



THE JAMES A. BAKER III  
INSTITUTE FOR PUBLIC POLICY  
OF RICE UNIVERSITY

## **CRITICAL ISSUES IN BRAZIL'S ENERGY SECTOR**

SUPPORT FOR THIS PROJECT HAS BEEN PROVIDED BY A GENEROUS GRANT FROM

**BP FOUNDATION**

RICE UNIVERSITY - MARCH 2004

## Introduction

Brazil's energy industry is at a crossroads. Following a decade of reforms and privatizations, a crippling power shortage in 2001 that rocked the nation, and a change of government on January 1, 2003, Brazil is reevaluating its plans to meet growing energy needs.

The country's energy policies of the last decade have been successful in many regards. Brazil has transformed itself from a major oil importer whose rising imports from the Middle East were leaving the country with crippling balance of trade deficits to an expected net exporter of crude oil before the end of this decade. But the country's energy use is expected to continue to climb in the coming years and without further restructuring of its energy sector, Brazil may have difficulty ensuring that sufficient investment can be made to continue to meet the rising need for fuel and electricity. In particular, Brazil needs to address the future status of state oil giant Petrobras, whose pervasive energy sector monopoly is hindering the development of competitive markets and discouraging needed private investment.

Brazil's production averaged only 670,000 barrels a day in 1991 against average demand of 1.5 million b/d. In the past, efforts by Brazilian leaders to fight inflation, stabilize the currency, and negotiate billions of dollars of loans from the International Monetary Fund (IMF) were made much more difficult by the country's oil import bill, which represented as much as 15% of the current account deficit in 1999 (see Lewis). By early 2003, following reforms in Brazil's oil exploration and production upstream sector, the country's domestic oil production had risen to 1.6 million b/d, only slightly below demand of 1.8 million b/d. Continued successes upstream will likely end Brazil's status as a significant oil importer over the coming years.

The country's economy contracted sharply in 2001-2002 following crippling energy shortages that rocked the Latin nation, leading to a 6% drop in energy demand since that crisis began. But energy demand is expected to grow significantly in the coming two decades as the country's

economy recovers, raising questions about whether Brazil will be able to meet its goal to become a major oil exporter to the hemisphere. A slowdown in the reform process has also raised questions whether the country will be able to attract sufficient private investment in energy infrastructure to support sustained economic expansion.

The fate of Brazil's energy industry will have dramatic influence on the country's future economic course and on the energy balance of the Western Hemisphere. Brazil's energy demand growth has been a major feature of Western hemisphere energy trade over the last decade and will continue to be an important indicator of international market trends. How Brazil meets its growing energy requirements will have direct bearing on the development of energy trade flows in the Western hemisphere.

Brazil's oil demand is projected to rise by 1% to 4% a year between now and 2015, according to Baker Institute forecasts (Medlock, Soligo, 2002) or between 400,000 b/d and 1.3 million b/d, meaning that much of the country's expected increase in production will simply offset domestic needs.

Expectations had been high that Brazil, with the development of energy sector reforms begun in the 1990s, might become a major net export supplier of oil within the Americas in the coming decade, reaching more than 3 million b/d of production. Such a development would have enhanced hemispheric energy security. It would also redress some of Brazil's economic problems created by volatile energy import costs to the central government. However, recent developments have caused some analysts to question whether targets of even 2.6 million (b/d) can be met given an uneven implementation in San Paulo's reform program. At stake are the country's economic future, its leadership role in South America, and the energy balance for the hemisphere. While some of Brazil's heavy crude will have to be exported because of lack of upgraded refining capacity, the country's internal needs may limit its status as a major oil exporter.

Brazil, the largest country in Latin America in size and population, accounts for almost half of Central and South America's economic output. It is the tenth largest energy consumer globally,

ranked just behind France and the United Kingdom. Brazilian energy demand grew by 1.7% in 2002, in line with growth rates in the United States, Iran, and South Africa. Brazil is the largest energy consumer in Latin America and ranks third behind the United States and Canada in the Western Hemisphere.

Brazil's energy demand fell in 2001-2002 in the aftermath of an energy crisis that slowed overall economic expansion. In addition, despite expectations that energy demand will return to the usual growth pattern soon, Brazilian leadership has put aside earlier plans to pursue an aggressive program of liberalization in the natural gas and power generation sectors. That program might have led to the expansion of Brazil's natural gas industry into a truly transparent and competitive industry and helped diversify investment in domestic energy markets away from dependence on state-controlled funding. But such liberalization would also have meant a dilution of the politically popular, social and economic benefits of heavy government intervention in the energy sector. Polling shows that such a dilution of government involvement in the energy sector would be unpopular in Brazil (see Kingstone).

The government of President Luiz Inacio Lula de Silva (Lula) faces difficult choices in forging a successful, long-term energy policy. There is no question that state-sponsored intervention in national energy businesses benefits many segments of the population and can be used as a tool of social policy and a prop to economic growth. However, such intervention can also potentially create a significant strain on the national treasury. Moreover, to the extent that governments force their state industry to provide fuel supplies and electricity at prices that are below international market levels, the more likely the long-term strain to the national treasury can become. Indirect subsidies can prompt other industrial investment that is uneconomic and will require additional support to be competitive for sustained operation.

The downstream energy sector has the potential to be productive for the overall economy. But in many cases in developing economies, downstream energy businesses can become a significant drain on national budgets, depending on various product pricing policies. When consumer prices are based on market levels and infrastructure is modern and well-maintained, it is possible to obtain a return on capital in the 10-15% range. However, if consumption is heavily subsidized,

equipment inefficient and infrastructure poor, then the potential losses can be significant, with product subsidies taking up a substantial portion of the national budget. Inefficient domestic industries, surviving only by the use of domestically subsidized energy supplies, subtract value from such natural resources.

Sector development growth that features heavily subsidized prices will have definitive consequences for investment, efficiency and long-term profitability of the energy sector. Use of market prices and standards will show both consumers and investors a different set of incentives for investments and use, with consequent changes in the value added to crude oil and natural gas. Low prices, by contrast, can distort demand by leading to investments that are uneconomic in the long run, by discouraging the efficient use of energy or by creating lost opportunity cost for domestic crude oil and gas production that might have been sold at international prices but instead was utilized to produce subsidized domestic products.

The electoral mandate of the new government of President Lula showed a clear preference for a slowdown in the energy sector reform process. Nevertheless, the government also knows that this decision could leave the country exposed to another serious crisis by failing to address several critical issues facing the country's energy sector in the coming decades, particularly in the natural gas and power generation industries. This energy policy dilemma mirrors that of many large energy-importing countries. Expensive but socially beneficial government intervention in the energy sector can serve as the basis for short-term economic stimulus as well as help redistribute income inside society. However, heavy government intervention in the energy sector can be expensive in the longer term, preventing a country from reaping the efficiency gains from the liberalization of energy markets and keeping it competitive internationally. Brazil has wavered between these two policy alternatives over the last decade, making it an interesting case study in the role of the public and private sectors in forging a suitable, sustainable energy security policy.

Brazil embarked on economic reform in the early 1990s by simultaneously liberalizing trade and developing a framework for privatization of major state owned industries. The cornerstone of these initiatives was the introduction of the *Real Plan* in mid-1994 to reduce inflation and tame

inflationary expectations. Restructuring and privatization of Brazil's energy industries took place as these reforms were implemented in the rest of the economy.

