OECD ECONOMIC SURVEY OF BRAZIL 2005:

REGULATION OF THE ELECTRICITY SECTOR

This is an excerpt from Chapter 3 of the OECD Economic Survey of Brazil, 2005

Background and main issues

Brazil has a modern electricity industry. The industry depends heavily on hydropower, accounting for nearly 80 per cent of generation capacity (Figure 3.2) and 90 per cent of electricity generated in 2003. Brazil has the largest capacity for water storage in the world, and one of largest transmission networks, given the long distances between power stations and consumers and the need for back-up circuits to ensure alternative supply routes and optimal regional balance in supply. Both private and government-owned companies operate in generation, transmission, and distribution.[1] Eletrobrás, controlled by the federal government, and three other state-owned companies account for one-half of generation capacity. On the other hand, more than two-thirds of the distributors are privately owned/controlled.[2] The transmission grid is run by a collegiate of players: producers, transmission and distribution companies, and the government through the Ministry of Mines and Energy.

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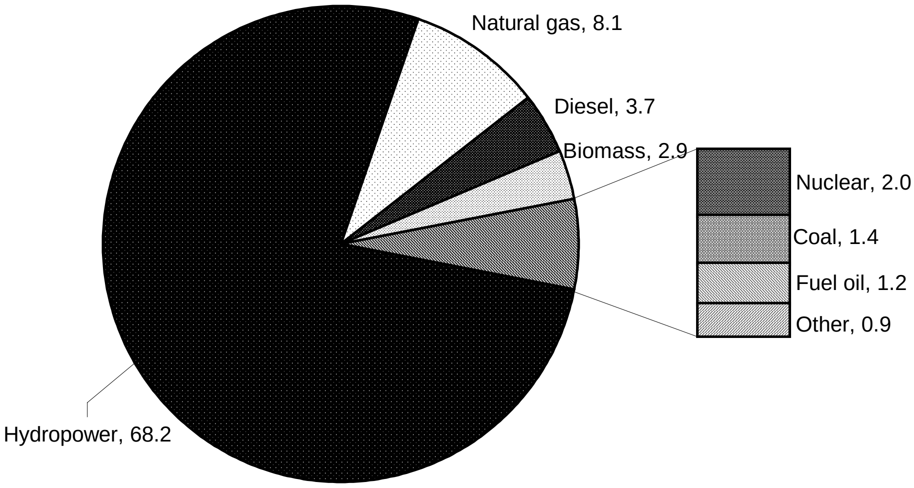
Figure 3.2. **Generation capacity by source**
in GigaWatts (July 2004)



Source: ANEEL.

Electricity demand is expected to continue to grow at a brisk pace. Currently, 97 per cent of households are connected to the electricity network. The income elasticity of demand for electricity is estimated by Eletrobrás at above unity. To illustrate, between 1980 and 2000, electricity demand increased on average by 5.4 per cent per year while GDP grew by 2.4 per cent on average per year. Investment is therefore needed to boost generation and transmission capacity because there is limited excess supply, despite the reduction in demand following the rationing programme implemented in 2001 in response to an energy shortage (Box 3.2).[3]

Box 3.2. The 2001 energy crisis and its aftermath

Mismatches in the expansion of electricity supply and demand worsened throughout the 1990s. Despite market-oriented reforms aiming to boost private investment, implemented after 1996, installed capacity expanded by only 28 per cent during 1990-99, whereas electricity demand increased by 45 per cent. The insufficient expansion of supply was partially mitigated by the depletion of water reserves. Recognizing the need to tackle the supply constraint, because the resumption of investment in hydropower plants was not likely to compensate for the delays that took place in the late 1980s and early 1990s, the government launched a programme (*Programa Prioritário de Termoeletricidade*, PPT) in 2000, aiming to encourage investment in gas-fired power plants and develop the market for natural gas. Due to regulatory uncertainty and the high cost of gas when transportation from Bolivia was factored in (see text), the PPT failed to provide strong enough incentives for new investment: of the 49 planned power plants, only 15 were built, adding about 4 GW in new generation capacity. Most of these new power plants came on stream too late to avoid a power shortage in 2001, when an unusually dry summer reduced reservoirs to a critical level. This, together with the rise in demand due to the economic recovery, resulted in a shortage of electricity during July-December 2001.

