



ENERGY & NATURAL RESOURCES

Key Issues for Rising National Oil Companies

KPMG INTERNATIONAL

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Foreword

The demand for energy is expected to grow by more than 50 percent by 2030.¹ How National Oil Companies (NOCs), who control 72 percent² of the world's oil reserves, respond to this challenge will be likely to have a significant impact on the stability of oil and gas markets in the future.

The importance of NOCs is underlined by the fact that they made two-thirds of the largest discoveries last year, according to Rystad Energy. In the annual Energy Intelligence Top 100 Ranking of the World's Oil Companies, NOCs take up nearly half of the positions.

This report explores the position of NOCs through interviews with senior executives and offers their insights into emerging issues for the oil and gas industry in the next 5-10 years. This research was carried out and the report written on behalf of KPMG firms by Dr. Valerie Marcel, Associate Fellow at Chatham House, who I would like to thank for the wealth of experience and knowledge that she brought.



Anthony Lobo

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¹ International Energy Agency

² IMF World Economic Outlook, 2006

Executive summary

The oil and gas industry is facing a major transition that is likely to require many of its key players to adapt significantly to a changing environment over the coming decade.

It is a widely reported view that the time of the oil industry being controlled by the major International Oil Companies (IOCs) is giving way to what many people are calling the “era of the NOC”. But interestingly, the NOC executives interviewed for this report rejected this idea. It implies for them a polarity and an opposition between NOCs and IOCs that is no longer reality in a world where more NOCs are moving outside their national boundaries and partially privatizing their assets. It was clear from the interviews that a number of NOCs are seen as being highly proficient, well-managed companies. Other NOCs are growing in capability and benefiting from the current environment of high prices and limited open acreage to demand more from potential partners and investors.

Over the next decade, this transition is likely to continue to take shape, giving rise to new opportunities and challenges for NOCs, IOCs and service companies. New players are likely to emerge and strategic relationships will be likely to adapt to suit their evolving needs.

Some of the key findings from our interviews were:

The growing capabilities of NOCs

- Higher oil prices increasingly mean that NOCs are able to self-finance projects and purchase technology from service companies – areas in which IOCs have historically had the advantage. Jamal Alnouri from Kuwait Petroleum Corporation said “It isn’t a question of service companies growing to replace IOCs, but of NOCs growing in competence and filling their gaps with service companies”

A shift from ownership to service contracts

- There is a shift away from Production Sharing Agreements (PSAs) (and other arrangements that give economic ownership of reserves) to service contracts which is particularly evident where there is low technical risk and a PSA does not make economic sense. This includes territories such as Iraq where the federal government has decided not to award PSAs. Where

PSAs continue to be used, their terms are commonly being renegotiated. Indeed Khalid Al-Falih from Saudi Aramco said “PSAs were negotiated on quite different price assumptions... (the price has quadrupled in just a few years) ... PSAs no longer offer a fair distribution of terms”.

The success of the service companies

- The emergence of service companies is a trend potentially still at its beginning. In particular, service companies are not evolving into IOCs even though they have the opportunity to do so. Milton Costa Filho from Petrobras summed this up “... [service companies] have all the opportunities to become operators. They hold really important information from NOCs, from their projects. But they have decided to remain service companies. There are very few service companies. They are in a very good position. Costs are high, services are limited and they are making good money”.



The IOC response

- IOCs may need to reinvent themselves and the package they are offering if they are to flourish alongside service companies and NOCs. With the decline of 'easy' oil starting to bite, the challenges facing many NOCs to maintain existing production levels are huge. Some NOCs are faring better than others, and future opportunities for IOCs may re-emerge, albeit the economic terms may be very different. In order for IOCs to respond to this changing

dynamic, analysts may need to move away from their traditional KPI metrics such as reserve replacement ratios – which assume a world where PSAs are the norm.

Investment in skills is a top NOC priority

- Lack of skilled personnel ranked as the top industry risk for NOC Titans (see part 2 for definition). The NOCs are investing heavily here – Saudi Aramco has an annual training budget of US\$500 million³; CNPC

spent US\$113 million⁴ in training in 2006. The second and third highest risks were rising costs in the industry and political instability.

The manner in which these opportunities and challenges are addressed by NOCs, IOCs and service companies will shape how the industry develops over the coming decade. Part 1 offers insight from NOC executives on these new trends. Parts 2 and 3 spotlight seven major NOC players of tomorrow.

Companies and executives interviewed

Saudi Aramco	Khalid A. Al-Falih, Executive Vice President for Operations Abdullatif A. Al-Othman, Senior Vice President for Finance
Gazprom	Executive working in business development
National Iranian Oil Company (NIOC)	Dr. Hojjatollah Ghanimifard, Executive Director of International Affairs
Iraqi National Oil Companies (SOC and INOC)	Thamir Ghadhban, Chairman of Advisory Commission, Prime Minister's Office, Government of Iraq
Kuwait Petroleum Corporation (KPC)	Jamal A. Alnouri, Managing Director of Planning
China National Petroleum Corporation (CNPC), PetroChina and China National Offshore Oil Corporation (CNOOC)	Three executives working in policy research, corporate communications, and economic & technology research
Petrobras	Milton Costa Filho, Managing Director of Petróleo Brasileiro México
Sonangol	Research only

³ Research by Dr. Valerie Marcel

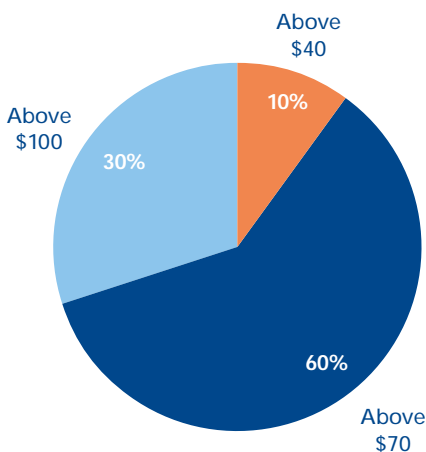
⁴ CNPC Annual Report 2006

Part 1

Emerging issues for rising NOCs

NOCs have grown in strength, but what does the future hold?

Where do NOC executives see the long-term average price of oil?



Source: based on interviews conducted in the first quarter of 2008 by Valerie Marcel and Yihe Xu, on behalf of KPMG International, 2008

Over the next decade, they will be faced with opportunities to increase their strength and cement their leading position in the oil and gas markets. At home, they should be able to benefit from high oil prices and the changing industrial landscape, which give them more options of partners with which to develop their resources. But the road is by no means easy and some NOCs may not fulfill their growth potential. Some challenges are specific to each NOC, such as their country's geology; others are common to oil and gas companies, such as the global context of climate change.

High oil price environment

According to the NOC executives interviewed, the low price era has come to an end. A key uncertainty in predicting future price trends was the strength of the US dollar. That said, most NOC executives interviewed in the first quarter of 2008 – when oil prices were closer to US\$100 per barrel – saw the long-term average price above US\$70 per barrel.

Interviewees cited the following factors to explain the increasing price trend:

- Environmentally-related constraints on the use of oil

This report focuses on two broad categories of NOC:

- 1) companies whose domestic reserves and production are so large that they are (and will continue to be) vital to global energy markets – these are referred to in this study as the NOC **Titans**.
- 2) companies whose performance and achievements are propelling them onto the global energy stage – these are the NOC **Tigers**. Such a ranking is fluid and the continued importance of Titans, for instance, hinges on their ability to harness the financial, technical and business tools to stay at the top of their game.



- The fast pace of investments in the petrochemical industry in the Middle East (which will curtail crude oil exports from those countries)
- Oil trading speculation
- The political situation in the Middle East
- The cost of development of more 'difficult oil'
- Tightness through the supply chain
- Increase in demand from China and India

No executive interviewed cited the assumptions of peak oil theory as a cause of higher prices. The general view is that high prices will prompt further investment in more costly resource development.

Downward price drivers included:

- Renewable and alternative energy sources
- New technologies allowing the development of difficult reserves
- Slow economic growth in Asia and in America

Executive Director of International Affairs at the National Iranian Oil Company (NIOC), Dr. Hojjatollah Ghanimifard, felt that prices in the coming decade would be increasingly regionalized, with sweet, light crudes fetching a high price (even doubling) in the Western Hemisphere, while prices for the more sour and heavy Persian Gulf crudes staying in today's range. "The Asian premium will disappear", as the markets there will benefit from competition between lower value Persian Gulf crudes and supplies of other crudes from "newcomers" elsewhere.

Is the power of NOCs dependent on high oil prices?

High oil prices are changing the industrial landscape for NOCs and IOCs alike. At home, NOCs now command greater power vis-à-vis IOCs. Higher revenues mean NOCs are increasingly able to self-finance projects and can purchase technological applications from service companies – two areas in which IOCs previously had an advantage to the extent they brought

capital and proprietary technology to projects. However, most NOC executives interviewed thought that the rise of NOCs was not "just about price". The change is also reflective of their holding more reserves, of course, but also of their increased capacity and skills, the evolution of governance in emerging economies, their increased ability to operate abroad and through the value chain, and their greater capacity to outsource work to service companies and consultancies. Khalid Al-Falih, Executive Vice President for Operations at Saudi Aramco, concluded, "This has turned the situation upside down. [The NOCs as customers] have more leverage now". However, some NOC Titans, such as NIOC, have funding concerns in this high-price environment because their available capital is not growing in line with greater government revenues, while operating costs are rising. As for the NOC Tigers, high prices are increasing the cost of acquisitions internationally, affecting them in much the same way as IOCs. Though Chinese

... the rise of NOCs has not been driven by just the increase in oil price. It reflects their increased capacity and skills, evolution of governance, ability to operate abroad and outsource work effectively to service companies.

NOCs can benefit from large financial reserves and lower operating costs, they incur greater costs when prices are high through profit windfall taxes imposed by Beijing – they also shoulder the burden of supplying the domestic market in refined products at a loss.

Resource nationalism... or resource rebalancing Is the rise in resource nationalism related to high oil prices?

Many producers display a strong popular and political sentiment seeking to protect national resources from foreign investment. Recent industry news items have shown a rise in rhetoric of resource nationalism, forced renegotiations of contracts (the Kashagan field in Kazakhstan), re-nationalizations and expropriations (Orinoco Basin project in Venezuela), and modifications of fiscal and legal terms for investment (Algeria's modification to the hydrocarbons law and the introduction of a profit windfall tax as well as Ecuador's special tax rate for high oil prices).

Political risk and political constraints on new acreage were cited as a top industry risk for three quarters of NOC Tiger executives. Negative attitudes to

foreign investment in some producing countries are indeed affecting these companies – for instance, CNPC's acquisition attempts in Russia were often met with opposition from Moscow, and Petrobras' plans in Venezuela, Bolivia and Mexico have been curtailed by nationalistic resource policies. In a context of high oil prices, resource nationalism is less risky for the host government: the customer has more bargaining power to dictate terms to foreign investors. High revenues also make it easier for national oil companies to manage operations without partnerships with foreign companies. As a Chinese oil executive put it, "Because of high crude prices, they want to produce their own barrels for high profit instead of allowing foreign investors to share the pie". They no longer need the capital injection that IOCs offer projects. They can pay for services to gap any capacity shortfall they might have. Over time, host governments' increased reliance on their NOCs will actually bolster their capacity, as they manage large projects alone or operate more of their fields. As long as prices remain in the high range of US\$70+, we can expect resource nationalism to stay strong.

