

COUNTRY ANALYSIS BRIEFS

Brazil

Last Updated: September 2007

Background

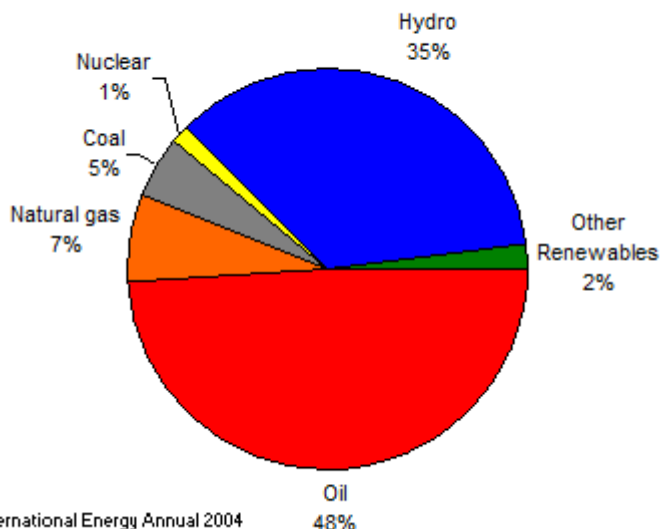
Brazil has experienced rapidly expanding oil, natural gas, and electricity consumption in recent years.

Brazil is the 10th 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 significantly in recent years. In addition, Brazil has made great strides in increasing its total energy production, particularly oil, over the past decade. Increasing domestic oil production has been a long-term goal of the Brazilian government.



The largest share of Brazil's total energy consumption comes from oil (48 percent, including ethanol), followed by hydroelectricity (35 percent) and natural gas (7 percent). The large share of hydroelectricity in Brazil's energy mix represents the dependence of electricity generation on hydroelectric dams. Natural gas is currently a small share of total energy consumption, but attempts to diversify electricity generation from hydropower to gas-fired power plants should cause natural gas consumption to grow in coming years.

Total Energy Consumption in Brazil, by Type (2004)

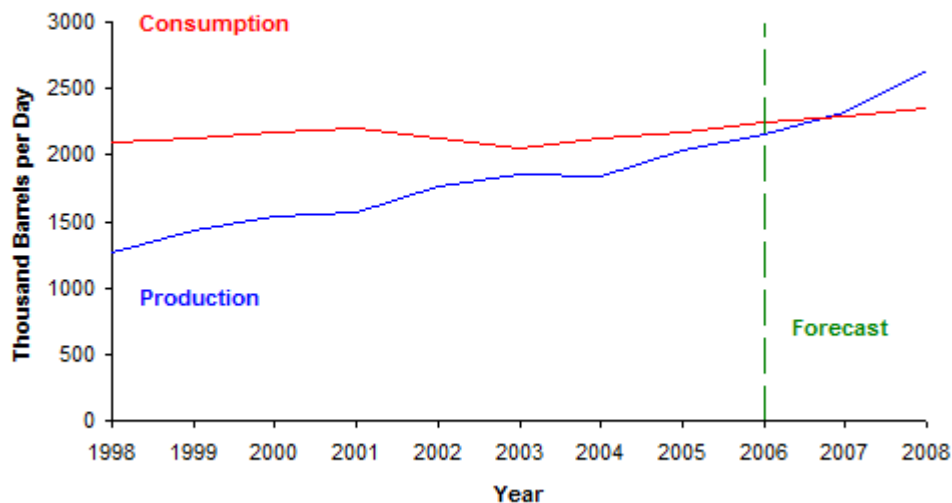


Oil Overview

Brazil has the second-largest crude oil reserves in South America, and is one of the fastest growing oil producers in the world.

According to *Oil and Gas Journal (OGJ)*, Brazil had 11.7 billion barrels of proven oil reserves in 2007, second-largest in South America after Venezuela. The offshore Campos and Santos Basins, located on the country's southeast coast, contain the vast majority of Brazil's proven reserves. In 2006, Brazil produced 2.2 million barrels per day (bbl/d) of oil, of which 77 percent was crude oil. Brazil's oil production has risen steadily in recent years, with the country's oil production in 2006 about 6 percent (or 130,000 bbl/d) higher than 2005. EIA estimates that Brazil's oil consumption in 2006 averaged 2.3 million bbl/d. Based on its August 2007 *Short Term Energy Outlook*, EIA forecasts Brazilian oil production to reach 2.32 million bbl/d in 2007 and 2.64 million bbl/d in 2008. As a result of this rising oil production, EIA estimates that Brazil will become a net oil exporter by the end of 2007.