The *Real Plan* dramatically reduced inflation through a combination of exchange rate reforms, structural economic reform, and privatization. Brazil's annual rate of inflation was over 2,000% in 1994, but plummeted to less than 3% by 1998. With inflation under control and structural economic reforms in place, Brazil experienced strong growth in the latter half of the 1990s and was able to attract private capital, especially foreign direct investment, to the energy industry (see Ellsworth/Gibbs).

A key event in energy sector reform was the Brazilian government's approval in July 1997 of the full text of the Brazilian Petroleum Investment Law. This law limited Brazilian treasury holdings in Petroleo Brasileiro S.A (Petrobras) and defined a new energy policy. Highlights and key objectives of the law included:

- Creation of the National Council for Energy Policy (CNPE) to set energy industry policy.
- Creation of the Agencia Nacional do Petroleo (ANP) to oversee deregulation and restructuring.
- Increased use of natural gas.
- Increased competition in the energy industry
- Domestic and foreign investment in power generation.

On paper, the new regulatory framework and energy law went a long way to lay the groundwork for an efficient, market-oriented structure. It nonetheless stopped short of forming a truly competitive and diversified marketplace. Despite the intention to create a more competitive energy market, the Brazilian government still retained monopoly control of key sectors of Brazil's energy complex and administered state control on certain energy prices.

At the same time, the independent regulatory bodies such as the ANP and ANEEL, while staffed with qualified personnel and backed with appropriate legal empowerment, still run the risk of

political interference through political appointments or politically motivated barriers to the funding of their operations. The regulatory body budgets pass through the legislative appropriations process and require “liberation” by the executive branch. In the case of ANP, it has had to struggle with Petrobras during its short existence, with some critics pointing to Petrobras’ consistent ability to retain access to the most promising basins in Brazil as evidence that the ANP is not where it should be in its independent oversight role.

Perhaps the most significant feature of the Brazilian energy picture today is the fact that state energy giant Petrobras was only partially privatized and was left with a dominant position in key areas of the country’s energy economy including resource asset ownership, pipeline ownership, generation ownership, and ownership in local distribution companies. This uncertain situation of partial reform has discouraged private sector investment, calling into question whether the Brazilian government will be able to finance the expansions that will be needed in the energy sector to sustain strong economic growth in the years to come.

The country faces a fundamental dilemma in energy policy. On the one hand, its state controlled energy sector represents an important source of government revenue, national employment, and national pride. On the other hand, players like state oil and gas monopoly Petrobras may have difficulty raising single-handedly the kind of capital needed to expand the country’s energy infrastructure to meet growing needs. Petrobras’ stranglehold on virtually all aspects of the crude, gas, and power industries has overshadowed and, in some cases, effectively shutout foreign investors. But increased movement toward more competitive markets in Petrobras’ key operational business areas such as domestic refining and marketing and natural gas market development would certainly erode the Brazilian state firm’s profit margins, depriving the federal government of Petrobras’ “cash cow” role that has been relied upon to soften Brazil’s serious debt problems.

Ironically, while the government relies in the short-term on immediate cash flow generated by Petrobras’ monopoly operations inside the country, it also runs the risk that it will not be able to sustain the costs of allowing this monopoly to continue in the long-term.

With the 2001 energy crisis squarely in Brazil's political past, the impetus for continued reform has slowed. The long-standing issue of further liberalizing Petrobras remains unresolved. As a result, the flow of foreign investment into Brazil's energy businesses has slowed dramatically. Without such investment, country may have difficulty maintaining long-term energy security and economic health.

The policy deadlock on energy issues in Brazil seems unlikely to break anytime soon because of the nature of the country's domestic political life, where a wide-range of "veto players" with discreet agendas are able to block any dramatic reforms. Moreover, extreme fragmentation of political parties thwarts effective decision-making, even in circumstances where a popular president has seemingly broad powers.

The process of energy sector reform has been influenced greatly by the country's political trends in recent years. The government of former President Fernando Henrique Cardoso (1994-2002) took major steps to inject competition and private investment into the sector and reduce the government's burdensome financial commitment to subsidize energy supplies to the nation. Under Cardoso, the state ended its monopoly on oil and natural gas exploration in Brazil; corporatized the management of Petrobras; identified imported natural gas as a new source of fuel for the electricity sector; and investigated private sector participation in the development of new power stations.

Nevertheless, the government stopped short of full liberalization, and its failure to move to market-related natural gas pricing has hindered the development of needed gas-fired power plants and industrial feedstock. In fact, the imposition of price controls in 2002 has scared off foreign investors, raising questions about the country's future development path. In addition, Petrobras' overwhelmingly dominant role is another factor thwarting private investors. Petrobras' significant ownership shares of gas fields in Bolivia, the Brazil to Bolivia (BTB) pipeline, important offshore oil and gas exploration blocks, and state distribution companies, as well as its dominant position in numerous thermal power projects, has effectively shutout competition in the past few years or at least hindered profitable opportunities that might have emerged for foreign investors. This, combined with an uncertain outlook for Brazil's natural gas



and power market, has prompted many foreign investors to pull out of the country's gas and power sectors or limit investment substantially, leaving questions regarding how Brazil will meet its rising energy needs in the coming years. A new giant gas find in Brazil's Santos Basin, announced by Petrobras last year, has raised many questions about how the country's gas markets may evolve. It remains unclear how quickly the state firm will bring the new source of gas to market.

The nature of Brazilian politics in recent years has given regional players a disproportionate voice in protecting local employment, investment resources, and patronage. Since 1988, the federal government has had to contend with the problem of restoring the fiscal health of the state. To garner the support needed to cope with the debt problem, successive governments have had to negotiate with the governors – who, unlike the president, face fewer legislative and political constraints on their decisions. As of 2003, the federal government was still finding itself negotiating and renegotiating successive, temporary "fiscal adjustments." These continuous renegotiations have helped preserve the governors' capacity to extract concessions from the federal government in exchange for temporarily giving up constitutionally mandated transfers. Moreover, state governors' ability to provide patronage resources to dependent local politicians gives them considerable influence over voting behavior in the federal legislature, giving the governors "veto power" in federal policymaking, even in areas where the federal constitution does not directly implicate them. This reality complicates the environment for implementing dramatic energy sector reforms that will affect regional stakeholders.

Whereas three main parties in President Cardoso's coalition supported either full or partial breaking of Petrobras' monopoly status, privatization and other market-enhancing reforms do not represent the majority preferences in society and congress in Brazil today. The new Lula government is straddling conflicting objectives of reducing poverty and averting a financial collapse. While the latter might argue in favor of continued privatization in the energy sector, such a path faces political hurdles. President Lula's powerbase is more closely aligned with entrenched interests who favor state domination of the energy sector and the protection of domestic jobs, leaving his administration more politically ambivalent to the path of reform and privatization in the energy sector than his predecessor. Lula has also shown reluctance to shift

his country away from its heavy reliance on hydroelectric power and he is more closely tied to nationalist sentiment where institutions such as Petrobras are concerned.

On the economic front, Lula does appear to be making some headway in turning around Brazil's troubled economy and has received an important endorsement from the International Monetary Fund. Although he was critical of the IMF's insistence on Brazil pursuing a strict monetary policy as a presidential candidate, Lula as president has clearly changed tack and during 2003 sought draconian budget cuts, announcing in February 2003 his determination to slash U.S. \$3.93 billion from budgeted spending for the year. Brazil kept interest rates at punishing levels of 28% for much of 2003 to maintain inflows of investment. They have since fallen to around 20%, which is still high. In December 2003, the IMF authorized a 15-month extension of its U.S. \$34 billion loan agreement with Brazil, along with U.S. \$6.6 billion in new funding. In addition, the IMF agreed to Brazil's request for more time to repay about U.S. \$5.8 billion of loans.