The end of PSAs?

Have the high prices significantly changed the terms of foreign investment in the oil and gas sector?

While Libya, Angola, Malaysia and others offer production-sharing contracts (PSAs and PSCs) – terms that are attractive to foreign investors – some new oil frontiers are closing the door on hopes of similar terms. Iraq is a case in point, illustrating the new focus on service contracts – much to the despair of potential investors. A Chinese oil executive illustrates the point: "Iraq – the country with huge hydrocarbon reserves that NOCs and IOCs are keen for – is now offering service agreements, instead of PSAs to foreign companies". Iraq has a desperate need for oil revenues to fund its reconstruction and will seek to develop its resources as quickly as possible. However, it was also one of the first countries to nationalize its oil sector and resource nationalism continues to influence oil policy. Thamir Ghadhban, Chairman of the Advisory Commission for Iraq's Prime Minister's Office, explained that many Iraqis fear the war was motivated by the interests of big oil majors and legislators were, as a result, "very vocal about the type

As a Chinese oil executive put it,
" Because of high crude prices, (NOCs)
want to produce their own barrels for
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of contract. They don't want PSAs". A commercial rationale also guided the choice of service contracts, as Mr. Ghadban explained, "There doesn't seem to be any merit for Iraq to develop its discovered reserves under a PSA regime. There is no technical risk. Even in exploration, there are high potential areas".

For several executives interviewed, PSAs (or PSCs) cannot as easily be justified in a lower-risk environment. On this point, an executive from Gazprom said, "My hypothesis would be that PSCs made a lot of sense at the time of weak or no NOCs (when IOCs indeed took disproportionate risk and were claiming the reward for it accordingly). To me it looks as if the industry is going through a trial-and-error exercise of what is the right mechanism to compensate participants for the risks they take". In this respect, host governments are faced with a challenge: how to distribute upstream development benefits and risks in a rising energy price environment.

Generally, as confidence grows in producing countries that the long-term average price will lean toward the high

end, host governments are willing to take the downside risk involved in a service contract. As Jamal Alnouri, Managing Director of Planning at Kuwait Petroleum Corporation (KPC), put it simply, "With more confidence in the price, you turn to service contracts".

Does this spell the end of PSAs? Khalid Al-Falih from Saudi Aramco said, "PSAs were negotiated on quite different price assumptions. With the structural shift, new risk profiles, with the mayhem in prices (the price has quadrupled in just a few years), then you would expect new financial terms. PSAs no longer offer a fair distribution of terms". Dr. Ghanimifard from NIOC reiterated this point, "IOCs have to accept that the terms of PSAs should change – for instance regarding sharing reserves". An executive from CNPC also thought terms were generally getting much tougher under all contractual regimes. He added, "The government take has significantly increased in any of these agreements. Five years ago, the government take in a PSA was something like 60 percent, but now it goes up as high as 80 percent with some reaching 95 percent".

A number of executives interviewed felt that IOCs can address this challenge by meeting the needs of the NOC and host government's more system-based approach (rather than project-based), which aims for an integrated development, linking the oil and gas project with wider and longer-term development objectives. As Milton Costa Filho from Petrobras put it, "If they really invest in social and environment responsibilities – heavy, heavy investments – it would really change the way the society perceives those companies". The implication there is that the IOCs' current image is an obstacle to foreign investment in a context of increased resource nationalism.

Mr. Filho also called for new contract types. The emphasis on booking reserves is particularly problematic and obscures the potential value gained from getting a share of the oil produced. "We must find another way to value contracts. Oil produced is important!"

" IOCs have to accept that the terms of PSAs should change..."

Dr. Ghanimifard, NIOC Executive Director

The rise of service companies

High oil prices are also facilitating another significant change in the industrial landscape: the discreet rise of oil services companies. Often operating in the background, sometimes through local subsidiaries, service companies can help host governments keep a low profile on foreign investment in the oil sector. For instance, Gazprom is now in control of big fields on Sakhalin Island, but service companies will operate in the background to help it develop the fields. Though Gazprom can tap in-house services for onshore developments in harsh conditions, it turns to service companies to assist with offshore upstream or LNG infrastructure developments. Saudi Aramco has orchestrated its recent capacity increases without relying on IOCs, but rather on service companies, whose activities it integrates and manages. Thamir Ghadhban, Chairman of the Advisory Commission for Iraq's Prime Minister's Office, attributed this rise to service companies being "more flexible about selling their technology. They interact more easily with NOCs. They offer a greater range of services without the sensitivity of booking

reserves. Therefore NOCs have an easier relationship with service companies than IOCs".

Is the new era one where service companies replace IOCs as major service providers to producers?

Proprietary technology and the know-how to manage large projects are offerings from service companies, such as Schlumberger and Halliburton, that were previously the sole domain of the oil majors. While the latter continue to have more experience in management of large-scale projects, service companies are closing the gap and are actually pushing ahead of the majors in terms of technology development. While most majors spent less than one percent of revenues in research, Schlumberger spent about three percent.⁵

While the oil majors want to own rights to the reserves they are developing and take a share of profits in line with market value of the oil produced (the basic terms of a PSA), oil services companies are happy to take a fixed fee for the service they provide and lay no claim to the resources. The increased reliance on

service companies therefore eases risks of domestic opposition for producing governments – because this type of investment is both discreet and allows greater national control over the development of the resources. Though, equally, it requires greater technical and management capacity by NOCs to oversee the provision of services. For high-capacity NOCs, the business model of service contracts carried out by service companies is an attractive alternative to the PSA model. Conversely, service companies would appear as riskier partners than the super-majors to less competent NOCs, which feel more confident with partners that have a track record and can manage the integration of services. Jamal Alnouri from KPC aptly framed the situation in this way: "It isn't a question of service companies growing to replace IOCs, but of NOCs growing in competence and filling their gaps with service companies. They are growing in sync with service companies".

Risk-taking is an area where IOCs continue to hold an advantage. "Today it seems less important, but in 2004-05 they were taking huge risks with

" (service companies) are more flexible about selling their technology. They interact more easily with NOCs ... without the sensitivity of booking reserves".

Thamir Ghadhban, Chairman of Advisory Commission,
Prime Minister's Office, Government of Iraq

⁵ Stanley Reed, "The Stealth Oil Giant", Newsweek, January 3, 2008

the price,” explained Khalid Al-Falih, Executive Vice President at Saudi Aramco; “Now there are project costs risks. There’s also political risk. That is another risk that service companies are not willing to take.”

Chinese oil executives interviewed felt that the emergence of service companies was a trend only at its beginning. That said most NOC executives did not see service companies changing their corporate mission or overtaking IOCs. As Milton Costa Filho from Petrobras explained, “When you think of Schlumberger, Baker-Hughes, Halliburton, they have all the opportunities to become operators. They hold really important information from NOCs, from their projects. But they decided to remain service companies. There are very few service companies. They are in a very good position. Costs are high, services are limited and they are making good money”.

In fact, their services are getting more costly and are increasingly committed years ahead of time, and this is

prompting the expansion of local service companies in the producing countries. Dr. Ghanimifard, Executive Director of International Affairs at NIOC, felt the coming decade would increasingly see these expensive service companies being replaced by homegrown talent. One could also expect NOCs to acquire or develop their own service companies. Gazprom, for instance, has subsidiaries handling pipeline construction and drilling, while PetroChina has construction companies that support its international operations.

What should be the strategic response of IOCs to the changing environment?

Though they may not overtake the IOCs’ E&P business, the industry challenges coming from service companies point to the inevitability of a strategic reassessment on the part of IOCs. Senior VP for Finance at Saudi Aramco, Abdullatif Al-Othman, said, “It will be interesting to see what will be the response of IOCs. Will they accept lower returns? Will they accept service agreements? Or will they work on a lease-type basis? You may have

niche IOCs for specific technical skills (like EOR or deep waters) or more commodity-type companies that are more or less an improved service company”. Both avenues require regaining lost ground on developing proprietary technology.

To make themselves indispensable as partners in the development of reserves they may need to reinvent themselves and what they’re offering. This could require emphasis on joint development of the value chain and comprehensive sustainable energy solutions. Mr Al-Falih, Executive Vice President for Operations at Saudi Aramco explained, “One area where IOCs have failed (and perhaps contributed to nationalism) is looking at the total needs of society. Not necessarily infrastructure or roads, but they can be active players in these societies”. However, as Mr. Al-Othman pointed out, “IOCs won’t be able to transform themselves as value-adding unless they educate analysts on how to value them” – and to look beyond reserve replacement ratios.⁶

... the emergence of service companies was a trend only at its beginning.

⁶ Cash-flow-based valuations would take account of wider operations, including, for example, the IOCs’ trading operations. Interviewees also thought valuations could include R&D programs and patents

Competition from the Tigers

Much attention has been given to China's national oil companies investing in oil exploration and production assets overseas. However, in the global energy investment picture, the amounts invested by CNPC and PetroChina are dwarfed by those of the oil majors. A Chatham House estimate of capital expenditure by Chinese companies in overseas projects between 1995-2005 shows that while they invested at least US\$27 billion in upstream projects abroad during that decade, the major US companies together invested US\$29.8 billion in 2004 alone.⁷ The numbers looking forward remain on a similar scale for Chinese investment overseas, as CNPC announced in 2005 it would invest US\$18 billion in foreign oil and gas assets over the next 15 years.⁸ Moreover, it is worth noting that these acquisitions have so far contributed relatively little to China's oil imports.

Do you think the NOC Tigers will have an upper hand on the traditional majors over the next 5-10 years?

Chinese executives interviewed felt that "The prominent issue now is

overreaction by foreign companies regarding Chinese NOCs' overseas expansion". They did not feel that they would be overtaking the super-majors any time soon. A CNOOC executive explained, "These IOCs have been operating in the producing countries for more than 100 years and have established good relations with local governments. The change will not be something like NOCs toppling over IOCs. It will be more of a head-to-head competition". And in this competition, the oil majors have the advantage of being better implanted in the traditional resource holding countries, leaving new market entrants with limited choices, smaller returns and more challenging fields. A CNPC executive confirmed that they would be faced with greater geological challenges, as "Most of the known resources have been taken by IOCs. For us, we have to participate in resource development in new areas, with which we are not familiar". Most executives from the Titan companies felt that the Asian Tigers' skills would not be on par with those of the super-majors by the end of the coming decade. Dr. Ghanimifard, Executive Director of International Affairs at NIOC, warned, "Newcomers

must prove they can do it better, faster and cheaper or they will be forced out". Nevertheless, they are "definitely a viable option for governments" and may "even take a major stake in IOCs", according to Abdullatif Al-Othman of Saudi Aramco.

