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COUNTRY ANALYSIS BRIEFS

Brazil

Last Updated: January 2011

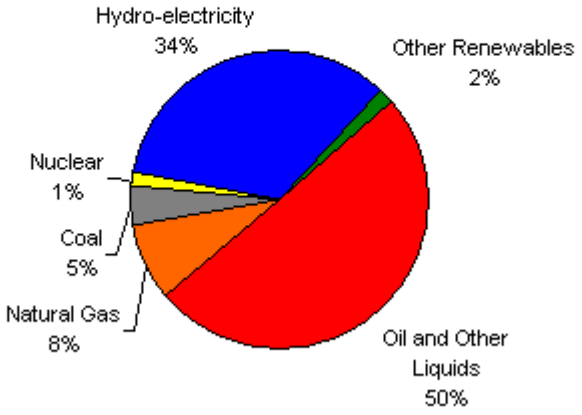
Background

Brazil has experienced rapidly expanding oil, natural gas, and electricity consumption in recent years.

Brazil is the ninth largest energy consumer in the world and the third largest in the Western Hemisphere, behind the United States and Canada. Total primary energy consumption in Brazil has increased by close to a third in the last decade, due to sustained economic growth. In addition, Brazil has made great strides in increasing its total energy production, particularly oil and ethanol. Increasing domestic oil production has been a long-term goal of the Brazilian government, and recent discoveries of large offshore, pre-salt oil deposits could transform Brazil into one of the largest oil producers in the world.

Total Brazilian energy consumption grew to 10.6 quadrillion British thermal units (BTU) in 2008. The largest share of Brazil's total energy consumption comes from oil and other liquids (50 percent, including ethanol), followed by hydroelectricity (34 percent) and natural gas (8 percent). Natural gas is currently a small share of total energy consumption, but attempts to diversify electricity generation from hydropower to gas-fired power plants could cause natural gas consumption to grow in the coming years.

Total Energy Consumption in Brazil, by Type (2008)



Source: Energy Information Administration

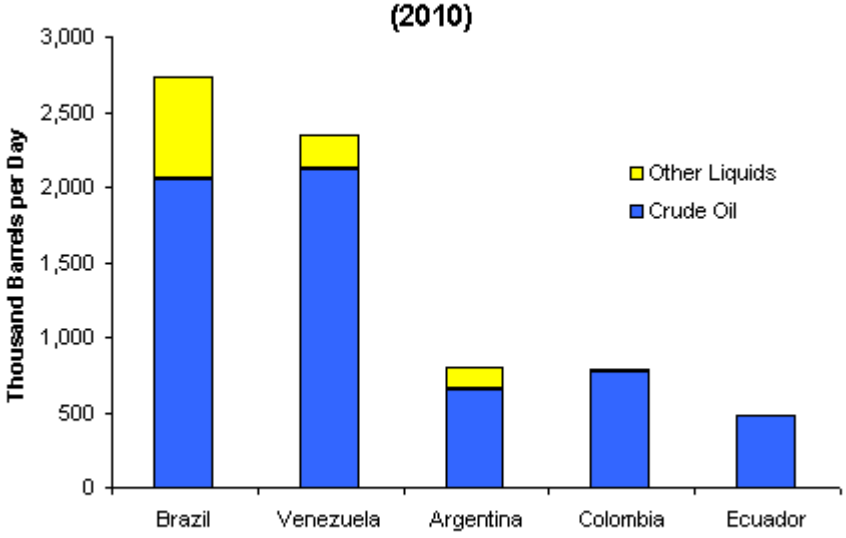
Oil and Other Liquids

Brazil was the largest producer of liquids in South America in 2010.

Overview

According to the *Oil and Gas Journal (OGJ)*, Brazil has 12.9 billion barrels of proven oil reserves in 2011, the second-largest in South America after Venezuela. The offshore Campos and Santos Basins, located off of the country's southeast coast, hold the vast majority of Brazil's proven reserves. In 2010, Brazil produced 2.7 million barrels per day (bbl/d) of liquids, of which 75 percent was crude oil. Brazil's oil production has risen steadily in recent years, with the country's oil production in 2010 about 150,000 bbl/d (6 percent) higher than in 2009.

Top 5 South American Liquids Producers (2010)



Source: EIA International Energy Statistics Database

Based on its January 2011 *Short-Term Energy Outlook*, EIA forecasts Brazilian oil production to reach 2.9 million bbl/d in 2011 and 3.0 million bbl/d in 2012. Brazil's liquids consumption averaged 2.52 million bbl/d in 2009. As a result of this rising oil production and flat consumption growth, Brazil became a net oil exporter in 2009.

