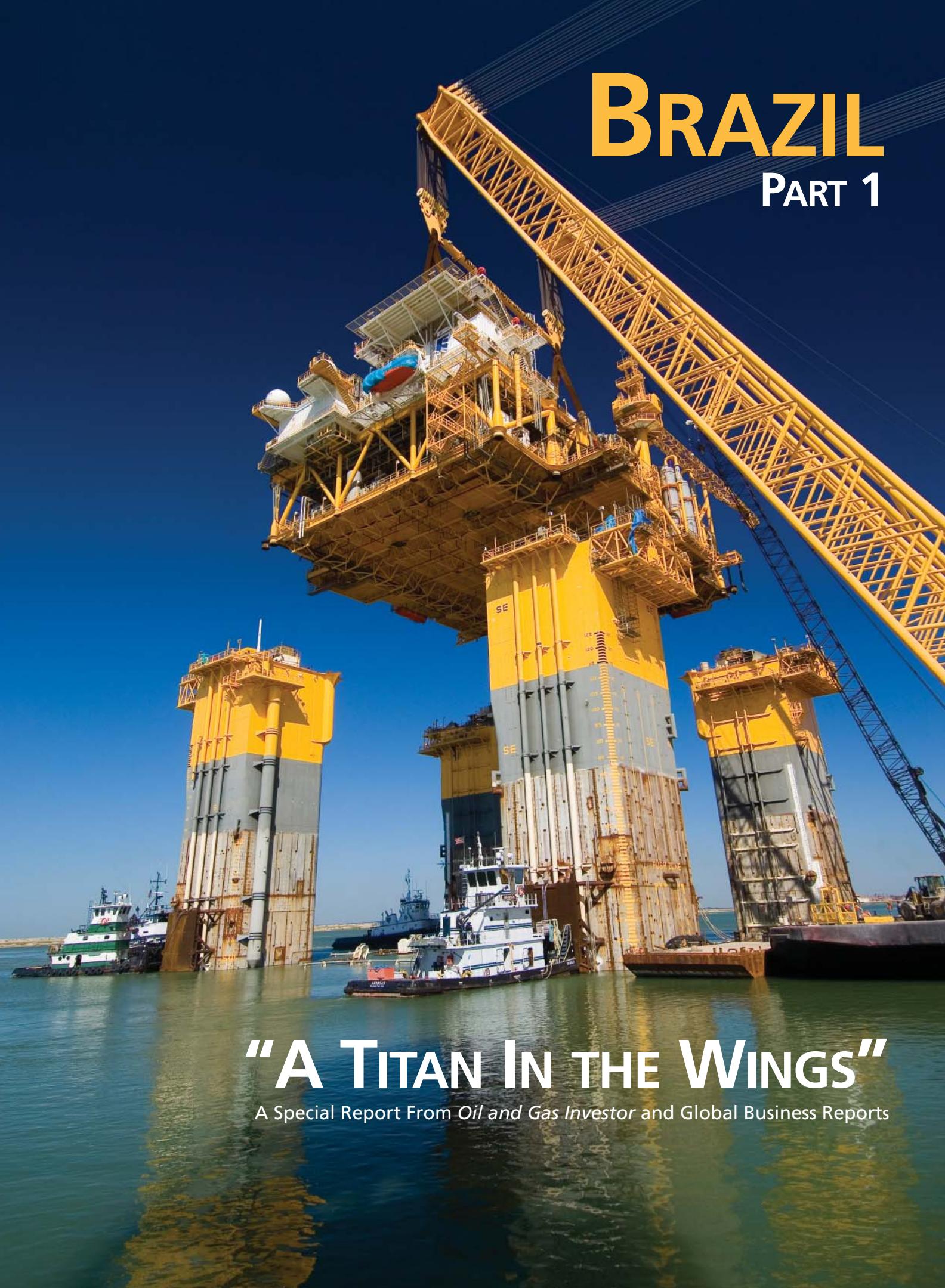


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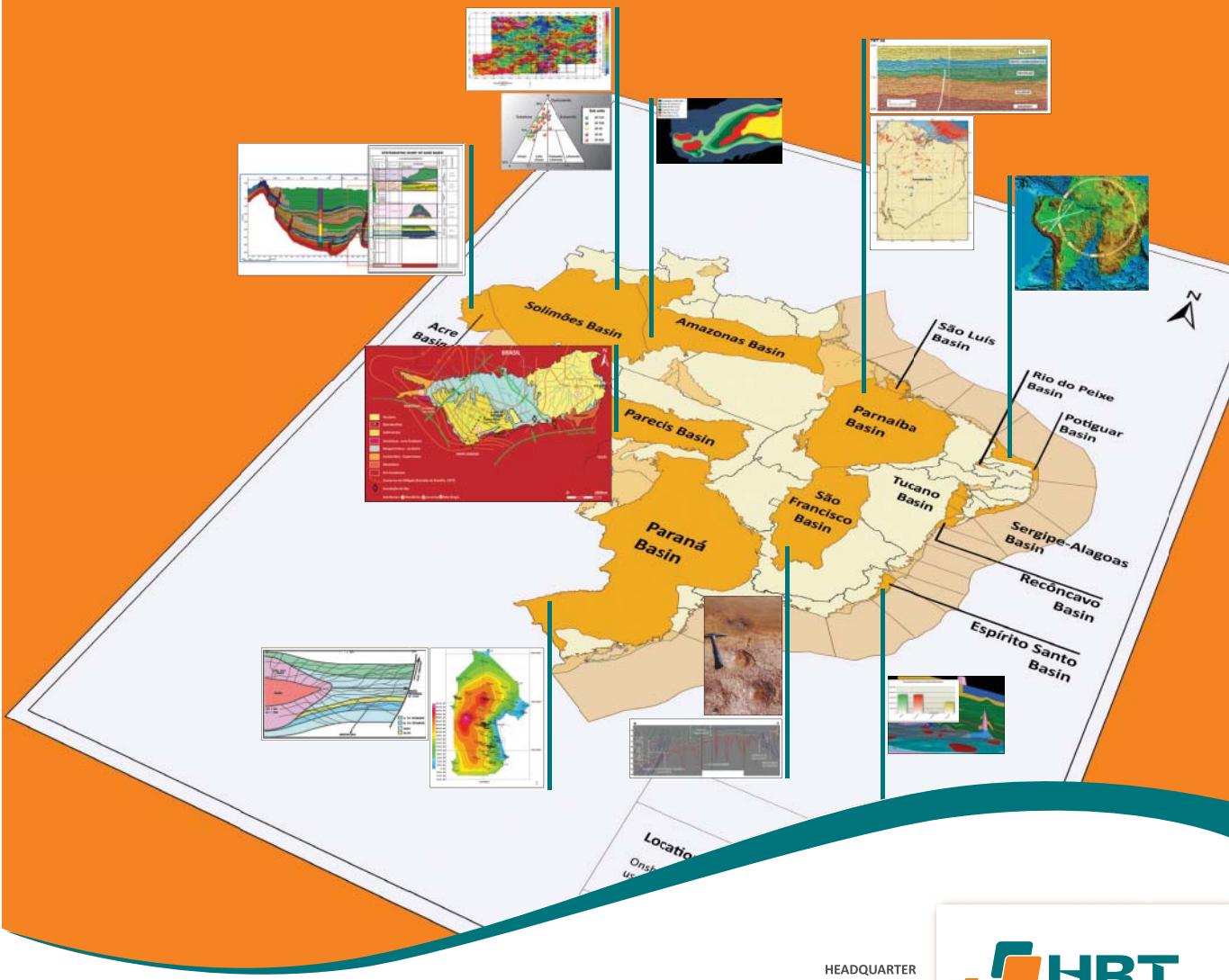


