Investments

in

exploration/production

and

refining

2015

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SUMMARY TABLE OF INVESTMENTS AND MARKETS: (2014 and 2015)

$billion	2014	2015
Global Investments in E&P	**683**	**539**
North America	194	125
Latin America	95	87
Europe	65	44
CIS	54	43
Africa	69	54
Middle East	59	61
Asia-Pacific	148	125
Upstream markets analyzed	**358**	**268**
Geophysical market	14	11
Drilling market (*)	277	202
including:		
Drilling on land	*34*	*24*
Drilling offshore	*62*	*55*
Offshore construction market	67	55
Investment in refining	**82**	**94**
Investment spending	29	32
Maintenance spending	34	39
Spending on catalysts and chemical products	19	23

(*) Including equipment and services for wells

Sources:
- Upstream oil sector, IFPEN from
  - global investments: Barclay's, DTI, NPD, DEA, IFP and figures published by various companies and countries, IFPEN forecasts.
  - geophysical market: IHS Energy, First Break, Spears & Associates, IFPEN.
  - drilling market: Baker Hughes, IHS energy, Offshore Rig Locator, Spears & Associates, IFPEN.
  - offshore construction market: IHS Energy, First Break, Spears & Associates, IFPEN.
- Downstream oil sector: IFPEN based on HPI Market Data, IFPEN forecasts

1. Changes in oil and gas prices

1.1. Emerging countries and the geopolitical situation, sources of concern

As in 2015, it appears that in 2016 numerous challenges will have to be confronted and managed - economic, financial, monetary and, naturally, geopolitical ones. The "Brexit", tensions between Russia and its neighbors, between China and the countries on the South China Sea, chronic instability in North Africa and the Middle East: these are among the issues likely to be in the news during 2016 and to influence the energy markets.

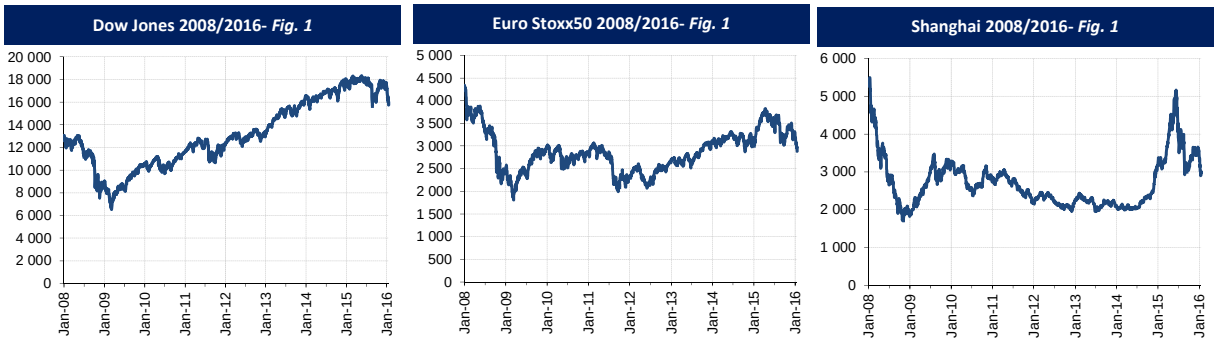
In 2015, economic growth stood at 3.1%, lower than at any time since 2012 (3.3/3.4%) and also lower than the 10-year trends (3.8%). This was the result of the relatively modest growth of the emerging countries (4% compared with 6% over ten years), although western countries' growth rate exceeded the 10-year average (1.9% compared to 1.5%).

Institutions such as the IMF and the World Bank are downbeat about 2016 (3.4% global growth), both highlighting a difficult climate for emerging and developing countries, which now account for over 50% of global GDP. This will certainly produce major volatility in the financial and monetary markets, in a continuation of the situation we have observed since the destabilization of the markets following the crisis in 2008.

If we consider the financial markets with a long-term perspective, there are some interesting trends in the offing for the United States, Europe and China:

- The halt in the growth of the Dow Jones in the United States (-2.3% in 2015) following multiplication by a factor of three since March 2009, which marked the beginning of the recovery plans after the subprime crisis.
- The sharp rise in the European index (Euro Stoxx50), which rose 4% in 2015 and has risen 61% since September 2011, dates from a low point when there were serious uncertainties related to the management of debts in Europe, including the Greek debt. However, it is still lower than at the beginning of 2008.
- The extreme, even irrational, volatility of the Shanghai market - increasing by 150% in one year then falling 40% between June and August 2015.

Figure 1: Changes since 2008 in the three financial indices: US, European and Chinese



Several ideas spring to mind: the possible end of a promising economic cycle in the United States, strengthened by a (poorly-timed) increase in interest rates; an anticipated economic recovery in Europe - but within the context of fragility requiring action by the European Central Bank; extreme uncertainty regarding the solidity of the Chinese economy, with the prospect of a brutal adjustment that goes beyond a simple and inexorable fall in the growth rate[1]. At the beginning of 2016, these

[1] Past rates of over +10% per annum, often quoted as the Chinese benchmark, are obviously not sustainable.

uncertainties in China shocked all the financial centers (falls of 8% to 10% on 21 January). The drop in the oil price (-28% on 21 January 2016) is contributing to this destabilization. The return to a lasting cost-effective price is becoming a necessity in order to exit this downward spiral.

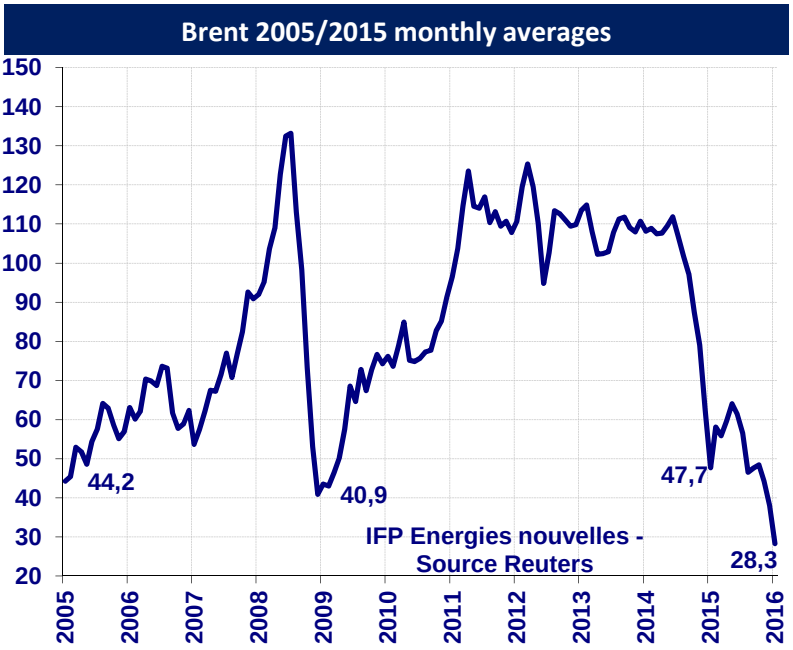
Beyond these short-term uncertainties, the issue of the energy transition could in the future create a blueprint for the energy sector. The agreement signed at the COP21 is regarded as historic and spells out a desire to break with past patterns. This change will not occur without difficulty but, in any case, the energy world, especially the hydrocarbons sector, must adapt to this new order.

1.2. Low oil price - but when will it end?

In 2015, the price of Brent stood at $52/barrel, down nearly 47% compared to 2014 ($99/barrel). The very perturbed geopolitical situation had little influence, apart from the concerns at the start of the year (26 March) following the armed intervention in Yemen by Saudi Arabia and its allies.

Overall, the excess of supply determined the price, which fell to below $50 after August, falling to $38 in December and to below $30 at the start of 2016. The continuation of OPEC's policy to defend its market share and the slight decrease in US production are the reasons for this downward price pressure. Based on future markets, since August 2015 the expected price for 2016 has fluctuated between $30 and $60/b.

Figure 2: Average monthly price of Brent in $/barrel between 2005 and January 2016



The main factors influencing the price will be: the level of global growth, which, according to the IMF, will possibly be "disappointing and uneven"; Iranian exports, likely to increase by about 0.5 Mb/d in the short term; the drop in US production caused by the decrease in drilling activity and, globally, the more gradual effects of the drop in upstream investments on production capacities; the change or otherwise in OPEC policy, which has been in effect since 2014; and the influence on production of growing regional tensions in the Middle East.

Solely based on the balance of supply and demand, we foresee that the market may re-balance itself at the end of 2016; this could result in a gradual upturn in price. In terms of general trends, we foresee two possible scenarios:

- The first scenario depends on the ability of OPEC and LTOs (Light Tight Oil) to address growth in future demand. If this occurs, the ceiling price will be defined by the maximum cost of mobilized LTOs and could, therefore, be at very modest levels of $30 or 60/b.
- In the second scenario, if supply is insufficient at low cost, reliance on more costly oils would ensue. This would result from sustained global demand, a change in OPEC strategy or a limited supply due to geopolitical reasons. The consequences of the current pullback in upstream investment could also result in such tensions.

Beyond these two major directions, upward volatility in the event of a significant shortage (as in 2008) or a decline in surplus (as in 2015) could shake up these two trajectories.

1.3. Fall in the price of gas on the three major markets

1.3.1. Gas price in Europe (based on the British NBP benchmark)

The benchmark spot price, the British market NBP, reached €20/MWh in 2015, down by 5% from 2014 - a background trend which started at the beginning of 2013 (€27/MWh), before the drop in the oil price from mid-2014. In dollar terms, this price stands at $6.5/MBtu, a 21% fall, due to the weakness of the euro (-16% in 2015).

2015 was notable in the United Kingdom for the renewed competitiveness of gas compared to coal - the price of which is falling significantly by 25% in $/t and 9% in €/t. This change is partly due to the increase in the “Carbon Tax Support”, which has been fixed since April 2015 at £18/ tCO2 (€25/tCO2) as against £9.5/tCO2 in 2014. This mechanism has also had the effect of supporting the price of electricity, which ensures the profitability of gas power plants. This is not the case in the rest of Europe, where the price of CO2, regulated only by the quotas market, is still low, at a 2015 average of €8/tCO2.

At the beginning of January, futures markets are capitalizing on a NBP price which is once again falling in 2016, estimated at about €15/MWh, or $4.7/MBtu - close to the prevailing conditions in 2009/2010. It is possible that it will rise towards the market equivalent price with coal of €18/MWh ($5.7/MBtu) and may exceed that price should there be tensions in the market (harsh winter, etc.).

Regarding the continent’s long-term contracts, each year they are coming closer to conditions prevailing on the spot markets. So, in France, the CRE (Commission de Régulation de l’Energie) considered since July 2015 a 77% share for spot prices to determine the supply costs. They are, therefore, increasingly correlated with spot prices.

1.3.2. Gas price in the United States (benchmark: the “Henry Hub’)

The Henry Hub price reached $2.6/MBtu in 2015, down by nearly 40% in one year. This is a historically low price, lower even than the 2012 minimum ($2.8/MBtu). This downward pressure reflects the continued rise in US production, estimated at 775 Gm3 (74.9 Bcfd) in 2015, i.e. 6% more than in 2014.

This increase has been spectacular, over 170 Gm3 in five years, the equivalent of the entire production of Canada and an increase of 260 Gm3 over ten years - almost half of Russia’s output (580 Gm3). For 2016, the EIA foresees an increase to 790 Gm3, which would mean independence in gas, whereas the rate of dependence of the country was 14/17% before 2007. The expected average price for 2016 is in line with this context of abundant supply and has fluctuated between $2.2 and $3/MBtu for six months. There is still uncertainty about the effect of the reduction in drilling (54% in one year) on production. One cannot exclude the possibility of lower than expected growth, which could put a slightly pressure on price.

If we assume an average price in 2016 of $2.6/MBtu, as in 2015, the cost of exported LNG would reach $5.0/7.6/MBtu to Asia and $3.7/6.4/MBtu to Europe, regardless of the fixed costs but including

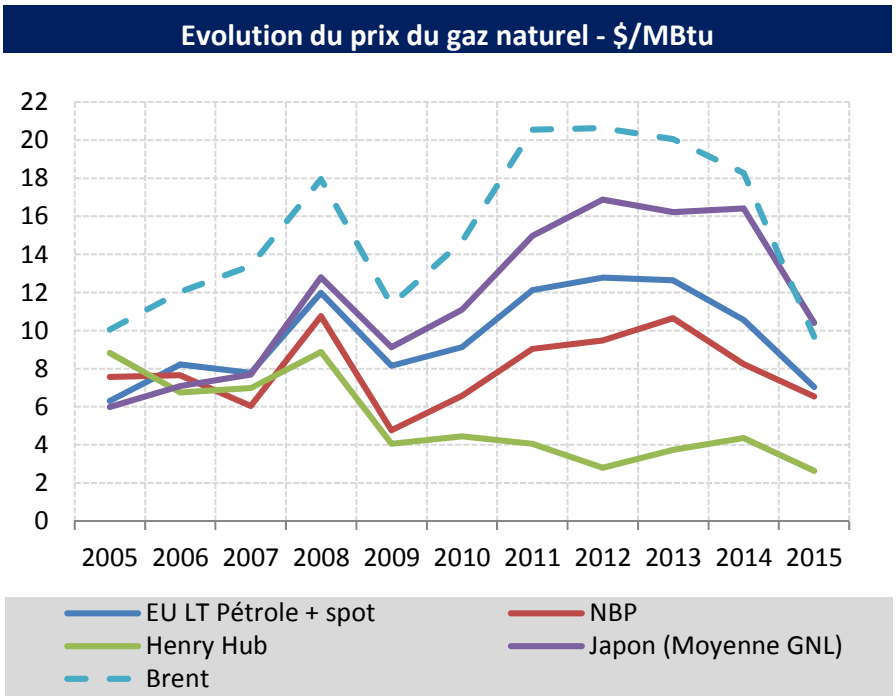
transport costs. These are competitive prices compared to the conditions expected in Asia ($7.2 to $8.6/MBtu) and Europe ($4.8 to $6/MBtu) based on an oil price of $40 to $60/b. The first exports of LNG from the shale gas revolution will begin in 2016. According to the EIA, they could reach 6.7 Gm3 (0.55 Bcfd).

1.3.3. Gas price in Japan (imported LNG)

The average import price of liquefied natural gas (LNG) in Japan dropped sharply in 2015, due to the large proportion of oil-indexed contracts (80%). It benefited from the drop in the oil price. It dropped around 36% from $16/MBtu in 2014 to around $10/MBtu in 2015. The price of spot deliveries has proportionately dropped even more, by 45%, from around $14 to $7.5/MBtu.

Although the crude price remains at $40/b, the import price could fall even further to nearly $7/MBtu - close to the conditions that prevailed in 2006. At $60/b, the average price is $8.6/MBtu. Scenarios involving a recovery of nuclear energy allow us to predict a fall in purchases of LNG, with a range of between 72 and 88 Mt. The low level corresponds to purchases in 2010.