Exploration and Production

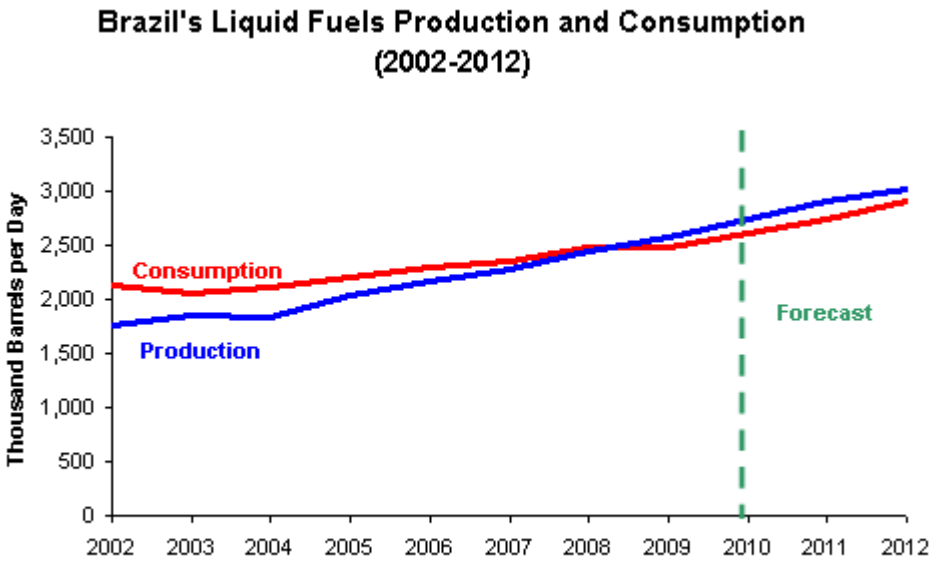
Most Brazilian oil is produced in the southeastern region of the country in Rio de Janeiro and

Espírito Santo states. More than 90 percent Brazil's oil production is offshore in very deep water and consists of mostly heavy grades. Five fields in the Campos Basin (Marlim, Marlim Sul, Marlim Leste, Roncador, and Barracuda) account for more than half of Brazil's crude oil production. These Petrobras-operated fields each produce between 100,000 and 400,000 bbl/d. International oil companies also play a role in Brazilian production. The Shell-operated Parque de Conchas project and the Chevron-operated Frade project are expected to achieve production levels of 100,000 bbl/d and 68,000 bbl/d, respectively.

Recent offshore exploration efforts in Brazil have yielded massive discoveries of pre-salt oil fields.

Exports

In 2009, Brazil's liquids production surpassed its liquids consumption. In the January 2011 *Short-Term Energy Outlook*, EIA projects that Brazil will continue to be a net exporter through the end of 2012. As pre-salt discoveries boost Brazilian production in the medium and long term, crude oil exports should steadily increase. However, this export growth could be moderated by increases in domestic consumption driven by rapid economic growth. Brazil still imports some light crude oil to meet the needs of its refinery fleet.



Source: EIA Short-Term Energy Outlook, January 2011

Sector Organization

State-controlled Petrobras is the dominant participant in Brazil's oil sector, holding important positions in up-, mid-, and downstream activities. The company held a monopoly on oil-related activities in the country until 1997, when the government opened the sector to competition. Royal Dutch Shell was the first foreign crude oil producer in the country, and it is now joined by Chevron, Repsol, Anadarko, Devon, Statoil and BG Group. Private competition in the sector is not just from foreign companies: Brazilian oil company OGX, which is staffed largely with former Petrobras employees, expects to start producing in the Campos Basin sometime in 2011.

The principal government agency charged with monitoring the oil sector is the National Petroleum Agency (ANP), which is responsible for issuing exploration and production licenses and ensuring compliance with relevant regulations. Recent legislation concerning pre-salt exploration and production has changed the operating environment somewhat. A full discussion of this can be found in the pre-salt section.