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Pre-salt Shakes Things Up

Massive discoveries off Brazil's coast herald a bonanza for Brazil's oil and gas sector, but huge efforts will be required to equip the industry to exploit them. Services are stretched, skills and equipment are lacking, and Petrobras has yet to loosen its grip. This report looks at the sector as it attempts to upscale and ramp up to the challenge.

Until recently, for most people Brazil has conjured up images of samba-dancing carnival goers or soccer—not hydrocarbons. Yet ever since President Getulio Vargas created Petrobras, the state oil company, in 1953, the country has been steadily increasing its oil and gas production. In 2006, Brazil finally achieved its aim of oil self-sufficiency, but, with production standing at about 1.9 million barrels of oil per day, it still failed to attract much attention. That was, until the pre-salt discovery.

The discovery of several significant offshore reservoirs in the so-called pre-salt region—a geological formation lying beneath a layer of salt in waters as deep as 3,000 meters and below as many as 7,000 meters of seabed—has raised expectations that Brazil may have discovered a 200-kilometer-by-800-kilometer oil province.

This has coincided with a general upturn in the country's economic fortunes. Brazil's economy has grown at an average annual rate of 4.5% since 2004. It is, however, important to remember that Brazil is only just emerging from almost two decades of economic problems. In 1980, economic mismanagement and political instability derailed almost 40 years of annual economic growth, plunging Brazil into a cycle of recession and recovery for the 1980s and much of the 1990s. Between 1986 and 1993, yearly inflation roller coastered between 500% and 2,500%, while in the same period gross domestic product oscillated wildly from -4.5% to 7.5%.

This economic turmoil had a profound effect on the oil and gas industry as the government cut investment in Petrobras. As the company enjoyed a virtual E&P monopoly, many Brazilian manufacturers and providers of goods or services specific to the oil and gas industry were forced to downscale or leave the market. Perhaps the most significant damage was to the workforce. For almost a decade the numbers of students studying engineering dropped, and less skilled and semi-skilled laborers were trained. This recent economic history played an important part in shaping economic conditions in Brazil today.

Nevertheless, throughout the tough times, Brazil's oil and gas production steadily increased, while Petrobras gained expertise in exploiting offshore reserves. The government also flirted with opening the market by inviting foreign firms to help explore and produce hydrocarbons in the so-called 'risk-rounds' of the late 1970s and 1980s, although this experiment produced few successful foreign ventures.

By 1994, then president Fernando Henrique Cardoso had tamed rampant inflation with Plan Real. Indeed, aside from a momentary blip in 2003, inflation has stayed below 10% since 1996. He then turned his attention to the hydrocarbon sector and amended the constitution to break Petrobras' monopoly.

The Petroleum Law (no 9.478) passed in 1997 transformed Brazil's hydrocarbon landscape. It created the National Council

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of Energy Policy (CNPE) to formulate hydrocarbon policy and the National Petroleum Agency (ANP) to enforce the legal framework. The first round of bidding for the concessions that were made available followed in 1999, with nine since.

Until recently, the bidding process was viewed as a success, with the ANP offering a clear concession contract, comparable to those available in North America or the North Sea. Indeed, by 2008 a total of 72 companies held ANP-distributed concessions, while national oil reserves were up from 7.1 billion barrels in 1997, to 12.6 billion barrels. In the same period, daily hydrocarbon production also rose, with national oil production leaping to 1.9 million barrels per day from 857,000 barrels daily, and gas output rocketing to 1.75 billion cubic feet per day from 950 million cubic feet daily.

A clamor for change

Yet the hyperbole surrounding the recent pre-salt discoveries, typified by claims by government minister and Petrobras chairman Dilma Rousef that Brazil could be "the next Saudi Arabia", has created a clamor for change. With several notable geologists claiming that there may be little or no exploratory risk in the pre-salt areas, many feel that the existing concession model must be adjusted or replaced.

On one side of the argument are politicians of various parties who want to secure more governmental control over reserves, either by switching to production-sharing agreements (PSAs) or by creating a new state entity to develop the pre-salt fields. Industry strongly opposed these options. The Brazilian Institute for Petroleum (IBP), which represents both the E&P companies and the service sector, maintains that the concession contract model should remain in place. The IBP's position is that the government can increase its "take-home" percentage by adjusting the royalties of the concession, so changing the model would be unnecessary and potentially harmful.

In the ninth bidding round, which came after Tupi, a pre-salt field believed to have 5 billion to 8 billion barrels, was discovered, the ANP decided to withdraw the concession blocks that fell within the pre-salt zone. Following the Carioca discovery, however, bidding rounds have been temporarily suspended.