The government appointed a special commission to manage the energy crisis (*Câmara de Gestão da Crise de Energia Elétrica*, CGE). Through a price-based rationing programme, with high penalties for excess consumption and discounts for energy savings, coupled with an information campaign on television, electricity consumption was reduced by 20 per cent and blackouts were avoided. This contributed to reduce the impact of the energy crisis on economic growth, which nonetheless decelerated sharply in 2001 to 1.3 per cent.

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Moreover, an emergency programme for power generation was also put in place with additional incentives for investment in expanding short-term power supply projects. The government created a special company (*Companhia Brasileira de Comercialização de Energia Emergencial*, CBEE) for buying electricity on an emergency basis (*i.e.*, mainly from small-scale diesel-based generators and small power plants fired using residuals from sugar cane). About 2.1 GW of capacity was hired by CBEE, financed by a temporary tax levied on electricity consumption, and automatically sold to the distribution companies. CBEE is scheduled to be closed by 2005.

Rationing was lifted at end-February 2002. Energy saving contributed to the reduction of waste, as industry and households replaced power generators and appliances by more cost-efficient substitutes. By 2003, electricity consumption had still not reached the level prior to the rationing programme. This persistent reduction in demand, coupled with the increase in installed capacity after 2001, created excess supply in the market, adversely affecting generators and some specific distribution companies.

There has been insufficient investment in the electricity sector and the role of gas-fired power is still uncertain. In an industry heavily reliant on hydropower, there tends to be a significant gap in generation costs between the existing hydropower plants, and the gas-fired generators. The cost of the energy produced under PPT was typically above USD 40/MWh, against an expansion cost of hydropower estimated at around USD 30/MWh. Also, the supply of gas is deemed insufficient to meet demand by industrial users and electricity generators, when gas-fired plants will be fully operational, undermining the role of existing plants as a reliable back-up to hydropower. The development of the gas sector, with the coming into stream of recently-found reserves off-shore and the integration of the Argentine network may, however, change this scenario. Meanwhile, Petrobras has underwritten most of the costs of PPT by purchasing several of the plants built in recent years, including some merchant plants. As in other countries, the idea of having merchant plants supplying energy during price spikes has proved unsuccessful. This is due in particular to Brazil's relatively good transmission network and the absence of a very segmented market that could generate arbitrage opportunities; given the integration of the system, there is very limited locational differences in spot market prices.

The new model and main challenges

A new model for the electricity sector was approved by Congress in March 2004 (see Box 3.3). Central to the new model is the creation of the "Pool" (*Ambiente de Contratação Regulado*, ACR), matching electricity demand and supply capacity through long-term contracts, which will replace on a competitive bases the "initial contracts" inherited from the 1990s. These contracts were designed as a bridge between the 1980s and the new environment after the privatisation of most distribution companies and schedule to gradually expire after 2002.[4]. The new framework is inspired by the "single-buyer" model, where an entity — typically the government — buys all electricity from producers and sells it to distributors. However, although establishing a common mechanism for the purchase of energy, the model allows market risk to be shared among participants instead of being borne exclusively by the government, which acts rather like an auctioneer than a buyer. With long-term contracts set through the Pool, price uncertainty will be broadly restricted to electricity traded in the free, short-term market and bilateral contracts between generators and large consumers. Indeed, the Pool is aimed at captive consumers, such as households and small businesses, with large consumers allowed to buy electricity directly from generators on a competitive, customised basis. Large consumers are also free to invest in generation, selling the energy that exceeds their needs. Their role is thus central in ensuring the adequate balance between supply and demand. When they identify the risk of excess investment, they are likely to purchase from the Pool, while indications of shortages will stimulate the contracting of new investment. In the same vein, medium-term contracts involving large consumers will complement the information derived from short-term markets that tend to reflect mainly high-frequency changes in the level of water reservoirs rather than medium-term expectations about the pace of supply and demand..

