The Impact of Pre-Salt

A Long-Term Perspective

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A REPORT PREPARED FOR PETROBRAS

Oxford Analytica

Head Office
Oxford Analytica, 5 Alfred Street, Oxford, OX1 4EH, UK
Tel: +44 (0) 1865 261614 Fax: +44 (0) 1865 242018

France
Oxford Analytica Inc. 5, rue de Surene, 75008 Paris
Tel: +33 142 89 08 36

United States of America
Oxford Analytica Inc. 1069 Thomas Jefferson Street, NW Washington, DC 20007
Tel: +1 (202) 342 2860 Fax: +1 (202) 342 2868

Oxford Analytica Inc. 420 Lexington Avenue, Suite 2650, New York, NY 10170
Tel: +1 (212) 916 7459 Fax: +1 (212) 867 8506

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Executive Summary

Brazil is beginning the development of its largest ever hydrocarbons discovery – the pre-salt reservoirs. If oil prices remain solid, and if the proposed new legal framework governing unlicensed pre-salt reservoirs is adjusted in some areas and implemented well, then Brazil has the chance to take a long-term trajectory towards a knowledge and innovation driven economy that includes a vibrant domestic oil and gas supplier and services industry. In doing so, it would emulate successful oil-producing countries such as Norway. However, achieving this will be difficult and will require overcoming numerous challenges from within the new framework itself, and others that are related to Brazil's current levels of institutional maturity and economic development. This report takes a long-term perspective in analysing how the impact of pre-salt is going to shape Petrobras, and what this will mean for Brazil.

The pre-salt reservoirs provide exceptional opportunities with potentially below average geological risks, albeit with significant need for investments in new technologies. Faced with this potential wealth, the Brazilian federal government has reprioritised its goals, aiming to spur broad-based, long-term economic development, by encouraging both a sustainable rate of production and a more equitable distribution of the wealth generated.

Both the future course of Petrobras and the ability of the government to realise its new goals are dependent on developments in the global oil market. Section I of this report ('The Outlook for Oil to 2030') assesses these developments. This report forecasts that oil prices will rise over the coming two decades. Real oil prices are projected to exceed the record highs of the late-1970s and early-1980s. In addition, there are major upside risks to the forecast. This outlook bodes well for Petrobras, raising the attractiveness of making the needed investments, which in turn will enable the generation of substantial wealth.

The future course of Petrobras and the ability of the government to realise its new goals will also depend on the regulatory and legal framework providing the right incentives for efficient and sustainable development of the pre-salt resource. In this respect, the government has judged that i) the current concession regime was not adequate and needed replacing, and ii) that there must be a renewed effort to promote Brazilian 'local content' – encouraging a broad and dynamic oil and gas sector supplier and services industry.

Accordingly, President Luiz Inacio Lula da Silva proposed a new legal framework for development of the pre-salt resource areas yet to be licensed. Section II ('Brazil's Prospective Pre-Salt Legal Framework') analyses the impact of the new regime, which the government hopes will give it greater control over the pre-salt resource, allowing

it to secure a larger portion of the revenues. We conclude that, while specific details of the legislation could be improved to ensure that the objectives are delivered, key to success will be disciplined implementation. Petrobras's excellent track record, and its status as a mixed company that already operates at the technological frontier provide solid preconditions for it to assume the greater responsibilities assigned to it under the new framework. Its greatest challenge will be to overcome the potential constraint on innovation and higher costs resulting from its overly dominant position.

Section III ('Local Content') examines Brazil's existing local content achievements, provides case studies from abroad, and suggests key considerations for ensuring that the potential for local content to benefit from the recent pre-salt discoveries is maximised. The heightened dominance of Petrobras under the proposed new legal framework, and in particular its envisaged role as sole operator, may allow some local suppliers and service providers to benefit from standardisation of products and services. However, this is counterbalanced by the pricing power that Petrobras will be able to exert over local industry, which will compound other risks associated with local companies' heavy dependence on a single purchaser. Nonetheless, Brazil's strong track record in promoting local content over the last three decades, combined with the government's clear objective of developing local content further, drawing on incentives in the new regulatory framework, remain key positive factors for the local supplier and services industry.

Introduction

PETROBRAS IN CONTEXT

For the last decades Brazil was intent on achieving energy security. The pre-salt reservoirs, Brazil's largest ever hydrocarbons discovery, open new doors. Now the goals extend to include the broader harnessing of indigenous sources of oil and gas in support of Brazilian development for the benefit of its people. Today, Brazil not only is self sufficient in oil; it is a net hydrocarbon products exporter. Behind this achievement is the story of Petróleo Brasileiro S.A. (Petrobras).

Energy was front and centre in the constitutional debates of the 1950s. Energy nationalism marked the discourse that led to greater state control over most aspects of the oil and gas sector and to the creation of Petrobras as the national oil company (NOC). In contrast to the situation in many emerging economies, the Brazilian energy sector, and Petrobras in particular, was soon exposed to the international energy world. For example, foreign firms partnered with Petrobras to conduct joint seismic and other technical studies that would lead to the first offshore discovery in 1969.

More recently, constitutional changes opened most aspects of Brazil's oil and gas sector to both foreign and domestic private participation. The open investment environment has attracted the most experienced, technologically advanced and well-capitalised companies to partner with Petrobras. According to BNDES, the national development bank, in 2009 Petrobras operated alongside 71 national and foreign enterprises in Brazil and abroad.

Petrobras has honed its ability to function both as a strong national champion and an international oil company. It is a publicly traded corporation, with the majority of the voting shares being held by the Brazilian government. This is a powerful model. It combines the government's need to exert control over a key sector of the economy while allowing markets to control the controllers, imposing governance and reporting structures on Petrobras that set it apart from most NOCs. Partly as a result of this, Petrobras has succeeded in positioning itself in the leading class of 'innovator NOCs'.

Petrobras is already one of the world leaders in the deep offshore exploration and production technologies that will be critical in extraction from the pre-salt reservoirs. It already operates almost a quarter of global deepwater production, more than any other company. As the upstream oil industry, its technology and organisation develop worldwide, Brazil's interest is for Petrobras to continue to draw the maximum benefit from offshore experience at home and abroad.

Today, Petrobras is poised to take on an even greater role, reaching beyond leadership of the country's energy sector. Petrobras has the chance to strengthen its position of belonging to a select group of companies capable of operating in a new segment of

upstream petroleum operations in the deep offshore, which can reap huge spin-off effects for long-term industrial development, employment, and competence. Eventually, in addition to being a traditional oil products exporter, the company could become a large exporter of sectoral knowledge. Achieving these goals will require substantial investment.

THE PRE-SALT RESERVOIRS

The pre-salt reservoirs are likely to catapult Brazil from 24th to 8th or 9th place in global reserves and turn the country into a major oil and gas producer. The reservoirs give Brazil and Petrobras unique opportunities, but with high investment needs and some market risk. Maximising recoveries in the most sustainable way, from complex geological formations located at the geographical exploration frontier, will require cutting-edge technology.

The pre-salt reservoirs span an area of approximately 149,000 square kilometres. The hydrocarbon accumulations are found at a total depth of some 5,000-7,000 metres below sea level, which includes some 2,000-2,500 metres of water and a 2,000-metre layer of salt. Based on Petrobras's own figures, of the total area, 28% is already licensed, and most of it (24%) to Petrobras. The original pre-salt cluster, an area of 15,000 square kilometres in the Santos Basin, is considered the 'best' of the pre-salt areas so far because all blocs have the same physical and geological attributes, and the accumulations are found under a solid (not-fragmented) thick layer of salt. In this area, Petrobras participates in seven blocs (as an operator on six and a partner with Exxon and Hess on the seventh) where, so far, 16 wells have been drilled. The findings from two of these wells – Tupi and Iara – combined with those of Whales Park, which is further north in the Campos Basin, are likely to double Brazil's booked reserves of 14 billion barrels. Estimates for the total size of the pre-salt reservoirs range from 20 to 300 billion barrels.

In spite of an above average exploration success rate, the wells are expensive to drill. Petrobras's own estimates peg the average well at 100 million US dollars. Moreover, once the exploration phase is over, the necessary infrastructure will have to be put in place to bring this oil to market. Add environmental considerations, which are likely to include carbon capture, transportation and re-injection into older adjacent reservoirs to boost production, and overall production costs will be significant. Petrobras estimates that it will invest 200-220 billion dollars over the period 2010-14.

THE GOVERNMENT'S CHALLENGES

Given this newfound potential, it is understandable that the Brazilian federal government redefine long-term development goals. Like most other oil-rich jurisdictions, it wants to secure the largest rents possible and design mechanisms to distribute the wealth equitably among geographical regions and social groups. To attain these goals, the government seeks to manage the wealth strategically. It faces four challenges:

- Designing a stable regulatory and fiscal framework capable of securing the highest possible rents for the state, while delivering the incentives necessary to attract the volumes of financial capital necessary to produce the resource.
- Increasing domestic industrial capacity, by improving manufacturing, technology development and human capital.
- Avoiding 'single focus' economic development based on the oil and gas sectors by ensuring a sufficiently diversified and competitive economy.

- Redistributing the wealth on social spending and other priorities.

Success in meeting these challenges will help to set Brazil on the same broader economic development path as knowledge and innovation driven oil and gas producers such as the United States, the United Kingdom, Norway, and Canada.

SECTION I

The Outlook for Oil to 2030

INTRODUCTION

Explaining Oil Prices

The oil supply/demand balance has proved a poor short-term guide to oil prices in recent years. For example, from April 2009 on, the supply/demand balance would predict a weak short-term price. Instead, oil prices increased steadily during the rest of 2009. This rise was mainly a result of the recovery of confidence in the general economic outlook.

Our assessment is that the three key short-term drivers of the oil price are medium and long-term expectations about the oil price; currency movements; and the 'financialisation' of energy commodities. The three are connected, and are influenced by secondary factors, such as sudden changes in the level of political risk in key supplier countries, or changing expectations about regulatory developments. The impact of these three drivers on short-term oil price formation is rising.

Increasingly important short-term price drivers The weight of literature on the subject from multilateral organisations and national regulators argues that fundamental rather than speculative pressures caused the rise in oil prices from 2004-2008. However, much of the work was based on data from the US Commodity Futures Trading Commission (CFTC) and pre-dated significant changes made last year on how the CFTC reports positions.

Real estate, bond and securities markets are now all viewed as having mispriced risk extensively, but the oil market is often still portrayed as an efficient, physically driven market in which financial factors have no influence on price. However, since the early 2000s, commodities have gone through a process of 'financialisation.' This has exposed prices to new and significant forces that can, at least for a time, distort price levels very significantly from what might be expected as a result of the short-term supply and demand balance.

Commodity financialisation was driven by the desire to diversify portfolios in the wake of the equity market bubble in 2000 and by the ill-founded idea that commodities provide a hedge against inflation. Investors now tend to trade in and out of commodities as an asset class, so their attractiveness has become relative – ie are they more or less attractive than other financial asset classes?

Like many other asset classes, short-term prices are increasingly connected to currency movements and macroeconomic expectations just as much as short-term fundamentals. This is the dominant narrative that has governed short-term oil price expectations in recent years. Investors aim to move ahead of the curve, contributing to the perception of 'having tomorrow's prices today'.

Long-term supply and demand Despite such short-term fluctuations, long-term oil price projections should still be centred on the outlook for the supply/demand balance as, eventually, the price trend is determined in large part by this. Forecasts of potential oil supply and demand to 2030 vary enormously.

RECENT MARKET DEVELOPMENTS

Oil Demand Context

The real oil price today is comfortably above levels during the period 1985-2005. Rapid world GDP growth drove a strong rise in demand for oil from 2002-08, which

accelerated the rise in oil prices. GDP growth in that period averaged close to 4% per annum (pa) on a purchasing power parity (PPP) basis, well above the average of 2.7% pa during the 1990s.