In exchange for the IMF loan extension and repayment adjustment, the Brazilian government has promised to maintain its primary budget surplus target at equal to 4.25% of gross domestic product (GDP) through 2004. Although the Brazilian economy is expected to have grown less than 1% in 2003 – as little as 0.3% -- the expectation by many private economists is that Brazil will see an economic growth of 3.5-4% in 2004, supported by declining credit costs, falling inflation, currency stability, and improved buying power.

The Cardoso administration was considered more committed to a radical reform path in the energy sector than the current government. Still, even Cardoso's reform program failed to rein in the overwhelming influence of Petrobras' monopoly power inside the country's energy business, thwarting efficient market competition and investment. Debate regarding the privatization of Petrobras remains taboo in political circles as the state firm continues to be viewed as a symbol of Brazilian nationalism and is supported by powerful internal domestic factions.

Despite the fact that the Brazilian public could potentially gain much economically from the privatization and deregulation of the energy sector, polls show that a majority of Brazilians oppose the further privatization of Petrobras, viewing it as the loss of a valuable symbol of economic nationalism.

Indeed, the political stakes for the future of Petrobras are enormous. Petrobras plays a critical role in government finances, raising the costs of reform and further privatization. Petrobras' sales of products represent more than 6% of the country's GDP. It is one of the largest consumers and driving forces in the Brazilian economy. In 2001, total capital investments rose to U.S. \$4.2 billion and domestic investments grew to U.S. \$3.9 billion or some 92%. Petrobras has commercial relations with many thousands of service and supply companies, contributing indirectly to hundreds of thousands of jobs. On the upstream side, the substantial expansion of its exploration, production, and transmission activities supports the domestic steel industry. It is Brazil's largest exporter, behind aircraft manufacturer Embraer, with the company's exports totaling nearly U.S. \$2.5 billion. It is also one of the largest sources of scientific research and advanced technological development in the country (see Lewis).

Petrobras is also a large annual source of income for the federal state. Petrobras paid U.S. \$2.4 billion in federal income tax in 2000 and U.S. \$1.2 billion in 2001. Petrobras' operations have also been critical as a means to pay off the federal government's debt in an era of large fiscal deficits. The gradual semi-privatization of Petrobras through the sale of public shares has generated more than U.S. \$4.7 billion for the federal government coffers, representing 11.8% of all federal sales of enterprises and banks. Petrobras also plays an important indirect role in the inflation-fighting monetary policies. As majority owner of Petrobras, the federal state uses the conglomerate to bolster financial resources, including policies that compel the company to buy and retain government securities. Some 90% of the U.S. \$2.1 billion that it holds in its contributory defined benefits pension plan, Fundacao Petrobras de Seguridade Social (PETROS), are in government securities. The federal government also uses Petrobras as a tool to improve its creditworthiness in international markets and loan negotiations with foreign governments and international organizations (see Lewis).

Petrobras is also important to key state and municipal governments as a source for funding for the development of local economic infrastructure. The indirect influence of Petrobras is particularly strong in localities in the Northeast and Central regions, where there are company towns that have few opportunities for alternative industry (see Lewis).

Petrobras' operations have been vital as a means to pay off the federal government's debt in an era of large fiscal deficits. However, its critical role in the economy has left Brazil in a quandary. On the one hand, the company's fiscal muscle is an important element keeping the national economy on its feet. On the other hand, this fiscal strength derives in great measure from the firm's monopoly status, dominating domestic energy markets, especially for refined products. However, Petrobras will have difficulty raising capital to meet Brazil's expanding energy demand single-handedly, forcing San Paulo to consider further opening the country's domestic market to private investment and market competition. This creates a "catch-22" where increased competition will hinder Petrobras' profits, reducing the government's immediate take, but making it more difficult to finance the facilities needed to meet rising energy demand.

Petrobras had been moving increasingly to international activities to diversify away from dependence on domestic markets in an effort to address this dilemma. The state concern hoped to earn a greater part of its revenues abroad, reducing its exposure to shrinking margins in a more competitive Brazilian market.

The newly elected Lula government, which is more domestically focused, has slowed that internationalization program. While the election of Lula as president has not radically changed the direction of the country's energy policies – other than prioritizing continued reliance on hydro-electricity at the expense of natural gas growth -- the new government has put its emphasis on domestic investment and job creation. Since his election, Lula has sought fiscal incentives to strengthen the competitiveness of domestic equipment manufacturing for exploration and production, rejecting the former Cardoso administration's policy of granting foreign oil-platform builders and foreign equipment producers tax exemptions for temporarily importing rigs and equipment into Brazil. The new industrial policy offers Brazilian oil-equipment manufacturers the same financing terms as foreign companies so they can compete better for Petrobras

contracts. Petrobras now requires that 65% of goods and equipment must be supplied by Brazilian manufacturers. In addition, a plan by Petrobras to buy into a U.S. refinery has been delayed indefinitely in favor of domestic investments, as foreign acquisitions would not provide jobs for Brazilians at home.

Still, of the U.S. \$22 billion of investments in exploration and production earmarked by Petrobras for the period of 2003-2007, some U.S. \$4.4 billion is still being dedicated towards projects abroad. Petrobras has oil and gas interests in 11 other countries including Argentina, Bolivia, Colombia, the U.S., and Angola. In October 2002, Petrobras paid U.S. \$1 billion for 59% of Argentina's second-largest oil producer, Perez Companc, which expects to spend U.S. \$2 billion to boost its international production in Venezuela, Peru, Bolivia, and Ecuador. Petrobras followed up that same year by spending U.S. \$88.5 million to purchase Petrolera Sante Fe, the Argentinean subsidiary of U.S. energy firm Devon Energy Corp.

Within the Lula government, there are key officials and advisors with strong leftist credentials. In particular, current Mines and Energy Minister, Dilma Rousseff, is a member of the left-wing Workers' Party (PT). Still, early indications are that she favors no radical change in the country's existing energy policies, which include partial privatization and partial reforms. She has instituted some adjustments in energy pricing policy and pushed for more national procurement to secure Brazilian jobs but has not called for a reversal of Petrobras' partial privatization or reversal of existing foreign participation in the Brazilian energy sector.

Divisions remain within the Brazilian government regarding how to proceed with gas sector reform. Rousseff announced in December 2003 the Lula government's intention to draw up a master plan to boost the use of natural gas and help the economy grow, following an earlier announcement about a new model for the electricity-sector. The new plan called for more gas-fired and other thermoelectric plants but made it clear that their construction would only be possible at lower natural gas prices. One of the proposed reforms included pooling cheaper hydroelectricity with more expensive thermoelectric plants. By pooling the various sources, the ministry hopes to reduce the electricity tariffs and to ensure that power is purchased from the newly constructed thermal plants.

Rousseff believes that lower prices for gas sold in Brazil, whether locally produced or imported, would be key to increasing the use of gas in industry, vehicles, and thermoelectric generation. Rousseff pointed out that Petrobras might face losing some of its lucrative fuel oil sales, which will be substituted by the cheaper gas. Petrobras, for its part, announced that it would cut the price of gas imports from Bolivia for domestic distributors for amounts exceeding normal consumption to boost domestic gas usage and reward consumers with the cost savings, beginning January 1, 2004 (see Ellsworth/Gibbs).

