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### Energy Planning in Brazil

by

Steve Thomas

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**PSIRU, Business School, University of Greenwich, Park Row, London SE10 9LS, U.K.**

Website: [www.psiru.org](http://www.psiru.org) Email: [psiru@psiru.org](mailto:psiru@psiru.org) Tel: +44-(0)208-331-9933 Fax: +44 (0)208-331-8665

**Researchers:** Prof. Stephen Thomas, David Hall (Director), Jane Lethbridge, Emanuele Lobina, Vladimir Popov, Violeta Corral

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## 1. Energy Planning in Brazil

### 1.1. The system

Brazil has a rapidly growing electricity system with a capacity of nearly 100GW, dominated by hydro-electric power stations, which comprise about 90% of capacity. Historically, the system has been dominated by public ownership through a Federally controlled (53.9%) holding company, Eletrobras, which has four main regional subsidiaries, FURNAS, CHESF, Eletrosul and Eletronorte which own a large proportion of the generation plants and the transmission system. A significant proportion of generation is provided by the Itaipu plant, 12GW, which is jointly owned by the Brazilian (through Eletrobras) and Paraguayan governments, although the vast majority of the power is supplied to Brazil. The heavy dependence of Brazil on the output of Itaipu was demonstrated by the major blackout that occurred in November 2009 in Rio de Janeiro and Sao Paulo after a failure at the Itaipu plant. The Brazilian electricity system is based on a handful of river basins with several large hydro-electric stations in each and with a reservoir capacity of up to three years of water. This allows demand to be met even in very dry years. A relatively small proportion of Brazil's hydro-electric potential has been exploited.

Distribution was through about 50 regional distribution companies mostly owned by State governments.

### 1.2. Privatisation/liberalisation

Around 1995, the Brazilian government, with the encouragement of the World Bank and with advice from Coopers and Lybrand, began efforts to try to impose a near exact copy of the 1990 British privatisation/liberalisation reforms to its electricity sector. Over the next 6 years, most of the distribution companies were privatised, mainly to US and European utilities. Ironically, the finance for these takeovers was often provided by the nationally-owned Brazilian national development bank, BNDES.

However, little of the generation sector was sold. A transmission system operator, ONS, was created although ownership of the assets remained largely with the Eletrobras subsidiaries. A regulator, ANEEL was also created to regulate markets and tariffs.

Over this period, little new generating capacity was built, despite demand growth of 5% per year or more. There were plans for new capacity, nearly all of which was gas-fired power stations but little hydro-electric capacity.

It was therefore inevitable that a dry year cause supply problems and summer of 2000/01 was dry enough that by the end of the rainy season, the reservoirs were at a very low level. To ensure continuous supply, a severe programme of demand reduction had to be introduced aimed at reducing demand by about 25%. This programme was successful in keeping the lights on, largely because of remarkable reductions in household electricity consumption. A legacy of this period was the signing of some very expensive power supply contracts for gas and diesel plants. This period is known as 'Apagão' or black-out even though the system did not fail.

The election of Luiz Inacio da Silva (Lula) in 2002 led to an abandonment of the privatisation /liberalisation programme. Demand did not 'rebound'. Energy efficiency measures such as in lighting and heightened public awareness of electricity demand meant that once the immediate

crisis had passed – summer of 2001/02 was wet – the need for new capacity was far less urgent and allowed time to develop a new planning system.

Eletrobras and its subsidiaries remained intact and no attempt was made to take the distribution companies back into public ownership. However, nearly all of the European and US utilities withdrew from Brazil after the 'Apagão'. In some cases, the companies were sold to Brazilian private interests while in others, the companies were repossessed by BNDES and were taken over by Eletrobras, which now owns 6 of the smaller distribution companies. AES still owns one of the Sao Paulo distribution companies, Eletropaulo, while AEI, owner of some of Enron's former non-US assets, owns another of Sao Paulo's distribution companies.

### 1.3. The new system

After a couple of years of policy development, a new Energy Planning Company (EPE, Empresa de Pesquisa Energética) under the Ministry of Mines and Energy was opened in 2004<sup>1</sup>. It has grown rapidly from a handful of staff and now employs about 250 people and is likely to grow further through its role in the development of Brazil's large newly found reserves of oil and gas.

New generation is now expected to be dominated for the next few decades by very large hydro-electric schemes such as Belo Monte (11GW) and Rio Madeira (6GW), although some thermal generation is also planned. The new hydro resources are predominantly far from the centres of demand, usually in the largely unexploited Amazon Basin, and will require major transmission links, often DC, to bring the power to demand centres in the South East so generation expansion needs to go hand in hand with development of transmission links often thousands of kilometres long. These projects are environmentally sensitive, although unlike the earlier schemes, the volume of water stored is much less so the amount of land used is much less.

For electricity, the free market in generation has been replaced by what is, in effect, a Single Buyer system to supply the majority of consumers. A parallel market for large industrial users, who can choose their electricity supplier, exists. Large consumers are free to exit the public system at any time but must give several years notice if they wish to re-enter the public system to allow for the distribution company to contract the additional capacity this will need.

Demand for electricity is forecast up to 20 years forward and EPE carries out studies of the cheapest way to meet demand. Because the new hydro capacity is complex and distant, EPE carries out the engineering studies and obtains all important planning consents. When this process is complete, the EPE carries out an auction and the company that bids the lowest price for power from the plant is awarded the contract to build and operate the plant for 15 years (thermal plants) or 20 years (hydro-electric plants). The Power Purchase Agreements are signed by all the distribution companies pro rata with their demand, so a company expected to sell 2% of Brazil's electricity demand must buy 2% of the station's output. Eletrobras and its subsidiaries are allowed to take up to 49% of any project.

The contest to build the 3.3GW Jirau plant, part of the Madeira complex, was won in May 2008 by a consortium of GDF Suez (50.1%), with two Eletrobras subsidiaries, CHESF and Eletrosul taking 20% each and the rest going to a Brazilian engineering group, Camargo Correa. Its bid offered to

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<sup>1</sup> <http://www.epe.gov.br/Paginas/default.aspx>

sell power to the regulated market for 71 Reais/MWh, well below the auction's 91-Reais/MWh price cap. The 3.15GW Santo Antônio plant, the other major part of the Madeira scheme was auctioned in 2007, with the winning bid 79 Reais/MWh compared to a price cap of 122 Reais/MWh. Madeira Energia, the winning bidder, is made up of engineering firm Odebrecht with 19%, engineering firm Andrade Gutierrez Participações (12%), Furnas (39%), the FIP Amazônia Energia Fund (20%) and Brazilian power company Cemig (NYSE: CIG) with 10%. Belo Monte is expected to be auctioned in October or November 2009 and is forecast to be on-line by 2014.

New transmission lines are planned by EPE and also auctioned to the lowest bidder. For example, the Madeira complex, situated in the North West of the country, will require 2 lines each of 2375km to link the plant to the Sao Paulo area. There were 16 bids for the Madeira transmission lines with the lowest bid more than 7% lower than the expected cost. The winning Madeira Transmissão consortium is made up of Furnas and Chesf with 24.5% stakes each and transmission firm CTEEP with the remaining 51%. CTEEP is a privatised (2006, previously owned by Sao Paulo state) transmission company from Sao Paulo.

Power from existing plants is also scheduled via auctions.