

4125 Words

Global perspectives – implications for the industry

SCOTTISH OIL CLUB

Friday, 8 February 2013

Global perspectives – implications for the industry

Andrew Gould

■

Minister, Ladies and Gentlemen, good afternoon, it's a great pleasure to be invited to address this conference and I would like to thank the organisers for their invitation.

I have been invited to address the topic of global perspectives and their implications for the industry. As some of you know, I spent the bulk of my career with Schlumberger, the worlds largest Oilfield Service Company.

Since I retired last year I have become the non executive Chairman of the BG-Group a leader in Natural Gas. I therefore, have acquired fairly recently a perspective from the other side. In fact, I was recently in Brazil where an acquaintance from Petrobras who I have dealt with in both Schlumberger and BG asked me, "Now you are on the other side don't you think that service company prices are too high". I will spare you my reply but his remark set me thinking that the Industries challenges in this decade will be very different from the last one.

I would therefore like to try to outline to you what I think will be the principal challenges that the hydrocarbons industry will face in the next decade. I cannot cover them all and noticeably I will not cover the effects of climate change on energy policy. I will be discussing the difficulties of maintaining adequate supplies of oil and gas.

I do feel, however, that the economic crisis the world is currently facing will have dire consequences on international efforts to limit emissions. In addition to restricting the money available to promote

more renewable sources of energy, the current low price of gas in the US has had as an effect the displacement of cheap thermal coal towards Europe. As a result while the USA is seeing a reduction in its emissions due in part to the substitution of gas for coal, the same is not true in Europe where coal has shown the largest increase as a source of fuel for power generation. In addition coal fired power generation used to balance renewable loading has led to significant increases in emissions.

Oil has no ready substitute and while high prices cause some demand destruction they do not lead to massive substitution. The same is not true of gas where high prices lead to substitution by coal thus negating efforts to control emissions. The IEA has recently warned that coal may remain the dominant energy source for a long time to come. The renewed debate around the use of nuclear generating capacity is another element adding to the possible increase in the use of coal.

But let me take a brief look back at the issues that dominated the first decade of this century.

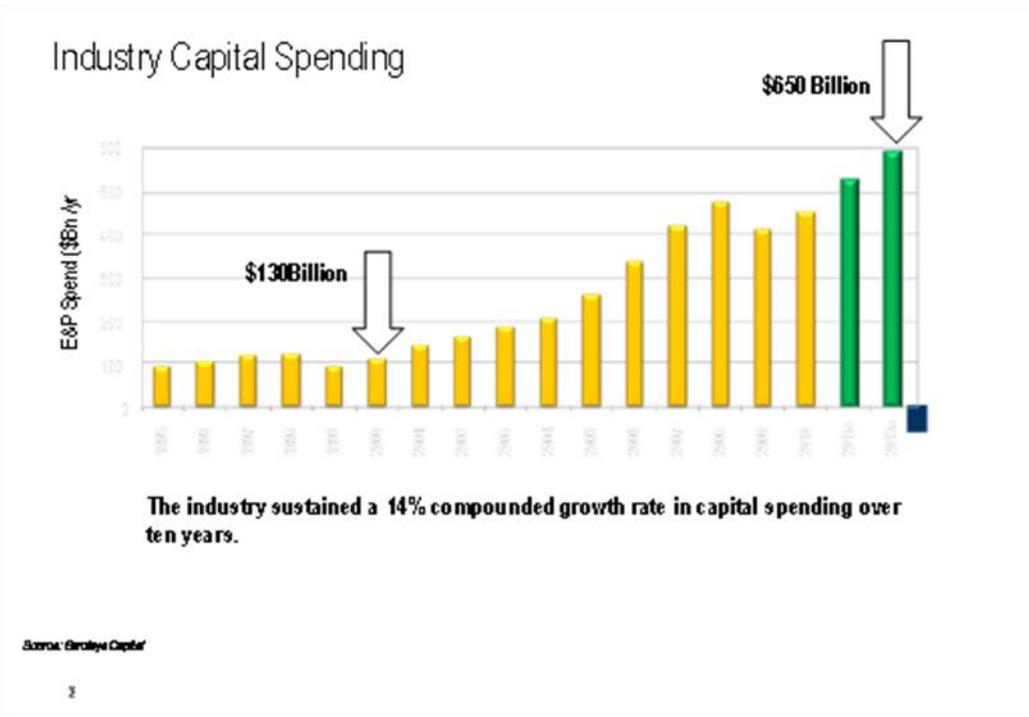
Background issues from the first decade of the century

- Between 2000 and 2010 China's primary energy demand more than doubled from 19.6 Million boe to 46 million boe. While oil consumption more than doubled oil and gas's share of the mix fell from 24% to 22% demonstrating the role of coal.
- Russia became the single largest producer of oil. The spectacular recovery in Russian production at the beginning of the decade delayed the increase in oil prices.
- Shift in the supply response, Exploration and Production capital expenditure increase from \$130 billion to \$545 billion and spending surveys indicate it may cross \$650 billion in 2013.

1

Firstly, undoubtedly the most important, shift of the past decade has been China. The OECD nations discovered that China, and to a lesser extent India and the Middle East, had assumed the mantle of demand driver. In 2000, China's primary energy demand was 19.7 million BOE/day of which oil and gas constituted 24%. Oil and gas represent a small fraction of the consumption, again demonstrating the role of coal. The world woke up to China's energy need with the spectacular demand increase in 2004, and by the end of the decade China's primary energy demand had risen to 46 million BOE/day, of which 22% was oil and gas. China's oil consumption more than doubled in ten years.