Brazil's Oil Production and Consumption



Sector Organization

State-controlled Petrobras is the dominant player in Brazil's oil sector, holding majority positions in up-, mid-, and downstream activities. The company held a monopoly on oil-related activities in the

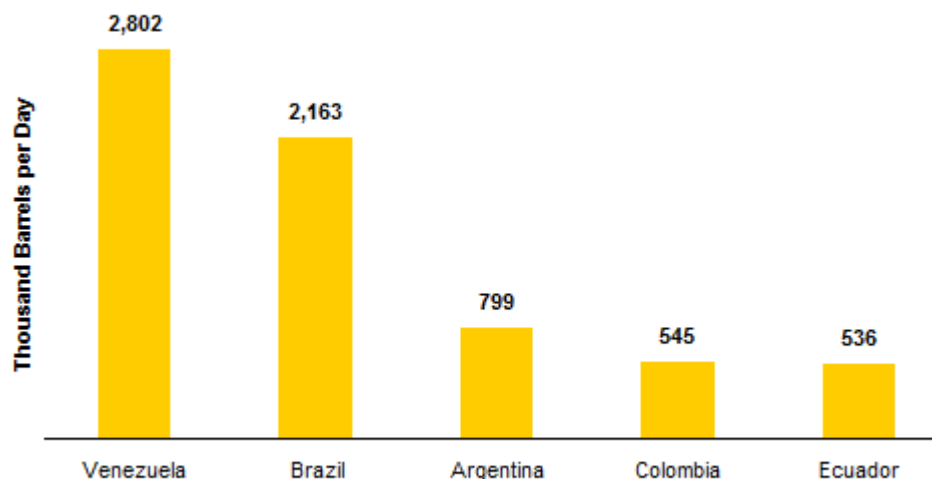
country until 1997, when the government opened the sector to competition and freed oil prices from state control. The principal government agency charged with monitoring the oil sector is the National Petroleum Agency (ANP), which is responsible for issuing exploration and production licenses and ensuring compliance with relevant regulations.

Despite the opening of the sector to private actors in the late 1990s, foreign-operated oil projects are rare in Brazil. Royal Dutch Shell was the first foreign operator of crude oil production in the country, operating a single, relatively small field in the Campos Basin. In mid-2007, Devon brought its Polvo field on-stream, representing the first oil project without any Petrobras participation.

Exploration and Production

Petrobras controls over 95 percent of the crude oil production in Brazil. The largest oil-production region of the country is Rio de Janeiro state, which contains about 80 percent of Brazil's total production. Most of Brazil's crude oil production is offshore in very deep water and consists of mostly-heavy grades. One of Brazil's marketed crude streams is Marlim, which has an API of 19.6° and a sulfur content of 0.67 percent.

Top 5 South American Oil Producers, 2006



Source: EIA Short Term Energy Outlook, August 2007

Petrobras has expanded production in recent years. In early 2006, it brought the Albacore Leste field online, which will eventually produce 180,000 bbl/d. Other 2006 production additions included expansion of the Golfinho (100,000 bbl/d increase) and Jubarte (60,000 bbl/d increase) fields. In the first half of 2007, Petrobras brought new production online at the Piranema field (20,000 bbl/d) and Espadarte (100,000 bbl/d) fields, while the company plans to bring the second phase of its Golfinho expansion (100,000 bbl/d) online by the end of 2007. Petrobras plans to spend at least \$39 billion on exploration and production projects in Brazil through 2011.

Shell's Bijupira-Salema project in the Campos Basin was the first field in Brazil not operated by Petrobras. The project came on-stream in 2003 and produces about 50,000 bbl/d. Shell also hopes to begin production at its BC-10 project (100,000 bbl/d) by the end of 2009. Devon brought its Polvo project (50,000 bbl/d) online in August 2007, representing the only upstream oil project without any Petrobras participation. Chevron is developing the Frade project (100,000 bbl/d), with first production expected in early 2009. Norsk Hydro plans to begin production at its Peregrine (formerly Chinook) field (100,000 bbl/d) in 2010. However, despite these potential new projects, Petrobras will remain the dominant oil producer in Brazil for the foreseeable future.