Increasing domestic oil production has been a high priority for the country's energy policy. Since opening its offshore coastline to international oil and gas exploration in the late 1990s, Brazil has attracted over U.S. \$600 million for exploration blocks. As a result of this investment activity and continued state investment by Petrobras, analysts project Brazilian oil production will reach 2.6 million b/d in 2010, up from 1.6 million b/d in early 2003. However, problems in the sector remain, as Petrobras has kept a grip on the on the most prolific acreage, and foreign drillers have experienced disappointing results in recent years. Lack of reform in the natural gas sector has also discouraged investors who must consider whether there will be economic outlets for major gas finds. Petrobras' surprise announcement in September 2003 that recoverable reserves in the Santos Basin were 14.8 trillion cubic feet (Tcf), up from previous estimates of 2.5 Tcf, could radically change the outlook for the gas sector, however, giving Brazil incentive to use more gas in its power business. El Paso Energy also has acreage in the Santos Basin.

The rise in Brazilian domestic oil production is unlikely to be large enough to allow the country to serve as a major net exporter to neighboring countries or the United States, as had previously been hoped. While heavy oil production will likely have to be physically exported instead of refined inside Brazil due to expected constraints in the country's domestic refining system, internal demand will nonetheless be closely matched to national production levels. Brazil's oil demand is projected to rise by 1% to 4% a year between now and 2015, according to Baker Institute forecasts (Medlock, Soligo, 2002) or between 400,000 b/d and 1.3 million b/d, fairly close in line with possible increases of 1 million b/d in oil production over the same period.

### **The History of Brazilian Energy Policy: Mixed Results**

President Lula faces the same challenges in the energy area as previous governments, but the way forward is less than clear. Brazil has been struggling to achieve energy self-sufficiency for several decades. It has experimented with a number of innovative programs, including a national initiative on agricultural alcohol-based fuels and expanded use of hydroelectric power. Rather than freeing Brazil from the dire economic consequences of dependence on oil imports, these programs created economic headaches of their own.

Brazil's experiment with alcohol-based fuels was intended, in the aftermath of the 1970s oil crises, to lower its dependence on Middle East oil imports. It was believed that the alcohol industry would ameliorate the nation's balance of payments and foreign debt problems and at the same time stimulate agricultural production. The Programa Nacional do Alcool was appealing politically because it would rely on the expertise of engineers and chemists at Petrobras and it was calculated to create nationalist pride in the then military government's handling of the oil crisis of the 1970s. The program also took advantage of Brazil's status as the world's second largest producer of sugar cane behind India to provide abundant and inexpensive fuel for the Latin American nation's automobiles.

In fact, by 1985, more than 90% of the cars produced in Brazil ran on alcohol. The program, however, forced the Brazilian government to provide a steady stream of subsidies to keep the price of alcohol below its high production costs. Although the Pro-Alcohol program was successful in lowering Brazil's dependence on oil imports, it did nothing to help solve either the balance of payments or the debt problems because the government had to rely upon foreign borrowing to fund Petrobras. In addition, in the early 1980s, when the price of crude fell, Brazil was unable to take advantage of the cheaper commodity oil price.

The establishment and subsidizing of the Pro-Alcohol program contributed to the foreign debt and while it raised the price of sugar and made some mechanized producers more profitable, the program did not dramatically increase rural wages or raise the standard of living in the northeast as had been hoped. At the same time, middle-class consumers complained about the quality of

alcohol-fueled vehicles. On the one hand, they enjoyed the government subsidies that maintained fuel prices below the internal price for oil but, on the other hand, the alcohol-fueled cars were viewed as less powerful and reliable than Japanese, American, and European cars running on gasoline. When the government eventually loosened restrictions on auto imports because of the high cost of its subsidization and because the public had wearied of the experiment, many consumers turned to imported cars, forcing domestic automobile manufacturers to offer gasoline-powered vehicles. By 1995, less than 5% of vehicles produced in Brazil used alcohol.

Brazil also tried to diversify away from oil by initiating a major hydroelectricity program. Hydroelectricity is Brazil's second largest source of energy, providing 33% of the nation's primary energy production and more than 90% of power-generating capacity (see Ellsworth & Gibbs). In 2002, Brazil was the second largest producer of hydroelectric power in the world (behind Canada). The country has immense hydroelectric resources, namely three great river systems – the Amazon, the Parana, and the Sao Francisco – and enormous unexploited hydroelectric potential. Most of Brazil's hydroelectric capacity is with facilities of at least 100 megawatts-electric (MWe) – there are more than 60 hydroelectric plants in the country of at least 100 MWe, 23 of which are greater than 1,000 MWe.

Still, Brazil's overwhelming reliance on hydroelectric-powered generation contributed in great measure to Brazil's 2001 power crisis and could undermine its ability to meet optimistic economic forecasts (see Ellsworth & Gibbs). The South American nation faced recurring blackouts in 2000 and 2001 because of drought conditions that left reservoirs about 30% full. Indeed, the Brazilian government was forced, in June 2001, to impose draconian measures to ration electricity usage throughout the country, with residential and industrial users ordered to cut energy consumption by 20% or face surcharges or power cutoffs.

Heavy rains that began late in 2001 and continued into early 2002 enabled the government to announce the end of the rationing program and even to boast that there would be no shortage of power at least through 2003. This was based on an assessment that reservoirs in Brazil's industrialized Southeast and Midwest were at 56% of capacity – enough to guarantee supply –



while in the more arid northeast, reservoirs were at 47.8% capacity. Nevertheless, current reservoir conditions aside, the country remains vulnerable to power outages.

In the midst of the power crisis, the Cardoso government launched an ambitious U.S. \$5 billion countrywide “crash” construction program that called for as many as 55 gas-fired power plants totaling 22,000 MW of capacity. With the return of the rains, however, the program was quickly abandoned and the successor Lula government has been happy to bolster the country’s hydro-electricity profile. Indeed, only 19 of those 55 proposed alternative natural gas fired projects have survived for a combined capacity of 4,012 MW, and Petrobras announced in July 2003 that it was canceling another four of these gas-fire power projects in which it had equity interest and re-evaluating two other projects, totaling 1,295 MW (see Ellsworth & Gibbs).

The country’s brief initiative to reduce its dependence on hydropower by building gas-fired power plants that would be fed by growing imports from Brazil’s Southern Cone neighbors, Argentina and Bolivia, as well as increased domestic natural gas production could have greatly eased the country’s delicate power situation. However, regulatory obstacles and the omnipotence of state energy firm Petrobras in both the gas and power sectors would also need to be addressed. This has complicated the shift to gas as support for Petrobras’ dominant status is quite entrenched.

Support for the continued monopoly of Petrobras has political, social, and historical roots. Brazil has followed an inward-oriented, state-led model of development since the 1930s. Brazil’s statist development model emerged as an ad-hoc response to the Great Depression and continued well into the 1980s. Import substitution industrialization (ISI) was a major feature of the Brazilian development strategy, and, over the 1930s and 1940s, the government became increasingly involved in producing basic inputs such as steel, aluminum, and electricity. A large number of important constituencies came to benefit directly from this development approach, and as a result, any shift to a more private sector led economic policy has to confront political opposition from those who preferred the status quo. Privatization in Brazil found opposition among labor unions, left-wing parties, industrialists who benefited from the state run enterprises (SOEs), and employees of the SOEs themselves (see Kingstone).