The second shift of the decade in oil and gas was undoubtedly the emergence of Russia as the single largest producer. Following the collapse of the Soviet Union, Russian production collapsed to as low as 6.1 million bpd. In the six years following 1999 it rose by more than three million bpd becoming the major reason why oil prices did not rise faster earlier in the decade.



The fourth shift was the supply response. At the beginning of the decade when supply/demand balances started to tighten, the industry faced its first supply challenge in 25 years. The cushion of excess supply created following the oil shocks of the 1970's was into steep decline. The decline of the three key pillars of the 1970s' supply response, Alaska, Mexico and the North Sea, was a feature of the decade. In 2000 the three produced 11.3 million of oil bpd. By 2010 this had declined to **7.7** million. The thin margin of excess capacity coupled with the rapid price increase led to an explosion in exploration and production Capex. Between 2000 and 2011 the spend in nominal terms went from \$130 to \$545 billion—a compound growth rate of over 14%—and global E&P spending surveys indicate that in 2012 it will approach \$650 billion.

Background issues from the first decade of the century

- The mood was one of resource shortage and a recognition of the shift in ownership of the remaining easily accessed conventional sources of hydrocarbon.
- Decline rates and peak oil theories were prominent in the industries psyche. Exploration and Production capital expenditure increase from \$130 billion to \$545 billion and spending surveys indicate it may cross \$650 billion in 2013.
- Resource nationalism was rife, perhaps 75% of the world's known conventional oil reserves closed to private capital.
- The decade saw the rise of the NOC's, there increasing contribution to the world's energy equation and there increasing technical sophistication and desire to learn.

1

The combination of high prices and the need to rapidly increase supply led to a period of frantic growth in exploration and production activity. Both the price and the supply challenge had major effects on the structure of the industry for the decade and for the future. In the 2000s resource nationalism was rife. The net result is that perhaps 75% of the world's known conventional oil reserves are closed to international private capital today, while 60% of production originates from non-NOC companies.

As a result the mood of the decade was one of resource shortage. Peak Oil theories abounded. Matt Simmons published "Twilight in the Desert" proposing that the production from the supergiant fields in Saudi Arabia was about to go into accelerated decline. Decline rates became a subject of major debate. The US prepared to make major LNG imports. The price signals reflected imminent shortage and the geopolitical factors only added to this. It all culminated with the trade at US\$145 in July 2008 shortly before the financial collapse. The subsequent oil price collapse and its rapid recovery continued to send signals that even in a market with slow demand growth concerns over adequate supply remain.

In fact, the story of the decade around resource shortage was very different. All the restrictions led the industry, particularly the IOCs and Independents, to opportunities offshore, in more remote and harsh environments, and to heavier or less mature hydrocarbons. In addition, the size of available conventional oil accumulations was becoming smaller and therefore more difficult to produce economically. These sources of conventional oil production were increasingly complemented by unconventional oils and gases. The enablers for this to happen were technology and price and in my opinion price was far more influential than technology.

A Decade of Resource Additions

- Increasing inventory of unconventional gas reserves both in the USA and worldwide. The IEA currently estimates remaining unconventional technically recoverable reserves at 328 tcm.
- Oil volumes have been higher since the emergence of pre-salt plays in Brazil. Drilling here has added over 30 billion barrels since 2006. Worldwide newfield oil discoveries of 122 billion barrels replaced almost 40% of global production during the decade.
- Gas volumes have been higher since the emergence of major new provinces in the Eastern Mediterranean and in East Africa from 2009. Newfield gas volumes of 122 billion boe replaced over 80% of global sales gas production for the decade.
- E&A spend tripled between 2004 and 2008 to reach around US\$70 billion per year, stabilising at this level with the global financial crisis, before returning to modest growth in 2011. Exploration well numbers dipped by 20% after 2008. A greater focus on challenging deepwater plays required higher spend per well, and hence spend has been broadly flat.
- Overall exploration well success rates have been broadly flat over the past decade, at around 40%.

Sources IEA and Wood Mackenzie

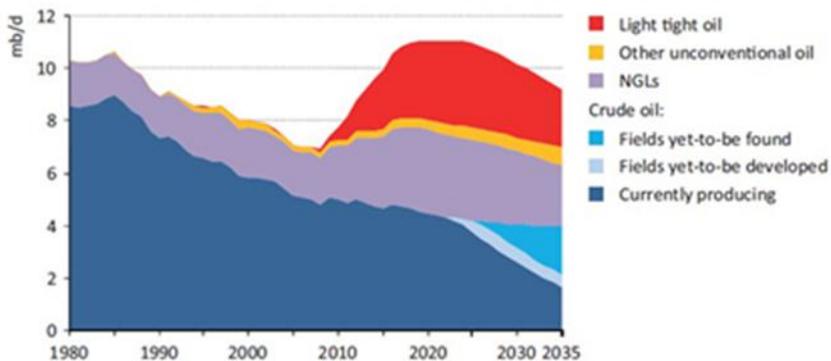
4

But the result was that by the end of the decade and in the beginning of this one a great deal of new resource had been added and more importantly a lot had been moved from resource to reserves. Of these the most spectacular were undoubtedly the inventory of shale gas in the USA. Worldwide, the amazing success of exploration and appraisal in the pre-salt domain in Brazil has materially altered volumes of new oil available. The price change had consequent effects on the economics of Canadian Oil sands projects. Exploration, underwent a general revival.