In addition, an increasing share of world growth was accounted for by emerging markets, which grew at 6% pa on a PPP basis for much of 2002-08. In the largest emerging markets, China and India, oil demand is significantly more sensitive to fluctuations in GDP growth than in advanced economies, which are more service oriented – so Chinese and Indian demand for oil grew exceptionally rapidly. This is particularly important because both countries are oil importers.

The slowdown in world growth to 3% in 2008, followed by the recession in 2009, when global GDP fell 1% in PPP terms (or 2.1% on a constant US dollar basis) contributed to declining oil demand for five consecutive quarters. According to the International Energy Agency (IEA), global oil demand in the second quarter of 2009 was down to 84.1 million b/d, almost 4% lower than in the first quarter of 2008.

Demand picked up slowly to 85.7 mb/d in the final quarter of the year, although for 2009 as a whole it averaged 84.9 mb/d, a drop of 1.5% from 2008 and the second successive annual decline. Non-OECD demand is estimated by the IEA to have risen 1.8% from the 2008 level, but OECD demand fell, down 4.3% from 2008.

Oil Demand Outlook for 2010

The Oxford Economics central scenario sees the world economy recovering only slowly in the near term, with GDP growth on a PPP basis of 3.7% in 2010. Growth will be faster in emerging markets, especially in emerging Asia, where it is forecast at about 7%, compared with just under 5% in 2009. But growth will be more subdued in North America and the EU, which together account for about two-fifths of oil demand. The OECD countries overall are forecast to grow by about 2.5% this year, while non-OECD countries are projected to grow by about 5%.

As a result of this expected pattern of economic growth, the main rise in demand for oil in 2010 will come from non-OECD countries, led by China. Oil consumption in non-OECD countries is likely to rise to some 41 million b/d from 39.3 million b/d in 2009, raising the non-OECD share of global oil demand from 44.5% in 2008. Despite the pick-up in growth in the OECD, several factors will deter an increase in oil demand there. These factors include tightening fuel economy standards and substitution into other sources of energy. OECD oil consumption is expected to be unchanged at about 45.5 million b/d in 2010. As a result, world oil demand is forecast by the IEA at just over 86 million b/d, a rise of only 1.5% from the 2009 level and little different from overall demand in 2008.

Oil Supply Context

Supply factors played a more modest role than demand in the swings in oil prices in recent years, although they certainly contributed to the run-up in prices to mid-2008. As surplus capacity declined, the impact on price of supply-side disruptions was magnified.

Although OPEC production rose steadily from 2002 onwards, this was partly offset by falling production in several non-OPEC countries, and lower than expected increases in capacity in Russia and Central Asia. There were also specific output setbacks in a

number of important oil producers, including Iraq, Nigeria and Venezuela. As a result, world oil supply increased by only 1.3% pa in 2002-08, slower than the 1.4% growth in oil consumption over the same period, leading to a rundown in world stocks.

The sudden collapse in oil demand in the second half of 2008 and the subsequent plunge in oil prices, with the threat of a collapse back to pre-2002 levels, prompted a much more coordinated and disciplined output response from OPEC. A series of quota cuts at the end of 2008 and in the opening months of 2009 saw output being reined in and much higher adherence to quotas than previously: OPEC's collective compliance rate to agreed quota cuts was over 80% in early 2009. This supply response, together with ongoing production problems in some countries, eg Nigeria, helped to stabilise and then push up prices in the first half of 2009, although the average price for 2009 was still 36% down from 2008.

However, the collective compliance rate with quota cuts had fallen to 58% by December 2009. Total OPEC production in December 2009 was running at 29.14 million b/d, its highest in over a year, with Nigeria's output recovering particularly strongly from its lowest level in two decades in August, as its ceasefire with rebel forces operating in oil-producing areas was maintained.

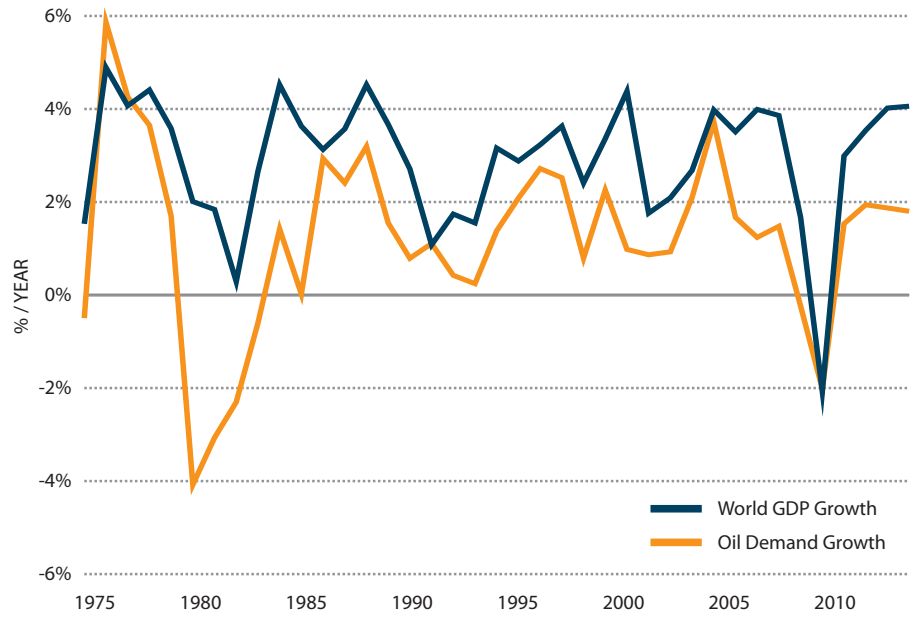
Oil Supply Outlook For 2010

As a result, OPEC oil production heading into 2010 is likely to remain at relatively high levels, with member countries' recent statements suggesting that they are comfortable with both current production levels and prices. Non-OPEC production is likely to rise only very modestly, with higher output in Russia and Central Asia being broadly offset by further falls in other countries, notably Norway, the UK and Mexico.

OIL SECTOR TRENDS OVER THE NEXT TWO DECADES

1. Global Economic Growth and Oil Demand

The next decade After the pick-up to 3% growth (on a constant US dollar basis) in 2010 from the 2.1% drop in 2009, the Oxford Economics central scenario sees world GDP growth accelerating to 3.5% in 2011 and 4% in 2012, and remaining in a similar range annually until 2020.



LEFT Global GDP Growth vs Global Oil Demand Growth.

Based on this GDP growth profile, Oxford Economics expects world oil demand to increase by 1.2% pa over the next ten years, rising from 86.3 million b/d in 2010 to 97.5 million b/d in 2020, somewhat lower than projected prior to the onset of the global downturn. Much of the increase in demand will be in the emerging markets, led by China and the rest of emerging Asia.

In its latest medium-term oil market scenario, the IEA includes two scenarios, the first of which sees oil demand rising by 1.4% pa or 1.2 million b/d pa over the period 2009-2014. The IEA's oil demand figures in its higher-growth scenario are based on world GDP growth accelerating to 3.1% in 2010 and then to 4.5% in 2014, stronger than the Oxford Economics forecasts.

The IEA also has a lower-growth scenario, which sees growth of just 2.1% in 2010, rising to about 3% pa for 2011-2014, weaker than the Oxford central projection. In this scenario, global oil demand is projected to rise by just 0.5% pa, or some 0.43 million b/d, over the five-year period.

Oil demand to 2030 The Oxford Economics central scenario sees world GDP growth in 2021-30 accelerating somewhat from the pace in 2011-2020 as the adverse after-effects of the 2008-09 global recession fully unwind. But overall, the pace of growth in the period is not expected to return to the rate of expansion seen in the ten years to 2008. Growth is likely to be led by the larger emerging markets, which will continue to grow in importance.

In its November 2009 study of energy demand prospects to 2030, the reference scenario (or base case) presented by the IEA sees world primary energy demand increasing by 1.5% pa between 2007 and 2030, equal to an overall rise of 40% from 12,000 million tonnes of oil equivalent (Mtoe) to 16,800 Mtoe, driven mainly by Asia, followed by the Middle East.

Fossil fuels will remain the dominant source of primary energy, accounting for over 75% of the overall increase in energy use over the period to 2030. Demand for coal is projected to show the biggest absolute increase over the period, while oil remains the single largest fuel, albeit with its share dropping from 34% currently to 30%. The IEA figures show demand for oil (excluding biofuels) growing by 1% pa over the period, rising from 85 mb/d in 2008 to 105 mb/d in 2030.

A sustained contraction in OECD oil demand to 2030 is likely. A key uncertainty is whether United States oil demand starts to follow a similar trend to Europe and Japan, where demand is declining, or reverts to growth, although at a slower rate than in the past.

The locus of demand growth will remain in the emerging economies. The Asian Development Bank (ADB) estimates that Asian oil demand will increase from 22.3 million b/d in 2005 to 39.3 million b/d in 2030, despite a fall in Japanese demand. While the IEA predicts 36.9 million b/d in 2030, the discrepancy between the two forecasts is less relevant than the scale of both. Moreover, the rate of this growth versus the expected contraction in OECD oil demand is stark. According to the IEA, OECD oil demand will fall from 43.2 million b/d in 2008 to 40.1 million b/d in 2030, a drop of 3.1 million b/d in contrast with total non-OECD growth of 21.2 million b/d, of which 14.9 million b/d comes from non-OECD Asia. Demand in the OECD may even

contract much more than is assumed by the IEA's reference scenario, which is based on existing policies and technologies.

The Oxford Economics forecast of long-term oil demand is similar to the IEA's, showing a rise of 1.1% pa over the period 2010-30 to 107.2 mb/d. The US Energy Information Administration (EIA) and OPEC also forecast oil demand to grow by 1.1% pa over the period 2010-30.

2. Investment Levels

The rate of development is critical to future oil supply and hinges on investment levels, which in turn are affected by a host of factors such as company behaviour, prices and access to resources.

In its 2008 World Energy Outlook (WEO), the IEA forecasts that by 2030 yet-to-be-found fields will produce 19 million b/d, based on new worldwide discoveries of 114 billion barrels. According to analysis of the 2008 WEO by Sweden's University of Uppsala, which accepts the 114 billion barrel figure as realistic, if the rate of development were restricted to that seen in the North Sea – an oil province that saw rapid development by historical standards – a figure of some 9 million b/d emerges for 2030 from yet-to-be-found fields, about half of the IEA figure.

To exceed historical rates of development, as with Brazil's pre-salt reservoirs or Iraq's stated ambition to raise output from about 2.5 million b/d to 12 million by 2015, levels of investment need to be exceptional. However, the IEA estimates that, as a result of the financial crisis, global oil and gas investment budgets in 2009 were cut by 19% compared with 2008, meaning a reduction of over 90 billion dollars.

The drivers producing a reduction on this scale have been a lack of credit, lower profits, and less immediate demand for capacity. The upstream has been hardest hit and smaller companies have scaled back investment plans more than the majors. The IEA notes that many of the largest companies have had to take on debt to supplement funding from cash flows, but that western majors have kept their spending plans broadly flat. Investment in non-OPEC countries is thought to have fallen most.

Further, the previous increase in upstream investment levels, in 2002-2008, needs to be seen against rising capital costs, which saw a period of rapid inflation from 2004 until mid-2008. Even after the recent recession, upstream capital costs are likely to remain much higher than pre-2004.

Investment rates also depend on company behaviour, meaning the willingness and ability of IOCs and NOCs to invest. In recent years, IOCs have been willing to return to investors more money than they have invested in new production, following a financial strategy based on 'value-based management'.

IOCs' share of the oil resource has fallen and as a result NOC behaviour has become ever more important. Like IOCs, NOCs are also looking to optimise revenues and national assets over the medium term. But in the case of some NOCs, investment in new production capacity is limited by their inability to re-invest profits, as these are taken by the state (eg in Mexico and, increasingly, Venezuela). Added to this are management and supply-side limitations that have undermined the ability of both IOCs and NOCs to invest and undertake multiple large projects.