The fault lines in the support for the ISI model began to emerge after the oil crises of 1973 and 1979, which exposed how highly vulnerable Brazil was to inflation and balance of payment problems. The military dictatorship that held power in Brazil in the 1960s and 1970s had repressed labor organizations as part of their effort to contain wage demands, hoping to create conditions for accelerated state-led growth. But labor leaders struck back, confronting the state, both over democracy and equity and weakening the consensus over the ISI approach (see Kingstone). Limited privatization was initiated in the 1980s to restore investment in key areas of the economy and to improve the state's overall fiscal health.

The first privatizations began in the steel industry and then moved into petrochemicals. The initiative towards privatization gained momentum under the Cardoso administration, which could point to a positive record from the early privatization efforts and from the then-president's success in stabilizing the Brazilian economy as finance minister in a previous interim government prior to his election. However, privatization in the energy patch was more politically challenging than in other areas. Still, the experiences of the 1970s and 1980s gave impetus to strategies that would lower dependence on oil imports, and, by 1995, a constitutional amendment was passed to end Petrobras' monopoly over all aspects of oil production in Brazil (see Kingstone). The hope was that allowing oil concessions to private firms would enhance the amount of domestic production that could be available in the future.

### **Oil Supply and Demand**

With the passing of the "Petroleum Law" in 1997 and the formation of the ANP in 1998, Petrobras lost its monopoly over exploration and production rights in Brazil, with the ANP overseeing control of the country's energy sector. Yet, the state firm continues to hold the rights to the most promising fields and prospects, including in the oil-rich Campos Basin and continues to dominate the ANP's bidding rounds.

Brazil has impressive petroleum resources, with proven oil reserves of 8.1 billion barrels. The offshore Campos Basin, located southeast of Rio de Janeiro, accounts for most of Brazil's oil

reserves and is the country's most prolific production area, contributing roughly 80% of overall output. The Basin's Marlim field, with proved reserves of 2.38 billion barrels, is Brazil's largest oil producing field, accounting for about 34% of Brazil's crude production. Petrobras has been operator of the field since it came on stream in 1991. The following table shows the breakdown for Petrobras' crude production in Brazil by area:

**January 2002 Petrobras Crude Production in Brazil**

<b>Production Area</b>	<b>Volume ('000 B/D)</b>
Solimoes Basin	59
Rio Grande do Norte and Ceara	100
Sergipe and Alagoas	49
Bahia	50
Espirito Santo	24
Campos Basin	1199
Santos Basin	4
Xisto	4
<b>Total</b>	<b>1489</b>

The Santos Basin, located in southern Brazil, lies offshore. Basin production began in 1991 from two fields, Caravela (oil and gas) and Merluza (gas and condensate). Total liquids output from the basin peaked at 15,200 b/d in 1996, but a Texaco-led consortium and Royal Dutch/Shell and its partner Petrobras made significant discoveries in the Santos Basin respectively in August and December 2001, raising prospects for increased output there.

The Campos Basin, which first began production from the Enchova field in 1977, is the most important producing basin in Brazil today. As with the Santos Basin, Campos lies offshore with most of the larger fields in very deep waters. The basin extends to water depths of 3,400 meters.

The first deepwater field, Albacora, in Campos came on stream in 1984, followed by, among others, Marlim, Marlim Sul, and Roncador. Campos Basin output is scheduled to break the 2 million b/d mark in 2004 thanks to increasing levels from the Marlim, Marlim Sul, and Roncador fields. At least 30 oil fields have been discovered in the Campos Basin, with seven deepwater fields holding more than 100 million barrels of oil reserves each. Brazil's ANP suggests that fields in the basin collectively hold 7 to 8 billion barrels of recoverable oil/condensate reserves. Foreign operators including Shell, El Paso, Devon Energy, Repsol YPF, TotalFinaElf, and BG have all made discoveries in the basin within the last year.

The fate of Brazil's nascent private sector oil and gas exploration program will be a critical factor in the outlook for Brazil's energy sector. However, with uncertainty abounding in the country's natural gas sector, gas discoveries by foreign investors may be hard to monetize.

Starting in 1997, foreign oil companies first became involved in Brazil's energy sector through joint ventures with Petrobras. In 1999, enabled international operators began to compete with Petrobras in international bidding for exploration acreage. Brazil has tendered 189 blocks successfully out of 1,065 blocks offered although Petrobras scored the highest number of awards in each round. Some foreign drillers, though successful in acquiring major acreage, have experienced disappointing results in recent years, prompting some to speculate that Petrobras has held the most prolific acreage for itself.

Since the ANP conducted the first bidding round in 1999, international participation appears to have peaked, with the number of foreign players decreasing rapidly since June 2001. Thirty-eight international firms qualified to bid in the first round, with 14 companies ultimately bidding and 11 being awarded 12 blocks of the 27 on offer. Petrobras won five of the 12 blocks that were awarded. The second round, held in June 2000, offered up 23 blocks in nine sedimentary basins, with 27 companies bidding on the acreage. Sixteen firms won bids on 21 blocks, with Petrobras gaining a number of blocks in partnership with foreign companies.

The third bidding round, held in June 2001, attracted 42 interested firms with 26 bidding on 53 blocks, 43 offshore and mostly in deep and ultra-deep areas. Of the bidders, 22 firms won 34

blocks, with Petrobras scoring 13 blocks and partnerships in 2 others. In the fourth round, held in June 2002, the ANP offered up 54 blocks, 39 offshore and 15 onshore. Eight blocks were in “frontier” areas and six were in the Campos Basin. Of the 17 firms that bid on the acreage, 14 were awarded 21 blocks, with Petrobras again emerging as the biggest winner.

The fifth bidding round, conducted in August 2003, demonstrated the most dismal participation of international firms, with only six operators submitting bids. The fifth round represented a departure from the previous rounds in that a cell structure was introduced, covering most of the unlicensed sedimentary areas in Brazil's Atlantic Margin basins. Some 908 blocks (cells) spread across nine basins were put on offer in the fifth round, compared to a combined 157 offered in the four earlier rounds, but the area of each cell was much smaller than previously put forward. The new bidding structure allowed companies to amalgamate smaller cells into larger, contiguous blocks, but in the end, only 101 cells were awarded, a mere 11% of those on offer. Petrobras, the only firm bidding on deepwater blocks, handily won 88 of the 101 blocks awarded, gaining seven blocks in the Campos Basin, one block in the onshore Reconcavo Bahiano Basin and another in the Foz do Amazonas Basin. With the new bidding structure that appears to encourage smaller players into participation, it is unlikely that future bidding rounds will attract renewed interest from international firms, which have been put off by disappointing exploration results and unpalatable fiscal terms. Some 31 foreign oil companies have won acreage in Brazil during the first five bidding rounds.

A lack of reform in the natural gas sector has also discouraged investors who must consider whether there will be economic outlets for major gas finds. Petrobras' surprise announcement in September 2003 that recoverable reserves in the Santos Basin were 14.8 trillion cubic feet (Tcf), up from previous estimates of 2.5 Tcf, could radically change the outlook for the gas sector, giving Brazil incentive to use more gas in its power business but it hardly creates an environment attractive to foreign competition. The find could have negative consequences for operators in Bolivia as well. It will take several years to make an accurate assessment of the full potential of the find and several more years before commerciality can be proved and the acreage developed. While, in the short-term, the Santos Basin discovery won't change Brazil's energy mix, it could

have a tremendous impact on Brazil's reliance on imports from its neighbors and trade in the Southern Cone in the medium-to-long-term.