Moving into this decade the success has continued. Exploration results in East Africa and Mozambique have added huge new reserves of natural gas. A whole new domain has been opened in the Eastern Mediterranean. The pre-salt domain of West Africa is producing promising results. The Norwegian sector of the North Sea and the Arctic has seen a successful revival of exploration. Australia and other parts of Asia have shown considerable success. Brazil continues to be a standout on the size and number of overall discoveries. As a result the world has moved into a mood where the feeling has become that sufficient resource and reserves are there to ensure that the production will follow.

US will overtake Saudi Arabia as the world's largest Oil Producer by 2020?

Figure 3.18 ▶ United States oil production by type in the New Policies Scenario



Note: The World Energy Model supply model starts producing yet-to-find oil after it has put all yet-to-develop fields into production. In reality, some yet-to-find fields would start production earlier than shown in the figure.

1

The IEA has postulated that the USA may overtake Saudi Arabia as an oil producer by 2020 largely due to the rapidly increasing production from shale and tight oil and Natural Gas liquids. Increasingly energy independence of the US is being discussed. There is much less talk about decline rates. There is speculation that adequate new oil production to meet demand will be on line by 2020. As for gas, there are theories that huge amounts of shale gas production, including exports, from the USA, coupled with the new gas production from Australia and East Africa and Russia will collapse the current three tier gas pricing into a single global market with the consequent complete delinking of gas prices from oil. The advent of new gas supply in the US has substantially modified trading patterns for LNG.

Of course, the existence of abundant resource and reserves is excellent news for the world's energy supply but what concerns me, and what I think will be the problem of this decade, will be turning reserves into production and delivering it to market on time and at a cost that provides a reasonable price to consumers and rate of return to the operators and service companies.

The underlying reasons that will make this task difficult are in my opinion threefold. Firstly, the new sources of production will come from hydrocarbons that are either poor by definition, (shale) or difficult to access, (deep offshore). Secondly, they both imply a scale change in the amount of activity the industry will have to support and manage to produce the desired result. Thirdly, the political, fiscal and security of the industry is in a state of permanent flux. In addition, we should never forget the effort necessary to mitigate the decline rate in the world's existing production base.

The industries traditional difficulties around political stability, fiscal take, contract sanctity and investment will remain throughout this decade. The inability of government to understand the extreme long term nature of our investment increases the cost of capital through the risk of changing terms and conditions or fiscal take. This is not a developing country risk. It is true of my own country the UK as it is of Alaska. I have to congratulate the Norwegian government on the stability of the contract and fiscal regime which despite high taxes has maintained Norway as an attractive destination for investment.

Oilfield Service Base Rumaila Field Iraq.



This decade will also be remarkable for the extent to which security issues will affect investment decisions. The general instability of many regimes around the world will be a limiting factor. It has been a growing feature of our industry over the last decade. Much of the ability of the industry to deliver adequate production in this decade depends on Iraq being able to continue to increase its production. The current political divide in that country, the difficulty of operating there, the failure to agree an oil law between Iraq and the Kurdish region are all factors for delay. The wider question of what will happen to the Sunni Shia divide when the Syrian regime falls is still a huge uncertainty. All these uncertainties will ultimately limit investment.

However, the difficulties I have just described are traditional to the oil and gas industry and the players know how to accommodate them. I am much more concerned that the industry is underestimating the difficulty of exploiting the new sources of reserves that have lent much optimism to current forecasts of new production. I would like to deal at some length with what I see as the two principal risks in the reserve base. The ability to increase and sustain shale production and the ability of the industry to handle further huge expansion offshore.

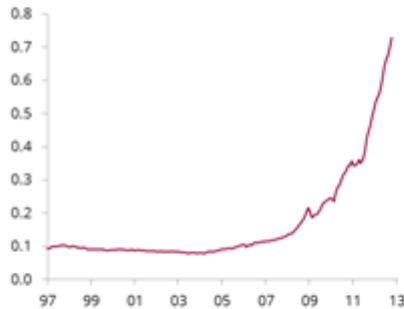
Let me first deal with shale. I intend to do this under two headings and my remarks apply fairly equally to both gas and liquids.

Firstly, I think it is important to point out that this is a source of hydrocarbon that requires a huge amount of development activity to produce significant volume. Individual wells are very rarely as productive as those drilled in conventional reservoirs where hydrocarbon has migrated and is trapped under pressure, hence the need for massive hydraulic fracturing to get the hydrocarbon to flow. This has meant that the economics of individual wells have remained a key criteria. Secondly, the wells in shale are subject to extremely rapid initial decline rates, as much as 60 to 70 % in the early years that are then followed by a long plateau at a low rate of production. In addition, there is some debate that where massive hydraulic fracturing has been used the plateau may not be sustained due to the fractures closing after a period of time.