Recent and Planned New Crude Oil Projects in Brazil			
Name	Operator	(Scheduled) Start Date	Peak Production (bbl/d)

Albacora Leste	Petrobras	April 2006	180,000
Golfinho Mod 1	Petrobras	May 2006	100,000
Jubarte I	Petrobras	December 2006	60,000
Espadarte RJS-409	Petrobras	January 2007	100,000
Piranema	Petrobras	July 2007	20,000
Polvo	Devon Energy	August 2007	50,000
Golfinho Mod II	Petrobras	October 2007	100,000
Roncador P-52	Petrobras	1Q2008	180,000
Roncador P-54	Petrobras	1Q2008	180,000
Marlim Sul Mod 2 P-51	Petrobras	3Q2008	180,000
Frade	Chevron	1Q2009	100,000
BC-10	Royal Dutch Shell	2Q2009	100,000
Golfinho Mod III	Petrobras	4Q2009	100,000
Peregrino	Norsk Hydro	1Q2010	60,000
Jubarte II P-57	Petrobras	3Q2010	120,000
Roncador III P-57	Petrobras	3Q2001	180,000
<i>Source: EIA</i>			

Pipelines

Transpetro, a wholly owned subsidiary of Petrobras, operates Brazil's crude oil transport network. The system consists of 4,000 miles of crude oil pipelines, coastal import terminals, and inland storage facilities. The overall structure of the network enables the movement of crude oil from coastal production facilities and import terminals to inland refineries and consumption centers.

Downstream

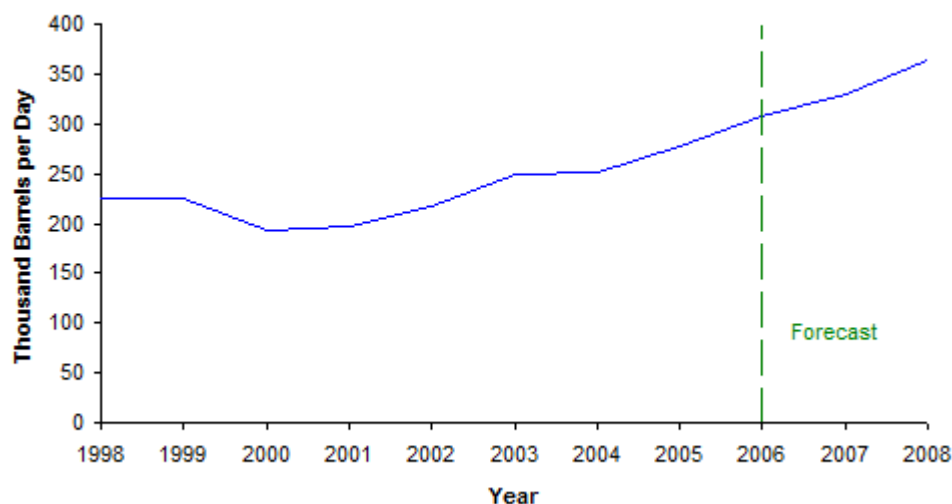
According to *OGJ*, Brazil has 1.9 million bbl/d of crude oil refining capacity spread amongst 13 refineries. Petrobras operates 11 facilities, the largest being the 360,000-bbl/d Paulinia refinery in Sao Paulo. Petrobras also controls a dominant stake in the retail products market. According to the International Energy Agency (IEA), regular unleaded gasoline prices averaged \$3.65 per gallon (including taxes) in 2005, versus \$2.30 per gallon in the United States.

In February 2005, Petrobras signed an agreement with Venezuela's state-owned Petroleos de Venezuela S.A. (PdVSA) to build a new, 200,000-bbl/d refinery in the northeastern Brazil at a cost of \$5 billion. The companies expect to complete the facility by 2010, with each country providing half of the crude oil processed there. The facility has reportedly suffered delays due to disagreements between the two countries, but media accounts indicate that Petrobras plans to proceed with the facility alone if necessary.