Though their investment numbers and operational track record have not supplanted IOCs globally, Asian NOC investment appears to be challenging the classic business model developed by oil majors. The advantages these NOC Tigers hold over IOCs include their willingness to engage in downstream projects, their probable lower costs of capital and risk, and the strong support they receive for their foreign investments from their home governments.⁹ For instance, to secure access to resources, the Asian national players have offered soft loans and infrastructure development – and broader bilateral commercial ties and military sales support their bids.

Will competition between these NOCs lead to more conflict?

Chinese oil executives interviewed felt that co-operation was the way forward, as this allows companies to build

"Newcomers must prove they can do it better, faster and cheaper or they will be forced out."

Dr. Ghanimifard, NIOC Executive Director

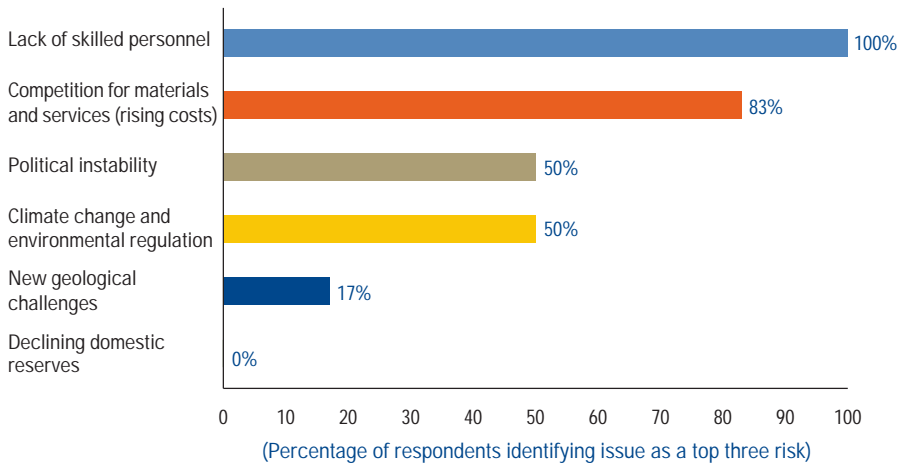
⁷ Chinese company expenditure is based on reported figures paid for oil projects only and is likely to be higher. Source: K. W. Paik, V. Marcel, G. Lahn, J. Mitchell, E. Adylov, "Trends in Asian NOC Investment Abroad", Chatham House Working Background Paper, March 2007; http://www.chathamhouse.org.uk/publications/papers/download/-/id/482/file/7076_r0307anoc.pdf

⁸ Baker Institute Policy Report, "The Changing Role of National Oil Companies in International Energy Markets", James A. Baker III Institute for Public Policy of Rice University, Number 35, April 2007, p 9

⁹ John Mitchell, Glada Lahn, "Oil for Asia", Chatham House Briefing Paper, March 2007

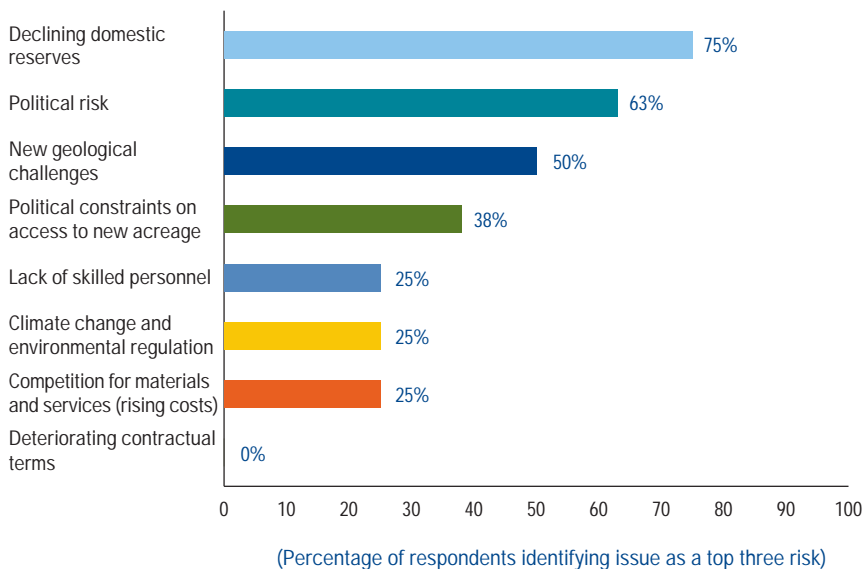
What do you see as the top three industry risks for your company over the next 10 years?

Titans



Source: based on research and interviews conducted by Valerie Marcel and Yihe Xu, on behalf of KPMG International, 2008

Tigers



Source: based on research and interviews conducted by Valerie Marcel and Yihe Xu, on behalf of KPMG International, 2008

synergies in terms of project financing, service and technology. The view that China's hunger for energy would lead to conflict illustrates, for the Chinese executives interviewed, a misunderstanding about their country's policy, which would show restraint in order to avoid conflict and promote a "harmonious world". Executives from the Titan companies agreed. Abdullatif Al-Othman at Saudi Aramco explained, "I don't subscribe to that view ... China's quest for energy should not be seen as a recipe for conflict".

Another concern regarding the new expansion of some Asian NOCs relates to their just nascent sense of responsibility for ensuring the respect of governance, human rights and social and environmental standards that are expected from IOCs. If unchecked, this trend could have negative consequences over the next decade in host countries, especially in Africa. According to one executive, there was also a risk that tension might increase between China and the US as a result of these NOCs investing in countries that Washington has put under sanctions or is trying to isolate.

The challenge of meeting demand

The International Energy Agency (IEA) expects global energy demand to grow by more than 50 percent by 2030 and estimates that the world is falling 20 percent short of needed investments in future energy supplies for the next 25 years.¹⁰

Producers are unequally equipped and motivated to meet the rise in demand with investments in new production. Saudi Aramco is self-appointed with the principal responsibility for supplying the world's energy needs, as the only producer committed to maintaining 1.5 – 2 million barrels per day (mnb/d) of spare capacity. It is pushing ahead with an approximate 20 percent production expansion. Other NOC Titans have faced obstacles in implementing expansion plans. This is notably the case for KPC, which has faced continued opposition from parliament for its plans to invite foreign oil companies to help it develop its Northern fields (Project Kuwait).

The (domestic and international) politicization of the NOC was a top industry concern raised in Iran – a hindrance in implementing capacity expansion plans that is affecting other NOCs as well. Other producers like Algeria have deliberately slowed the pace of development of resources in light of high revenues and concerns for the depletion of reserves.

Demand uncertainty continues to be an industry threat for some executives interviewed within the Titan companies. Of specific concern were policies in consuming countries that discouraged investment in new capacity. On this point, Khalid Al-Falih of Saudi Aramco said that consuming countries “should make sure they don't give an inadvertent signal that their country is not supportive of investments made to increase energy supply”. He was concerned that Venezuela's recent changes in contract terms had resulted in international litigation and the freeze of PDVSA's assets abroad. An executive at Gazprom

said that since governments are getting more involved in resource management and market regulation, “one could not only be talking about resource nationalism but also about market nationalism (especially recent EU and US regulations)”.

Moreover, throughout the industry, project implementation has become more challenging as a result of rising costs in engineering, procurement and construction. The availability of rigs and other critical exploration and development equipment is proving a particular challenge. Three quarters of executives interviewed listed rising costs as a top challenge for their company in the next decade.

The longer-term outlook for natural gas depends critically on how effectively the Middle East and the FSU are able to provide exports to meet demand (particularly growing demand in Asia, where imports are expected to double

The longer-term outlook for natural gas depends critically on how effectively the Middle East and FSU are able to provide exports to meet demand...

¹⁰ IEA World Energy Outlook 2006

between 2005 and 2020). Expectations regarding Middle East gas rest heavily on two fields: South Pars in Iran and the North Field in Qatar, which account for 61 percent of the Middle East's uncommitted gas.¹¹ Qatar's expansion plans are set to provide a third of the probable capacity additions until 2012, but further expansions are on hold, as Doha has adopted a "wait and see" policy.¹² Meanwhile, Iran's gas will be needed to supply domestic markets and for re-injection into its oil fields. Iran's export plans have been slowed by geopolitical tension and sanctions, as well as pricing disputes – halting progress on the Iran-Pakistan-India pipeline for instance. Russia's gas export plans to Asia have also been marred in pricing disputes.

For NOCs to meet growing energy demand, they will require political commitment to production expansion, the mobilization of financial and human resources, the easing of geopolitical obstacles, and price alignment with customers.

According to Milton Costa Filho from Petrobras, the investment challenge is so great that IOC-NOC partnerships should inevitably re-emerge as a driving force of the industry – though this will have to wait out the current period of resource nationalism.

End of easy oil

The decline of easy oil is near for many of the Titans. The future of the oil and gas industry will be shaped by unconventional technologies, such as those needed to enhance oil recovery, to develop sour crude and gas, contaminated gas, heavy oil, offshore oil, and to produce from extreme environments, such as the Arctic and desert. Some national oil companies have been spoiled by their favorable geology in the past decades, often providing lifting costs below US\$2 billion in the Persian Gulf, but they will now need to turn to more challenging reserves and to new technologies for maximizing the lifespan of existing fields.

How well can NOCs handle these new geological challenges?

Some NOCs do not have sufficient skills in these areas and they are likely to face difficulties when new acreage falls largely within "difficult reserves" or when they must offset the decline of mature fields. The stakes are high for NOCs and their governments. Failure on the part of an NOC to offset decline in a giant mature field, for instance, could lead its government to reassess a policy of reliance on national means to develop resources. In some cases, however, such a reassessment is what NOCs are hoping for. KPC in Kuwait and Pemex in Mexico would both like to see changes to the hydrocarbon laws allowing them to partner with foreign oil companies to develop their resources.

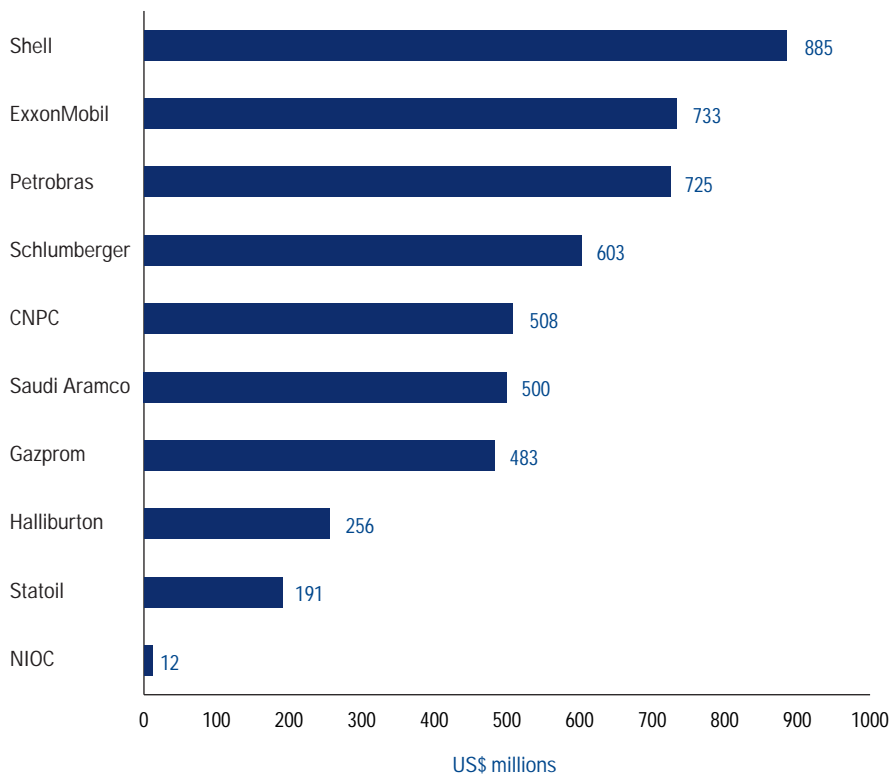
Similarly, not all internationalizing NOCs have the technological skills and experience for unconventional oil and gas development. Each company has its strength: CNPC is strong in enhanced oil recovery, while CNOOC is experienced in heavy oil E&P – and Petrobras is renowned in the area of deep offshore.