For President Luiz Inacio Lula da Silva, or 'Lula', the decisive moment has arrived. Before Lula and his leftwing *Partido Dos Trabalhadores* (Workers Party) came to power in 2003, many feared that he would reverse the economic reforms and privatizations of his predecessor, Cardoso. However, until now Lula has encouraged the fledgling oil and gas independents and worked with Petrobras to encourage local firms to compete for service tenders. Yet the pre-salt layer has thrown up a question that Lula must answer: Should he continue with the market-based concession contract system that has served Brazilian oil and gas well until now, or should he listen to the call of some of his more nationalistic comrades and change the system to ensure Brazil retains more control over its most valuable asset? Looming elections make second-guessing the maverick Lula an even more difficult task.

This report presents the story thus far, and by examining the growth of the service industry, equipment manufacturers and independents, explores how the Brazilian hydrocarbon sector could move forward. □

An Interview With Petrobras' José Sergio Gabrielli de Azevedo

The president of Petrobras discusses the company's strategic plan, biofuels' potential and the impact of the pre-salt discoveries.

Global Business Report (GBR) Petrobras was formed with the aims of making Brazil oil self-sufficient and promoting the country's economic development. It also has a duty to satisfy shareholders; what are the challenges of being a semi-public company?

Mr. Gabrielli While not losing focus on the achievement of profitability and safety in all our operations, our mission is to contribute to the development of Brazil as well as other countries in which we operate, bearing social and environmental responsibility in mind.

The key to good coexistence between public-private ownership is the adoption by the company of an efficient corporate-governance model that guarantees all shareholders the strategic control of the company. Petrobras is continuously striving to improve its corporate-governance practices, aiming at increasing its credibility and transparency, in addition to the quality of communication with shareholders, investors and other stakeholders. We are listed on the stock exchanges of São Paulo, New York, Buenos Aires and Madrid, which forces us to be a transparent company, resorting to the most modern corporate-governance practices.

Petrobras is a member of the Dow Jones Sustainability Index and the Corporate Sustainability Index of Bovespa, the stock exchange of São Paulo, in addition to being a party to the United Nations (UN) Global Pact, which shows our commitment to sustainability. Recently, we were given the rank of most sustainable oil company in the world, by Management & Excellence, the research and rating firm.

GBR The Tupi and Carioca discoveries clearly represent a massive opportunity for Petrobras, yet the investment required to develop these reservoirs will be significant. How have these discoveries changed Petrobras' plans for international growth?

Mr. Gabrielli The pre-salt discoveries represent new challenges, and they will also require large investments. Today 15% of our investments are outside of Brazil. With the increase in opportunities due to these recent pre-salt discoveries, we will be able to further concentrate our resources in this country, and rationalize our international investments, thus operating with a more specific focus. We will not stop our foreign activities, however. This year, for example, Petrobras has taken on a refinery situated in Okinawa, Japan, and has announced the acquisition of ExxonMobil and Esso Oil in Chile.

GBR Following the 1997 Petroleum Law, many new E&P companies entered the Brazilian market. How has Petrobras responded to the increased domestic competition?

Mr. Gabrielli Petrobras, being the only company exploring oil and other derivatives in Brazil, has secured competitive advantages against current and future players within the oil and natural gas markets. We currently operate in the main development areas, and hold almost all the existing refining capacity in the country. Furthermore, Petrobras is a world leader in deepwater technologies and invests in research and development (R&D) for well exploration in depths of more than 3,000 meters. The company's built knowledge in drilling, exploration, de-



velopment and production of deep water allows Petrobras to attain high success rates and to reduce extraction costs. We count on a highly qualified technical team and the largest research center in Latin America, the CENPES, thus enjoying a privileged position before the competition.

GBR During the next five years foreign firms are expected to invest \$30 billion in the Brazilian oil and gas sector. How has Petrobras utilized relationships with international players to achieve its aspirations?

Mr. Gabrielli The partnership with other companies is important because it allows Petrobras to share risks, capital and technological needs, at the same time it promotes its development and expansion. As a result of its significant experience, knowledge and large infrastructure in Brazil, Petrobras has attracted important partners in the areas of exploration, development, refining and energy. A few of them are Galp, Repsol-YPF, ExxonMobil, Shell, British Petroleum, Chevron-Texaco and Total, among others.

GBR In addition to hydrocarbon reserves, Brazil also has an enormous potential in biomass-based fuels. How does Petrobras plan to grow in this area?

Mr. Gabrielli Petrobras acknowledges the significance of the introduction of biofuels into the Brazilian energy matrix, for its high economic, environmental and particularly, social value, because it greatly contributes to family agriculture. Besides helping with the reduction of global warming, biofuels generate inland employment and revenue. We plan to invest US\$1.5 billion by 2020 in this area, and we have already created a subsidiary to manage these projects. Petrobras Biofuels, with an investment of R\$295 million, was created with the aim to become a leading company in the national production of biodiesel, and to increase its participation in the ethanol business, focusing on the international market.