Another important aspect of the model, in particular in a situation of temporary excess supply is the splitting of the market between the "old" generation plants (built before 2000) and the "new" ones. This ensures that short-term price considerations will not harm the adequate remuneration of future investments. The segmentation may, in addition, prevent the old generators from capturing the hydro rent. Electricity generated by various sources will therefore be pooled and sold to distributors at a price determined by the average of the different generation costs. The new model does not change the regulatory framework for transmission.

Box 3.3. The new model for the electricity sector

The new regulatory framework for the electricity sector has the following key features:

Electricity demand and supply will be coordinated through a "Pool" (*Ambiente de Contratação Regulado*, ACR).[1] Demand will be estimated by the distribution companies, which will have to contract 100 per cent of their projected electricity demand over the following 3 to 5 years. These projections will be submitted to a new institution (*Empresa de Planejamento Energético*, EPE), which will estimate the required expansion in supply capacity to be sold to the distribution companies through the Pool. The price at which electricity will be traded through the Pool is an average of all long-term contracted prices and will be the same for all distribution companies. All current electricity procurement contracts remain in place; therefore, each distribution company will have different portfolios of contracts. To optimize the functioning of the Pool, self-dealing (*i.e.,* the purchase of electricity by distributors from their own subsidiaries) will no longer be possible. As such, vertically-integrated companies will need to be unbundled.

In parallel to the "regulated" long-term Pool contracts, there will be a "free" market (*Ambiente de Contratação Livre*, ACL). Although in the future, large consumers (above 10 MW) will be required to give distribution companies a 3-year notice if they wish to switch from the Pool to the free market and a 5-year notice for those moving in the opposite direction a transition period is envisaged during which these conditions will be made more flexible. These measures should reduce market volatility and allow distribution companies to better estimate market size. If actual demand turns out to be higher than projected, distribution companies will have to buy electricity in the free market. In the opposite case, they will sell the excess supply in the free market. Distribution companies will be able to pass on to end-consumers the difference between the costs of electricity purchased in the free market and through the Pool if the discrepancy between projected and actual demand is below 5 per cent. If it is above this threshold, the distribution company will bear the excess costs.

The government opted for a more centralised institutional set-up, reinforcing the role of the Ministry of Mines and Energy in long-term planning. EPE will submit to the Ministry its desired technological portfolio (*i.e.,* the shares in supply of electricity produced through hydropower plants, gas-fired plants, and other renewable fuels), and a list of strategic and non-strategic projects. In turn, the Ministry will submit this list of projects to the National Energy Policy Council (*Conselho Nacional de Política Energética*, CNPE). Once approved by CNPE, the strategic projects will be auctioned on a priority basis through the Pool. Companies can replace the non-strategic projects proposed by EPE, if their proposal offers the same capacity for a lower tariff. Another new institution is a committee (*Comitê de Monitoramento do Setor Elétrico,* CMSE), which will monitor trends in power supply and demand. If any problem is identified, CMSE will propose corrective measures to avoid energy shortages, such as special price conditions for new projects and reserve of generation capacity. The Ministry of Mines and Energy will host and chair this committee. No major further privatizations are expected in the sector.

1. The Brazilian Pool differs from those in other countries (the former UK electricity pool, the Scandinavian Nordpool) because the former is based on long-term contracts, whereas in the latter case it focuses on very short-term contracts. For more information on the Nordic electricity market, see Bergman (2002). For more details on the reform in the electricity sector, see IEA (2004).