3. Production of Unconventionals

The production expansion profile of unconventional resources is highly constrained compared to the possibilities for conventional crude.

Oil sands The oil sand reserves around the world may become an increasingly important source of oil over the next 20 years, but these are very expensive means of producing oil, requiring oil prices to remain high for a lengthy period to justify the huge investments involved.

Oil sands produce very heavy, viscous oil, which requires considerable refining for normal usage, meaning that much more energy is needed for production than for conventional oil resources. Oil sands and other heavy oil deposits are located in many countries, but the two main sources currently are Canada and Venezuela, both of which have massive reserves. Production of oil sands currently accounts for some 45% of Canada's total oil output, but since the onset of the financial crisis and global recession there have been large cutbacks in capital spending on these projects.

In 2009, Alberta's Energy Resources Conservation Board forecast production from oil sands of 2.7 million b/d in 2018. The Canadian Association of Petroleum Producers has predicted 2.6 million b/d in 2018 and 3.3 million b/d in 2025, if oil prices are sufficiently high to allow growth. In the absence of new projects, relatively constant output of 1.96 million b/d in 2018 and 1.99 million b/d in 2025 is forecast. Investment in oil sands production, and therefore future output, is heavily influenced by prices and price expectations. Moreover, even in high growth scenarios, potential production compared with reserve size is small in comparison with conventional resources. Neither Canada nor Venezuela is likely to reach Saudi Arabia's level of output for several more decades.

Biofuels The other unconventional is biofuels, or more broadly anything-to-liquids (XTLs), which encompasses coal-to-liquids, gas-to-liquids and biomass-to-liquids. While biofuels have increased their market share, first generation biofuels – with the exception of sugar-cane ethanol – have quickly run into problems regarding their sustainability, particularly regarding land-use change, and their competition for land resources with food. The same drivers – population and income growth – apply for both food and oil demand and this conflict looks likely to re-emerge in the years ahead.

The two key parameters in second-generation biofuels are the efficiency of the conversion process from biomass to fuel and the yield per hectare of biomass. Claims that biofuels – principally corn-based ones – can be grown effectively on marginal land ignore the decline in yield that this implies, as well as the associated increase in inputs in terms of fertiliser and fuel for sowing and harvesting, which will impact both energy and carbon balances. Therefore, the cost and reputation of second-generation biofuels remain closely linked to land quality, which, as with some first generation biofuels, leaves them open to significant risk in the food versus fuel debate.

Environmental concerns regarding land contamination, water use and carbon dioxide emissions are likely to limit the expansion of coal-to-liquids (CTLs). China has made heavy investments in CTL technology, but in recent years it has sought to rein in the development of new plants, reducing its programme to two main projects, although others do exist. While gas-to-liquids (GTL) expansion plans worldwide have also been

scaled back from earlier expectations, the industry is maturing, and the 140,000 b/d Pearl plant in Qatar is likely to come into operation in 2011. Both technologies are likely to make only a marginal contribution to transport fuel supply over the next ten years, and even in 20 years, their impact may still be fairly limited.

4. Opec's Growing Role

OPEC production Oil production by non-OPEC countries is expected to decline from about 2011/2012 onwards. Output by major producers such as Mexico, Norway and the UK is likely to continue in trend decline, and many smaller producers face problems with ageing fields and a lack of investment in recent years. Although production increases will be realised in Canada, Brazil, and the United States (in the Gulf of Mexico) it is unlikely that the amounts will be enough to offset the overall decline. As a result, the call on OPEC is expected to increase steadily, enabling some major producers to expand production in line with their long-term potential.

Several of the major Middle Eastern producers, such as Saudi Arabia, Kuwait and the UAE, have the potential to expand output. Two major producers, Iraq and Nigeria, are expected to seek to raise their output significantly. Despite being a member of OPEC, Iraq is likely to resist inclusion in the cartel's output quotas while it seeks to fund national reconstruction. Other OPEC members likely to press for higher quotas in the future are Algeria and Angola.

Some of these countries are likely to raise output levels regardless of actual quotas as long as they can do so without leading to a collapse in world oil prices. As a result, the IEA forecasts OPEC crude capacity to grow by 2.8 mb/d over the period to 2014, taking its capacity to 36.9 mb/d. Growing dependence on OPEC oil production as a share of world output appears inescapable, even for several years beyond that date.

This means that the political risk associated with OPEC countries will rise in importance in the formation of price expectations. Key risks include tensions within Iran; the stand-off between Western powers and Iran over its nuclear programme; ongoing internal conflict in Iraq; possible terrorist attacks on major oil installations; in the longer term, potential leadership succession issues in Saudi Arabia; and a worsening of insecurity in the Niger Delta.

In terms of new output, the most important of these is perhaps the situation in Iraq, as the country has the potential to increase its current oil production five to six-fold over the next two decades. This would see it meeting a substantial, and potentially critical, portion of future demand growth.

OPEC's price strategy OPEC's strategy will remain a key determinant of price; and as conventional non-OPEC reserves in many countries deplete, OPEC's ability to influence prices will increase. OPEC has shown that it does have the institutional capacity and motivation to act when prices fall. However, recent history demonstrates that in a tight supply situation, OPEC has little ability to put a cap on prices.

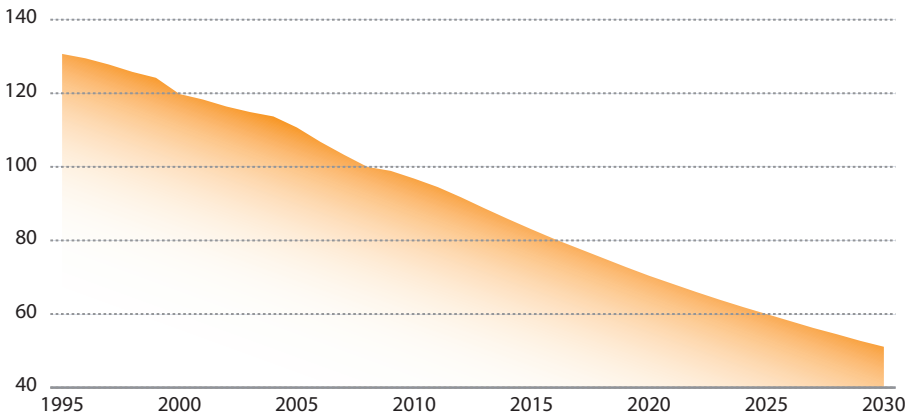
OPEC has long faced the conundrum that low prices diminish its revenue base yet high prices encourage non-OPEC production, a loss of market share, long-term demand destruction in the form of substitution, and potentially a slowdown in the world economy. Loss of market share should be mitigated by the depletion of mature

non-OPEC oil production, but substitution through the development of biofuels and innovations such as the electric car remain serious long-term threats.

Therefore, OPEC's interest is in keeping oil prices high, but not so high that substitution effects undermine the future market for oil. However, its response to high and low prices has been asymmetric: it has a bias towards tolerating high prices for longer than low ones as high prices bring immediate short-term financial benefits. In addition, its ability to put a cap on rising prices depends not only on its level of surplus capacity but also on its willingness to deploy that capacity. Saudi Arabia, as the principal guardian of OPEC's spare capacity, remains the critical decision maker in this regard.

5. 'Green' Legislation

The level of global oil intensity (the amount of oil needed per unit of GDP) will continue to fall as governments in developed countries lead the implementation of carbon tax policies and other measures to discourage the demand for hydrocarbons. But emerging economies are more energy intensive than developed economies, with China and India particularly energy intensive, so the continued faster growth in the developing world is likely to more than offset declining demand elsewhere.



RIGHT Global Oil Intensity
(2008=100)

The December 2009 Copenhagen climate change summit failed to deliver the hoped-for commitments by countries to cut greenhouse gas emissions by 50% by 2050 (and hence use less hydrocarbon fuel). This was compounded by the recent setbacks to US President Barack Obama's attempts to introduce cap-and-trade legislation. Nonetheless, the move to combat global warming will almost certainly gather momentum again in the years ahead.

The United States and the EU (the latter until 2012 under the Kyoto Protocol) have programmes that require an increasing percentage of energy demand to be met from a combination of energy efficiency savings and renewable energy, together with an increasing use of biofuels. But China and India, plus many other emerging markets, are reluctant to agree to any binding commitments to reduce emissions or the growth of demand for hydrocarbon fuels.

The growing use of carbon taxes looks certain to curb some demand for oil in the years ahead, although the main impact may initially be on the use of coal. But in the absence of coordinated global action to stem the rise in carbon emissions, rising carbon prices and carbon cap and trade schemes in developed countries will make it more economically efficient for companies to emit where it is cheaper, which tends

to be in the lower-income countries where a lower price is placed on environmental quality. In turn, this is likely to erode the impact of carbon taxes on global demand for oil over the next two decades.

6. The Transportation Sector

Vehicle ownership Rising incomes in developing countries for a significant segment of the population are allowing first-time car ownership, effectively a one-off step change in oil demand. Moreover, the relationship between car ownership and income is highly non-linear; low incomes mean low per capita car ownership, but per capita car ownership rises twice as fast as income at middle-income levels.

The Chinese car market has become the most dynamic in the world, and is based primarily on standard diesel and petrol engines. Despite inroads for compressed natural gas as a motor fuel, and substantial investment in the development of electric vehicles, China's motorisation and urbanisation processes appear to be following a pattern similar to other Asian developing economies.

There is the possibility that China could 'leapfrog' technologies, with early adoption of electric vehicles, in the way that other developing regions in the world have bypassed landline telephony for mobile. But China's car industry for the moment is oil-based. The government's direct prioritisation of the vehicle industry in its allocation of stimulus funds reflects the sector's growing importance to the economy. This is because car production has knock-on effects for parts manufacturers, metal producers and petrochemicals. The significance is that the car industry will continue to play a very large role in the Chinese economy; it may – as in the United States and South Korea – become too big to fail. Therefore, the sector is likely to provide sustained support for global oil demand growth over the next decade.

Globally, the rate of market penetration of alternatively fuelled vehicles is likely to prove slow in comparison with the expected growth in oil demand. Nonetheless, by 2030, new forms of transport, notably the electric car, may be gaining traction, and these would fundamentally challenge oil's central role in the market for transportation fuel. These developments are typically categorised as downside risks to the oil price, but their potential market failure, or slow rate of market penetration, is just as much an upside factor.

7. Population Growth

Asia-Pacific's population is projected to grow from 3.55 billion in 2005 to 4.44 billion in 2030. According to the ADB, India's average annual population growth will be 1.1%, while China's is estimated at 0.4%. Although low in percentage terms, this is high in absolute numbers. Together, the two nations by 2030 will make up 64.7% of the region's population. Developing Southeast Asia makes up a further block about half the size of China or India in population terms.

8. Urbanisation

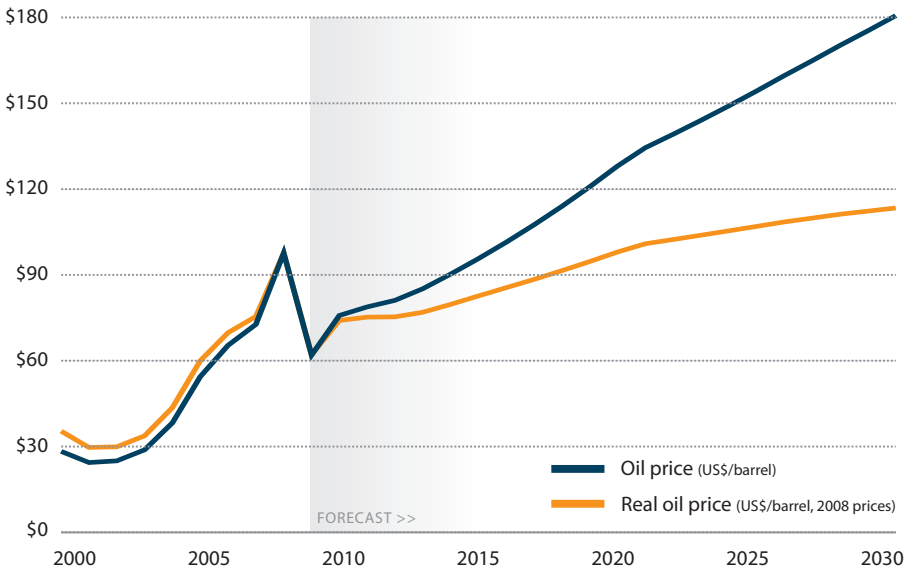
The non-OECD population is also urbanising rapidly. According to the UN, Asia's urban population will grow by 2.2% annually, in comparison with total population growth of 0.9% a year. Urban incomes tend to be higher than rural ones, and the process of urbanisation itself promotes motorisation as job density increases in city centres, industry moves to city outskirts, and residential areas form in-between.