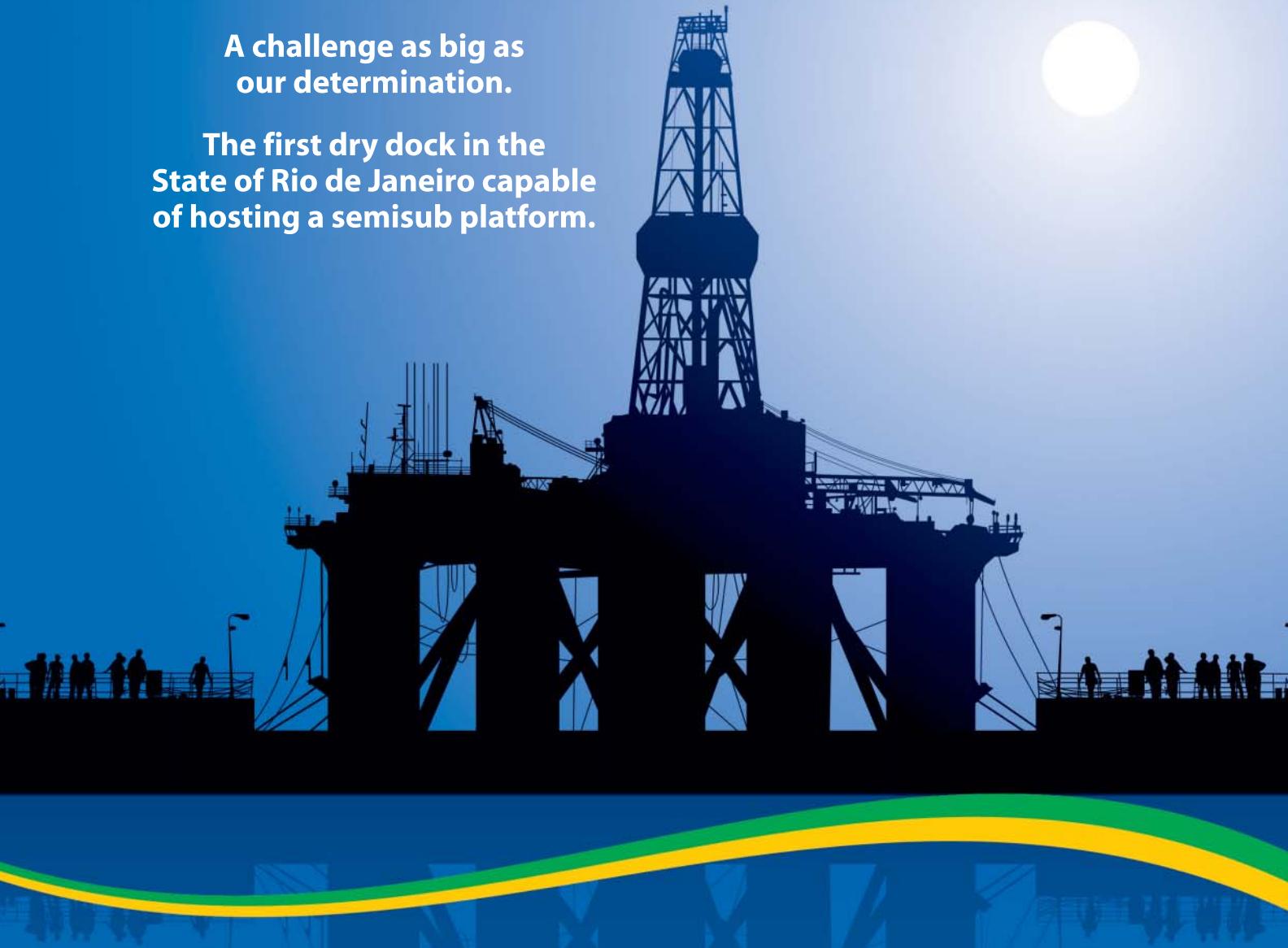
GBR Given the dynamic, rapidly evolving nature of the Brazilian E&P market and Petrobras' diverse E&P portfolio, what is the company's medium- to long-term growth strategy?

Mr. Gabrielli Ahead of the pre-salt discoveries, Petrobras was already planning to invest US\$122.4 billion from 2008 to 2012. At the moment, we are currently revising the strategic planning, and certainly the amount of investment shall be enlarged with the inclusion of the new opportunities into our investment portfolio, in light of the recent discoveries announced in the pre-salt, and its prospects. The data should be consolidated by early October. In terms of the company's growth potential, we forecasted an average rate of 7% until 2015 before contemplating the pre-salt discoveries. Our goal is to increase the current production from 2.3 million barrels per day to 4.1 million in 2015, including our refining capacity. We are building five refineries in Brazil, which will allow us to expand our production of vehicle gasoline, diesel fuel, fuel oils, and aviation fuel, with the highest quality standards. Our objective is to export refined products, with higher added value in the markets. The most recent Brazilian refinery was built in 1980. □



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ÓLEO E GÁS

Independents: Squeezed Within a Vast Space

For the independent sector to grow, it must consolidate and raise output to sustain service and downstream sectors of its own.

In Canada and North America, independents account for more than half the jobs in the E&P sector. In Brazil, however, independents create less than 5% of E&P jobs. This is not so surprising when one considers that the North American E&P industry is more than 150 years old, whereas the first open bidding rounds in Brazil started fewer than 10 years ago.

Until 1997 nearly all of Brazil's considerable E&P expertise was concentrated within Petrobras. Subsequently, the National Council of Energy Policy (CNPE) faced the difficult task of fostering an independent sector from scratch. Their solution was to offer small, mature onshore concessions, which had already been developed by Petrobras, to auction. In 2004, in bidding rounds five and six, the National Petroleum Agency (ANP) offered the first selection of concessions, followed by a section of the seventh bidding round, which contained inactive areas with marginal accumulations.

Initially, the low price of oil kept many speculative operators away, but as the price of oil increased, more independents joined the fray. The seventh round was very successful, with 114 companies qualifying for the bidding process.

Nevertheless, the independent sector in Brazil faces a number of fundamental challenges, including no independent downstream industry, and the lack of available acreage, which has been exacerbated by the government's decision to suspend further bidding rounds.

These challenges prompted several independents to join to form the Brazilian Association of Independent Oil and Gas Producers (ABPIP) in November 2007. "Life for an independent oil company in Brazil today is very difficult, but we hope that by working together we can alleviate some of our problems," says ABPIP chairman Wagner Frei.

There are now more than 50 independents active in Brazil-

ian E&P, forming a diverse mix of small startups, E&P offshoots of engineering firms and large publicly traded operators. Most operate onshore, because for many, the high costs involved with offshore development are prohibitive, although there are some who have been granted licenses to operate in shallow and even deep water.

A typical Brazilian independent is the civil-engineering firm that sensed an opportunity with the opening of the market and bid for the inactive areas with marginal accumulations.

One of the main attractions of such concessions was that Petrobras' previous activity in these mature, onshore basins had put in place the infrastructure for treating and transporting oil.

"We think there is still the potential for many deep-gas plays in the Reconcavo Basin, where the average well depth is 1,500 meters, meaning many deeper fields are yet to be discovered. In the Reconcavo Basin there are 1,500 exploratory wells, but less than 1% is of 3,000 meters depth or more," says Kazumi Miura, director of Brazilian independent Starfish Oil and Gas.

Also, many of the wells had been developed with outdated technology, meaning that even a minimal investment in equipment could considerably improve the output of existing fields.

Engineers turned producers

The opportunistic mentality of these engineers-turned-producers owes much to Brazil's turbulent economic history. "In the early 1980s, there was 80% inflation in a 15-day period," says Jefferson Paes de Figueiredo Filho of Darwin Engenharia, a small civil-engineering company that bid unsuccessfully in the seventh round. "This forced entrepreneurs to be agile and to adapt quickly to events. Subsequently, many companies were not fazed by the opening of the oil and gas market."

