Refining: Adjusting to a changing business environment

During the latter half of 2008, the sharp deterioration in the economic situation translated into a decline in world oil demand and, after a certain time lag, a collapse in refining margins. In 2009, this downtrend continued and was aggravated by the emergence of large amounts of surplus capacity. For one thing, the investment programs undertaken in recent years to cover growing demand for petroleum products cannot be discontinued in an abrupt manner. For another, the growth rate in 2009 was obviously flagging and inertia was strong, contributing to the accumulation of excess capacity. In the OECD countries, the current slump is expected to persist. In the medium term, a reorganization of the sector is anticipated, especially in Europe and in the United States: refining capacity will be scaled back and more stringent refinery emissions standards (SO_2, CO_2 quota) and fuel specifications (sulfur content in bunker fuels) will be enforced. Projects will gravitate even more towards the regions of high-growth demand: the bulk of new capacity will be located in Asia.

Excess capacity and regional disparities

The year 2008 brought a sharp downturn due to the economic crisis. Demand underwent a severe contraction in the second half year and refining overcapacity surged. Trends were mixed at regional level.

In the United States, a steep drop in demand resulted in a decrease in the refining capacity deficit (Figure 1), which fell by 6% in one year. Gasoline and residual fuel oil were down significantly although the consumption of distillates showed better resistance. This trend had an immediate impact on gasoline imports from Europe, which plunged by nearly 70% compared to the 2007 level. Falling demand led to a significant drop in refinery utilization rates.

In the Asia-Pacific zone, demand stabilized as refining capacity rose, although more slowly than in previous years. Overall, the situation tended towards a capacity-demand equilibrium despite the persistence of a slight deficit. China and India, the regional heavyweights, reported strong growth in demand for 2008. China ran a deficit of refining capacity while India presented a slight surplus.

In Europe, demand and refining capacity remained relatively stable. The decrease in demand for naphtha, gasoline and residual fuel oil was offset by an increase in diesel consumption. Under these circumstances, refining capacity remained unchanged, in the vicinity of 14.7 Mbbld (million barrels per day). The refining industry in Europe found itself facing a major challenge: it needed to manage a growing gasoline surplus while having to cover steadily rising demand for middle distillates, despite the fact that the European refining industry is structured to run a deficit for diesel and a surplus for gasoline. It is likely that, over the long term, demand for gasoline in the United States, long an outlet for European gasoline, will find itself at a lower level than in the past[1] or perhaps

(1) *In 2007, the US Energy Independence and Security Act approved an increase in the use of gasolines of non-fossil origin and stressed the need to substantially improve motor fleet efficiency. New emissions standards will also be implemented by the Obama administration*

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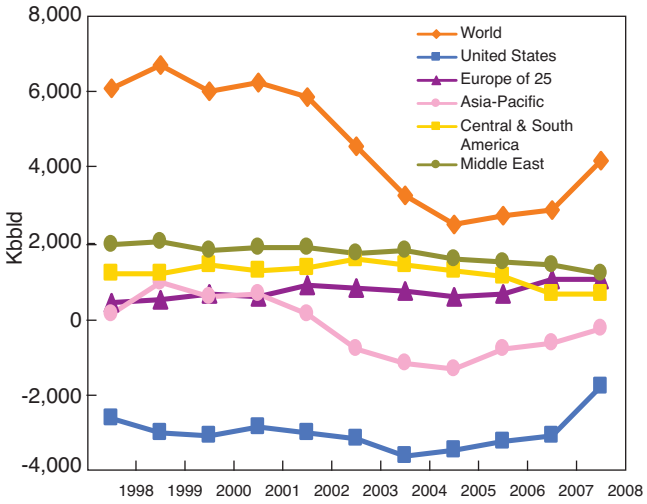
Fig. 1 - Gap between refining capacity and demand for products



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

vanish altogether. It will be necessary to find new markets for the surplus or reduce output. On the other hand, demand for diesel will remain strong in future. Refiners will have to decide whether to boost imports – from Russia or the Middle East – or invest (e.g. in hydrocracking units).