... the challenge for some NOCs is how they develop unconventional technologies to maximize the lifespan of existing fields and develop more complex ones...

¹¹ James T. Jensen, "The Role of Natural Gas in the Energy Future of the Asia Pacific Region", Presentation to the Kennedy School Seminar on Asia in the World Economy, Harvard University, February 27, 2008

¹² Ibid

Research and development costs (2006)



Notes: Schlumberger figure excludes US\$16 million in relation to relocation of a research facility
 Annual reports may not be wholly comparable as they are prepared under different financial standards

Sources: company annual reports (2006); NIOC data (2004) from company website; CNPC data (2004) from Max von Zedtwitz, "Chinese Multinationals: New Contenders in Global R&D", www.goingglobal2006.vtt.fi/pdf/max_von_zedtwitz.pdf (accessed 19/03/08); and Saudi Aramco data from interviews with the author.
 Gazprom sourced from 2006 IFRS financial statements.

Governments and their NOCs should select partners with the appropriate skills to support the development of challenging fields, whether IOCs, service companies or internal resources. They should also frame the investment terms in a way that incentivizes the partner to commit its technology and capital to the project.

Investment in research and development is also an important response to the technical challenge.

NOC-NOC co-operation is another way to address the R&D challenge. Companies can pool limited human resources and share costs. They can also draw from the experience of peers with different geological or operational challenges.

Acquisitions can also help NOCs acquire the needed technological experience to tackle new geology. An NOC could acquire a MidCap or smaller Independent company to that end.

Attracting talent

The industry is facing a major human resource challenge with the shortage of new talent with which to replace today's ageing work force, many of whom will

be retiring during the next decade. Demand for experienced, qualified personnel is far greater than availability in many parts of the world. Previous industry layoffs and recruitment freezes at times of low prices greatly reduced the attractiveness of the sector. The majors and super-majors are estimated to have collectively displaced more than 1.1 million employees between 1984 and 2005 (John S. Herold). Part of the problem is also that in some regions, such as North America and Europe, the petroleum industry is increasingly perceived by young engineering graduates as an industry of the past.

This issue has clearly affected NOCs very differently, depending on the size of their population, the national level of education, the capacity of the national oil industry to attract and retain talent through pride in the national industry and competitive salaries, and the safety and stability of the country. The lack of skilled personnel and the broader challenge of human resources were listed as a top concern for three quarters of NOCs in this study. Indeed, demands for mid-career professionals are expected to exceed supply in all regions over the next decade. According to a Schlumberger survey, countries most

affected by shortages of petroleum geology and engineering university graduates are: the United States, Canada, Saudi Arabia, Iran, and to a lesser extent, the UAE and Russia; while Venezuela, India, China, Indonesia, and Mexico have excess graduates in those fields. In interviews however, several

executives working in countries with shortages of graduates felt that adjusting their HR practices to retain talent was a bigger concern than recruiting. Meanwhile, in China and Brazil (countries with good supplies of graduates) the skills shortage was cited as a future industry risk.

The human resource challenge in various producing countries

	Large pool of educated graduates	NOC attractive employer	Country stable	Comments
Iraq				Severe country and industry brain drain
Iran	✓			Severe country and industry brain drain
Saudi Arabia		✓	✓	Education mismatch with industry needs
Angola		✓		Country underdeveloped
Russia	✓	✓	✓	Demand for talent outpaces supply
Brazil	✓	✓	✓	Demand for talent outpaces supply
China	✓	✓	✓	Poaching will affect supply

Source: based on research and interviews conducted by Valerie Marcel and Yihe Xu, on behalf of KPMG International, 2008

... the lack of skilled personnel was the number one risk for the NOC Titans over the next 10 years...

In their international operations, the skills shortage affects many NOCs in the same way as IOCs. Petrobras faces shortages of skilled personnel in its ventures abroad, as do other companies in the industry. Its rapid growth is creating a human resource challenge: Petrobras needs to hire 15,000 people in five years.¹³ The company has responded with domestic recruiting, sending Brazilians to man their operations overseas (notably in Venezuela, Bolivia, and Argentina). They are also recruiting young graduates from local universities and training them in Brazil.

Companies can turn to contractors and service companies to help reduce the impact of human resource shortages.

There is also some room for tapping the huge talent pool in China and India. For comparison, while the U.K. produced 24,500 engineering graduates in 2004 and the U.S. 70,000, India produced 350,000 and China an outstanding 600,000.¹⁴

However, poaching mid-career professionals from competitors will not remediate the problem longer term. A more constructive and effective solution is to increase the attractiveness of the industry to young people and to train and stimulate them on the job. Companies need to develop close ties with universities and help build high-standard petroleum engineering and geology departments.

Some strategically-minded NOCs are proactive in building a new pool of qualified candidates to supply their workforce in the coming decade. Petrobras has worked for almost 50 years at developing skills in the company. Saudi Aramco operates an ambitious training program for Saudis, with an annual training budget of almost US\$500 million.¹⁵ In 2006, some 11,000 students were enrolled in Saudi development programs and approximately 35,300 employees were enrolled in E-learning courses. Aramco was also tasked by King 'Abd Allah to

create a new science and technology university. Petronas has sponsored over 16,000 scholars through 1975-2005 at a cost of US\$370 million.¹⁶ In 2006, CNPC spent US\$115 million in training 760,000 employees.¹⁷

A demographic trend that could help to alleviate personnel shortages in several producing countries is the education of women in large numbers, particularly in the fields of engineering. Though men have historically dominated the oil and gas industry, this may soon change. In Iran, for instance, women make up over 60 percent of university graduates and dominate enrolment in engineering schools. A number of managers at NIOC predicted an important role for Iranian women in the future management of Iran's oil industry.¹⁸

Some strategically-minded NOCs are proactive in building a new pool of qualified candidates to supply their work force in the coming decade.

¹³ Interview with author

¹⁴ 3i, "Shifting Sands – The future of the oil industry"; <http://www.3i.com/publicationsandevents/the-generation-gap-a-huge-issue.html> (accessed 18/03/08)

¹⁵ Interview with the author

¹⁶ "Investing in Oil Sector Capacity Building: PETRONAS Case Study on Education", Presentation at the 2nd *Good Governance of the National Petroleum Sector Workshop*, Chatham House, London, September 21-23, 2005.

¹⁷ CNPC Annual Report 2006

¹⁸ Valerie Marcel, *Oil Titans: National Oil Companies in the Middle East* (Chatham House/Brookings: 2006), op. cit, pp. 63-66, 113

The fallout from climate change

The energy industry will need to tackle carbon emissions in the coming decades. Policy responses to climate change and new investments in cleaner fuels may threaten the long-term demand for oil. They may also create new opportunities for energy companies. Some NOCs and IOCs are already investing in cleaning up fossil fuel production – and even in renewables. Others appear to be resisting.

Climate change does not yet figure very highly on the strategic horizon for a number of NOCs. “No impact. Climate change could raise the operation cost, but it is under control”, said a Chinese executive. At Petrobras, Milton Costa Filho saw the strategic risks from climate change as affecting their business in 20-30 years’ time, not in the coming decade. Executives who perceived a short- to medium-term

impact on their business referred to the rise of environmental regulations (on refined products, for instance), as well as uncertainty of demand resulting from climate change policies.

Promoting domestic use of clean fuels and energy conservation was also a priority in some producing countries.

Oil companies that have invested in the development of technologies and markets for cleaner energy could have a strategic advantage in the coming decade. New technological development challenges will include renewables, coal gasification, and carbon capture and storage. National oil companies that have not addressed these new challenges internally may need to turn to partners for help.

Petrobras has made great advances in the development of biofuels production and markets in Brazil and abroad, and of second-generation

biofuels technology. It is hoping to export these technologies and develop itself as an energy company of the future, offering a range of sustainable energy solutions. “Some doors are closing, but others are opening – like new clean energies. We must see energy as a whole”, explained Milton Costa Filho. Few NOCs are taking such bold steps, though there are various research programs under way. Following Saudi Arabia’s initiative, several Gulf countries have contributed funds to the Gulf research drive to study ways of reducing fossil fuel emissions. And, in general, oil producers may start to capitalize on carbon trading by investing in carbon capture and storage. For Gazprom, predominantly a gas company, the new policy and market environments related to climate change clearly offer opportunities. Its gas customers are in many cases interested in carbon trading and this helps to create commercial incentives to invest in energy efficiency technologies.

... several Gulf countries have contributed funds to study ways of reducing fossil fuel emissions...

Part 2

Tomorrow's big NOC players



Selected Titans and Tigers covered by our research

Titans	Tigers
<p>Saudi Aramco (Saudi Arabia) Gazprom (Russia) National Iranian Oil Company (NIOC) Iraqi National Oil Company (INOC) and South Oil Company (SOC) Kuwait Petroleum Corporation (KPC)</p>	<p>PetroChina and China National Petroleum Company (CNPC) Petrobras (Brazil) Sonangol (Angola)</p>
Selection criteria for Titans:	Selection criteria for Tigers:
<ul style="list-style-type: none"> • Importance to markets today: <ul style="list-style-type: none"> – Oil and gas export ranking – Dependence of key importers • Importance to markets tomorrow: <ul style="list-style-type: none"> – Proved oil and gas reserves – Lifespan of reserves – Potential growth of production – For gas Titans: feasibility of export routes and availability of gas for export 	<ul style="list-style-type: none"> • Financial performance: <ul style="list-style-type: none"> – Market value, revenues, return on invested capital, profit and assets • Operational performance: <ul style="list-style-type: none"> – Reserve replacement ratio – International outreach • Ambition and achievements