Larger engineering firms also responded to the ANP's lure.

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Queiroz Galvao Oleo and Gas, the E&P subsidiary of Brazilian engineering giant Galvao Engenharia, was one of the few Brazilian independents to match the financial criteria required to gain a class A operator license and build a diverse E&P portfolio. The company generates considerable cash flow through its stake in Manatii, Brazil's biggest non-associated gas field currently in production, yet it still had to turn to the banks to finance its aggressive drilling program of 10 wells in the next two years. In total, it raised \$1 billion through a combination of reinvestment, national bank loans and a deal with a consortium of European banks. Previously, international banks would have balked at lending private Brazilian firms such funds, while Brazilian companies had grown weary of the expensive credit at home. As news of the Brazilian hydrocarbon boom spreads, such deals are more feasible, though not for all.

While financing has become an option for independents with large capital assets, it remains out of reach for many of the smaller players. At 11.75%, the Brazilian central bank sets one of the highest benchmark rates in the world, which makes lines of industrial credit, even from a state development bank (BNDES), too expensive for smaller firms.

"Not only is credit in Brazil very expensive; but banks tend to finance development projects as opposed to exploration projects. This restricts smaller firms to re-working mature wells instead of finding new ones," says ABPIP chairman Wagner Frei.

Another source of capital is, of course, the market. São Paulo's Bovespa, Latin America's most valuable stock exchange, enjoyed a phenomenal 2007, surging 44% in local currency terms and hosting a record 63 IPOs. In early 2008, however, the crisis affecting the world's capital markets caused 20 Brazilian IPOs to be cancelled, and the prospect of a Brazilian independent E&P IPO seemed very distant. That all changed in June 2008, when Brazil's richest man, Eike Batista, created a multi-billion-dollar E&P company from nothing. Indeed, if there is one company that epitomizes the new-found optimism in the

Brazilian independent E&P sector, it is Batista's OGX.

Formed as a wholly owned subsidiary of Batista's EBX holding company, OGX's first move was to headhunt a team of ex-Petrobras executives who had a proven track record in discovering and developing hydrocarbons in Brazil. Presenting this team and an aggressive strategy as its assets, the company raised \$1.3 billion from a select group of private equity investors. This capital allowed it to compete in the ninth bidding round, where it spent \$800 million on bonus payments for 23 blocks and a further \$400 million on exploratory commitments. Armed with an exploration portfolio that Dallas-based oil reserve appraisal team De Goyler and McNaughton judged to contain 20 billion barrels of un-risked resources and 4.8 billion barrels of risked resources, OGX became the first independent Brazilian E&P to list on the Bovespa, raising \$4.1 billion in one feverish day's trading.

Some industry commentators claim that OGX overpaid at the ANP auction. Such criticisms are dismissed as ignorance by Rodolfo Landim, OGX chief executive officer: "The bonus we paid in round nine may seem very high, but the true value of the blocks is much higher. Indeed, very few companies in Brazil today actually understand the value of the pre-salt."

The success of Brazil's first independent IPO has whetted the appetite of other companies.

"There was an IPO planned for February 2008, but it was cancelled because at the time it was very difficult to raise capital in the markets and there were worries about the valuation. Now, in the aftermath of OGX's hugely successful IPO, the atmosphere is different," says Kjetil Braaten Solbraekke, chief executive officer of Norse Energy in Brazil.

Norse Energy has grown in Brazil through acquisitions of smaller independents and interests in producing fields. Solbraekke insists that acquiring Brazilian independents is essential, because it provides the local knowledge needed to understand the country's E&P culture. Indeed, nearly all of the

An Independent Brazilian E&P Company

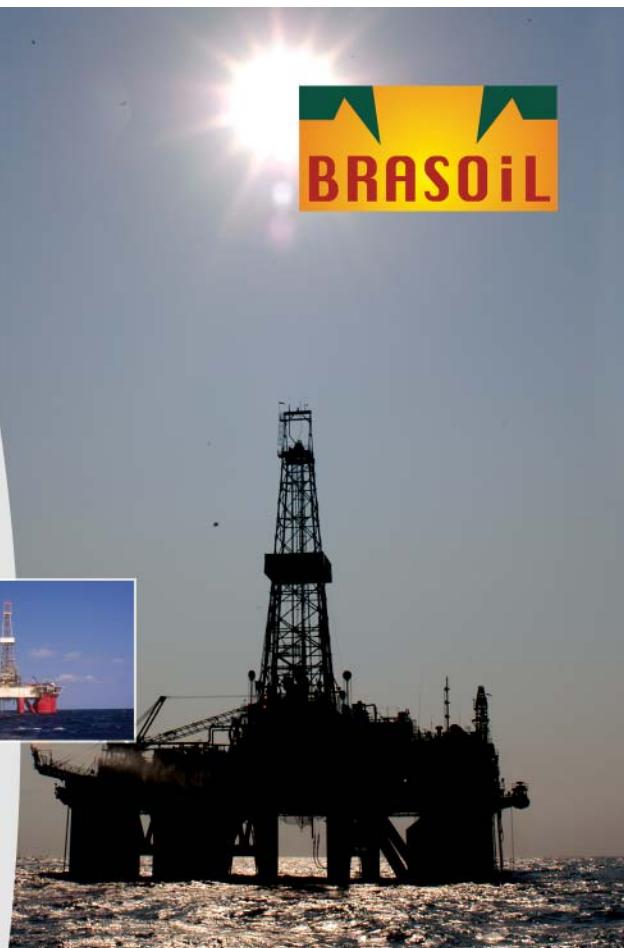
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Brazilian nationals working in senior positions in the independent sector have a stint at Petrobras on their curriculum vitae. This creates a massive potential for networking, which foreign companies would be foolhardy to ignore.

Harvey Gardiner, chief executive officer of Koch Petroleo do Brasil, accepts that using local knowledge and experience is essential. He says it is just a question of how: "There are different models for starting an E&P company here. Some people hire an experienced leader from Petrobras and hope he can develop the company, while other firms choose to partner or acquire an experienced operator." Koch Petroleo entered the Brazilian market in 2000 when it acquired local operator ATP Petroleo and retained 80% of the staff.