FORECAST FOR OIL PRICES

As a result of the supply and demand factors discussed, it is likely that the world price of oil will continue to rise steadily over the coming decade. However, there is significant risk of softer prices in the short term; while demand is recovering, spare capacity now exceeds 6 million b/d by some estimates. Stocks remain high, notably the levels of oil products and crude stocks held offshore. A potential supply crunch, based on reduced rates of investment and accelerating non-OECD demand, might only be expected in 2012-2014.

The Oxford Economics central scenario forecasts that the price of Brent crude will climb to close to 95 dollars/barrel (d/b) in 2015 (82 d/b at constant 2008 prices) and to 128 d/b in 2020 (97.5 d/b in 2008 prices). This corresponds to an average annual real increase in oil prices of about 2.5% pa over the period.

Oxford Economics then expects oil prices (in nominal terms) to rise to 180 d/b in 2030, a little below both the IEA projection of 190 d/b in 2030 and the EIA's forecast of 186 d/b. The pace of increase in real oil prices is forecast to slow to about 1.5% pa in the period 2020-30 from 2.5% pa in 2010-20. The Oxford Economics forecast of the price of oil in constant 2008 US dollar terms is 113 d/b, slightly below the IEA's forecast of 115 d/b. This takes real oil prices above the record highs seen in the late-1970s and early-1980s.



UPSIDE RISKS TO THE FORECAST

A 'second supply crunch' is not inevitable, but it does appear likely on the basis of a recovery in the world economy, the weakness of measures to tackle climate change, existing decline rates, access to resources and current levels of investment. The gradual shift in market share to OPEC will increase both the impact of the cartel's policies on the oil market, and the importance of geopolitical events in the Middle East.

The key upside risks to the forecast are:

Lower prices in the short term constraining investment

Weaker than expected economic growth in the short to medium term would weaken oil demand, possibly lowering prices in the short term. However, this would have the

effect of dampening investment, thereby potentially adding to long-term capacity problems and increased upward pressure on prices in the future.

Higher rates of investment need to be supported by high prices, particularly in an environment in which credit remains restricted and borrowing costs are expected to rise. Lower oil prices in the short-term will also retard the expansion of unconventionals and shorten the life of mature oil provinces, where the affordability of developing smaller fields is dependent on existing infrastructure that at some point faces decommissioning.

Geopolitics in the Middle East

Important upside risks to the central oil price forecast stem from the risk of further tensions in the Middle East, which currently appear most likely to be linked to tensions between the West and Iran over the latter's nuclear ambitions. However, the stability of Iraq and its attitude towards foreign investment is also important.

Not only is there the risk that Iran's 2.4m b/d of oil exports could be halted, which on its own would be a major blow to world supplies as it is the world's fourth largest oil exporter (after Saudi Arabia, Russia and Norway), but also that Tehran might respond by blocking shipping in the Gulf. Some 40% of all seaborne oil trade (20% of total oil trade) passes through the 21-mile wide Strait of Hormuz, just off the coast of Iran – an easy target for disruption.

Currency Movements

A significant risk to the forecast is the impact of currency movements, in particular trends in the US dollar. In 2003-2008, the price of oil rose strongly when measured in US dollar terms, but it was more stable when measured in terms of gold or euros.

According to the IMF, 40-50% of the climb in the oil price in that five-year period was the result of US dollar weakness, and the recovery of the US dollar in 2009 probably played a part in the fall in oil prices from 2008. Any extended period of US dollar weakness in the years ahead could see oil prices rising faster than in the central scenario.

Other Key Upside Risks

Other key upside risks include conflict in the Middle East more generally; political upheaval in a major African producer such as Nigeria or Angola; or heightened tensions between the current leadership in Venezuela and the United States.

SECTION II

Brazil's Prospective Pre-Salt Legal Framework

KEY FINDINGS

Overview

The Brazilian government judged that the current concession regime was not adequate to achieve new goals made possible by the pre-salt bonanza. Accordingly, President Luiz Inacio Lula da Silva proposed a new legal framework for development of the pre-salt resource areas yet to be licensed (ie the already licensed blocs will be developed under the old regime). Through this new regime, the government hopes to gain greater control over the pre-salt resource, securing a larger portion of the revenues, and encouraging both a sustainable rate of production and an equitable redistribution of wealth.

The government's intention is for the new regime to drive innovation, following countries such as Norway and other knowledge and innovation driven economies. The contractual regime itself – PSA or concessionary – is only one component of the government's management and incentive structure that seeks to redefine roles and broaden the impact of Brazil's newfound resource wealth to maximise the opportunity both for Brazil and Petrobras. While specific details of the legislation could be improved to ensure that the objectives are delivered, key to success will be disciplined implementation.

Implementing The New Framework

Petrobras's excellent track record, and its status as a mixed company that already operates at the technological frontier provide solid preconditions for it to assume the greater responsibilities assigned to it under the new framework. Its greatest challenge will be to overcome the potential constraint on innovation and higher costs resulting from its overly dominant position.

Most oil companies will adapt to the new system provided there is stability, transparency, and a sense that control is proportionate to financial commitment. Under the prospective PSA regime, as under the current concessionary one, foreign and domestic oil companies will primarily be attracted by the incentive of being able to 'book' reserves. However, as discussed below, many may be deterred by their inability to exert influence on the operations management committee – particularly in cases of significant investment. Also, the use of Petrobras as a service contractor, giving it access to exclusive data – even before approval of the legislation – generates concerns about the company's privileged status.

As under the previous framework, the federal government retains sufficient control to set the pace for a sustainable development of the pre-salt resources, accommodating local industry and diminishing macroeconomic risks. There is some risk of excessive government control leading to politicisation and/or bureaucratisation and, as opposed to attracting investment, deterring it. For Petrobras, maintaining the ability to re-invest profits will be crucial for incentivising efficiency and enabling technology development, and future governments will need to continue to recognise this.

Further, Petrobras will have the opportunity to balance its overwhelming presence in the pre-salt reserves by divesting from smaller, less productive plays to create opportunities for small and medium sized oil companies, spurring the development of a new segment in the oil and gas sector. The presence of companies of all sizes would act as an incentive to innovation and increase demand for services.

Therefore, Brazil's new regulatory framework has the potential for success. Like many other jurisdictions, such as Norway, the Brazilian government needs to be willing to adjust the regulatory framework over time, as further resources are discovered; market conditions change; and technology advances. Brazil's historically pragmatic approach to attaining its objectives in the energy sector suggests that, in the future, governments will not baulk at adjusting the prospective regulatory regime should it fail to deliver an adequate framework for attracting investment; efficient and sustainable exploitation of the pre-salt reservoirs; and the achievement of further economic and social goals for the country.

Broader Uncertainties

As international experience shows, while a regulatory framework defines roles, it is the key institutions within that framework – including the government, regulatory agencies, and the NOC – that are critical determinants of long-term results. While Brazil's prospective framework will shape the pre-salt resource development, it will require broader commitment by the Brazilian government to set the country on a trajectory towards a knowledge and innovation driven economy that includes a vibrant domestic oil and gas supplier and services industry. The major obstacles to Brazil's ability to follow the path of other producing countries that have been successful in pursuing such trajectories lie outside the narrow focus on the regulatory framework. Comparing Brazil to Norway, a country often cited as an example of good practice in development of the hydrocarbons sector, is illustrative:

- **Institutions and Governance** Petrobras will perform better, and its impact on Brazil will be more positive, if Brazil's political and economic institutions remain stable and strong, and function efficiently and with minimal corruption. Such broader quality of institutions and governance has been critical to Norway's success, and it is not yet clear that Brazil can deliver similar quality for a sustained period, even if many of the current signs are positive. For example, Brazil ranks 75th in Transparency International's 2009 Corruption Perceptions Index.
- **Wealth and Income Inequality** Norway in 1960 had a gross domestic product (GDP) per capita of 10,700 US dollars (compared to 42,700 today). Brazil's GDP per capita today stands at 4,400 dollars . Moreover, apart from being less wealthy, Brazil today has higher income (and wealth) inequality than Norway had in the 1960s: Although Brazil's Gini coefficient, which measures income inequality, is on a long-term downward trend, it remains above 0.55 (on a scale of zero to one, where zero represents most equal and one most unequal), compared to Norway's 0.3-0.4 during the 1960s and 1970s (and 0.25 today). This creates political pressure for immediate redistribution of hydrocarbons wealth, making it more difficult to justify slowing field development to allow local content time to catch up; or saving a substantial proportion of that wealth; or investing in programmes whose benefits are felt mainly in the long term – all three of which Norway was able to carry out very successfully.
- **Size and Diversity** The complexities of redistributing oil wealth in a large and diverse country such as Brazil are highlighted by the current debate surrounding distribution of royalties under the new regulatory framework. Brazil is very diverse not only in terms of income inequality, but also in terms of the geographical spread of natural resources endowments and population centres. Such diversity was less of an issue for Norway's geographically more tightly

clustered and smaller population (totalling 3.6 million people in 1962 and 4.9 million today, compared to Brazil's population of 192 million today).

- **Competitiveness** Norway was able to enter into a 'virtuous circle', whereby improvements in technology, human capital and entrepreneurship in the oil and gas sector catalysed similar improvements in the wider economy, and vice versa. This was critical to overcoming the resource curse. It was achievable because of the rapid progress the country as a whole was making in areas such as education and training, and technology – areas where, outside of the hydrocarbons sector and a few other sectors (eg aeronautics and financial services), in Brazil there is still considerable room for improvement (see also Section III below).

As a result of these broader factors, Brazil will find it difficult to emulate the Norwegian experience, at least in the medium term. However, the more successful Petrobras and the Brazilian hydrocarbons sector becomes, the greater the opportunities for these broader issues to be resolved. Should the new regulatory framework for the pre-salt reservoirs address the challenges discussed below, it could prove to be a very solid starting point.

THE PROPOSED BRAZILIAN LEGISLATION

The proposed legislation consists of four separate bills currently under consideration by the Brazilian Congress . The main elements of each bill as proposed by the government are:

A New Production-Sharing Regime

Brazil's current concession regime includes a signature bonus, royalties (which vary from 5-10%), special participation for very productive wells (from 10-40% of net profits), and a rent or retention payment.

Production-sharing agreements (PSAs) will replace concessions as the contractual arrangement for all the so far unlicensed pre-salt areas (72% of the exploration area), as well as any additional areas deemed in the "national strategic interest" by the National Energy Policy Advisory Council (CNPE). As in other production-sharing regimes, contracts will be based on sharing 'profit oil', which is calculated by subtracting from the production the 'cost oil' (ie total production less E&P costs, investments and royalties). Winning bids will be determined principally by the share of profit oil for the state.

Awards will be made either through public auctions, in which Petrobras will be the sole operator, with a stake of at least 30%, or awarded directly to Petrobras, if the area is deemed strategic. This arrangement dramatically enhances the privileges afforded to Petrobras compared to the current concessionary regime, in which all companies are treated equally.

Companies can only present one bid per bloc (alone or in a consortium). The government will be represented in each deal by Petrosal, a new state company (see below). Petrosal will not assume any financial liability in the project, so project financing will be the sole responsibility of the winning company or consortium and Petrobras. Petrosal will be the auditor of the cost oil.