The under-subscription to exploration block tenders and subsequent disappointing results for some international investors mean the rise in Brazilian domestic oil production may not wind up being large enough to allow the country to serve as a major net exporter to neighboring countries or the United States, as had previously been hoped. Brazil's oil demand is projected to rise by 1% to 4% a year between now and 2015, according to Baker Institute forecasts (Medlock, Soligo, 2002) or between 400,000 b/d and 1.3 million b/d, meaning that much of the country's expected increase in production will simply offset domestic needs. Only limited crude oil exports will be made for quality reasons, if Brazil's refining sector cannot handle the processing of extra heavy production.

According to the International Energy Agency, in 1999 Brazilian total primary energy supply (TPES) was about 180 million tons of oil equivalent (MTOE), approximately 89 million tons of which was crude oil. To put this into perspective, Brazilian TPES is only about 1/13<sup>th</sup> of that in the United States, but accounts for almost half of TPES in all of South America. Thus, growth in Brazilian energy use is extremely important to the flow of energy supplies in the South American region. In addition, growth in Brazilian TPES will pull on marginal supplies in the Western Hemisphere, thereby making it important to the flow of energy supplies to countries such as the United States as well.

Using longitudinal data for 15 Latin American countries, the United States, and Canada, Medlock and Soligo (2002) posit a non-linear specification for demand by end-use sector to forecast energy demand in Brazil. Forecasts are made using three different scenarios of economic growth. Specifically, it assumed that real GDP per capita, measured in 1995 PPP\$, grows at a rate of 0.5%, 2.0%, and 3.5% per annum. Population is assumed to grow at 1.2% per annum (the projected rate of growth according to the *World Bank Development Indicators, 2001*), and energy prices are assumed to converge to their 20-year historical average values. The

results indicate that by the year 2015, TPES in Brazil will increase by between 1.07% and 2.85% per year under the GDP growth rate scenarios considered.

Because the forecast of TPES is generated by end-use sector, inferences can be made about the future composition of energy use. For example, an accelerated rate of growth in energy demand in the transportation sector relative to the other end-use sectors might cause the share of oil in total energy to increase. Similarly, an increase in electricity demand might cause natural gas use to increase relative to other primary fuels, notwithstanding the capacity for hydroelectric generation to increase. Under the assumption that the percentage of oil in total energy consumption in each end-use sector remains constant, or even rises somewhat, given the dependence of the transportation sector on oil, the forecasts for TPES indicate that by the year 2015 total primary oil requirements in Brazil will rise by between 1.24% and over 3.2% per year. If the percentage of oil in total energy consumption remains constant, Brazil can expect an increase in oil demand of between 0.42 million b/d and 1.27 million b/d, compared with consumption of about 1.8 million b/d in the first half of 2003.

### **Brazil's Gas Industry**

Brazil has 8.1 trillion cubic feet (Tcf) of natural gas reserves, the fourth largest in Latin America behind Venezuela, Bolivia, and Argentina. But despite these tremendous gas resources that Brazil has to tap into, gas currently makes up a mere 20 MMcf/d or 3% of the country's primary energy consumption, compared to 23% for North America and 19% in Western Europe. The relatively small role that gas plays in Brazil's energy matrix is in sharp contrast to other regions in the world and reflects the early state of Brazilian industry.

A lack of infrastructure and pipeline deliverability has limited outlets for natural gas production to local Brazilian gas markets. Brazil's domestic gas pipeline infrastructure is owned and controlled by Petrobras and is relatively limited due to Petrobras' historical focus on upstream oil development.

In recent years, infrastructure-planning activity has been directed towards linking the supply basins of Argentina and Bolivia to demand centers in South and Southeast Brazil. Additionally, Petrobras has entered into a joint venture with Shell to import liquefied natural gas (LNG) into Northeast Brazil through development of a re-gasification facility at Suape, in Pernambuco State.

The completion of the 1 Bcf/d BTB transnational pipeline is arguably the most significant recent event in the development of Brazil's natural gas industry. At a total cost of U.S. \$1.8 billion, the 3,100 km pipeline begins in the gas fields near Santa Cruz, Bolivia and serves 29 Brazilian cities, including Sao Paulo, before reaching its terminus at the city of Porto Alegre. It passes through the states of Mato Grosso do Sul, Sao Paulo, Parana, Santa Catarina, and Rio do Sul. These states account for 82% of domestic industrial production and 71% of national energy consumption.

The BTB pipeline provides a major natural gas backbone for Southeast Brazil and sufficient capacity to serve several large power projects, industrial load, and pockets of residential/commercial demand. Additionally, other pipelines from Argentina offer Brazil access to competing supplies. Other transnational pipelines linking Argentina to Chile, Brazil, and Uruguay, and potentially Peru's giant Camisea gas field to Brazil, offer a tantalizing glimpse of the degree of interconnectivity that could develop among Southern Cone nations, were regulatory and pricing obstacles to be surmounted.

Although the BTB began delivering gas to São Paulo in March 1999, Petrobras and Bolivia began wrangling over contract terms in 2002 when Petrobras found its throughput declined dramatically as economic growth and overall energy demand for the nation slid. But Petrobras' take-or-pay deal with Bolivia that runs through 2019 has meant that the state firm is being forced to pay higher prices for the Bolivian gas imports. The original 20-year deal in 1999 stipulated a basic price range of U.S. \$0.96- \$1.50 per thousand cubic feet and maximum volumes of 750-850 MMcf/d. Petrobras is now importing about one half of that amount and with the Brazilian currency's depreciation against the U.S. dollar, it is stuck paying the equivalent of U.S. \$3.60 per thousand cubic feet. Although a series of negotiations between Petrobras and its Bolivian counterpart to amend the take-or-pay contract to appease Petrobras failed to produce results; a



political decision by President Lula in November 2003 to support new Bolivian leader Carlos Mesa indefinitely suspended the price talks.

Brazil will continue to meet projected gas consumption from a combination of domestic production and imports in the short-term, though the massive gas find in the Santos Basin in 2003 could certainly have a great impact on Brazilian imports in the medium-to-long-term, depending on the commercialization of the find and the development time lag. Pro-gas policies of the previous government led to an increase in domestic gas production from approximately 140 Bcf in 1988 to a peak of 257 Bcf in 2000. Domestic consumption rose to an estimated 339 Bcf in 2001. With 58 years of reserves currently in the ground, production could readily be increased to more than 1 Tcf a year.

The major discovery by Petrobras in May 2003 in Block BS-400 of the Santos Basin could dramatically change Brazil's gas supply/demand picture in the medium-to-long-term and could have a profound impact on Southern Cone energy mix as well. Petrobras had initially estimated the discovery to be the largest it had had to date, at 2.47 Tcf, but subsequent testing prompted the state energy firm to announce in September 2003 that its estimates for the find had been boosted to a whopping 14.8 Tcf. Potentially tripling national gas reserves, the Santos find has sweeping implications for Brazil's ability to meet its burgeoning gas demand and for its need to rely so heavily upon its neighbors and commitment to a number of pipeline projects.