Figure 3: Average monthly price of natural gas by region in $/MBtu between 2005 and 2015



2. Investment in exploration/production: the end of an upward cycle

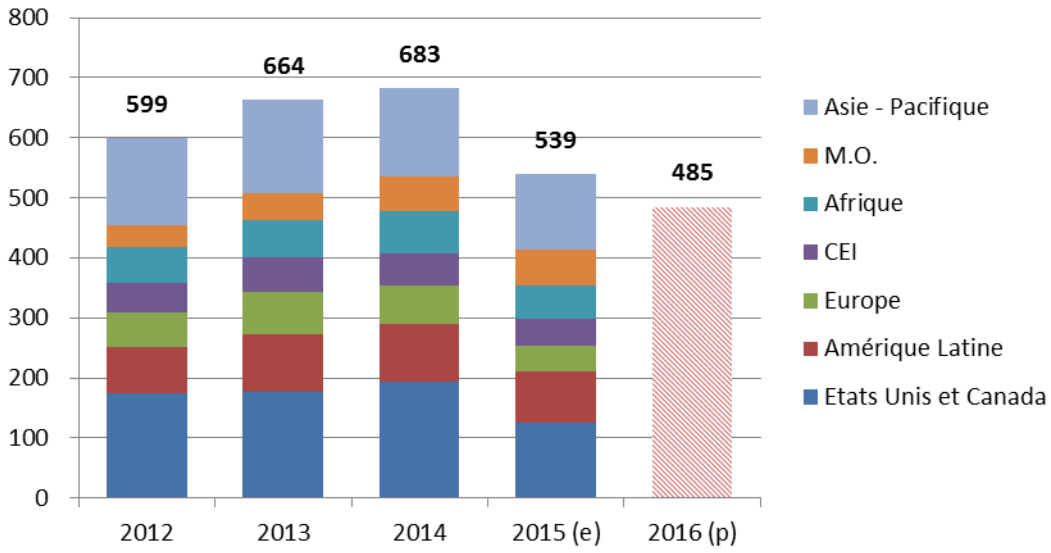
2015 marked a downturn in upstream oil investment trends, which followed an upward cycle that lasted over a decade. Investments in E&P had increased six-fold since 1999, posting uninterrupted growth with the exception of 2010, when investments fell following a sharp drop in oil prices, and in 2002 when they were stagnant. Clearly, the main reason for this downturn is the drop in oil prices since mid-2014, but it should be noted that even at the beginning of last year, many international companies were announcing strategic reorientations, favoring budgetary discipline and profitability over growth. Thus, declining oil prices have simply accelerated and amplified a shift that was already underway. This downward trend is expected to continue during 2016, albeit at a slower pace.

2.1. A sharp decline in investments during 2015

Following a moderate 3% increase in 2014 after four years of strong growth (+60% between 2009 and 2013), investments in exploration/production (E&P) are projected to fall 21% this year to approximately $540 billion, down by more than $140 billion compared with the previous year (fig. 4).

This trend has been especially pronounced for independents, whose budgets fell by 34% compared with 15% for the majors, and only 11% for national companies (NOC). At the regional level, only the Middle East avoided the slump, with investments expected to rise by 3%, supported by NOCs which represent approximately 70% of regional investments. North America and Europe suffered the sharpest declines, with budgets falling by 35% and 33% respectively. The pullback in investment in Africa (-22%) and the CIS countries (-21%) was fairly close to the global average, while Asia-Oceania (¬15%) and particularly Latin America (-8%) posted smaller declines.

Figure 4: Change in global investment in E&P

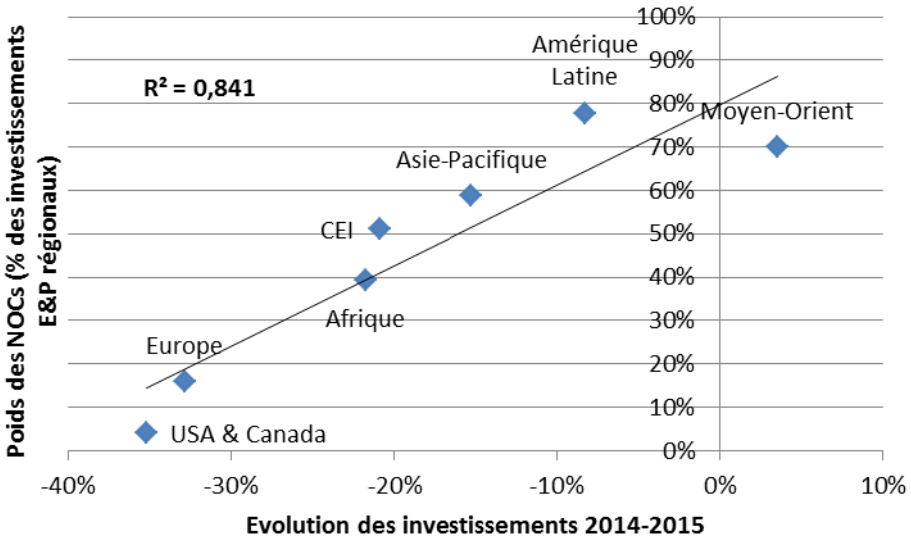


The downward trend should continue in 2016. Early indications by companies currently support the likelihood of further investment budget reductions of around 10%, if there is no significant change in the outlook for price per barrel and oil demand. Note that, even before the price of crude oil fell sharply, a slowdown - or even a decline - in investments was already anticipated in certain regions, particularly Europe and Oceania. Revised figures for 2014 reveal that investments had already started to decline in four regions: Europe (-7 %), the CIS (-7%), Asia-Pacific (-5 %) and Latin America (¬2%).

2.2. Investment trends vary significantly by region

Except for the Middle East, all regions worldwide posted a net decline in investment, with relatively marked regional differences (Fig. 5). Note that there seems to be an inverse relationship between the relative weight of NOC investments and the extent of their decline in a given region. North America and Europe, where NOCs have a small presence (aside from Statoil in Europe), suffered the largest declines, while Latin America and the Middle East - where investments by NOCs represent between 70% and 80% of the total - were less affected. The Middle East even posted moderate growth in E&P expenditures. Declines in other regions, where NOCs represent between 40% and 60% of investment (the worldwide average was 45% in 2015), fell within the middle of the range.

Figure 5: Change in global investment in E&P and influence of NOCs



In North America, investments are taking the full brunt of falling oil prices, which jeopardizes the profitability of deposits. Shale oil and gas are particularly affected due to a shorter investment cycle than conventional oil and gas, since rapid declines in well productivity require ongoing investment to maintain production levels. The number of wells drilled dropped precipitously across the Atlantic this year, falling by nearly 50% in the United States and Canada, illustrating the strong reactivity of North American operators.

In Europe, even before the fall in oil prices, investment was already expected to decline sharply in the North Sea due to a lack of new major projects. Since August 2014, the Norwegian statistics bureau has predicted an 18% decline for investments in Norway in 2015. Thus, the current crisis has merely reinforced this trend, though it should be noted that the fall in value of the krone (NOK) against the dollar accounts for a significant part of the downturn as expressed in USD, -29%, while it is only -10% in NOK. The Norwegian government expects a further 10% decline (in NOK) in 2016. In the United Kingdom, which has experienced a sharp decline this year (-38% in USD, -34% in GBP), and where numerous deposits are not profitable at current prices, the outlook is even more pessimistic (around -30% in GBP predicted in 2016).

Investments in Africa fell by 22% following a sharp 13% rise in 2014 stimulated by successful explorations in sub-Saharan Africa. They could bounce back in Egypt in 2016, following the massive Zohr discovery by ENI last September. But this will not be enough to revive the growth of E&P investments in the region, where the crisis in the oil sector has been heightened by insecurity in a number of countries, especially in North Africa. However, the numerous discoveries made in sub-Saharan Africa (Congo-Brazzaville, Gabon, Senegal, Kenya, Tanzania, Mozambique, etc.) and the development of major projects, specifically in Angola, provide a positive long-term outlook.

In the CIS, investments are expected to drop by 21% this year, following a 7% decline in 2014. They are suffering from declining oil prices, US and European sanctions and falling demand for gas in Gazprom's principal export markets. Gazprom's investments are expected to decline by 22%, including its subsidiary Gazprom Neft, while investments by Rosneft - the other regional giant - are projected to fall by 13%.

There was a 15% decline in the Asia-Pacific region, where NOCs are responsible for approximately 60% of regional investments. The drop is especially significant for Chinese NOCs. Investments by Petrochina, the world's leading investor in 2014 and 2015, are expected to fall by more than $5 billion. CNOOC, which had invested close to $11 billion in the region, is anticipating a 35% reduction in its budget for 2015. The Indian company ONGC is the only NOC whose investments rose during 2015 (+21%), while investments remained stable at its compatriot company, Oil India Limited. Investments by other non-Chinese NOCs also declined: -18% for Petronas, -12% for Pertamina and PetroVietnam, -10% for PTTEP. In Australia, investments were expected to decline, with the development of a number of LNG projects having peaked in 2014.

In Latin America, where the weight of NOCs in E&P investments approaches 80% (including 60% for Petrobras, Pemex and PDVSA combined), the decline was more limited (-8%). Petrobras reduced its 2015-2019 five-year investment plan by 37% compared with the previous plan (2014-2018). However, this did not significantly impact investments for 2015, since they had already retreated by 20% in 2014. The Brazilian company's E&P budget is expected to remain relatively stable this year. PDVSA's investment expenditures are also expected to stabilize, while investments by Pemex should fall by 12%.

The Middle East was the only region to record growth in 2015, estimated at around 3%. The increase was especially marked in Oman (+ 20 %) – where activity has been simulated by development of the Khazzan unconventional gas field and by numerous enhanced oil recovery (EOR) projects - and in Kuwait (+16.5%), where KOC is investing to optimize the Burgan operation - its main asset - and to increase its production capacity. Investments are also increasing in Abu Dhabi and in Qatar, but are stagnant in Saudi Arabia, where Saudi Aramco has slowed the development of new oil projects in response to falling oil prices, while continuing to invest in gas fields to cope with soaring demand. The Iraqi government, faced with budgetary constraints, has asked BP and ExxonMobil to reduce their investments in the Rumaila and West Qurna-1 fields.

2.3. Independents are particularly affected

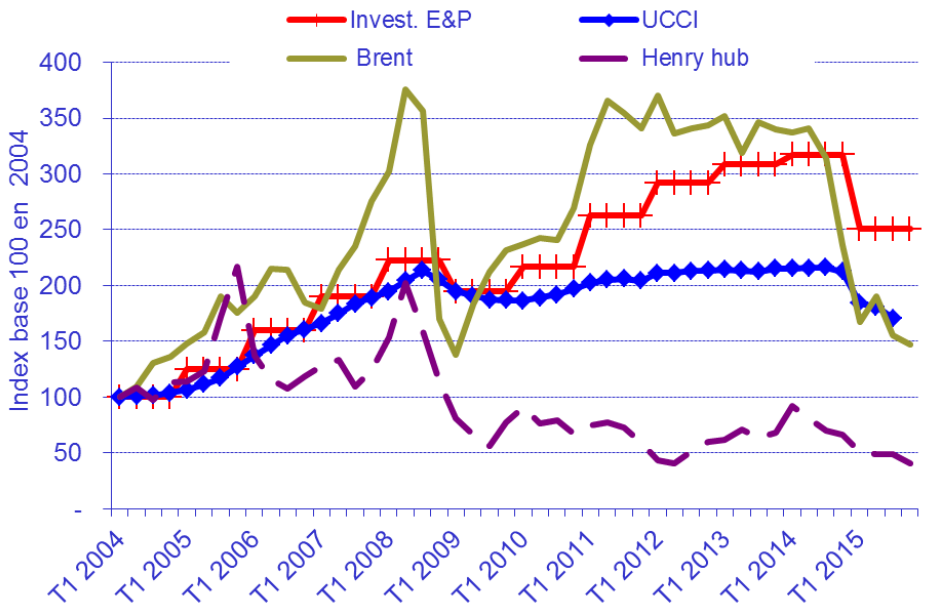
The decline in investment during 2015 has been significantly more pronounced for independents (-34%) – which represent about 1/3 of global investment and which substantially increased their E&P expenditure in 2014 (+11%) – than for other types of players. As with all players, the decline was markedly greater in North America, where investment by independents fell by more than 40% over one year, versus a decline of slightly below 25% in the rest of the world. Investments by majors (some 20% of the world's total) fell by approximately 15% in North America, as in the rest of the world. Shell and ExxonMobil experienced a sharper decline (around 20%), while Total's investments fell by only 6%. Chevron and BP fell within the middle of the group, with a drop of about 15% of their capital expenditure. Lastly, investments by NOCs (around 45% of the worldwide total in 2015) fell 11% compared with 2014, declining in all regions except for the Middle East, where they rose by 5%.

2.4. Sharp drop in investment costs

The IHS-CERA Upstream Capital Costs Index (UCCI Index) fell 20% between the fourth quarter of 2014 and the third quarter of 2015, by far the largest one-year decline ever recorded for the index since it

was created in 2000 (fig. 6). During the 2008-2009 crisis, when Brent lost more than 60% of its value between the second quarter of 2008 and the first quarter of 2009, the UCCI index only fell 13% between its peak in the third quarter of 2008 and its low point during the first quarter of 2010. According to a Wood Mackenzie study published in April 2015, exploration costs could fall by more than 30% in 2015 and 2016. Around two-thirds of savings would be achieved through lower unit costs on a like-for-like basis, while the remaining one-third would come from simplification of processes, improvements in efficiency and the declining dollar.

Figure 6: Change in E&P investment, prices and costs



3. Drilling and the global drilling market, Upstream activities and markets

Following a relatively stable year in 2014 in terms of drilling (+1.6%), in 2015 there has been a sharp decline in activity (-32%). This decline has had a stronger impact on onshore drilling (-32%) than offshore drilling (-14%). The largest decline was in the United States (-50%), with the decrease in onshore drilling for unconventional resources (shale gas and oil).

This reduction in drilling led to a comparable fall in turnover figures. The onshore drilling market fell by 28% in 2015 compared to an 11% fall in offshore drilling. In 2015, the overall market for drilling and associated services stood at around $200 billion compared to $275 billion in 2014.

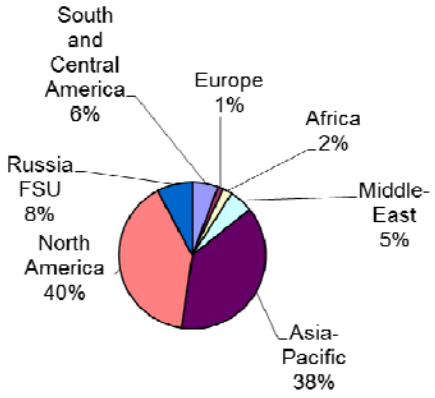
In 2016, without a re-balancing of crude supply and demand, drilling and the drilling market will continue to fall by at least 5% but will not reach the low point of 2009 ($155 billion) that followed the financial economic crisis.

3.1. Onshore and offshore drilling

3.1.1. Number of wells drilled worldwide

Since 2011, the number of wells drilled worldwide both onshore and offshore has exceeded 100,000 each year. In 2014 this figure was 104,000. Following the fall in the per barrel price in 2015, drilling has reduced considerably. The number of new wells per annum has declined by 32% compared to 2014 and now stands at around 71,000. By way of comparison, the low point for drilling in 2009 was 83,000 wells.

Figure 7: Estimated distribution by region of wells drilled onshore and offshore in 2015.



(Sources: IFPEN, Spears & Associates)

North America, where previously over half of global drilling was located, now stands at 40%, due to the very sharp drop in drilling in Canada and the United States (-50%). Almost 29,000 wells at least have been drilled in this region in 2015, especially onshore in unconventional reserves (shale oil and gas).

Compared to 2014, the share of wells drilled in Asia-Pacific has increased by 10% and now stands at 38%. Drilling in Asia-Pacific is still mainly (90%) concentrated in China.

Of the 71,000 new wells drilled in 2015, around 3000 have been drilled offshore, a share of 4%.

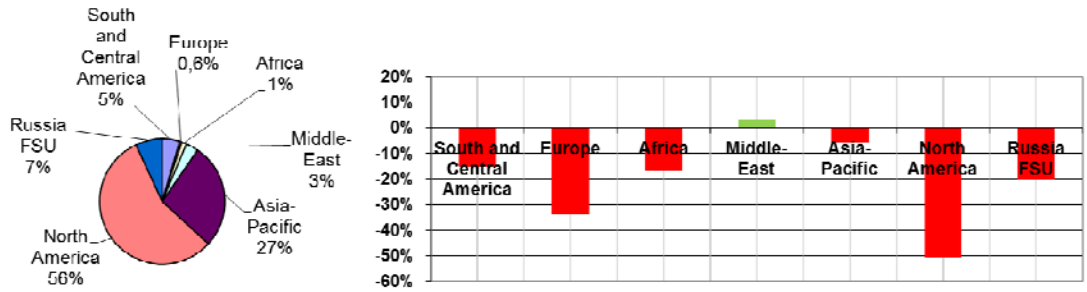
3.1.1.1. Number of onshore wells

In 2014, global onshore drilling remained relatively stable (+1.5%) compared to 2013, with a little over 100,000 wells drilled. The largest growth in drilling was in the Middle East (+12%) and parts of

Europe (+10%). The sharpest falls were in Russia (-6%) and the Far East (-8%). The other regions, especially North America (Canada and the United States), South America and Africa were relatively stable.