Titans

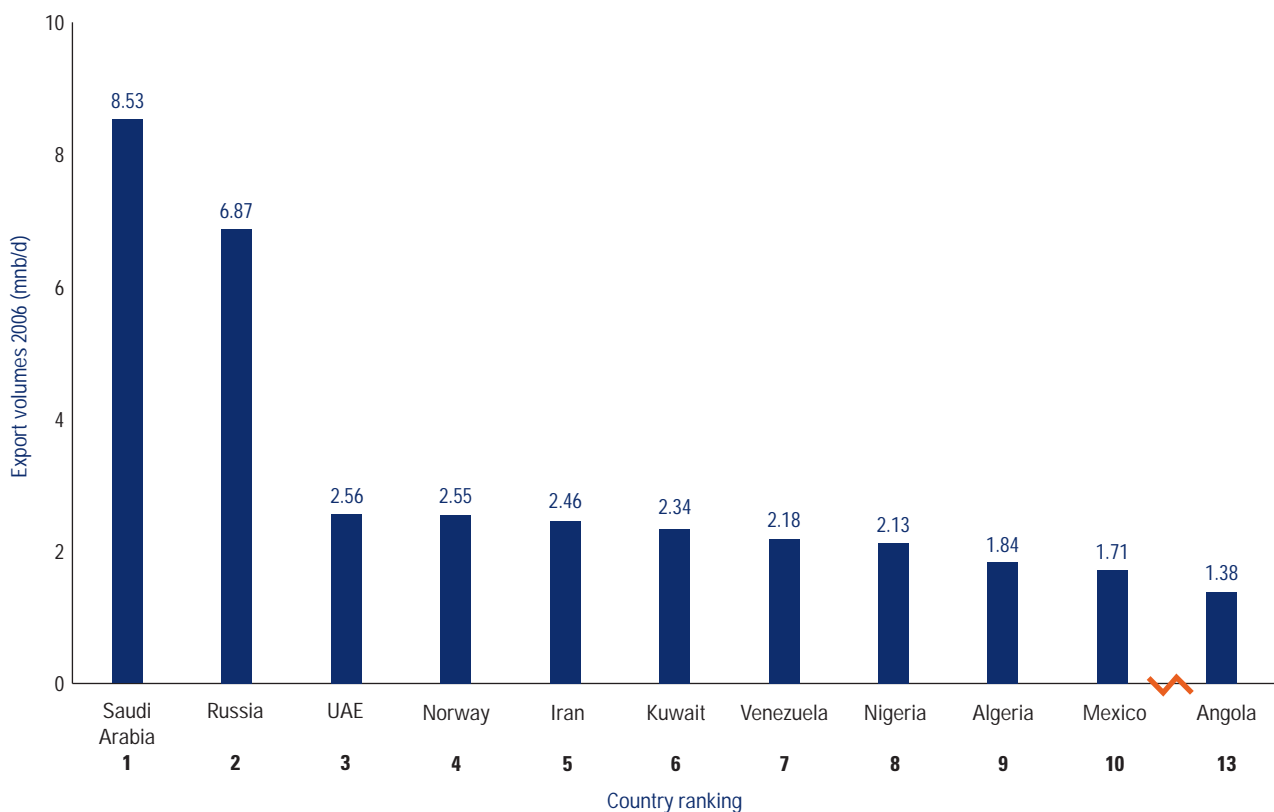
Importance to markets today

For the sheer size of their energy exports today and their critical importance to key energy importers, Saudi Aramco and Gazprom stand out, but other Titans follow: ADNOC of Abu Dhabi, NIOC of Iran, Venezuela's PDVSA and Kuwait's KPC. At the top of the list, Saudi Aramco has established

itself as the swing producer for oil markets. It defends its market share in strategic markets, such as the USA, Europe and Asia. Similarly in the world of gas, Gazprom has cemented its position as a strategic supplier for European markets and is securing new gas trade relationships with the USA and Asia. NIOC, ADNOC, PDVSA and KPC follow as key suppliers of crude

to the world market. Producers in the Persian Gulf have developed long-term relationships with their customers, which are tied into rolling, term contracts. PDVSA has a strong interdependent trade relationship with the USA, though political tension between both countries repeatedly threatens to disrupt this relationship.

Largest oil exporters



Note: countries are ranked 1-13 with Saudi Arabia ranked 1. The zigzag line indicates omitted ranks 11 and 12

Source: Energy Information Administration - <http://tonto.eia.doe.gov/country/index.cfm> [accessed 10 June 2008]

Importance to markets tomorrow

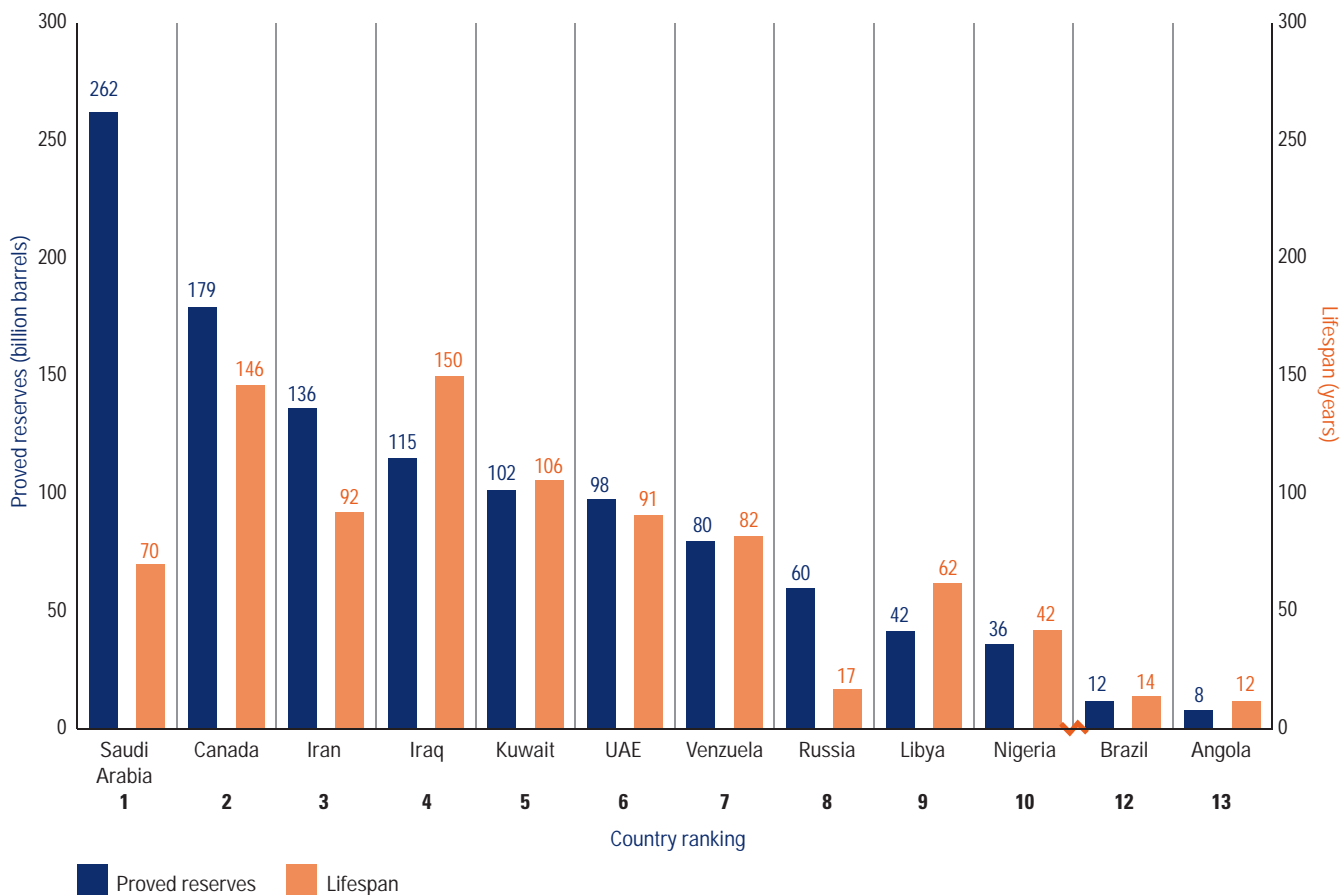
In terms of importance to oil markets tomorrow, proved oil reserves give an indication of development potential. In this respect, Saudi Aramco, NIOC and Iraq's national oil companies stand out with their large conventional reserves.

Saudi Aramco in particular will continue to play a key role. It is entrusted with a fifth of global oil reserves and enjoys among the lowest production costs. Iraq's oil reserves rank as the second largest in the world (conventional oil), with only a fraction of its known fields

in development. It also has some of the lowest lifting costs of the major oil-producing countries.

Looking at the expected lifespan of these reserves, Iraq's national oil companies, KPC and ADNOC

Largest oil reserve holders – proved oil reserves and production lifespan



Notes: Lifespan calculation based on production and reserves data
 Production data is the full year 2007 and reserves are as at January 1, 2007

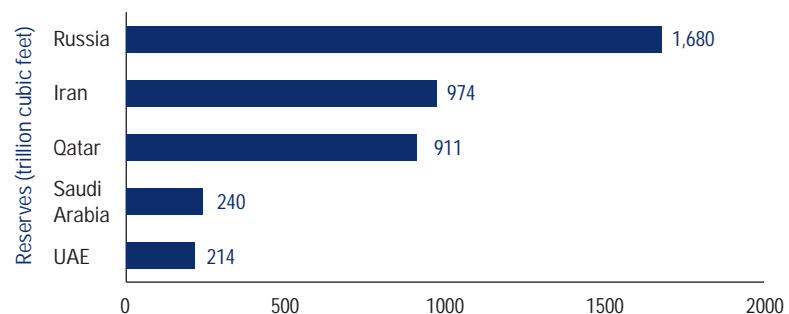
Source: Oil and Gas Journal, 2007. Energy Information Administration, posted: April 21, 2008 (World Production of Crude Oil, NGPL, and Other Liquids, and Refinery Processing Gain, Most Recent Annual Estimates, 1980-2007)

all rank highly. In terms of expected production growth, Saudi Aramco leads the ranking of production expansions thanks to its upstream investment program aiming to increase sustained capacity by 20 percent to 12 mnb/d by 2009. Iraq's Ministry of Oil plans to increase production capacity to 6 mnb/d by the end of the decade (requiring investments in the order of US\$25-75 billion). The South Oil Company (SOC) is set to play a key role in this expansion, with a number of fields earmarked for immediate development. However, there are uncertainties regarding the realization of these plans because of grave security concerns, as well as political disagreements slowing the legislative process for establishing the structure and laws of the hydrocarbons sector. In any case, Iraqi oil policy and industry performance will have a critical influence on the world oil markets in the coming decade. KPC's plans to increase production to 4 mnb/d by 2020 showed little progress until recently. The company's newly-appointed management has committed US\$20 billion to reach its interim 3 mnb/d target by 2009/10. NIOC aims to increase its oil production to 5 mnb/d by 2010 – a plan that hinges on easing geopolitical tensions and sanctions against Iran, but also on removing a number of financial and organizational hurdles domestically.