In the Middle East, the last decade has seen steady erosion of the capability of refining capacity to cover demand. Capacity grew significantly between 2000 and 2008, but demand progressed twice as fast. In the past year, the situation deteriorated significantly due to a hike in demand (+6%) at a time when new capacity came onstream more slowly (+1%).

Generally speaking, the situation seemed to be improving in 2008 as a result of contrasting trends: world oil demand saw a year-on-year decrease (–0.5%) whereas, on the supply side, refining capacity was still being added (+0.9%).

Since last year – to be precise, since the latter half of 2008 – a situation of excess capacity has once again emerged. This has translated into lower refinery utilization rates, higher oil stock levels and (after a time lag) deterioration in margins.

For 2009, the IEA predicts that world demand will shrink by a further 2.0%, or 1.7 Mbbld (IEA-OMR, Oct. 09), especially in the OECD countries. The global economic slowdown has aggravated the general downturn in petroleum product consumption, in spite of the vigor of Chinese demand (+5.1%). The investments undertaken in recent years by refiners, encouraged by the good bottom-line figures obtained in the sector, accelerated the accumulation of new capacity.

The trends observed in second-half 2008 were even more pronounced in 2009:

- the refinery utilization rate was down in every geographic region. The world average stood at 84.5% in Q12009 versus 87% in 2008,
- the stocks of crude and petroleum products rose to record highs,
- refining margins collapsed, especially in the second half of the year, under the weight of high inventory levels and uncertainties about economic recovery.

A deterioration of refining margins

Generally speaking, refining margins reflect the nature of the equilibrium between supply and demand. The last few years have been marked by high levels of tension between supply and demand, leading to a significant increase in margins. Since last year – since mid-2008, to be precise – margins have been falling, only to collapse and hit rock bottom in 2009 (Table 1).

Table 1

Complex refining margins (annual average in $/bbl)

	2004	2005	2006	2007	2008	2009 (e)**
Brent Cracking (NW Europe)	3.77	4.98	4.04	5.09	4.90	1.52
LLS* Cracking (Gulf Coast, US)	1.69	5.37	5.21	4.83	2.18	0.31
Dubai Hydrocracking (Singapore)	3.74	3.96	2.19	3.47	3.06	– 0.96

* Light Louisiana Sweet ** Average for the first nine months of the year

Source: Oil Market Report (IEA) and IFP

The curves for the average annual refining margins illustrate this tendency (Figure 2). Margins were down by 66% on the European market (those for Brent Cracking fell from $4.90/bbl in 2008 to $1.52/bbl after Q32009) and by 75% on the U.S. market (for LLS Cracking, they dropped from $2.18/bbl to 0.31/bbl). On the Asian market, refining margins plunged even farther (those for Dubai Hydrocracking declined to –$0.96/bbl from $3.06/bbl), posting negative averages for the first nine months of 2009.

Until 2008, demand for distillates – diesel and jet fuel – had been accelerating, which enhanced their value significantly compared to other products. This led to a large diesel-crude crack spread and helped keep margins up. Starting in the second half of 2008, the spot crack spread fell sharply for middle and light distillates, causing margins to collapse, a trend that still persists today.

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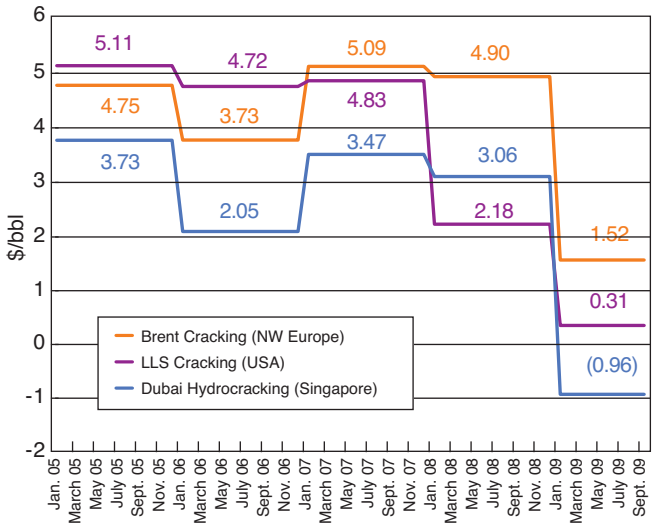
Fig. 2 - Variations in monthly and annual complex refining margins