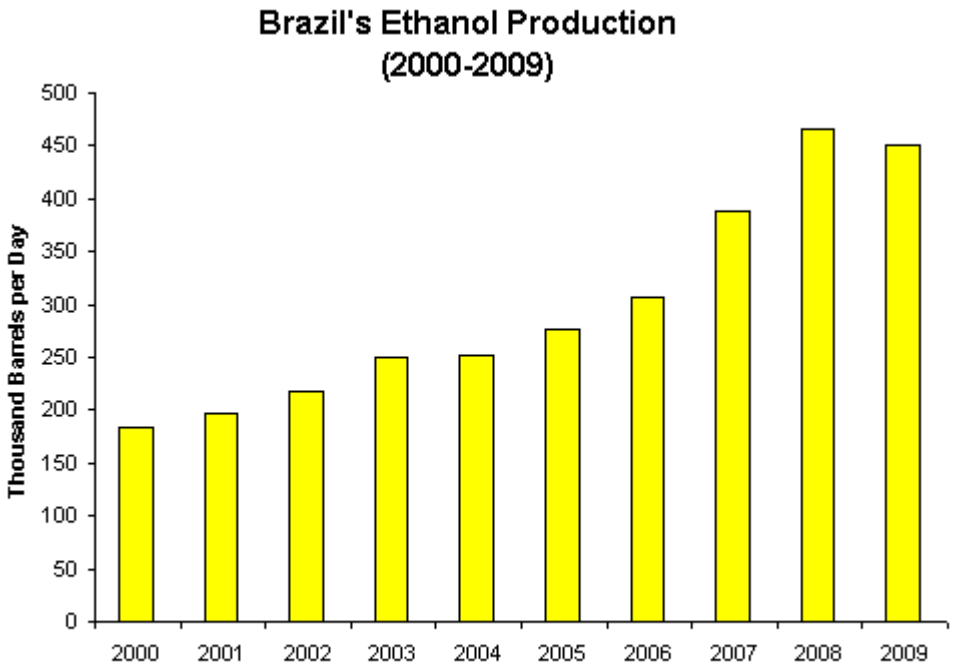
Downstream

According to *OGJ*, Brazil has 1.9 million bbl/d of crude oil refining capacity spread amongst 13 refineries. Petrobras operates 11 facilities, the largest being the 360,000-bbl/d Paulinia refinery in Sao Paulo. The refining capacity in Brazil is relatively simple, meaning that the country must export some of its heavy crude oil production and import light crude oil – domestic crude constituted 79 percent of total domestic refinery feedstock in 2009. To meet burgeoning domestic demand, Petrobras plans to increase its Brazilian refining capacity to more than 3.0 million bbl/d by 2020. Under the company's 2010-2014 business plan, Petrobras will build five additional

refineries to meet this goal. These facilities will be designed to process heavier grades of crude, increasing the share of Brazilian oil processed in these refineries to 91 percent.

Ethanol

Brazil is the second largest producer of ethanol in the world behind the United States. In 2009, Brazil produced 450,000 bbl/d of ethanol, down from 467,000 in 2008. Despite this decline, the Brazilian Sugarcane Industry Association (UNICA) expects production to rise again following a successful 2010-2011 harvest season.



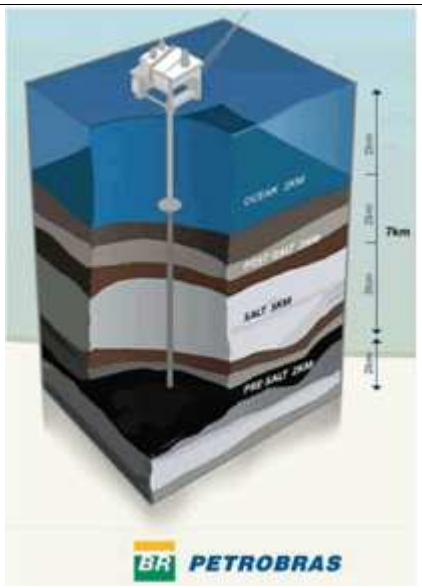
Source: EIA International Energy Statistics Database

Although Brazil is the world's leading ethanol exporter, most of this added production will go to meet increasing domestic demand. All gasoline in Brazil contains ethanol, with blending levels varying from 20-25 percent. Additionally, over half of all cars in the country are of the flex-fuel variety, meaning that they can run on 100 percent ethanol or an ethanol-gasoline mixture.