In 2015, the situation changed completely, with the fall in the per-barrel price and the decrease in drilling in North America (-50%). The drop in onshore drilling was on average -32%. Apart from the Middle East, where there was slight growth (+3%), all the regions of the world were affected by the decrease: drilling fell by 33% in Europe and in Russia by 20%.

Figure 8: Distribution of onshore wells drilled in 2014 (a) by region and (b) by estimated annual growth in 2015.



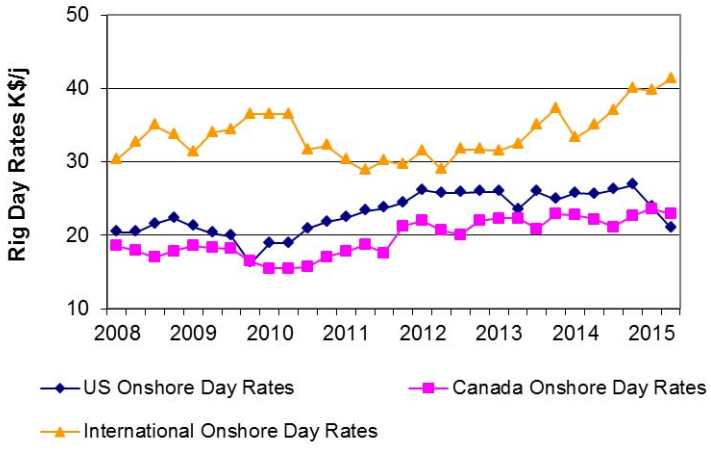
(a) *(b)* *(Sources: IFPEN, Spears & Associates)*

- **Onshore rig rates**

In 2014, international rig rates (apart from North America) rose by 7%, while in Canada they remained stable and rose by 4% in the United States.

In mid-2015, international rig rates showed a rise of 10%. In the United States, with the 50% drop in drilling, the drop in the first six months of the year was 15%. In Canada, despite an expected fall in drilling in 2015 similar to that in the United States, in mid-2015 the rates for the first six months of the year had remained stable.

Figure 9: Rig rates for onshore drilling equipment in North America and in the rest of the world



(Sources: IFPEN, Spears & Associates)

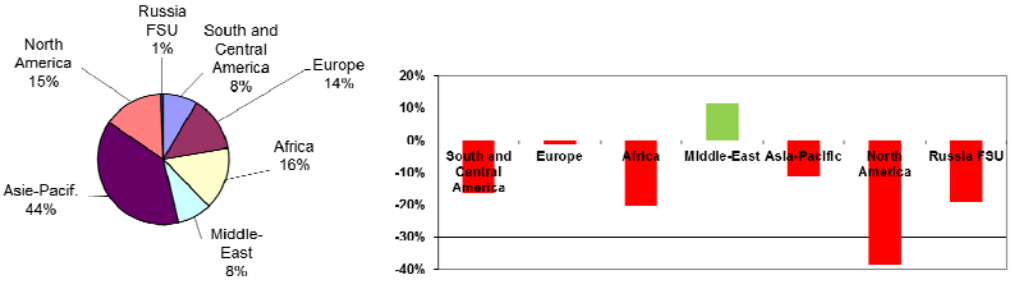
3.1.1.2. Number of offshore wells

In 2014, offshore drilling was relatively stable compared to 2013, with around 3500 wells drilled. The largest increases were in Africa (+14%) and the Middle East (+13%) and the sharpest decrease was in

South America (-18%) due to the downturn in Brazilian offshore drilling. The other regions were more or less stable, especially the Gulf of Mexico in the United States, Asia-Pacific, Europe and Russia.

In 2015, it is estimated that the amount of offshore drilling should fall internationally by -14%, i.e. under half the drop in onshore drilling. The largest drop will be in North America and the Gulf of Mexico (-40%). Only the Middle East will have shown an increase in 2015 (+11%), while Europe will have been stable (-1%). All the other regions are in a downturn, with drops in activity from -10% to -20%. With a per-barrel price under $60, the development of offshore deep-water fields and ultra-deep-water fields has become very difficult.

Figure 10: Distribution of offshore wells drilled in 2014 (a) by region and (b) by estimated annual growth in 2015.



(a) *(b)* *(Sources: IFPEN, Spears & Associates)*

- **Offshore drill rig utilization rates**

This includes the utilization rates for semi-sub and jack-up rigs, as well as drilling ships at international level and by region.

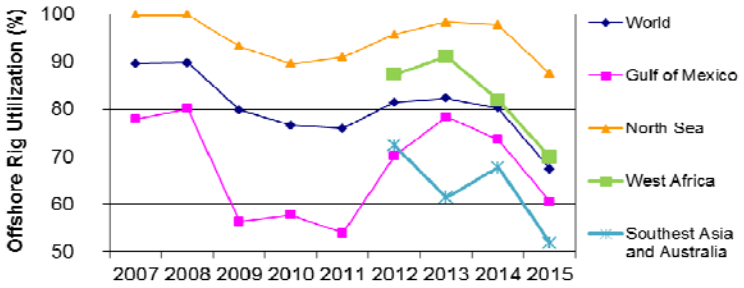
In 2014, for all regions taken together, average utilization rates of drilling ships, which in 2014 were 94%, should stand at around 80% in 2015. Utilization rates of jack-ups fell from 87% to 75%; semi-subs were least impacted by the fall in drilling activity, with their utilization rates falling from 84% to 77%.

By region in 2014, utilization rates remained stable in Europe, at 98%. They fell by 6% in the Gulf of Mexico and 10% in West Africa. Only in South-East Asia was there a rise in rig utilization rates (+10%).

In 2015, with the drop in offshore drilling activity, average rig utilization rates will have fallen by 16% globally. This was the case across the globe. Utilization rates in the Gulf of Mexico fell by 18%, while remaining above the lowest rates recorded between 2009 and 2011. The drop will be -23% in South-East Asia and slightly less in West Africa (-15%). In Europe, the drop in utilization rates will be lower (¬10%).

For 2016, taking into account the overcapacity of drilling rigs and the continued construction of new offshore rigs, we expect the fall in utilization rates to continue unless there is a sharp rise in decommissioning of older rigs.

Figure 11: Mean annual offshore rig utilization rates for the whole world, the Gulf of Mexico and the North Sea



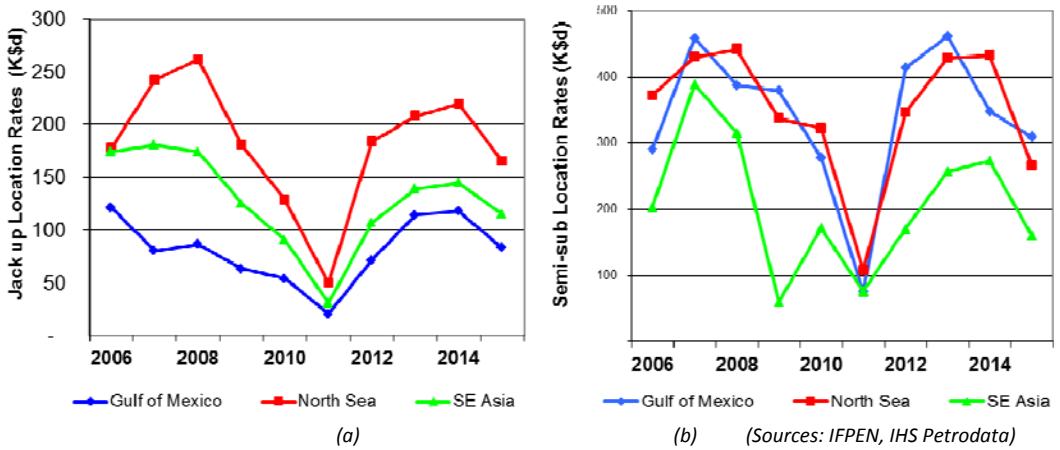
(Sources: IFPEN, IHS Petrodata)

- **Offshore rig rates**

In 2014, apart from semi-subs in the Gulf of Mexico, where rig rates fell by -25%, the overall rig rate for semi-subs and jack-ups had risen and recovered from its fall in 2009-2011.

In 2015, the drop in rig rates was general, regardless of region or type of rig. For semi-subs, it was of the order of -40% for the North Sea and South-East Asia. The Gulf of Mexico fell a little less (-10%), since rig rates had already fallen sharply the previous year. For jack-ups, the drop was of the order of -20% in South-East Asia and -30% and -25% respectively in the Gulf of Mexico and the North Sea.

Figure 12: Mean annual rates for (a) semi-sub and (b) jack-up rigs in the Gulf of Mexico, the North Sea and South-East Asia.



(a) *(b)* *(Sources: IFPEN, IHS Petrodata)*

3.1.2. Drilling, equipment and well services markets

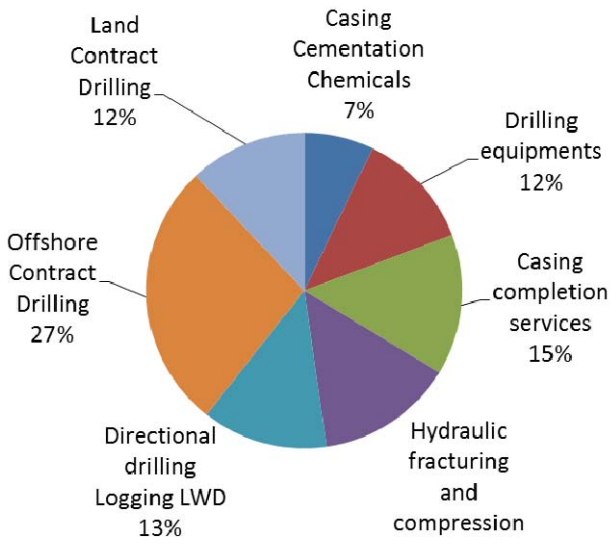
In 2014, the global drilling and associated services market was worth $277 billion, 10% more than in 2013. Bearing in mind the sharp drop in drilling in 2015, the global market should fall this year by 27% and stand at around $200 billion.

The offshore drilling market fell by 11% but performed better than the onshore market (-28%). The offshore drilling market, worth $55 billion in 2015, was almost double the worth of the onshore market ($24 billion).

The most affected markets were well services, especially the fracking market, which fell by 38% over the year. Fracking and pumping operations, which account for 14% of the overall drilling market, had followed the rise in the development of shale gas in the United Stated and in 2015 they have generated turnover of around $27 billion. The tools, equipment and drilling products market rose in 2015 to $24 billion, i.e. a drop of 26% compared to 2014. The well completions, casings and services

market has been more heavily affected, with a drop of 35% to $29 billion. The logging and directional drilling market has fallen by 29% to $26 billion.

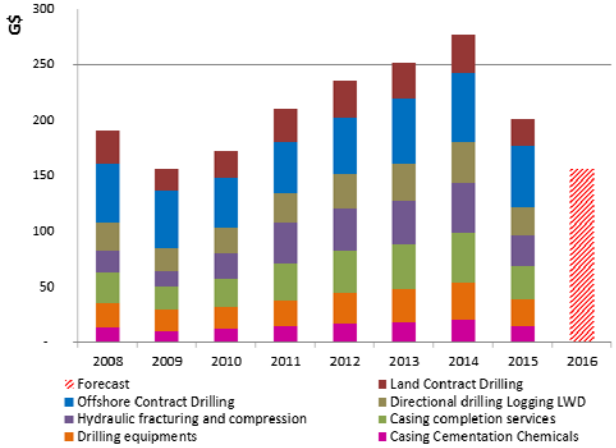
Figure 13: Estimate of various drilling market segments in 2015.



(Sources: IFPEN, Spears & Associates)

In 2016, in the absence of a recovery in the per-barrel price, the drilling market could continue its fall (-6%) and reach $190 billion. However, it should remain above $150 billion, which would correspond to its low point in 2009 before the growth in drilling of unconventional reserves in the United States. If this low point were to be reached again this would correspond to a fall in the market of 23% in 2016.

Figure 14: Increase/decrease in size of the various drilling market segments since 2008 and forecasts for the global market in 2016



(Sources: IFPEN, Spears & Associates)

3.1.2.1. Onshore drilling market

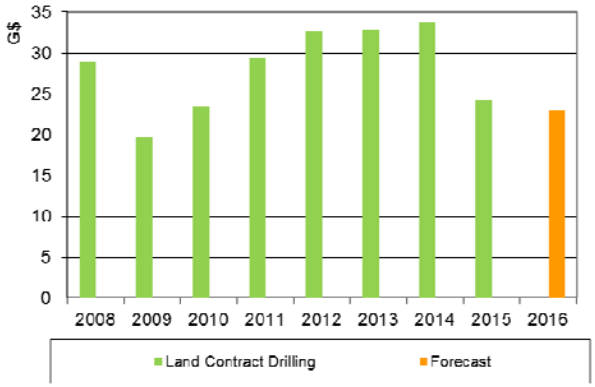
Turnover from onshore drilling operations alone increased by 3% in 2014 and reached a record figure of $34 billion. With the drop in drilling of unconventional reserves in the United States, the market fell in 2015 by 28% to amount to $24 billion.

8 major groups hold 54% of the global drilling market and fourteen companies hold two thirds of the market. The sector leader is Nabors Industries, with a 12% share of the market, followed by Helmerich & Payne (10%). Eurasia Drilling is in third position (9%).

In 4th, 5th and 6th places are: Ensign, Precision Drilling and Patterson-UTI, all three with around a 5% market share. Saipem and Schlumberger, for which onshore drilling is not strictly their core business, are in 7th and 8th places respectively.

Among those companies with sharp falls in turnover in 2015 we find Ensign, Helmrich & Payne and Patterson-UTI with falls ranging from 30% to 40%. At the other end of the spectrum we find Eurasia Drilling and Ensign, faring better with falls limited to around -10%.

Figure 15: Increase/decrease in size of the onshore drilling market and market share of the major onshore drilling companies in 2015.



Company	2015 estimation	sum
Nabors Industries	12%	12%
Helmerich & Payne	10%	22%
Eurasia Drilling Co.	9%	31%
Ensign Resource Svs	5%	36%
Precision Drilling	5%	41%
Patterson-UTI	5%	46%
Schlumberger	4%	50%
Saipem SPA	4%	54%

(Sources: IFPEN, Spears & Associates)

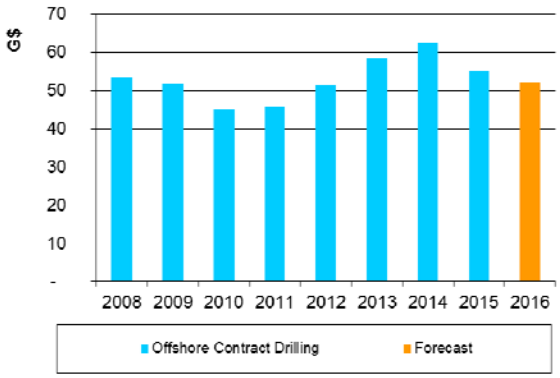
3.1.2.2. Offshore drilling market

The value of the offshore drilling market alone is twice as large as the onshore drilling market. It grew in 2014 by 6%, reaching a record value of $62 billion. In 2015, the fall was around 11%, i.e. clearly less than for onshore drilling (-28%) and the market amounted to around $55 billion.

The offshore drilling market is also extremely concentrated since half is accounted for by 8 large groups and two thirds by 15 companies. In spite of sharp drop in turnover in 2015, the leading offshore drilling contractor is still Transocean, with 13% of the market share. Seadrill and ENSCO are still in 2nd and 3rd places respectively, each with around a 8% share of the market.

We find Noble Drilling, Diamond Offshore and COSL with between 4% and 5% of market share. The latter and Transocean have been badly affected in turnover terms in 2015. Rowan and Maersk, in 7th and 8th places, are among the rare companies increasing their turnover, with +11% and +14% respectively.