SUPPLY

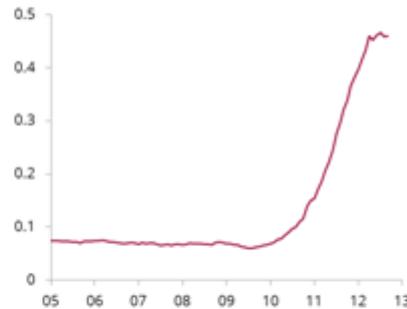
Growth in US unconventional oil output has been impressive

North Dakota oil production
mbbl



North Dakota oil output has risen to record highs

Texas oil production
mbbl



Eagle Ford together with Bakken are the most prolific basins

Source: Texas Oilfield Services; Bakken Data Reporting; EnergyInformation.gov

This implies that while the initial build up of production is extremely impressive, as for example, the recent oil production numbers from the Bakken have shown, the maintenance of ever higher production levels is a treadmill, ever higher levels of activity are needed as the wells age to compensate for rapid decline rates. This activity remains extremely price sensitive and a small drop in the price of the commodity can rapidly affect levels of drilling as we saw briefly in the second quarter of this year in the US.

Unconventional Completions – Today

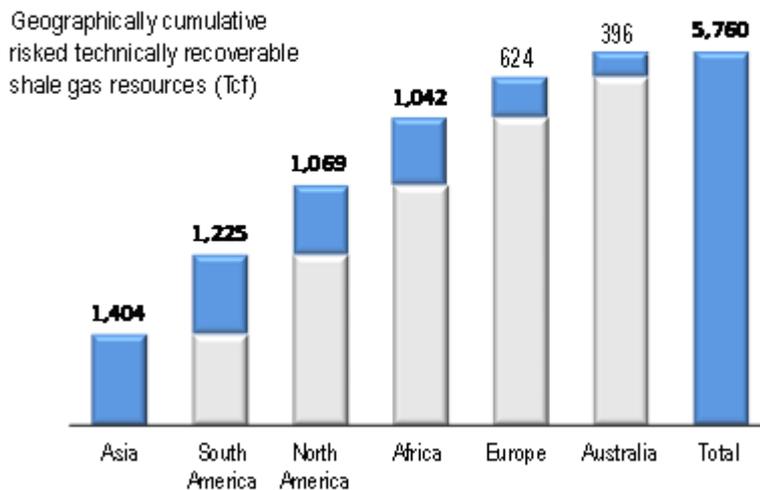
- 8 Well Pad
- 92 Stages pumped in 6 days
- 34,000,000 Lbs of Sand
 - 850 Truckloads
- 40,000,000 Gals of Water
 - 8,000 Truckloads
- 30 Pumps (80,000 HHP)
- 50 People



2011

Secondly, when looking at shale it is important to bare in mind the role that the service and logistics industries play in enabling the rapid increases and decreases in activity that shale implies. By its nature the production of shale requires a high concentration of oilfield service equipment and logistics as the above example shows. Pressure pumping fleets and rigs, trucks to carry sand, proppant and water. In the US, these abound but more importantly, they can be scaled up and moved around the country rapidly. For a service company to earn a return in the US and keep its pricing at a level that makes the well economic for the operator is made possible by a high utilization factor for the equipment. Continued efficiencies achieved through scale improve results over time.

Worldwide Shale Gas Resources are Significant

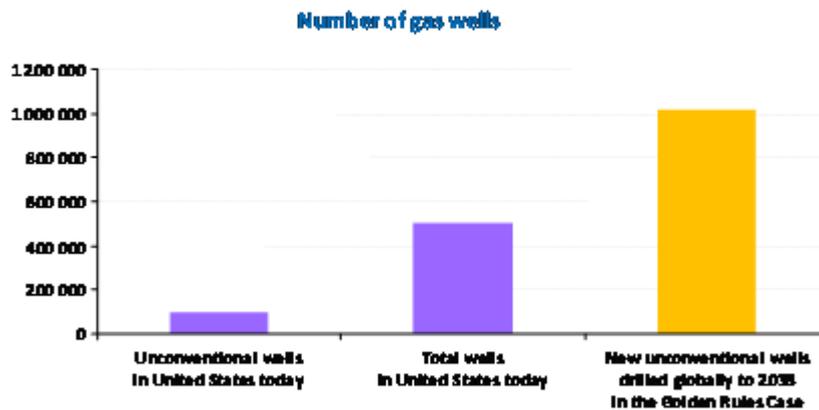


Source: EIA World Shale Gas Resources, 2011

Today, the US and possibly Canada are the only markets where the service industry exists at a scale that can achieve the required level of activity at a reasonable cost. In some markets, such as Argentina there is an industry that can be scaled up but in many others the basic requirements for shale development do not exist. Of course they can be created but it will be long and hard and will imply a cost of exploitation very different from that of the US.

Three other matters have favoured the rapid development of shale in the US. The first is the mineral ownership law of the country which gives the landowner a stake in the exploitation of the subsurface. This may explain the second which is the relative tolerance of the short term environmental impacts of shale's exploitation. This is not the same in the rest of the world as the development of the hydraulic fracturing debate in Europe has shown. The third is the relative availability of some data about the shale in the US due to the fact that the industry has been drilling through them for a hundred years. This is simply not the case in the rest of the world so the industry needs a period of fairly conventional exploration before it moves into full scale development.

