and demand until 2013.

Despite a growing need for spending to boost capacity and cover demand, planned investment in new refining and conversion capacity will see a net slowdown in 2009 due to the severe deterioration of the economic conjuncture. Demand and margins are not headed in the right direction. The profitability of refining operations is not certain. Moreover, the smaller and more vulnerable companies will certainly be affected by the credit crunch. In other words, not only are business prospects gloomy, but finding sources of financing will become problematical.

By way of an illustration, it was recently announced that the award of construction tenders for the Jubail refinery and petrochemicals project (400,000 bbl/d), a joint venture formed by Total and Saudi Aramco, will be delayed by at least three months. It was noted that conditions had changed and that recent events—the financial and economic crisis and its impact on the oil market—had to be taken into account. This announcement followed a decision by ConocoPhillips and Saudi Aramco to delay the bidding process for construction of a joint venture refinery at Yanbu (400,000 bbl/d) by several months, because of the uncertainty on the financial market. The chairman and chief executive officer of the US oil major remained optimistic: “We believe that this short delay will allow the markets to adjust from the current uncertainties and provide a stronger basis for the long-term success of the refinery.” One can only hope that the delay will indeed be short.

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