Figure 16: Increase/decrease in size of the offshore drilling market and market share of the major onshore drilling companies in 2015.



Company	2015 estimation	sum
Transocean, Inc.	13%	13%
Seadrill	8%	21%
ENSCO	8%	29%
Noble Drilling	5%	35%
Diamond Offshore	4%	39%
COSL	4%	43%
Rowan Companies	4%	47%
Maersk Group	3%	50%

(Sources: IFPEN, Spears & Associates)

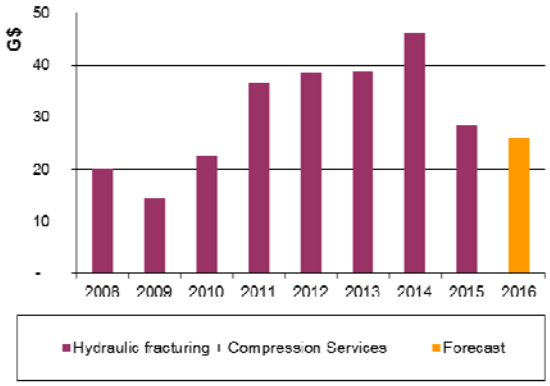
3.1.2.3. Fracking market

The value of the fracking market reached a record high of $46 billion in 2014, i.e. a further 20% increase over one year. After two years of strong growth (60%) in 2010 and 2011, the market stabilized in 2012 and 2013, growing by 3% and then shrinking by 4%, respectively.

In 2015, the fall was very sharp (-38%), with the slowdown in production from unconventional reserves, and overall turnover should amount to around $28 billion.

Nine companies share 80% of the market. The top three companies, Halliburton, Schlumberger and Baker Hughes, generate 57% of global turnover. Without an asset transfer, the merger of Halliburton and Baker Hughes would give the new group a 38% market share.

Figure 17: Increase/decrease in size of the fracking market and estimated market share of its major companies in 2015



Company	2015 estimation	sum
Halliburton	27%	27%
Schlumberger	19%	46%
Baker Hughes	11%	57%
Calfrac Well Services L	5%	62%
C&J Energy Services	5%	67%
FTS International	5%	71%
Weatherford	4%	75%
Trican	3%	78%
Patterson-UTI Energy, I	3%	81%

(Sources: IFPEN, Spears & Associates)

3.2. Geophysical activity and the geophysical market

The fall in the per-barrel price and investments in exploration/production have had a strong impact in the geophysical sector.

In 2015, the fall in activity and turnover has been 28%. With the successive decommissioning of ships announced by the major contractors, the proportion of scrapped ships has increased from several percent prior to mid-2014 to 24% in October 2015. This has curbed the fall in the number of ships in operation, which at the end of 2015 is now oscillating around 50%.

In October 2015, the fall in prices reached 30% overall for the year, for 3D seismic, 2D and source boats. The fall in acquisitions prices seems to be bottoming out, with margins being wiped out for contractors.

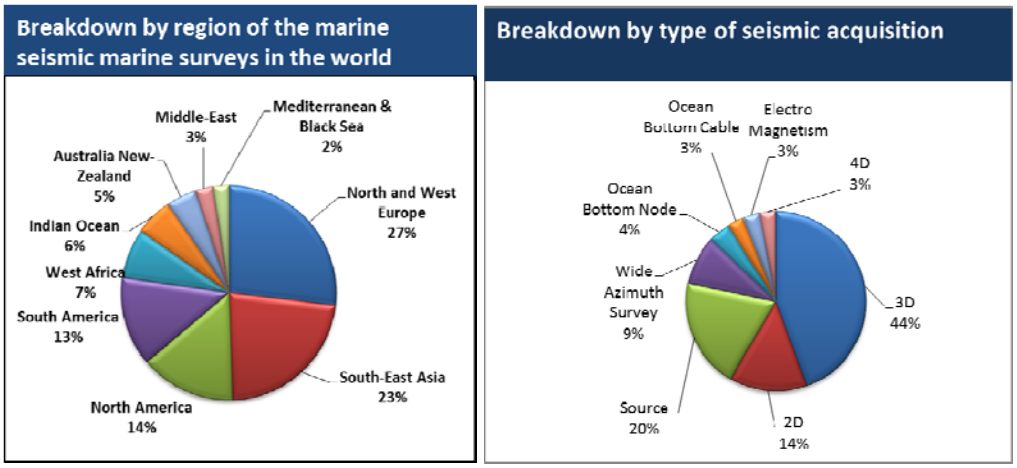
Contractors as a whole are not expecting an imminent bounce-back of acquisition prices.

3.2.1. Geophysical activity

On a rolling twelve-month basis, in October 2015, the drop in activity, regardless of the type of marine acquisition, had increased compared to July. The drop was 27% - consistent with the observed fall in turnover. The recovery in activity seen in July 2015 was merely seasonal - the meteorological conditions in the third quarter were generally more favorable for marine seismic acquisition.

Three large regions are still active in marine seismic exploration. The largest is north-west Europe, with 27% of acquisitions, especially in the North Sea, then South-East Asia (23%) and North America with the Gulf of Mexico (14%).

Figure 18: Distribution of marine seismic testing campaigns over the last 12 months, by (a) region and (b) acquisition type.



(a) *(b)* *(Sources: IFPEN, IHS)*

- **Progress of activity by region**

In October 2015, over a twelve-month period, only two regions increased their number of marine campaigns. Latin America increased by 60%, with offshore Atlantic Ocean exploration, and South-East Asia increased by 16%. All the other regions showed a decrease: the sharpest fall was in West Africa (-44%); the fall was 25% in North America and the Middle East. The Mediterranean/Black Sea region also fell (-18%), with this region having previously undergone several great successes in

exploration, especially in the eastern Mediterranean. North-west Europe is stable in terms of activity and the Indian Ocean is showing a slight fall (-6%).

- **Changing nature of campaigns**

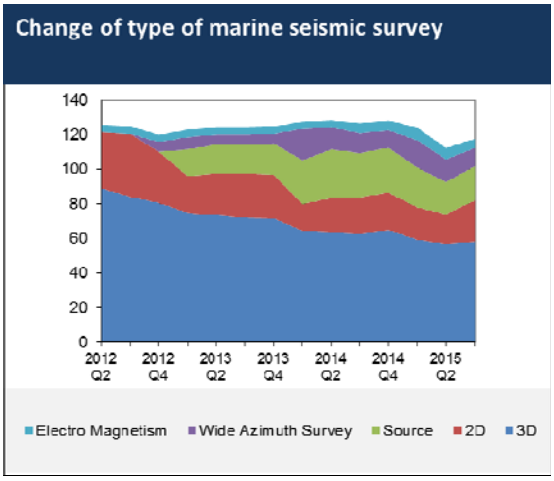
In the long term, we can see that the number of classic 3D marine campaigns is stagnating while the number of wide azimuth 3D campaigns is increasing. Seismic 3D is changing with the complexity of the geological objects to be investigated.

The advantages of wide azimuth 3D campaigns are that they use the source boats to obtain lateral lighting of the exploration objectives. This type of acquisition is welcome, given the overcapacity in acquisition vessels.

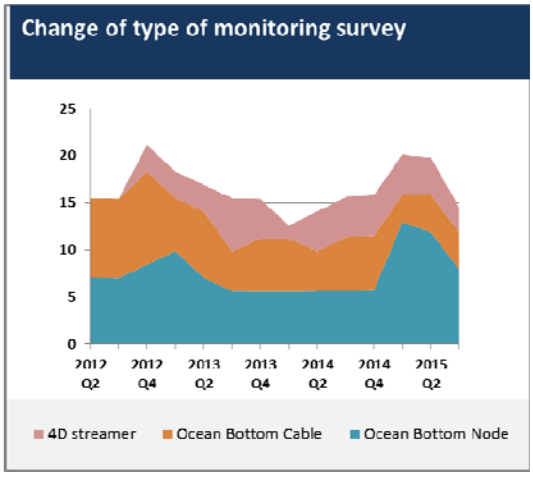
Compared to the second quarter of 2015, we are seeing a recovery in marine 2D campaigns, which can be explained simply by a reduction in investments which overall is half of that for 3D.

With regard to seismic monitoring, the number of 4D campaigns by streamer is still limited, at under five per year. The number of campaigns using ocean bottom cables (OBC) is around the same. In mid-2015, we are seeing revived interest in campaigns using nodal submarine recording.

Figure 19: Change in number of marine campaigns by (a) seismic campaigns and EM (b) monitoring campaigns



(a)



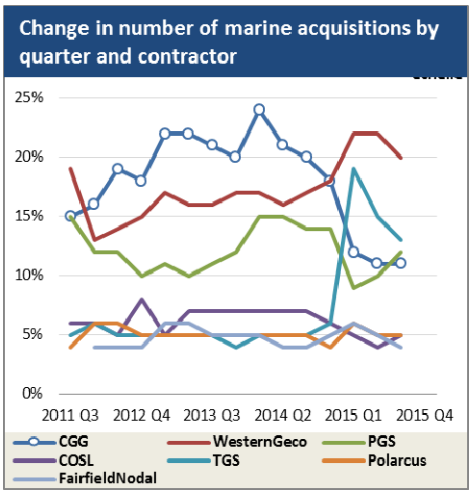
(b) *(Sources: IFPEN, IHS)*

- **Distribution of campaigns by contractor**

If we consider the number of marine campaigns undertaken by the main contractors each quarter, we have seen three types of change since 2014:

- contractors which have increased their activity, WesternGeco (+5%) and TGS (+10);
- contractors which have reduced their activity, CGG (-10%) and PGS (-5%);
- contractors which have more or less retained their level of activity (stable).

Figure 20: Change in number of marine acquisitions by quarter and contractor



Historically, over 20% of marine seismic campaigns were carried out by CGG. Since 2015 this percentage has fallen by half, mainly to the advantage of Western-Geco (Schlumberger), Petroleum Geo-Services (PGS) and TGS.

Regarding onshore seismic testing, this is mainly a market reserved for Chinese companies, due to the low cost of their labour.

- **Rig rates and ship utilization rates**

The fall in the per-barrel price and upstream investments is having a direct impact on exploration activity and the price of services, especially since the market has a surplus capacity of acquisition resources, despite the decommissioning and reconversion of older ships.

- **Ship occupancy rate**

Since mid-2014, the rate of ships in operation (Figure 21a) has fallen below 60%, while previously it varied between 60% and 80%. With the successive decommissioning of ships announced by the major contractors, the proportion of scrapped ships has increased from several percent prior to mid-2014 to 24% in October 2015. This has curbed the fall in the number of ships in operation, which at the end of 2015 is now oscillating around 50%.

The ship occupancy rate should be analyzed together with multi-client survey activity and the rate of pre-financing of these surveys. Multi-client surveys enable the creation of libraries of seismic data on the geographical areas of interest which are the subject of the allocation rounds for exploration. It is a way of making ships or expensive equipment which would otherwise be inactive profitable.

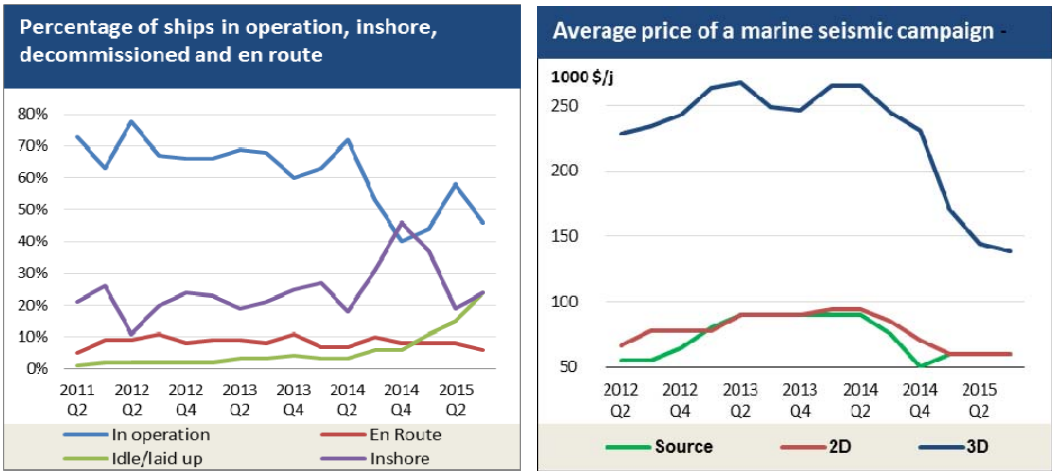
- **Price of marine seismic campaigns**

The surplus capacity of acquisition resources has caused a fall in prices since 2014 (Figure 21b). The postponement of exploration projects has made negotiations and the competition between players much more tense. In October 2015, the fall in prices reached 30% overall for the year, for 3D and 2D seismics and source boats.

Acquisitions prices seem to be bottoming out, with margins being wiped out for contractors. Contractors as a whole are not expecting an imminent bounce-back of acquisition prices; the catalyst for this would be a rise in the per-barrel price at the end of 2016.

Due to a lack of sufficient cash assets and the length of the crisis, some players such as Dolphin and CGG have been forced to raise funds from their shareholders. These players' survival depends on this, since they do not have enough cash assets.

Figure 21: (a) Percentage of ships in operation, inactive, decommissioned and en route, (b) Average price of a marine seismic testing campaign - 2D, 3D or from a source boat, 1000 $/day.



(Sources: IFPEN, IHS Petrodata)

3.2.2. Geophysical market

In 2015, CGG and Schlumberger (together with its subsidiary Western-Geco) accounted for 45% of the market, a little under half of the global geophysical market. In all, eight firms hold 77% of the market. PGS, TGS-NOPEC and Halliburton are in 3rd, 4th and 5th place respectively. The Russian company IG Services (in which Schlumberger holds a 30% stake) is in 6th position, followed by Dolphin Geophysical and China Oilfield Services.

The Norwegian seismic survey group, Dolphin Group, announced on 14/12/2015 that it had filed for bankruptcy, since the prolonged fall in crude oil prices had reduced the demand for testing from oil companies.

As far as equipment is concerned, CGG's subsidiary Sercel is still the market leader with more than a 60% share in the world market, followed by ION and Geospace Technologies. This segment of the market has been particularly affected by the crisis, given the low demand for renewal of equipment and to equip new seismic teams.

- **Market segmentation**

The market under examination is made up of various geophysical sectors:

- the acquisition and processing of geophysical data (seismic and electromagnetic). Geoscience surveys, sale of software and consultancy are accounted for in the data processing segment;
- equipment intended for data measurement: sensors, seismic sources, recording laboratory.

- **Changes in the market**

From 2009, the market had recovered and had a turnover in 2012 and 2013 of $16 billion, slightly above the record figure in 2008 (Figure 22). The geophysical equipment segment has over the years been around 10% to 14% of the overall market.

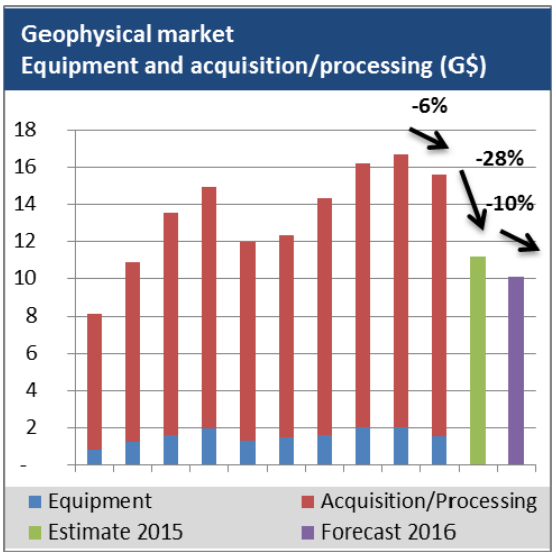
In 2014, the market fell by 6% - much less than the expected 20%, given the surplus capacity of the acquisition resources that year.