A huge task for industry



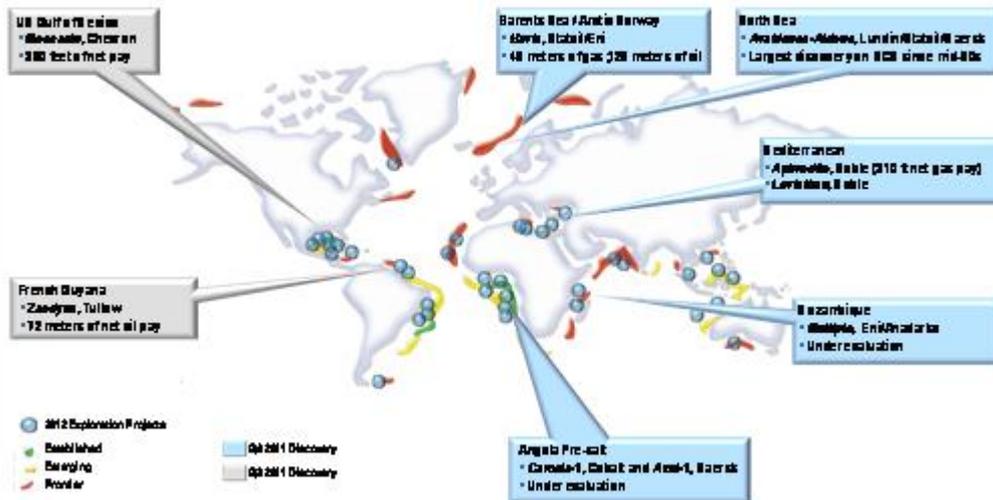
More than one million new unconventional gas wells would be needed globally to 2035: applying the "Golden Rules" could raise costs slightly, by 7% for a typical shale-gas well

Source: IEA Golden Rules

To summarize, I can find no better evidence than that shown by the IEA in its special report 'Golden rules for a Golden Age for Gas'. This chart implies that to achieve the levels of production in unconventional gas proposed would mean drilling over one million new gas wells by 2035. This compares to the current approximate 100,000 unconventional wells that have been drilled to date in the US and the 500,000 wells that have been drilled since the start of the industry. This is a massive task and to re-emphasize my initial point, achieving the industries ambitions in unconventional will take much longer than many of the forecasts propose with investment levels and costs that will imply a strong pricing environment particularly for the resource outside the United States.

If we can doubt the feasibility of the development of unconventional sources of hydrocarbon on the scale envisaged we can equally doubt the possibility of developing all the new offshore and frontier discoveries in the next decade. Between 2000 and 2010 the number of rigs working offshore roughly doubled with the bulk of the increase in the second half of the decade.

Recent Discoveries and Frontier Exploration

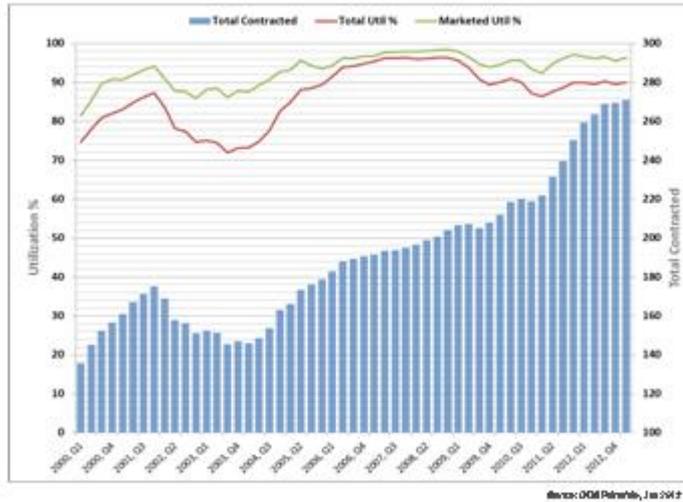


Source: Oilfield Review, US Bureau of Economic Geology, NPD, Infield, Company press releases

In the long period of low oil prices Deep Water offshore activity was essentially in the triangle between the Gulf of Mexico, West Africa and Brazil. Small pockets of activity existed in Asia. The support and supply services were organized around these three markets

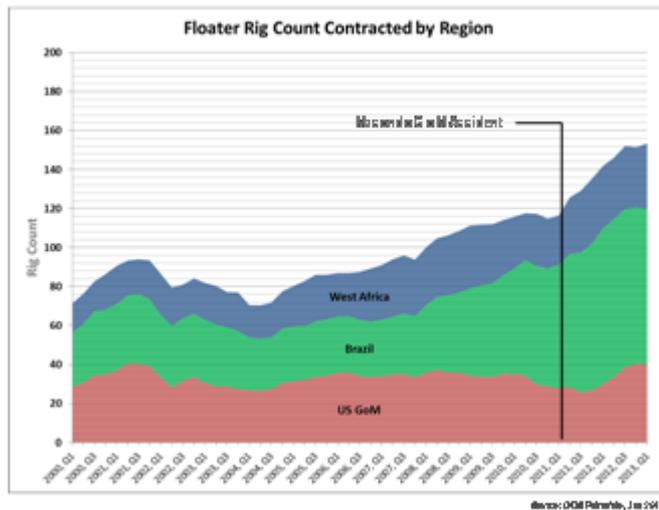
Several events have occurred in the last few years which fundamentally changed the dynamics of the offshore market and this is likely to continue. The first was a much wider range of geographic destinations that occurred with the revival of exploration. The equatorial margin in West Africa and Central America, whole new deepwater provinces in the Mediterranean and East Africa, higher activity levels in Australia and South East Asia.