Having local knowledge onboard does not only help foreign independents network; it also assists them in navigating the complicated maze of regulations that cover tax, the environment, labor laws, and more. Indeed, the Brazilian love affair with bureaucracy strangles smaller independents who can ill afford the time and cost of dealing with them.

"Brazil has a regulatory culture that many international firms may find difficult when they first come to the country," says Gardiner.

The "Brazilian Condition"

The governor of Rio de Janeiro, Sergio Cabral, has been working hard to cut bureaucracy. One measure he introduced has cut the time required to open a company from 60 days to 15. Because much of the taxation and regulation that affects independents is issued at a state level, however, foreign companies that operate nationally often must use multiple systems and deal with a bewildering array of authorities.

Another aspect of the "Brazilian condition" that foreign independents must be prepared to accept is Petrobras' domination of the downstream sector. There are no independent refineries in Brazil; all are owned by Petrobras.

Similarly, Petrobras dominates the transportation and sale of gas. The company controls the only network of distribution pipes in the country and owns all but two of the state gas companies. Most observers agree that the gas market still has not been fully opened, and many independents are anxiously awaiting the outcome of a fierce senate battle that will determine the Gas Law, which has taken three years to meander through the lethargic Brazilian parliamentary process.

But perhaps the most contentious issue between Petrobras and the independents is acreage. Unless more onshore areas with marginal accumulations are released by Petrobras to the ANP, and in turn to the smaller independents, these companies are unable to expand their operations.

"Petrobras has marginal fields it could divest," says ABPIP's Frei. "They sold part of them, but they never completed another sale. Unless you have support from Petrobras, it is impossible for smaller independents to move to the next level. Furthermore, Petrobras does not need to concentrate on these fields; it has the pre-salt discoveries to focus on. Also, these smaller fields are concessions that smaller companies can exploit more efficiently."

Sergio Gabrielli, president of Petrobras, recently addressed the issue, saying: "It is true that Petrobras has an important role to play in helping the independent sector develop. However, it is also true that many of these mature basins provide important revenue for Petrobras. Indeed, in most of the world the majority of oil comes from mature basins, not from new discoveries."

There is no doubt that the independent sector in Brazil is entering a period of change. For the sector to grow it needs to consolidate and raise output to a level strong enough to sustain a diverse service industry and perhaps even an independent downstream industry. Brazil has the potential to make this happen, but the lip-service paid to creating a strong independent sector must be supported by sensible policy that eases crucial issues such as tax and the availability of suitable concessions. □



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Playing Catch-up

Brazil must overcome a shortage of manpower and know-how as it rebuilds its service industry.

Brazil's production of oil and gas has skyrocketed in the last 10 years, with the country now producing two times more oil and almost twice as much gas as it did in 1998. This had already caused an enormous strain on goods and services, with the service industry trying to play catch-up, when the pre-salt reservoirs were discovered.

The pre-salt discoveries turned the expanding Brazilian oil and gas industry into a booming one, and although none of the pre-salt fields are producing yet, they are already demanding attention and resources from the service industry. This supply-and-demand imbalance is compounded by a worldwide shortage in offshore personnel and equipment as easy oil thins out and E&P firms must go to further lengths to find oil.

The Brazilian service market is also evolving from a unique position. Despite supporting a nation that produces 1.9 million barrels per day, the service industry is still largely molded around Petrobras. The service industry now faces a challenge to reposition itself for a new breed of international and independent clients with different needs. Another hurdle is that the oil and gas service market—which is cyclical by nature—is even more so in Brazil, due to the volatile economy of recent decades. Indeed, Brazil's service industry is still recovering from the severe contractions of the 1980s and 1990s, when the government slashed Petrobras' spending. These "lost decades" have left the Brazilian service industry with a shortage of manpower and of diverse skills.

As if the situation were not challenging enough, at successive bidding rounds ambitious policy makers at the National Council of Energy Policy (CNPE) have raised the local content percentage of E&P projects so that it now stands at 65%.

To help the local oil and gas service industry overcome its weaknesses, in 1998 the National Organization of the Petroleum Industry (ONIP) was created. This organization acts as a liaison between suppliers and E&P companies, attempting to identify and erase bottlenecks in the supply chain. It also operates as a conduit for the industry to voice concerns with the federal or state government.

The organization's main aim is to boost local content in E&P

projects. However, Bruno Musso, superintendent at ONIP, concedes that there has to be a level of realism applied to the local content objectives: "There are some market niches where we are competitive, some where we could be and some where it does not make commercial sense."

One service area where Brazilians can compete is geophysical analysis and consultancy. Following the Petroleum Law in 1997, many Petrobras-trained geologists decided to leave the security of the world's sixth largest company and form independent service firms.

"International firms who have just come to the country, or those who are staying for a short period of time and do not want to develop their own geological teams, need companies like mine," insists Jorge Calderon, director of geological survey firm CWA Services.

Ex-Petrobras specialist Marcio Rocha Mello, owner of geophysical firm HRT Petroleo, claims that by securing a top-team of ex-Petrobras geologists, he can offer a service that is unrivaled in Brazil.

"The key to our success is our knowledge of Brazil's sedimentary basins. I worked for Petrobras for 20 years, and my vice-president was the head of E&P at Petrobras for 15 years—it would be very difficult for an international company to compete with us in these areas," says Mello.

"Our aim is that Brazilian manufacturers can become competitive and export to other oil-producing markets. This will help Brazil gain added value from the discoveries and spread the benefits across a broad industrial base," explains Musso.

The sedimentary basins of Brazil's Atlantic Coast originate from the same geological formation as Africa's West Coast and the Gulf of Mexico. This gives HRT Petroleo expertise that it can export to these markets.

"The key to international expansion is entering markets where you have a competitive advantage," says Mello. "I am starting a North American venture at the moment, and I have hired the three top petroleum geologists for my laboratory. This will give me the competitive advantage in America."

Crucially, the CNPE's local content policy balances protec-



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tionism with competition by classifying any firm that manufactures in Brazil as a local producer, regardless of whether its capital is controlled by a foreign entity. ONIP wants foreign producers and service companies to set up production facilities and offices in Brazil.

"We want to attract international partnerships, especially with regards to technology transfers," says Musso.