The bill also lays out the responsibilities of the CNPE as well as those of the Ministry of Mines and Energy (MME), and the regulator, the National Petroleum Agency (ANP). In addition, given the state's need to acquire information on the delimitation and potential of the reservoirs, in a departure of traditional roles, the bill determines that Petrobras can be contracted to conduct exploratory studies on behalf of the MME directly or via the ANP. In other words, the bill establishes that the government can contract Petrobras to provide geological and drilling services.

An amendment to the bill passed by the Chamber of Deputies on March 10, 2010, provides for existing concessions as well as new contracts to be subject to revised rules for the distribution of royalties. The major producing states (Rio de Janeiro, Espirito Santo and São Paulo) stand to lose most from this amendment, which will benefit non-producing states. However, the constitutionality of this amendment is being challenged, and the amendment may also be overturned in the Senate. Even if it is approved in the Senate, the president may veto it.

The Creation of Petrosal

In order to meet its objectives, the government sees the need to establish a team of bureaucrats that understand the energy sector – hence the creation of a new state company, Petrosal. It will be constituted as a commercial company – with all the reporting and legal obligations of similar enterprises – but wholly owned by the Brazilian government and linked to the MME. Petrosal will be a partner in all pre-salt PSAs but assumes no financial liabilities. The company will represent the state in the daily operations of these contracts, through its representation in the operations management committee. Petrosal will also be responsible for the sale of the product received as payment for the state's share of the profit oil. Petrosal will receive a management fee and part of the signature bonus. It will be managed by an administrative council and an executive board, both named by the president of Brazil.

The Social Fund

The main objective of the new Social Fund is to provide funds for poverty alleviation, educational development, culture, science and technology and environmental sustainability programmes. The Fund will be directly linked to the president's office. It will receive a portion of the royalties and signature bonus, a percentage of the revenues generated by the commercialisation of the oil received by the state, as well as interest received on investments. Other revenues will be considered.

The bill deals with permissible investments, which include financial and other instruments, in Brazil or abroad, chosen based on their expected return, low risk and liquidity. Investment policy will be determined by a non-remunerated financial committee whose members serve at the discretion of the president. The use of the Fund's resources will be governed by a non-remunerated deliberating council composed of individuals from civil society and the federal bureaucracy. Its membership, competencies and procedures will be established by presidential decree. The Finance Ministry will report quarterly to Congress on the Fund's activities.

Onerous Relinquishment to Petrobras

The term 'onerous relinquishment' means, in this case, that the state will relinquish, without a bidding process, its rights to the hydrocarbons contained in a not-yet-licensed area of the pre-salt reservoirs limited to no more than five billion barrels of oil equivalent (boe). The state will exchange these rights for shares in Petrobras, some

or all of which could then be acquired by the investor community. Subject to sufficient investor appetite, this capitalisation of Petrobras will generate cash inflows that Petrobras can use to help fund its capital expenditure. In addition, the expectation is that booking this extra five billion boe will increase Petrobras's ability to borrow for the same purpose.

The Congressional Process

If the bills are approved and become law, there is a chance that an independent party (or parties) start legal procedures questioning the constitutional legality of the new framework. Such a legal challenge would add uncertainty to the process, in turn raising the costs of financing pre-salt exploration projects. There may be a challenge related to Petrobras's role as sole operator, which tests Brazil's constitutionally based commitment to competition.

ASSESSING THE LEGISLATION

Petrobras and the federal government have argued that PSAs are more suitable for large and very low risk reserves, while concessions are better for smaller, more risky activities. The assessment of the pre-salt reservoirs as low risk may be premature, given the large territory where these reserves are found and the low number of wells drilled thus far. Further, linking the E&P regime type to level of risk is debateable. However, this discussion does not detract from the fact that there are both opportunities and concerns associated with the new framework.

Opportunities

1. Exploit operator role for commercial gain Granting Petrobras exclusive operator rights may appear to be in the company's best interests, and if carefully managed it could be. The central role envisioned for Petrobras provides an unprecedented opportunity for the company to grow. It will be key for the government to continue to allow Petrobras to function as an enterprise equally responsive to all its stakeholders.

2. Establish clarity and limits in Petrobras-government relationship It is paramount for Petrobras to define its own role as opposed to that of the government. The new legislation provides the opportunity to do this, through the creation of Petrosal. This could open a venue for the government to become a responsible and active participant in hydrocarbons development.

3. Revenue gain for the government The new framework will enable the government to secure a larger portion of the revenues from the hydrocarbons sector, with which it can encourage economic diversification and an equitable redistribution of revenues. One tool for this will be the new Social Fund. The set-up of the Fund as proposed by the government to Congress gives it the potential to have a positive long-term impact. However, it will be critical that good governance practices are adopted in the Fund's management. These include transparency, accountability, independent and professional asset allocation, and an absence of ad hoc political interference in the channelling of the Fund's resources. The latter will provide the greatest challenge for the Fund.

4. Strengthen the hydrocarbons sector bureaucracy The creation of Petrosal also opens the door for the government to build up a generation of public sector professionals, well-versed in knowledge directly related to the local resources and capable of effective monitoring and management of sectoral development.

5. Achieve sectoral stimulus through divestments The increase in Petrobras's overall exploration and development portfolio allows the company to divest of less productive prospects with little impact on its bottom line. Many of these are still very profitable for small oil and gas companies. In this sense, in addition to being an engine of growth for the oil and gas service sector, Petrobras could act as the motor for the development of the domestic exploration and production (E&P) sector.

6. Pursue benefits of standardisation In principle, good solutions developed by suppliers and service providers for Petrobras will be replicable on other projects operated by Petrobras, permitting the suppliers and service providers to homogenise technologies and processes, reducing costs and raising efficiency.

7. Book reserves As under the current concessionary one, foreign and domestic oil companies will primarily be attracted by the incentive of being able to 'book' reserves. This will provide a strong incentive for most companies to adapt to the new system.

8. Guarantee transparency and accountability PSA negotiations often are not transparent and the resulting contract is often kept confidential. Thus, PSAs may lend themselves more easily to corruption than the more transparent and accountable concessionary system. However, the current objective in Brazil is to have a PSA system in which the bidding process functions transparently, as the successful implementation of the broader prospective regulatory framework and policy requires transparency and accountability.

9. Address environmental impact Unless carefully regulated, development of the pre-salt reservoirs may have a negative impact on environmental sustainability, eg through greater emissions. The government has yet to take substantive steps on environmental policy for the pre-salt exploitation. However, the new regulatory regime presents an opportunity to address this issue head on. Moreover, Petrobras is planning voluntarily to implement carbon capture and reinjection.

10. Manage pace of development As under the previous framework, the federal government retains sufficient control to set the pace for a sustainable development of the pre-salt resources, accommodating local industry and diminishing macroeconomic risks.

Concerns

1. Management challenge of huge portfolio The framework adds further dimensions to Petrobras's already huge portfolio of tasks, in Brazil and internationally, increasing management challenges.

2. Risks associated with Petrobras's privileged position in exploration and production There are strong risks associated with the company's status as sole operator, including slow field development (which need not be negative), increasing costs, and discouragement of the use of new and varied technologies, stifling innovation. The lack of competition means that operator performance cannot be compared, and thus will be more difficult to improve, as well as to regulate. In addition, Petrobras might find itself in the position of having to join a consortium that won a bid that was higher than the one Petrobras itself made – which presumably would have been formulated based on the company's assessment of the profitability of the bloc being auctioned.

However, in some cases Petrobras may in practice share the operational tasks while maintaining the title of operator.

3. Risks associated with Petrobras's dominance over local procurement The granting of operational dominance to Petrobras means that the company will be the only buyer in the supplier and service markets, and hence be able to exert downward price pressure. Associated disincentives to innovation may affect Petrobras's supply chain. This may complicate successful development of local content for exploitation of the unlicensed pre-salt reservoirs. In contrast, in areas outside of those reservoirs, local content benefits from dealing with several operators.

4. Insufficient personnel Although Petrobras has many personnel qualified in skills needed for development of the pre-salt reservoirs, in the short term it will not have enough of them to keep pace with the planned magnitude of the challenge. Petrobras's strategy for field development will need to allow a transition to build up these skills. The introduction of flexible hiring procedures by Petrobras would facilitate the attraction of foreign expertise. To some extent, that expertise will be provided by foreign oil companies and suppliers, and it will be critical for Petrobras to develop partnerships that permit such expertise to be integrated into operations.

5. Concentrated operating committee control Project administration will fall to the operations management committee, to which Petrosal will appoint half of the members, including the chair, who will have the quality vote and veto power. As operator, Petrobras will also be represented, presumably with a membership equivalent to its 30% participation. The result would be that the two state-controlled enterprises would have almost complete control of the operating committee of all projects. This is a concern for private sector companies, which is compounded by the fact that Petrosal will not contribute financially to projects.

6. Risk of blurring of roles The legislative proposal blurs responsibilities and roles, as the government appears keen to use Petrobras as a service contractor to the ANP in the mapping of the new reserves. Moreover, it reserves the right to demand that Petrobras drill wells in areas that are defined as important for the 'national strategic interest'. There are also other areas, eg promotion of new technologies, in which Petrobras's role may be blurring with that of the government, and where clarification of roles could lead to better use of synergies – combining Petrobras's knowledge of the hydrocarbons industry with the government's reach in national policymaking.

7. Challenges to Petrosal's effectiveness The objective is for Petrosal to become a lean and efficient institution, staffed by skilled bureaucrats. However, partly because of the need to draw on the country's most skilled sectoral specialists, its relationship with Petrobras may become complex. There is a risk that, over time, Petrobras 'captures' Petrosal if relations between the two companies become too close, and if Petrosal needs to rely heavily on the expertise of current or former Petrobras employees. This would reduce conflicts with Petrobras but may cause tensions with other oil companies and could diminish Petrosal's effectiveness.

8. Complexity of parallel contractual regimes There are risks attached to managing two different contractual regimes concurrently in one area, as pre- and post-salt operation will be developed in parallel. For example, complex modern oil wells may

produce from different layers (ie both pre- and post-salt). This could raise legal and accounting issues with regard to the separation of the crude oil produced there.

9. Difficulties of monitoring and controlling Insufficient cost control is a common concern for the host government under a PSA regime, as operating companies, since they are compensated in cost oil, may have less incentive to control costs, and the government shares the exploration and production risks. Moreover, the calculation of cost oil and profit oil is known to be complex. Because the volume of cost oil is dependent on investment costs, government oversight of the development budget is necessary. If the government were routinely to approve development budgets without careful monitoring, oil companies could realise more cost oil than would be warranted with efficient development. The extent to which the government succeeds in its role in effectively monitoring and controlling costs without stifling the process will be a key factor determining the efficiency of the pre-salt exploitation.

INTERNATIONAL EXPERIENCE RELEVANT TO BRAZIL

The nature of the contracting regime (PSA or concessionary) is only one element of the broader political, institutional and legal setup that determines the degree of success a country has in developing its hydrocarbons sector. Moreover, PSA and concession regimes can be structured so as to be little different in financial terms. Rather, the key difference often relates to political symbolism regarding sovereignty: Under a PSA regime, the government is perceived to retain more control over the nation's resources than under a concession regime. This helps to explain why many countries' hydrocarbons sectors are centred on PSA regimes. Some of these countries provide examples of good practice in structuring and implementing PSA regimes, and some bad practice. This section highlights particularly clear examples of both. Certain countries that use concession regimes, notably Norway, are also cited as these can provide similarly valuable examples for Brazil as it moves towards implementing its prospective new regulatory framework.

