Lessons from the last decade, strategies for the next two

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Despite the crises of the last decade, the world consumed energy in 2010 at a level that was not expected to be reached before 2015. This did not come from demand in the OECD countries, but from that of the developing countries. In spite of this, energy poverty remains a major issue with nearly 1.6 billion people around the world without access to electricity.

I would like to examine the subject in terms of the major events and trends of the 2000s that have had, or will have, a lasting effect on the exploration and production industry. I will try to relate these to the strategies that I think will be necessary for the next two decades. These choices will naturally be personal, and not necessarily those of Schlumberger where I have spent the last 35 years.

Oil and gas supplies have always been subject to political and geopolitical interference. Fear of disruption has governed political action almost since the birth of the industry and the quest for energy security has motivated every form of such action.

The last decade was marked by a fundamental shift in the security of supply which had been the preserve of the OECD nations for the last hundred years. We discovered that China, and to a lesser extent India, had assumed the mantle of demand driver with the world waking up to China's energy needs through the spectacular increase in demand of 2004. In terms of oil alone, China's apparent consumption more than doubled in ten years. This was the first, and undoubtedly the most important, shift of the past decade.

The second shift was undoubtedly the emergence of Russia as the single largest producer of oil and gas. Following the collapse of the Soviet Union, Russian production collapsed to as low as 6.1 million barrels a day (mb/d). In the six years following 1999, it rose by more than 50 per cent and became the major reason why oil prices did not rise much faster, much earlier.

When supply and demand balances started to tighten in the early 2000s, the industry faced its first supply challenge in 25 years. The cushion of excess supply created following the oil shocks of the 1970s began to shrink. The decline of the three key pillars of the 1970s, Alaska, Mexico and the North Sea, was evident. The age of the production base was becoming obvious and exploration and production capital expenditure duly exploded leading to a period of frantic growth in activity that in turn had major effects on the exploration and production industry's structure.

The first of these was the re-emergence of resource nationalism. This was not new – countries have expelled foreign interests in the past after all. Nor was resource nationalism limited to foreign interests, as the capture of greater shares of petroleum rent takes many forms; very often in the form of taxation. However, whatever the form the consequences are the same – creating uncertainties about the stability of the investment climate and restricting capital flow, both of which slow the supply response.

In the 2000s, resource nationalism was rife. Russia changed investment rules to capture a greater share of the rent. Venezuela closed again, and the Middle East did not open significantly. Mexico did not open at all. Iran and Sudan remained largely off limits through sanctions. And after a spate of extraordinary discoveries Brazil started to close again – not to investment but to the notion of foreign operators in the pre salt domain. Consequently, perhaps 75 per cent of the world's known conventional oil reserves are today closed to international private capital while 60 per cent of production originates from international and independent oil companies.

Wide range of national companies

Largely as a result, national companies form a vast range – both in structure and ability. Some are major offshore operators; others have mastered complex project management. Several are sophisticated technology users, and are often more ambitious than their international colleagues. They are determined to learn, and can compete with the best. They manage their resource as part of the national wealth. Others are emerging with increasingly large international portfolios as they respond to their countries' energy demands.

The role of the service industry in providing technology and process to the national oil companies has been much debated. From time to time it has been believed that by providing these services to the national oil companies the service industry has slowed international capital access to closed domains. In fact, the role of the service industry has not changed; their big opportunity came after the nationalizations of the 1970s and their role has gradually expanded through more sophisticated offerings during a period when international oil companies reduced research and development expenditure while encouraging service industry competition.

Another aspect of access that should not be ignored is the ability of pressure groups to restrict access to some of the most promising remaining reserves. The example of the United States is obvious where even prior to the

Deepwater Horizon accident the ability of various lobbies to convince politicians to restrict access was legendary.

These restrictions have led international operators and independents to opportunities offshore and in harsher and more remote environments. Furthermore, newly discovered conventional oil accumulations have become smaller while sources of conventional production are increasingly complemented by unconventional oils. In addition, heavy or unconventional oil projects including shale oil and various conversions from coal or gas are massive undertakings of long duration that require huge amounts of capital.

As a result, if there is one common characteristic in the oil exploration and development projects to be executed in the next 20 years, it is that they will become more complex, more difficult to execute, and more expensive.

If the 2000s were a decade of tremendous change for oil it was equally true, if not more so, for gas. Conventional oil is completely fungible, where constraints in the distribution of either crude or products have become minor. From well head to consumer a full competitive chain with many alternatives exists. The same is not true of gas where movement to market by pipe or LNG is still an incomplete chain.