But the single-buyer model also has disadvantages. *First,* the government has ultimate responsibility to set priorities for new generation capacity and the country's desired energy mix and these decisions may not necessarily be the most efficient. In several countries that have adopted the single-buyer model (*e.g.,* Hungary, Indonesia, Pakistan, and Thailand), an upward bias in electricity capacity has been observed.[5] *Second,* this model is not well suited to deal with demand shortfalls, as prices do not reflect short-term variations in demand. As a result, although the existence of CMSE may mitigate risks, losses are mostly borne by the distribution companies because selling prices and quantities are set in advance. *Third,* because the price set by the Pool is an average of long-term contracted prices and applies to all participating companies, all other distributors would be affected, albeit to a lesser extent, if a given market participant had financial difficulties, reflected in higher production costs.

Although the new model reduces market risk, its ability to encourage private investment in the electricity sector will depend on how the new regulatory framework is implemented. Several challenges are noteworthy in this regard. *First,* the risk of regulatory failure that might arise due to the fact that the government will have a considerable role to play in long-term planning should be avoided by enhancing the Ministry of Mines and Energy's technical capabilities, while insulating the new institutions from political interference. *Second,* rules will need to be designed for the transition from the current to the new model to allow current investments to be rewarded adequately. *Third,* because of its small size, price volatility may increase in the short-term electricity market, in turn bringing about higher investment risk, albeit this risk will be attenuated by the role of large consumers. The high share of hydropower in Brazil's energy mix and uncertainty over rainfall also contribute to higher volatility of the short-term electricity market. *Fourth,* although the new model will require total separation between generation and distribution, regulations for the unbundling of vertically-integrated companies still have to be defined. Distribution companies are currently allowed to buy up to 30 per cent of their electricity from their own subsidiaries (self-dealing).[6] *Finally,* the government's policy for the natural gas sector needs to be defined within a specific sectoral framework (discussed below).

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NOTES

1 . In 2004, 59 companies operated in generation and 64 in distribution.

2 . The electricity industry underwent important institutional changes in the 1990s, including the adoption of Law 9 074 in 1995 allowing for independent power producers (IPPs) and large consumers (more than 10 MW) to buy electricity from the supplier of their choice, including IPPs. In 1996, Law 9 427 created ANEEL (*Agência Nacional de Energia Elétrica*), the regulator for the electricity sector. In 1998, the government created an independent system operator (*Operador Nacional do Sistema Elétrico*, ONS) responsible for the technical coordination of electricity dispatching and for the management of transmission services, and a wholesale market (*Mercado Atacadista de Energia*, MAE) in charge of netting the differences between agreed quantities in bilateral contracts and actual production. By November 2000, 24 state companies had been privatised. For more information, see OECD (2001, 2002*b*).

3 . The 2004-07 multi-year budget (PPA) foresees an expansion in capacity of 3.5 GW per year, compared to an average of 1.5 GW per year in the 1990s. The IEA estimates that electricity demand will increase 2.5 times between 2000 and 2030, or at an average annual rate of 3.2 per cent. This growth rate is estimated by the IEA to require USD 330 billion in new investment (USD 156 billion for new generation capacity and USD 175 billion for the expansion of the distribution and transmissions systems). Almeida (2004) estimates the annual growth rate of electricity demand to be higher (5 per cent), but the investment cost to be lower (USD 8 billion per year), although his estimate is above that of the government.

4 . Following the privatisation of generation and distribution at the end of the 1990s, long-term power supply contracts between generators and distributors were cancelled and replaced by “initial contracts”. Under these contracts, generators continued to sell electricity on a historical cost-of-service basis. In 2001, ANEEL decided to annul one-quarter of the “initial contracts” per year between 2002 and 2005, and gradually transfer electricity exchange to the wholesale market for short-term electricity dispatching. The wholesale market was created in 1998, but handled only a small share of electricity transactions until the expiration of the “initial contracts”. All electricity exchange was planned to be carried out through the wholesale market by 2006. See Almeida (2004), for more information.

5 . For more information, see Lovei (2000).

6 . For example, CEMIG and COPEL, the distribution companies of the states of Minas Gerais and Paraná, respectively, are vertically integrated and will need to be unbundled.

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