Country Experiences

Norway Norway's management of its oil resource displays many elements of best practice on a range of issues. A notable area is in the regulation of the oil resource. In the early days, the responsibilities were divided between the Ministry of Petroleum, which developed policy, the National Petroleum Directorate, which monitored and regulated, and Statoil, which operated commercially. By developing Statoil as the NOC, the Norwegian government was able to use the company's technical skills and knowledge to control and monitor oil production, particularly in overseeing foreign oil companies. This helped drive the government's knowledge base, but also resulted in the evolution of regulatory responsibility.

In the 1980s, as Statoil's influence grew, the commercial operation was split between the non-operational State Direct Financial Involvement (SDFI) and Statoil. This has allowed for the partial privatisation of Statoil, distancing it from government influence.

Norway is known for its efforts to avoid 'Dutch disease', associated with the export of oil. The government sought to slow down investment and development to ensure that local content was given time to adapt. Under the Petroleum Activities Law, the government is authorised to regulate oil production levels. In addition, transparency was enhanced through public announcement of selection criteria, and the reasons for awarding the contract to the successful company. Pre-bid qualifications were used to

assure competitive technological capabilities of potential operating companies. (See also Section III below.)

Angola When the Marxist-Leninist MPLA came to power in Angola in 1975, foreign oil companies withdrew from the country. The oil sector was nationalised, with the NOC Sonangol created to manage the country's oil resources. Despite an ongoing civil war, Sonangol implemented a PSA framework and was able to attract foreign oil companies back into Angola. Arguably, the legal and fiscal security that PSAs provided has helped to turn Angola into Africa's second largest oil producer. Though the PSAs offered are tough, in principle they provide foreign oil companies with an attractive regime, including a 50% income tax instead of a royalty payment. However, the lack of transparency in contracting can result in long delays and has at times created poor relations between foreign oil companies and Sonangol.

Algeria Algeria has used PSAs since 1986. Amendments introduced in 1991 to the hydrocarbons law were relatively successful in encouraging foreign companies to agree PSAs with the government. As a result, between 1987 and 2000, new oil reserves totalling some seven billion barrels were discovered. Under further reforms introduced in 2005-06, Algeria began to move away from the PSA model, granting long-term oil and natural gas concessions to foreign companies, provided that they operate in cooperation with Sonatrach, the NOC – and introducing a windfall tax of up to 50% of profits if oil prices are above 30 dollars/barrel. These changes have generated confusion for foreign companies, raising questions about contractual and institutional stability, and the long-term outlook for the investment environment, and have led to several arbitration cases. The recent high-level corruption scandal at Sonatrach may be a further sign of institutional weakness.

Azerbaijan Azerbaijan has adopted a similar model to Angola, eschewing royalty in favour of a tax of 10-35%, depending on participating share. Despite a high signature payment, Azerbaijan provides an attractive PSA regime and in particular enables operating costs to be recoverable immediately. The system has been successful in rapidly attracting foreign investment into the oil sector: As of late 2009, 28 PSAs, involving companies from 16 countries, are expected to generate over 60 billion dollars in new investment. In Azerbaijan, a production-sharing agreement is an all-encompassing contract that carries the force of law and requires the ratification of parliament and the president. Though this can be time consuming, it provides for a stable legal framework.

Some PSA regimes use model contracts, but Azerbaijan has taken an alternative approach in which each PSA is unique to the specific requirements of the project. This can provide a favourable framework for foreign investors, while ensuring that the NOC can achieve specific requirements.

Indonesia Together with a number of other factors, PSAs in Indonesia contributed to the development of bureaucratic, inefficient and sometimes corrupt operations at Pertamina, the NOC. By granting Pertamina extensive autonomy in a monopolistic position and then backing it politically at the highest levels, the government ensured that there was little transparency or accountability in the NOC. As a result, Pertamina failed to develop technical expertise and instead was content to act as supervisor of PSA contracts and (sometimes corrupt) local content procurement requirements.

Further, Pertamina was for many years prevented from re-investing sufficiently in oil exploration.

Since the late 1990s, and the election of democratic governments in Indonesia, Pertamina has been subjected to extensive investigation and reform. It has lost its monopoly position and separate regulatory agencies have been created to ensure greater transparency and openness in operations and in the award of contracts.

Malaysia Malaysia's Petronas was created in a similar monopolistic position to Pertamina but with the aim of operating as a profit generating commercial company. Though reporting directly to the prime minister, and with total control over the country's oil and gas resources, it has been made to operate with relative efficiency and accountability. As a national champion, it was also encouraged to act on behalf of Malaysia overseas, and this has seen its international activities rise to some 40% of revenues. Petronas has been allowed to re-invest profits and has developed extensive technical expertise, enabling it to expand domestically and internationally.

Mexico The major obstacle to further development of the Mexican oil industry is the state's monopoly, which has fostered inefficiency and a lack of transparency. Mexico's oil supply and service industry suffers from considerable financial, technical, organisational and managerial problems.

The propensity of the Mexican government to take most of the surplus generated by PEMEX leaves little capital for investment and technical innovation, and few incentives for efficiency. Mexico's failure to attract foreign investment is the result of a constitutional constraint on private companies booking reserves. The combination of undercapitalisation and inability to secure foreign investment has translated into a decline in production.

Venezuela PdVSA had traditionally been considered to be one of the better-managed NOCs, measured in terms of volume produced in relation to employment. It has usually held strong operatorship in major projects and for many years supported strong research facilities. However, in the face of the company's clear politicisation under President Hugo Chavez, this lead operatorship role has been insufficient to prevent the company's recent stagnation.

International Many sovereign wealth funds are financed by the export of commodities, in particular oil. This includes not only Gulf state funds, such as the Kuwait Investment Authority (established in 1953) but also funds in the United States (the Alaska Permanent Reserve Fund, 1976) and Canada (the Alberta Heritage Savings Trust Fund, 1976). The objectives of such funds include cushioning the domestic economy against swings in global commodity prices and creating a reserve of wealth for when the natural resource has been depleted. SWFs usually invest mainly in bond and equity markets.

KEY FINDING	GOOD PRACTICE	BAD PRACTICE
PROVIDING FISCAL STABILITY TO ATTRACT INVESTMENT		
PSAs provide a stable and attractive contract instrument.	Azerbaijan, Angola	
Customising PSAs, eg eliminating royalties on companies' behalf, can increase the perceived stability of the contractual framework.	Azerbaijan	
Switching from a PSA regime to concessions can engender instability in relations with existing investors.		Algeria
FOSTERING COMPETITION		
If the regulatory framework provides for excessive dominance 'at home', then honing the NOC's competitiveness by participating internationally is key.	Malaysia	Indonesia (previously)
Development requiring heavy investment calls for private capital, to enhance competition and innovation, and to reduce costs.	Norway, Canada	Venezuela
Local content procurement requirements, if not properly monitored, can be a key area for corruption to develop.	Norway, UK	Indonesia (previously)
Local companies' dependence on a single purchaser is not in the long-term interests of local content.		Mexico
Governments need to permit their NOCs to re-invest a sufficiently high share of their profits for them to remain competitive.	Malaysia	Mexico, Venezuela
Politicisation erodes NOC competitiveness.		Venezuela
A dominant operator position can prove unsuccessful.		Mexico, Venezuela
CONTROLLING AND MONITORING PRODUCTION		
In order to control and monitor oil production, governments need to ensure that they have access to the necessary skills and technical knowledge.	Norway	
CLEAR SEPARATION OF ROLES		
Separation of roles and responsibilities of entities involved in managing the oil resource is key.	Norway	
The regulatory framework can be adjusted over time to ensure that the influence of entities is balanced.	Norway	
ADJUST THE PACE OF RESOURCE DEVELOPMENT		
Controlling the pace of oil extraction can ensure that economic development is sustainable and that local content is given time to adjust.	Norway	
SAVING SOME OF THE REVENUES		
Saving natural resource income through a sovereign wealth fund (SWF) can provide an important macroeconomic stabiliser for a country, benefiting current and future populations, as well as driving economic development in times of crisis.	Norway, Kuwait, Chile, Alberta (Canada)	
For oil funds to operate effectively there is a need for prudent and disciplined fiscal management.	Norway	Venezuela
ENSURING TRANSPARENCY AND ACCOUNTABILITY		
Transparency and accountability in the management of the natural resource ensures a more stable and predictable regime.	Malaysia, Norway	Indonesia (previously)
Transparency ensures that oil revenues are directed towards their intended purpose.		Indonesia, Venezuela
TAILORED CONTRACTS CAN GENERATE LONG-TERM VALUE		
The use of PSAs can provide a flexible framework that tailors individual parameters to the given project.	Azerbaijan	

SECTION III

Local Content

KEY FINDINGS

Overview

If managed optimally, the pre-salt exploitation has the potential to have a huge impact on Brazil's oil and gas sector, and, in turn, on the federal government's ability to realise its goal of spurring broad-based, long-term economic development. The breadth and depth of the impact will depend on the eventual scale of the pre-salt reservoirs. The higher these turn out to be, the more the federal government is likely to emphasise new local content development and wider social and industrial policies for the sector and beyond.

Opportunity and Risk for Local Content

International experience shows that often it is the more challenging types of exploration and production that need most innovation and, consequently, have provided greater local content opportunities, eg, the North Sea play since the 1960s. Today, the move of the Norwegian oil industry into the Arctic might well cause the share of local content to increase, as experience has to be built, and there are no experienced foreign suppliers. This is a clear parallel with Brazil in the past and again today. Furthermore, Brazil's strong track record in promoting local content over the last three decades, combined with the government's clear objective of developing local content further, drawing on incentives in the new regulatory framework, bode well for the local supplier and services industry.

However, overdependence on Petrobras poses serious risks for local content development. It is part of the reason why, in the past, Brazilian suppliers and service providers failed to develop long-term commitments to efficiency, technological innovation and managerial modernisation. Lack of competition will increase the challenges of solving these weaknesses. In addition, Petrobras's significant dominance in the local procurement sector increases opportunities for rent-seeking behaviour. Consequently, the importance of best practice transparency in all procurement systems cannot be overemphasised. Moreover, targeted government support to supplier and service companies to assist in upgrading skills and remedying competitive deficiencies will be central to enabling domestic industry to meet demand.

Achieving the Key Success Factors

The key success factors discussed in more detail below will not all be achieved in the short term; it will take at least one to two decades before the Brazilian supplier and services industry begins to compete regularly on quality and price with international peers in a wide range of offshore technologies and skills. The main elements of international good practice that will need to be adopted for this to happen are:

- A broad local research effort, which to some degree should be mandatory for foreign oil companies participating in pre-salt exploitation, as was the case in Norway. As discussed below, this is already taking shape in Brazil.
- An interpretation of the new regulatory framework that promotes both competition and partnerships among foreign and domestic oil companies, as took place in Norway. This will stimulate cost reductions and quality improvements. Moreover, Norway's experience showed that – given the right incentives for promoting local content – there was little difference in the share of local content between Statoil, the domestic NOC, and other companies.
- Transparency and predictability in enforcing procurement and other rules related to local content. This approach was shown to work in Norway; as

mentioned in Section II above, it will be difficult to manage this to the same degree in Brazil.
- The emulation of Norway's strategy to manage the unfolding of the 'resource curse' by controlling the speed of development of the oilfields. It will be more difficult to slow the pace of exploitation in Brazil, given political pressure and pressing social needs.
- Systematic government support for local content to break into export markets, as happened in Norway and through the UK's Offshore Supplies Office. Most Brazilian local content is still some way from making significant inroads internationally, but this is likely gradually to change.

Beyond these factors specific to successful promotion of local content is the need to synchronise expansion of the hydrocarbons sector with wider national policies, especially in the areas of training; access to capital for small and medium sized enterprises; and wider business climate improvements. The more successful national policies are in these areas, the more competitive and attractive to investors local industry and content will become, ultimately benefiting the companies involved in exploration and production of the pre-salt reservoirs, including Petrobras.