In 2015, despite the rationalization of the acquisition resources (decommissioning and recycling of the older ships), turnover for the first three quarters of 2015 seem to indicate a fall of around 28% at the global level. The global market would then amount to $11 billion - lower than in 2009.

For 2016, despite the resulting reductions in the marine seismic fleet, professionals in the industry do not foresee any recovery of acquisition prices without a net increase in oil demand and a rise in the per-barrel price.

Turnover for 2016 should therefore fall again, given the weak outlook for the market; this fall could be around 10%. Fragile players could disappear, be bought out or go bankrupt.

Figure 22: Geophysical market (equipment and acquisition/processing).



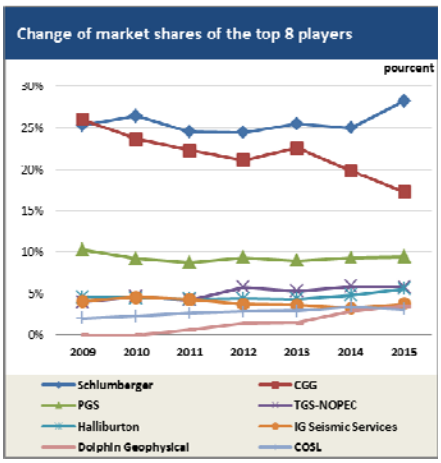
The first three quarters show that the falls in contractor turnover for 2015 will be from -20% to -50% compared to 2014. The most affected segment will be the equipment segment, with reductions of 50% to 70%.

For the top 8 players, in terms of turnover, the drop will be a little lower, from 15% to 40%. If the figures for 2015 are confirmed, the market gap between Schlumberger and CGG will grow, with CGG losing 4% of its market share.

Figure 23 (a) 2015 turnover, annual changes and market shares of the top 8 players. (b) Change in market shares since 2009.

2015 turnover, annual changes and market shares of the top 8 players

M$	CA 2015e	2015e/2014	Parts %
Schlumberger	3 155	-19%	28%
CGG	1 923	-38%	17%
PGS	1 060	-27%	9%
TGS-NOPEC	650	-29%	6%
Halliburton	625	-17%	6%
IG Seismic Services	425	-16%	4%
Dolphin Geophysical	395	-10%	4%
COSL	350	-33%	3%



Sources: IFPEN, Spears & Associates

3.3. Offshore construction activity and the offshore construction market

Offshore rig construction activity, after increasing by 5% in 2014, is expected to fall by 15% this year. With the reduction in offshore drilling, the decline in the construction of drilling vessels will deepen (¬27%), doubling compared to 2014. Regarding floating platforms, new constructions have fallen by 11% over the year. The drop in demand for FPS is around the same (-11%).

With a per-barrel price of under $50 at the end of 2014, many deep-water and ultra deep-water projects were postponed. Such projects requiring submarine installations affect this sector (*subsea*), which in previous years had grown very strongly.

Overall, the offshore construction market amounted to $55 billion in 2015 - a drop of 18% compared to 2014, which was a record year with a global turnover of around $67 billion.

Every segment is declining. Offshore construction and its services have fallen by 22%, despite having regularly grown since 2010. The subsea equipment segment, hitherto very dynamic with annual growth of over 10%, has fallen by 12% in 2015. Floating Production, Storage and Offloading (FPSO) services are currently only falling by 5%.

In 2016, the decline in the offshore construction market should deepen, given the amounts of CAPEX to be invested and the average cost of deep-water activities, which we can assume are around $60/b.

3.3.1. Offshore construction activities

3.3.1.1. Offshore activity by region

In the Gulf of Mexico, operators are more interested in developing existing fields than in launching new, costly offshore projects. Nevertheless, several new projects, such as the Shell project for Appomattox, Anardarko's for Heideberg and Hess's for Stampede, emerged in 2015.

The Gulf of Mexico contains a huge number of production installations, which in 2015 generated a large amount of decommissioning activity, with 27 fixed platforms decommissioned in 2015, most of which are steel jacket type platforms.

In the United Kingdom, production from the North Sea continental shelf is declining sharply. Growth activities are well-plugging and the decommissioning of installations. Around 27 fields in the continental shelf have stopped producing in the last 5 years and other fields are expected to close due to the fall in the oil price.

From now until 2025, there will be over 400 wells to plug, 290 fixed platforms to decommission, 33 floating installations, 370 well-heads and subsea structures and 20,000 km of pipeline.

However, the North Sea has a large number of high pressure, high temperature (HPHT) fields, which are genuine potential resources but which also present technological challenges to generate products at an acceptable cost. Given the current low per-barrel price, the United Kingdom government has decided to modify the fiscal status of these fields in order to relaunch development activity, especially ultra high pressure and temperature fields.

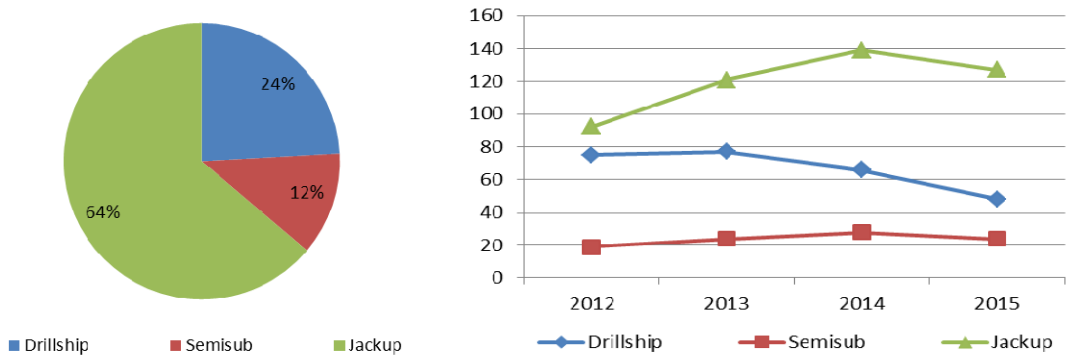
In South America, Brazilian offshore activity has considerably decreased following corruption scandals involving the state company Petrobras and engineering companies. The lack of suppliers able to meet local employment conditions and the depreciation of the Brazilian currency against the dollar have also contributed to a slowdown in activity.

3.3.1.2. *Offshore rig construction activity*

At the end of 2014, of 233 orders for offshore rigs, 60% were for jack-ups, 28% for semi-submersibles and 12% for drilling vessels. This represented over a year a 5% average increase in activity, which mainly benefited semi-subs (+17%) and jack-ups (+15%), while drilling vessel construction fell (-14%).

At the end of 2015, with the global reduction in the number of offshore rigs, we can see a reduction in rig construction orders (-15%). The most significant change (-27%) concerns drilling vessels, but the change has also been negative for semi-subs (-14%) and jack-ups (-9%).

Figure 24 : *(a) Distribution of rig constructions in 2015 by type. (b) Change in number of rigs under construction from 2012 to 2015.*



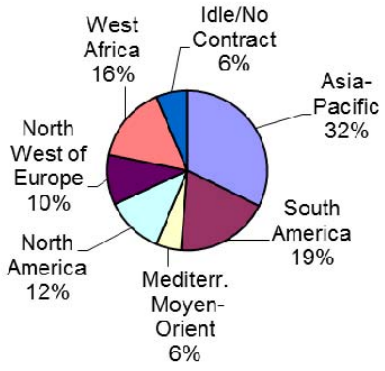
3.3.1.3. *Floating Platform Systems (FPSs)*

1. Existing FPS fleet

At the end of 2015, there are around 370 FPSs in the world. The number of FPSs has slightly decreased over 12 months (-2%). The geographical areas where the fleet is decreasing are: north-west Europe (-9 units), West Africa (-5 units) and Asia-Pacific (-3 units). These falls are to a large extent being compensated for by the only area where there is an increase, South America (+13 units).

Unused FPS accounted for 6% of the total - a fall of 10% over 12 months. FPSOs account for around two thirds of FPSs. The oldest floating platform systems and the single-hull designs are the ones that are most often without contract and which are scheduled to be dismantled soon.

Figure 25: Geographical distribution of the existing fleet of floating platforms in mid-2015.



(Sources: IFPEN, IHS)

2. FPS fleet under construction

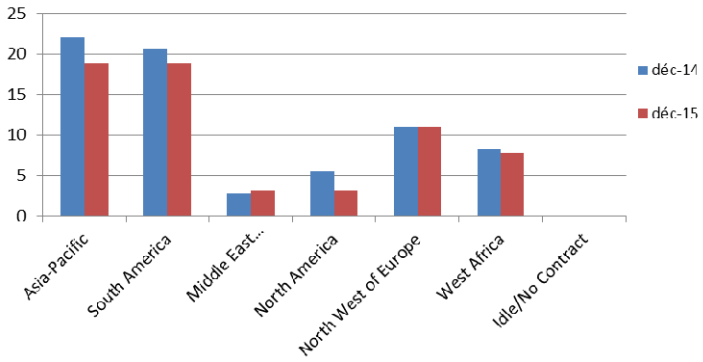
At the end of 2015, there are around 63 FPSs under construction. The number of FPSs has decreased over 12 months by 11%. South America and the Asia-Pacific – which is where two thirds of the world's construction projects are based – have seen falls of 14% and 9%, respectively.

The number of units under construction in North America has dropped from 6 to 3 units over twelve months. Activity in the other regions of the world is stable. Since 2013, no FPS construction has been undertaken without a future contract.

In South America, Petrobras has postponed until the end of 2015 the tender dates for the FPSOs for the Libra and Sepia fields. The outlook for production for 2020 has also been revised downwards but has become more realistic, with a forecast of 2.8 Mb/day in 2020, as against 4.2 Mb/day previously.

Brazilian subsea subsalt production costs are estimated at around $45/b, to which must be added infrastructure costs for gas export ($7/b). With the per-barrel price under $50/b, these projects remain viable, given the very high productivity of the wells - over 30,000 b/day of oil.

Figure 26: Number of floating platforms under construction at the end of 2014 and the end of 2015.

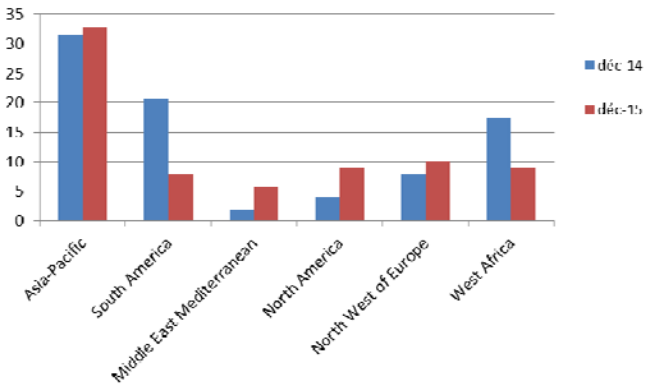


(Sources: IFPEN, IHS)

3. FPS demand until 2020

To 2020, the demand for FPS construction is 74 units in total for all regions - a fall of 11% compared to 2014. The fall comes mainly from two regions: South America (-13 units) and West Africa (¬9 units). This is partially compensated for by the outlook for development in the Mediterranean (+4 units) and North America (+4 units) and the continued demand in the Asia-Pacific and north-west Europe.

Figure 27: Demand up to 2020 for floating platforms by geographical area at the end of 2014 and the end of 2015.



(Sources: IFPEN, IHS)

3.3.1.4. Subsea construction

The first subsea installation dates back to 1963, but the subsea and laying vessel industry only really started to take off at the start of the 1990s with deep offshore developments.

Between 1980 and 2012, nearly 5000 subsea installations were laid. The record year was 2008, which saw 330 installations laid. The North Sea has played an important role in the development of the subsea industry – 35% of all installations since 1980 have been in the North Sea.

Regional developments, as well as developments in difficult conditions and in deep sea locations have contributed to the increase in popularity of subsea installations. In 2006, only 25% of all discoveries were at depths of more than 1000 m. By 2012, however, half of all discoveries were at depths of more than 1000 m.

The North Sea, the Gulf of Mexico and the Gulf of Guinea are the regions with the highest concentration of subsea installations. They are followed by South America and West Africa, regions that are both seeing strong growth.

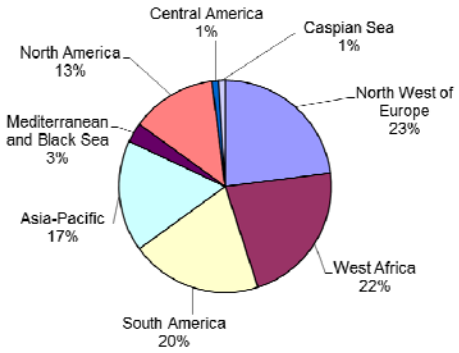
In mid-2014, more than 300 potential subsea projects were identified. 20% of these are at depths of between 300 and 1500 m, and 16% are at depths of more than 1500 m. The number of deep-water developments continues to increase as resources at depths of less than 300 m have in the main already entered production.

The subsea industry is having to tackle increasingly complex projects, an absence of standardization and a shortage of qualified personnel. The result is a sharp increase in costs which are difficult to sustain at a time when investments are limited. With a per-barrel price under $50, the most complex deep-water and ultra deep-water projects requiring subsea installations have been postponed.

Figure 28 gives the demand for subsea construction over the period 2013 to 2017. This demand corresponded to a context of a per-barrel price of $100 and must be regarded as relative.

North-west Europe and West Africa are in pole position due to developments in regional fields and the number of already existing offshore production installations.

Figure 28: Demand for subsea construction over the period 2013 to 2017



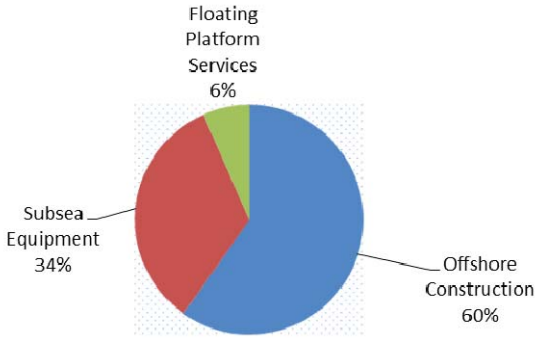
(Sources: IFPEN, IHS)

3.3.2. Offshore construction market

Overall, the offshore construction market should amount to $55 billion in 2015 - a drop of 18% compared to 2014, which was a record year with a global turnover of around $67 billion.

The market is made up of three segments: the offshore construction market and its services, which accounts for 60% of the overall market, subsea equipment (34%) and services associated with the leasing of FPSOs (6%).

Figure 29: Estimated market share of the three offshore construction market segments in 2015



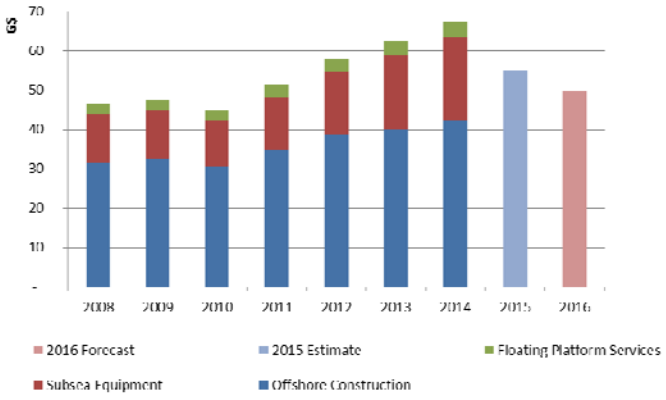
(Sources: IFPEN, IHS)

In 2015, all the segments that make up the market declined. The main segment, offshore construction and its services, has seen its turnover fall 22%, despite having regularly grown since 2010. The subsea equipment segment, hitherto very dynamic with annual growth of over 10%, has fallen by 12% in 2015. FPSOs have fallen slightly by 5%.

These decreases in the market are comparatively smaller than in the exploration segment but offshore development has been affected by the per-barrel price drop. In particular, the most complex or costly projects have been postponed or cancelled.

In 2016, with the per-barrel price remaining low, the offshore construction market will continue to suffer, since offshore production costs are much higher than onshore costs. Nevertheless, for the majors the offshore segment will remain a key way of accessing resources.