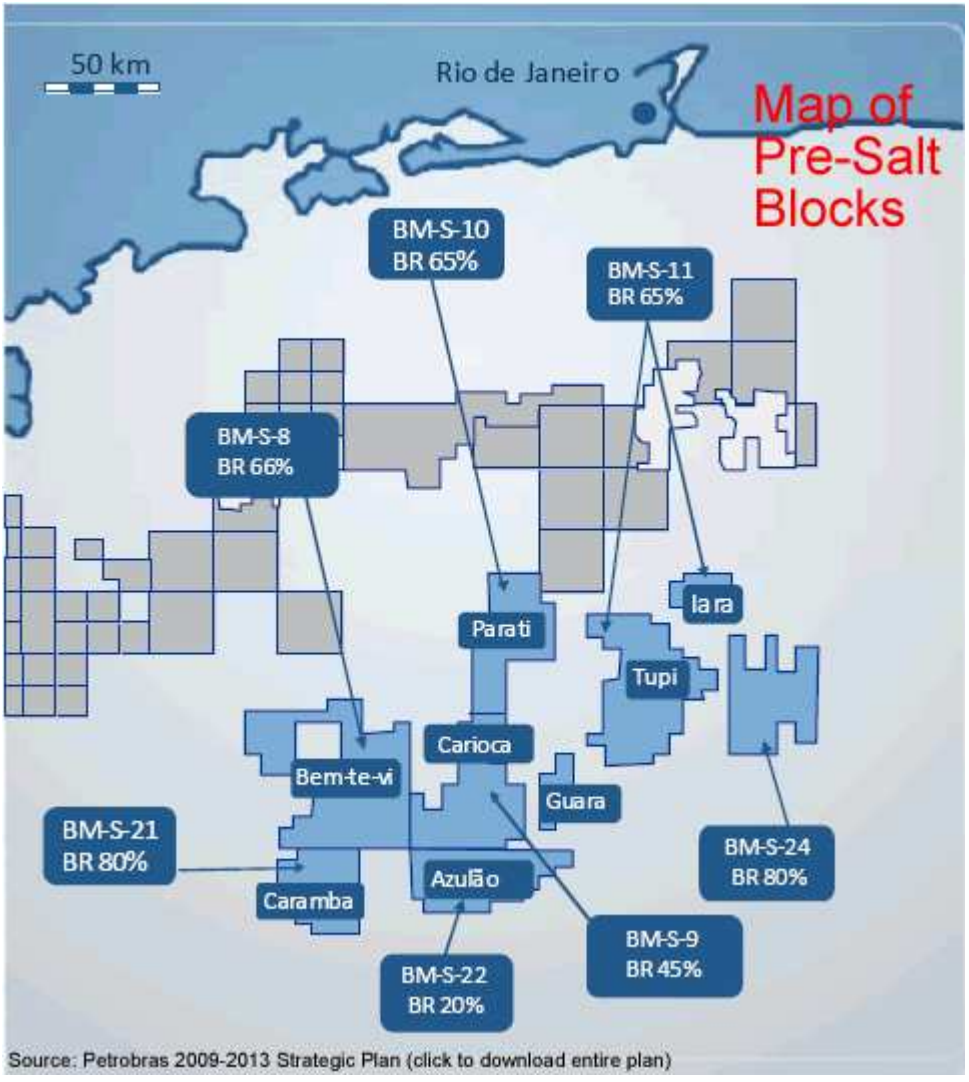
Pre-Salt Oil

The largest oil discoveries in recent years have come from Brazil 's offshore, pre-salt basins.

A consortium of Petrobras, BG Group, and Petrogal discovered the Tupi field in 2007, which contains substantial reserves that occur in a pre-salt zone 18,000 feet below the ocean surface under a thick layer of salt. Following Tupi, numerous additional pre-salt finds were announced in the Santos Basin, such as Iracema, Carioca, Iara, Libra, Franco and Guara. Additional pre-salt discoveries were also announced in the Campos and Espirito Santo Basins. Estimates for the total pre-salt resources vary. Some analysts place total extent of pre-salt recoverable oil and natural gas reserves at more than 50 billion barrels of oil equivalent.



In December, 2010 Petrobras submitted a declaration of commerciality to the ANP for the Tupi and Iracema fields, which renamed the fields Lula and Cernambi, respectively. The total recoverable reserve estimate for these fields is 8.3 billon barrels of oil equivalent (boe) (6.5 billion boe for Tupi and 1.8 billion for Iracema).



Petrobras plans to develop its major pre-salt assets in three discrete phases: extended well tests,

pilot projects, then large-scale production through multiple, duplicate floating production, storage, and offloading (FPSO) facilities. The Tupi Pilot project, which has a production capacity of 100,000 bbl/d, began in October 2010. In its 2010-2014 business plan, Petrobras plans to invest $33 billion in pre-salt exploration and production activities to achieve an oil production target of close to 4 million bbl/d by 2020. More than a quarter of this target is to come from pre-salt oil.