Source: Oil Market Report (IEA) and IFP

Demand is expected to remain sluggish in the short and medium term and new refineries will be coming onstream. The resulting "cushion" of excess capacity will not allow margins to recover any time soon.

Net income is still down

In 2008, the world economic crisis had a heavy impact on the financial performance of refining divisions at oil companies. Following the decrease in oil demand and refining margins, corporate financial statements – already adversely affected in 2007 – continued to deteriorate. In 2008, most of the oil companies based in Europe and the United States saw a year-on-year decline in net income. Only Total, BP and ENI posted a positive bottom line (Table 2). The latter two were merely "catching up" after reporting negative figures the previous year, returning close to their 2006 level. Total reported positive net income that was not as high as in 2008, but did not see an abrupt drop-off in business, unlike its competitors in 2007. In contrast, Repsol-YPF, RDShell, Conoco-Phillips and two U.S. refining specialists – Tesoro and Valero – posted net income that was down substantially over the previous year. Chevron did fairly well in 2008, with only a slight year-on-year decrease. All in all, the rise in margins during the fourth quarter of 2008 did not suffice to recoup the losses accumulated over the year, but probably avoided greater losses.

Overall, net income for first half 2009 (Figure 3) had deteriorated compared to the same period of 2008, down by an aggregate of 44% for the companies considered. The companies in the U.S. all saw decreases: Valero

Table 2

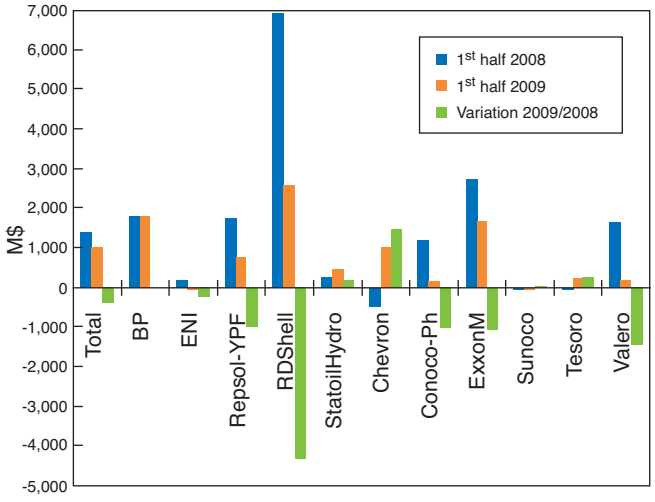
Net corporate income
in the refining-distribution sector (millions of $)

	Difference in $M 1st half 09 and 1st half 08	2008	2007	Variations as a % 2008/07
Total	–387 (–28%)	3,780	3,475	8,8
BP	–18 (–1%)	4,176	2,621	59,3
ENI	–236 (–124%)	750	437	71,6
Repsol-YPF	–974 (–56%)	1,635	3,021	–45,9
Shell	–4,347 (–63%)	446	10,439	–95,7
Statoil	191 (77%)	458	504	–9,1
Chevron-Texaco	1,466 (ns)	3,429	3,502	–2,1
Conoco-Phillips	–1,031 (–87%)	2,322	5,923	–60,8
ExxonMobil	–1,079 (–40%)	8,151	9,573	–14,9
Sunoco	21 (ns)	716	841	–14,9
Tesoro	256 (ns)	673	1,180	–43,0
Valero	–1,440 (–88%)	1,166	7,604	–84,7

Source: Annual reports and BIP

(–88%), Conoco-Phillips (–87%) and ExxonMobil (–40%). The same held true in Europe: ENI (–124%), RDShell (–63%), Repsol-YPF (–56%) and Total (–28%). Among the other U.S. companies, Sunoco reported a slight improvement but remained in the red whereas Tesoro and especially Chevron were back in the black after posting negative figures for first half 2008. ENI was the only European company to report negative net income for first half 2009.

