

# **Brazil and its Nuclear Power Programme**

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### **A) The Angra 3 Nuclear Power Project**

Nuclear energy provides about 3% of Brazil's electricity. In 2007, gross production was 445 billion kWh, with net imports of 39 billion kWh being required. Of the total generated in the country, 84% of power was from hydro, 3.5% from gas, 4% from biomass, just over 5% from coal and oil, and 3% (12.4 million kWh) from nuclear. In 2009, nuclear power generated 13 billion kWh of electricity. Per capita electricity consumption in Brazil has grown strongly since 1990 – from under 1500 kWh/yr in 1990 to nearly 2200 kWh/yr in 2007.

The high dependence on hydro gives rise to some climatic vulnerability which is driving policy to diminish dependence on it. Despite this, in February 2010 the government approved \$9.3 billion investment in the new 11.2 GWe Belo Monte hydro scheme, which will flood 500 sq km of the Amazon basin and supply about 11% of the country's electricity. About 40% of Brazil's electricity is produced by the national Eletrobrás Systema. About 20% of electricity is from state-owned utilities, and the rest is from privately-owned companies.

Angra 1 suffered continuing problems with its steam supply system and was shut down for some time during its first few years. Its lifetime load factor over the first 15 years was only 25%, but since 1999 it has been much better. Civil works on Angra 2 started in 1976 and, due to a lack of financial resources and a lower than expected growth in demand, only commenced operation at the end of 2000. Angra 3 was designed to be a twin of unit 2, with a 1,400MW generating capacity. Work started on the project in 1984 but was suspended in 1986 before full construction began. Around 70% of the equipment is on site, full construction did not begin and work on the project was suspended in 1986.

In November 2006 the government announced plans to complete Angra 3 and also build four further 1000 MWe nuclear plants from 2015 at a single site. Angra 3 construction approval was confirmed by Brazil's National Energy Policy Council in June 2007 and received Presidential approval in July. Environmental approval was granted in March and all other approvals by July 2009. In December 2008, Eletrobrás Termonuclear S/A (Eletronuclear) signed an industrial cooperation agreement with Areva, confirming that Areva will complete Angra 3 and be considered for supplying further reactors. Areva also signed a services contract for Angra 1. First concrete for Angra 3 was due in 2009. A construction licence was granted by the National Nuclear Energy Commission (CNEN) at the end of May 2010, and construction resumed two days later, in June. The plant is expected in operation at the end of 2015 after 66 months.

### **B) Financial challenges**

Economically, power from existing nuclear plants is about 1.5 times more expensive than that from established hydro, and power from Angra 3 is expected to be slightly over twice as expensive as old hydro, about the same as that from coal and cheaper than that from gas. Overall, including Angra 3 in projections reduces network prices slightly. Plans to build two new nuclear plants in the northeast and two more near Angra in the southeast are underway<sup>1</sup>. At the end of 2009, Eletronuclear commenced initial siting studies at four potential locations in the northeast<sup>2</sup>, and is aiming to present a list of 40 possible sites to the Mines & Energy Ministry by mid-2011. Eletronuclear is looking at the Westinghouse AP1000 (which is reported to be favoured), the Areva-Mitsubishi Atmea-1 and Atomstroyexport's VVER-1000.

In December 2010, The Brazilian Development Bank (BNDES) approved BRL 6.1 billion (US\$ 3.6 billion) in financing for Angra 3, covering almost 60% of the BRL 9.9 billion estimated cost. This month Eletronuclear received an offer for a EUR1.5bn (US\$2.02bn) loan from a pool of five French banks led by Société Générale to develop its Angra III nuclear power plant in Rio de Janeiro state. This is only one of many recent developments in the country's nuclear sector. Sustained by strong economic and demographic growth, Brazil's power demand is indeed expected to increase significantly in the coming years and the country is planning to boost nuclear generation along with its more developed hydro generation. Brazil's Senate still has to approve the loan, and a decision on the matter is not expected until the second half of 2011. Construction of Angra 3 is currently underway and the new nuclear power plant is expected to start production by 2015. The total investment for the project has been estimated at BRL9.9bn (US\$5.91bn).

### **C) About Eletronuclear and BNDES**

Eletronuclear was established in 1997 for the purpose of operating and building thermal nuclear power plants in Brazil. A subsidiary of Eletrobrás, Eletronuclear is a government-controlled company that accounts for the generation of approximately 3% of electric power consumed in Brazil. By the interconnected electric power system, such power reaches the main consumer centers in Brazil and corresponds, for example, to more than 50% of electric power consumption in the State of Rio de Janeiro, a proportion to be considerably expanded on completion of the third unit of Admiral Álvaro Alberto Nuclear Power Station (CNAEA). At present, nuclear power plants Angra 1 - with a generating capacity of 657 electric megawatts, and Angra 2 - rated at 1350 electric megawatts are in operation. Angra 3, to practically be a replica of Angra 2, (incorporating the technological advances made since the construction of the latter) is also planned

BNDES is the main financing agent for development in Brazil. Since its foundation, in 1952, the BNDES has played a fundamental role in stimulating the expansion of industry and infrastructure in the country. Over the course of the Bank's history, its operations have evolved in accordance with the Brazilian socio-economic challenges, and now they include support for exports, technological innovation, sustainable socio-environmental development and the modernization of public administration. The Bank offers several financial support mechanisms to Brazilian companies of all sizes as well as public administration entities, enabling investments in all economic sectors. In any supported undertaking, from the analysis phase up to the monitoring, the BNDES emphasizes three factors it considers strategic: innovation, local development and socio-environmental development. The BNDES' disbursements reached R\$ 168.4 billion in 2010, a 23% increase when compared to the previous year. The result takes into consideration Petrobras' R\$ 24.7 billion capitalization operation. When this operation - a one-off and non-recurring - is not considered, the Bank's disbursements ended 2010 at R\$ 143.7 billion, a 5% increase when compared to 2009, growth which is compatible with previously made projections. Industry accounted for 47% of the Bank's total disbursements, followed by Infrastructure, with 31% presence, and by Trade and Services, at 16%. In all areas of activity (agriculture, industry, infrastructure, trade and services) disbursements grew in 2010, resulting mostly from the successful Investment Maintenance Program (PSI). Launched in July 2009

and expected to last until next March 31, 2011, PSI guaranteed the return of investment to the country amidst the global financial and economic crisis.