Brazil's pre-salt announcements immediately transformed the nature and focus of Brazil's oil sector, and the potential impact of the discoveries upon world oil markets is vast. However, considerable challenges must still be overcome in order to bring these reserves to fruition. The difficulty of accessing reserves, considering both the large depths and pressures involved with pre-salt oil production, represent technical hurdles that must be overcome. Further, the scale of the proposed expansion in production will also stretch Petrobras' exploration and production resources and Brazil's infrastructure.

Regulatory Reforms

The Brazilian government released the proposed regulatory framework for the pre-salt reserves in August 2009. The framework consists of four pieces of legislation. The first two laws were signed into law in July of 2010. The first law creates a new agency, Petrosal, to administer new pre-salt production. The second allowed the government to capitalize Petrobras by granting the company 5 billion bbl of unlicensed pre-salt oil reserves in exchange for larger ownership share.

The other two bills, establishing a new development fund to manage government revenues from pre-salt oil and laying out a new production sharing agreement (PSA) system for pre-salt reserves, passed through Brazil's congress in December of 2010. In contrast to the earlier concession-based framework, Petrobras will be the sole operator of each PSA and would hold a minimum 30 percent stake in all pre-salt projects. Some analysts fear that the new system's increased level of state involvement and drain on Petrobras' resources could slow the development of these resources.

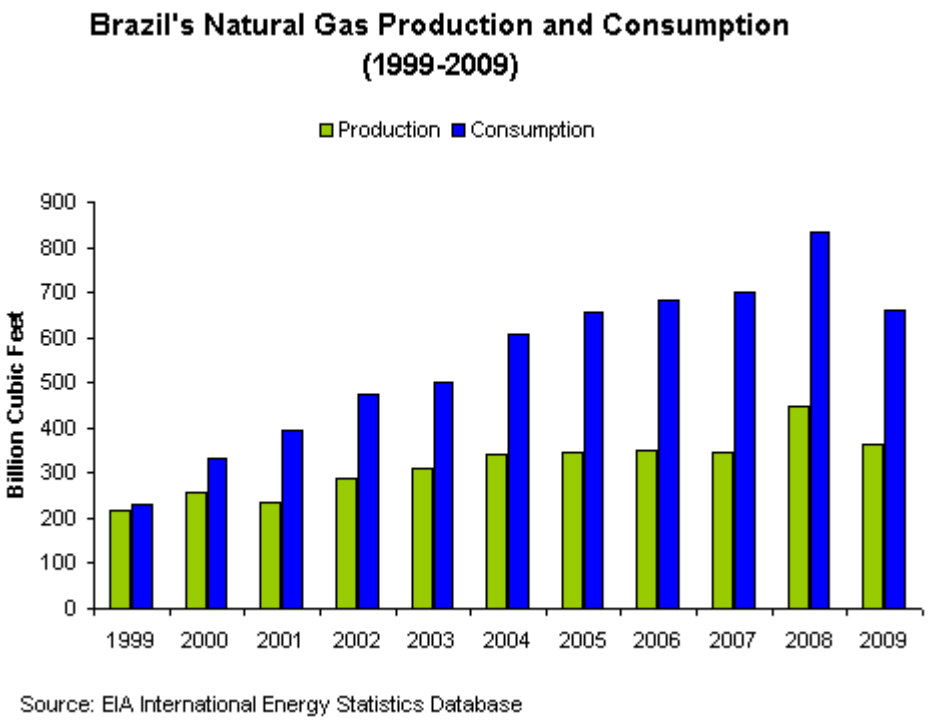
Debate on the issue of royalty distribution among Brazilian states is expected to continue well into 2011. Once a final agreement is in place, Brazil is expected to hold an eleventh auction round for exploration blocks in 2011.

Natural Gas

Natural gas constitutes only a small portion of Brazil 's total energy consumption.

OGJ reported that Brazil had 12.9 trillion cubic feet (Tcf) of proven natural gas reserves in 2011. The Campos, Espírito Santo, and Santos Basins hold the majority of reserves, but sizable reserves also exist in the interior of the country. Despite Brazil's substantial natural gas reserves, natural gas production has grown slowly in recent years, mainly due to a lack of domestic transportation capacity and low domestic prices. In 2009, Brazil produced 363 billion cubic feet (Bcf) of natural gas – the majority of this production was associated with oil.

Natural gas consumption is a small part of the country's overall energy mix, constituting only 8 percent of total energy consumption in 2008. Brazil experienced a demand spike from 701 Bcf to 835 Bcf in 2008, as a result of low water levels in hydroelectricity reservoirs increased demand for thermal power generation and high oil prices made natural gas an attractive substitute fuel in the industrial sector. In 2009 demand contracted to 661 Bcf.