Figure 30: (a) Offshore construction market. (b) Estimated market shares in 2015 by company.



Company	2015 Estimate	Sum
Saipem SPA	13%	13%
Technip	9%	23%
FMC	9%	32%
Subsea 7 S.A.	9%	40%
SBM Offshore	5%	45%
McDermott	5%	51%
Cameron	5%	55%
Aker Solutions	4%	60%
KBR	4%	64%
Oceaneering Intl	3%	67%

(Sources: IFPEN, Spears & Associates)

Two thirds of global turnover is accounted for by 10 companies, which are mainly involved in offshore construction. The leading companies in this field are Saipem, with 13% of the global market, and Technip (9%), followed by FMC and Subsea 7.

In the subsea equipment sector, FMC is the leading company, followed by Technip, and Cameron, which was bought by Schlumberger in August 2015 for $14.8 billion.

In the floating platform services sector, SBM Offshore is the leading company - its specialty is FPSO.

Conclusion

Given the extremely low per-barrel price for the whole of 2015, operators have had to make choices about where to invest.

The geophysical sector, which is just upstream of the E&P chain, has been the most affected. The geophysical market is expected to shrink by 28% in 2015 – bringing the global market below the level experienced in the crisis of 2009.

The price of services is at its lowest and contractors' margins have been severely reduced. The current situation is endangering the most fragile players in the market.

Both the onshore and offshore drilling markets are declining. In particular, onshore activity is feeling the full impact of the slowdown in drilling for unconventional production in the United States. The latter technique uses a host of horizontal drains and the wells involved have a short lifespan but it had energized the market in recent years. Offshore drilling is performing better than onshore drilling but is still showing a fall of 11%.

The offshore construction market, which historically is driven by subsea activities, has decreased by 10%. The most complex and costly projects, especially deep-water and ultra deep-water projects, have been postponed. Half of the deep-water resources require a per-barrel price of $60 in order to ensure a 10% return on investment.

Without a major recovery in global economic prospects and a significant rise in per-barrel price, we can expect to see in 2016 a stagnation or a continued deterioration of the markets, although we do appear close to the lowest points.

Table 1: Summary table of increases/decreases in investments and markets analyzed

	2014	2015	2016
E&P investment	**+3%**	**-21%**	**-10%**
Geophysical market	**-6%**	**-28%**	**-10%**
Drilling market			
Onshore	**+3%**	**-28%**	**-5%**
Offshore	**+6%**	**-11%**	**-10%**
Offshore construction market	**+8%**	**-18%**	**-10%**

4. 2015, a breath of fresh air for refining

In 2015, the refining sector has benefited from a favorable environment: a fall in crude prices and relatively stable gasoline and middle distillates prices, due largely to an increase in demand for road transport fuel, especially in OECD countries.

The gross margins for refining (difference between the value of the refined products and the price of crude oil) took off in the first half of 2015, including in Europe, where the margin on Brent reached a level that we had not seen since 2012.

This rise in refining margins was more than welcome for the integrated oil companies which over the same period had to cope with the sharp drop in income from their upstream activity. Apart from the healthy state of margins, 2015 has also been marked by a stabilization or decrease in industrial costs. In this context, companies have continued to invest and the global expenditure of the refining industry has increased by over 15% in 2015.

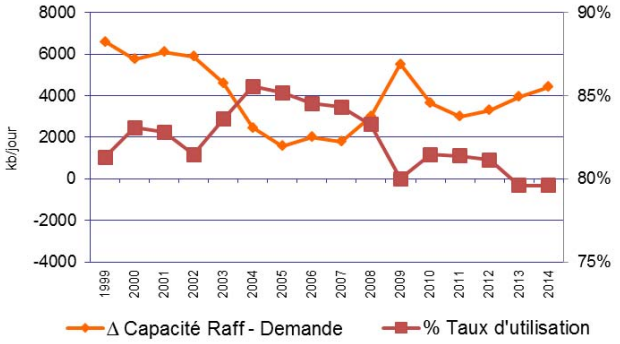
Despite this improvement, this sector continues to face major structural difficulties related to significant surplus capacities and strong competition. A downward trend seems to be on its way already. In the second half of 2015, refining margins have fallen in all regions, including the United States. The record level of crude stocks and products, the rise in power of the ultramodern refineries in the Middle East, the price war between Russian, Indian and Asian refiners to position their products on export markets will place a heavy strain on margins in the medium term and on investments in 2016. Estimated expenditure for 2016 is more moderate, focused on overall stabilization, with manufacturing companies dreading margin volatility.

There is long-term uncertainty, as shown in particular by a slowdown in projects in planning for three years. Despite this slowdown, surplus capacities remain due to a lower growth in demand. This trend is reflected in the medium-term forecasts, which predict a new cycle of growth in surplus capacity from 2018 with the commissioning of numerous projects currently being planned.

4.1. Continued surplus capacities and fall in utilization rates

After a marked phase of surplus capacities at the global level between 2009 and 2011 - falling from 5.5 Mb/day in 2009 to 2.9 Mb/day in 2011 - the trend has reversed since 2012. From that date - and in contrast to the period 2003-2008 - the growth in global demand has tended to slow while refining capacities have continued to grow strongly. In 2014, surplus capacities amounted to 4.4 Mb/day compared to a low point of 2 Mb/day in 2007. Refinery utilization rates have tended to decrease slightly.

Figure 31: Global surplus refining capacities and refinery utilization rates



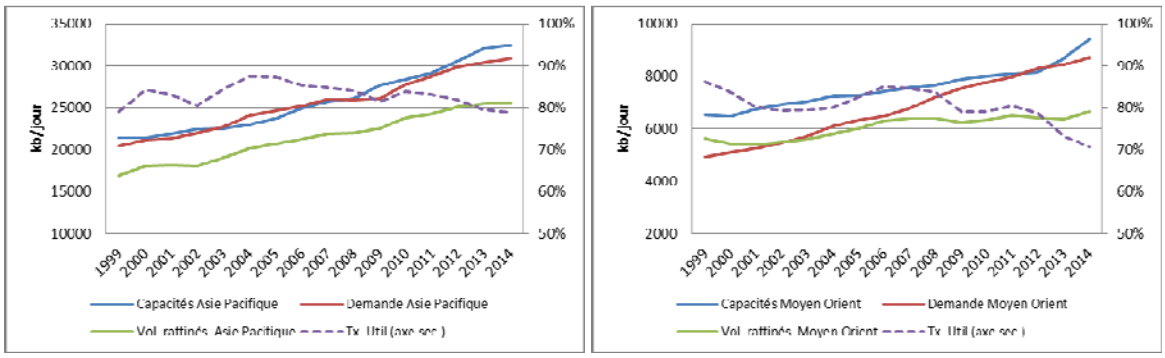
Source: IFPEN, from BP Statistical Review of World Energy 2015

However, situations are contrasting depending on the region.

In Asia-Pacific and in the Middle East, the construction of new refining capacities is running in parallel with a demand which is still sharply increasing. There are numerous medium-term projects.

It is a paradox to see the simultaneous coexistence of a large number of medium-term projects and low refinery utilization rates that have been on a downward trend since the start of the decade. In 2014, these rates were below 80% (79% for Asia-Pacific and 71% for the Middle East). In the case of China, the low operation rate is mainly due to the existence of a market which is still fragmented and includes a large number of small obsolete structures ("Teapots" - 20% of the country's capacities).

Figure 32: Asia and the Middle East: surplus refining capacities, refinery utilization rates and crude processed.



Source: IFPEN, based on the BP Statistical Review of World Energy 2015

South and Central America differs from the previous regions in the sense that, despite a large increase in demand, the level of refining capacities has remained stable. For three years demand has been greater than existing refining capacities. Utilization rates, which historically have been relatively low, have been improving for several years and thus are responding to the increase in demand.

In **Europe** and the **United States**, the situations are not the same: while in the United States the characteristic capacity deficit has been reduced over several years, in Europe there is still surplus capacity.

The relative improvement of the situation in the United States is due to the increase in demand and near-stagnation in refining capacities. In Europe, demand and capacities are falling slightly in line with each other, while the utilization rate of refineries has been stable for five years. In this context, we foresee an almost unchanged medium-term situation in terms of surplus capacities, with a slight dip since 2012. Oil consumption will not return to previous levels, even if there is an economic upturn: the reduction in overall energy intensity and the improvement in energy efficiency should create a lasting situation of low energy use.

In general, the trends in emerging countries are carrying the day. With 45% of oil consumption in 2012 and 48% of refining capacities, these areas are driving the global market in terms of surplus refining capacities. This trend will be accentuated in the medium term.

For **2015**, the IEA has revised upwards its forecasts for the growth of global demand - growth buoyed by low prices - to 94.6 Mb/day; this amounts to a rise of 1.8% in global consumption of crude in 2015 and of 1.4% to 95.8 Mb/day in 2016, due to a strengthened global recovery.

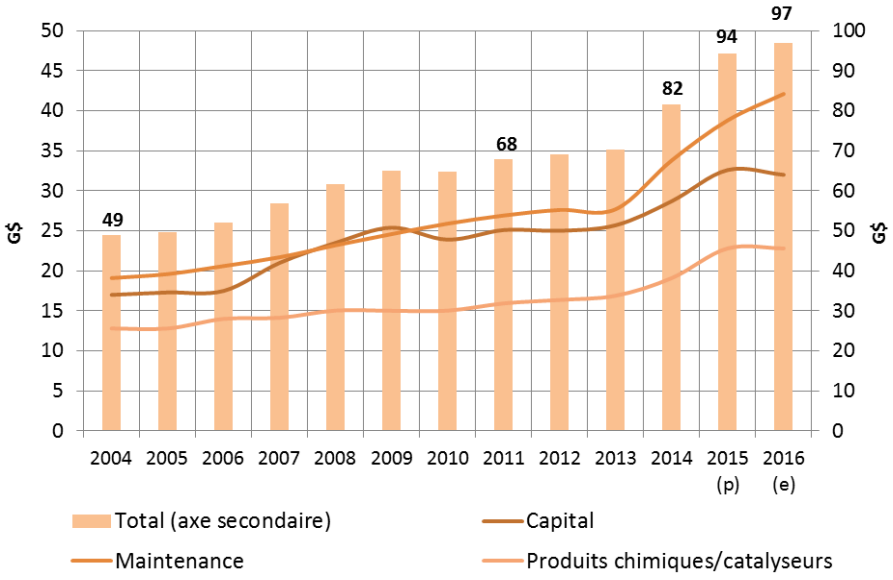
On the refining side, the establishment of new capacities in the medium term is progressing rapidly - for more detail see below - despite the doubts or delays regarding some projects; again, this is a response to the increase in demand.

However, the outlook remains fragile if based on the World Bank's economic growth forecasts for 2016 - the Bank is predicting a slowdown in global growth this year.

4.2. Improvement of refining margins and increase in maintenance costs

The overall change in refining capacities is accompanied by a slight increase in overall investments. Between 2014 and 2015, the forecasts show that total expenditure has increased by 15.5% from $82 billion to $94 billion, despite the fall in the oil price since mid-2014. The three budget lines under consideration - capital, maintenance and chemical products/catalysts - are contributing to this result with more or less similar increases - 13.6%, 14.8% and 19.4% respectively.

Figure 33: Change in the refining industry's global expenditure (in billions of $)



Source: IFPEN based on HPI Market Data: (f) forecast, (e) estimates

4.2.1. Improving refining margins

2015 has been a favorable year for investments in refining. Refining margins are still high in OECD countries due to an increase in demand for road transport fuels. The Brent margin has reached $10/bbl, a level that we had not seen since 2012. The year's average is $7.0/bbl - a record level for a region that is characterized by its surplus capacity and sluggish demand.

The crude price has fallen more sharply than the price of gasoline, diesel and kerosene. In the United States, refining margins in 2015 have been generally high, with the rise in demand for gasoline, especially in the United States and Asia, has-driven margins to levels not seen since 2008. Strikes at refineries in the United States have also contributed to the rise in margins.

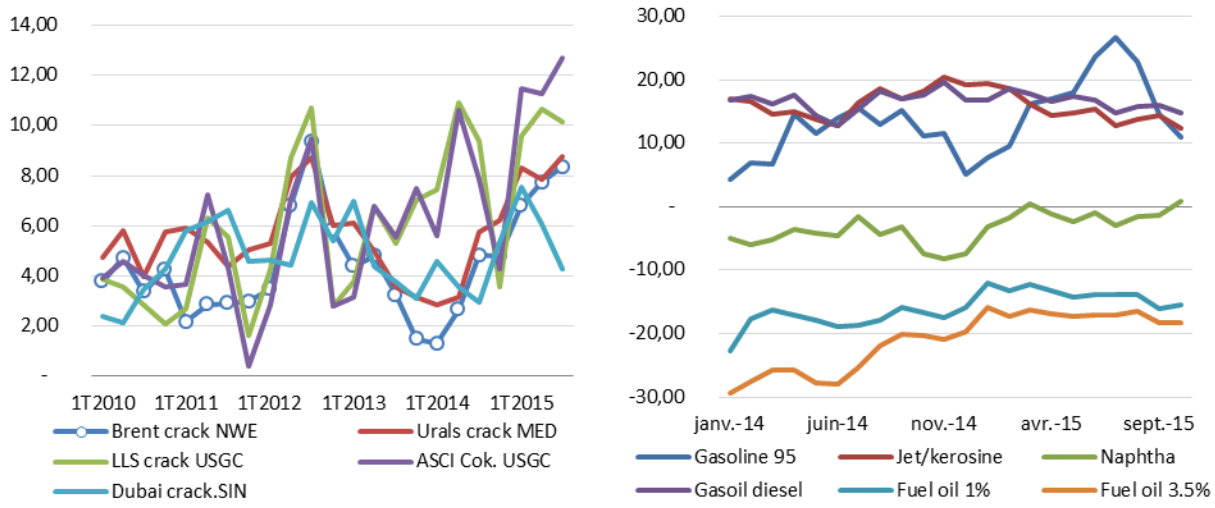
Refiners have taken advantage of this favorable economic environment by operating at maximum capacity and making new investments. In the United States, refineries are running at full capacity, with an utilization rate currently over 90%.

In Europe, the number of refineries down for maintenance is currently at its lowest level. In effect, refiners scheduled for October maintenance operations only affecting a capacity of 300,000 barrels of crude per day - a third of the operations scheduled in 2014 for the same period. Maintenance affecting a capacity equal to or over 500,000 b/day has been postponed until March or April 2016[2].

However, many specialists feel that this upturn will not last and, as a result of mainly cyclical economic factors, surplus capacities will push down margins.

[2].BIP 21/09/2015

Figure 34: Refining margins (US$/bbl) and EU Cracks Products (US$/ton)



Source: Argus

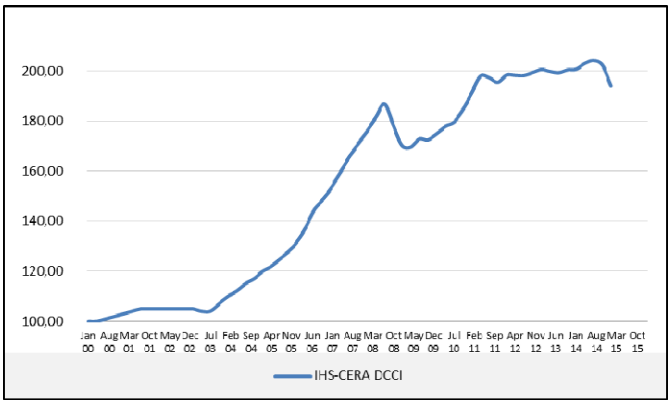
4.2.2. Oil companies and recovery of refining

In this context, oil companies have posted generally positive results in 2015 and just this once refining is performing better than upstream oil, which often posts losses. The refining divisions of companies like ExxonMobil, Esso SAF, Total, Shell, Eni, Chevron, etc. have seen a genuine upturn in their activity, which is enabling them to limit the devastating effects of cheap oil. Total's adjusted net operating income from its refining-chemistry division was $1.1 billion in the first quarter of 2015[3], three times than in 2014.