However, Petrobras is remaining guarded about the impact of the revised estimates, noting that it will take time to determine whether the discovery is commercially viable. Guilherme Estrella, Petrobras' director of exploration and production, noted on September 4, 2003 that it could take 8 to 10 years for the new gas discovered in the Santos Basin (off the coast of Sao Paulo) to reach Brazilian consumers. Estrella pointed out that the Santos volumes lie near large consumption centers – the Rio-Sao Paulo circuit – in the country's most industrialized region, the Southeast, which currently consumes much of Brazil's diesel fuel production, which could be replaced by the new gas (see Ellsworth & Gibbs).

The revised upward estimates of the Santos Basin gas discovery have added a new twist in Brazil's efforts to renegotiate its "take-or-pay" gas import contract with Bolivia. The price of Bolivia's gas imports – fixed in U.S. dollars and based on international market prices – is now roughly 30% more than the cost of the gas that Brazil imports from Argentina or produces itself. With Brazil paying for an obligatory 850 MMcf/d despite the fact that consumption requirements from Bolivia really stand at 500 MMcf/d, the Santos find is adding more impetus for the country to find more favorable terms for its Bolivian supplies. Under the agreement signed in the early 1990s, Bolivian imports were to increase steadily to a maximum of 1 Bcf/d between 2007 and 2019, when the contract is due to expire.

Although Brazil's gas demand has declined in recent years, it is still expected to grow by 41% from 1 Bcf/d in 2002 to 1.7 Bcf/d in 2007. Thermoelectric power is anticipated to account for 35% of that gas demand in 2007 compared to 19% in 2002. Natural gas currently accounts for only 3% of Brazil's energy consumption, and it is questionable now whether the forecast for gas to grow to about 25% of Brazil's energy matrix by 2010 -- thanks to an aggressive expansion in thermal power generation -- will bear out. A number of gas pipelines originating from Bolivia and Argentina that were proposed in the late 1990s to serve concentrated industrial and power generation demand potential in Brazil's Southern or Southeastern states have hit snags, either as a result of the drop in demand or the economic downturn and have either been stalled or cancelled (see Ellsworth/Gibbs).

To spur development of gas-fired power plants and eliminate project risks associated with commodity price volatility, the Ministry of Mines and Energy (MME) under President Cardoso established a fixed gas price of U.S. \$2.47/MMBtu for plants in the Emergency Thermal Power Program. However, even with this guaranteed fuel price, thermal independent power project (IPP) development in Brazil lagged due to the power-pricing regime established by the National Electricity Regulatory Agency (ANEEL).

Moreover, with the scaling back of the construction of new gas-fired thermal plants, Brazil is now using only about three-quarters of its daily contract supplied by Bolivia but, given take or pay contract terms, still has to pay U.S. \$1.50 per MMBtu for the full volume it agreed to buy

from its neighbor. In addition, while IPPs pay for their fuel in U.S. dollars, they are forced to sell their power to distributors in Brazilian *reais*. Furthermore, final prices to distributors are capped at a maximum limit. This regulatory policy not only limits IPPs to small fixed margins, but also exposes them to substantial currency risk (see Ellsworth/Gibb).

Failure to resolve the disparity between the gas price and generation price cap will continue to inhibit the foreign investment that is essential to the development of sufficient generation capacity to meet future power demand. The consequences are readily apparent, as critical industries, such as aluminum, mining, and chemicals, have cited a lack of generation capacity as a constraint to future production growth. If sufficient reserve thermal generation capacity does not come on line as an insurance against future drought, the country's future economic growth could be severely jeopardized. Recognizing the problems, the government has considered enacting emergency regulations that mitigate some foreign exchange risk by fixing the price of imported gas in *reais* for periods of 12 months. During that period, Petrobras would absorb costs from currency fluctuations, although they would eventually be able to pass the costs on to distributors and consumers. While this system would allow markets to correct in the long-run, it might still create distortions.

With international developers shying away, Petrobras has fortified its leading role in the development of thermal power generation in Brazil with substantial short-term losses. In its first quarter financial results, Petrobras took a U.S. \$236 million provision for financial exposure to thermal generation in 2003. The company has minority equity stakes in nine of the 12 thermal power projects completed in 2001, and is the sole developer for the 602 MW Canoas project in Rio Grande do Sul state and the 466 MW Tres Lagoas project in Mato Grosso do Sul. In the ten-year expansion plan for the Brazilian electric sector, Petrobras will have a minority role in 23 thermal power plants. Twelve of these plants will be dedicated to the production of electricity only and will account for 3,705 MW of capacity. The other 11 plants will produce both power and steam, with the electricity allocated for Petrobras' consumption and sales to large industrials (see Ellsworth/Gibb).

Traditionally, in many countries, including Brazil, the state has played a central role in electricity development. Electricity services are critical to economic development and the elimination of poverty. How electricity is distributed and consumed can have an important impact on the economy and society. Political institutions influence how politicians distribute electricity. Aggregate results among the world's developing countries revealed that authoritarian regimes have favored bringing electricity services to the industry sector as the highest priority (See Brown). In Latin America, the commercial-public sector witnessed disproportionate consumption under authoritarian governments, implying that regime type affects the strategy politicians favor in the distribution of benefits. In Brazil, as in other developing countries, under authoritarian rule, politicians were more likely to distribute electricity to sectors in which government bureaucrats maintained some level of control: the public sector. Under democratic governance, however, this began to change and the residential household sector witnessed relatively high levels of consumption (see Brown). Electricity consumption by the household sector hovered around 20% during the period of authoritarian rule (1964-1985) in Brazil. By contrast, electricity consumption by the household sector increased dramatically shortly after Brazilians regained the right to directly elect a president. In two to three short years, electricity consumption by the household sector shot up from 20% to 25%, roughly a 25% increase.

The interest from the central government in promoting and providing electricity services underscores one of the basic dilemmas of national energy policy for many countries. State involvement in the electricity sector can often come at a high cost, especially where consumer subsidies are provided or where investment is required in less than commercial, rural markets. As noted above, Petrobras took a U.S. \$236 million provision for financial exposure to thermal generation in early 2003. The question facing Brazil is whether Petrobras, having embarked on a move towards corporatization, can provide a competitive return to shareholders if it is burdened with the social and fiscal responsibility of Brazil's gas and power sectors. A study of Petrobras' performance relative to other international oil companies reveals that the Brazilian firm is competitive with multinational oil and gas companies on a wide variety of measures including: size; life of assets; profitability; efficiency (real sales per employee); investment (capital expenditures plus sales); output (real sales, adjusted by CPI); employment; and leverage (total

debt plus total assets) (see presentation by Aegis Energy Advisors). Nevertheless, the company faces many challenges in maintaining or improving this competitive position.

Absolute size comparisons show that Petrobras is similar in size to the integrated majors in many measures such as reserves, production and refining capacity, but smaller than these firms in such financial measures as total assets, revenue, net income and earnings before interest, taxes and depreciation (EBITDA). Petrobras, however, has many fewer employees – about 57 percent on average – than the integrated major companies. Operations measures show that Petrobras' reserves are much more liquid oriented and long-lived than the majors or integrated majors, but that its gas reserves are much smaller than these competitors are. Petrobras is somewhat less downstream integrated, in terms of refinery integration, than the majors are.

Petrobras' operating performance is mixed. In the upstream sector, it lags behind its international oil company peers, with earnings adversely affected because production is predominantly heavy oil and oil from deep offshore fields. Royalties and the “take” by the Brazilian central government are also comparatively high. In the downstream sector, Petrobras exhibits performance that is superior to its peers, despite increased competition in recent years. This achievement reflects perhaps its protected status inside the Brazilian market and may not be sustainable in the long run if the Brazilian government returns to a path of accelerated liberalization in the country's energy sector. Petrobras' strong downstream profitability allows it to perform well in terms of costs and profitability per employee.