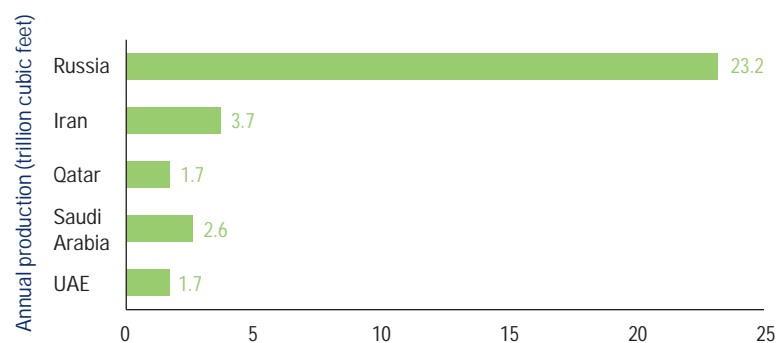
Looking specifically at tomorrow's gas Titans, they are located in Russia and the Middle East. Energy Information Agency (EIA) estimates have each region accounting for around 20 percent of the

global increase in annual production through to 2025. The top gas reserve holders, Russia, Iran, and Qatar, together accounted for about 58 percent of the world's total reserves.¹⁹

Largest gas reserve holders as at January 1, 2007



Largest gas producers in 2006



Note: Production data is for the full year 2006 and reserves are as at January 1, 2007

Sources: Oil & Gas Journal 2007

Energy Information Administration, posted: May 20, 2008 (World Dry Natural Gas Production, Most Recent Annual Estimates, 1980-2006)

The top gas reserve holders, Russia, Iran and Qatar, together accounted for about 58% of the world's total reserves.

¹⁹ EIA, International Energy Outlook 2007

Proved gas reserves ranking	Gas exports ranking
1st Russia	1st
2nd Iran	30th
3rd Qatar	9th for all gas/1st for LNG
4th Saudi Arabia	NA
5th UAE	23rd

Source: Energy Information Administration (2006)

Indicators of future importance also include the availability of gas for export and of infrastructure to transport exports. Russia's Gazprom and Qatar Petroleum have invested heavily in export infrastructure, while other large gas reserve holders, Saudi Aramco and ADNOC (except for LNG) dedicate gas for domestic use. NIOC has very ambitious plans for expanding production for export and developing new export routes – and large reserves to back up its plans, but export infrastructure today remains limited compared to Gazprom and QP. NIOC is discussing various pipeline routes and LNG options with keen potential buyers in the Persian Gulf and South Asia. Gazprom is expected to provide exports mainly by pipeline, building on

its extensive network to Europe and developing new routes to China and South Korea. It is also beginning to enter LNG markets. Qatar Petroleum is already the single largest supplier of liquefied natural gas, exporting largely to Asia. However, Qatar's five-year moratorium on new gas development projects at its giant offshore North field effectively halts further production and export expansions until 2012 – and maybe later – in order to slow depletion of its reserves.

Tigers

At a time when many IOCs are redistributing windfalls from high oil prices to shareholders and buying back shares, NOC Tigers are investing aggressively in new sources of oil

and gas and boosting their production. They are also developing their international portfolio.

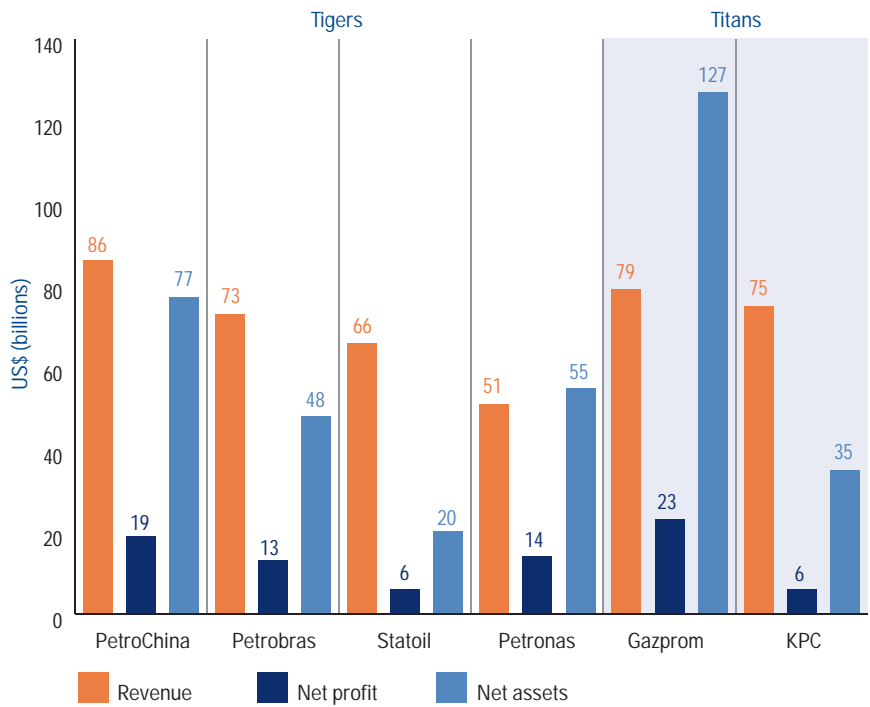
Our selection criteria focuses on financial and operational performance, as well as ambition. It also aims to spotlight new players whose activities and goals are little known. Clearly, performance benchmarking of NOCs is made more difficult by limited access to data for a number of key companies. However, a growing number of NOCs have partially-listed subsidiaries or are listed themselves, and in these cases do make public disclosure of operational and financial data. Among fully-owned NOCs, there is also a trend to disclose more information than required (as in the cases of CNPC and KPC).

Performance

Financial

Financial performance is indicated by market value, revenues, return on invested capital, profit and assets. On the basis of these measures, PetroChina is top of the list, followed by Petrobras and Petronas. Data for Sonangol is too limited to allow comparisons.

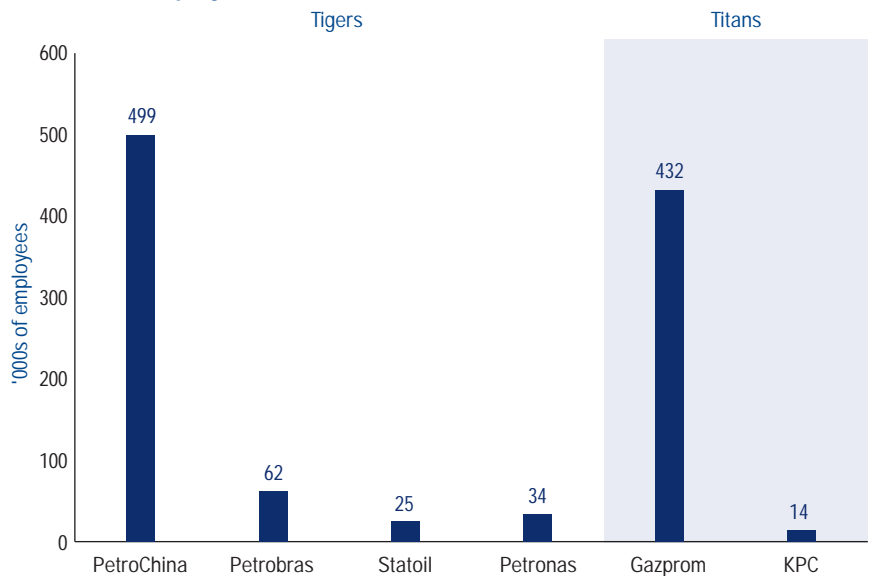
Revenue, net profit and net assets



Note: Annual reports may not be wholly comparable as they are prepared under different financial standards

Source: KPC and Petronas sourced from annual report for the year ended March 31, 2007; Gazprom sourced from IFRS Financial Statements December 31, 2006; all other companies sourced from 2006 annual reports

Number of employees



Source: KPC and Petronas sourced from annual report for the year ended March 31, 2007; PetroChina annual report, 2005; Gazprom sourced from IFRS Financial Statements December 31, 2006; all other companies sourced from 2006 annual reports.

Operational data

		Production		Reserves		Reserve replacement ratio %
		Oil and condensate (mnb/d)	Natural gas (mnboe/d)	Oil and condensate bn bbls	Natural gas bn boe	
Tigers	Petrobras	1.9	0.4	12.3	2.7	174
	Petronas	0.9	1.2	7.6	18.3	166
	PetroChina	2.3	0.7	11.6	8.9	104
	Statoil	1.1*		4.2*		94
	Sonangol	1.4		8.0		n/a
Titans	Saudi Aramco	8.9		259.9	44.7	104
	Gazprom	0.9	9.6	19.0	187.8	n/a
	NIOC	3.8		136.0	177.2	n/a
	Iraqi NOCs	2.0		115.0	20.2	n/a
	KPC	2.6		101.0		n/a

* Statoil provides combined data for oil and natural gas

Notes: Statoil annual report provides combined data for oil and natural gas

Petronas reserve replacement ratio was calculated on the basis of separate data for domestic and international production

NIOC's reserve data is presented as at early 2005

Source: Chatham House project on Asian national oil companies; annual reports (2006): Petrobras, PetroChina, Statoil, CNPC, Gazprom; KPC annual report 2005-2006; SOMO; Saudi Aramco annual review 2006; EIA Country Analysis Briefs – Iraq; Annual Report (2007), Petronas : Summary of Consolidated Financials and other Data for Year Ended March 31, 2006

Operational

Operational performance for NOCs is indicated by the reserve replacement ratio and production growth. Petrobras' reserve replacement is excellent, as the table opposite shows, followed by Petronas and PetroChina (and its parent CNPC). Thanks to efforts by their NOCs, Brazil and Angola are among the fastest-growing oil producers in the world.

Indeed, Angola's crude oil production has more than quadrupled over the past two decades, with production averaging 1.4 mnb/d in 2006. Production is set to reach 2 mnb/d in 2008 with further deep-water production coming online. Petrobras' exploration success rate in Brazil was 42 percent in 2006.²⁰ While Pemex and PDVSA's domestic outputs have been stagnant or falling, Petrobras approximately doubled its production and reserves between 1996

Brazil and Angola are among the fastest growing oil producers in the world.

²⁰ Interview with author

and 2006.²¹ And though Venezuela's reserves overwhelm Brazil's (Mexico's are now very similar), Petrobras may soon take PDVSA's place as Latin America's second largest producer (behind Pemex).

These companies have also demonstrated strong international outreach. Petronas has activities in 33 countries.²² Its overseas operations make up around one-third of its revenue and around 23 percent of its total reserves.²³ Statoil is also very active in the international arena, present in 34 countries with E&P activities in 15 of these. Its international output accounts for 15.7 percent of its total output. Petrobras is in 27 countries,²⁴ and exploring for oil and gas in 16 foreign countries, with a strong presence in Latin America, as well as the US, West Africa and the Middle East. CNPC is active in 26

countries, with a strong representation in Africa and Russia-Central Asia. Sonangol's international activities are conservatively estimated to reach a dozen countries, with a growing presence in Portugal and West Africa. Most of Sonangol's international activities are in the downstream sector and other non-core sectors.

Ambition and achievements

In terms of high aspirations and real achievements, Petrobras, PetroChina, and Petronas stand out in the industry. But special mention should be made of Sonangol for the huge strides the company has made in a short period to become an operator, boost production in Angola, build national capacity, improve its governance, and set its sights towards international operations and the listing of a subsidiary.

In terms of high aspirations and real achievements, Petrobras, PetroChina and Petronas stand out in the industry.