ONIP also receives support from its fellow association, the Federation of Industries of Rio de Janeiro (FIRJAN). "The international perception of Rio de Janeiro is often focused on carnival, football and the beach and is blind to the business potential here. FIRJAN takes part in road-shows and trade delegations with the state governor to change that perception," explains FIRJAN chairman Eduardo Gouvea Vieira.

Metroval, a service company that today manufactures, installs and operates oil and gas measuring equipment, is an example of a Brazilian company that gained a competitive advantage in the domestic market by working with an international firm. In 1989, it started manufacturing oval gear-type positive displacement meters through a technology-transfer agreement with German manufacturer Bopp & Reuther. It then signed another technology-transfer agreement with German manufacturer Rheonick Messgerate to become the sole



Eduardo Gouvea Vieira, president of FIRJAN

manufacturer of Coriolis mass flow meters in Brazil.

"These technology-transfer agreements helped us gain expertise. We were then able to offer world-class products as a Brazilian producer," says Paolo Fiorletta, Metroval's director.

As demand from the oil and gas sector began to pick up in the early 2000s, Metroval responded by opening a new base in the industrial heart of Brazil's offshore industry, Macae. The company also added value to its service by creating training teams that could instruct platform crews how to operate the increasingly complex flow meters. Although Metroval is well positioned to exploit the boom in oil and gas, Fiorletta concedes

that it faces some difficult challenges.

"The main obstacle to our growth is the shortage of trained staff that is gripping the industry. Metroval distinguishes itself from its competitors by offering top-quality consultation, training and installation services, yet we are struggling to attract new staff to fuel growth," he says.

During the 1980s and the 1990s, the engineering and manufacturing industries suffered a massive contraction and resulting job losses. Subsequently, the numbers of students in engineering dwindled. Brazilians used to boast that they had the most highly educated taxi drivers in the world, as graduates struggled to find work.

One company leading the way in solving this problem is Chemtech. Formerly a Brazilian closed-capital engineering company, but now part of the Siemens group, it has been judged as the best company to work for in Brazil by the Great Place to Work Institute. Luiz Rubiao, chief executive officer, says: "Keeping staff happy is not solely about paying more money than your competitor; it involves a range of factors. Personnel have to feel they have potential to improve their career, and a company needs to develop them, as people, not just as a workforce."

One innovative way Brazil is trying to solve the manpower problem is through the National Plan for Professional Qualifications (PROMINP). Launched in 2003, PROMINP is a government initia-

A photograph showing the back of a worker wearing a red long-sleeved shirt with a blue and white 'chemtech A Siemens Company' logo patch on the shoulder. The worker is wearing a white hard hat and red ear protection. In the background, there is a large industrial facility with various pipes, structures, and scaffolding under a clear sky.

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tive that brings together the E&P companies, industrial associations, development banks, academia and the Minister for Mines and Energy to analyze where Brazilian industry needs to improve if it is to successfully service the booming hydrocarbon industry. PROMINP has responded to the personnel shortage by running a series of training courses. The training scheme is now in its third cycle and has grown to fill 15,000 vacancies in 17 states. A free public exam determines entry.

These courses, and the rising numbers of engineering and geological graduates, will help, but it will take time. Analysts estimate that it will be 10 years before Brazil starts to remedy its shortfalls in trained personnel. Although the pre-salt discoveries themselves will take time to come online, sourcing manpower is likely to be a problem in Brazil in the medium-term.

Another innovation is an agreement between Petrobras and the National Organisation for Apprenticeship (SENAI), an organization that fosters the development of small companies. Petrobras informs the organization about niche markets it believes local suppliers could service, and, in turn, SENAi works with these companies to help them gain the International Standard for Organization (ISO) certificate or HSE requirements needed to work with Petrobras. To date, more than 2,300 companies have benefited from this scheme.

The pre-salt discoveries also have created a number of specific technical challenges that the Brazilian, indeed international, service industry will have to meet.

"The layer of salt that lies above the reservoirs causes a number of problems from a production point of view," says Ricardo Beltran, head of production development at CENPES, the Petrobras research center. "It obscures the results of seismic analysis, which means we know less about the reservoir. It also absorbs energy from the drilling process and puts enormous pressure on the drilling units."

These challenges present a wealth of opportunities for international service firms. Once a year, CENPES technicians scour

The pre-salt discoveries also have created specific technical challenges that the Brazilian, indeed international, service industry will have to meet.

the inventories of the world's service and manufacturing industry to discover which institutions or companies are world leaders in fields that interest Petrobras. Petrobras then contacts the relevant company; for example, at the moment it is trying to work together with Schlumberger and Baker Hughes to open a research and development center in Brazil.

Some companies do not wait to be contacted by Petrobras. Weatherford, which has been steadily increasing the scale of its Brazilian operations in recent years, has formed a pre-salt team to look at ways to engineer solutions to Petrobras' problems.

In a 2006 study that Professor Adilson de Oliveira of the Federal University of Rio de Janeiro completed for PROMINP, he calculated that Brazilian manufacturers of oil- and gas-related products would have to increase capacity by 250% between 2013 and 2025 to meet the industry's rising demand. Now, in the pre-salt era, he concedes that figure will have to be revised upwards. To achieve those goals is a challenging task, especially with the shortage of manpower and know-how, but it is a task that the Brazilian service industry is taking on with zeal. With strong institutions such as ONIP and SENAi, and initiatives forthcoming from public bodies and private companies, there is every likelihood that Brazilian businessmen will again adapt to a rapidly changing situation. □

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Shipyards: All Hands On Deck

Both state and government entities are determined to rebuild Brazil's maritime infrastructure to support the recent offshore discoveries.

One of the oil and gas sub-sectors facing the most intense pressure to increase production in the wake of the pre-salt discoveries is naval construction and maintenance. The logistical demands of extracting billions of barrels of oil from a widespread area approximately 200 kilometers from the coast, and a political desire to improve Brazilian maritime infrastructure, have created enormous challenges, and opportunities, for Brazil's shipyards.

As part of its pre-salt discovery strategy, Petrobras recently announced a plan to bolster its fleet with 146 new vessels by 2016; furthermore, the state-controlled company pledged that all the vessels would be built in Brazil. The vessels will be a mix of platform supply vessels (PSV), anchor handling tug supply vessels (AHTS) and tankers. Petrobras also plans to contract, or build, 24 production platforms and 40 drilling rigs. In addition, the company plans to create the world's first FPSO factory, because the massive demands of the pre-salt platforms will allow multiple constructions of clone production-platform units.