During the last decade, the entire gas infrastructure and its sources of supply came into focus. Consumption increased rapidly, as did supply. The huge LNG and pipeline infrastructure projects begun in the 2000s have the potential to fundamentally change traditional wisdom and completely allay fears of rupture in gas supply in Western Europe. The rapid development of gas resources in Australasia considered stranded only ten years ago has changed the availability of long-term supply for China, Korea and Japan. And in the US, the development of shale gas has changed the dynamics of domestic supply. Of these factors, the huge expansion in LNG and the development of shale gas in the US truly marked the decade and although markets are currently oversupplied following the dramatic drop in demand in 2009, this effect will be eliminated in a few years time.

The US shale revolution required technology, market forces and entrepreneurship. Today's combination of horizontal wells and hydraulic fracturing has made certain shales economic, but technology will have to move much further to systematically extract full value from every shale as current extraction methods are both wasteful and expensive.

Shale gas enthusiasm has been sufficient to lead to major revisions in US reserves. In the rest of the world, where knowledge of shales is vastly inferior to that of the US, countries and companies are actively searching →

Schlumberger helped drill a backup third shaft for the successful rescue of the 33 miners trapped in Chile's San José mine

→ to understand the potential of their own shale gas resources. But much remains to be done before we can be assured that the world's shales are as prospective as those of the United States. Environmental, water and land considerations, among others, must be resolved.

No review of the last decade would be complete without mention of the tragedy that occurred in April 2010 in the US Gulf of Mexico. Eleven men lost their lives on the Deepwater Horizon, the accident led to the largest oil spill in US history, and the incident received one of the largest media exposures ever seen. This one event will have major effects on the way the industry operates in the foreseeable future.

Having now outlined the major changes of the past decade, I would like to turn to some of the objectives I believe the industry will need to examine.

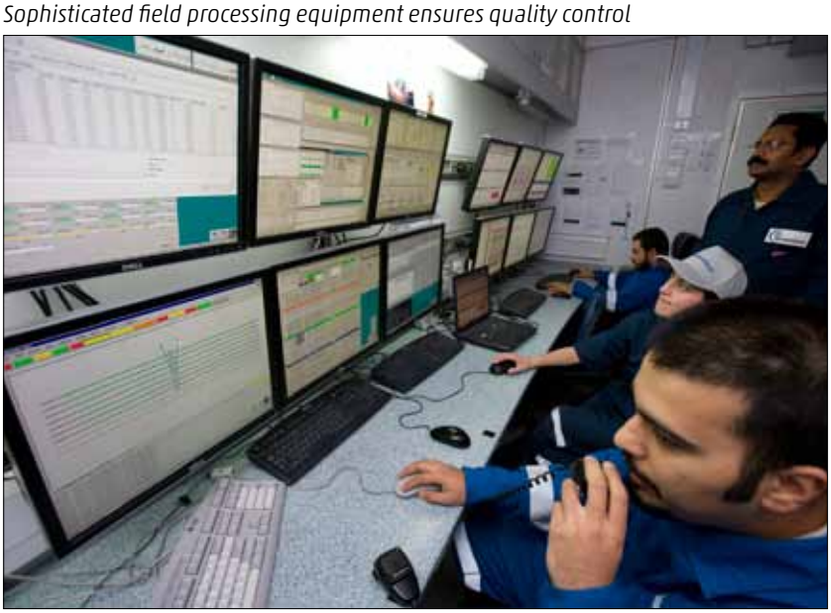
The first and most important will be to re-establish the confidence of the regulator and the public in the industry's capacity to find and produce deepwater oil and gas resources safely. In the last ten years, more than half of all new resources discovered worldwide have lain offshore. Partly as a result, offshore production is expected to supply approximately one third of the world's needs late in the next decade. And with deepwater production increasing steadily, its contribution will correspond to approximately 10 per cent of global supply by then.

Regulation will therefore become stricter, standards upgraded and oversight increased. Safety and management systems will be constantly tested and improved. Comprehensive spill response plans will be required. Technology will become increasingly critical for deepwater success and those who possess it will derive competitive advantage. Automation and instrumentation will have to be adapted to create a control environment similar to the aerospace or nuclear industries. Above all, the industry will require increasing numbers of competent and well-trained people to execute improved processes. As a result, the overall time to new deepwater production will increase, costs will escalate and those who do not adapt will lose.

The second objective for the industry will be the need to dramatically improve its project management skills. Projects have become larger and more costly as complexity has grown. There are now over 200 projects worldwide that have budgets in excess of US$1 billion. It is extraordinary that national and independent oil companies now represent over 80 per cent of total industry capital expenditure. It is also extraordinary that 40 oil and gas companies have annual capex budgets in excess of US$4 billion – up from only 10 in 2001.