²¹ BP Statistical Review of World Energy 2007

²² Petronas has upstream interests in 25 countries (company website)

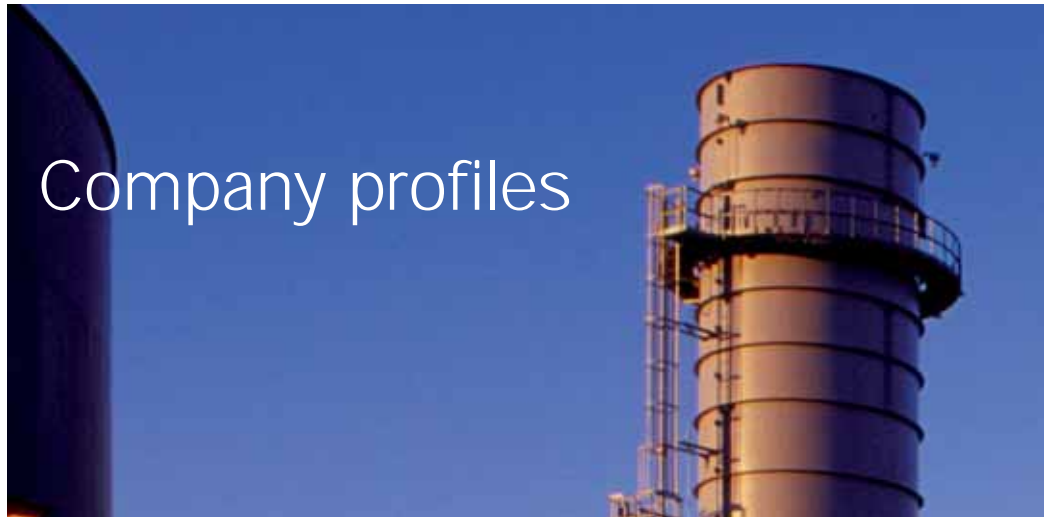
²³ K. W. Paik, V. Marcel, G. Lahn, J. Mitchell, E. Adylov, "Trends in Asian NOC Investment Abroad", op. cit., p. 24

²⁴ From company website

http://www.petrobras.com/ptcm/appmanager/ptcm/dptcm.jsessionid=qWQkL1pMTbDh4LtTmNqzYnzG0yD7YYPG13JDv17Cq8vVNT9p1Fr4y!-1318129065!218769449?_nfpb=true&_pageLabel=petr_com_mundo

Part 3

Company profiles



Saudi Aramco

Saudi Aramco is the biggest of the Titans. It is the largest oil producer and exporter in the world. Its critical role on international oil markets is expected to grow further as it currently produces 13 percent of global oil but holds 22 percent of proved oil reserves.²⁵ It will also be a Titan of tomorrow because of its demonstrated skills as an operator and a swing supplier to world markets.

Saudi Aramco defies preconceptions of many state companies as lacking technological capability and independence from government. The company seeks to be the best, to surpass other NOCs; it gives a special emphasis to professionalism and technology.²⁶ It was created through nationalization like many other NOCs, though the gradual acquisition of assets was a

smooth process in which the original company's experience and organization were largely retained – thanks to technical and marketing agreements with the foreign consortium members lasting until the late-1980s. Since then, the political leadership was careful to give Saudi Aramco the operational autonomy and means to accomplish its mission successfully.

Part of its mission is its multifaceted commitment to the development of the Kingdom's economy. In support of government policy on diversification, Saudi Aramco leverages activities in the hydrocarbons sector to promote manufacturing and employment in the Kingdom, notably through its integrated petrochemical and refining complexes and provision of gas to domestic industry and utilities. It also strives to enhance private sector

Saudi Aramco is the largest oil producer and exporter in the world.

²⁵ BP Statistical Review of World Energy 2007

²⁶ V. Marcel, *Oil Titans*, op. cit., Chapter 3



capacity by using local businesses in the oil and gas equipment and services sectors for its operations.

The consuming world is expecting Saudi Arabia to provide a large share of future oil needs. Saudi Aramco has given indications of being able and willing to increase its production in response to rises in world demand for oil. But Saudi policy makers and oil professionals are also concerned with demand uncertainty and maintaining the Kingdom's long-standing policy of a maximum depletion of 2-3 percent of the remaining reserves (current depletion rates are well below this maximum). In the spring of 2008, they indicated that they are aiming for a sustained capacity of 12.5 mnb/d, and not the hoped for 15 mnb/d.²⁷ Over the long term, of course, depleted

reserves will not be replaced indefinitely and production will inevitably reach a plateau, which Saudi Aramco will endeavor to maintain for as long as possible.²⁸ One of the key questions in this respect is what recovery rates will Saudi Aramco achieve? At a recent conference, a senior Saudi Aramco executive announced that they would add 100 billion barrels of recoverable reserves by improving their recovery techniques, thus boosting recovery from 51 percent to 70 percent.²⁹

Gazprom

Gazprom is the world's largest gas company and holds the largest share of gas reserves. According to market capitalization, Gazprom is among the five largest energy companies in the world. It produces nearly 90 percent of Russia's vast gas resources and

operates the gas pipeline network. As fixed by law, Gazprom has a monopoly over gas exports. More broadly, Gazprom has benefited from opportunities created by the government's drive to increase national control over the energy sector.

The company's strategy also highlights new ambitions that are taking the gas giant outside Russia's borders. It is already a strategic supplier of pipeline gas to Europe and now seeks to become a major LNG supplier to North America and Asia. It is represented in over 30 countries – largely in marketing, but increasingly in E&P as well (Libya, India, Vietnam, Iran, for instance). In its public statements, the company announced it seeks to increase its authority and influence in the world community.

Gazprom is the world's largest gas company and holds the largest share of gas reserves.

²⁷ Research by Dr. Valerie Marcel

²⁸ John Mitchell and Daniela Schmidt, "Petroleum Depletion, Dependence and Development in Saudi Arabia", Chatham House, Forthcoming

²⁹ Abd Allah Al-Saif, Saudi Aramco Senior Vice President, "Saudi Aramco Responds to the Call to Deliver", Fusr Drilling Symposium, Dhahran, 1 December 2007, reproduced in John Mitchell (forthcoming)

Its diversification strategy focuses on expanding its LNG exports, developing its oil business and establishing a competitive presence in the power generation industry. The acquisition of Sibneft allowed the company to take on a significant position in the Russian oil industry, which is fragmented despite Rosneft's emergence as the national champion. Internationally, Gazprom is targeting an expansion of oil and gas activities throughout the supply chain, with an emphasis on the mid and downstream, through competitive bidding and asset swap deals.

Looking at challenges facing Gazprom in the coming decade, the company is required by Russian law to supply gas at regulated prices for heat and power in Russia's domestic market. Low prices have constrained Gazprom's available capital for reinvestment in the sector and has reduced efficiency incentives internally. However, in November 2006 the Russian government decided to incrementally increase domestic prices towards market levels. Ageing fields and insufficient export pipelines are also a concern going forward. The "Big Three", Gazprom's largest fields, accounting for more than 70 percent³⁰

of its production, are now in decline. Gazprom will need to invest to offset this decline, develop new reserves and secure more reliable export routes to meet its long-term target of increasing European sales. To this end, Gazprom has put in place a reserve replacement program, which includes the start-up of new fields and associated infrastructure development necessary to meet domestic and export market commitments through to 2030.³¹

NIOC

The National Iranian Oil Company was set up in 1948 in the midst of the turbulent politics in Iran, including foreign attempts to control the industry and government. This history has shaped Iran's oil industry, and in particular, its attitudes to foreign involvement in the sector. NIOC today is a company deeply intertwined with the Ministry of Petroleum, both organizationally and financially.³²

NIOC reached a record daily output of 4.2 mnb/d in March 2007 (against an average 3.9 mnb/d of crude in 2006). It plans to increase oil production to 5 mnb/d by 2010.

It has the reserves to support this expansion, boasting the second largest conventional oil reserves in the world. Challenges for NIOC include the reticence of foreign companies to invest in a context of geopolitical uncertainty and US/UN sanctions, government interference in the company's operations, limited access to the capital generated from petroleum exports, the geological difficulty of developing new reserves and the decline of mature oil fields. Iran's mature fields face a rate of natural decline estimated at 8 percent onshore and 10 percent offshore, which require substantial investments in enhanced oil recovery. Iran's improved buyback contracts have succeeded in attracting some investors to develop its resources. In terms of financial constraints, gasoline subsidies siphon a large chunk of Iran's oil revenues every year – the IMF has estimated their cost at 12 percent of Iran's GDP. They have created a particular problem for NIOC by stimulating unsustainable domestic consumption, which it can only meet by importing gasoline at market prices. A recent rationing policy helped to

The Iranian government has a strategy for Iran to become the world's third largest gas producer by 2024.

³⁰ Research by Dr. Valerie Marcel

³¹ Interview with author

³² V. Marcel, *Oil Titans*, Chapters 1 and 4

restrain consumption, but there are no indications that the political will is there to remove the subsidies.

Iran has large ambitions in terms of gas. In its 20-year plan, the Iranian government presented a strategy for Iran to become the world's third largest gas producer (taking up 8-10 percent of the global gas business) by 2024. In view of Iran's proved reserves and prospectivity potential, its gas production can rise to meet domestic demand, oil field injection needs and some export. Gas buyers abound, as Iran's neighbors in the Persian Gulf face supply shortfalls. However, projects have been stalled by pricing disputes, as many buyers are unwilling to pay the price for importing gas from Iran. Other obstacles may stall export plans, which are similar to those faced by its oil industry.

Iraqi national oil companies (SOC & INOC)

The Ministry of Oil currently has central control over oil and gas production and development in all but the Kurdish territory through its two upstream operating companies, the North Oil

Company and the South Oil Company (SOC). These operate as autonomous companies with their own management structures, and regional authorities have increasing influence over them. At present, the SOC is Iraq's main operating company and national oil company and operates in an area with huge development potential. The cluster of super-giant fields of southeastern Iraq make up the world's largest known concentration of fields of such magnitude and account for 70-80 percent of the country's oil reserves (EIA, Iraq). Looking to the medium term, the southern fields intended for immediate development for export could produce an additional 2 mnb/d with moderate investment, according to EIA estimates. In contrast, the other major upstream company, the North Oil Company, has only maintained an average production of 200,000b/d from Kirkuk and other northern fields – a fraction of the pre-war peak of 680,000 b/d.

Baghdad has ambitious plans to increase production capacity to 4 mnb/d³³ of oil and 4 billion cubic feet per day (cf/d) of gas within a

couple of years. Though security problems and poor infrastructure – as well as the lack of clarity on oil policy and the national industry's structure – mean it is unlikely that expansion plans for the next 2-3 years will be met, the longer-term picture may warrant more optimism. The national oil industry has proved remarkably resilient. In spite of problems plaguing its operations, the SOC maintained export levels of 1.54 mnb/d (Q4 2007). With sustained investment, Iraqi production could return to its historical levels of 3.5 mnb/d in the next decade.

Turning first to challenges, major security and political risks threaten the prospects for the re-emergence of Iraq as one of the world's largest exporters. In spite of recent improvements in security, there is a continued risk that the situation could unravel from counter-insurgency to civil war. And in terms of political obstacles to industry growth, there are serious disagreements among regional and federal political representatives about the future structure of Iraq's oil industry, as they try to agree on a hydrocarbons law.