THE RATIONALE FOR LOCAL CONTENT PROMOTION

The oil and gas industry value chain includes input factors, goods and services for exploration, production, processing, and distribution. In many producing nations, most parts of this value chain are provided by foreign labour and expertise. Thus, governments have two main motives for encouraging domestic industry instead of relying on foreign suppliers to provide the elements in this value chain:

- Primarily, such encouragement of 'local content' is a mechanism for raising domestic income levels, by stimulating industrial growth and generating employment. The oil and gas industry is a capital-intensive, not a labour-intensive industry. However, it has significant spillover effects, so overall the potential for employment creation is very substantial.
- A second motive is to increase government revenues directly through an increase in the local tax base. The rationale is that, for the most part, the income generated by foreign suppliers of a domestic petroleum industry is taxed in the company's home country.

Oil sector local content can be high or low value added. The provision of equipment, supplies, and services with high value added usually requires an industrial base, technological expertise, a strong technical tradition and a skilled workforce. The United States, Canada, Norway and the UK provide successful examples. In many other countries, local oil services tend to be low value added, such as catering and freighting.

BRAZIL'S MACROECONOMIC CONTEXT

Relative Scale of Oil Industry

The established hypothesis is that the 'resource curse' is almost unavoidable for countries whose governments have access to substantial rent from the natural resources sector. The curse can be regarded as having several components, including:

- 'Dutch disease': As natural resources exports increase, this places upward pressure on the value of the country's currency, which makes other domestic

sectors less competitive internationally. This can lead to de-industrialisation of those sectors.
- As dependence on a single commodity-exporting sector rises, volatility of fiscal revenues caused by swings in that commodity's price create challenges for sustaining public expenditure in times of low prices, and increase the propensity for wastage in times of high prices.
- Rent-seeking behaviour, corruption and inefficiency can become widespread in an economy in which a single resource generates a large proportion of fiscal revenues.

Brazil's domestic manufacturing sector will need to rise to the challenge of becoming more competitive, facing the risk of Dutch disease being generated not only by the oil and gas sector, but also by the agricultural sector. The optimistic assessment for the impact of oil and gas sector growth on Brazil's wider economy is that, even with the pre-salt, the oil and gas sector will not become too large compared to the total economy. According to Petrobras, the size of the multiplier effect of its investments in the oil sector is equivalent to 10% of GDP, while the Brazilian Institute for Geography and Statistics (IBGE) places the direct sectoral contribution to GDP at only 3.25% in 2007. Although this contribution is likely to rise, the country will not become as heavily dependent on the production and export of a single natural resource as many other leading producers that are suffering from the resource curse are, eg Venezuela. Moreover, unlike in smaller economies, the risk in Brazil will to some extent be mitigated by growing domestic demand for products from other sectors.

More generally, future Brazilian federal and state governments will need to demonstrate sound fiscal management of rising oil and gas sector revenues. For example, current tax revenues of some 20 billion dollars from the sector may rise fivefold by 2025, according to an estimate by academics from the Federal University of Rio de Janeiro and the Fluminense Federal University. At the core of this fiscal management will be the implementation of a solid framework, based on international good practice, for the new Social Fund (see Section II above).

Competitiveness

A recent report from the World Economic Forum on global competiveness classified countries into three stages of development: factor driven, efficiency driven, and innovation driven. Although Brazil is making rapid progress in many components of competitiveness, the country is still in the efficiency driven stage of development, whereas countries such as the United Kingdom and Norway, which also explore deepwater oil fields, are in the innovation driven stage. The challenge facing Brazil is to ensure that exploitation of its pre-salt reservoirs leads to further improvements, rather than declines in the overall economy's competitiveness. An important element of this will be the extent to which innovation and technological progress in the oil and gas sector spills over into other sectors.

Oil and Gas Supplier Catch-Up?

The pre-salt discoveries are enthusing many of Brazil's oil and gas suppliers, some of which expect to dramatically increase sales to Petrobras. Globally, the number of oil and gas industry suppliers based in a country is one indicator of that country's success in promoting local content in the sector. The United States is a leader in this regard: Almost 50% of oil and gas industry suppliers worldwide are from the United States, while the country's daily oil production is only 7.8% of global production.

Other indicators, which are more difficult to measure, include the share of national suppliers in global trade, and the share in terms of technological leadership – dominating state-of-the-art technology in this capital intensive sector has a significant wider national economic impact. On these criteria too, there is considerable scope for Brazil to catch up with leading countries, notably the United States.

LOCAL CONTENT IN BRAZIL'S OIL & GAS SECTOR

Historical Development

Petrobras's strong purchasing power and commitment to technology have always been deployed as major drivers for Brazil's aggressive industrial policy. Policies aimed specifically at supporting oil-related local content in Brazil were introduced in the early 1970s, when Petrobras started its transformation from a company primarily focused on the refinery business to become one of the world leaders in offshore E&P technology. Repeatedly throughout this time, it has faced new oil frontiers in Brazilian waters and has innovated in response.

As a result, during the 1970s and 1980s, Petrobras had a leading role in the development of Brazil's oil-related local content. The local content share of materials, equipment and services supplied to Petrobras reached almost 90% by the end of that period. However, although this encouraged a boom in the production capacity of local suppliers, insufficient attention was given to major competitive variables such as long-term commitment to efficiency, technological innovation and managerial modernisation.

The federal government's efforts to open the Brazilian economy in the 1990s obliged the domestic oil and gas sector to face international competition. The Oil Law – which ended Petrobras's E&P monopoly – was approved in 1997. The law also created the oil regulator, ANP (to pave the way towards more competitive domestic oil and gas markets). The changed business environment contributed to the modernisation of Petrobras. Eventually, its foreign subsidiary, Braspetro, was incorporated into the main company and Petrobras started to contract suppliers through international bidding processes. Since oil prices were low (and declining), the government decided to reduce support for local content.

In the short-term, the business environment became much tougher for local content. Eventually, Brazilian suppliers struggled to win major contracts. The Brazilian shipyards, for example, were failing to survive without high subsidies.

Policy Instruments and Institutions

In the face of growing opposition to the declining support for local content, the government was obliged to introduce compensatory policies and establish new institutions. Their impact has been long-term and continues today. The new institutions and regimes included:

1. ANP's Human Resources Programme (PRH) The PRH was created in 1999 by ANP to allocate a share of the oil rents attributed to the Science & Technology Ministry for promoting the training of skilled human resources for the fast-growing biofuels, oil and gas industries. The programme was established mainly in partnership with the leading Brazilian academic institutions. From 1999-2008, ANP funded over 4,500 scholarships. In 2009, ANP and Petrobras signed an agreement under which

Petrobras will join the PRH and fund additional scholarships. Students will be selected by academic institutions to develop research projects in partnership with Petrobras.

2. CTPETRO and company R&D funding Among the 15 largest global energy companies, Petrobras spent most on R&D as a percentage of revenues in 2007, and second most in absolute terms. Until 1998, Petrobras was the only significant sponsor of oil-related R&D in Brazil. In 1998, the company invested 260 million US dollars in technology programmes. The 1997 Oil Law led to the creation of the oil R&D fund, CTPETRO. In 2001, CTPETRO invested 282 million dollars in R&D activities, almost as much as the 335 million dollars invested by Petrobras directly that year. The Oil Law also established the obligation for the most productive oil concessionaries to invest a portion of their total revenues in R&D programmes in Brazil.

3. Local content commitments In awarding new exploratory rights through the current concession regime, ANP used the concessionaries' commitments to purchase from local companies as an important criterion in the auction processes. More recently, the federal government adjusted Petrobras's purchasing policy to include compulsory demands for minimum local content in the purchasing auctions. Under associated rules, local suppliers can become eligible for special financing terms from the federal development bank, BNDES.

4. REPETRO REPETRO is a special tax regime adopted for local oil sector suppliers. It is designed to redress some of the international competitive disadvantage imposed on domestic suppliers by Brazil's complex tax system.

5. PROMINP PROMINP (Programme to Promote the National Oil and Natural Gas Industry) was created in 2003 to encourage domestic suppliers to offer critical inputs that are competitive in terms of price, quality and delivery. Initially, PROMINP struggled to make a significant impact. The programme's key elements include:

- worker training;
- fostering new industrial technologies that yield higher productivity and competitiveness at lower costs;
- facilitating the inclusion of small companies in the oil and gas supply chain;
- supporting alternative financing mechanisms; and
- providing a gateway for supply chain companies.

After the major pre-salt discoveries started to be announced, Petrobras was called on by President Luiz Inacio Lula da Silva to give PROMINP greater support. As a key existing programme in the area of local content promotion, PROMINP is likely to be further boosted as a result of the exploitation of the pre-salt reservoirs.

Current Situation and Outlook

Despite setbacks experienced during the 1990s and in the large deepwater E&P projects of the 1990s and early 2000s (for which the government's commitment to local content took second place to prioritising rapid investment), Brazilian oil- and gas-related local content has remained at relatively high levels from the 1990s to the present, receiving a further boost since 2003. According to PROMINP, the proportion of local content in the oil and gas sector stood at 75% in 2009, up from 57% in 2003. This rise led to the creation of 640,000 jobs along all parts of the value chain, although local content has been higher in downstream activities than in E&P.

PROMINP's short-term target minimum level for local content is about 65%. PROMINP's targets have consistently been exceeded in recent years, and this looks likely to continue to happen, given the renewed emphasis on local content promotion in the prospective new legal framework. There will be a growing need for new, innovative local content, to develop and improve extraction from the pre-salt reservoirs. Under a best-case scenario for Brazil's oil and gas supplier and services industry, the level of local content could rise over the next 10-15 years to about 90%, as experienced at the height of Norway's successful promotion of local content (see below). However, attaining this increase will require a number of key success factors to be met.

Key Success Factors

Although the targeted institutions and regimes discussed above have helped to strengthen further the Brazilian oil sector's promotion of local content, they are not sufficient to ensure sustainable, long-term growth and competitiveness of domestic local content. As development of the pre-salt reservoirs gathers pace, Petrobras is likely once again to assume its historical vanguard role in promoting a modern and dynamic national oil and gas industry.

Key success factors will include:

1. Improving certification procedures Under the current concession regime, verification for the stipulated local content commitments could be made more transparent and less costly for Petrobras and for suppliers. New, more efficient certification procedures could be adopted. The National Petroleum Industry Organization (ONIP), whose membership includes the main domestic contractors in the oil sector, has been developing such a system – to verify the origin of goods and services. The aim is to create a registry of local content-approved suppliers to be accepted by all oil companies operating in Brazil. This will help ANP, Petrobras and BNDES to assess compliance with suppliers' local content commitments.

2. Flexibility to import foreign inputs in the short term A lack of specialist skills in some areas will challenge the ability of local suppliers, requiring more foreign partnerships or contracting with foreign companies to develop the pre-salt reservoirs efficiently, at least in the short term. Close collaboration, including exchange of personnel, between foreign companies and local suppliers will be important.

Similarly, the adoption of more costly domestic oil related inputs in the short term would drive capital away from the government and/or Petrobras and other oil companies, effectively 'subsidising' (at least temporarily) local content. The optimal solution for the reservoirs' development in the short term is likely to be a combination of local content and imports.

3. Slowing down some pre-salt development Maximising the long-term impact on local content means setting a slower development of the pre-salt reservoirs in order to allow the country to prepare itself to exploit the new reserves with domestic resources. However, given the country's pressing social needs and fiscal commitments, political pressure is likely instead to be exerted for the fastest possible development of the pre-salt reservoirs.

4. Labour market reform Successful development of local content will be helped by reforms designed to improve labour productivity. Development of the pre-salt

reservoirs might increase momentum for the political system to deliver those reforms. However, the risk of rapid oil sector-led income growth camouflaging the need for such reforms remains.

5. Ensure sectoral spillovers Spillovers into other economic sectors need to be assured. Non-oil sectors need to be prioritised by policy. This is partly because the oil sector will keep attracting the best resources in the country. For example, many of the best engineering, management and other students in Brazil's top universities aspire to work for Petrobras. The shortage of high productivity human resources in other sectors may become even more acute, risking de-industrialisation of some sectors, eg textiles or hi-tech.