Size and complexity are consequently enhancing the role of project management as a core industry skill. In the past, this has been found in just a few companies – the super-majors in particular. But with more companies executing larger projects, often in remote or complex environments, the need to train seasoned project managers is becoming acute. Such a skill is not rapidly acquired as it mixes technical and organisational capability with strong leadership ability. It involves constant evaluation of options and their potential implications and is, to a large extent, a transferable skill with many other industries.

Sophisticated field processing equipment ensures quality control



The third objective that will be important in the next two decades concerns the true viability of shale gas. There is no doubt that the resource is large. However, so many unknowns remain that it is extremely difficult today to estimate its ultimate potential. We have insufficient data, and we do not have the reservoir modelling capability to lend credibility

to reserve or recovery numbers. Our traditional geological and petrophysical models do not apply. We cannot use the usual evaluation methods to identify productive zones. The production mechanism itself is not understood and the decline patterns even less.

Today's method of extraction puts the wellbore in communication with as much of the rock as possible to get gas to flow through created fracture networks. To do this, long horizontal sections are completed with staged sets of perforations that are then massively hydraulically fractured. The process uses huge amounts of horsepower, sand, proppant and above all, fresh water. Such a brute force approach has resulted in huge variability in individual well production.

If we are going to exploit the full potential of shale gas, we need a technology package that allows optimisation of completion design as a function of reservoir quality. In time, the industry will find ways to map reservoir quality, tying shale responses directly to wireline or logging-while-drilling measurements. This will help optimise well design, completion design and fracturing treatment. Only then will we then drill the best wells, and fracture the best intervals. Shale gas undoubtedly has a major contribution to make to future energy supply, but technology will have to evolve considerably for it to realize its full potential.

As a fourth objective, the industry must face the fact that it will be desperately short of experienced human resources if it is to maintain the rhythm of exploration and production necessary to sustain oil and gas supplies. The 16 years of low oil prices after 1986 meant that little recruiting was done, and many earth science and petroleum engineering faculties were closed. In the 2000s, the industry recognized the problem and recruiting and training began to pick up.

All operators alike – international, national and independent – are relying on technology to a large extent to increase the productivity of their petrotechnical professionals. Only the majors are counting on processes of standardisation and codification to a large extent to be able to staff projects with more junior people. The independent and national operators appear to be relying more on outsourcing to better utilise their staff. It would seem to me that increased project size and complexity require that better process be essential to proper manpower utilisation with outsourcing not being an adequate solution on its own. A failure to implement process will also make it more difficult to comply with the regulator as competency assurance will become an essential tool for certain key positions.

If the industry is to meet the challenges it faces, it will need much greater training to create the technical population it will require. Technology and process will help, but they cannot remove the need for a highly technical and competent workforce.

Finally, no discussion of oil and gas for the next two decades would be complete without mention of greenhouse gas emissions. Energy-related carbon dioxide (CO_2) emissions have increased by over 40 per cent over the past two decades with forecasting agencies projecting similar relative increases over the next 20 years. The sustainability of such a rise has been questioned by many leading climate experts. A reduction to the levels recommended at recent G20 summits would require a portfolio of carbon abatement options, among which energy efficiency would clearly have the largest impact and lowest abatement cost.

Analyses by the International Energy Agency and other organisations have, however, shown that carbon capture and storage (CCS) has the potential of providing nearly 20 per cent of the reductions required by 2050. But in order to achieve this ambitious target, CCS needs five main ingredients – financial mechanisms, legal and regulatory frameworks, technological innovation and cost reduction, international collaboration, and public acceptance.

The Cancun climate change conference made some progress on financial mechanisms through the adoption of CCS as a clean development mechanism but there is still a long road ahead for carbon abatement prices to reach levels that would make CCS fully commercial. Enhanced oil recovery using CO_2 could help speed-up the learning curve to some extent, as well as providing an economic incentive and developing part of the surface infrastructure. Storage applications from the main emitters such as power plants would need CO_2 prices far above the level currently foreseen in emission trading markets. The focus over the next few years should probably therefore be on building experience through pilot projects to serve as public confidence builders as well as technological test beds.

I believe that the issues I have raised, post-Macondo operations, project management, shale gas technology, human resources and energy emissions will all be important issues for the two decades to come. I also believe after three and a half decades in this business that the resourcefulness and enthusiasm of the people who work in the oil and gas industry will be equal to overcoming the challenges. This is a very different industry from the one I joined in 1975. ■