Ethanol

Brazil is one of the largest producers of ethanol in the world and is the largest exporter of the fuel. In 2006, Brazil produced 308,000 bbl/d of ethanol. Based on the August 2007 *Short Term Energy Outlook*, EIA forecasts that Brazil's ethanol production will reach 329,000 bbl/d in 2007 and 365,000 bbl/d in 2008. 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. Eight in ten new cars sold in Brazil are flex-fuel vehicles. All gasoline in Brazil contains ethanol, with blending levels varying from 20-25 percent. Ethanol in Brazil comes from sugar cane, which prospers in the country's tropical climate. Coimex Trading, a subsidiary of Brazilian conglomerate Grupo Coimex, is the largest producer of ethanol in Brazil.

Brazil's Ethanol Production



Source: EIA Short Term Energy Outlook, August 2007

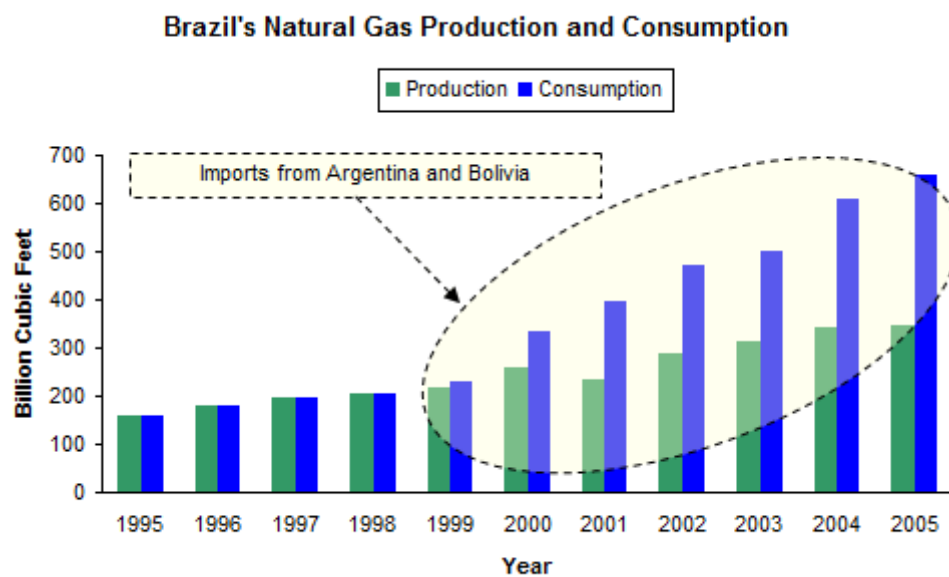
In recent years, Brazil has sought to increase ethanol exports, especially to the United States. In 2006, Brazil exported 29,600 bbl/d of ethanol to the United States, quadruple the amount exported to the U.S. in 2005. The increase in exports to the U.S. was driven by the phase-out of methyl tertiary butyl ether (MTBE) in the U.S., which effectively replaced MTBE with ethanol as an additive to gasoline. To help facilitate additional exports, Petrobras announced a plan in early 2006 to build an ethanol pipeline from Goias, an interior area at the center of Brazil's sugarcane production, to Sao Paulo. However, surging domestic demand and high domestic prices may limit export growth. In addition, Brazil's ethanol exports face high tariffs in some markets, such as the 54 cent per gallon tariff in the United States.

Natural Gas

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

OGJ reported that Brazil had 10.8 trillion cubic feet (Tcf) of proven natural gas reserves in 2007. The Campos and Santos Basins hold the majority of reserves, but there are also sizable reserves in the interior stretches of the country. Despite Brazil's sizable 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 2005, Brazil produced 345 billion cubic feet (Bcf) of natural gas, up 1 percent from 2004 levels. In the future, Brazil hopes to increase natural gas production through an expansion of the domestic natural gas transport network, ending flaring at oil-producing facilities, and increased development of existing reserves.

Natural gas consumption is a small part of the country's overall energy mix, constituting only 7 percent of total energy consumption in 2004. However, natural gas demand is rising. In 2005, Brazil consumed 660 Bcf of natural gas, up 8 percent from 2004. High oil prices have helped spur natural gas demand in Brazil: natural gas is mostly used as a substitute for fuel oil in industrial and power-generating applications, and domestic prices for natural gas are much lower than international fuel oil prices. Further, the introduction of natural gas imports has led to a rapid growth in domestic consumption.