Source: EIA International Energy Statistics Database

Sector Organization

Petrobras plays a dominant role in Brazil's entire natural gas supply chain. In addition to controlling the vast majority of the country's natural gas reserves, the company is responsible for most domestic Brazilian gas production and for gas imports from Bolivia (see below). Further, Petrobras controls the national transmission network and it holds a stake in 18 of Brazil's 27 state-owned natural gas distribution companies. However, Brazil passed a new Natural Gas Law in 2009 which created a separate regulatory framework for natural gas. This law is expected to facilitate private investment in the sector.

Exploration and Production

The largest share of Brazil's natural gas production occurs in offshore fields in the Campos Basin in Rio de Janeiro state. Most onshore production occurs in Amazonas and Bahia states and is mostly for local consumption due to the shortage of transportation infrastructure.

In order to meet rising demand and decrease reliance on imports, Petrobras plans to bring several new natural gas projects online over the coming years. The largest is the Mexilhao project, which contains estimated total reserves of 8 Tcf. Current plans call for production to come online in March 2011 at 154 Bcf per year, eventually rising to 193 Bcf per year.

As discussed in the oil section of this report, recent announcements about discoveries in Brazil's offshore pre-salt have generated much excitement. Along with their potential to significantly increase oil production in the country, the pre-salt areas are estimated to contain sizable natural gas reserves as well. According to Petrobras, Tupi alone could contain 5-7 Tcf of recoverable natural gas, which if proven, could increase Brazil's total natural gas reserves by 50 percent.

Pipelines

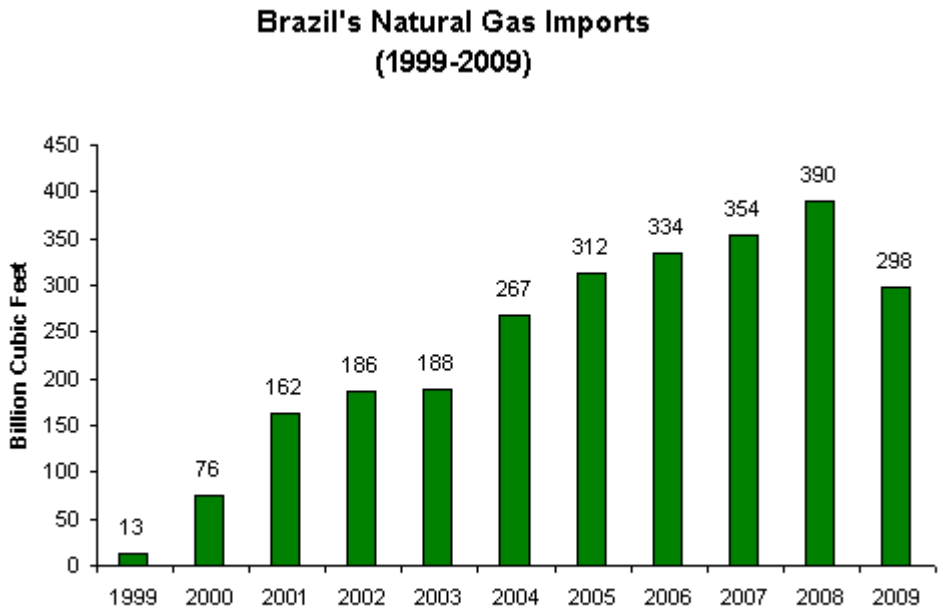
Petrobras operates Brazil's domestic natural gas transport system. The network has over 4,000 miles of natural gas pipelines, mostly in the southeast and northeast parts of the country. For years these systems were not interconnected, which has hindered the development of domestic production and consumption. However, in March 2010 the Southeast Northeast Interconnection Gas Pipeline (GASENE) linked these two markets for the first time. This 870-mile pipeline, which runs from Rio de Janeiro to Bahia, is the longest ever built in Brazil. GASENE is intended to offset supply shortfalls in the northeast caused by declining local production with southeastern offshore supply.

The other major natural gas market in Brazil is the Amazon region. In 2009, Petrobras completed construction of the Urucu pipeline linking Urucu to Manaus, the capital of Amazonas state. This project is expected to facilitate the development of the Amazon's considerable, and largely

untapped, natural gas reserves.

Imports

Brazil imported 298 Bcf of natural gas in 2009, a 24 percent drop from 2008. The decline in Brazilian overall natural gas demand, coupled with policy choices aimed at reducing imports, led to this decline. The country currently receives imports by pipeline from Bolivia and liquefied natural gas (LNG) imports from Trinidad and Tobago and Nigeria. Import growth in the future is expected to be met more with LNG than with conventional pipeline imports.