Fig. 3 - Net corporate income in the refining-distribution sector, 1st half 08/1st half 09



Source: IFP

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Between first half 2008 and first half 2009, the financial statements of European companies generally deteriorated more (–47%) than those of U.S. companies. However, one should not forget that the deficit reported by RDShell alone accounted for 75% of the European deficit and that the Anglo-Dutch oil major announced a restructuring plan at the end of May.

Sinopec and Petrochina

The situation in which the largest Chinese refining companies find themselves is very different than that of U.S. and European firms. Sinopec (Asia's leading refiner) and Petrochina (China's Number Two refiner) have seen their financial performance improve significantly. One reason is that the mechanism used to set product prices on the local market has been changed to more accurately reflect the state of the market. Sinopec reported net profits for second half 2009 that were four times higher than for the same period of 2008. They totaled 33 billion yuans (3.5 billion euros), an increase of 330%. Petrochina posted operating profits of 17.2 billion yuans for its refining branch, compared to a loss of 59 billion yuans one year earlier. In 2009, Petrochina strengthened its position in the downstream sector of the oil industry by acquiring assets worth $1.6 billion. Its refining capacity is expected to grow by more than 65% to nearly 200 million tons a year by 2017.

Moreover, the decrease in the value of the American dollar provides an additional incentive for Chinese companies to step up the pace of their acquisitions abroad.

The appearance of surplus capacity, due to the drop in sales volume in the United States and Europe, adversely affected corporate bottom lines. On the U.S. market, the refiner Tesoro reported an average decline of 8.5% in the volumes of crude that it processed in first half 2009 while its sales of petroleum products fell by nearly 10%. In Europe, the situation of RDShell was typical: the volumes of crude processed were down on average by 12% and sales by 9% for first half 2009. The volumes processed by Total in the second half-year dropped by 5%. The French oil company is "planning to close some of its European refining units temporarily to absorb the excess refinery output on the market," declared P. de la Chevardières[2]. The company also expects the refinery utilization rates to fall.

Spending slowed in the refining sector

In 2008, operators continued to invest at a sustained rate in a business environment that was unfavorable, particularly in the second half-year. Capital expenditure rose by nearly 9%, slightly less than in the previous fiscal year (Table 3). However, refining capacity only went up 1% during the period.

The onset of the crisis did not show up clearly in the values reported at year-end. The inertia of investment programs already underway preserved spending from a contraction in 2008.

Forecasts for 2009 predict a significant slowdown in activity in direct response to the impact of the economic crisis. Aggregate spending will not rise by more than 3% versus 8.6% in 2008.

Tableau 3

World spending by the refining industry (G$)

	2006	2007	2008	2009 (e)
Investment	17.5	21.0	23.5	24.0
Maintenance*	20.6	21.7	23.2	24.6
Catalysts and chemicals	14.0	14.1	15.0	15.0
Total	52.1	56.8	61.7	63.6

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

Source: IFP based on HPI Market Data ; (e) estimates

Capital spending grew more slowly in 2009 (+2%). Even in the more dynamic parts of the world such as the Asia-Pacific region, world refining capacity registered a slowdown.

Maintenance spending remained relatively stable at +6.0%, compared to +6.9% for the previous year. Refiners maintained spending on maintenance, waiting for the economy to recover. One should recall that, by relieving bottlenecks, maintenance boosts production capacity by about 2%/year.

Spending on catalysts and chemicals, which is proportional to the amount of processing done at the refinery, remained status quo, which is indicative of the business slowdown. The stiffer marine fuel standards introduced by the International Maritime Organization (IMO) at the end of 2008 call for investments in this area.