Sector Organization

Petrobras is the largest producer of natural gas in Brazil. The company reportedly controls over 90 percent of Brazil's natural gas reserves. Other important participants in the sector include Sulgas and Britain's BG. ANP has sought to attract international investment to the sector, with recent exploration licensing rounds including many gas-prone areas. Petrobras is also the largest wholesale supplier of natural gas. The industrial sector is the largest consumer of natural gas in Brazil, representing about 80 percent of total domestic consumption. However, the two fastest growing sectors are thermal electricity generation and vehicular compressed natural gas (CNG).

Exploration and Production

The largest share of Brazil's natural gas production occurs from 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 lack of transportation infrastructure.

In order to meet rising demand, Petrobras plans to bring several new natural gas projects online the coming years. The largest is the Mexilhao project, which contains estimated total reserves of 14 Tcf. Current plans call for production to come online by 2009 at 100 Bcf per year, eventually rising to 180 Bcf per year.

Pipelines

Petrobras operates Brazil's domestic natural gas transport system. The network has over 1,550 miles of natural gas pipelines, mostly in the southeast and northeast parts of the country. The network consists of main systems in the southeast, northeast, and the state of Espirito Santo; these systems are not currently interconnected, which has hindered development of domestic production and consumption. In June 2006, China's Sinopec began construction on the 730-mile Gasene pipeline linking the northeast and southeast networks. In 2005, construction began on the Gas Unificacao, or Gasun; the 1,400-mile Gasun will link Mato Grosso do Sul, in southwest Brazil, to Maranhao, in the northeast.

A lack of natural gas transportation infrastructure in the interior regions of the country has hindered exploration and production. In particular, Amazonas state contains considerable reserves that remain unexploited, especially the Urucu field, which contains Brazil's largest onshore natural gas reserves. In 2005, Petrobras began construction of the Urucu pipeline that will link Urucu to Manaus, the capital of Amazonas state. The project includes construction of a 240-mile pipeline from Manaus to Coari, where it will interface with an existing liquefied petroleum gas (LPG) pipeline that Petrobras will convert to transport natural gas. The Urucu pipeline will parallel an existing oil pipeline and carry natural gas that is currently re-injected or flared during oil production. Petrobras also plans to build a pipeline from Urucu to Porto Velho, capital of Rondonia state, with construction scheduled for completion by 2008.

Import Pipelines

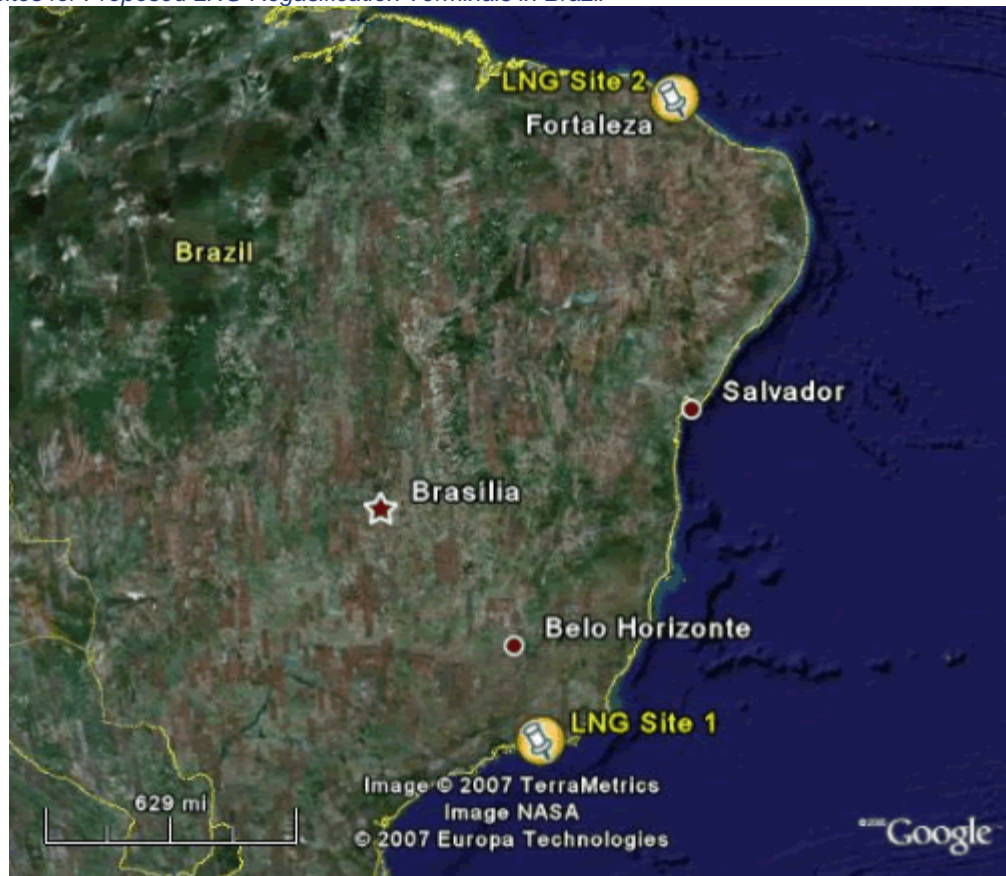
Brazil imports natural gas from Bolivia via the Gasbol pipeline linking Santa Cruz, Bolivia to Porto Alegre, Brazil, via Sao Paulo. The 2,000-mile Gasbol has a maximum capacity of 1 Bcf per day (Bcf/d), though it often operates at reduced volumes. Gasbol also has a 170-mile extension that connects to a natural gas-fired power plant in Cuibana, supplying 100 million cubic feet per day (MMcf/d).