4.2.3. Stabilization of industrial costs

We can see a stabilization or a fall in the costs of design and construction in 2015. For many years the opposite situation had been the case, with a continued rise in industrial costs. In this context, manufacturers and financiers had been prudent with their investment - "cost-conscious" - and had been more selective in their choice of projects to implement.

Figure 35: Index of refinery construction – IHS CERA, baseline 100 (2000)



The reversal of this trend is now favorable for investment. However, market uncertainties and an understandable prudence on the part of refiners, especially in Europe, which are used to subsisting on margins that are frequently low, is favoring a certain degree of moderation for 2016.

4.2.4. 2016: an increase in maintenance costs and a decrease in capital expenditure

We foresee in 2016 a renewed increase in general expenditure but at a much slower pace than in the previous two years. In effect, the growth expected for 2016 is only 2.9%, compared to 16.1% and 15.5% in 2014 and 2015 respectively. General expenditure should reach US$97 billion. This brake on expenditure in 2016 is mainly due to falling capital expenditure (1.8%) and stable expenditure on chemical products and catalysts. Only maintenance (+8.5%) is showing a slight increase. This is due to

[3]The French group has also benefited from restructuring it has been undertaking for three years.

the fact that refiners have shown a strong tendency to postpone some maintenance operations (especially those involving a shut-down of industrial facilities) initially scheduled for 2015 to 2016 in order to benefit refining margins for as long as possible.

Table 2: Refining industry global expenditures (in billions of $)

	2012	2013	2014	2015 (p)	2016 (e)
Investment	25.0	25.7	28.7	32.6	32.0
Maintenance*	27.6	27.7	33.8	38.8	42.1
Catalysts and chemical products	16.4	16.9	19.1	22.8	22.8
Total	69.0	70.3	81.6	94.2	96.9

Source: IFPEN based on HPI Market Data; (p) projected
**40% for facilities and equipment and 60% on labour and services.*

Further to the explanation of the refining margins, manufacturers will in 2016 favor the optimization of maintenance activities. Maintenance expenditure should show continued growth for the third consecutive year.
Moreover, refineries are increasingly externalizing their maintenance services and the labor share of those costs is increasing. Labor accounts for 60% of the maintenance budget, with the remaining 40% covering equipment expenditure.
Meanwhile, capital expenditure will remain close to the 2015 level - historically high.

The Volkswagen affair, difficulties for the automotive industry and a boost for European refining:

There is a risk that diesel, which had already come under intense scrutiny in terms of pollution, will bear the full brunt of the Volkswagen affair and that its decline will seriously hurt the automotive industry in the years ahead. The reduction in the fiscal advantages currently enjoyed by diesel in Europe, although announced before the German firm's scandal, will probably be accelerated. France would like to end fiscal advantages by 2020. In addition, the Euro VI standard, applicable since September 2015 for new cars, could be accompanied by CO2 and nitrogen oxide tests, which would cause a fall in the competitiveness of diesel for small vehicles. The European Commission seems favorable to this approach.

The issue is also important for the refining sector, which could take advantage of the situation. It is well-known that European refineries, especially French ones, are mainly oriented towards the production of gasoline rather than diesel, while the market is oriented the other way around.

A better balance between supply and demand would certainly be good news for refiners.

4.3. Despite the trend of moderation, Asia remains the Eldorado of investments

The projects analyzed here concern (a) atmospheric distillation units and (b) conversion units globally; these are projects recorded in 2015[4].

4.3.1. New atmospheric distillation capacity

- **Medium-term developments**

In general, the trend has been a year-on-year reduction of projects since 2011. In 2011, projects created an additional capacity of 9.0 Mb/day; in 2015, only 6.6 Mb/day was added (7% of current

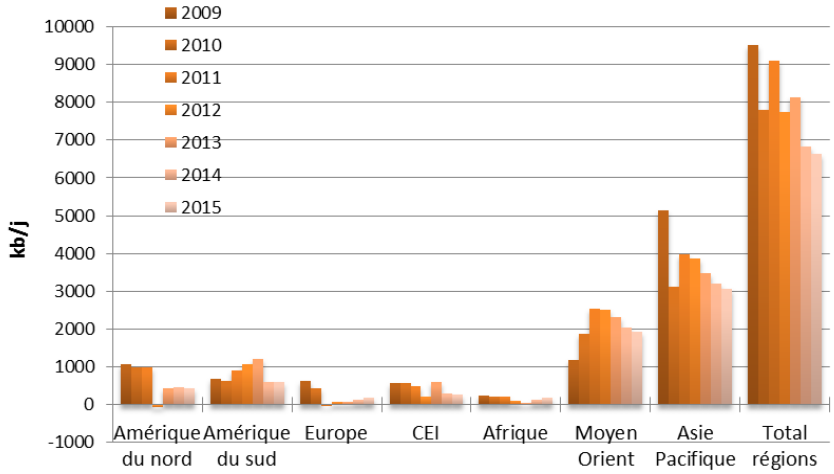
[4]A distinction should be made between two types of projects. "Probable" projects have a high likelihood of being carried out whereas "possible" projects tend to be announced for their effect and are less likely to materialize. We will discuss probable projects only.

global atmospheric distillation capacity) - a reduction of 27% in four years (Fig. 35). This trend is shown especially clearly by the developments in the Middle East and Asia-Pacific, where there has been a fall of around 25% in new projects. These two regions alone account for three quarters of the projects identified in 2015. By 2020, among the major projects (> 150 kb/day), 2.0 Mb/day are planned in Asia-Pacific, of which 1.4 Mb/day are in China and 1.5 Mb/day in the Middle East. The other regions are still stable (North and South America and the CIS) or increasing slightly (Europe and Africa).

Most of the projects identified (55%) in 2015 are scheduled for 2018 or later, although most are scheduled for the beginning of that period. Between 2016 and 2017 only 30% of projects had to be completed; in the financial years 2012 and 2013 this proportion oscillated between 45% and 50%. This phenomenon is due to the many postponed projects from 2014.

Three major refineries were commissioned in 2015 and added to the existing capacities: the Ruwaïs refinery in Abu Dhabi (expansion by 400 kb/day), the Yasref (Yanbu) refinery in Saudi Arabia (400 kb/day) and Paradip in India (300 kb/day). In total, 2015 should see an addition of 1.7 Mb/day.

Figure 36: Refining projects – distillation capacity by geographical region



Source: IFPEN based on data from KBC

Between 2014 and 2015, the situation has, in general, remained the same, with a slight decrease in 2015 (-3%). In comparing the two years, we can see that the amount of new, planned capacity (new factories + extensions) is falling while refineries/units closure projects have been smaller in 2015 (Figure 37). In addition, we can see that refinery extension projects exceed new installation projects in volume (and in number).

The main projects where refining capacity is equal to or greater than 150 kb/day:

o	Sinopec, Zenhai Refining, eastern China	240 kb/day	2016
o	CNOOC, Huizhou (Guangdong), south-eastern China	200 kb/day	2018
o	Sinopec/KPI/Total, Donghai Island, south-eastern China	300 kb/day	2018
o	PetroChina/PDVSA, Jienyang, Guangdong, south-eastern China	400 kb/day	2019
o	PetroChina, Kunming, Yunnan, south-western China	260 kb/day	2016
o	Petronas, RAPID Refinery, Pengerang, Johor, Malaysia	299 kb/day	2020
o	CPC, Talin, Taiwan	150 kb/day	2016
o	PetroVietnam/KPC/Mitsui/Idemitsu-Nghi Son, Vietnam	200 kb/day	2018
o	Turcas/Socar, Aliaga Star, Turkey	214 kb/day	2018
o	KNPC, Mina Abdullah, Kuwait	264 kb/day	2018
o	KNPC, Al Zour, Kuwait	615 kb/day	2020
o	Oman Refineries & Petrochemicals/IPIC, Duqm, Oman	230 kb/day	2020
o	Saudi Aramco, Jazan, Saudi Arabia	400 kb/day	2020

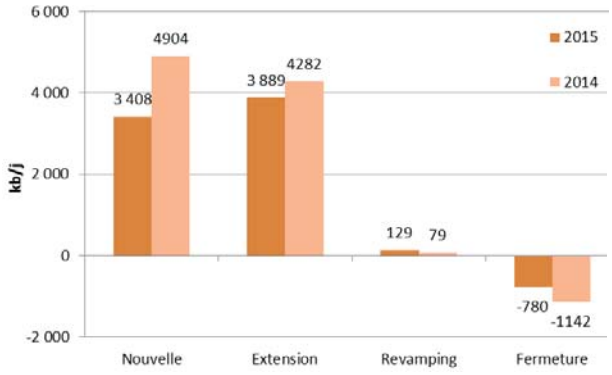
Source: IFPEN based on data from KBC

- **Reductions in capacity (closures and transformations)**

– Since 2010, the reductions in capacity through closures and transformation have amounted to 7.8 Mb/day, distributed evenly between Europe and North America/the Caribbean (34% each), with the rest in the Asia-Pacific area (Fig. 37). For Europe this represents 20% of existing capacity in 2010, for North America 14% and for Asia-Pacific 8.5%. France alone recorded a reduction of almost a third of the capacity in Europe, with 725 kb/day (43% of its existing capacity in 2010).

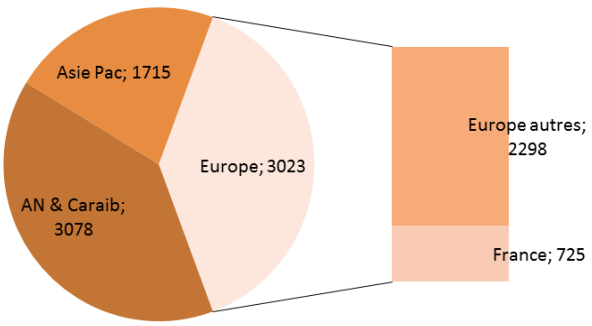
In North America, closures were concentrated between 2010 and 2013, in which period 1.3 Mb/day was destroyed. In Europe, this process occurred over the entire period between 2010 and 2015; it amounted to 3.0 Mb/day in total and will probably continue in the years ahead.

Figure 37: Additional atmospheric distillation capacity by type of development 2014-2015



Source: IFPEN based on data from KBC

Figure 38: Reduction in refining capacity since 2010 (closures/transformations)



Source: IFPEN

In France, capacity reductions involve six refineries: Petroplus –Reichstett, Petit Couronne; Total – Dunkerque, Gonfreville (atmospheric distillation units), La Mède; LyondellBasell – Berre.

In Asia-Pacific, almost 60% of refinery closures involve Japan (770 kb/day) spread over the period with a high in 2014 (520 kb/day).

– In 2015, 710 kb/day have been destroyed globally, of which 436 kb/day is in Europe, only 54 kb/day in North America and 220 kb/day in Asia-Pacific. In Europe, Total has announced a reduction by half of the capacity of its Lindsay refinery in the United Kingdom, bringing its capacity down to 100 kb/day; this involves the closure of a number of units, including one atmospheric distillation unit, and a reformer. Total has also announced the reconversion of the La Mède refinery for the production of biofuels. Tamoil has also announced that refining activities at the Collombey refinery in Switzerland will be interrupted but has not announced the refinery's closure. We should add to the European refineries the Chevron Kapolei refinery in the United States (54 kb/day) and the CPC Corporation Kaohsiung refinery in Taiwan (220 kb/day).

– The capacity reduction projects which were planned for 2015 and which will be rolled out by 2020 involve mainly the Middle East, with an additional 560 kb/day, especially in Kuwait (400 kb/day). In a similar vein is the new Japanese plan to improve the efficiency of its refining facilities through new closures. The plan is to reduce around 10% of refining capacity, i.e. 400,000 b/day of the 3.95 million b/day of the country's capacity. China will probably continue to close its uncompetitive refineries but data on this is difficult to obtain.

– The volatility of refining margins may mean that in the future they will be at less favorable levels than current levels. According to this hypothesis, the persistence of global surpluses may drive down margins and also undermine the refineries which are the least profitable, the most antiquated, the smallest and least suited to market needs, which will require major transformation investment. Nevertheless, the low oil price, which will continue at least until 2016, is encouraging the consumption of petroleum products (especially in areas where they are only lightly taxed) and is helping to ensure that the environment is favorable for the maintenance of margins. However, there are still many uncertainties in the short and medium term which at the very least are making all predictions risky.

Medium-term projects to close atmospheric distillation units, situation in 2015:

o	NIS, Novi Sad, Serbia & Montenegro	60 kb/day	2016
o	KNPC, Mina Abdullah, Kuwait	80 kb/day	2018
o	KNPC, Mina Al-Ahmadi, Kuwait	120 kb/day	2018
o	KNPC, Shuaiba, Kuwait	200 kb/day	2020
o	Saudi Aramco, Jeddah, Saudi Arabia	100 kb/day	2020

Source: IFPEN based on data from KBC

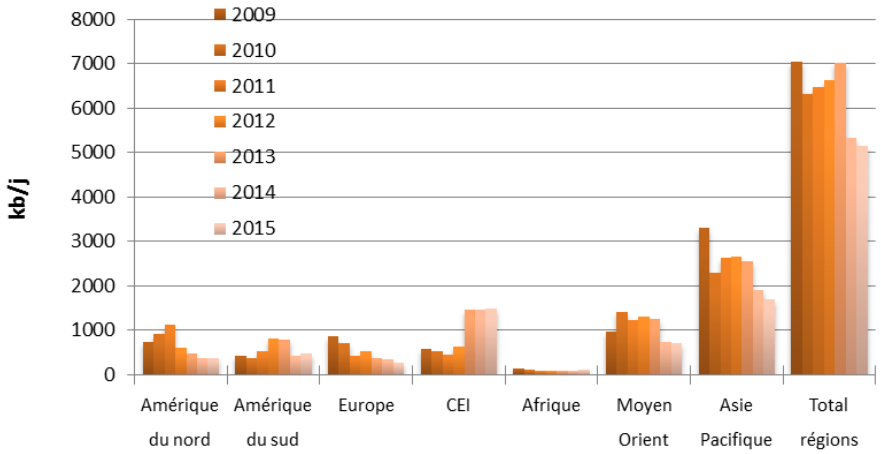
4.3.2. New conversion capacity

The new **conversion** capacity planned globally amounts to 5.1 Mb/day in 2015 - a 4% reduction in size compared to the previous year, while in terms of project number the portfolio is unchanged (140). This was the second consecutive fall in conversion projects after a brutal drop between 2013 and 2014 (-24%), especially in the Middle East (-42%) and Asia-Pacific (-25%) but also due to a general portfolio of projects sharply dropping in 2014 (-31%)[5].

In contrast to the Middle East and Asia-Pacific, since 2013 the CIS area has seen a slight increase in its conversion projects, overtaking the Middle East in 2014 and 2015 - a reflection of Russia's effort to modernize its refining facilities.

[5] 5334 kb/day in 2013, 7012kb/day in 2014

Figure 39: Refining projects – distillation capacity by geographical region



Source: IFPEN based on data from KBC

Hydrocracking projects account for 42% of planned volumes, i.e. 2.2 Mb/day of a total of 5.1 Mb/day, then come coking projects with 34% (1.7 Mb/day) and fluid catalytic cracking (FCC/RFCC) with 23% (1.2 Mb/day); visbreaking and thermal cracking only account for 1.0% of medium-term planned volumes (Fig. 40).

Although overall the projects are distributed more or less equally between atmospheric distillation and conversion, showing small variation over time (around 56%/44%), some regions such as Asia-Pacific, the Middle East and South and Central America are clearly focusing more on distillation projects than on conversion projects (Fig. 42). These regions are focusing more on the option of increasing new capacity (new refineries and/or increases in capacity of existing units) in order to satisfy their local market.