Looking at 2010, we estimate that total spending will stabilize in the vicinity of $60 billion (Figure 4). Capital expenditure is expected to fall, due to continued low margins. Spending on maintenance will probably continue to rise in order to keep refining infrastructure in working order for the duration of the crisis. Spending on chemicals and catalysts is expected to remain stable pending refiners' reaction to the tougher standards.

(2) *Chief Financial Officer (Group) in the Bulletin de l'Industrie Pétrolière August 3, 2009*

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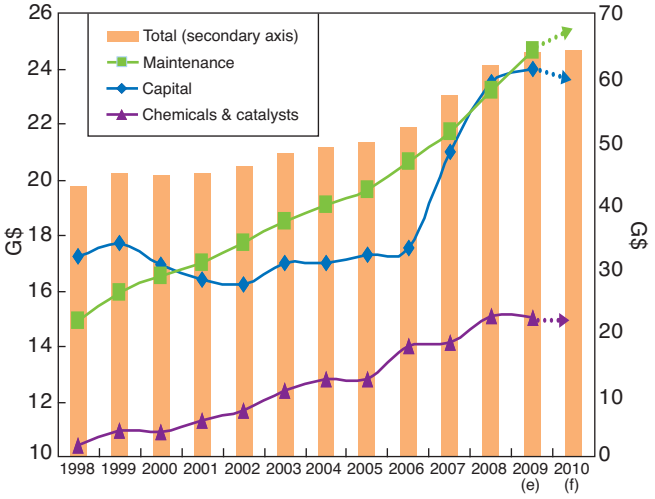
Fig. 4 - Spending in the world refining sector



Source: IFP based on HPI Market Data; (e) estimates; (f) forecast

Stiffer marine fuel standards

The biggest change for the refining industry, especially in Europe, is probably the potential impact of the amendment to Annex VI on the future quality of bunker fuel. The amendment could have a considerable impact and pose major challenges for the refining industry.

Reducing the sulfur content of any fuel oil used on board ships to 3.5% outside the ECAs[3] – or to 1% within an ECA – is not very likely to create problems for refiners: blends can be changed in such a way as to redistribute high-sulfur components.

On the other hand, the 0.1% limit (ECA) and 0.5% limit (outside ECAs) present a real challenge for the refining industry. They will lead to the emergence of potential requirements for the conversion of bunker fuel to diesel towards the end of the period during which constraints will be implemented (2020-2025)[4]. The baseline scenario of an IFP project entitled "*Raffinage 2030: Quels procédés pour quels carburants?*" ("Refining 2030: Which processes should be used to produce which motor fuels?") anticipates that total demand for LSFO bunker fuels (0.1%S + 0.5%S) will reach 280 Mt by 2030.

The changes expected in the SECAs[5] may encourage middle distillates to shift to bunker fuels by about 2015, which will tend to aggravate the European deficit for these products. To produce bunker fuels of better quality, it will be necessary to invest in desulfurization or conversion programs; the costs entailed will be a major constraint in meeting the new standards. This trend constitutes a key challenge that refiners will have to meet in the years to come.

(3) *ECA: Emission Control Areas*
(4) *Regarding the conversion of bunker fuels to diesel, Wood Mackenzie estimates the requirement to be about 200 Mt. It would take 80 large upgrading projects to cover this trend in demand*
(5) *SECA: Sulphur Emission Control Area*

New investments shifting to Asia

A distinction should be made between two types of project announced in the refining sector. "Probable" projects have a high likelihood of being carried out whereas "possible" projects tend to be announced for the effect and are less likely to be carried out[6].

Distillation capacity

If we only look at probable projects, the new distillation capacity in the world amounted to 9.5 Mbbld in 2009, up 9% over 2008 (Figure 5). The trend varied from region to region. Projects were down in the Atlantic Basin and the Middle East in 2009 compared to 2008 (–7% and –18%, respectively) but grew substantially in the Asia-Pacific region (+33%) to represent more than half of additional capacity. Demand in the latter region drove the expansion of distillation projects worldwide.