Brazil also receives natural gas from Argentina via the Parana-Uruguayana pipeline. The 275-mile, 100-MMcf/d pipeline supplies a gas-fired power plant operated by AES. There is a 380-mile extension of the pipeline under construction that will link Uruguayana to Porto Alegre. Finally, the operators of the Southern Cross pipeline, currently linking Buenos Aires to Montevideo, hold a concession to extend the pipeline to Porto Alegre.

Liquefied Natural Gas

The construction of liquefied natural gas (LNG) terminals in Brazil could allow for larger natural gas imports and a reduced dependency upon existing import sources. In early 2007, Petrobras contracted with Golar LNG for two floating regasification and storage units (FRSU), for delivery in 2008 and 2009. The two vessels will provide for a combined 670 MMcf/d of gas sendout capacity, with the first moored in the southeast (Rio de Janeiro state, 450 MMcf/d) and the second in the northeast (Ceara state, 220 MMcf/d). Petrobras has sought to secure LNG supplies from numerous sources, including Algeria, Nigeria, and the Middle East.

Sites for Proposed LNG Regasification Terminals in Brazil

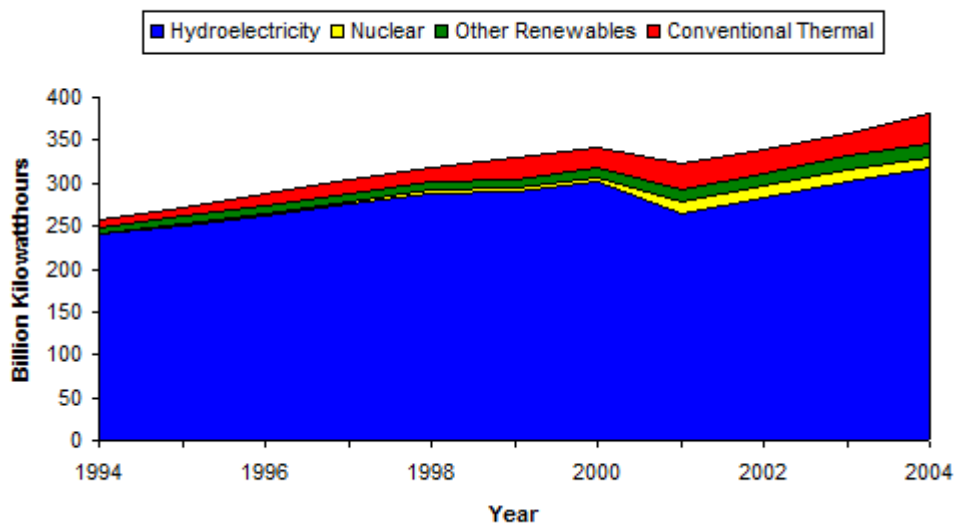


Electricity

Brazil has the third-largest electricity sector in the Western Hemisphere.

Brazil had 86.5 gigawatts of installed generating capacity in 2004, with the single largest share being hydroelectricity. In 2004, the country generated 380.9 billion kilowatthours (Bkwh) of electric power, while consuming 391.7 Bkwh. The largest source of electricity generation is hydropower (83 percent). Most imported electricity comes from Argentina.