Source: EIA International Energy Statistics Database

Imports from Bolivia

Brazil imports natural gas from Bolivia via the Gasbol pipeline, which links Santa Cruz, Bolivia to Porto Alegre, Brazil, via Sao Paulo. The 2,000-mile Gasbol has a maximum capacity of 1.1 Bcf per day (Bcf/d). In early 2009, Brazil announced that it would reduce imports from Bolivia from 1.1 Bcf/d to 0.7 Bcf/d. According to ANP, Brazilian imports of Bolivian gas have since declined by 27 percent. However, Bolivia still accounted for 96 percent of Brazil's total natural gas imports.

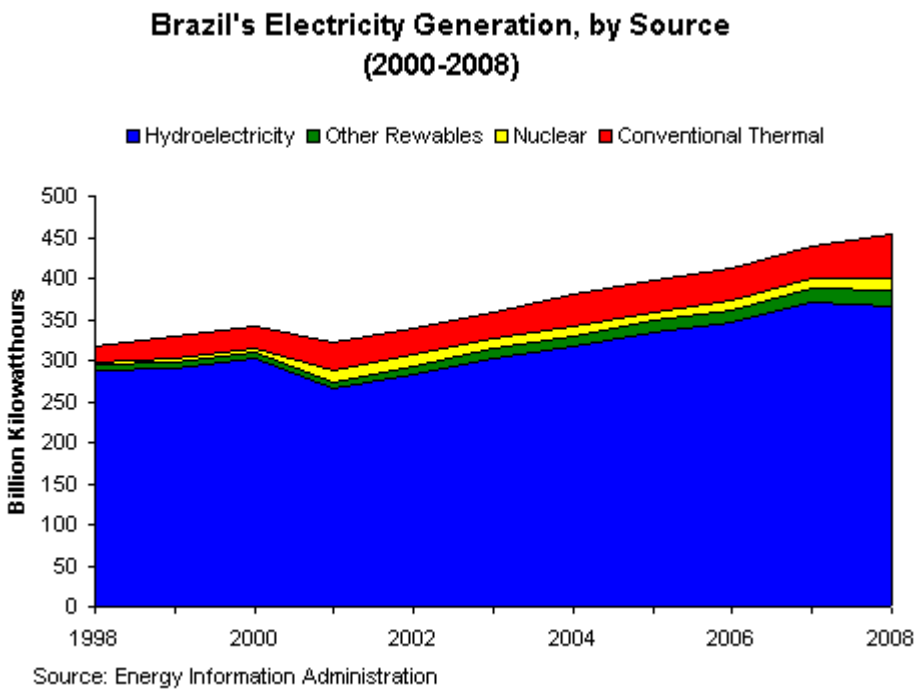
Liquefied Natural Gas

Brazil has two liquefied natural gas (LNG) regasification terminals, both installed in the last two years: the Pecem terminal in the northeast, and the Guanabara Bay terminal in the southeast. Both facilities are floating regasification and storage units (FRSU) operated by Golar LNG, with a combined sendout capacity of 740 MMcf/d. The Pecem received its first LNG cargo from Trinidad and Tobago in July 2008, while the Guanabara Bay terminal came online in May 2009. According to ANP, Brazil received 15 Bcf of natural gas in the form of LNG in 2009, mostly from Trinidad and Tobago.

Electricity

Brazil has the third-largest electricity sector in the Western Hemisphere, behind the United States and Canada.

Brazil had 104 gigawatts of installed generating capacity in 2008, with the single largest share being hydroelectric capacity. In 2009, the country generated 461 billion kilowatthours (Bkwh) of electric power, while consuming 421 Bkwh. Hydropower accounted for 84 percent of this generation, with smaller amounts coming from conventional thermal, nuclear, and other renewable sources.



Sector Organization

The government plays a substantial role in the Brazilian electricity sector. Until the 1990s, the state controlled the electricity sector almost completely. Brazil initiated an electricity sector privatization process in 1996. However, when drier-than-average weather led to severe energy shortages in 2000 and 2001, the process stalled. While around 65 percent of electricity distribution companies were privatized, the bulk of Brazil's major generation assets remain under government control. Electrobras, a state-owned holding company, constitutes the dominant player in the electricity market. The government also owns almost the entire electricity transmission network.

In 2004, the Brazilian government implemented a new Power Sector Model. This hybrid approach to state involvement splits the sector into regulated and unregulated markets for different producers and consumers. This allows for both public and private investment in new generation and distribution projects. Under the plan, however, Electrobras was formally excluded from privatization efforts.