Owing to the crisis, many projects have been postponed to a later date pending a rally in demand. For instance, the Yanbu refinery project (Conoco-Phillips) and the Jubail project (Total) – both in Saudi Arabia and estimated at 400,000 bbld – have been put off to 2014 and 2013, respectively. Recent announcements seem to indicate that the refinery sector may go through another round of restructuring. For instance, RDShell is selling several refineries in Europe and Western Refining, an independent company, is closing one of the two refineries that it operates in the state of New Mexico (United States).

Three-quarters of all new refineries are located in Asia. Most are in three countries: India, where projects represent 1.2 Mbbld of distillation capacity, followed by China (1.0 Mbbld) and Vietnam (0.5 Mbbld of additional capacity).

Conversion capacity

Considering "probable" projects exclusively, new conversion capacity stood at 17.1 Mbbld worldwide in August 2009, comparable to 2008 (Figure 6). In other words, projects of this type had stabilized. However, the year-on-year trend varied considerably by geographic region. The Middle East had to face a serious slowdown in conversion projects, which were down by more than 30% in one year: capacity fell from 3.4 Mbbld in 2008 to 2.4 Mbbld in 2009. In the United States, many projects were postponed. For instance, Valero suspended plans for two hydrocrackers

(6) *Projects known in August 2009*

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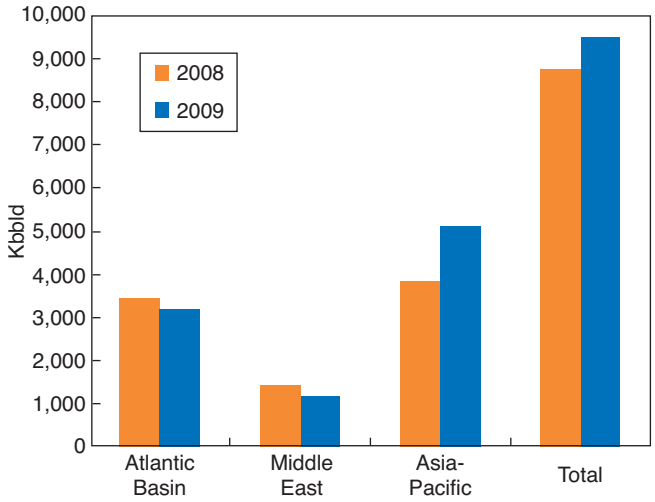
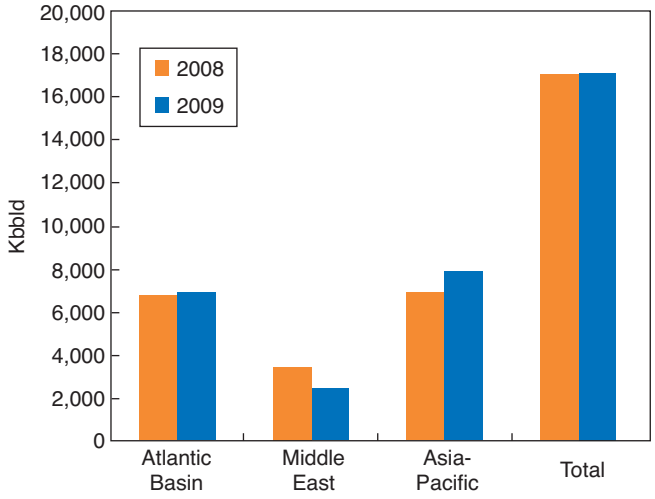
Fig. 5 - Refining projects - Distillation capacity



Source: IFP based on data from KBC

Fig. 6 - Refining projects – Conversion capacity



Source: IFP based on data from KBC

for its Saint Charles and Port Arthur refineries. At the same time, the Asia-Pacific region grew 15% during the same period, becoming world leader for investments in new conversion capacity with 45% of known new conversion capacity. The Middle East and North America trailed behind, with 14% and 13%, respectively.