Figure 40: Refining projects – conversion capacity by unit type in 2015

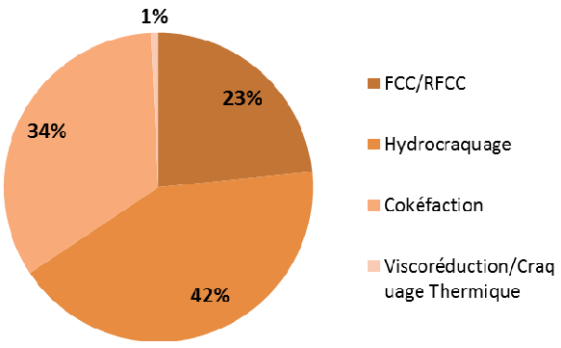
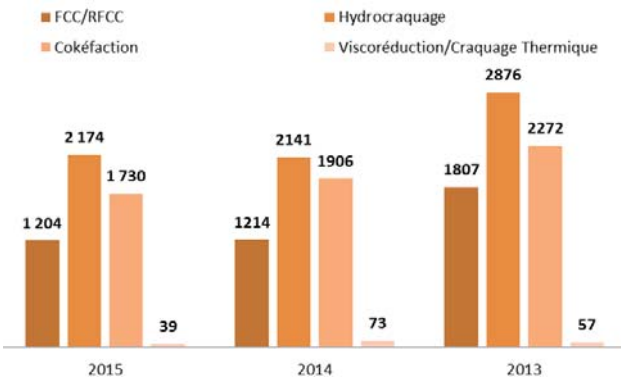


Figure 41: Refining projects – conversion capacity by unit type - changes 2013-2015



Source: IFPEN based on data from KBC

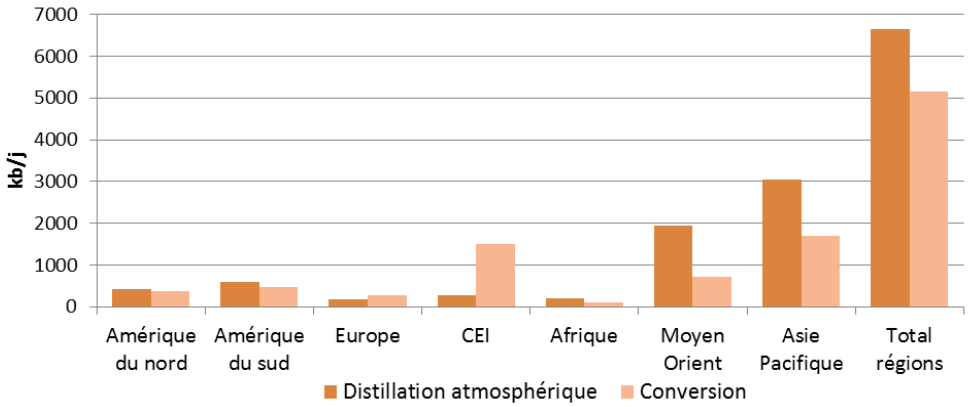
The main conversion projects with a capacity equal to or above 80 kb/day:

o Petrobras, Pernambuco RNEST, Br	Delayed coking	80 kb/day	2015
o Tankreer, Ruwais, Abui Dhabi	RFCC	127 kb/day	2015
o Sinopec, Zenhai Refining	Hydrocracking	80 kb/day	2016
o Rosneft, Tuapse, Russia	Hydrocracking VGO	86 kb/day	2017
o Marathon Petroleum – Garyville, US	Residue Hydrocracking	80 kb/day	2018
o Pemex, Tula, Mexico	Coking	83 kb/day	2018
o Lukoil, Nizhny, Novgorod, Russia	Hydrocracking	96 kb/day	2018
o PetroVietnam/KPC/Mitsui/Idemitsu, Vietnam	RFCC	100 kb/day	2018
o PetroChina/PDVSA, Jieyang, China	FCC	80 kb/day	2016
o Saudi Aramco, Jazan, Saudi Arabia	Hydrocracking	106 kb/day	2020
o PetroChina/PDVSA, Jieyang, China	Delayed coking	120 kb/day	2019
o PetroChina/PDVSA, Jieyang, China	Hydrocracking	120 kb/day	2019
o Petronas, RAPID Ref., Pengerang Malaysia	RFCC	124 kb/day	2020

Source: IFPEN based on data from KBC

Europe, especially the CIS, is in a completely different situation, since for these regions conversion projects are an absolute priority given the necessity to adapt facilities to consumption needs. In Europe, conversion projects account for 60% of the total volume of projects[6] *(atmospheric distillation + conversion). In Russia, due to the program of refurbishment and modernization of refining facilities, this figure is over 84%. This program ultimately risks being a burden on European refining (see box).*

Figure 42: Refining projects - distribution by project type: distillation/conversion



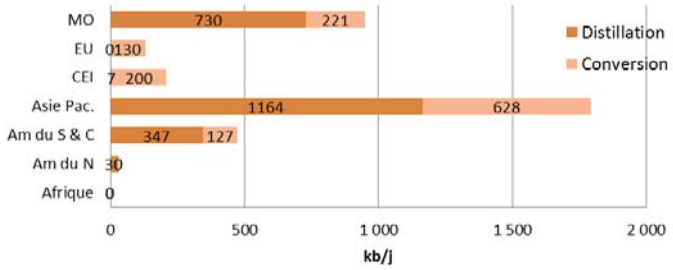
Source: IFPEN based on data from KBC

The United States is seeing an even distribution[7] *of investment. High margins and a growth in demand and economic activity in the region are encouraging refiners to invest both in deep conversion and light crude processing*[8].

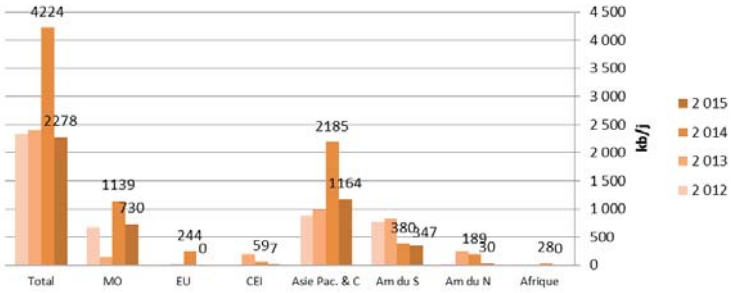
[6] Not including closures of assets.
[7] The US is undergoing a process of restructuring the refining sector - a process that consists of optimizing in each district (PADD) its crude fraction between local light crudes and imported heavy crudes.
[8] Oil Medium Term Market Report 2013, Market Trends and Projections to 2018, IEA.

Postponed projects: For various technical, economic, financial and/or geopolitical reasons, over a third of projects have been postponed by at least a year:

- *34% of atmospheric distillation projects - 2.3 Mb/day - have been postponed. Most of these projects (51%) are in the Asia-Pacific area (1160 kb/day). The remaining volumes are spread among the Middle East (32%) and South & Central America (15%). In terms of the change over time, the situation in 2014 showed an especially high level of postponements compared to usual levels (practically double the figures announced in 2015 and before 2014). The brutal fall in the price of crude from mid-2014 and the resulting uncertainties are the reason for this "tidal wave" of postponements. In 2015, they fell - boosted by a definite re-establishment of refining margins.*
- *25% of conversion projects - 1.3 Mb/day - have been postponed. Outside Asia-Pacific, which accounts for 50% of conversion project postponements, the distribution is relatively even between the other regions: the Middle East (17%) and the CIS (15%) are the most affected regions, next come South & Central America and Europe with 10% each of postponements recorded in 2015.*



Postponed atmospheric distillation projects - changes since 2012:



Source: IFPEN based on data from KBC

4.4. Increase in capacity and stabilization of medium-term demand

4.4.1. General developments

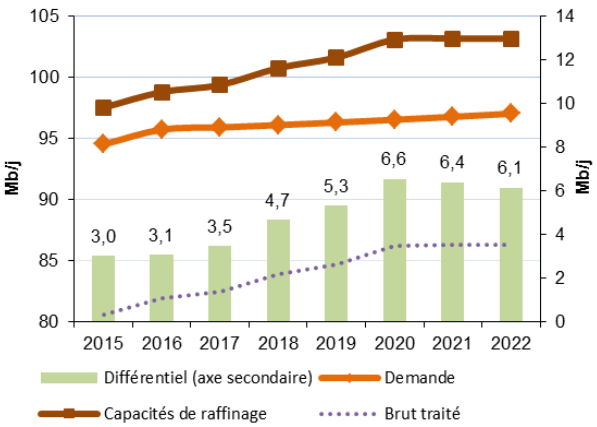
Figure 43 shows the increase in refining capacity throughout the world based on projects that are currently at an advanced stage of development and which are likely to be completed. It also shows predictions for increase in demand as provided by the IEA [9]*in its central scenario. The international organization foresees a moderate increase in world oil demand over the medium and long term*[10]*. This will result in a heightened surplus capacity in the medium term.*

In 2015, refining capacity amounted to 97.5 Mb/day[11] *and the oil demand*[12] *to 94.5% Mb/day, i.e. a surplus of 3.0 Mb/day. In 2020, refining capacity should amount to 103.1 Mb/day and demand should reach 96.5% Mb/day - thus the surplus will be 6.6 Mb/day, i.e. an additional 3.6 Mb/day.*

[9] OMR – Oil Market Report and WEO 2015.
[10] Average annual growth in oil demand of 0.5% between 2014-2040 under the "New Policies Scenario". WEO 2015.
[11] BP Statistical Review 2015
[12] BP Statistical Review 2015. Including marine fuels, aviation fuels and biofuels.

Between 2015 and 2017, the overall surplus should remain stable. After this period, demand will tend to stabilize, increasing slightly between 2017 and 2022. On the supply side, refining capacity will continue to increase, above all from 2018 under the impact of planned new projects, simultaneously increasing the surplus capacity.

Figure 43: Medium-term global change in refining capacity and demand



Source: IFPEN based on data from KBC and the IEA

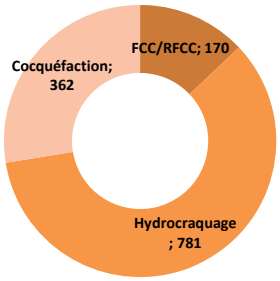
Without considering the actual refining capacity but rather the volume of crude processed, and assuming an average overall utilization rate of 82.5%[13] *between 2015 and 2022, we see a volume of supply of products that is lower than demand, a difference that will be covered by unrefined products such as natural gas liquids (NGLs), liquid biofuels, GTL as well as crude oil used directly for electricity production*[14]*. Due to the sharp growth in this kind of supply in recent years, net demand for refined products - "call on refining" - has been much lower than net nominal additions in capacity, which has led to a glut in refining capacity. The incorporation into the market, especially from 2018 onwards, of a large amount of new refining capacity, together with a growing supply of unrefined products, will probably heighten the difference between supply and demand of refined products.*

Russian refinery modernization program:

The Russian refining sector has for several years been undertaking a modernization program of refineries, with the aim of adding hydrocracking (800 kb/day), coking (360kb/day) and FCC (170 kb/day) capacity by 2020 (see figure below).The units already in operation under this program aim to improve the quality of gasoline, including isomerization, hydro treatment and reforming units.

Given that the majority of modernization projects are hydrocracking and coking units - which process VGO and residues - the production of ultra-light diesel fuels will increase and, in contrast, the production of fuel oils will decrease. Gasoline production will also increase due to the planned capacity in FCC units.

Projects scheduled for conversion by 2020 (kb/day):



Source: IFPEN based on data from KBC

4.4.2. Regional considerations

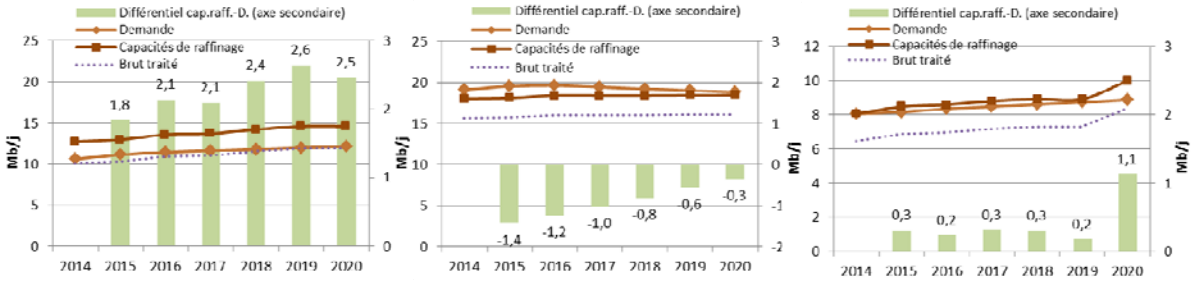
Breaking down our observations by area gives us very contrasting situations. In China, medium-term capacity is based on demand, the large volume of projects enables China, in capacity terms, to maintain a gap between supply and demand. In reality, with an average utilization rate of 79% for fifteen years, China is now in a fraught situation with regard to supply and demand of refined

[13] Average utilization rate 2000-2014. Source: BP Statistical 2015.
[14] KBC, Outlook for the World Refining Industry 2015.

products. In order to escape this situation, China will improve the loading rate of its refineries and correspondingly modernize and consolidate the sector - this will mean more closures of small facilities[15]. *Furthermore, the country has tightened its requirements up considerably in terms of product quality. In 2015, refineries should be able to produce Euro IV quality gasoline and from 2017 to produce Euro V. Although the new quality requirements are not directly linked to refineries' operating rate, they promote better utilization of refining facilities.*

Figure 44: Medium-term change in refining capacity and demand, by region:

China *United States* *Middle East*



Source: IFPEN based on data from KBC and the IEA

The Middle East, in terms of capacity, is in a fraught situation, with a small gap between demand and capacity that will grow slightly from 2020 onwards due to the commissioning of large projects from 2020. The relatively low average utilization rate (2000-2014) of 81% is accentuating the product deficit in the region. The arrival of new capacity should balance supply and demand for refined products.

In contrast, in Europe and the United States demand is falling or stabilizing. This phenomenon is accentuating surplus capacity in Europe, where more reductions in capacity are expected. The United States, which historically runs a deficit in capacity terms, is tending towards a balance in supply and demand, due to the twin effects of a fall in demand and the stabilization of internal capacity. With a high utilization rate of over 90% in 2015, US refineries are increasingly responding to internal demand. Since 2007, there has been a reduction in US imported oil and petroleum products totaling 3 and 4 Mb/day respectively.[16]

4.4.3. Investment opportunities

Future investments need to be able to respond better to:

- the strengthening of quality specifications for petroleum products, especially those pertaining to their sulfur content,
- structural influences on demand, such as the influence of diesel and the surplus of gasoline in Europe and, correspondingly, the need to adapt industrial installations,
- the change in regulations on refineries, especially in Europe (but also more recently in the United States) that call for a reduction in the current levels of local pollution (e.g. SO2, NOx, PM and CO, etc.) and general pollution (CO2 for the most part, via quota allocation plans and the ETS Directive[17]) in refineries.

In general, efforts must be made to modernize and consolidate the refining sector where it is deemed necessary, such as in Asia-Pacific, Latin and Central America and also the Middle East in order to optimize production, especially by improving the refinery utilization rate, which is very low

[15] This phenomenon could be boosted by recent price provisions on the domestic market that especially penalize small facilities.
[16] The United States remains a net oil importing country (6.8 Mb/day currently versus 10 Mb/day in 2007).
[17] Emission Trading Scheme

in these regions. European refiners must address the trends set out above in a context of increasing competition that risks once more putting the competitiveness of European refining to the test.

Finally, we must highlight the measure taken recently by the US Congress to lift the ban on US producers' export of crude. Europe will be the main destination for this "new" petroleum and European refiners will benefit from it, since they are better equipped to process this quality of US petroleum than US refineries. However, if the embargo is lifted, exports of US crude are still dependent on the difference in price between WTI and Brent - a difference which has closed considerably in recent weeks. We believe that the price difference between Brent and WTI needs to be $6-$8/bbl for it to be economic to export US crude to Europe. In fact, the lifting of the embargo should not change the current European refining situation in the short term but it is something to be taken into account in future investment decisions.

After an economic downturn in 2015, global growth in 2016 will be "disappointing and uneven", according to the IMF. The bleak outlook for 2016 could have an impact on the development of future projects in refining and the general slowdown in 2015 of planned new projects could be intensified in 2016.