Global Deepwater Market



The number of available Deepwater rigs has doubled between 2004 and today and it is forecast through the number of new builds currently laid down that the count is likely to go on increasing. It is important to look at where these rigs are currently located. If we look at the three traditional centres of Deepwater activity the current status of contracted rigs looks like this.

Key Deepwater Regions Rig Count



What this clearly shows is that the program of Petrobras following the Deepwater pre-salt discoveries has fundamentally changed the relative importance of the traditional deepwater

markets. The steep ramp up of activity in Brazil began in 2008 and has continued to this day and is forecast to continue as Brazil brings on rigs built within the country. To some extent, the affect of Brazil on the overall market has been mitigated by budget restrictions following the financial crisis of 2008 and above all by the shut down of all operations in the Gulf of Mexico after Macondo. Current plans would show Petrobras operating at least three times as many deepwater rigs as it nearest rival and more rigs than the next three largest deepwater players combined

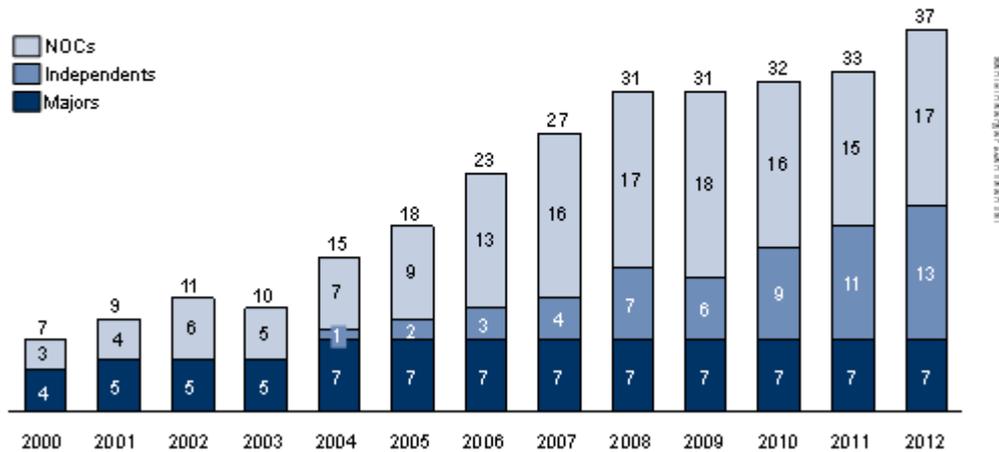
Even at the current stage of the Brazil development huge strains have been placed on the capacity of the industry to service and supply the increase in activity. Shore based support and logistics have seen and are seeing huge expansion and this is in advance of moving the activity in the pre-salt into a full development phase. Currently only two FPSO's are active in the pre-salt fields but this is rise to as many as 17 over the next 5 to 7 years. All the associated equipment (Subsea equipment and control systems, risers, gathering systems and export systems and installation vessels) and the supply of labour to perform these tasks are still in the process of being created.

As deepwater activity moves from exploration to development in other geographical areas the strains on the service and supply industry will continue to increase. The Gulf of Mexico is now back to pre Macondo levels of activity. Australia is in a massive gas development phase both on land and offshore. Gas discoveries on the East Coast of Africa will face huge challenges in development as there is no supporting infrastructure in place and everything will have to be done form scratch. The Arctic is taking its first tentative steps.

The consequences of all this on the industry can already be seen in the statistics.

More Companies have to manage mega-budgets

E&P COMPANIES SPENDING >\$5BN (2011 US\$) CAPEX PER YEAR
of companies



Sources: Rystad Energy; US PPI

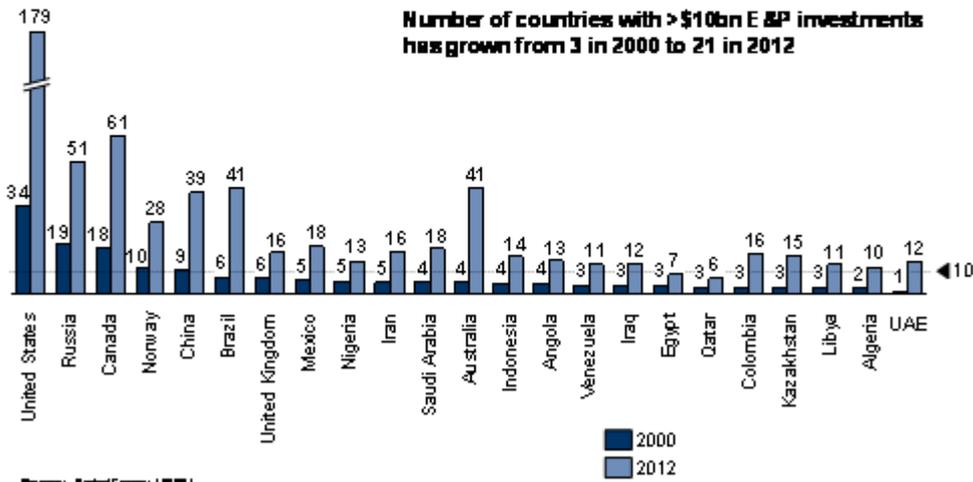
© 2012 Rystad Energy. All Rights Reserved.