Medium-term incremental distillation capacity and demand

Based on the situation observed in 2009, additional refining capacity should exceed the expected level of demand, which is expected to recover gradually. Overcapacity should expand, especially on the North American and European markets. The low level of refinery utilization rates in 2009 (and probably 2010 as well) is an indicator of a surplus. Refineries and production units may have to close, starting with those that are least profitable and most obsolete, not to mention those that are small, do not produce what the market wants and/or would cost a great deal to revamp. A good example is RDShell, which plans to concentrate more on its huge refining complexes (e.g. those in Port Arthur, Texas and Amsterdam) and less on small, isolated units like Stanlow.

The observed slowdown in projects – hence the addition of new capacity – ought to favor the recovery of margins. But, according to current forecasts, the growth rate for projects will remain higher than that of medium-term demand. This does not include "possible" projects which, if carried out, would further increase surplus capacity.

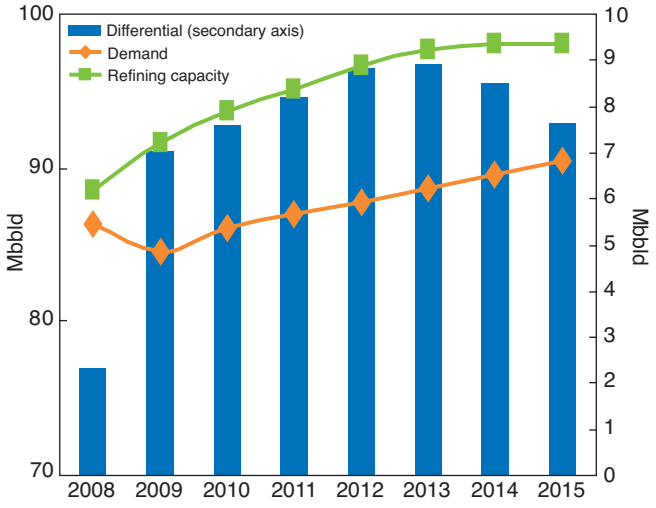
In the medium term, world refining capacity – to which probable projects must be added – should continue to easily exceed world demand (Figure 7).

High-demand regions are attracting more and more new refining projects intended to add distillation and conversion capacity. Market watchers are seeing confirmation of the mainstream trend noted last year: investments are shifting away from the OECD countries, historically the most active, towards the new emerging countries, mostly those in Asia. Despite the challenges posed by climate change issues, such as announced intentions of eventually making the transport sector less dependent on oil, including in the emerging countries, this trend should persist in the years to come.

Overall, it will remain imperative to invest in response to:

- the stiffening of quality specifications for petroleum products, especially those pertaining to their sulfur

Fig. 7 - Medium-term refining capacity and demand trends (2009)



Source: IFP based on data from KBC and the IEA

content. The regulatory trend with respect to marine (bunker) fuels may accelerate the implementation of deep conversion refining units,

- structural trends in demand, among them the respective market shares of diesel and (surplus) gasoline in Europe as well as durably lower demand in some geographic regions, to which refining capacity must adjust. The very high cost of hydrocracking units – needed to cope with the increasing percentage of diesel vehicles in the fleet, especially in Europe – will continue to inhibit their growth, especially in a market where low margins penalize investment,
- the trend in regulations weighing on refineries. The regulations being implemented, especially in Europe, call for reducing the current mandatory levels for local emissions (e.g. SO_2, NOx, PM and CO) and global emissions (CO_2 for the most part, via quota allocation plans and the ETS Directive[7]). As a result, emission reduction techniques or CCS[8] technologies will have to be deployed on a larger scale, which will act as a drag on investments.

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Final draft submitted in November 2009

A full report on this subject (in French) may be downloaded from:
http://www.ifp.fr/information-publications/etudes-disponibles

(7) Emission Trading Scheme
(8) Carbon Capture and Storage