Hydroelectricity

Brazil generated 387 Bkwh of hydroelectric power in 2009. Many of Brazil's hydropower generating facilities are located far away from the main demand centers, resulting in high transmission and distribution losses. Brazil's largest hydroelectric generation asset is the Itaipu facility on the Parana River, which Brazil maintains with Paraguay. According to Itaipu Binacional, the facility generated 94.7 Bkwh of electricity in 2008. Although Brazilian planners aspire to diversify away from hydropower to mitigate supply shortage risks brought about by dry weather, new hydro projects continue to move forward. Most notable among these projects is the Belo Monte plant in the Amazon basin which, upon completion, will be the third largest hydroelectric plant in the world behind China's Three Gorges Dam and Itaipu.

Thermal Generation

Thermal generating sources provided only a small part of Brazil's electricity supply, contributing about 13 percent in 2009. According to Brazil's Ministry of Energy and Mines, the largest contributor to Brazil's thermal power generation in 2009 was biomass (38 percent). This figure includes "autoproducer" electricity, which is generated at ethanol plants by burning sugar cane byproducts. This source could increase in significance if transmission and distribution hurdles are overcome.

Other thermal generation sources play a small role in Brazil's electricity mix. Petroleum use in the electricity sector has been declining for some time. Despite efforts to increase natural gas use in the power generation fuel mix, natural gas share of thermal generation remains small due its high

cost relative to hydroelectricity. However, EIA projects that natural gas use in the electricity sector will increase as Brazil expands and diversifies its natural gas supplies.

Nuclear Power

Brazil has two nuclear power plants, the 630-megawatt (MW) Angra-1 and the 1,350-MW Angra-2. State-owned Eletronuclear, a subsidiary of Eletrobras, operates both plants. Construction of a third plant, the 1,350-MW Angra-3, started in 1986, but was never finished. In 2008, construction began again, with completion slated for 2015. According to industry sources, Eletronuclear plans to build at least four new nuclear power plants (in addition to Angra-3) by 2030, in order to meet expected growth in Brazilian electricity demand.

Quick Facts

Energy Overview

Proven Oil Reserves (January 1, 2011)	12.9 billion barrels
Oil Production (2010)	2,721 thousand barrels per day.
Oil Consumption (2009)	2,522 thousand barrels per day
Crude Oil Distillation Capacity (2009)	1,908 thousand barrels per day
Proven Natural Gas Reserves (January 1, 2011)	12.9 trillion cubic feet
Natural Gas Production (2009)	363 billion cubic feet
Natural Gas Consumption (2009)	661 billion cubic feet
Recoverable Coal Reserves (2005)	7,791 million short tons
Coal Production (2009)	6.9 million short tons
Coal Consumption (2009)	25.4 million short tons
Electricity Installed Capacity (2008)	104.0 gigawatts
Electricity Production (2009)	461 billion kilowatt hours
Electricity Consumption (2009)	421 billion kilowatt hours
Total Energy Consumption (2008)	10.6 quadrillion Btus*
	54.1 million Btus
Energy Intensity (2008)	5,977 Btu per $2005 – PPP*

Environmental Overview

Energy-Related Carbon Dioxide Emissions (2009)	420 million metric tons
Per-Capita, Energy-Related Carbon Dioxide Emissions (2009)	2.11 metric tons
Carbon Dioxide Intensity (2009)	0.24 metric tons per thousand $2005-PPP**

* The total energy consumption statistic includes petroleum, dry natural gas, coal, net hydro, nuclear, geothermal, solar, wind, wood and waste electric power.
**GDP figures from Global Insight estimates based on purchasing power parity (PPP) exchange rates.

Links

EIA Links

EIA - Historical Energy Data on Brazil

U.S. Government

CIA World Factbook - Brazil
U.S Embassy in Brazil
U.S. State Department's Consular Information Sheet - Brazil
U.S. State Department's Background Notes on Brazil

Foreign Government Agencies

Agência Nacional de Energia Elétrica
Agência Nacional do Petróleo (ANP) (National Petroleum Agency)
Ministério de Minas e Energia (MME) (Ministry of Mines and Energy)

Sources

Agence France Presse
Agência Nacional do Petróleo
American Journal of Agricultural Economics
Americas Oil and Gas Insights
Argus Latin American Energy and Latin American Power Watch
Associated Press
Business Daily Update
Business News Americas
Chemical News and Intelligence
ChevronTexaco
CIA World Factbook
Coal Americas
Comtex News Network
Courier Mail (Australia)
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