The number of E&P companies spending more than \$5 billion in Capex has increased from 7 to 37 in 12 years. If deepwater in general and Brazil in particular were unique cases the market might be able to absorb the additional workload but the general trend is towards and increasing number of mega projects with mega budgets. There is undoubtedly a level of inflation in the cost numbers but there is also a level of complexity and inefficiency that has been introduced by the type of company taking on projects and the dearth of project management skills in both the operators and the service companies. Also expanded geographical scope has played a role

... and in growing number of countries

COUNTRIES WITH THE LARGEST E&P INVESTMENT SPEND

US\$bn (real 2011\$)

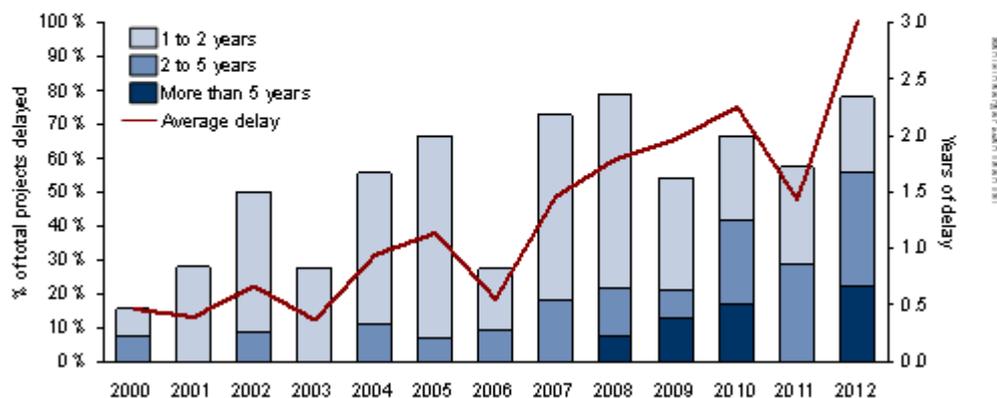


This chart demonstrates the increasing geographic spread of E&P investment, countries with E&P budgets of more than \$10 Billion has grown from 3 in the year 2000 to 21 in 2012. The first 6 from the right and Australia have the biggest increases but the tail of countries spending more is longer. It is notable that with the exception of Kuwait all the key Middle East OPEC producers are in the list

Complexity is causing more frequent and severe delays

MEGA-PROJECTS DELAYS AND SEVERITY

% of total projects with budget >\$1bn (real 2011\$) delayed; years of delay



Source: IHS Upstream database, February 2012; UBPPI - Projects exceeding \$1bn (in 2011 US\$) represent an average of 14 projects per year.
© 2012 Halliburton Services. All Rights Reserved.

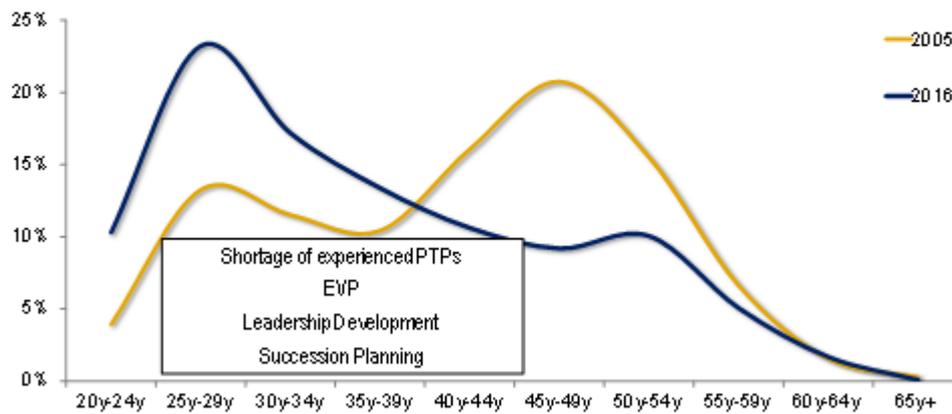
Recent studies have shown persistent and increasing delays in the delivery of large projects. There is an increase in the number of NOC's and independents taking on large projects. Many of these companies have traditionally have not developed the skills to handle large projects particularly offshore.

As a result, it is clear that the industry's capability to deliver large scale projects is not keeping pace, today, for instance, megaprojects are delayed on 1.5-2 years average, and the number of those with very severe delays (2+ years) increasing exponentially. Unfortunately, it is unlikely that this situation will improve in the short term as the industry still has to face severe shortages in capacity and nowhere is this more acute than in the domain of people skills.

Straight from Baby Boomers to Whyers

PTPs PER AGE BRACKET ON A GLOBAL BASIS

Percentage of PTPs



Note: China excluded. Oil field services excluded.
 Retirement rate: 11% for 55-60y, 11% for 61-64y, 11% for 65-69y.
 Graduate recruitment targets (projected in the above graphic) for 2015 as a basis: 450k for 20-24y, 1150k for 25-29y.
 Retiree rate: 150k (7% leaving the E.P. industry).
 Source: IBC Global HR Benchmark 2011, 2016

The data I am now going to show you comes from the Schlumberger Business consulting Human Resources benchmark survey which has been in existence for 9 years and gathers data from about 40 operators who represent roughly 40% of the world's production.