Brazil's Electricity Generation, by Source



Source: EIA *International Energy Annual*

Hydroelectricity

Brazil generated 380.9 Bkwh of hydroelectric power in 2004, accounting for 83 percent of its total electricity supply for that year. Together with Paraguay, Brazil maintains the world's largest operational hydroelectric generating complex, the Itaipu facility on the Parana River, which generated 87.97 Bkwh of electricity in 2005. 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 heavy reliance on hydroelectricity has caused problems in the past, especially during years of below-average rainfall.

Conventional Thermal

Conventional thermal generating sources provided only a small part of Brazil's electricity supply. According to ANP, Brazil had 7,000 MW of installed, natural gas-fired electricity generating capacity in 2004, providing around 4 percent of Brazil's electricity supply that year. Petrobras estimates that natural-gas fired generating capacity in Brazil could increase to 13,000 MW by 2017. However, questions about the future availability of Bolivian natural gas imports or a lack of adequate domestic production could hinder investment in new capacity.

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. A third, 1,350-MW plant, Angra-3, remains partially constructed. In 2007, Eletronuclear received permission from the Brazilian government to resume construction of Angra-3, and the company also began the process of applying for permission from Ibama (Brazil's environmental regulatory agency) to begin operations at the plant. Eletronuclear announced in August 2007 that it had begun the process of selecting a site for a fourth nuclear power plant in Brazil.

Profile

Energy Overview

Proven Oil Reserves (January 1, 2007E)	11.7 billion barrels
Oil Production (2006E)	2,163 thousand barrels per day.
Oil Consumption (2005E)	2,250 thousand barrels per day
Crude Oil Distillation Capacity (2006E)	1,908 thousand barrels per day
Proven Natural Gas Reserves (January 1, 2007E)	10.8 trillion cubic feet

Natural Gas Production (2005E)	345 billion cubic feet
Natural Gas Consumption (2005E)	660 billion cubic feet
Recoverable Coal Reserves (2004E)	11,148 million short tons
Coal Production (2004E)	6.2 million short tons
Coal Consumption (2004E)	23.5 million short tons
Electricity Installed Capacity (2004E)	86.5 gigawatts
Electricity Production (2004E)	380.9 billion kilowatt hours
Electricity Consumption (2004E)	391.7 billion kilowatt hours
Total Energy Consumption (2004E)	9.1 quadrillion Btus*, of which Oil (48%), Hydroelectricity (35%), Natural Gas (7%), Coal (5%), Other Renewables (2%), Nuclear (1%)
Total Per Capita Energy Consumption (2004E)	49.3 million Btus
Energy Intensity (2004E)	6,279.2 Btu per \$2000-PPP**

Environmental Overview

Energy-Related Carbon Dioxide Emissions (2004E)	336.7 million metric tons
Per-Capita, Energy-Related Carbon Dioxide Emissions (2003E)	1.8 metric tons
Carbon Dioxide Intensity (2004E)	0.2 Metric tons per thousand \$2000-PPP**

Oil and Gas Industry

Organization	Petrobras: national oil and gas company with partial government ownership, Royal Dutch Shell, Devon
Major Oil/Gas Ports	Sao Sebastiao, Paranagua, Salvador, Tramandai, Sao Francisco do Sul, Aracaju, Maceio, Recife, Natal, Fortaleza, Belem
Major Oil and Natural Gas Basins	Campos Basin, Santos Basin
Major Refineries (capacity, bbl/d)	Paulinia-Sao Paulo (350,000), Mataripe-Bahia (293,700), Duque de Caxias-Rio de Janeiro (232,2000), Sao Jose dos Campos-Sao Paulo (241,500), Canoas-Rio Grande do Sul (180,900), Araucaria-Parana (180,900), Cubatao-Sao Paulo (162,900), Betim Minas Gerais (144,800)

* The total energy consumption statistic includes petroleum, dry natural gas, coal, net hydro, nuclear, geothermal, solar, wind, wood and waste electric power. The renewable energy consumption statistic is based on International Energy Agency (IEA) data and includes hydropower, solar, wind, tide, geothermal, solid biomass and animal products, biomass gas and liquids, industrial and municipal wastes. Sectoral shares of energy consumption and carbon emissions are also based on IEA data.

**GDP figures from OECD 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 \(MME\) \(Ministry of Mines and Energy\)](#)

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