³³ Research by Dr. Valerie Marcel

However, should the political and security situations in Iraq improve even marginally, the SOC (Iraq's largest upstream national oil company operating today) and the future Iraqi National Oil Company (INOC) (which is set to become the parent company in charge of SOC and of other regional companies likely to be created) should be two of the key players in the petroleum industry of the next 5-10 years. Achieving production expansion plans of 4 mnb/d³⁴ will also depend on foreign investment – the scale of which will require a sound legislative framework. The draft hydrocarbons law sets out a major role for a reconstituted INOC in the future development of the country's resources (at least of the discovered reserves).

Petrobras

Petrobras has been developing Brazilian oil since 1953. It lost its monopoly over oil and gas production in 1997, when the National Petroleum Agency (ANP) was tasked with granting E&P rights and monitoring the sector. Despite the new competitive regime, Petrobras retained

a dominant role in Brazil's up, mid, and downstream sectors. It controls over 95 percent of the crude oil production in the country.³⁵ But it also has operational or office activities in 27 countries and, in 2006, was ranked by Petroleum Intelligence Weekly as the 15th top oil company in the world and 7th among publicly-traded ones. Platts Top 250 ranked Petrobras ninth in its listing of companies with outstanding financial performance. It is a model of how NOCs can evolve towards the private sector, while retaining a concern for national objectives. As a hybrid-NOC, it has the structure of a private-sector company but also a majority of government shares at the voting level (the government owns 55.7 percent of common shares/voting capital and 32.2 percent total capital in 2006).

Like many NOCs, Petrobras has come a long way since its creation. It once bartered chickens for imported oil and focused on supplying Brazil's energy needs. It has since developed in-depth experience in offshore oil, which helped

to boost its domestic production. Thanks to Petrobras' activities, Brazil will shortly become a net exporter of oil. It plans to increase its total production (oil, NGL and natural gas) to 4.1mboe/d by 2015.

Petrobras' focus is no longer on ensuring Brazil meets its energy needs, but on creating value from upstream through to downstream activities in Brazil and internationally. In the upstream, it is applying its deepwater drilling experience in previously inaccessible offshore blocks from Angola to the Gulf of Mexico. In the Gulf of Mexico it is going against the trend and is set to invest US\$2 billion by 2010³⁶ in the Gulf's deep offshore, an area where few companies are prepared to go. As with its investments offshore in the Gulf of Guinea, Petrobras is attracted to the geological similarities of the Gulf of Mexico and the Brazilian coast, which the company has used as a giant testing lab for offshore technologies over the past decades.

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³⁴ Research by Dr. Valerie Marcel

³⁵ EIA, Country Analysis Brief, Brazil, September 2007

³⁶ Research by Dr. Valerie Marcel

Petrobras sees itself as a company offering comprehensive energy solutions. It is betting on second-generation biofuels and plans to export its skills and technology in this area to other countries. In the next four years, it will invest US\$1.5 billion to develop its biofuels activities.³⁷

Petrobras' key risks relate to its new investments in politically-unstable regions; notably in Nigeria and Iran, but also in Latin America, where the rise of resource nationalism has threatened some of its assets.

PetroChina and CNPC

PetroChina was established as a joint stock company in 1999 as part of the restructuring of CNPC. According to the annual report, CNPC injected into PetroChina most of its high quality assets relating to its E&P business, refining and marketing, chemicals and natural gas businesses. The intention of the restructuring and IPOs was to make these state-owned firms more

like vertically-integrated IOCs elsewhere. In connection with this process, the company has been spinning off or eliminating many unprofitable ancillary activities.

PetroChina is CNPC's largest listed subsidiary. An IPO of a minority stake of 13.71 percent was carried out on both the Hong Kong and New York stock exchanges in April 2000. In its debut on the Shanghai Stock Exchange in November 2007, PetroChina's market valuation exceeded US\$1 trillion, the highest ever recorded. During five months, it dethroned ExxonMobil as the most valuable company in the world, but slipped to the second rank in March 2008, as its shares slumped 58 percent since the listing. Its revenues for the first half of 2007 were less than a third of that of ExxonMobil. PetroChina suffers losses in its refinery business because of government-imposed price caps and upstream earnings are affected by the government's windfall tax. Competition

for new reserves has pushed up costs – and risks – for PetroChina. At the end of 2006 the lifting cost for oil and gas operations was US\$6.74 per barrel, an increase of 27.7 percent from the preceding year. The increase in costs was due in large part to the group turning to reserves more difficult to explore and taking on riskier operations. PetroChina uses advanced EOR technology in some major ageing domestic fields to battle natural decline. At its largest field, Daqing, where production is falling by 40,000 b/d, the watercut nears 90 percent.³⁸ In addition, rises in the cost of raw materials, such as steel, and the tight supply of oil services also increased operating costs. The company has also moved to tap what it calls the useless reserves, which require more costly advanced technology for exploration.³⁹ Analysts nonetheless forecast strong profit growth and the Platts Top 250 companies ranked PetroChina as sixth in recognition of outstanding financial performance.

³⁷ This amounts to 1% of its total investment plan for that period. Source: "2020 Petrobras Strategic Plan; 2008-2012 Business Plan", presentation by José Sergio Gabrielli de Azevedo, CEO, Petrobras

³⁸ Research by Dr. Valerie Marcel

³⁹ Author interview with Yihe Xu, China Analyst, Upstream, 2008

The strategy of CNPC and PetroChina, and their sister companies, CNOOC and Sinopec, has been to develop new reserves where possible and to invest in pipeline routes to export oil to China (most notably from Russia and Central Asia). CNPC has 69 projects in 26 countries with greater importance attached to Africa and Russia-Central Asia for CNPC's future equity oil mix.

Sonangol

The state-owned Sociedade Nacional de Combustiveis de Angola (Sonangol) was created in 1976, one year after Angola gained independence from Portugal. Sonangol is the exclusive concessionaire for exploration and production of the country's onshore and offshore hydrocarbons. It works with foreign companies through joint ventures and PSAs. However, Sonangol is much more than an administrative regulator and concession allocator in the oil and gas industry. It is a powerful entity in Angola, with a direct door to the president's office. It has also started to operate some of the fields awarded. It enjoys a strong reputation of competence among Western banks and oil companies which have had

dealings with it.⁴⁰ More so than other NOCs in the region, Sonangol's technical capabilities and assertiveness in dealing with partners have made it a force IOCs must reckon with. Though Sonangol remains little known outside Angola, it has been making quick and substantial progress in recent years.

As a concessionaire, it has stepped up production in Angola, achieving one of the quickest growing rates of production. Angolan production languished for most of the country's 27 years of civil war. When it finally ended in 2003, Angola emerged as a key West African oil exporter. Angola has benefited from a number of discoveries in deepwater blocks and more recently in ultra-deep waters, resulting in ongoing upward revisions of production profiles, according to Wood Mackenzie. The EIA estimates that it can produce 3.1⁴¹ mnb/d in 2030, provided it moves swiftly to explore new reserves.

Because of Angola's strong production growth rates, previous success in offshore discoveries and openness to foreign investment, it is the new

darling of oil consumers and finds itself in the middle of a growing rivalry between Western, Asian and Russian oil companies for its oil resources. In what is perceived internally as a sign of Angola's success and importance as an exporter, the country joined OPEC this year.

Sonangol's corporate ambition is to establish itself as an operator and to explore and develop oil and gas resources in Angola and overseas. Sonangol Pesquisa e Produção (P&P) was created in 1991 as the Group's production arm. It has been operating on Blocks 4 and 3/05, where it produces a total of 82,000b/d.

The Sonangol Group has acquired stakes in a number of companies abroad, creating a constellation of business interests dubbed the Sonangol 'Universo'.⁴² Its international activities range from refining and shipping to insurance. It has also taken on international exploration in 2004 by buying a stake in a Chinese-Argentinian venture, China Sonangol International Holding. Sonangol's breadth dates back to the years of

⁴⁰ Ricardo Soares de Oliveira, "Business success, Angola-style: postcolonial politics and the rise and rise of Sonangol", *Journal of Modern African Studies*, 45, 4 (2007)

⁴¹ EIA, International Energy Outlook 2007

⁴² Oliveira (2007), op cit., p.604

civil war in Angola, when the company was called on to carry out all kinds of non-core activities. In an effort to rationalize these activities, the group created Sonangol SGPS in 2004 to align subsidiaries with the E&P division's long-term activities and strategy. However, the group does not appear to be significantly divesting from non-core activities and is even looking for new investment opportunities in various sectors.

In an effort to shore up national capacity – rather than simply substitute itself for the state and private sector – Sonangol has also helped the smaller

private Angolan oil company, Somoil, develop into an operating company and has granted it a small block. This is an unusual step for an NOC, as few are inclined to invite local companies to participate in the sector, let alone help them acquire the necessary skills to operate.

Industry challenges for Sonangol relate to maintaining the country's production rates, which threaten to head towards a sharp decline (peaking at 2.6 mnb/d by 2011) without further discoveries. The capacity of Sonangol to insulate itself from national woes is also a concern, in a context of persistent

under-development, poverty, corruption and lack of transparency. In that respect, a growing part of Sonangol's business and governance standards stand in contrast with national practices. It is subject to fiscal and cost audits by an international auditor. Moreover, Sonangol held public competitive bid rounds to several deepwater blocks.⁴³ Sonangol will soon invite non-executive members to its board, and is also planning a public listing of one of its subsidiaries. With this steady progress, Sonangol is likely to become a more familiar industry player in the coming decade.



⁴³ World Bank, "Petroleum Sector Non-lending Technical Assistance (accessed 23 January 2008), <http://go.worldbank.org/M69ZBBC000>

Methodology

Dr. Valerie Marcel, conducted semi-directional interviews in person with executives from the Kuwait Petroleum Corporation, Saudi Aramco, the National Iranian Oil Company and a high-ranking government official in Iraq. She conducted similar telephone interviews with executives from Petrobras and Saudi Aramco as well as e-mail interviews with an executive at Gazprom. Yihe Xu, China Analyst at Upstream, conducted in-person interviews with executives at the China National Petroleum Corporation, PetroChina and the China National Offshore Oil Corporation, using the same questionnaire. Background interviews were done by telephone with consultants knowledgeable about Sonangol.

Key conversions (2006)

Key conversion rates/assumptions	
cf'000/boe	0.18
boe/cm	0.00629
bbl/mt	7.28
cf/mt	28.6

Key exchange rate conversions		
	Average	Year-end
KWD/USD	0.29	0.29
Real/USD	2.18	2.18
RUR/USD	27.19	26.33
NOK/USD	6.42	6.24
CNY/USD	7.98	7.98
MYR/USD (2005)	0.26	0.26

Source: www.oanada.com

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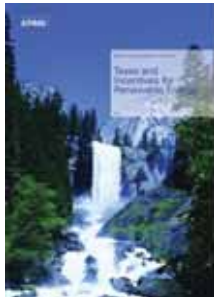
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