The Brazilian state firm's overall financial position is comparable to its peer class, which would bode well for a further privatization of the firm. Its “leverage” as reflected in long-term debt is comparable to its peers. However, its use of capital and equity, measured as a percentage of earnings, show that the conglomerate has lower book equity, enjoys comparatively low income tax rates, and reinvests much more of its earnings in production expansion and refining upgrades than the majors reinvest.

The full privatization of Petrobras would entail several challenges, not the least of which is its overwhelming domination of domestic energy businesses. As a government entity, Petrobras is

now burdened with certain responsibilities that it could shed, were it a fully private entity. But from a public welfare point of view, stronger regulatory and enforcement frameworks would be needed and even a forced sell-off of certain key Petrobras' assets to ensure truly competitive energy markets would result in Brazil.

The goals of Petrobras' ongoing corporate restructuring seem to mirror those of its multi-national cohorts. It is entering international capital markets to compete for resources, rationalizing its internal information systems and management training procedures according to international standards, and fostering an identity among its employees that tries to distinguish them from the average worker in the Brazilian public sector enterprise. "We've entered the race for capital," Ronnie Vaz Moreira, Petrobras' CFO, has said, "We want to send a message to the market that we don't want our debt tied to Brazil risk; we want to be compared to our oil and gas peers."

But questions remain whether Petrobras can sustain its corporatized performance in the long run if it is increasingly called on to accommodate social policy or secure energy infrastructure for the nation, regardless of profitability. On the flip side, any move to more fully competitive energy markets inside Brazil, while reducing the long-term financial burden on the state, will almost certainly affect Petrobras' profitability as earnings are currently buttressed by the company's politically well-guarded monopoly status in many businesses inside Brazil (see presentation by Aegis Energy Advisors).

The choice remains open to privatize Petrobras further. To do so would require compensation of stakeholders but this is likely to be more politically feasible than in other societies (see Lewis). Ironically, despite apparent popular opposition to any further sell-off of the state concern, the costs of privatization, which typically can slow the political process of such reform, have already largely been borne by company, government, and the Brazilian public. The corporatization of Petrobras thus far has produced an integrated company capable of competing economically with its peers in the turbulent international energy marketplace.

The energy crisis of 2001 may have been ameliorated by rain and rationing, but Brazilians, like Californians, could still face new crises in the future. Although Petrobras may often be

compared with Petrochina, Sinopec, and CNOOC in terms of performance and as future competitors for energy supplies, the gradual and informal privatization of China's oil and gas enterprises has only exacerbated conflict between central state and local government, government and industry, management and employees. Petrobras does not face such problems in its further privatization (see Lewis and privatization presentation by Aegis Energy Advisors).

The obstacles to the development of Petrobras into a major competitor in international oil and gas markets mainly lie with the failure to decentralize fiscal authority successfully, including the responsibility for environmental cleanup, and the under-development of Brazil's new regulatory authority and its ability to constrain the monopolistic behavior of this semi-privatized, giant energy conglomerate. Although there have been modest achievements with the creation of a regulatory agency (ANP) that can enforce newly enacted laws and regulations opening up the energy sector, major obstacles remain that discourage both domestic and foreign investment:

- Despite the liberalization of fuel prices, including imports, the federal government continues to use its ownership authority to set energy prices as a macro-economic policy tool, with resulting swings in prices for the Brazilian consumer according to shifting government goals;
- Despite the establishment of an independent regulatory authority, potential investors seem to be discouraged by the monopoly of information on production and transmission of hydrocarbons held by Petrobras and the lack of alternative, credible sources of data and analysis;
- Despite instructions by the ANP to do so, Petrobras apparently has been slow to respond to regulations that require it to open up third-party access by non-affiliated marketers and shippers (especially in the case of trans-Bolivian gas pipeline access);
- Despite government statements that it intends to internationalize the energy sector, competition in the gas market is hindered by a lack of international cooperation in the

Southern Cone to create a truly regional gas market that delinks gas from oil prices and links power and gas prices.

In conclusion, Brazil can afford to privatize Petrobras and liberalize the energy sector in order to guarantee the low-cost provision of fuels in future energy crises. However, to implement these reforms successfully, it needs to create a decentralized fiscal system that does not require a state oil and gas company as a macro-economic policy tool, and it needs to strengthen the independent regulatory authority of the state in order to protect the interests of the Brazilian consumer. Fortunately, for Brazilians, the institutional obstacles to such reforms are lower than in other transition economies.

### **Recommendations**

➤ *Integrated Southern Cone gas prices.*

A truly regional (Southern Cone) gas market requires the transnational harmonization of natural gas commodity prices between Argentina, Brazil, and Bolivia. Producer gas prices in all three countries are currently based on a netback from regulated wholesale and retail prices, which in turn are tied to a basket of international oil prices. Wellhead prices seen by producers are therefore not market derived, and due to political and regulatory uncertainty, often impede full participation by foreign producers. Assuming that the political will exists to tame the power of state-run monopolies, Brazil and other Southern Cone countries should seek to move away from a gas price linked to oil. Ideally, new market entrants, such as third-party marketers and private producers, would add diversity and competition to the market. This would be a first step towards the creation of a commoditized gas market, with a gas price determined by supply and demand fundamentals.

➤ *Linkage of power and gas prices.*



The development of Brazil's gas industry is predicated on the development of gas-fired power generation. However, the development of this industry is hampered by the "delinkage" of power from gas prices. Under a rational pricing mechanism, power prices are determined by the marginal power producer, most often natural gas-fired and margins are guaranteed through power purchase agreements that explicitly link power to gas prices. Presently, power is sold at a regulated rate in *reais*. Gas, however is sold at a fixed rate in U.S. dollars to new power plants. All other consumers pay a price linked to international oil prices. This not only exposes the power producer/gas consumer to commodity price risk, but also to risk from currency fluctuations. This problem has been exacerbated by higher oil prices, which are completely unrelated to the Brazilian gas market. Again, the creation of a competitive gas market in the Southern Cone would solve many of the problems of tying commodity prices to arbitrary indices.

➤ *Strong regulatory agencies and policy coordination across countries.*

On paper, Brazil has organized its gas pipeline industry as an open access system. However, Petrobras can flout its dominant position in the industry and effectively shut out potential competitors. Most foreign energy companies consider it challenging to enter the Brazilian energy market without the involvement of Petrobras. The ANP requires more "teeth" to be able to enforce existing third-party access rules. The effectiveness of the ANP is currently limited by the market and political power of Petrobras. The budget of the ANP and other regulatory bodies should also be enhanced to ensure that they are adequately staffed and not subject to interference from other bodies of government.

➤ *Collection and dissemination of information.*

Currently, Petrobras holds a monopoly on information on Brazil's production and transmission system. The ANP requires federal budgetary support to create and maintain information systems that can be disseminated electronically to all potential market participants. This will create a level playing field capacity and transparency for all participants.

➤ *Improved third party access to transmission.*

Third-party producers and marketers that are not vertically integrated with pipeline and gathering system can be discriminated against by Petrobras, which controls domestic and major transnational pipeline routes. Access to pipeline systems must be made available on a nondiscriminatory basis.

➤ *Creation of market mechanisms to attract participants.*

Creation of a secondary market in pipeline capacity, with active participation of producers, marketers, and consumers would create some price transparency.