This challenge to create a world-class maritime infrastructure to support the oil and gas industry is further complicated by the troubled past of Brazil's shipyards, 85% of which are based in Rio de Janeiro. Brazilian naval construction enjoyed a boom in the 1970s when the then state-owned mining group, Compania do Vale Rio Dolce (CVRD), created a fleet of versatile, supersized cargo vessels capable of exporting iron ore and returning to Brazil laden with oil. In the 1970s, the Brazilian naval construction industry was the second-largest in the world and employed approximately 40,000 people. The economic instability of the 1980s was especially bad for shipbuilders, however, as hyper-inflation rendered long-term construction contracts worthless. By the mid-1990s, several shipyards had been forced to close.

"It was impossible to offer clients a fixed price when inflation was running at 40%. This reduced confidence in our contracts as companies would be given a price that was raised after one year. Brazil lost many international customers because of this," remembers Waldemiro Arantes Filho, president of AkerPromar shipyard.

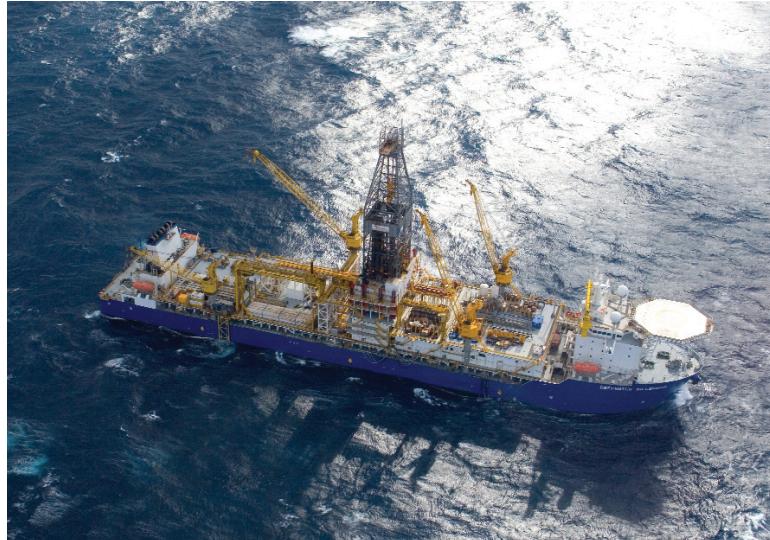
Manpower shortage

One of the most serious challenges facing the industry, both for the construction of platforms and supply vessels, is personnel. In the mid-'90s the number of people directly employed in shipping had dropped to 500; the industry was only just beginning to recover when Petrobras announced the massive new order. Years of inactivity have created a chronic manpower shortage, ranging from semi-skilled workers to naval engineers.

"We were the lost generation of naval architects," recalls EISA shipyard director Jorge Goncalves. "In my class (during the 1980s) there were only four of us."

In the absence of a federal or state program to train a workforce, many shipyards are taking the initiative to offer training themselves. AkerPromar has created an in-house welding school that trains 65 of its 850 staff on an ongoing basis. The company also sends engineers to Norway to gain international experience.

Mac Laren Oil is taking a more radical approach to the personnel problem. The family-owned yard, which was the only Brazilian shipyard not to close or change ownership during the economic crisis, is using a range of social programs to create a workforce. One of the programs is a welding training workshop for prisoners near the end of their sentences. Approximately 3,000 prisoners will benefit, and those that pass the course will be offered jobs with the shipyard. Another scheme offers free training to encourage women to work as welders.



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Gisella Mac Laren's company is bringing innovative solutions to Brazil's extreme human resources situation.

"There is no doubt that sourcing labor will become one of the major challenges for Brazilian shipbuilders trying to increase capacity," says Mac Laren Oil president Gisella Mac Laren.

Another problem facing the shipbuilding industry is acquiring the technical expertise needed to build the platforms and the new generation of diesel-electric PSVs and AHTSs. The decades of under-investment in Brazilian naval engineering mean that many firms have to find the technical know-how abroad. Joint ventures between Brazilian yards and foreign shipbuilders can provide the injection of capital and technology that the Brazilian shipbuilding industry needs if it is to meet the oil and gas sector's growing demand.

In the case of the Promar shipyard,

selling 51% to Aker gave it the financial solidity to be able to offer guarantees to clients. Mac Laren Oil's recent five-year joint venture with Singaporean shipbuilder Jurong, means the 70-year-old shipyard can build semi-submersible rigs for the first time. The international consortium of Singaporean shipbuilder Keppel Fels and the French engineering group Technip, (FSTP) worked with Brazilian shipyards to build P-51—the first semi-submersible platform built entirely in Brazil.

"We had our eye on Brazil for some time, and eventually we decided to take the plunge," says Michael Chia, executive director of Keppel Fels. "But for us it was essential that we found the right local partner."

The FSTP consortium was also lured by the Rio de Janeiro state government's decision to exempt the builders of P-51 from the Tax on the Circulation of Goods, Interstate and Intercity Transportation and Communication Services (ICMS). This saved the consortium approximately \$150 million.

Another initiative helping to revive Brazil's shipyards is the Merchant Mariners Fund (FMM). This fund derives from the taxes levied against foreign ships using Brazilian ports. In recent years, the fund has moved proactively to help the shipyards rebuild. For example, the FMM gave Mac Laren Oil the funding it

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needed to build the first dry dock in Rio de Janeiro that is capable of building semi-submersibles.

In the past 10 years, 20 shipyards have reopened in Rio de Janeiro alone. This demonstrates the ability of Brazilian industry to move quickly to adapt to changing scenarios. It also reflects the determination at both the state and government level to rebuild an industry that is vital to a country whose newly found oil wealth lies offshore. This commitment is underlined by Rio de Janeiro's Secretary for State Julio Bueno, who says: "By working closely with the shipyards we have managed to revive the sector, and we will continue to support this industry." Indeed, Brazil's shipyard story exemplifies how the country's industry is being harnessed to support the oil and gas sector and meet the pre-salt challenge. □



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