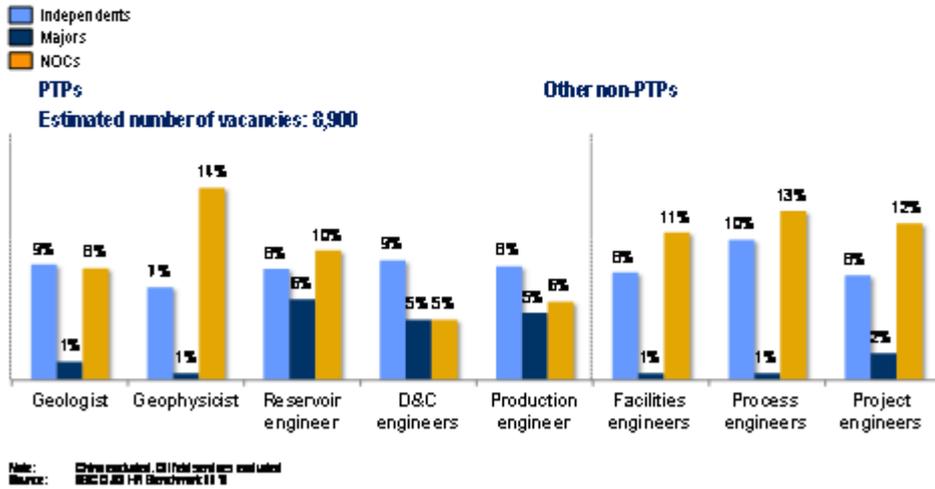
The industry has been aware for some years that it would face what has been known as 'the big crew change', the retirement of the generation of petrotechnical professionals that went to work in the years following the oil shocks of the 1970's. This chart shows clearly that the age profile is such that the bulk of these retirements is going to occur in the next five years and the failure to recruit in the 1990's and early 2000's will result in a huge deficit of people in the 15 to 20 years experience bracket. These are the age group most needed to fill the senior management and technical positions that the current wave of development activity will require.

The issue becomes how the industry will deal with the shortage.

Vacancies are high

WHAT IS YOUR COMPANY'S PERCENTAGE OF VACANCY PER DISCIPLINE?

Average percentage per peer group



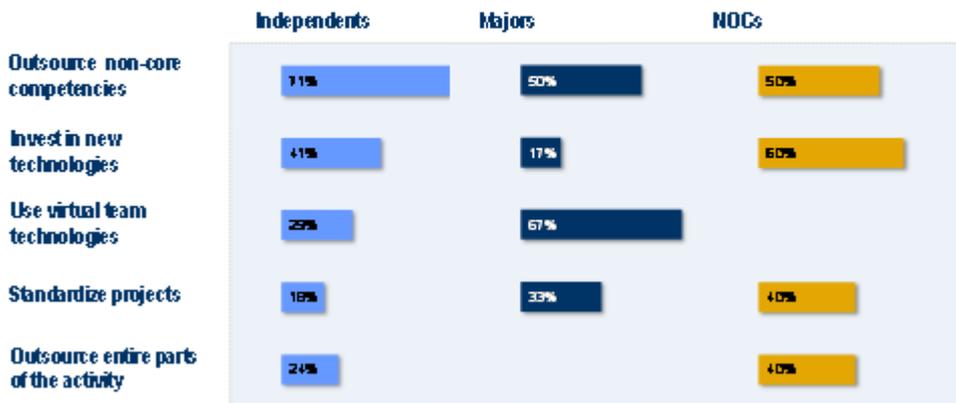
It is currently estimated that the number of unfilled vacancies in key technical disciplines is roughly 9000 people. One only has to look at the job vacancy pages of Upstream and other industry journals to see how active the market is. Websites marketing both jobs and people abound. The survey shows that in function of the declared recruiting plans, the future requirement and the probable rate of retirement that 20% of the jobs will be unfilled by 2016.

The direct consequence of this is that project delays continue to increase and the tendency of operators both IOC's and NOC's to consciously defer projects or to take more risk due to staffing problems continues to increase. In 2012 over 70% of survey respondents replied that projects would be delayed due to staffing shortages while over half the respondents said they would accept more risk.

Outsourcing and technology are used to mitigate staffing difficulties

HOW DO YOU MITIGATE STAFFING DIFFICULTIES?

Percentage of respondents per peer group



Source: IBC 2011 Benchmark 11.1

This situation is also changing the way the industry works. The use of virtual team technologies to spread experience is a prime example. More non core competencies are being outsourced to the service industry. Technology investments in software have greatly speeded up many aspects of the exploration and production process improving productivity. However, the fact remains that a large skills shortage is hitting the industry at a time when it is trying to ramp up development activity.

SCOTTISH OIL CLUB

Friday, 8 February 2013

Global perspectives – implications for the industry

Andrew Gould

Minister, Ladies and gentlemen, I have tried to outline that the world has recently gained much confidence in the availability of future supplies of hydrocarbon resource and as usual predictions are now swinging to the wildly optimistic. There is no doubt that huge amounts of resource remain, but the task of turning them into reserves and production is complicated by questions of hydrocarbon type, access, lack of technical knowledge and above all by inadequate human resources and capacity to grow the industries support and service structures in a much more dispersed geography. It is important to remember that I have only addressed a subset of the oil and gas debate and notably have not talked at all about the health and maintenance of the existing production base which as it ages requires greater and greater care.

I do not wish to be unduly pessimistic. This is an industry with a remarkable ability to adapt. I am merely pointing out that current ambitions to renew production in this decade are fraught with new problems and risks of delay.

Thank you very much for your attention.