If the oil industry starts to offer high paying jobs, which is almost certain to occur, it will attract workers from other sectors, and these sectors will have the burden of training unskilled workers, which they will find very difficult given their resource constraints. A good local content programme will boost education and research broadly within the country, thereby benefiting wider industry.

6. Technology transfer Petrobras is taking on the challenging responsibility for diffusing new technologies to small businesses. As a general rule, it is important to bring small companies on board because they can guarantee the flexibility and the innovation that sometimes is not present in large corporations. This has happened in the United States, Canada and to some extent in the North Sea region. However, so far, in Brazil, technology leadership has been taken by Petrobras.

Over time, it is likely to be beneficial for Petrobras to share its technologies with smaller companies. Ultimately, those smaller companies need to be encouraged to develop and fund their own technologies. Some may find it too risky to invest in technology if their only buyer is Petrobras.

7. Systematic training Worker training efforts are already significant. Yet the exploration and development of the pre-salt reservoirs will require a huge additional training effort. A comprehensive local training system is required, going beyond the PRH. This should involve wide-ranging partnerships with international training groups specialised in the sector, as well as efforts to harmonise certificates and qualification requirements across the domestic sector and internationally.

8. Focus on high value add skills Brazil has the potential to develop human capital in high value add jobs, in areas such as research, technology development, engineering and geology, but also in management. Brazil's MBA programmes already have strong participation from people coming from Petrobras or other energy companies, and those companies also train people abroad. However, to keep pace with the pre-salt exploitation, greater numbers of high value add workers will be needed.

9. Building of clusters If the pre-salt reservoirs are large enough, the global oil supplier and services industry may struggle to meet demand for technologically advanced deepwater equipment. There is a clear parallel between exploitation of the North Sea in the 1970s and 1980s, and Brazil's pre-salt operations – both requiring quantum leaps in technology and management. This could create the opportunity for Brazil to meet a substantial part of the shortfall, through developing one or more oil and gas focused 'clusters', similar to Houston, Calgary, Aberdeen, or Stavanger, or to Silicon

Valley in the hi-tech field. Such clusters, in which both R&D and manufacturing can take place, can have a catalytic effect on the development of local content. This could also drive a major shift in Brazil's economic axis towards coastal areas.

This is already beginning to happen in Rio de Janeiro, where a cluster focused on offshore technology is starting to emerge, centred on the development of research facilities on Fundao Island. Petrobras's own Centre for Research and Development (Cenpes) is located there. Other companies establishing research facilities in Rio include Baker Hughes, which over the next four years is planning to invest some 29 million dollars (with Petrobras also investing over 16 million dollars in the project), to create the Baker Hughes Rio Technology Centre, to research pre-salt reservoir challenges with input from several major Brazilian universities. Similarly, Schlumberger this year is launching a technology research facility, its thirteenth such centre worldwide and its first in the Southern hemisphere. Schlumberger expects the facility to employ some 300 Brazilian researchers. Halliburton has already announced plans for a technology centre to be opened in 2011, and several other companies are likely to follow suit.

These clusters should ultimately establish real economic linkages between oil and gas extraction and other sectors, making use of the potential for spin-off secondary and tertiary economic activities from the hydrocarbons sector. Such linkages with the broader economy can, in the longer term, become part of a 'virtuous circle', through which positive development of the national innovation system stimulates further growth in the cluster.

10. Energy efficiency and diversity The transition towards a more energy efficient and more energy diverse economy should continue despite the focus on the pre-salt reservoirs. Petrobras should strive to produce hydrocarbons in the most sustainable way possible, and oil and gas should lead a well-diversified energy matrix, which will include a variety of fuel and energy solutions. This will broaden the benefits to local content.

PROMOTION OF LOCAL CONTENT IN OTHER COUNTRIES

Introduction

Almost every oil-producing country has provided some level of support for local content, at least nominally. For example, local content arguments were already present in justifying Argentina's creation of YPF in the early 1920s and in Mexico's nationalisation of the oil industry and creation of PEMEX in the mid-1930s. Exceptions include those countries with small domestic populations and limited capacity to develop local industry (eg some Gulf countries, which have often needed to import much of their labour and capital).

Often it is the more challenging types of exploration and production that need most innovation and, historically, have provided greater local content opportunities, eg, the North Sea play. Several countries, including Brazil, have enjoyed substantial success in the development of local content – but perhaps none more so than Norway. Another success story is the work of the UK's Offshore Supplies Office. These two case studies are analysed below.

Case Study 1: Norway

Overview At the outset of its oil sector activities, in the early 1960s, Norway had no indigenous oil or oil services industry. The local content of investment grew from

almost nothing in the late 1960s to about 90% twenty years later. Today, the domestic oil supplies industry is large, technologically advanced and covers most stages of the value chain. Norway's oil services industry, with government support, is increasingly turning its attention to export markets: international oil companies take Norwegian suppliers overseas, eg, as Total has done in Angola.

Norway has established itself as a leader in offshore and especially deepwater petroleum technology. A consistent research effort, with oil companies contributing competence, funds and personnel, laid the ground for the technology development that since the mid 1980s has reduced unit costs in petroleum development by 3-5% a year.

However, despite this progress, the country has also experienced the disadvantages of local cost pressure and an excessive dependence on petroleum development. Wages in other sectors were affected by the high paying jobs in the oil sector and the economy as a whole was affected by oscillations in oil prices.

Share of local content Since the protectionist and preferential policies were discontinued in 1994 upon conclusion of the free trade agreement of the European Economic Area (EEA), data on local content are no longer as reliable, but the government estimates that it has declined to about two-thirds as a result. The share is higher in maintenance and current operations than in new investment, where it probably is 50-60%. The Norwegian government's heavy focus in recent years on the development of niche high-technology expertise in areas such as deepwater development and improved recovery techniques means that these areas contribute significantly to current local content, while some lower value-add supplies and services are imported. There appears to be little difference in the share of local content between Statoil (the domestic NOC) and other companies operating in Norway.

In the recent Snøhvit LNG project, located offshore in Arctic waters, and operated by Statoil, the share of Norwegian content has been lower than normal, probably about 50%. However, the project has been the victim of significant cost and time overruns. Against this backdrop, the move of the Norwegian oil industry into the Arctic might well cause the share of local content to increase, as experience has to be built, and there are no experienced foreign suppliers.

Employment impact The local content procurement policy has strengthened employment directly in the oil sector and through spillover effects. Norway currently produces about 3.2 million b/d in crude oil and about 80 billion cubic metres annually of natural gas, with a direct industry employment of about 16,000 persons. Related services employ another 12,000, and the related supply industries another 60,000, making a total of about 90,000 out of a labour force of 2.3 million.

Procurement policy The Norwegian success in achieving high local content is largely due to government policies, which encouraged partnerships between foreign and domestic companies, and research programmes, which were mandatory. Since 1970, successive governments have regarded it as essential to promote competition in the oil industry, while at the same time actively promoting the business opportunities for Norwegian industry.

The essentials of the procurement policy from 1972 to 1994 were:

- At contract award stage, operators were obliged to inform the government of their evaluation with the recommended supplier, price, country of origin and Norwegian content.
- The Norwegian content was calculated as value added in Norway both in manpower and monetary values, regardless of ownership of firms.
- The government did not specify content or supplier. In practice, this meant that the government set targets for the share of the value added to be realised by Norwegian suppliers, but left the oil companies to choose how to reach the targets, with management having the discretion to decide what parts and services should be procured locally, and from which suppliers. The government had no competence to evaluate the specific oil company requirements or the supplier qualifications.
- In 1972, the Norwegian Petroleum Directorate (NPD) was established as the administrative branch for the sector and Statoil as the caretaker of commercial interests.
- To enforce procurement policy, in 1972, the Ministry of Industry established a Goods and Services Office as a watchdog to control the oil companies' contracting and procurement activities. Prior to tender invitations, the operator had to announce the tender schedule and companies to be invited. The government's role was to ensure that qualified Norwegian companies were included on the bidders' list.
- Information on upcoming tender invitations was also to be submitted to the Ministry of Petroleum and Energy twice a year by the operators. The Ministry collected the information and released it to all the Norwegian suppliers. Operators also had to file annual reports, with the intention of providing the Ministry with additional information on previously reported contracts and reporting the value of services used.

The emphasis placed on local content made it essential for all oil companies to use Norwegian goods and services. The Ministry's policy was to be transparent and predictable in respect to enforcement of the procurement policy, publicising who used what from which local suppliers.

Other key elements Other key elements of Norway's local content policy included:

- The strategy adopted to manage the unfolding of the 'resource curse' was to control the speed of development of the oilfields. A moderate scale of production of oil and gas was aligned with a slow introduction of the use of revenues in domestic consumption. This was facilitated by the fact that the government controlled exploration, production, part of refining, distribution, and the petrochemicals industry. So far, only 35% of the estimated resources on the continental shelf have been produced. This slow development was made possible by Norway's relative economic prosperity.
- As an observer in all license groups, the Ministry secured insight into all the operators' contracting activities. Good cooperation between the authorities, the operators and the contracting and supplier industry was essential in developing high local content in Norway.
- An aggressive fast-track training plan was established that sent Norwegian workers to train abroad. Later, these workers were brought back to train the locals.

- Companies were required to conduct at least 50% of the research for new technology used in local oil projects in local institutions, thereby fostering the development of national innovation systems.

The effect of the general local content target, measured by value added, was that oil companies, in order to comply, generally preferred to procure high-value parts and equipment locally, contributing to technology development in Norway, and importing less sophisticated parts from abroad.

Case Study 2: United Kingdom

UK government policy helped to raise substantially local content in the country's hydrocarbons sector over the course of the 1970s and 1980s, with almost all post-development operations being sourced from the local economy by the mid-1980s. The Offshore Supplies Office (OSO), an independent government agency, was responsible for monitoring and establishing reporting and auditing procedures for assessing local content in purchases made by oil companies.

The OSO played a critical role in steadily increasing the participation of UK industry in the oil and gas sector. (In some cases this participation was by foreign – mainly US – firms, through local branches that employed local labour.) During their operations, companies were required to submit quarterly reports to the OSO for significant contracts awarded. The companies were required to list the contractors hired and those who competed but were not chosen. The OSO used these reports to determine whether qualified British companies were being overlooked. The OSO also evaluated local contractors and, through a range of programmes, help them upgrade their skills and competencies to remedy competitive deficiencies.

As a result, and even though the OSO monitoring delayed some projects, the British share of the UK Continental Shelf (UKCS) procurement, which was below 20% of the total in the early 1970s, rose to 60% by 1977, and to a peak of 87% in 1988.

By 1994, the OSO had been adapted to aid UK companies in export markets. The British offshore industry had become mature enough to remain competitive in the absence of government support, a development that, like in Norway, was also prompted by European trade integration.

About Oxford Analytica

OVERVIEW

For some 35 years, Oxford Analytica has been providing timely, objective and authoritative analysis of the implications of major global economic, political and public policy developments for leading corporations and governments. Oxford Analytica draws upon the judgement of a network of some 1,500 independent analysts and experts from the world's leading universities and research centres. This expertise is made available to clients of Oxford Analytica on a daily basis via the online Oxford Analytica Daily Brief and Global Stress Points Matrix services and via specifically commissioned consulting studies.

PREPARATION OF THIS REPORT

This report was prepared by two of Oxford Analytica's full-time staff members: Mark Elsner, Managing Consultant, based in the Washington, DC office, co-ordinated the scope of the project with Petrobras. Janika Albers, Consultant, based in the Oxford office, managed the project. Research, editing and quality control were provided by other in-house team members.

The report was constructed based on a series of inputs from members of the Oxford Analytica scholar-expert network. These inputs were obtained through telephone interviews and written contributions, and included rigorous cross checking of other experts' inputs and ongoing expert guidance of in-house research. Major contributions were made by eight experts, based in the United Kingdom (3), Brazil (2), Canada, Norway, and the United States.